GSF®

Geotextile Sand Filter

New Hampshire
Design & Installation Manual

eljen
CORPORATION
Innovative Onsite Products & Solutions Since 1970

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Glossary of Terms

GSF Module	The individual module of a GSF system. The module is comprised of a cuspated plastic core and corrugated geotextile fabric.
GSF “B43” Module	Dimensions: 36” wide x 48” long x 7” tall
Biofabric	Special filter fabric within the Geotextile Sand Filter Modules upon which the primary biomat layer forms. A single B43 module contains approximately 100 sqft of Biofabric.
Combination System	Multiple serial distribution layouts generally fed with equally divided effluent flow from a special distribution box or other accurate dosing device.
Cover Fabric	The geotextile cover fabric (provided by manufacturer) that is placed over the GSF modules and distribution pipes to prevent backfill and fines from entering the system.
Cuspated Core	The rigid plastic core of the GSF module. It separates the geotextile fabric and creates downward infiltration channels and upward aeration channels to provide primary filtration and biological treatment of the septic effluent. The curvilinear shape of the cuspations offers increased treatment surface area and greater effluent storage.
Min. Design Flow	Minimum Design Flow, per Bedroom: 90 Gallons per day. Specific situations may suggest the use of higher values.
Distribution Box	D-Box) a plastic or concrete box that receives effluent from a septic tank and splits the flow to pipes placed above the GSF modules. For equal distribution, all outlet pipe orifices are typically set at the same elevation to equalize the flow to each line
Drop Boxes	A Drop Box is a Distribution Box placed at the beginning of each row of GSF modules when installed on a slope. Septic tank effluent is pumped to the upper most Drop Box. Flow Equalizers are installed on the pipe in the drop box (es) and set so that the upper most trench may overflow to the next lowest trench. Drop Boxes are set to provide a means of sequential distribution along slopes.
EDA	Effluent Disposal Area.
Flow Equalizer	Special insert placed in the end of distribution pipes at the distribution box to minimize effects of settling and out of level installation.
GSF	The Eljen Geotextile Sand Filter modules with 12-inches of specified sand along the base and 6-inches layer along the sides of all modules. .
Wire Clamps	Clamps secure perforated pipe to the GSF modules during the backfilling operation.
LTAR	Long Term Acceptance Rate (LTAR) is the average equilibrium absorption rate for effluent in a system, usually expressed in gallons per day per square foot. It should not be confused with the design loading rate that is used by regulatory officials in their regulations.

Glossary of Terms

Serial or Sequential Distribution Designs common to sloping sites where GSF lines that are laid on contour receive effluent from a series of “spill-overs” at different elevations. Effluent first utilizes up-slope trenches or row, excess volume is passively directed sequentially to each lower trench or line.

SHWT Seasonal High Water Table

Specified Sand To ensure proper system operation, the system must be installed using ASTM C33 sand with less than 10% passing #100 sieve and less than 5% passing #200 sieve. Listed below is chart outlining the sieve requirements for the specified sand.

Sieve Size	Specification Percent Passing (Dry Sieve)
0.375"	100.0 -100.0
#4	95.0 - 100.0
#8	80.0 - 100.0
#16	50.0 - 85.0
#30	25.0 - 60.0
#50	10.0 - 30.0
#100	< 10.0
#200	< 5.0

STE Septic Tank Effluent (STE) is anaerobically digested effluent that is discharged to a Geotextile Sand Filter module for further treatment.

Width & Length The system width is the sand dimension perpendicular to the GSF module rows. The system length is measured parallel to the rows of GSF modules.

Introduction

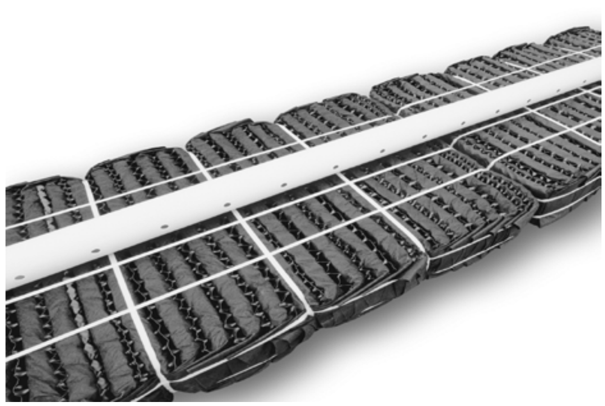
This manual provides design and installation information for the Eljen GSF Geotextile Sand Filter system using the B43 GSF module. Design layouts and installation instructions for sequential, equal or dosed distribution systems are included. Details on unique design and construction procedures for New Hampshire are also provided. For design standards for specially engineered dosing systems, contact Eljen's technical support department at 1-800-444-1359. GSF systems must be designed and constructed according to the current edition of the New Hampshire Subdivision and Individual Sewage Disposal System Design Rules; Chapter Env-Wq 1000.

The Eljen GSF system technology is based on research conducted by nationally recognized engineering scientists from the University of Connecticut. Eljen Corporation has over 30 years of success in the onsite wastewater industry, with tens of thousands of systems currently in use. The system specifications in this manual are founded on this research and history.

The GSF technology is based on scientific principles which state that improved effluent quality provides increased soil absorption rates. GSF's proprietary two-stage Bio-Matt™ pre-filtration process improves effluent quality while increasing reliability and ease of operation.

Third-party independent testing data based on NSF/ANSI Standard 40 Protocol has shown that the Eljen GSF provides advanced treatment of septic tank effluent to better than secondary levels.

The Eljen GSF Geotextile Sand Filter



GSF System Description

The Eljen GSF Geotextile Sand Filter system is a cost-effective upgrade from other septic technology. Comprised of a proprietary two-stage Bio-Matt™ pre-treatment process, the geotextile modules apply a better-than-secondary aerobic effluent to the soil, increasing the soil's ability to accept the effluent. The result is superior effluent treatment in a smaller area.

How the GSF System Works

- Perforated pipe is centered above the GSF module to distribute septic effluent over and into mini-trenches created by the cuspated core of the geotextile module.
- 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 bacteria growth on the Bio-Matt geotextile fabric interface.
- An anti-siltation geotextile fabric covers the top and sides of the GSF module and protects specified sand and soil from fines (found in aggregate) that can clog the sand, while maintaining effluent storage within the module.

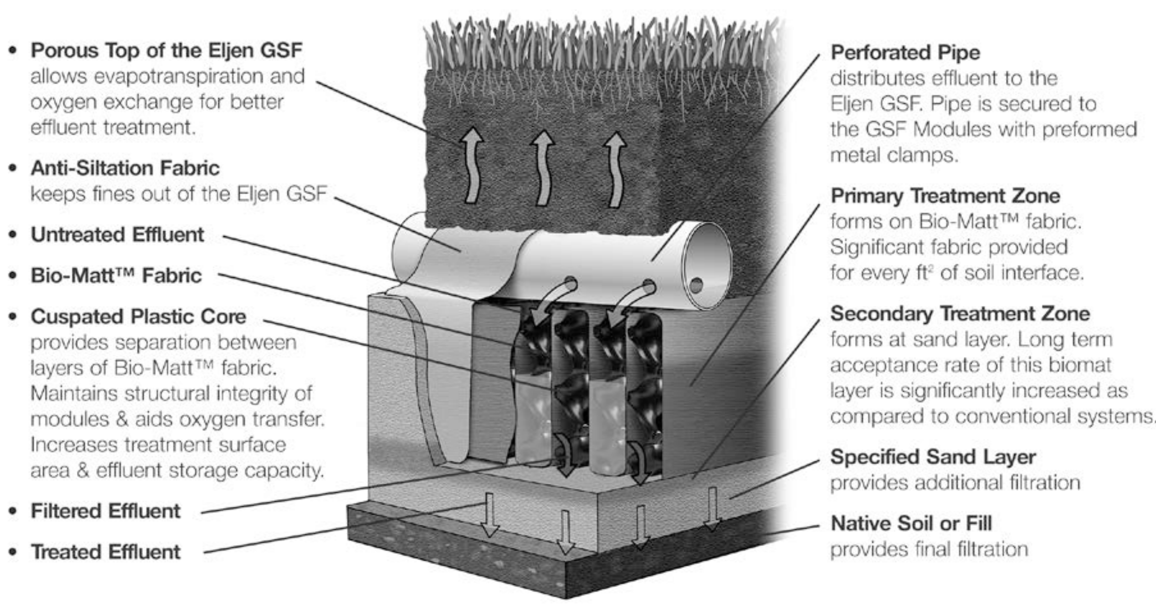
Primary Treatment Zone

Septic tank effluent is applied to GSF modules. A single length of filter fabric is interwoven between sheets of cuspated core significantly increases the surface area compared to the native soil interface. The interwoven filter fabric encourages biological activity while creating an enhanced biological primary treatment zone and improving the long term acceptance rates of the underlying specified sand base.

Secondary Treatment Zone

The long term acceptance rate of the specified sand interface is increased based on the primary treatment. Specified sand provides additional filtration prior to reaching the native soils.

FIGURE 1: GSF SYSTEM OPERATION



1.0 Basic System Design

1.1 DISPOSAL FIELD SIZE: Sizing table and formula (Table 1) applies for commercial and residential systems. A typical GSF system is about ¼ the size of stone and pipe systems, and less than ½ the size of chamber systems. The number of GSF modules required is the same for trench or bed systems. A minimum of 12” separation is required between parallel rows of a GSF bed system to utilize sidewall infiltration area. Please refer to Section 7 for additional design information on commercial systems.

1.2 DEPTH TO SHWT: The GSF system must be designed 36” above SHWT and ledge. Depth to SHWT is measured from the bottom of the GSF module. The depth to SHWT includes the 12-inches of specified sand base and 24-inches of fill or native soils.

1.3 SPECIFIED SAND SPECIFICATION FOR TRENCH AND BED SYSTEMS: 12” of specified sand immediately under all modules; 6” of specified sand is required along the sides of all modules, and around the perimeter of the GSF system. Specified sand must meet the following specifications: ASTM C33 WASHED CONCRETE SAND WITH LESS THAN 10% PASSING#100 SIEVE AND LESS THAN 5% PASSING A #200 SIEVE. Please place a prominent note to this effect on each design drawing. See page 4 of this manual for more information on the ASTM C33 sand specification.

1.4 FILL FOR RAISED SYSTEMS: Fill material below the 12” 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.

1.5 PLACING GSF MODULES: Each row of modules must be laid level and end to end on the above specified sand bed with a minimum spacing of 12” between parallel rows. No mechanical connection is required between units.

1.6 DISTRIBUTION PIPE: SDR 35 or equivalent is required. Place SDR 35 perforated pipe on top of GSF modules with holes at 5 and 7 o’clock. Complete system piping with solid SDR 35 pipe and fittings. Refer to sections 2.2 and 3.4 for level and serial piping details respectively. Secure pipe to GSF modules with provided clamps (hoops), one clamp per Eljen module.

1.7 DISTRIBUTION BOX: Set gravity system D-Box outlet invert a minimum of 0.5” or 1/8” per foot above invert of distribution pipe over modules (2” minimum for pumped systems). The fill below the distribution box and pipes connecting to it must be compacted to prevent settling. Flow Equalizers are highly recommended in D-Box for gravity level systems. Do not use equalizers in pumped systems.

1.8 COVER FABRIC: Geotextile fabric, provided with the system, must be 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 neither block holes nor be stretched from the top of the pipe to the outside edge of the modules. “Tenting” will cause undue stress on fabric and pipe.

1.9 BACKFILL & FINISH GRADING: Carefully place backfill over the modules, followed by loam to complete a total minimum depth of 12” as measured from the top of the module. Systems with total cover that exceeds 18” as measured from the top of the module shall be vented at the far end of the system. Backfill material shall be a well graded sandy fill; clean, porous, and devoid of sand rocks larger than 2”, with a maximum of 10% passing a #200 sieve. Divert surface runoff from the effluent disposal area (EDA). Finish grade to prevent surface ponding. Seed loam to protect from erosion.

1.0 Basic System Design

1.10 NUMBER OF GSF MODULES REQUIRED: Table 1, on page 21, indicates the minimum number of B43 modules required for various soil percolation rates for all systems. Residential systems use a minimum of 5 type B43 modules per bedroom. See Section 7 for additional considerations for commercial systems and Section 1.11 for additional design criteria regarding residential systems. Example trench and bed configuration drawings are located on pages 22-26 of this manual. Half length modules are available for sites with space constraints.

1.11 ADDITIONAL FACTORS EFFECTING RESIDENTIAL SYSTEM SIZE: Homes with expected higher than normal water should have an increased septic tank capacity and/or multiple compartment tanks and larger than minimum effluent disposal areas.

For example:

- Luxury homes, homes with Jacuzzi style tubs, and other high use fixtures.
- Homes with known higher than normal occupancy.
- Homes with water conditioner backwash (Diversion from septic tank required).
- Homes on high-pressure town water: recommend that the homeowner install a water pressure regulator to reduce pressure to 45-50 psi.

<u>See Table 1 for sizing requirements for higher water usage designs.</u>

Designers should use discretion when there are multiple additional factors involved. Increase size in proportion to excess flow.

1.12 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.

1.13 GARBAGE DISPOSALS: 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(e). An appropriate septic tank filter must be installed and the number of GSF modules shall be increased by 30%.

1.14 WATER CONDITIONERS: Water conditioners can adversely affect septic tank treatment and add to hydraulic load of the EDA. **Discharge residential conditioner backwash from these devices shall be into a separate alternative disposal system.**

1.15 SYSTEM VENTING: All systems require sufficient oxygen supply to the EDA to maintain proper long term effluent treatment. Therefore, the following situations require venting <u>at the far end</u> of the EDA:

- Any system with more than 18 inches of total cover as measured from the top of the module.
- All pump systems.
- Areas subject to compaction.

1.16 VEHICULAR TRAFFIC: All vehicular traffic is prohibited over the GSF system. This is due to the compaction of material required to support traffic loading which greatly diminishes absorption below the EDA, and the void space that naturally exists in soils for oxygen transfer on top of the EDA is reduced by compaction from vehicular traffic.

1.0 Basic System Design

1.17 SEPTIC TANKS: Many designers are now specifying 2 septic tanks in series or dual compartment tanks for all their systems. Eljen supports this practice as it helps to assure long system life by reducing suspended solids and BOD to the effluent disposal area. Gas baffles and/or filters are also recommended.

1.18 SEPTIC TANK FILTERS AND RISERS: Wastewater filters are **strongly recommended** as a means of preventing solids from leaving the tank. Access risers are required on tanks more than 6" below finish grade (Env-Wq 1010.05). Eljen recommends that access risers be used on any tank with a filter.

2.0 Systems for Level Sites

2.1 SYSTEM CONFIGURATIONS: Design level in-ground or raised systems with 12" minimum spacing between module rows. The sand bed, GSF modules and distribution pipes must be installed level at their design elevations.

2.2 DISTRIBUTION PIPE LAYOUT: Perforated SDR 35 pipe runs along the center of the modules. Ends must be connected with solid SDR 35 pipe at the far end of the system and at mid points in systems over 40' long. Solid pipe is used to connect perforated lines to the distribution box. **Serial piping in level systems is not allowed.**

3.0 Systems for Sloped Sites

3.1 DESIGN FLOW: Serially dosed GSF systems may be used on sloped sites. Limit a single serial line to 900 gallons per day

3.2 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.

3.3 DISTRIBUTION BOX: Provide a D-Box at the beginning of the first row of modules for effluent velocity reduction and a system inspection port.

3.4 DISTRIBUTION PIPE: The perforated SDR 35 distribution pipe must be capped at the end of each row of modules. Overflow is achieved by placing an end capped length of perforated pipe (10' long or at least 50% of the module row length) at the end of each row next to the distribution pipe and connecting it with solid pipe to the next lower elevation row of modules as shown in the Eljen Installation Instruction sheet. This procedure continues to the last row of modules. Refer to Figure 8 for sloped field design and detail of the overflow.

4.0 Combination Systems

4.1 DESIGN FLOW: Limit a single serial line to 900 gallons per day. Higher flows require multiple parallel lines to reduce flow to less than 900 gallons per day.

4.2 EQUAL DISTRIBUTION: Use a suitable dosing device to assure proper effluent distribution to each serial line. If standard distribution boxes are used place them on stable compacted fill or on a concrete pad or foundation and use flow equalizers for gravity systems only to provide the same effluent to each serial leach line. Example: Design Flow = 2400 gallons per day ÷ 3 = 800 gallons per day per line.

4.3 SAND AND BACKFILL: The specified sand, fill material, and backfill requirements are the same as in level systems.

5.0 Pumped Systems

5.1 PUMP DISTRIBUTION BOX: Specify an oversized distribution box for pumped systems. Provide velocity reduction in the D-Box with a tee or baffle. Set D-Box invert 2” higher than invert of perforated pipe over GSF modules. Do not use flow equalizers or other restricting devices in the outlet lines of the D-Box. Pump chamber and EDA shall be vented.

5.2 DOSING DESIGN CRITERIA: Use a maximum of 4 gallons per dose per B43 module in the system. Adjust pump gallons per minute and run time to achieve the above maximum dose. Use a minimum pump run time of one minute. Longevity of currently available effluent pumps is not affected by shorter run times. Choose force main diameter to minimize percentage of dose drain back. Effluent velocity in force main should fall between approximately 3 and 5 ft/sec. Pump flow rate shall be less than 30 G.P.M. in residential systems. Design for 5-6 doses per day, dosage should be 30-60 gallons per dose on residential systems.

5.3 PRESSURE DISTRIBUTION: Dosing with small diameter pressurized laterals is not recommended. No system reduction is allowed.

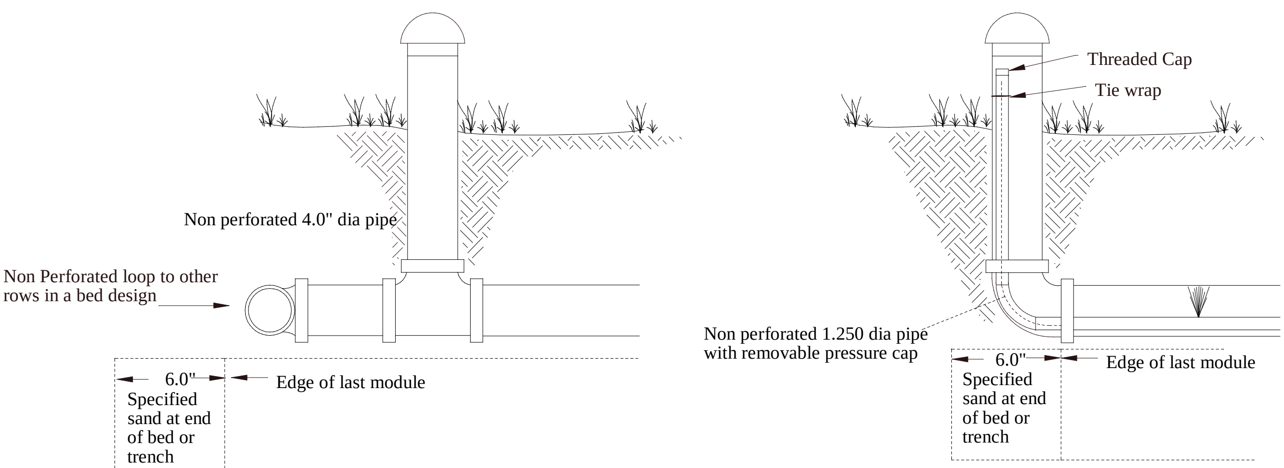
6.0 Ventilated System

6.1 Ventilated System: Air vents are required on all absorption systems located under impervious surfaces or systems with more than 18” 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 bed has aeration channels between the rows of filter 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. The extension of the distribution pipe to the vent provides adequate delivery of air into the GSF system, as shown in Figure 2.

Home plumbing operates under negative pressure due to hot water heating the pipes and reducing the density of air in the house vent. As hot air rises and exits the home, it must be replaced by air from the GSF. To maintain this air flow and fully aerate the GSF system, it is important that air vents are located only on the distal end of the GSF pipe network. If a pressure dosed system is specified, an additional 2” air line must be extended from the GSF D-Box back to the septic tank or the riser on the pump tank is required. This maintains the continuity of air flow from the field into the house plumbing.

In the gravity fed GSF system, the vent is usually a 4” diameter pipe extended to a convenient location behind shrubs. Corrugated pipe can be used with the placement and grade such that any condensation that may accumulate in the pipe does not fill and thus close off this line. If the vent is extended, the pipe must not drain effluent and must have an invert higher than the system. Down-slope vents must first go 4” above the trench and also have a drain hole at the lowest point to drain any condensation.

FIGURE 2: VENT DETAILS FOR GRAVITY/DEMAND DOSED AND PRESSURE DISTRIBUTION SYSTEMS



Gravity / Demand Dosed

Pressure

7.0 Commercial Systems

7.1 MAXIMUM UNIT LOADING: Maximum design flow is 30 gallons per day per B43 module for domestic type wastewater. See the sizing table on Table 1.

7.2 DESGIN FLOW: Use NH Rules Env-Wq 1008.03 to determine design flow for commercial systems, with the exception that the highest measured single day flow in a 12 month period shall not result in a design flow less than the measured average flow with a peaking factor of 2 to 3 depending on the type of usage.

7.3 MULTI-FAMILY DWELLINGS: Condominiums, apartments, trailer parks, RV campgrounds and other systems with domestic type wastewater may use the design formula in Section 7.7 with the maximum loading specified in Section 7.1. Make sure that garbage disposals are not being installed or specified. Appropriate sized septic tank effluent filters are required for all commercial systems over 1000 gallons per day design flow.

7.4 RESTAURANTS: Restaurant systems shall be sized at least 50% larger with a maximum loading of 20 gallons per day per B43 module. Designs shall use 1 or more appropriately sized grease filters at the outlet of the grease trap required by NH Rules. Specify grease traps whose outlets are compatible with the filter designed or allow for external filter between grease trap and septic tank. Combine kitchen flow with black water flow in 1 or more septic tanks. Multiple tanks are preferred. Install 1 or more appropriately sized septic tank effluent filters at the outlet of the final septic tank.

7.5 LAUNDROMATS: Laundromat systems shall be sized at least 50% larger with a maximum loading of 20 gallons per day B43 module. Designs shall use 1 or more appropriately sized filters to help remove suspended lint.

7.6 OTHER COMMERCIAL SYSTEMS: Other non-residential systems, e.g. schools, butcher shops, milk or ice cream facilities etc. may require more conservative sizing. The designer is advised to contact White Mountain Environmental Solutions for recommendations on sizing prior to design and submission of plans to NHDES.

7.7 FORMULA FOR DESIGN FLOW ADJUSTMENT: Commercial design flow when the septic effluent has a **higher** BOD5 + suspended solid concentration (>240 mg/L) than normal domestic wastewater can be adjusted by multiplying by the following factor:

$$\sqrt[3]{\frac{(BOD_5 \text{ mg/l} + SS \text{ mg/l})}{240}}$$

This factor shall not be used if its value is less than one.

7.8 COMMERICAL SYSTEM PLANS REVIEW: Eljen Corporation’s New Hampshire’s technical representative is available for a no cost review of any commercial New Hampshire GSF design prior to submission for review and approval from NHDES. Please contact Eljen Corporation for contact information. Overall responsibility for system design remains with the licensed designer and/or professional engineer.

8.0 Designing GSF for Failed Systems

Before designing a GSF system to replace a failed system, ***IDENTIFY THE CAUSE OF FAILURE*** and adjust new system size accordingly.

1. System may be overloaded due to:

- Leaky plumbing fixtures.
- Pump settings incorrect or not working properly.
- More occupants or bedrooms than system were designed for.
- Unusually high water usage.
- Garbage disposal.
- Water softener backwash.
- Detrimental chemicals being used.
- Excessive grease in system.
- Failed or missing septic tank outlet baffle.
- Infiltration of ground water into a leaky septic tank or pump chamber.

2. System is faulty in design or installation:

- Specified sand that does not meet the requirements as outlined in this manual.
- Poor fill material under bed.
- System too close to water table.
- Mounding due to poor drainage or soil permeability.
- Part(s) of the system not utilized due to blockage or excessive settling.
- System is undersized.

9.0 Required Notes on Design Plans

1. This system **"is not"** designed for the use of a garbage grinder.

2. If the system **"is"** designed for the use of a garbage grinder include the following note on the plans:

   "A garbage grinder will be used in the structure served by the septic tank; the size of the septic tank has been increased by 50% in accordance with Env-Wq 1010.01(e). An appropriate septic tank filter is installed and the numbers of GSF modules have been increased by 30%."

3. This system is not designed for backwash from a water softener.

4. Organic Loam Layer must be removed from trench or bed and slope extension areas prior to fill placement.

5. Scarify subsoil prior to fill placement.

6. Fill material shall meet or exceed State of NH code requirements. (Env-Wq 1021.03). All fill material shall be clean bank run sand, free of topsoil or humus, dredging " sand directly beneath the EDA and 6" surrounding the GSF modules shall be washed concrete sand meeting the requirements of ASTM C33 with less than 10% passing a #100 sieve and less than 5% passing a #200 sieve.

7. Backfill material shall be bank run sand with less than 10% passing a #200 sieve and no stones larger than 2" in any dimension to a maximum depth of 12" over the GSF modules and covered with 4" to 6" of clean loam.

8. Any system which is more than 18" below finish grade as measured from the top of the module shall be vented.

9. This design complies with and must be installed in accordance with the September 10, 2010 "Eljen New Hampshire Design and Installation Manual".

10.0 Inspection of GSF Systems

Possible problem areas to check if a system is not working properly.

SEPTIC TANK

- Clogged filter.
- No outlet baffle or tee.
- Infiltration of ground water or surface water.
- Tank needs to be pumped.
- Line to D-Box needs repair.
- Cracked or leaking Septic Tank
- Line to septic tank is clogged.

PUMP SYSTEMS

- Incorrect float settings or pump selection.
- Wiring or electrical problems.
- Infiltration of ground water or surface water into pump chamber.
- No vent installed on disposal area.
- Line to D-Box needs repair.
- Pump chamber not vented.

EFFLUENT DISPOSAL AREA

- Excessive backfill over system - (More than 18” requires venting).
- Crushed Distribution Pipe(s)
- Distribution Pipes are not Level
- Poor quality backfill over system - (No oxygen flow to system).
- Poor quality sand or fill used below the system.
- Loam was not removed prior to construction.
- Bed is too small for actual use - (Excessive use or bedrooms).
- Surface drainage not pitched away from field.

Important Guidelines

- Place the 7" tall Geotextile Sand Filter Modules on top of a 12" minimum level surface of ASTM C33 specified sand with less than 10% passing #100 sieve and less than 5% passing #200 sieve. You must use the specified sand as listed on page 4 of this manual to ensure proper system operation.
- Specified sand placed along both sides and across the top of the GSF module ensures aeration of the modules. Additional sand placed above the module is recommended.
- Use the provided hoops to secure the approved perforated 4" diameter distribution pipe SDR 35 or equivalent to the top of each GSF module.
- Cover the tops and sides of the modules along the entire length of each row with Eljen Geotextile cover fabric.
- Where the percolation rate exceeds 30 minutes-per-inch or the soil texture is finer, the system should be built from one end to the other to avoid any compaction of the soil by the excavator.
- When backfilling the installation with native soil, stones 2 inches or larger must be removed.
- Finish by grading the area to divert storm water runoff away from the system.
- Do not drive backhoe wheels over GSF modules with less than 12 inches of cover over the distribution pipe. Driving or paving over the Geotextile Sand Filter area is prohibited. For shallow installations, light-weight track-mounted machines are best for setting the final grade. It is also permissible to back-blade the soil to set final minimum cover. Perimeter landscape timbers are also recommended to locate the shallow beds, thereby keeping vehicles off the system.
- Seeding and stabilizing the soil cover is required to protect the system from soil erosion.
- Where the elevation of the surface exceeds the natural grade, a block or landscape timber frame or sloping soil toe at a 3:1 grade can be used to help eliminate soil erosion and support maintenance of the stabilizing grass cover adjacent to the GSF.
- For pumped systems, provide a well anchored D-Box with a velocity reduction tee or baffle. Do not use flow equalizers in pump systems. Vent system at far end of the trench or bed.

Trench and In-Ground Bed System Installation Instructions

1. Carefully lay out the system components and boundaries. Define the location and elevation of the trench or bed and distribution box based on the septic tank outlet elevation and pipe grades required to maintain flow to each component.
2. Prepare the site according to NHDES regulations. Do not install a system on saturated ground or wet soils that are smeared during excavation. Keep heavy machinery off clay soils used for the GSF system as well as down-slope from the system where soil structure is critical for absorption and drainage of the treated effluent.
3. 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.
4. Excavate the trench or bed. Scarify the receiving layer to maximize the interface between the native soil and specified sand.
5. Minimize walking in the trench or bed prior to placement of the specified sand to avoid soil compaction.
6. Place specified sand in two 6" lifts, compacting each lift at a time. The compacted height below the GSF module must be 12".
7. A hand tamper is sufficient to stabilize the sand below the GSF modules. Check the zero grade of the top of the sand using a 2 x 4 and carpenter's level or a laser before placing the modules.
8. Place GSF modules with PAINTED STRIPE FACING UP, end to end on top of the specified sand.
9. Provide D-Box(s) installed in accordance with the current NHDES regulations. Install flow equalizers in the D-Box. Do not use flow equalizers in pump systems.
10. Use 4" SDR 35 non-perforated pipe from the distribution box to the GSF modules.
11. Center 4" SDR 35 perforated distribution pipe lengthwise over modules with orifices at 5:00 and 7:00. Connect mid points on level bed systems on module rows over 40' long.
12. Secure pipe to GSF modules using one Eljen hoop per module. Push hoop ends straight down into up-facing core, through the fabric and into the underlying sand.
13. Spread Eljen cover fabric lengthwise over the pipe and drape over the sides of the GSF module rows. Secure in place with specified sand between and along the sides of the modules. Avoid blocking holes in perforated pipe by placing the cover fabric over the pipe prior to placing fill over the modules.
14. Place 6" minimum of specified sand along the outside perimeter of the modules and at the ends of each module row. Minimum spacing between module rows in a bed configuration shall be 12".
15. Complete backfill with loam to 12" minimum over the GSF modules. Backfill exceeding 18" requires venting at the far end of the trench. Fill should be clean, porous and devoid of large rocks. Use well graded sandy fill with a maximum 10% passing a #200 sieve. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly. Backfill in direction of perforated pipe.
16. Divert surface runoff. Finish grade to prevent surface ponding. Seed loam, and protect from erosion.

Raised or Fill System Installation Instructions

1. Carefully lay out the system components and boundaries. Define the location and elevation of the raised bed or fill system and distribution box based on the septic tank outlet elevation and pipe grades required to maintain flow to each component.
2. Prepare the site according to NHDES regulations. Do not install a system on saturated ground or wet soils that are smeared during excavation. Keep heavy machinery off clay soils used for the GSF system as well as down-slope from the system where soil structure is critical for absorption and drainage of the treated effluent.
3. Plan all drainage requirements above (up-slope) 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.
4. Excavate the bed. Scarify the receiving layer to maximize the interface between the native soil and specified sand.
5. Minimize walking in the excavated area prior to placement of the specified fill material to avoid soil compaction.
6. Place fill material meeting Env-Wq 1021.03 onto the soil interface as you move down the excavated area. If this is done in two steps, bring in the fill material from the up-slope side of the excavation. Compact specified sand below the GSF module in two 6" lifts with a light tracked machine, to a total height of 12" below the module.
7. A hand tamper is also sufficient to stabilize the sand below the GSF modules. Check the zero grade of the top of the sand using a 2 x 4 and carpenter's level or a laser before placing the modules.
8. Place GSF modules with PAINTED STRIPE FACING UP, end to end on top of the specified sand.
9. Provide D-Box(s) installed in accordance with the current NHDES regulations. Install flow equalizers in the D-Box. Do not use flow equalizers in pump systems.
10. Use 4" SDR 35 non-perforated pipe from the distribution box to the GSF modules.
11. Center 4" SDR 35 perforated distribution pipe or equivalent lengthwise over modules with orifices at 5:00 and 7:00. Connect mid points on level bed systems on module rows over 40' long.
12. Secure pipe to GSF modules using one Eljen hoop per module. Push hoop ends straight down into up-facing core, through the fabric and into the underlying sand.
13. Spread Eljen cover fabric lengthwise over the pipe and drape over the sides of the GSF module rows. Secure in place with specified sand between and along the sides of the modules. Avoid blocking holes in perforated pipe by placing the cover fabric over the pipe prior to placing fill over the modules.
14. Place 6" minimum of specified sand along the outside perimeter of the modules and at the ends of each module row. Minimum spacing between module rows in a bed configuration shall be 12".
15. Complete backfill with loam to 12" minimum over the GSF modules. Backfill exceeding 18" requires venting at the far end of the trench. Fill should be clean, porous and devoid of large rocks. Use well graded sandy fill with a maximum 10% passing a #200 sieve. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly. Backfill in direction of perforated pipe.
16. Divert surface runoff. Finish grade to prevent surface ponding. Seed loam, and protect from erosion.

Serial Distribution on Slopes System Installation Instructions

1. Carefully lay out the system components and boundaries. Define the location and elevation of the serial distribution system and distribution box based on the septic tank outlet elevation and pipe grades required to maintain flow to each component.
2. Prepare the site according to NHDES regulations. Do not install a system on saturated ground or wet soils that are smeared during excavation. Keep heavy machinery off clay soils used for the GSF system as well as down-slope from the system where soil structure is critical for absorption and drainage of the treated effluent.
3. Plan all drainage requirements above (up-slope) 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.
4. Excavate the bed. Groove receiving layer by raking or contour plowing at a right angle to slope before placing the specified fill material or specified sand. Scarify the receiving layer to maximize the interface between the native soil and specified sand.
5. Minimize walking in the excavated area prior to placement of the specified fill material to avoid soil compaction.
6. Place fill material meeting Env-Wq 1021.03 onto the soil interface as you move down the excavated area. If this is done in two steps, bring in the fill material from the up-slope side of the excavation. Compact specified sand below the GSF module in two 6” lifts with a light tracked machine, to a total height of 12” below the module.
7. A hand tamper is sufficient to stabilize the sand below the GSF modules. Check the zero grade of the top of the sand using a 2 x 4 and carpenter’s level or a laser before placing the modules.
8. Place GSF modules with PAINTED STRIPE FACING UP, end to end on top of the specified sand.
9. Septic tank effluent flows to a Drop Box placed at the beginning of the upper most trench. One pipe from this Drop Box is plumed along the length of the upper row of GSF modules. The second pipe is an (overflow pipe) and is connected to the next lowest Drop Box. The invert of the Dial a flow opening must be rotated so that it is above the invert height of the pipe loading the GSF modules. This procedure will ensure the upper trenches are utilized prior to flowing to the next down slope trench. This process is duplicated until reaching the lowest trench in the sloped system which does not require Dial a flow adapters or an over flow pipe. See Figure 12.
10. A Drop box is required in front of each row of GSF modules.
11. Use 4” SDR 35 non-perforated pipe or equivalent from the distribution boxes to upper most Drop Box.
12. Install a line of 4” SDR 35 perforated distribution pipe lengthwise on the first row over the GSF modules with orifices at 5:00 and 7:00. Cap the pipe at the far end.
13. Secure pipe to GSF modules using one Eljen hoop per module. Push hoop ends straight down into up-facing core, through the fabric and into the underlying sand.
14. Spread Eljen cover fabric lengthwise over the pipe and drape over the sides of the GFS module rows. Secure in place with specified sand between and along the sides of the modules. Avoid blocking holes in perforated pipe by placing the cover fabric over the pipe prior to placing fill over the modules.
15. Place 6” minimum of specified sand along the sides of the modules and at the ends of each module row.

16. Complete backfill with loam to 12” minimum over the GSF modules. Backfill exceeding 18” requires venting at the far end of the trench. Fill should be clean, porous and devoid of large rocks. Use well graded sandy fill with a maximum 10% passing a #200 sieve. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly. Backfill in direction of perforated pipe.
17. Divert surface runoff. Finish grade to prevent surface ponding. Seed loam, and protect from erosion.

TABLE 1: Standard GSF B43 System Sizing

Percolation Rate Minutes / Inch	2 Bedroom 300GPD	3 Bedroom 450GPD	4 Bedroom 600GPD	Each Additional Bedroom 300GPD	** Commercial Per 100 GPD	*** Commercial Per 100 GPD
2	10	15	20	5	6	7
4	10	15	20	5	6	7
6	10	15	20	5	6	7
8	10	15	20	5	6	7
10	10	15	20	5	6	7
12	10	15	20	5	6	7
14	11	16	21	6	7	8
16	11	17	22	6	7	8
18	12	18	23	6	7	8
20	12	18	24	6	7	8
22	13	19	25	7	8	9
24	13	20	26	7	8	9
26	14	21	27	7	8	9
28	14	21	28	7	8	9
30	15	22	29	8	9	10
32	15	23	30	8	9	10
34	16	24	31	8	9	10
36	16	24	32	8	9	10
38	17	25	33	9	10	11
40	17	26	34	9	10	11
42	18	27	35	9	10	11
44	18	27	36	9	10	11
46	19	28	37	10	11	12
48	19	29	38	10	11	12
50	20	30	39	10	11	12
52	20	30	40	10	11	12
54	21	31	41	11	12	13
56	21	32	42	11	12	13
58	22	33	43	11	12	13
60	22	33	44	11	12	13

(Half-Length B43 modules are available, e.g. 15 B43 modules can be 2 rows of 7.5 modules per row)

** Typical commercial systems with “residential type” flow per Manual Section 7.3.

*** Restaurants, Laundromats, etc: Refer to Sections 7.4 & 7.5.; use the Design Flow adjustment formula in Section 7.7

FIGURE 3: VERTICAL SEPARATION TO SEASONAL HIGH WATER TABLE, SHWT

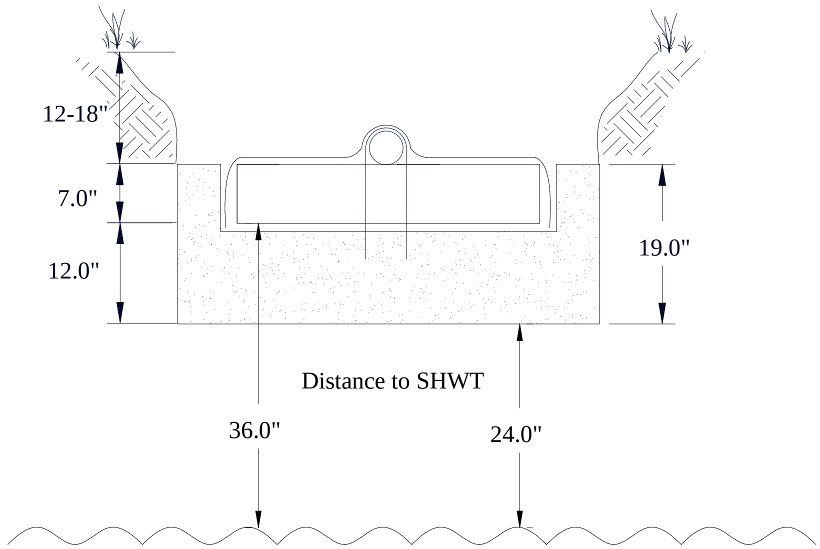


FIGURE 4: B43 GSF TRENCH CROSS SECTION

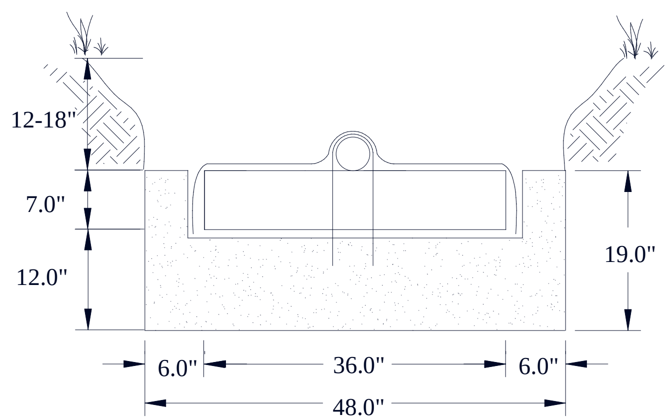


FIGURE 5: B43 BUTTEREFLY TRENCH CONFIGURATION

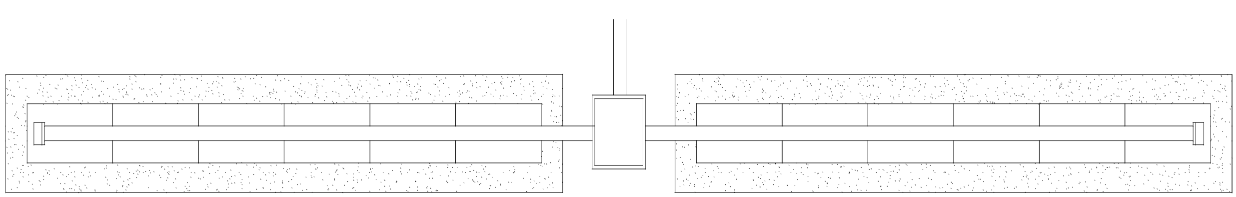


FIGURE 6: GRAVITY DISTRIBUTION B43 BED DESIGN

Three Bedroom Home (21) modules
Three rows of (7) B43 Modules = 12.0' wide x 29.0' long on 4-foot centers
Note: Half modules are available

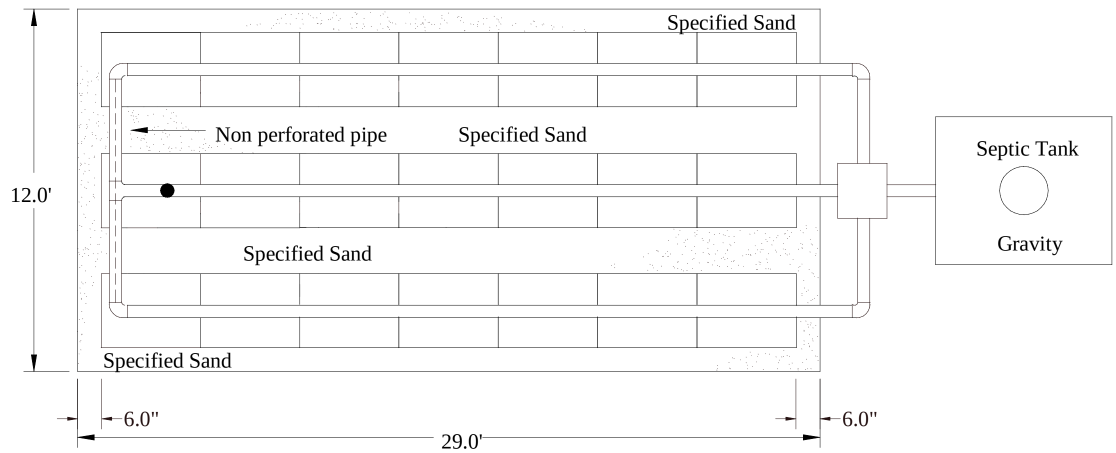


FIGURE 7: DEMAND DOSED B43 BED DESIGN

Three Bedroom Home (21) modules
Three rows of (7) B43 Modules = 12.0' wide x 29.0' long on 4-foot centers
Note: Half modules are available

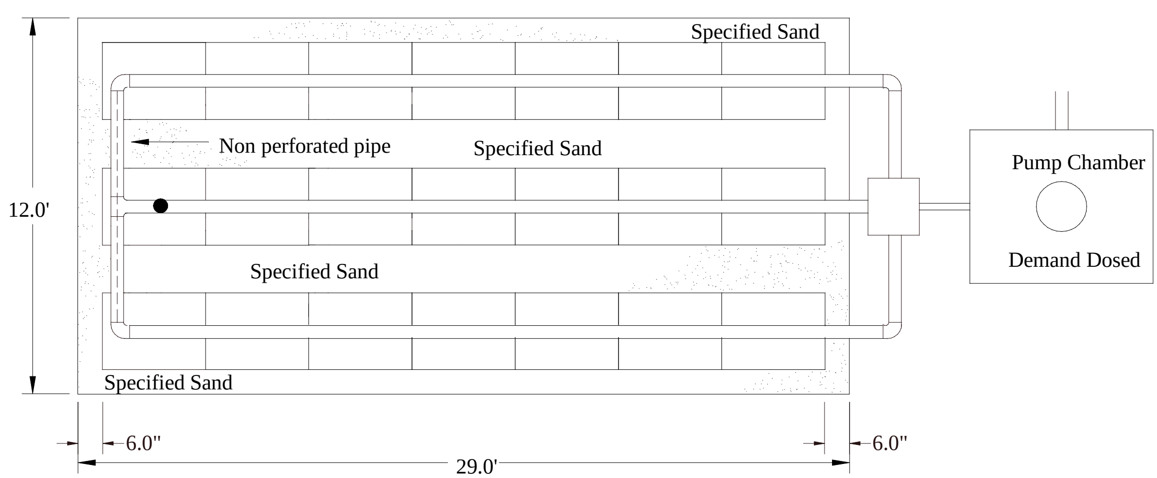


FIGURE 8: TIME PRESSURE DOSED B43 BED DESIGN

Three Bedroom Home (21) modules
Three rows of (7) B43 Modules = 12.0' wide x 29.0' long on 4-foot centers
Note: Half modules are available
Vent or clean out at end of lines as per Engineers Requirements

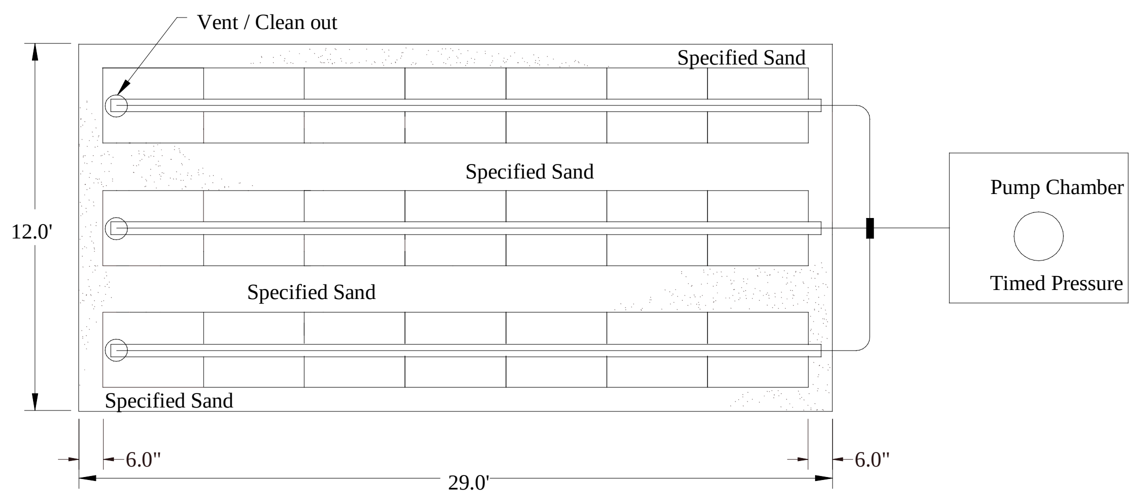


FIGURE 9: B43 BED DESIGN NON-PERFORATED CROSS OVER PIPES

Three Bedroom Home (24) modules
Three rows of (8) B43 Modules = 12.0' wide x 33.0' long on 4-foot centers
Note: Half modules are available

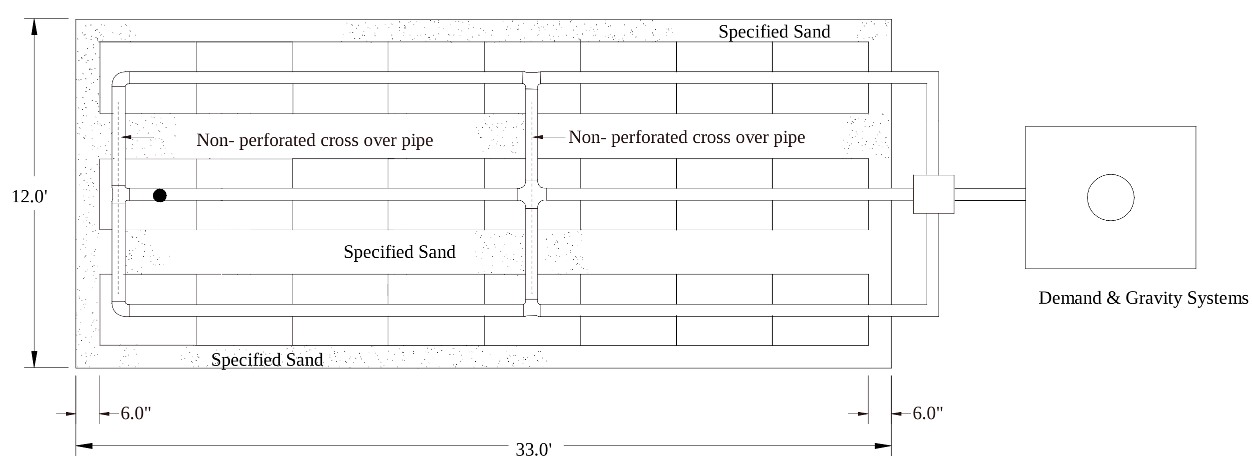


FIGURE 10: TYPICAL B43 BED CROSS SECTION DESIGN

Three rows of B43 Modules = 12.0' wide on 4-foot centers
Note: Half modules are available

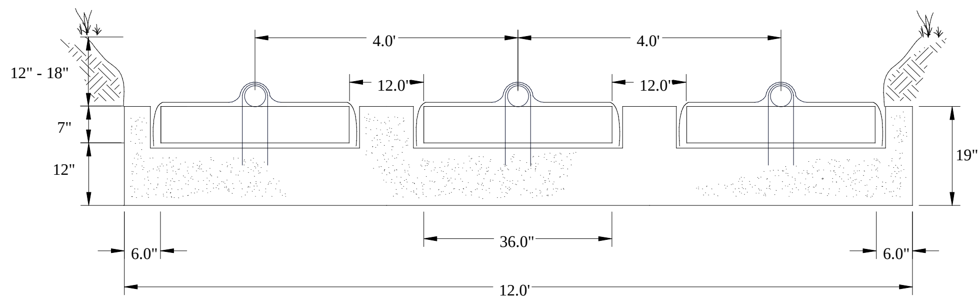


FIGURE 11: TYPICAL SLOPED B43 BED CROSS SECTION DESIGN

Three rows of 7 B43 Modules = 29.0' in Length
Note: Half modules are available

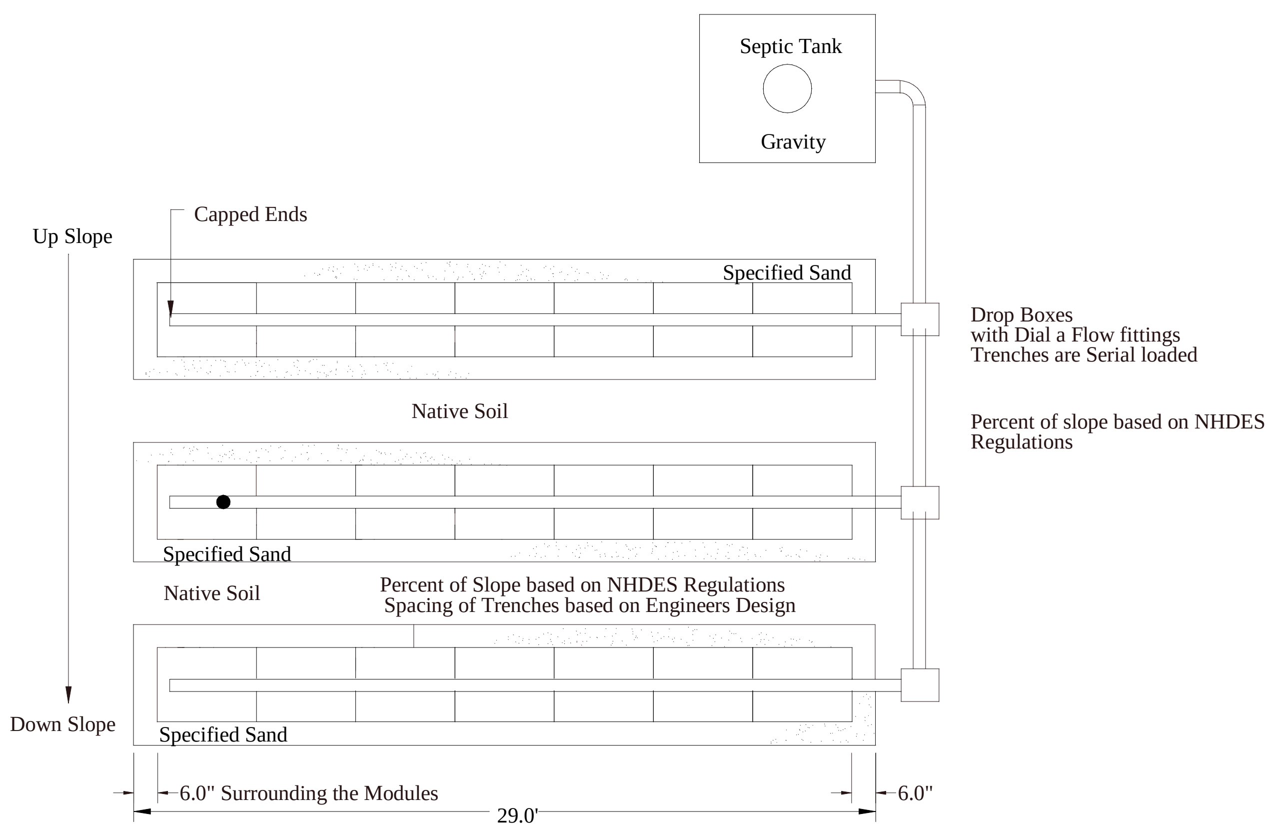


FIGURE 12: SEQUENTIAL LOADING OUTLET SETUP IN DROP BOX

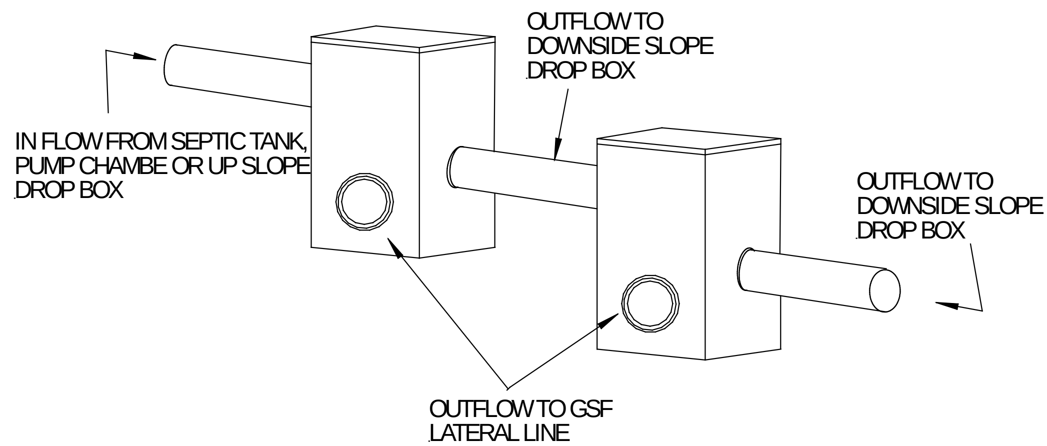
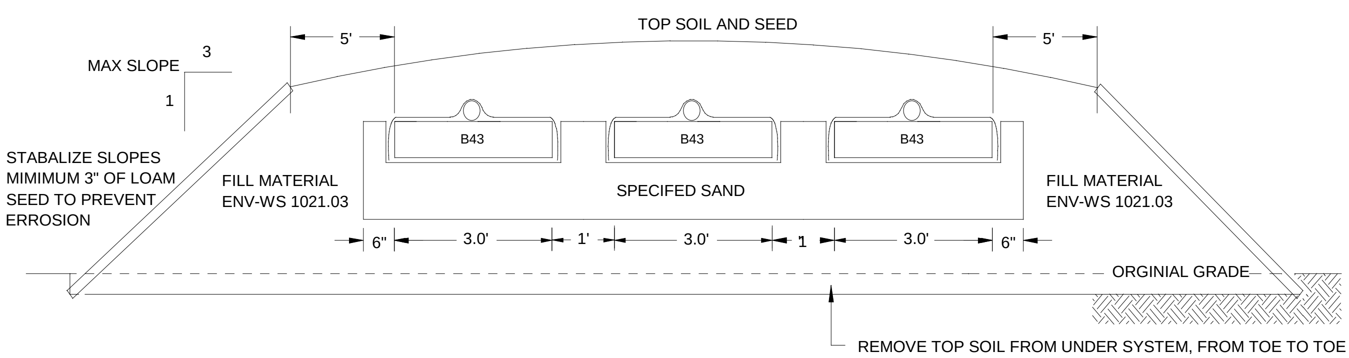


FIGURE 13: TYPICAL RAISED BED DESIGN

Three rows of B43 Modules
Note: Half modules are available



Notes:

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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