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Glossary of Terms

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. Barrier material cannot be substituted.

Design Flow The estimated peak flow that is used to size a GSF system is 150 gallons per day per bedroom.

GSF Unit The Eljen Geotextile Sand Filter Modules and the minimum 6-inch (for subsurface trench or bed) or minimum 12-inch (for above grade or elevated sand mound) sand layer at the base and 6 inches along the sides of the modules.

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

Specified Sand To ensure proper system operation, the system MUST be installed using Indiana Department of Transportation Specification 23 (INDOT SPEC 23) sand AND must be used in accordance with ISDH Rule 410 IAC 6-8.3 (80) (j) or ISDH Rule 410 6-10.1 (88) (j). Ask your material supplier for a sieve analysis to verify that your material meets the required specifications. Please place a prominent note to this effect on each design drawing.

### TABLE 1: SPECIFIED SAND SIEVE REQUIREMENTS

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Sieve Square Opening Size</th>
<th>Specification Percent Passing (Wet Sieve)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>9.52 mm</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>4.76 mm</td>
<td>95 - 100</td>
</tr>
<tr>
<td>No. 8</td>
<td>2.38 mm</td>
<td>80 - 100</td>
</tr>
<tr>
<td>No. 16</td>
<td>1.19 mm</td>
<td>50 - 85</td>
</tr>
<tr>
<td>No. 30</td>
<td>590 µm</td>
<td>25 - 60</td>
</tr>
<tr>
<td>No. 50</td>
<td>297 µm</td>
<td>5 - 30</td>
</tr>
<tr>
<td>No. 100</td>
<td>149 µm</td>
<td>0 - 10</td>
</tr>
<tr>
<td>No. 200</td>
<td>75 µm</td>
<td>0 - 3</td>
</tr>
</tbody>
</table>
GSF System Description

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 (geotextile) 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.
- A cover 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 Conditions for Use

1.0.1 ALTERATION OF MODULES: GSF modules shall not be altered by cutting or any other type of physical modification.

1.0.2 WATER SOFTENER BACKWASH: Water softener backwash shall be discharged to a separate soil absorption field meeting all required state codes and local regulations.

1.0.3 SEPTIC TANK OUTLET FILTERS: Eljen requires the use of outlet filters on all tanks including single compartment tanks, up-sized tanks or when the dwelling has a garbage disposal installed.

1.0.4 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 the following measures must be taken to prevent solids from leaving the tank and entering the GSF system:

- Increase the septic tank capacity by a minimum of 30% or
- Installation of a second septic tank installed in series if a multi-compartment tank isn't used

1.0.5 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.

1.1 System Design

1.1.1 REQUIREMENTS: GSF systems must meet ISDH Rule 410 IAC 6-8.3 except as outlined in this manual.

- The sizing tables in this manual applies to residential systems of any size and
- Commercial systems with daily design flows less than or equal to 750 GPD

Sizing examples are found in this manual. Please contact Eljen’s Technical Resource Department at 1-800-444-1359 for design information on commercial systems and adhere to ISDH Rule 410 6-10.1.

1.1.2 NUMBER OF GSF MODULES REQUIRED: The tables found in this manual indicate the minimum number of A42 or B43 modules allowed. Systems can always be designed beyond the minimum required number of modules. The minimum design requirements per 150 gpd are 6 A42 modules or 6 B43 modules.

1.1.3 SUITABLE SITE AND SOIL CONDITIONS: The Eljen Modules may be designed for all sites that meet the criteria described in the Indiana State Department of Health, Residential Onsite Sewage Systems, Rule 410 IAC 6-8.3 (70-73) or ISDH Rule 410 6-10.1 (78-80).

1.1.4 SEQUENTIAL LOADING: Sequential distribution may only be utilized for sloping sites. Sequential Distribution uses a distribution box equipped with speed levelers. The uppermost line of the system and the inlet to the distribution box will be left open. Down slope lines from the distribution box will have the speed leveler at 9 o’clock. Figure 2 demonstrates this practice which 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 and parallel distribution cannot be used. These systems are approved in writing on a case by case basis by the Eljen Technical Department.
1.1 System Design

1.1.5 SYSTEM GUIDANCE  The chart below directs you to the appropriate section of this manual for the design and installation of the system.

<table>
<thead>
<tr>
<th>Minimum Depth of Installation from Existing Grade</th>
<th>Number of Laterals per Excavation</th>
<th>Slope</th>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Inches or Greater</td>
<td>Single</td>
<td>0 – 15%</td>
<td>Subsurface Trench and Single Lateral Bed</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Multiple</td>
<td>0.0 - 0.5%</td>
<td>Subsurface Bed</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5 – 15%</td>
<td>Sloped Subsurface Bed</td>
<td>21</td>
</tr>
<tr>
<td>Existing Grade</td>
<td>Single</td>
<td>0 - 6%</td>
<td>Elevated Sand Mound</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Multiple</td>
<td>0.0 - 0.5%</td>
<td>Above Grade Bed</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5 – 6%</td>
<td>Sloped Above Grade Bed</td>
<td>41</td>
</tr>
</tbody>
</table>

Use the section above to go to the correct portion of this manual.
2.0 Subsurface Trench and Single Lateral Bed Design and Installation

2.0.1 ACCEPTABLE METHODS OF DISTRIBUTION: Gravity, dosed and pressure distribution are acceptable.

2.0.2 MINIMUM DEPTH FROM ORIGINAL GRADE FOR SUBSURFACE SYSTEMS: The minimum depth for subsurface systems is 4 inches from original grade to the sand/soil interface for the system.

2.0.3 GENERAL CROSS SECTIONS

FIGURE 3: SUBSURFACE A42 TRENCH CROSS SECTION

All subsurface trenches and single lateral beds are required to have:

- 6 inches of Specified Sand at the edges of the GSF module.
- 6 inches of Specified Sand at the beginning and end of each GSF Row.
- Minimum 6 inches of Specified Sand directly below the GSF module.
- Minimum 12 inches of cover soil material above the 4-inch distribution pipe.
- Maximum trench or single lateral bed depth from final grade is 36 inches.
2.0 Subsurface Trench and Single Lateral Bed Design and Installation

2.0.4 VERTICAL SEPARATION TO SEASONAL HIGH-WATER TABLE OR LIMITING LAYER: Refer to section Rule 410 IAC 6-8.3 70.b.5 for subsurface absorption systems or ISDH Rule 410 6-10.1 (61).

<table>
<thead>
<tr>
<th>Vertical Separation Distance (VSD)</th>
</tr>
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<tbody>
<tr>
<td>System Type</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Subsurface Trench and Single Lateral Bed System</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Pressure Distribution</td>
</tr>
</tbody>
</table>

VSD measured from the bottom of the excavated trench or bed for the subsurface system.

2.0.5 DISTRIBUTION BOX: Parallel distribution is preferred. Sequential distribution may be utilized for sloping sites and must conform to 1.1.4. Distribution boxes are required to be 5 feet from the proximal end of each soil absorption field trench.

2.0.6 PARALLEL DISTRIBUTION: Parallel distribution is the preferred method of application 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.

2.0.7 TRENCH LENGTH: Trenches will have a maximum of 100 ft in length unless pressure distribution is used per 410 IAC 6-8.3 (74) (r) or ISDH Rule 410 6-10.1 (82) (r).

2.0.8 EQUAL LENGTH: Trenches must be of equal length in order to provide equal distribution.

2.0.9 SPACING GUIDANCE BETWEEN TRENCHES AND SINGLE LATERAL BED ROWS: Ensure trenches are of equal length throughout the system. If using the B43 in a single lateral bed system, ensure there is center to center distance of 10 feet and 7.5 feet center to center distance for the A42 in a trench.

2.0.10 DISPERSAL AREA: Dispersal area requirements are located in IAC 6-8.3 (58) or ISDH Rule 410 6-10.1 (62).

2.0.11 MINIMUM SLOPE REQUIREMENTS: Maintain a 3:1 slope or gentler for all slopes off the application area.

2.0.12 SUBSURFACE DRAINS: If subsurface drains are utilized they must remain 10 feet from the edge of the system sand perimeter.
2.0 Subsurface Trench and Single Lateral Bed Design and Installation

2.0.13 SIZING GSF SYSTEMS:

**TABLE 3: GSF TRENCH AND SINGLE LATERAL BED SIZING CHART**

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/sf)</th>
<th>Minimum Absorption Area Required (Square Feet)</th>
<th>A42 Modules per House</th>
<th>B43 Modules per House</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedrooms per House</td>
<td>Bedrooms per House</td>
<td>Bedrooms per House</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>1.2</td>
<td>252</td>
<td>335</td>
<td>419</td>
</tr>
<tr>
<td>0.75</td>
<td>402</td>
<td>536</td>
<td>670</td>
</tr>
<tr>
<td>0.6</td>
<td>503</td>
<td>670</td>
<td>838</td>
</tr>
<tr>
<td>0.5</td>
<td>603</td>
<td>804</td>
<td>1005</td>
</tr>
<tr>
<td>0.3</td>
<td>1005</td>
<td>1340</td>
<td>1675</td>
</tr>
<tr>
<td>0.25</td>
<td>1206</td>
<td>1608</td>
<td>2010</td>
</tr>
</tbody>
</table>

*Notes:*
- The Minimum Absorption Area has been adjusted to reflect a 33% reduction in absorption field area.
- Any jetted bath tub with a capacity greater than 125 gallons will be treated as an extra bedroom for the system sizing requirements per Rule 410 IAC 6-8.3.
2.1 Subsurface Trench and Single Lateral Bed Design Example

Example 1: Subsurface Trench (A42 Module) and Single Lateral Bed System (B43 Module)

House size: 3 Bedrooms
Design Flow: 450 gpd
Soil Loading Rate: 0.3 gpd/ft²
Absorption Field Type: Trench

Calculate Minimum Basal Area and Units Required

Refer to Table 3 for the minimum number of units and minimum sized basal area required for installation.

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/sf)</th>
<th>Minimum Absorption Area Required (Square Feet)</th>
<th>A42 Modules per House</th>
<th>B43 Modules per House</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedrooms per House</td>
<td>Bedrooms per House</td>
<td>Bedrooms per House</td>
</tr>
<tr>
<td>0.3</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>1005</td>
<td>1340</td>
<td>1675</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>84</strong></td>
<td><strong>112</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>140</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>63</strong></td>
<td><strong>84</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>105</strong></td>
</tr>
</tbody>
</table>

Calculate Minimum Trench Length

A42: 84 units x 4 ft/unit = 336 linear ft
B43: 63 units x 4 ft/unit = 252 linear ft

Trench Width

A42: 3 ft
B43: 4 ft

Final Dimension Layout

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

A42 – Trench

<table>
<thead>
<tr>
<th>Min. Product Length</th>
<th>336 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>(note: 6 inches sand required at each end of trench which makes the minimum trench length 337 ft)</td>
<td></td>
</tr>
<tr>
<td>Trench Width</td>
<td>3 ft</td>
</tr>
<tr>
<td>Minimum Number of Units</td>
<td>84 A42 Modules</td>
</tr>
<tr>
<td>Designed Absorption Area</td>
<td>1,011 ft²</td>
</tr>
</tbody>
</table>

B43 – Single Lateral Bed

<table>
<thead>
<tr>
<th>Min. Product Length</th>
<th>252 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>(note: 6 inches sand required at each end of trench which makes the minimum trench length 253 ft)</td>
<td></td>
</tr>
<tr>
<td>Trench Width</td>
<td>4 ft</td>
</tr>
<tr>
<td>Minimum Number of Units</td>
<td>63 B43 Modules</td>
</tr>
<tr>
<td>Designed Absorption Area</td>
<td>1,012 ft²</td>
</tr>
</tbody>
</table>
2.1 Subsurface Trench and Single Lateral Bed Design Example

FIGURE 5: PLAN VIEW – 450 GPD – B43 – SINGLE LATERAL BED SYSTEM

DISTRIBUTION BOX (MIN 5 FT FROM FIELD)

SPECIFIED SAND

NATIVE SOIL

MIN 10’

3’

FIGURE 6: SECTION VIEW – B43 – SINGLE LATERAL BED SYSTEM – ≤ 0.5% SLOPE

FINAL GRADE

MIN 12’ OF COVER SOIL MATERIAL

NATIVE SOIL

SPECIFIED SAND

GEOTEXTILE FABRIC

MIN 12” OF SOIL COVER MATERIAL

NATIVE SOIL

SPECIFIED SAND

GEOTEXTILE FABRIC

FINAL GRADE

Loading Rate 0.3 gpd/ft², Design Flow 150 gpd x 3 Bedrooms = 450 gallons per day.
(21 Modules per Row)

FIGURE 7: SECTION VIEW – B43 – SINGLE LATERAL BED SYSTEM – 0.5 – 15% SLOPE

FINAL GRADE

MIN 12” OF SOIL COVER MATERIAL

NATIVE SOIL

SPECIFIED SAND

GEOTEXTILE FABRIC

FINAL GRADE

Loading Rate 0.3 gpd/ft², Design Flow 150 gpd x 3 Bedrooms = 450 gallons per day.
(21 Modules per Row)
2.2 Subsurface Trench and Single Lateral Bed Design Installation Steps

1. Ensure all components leading to the GSF system are installed properly. Outlet filters are required with the GSF system. Connections of lines to tanks and distribution boxes must follow requirements of 410 IAC 6-8.3 or ISDH Rule 410 6-10.1.

2. Determine the number of GSF Modules required using Table 3.

3. Prepare the site. Do not install a system in saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas. Refer to IAC 6-8.3 or ISDH Rule 410 6-10.1 for all site preparation requirements prior to site construction.

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. All drainage requirements shall be in accordance with 410 IAC 6-8.3 (59) or 410 6-10.1 (63).

5. Excavate the trench absorption area; scarify 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 a minimum of 6 inches of Specified Sand in the absorption area and stabilize level. The first 6 inches of sand immediately under and around the perimeter of the GSF system must be INDIANA DEPARTMENT OF TRANSPORTATION (INDOT) SPECIFICATION 23 SAND. See Table 1 for more information on the sand and sieve specifications.

8. Place GSF modules with PAINTED STRIPE FACING UP. Each row of modules is laid level in its length and width, end to end, along their four-foot length on the Specified Sand layer. No mechanical connection is required between modules.

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. All distribution piping must meet the requirements of ISDH Rule 410 6-8.3 Section 67 or ISDH Rule 410 6-10.1 Section 75.

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

11. (Pressure Distribution Systems) Insert a Sch. 40 pressure pipe which meets 410 IAC 6-8.3 (67) or ISDH Rule 410 6-10.1 (75), into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o’clock position as shown in Figure 26. Each pressure lateral will have a drain hole at the distal end of the lateral at the 6 o’clock position. Each pressure lateral shall have a clean out at the end of the trench.

12. The 4-inch distribution pipe shall be capped or vented.

13. 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. 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.

14. 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 trench.
2.2 Subsurface Trench and Single Lateral Bed Design Installation Steps

15. Complete backfill with cover soil material to a minimum of 12 – 19 inches measured from the top of the 4-inch distribution pipe. Fill must be clean, porous and able to sustain vegetation. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly.

16. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.
3.0 Subsurface Bed Design and Installation

3.0.1 ACCEPTABLE METHODS OF DISTRIBUTION: Gravity, dosed and pressure distribution are acceptable.

3.0.2 MINIMUM DEPTH FROM ORIGINAL GRADE FOR SUBSURFACE SYSTEMS: The minimum depth for subsurface systems is 4 inches from original grade. That is the start of the sand/soil interface for the system.

3.0.3 GENERAL CROSS SECTION

FIGURE 8: SUBSURFACE BED CROSS SECTION

All subsurface bed systems are required to have a minimum of:

- 6 inches of Specified Sand at the edges of the GSF module.
- 6 inches of Specified Sand at the beginning and end of each GSF Row.
- 6 inches of Specified Sand directly below the GSF module.
- Minimum 12 inches of cover soil material above the 4-inch distribution pipe
- Maximum excavation depth from final grade is 36 inches.

3.0.4 VERTICAL SEPARATION TO SEASONAL HIGH-WATER TABLE OR LIMITING LAYER: Refer to section Rule 410 IAC 6-8.3 70.b.5 for subsurface absorption systems or ISDH Rule 410 6-10.1 (61).

<table>
<thead>
<tr>
<th>Vertical Separation Distance (VSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Type</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Subsurface Bed</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Pressure Distribution</td>
</tr>
</tbody>
</table>

VSD measured from the bottom of the excavated bed for the subsurface system.

3.0.5 DISTRIBUTION BOX: Parallel distribution is preferred. Sequential distribution may be utilized for sloping sites and must conform to 1.1.4. Distribution boxes are recommended to be 5 feet from the proximal end of each soil absorption field row as per Rule 410 IAC 6-8.3 Section 75.i or ISDH Rule 410 6-10.1 Section 74. This may be amended to shorter distance per the designer.

3.0.6 PARALLEL DISTRIBUTION: Parallel distribution is the preferred method of application 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.

3.0.7 ROWS REQUIRED: All bed systems shall have a minimum of two rows of modules.

3.0.8 ROW LENGTH: Rows will have a maximum of 100 ft in length unless pressure dosed per 410 IAC 6-8.3 (74) (r) or ISDH Rule 410 6-10.1 (82) (r).

3.0.9 EQUAL LENGTH: Rows must be of equal length in order to provide equal distribution.
3.0 Subsurface Bed Design and Installation

3.0.10 DISPERSAL AREA: Dispersal area requirements are located in IAC 6-8.3 (58) or ISDH Rule 410 6-10.1 (62).

3.0.11 MINIMUM SLOPE REQUIREMENTS: Maintain a 3:1 slope or gentler for all slopes off the application area.

3.0.12 SUBSURFACE DRAINS: If subsurface drains are utilized they must remain 10 feet from the edge of the system sand perimeter.

3.0.13 SIZING GSF SYSTEMS:

**TABLE 4: GSF SUBSURFACE BED SIZING CHART**

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/sf)</th>
<th>Minimum Basal Area Required (Square Feet)</th>
<th>A42 Modules per Room</th>
<th>B43 Modules per Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedrooms per House</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1.2</td>
<td>252</td>
<td>335</td>
<td>419</td>
</tr>
<tr>
<td>0.75</td>
<td>402</td>
<td>536</td>
<td>670</td>
</tr>
<tr>
<td>0.6</td>
<td>503</td>
<td>670</td>
<td>838</td>
</tr>
<tr>
<td>0.5</td>
<td>603</td>
<td>804</td>
<td>1005</td>
</tr>
<tr>
<td>0.3</td>
<td>1005</td>
<td>1340</td>
<td>1675</td>
</tr>
<tr>
<td>0.25</td>
<td>1206</td>
<td>1608</td>
<td>2010</td>
</tr>
</tbody>
</table>

*Notes:*
- The Minimum Basal Areas have been adjusted to reflect a 33% reduction in absorption field area.
- Any jetted bath tub with a capacity greater than 125 gallons will be treated as an extra bedroom for the system sizing requirements per Rule 410 IAC 6-8.3.

3.0.14 SYSTEM LENGTH AND WIDTH: Best engineering practices should be used when construction the bed systems. Rule IAC 6-8.3 (79) (2) and ISDH Rule 410 6-10.1 (87) (b) states the dimensions of the bed shall be as long and narrow as the site allows.

3.0.15 BED DESIGN: For beds with less than a 0.5% slope, evenly distribute the bed laterals in the basal area. A minimum separation distance between laterals for A42’s is 3’ and a minimum separation distance between laterals of 4’ for B43’s.
3.1 Subsurface Bed Design Example

Example 2: Subsurface Bed System – A42 Modules – 0.0 – 0.5% Slope

House size: 4 Bedrooms
Design Flow: 600 gpd
Soil Loading Rate: 0.3 gpd/ft²
Absorption Field Type: Bed
Site Slope: Less than 0.5%

Calculate Minimum Basal Area and Units Required

Refer to Table 4 for the minimum number of units and minimum basal area required for installation.

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/sf)</th>
<th>Minimum Basal Area Required (Square Feet)</th>
<th>A42 Modules per Room</th>
<th>B43 Modules per Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedrooms per House</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>0.3</td>
<td>1005</td>
<td>1340</td>
<td>1675</td>
</tr>
</tbody>
</table>

Units required per bedroom x bedrooms = Total units required
A42: 12 units/bedroom x 4 bedrooms = 48 A42s
B43: 10 units/bedroom x 4 bedrooms = 40 B43s

Calculate Minimum Bed Basal Area Length

For This Example, Assume the Number of Bed Rows Equals Two (this encourages the longest and narrowest subsurface bed design):

- Modules per row: Modules Needed ÷ Rows
  - A42: 48 units ÷ 2 rows = 24 modules per row
  - A42: 24 units x 4 ft/unit +1 ft = 97 linear ft
  - B43: 40 units ÷ 2 rows = 20 modules per row
  - B43: 20 units x 4 ft/unit +1 = 81 linear ft

Calculate Bed Basal Area Width

a) Minimum A42 Basal Area Width
   - A42: Rows x 3 ft = 2 x 3 ft = 6 ft
b) Proposed Basal Area Width
   - A42: 1340 ft² ÷ 97 ft = 13.8 ft,
   - b) round to 14 ft
   - A42: Use greater width of a or b: 14 ft

Determine Lateral Spacing

<table>
<thead>
<tr>
<th>Slope</th>
<th>Upper Edge to Lateral Spacing</th>
<th>Lateral to Lateral Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than or Equal to 0.5%</td>
<td>A42</td>
<td>B43</td>
</tr>
<tr>
<td></td>
<td>Lateral to Lateral Spacing ÷ 2</td>
<td>Basal Area width divided by number of rows</td>
</tr>
</tbody>
</table>

Lateral to Lateral Spacing = Bed Width ÷ Rows
Upper Edge to Lateral Spacing = Lateral to Lateral Spacing ÷ 2

A42: 14 ft ÷ 2 rows = 7 ft
B43: 17 ft ÷ 2 rows = 8.5 ft

A42: 7 ft ÷ 2 = 3.5 ft
B43: 8.5 ft ÷ 2 = 4.25 ft
3.1 Subsurface Bed Design Example

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

<table>
<thead>
<tr>
<th>A42</th>
<th>B43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal Area Length:</td>
<td>Bed Length:</td>
</tr>
<tr>
<td>97 ft</td>
<td>81 ft</td>
</tr>
<tr>
<td>Basal Area Width:</td>
<td>Bed Width:</td>
</tr>
<tr>
<td>14 ft</td>
<td>17 ft</td>
</tr>
<tr>
<td>Minimum Number of Units:</td>
<td>Minimum Number of Units:</td>
</tr>
<tr>
<td>48 A42 Modules</td>
<td>40 B43 Modules</td>
</tr>
<tr>
<td>Center to Center Spacing:</td>
<td>Center to Center Spacing:</td>
</tr>
<tr>
<td>7 ft</td>
<td>8.5 ft</td>
</tr>
<tr>
<td>Edge to Center Spacing:</td>
<td>Edge to Center Spacing:</td>
</tr>
<tr>
<td>3.5 ft</td>
<td>4.25 ft</td>
</tr>
<tr>
<td>Designed Basal Area:</td>
<td>Designed Basal Area:</td>
</tr>
<tr>
<td>1,358 ft²</td>
<td>1,377 ft²</td>
</tr>
</tbody>
</table>

**FIGURE 9:** PLAN VIEW – 600 GPD – A42 – BED SYSTEM – ≤ 0.5% SLOPE

**FIGURE 10:** CROSS SECTION VIEW – 600 GPD – A42 – BED SYSTEM – ≤ 0.5% SLOPE
3.2 Subsurface Bed Design Installation Steps

1. Ensure all components leading to the GSF system are installed properly. Outlet filters are required with the GSF system. Connections of lines to tanks and distribution boxes must follow requirements of 410 IAC 6-8.3 or ISDH Rule 410 6-10.1.

2. Determine the number of GSF Modules required using Table 4.

3. Prepare the site. Do not install a system in saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas. Refer to IAC 6-8.3 or ISDH Rule 410 6-10.1, for all site preparation requirements prior to site construction.

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 system once it is complete. All drainage requirements shall be in accordance with 410 IAC 6-8.3 (59).

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

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

7. Place a minimum of 6 inches of Specified Sand in the basal area and stabilize level. The first 6 inches of sand immediately under and around the perimeter of the GSF system must be INDIANA DEPARTMENT OF TRANSPORTATION (INDOT) SPECIFICATION 23 SAND. See Table 1 for more information on the sand and sieve specifications.

8. Place GSF modules with PAINTED STRIPE FACING UP. Each row of modules is laid level in its length and width, end to end, along their four-foot length on the Specified Sand layer. No mechanical connection is required between modules.

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. All distribution piping must meet the requirements of ISDH Rule 410 6-8.3 Section 67 or ISDH Rule 410 6-10.1 Section 75.

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

11. (Pressure Distribution Systems) Insert a Sch. 40 pressure pipe which meets 410 IAC 6-8.3 (67) or ISDH Rule 410 6-10.1 (75), into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o’clock position as shown in Figure 26. Each pressure lateral will have a drain hole at the distal end of the lateral at the 6 o’clock position. Each pressure lateral shall have a clean out at the end of the row.

12. The distribution pipe shall be capped or vented.

13. 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.

14. 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.
15. Complete backfill with cover soil material to a minimum of 12 – 19 inches measured from the top of the 4-inch distribution pipe. Fill must be clean, porous and able to sustain vegetation. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly.

16. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.
4.0 Sloped Subsurface Bed Design and Installation

4.0.1 ACCEPTABLE METHODS OF DISTRIBUTION: Gravity, dosed and pressure distribution are acceptable.

4.0.2 MINIMUM DEPTH FROM ORIGINAL GRADE FOR SUBSURFACE SYSTEMS: The minimum depth from original grade for subsurface systems is 4 inches. That is the start of the sand/soil interface for the system.

4.0.3 GENERAL CROSS SECTION

All subsurface bed systems are required to have a minimum of:

- 6 inches of Specified Sand at the edges of the GSF module.
- 6 inches of Specified Sand at the beginning and end of each GSF Row.
- 6 inches of Specified Sand directly below the GSF module.
- Minimum 12 inches of cover soil material above the 4-inch distribution pipe
- Maximum excavation depth from final grade is 36 inches.

4.0.4 VERTICAL SEPARATION TO SEASONAL HIGH-WATER TABLE OR LIMITING LAYER: Refer to section Rule 410 IAC 6-8.3 70.b.5 for subsurface absorption systems or ISDH Rule 410 6-10.1 (61).

<table>
<thead>
<tr>
<th>Vertical Separation Distance (VSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Type</strong></td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Subsurface Bed</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Pressure Distribution</td>
</tr>
</tbody>
</table>

VSD measured from the bottom of the excavated bed for the subsurface system.

4.0.5 DISTRIBUTION BOX: Parallel distribution is preferred. Sequential distribution may be utilized for sloping sites and must conform to 1.1.4. Distribution boxes are recommended to be 5 feet from the proximal end of each soil absorption field row as per Rule 410 IAC 6-8.3 Section 75.i or ISDH Rule 410 6-10.1 Section 74. This may be amended to shorter distance per the designer.

4.0.6 PARALLEL DISTRIBUTION: Parallel distribution is the preferred method of application 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.
4.0 Sloped Subsurface Bed Design and Installation

4.0.7 ROWS REQUIRED: All bed systems shall have a minimum of two rows of modules.

4.0.8 ROW LENGTH: Rows will have a maximum of 100 ft in length unless pressure dosed per 410 IAC 6-8.3 (74) (r) or ISDH Rule 410 6-10.1 (82) (r).

4.0.9 EQUAL LENGTH: Rows must be of equal length in order to provide equal distribution.

4.0.10 DISPERsal AREA: Dispersal area requirements are located in IAC 6-8.3 (58) or ISDH Rule 410 6-10.1 (62).

4.0.11 MINIMUM SLOPE REQUIREMENTS: Maintain a 3:1 slope or gentler for all slopes off the application area.

4.0.12 SUBSURFACE DRAINS: If subsurface drains are utilized they must remain 10 feet from the edge of the system sand perimeter.

4.0.13 SIZING GSF SYSTEMS:

TABLE 5: GSF SLOPED SUBSURFACE BED SIZING CHART

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/sf)</th>
<th>Minimum Basal Area Required (Square Feet)</th>
<th>A42 Modules per Room</th>
<th>B43 Modules per Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedrooms per House</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1.2</td>
<td>252</td>
<td>335</td>
<td>419</td>
</tr>
<tr>
<td>0.75</td>
<td>402</td>
<td>536</td>
<td>670</td>
</tr>
<tr>
<td>0.6</td>
<td>503</td>
<td>670</td>
<td>838</td>
</tr>
<tr>
<td>0.5</td>
<td>603</td>
<td>804</td>
<td>1005</td>
</tr>
<tr>
<td>0.3</td>
<td>1005</td>
<td>1340</td>
<td>1675</td>
</tr>
<tr>
<td>0.25</td>
<td>1206</td>
<td>1608</td>
<td>2010</td>
</tr>
</tbody>
</table>

Notes:
- The Minimum Basal Areas have been adjusted to reflect a 33% reduction in absorption field area.
- Any jetted bath tub with a capacity greater than 125 gallons will be treated as an extra bedroom for the system sizing requirements per Rule 410 IAC 6-8.3.

4.0.14 SYSTEM LENGTH AND WIDTH: Best engineering practices should be used when construction the bed systems. Rule IAC 6-8.3 (79) (2) and ISDH Rule 410 6-10.1 (87) (2) states the dimensions of the bed shall be as long and narrow as the site allows.

4.0.15 BED DESIGN: For all slopes greater than 0.5%, Eljen recommends moving the upper most lateral a distance of 1.5’ to 2’ (for A42 and B43 respectively) from the upper edge of the basal area while maintaining a minimum of 6 inches between the module and the upper edge of the basal area. For sloping sites greater than 0.5%, you shall have a distance between laterals of 3’ for A42 and 4’ for B43’s.

4.0.16 SAND EXTENSION: For subsurface bed systems on slopes between 0.5% and 10%, a minimum of 4 feet of INDOT SPEC 23 sand extending from the edge of the furthest downslope GSF module is required. For slopes between 10% to 15%, a minimum of 6 feet of INDOT SPEC 23 sand extending from the edge of the furthest downslope GSF module is required. If the design calls for less sand than prescribed above, add a downslope sand extension to meet the minimum 4 or 6-foot sand requirements from the edge of the furthest downslope GSF module.
4.1 Sloped Subsurface Bed Design Example

Example 3: Bed System – A42 Modules – Greater than 0.5% slope – Greater than 0.3 gpd/sf loading rate

House size: 3 Bedrooms
Design Flow: 450 gpd
Soil Loading Rate: 0.75 gpd/ft²
Absorption Field Type: Bed
Site Slope: 11%

Calculate Minimum Basal Area and Units Required

Refer to Table 5 for the minimum number of units and minimum basal area required for installation.

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/ft²)</th>
<th>Minimum Basal Area Required (Square Feet)</th>
<th>A42 Modules per Room</th>
<th>B43 Modules per Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 Bedrooms</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>0.75</td>
<td>402</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

Units required per bedroom x bedrooms = Total units required
A42: 8 units/bedroom x 3 bedrooms = 24 A42s
B43: 7 units/bedroom x 3 bedrooms = 21 B43s

Calculate Minimum Bed Basal Area Length

For This Example, Assume the Number of Bed Rows Equals Two (this encourages the longest and narrowest subsurface bed design):

A42: 24 units ÷ 2 rows = 12 modules per row
A42: 12 units x 4 ft/unit +1 ft = 49 linear ft
A42: 3 ft

B43: 21 units ÷ 2 rows = 10.5, round 11 modules per row
B43: 11 units x 4 ft/unit +1 = 45 linear ft
B43: 4 ft

Determine Lateral Spacing

<table>
<thead>
<tr>
<th>Slope</th>
<th>Upper Edge to Lateral Spacing</th>
<th>Lateral to Lateral Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater 0.5%</td>
<td>A42</td>
<td>B43</td>
</tr>
<tr>
<td></td>
<td>Min 1.5 ft</td>
<td>Min 2 ft</td>
</tr>
<tr>
<td></td>
<td>A42</td>
<td>A42</td>
</tr>
<tr>
<td></td>
<td>Min 3 ft</td>
<td>Min 4 ft</td>
</tr>
</tbody>
</table>

Lateral to Lateral Spacing from Table above.
A42: 3 ft
B43: 4 ft

Upper Edge to Lateral Spacing from Table above.
A42: 1.5 ft
B43: 2 ft

Calculate Bed Basal Area Width

a) Minimum A42 Basal Area Width
A42: Rows x 3 ft = 2 x 3 ft = 6 ft

or
b) Proposed Basal Area Width
A42: 402 ft² ÷ 49 ft = 8.2 ft, round to 8.5 ft

A42: Use greater width of a or b: 8.5 ft

a) Minimum B43 Basal Area Width
B43: Rows x 4 ft = 2 x 4 ft = 8 ft

or
b) Proposed Basal Area Width
B43: 402 ft² ÷ 45 ft = 8.9 ft, round to 9 ft

B43: Use greater width of a or b: 9 ft
4.1 Sloped Subsurface Bed Design Example

**DESIGN REQUIREMENT:** For bed systems on slopes between the grades of 0.5% and 10%, a minimum downslope extension of 4 feet of INDOT SPEC 23 sand extending from the edge of the furthest downslope GSF module is required. For slopes between the grades of 10% to 15%, a minimum downslope extension of 6 feet of INDOT SPEC 23 sand extending from the edge of the furthest downslope GSF module is required.

**Calculate Lateral to Lower Edge Spacing**

Proposed Basal Area Width – Upper edge to Lateral Spacing – Lateral to Lateral Spacing =

<table>
<thead>
<tr>
<th></th>
<th>A42</th>
<th>B43</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.5 ft – 1.5 ft – 3 ft =</td>
<td>4 ft</td>
</tr>
</tbody>
</table>

**Calculate Sand Extension**

<table>
<thead>
<tr>
<th></th>
<th>A42</th>
<th>B43</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 ft – 1 ft =</td>
<td>3 ft</td>
</tr>
</tbody>
</table>

Since the slope is 11% which requires a 6 ft sand extension from the edge of the last module.

<table>
<thead>
<tr>
<th></th>
<th>A42</th>
<th>B43</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sand extension =</td>
<td>6 ft</td>
</tr>
</tbody>
</table>

**Adjusted Lateral to Lower Edge**

<table>
<thead>
<tr>
<th></th>
<th>A42</th>
<th>B43</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sand Extension + 1 ft</td>
<td>6 ft + 1 ft =</td>
</tr>
</tbody>
</table>

**Adjusted Cell Width**

Adjusted Lateral to Lower Edge – Lateral to Lower Edge + Proposed Basal Area Width

<table>
<thead>
<tr>
<th></th>
<th>A42</th>
<th>B43</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 ft – 4 ft + 8.5 ft =</td>
<td>11.5 ft</td>
</tr>
</tbody>
</table>

**Final Dimension Layout**

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

<table>
<thead>
<tr>
<th></th>
<th>A42</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal Area Length:</td>
<td>49 ft</td>
</tr>
<tr>
<td>Basal Area Width:</td>
<td>11.5 ft</td>
</tr>
<tr>
<td>Minimum Number of Units:</td>
<td>24 A42 Modules</td>
</tr>
<tr>
<td>Center to Center Spacing:</td>
<td>3 ft</td>
</tr>
<tr>
<td>Edge to Center Spacing:</td>
<td>1.5 ft</td>
</tr>
<tr>
<td>Designed Basal Area:</td>
<td>563.5 ft²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>B43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal Area Length:</td>
<td>45 ft</td>
</tr>
<tr>
<td>Basal Area Width:</td>
<td>13.5 ft</td>
</tr>
<tr>
<td>Minimum Number of Units:</td>
<td>22 B43 Modules</td>
</tr>
<tr>
<td>Center to Center Spacing:</td>
<td>4 ft</td>
</tr>
<tr>
<td>Edge to Center Spacing:</td>
<td>2 ft</td>
</tr>
<tr>
<td>Designed Basal Area:</td>
<td>607.5 ft²</td>
</tr>
</tbody>
</table>
4.1 Sloped Subsurface Bed Design Example

FIGURE 12: PLAN VIEW – 450 GPD – A42 – BED SYSTEM – 0.5 – 15% SLOPE

FIGURE 13: CROSS SECTION VIEW – 450 GPD – A42 – BED SYSTEM – 0.5 – 15% SLOPE
### 4.2 Sloped Subsurface Bed Design Installation Steps

1. Ensure all components leading to the GSF system are installed properly. Outlet filters are required with the GSF system. Connections of lines to tanks and distribution boxes must follow requirements of 410 IAC 6-8.3 or ISDH Rule 410 6-10.1.

2. Determine the number of GSF Modules required using Table 5.

3. Prepare the site. Do not install a system in saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas. Refer to IAC 6-8.3 or ISDH Rule 410 6-10.1, for all site preparation requirements prior to site construction.

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 system once it is complete. All drainage requirements shall be in accordance with 410 IAC 6-8.3 (59).

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

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

7. Place a minimum of 6 inches of Specified Sand in the basal area and stabilize level. The first 6 inches of sand immediately under and around the perimeter of the GSF system must be **Indiana Department of Transportation (INDOT) Specification 23 Sand**. See Table 1 for more information on the sand and sieve specifications.

8. Place GSF modules with **PAINTED STRIPE FACING UP**. Each row of modules is laid level in its length and width, end to end, along their four-foot length on the Specified Sand layer. No mechanical connection is required between modules.

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. All distribution piping must meet the requirements of ISDH Rule 410 6-8.3 Section 67 or ISDH Rule 410 6-10.1 Section 75.

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

11. (Pressure Distribution Systems) Insert a Sch. 40 pressure pipe which meets 410 IAC 6-8.3 (67) or ISDH Rule 410 6-10.1 (75), into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o’clock position as shown in Figure 26. Each pressure lateral will have a drain hole at the distal end of the lateral at the 6 o’clock position. Each pressure lateral shall have a clean out at the end of the row.

12. The distribution pipe shall be capped or vented.

13. **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.

14. 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.
4.2 Sloped Subsurface Bed Design Installation Steps

15. Complete backfill with cover soil material to a minimum of 12 – 19 inches measured from the top of the 4-inch distribution pipe. Fill must be clean, porous and able to sustain vegetation. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly.

16. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.
5.0 Elevated Sand Mound Design and Installation

5.0.1 ACCEPTABLE METHODS OF DISTRIBUTION: Elevated Sand Mounds require pressure distribution.

5.0.2 GENERAL CROSS SECTION

FIGURE 14: ELEVATED SAND MOUND CROSS SECTION

All elevated sand mound systems are required to have a minimum of:

- 12 inches of Specified Sand at the edges of the GSF module.
- 12 inches of Specified Sand at the beginning and end of each GSF Row.
- 12 inches of Specified Sand directly below the GSF module.
- Minimum 12 inches of cover soil material above the 4-inch distribution pipe.

5.0.3 VERTICAL SEPARATION TO SEASONAL HIGH WATER TABLE OR LIMITING LAYER: Refer to section Rule 410 IAC 6-8.3 72.b.4 for elevated systems or ISDH Rule 410 6-10.1 (61).

<table>
<thead>
<tr>
<th>System Type</th>
<th>Daily Design Flow</th>
<th>Limiting Layer</th>
<th>Seasonal High Water Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated Sand Mound (12” of sand under GSF modules and a pressure distribution network)</td>
<td>Any</td>
<td>20”</td>
<td>20”</td>
</tr>
</tbody>
</table>

VSD measured from the existing grade for the elevated sand mound system.

5.0.4 ELEVATED SAND MOUND SYSTEM: Follow the requirements in 410 IAC 6-8.3 (79) to complete the mound. When placing the Eljen application area on the basal area, there must be 12 inches of INDOT SPEC 23 Sand under the A42 or B43 Modules.

5.0.5 APPLICATION AREA REQUIREMENTS: The application area is the GSF Module and the upslope and downslope sand from the module. Modules may not have more than one foot of sand up or downslope of any module. The maximum distance of the distribution cell edge measured to the module is one foot, and the minimum distance to the distribution cell edge is six inches.

5.0.6 PLACEMENT OF THE ELJEN APPLICATION AREA: Place the Eljen application area in the middle of the basal area for sites with slopes less than 0.5%. For sites with greater than 0.5% slope, place the Eljen application area along the upper edge of the basal area.

5.0.7 DISPERSAL AREA: Dispersal area requirements are located in IAC 6-8.3 (58) or ISDH Rule 410 6-10.1 (62).
5.0 Elevated Sand Mound Design and Installation

5.0.8 SAND EXTENSION: For Elevated Sand Mound systems between 0.5% and 6% slope, a minimum of 4 feet of INDOT SPEC 23 sand extending from the edge of the furthest downslope GSF module is required. If the design calls for less sand than prescribed above, add a downslope sand extension to meet the minimum 4 foot sand requirements from the edge of the furthest downslope GSF module.

5.0.9 MINIMUM SLOPE REQUIREMENTS: Maintain a 3:1 slope or gentler for all slopes off the application area. Elevated systems using GSF modules will not be permitted on slopes greater than 6%.

5.0.10 SUBSURFACE DRAINS: If subsurface drains are utilized they must remain 10 feet from the edge of the system sand perimeter.

FIGURE 15: CROSS SECTION – MOUND SYSTEM

EXISTING GRADE GREATER THAN 0.5%

FIGURE 16: PLAN VIEW – MOUND SYSTEM
5.1 Elevated Sand Mound Design Example

Example 4 – Elevated Sand Mound – A42 Modules – Greater than 0.5% - 6% slope.
House Size: 4 bedrooms
Daily Design Flow: 4 Bedrooms x 150 gallons per day 600 gpd
Slope of site: 6%
Soil Loading Rate: 0.25 gpd/ft²

A42: Minimum number of modules per bedroom: 6 per Bedroom x 4 Bedrooms 24 A42 Modules
B43: Minimum number of modules per bedroom: 6 per Bedroom x 4 Bedrooms 24 B43 Modules

CALCULATE VARIABLES:

A – Distribution cell width = 4 ft
(NOTE: The minimum width of distribution cell is 4 ft.)
Cell width must conform to 6-8.3 (79) (3) (A)
Consult the state code, 6-8.3 (79) (a) (3). Minimum distribution cell width is 4 feet for all systems. If the site permits, promote long and narrow systems. For this example, the maximum distribution cell width is:

Maximum Distribution Cell Width (ft) = 0.83 $\sqrt{\frac{DDF \text{ (gpd)} \times SLR \text{ (gpd/ft²)}}{n}}$

<table>
<thead>
<tr>
<th>DDF (gpd)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1500</td>
<td>3</td>
</tr>
<tr>
<td>1501 - 3000</td>
<td>4</td>
</tr>
<tr>
<td>3001 - 4000</td>
<td>5</td>
</tr>
</tbody>
</table>

For this example, the maximum distribution cell width is: 5.8 ft

B – Distribution cell length = Daily Design Flow ÷ 1.2 gpd/ft² (constant) ÷ Distribution Cell Width
600 gpd ÷ 1.2 gpd/ft² ÷ 4 ft = 125 ft

Modules required – Modules required are determined by (Distributions Cell Length – 1) ÷ 4
Modules required = (125 – 1) ÷ 4 = 31 modules
For this system we decided to use B43s. For this system, use 31 B43 Modules.

C – Up slope sand depth under distribution cell = Minimum 12 inches
(NOTE: For this example, assume the depth of sand at the up-slope edge of the distribution cell is 1 ft to maintain separation distance from the infiltrative layer. Note: Infiltrative layer is measured to sand/soil interface.)

D – Down slope sand depth under distribution cell = Minimum 12 inches
C + (Slope of site x A)
1 ft + (0.06 x 4 ft) = 1.2 ft

E – Distribution cell depth – Constant 7 in., convert to feet – 0.6 ft
5.1 Elevated Sand Mound Design Example

F – Depth of final cover = 16 inches or 1.3 ft, this includes cover and pipe over the module.
(NOTE: For the side slope of the mound, we are using a required 3:1 slope)

G – Distance from edge of distribution cell to down slope edge of system:
    Down slope correction factor = 100 ÷ [100 – (side slope x % ground slope)]
    100 ÷ [100 – (3 x 6)] = 1.2
    3 x (D + E + F) x Down slope correction factor + .5 ft for Berm
    3 x (1.2 + 0.6 + 1.3) x 1.2 + .5 = 11.7 ft

H – Distance from edge of distribution cell to up slope edge of system
    Up slope correction factor = 100 ÷ [100 + (side slope x % ground slope)]
    100 ÷ [100 + (3 x 6)] = 0.9
    3 x (C + E + F) x Up slope correction factor + .5 ft for Berm
    3 x (1 + 0.6 + 1.3) x 0.9 + .5 = 8.3 ft

I – Distance from end of distribution cell to edge of system
    3 x [(C + D)/2 + E + F] + .5 ft for Berm
    3 x [(1 + 1.2)/2 + 0.6 + 1.3] + .5 = 9.5 ft

L – Overall mound system length
    B + 2(I)
    125 ft + 2 (9.5 ft) = 144 ft

W – Overall mound system width
    A + G + H
    4 + 12.2 + 8.3 = 24.5 ft
5.1 Elevated Sand Mound Design Example

VERIFY MINIMUM REQUIREMENT MET:

**TABLE 7: MINIMUM ELEVATED SAND MOUND BASAL AREA REQUIRED**

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/ft²)</th>
<th>Minimum Basal Area Required (Square Feet)</th>
<th>A42 Modules per Room</th>
<th>B43 Modules per Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedrooms per House</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1.2</td>
<td>252</td>
<td>335</td>
<td>419</td>
</tr>
<tr>
<td>0.75</td>
<td>402</td>
<td>536</td>
<td>670</td>
</tr>
<tr>
<td>0.6</td>
<td>503</td>
<td>670</td>
<td>838</td>
</tr>
<tr>
<td>0.5</td>
<td>603</td>
<td>804</td>
<td>1005</td>
</tr>
<tr>
<td>0.25</td>
<td>1206</td>
<td>1608</td>
<td>2010</td>
</tr>
</tbody>
</table>

Notes:
- The Minimum Basal Areas have been adjusted to reflect a 33% reduction in absorption field area.
- Any jetted bath tub with a capacity greater than 125 gallons will be treated as an extra bedroom for the system sizing requirements per Rule 410 IAC 6-8.3.

Using the Table 7, determine required basal area

Minimum required basal area: 

Determine the Minimum Distribution Cell Size: Daily Design Flow $\div$ 1.2 gpd/ft² 

600 gpd $\div$ 1.2 gpd/ft² 

1608 ft²

Determine minimum downslope area needed: Minimum required basal area – minimum distribution cell size 

1608 ft² - 500 ft² 

1108 ft²

Determine if Design meets required downslope. 

B (Distribution Cell Length) x G 

125 ft x 11.7 ft 

1462.5 ft²

Since 1462.5 ft² is greater than 1108 ft², the design meets the minimum basal area requirements.

Make sure to consult Rule 410 IAC 6-8.3-80 or ISDH Rule 410 6-10.1 Section 87, Design of Basal Area. In this example, the sand extension from the distribution cell meets the minimum requirements. Final Dimensions of the system are on the following page.

**DESIGN REQUIREMENT:** 410 IAC 6-8.3-80 and ISDH Rule 410 6-10.1 Section 87 state use the greater result: (for this section, the Distribution Cell Width is equivalent to the Aggregate Bed Width referred to in section 80)

a) Minimum basal area sand width = minimum basal area (from Table 8) $\div$ length of bed (B) 

1608 ft² $\div$ 125 ft = 12.86 ft

b) For slopes, less than or equal to 0.5%: 

Eljen application area width + 14 ft

c) For slopes, greater than 0.5%: 

Eljen application area width + 9 ft 

4 ft + 9 ft = 13 ft

Actual basal area width is A + G. 4 ft + 11.7 = 15.7 ft

From section 6-8.3-80 it was determined the system required a minimum of 13 ft of Eljen application area width and downslope basal width. The design is more (Actual basal area width = 16.9 ft) and G (Distance from edge of distribution cell to down slope edge of system) shall not be increased.
5.1 Elevated Sand Mound Design Example

FIGURE 17: CROSS SECTION – MOUND SYSTEM
EXISTING GRADE GREATER THAN 0.5%

FIGURE 18: PLAN VIEW – MOUND SYSTEM

FIGURE 19: PLAN VIEW – 600 GPD – APPLICATION AREA MOUND SYSTEM
5.2 Elevated Sand Mound Installation Steps

1. Ensure all components leading to the GSF system are installed properly. Outlet filters are required with the GSF system. Connections of lines to tanks and distribution boxes must follow requirements of 410 IAC 6-8.3 or ISDH Rule 410 6-10.1.

2. Determine the mound dimensions using Table 7.

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. Refer to ISDH Rule 410 6-8.3 Section 86 or ISDH Rule 410 6-10.1 Section 94.

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 system once it is complete. All drainage requirements shall be in accordance with 410 IAC 6-8.3 (59) or 410 6-10.1 (63).

5. Scarify the basal layer to maximize the interface between the native soil and Specified Sand. Minimize walking on the receiving layer prior to placement of the Specified Sand.

6. Place Specified Sand in two 6-inch lifts, stabilize after each lift. The stabilized height below the GSF module must be level at 12 inches. All of the sand used in the construction of the system sand components must be INDIANA DEPARTMENT OF TRANSPORTATION (INDOT) SPECIFICATION 23 SAND. See Table 1 for more information on the sand and sieve specifications. Refer to ISDH Rule 410 6-8.3 Section 87 or ISDH Rule 410 6-10.1 Section 95.

7. Place GSF modules with PAINTED STRIPE FACING UP, level in its length and width, end to end, along their four-foot length on the Specified Sand layer.

8. 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.

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

10. Insert a Sch. 40 pressure pipe which meets 410 IAC 6-8.3 (67) or ISDH Rule 410 6-10.1 (75), into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o’clock position as shown in Figure 26. Each pressure lateral will have a drain hole at the distal end of the lateral at the 6 o’clock position. Each pressure lateral shall have a clean out at the end of the trench.

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. Place a minimum of 12 inches of Specified Sand along both sides of the modules edge. A minimum of 12 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.

13. Complete backfill with cover soil material to a minimum of 12 – 19 inches measured from the top of the 4-inch distribution pipe. Fill must be clean, porous and able to sustain vegetation. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly. Placement of the soil material and final grade shall be in accordance with 410 IAC6-8.3-89 (a)-(c).

14. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion. All drainage requirements shall be in accordance with 410 IAC 6-8.3 (59)
6.0 Above Grade Bed Design and Installation

6.0.1 ACCEPTABLE METHODS OF DISTRIBUTION: Gravity, dosed and pressure distribution are acceptable.

6.0.2 GENERAL CROSS SECTION

FIGURE 20: SUBSURFACE BED CROSS SECTION

All above grade bed systems are required to have a minimum of:

- 6 inches of Specified Sand at the edges of the GSF module.
- 6 inches of Specified Sand at the beginning and end of each GSF Row.
- 12 inches of Specified Sand directly below the GSF module.
- Minimum 12 inches of cover soil material above the 4-inch distribution pipe

6.0.4 VERTICAL SEPARATION TO SEASONAL HIGH WATER TABLE OR LIMITING LAYER: Refer to section Rule 410 IAC 6-8.3 72.b.4 for above grade beds or ISDH Rule 410 6-10.1 (61).

<table>
<thead>
<tr>
<th>Vertical Separation Distance (VSD)</th>
<th>System Type</th>
<th>Daily Design Flow</th>
<th>Limiting Layer</th>
<th>Seasonal High Water Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above Grade Bed (12&quot; of sand under GSF module)</td>
<td>Any</td>
<td>20&quot;</td>
<td>20&quot;</td>
<td></td>
</tr>
</tbody>
</table>

VSD measured from the existing grade for the above grade bed system.

6.0.5 DISTRIBUTION BOX: Parallel distribution is preferred. Sequential distribution may be utilized for sloping sites and must conform to 1.1.4. Distribution boxes are recommended to be 5 feet from the proximal end of each soil absorption field row as per Rule 410 IAC 6-8.3 Section 75.i or ISDH Rule 410 6-10.1 Section 74. This may be amended to shorter distance per the designer.

6.0.6 PARALLEL DISTRIBUTION: Parallel distribution is the preferred method of application 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.

6.0.7 ROWS REQUIRED: All bed systems shall have a minimum of two rows of modules.

6.0.8 ROW LENGTH: Rows will have a maximum of 100 ft in length unless pressure distribution is used per 410 IAC 6-8.3 (74) (r) or ISDH Rule 410 6-10.1 (82) (r).

6.0.9 EQUAL LENGTH: Rows must be of equal length in order to provide equal distribution.

6.0.10 DISPERSAL AREA: Dispersal area requirements are located in IAC 6-8.3 (58) or ISDH Rule 410 6-10.1 (62).
6.0 Above Grade Bed Design and Installation

6.0.11 MINIMUM SLOPE REQUIREMENTS: Maintain a 3:1 slope or gentler for all slopes off the application area. Elevated systems using GSF modules will not be permitted on slopes greater than 6%.

6.0.12 SUBSURFACE DRAINS: If subsurface drains are utilized they must remain 10 feet from the edge of the system sand perimeter.

6.0.13 SIZING GSF SYSTEMS:

**TABLE 8: GSF ABOVE GRADE BED SIZING CHART**

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/sf)</th>
<th>Minimum Basal Area Required (Square Feet)</th>
<th>A42 Modules per Room</th>
<th>B43 Modules per Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedrooms per House</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1.2</td>
<td>252</td>
<td>335</td>
<td>419</td>
</tr>
<tr>
<td>0.75</td>
<td>402</td>
<td>536</td>
<td>670</td>
</tr>
<tr>
<td>0.6</td>
<td>503</td>
<td>670</td>
<td>838</td>
</tr>
<tr>
<td>0.5</td>
<td>603</td>
<td>804</td>
<td>1005</td>
</tr>
<tr>
<td>0.25</td>
<td>1206</td>
<td>1608</td>
<td>2010</td>
</tr>
</tbody>
</table>

**Notes:**
- The Minimum Basal Areas have been adjusted to reflect a 33% reduction in absorption field area.
- Any jetted bath tub with a capacity greater than 125 gallons will be treated as an extra bedroom for the system sizing requirements per Rule 410 IAC 6-8.3.

6.0.14 SYSTEM LENGTH AND WIDTH: Best engineering practices should be used when construction the bed systems. Rule IAC 6-8.3 (79) (2) and ISDH Rule 410 6-10.1 (87) (b) states the dimensions of the bed shall be as long and narrow as the site allows.

6.0.15 BED DESIGN: For beds with less than a 0.5% slope, evenly distribute the bed laterals in the basal area. A minimum separation distance between laterals for A42’s is 3’ and a minimum separation distance between laterals of 4’ for B43’s.
6.1 Above Grade Bed Design Example

Example 5: Above Grade Bed System – A42 Modules – 0.0 – 0.5% Slope

House size: 4 Bedrooms
Design Flow: 600 gpd
Soil Loading Rate: 0.25 gpd/ft²
Absorption Field Type: Bed
Site Slope: Less than 0.5%

Calculate Minimum Basal Area and Units Required

Refer to Table 8 for the minimum number of units and minimum basal area required for installation.

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/sf)</th>
<th>Minimum Basal Area Required (Square Feet)</th>
<th>A42 Modules per Room</th>
<th>B43 Modules per Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.25</td>
<td>1206</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>1608</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Units required per bedroom x bedrooms = Total units required
A42: 13 units/bedroom x 4 bedrooms = 52 A42s  B43: 11 units/bedroom x 4 bedrooms = 44 B43s

Calculate Minimum Bed Basal Area Length

For This Example, Assume the Number of Bed Rows Equals Two (this encourages the longest and narrowest subsurface bed design):

A42: 52 units ÷ 2 rows = 26 modules per row
A42: 26 units x 4 ft/unit + 1 ft = 105 linear ft
B43: 44 units ÷ 2 rows = 22 modules per row
B43: 22 units x 4 ft/unit + 1 = 89 linear ft

Calculate Bed Basal Area Width

a) Minimum A42 Basal Area Width
a) Minimum B43 Basal Area Width

A42: 1608 ft² ÷ 105 ft = 15.3 ft,
b) round to 16 ft

A42: Use greater width of a or b: 16 ft
B43: Use greater width of a or b: 19 ft

Determine Lateral Spacing

Center to Center of Lateral Spacing = Bed Width ÷ Rows
A42: 16 ft ÷ 2 rows = 8 ft
B43: 19 ft ÷ 2 rows = 9.5 ft

Edge to Center of Lateral Spacing = Center to Center of Lateral Spacing ÷ 2
A42: 8 ft ÷ 2 = 4 ft
B43: 9.5 ft ÷ 2 = 4.75 ft
6.1 Above Grade Bed Design Example

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

<table>
<thead>
<tr>
<th></th>
<th>A42</th>
<th>B43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal Area Length:</td>
<td>105 ft</td>
<td>89 ft</td>
</tr>
<tr>
<td>Basal Area Width:</td>
<td>16 ft</td>
<td>19 ft</td>
</tr>
<tr>
<td>Minimum Number of Units:</td>
<td>52 A42 Modules</td>
<td>44 B43 Modules</td>
</tr>
<tr>
<td>Center to Center Spacing:</td>
<td>8 ft</td>
<td>9.5 ft</td>
</tr>
<tr>
<td>Edge to Center Spacing:</td>
<td>4 ft</td>
<td>4.75 ft</td>
</tr>
<tr>
<td>Designed Basal Area:</td>
<td>1,680 ft²</td>
<td>1,691 ft²</td>
</tr>
</tbody>
</table>

**FIGURE 21: PLAN VIEW – 600 GPD – A42 – BED SYSTEM – ≤ 0.5% SLOPE**

**FIGURE 22: CROSS SECTION VIEW – 600 GPD – A42 – BED SYSTEM – ≤ 0.5% SLOPE**
6.2 Above Grade Bed Design Installation Steps

1. Ensure all components leading to the GSF system are installed properly. Outlet filters are required with the GSF system. Connections of lines to tanks and distribution boxes must follow requirements of 410 IAC 6-8.3 or ISDH Rule 410 6-10.1.

2. Determine the number of GSF Modules required using Table 8.

3. Prepare the site. Do not install a system in saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas. Refer to IAC 6-8.3 or ISDH Rule 410 6-10.1, for all site preparation requirements prior to site construction.

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 system once it is complete. All drainage requirements should be in accordance with 410 IAC 6-8.3 (59) or ISDH Rule 410 6-10.1 (63).

5. Scarify the receiving layer to maximize interface between the native soil and Specified Sand.

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

7. Place Specified Sand in two 6-inch lifts, stabilize after each lift. The stabilized height below the GSF module must be level at 12 inches. All of the sand used in the construction of the system sand components must be INDIANA DEPARTMENT OF TRANSPORTATION (INDOT) SPECIFICATION 23 SAND. See Table 1 for more information on the sand and sieve specifications.

8. Place GSF modules with PAINTED STRIPE FACING UP. Each row of modules is laid level in its length and width, end to end, along their four-foot length on the Specified Sand layer. No mechanical connection is required between modules.

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. All distribution piping must meet the requirements of ISDH Rule 410 6-8.3 Section 67 or ISDH Rule 410 6-10.1 Section 75.

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

11. (Pressure Distribution Systems) Insert a Sch. 40 pressure pipe which meets 410 IAC 6-8.3 (67) or ISDH Rule 410 6-10.1 (75), into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o’clock position as shown in Figure 26. Each pressure lateral will have a drain hole at the distal end of the lateral at the 6 o’clock position. Each pressure lateral shall have a clean out at the end of the row.

12. The distribution pipe shall be capped or vented.

13. **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.

14. 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 in gravity distribution. A minimum of 12 inches of Specified Sand is placed in between module rows.
6.2 Above Grade Bed Design Installation Steps

15. Complete backfill with cover soil material to a minimum of 12 – 19 inches measured from the top of the 4-inch distribution pipe. Fill must be clean, porous and able to sustain vegetation. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly. Placement of the soil material and final grade shall be in accordance with 410 IAC6-8.3-89 (a)-(c).

16. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.
7.0 Sloped Above Grade Bed Design and Installation

7.0.1 ACCEPTABLE METHODS OF DISTRIBUTION: Gravity, dosed and pressure distribution are acceptable.

7.0.2 GENERAL CROSS SECTION

**FIGURE 23: SLOPED ABOVE GRADE BED CROSS SECTION**

All sloped above grade bed systems are required to have a minimum of:

- 6 inches of Specified Sand at the edges of the GSF module.
- 6 inches of Specified Sand at the beginning and end of each GSF Row.
- 12 inches of Specified Sand directly below the GSF module.
- Minimum 12 inches of cover soil material above the 4-inch distribution pipe

7.0.3 VERTICAL SEPARATION TO SEASONAL HIGH-WATER TABLE OR LIMITING LAYER: Refer to section Rule 410 IAC 6-8.3 72.b.4 above grade beds or ISDH Rule 410 6-10.1 (61).

<table>
<thead>
<tr>
<th>Vertical Separation Distance (VSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Type</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Above Grade Bed (12” of sand under GSF module)</td>
</tr>
</tbody>
</table>

VSD measured from the original grade for the sloped above grade bed system.

7.0.4 DISTRIBUTION BOX: Parallel distribution is preferred. Sequential distribution may be utilized for sloping sites and must conform to 1.1.4. Distribution boxes are recommended to be 5 feet from the proximal end of each soil absorption field row as per Rule 410 IAC 6-8.3 Section 75.i or ISDH Rule 410 6-10.1 Section 74. This may be amended to shorter distance per the designer.

7.0.5 PARALLEL 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.

7.0.6 ROW LENGTH: Rows will have a maximum of 100 ft in length unless pressure distribution is used per 410 IAC 6-8.3 (74) (r) or ISDH Rule 410 6-10.1 (82) (r).

7.0.7 ROWS REQUIRED: All bed systems shall have a minimum of two rows of modules.

7.0.8 EQUAL LENGTH: Rows must be of equal length in order to provide equal distribution.

7.0.9 DISPERSAL AREA: Dispersal area requirements are located in IAC 6-8.3 (58) or ISDH Rule 410 6-10.1 (62).
7.0 Sloped Above Grade Bed Design and Installation

7.0.10 SAND EXTENSION: For Above Grade Bed sloping systems between 0.5% and 6% slope, a minimum of 4 feet of INDOT SPEC 23 sand extending from the edge of the furthest downslope GSF module is required. If the design calls for less sand than prescribed above, add a downslope sand extension to meet the minimum 4 foot sand requirements from the edge of the furthest downslope GSF module.

7.0.11 MINIMUM SLOPE REQUIREMENTS: Maintain a 3:1 slope or gentler for all slopes off the application area. Elevated systems using GSF modules will not be permitted on slopes greater than 6%.

7.0.12 SUBSURFACE DRAINS: If subsurface drains are utilized they must remain 10 feet from the edge of the system sand perimeter.

7.0.13 SIZING GSF SYSTEMS:

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/sf)</th>
<th>Minimum Basal Area Required (Square Feet)</th>
<th>A42 Modules per Room</th>
<th>B43 Modules per Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedrooms per House</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1.2</td>
<td>252</td>
<td>335</td>
<td>419</td>
</tr>
<tr>
<td>0.75</td>
<td>402</td>
<td>536</td>
<td>670</td>
</tr>
<tr>
<td>0.5</td>
<td>603</td>
<td>804</td>
<td>1005</td>
</tr>
<tr>
<td>0.25</td>
<td>1206</td>
<td>1608</td>
<td>2010</td>
</tr>
</tbody>
</table>

Notes:
- The Minimum Basal Areas have been adjusted to reflect a 33% reduction in absorption field area.
- Any jetted bath tub with a capacity greater than 125 gallons will be treated as an extra bedroom for the system sizing requirements per Rule 410 IAC 6-8.3.

7.0.14 SYSTEM LENGTH AND WIDTH: Best engineering practices should be used when construction the bed systems. Rule IAC 6-8.3 (79) (2) and ISDH Rule 410 6-10.1 (87) (b) states the dimensions of the bed shall be as long and narrow as the site allows.

7.0.15 BED DESIGN: For beds with less than a 0.5% slope, evenly distribute the bed laterals in the basal area. A minimum separation distance between laterals for A42’s is 3’ and a minimum separation distance between laterals of 4’ for B43’s.
Example 6: Above Grade Bed System – A42 Modules – Greater than 0.5% slope

<table>
<thead>
<tr>
<th>Soil Loading Rate (gpd/sf)</th>
<th>Required Area of Absorption Field (Square Feet)</th>
<th>A42 Modules per Room</th>
<th>B43 Modules per Room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bedrooms per House</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1206</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1608</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2010</td>
<td></td>
</tr>
</tbody>
</table>

Units required per bedroom x bedrooms = Total units required
A42: 13 units/bedroom x 3 bedrooms = 39 A42s
B43: 11 units/bedroom x 3 bedrooms = 33 B43s

Calculate Minimum Bed Basal Area Length
For This Example, Assume the Number of Bed Rows Equals Two (this encourages the longest and narrowest subsurface bed design):

- Modules per row: Modules Needed ÷ Rows
  - A42: 39 units ÷ 2 rows = 19.5 modules per row
  - B43: 33 units ÷ 2 rows = 16.5 modules per row
- A42: 20 units x 4 ft/unit + 1 ft = 81 linear ft
- B43: 17 units x 4 ft/unit + 1 = 69 linear ft

Determine Lateral Spacing

<table>
<thead>
<tr>
<th>Slope</th>
<th>Upper Edge to Lateral Spacing</th>
<th>Lateral to Lateral Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A42</td>
<td>B43</td>
</tr>
<tr>
<td></td>
<td>A42</td>
<td>B43</td>
</tr>
<tr>
<td>0.5% - 6%</td>
<td>Min 1.5 ft</td>
<td>Min 2 ft</td>
</tr>
<tr>
<td></td>
<td>Min 3 ft</td>
<td>Min 4 ft</td>
</tr>
</tbody>
</table>

Lateral to Lateral Spacing from above table.
A42: 3 ft
B43: 4 ft

Upper Edge to Lateral Spacing from above table.
A42: 1.5 ft
B43: 2 ft

Calculate Bed Basal Area Width

a) Minimum A42 Basal Area Width
- A42: Rows x 3 ft = 2 x 3 ft = 6 ft

or
b) Proposed Basal Area Width
- A42: 1206 ft² ÷ 81 ft = 14.8 ft,
  - round to 15 ft

A42: Use greater width of a or b: 15 ft

a) Minimum B43 Basal Area Width
- B43: Rows x 4 ft = 2 x 4 ft = 8 ft

or
b) Proposed Basal Area Width
- B43: 1206 ft² ÷ 69 ft = 17.5 ft,
  - round to 17.5 ft

B43: Use greater width of a or b: 17.5 ft
7.1 Sloped Above Grade Bed Design Example

**DESIGN REQUIREMENT:** 410 IAC 6-8.3-80 states use the greater result: (for this section, the Minimum Bed Width is equivalent to the Aggregate Bed Width referred to in section 80)

a) Minimum basal area width = minimum basal area (from Table 9) ÷ bed basal area length

   \[
   \text{A42: } 1206 \text{ ft}^2 \div 81 \text{ ft} = 14.9 \text{ ft} \\
   \text{B43: } 1206 \text{ ft}^2 \div 69 \text{ ft} = 17.5 \text{ ft}
   \]

b) For slopes, greater than 0.5%:

   Minimum Basal Area Width + 9 ft

   \[
   \text{A42: } 6 \text{ ft} + 9 \text{ ft} = 15 \text{ ft} \\
   \text{B43: } 8 \text{ ft} + 9 \text{ ft} = 17 \text{ ft}
   \]

   Minimum basal area width is the greater of a or b.

   A42: a) 14.9 ft \\
   A42: b) 15 ft \\
   Use 15 ft for Basal Area Width

   B43: a) 17.5 ft \\
   B43: b) 17 ft \\
   Use 17.5 ft for Basal Area Width

**Final Dimension Layout**

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

<table>
<thead>
<tr>
<th>A42</th>
<th>B43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal Area Length:</td>
<td>81 ft</td>
</tr>
<tr>
<td>Basal Area Width:</td>
<td>15 ft</td>
</tr>
<tr>
<td>Minimum Number of Units:</td>
<td>40 A42 Modules</td>
</tr>
<tr>
<td>Center to Center Spacing:</td>
<td>3 ft</td>
</tr>
<tr>
<td>Edge to Center Spacing:</td>
<td>1.5 ft</td>
</tr>
<tr>
<td>Designed Basal Area:</td>
<td>1,215 ft²</td>
</tr>
</tbody>
</table>
7.1 Sloped Above Grade Bed Design Example

FIGURE 24: PLAN VIEW – 450 GPD – A42 – BED SYSTEM – 0.5% - 6% SLOPE

FIGURE 25: CROSS SECTION VIEW – 450 GPD – A42 – BED SYSTEM – 0.5% - 6% SLOPE
7.2 Sloped Above Grade Design Installation Steps

1. Ensure all components leading to the GSF system are installed properly. Outlet filters are required with the GSF system. Connections of lines to tanks and distribution boxes must follow requirements of 410 IAC 6-8.3 or ISDH Rule 410 6-10.1.

2. Determine the number of GSF Modules required using Table 9.

3. Prepare the site. Do not install a system in saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas. Refer to IAC 6-8.3 or ISDH Rule 410 6-10.1, for all site preparation requirements prior to site construction.

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 system once it is complete. All drainage requirements should be in accordance with 410 IAC 6-8.3 (59) or ISDH Rule 410 6-10.1 (63).

5. Scarify the receiving layer to maximize interface between the native soil and Specified Sand.

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

7. Place Specified Sand in two 6-inch lifts, stabilize after each lift. The stabilized height below the GSF module must be level at 12 inches. All of the sand used in the construction of the system sand components must be INDIANA DEPARTMENT OF TRANSPORTATION (INDOT) SPECIFICATION 23 SAND. See Table 1 for more information on the sand and sieve specifications. Refer to Section 87 of the Rule.

8. Place GSF modules with PAINTED STRIPE FACING UP. Each row of modules is laid level in its length and width, end to end, along their four-foot length on the Specified Sand layer. No mechanical connection is required between modules.

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. All distribution piping must meet the requirements of ISDH Rule 410 6-8.3 Section 67 or ISDH Rule 410 6-10.1 Section 75.

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

11. (Pressure Distribution Systems) Insert a Sch. 40 pressure pipe which meets 410 IAC 6-8.3 (67) or ISDH Rule 410 6-10.1 (75), into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o’clock position as shown in Figure 26. Each pressure lateral will have a drain hole at the distal end of the lateral at the 6 o’clock position. Each pressure lateral shall have a clean out at the end of the row.

12. The distribution pipe shall be capped or vented.

13. **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.

14. 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.
7.2 Subsurface Bed Design Installation Steps

15. Complete backfill with cover soil material to a minimum of 12 – 19 inches measured from the top of the 4-inch distribution pipe. Fill must be clean, porous and able to sustain vegetation. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing or shifting of pipe assembly. Placement of the soil material and final grade shall be in accordance with 410 IAC6-8.3-89 (a)-(c).

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

8.0 Dosing Distribution Requirements

8.0.1 ADDITIONAL REQUIREMENTS: Dosing tanks and effluent pumps must comply with ISDH Rule 410 6-8.3 Section 62 and 65 or 410 6-10.1 Section 70 and 73 for dosing tanks and effluent pumps.

Section 410 IAC 6-8.3 (78) or 410 6-10.1 (86) Subsurface Pressure Distribution is enforced except when noted. A design head of 3 feet is required for pressure distribution systems.

8.0.2 DOSE VOLUME: Dose volume is calculated as follows. Use a maximum of 3 gallons per dose per A42 module or 4 gallons per dose per B43 module in the system. For the A42, a minimum of 1.5 gallons per dose per module or 2 gallons per dose per B43 module.
9.0 Pressure Distribution Requirements

Standard procedures for design of pressure distribution networks apply to the GSF system. Eljen recommends using a 1.5-inch Sch. 40 pressure pipe with ¼ inch orifices placed 4-foot on center so the orifices fall in the center of each module. Each lateral will have one drain hole placed at the end of lateral at 6 o’clock. Engineers are allowed to design their own pressure distribution network as long as it falls within the ISDH guidelines.

All pressure distribution systems must be made of Sch. 40 pipe from 1 to 1.5 inch, have equivalent and equally spaced orifices, a drain hole and a pressure clean out or other means of flushing the pressure lateral.

The Sch. 40 pressure line is placed within a standard 4-inch perforated pipe. The perforation 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 26: PRESSURE PIPE PLACEMENT
9.0 Pressure Distribution Requirements

FIGURE 27: PRESSURE CLEAN OUT

FIGURE 28: CONTOURED TRENCH INSTALLATION

Figure 28 depicts a GSF Pressure Distribution trench placed on a contour or winding trenches to maintain horizontal separation distances. The above graphic could also be used in a dosed or gravity fed system if the pressure line was removed from the 4-inch diameter perforated distribution pipe.
10.0 Pump Controls

Pump 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 dosing tank and is secure from tampering and resistant to weather (minimum of NEMA4X). 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 force main so that they can be easily replaced and/or adjusted without removing the pump.

11.0 System Ventilation

11.0.1 SYSTEM VENTILATION: Air vents are required on all absorption systems located 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 Module has aeration channels inside the physical unit and in between the rows of 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.

Typically, 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 airflow and fully aerate the GSF system, it is important that air vents are located only on the distal end of the GSF pipe network.

11.0.2 VENTILATION PLACEMENT: In a GSF system, the vent is usually a 4-inch diameter pipe extended to a convenient location behind shrubs, as shown below. Non-perforated 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 29: GSF WITH 4” VENT EXTENDED TO CONVENIENT LOCATION
12.0 Inspection/Monitoring Port

The system shall include an Inspection/Monitoring Port designed and installed with access from the ground surface. It shall be open and slotted at the bottom, and be void of sand or gravel to the infiltrative surface to allow visual monitoring of standing liquid in the absorption field. The figures below depict construction and placement of the Inspection/Monitoring Port. For beds and elevated systems, place one port per lateral. At least one inspection port should be placed at the midpoint of a row. At the distal ends, use 90-degree elbows and extend to the surface as an additional inspection port, capped and sealed to be watertight. One inspection port should be located downslope in the toe as well.

**FIGURE 30: MONITORING WELL FOR SAND-SOIL INTERFACE**
13.0 Indiana GSF Registration Form

In accordance with manufacturers requirements for each installation, Indiana installers of Eljen systems must complete and fax, email or mail a copy of this form to one of the following addresses:

US Mail:

Eljen Corporation
125 McKee Street
East Hartford, CT
06108


Email: info@eljen.com – Subject: IN GSF System Installation Form

Fax: 860-610-0427 – Subject: Indiana GSF System Installation Form
13.0 Indiana GSF Registration Form

INSTALLED BY:  

<table>
<thead>
<tr>
<th>NAME</th>
<th>COMPANY</th>
<th>ADDRESS</th>
<th>TELEPHONE</th>
</tr>
</thead>
</table>

DESIGNED BY:  

<table>
<thead>
<tr>
<th>NAME</th>
<th>COMPANY</th>
<th>ADDRESS</th>
<th>TELEPHONE</th>
</tr>
</thead>
</table>

INSPECTED BY:  

<table>
<thead>
<tr>
<th>NAME</th>
<th>COMPANY</th>
<th>ADDRESS</th>
<th>TELEPHONE</th>
</tr>
</thead>
</table>

SITE LOCATION:  

<table>
<thead>
<tr>
<th>NAME</th>
<th>COMPANY</th>
<th>ADDRESS</th>
<th>TELEPHONE</th>
</tr>
</thead>
</table>

---

MODULES USED  
B43 (48in x 36in x 7in)  
A42 (48in x 24in x 7in)

---

NUMBER OF BEDROOMS  
1  2  3  4  5  (Number Greater than 5) ___

---

DAILY DESIGN FLOW: Number of Bedrooms x 150 gpd = _____________

---

SYSTEM CONFIGURATION:  
Subsurface Bed  
Above Grade Bed  
Trench  
Elevated sand mound

(Circle One)  
Subsurface requires 6 inches of sand beneath module  
Elevated sand mounds and above grade beds requires 12 in of sand beneath module

---

TYPE OF SYSTEM:  
Gravity  
Pressure  
Dosed

(Circle One)
AREA REDUCTION: Refer to section labeled notes below tables 5 and 6 on page 12

SITE SLOPE: Elevated Systems: (6% max slope) Subsurface System (15% max slope)
(Circle One)

TRENCH/LATERAL LENGTH:
Gravity and Dosed systems have a maximum length of 100 feet.

SUBSURFACE DRAINAGE
(Circle One)
Yes No

*Reference 410 IAC 6-8.3 (59) or 410 6-10.1 (63) for depth requirements of subsurface drainage.

VENTING
(Circle One)
Yes No

*Venting is required if system cover exceeds 18 inches.