Calculating Length and Width for Limiting Zone with ≥ 20 Inches of Suitable Soil

The final design square footage is dependent on the total number of required modules and corresponding specified sand dimensions.

These requirements will determine the proposed absorption area's length and width.

Length of the Absorption Area

To complete the final length calculation, the number of modules and the number of runs or rows must be known. This was covered in Lesson 3-2. The actual number of individual runs or rows will be determined by the proposed site and the corresponding area available for installation as well as the slope. The minimum length:width ratios for elevated systems are 4:1 for slopes > 8% but < 12% and 6:1 for slopes from 12 to 15%.

Gravity Flow and End Fed Pressure Distribution

Length of absorption area =

number of modules x 4 ft (module length) + 1 ft (6 inches of specified sand on each lateral end)

Example: 10 (modules) x 4 ft + 1 ft = 41 ft

Pressure Distribution and Central Manifold Distribution

Length of absorption area =

number of modules x 4 ft (module length) + 1 ft (6 inches of specified sand on each lateral end) +

.5 ft (manifold lateral offset if using center feed manifold)

Example: 10 (modules) x 4 ft + 1 ft + .5 ft = 41.5 ft

Calculating Length and Width for Limiting Zone With >20 Inches of Suitable Soil

Width of the run

To complete the width calculation, the average percolation rate is used. The rate will determine the inches of specified sand that must be placed on each side of the module. This sand width added to the standard 3-foot width of the module will provide the total width of the run. The run will be either a minimum of 4 feet wide (if the percolation rate is 3 to 60 minutes per inch) or a minimum of 6 feet wide (if the percolation rate is 61 to 180 minutes per inch). To determine the bed width, multiply the row width by the number of rows.

Percolation Rate 3-60 Minutes Per Inch

Minimum width of run = 4 feet

3 ft (module width) + 1 ft (6 inches of specified sand on each side of module)

Percolation Rate 61-180 Minutes Per Inch

Minimum width of run = 6 feet

3 ft (module width) + 3 ft (18 inches of specified sand on each side of module)

Calculating Length and Width for Limiting Zone With <20 Inches of Suitable soil

On sites with less than 20 inches of suitable soil, the shallow limiting zone elevated absorption area must be used. The soil morphological analysis and corresponding hydraulic linear loading rate (HLLR) table will determine the length and width of this absorption area. Minimum system length for a system design using the HLLR table is calculated by dividing peak daily flow (gpd) by the HLLR.

The shallow limiting zone elevated absorption area must be pressure dosed.

Pressure Distribution

End Manifold Configuration - Length of absorption area =
number of modules in an absorption area x 4 ft (module length) +
1 ft (6 inches of specified sand on each lateral end)

Central Manifold Configuration - Length of absorption area =
number of modules in an absorption area x 4 ft (module length) +
1 ft (6 inches of specified sand on each lateral end) + .5 ft (manifold lateral offset)

Calculating Length and Width for Limiting Zone <20 Inches of Suitable soil

Pressure Distribution

Width of absorption area

The HLLR and the infiltration loading rate (ILR) from the HLLR table will provide the minimum width of the absorption area.

If the width that results from the table is less than 4 feet, the required 6 inches of sand on both sides of the module must still be used. Therefore, the minimum absorption area width is 4 feet.

If the width is more than 4 feet, then additional sand will be required to meet the width required by the HLLR table.

Example: Required width (according to HLLR) = 4.5 feet

Round to nearest whole number

Required minimum width = 5 feet

5.0 ft. - 3 ft module = 2.0 ft of additional sand

The HLLR and the ILR will be provided by the qualified soil scientist. However, it is the local agency SEO's responsibility to verify that the loading rates are consistent with the information provided in the soil morphological report.

LESSON 3-3: Eljen GSF System Absorption Area Configurations

Example #1: An Elevated Absorption Area Pressure Dosing Design

Percolation Rate – 31 min/in
House size – 3 bedrooms
Design Flow – 400 gpd (Chapter 73.17)

A) Determine the square feet of Absorption Area per gallon per day:

Absorption area (ft^2) based on the percolation rate and peak daily flow
For a percolation rate of 31 min/in: ((Avg. Perc Rate - 30) x (0.026) + 1.50)) = 1.53 ft^2 per gallon (gal)
Absorption area for 3 bedroom: 400 gal/day x 1.53 ft^2 /gal = 612 ft^2
Reduce Absorption Area by 40%: 610 ft^2 x (1 – 0.4) = 368 ft^2.

B) Determine number of modules:

The B43 Module Basal Area is 16 ft^2 for percolation rates between 3 min/in – 60 min/in
Number of Modules = Reduced Trench Area ÷ B43 Basal Area: 368 ft^2 ÷ 16 ft^2 = 23.0, use a minimum of 23 Modules

LESSON 3-3: Eljen GSF System Absorption Area Configurations

Example #1: An Elevated Absorption Area Pressure Dosing Design (End feed)

C) Calculate Absorption Area Length:

(# of Mod ÷ # of Rows x 4 ft) + 1 ft of Specified Sand = Absorption Area Length

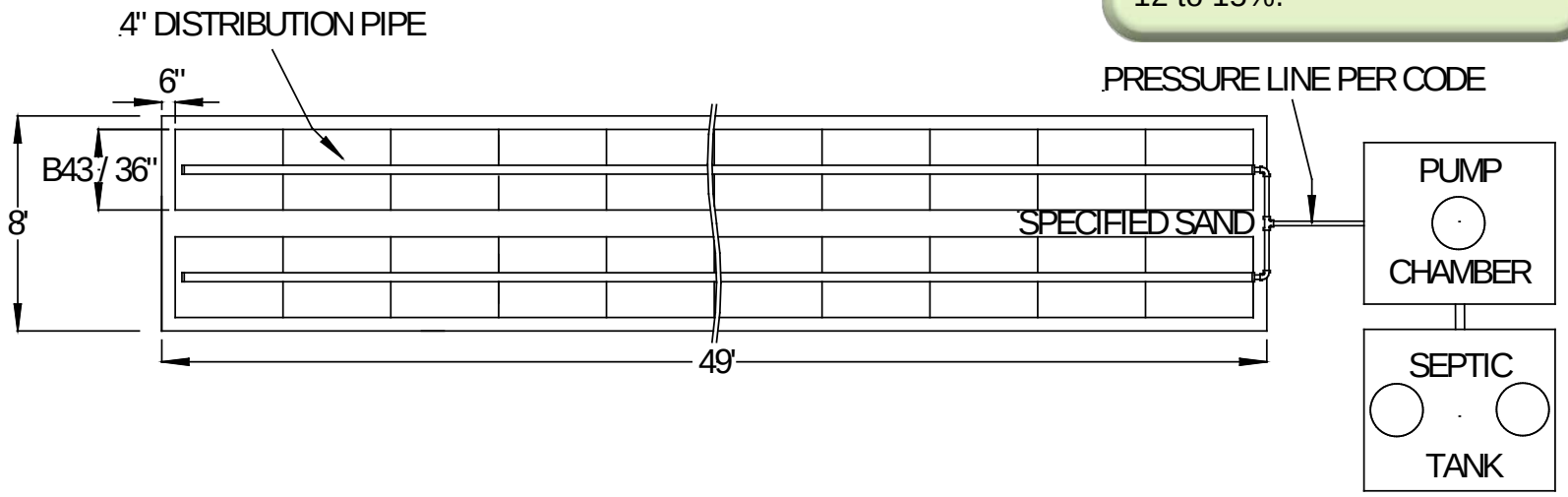
End feed: 2 Rows: 23 Mods ÷ 2 Rows = 11.5 Mods, use 12 Modules: 12 Mods x 4 ft + 1 ft = 49 ft Absorption Area Length

D) Calculate Approximate Run Width (For this example, we decided to use two rows):

The minimum width is 4 ft per row for percolation rates 3 – 60 min/in.

Since this system uses two rows, the minimum width is 4 ft x 2 rows = 8 ft.

The minimum length:width ratios for elevated systems are 4:1 for slopes > 8% but < 12% and 6:1 for slopes from 12 to 15%.



LESSON 3-3: Eljen GSF System Absorption Area Configurations

Example #1: An Elevated Absorption Area Pressure Dosing Design (Central Manifold)

C) Calculate Absorption Area Length:

(# of Mod ÷ # of Rows x 4 ft) + 1 ft of Specified Sand + 0.5 ft (Lateral Offset) = Absorption Area Length

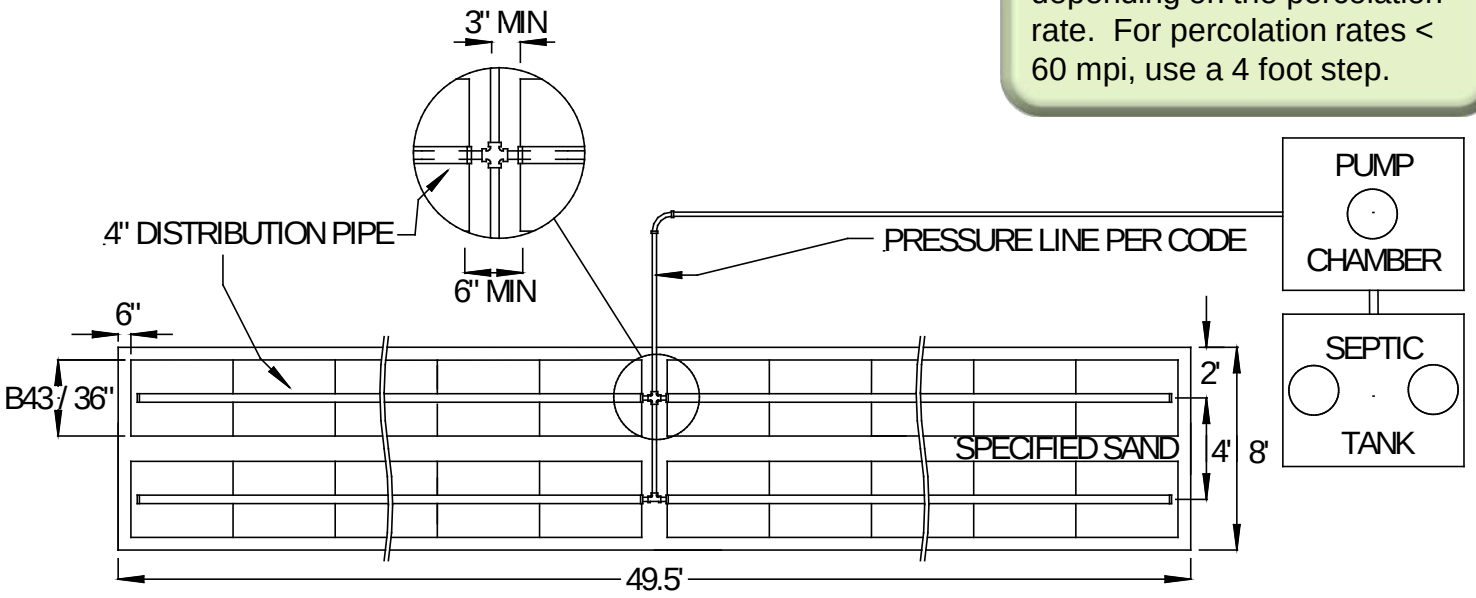
Central Manifold: 2 Rows: 23 Mods ÷ 2 Rows = 11.5 Mods, use 12 Modules: 12 Mods x 4 ft + 1 ft + 0.5 ft = 49.5 ft Absorption Area Length

D) Calculate Approximate Absorption Area Width (For this example, we decided to use two rows):

The minimum width is 4 ft per row for percolation rates 3 – 60 min/in.

Since this system uses two rows, the minimum width is 4 ft x 2 rows = 8 ft.

Eljen GSF units sit on either a 4 foot bench or 6 foot step depending on the percolation rate. For percolation rates < 60 mpi, use a 4 foot step.



LESSON 3-3: Eljen GSF System Absorption Area Configurations

Example #2: Shallow Limiting Zone Absorption Area (Less than 20 Inches from Limiting Horizon)

House size –	3 bedrooms
Design Flow –	400 gpd (Chapter 73.17)
Slope on the Limiting Horizon –	12%
Distance from Limiting Horizon –	15 in
Soil Characteristics	
Texture -	Silt Loam (SIL)
Structure	
Shape -	Fine – Sub angular - Blocky(BK)
Grade -	Friable - Weak (1)

A) Determine the Infiltration Loading Rate (gal/ft^2/day):

Refer to the Hydraulic Linear Loading Rate Table 1 of the Eljen listing to determine the Infiltration Loading Rate. Use the Soil Characteristics to determine the rate.

0.6 gal/ft^2/day

B) Determine the Hydraulic Linear Loading Rate (gal/ft/day):

Refer to the Hydraulic Linear Loading Rate Table 1 of the Eljen listing to determine the Hydraulic Linear Loading Rate. Use the Infiltration Loading Rate and information about the Limiting Horizon to determine the rate.

3.5 gal/ft/day

LESSON 3-3: Eljen GSF System Absorption Area Configurations

C) Determine Required Length of Bed: (Design Flow ÷ Hydraulic Linear Loading Rate)

(400 gpd ÷ 3.5 gpd/ft) = 114.3 ft, round up to 115 ft

D) Determine Width of Bed: Hydraulic Linear Loading Rate ÷ Infiltration Loading Rate

Bed width cannot be less than 4 ft. If the required trench width is smaller, increase to a 4 ft width, otherwise round up to the nearest whole foot.

3.5 gpd/ft ÷ 0.6 gpd/ft^2 = 5.8 ft, round up to 6 ft

E) Calculate the Number of Modules:

Number of Modules = Trench Length ÷ 4 ft/module

Number of Modules = 115 ÷ 4 ft = 28.75 Modules, round up to 29

LESSON 3-3: Eljen GSF System Absorption Area Configurations

End feed Calculations

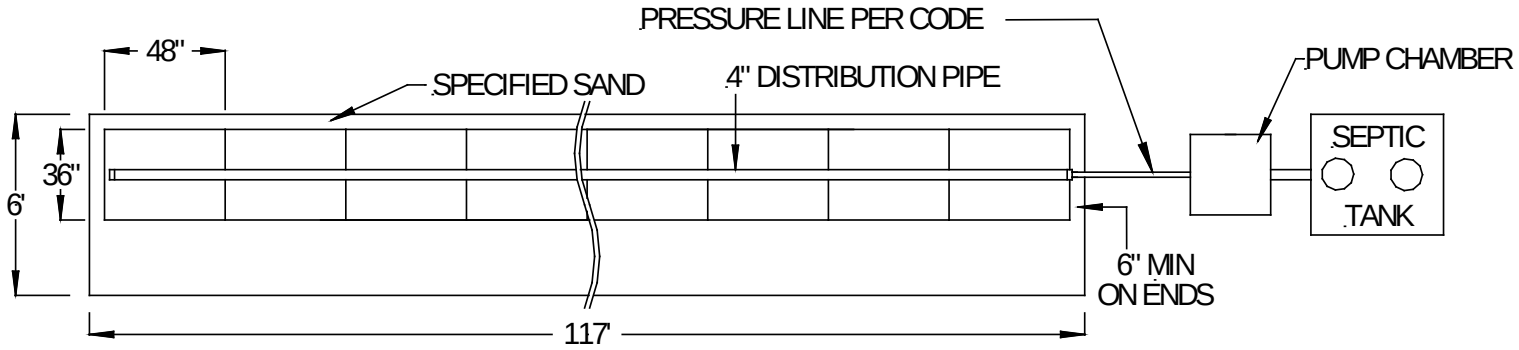
F) Determine Actual Trench Length:

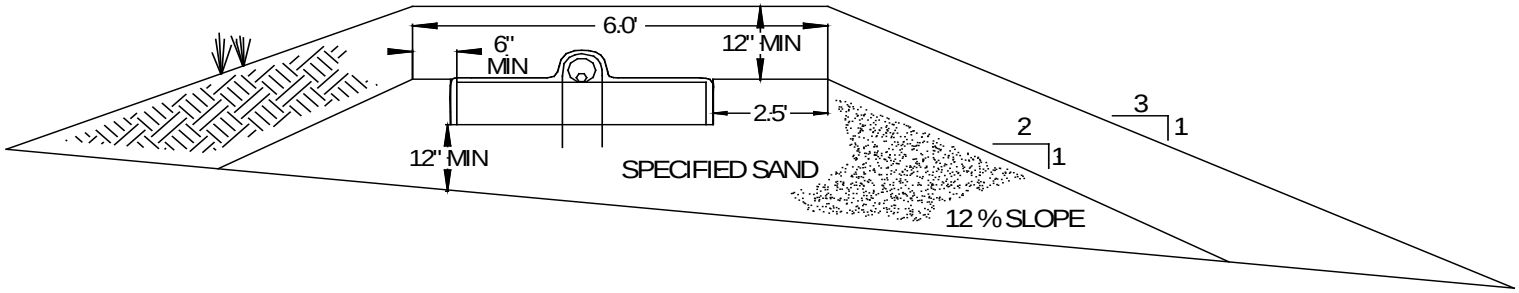
Modules x Length of Module + 1 ft of Specified Sand at row ends =

29 Modules x 4 ft + 1 ft = 117 ft

G) Actual Absorption Area: Actual trench length x Width of Trench

117 ft x 6 ft = 702 ft^2





LESSON 3-3: Eljen GSF System Absorption Area Configurations

Central Manifold Calculations

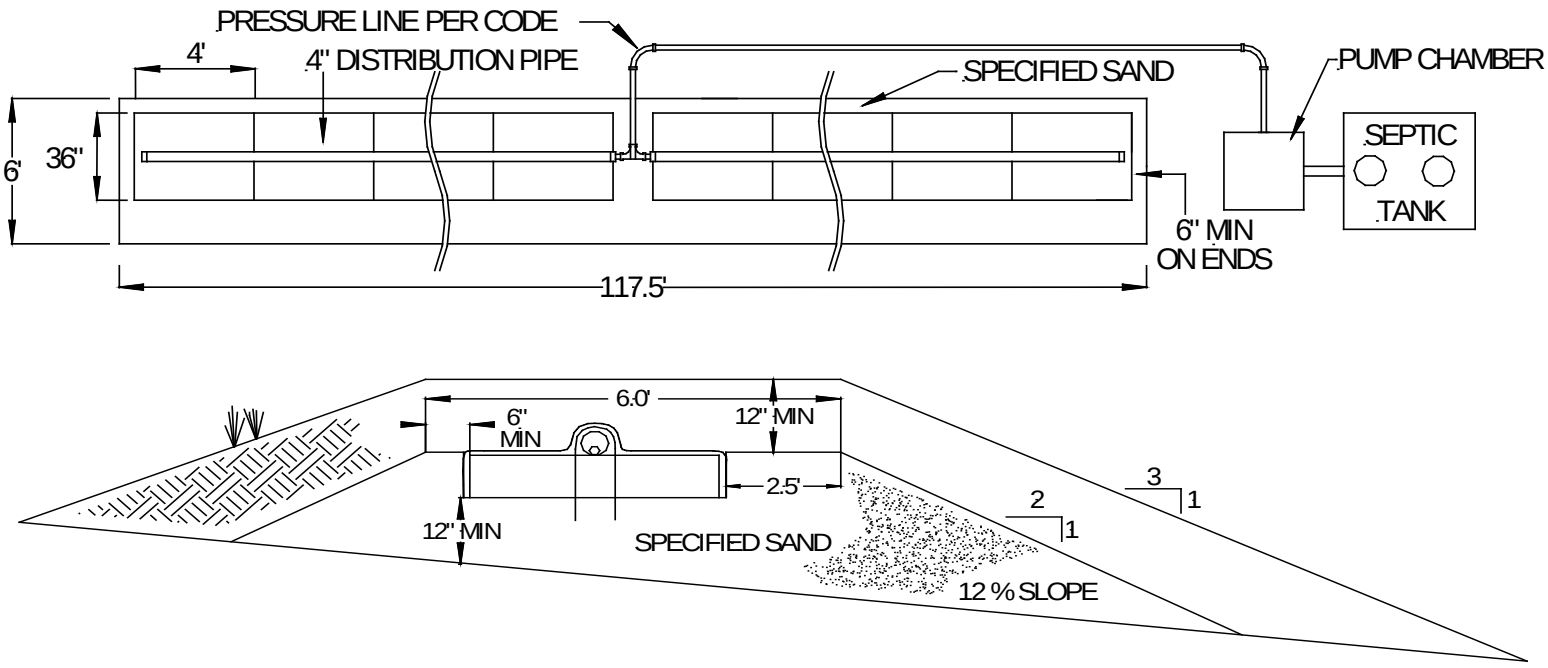
F) Determine Actual Trench Length:

Modules x Length of Module + 1 ft of Specified Sand at row ends + 0.5 ft Lateral Offset =

29 Modules x 4 ft + 1 ft + 0.5 ft = 117.5 ft

G) Actual Absorption Area: Actual trench length x Width of Trench

117.5 ft x 6 ft = 705 ft^2



LESSON 3-3: Eljen GSF System Absorption Area Configurations

Calculating the Length, Width, and Final Square Feet of Absorption Areas
Actual Absorption Area configurations

Common Approved GSF Installation Options in Pennsylvania

1) **Elevated absorption area, pressure distribution**
2) **Shallow limiting zone elevated absorption area**
3) **Trench, gravity distribution**
4) **Trench, pressure distribution**
5) **In ground bed, gravity distribution**
6) **In ground bed, pressure distribution**