Eljen In-Drain™ GSF *Geotextile Sand Filter*

Design and Installation Manual

For New Systems and Repairs

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Eljen In-Drains ™

Introduction

Eljen In-Drain technology is based upon 25 years of published research work and field experience.

The Eljen In-Drain system is a cost effective, treatment based upgrade from conventional stone and other absorption systems. The Eljen In-Drain design is based on proven enhancements. Evapo-transpiration, oxygen transfer, biodegradation, soil treatment and long term operation are accomplished by using bio-textile pre-filtration and controlled soil loading. The installation is protected from long term siltation failure with a geotextile fabric cover.

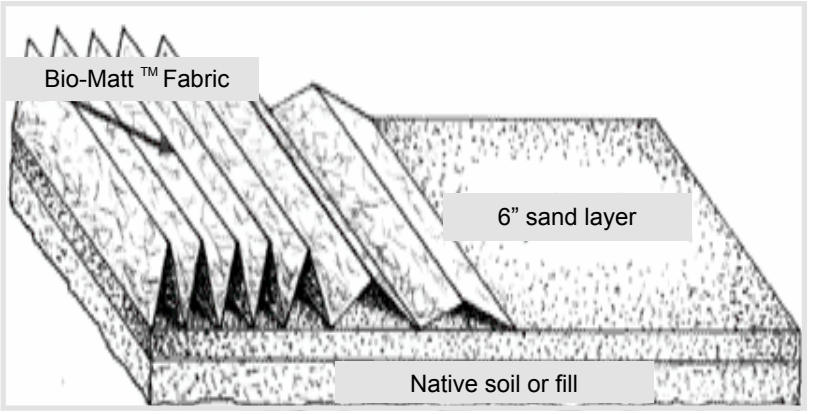
Eljen In-Drains, Type "B" finished dimensions are 36" x 48" x 7". In-Drains are designed to create multiple vertical infiltrating surfaces, which provide approximately 8 times the biofabric area per square foot of In-Drain bottom area. Type B In-Drains are constructed of multiple fins securely banded together into rigid modules.

The primary biomat clogging layer forms within the In-Drain on the biofabric. The In-Drain absorption system is sized for the long term acceptance rate (LTAR) of the site. In-Drain systems are designed to operate indefinitely, not for a useful life of 15-30 years. The soil directly below the In-Drain modules never develop a significant biomat layer, thus allowing In-Drain absorption fields to be approximately 1/3 the size of a conventional stone and pipe system. A combination of lower final grade and smaller leach area reduces land requirements by about 50% and cuts clearing costs on wooded sites. In-Drain trenches can be stepped down slopes, thus further reducing fill requirements. Smaller and shallower leach bed areas also minimize site impact. Reduced system size allows more flexibility for the designer in dealing with site constraints.

Refer to Addenda for discussion of basic design concepts and calculation of effective infiltration areas for In-Drain leach fields. A list of published references follow the addendum.

In-Drain System Advantages

1. **In-Drain absorption systems are designed to last indefinitely. They are based on the long term acceptance rate (LTAR) of the site, not the 15-30 year half life of conventional systems.**
2. **In-Drain absorption systems areas are only about 1/3 the size of conventional stone and pipe systems.**
3. **In-Drains provide less costly and less time consuming replacement of failed absorption systems.**
4. **Lower costs are encountered where difficult terrain is present in leach field area. In-Drain rows can be stepped down slopes to reduce site impact and fill requirements.**
5. **In-Drain biofabric has approximately 8 times the amount of surface area for the biomat layers to form, compared to a conventional absorption systems.**
6. **System failure is minimized because the biomat layer forms inside the fabric; little biomat forms on the underlying sand.**
7. **Effluent infiltrates into the soil situ soil beneath the In-Drain modules, 3 to 10 times faster, due to double filtration of wastewater by biofabric and sand.**
8. **A very effective biomat layer forms within the In-Drains because the aerobic action that occurs results in a more rapid biodegradation of pollutants.**
9. **In-Drains provide better protection of groundwater because biomat inside the fabric results in a pre-treated effluent.**
10. **Steady infiltration from In-Drains reduces occurrence of overload of temporary ponding on the soil. This results in aerobic-anaerobic stability, removing pollutants from the effluent by biochemical action. Temporary ponding in other leach fields results in aerobic-anaerobic destabilization so that untreated pollutants move into the soil.**
11. **Long term siltation, that can bring about failure in other leach fields, is prevented by the geotextile fabric cover of the In-Drain system.**
12. **In-Drains provide greater evapotranspiration than with the conventional stone leach or chamber leach fields.**



Terms and Definitions

- **In-Drain, Type B**: A module measuring 36" x 48" x 7" made of interleaved recycled plastic cuspated core and 100 square feet of biofabric.
- **Bio-Mat fabric**: Special filter fabric within In-Drain modules upon which primary biomat layer forms.
- **Geotextile fabric**: Anti-Siltation fabric placed over In-Drain assembly to prevent fill and fines from washing into modules.
- **Cuspated core**: Rigid plastic core used to separate biofabric, thereby creating multiple infiltrating channels.
- **Wire clamps**: Used to laterally secure perforated pipe
- **Serial distribution**: In-Drain layout suited for sloping sites where multiple rows of modules are fed in series rather than in parallel from a distribution box.
- **LTAR**: Long Term Acceptance Rate
- **STE**: Septic Tank Effluent
- **SHWT**: Seasonal High Water Table
- **Design flow**: 150 gallons per day per bedroom.

Basic System Design

- System Sizing Table applies for all residential systems. In-Drain systems receive a 50% reduction compared to an aggregate system.

- In-Drain modules are placed on top of a level 6 inches (minimum) layer of washed concrete sand meeting ASTM C-33. Also, 6 inches of concrete sand is placed on the sides of the trench or between the modules and soil interface. Leach bed excavation and concrete sand must be level. The perforated distribution pipe shall be 4 inches (SDR35) in diameter meeting ASTM D 3034. The distribution pipe is secured to the In-Drain modules with wire clamps. In dual leach field systems, pipe shall be looped on ends. In systems 30 feet or more in length, midpoints shall be connected. Geotextile fabric is placed over the top and sides of In-Drain rows to prevent long term siltation or back fill material infiltration. After geotextile fabric is in place, carefully back fill with native soil. Stone sizes of 2 1/2" or larger rocks should be removed before back filling.

- The number of In-Drain modules required is the same for trench or cluster system.

- A 12 inch space is required between parallel rows of a standard In-Drain cluster system to gain side wall infiltration to leaching area.

- Number of In-Drain modules required for standard In-Drain systems: System Sizing Table (Pg.10), indicates the number of standard In-Drain modules required based, on percolation rate or soil classification. Minimum design flow shall be based shall be based on State or Local Code.

- Finished grading in the leach field area must divert surface runoff away from the leach area. Driving or paving over In-Drain areas is prohibited.

Installation

Trench Installation

1 Prepare the site according to state and local regulations. Do not install system on frozen or saturated ground.
2 Scarify receiving layer to eliminate smearing.
3 Add 6" layer of washed sand, with no more than 5% passing a #200 sieve and 10% passing a #100 sieve.
4 Avoiding footprints, place In-Drains with painted stripe facing up, end-to-end on sand in trench or bed.
5 Center 4" perforated distribution pipe lengthwise over In-Drains. Use solid pipe over compacted sand from distribution box to In-Drains.
6 Secure pipe to In-Drain unit, using one Eljen wire clamp per In-Drain unit. Push clamp ends straight down though core, forcing through fabric into underlying sand.
7 Spread Eljen cover fabric lengthwise over pipe and drape over sides of In-Drains. Secure in place with hand-shoveled sand using caution to avoid blocking holes in perforated pipe.
8 Place medium to coarse sand 6" (minimum) at the sides in trench (12" in bed configuration).
9 Complete backfill and loam to 12" (minimum) over pipe. Fill should be clean, porous, and devoid of large rocks.
10 Divert surface runoff. Finish grade to prevent surface ponding. Seed loam, and protect from erosion.

Sloping system

1 Prepare site as for Trench system.
2 Groove receiving layer by raking or contour plowing at right angle to slope before placing fill or sand.
3 Install rows of In-Drains at design elevations.
4 Provide a well-anchored D-box with velocity reduction tee or baffle. D-box serves as an inspection port.
5 Install 4" perforated pipe on the first row of In-Drains, and cap pipe at far end. Cap perforated pipe on the opposite end.
6 Secure pipe to In-Drain unit, using one Eljen wire clamp per In-Drain unit. Push clamp ends straight down though core, forcing through fabric into underlying sand.
7 Spread Eljen cover fabric lengthwise over pipe and drape over sides of In-Drains. Secure in place with hand-shoveled sand

using caution to avoid blocking holes in perforated pipe.

8 Place medium to coarse sand 6” (minimum) at the sides in trench (12“ in bed configuration).

9 Place drop manholes as needed for each level.

10 Complete backfill and loam to 12” (minimum) over In-Drains. Fill should be clean, porous, and devoid of large rocks.

11 Divert surface runoff. Finish grade to prevent surface ponding. Seed loam, and protect from erosion.

Pumped system

1 Prepare site as described for the trench system.

2 Provide a well-anchored D-box with a velocity reduction tee or baffle.

3 Assemble system as described for gravity designs.

In-Drains in trench

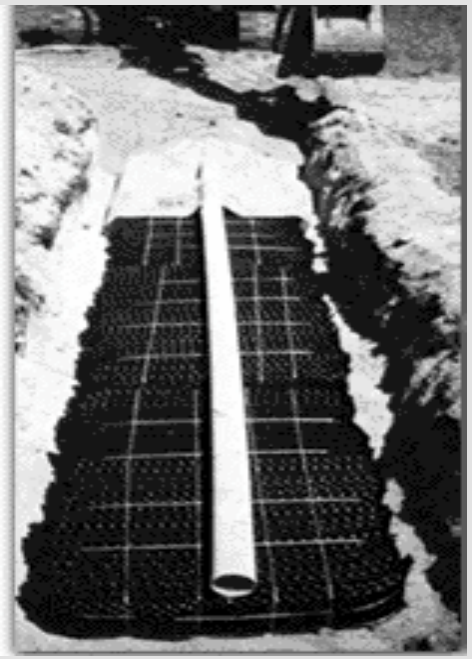


Figure one: Trench cross section

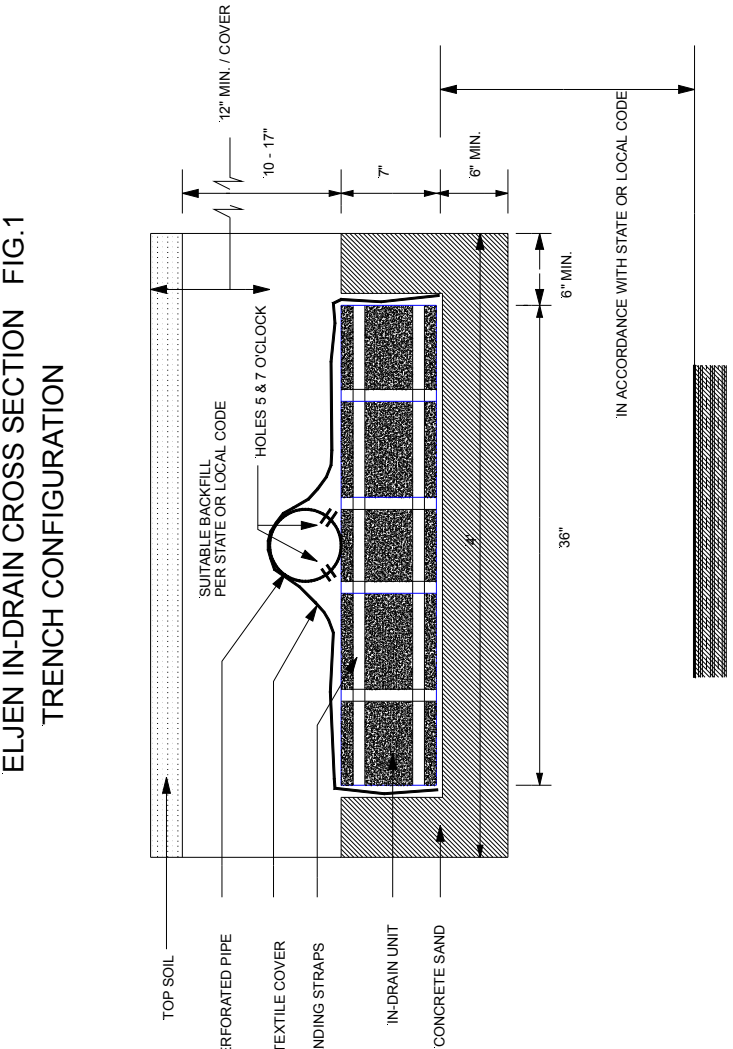


Figure two: Cluster installation

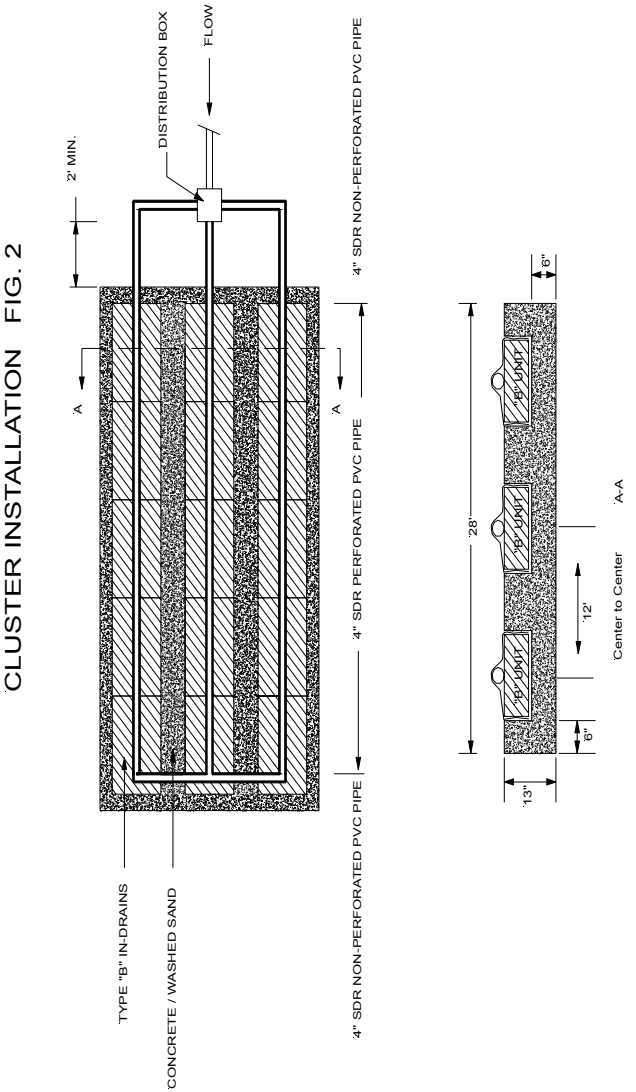
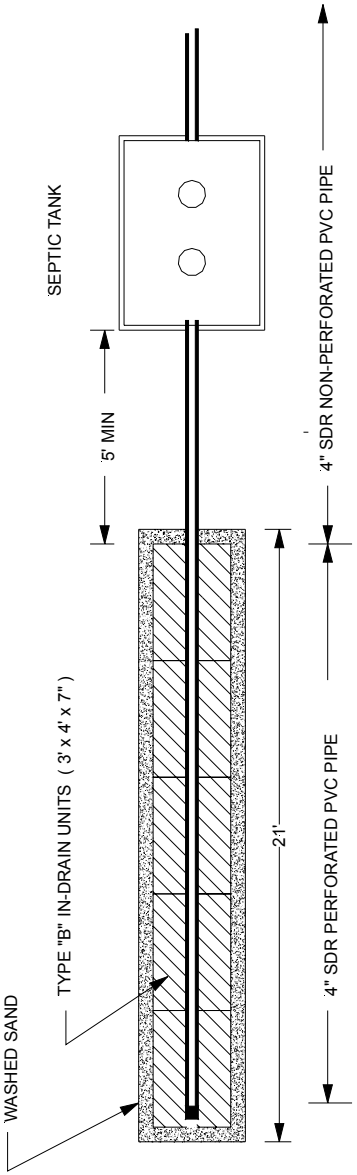


Figure three: Trench configuration



Sizing Table

PERCOLATION RATE	SQUARE FEET OF EFFECTIVE AREA REQUIRED		
MINUTES TO DROP ONE INCH	2 BEDROOM HOUSE	3 BEDROOM HOUSE	4 BEDROOM HOUSE
1.0 – 10 MINUTES	375	495	660
10.1 – 20 MINUTES	500	675	900
20.1 – 30 MINUTES	565	750	1000
30.1 – 5 MINUTES	675	900	1200
45.1 – 60 MINUTES	754	990	1320

Example: 2 bedrooms
30 min percolation rate

1) From the table find the square footage required
= 565 sqft of effective area required.

2) 565 sqft ÷ 4.7 sqft (In-Drain effective leaching credit)
= 120.21 Lf of trench required

3) 120.21 lf ÷ 4 ft (In-Drain length) = 30.05 units

31: In-Drain Units required

Addendum

Long term acceptance rate is the small but finite infiltration rate of septic tank effluent through a biomat layer when biological equilibrium is reached. In-Drain leach field sizing is based on measured soil percolation rates, prescribed design flows and prescribed wastewater application rates. Refer to Figure 1 for Cross Section View of In-Drain module.

In-Drain biofabric was tested using septic tank effluent over 20 years ago. Long term acceptance rate of biofabric not touching soil was measured with septic tank effluent to be greater that 1 gal/sq. ft./day. Also, biofabric was found not to produce any masking when used in contact with the soil. Biofabric filtered effluent was observed to have low soil clogging capacity. Biofabric pre-filtration significantly reduces the infiltration limiting biomat layer on the soil directly below a standard In-Drain module.

Actual measurements reveal an improved soil LTAR of 3 to 10 times the non-prefiltered case with a typical system average of 4 to 6. The LTAR enhancement for a given absorption system will vary within this range depending on location and time. In other words at any particular time different areas of the absorption bed soil will have LTAR enhancement within the stated range. Likewise, the LTAR enhancement of a particular section of absorption bed will vary over a period of time. In-Drain leach fields are conservatively designed using an infiltration enhancement factor equal to 2.0 This is the principal basis for the small size of In-Drain absorption systems.

References

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Improving the Environment Since 1976

ELJEN CORPORATION was founded in 1976 to address the growing concerns with many of the environmental problems caused by traditional systems.

Eljen pioneered the design and development of the very first completely prefabricated, non-aggregate drainage system.

The Eljen In-Drain™ GSF was developed to solve the increasing problems caused by the growing need for higher capacity septic systems in limited space, and the rising costs of traditional methods.

Our systems have proven their effectiveness by withstanding the test of time. Many of our earliest installations continue to provide the same benefits to this day.

If you have a drainage problem of any type, call Eljen first.

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