



Installation / Design Guideline: J-DRain SWD Natural / Synthetic Turf Drainage

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INTRODUCTION

Trench drainage systems installed in natural turfs shorten the interval of time required to re-open a field to play after a heavy rainfall. Good drainage also promotes a healthier turf and helps turf resist damage from athletic activities by removing standing water and providing drainage to the root zone. Drainage systems in synthetic turf installations remove water collected in the underdrain system more effectively and economically than conventional pipe trenches.

TYPES OF INSTALLATION

There are many design variables to consider when planning a drainage installation in either natural or synthetic turf. First you must identify precisely what type of installation you require. The following choices will help guide you:

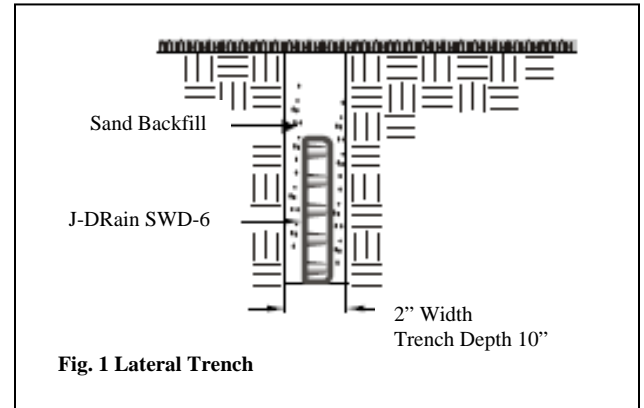
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| 4. Golf Course Greens, Fairways & Tee Boxes | Pages 12 – 15 |

NATURAL TURF – Rectangular Fields

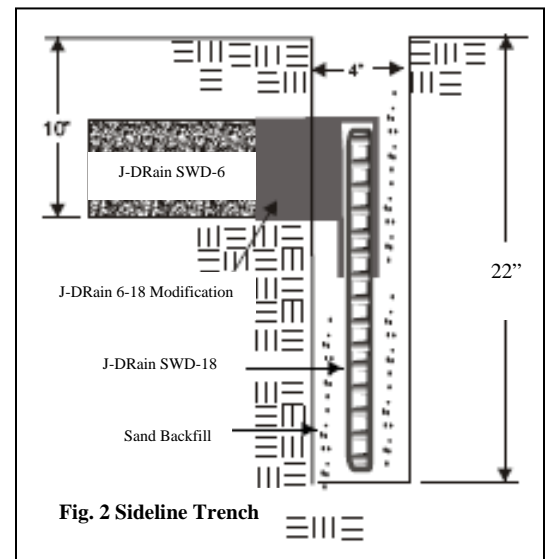
SYSTEM COMPONENTS:

Prior to undertaking the design of the drainage layout, we need a clear understanding of the components of the drainage system. The following identifies these components:

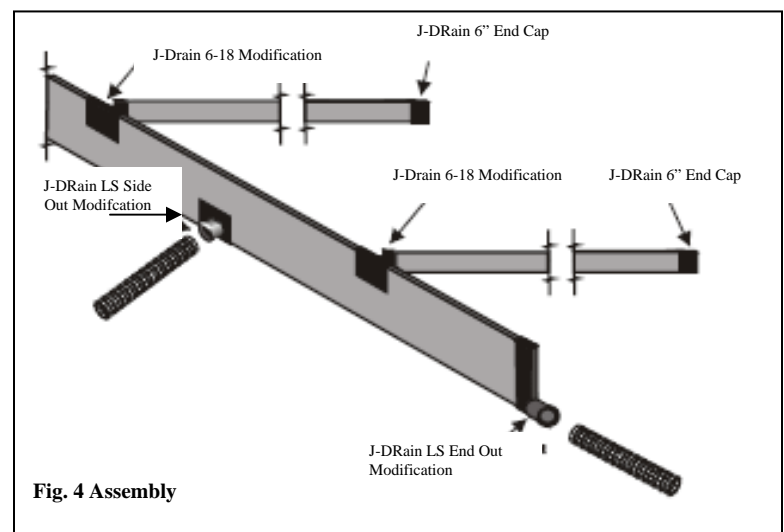
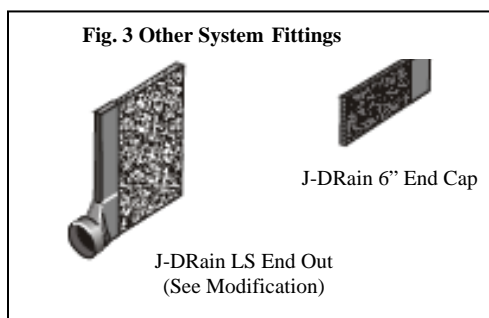
Lateral Trench: A trench that runs laterally across the field at regular intervals for the purpose of collecting excess field water (See Fig. 1). The trench is 2” wide and only 10” deep. Its very narrow cross-section causes little damage and disruption to existing turfs. **J-DRain SWD-6** is placed vertically in the trench and the trench is backfilled with sand. Soil from the excavation of the trench is removed from the field.



Sideline Trench: A trench that generally runs just outside the perimeter of the field. The excess field water collected by the lateral trenches empty into the sideline trench for easy removal to a nearby storm sewer or is vented to daylight at a lower elevation. The sideline trench is typically 4” wide and 22” deep (See Fig. 2). **J-DRain SWD-18** is placed vertically in the trench. The lateral trenches connect to the sideline trench by taping the 6” SWD to 1 foot of 18” SWD using J-Tape. It also has sand backfill with all trench excavations removed.



Other Fittings: **J-DRain LS Sideout** empties water from the sideline trench into a 4” pipe. It can be positioned at any location along the sideline trench. **J-DRain LS End Out** is used at the end of a sideline trench to transfer water to a 4” pipe. **J-DRain 6” End Cap** is used to cover a cut end of **J-DRain SWD-6** (See Fig. 3).



SYSTEM ASSEMBLY: Fig. 4 shows an assembly of the components of the drainage system along with their proper fittings for connections.



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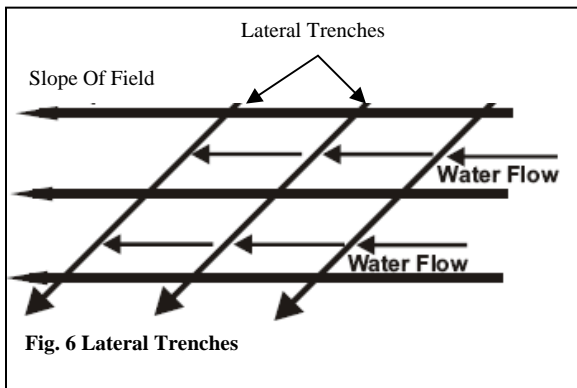
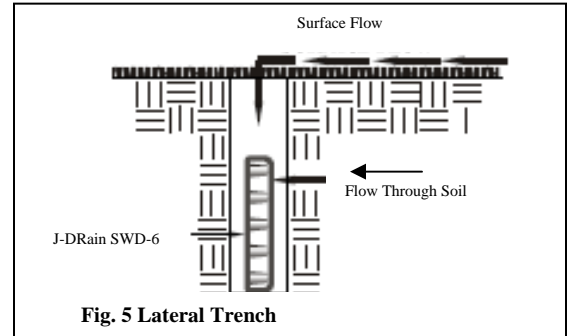
NATURAL TURF – Rectangular Fields

DESIGN METHODOLOGY:

There are many design variables when preparing a drainage scheme for a natural turf field. The most important variables are:

1. Slope of Field
2. Surface Flow
3. Permeability of the soil

The slope of the field plays a very important role in the drainage scheme. The flow through the soil is limited by the permeability of the soil and is generally very low. Surface flow is dependent upon the slope of the field and generally is the major contributing factor in drainage and surface drying (See Fig. 5). As surface water travels down the slope of the field it seeks a lateral trench and quickly enters because the permeability of the sand backfill is much higher than the permeability of the soil (See Fig. 6).



CALCULATING FLOW CAPACITY OF DRAINAGE SYSTEM:

All of the design variables make it difficult, if not impossible, to determine water flow through the turf and soil. Trench drainage systems rely on surface flow and the ability of the surface water to penetrate the turf in order to enter the trench. The permeability of the turf can easily be influenced by the type of grass, the amount of turf compaction and thatch buildup in the turf.

Determining the drainage capacity of the system is a very simple matter: Merely multiply the flow rate of the trench drain by the number of trenches.

Example: 200' x 360' field

$$15 \text{ gals/min. flow rate} \times 72 \text{ lateral trenches (36 per side)} = 1,080 \text{ gals/min}$$

Common sense tells us that the existing turf cannot possibly deliver this volume of water to the drainage system due to the permeability of the turf and the soil. Otherwise, the field would be drained in a matter of minutes.



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NATURAL TURF – Rectangular Fields

Consider this example:

A field 200' x 360' with a two inch rainfall produces approx. 90,000 gallons of water.

If all of the water passed directly to the drainage system, the field would be dry in approximately one hour. Real conditions tell us that the majority of the rainfall in a two inch rain drains off of the field to the sidelines leaving a saturated surface. This saturated surface is what we deal with in designing a proper drainage system.

Assumption: 50% of rainfall on field runs off to sideline

90,000 gals. X 50% remaining = 45,000 gals.

You could further assume that a minimum 4 to 6 hours will be required for field drainage,

$$45,000 \div 4 = 11,250 \text{ gals/hour}$$

Clearly the drainage system capacity greatly exceeds the field design requirements.

Conclusion: Slope of the field and the distance between the trenches, along with the permeability of the turf and soil are the more important components of the drainage system than the capacity of the drainage system. Additional trenches are added to shorten the distance surface water has to travel to the trench and not to increase the flow capacity of the system.

FIELD DRAINAGE LAYOUT:

1. Identify slope of field (See Fig. 7)
 2. Place lateral trenches across field (See Fig. 8) Lateral trenches should intercept slope at 45-degree angles. Include extended area along sidelines for coaches & players.
- Note: Place lateral drains at 10' to 12' intervals
3. Place sideline trenches in such a way as to connect all lateral trenches on both sides of the field (See Fig. 9)

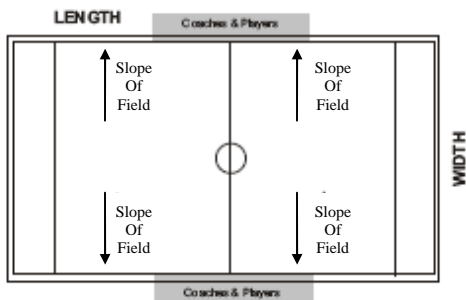


Fig. 7 Determine Slope of Field

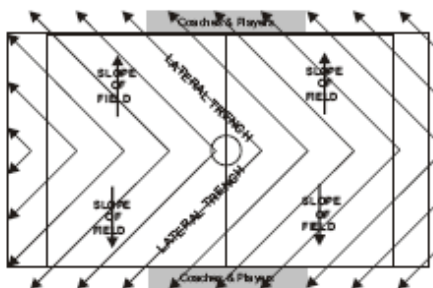


Fig. 8 Lateral Trenches

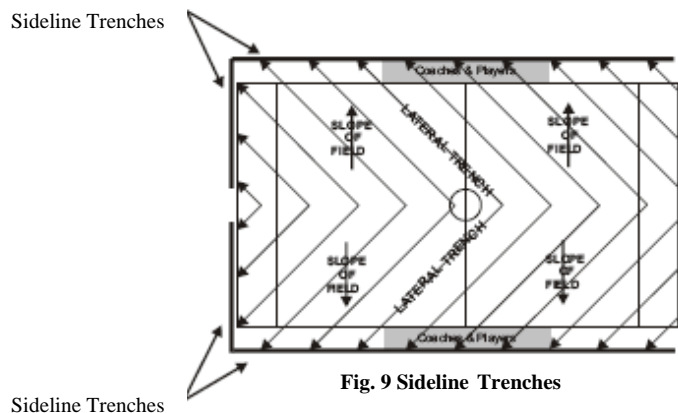


Fig. 9 Sideline Trenches



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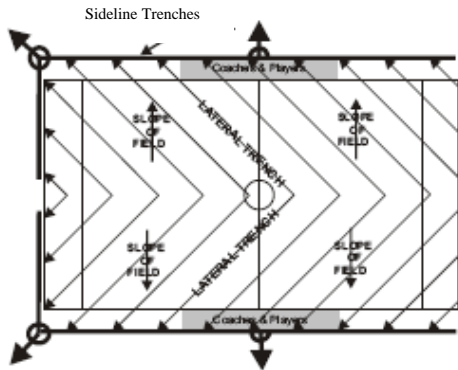
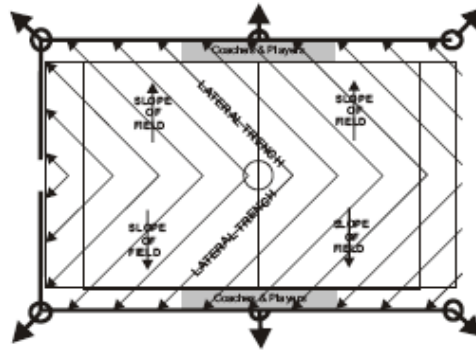


Fig. 10 Four Collection Points

COLLECTION POINTS: ○ Collection points are locations where the sideline trenches make a transition to 4" pipe for removal to daylight or a nearby storm sewer (See Fig. 10). If the sideline trenches have a natural slope, place the collection points at the low corners. Place a minimum of 4 collection points per field. Sideline trenches that have little or no slope should have two additional collection points added in the other two corners of the field (See Fig. 11).

Fig. 11 Six Collection Points



FLAT OR MINIMUM SLOPE FIELDS:

This type of field should have a sideline trench around the entire field (See Fig. 12). Collection points should occur at all four corners of the field. For the placement of the lateral trenches divide the field into four sections (See Fig. 13). Then place the lateral trenches in a manner in which the collected water in the lateral trenches travels the shortest possible distance to the sideline trenches (See Fig. 13).

NOTE: It is recommended that the spacing of the lateral trenches is shortened to 8' to 10' on center. With little or no slope, the travel time of the surface water to reach the lateral trenches is longer.

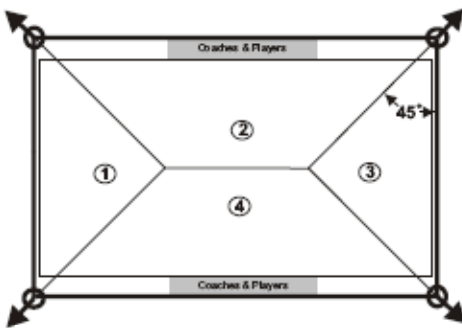


Fig. 12 Divide Field Into Four Sections

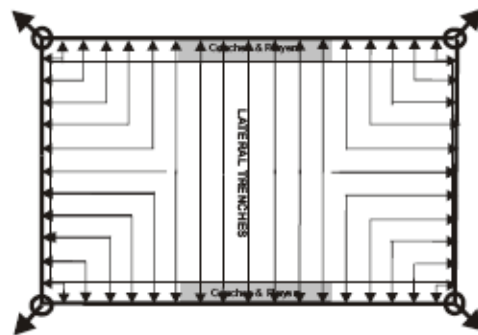


Fig. 13 Lateral Trenches on Flat Field



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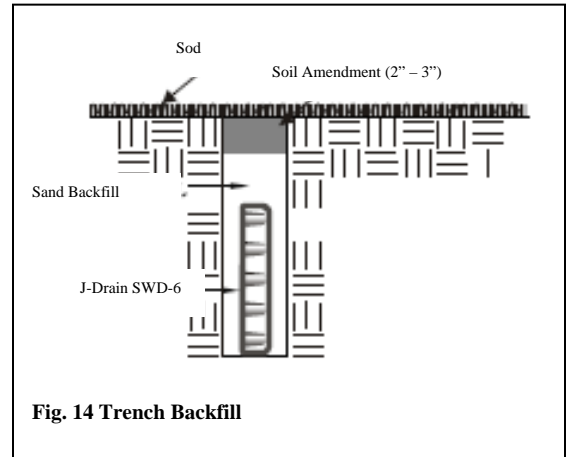
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NATURAL TURF – Rectangular Fields

BACKFILL PROCEDURE:

TRENCH BACKFILL: All trenches should be backfilled with sand (See Fig. 14). The sand should be clean, free draining, well-graded and free of fine grained soil particles in the silt and clay particle size. After backfilling the trenches with sand, it is recommended that the sand be flooded with a garden hose so that the sand settles and consolidates in the trench. After flooding, refill the trench with additional sand.

For optimum results and to assist in the prevention of browning of the turf immediately over the trenches, fill the top 2" – 3" of the trenches with a professional turf and horticultural soil amendment. These sport field conditioners are typically made of ceramic, shale or clay granules and support consistent turf growth as they help retain moisture and nutrients for the turf. If you choose this option, re-fill the trenches with the soil amendment instead of sand after flooding the trenches for settlement (See Fig. 14).

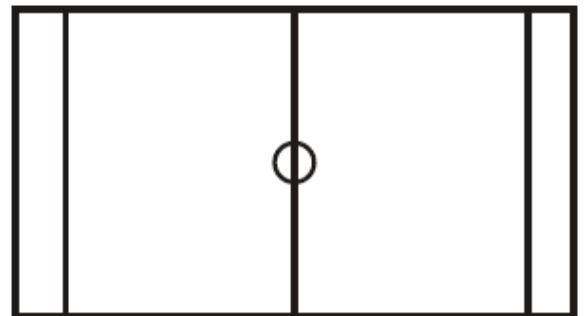


RECOMMENDED SOIL AMENDMENT: "Turface MVP" or "Field & Fairway" as manufactured by Profile. Check website for availability: (www.turface.com).

DESIGN ASSISTANCE:

US Fabrics Inc. will provide assistance free of charge for laying out your drainage scheme. Simply fill out a drawing as shown below and mail, fax (513) 271-4420 or e-mail (info@usfabricsinc.com). Please furnish all of the following information:

1. Locate on a plat (similar to the ones shown to the right) the slope of the field. Indicate if there is more than one slope as in a crowned field. Use arrows and list the amount of space.
2. Locate the length and width of the playing area of the field. Draw on the plat any additional areas along sidelines that you wish drain, i.e. player and coaching areas.
3. Locate any adjacent storm sewers and indicate location and distance from field. If water collection is to daylight into a ditch or lower area, indicate the areas on the field.
4. Locate any and all underground utility lines, i.e. irrigation and sprinklers, electrical and any others.
5. Type of turf (Natural or Synthetic).



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NATURAL TURF – Baseball Fields

BASEBALL FIELDS:

NOTE: Prior to beginning this section, it is recommended that you review the section on system components on page 2 and design methodology on page 3.

A typical drainage scheme for a baseball field is shown in Fig. 15. This scheme is based on the same principals as discussed earlier – lateral trenches intercept slope and sideline trenches connect lateral trenches. The infield typically requires a longer drying time than the outfield so the spacing should be shortened as shown below.

Lateral trench spacing on infield: 8' – 10'
Lateral trench spacing on outfield: 10' – 12'

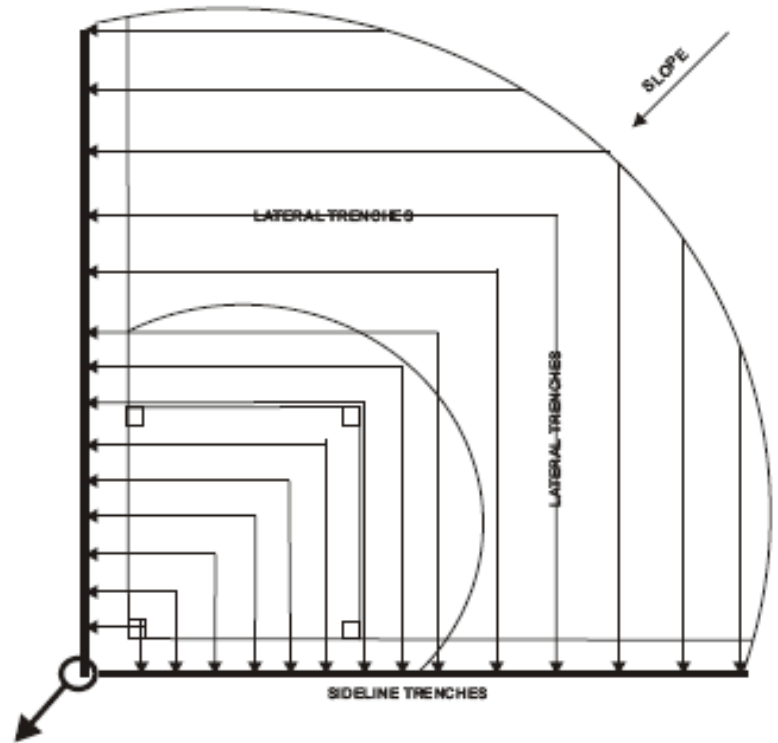
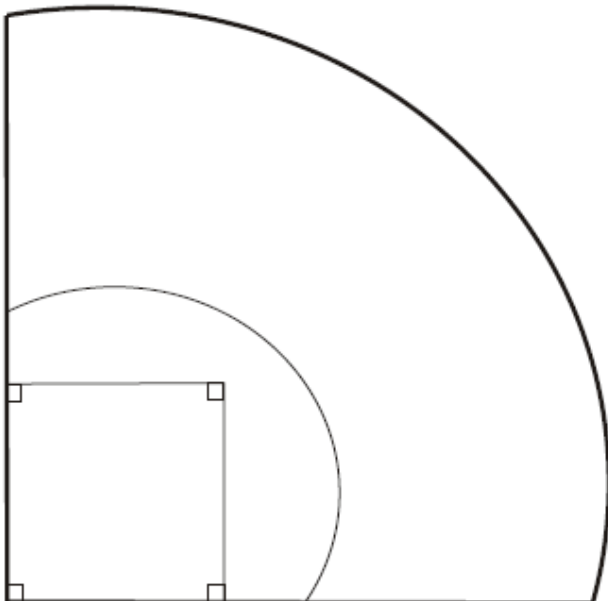


Fig. 15 Typical Baseball Field

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2. Locate the length and width of the playing area of the field. Draw on the plat any additional areas along sidelines that you wish drain, i.e. player and coaching areas.
3. Locate any adjacent storm sewers and indicate location and distance from field. If water collection is to daylight into a ditch or lower area, indicate the areas on the field.
4. Locate any and all underground utility lines, i.e. irrigation and sprinklers, electrical and any others.
5. Type of turf (Natural or Synthetic).



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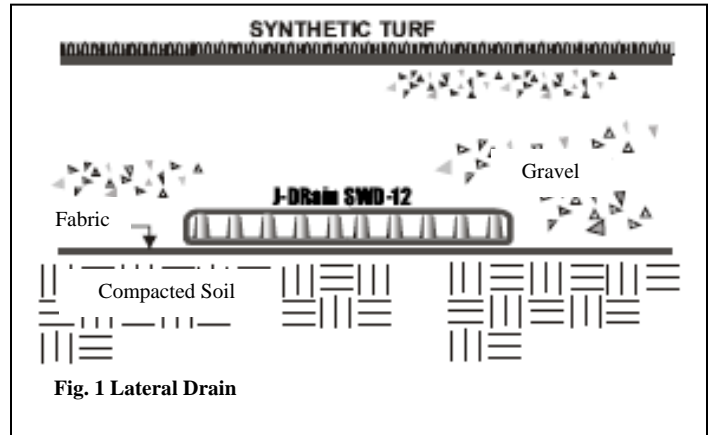
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SYNTHETIC TURF – Rectangular Fields

SYNTHETIC TURF SYSTEM COMPONENTS:

Lateral Drains: J-DRain SWD-12 is laid at regular intervals across the field. It extends from the center of the field and slopes to the sidelines for the purpose of removing rainwater from the gravel fill lying under the synthetic turf. J-DRain SWD-12 is a prefabricated composite consisting of a rigid inner core wrapped with a filter fabric. It is capable of conveying large volumes of water to the sideline trenches.

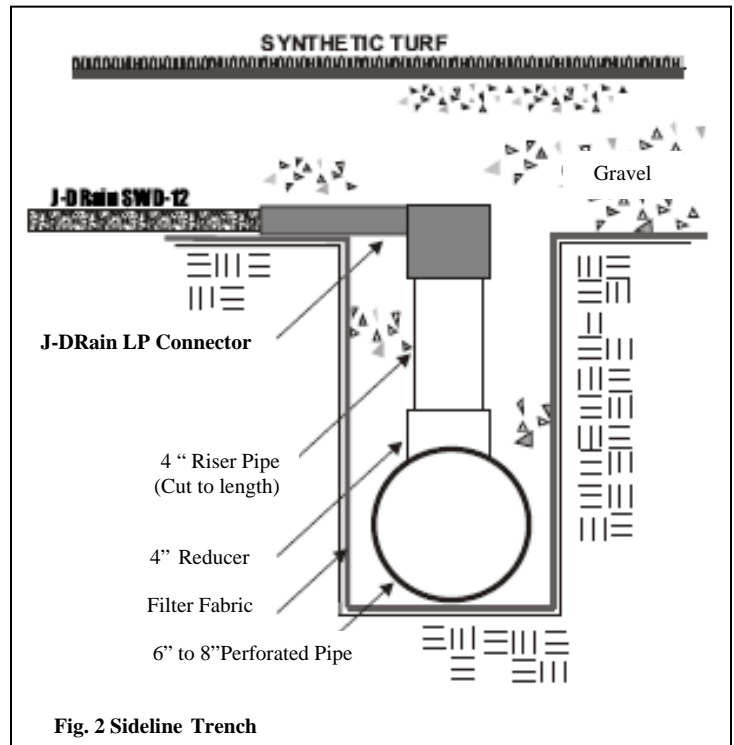
NOTE: Lateral drains are spaced on 12' to 15' centers.



SIDELINE TRENCH:

A sideline trench generally runs just outside the perimeter of the field. The excess field water collected by the lateral drains empties into the sideline trench (See Fig. 2). The sideline trench is lined with a filter fabric and contains a 6" to 8" pipe for carrying the water to a proper discharge point which generally occurs at the corners of the playing field.

J-DRain SWD-12 lateral drains are connected to the sideline pipe with a J-DRain LP Connector as shown in Fig. 2.



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SYNTHETIC TURF – Rectangular Fields

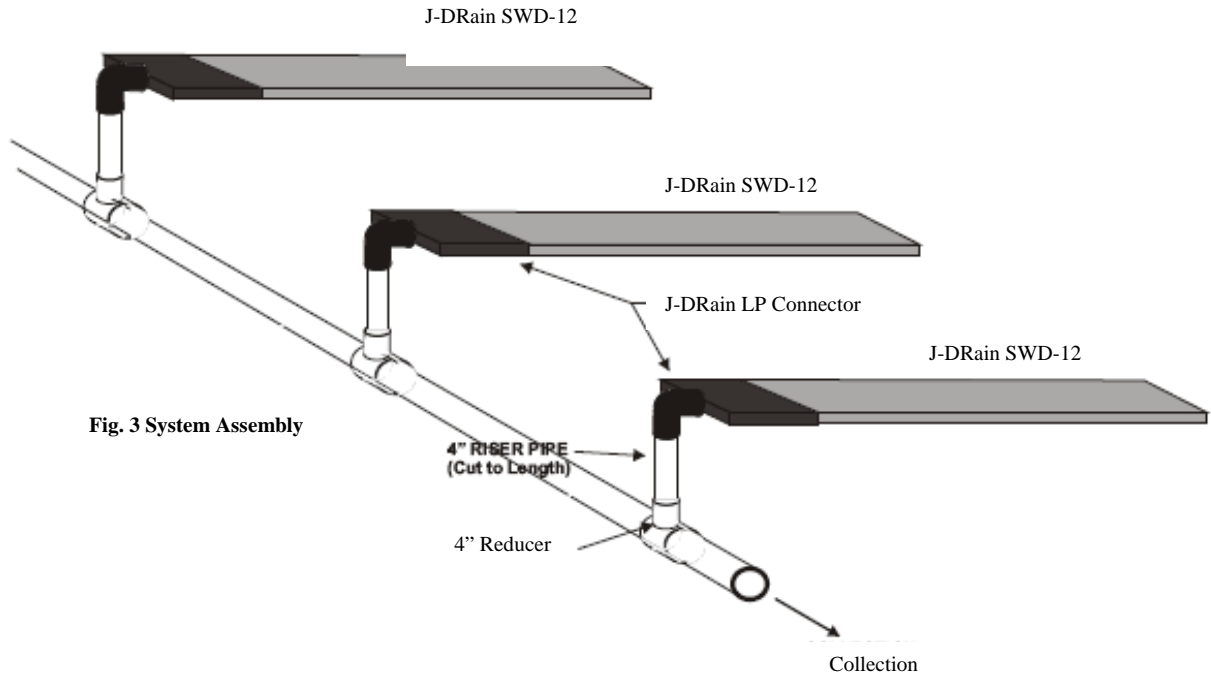


Fig. 3 System Assembly

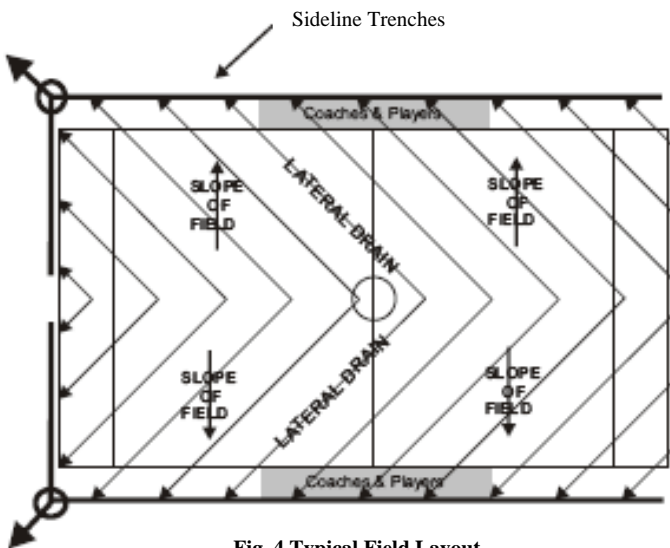


Fig. 4 Typical Field Layout

FIELD LAYOUT:

During construction the field is generally graded with a slope from the center to sidelines. Sideline trenches are dug for the collection pipe and the trench is sloped to the collection corners. After grading and compaction, the field and the trenches are lined with a filter fabric. The pipe and the **J-DRain SWD-12** (lateral drains) are placed on the field as shown in Fig. 4. The lateral drains are placed at an 45° angle to the slope so that water traveling down the slope seeks out a lateral drain.



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SYNTHETIC TURF – Rectangular Fields

CALCULATING FLOW RATE OF DRAINAGE SYSTEM

WATER FLOW RATES:

Unlike natural turfs where permeability of the turf and permeability of the soil play vital roles in design and flow rates, synthetic turfs are designed for water to drain through the turf at a rapid rate. The primary restriction of the flow is the infill that is used in many of the new synthetic turf systems. Aggregate fill underlying the turf is capable of holding a large volume of water in the open space in the aggregate. It is the role of the lateral drains placed under the aggregate to capture water and deliver it to the sideline trenches as quickly as possible. The total drainage capacity of the system can be calculated as follows:

$$\text{Number of Lateral Drains} \times \text{Lateral Drain Flow Rate} = \text{Total Drain Capacity}$$

J-DRain SWD-12 has a flow capacity of 30 gal/min at a hydraulic gradient of .1.

Assuming a drainage scheme has 30 lateral drains per side of the field (10' centers), the calculated flow rate is as follows:

$$30 \text{ gal/min} \times 60 \text{ lateral drains (12' on center)} = 1800 \text{ gal/min}$$

$$1800 \text{ gal/min} \times 60 \text{ min/hour} = 108,000 \text{ gal/hour}$$

A field 200' x 360' with a two inch rainfall produces approx. 90,000 gallons of water

Conclusion: With a heavy rainfall, as much as 25% of the rainfall will run off the surface to the sidelines. The water flow rate through the turf may be somewhat restricted by the infill. This, together with the fact that the aggregate fill under the turf acts as a large reservoir for the rainfall, means the drainage system easily meets or exceeds the drainage requirement.

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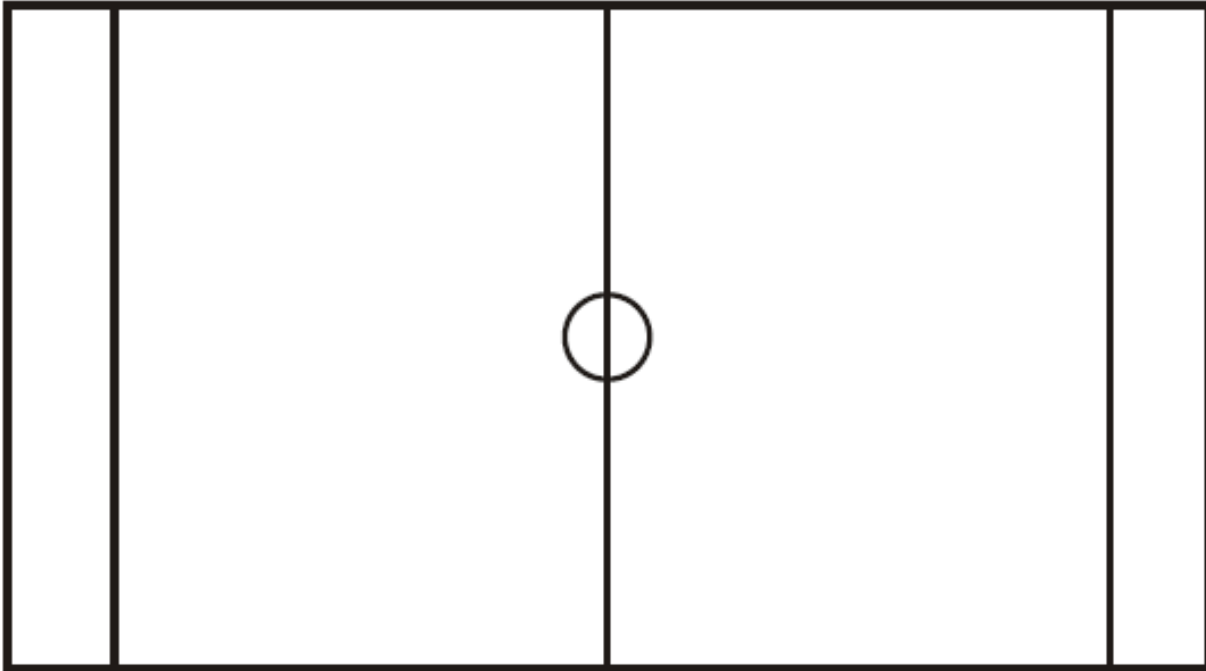
1. Locate on a plat similar to the ones shown below the slope of the field. Indicate if there is more than one slope as in a crowned field. Use arrows and list the amount of space.
2. Locate the length and width of the playing area of the field. Draw on the plat any additional areas along sidelines that you wish drain, i.e. player and coaching areas.
3. Locate any adjacent storm sewers and indicate location and distance from field. If water collection is to daylight into a ditch or lower area, indicate the areas on the field.
4. Locate any and all underground utility lines, i.e. irrigation and sprinklers, electrical and any others.
5. Type of turf (Natural or Synthetic).



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NATURAL TURF – Golf Course - General Landscape

PURPOSE:

The purpose of this document is to provide the basic data necessary to design a drainage layout for Golf Courses, Commercial & Residential Landscape.

SYSTEM COMPONENTS:

Lateral Trench: A trench that runs laterally across the drainage area at regular intervals for the purpose of collecting excess field water. The trench is 2" wide and only 10" deep. Its very narrow cross-section causes little damage and disruption to existing turfs. **J-DRain SWD-6** is placed vertically in the trench and the trench is backfilled with sand. Soil from the excavation of the trench is removed from the field.

Collector Trench: A trench that generally runs down the center or at the edge of the drainage area. The excess field water collected by the lateral trenches empties into the collector trench for easy removal to a nearby storm sewer or is vented to daylight at a lower elevation. The collector trench is typically 4" wide and 18" deep (See Fig. 2).

J-DRain SWD-12 is placed vertically in the trench. The lateral trenches connect to the sideline trench with a **J-DRain NV Fitting** (See Fig 2). It also has a sand backfill and all trench excavations are removed.

Other Fittings: **J-DRain 6-6T Connector** empties water from the lateral trench to the collector trench (See Fig. 3).

J-DRain 6-6 Splice is used to join two sections of at the end **J-DRain SWD-6**. **J-DRain 6" End Cap** is used to cover a cut end of **J-DRain SWD-6**. **J-DRain 6-4 End Out** is used to transition to a 4" corrugated pipe. **J-DRain 6-4 Side Out** is used to transition to a 4" corrugated pipe.

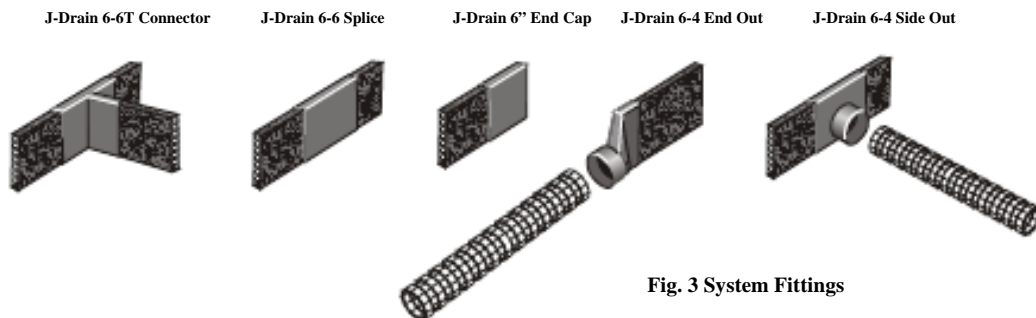
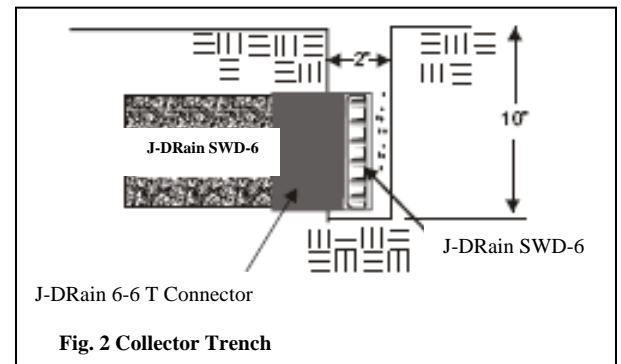
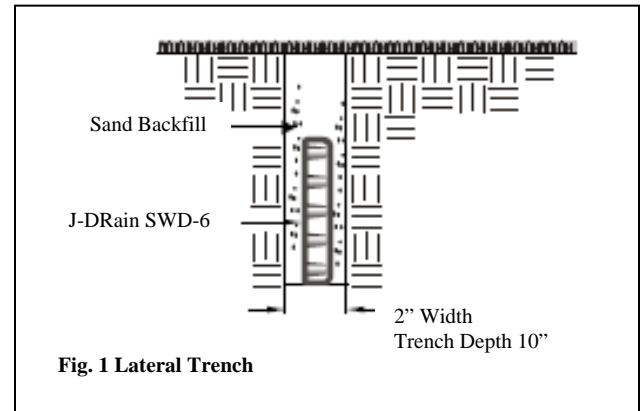


Fig. 3 System Fittings



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NATURAL TURF – Golf Course - General Landscape

DESIGN METHODOLOGY:

There are many design variables when preparing a drainage scheme for a natural turf area. These variables include:

1. Slope of Surface
2. Collector Trench Locations
3. Lateral Trench Locations
4. Collection Points
5. Discharge Points
6. Proper Trench Back Fill

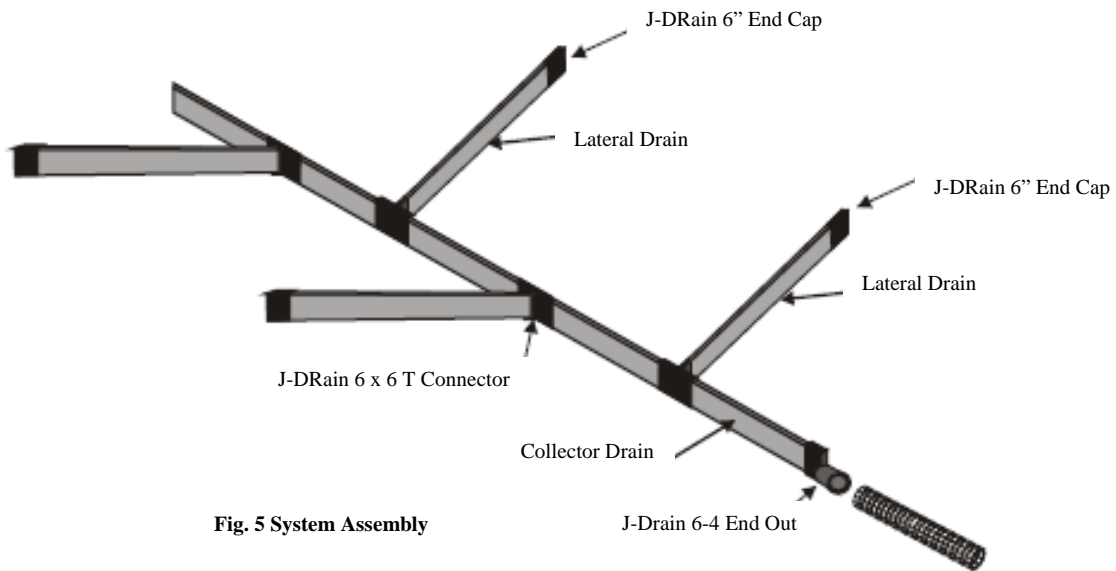


Fig. 5 System Assembly

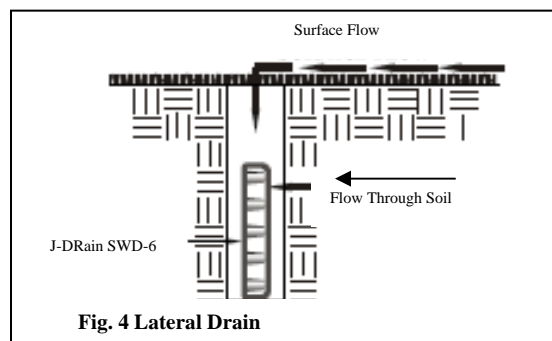


Fig. 4 Lateral Drain



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NATURAL TURF – Golf Course - General Landscape

STEP 1.

DETERMINING SLOPE OF DRAINAGE AREA:

The slope of the drainage area plays a very large role in the drainage scheme. Flow through the soil and surface flow are the major contributing factors in field drainage effectiveness (See Fig. 5). Flow through the soil is limited by the permeability of the soil and is generally very low. Surface flow is dependent upon the slope of the surface and generally is the major contributing factor in drainage and surface drying. As surface water travels down the slope it seeks a lateral drain (See Fig. 6) and quickly enters because the sand backfill in the trench has a much higher permeability than the adjacent soil. It is very important then that the slope of the drainage area is intercepted by lateral drains at approximately 45 degrees. This ensures that water flowing across the surface will flow into a lateral drain.

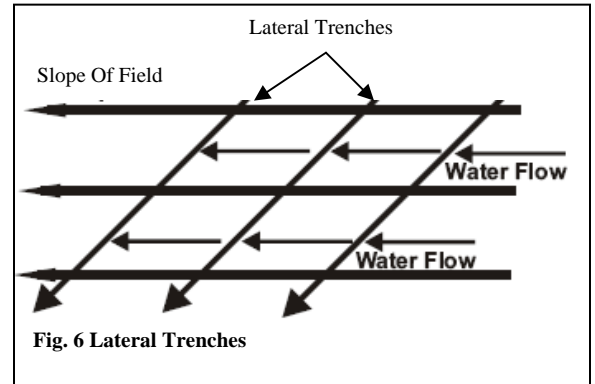


Fig. 6 Lateral Trenches

STEP 2.

DRAINAGE LAYOUT:

With a paint spray marker or chalk, mark the collector trench down the middle of the area to be drained.

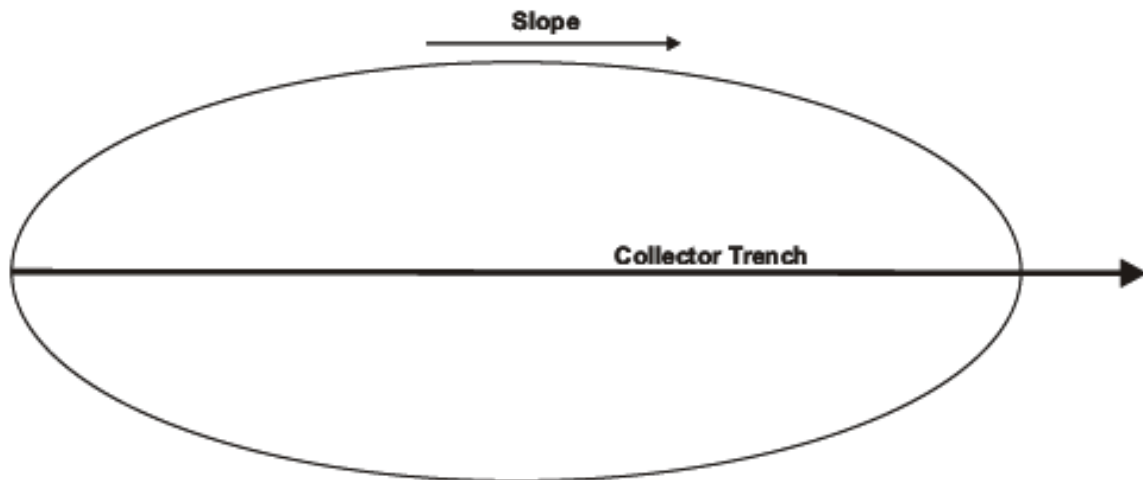


Fig. 7 Collector Trench



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NATURAL TURF – Golf Course - General Landscape

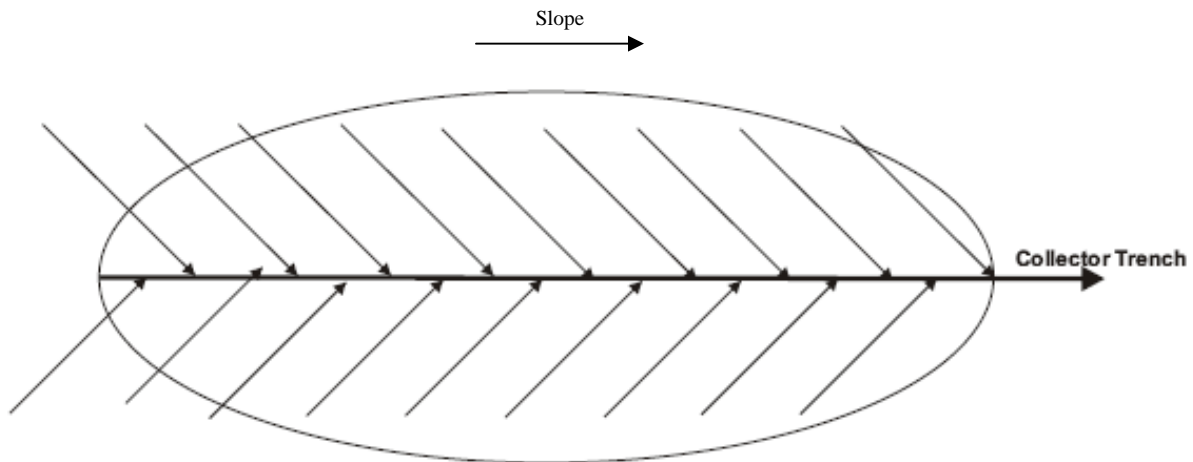


Fig. 8 Collector Trench

DESIGN ASSISTANCE:

US Fabrics Inc. will provide assistance free of charge for laying out your drainage scheme. Simply fill out a drawing as shown to the left and mail, fax (513) 271-4420 or e-mail (info@usfabricsinc.com). Please furnish all of the following information:

1. Locate on a plat the slope of the field. Indicate if there is more than one slope as in a crowned field. Use arrows and list the amount of space.
2. Locate the length and width of the playing area of the field. Draw on the plat any additional areas along sidelines that you wish drain, i.e. player and coaching areas.
3. Locate any adjacent storm sewers and indicate location and distance from field. If water collection is to daylight into a ditch or lower area, indicate the areas on the field.
4. Locate any and all underground utility lines, i.e. irrigation and sprinklers, electrical and any others.
5. Type of turf (Natural or Synthetic).



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