Landscape Drainage Guide





Multi-FLOW
Professional Drainage Systems

1 Basic Principles of Artificial Drainage

The open trench is the most basic model for an artificial drainage system.

This guide assumes that you will be using Multi-Flow for a collector system.

length (feet) X width (feet) X .623 (gallons)

=

gallons of water produced by a 1-inch rainfall

Artificial drainage

Artificial drainage is the removal and relocation of excess soil water. Once soil has reached the point where all its voids are filled and it is holding all the water that it is capable of holding, additional water from rain or irrigation will pond on the surface or flow to a low point. A drainage system provides a passageway through which excess water can escape the saturated area. Traditionally this was done using round concrete, clay, PVC, or HDPE pipe. More recently panel-shaped drains such as Multi-Flow are providing that escape route.

Consider the open trench

For the most basic model of an athletic field drainage system, imagine a field that contains numerous parallel narrow trenches. Water from neighboring saturated soils or from puddles on the surface will seep into these trenches and flow from the area. Drainage products are a lot like that. They simply hold the walls of the trench open while allowing the surface to be covered and used.

Gravity rules!

Like natural drainage systems, artificial drainage systems rely on gravity. They cannot draw water "uphill." Therefore, drainage systems are dependent on continuous natural or created slope. Water flows to a lower point whenever that is available.

Collection and transport

Modern artificial drainage systems are comprised of:

- collector lines to gather the water
- a transport system to carry the water away

This Drainage Guide assumes that you will be using Multi-Flow for a collector system and either dual-wall corrugated or PVC pipe for a transport system.

When planning the layout of drainage collector lines consider these factors:

- Drainage lines that are spaced more closely together provide a more thorough and rapid response. In many situations 10 - 15 foot spacings are ideal.
- Drainage lines that are placed closer to the surface will generally respond more quickly. Drainage lines that are placed deeper will generally drain a wider area but will take a longer time to do so.
- Soil particle size will dramatically affect the speed at which water moves through the soil. Coarse, loosely-packed soils allow for fast water movement. Fine, compacted soils yield water at a slower rate. Placing collectors closer together and closer to the surface is helpful in porous soils because water in these soil types reaches the collectors quickly and extra carrying capacity is required. Close spacings are helpful in dense soils because closer spacings mean that water need not travel so far to get to the collectors.
- Soil is often not uniform. Layers of clay or hard pan will affect the flow of water significantly.
- Collector line length should be calculated based on the carrying capacity of the product. For example, in order to stay ahead of one inch of rainfall per hour, using 6-inch Multi-Flow (capable of carrying 1020 gallons per hour) on 12 foot centers, the line should not exceed 136 feet in length. (One square foot of water one inch deep is .623 gallons. 136 X 12 X .623 = 1017 gal.)

Avoid blockage

Flowing water carries soil particles with it. Safeguards must be taken to halt the migration of silt and clay or the collectors will become blocked. Multi-Flow's geo-textile filter will prevent blockage of the collectors. Coarse, clean sand will prevent blockage of the geo-textile filter.

Vertical Applications of Multi-Flow in Landscape Settings

A. Equipment needed:

- four-inch chain trencher and/or trenching spade
- wheelbarrow and/or turf utility vehicle such as a Gator™ or Mule™
- utility knife
- laser level or hand level
- centering device(s) (optional)
- water hose (optional)

B. Materials needed:

- appropriate size of Multi-Flow pipe for collector system
- appropriate Multi-Flow connectors
- clean, very coarse, sand
- PVC or dual-wall corrugated pipe for transport system
- adaptors if needed
- pipe tape

C. Procedure

1. Trenching

Plot a path through the problem area to a discharge point, marking the route with paint or flags. The discharge point can be a ditch, the street, a catch basin, another drain line or a declining hillside. Begin trenching at the discharge point and proceed toward the highest point of the problem area. Stop periodically to ensure that proper grade is maintained. Remove excavated material from the site.

2. Laying out the drain

Roll out the Multi-Flow drain along side the trench. At the ends, pull back the geo-textile filter and snap the connectors in place. They slip on more easily if they have been manually pre-stretched. Push fittings, such as end caps, couplers, side outlets or end outlets, firmly over the pipe to ensure a secure fit. Then pull the fabric over the fitting and secure it in place with wide water-proof tape. This ensures that soil will not enter behind the fabric and block the drain core.

3. Connecting to transport system

Frequently connection to the transport system will be made from the bottom of a multi-purpose connector. Most commonly this will be a 0600M, 1200M, or 1800M. All multi-purpose connectors can be used to empty from the bottom (or from the side in a horizontal application). A standard PVC elbow can be slipped over the Multi-Flow connector. Pipe glue will ensure a lasting connection. When it is possible to tap into a new or existing transport line, Corru-Taps (for corrugated pipe) and Rigi-Taps (for PVC) make the task easy. They connect to any multi-purpose connector. Access to the transport pipe is made with a hole saw. This method can be used only with a transport pipe 8-inch or larger in diameter.

In some situations it works best to discharge the water through an end outlet or side outlet. In these cases, remove the plastic membrane covering the opening of the outlet with a utility knife. Cut the hole so that the exit pipe fits snugly and is located at the bottom of the fitting. Insert the exit pipe into the opening and stabilize the joint using wide waterproof pipe tape. Three-inch pipe fits into a 6-inch Multi-Flow basic connector. Four-inch pipe is used with 12 and 18-inch formats.

4. Backfilling

Use clean very coarse sand to fill the trench. Hold Multi-Flow in the center of the trench while backfilling. Bring the sand to the surface or near to it. Jetting the sand-filled trench with water will help to settle the sand in place quickly. The trench can be topped off with topsoil or rock. Never cap the trench with clay or other dense material.

Begin trenching at the lowest point and proceed up grade. Always check with local utilities before digging.

Cut Multi-Flow collector lines to the desired length using a utility knife.

A standard PVC elbow can be slipped over a Multi-Flow multi-purpose connector.

Hold Multi-Flow in the center of the trench while backfilling.

Planters are one of several applications easily and effectively drained using a horizontal installation.

This Corru-Tap is one way to connect to the transport system in a horizontal application. It connects 12-inch Multi-Flow to a corrugated pipe. A similar connector is available for 6-inch Multi-Flow. Rigi-Taps are used for connections to PVC pipe.

Cover with clean, very coarse sand before bringing in fill.

Horizontal Applications of Multi-Flow in Landscape Settings

A. Equipment needed:

- spade and/or walk behind loader
- wheelbarrow and/or turf utility vehicle
- utility knife
- laser level or hand level

B. Materials needed:

- appropriate size of Multi-Flow pipe for collector system
- appropriate Multi-Flow connectors
- clean, very coarse, sand
- PVC or dual-wall corrugated pipe for transport system
- pipe tape

C. Procedure

1. Trenching

Horizontal installations usually do not require trenching. When used in new construction settings such as in golf greens, planters, green roofs, under playground equipment, or synthetic turf, Multi-Flow can be laid out over the prepared site before the fill is brought in. Mark a path from the system high point to the discharge point. The discharge point can be another drain line, a ditch, the street, a catch basin, or a declining hillside. Maintaining grade is especially critical in horizontal installations. If trenching is required, use a walk behind loader and begin excavation at the discharge point and proceed toward the highest point.

2. Laying out the drain

Roll out the Multi-Flow drain. At the ends, pull back the geo-textile filter and snap the connectors in place. They slip on more easily if they are pre-stretched. Push fittings, such as end caps or couplers firmly over the pipe to ensure a secure fit. Then pull the fabric over the fitting and hold it in place with wide water-proof tape. This ensures that soil will not wash behind the fabric and infiltrate the drain core.

3. Connecting to the transport system

PVC makes for a good transport pipe because of its strength. When a larger transport pipe is needed (8-inch or larger) dual-wall corrugated pipe also works well.

Connection to small diameter PVC is generally made with an elbow or an in-line tee. Connection to larger diameter PVC (8" and larger) is best made with a Multi-Flow Rigi-Tap. Either way, these connections can be made from a single-sided outlet (e.g. 0600M), a multi-purpose coupler (e.g. 06009), a side outlet (e.g. 06003), a double wye (06016), or a cross (06018), all depending on the specifics of the system layout. Connection to 8-inch and larger dual-wall corrugated pipe is the simplest because it can be made directly using a Multi-Flow Corru-Tap and a hole saw.

4. Backfilling

Use clean very coarse sand to cover the Multi-Flow drain. One to two inches of sand should be spread over the drain and sand should extend three to six inches on each side of the Multi-Flow. Never use native soils or bring in fill containing clay or other dense material.

Quality backfill means a longer lasting system

At Varicore, we regularly receive questions about backfill. We sometimes even encounter the misconception that select backfill is a concept linked exclusively to Multi-Flow drainage. Your backfill choice will have no greater and no less effect on the life of a Multi-Flow system than it will on any other drainage system. Multi-Flow systems, and all other drainage systems enjoy longer life when quality backfill is used.

French drains block

It is a well known fact that French drains frequently block up, sometimes in a remarkably short amount of time. This blockage typically occurs on the trench liner. Small particles of clay or silt are carried by moving water until they are intercepted by the filter, which eventually blocks totally. The actual life span of a French drain depends on the soil type and the rainfall amounts. This same blockage can occur with round pipe or panel drain wrapped in geo-textile. Highway departments and golf course managers have wrestled with this issue for many years.

Very coarse sand

The best solution to this problem is to surround the geo-textile filter with very coarse sand. Sand is an excellent filter of clay and silt. As the water containing these contaminants moves through the sand, it slows down and the particulate matter drops out. An inch or more of sand is a very effective filter.

A sand filter is far more feasible with a Multi-Flow system than with a traditional French drain. It would be very difficult, if not impossible, to insert a layer of sand between the trench wall and the geo-textile liner in a French drain. However, it is relatively easy and affordable to use sand as a backfill medium surrounding Multi-Flow in a four inch wide trench. With sand as a primary filter and the 4-ounce needle-punched geo-textile as a secondary filter, Multi-Flow systems provide long-lasting, effective drainage.

Perfect sand

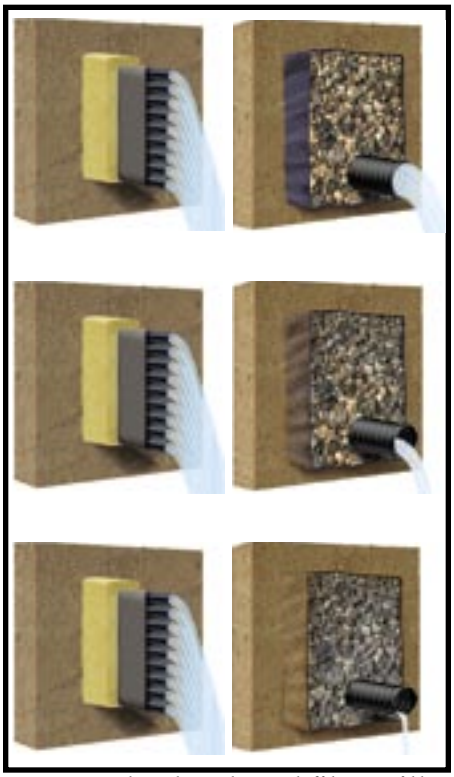
According to the USDA system of classification, very coarse sand has an approximate particle size of between 1.0 and 2.0 mm. Some designers have used this for a sand spec:

When passed over a sieve, very coarse sand will have:

- less than 5% retained on a #10 U S standard sieve,
- less than 5% passing a #30 U S standard sieve
- no more than 1 % pass through a #50 U S standard sieve.

Unfortunately, good quality sand is not uniformly available. The closer installers come to this recommendation, the longer their system will last. Absolute conformity is frequently not practical. On one hand, sand contaminated with clay or silt will impede the movement of water as well as accelerate the blinding of the drainage system. On the other hand, pea rock and mixed particle size gravel allow for rapid movement of water in the beginning, but are susceptible to infiltration by fines. They might not be aggressive enough in protecting the fabric filter. Buck shot or washed medium sand are better choices, but will not perform as well as clean, very coarse sand. When the perfect sand cannot be found, look for an alternative following these two criteria and in this order:

1. Look for sand that is clean
2. Look for sand that is coarse



A properly placed sand filter will dramatically extend the life of a drainage system.

Very coarse sand makes for the best backfill.

Backfill estimation guideline:
trench depth (inches) X trench width (inches) X trench length (feet) I 3888 = yards³ of backfill
(total volume of trench)

4 Frequently Asked Questions

Why is drainage so important for healthy turf?

Walking on, maintaining, or driving over soil that is saturated will compact the soil, forcing suspended soil particles into air voids. This will inhibit the growth of healthy grass and other plants as well as making the surface hard and uneven.

Is it possible to over drain my site?

Drainage cannot and will not remove all water from the soil. It only reduces it from the unacceptable "saturation point" to the desired level of "field capacity." At this point, water clings to surrounding soil particles which refuse to yield any more moisture to gravity. Fortunately, plants can still access this remaining soil water. Due to plant usage, combined with evaporation, soil moisture levels will eventually fall to a "wilting point" at which time additional water becomes mandatory.

Why use Multi-Flow for a collector system?

Following best management practices, the Multi-Flow drainage system excels in a number of ways. Shape, function, strength and design combine to make Multi-Flow an unparalleled product:

- Multi-Flow provides a large surface area that interfaces with saturated soils. This allows water to enter the system rapidly.
- Multi-Flow's narrow shape allows for insertion into a narrow trench resulting in minimal excavation.
- Multi-Flow's enclosed, circular, flow channels allow for extraordinary flow rates.
- Multi-Flow's strength allows it to be installed in shallow applications where it might be subjected to the weight of surface traffic as well as in extra deep installations where it may bear the weight of many tons of soil.
- Multi-Flow comes wrapped in a premium, needle-punched, geo-textile filter preventing sand and soil from entering and blocking the system.
- A large array of connectors allows the Multi-Flow system to be configured in limitless designs. Horizontally or vertically, Multi-Flow can be laid out in almost any pattern using 45° or 90° alignments. It can combine 6", 12" and 18 "products and can empty from the end, side, or bottom.
- Multi-Flow is pliable, making it suitable for tight corners and assisting in connecting fittings conveniently.

What are the requirements of a transport system?

Transport systems need to be able to carry water away from the site as fast as the collector system can accumulate it. Furthermore, the transport system must be at least as strong as the collector system. PVC and dual wall corrugated HDPE pipe are good options.

Flow rate requirements will vary depending on the number of collector lines that are being fed into a given transport pipe. 6-inch, 12-inch, and 18-inch Multi-Flow collectors are capable of delivering 17, 29, or 45 gallons per minute, respectively. (Changes in slope and/or head pressure will alter these rates.) Multiply the number of collector lines times the appropriate gpm to determine the maximum expected rate.

Why does Multi-Flow incorporate a geo-textile filter?

Without a geo-textile filter, drainage products can fill with soils. When rainfall is heavy, drainage systems tend to wash clean inside, but during drier periods, blockage is common. Systems that do not employ a geo-textile tend to use crushed rock or similar backfill. The voids in these backfills are prone to wash full of soil as well. Geo-textiles are a very effective way of keeping these particles out of the pipe.

Not all geo-textiles are equally effective at this task. First of all, geo-textiles with larger openings do not blind as quickly as those with smaller openings. Of course those with larger openings are also less effective as filters. Secondly, those with a needle-punched surface last longer than those with a smooth surface because they have more surface area for collecting fines. Multi-Flow employs a heavy needle-punched polypropylene filter with openings as large as a # 70 U.S. standard sieve. Its openings are of optimum size and its "fuzzy" surface provides more filter area.

Should the seam in the filter be placed up or down?

Multi-Flow is reversible. There is no top or bottom.

If I cannot find the recommended backfill medium should I select another drainage system?

Obviously we would not want to see installers backfill Multi-Flow, or any other drainage product for that matter, with native soil. The system would quite likely suffer pre-

mature failure. The customer might then blame the drainage product instead of the real culprit, the fines, for that failure. We know that sometimes customers must settle for less than the very best. Any kind of select backfill is to be preferred over the native excavated soil. Multi-Flow's size and shape makes premium backfill a more realistic possibility than in a French drain system. However, that is only one of many attractive Multi-Flow features. Superior strength, increased surface area, faster flow rates, better quality filter, professional and speedy service, and an unparalleled connector system all combine to put Multi-Flow head and shoulders above the competition with or without the very best backfill. It would be unfortunate if someone chose to install an inferior drainage product because of the illusion that it could be safely backfilled with inferior backfill.

Will my choice of backfill void Multi-Flow's warranty?

Multi-Flow's warranty is not affected by backfill choices. Varicore Technologies guarantees that each roll of pipe leaving our factory meets the high standard laid out on our product spec sheet. Choice of backfill and installation techniques will in no way affect this warranty. Varicore manufactures the highest quality drainage products. So, it encourages the end user to insist on installation practices that insure the longest possible life and the highest level of performance from the drainage system.

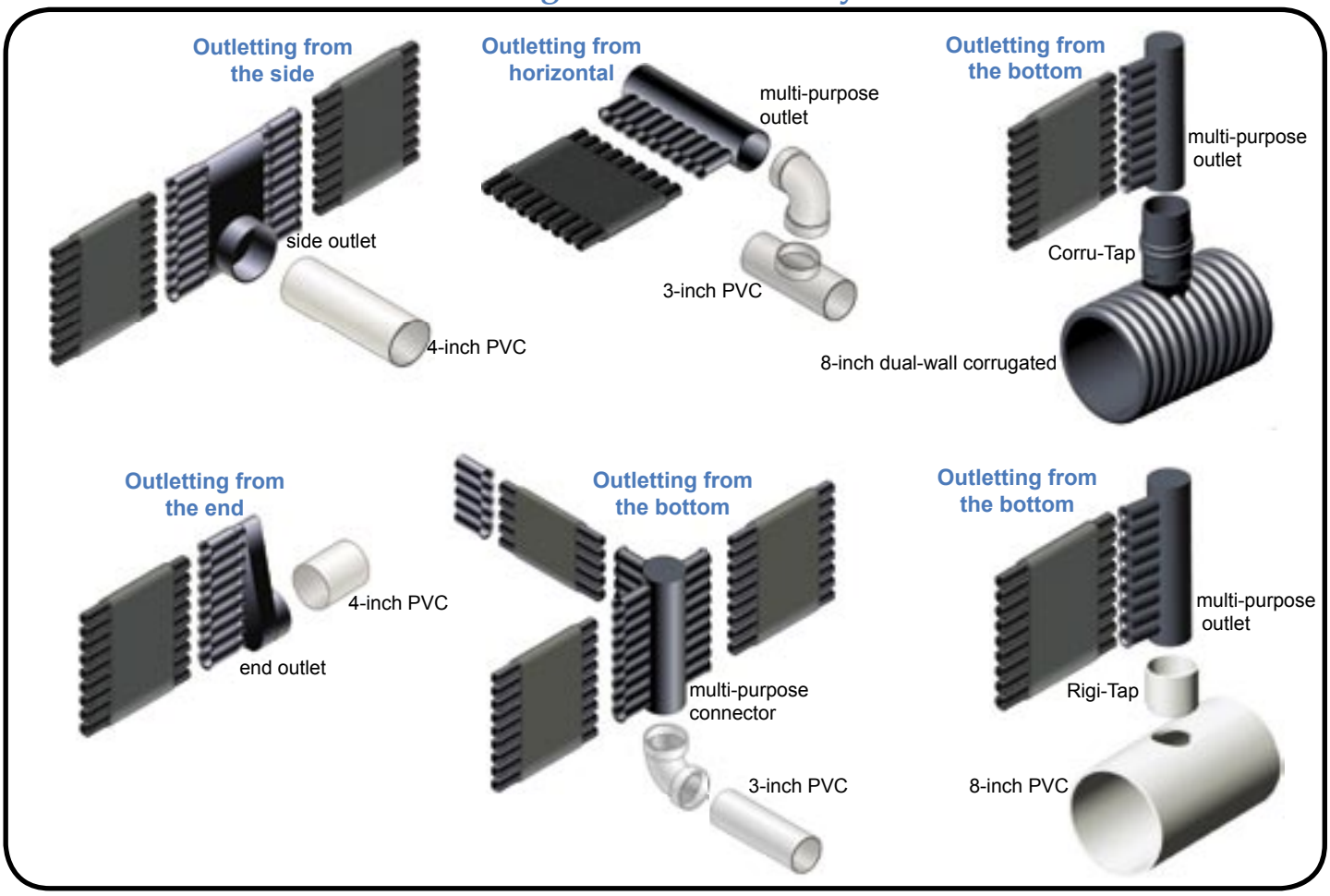
How do I decide whether to install Multi-Flow horizontally or vertically?

The unique features of your drainage site will determine the drainage profile. Vertical installations are most common. They allow for installation in a narrow trench with less excavation, less spoil, and less backfilling. Horizontal installations are used when the situation calls for a low profile or to avoid trenching altogether. Typical horizontal applications include: planters, green roofs, playgrounds, golf greens, and under synthetic turf or pavers.

How do I connect to my transport system?

You can exit the Multi-Flow system, from an end outlet, a side outlet, or from any multi-purpose connector. In most situations, exiting from a multi-purpose connector is advised. Multi-purpose connectors attach to 3-inch schedule 40 pipe. Industry standard bushings can be used to connect to other sizes. In a horizontal application, you can also exit from a 6-inch horizontal cross or double wye. Transition to a transport pipe with an 8-inch diameter or larger is best made with Multi-Flow Rigi-Taps (for PVC) or Corru-Taps (for dual-wall). To connect to smaller diameter pipe, industry standard tees, wyes, and reducers are recommended. The illustrations below demonstrates some of these options.

Outletting the Multi-Flow System



Drainage Core

Property	Test Method	Value
Thickness, inches	ASTM D-1777	1.0
Flow Rate, gpm/ft *	ASTM D-4716	29
Compressive Strength, psf	ASTM D-1621 (sand method)	6000
Perforations/ sq ft	----------	> 300

Geo-textile Filter

Property	Test Method	Value
Weight (oz/yd²)	ASTM D-3776	4
Tensile Strength, lb.	ASTM D-4632	100
Elongation, %	ASTM D-4632	50
Puncture, lb.	ASTM D-4833	50
Mullen Burst, psi	ASTM D-3786	200
Trapezoidal Tear, lb.	ASTM D-4533	42
Coefficient of Perm, cm/sec	ASTM D-4491	0.1
Flow Rate, gpm/ft²	ASTM D-4491	100
Permittivity, 1/sec.	ASTM D-4491	1.8
A.O.S., U.S. sieve	ASTM D-4751	70
UV Stability, 500 hrs. %	ASTM D-4355	70
Seam Strength, lb/ft	ASTM D-4595	100
Fungus	ASTM G-21	No Growth

Notes:

Values given represent minimum average roll values.
*at gradient = 0.1, pressure = 10 psi for 100 hours in horizontal installation

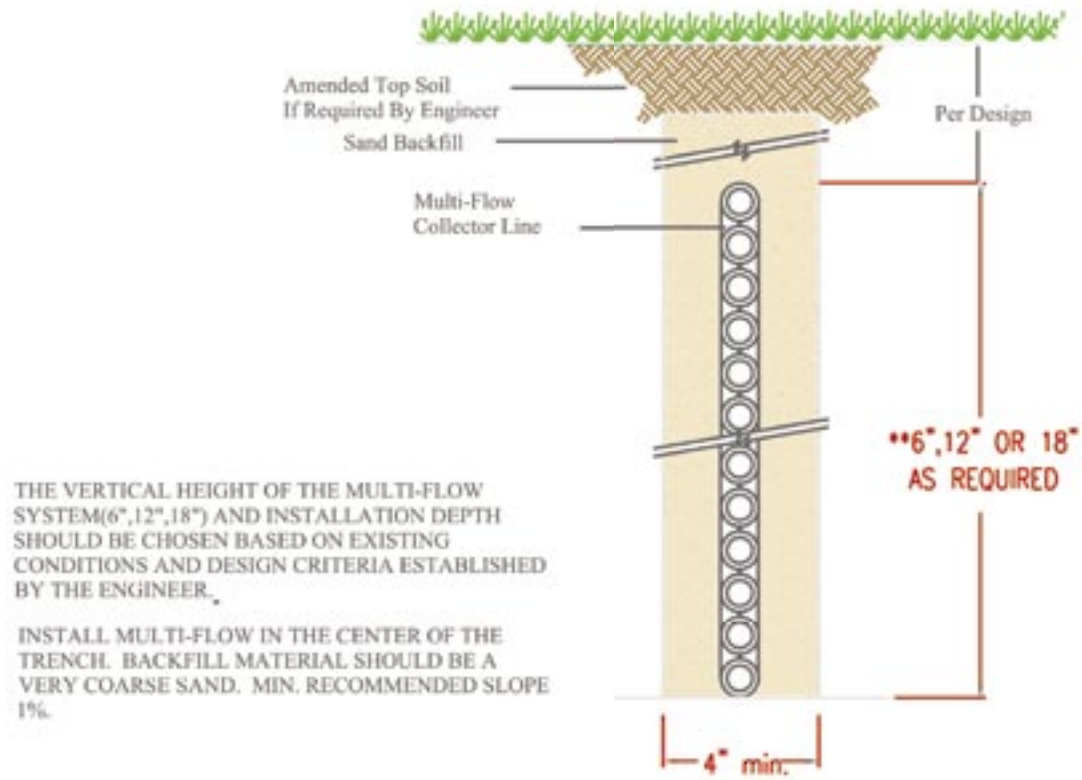
Multi-Flow is available in three sizes: 6-inch, 12-inch, and 18-inch. Standard 150-foot length rolls are shipped in 55 inch diameter rolls.

For purposes of project design, assume the following flow rates:

6-inch - - - - - - - - - - - - - 17 gpm
12-inch - - - - - - - - - - - - - 29 gpm
18-inch - - - - - - - - - - - - - 45 gpm

Rates will rise as slope and head pressure are increased and fall as they are decreased.

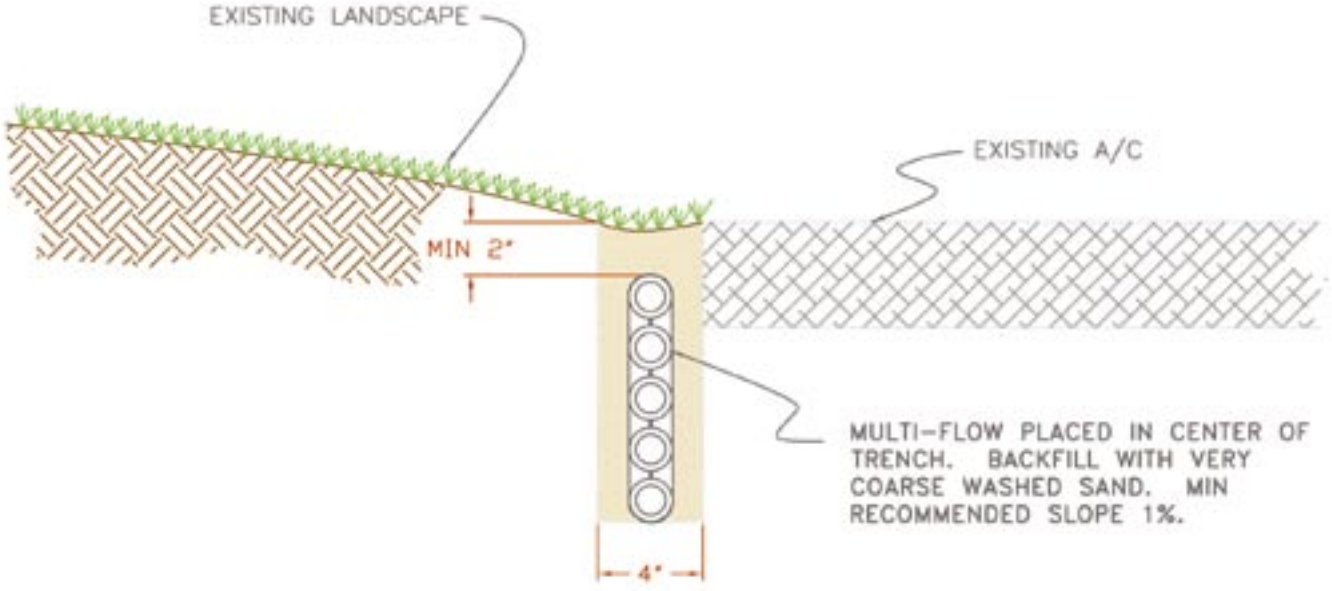
UNDER TURF INSTALLATION



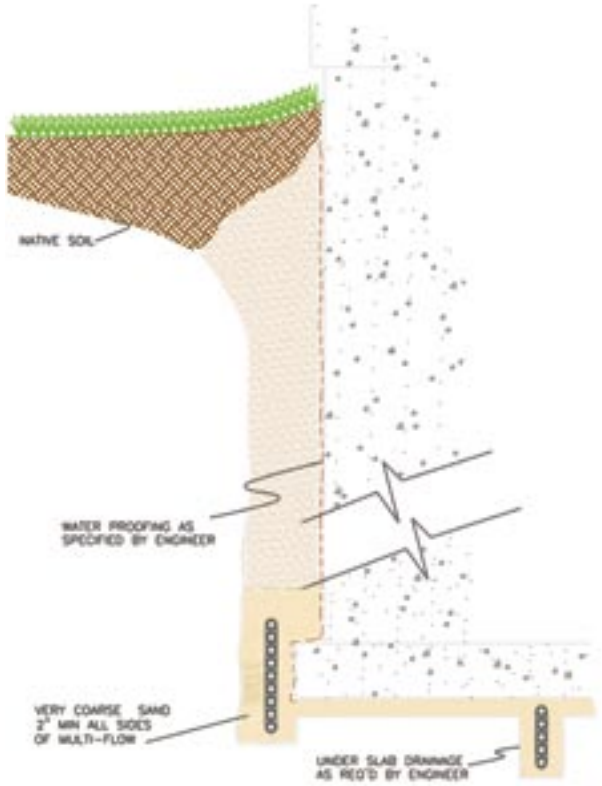
THE VERTICAL HEIGHT OF THE MULTI-FLOW SYSTEM(6",12",18") AND INSTALLATION DEPTH SHOULD BE CHOSEN BASED ON EXISTING CONDITIONS AND DESIGN CRITERIA ESTABLISHED BY THE ENGINEER.

INSTALL MULTI-FLOW IN THE CENTER OF THE TRENCH. BACKFILL MATERIAL SHOULD BE A VERY COARSE SAND. MIN. RECOMMENDED SLOPE 1%.

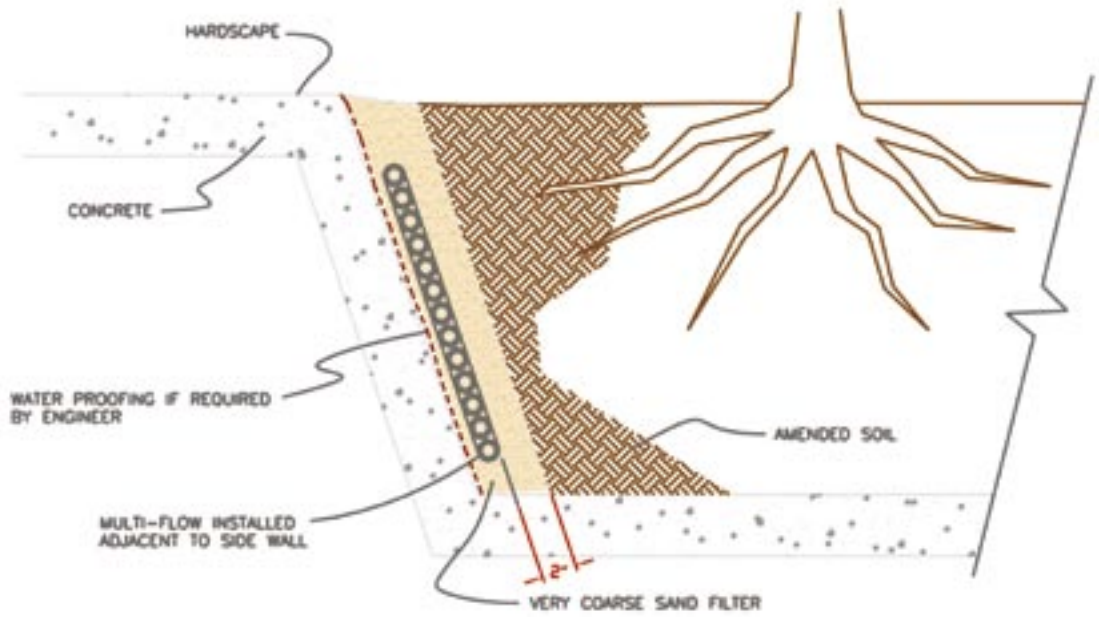
TURF TO ASPHALT OR CONCRETE INSTALLATION



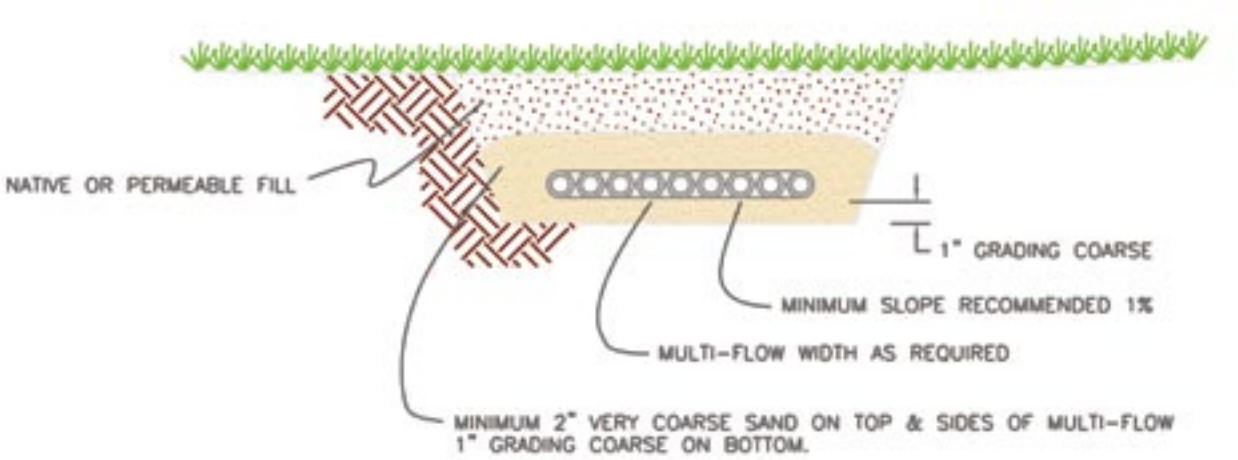
UNDER SLAB INSTALLATION



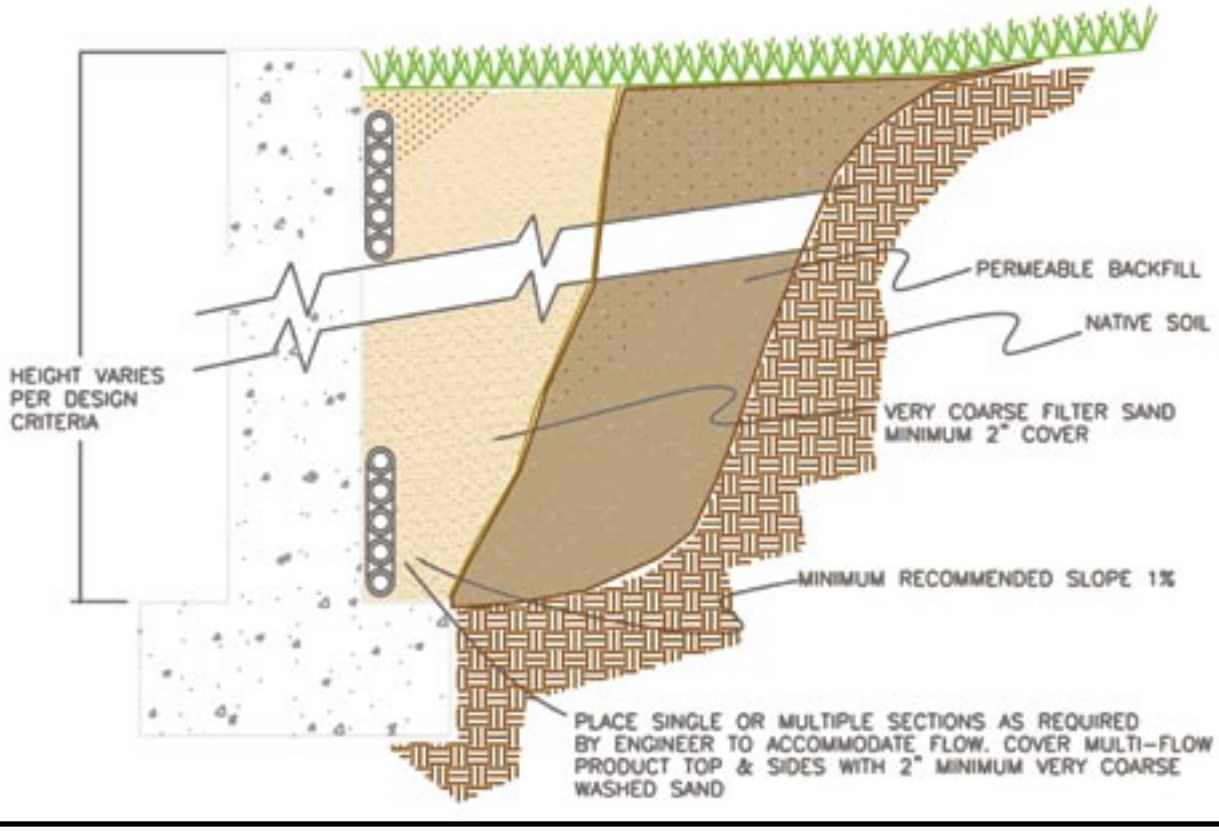
TREE WELL INSTALLATION



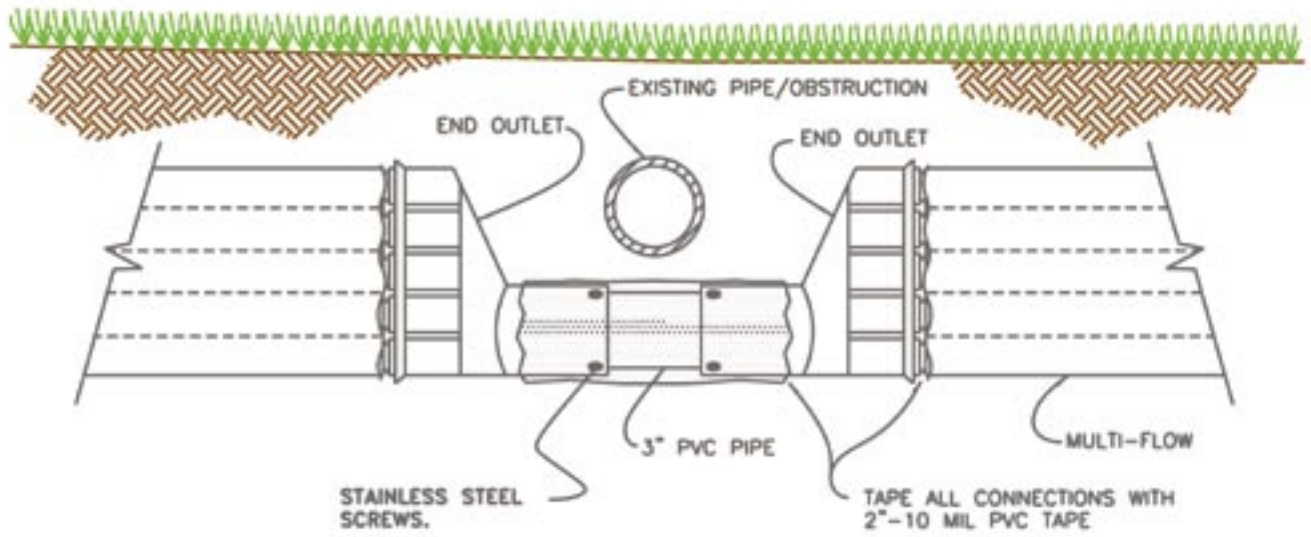
SHALLOW HORIZONTAL INSTALLATION



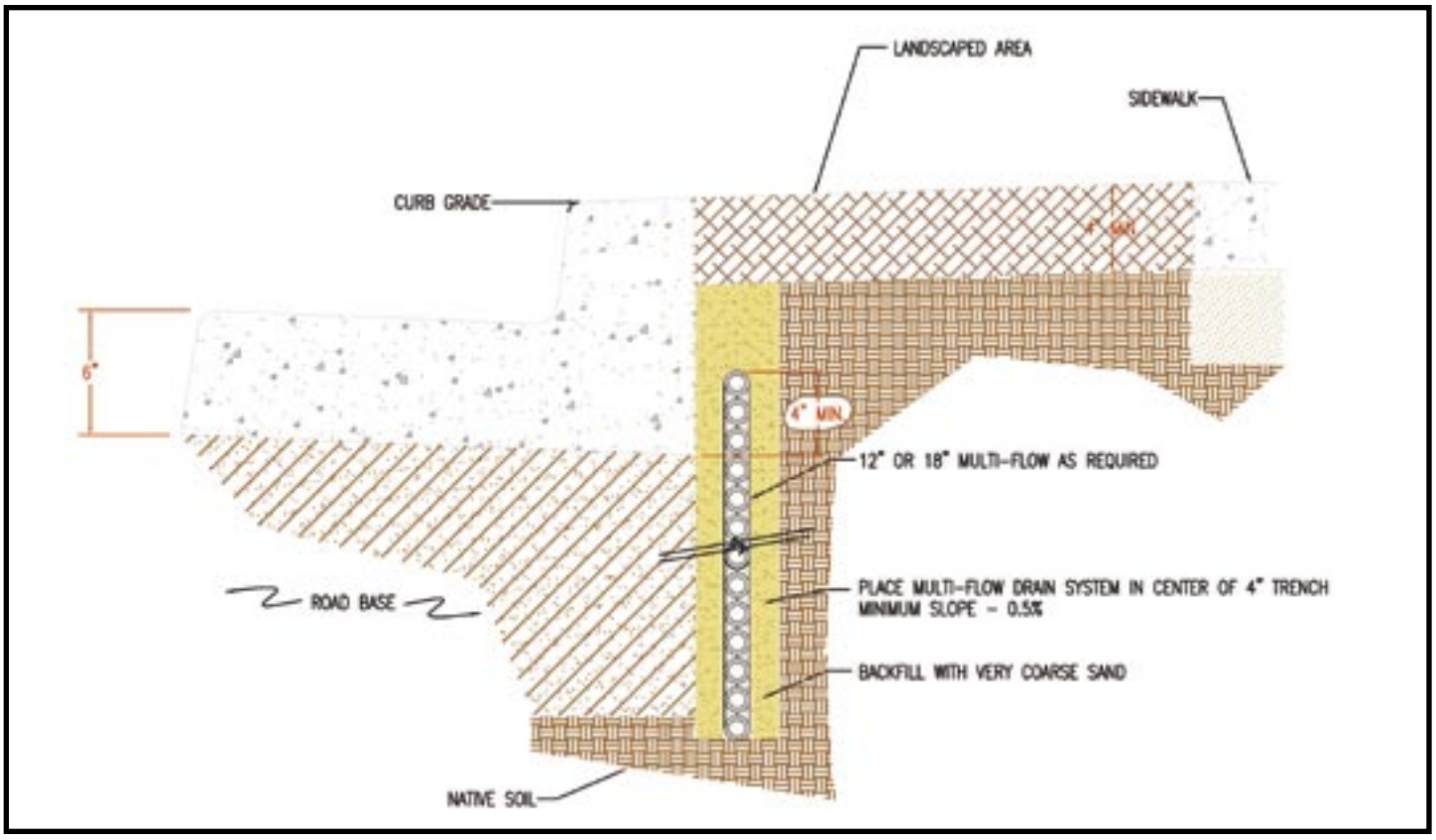
RETAINING WALL INSTALLATION



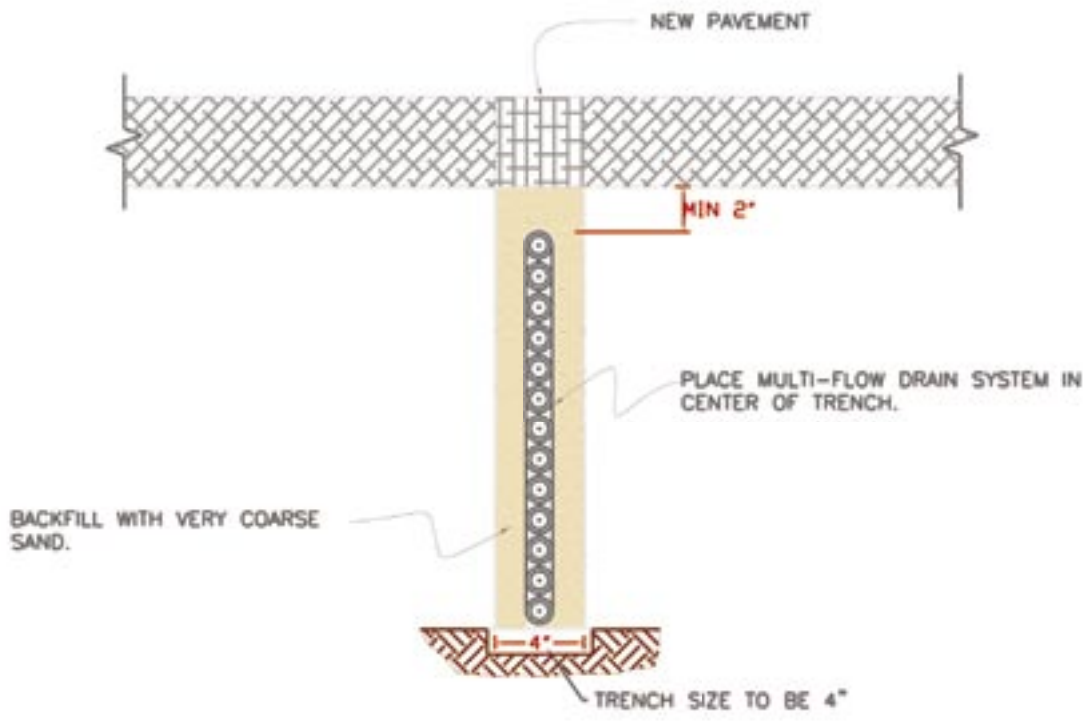
UNDER OBSTRUCTION INSTALLATION



CURB AND GUTTER INSTALLATION

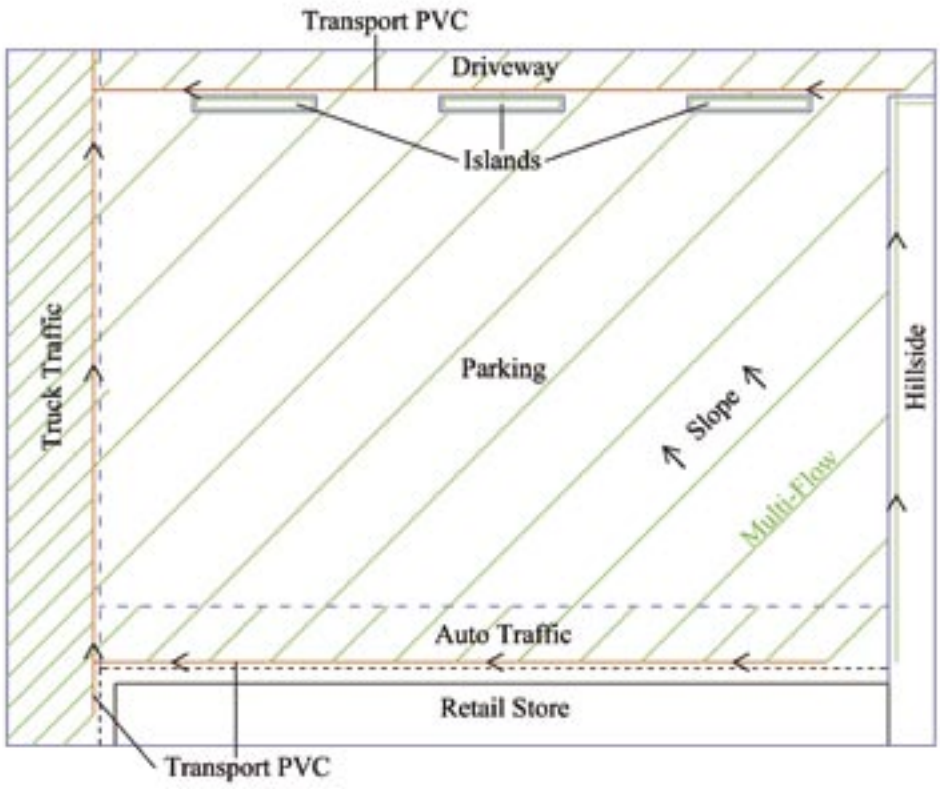


UNDER PAVEMENT INSTALLATION



SAMPLE PARKING LOT DRAWING

Varicore provides complimentary drawings for specific sites.



We hope that this Multi-Flow Landscape Drainage Design Guide is helpful to you. We take pride in our professional customer service from the design phase through product delivery. Product catalogs and drainage guides for other applications are available upon request. Our design staff stands ready to provide you with assistance in preparing plans and advice for specific drainage projects.

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