FocalPoint

BIOFILTRATION SYSTEM
INSTALLATION GUIDE

DISTRIBUTED BY:

Fabco Industries, Inc
66 Central Ave · Farmingdale, NY 11735
Tel: 631 393 6025; Fax: 631 501 5528
www.fabco-industries.com

Summary

FocalPoint is a scalable biofiltration system which combines the efficiency of high flow rate engineered soils with the durability and modularity of a highly pervious flat pipe underdrain/storage/infiltration system. While originally developed as proprietary technology, these systems are also available in a tightly specified generic format.

The following contents of FocalPoint Installation Guide are the necessary steps required for a FocalPoint Biofiltration System installation and activation. In this guide there will be a detailed chapter with corresponding pictures for each step to improve your profitability on the installation, advises in steps that require extra attention and addresses issues that must be handled in a particular manner.

ALL STEPS MUST BE COMPLETED IN THE ORDER OUTLINED TO ENSURE A SUCCESSFUL FOCALPOINT INSTALLATION AND ACTIVATION.

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General Notes

Be sure to contact your local Convergent Water Technologies Value Added Reseller (VAR) at least two weeks prior to installation. We will provide you with onsite installation support AT NO CHARGE in order to facilitate your installation.

All pictures, illustrations and instructions have been included to guide you through a typical installation. The approved engineering drawing should ALWAYS take precedence over these instructions.

It is advised that the FocalPoint system is installed after stabilization, or when other landscaping is being done. The components of the FocalPoint system include an engineered, high-flow media that must be protected from site erosion and sediment. The easiest way to prevent this is to not install it until the final phase of construction.

If it is necessary that the system be installed prior to final stabilization, please contact a Convergent Water Technologies VAR to discuss proper BMPs to protect the integrity of the system. Once completed, storm water should not be allowed to enter the FocalPoint system until the site is completely stabilized. Otherwise, the FocalPoint system may become prematurely contaminated with sediments from the project.

Throughout this document you will see three types of notes:

***TIP**: Ideas to improve your profitability on the installation*

***IMPORTANT**: Steps that require extra attention*

***WARNING**: Critical issues that MUST be handled correctly to ensure a good installation*

TOOLS YOU WILL NEED:

- Laser or Transit
- Measuring Tape (Long enough to mark FocalPoint footprint)
- Razor Knife
- Screw Driver / Nut Driver Set
- String Line
- Marking Paint
- Reciprocating Saw (To cut in Inspection & Maintenance Ports) Dead Blow Mallets
- Worktables (3/4" plywood placed on saw horses work well) Hog rings and hog ring gun for Gabion if used
- Level

MATERIALS YOU WILL NEED:

- Element$_3$ Modular Underdrain Panels 8oz Non-Woven Geotextile Envelope Element$_2$ Biaxial Screen
- Washed 3/8" - 1/2" pea gravel
- Element$_1$ High Flow Biofiltration Media
- Base Material (95% compactable angular stone (½" – 1½") or sand
- Pipe Boot Kits (If not using kits, you will need duct tape and a stainless steel band clamp for each inlet and outlet pipe, and for each inspection or maintenance port.)
- Pipe for Inspection and Maintenance Ports (Typically 6" and 12" SCH 40 PVC) Six inch atrium grate
- Gabion basket(s)
- Washed 3" x 5" rock (For Gabions or Flow Dissipation)
- Aged shredded hardwood bark mulch

EQUIPMENT YOU WILL NEED:

- Forklift and other equipment/tools needed to unload box truck
- Walk behind trench roller (plate compactor may also work)

Note: This list does not include equipment or tools needed to excavate or level the floor of the excavation

1 ASSEMBLE MODULAR UNDERDRAIN

If Modular Underdrain units arrive on your project in flat panels they will need to be assembled on-site. Assembling the units should take 2-3 minutes per module. This is a conservative estimate used to approximate the total man hours needed for assembly. The estimate includes the workers doing the assembly as well as material handling people to keep the assembly workers moving.

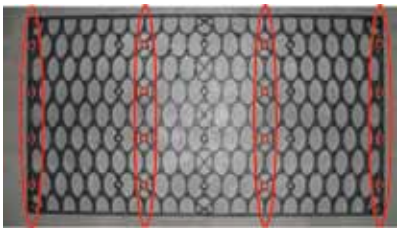


Figure 1: Attach small plates at locations marked in red. The holes to be used for the middle panels are centered on an "X"

Unit	Mini	Single	Double	Triple	Quadruple	Penta
Time	2-3 minutes	2-3 minutes	4-6 minutes	6-9 minutes	8-12 minutes	10-15 minutes

Assembly Instructions – following the drawings in Fig. 2: Connect four small panels (B) into one large panel (A) using the short pegs (not the long pegs). Attach small panels onto the large panel at the locations marked in red on Fig. 1. Do NOT use the row of pin holes directly in the center or the two interior rows nearest the edges, as marked in red on Fig. 1.

Next, working from one end to the other, attach a second large plate (A) on the opposite side of the first.

Once the top and bottom large plates are attached, two more side plates (A) are attached to complete the sides of the Modular Underdrain unit. The picture in figure 2 shows is a SINGLE MINI Modular Underdrain. A single modular underdrain unit will be assembled in the same manner.

To build a DOUBLE unit (or larger), follow the directions above, starting at "Assembly Instructions:" using the top of the existing unit as the large plate.

Figure 2: Follow these steps to assemble the underdrain units

Figure 3: Assembling on site during excavation will increase speed once the excavation is completed

To increase the speed of the installation, many contractors choose to assemble the Modular Underdrain units prior to or during excavation (Step 2) and base preparation (Step 3) (Fig. 3). Other contractors wait until these steps are completed and then perform the assembly IN THE EXCAVATION allowing completed units to be placed into their final location as they are assembled. Consider which option will work best for your project.

2 EXCAVATE

Excavate the designated area according to plans.
Typical excavations should include:

- One foot perimeter around underdrain modules to allow for proper compaction of backfill
- Enough depth to accommodate a minimum 3" base (if required) below the underdrain modules

Level the bottom of the excavation (Fig. 4) as shown on plans. Most excavations have a flat bottom while some will slope toward the outlet pipe slightly.

Prepare the subgrade according to plans. This could require compaction for stability or possibly prohibit compaction for infiltration.

Figure 4: Excavation according to plans, following all governmental regulations

3 PREPARE BASE

Standing water in the excavation will prevent proper base preparation and must be removed, if present. In regions with sandy soils meeting the requirements noted and where the subgrade elevation is above the groundwater table, imported base materials may not be needed.

Install Base Materials. Base materials must be:

Compaction	95% Compaction
Shape	Angular
Size	Not larger than 1.5" in diameter
Consistency	Free of lumps, debris, and sharp objects that could cut geotextile
Applicability	Stone or sand is acceptable if it meets these requirements; In no case shall clays be used

Grade and level base as shown on plans.

Tip: Creating a smooth, level platform will allow for faster installation of Modular Underdrain, as they will fit together evenly, eliminating detail work that can delay your progress (Figure 5)

Figure 5: Base must be smooth to ensure units fit together without gaps

4

PLACE GEOTEXTILE ENVELOPE

Geotextile will be required on all FocalPoint installations to seperate the surrounding in-situ soils from the Focalpoint System. Check your plans to ensure that geotextile is to line your entire excavation.

Cut full-width strips of Geotextile to the proper length and place them over the base and up the sides of the excavation, covering the floor and walls of the excavation. The geotextile should extend at least 2' beyond the excavation.

Allow enough geotextile to wrap the top of the system as well to aid in protecting the system until the site is completely stabilized and ready for activation.

Figure 7: Pre-Fabricated geotextile envelope with pipe boot allows for simple installation.

Figure 6: Rolled geotextile cut to fit the excavation is the most economical way to keep in-situ soils from migrating into the FocalPoint System. Geotextile strips must cover entire excavation.

Geotextiles are flammable. No smoking should be permitted on the geotextile.

Adjacent panels of material should be overlapped by 12" or more, as shown on the plans (Fig. 6).

Use pins, staples, sandbags or other ballast to hold the geotextile in place, preventing it from blowing or sliding out of position.

Patch any holes made in the Geotextile by placing a small patch of fabric over the damaged area. The patch must be large enough to cover the damaged area with at least 12" of overlap on undamaged material.

5 INSTALL MODULAR UNDERDRAIN *continued*

Begin placing Modular Underdrain in the corner of the marked area. Do NOT place units on their sides, as this will void the warranty. Check your plans to ensure correct orientation of the Modular Underdrain (Fig. 9).

Check the plans to ensure the Modular Underdrain is running in the correct direction (North/South vs. East/West) to match the footprint shown.

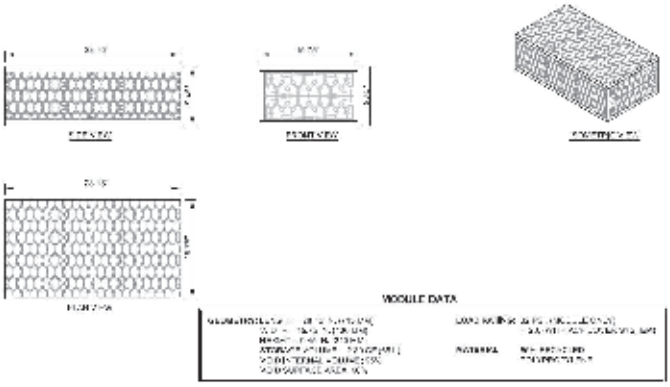


Figure 9: Make sure the tanks are oriented properly in the excavation.

Figure 8: Place modular underdrain in specified configuration within geotextile envelope.

Moving Modular Underdrain units into the excavation quickly is essential to a profitable installation. Many contractors fabricate a platform that can be lifted by their forklift to quickly move a large number of units with each lift for large systems.

Figure 9A: Minor Variations (less than width of top plate) in tank height are acceptable

Modular Underdrain units should fit together evenly. Minor gaps between units (< ½") or variations in the height of the units (< ½") are acceptable (Fig. 9A), but reasonable efforts should be made to minimize these variations. Minor gaps will be eliminated during compaction of side backfill material.

No lateral connections between adjacent underdrains modules are required.

Whenever possible, the large side plate of the tanks should be placed on the perimeter of the system. This will require that two ends of the tank area will have a row of tanks placed perpendicular to all other tanks (Fig. 10). This perpendicular row is required when the base of the Modular Underdrain is > 10' below finished grade. This may be the case when rainwater harvesting or underground detention are required.

6 INSTALL INSPECTION/MAINTENANCE PORTS

All ports should be made from pipe long enough to extend from the bottom of the Modular Underdrain to finished grade of the FocalPoint System. They are typically Schedule 40 PVC pipe, but can be formed from other types of pipe, as well.

Figure 11: 8" slots cut in to bottom of inspection port caps

Identify the location of all ports and remove the Modular Underdrain Module from each location.

Ports are typically made from 6" Schedule 40 PVC pipe. Cut the pipe to length, leaving enough excess to trim the top when final grade is reached.

If the pipe is not already perforated, cut several horizontal slots in the pipe starting at the bottom (Fig. 11). Slots should extend as high as the height of the lowest underdrain module being used. No perforations should be visible above the top of the Modular Underdrain once the port is in place.

Using your reciprocating saw, cut the horizontal underdrain module plates in the center, between the two internal verticle plates, to accommodate the port (Fig. 12). If the pipe will not fit between the two interior plates, one or both plates may be moved to the outer connection locations on the large plate . All horizontally oriented plates will need to be cut EXCEPT FOR THE BOTTOM PLATE. In total you will need to cut:

Unit	Cut
Mini & Single	1 plate
Double	2 plates
Triple	3 plates
Quadruple	4 plates
Penta	5 plates

If the location of the inspection ports is not shown on your plans, use a single inspection port located in the middle of the underdrain field

IMPORTANT: Do not over-cut the Modular Underdrain plates. Minimize the gaps between the pipe and the Modular Underdrain plates. This is particularly important with the top plate.

For all units larger than a Single or Mini Underdrain Module, you will need to disassemble the Underdrain module in order to cut the interior plates. Reassemble the Underdrain Module when cutting is completed, and replace the Modular Underdrain Module into the proper location.

TIP: If using Prefabricated Pipe Boot Kits, install them onto the pipe now, leaving the band clamps loose so that final adjustments may be made in Step 7.

Install the pipe into the Underdrain Modules.

Place 6" pipe with pre-cut slots into hole cut to accomodate inspection port so that it fits snug (Fig. 13). Be sure to cut the top of the pipe so that once the FocalPoint Inspection Port Cap is placed onto the top of the pipe, the top of the Inspectiopn Port Cap will be flush with finished grade. Once the pipe is in place, put the FocalPoint inspection port Cap or a temporary cap on the port to prevent debris from entering the system during backfill procedures (Fig. 14).

Figure 12 (Top): Cut 6" Hole into top panel of underdrain module to accomodate 6" pipe

Figure 13 (Bottom): Place inspection port into underdrain module

Figure 14 (Right): Cut inspection port to appropriate height stated on plans. Seal the opening on top of the pipe with the FocalPoint Inspection Port Cap or temporary lid

7

INSTALL BIAXIAL MESH

Clean off any debris that may be lying on top of the exposed geotextile around the perimeter of the Modular Underdrain.

Cut strips of Biaxial Mesh to fit over the top and down both sides of the underdrain module. Adjacent strips of Biaxial Mesh should overlap at least 12" or as shown on plans. Use rock bags or other ballast to temporarily secure overlaps (Fig. 15).

Where Modular underdrain intersects an Inspection or Maintenance Port, cut an "X" into the geotextile and pull it over the pipe. The flaps of the "X" should point AWAY from the Modular Underdrain (Fig. 16). Use stainless steel band clamp to seal the flaps to the pipe.

Figure 15 (Above): 12" overlap of Biaxial Mesh on top of underdrain module

IMPORTANT: Take special care with Inside Corners on the footprint of the system. Cut Biaxial Mesh as needed to ensure that it lays flat against the Modular Underdrain. Use additional pieces to seal the corner and any cuts that are made (12" overlap).

Figure 16 (Below): Cut an "X" into Biaxial Mesh to accomodate pipe penetration

Figure 17: fold corners flat against the tank

Fold Biaxial Mesh for outside corners similar to sheets on a bed, and lay excess material flat against Modular Underdrain. Leave corners loose to avoid creating weak spots in the material. Temporarily secure excess fabric with duct tape (Fig. 17 left).

Tip: If using Prefabricated Pipe Boot Kits, install them onto the Inlet and Outlet Pipes, leaving the band clamps loose so that final adjustments may be made.

Connect Inlet & Outlet Pipes

Where the inlet and outlet pipes connect to the underdrain module or exits the excavation, cut an "X" into the Biaxial Mesh or geotextile so that the pipe runs through the geotextile and makes DIRECT contact with the underdrain mudule (Fig: 18). Pull the flaps of the "X" cut over the pipe so that the flaps of the "X" point AWAY from underdrain module. Use a stainless steel band clamp to seal the flaps to the pipe.

Figure 18: Cut "X" in Biaxial Mesh and Geotextile to accomodate outlet pipes and seal with stainless steel band clamps

8 BACKFILL SIDES & TOP WITH PEAGRAVEL

Backfill bridging stone material around perimeter of the underdrain modules, distributing the material evenly to prevent shoving of the underdrain modules.

Use a trench roller, plate compactor, or hand tamper to compact backfill. When using taller underdrain modules, this should be donw in 12" lifts.

Continue placing and compacting backfill around underdrain modules until the bridging stone reaches the top of the underdrain modules. Once bridging stone is level with the top of the underdrain, place 6" (or as specified) on top of underdrain modules (Fig 20).

Figure 20 (Above): Place 6" of bridging stone on top of Biaxial Mesh

Figure 21 (Right): Use Inspection Port as marker

Figure 19: Compaction is critical in order to keep soils from settling around the tank.

TIP: Before you place peagravel use your inspection port to mark the different levels of fill as specified (Figure 20)

9 PLACE ELEMENT$_1$ SOILS

Once pea gravel is level, place 6" of Element1 Biofiltration Media on top of the pea gravel. Use marked stakes to ensure elevations. Once 6" of media has been placed, set Gabions if applicable. Once Gabions have been installed, continue placing Element1 Biofiltration Media until it is at the required depth. The top of the Element1 Biofiltration Media should be 6" below the top of the gabion wall or as specified.

WARNING: Element$_1$ soils are engineered soils—do not mix Element$_1$ soils with any other site, fill or excavation soils.

Figure 22: Place Element$_1$ soils, being careful not to mix with any other site soils, to specified depth

Figure 23: Level Soils once they are filled to specified depth

PLACE & FILL GABION

The gabion baskets are 12" tall. The interior diameter of the gabion baskets needs to be equal to the exterior diameter of the underdrain unless specified otherwise. The top of the gabion should stick up 6" above the top of the Element1 Biofiltration media and 3" above the bark mulch.

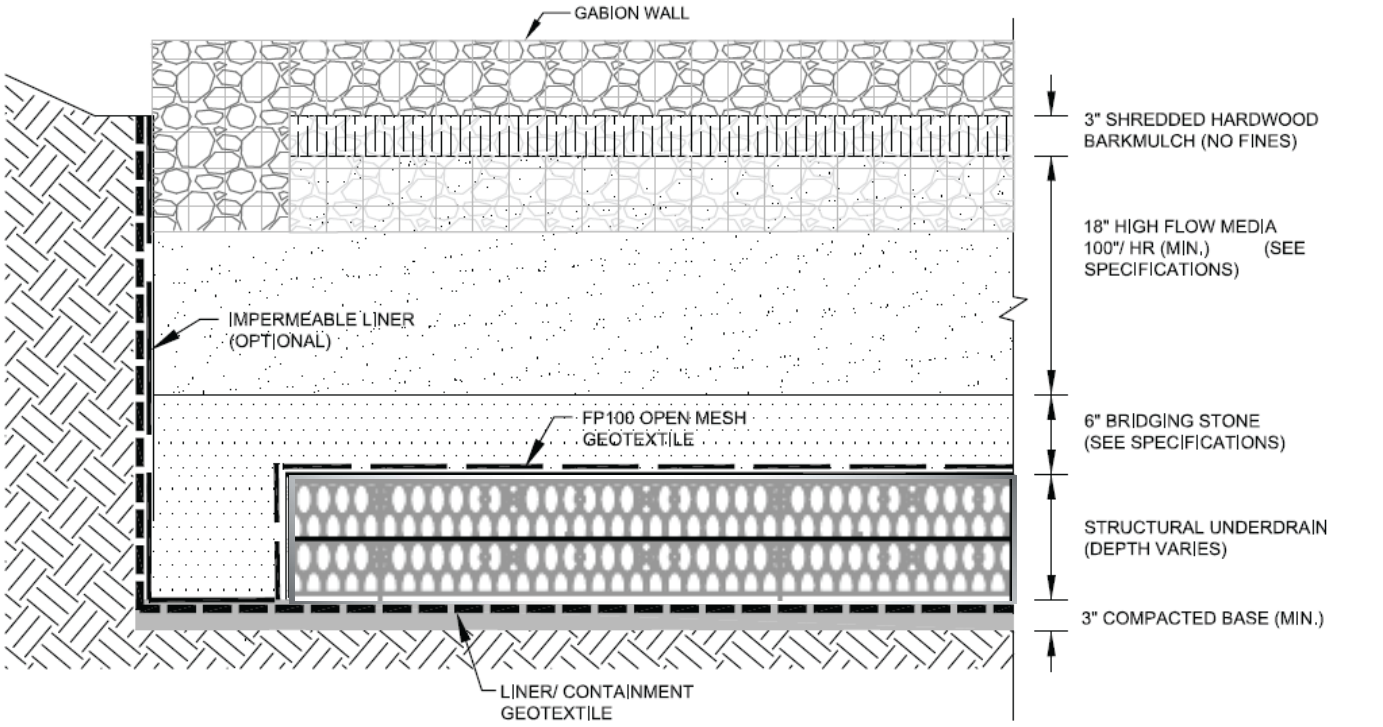
Place a geotextile separation barrier between the gabion and existing site soils as well as the gabion and engineered soils so that soil will not migrate into the rock creating a void. (Figure 24).

Once the gabion baskets are placed, overfill the gabions with 3" x 5" washed bull rock, or other specified material Once filled, seal the baskets with hog rings placed every three inches so that rock cannot be removed.

Figure 24: Place gabion wall so that it is square and level

Figure 25: Overfill rock into gabion and seal tight to prevent sagging. Rock will settle over time.

Figure 26



NEEDS TO BE ACTIVATED

Protecting the FocalPoint Biofiltration System during construction is of the utmost importance. The sediment contained in the runoff from an non-stabilized drainage area may contaminate the biofiltration media and reduce the effectiveness of the FocalPoint system. This protection is not difficult to manage and can be provided by Erosion and Sediment Control (ESC) procedures common to most active jobsites.

Figure 27: Geotextile Fabric

Figure 28: Protected FocalPoint Biofiltration System

WARNING

FAILURE TO INSTALL AND MAINTAIN ADEQUATE ESC PROTECTION FOR THE FOCALPOINT MAY VOID THE WARRANTY AND PERFORMANCE GURANTEES.

The simplest protection can be provided by the excess geotextile that was left from Step 4. Wrap the fabric over the mulch with at least a 6" overlap, much like wrapping a present (Figure 28). With torch, tack-weld the two fabrics together by melting the top layer with the bottom layer. You should practice this procedure on scrap material away from the system prior to attempting to do it over the system. Non-woven geotextiles are flammable and you must take extreme caution in doing this so that you do not leave the flame on the geotextile for too long. This procedure will create a perfect seam that will prevent sediment from bypassing the geotextile (Figure 29). If you cut your fabric too short, just make a patch for the uncovered area with another piece of geotextile, welding it all the way around.

Figure 29: Geotextile being melted together with a torch.

TIP: If you add a hose extension onto the torch, it makes the procedure much easier (See Picture)

Figure 30: A hose extention added to a blow torch.

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NEEDS TO BE ACTIVATED *continued*

Figure 31: FocalPoint Warning Sign

Once the system is sealed, use a stencil, sign or any other warning mechanism to warn other contractors not to remove the cover until ready for activation (Figure 31) . This will protect the system until final stabilization. Other erosion control mechanisms may be required upstream of the FocalPoint Biofiltration System such as check dams, erosion control blankets, wattles and other best management practices. Please contact your local FocalPoint Value Added Reseller for suggestions.

WARNING
FOCALPOINT ACTIVATION MUST NOT TAKE PLACE UNTIL THE DRAINAGE AREA IT SERVES HAS REACHED 70% STABILIZATION.

70% of the surface area of the drainage area or swale should be fully mulched, sodded, sprigged, or hydro mulched with a Bonded Fiber Matrix or better (e.g., Profile ProMatrix or Flexterra) prior to activation. Parking lots draining into the swales should be swept and any plantings outside the FocalPoint should be completed. The FocalPoint biofiltration media will be planted at the time of Activation.

Once 70% stabilization has been achieved; contact your local Convergent Water Technologies Value Added Reseller (www.convergentwater.com) for activation. Activation includes removing the protective cap on the biofiltration media bed and in situ testing of the media to insure that it meets performance specifications, by means of an hydraulic conductivity test. This activation is provided by Convergent's VAR (or certified contractor) at no additional charge. At this time you may add specified plants to the media bed and the 3" non-floatable mulch layer if indicated (typical).

IMPORTANT: The FocalPoint Biofiltration System should always remain capped until 70% stabilization is achieved and be the last thing planted to ensure that construction sediment does not enter the system.

WARNING
FAILURE TO CONFORM TO THIS STEP MAY VOID THE WARRANTY AND PERFORMANCE GUARANTEE. FOR THE FOCALPOINT ACTIVATION CHECKLIST, CONTACT YOUR VALUE ADDED RESELLER.

Figure 32: Protected FocalPoint Biofiltration System

PLANTINGS & MULCH

Placing the Plant:

1. Dig planting holes the depth of the root ball and two to three times as wide as the root ball. Wide holes encourage horizontal root growth that plants naturally produce.

2. With trees, you must ensure you are not planting too deep!! Don't dig holes deeper than root balls. The media should be placed at the root collar, not above the root collar. Otherwise the stem will be vulnerable to disease.

SPACING		
Type of Planting	**Rootball Size**	**Spacing on Center**
Shrubs	< 1 gallon	24 inches
Shrubs	5 gallons	42 inches
Shrubs	15 gallon	60 inches
Clump Grasses		24 inches
Small Trees		12 feet

Planting:

1. Remove plastic containers from container-grown plants. For plants in fiber pots, break away the top or remove the pot entirely.

2. If roots are circling around the root ball exterior, cut through the roots in a few places and remove the first inch of roots and planting material around the root ball. Cutting helps prevent circling roots from eventually girdling the trunk. If roots are not circling, the root ball should still be rubbed to loosen roots and promote growth into the media.

3. Remove tags and labels from plants.

4. Prune broken branches or suckers.

5. Only stake trees with large crowns, or those situated on windy sites or where people may push them over. Stake for a maximum of one year. Allow trees a slight amount of flex rather than holding them rigidly in place. Use guying or attach material that won't damage the bark. To prevent trunk girdling, remove all guying material after one year.

6. Plants should be watered at planting, especially during drought periods.

THINGS NOT TO DO:

- Mulch in excess of 3 inches
- Compacting media around the root ball
- Do not use annuals
- Keep in mind that some perennials (i.e. daylilies, hostas, etc…) die back in fall and re-emerge in spring. If you want greenery year round, be mindful of the perennials used.

Mulching:

Cover the exposed root ball top with mulch. No mulch volcanoes! Mulch should not touch the plant base because it can hold too much moisture and invite disease and insects. Evenly place 3 inches of shredded hardwood mulch on the surface of the media.

Erosion Control:

Where water is entering a focal point in one location, be sure to place erosion control stones to prevent scouring

PERFORMANCE & VERIFICATION

The Rub-I Infiltrometer is the most effective way to field verify engineered soil performance for bioswale, applications where effective soil drainage is an imperative. The Rub-I was designed to test the effectiveness of high flow soils and to ensure quality control both in the lab, in the field, and for years beyond initial installation. Current ASTM standards for infiltration testing are not valid for flow rates exceeding 16 in / hr. To ensure the highest level of effectiveness Convergent specifies that the FocalPoint System be tested within 60 days of installation and recommended the system be tested annually thereafter to provide ongoing quality assurance.

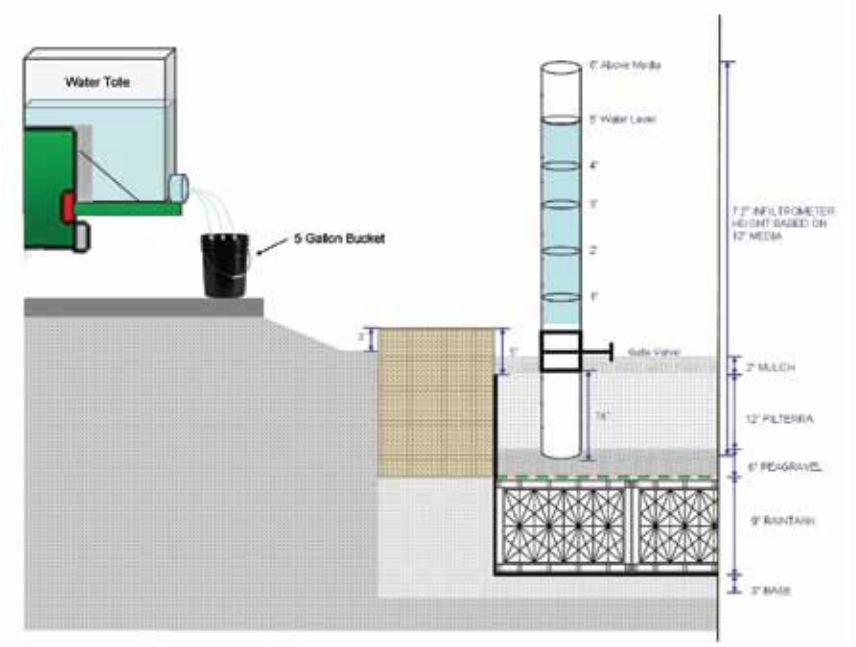
Objective:

Provide as-built confirmation of proper installation and hydraulic performance, to meet minimum high flow rate (30" / hour) Infiltration rate requirements, of bioretention media on newly-placed bioretention systems. This procedure measures the entire media profile under saturated conditions to insure a reliable and accurate result.

Example Site Test Layout and Design Schematic:

(FSA = filter surface area, DA = drainage area)

For bioretention systems with a surface area less than 50 m2222 (538 ft2), in situ hydraulic testing should be conducted at three points that are spatially distributed. For systems with a surface area greater than 50 m2, an extra monitoring point should be added for every additional 100m2 (1076 ft2). (Values are based on recommendations from the Facility for Advancing Water Biofilitration.) Testing should be performed on the perimeter since this is the area most likely to be impacted by sediment in the runoff.



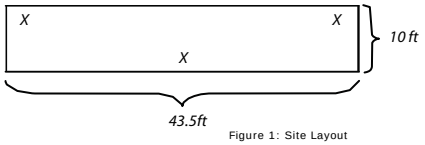


Figure 1: Site Layout

Test Methodology:

1. Carefully scrape away any surface covering (e.g. mulch, gravel, leaves) without disturbing the soil filter media surface.
2. Confirm media profile depth by using a shovel to dig to under drain stone and place measuring tape in hole to determine depth from top of under drain stone to top of media bed. A flash light may be needed to ensure the under drain stone has been reached before a depth measurement is taken.

Media Depth (inches)	Max Drawdown Time (min:sec)
12	18:18
14	21:24
16	24:18
18	25:42
20	27:00
22	29:30
24	31:54
26	34:06
28	18:18
30	18:18
32	18:18
34	18:18
36	18:18
38	46:18
40	47:42
42	49:00
44	50:12
46	43:24

Figure 3: Hammering Pipe Into Media

Figure 4: Pipe Installed Into Media

Figure 5: Oil Application

Figure 6: Dissipater Stones

1. Carefully scrape away any surface covering (e.g. mulch, gravel, leaves) without disturbing the soil filter media surface.

2. Confirm media profile depth by using a shovel to dig to under drain stone and place measuring tape in hole to determine depth from top of under drain stone to top of media bed. A flash light may be needed to ensure the under drain stone has been reached before a depth measurement is taken.

3. At another location cleared of mulch, locate the 6 inch wide white PVC pipe (beveled end down) on the surface of the media. Ensure testing is not too close to vegetation. Place the wooden board over the pipe and then gently pound with the sledge hammer on top of the board (Figure 3). Hammer the PVC pipe into the entire media profile based on the depth previously determined until it is approximately 3 inches above the media (Figure 4). Check with level. Note: It is important that the pipe is driven in slowly and carefully to minimize disturbance of the filter media profile. The media may slightly move downward in the pipe during hammering, but not more than 1 inch, and will not significantly affect hydraulic performance.

4. If pipe is less than 3 inches from media surface, remove media around outside of pipe so that the pipe is 3 inches from the media bed so that the gate valve coupling will properly slide onto the pipe.

5. Remove board and rub mineral oil on outside of PVC pipe above media (Figure 5).

6. Place 2 inch dissipater stones into pipe (Figure 6).

7. Slide gate valve with clear PVC cylinder down onto the media PVC pipe (Figure 7). Note: Disregard black coupling on clear pipe as well as pipe plug. These were spare pieces used for the demonstration but are not part of the final design.

8. Measure from the original surface of the media within the column to the 1ft, 2 ft, 3 ft, 4 ft and 5 ft gradations, and mark them on the clear PVC cylinder (Figure 8). The 1 ft and 5 ft marks are the critical marks, since the time to fall between these two intervals will be the pass/fail criteria for the test. (The time at other intervals between 1ft and 5 ft can be recorded for additional information, but will not be used in the pass/fail criteria).

9. Fill a 5 gallon bucket with 3 gallons from the filled 55 gallon drum. Leave cap off of drum at test site to prevent airlock.

10. Ensure the gate valve to the infiltrometer is closed. Fill with the 3 gallons of water (Figure 9). To create a worst case flow rate scenario (i.e. saturated condition), an initial wetting of the media using the infiltrometer is conducted by opening up the gate valve completely. The gate valve should be slowly opened by tapping on the handle with a hammer or wrench to prevent disturbance of the media surface by a sudden high flow of water. Pulling open by hand tends to force the valve open too quickly.

11. After the water level disappears from the clear column, a drain down time of 25 minutes is allowed to ensure free water has drained from the system. The media is now at field capacity (fully saturated).

12. After 25 minutes, ensure the gate valve is closed. Fill the 5 gallon bucket with water and continue to fill the column until water level reaches the very top of the clear pipe. Water is then re-introduced by opening the gate valve slowly by tapping the handle with a tool. The stopwatch should be started at the 5 ft gradation and time recorded at every 1 ft gradation. The stopwatch time is stopped when the water level reaches 1 ft.

13. Pass/fail criteria is based on maximum drawdown times (Table 1). For example, a media profile depth of 12 inches should not exceed a drawdown time of 18 minutes and 18 seconds between the 5 ft and 1 ft gradations.

For bioretention systems with a surface area less than 50 m2 (538 ft2), in situ hydraulic testing should be conducted at three points that are spatially distributed. For systems with a surface area greater than 50 m2, an extra monitoring point should be added for every additional 100 m2 (1076 ft2). These values are based on recommendations from the Facility

Figure 7: Infiltrometer Placement

Figure 8: Gradation of Clear Pipe

Figure 9: Infiltrometer Filled with Water