SURVEYING ENGINEERING LAND PLANNING

Northeast Civil Solutions

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October 14, 2014

Ms. Helen Donaldson, Planner
City of Portland
389 Congress Street
Portland, Maine 04104

RE: Pamela Road Extension/Subdivision Amendments

Dear Ms. Donaldson,

Northeast Civil Solutions (NCS) is in receipt of comments from you regarding preliminary staff review comments. **Responses to each of the comments can be found following each comment in BOLD**.

Staff Review Comments on Level III Subdivision Amendments

On the question of street name, Jennifer Thompson, Associate Corporation Counsel has suggested changing the name on the plat to match the city's adopted, accepted street name for the remainder of the street (i.e. Pamela Road), and eventually adopting the proposed portion of the street as such. This would resolve any future confusion. Please revise the plan accordingly and add clarifying notes, as necessary. **The proposed road extension will be called Pamela Road.**

Ms. Thompson has provided the following comments

- That the notes identify the number of lots in the subdivision. **The current plan amends 2 lots, from the original subdivision completed in 1969, to bring them into compliance with current zoning regulations.**

- [That the plant should include] reference to homeowners' association documents and reflect any areas that are subject to control by the association. **No Homeowners Association is proposed with this subdivision.**

- The legend should include the wetland symbol and the notes should reflect any restriction relating to those areas. **Wetland symbols have been added.**

- Any easements… need to be called out (with recording information) in the notes. **Easements have been identified on the Subdivision Plan.**

Mr. Bill Clark provided the following comments:

- [The plat does] not show the end of the existing acceptance. It may go 75.00 feet along Lot 44 to where the new acceptance will start. Their surveyor will need to verify this. **The end of the street acceptance has been added to the plan.**

- Only need to set granite monuments on the side of the street along the 3.00 foot offset line. **Granite monuments are shown along one side of the street.**

- Need to show monuments on the site plans also so there will not be any conflicts with other utilities such as buried electric ETC. **The granite monuments are now shown on the site plan. No conflicts are identified.**

Mr. David Senus, the city's consulting civil engineer has provided the following comments:

- The applicant has noted that a Natural Resource Protection Act (NRPS) Permit will be required for the 5,397 SF of wetland fill associated wit the road construction, and a copy of the permit application will be sent to the City of Portland under separate cover. It appears for the Subdivision Plan that significant wetland impact may result from the development of several of the proposed lots, the applicant should ensure that anticipated wetland impacts associated with the development of the new lots is also coordinated and permitted through the Maine DEP. **A NRPA permit application has been submitted with regard to the work involved with the road construction. The applicant plans to sell each of the lots, so therefore including wetland impacts for each lot at this time is not required. However, a conceptual wetland impact plan has been prepared to indicate that all houses could be constructed without having to obtain a Tier2/3 NRPA Permit.**

It would be beneficial to secure the required NRPA permits for the subdivision at this time, in order to ensure that wetland fill boundaries are recorded on the plat. **Noted**

A Block for the Planning Director's signature should be added to the plat. **A signature block has been added to the subdivision plan.**

Preliminary Staff Comments on Level II Site Plan/14-403 Street Extension

A. Transportation Standards

1. **Impact on Surrounding Street Systems**
   No Comments at this time.

2. **Access and Circulation**
   Mr. Thomas Errico, the city's transportation engineer has provided the following comments
   - The proposed driveway location for the lots meets City Standards. **Noted**

- The location of Pamela Road at Alice Street is acceptable and complies with City standards from a driveway corner clearance perspective (distance to existing driveways on Alice Street). **Noted**

- The crosswalk at Alice Street should be two parallel lines. **The crosswalk is now shown as two parallel lines.**

- The handicap ramp design at Alice Street is not a preferred layout and Bruce Hyman should review and approve the configuration. Note that Bruce Hyman's comments will be forwarded under separate cover). **The handicap ramps have been revised per city comments.**

- The city has a circular arc standard for right-of-way boundaries that meet at the intersection of two streets. DPS should confirm that this not a requirement. (again, not that confirmation will be provided under separate cover). **DPS has confirmed there is no requirement to revise the ROW intersection.**

3. **Public Transit Access**
   No comments at this time.

4. **Parking**
   No comments at this time.

5. **Transportation Demand Management**
   No comments at this time.

B. Environmental Quality Standards

1. **Preservation of Significant Natural Features**
   No comments at this time

2. **Landscaping and Landscape Preservation**
   Per the city's site plan ordinance and as prescribed in Section 4 of the city's Technical Manual, two street trees are required per lot. These should be added to the site plan. It is noted that the site plan shows a "proposed tree line." If this is intended to meet the street tree requirement, notes regarding its protection should be added to both the site plan and subdivision plats. **Street trees are now proposed, two per lot. See sheet 4 of 12.**

3. **Water Quality, Storm Water Management and Erosion Control**
   Mr Senus provided the following comments
   - The City of Portland required all Level II site plan applications submit a stormwater management plan pursuant to the regulations of Maine DEP Chapter 500 Stormwater Management Rules, including conformance with Basic, General and Flooding Standards (Technical Manual, Section 5.II.

Applicability in Portland. C.a. and City of Portland code of Ordinances Sec. 14-526. Site plan standards. (b). 3. B). **Noted**

- Basic Standards: The Applicant has provided a plan, notes and details to address erosion and sediment control requirements, inspection and maintenance and good housekeeping practiced in general accordance with Appendix A, B and C of Maine DEP Chapter 500. **Noted**

- General Standards: The project will result in a net increase in impervious area of approximately 28,500 square feet. As such, the project is required to include specific stormwater management features for stormwater quality control. The Applicant has proposed a FocalPoint Bioretention System and an Isolator Row to treat the stormwater runoff from the proposed road. This system provided an appropriate means of providing treatment under the General Standards. Calculation should be provided demonstrating that a sufficient percentage of impervious and developed areas will be treated in accordance with the General Standards (note, this project can be considered "Linear" under the general Standards). **The Stormwater Analysis Memo now indicates the amount of treated area in accordance with the general standards that cover linear projects.**

- Flooding Standard: The project will result in a net increase in impervious area of approximately 28,500 square feet. As such the project is required to include specific stormwater management features to control the rate of stormwater runoff from the site. The Applicant should address whether the project, as designed, meets the Flooding Standard or whether the Applicant is requesting a waiver from the Flooding Standard with the proposed connection to the municipal separated storm drain system. **A waiver request to exclude the flooding standard requirement is attached.**

- The Applicant should provide a post construction stormwater inspection and maintenance plan developed in accordance with and in reference to Chapter 32 of the City of Portland Code of Ordinance and the Isolator Row Maintenance Criteria provided in Section 7.4.4 of Chapter 7.3 of Volume III of the Maine DEO Stormwater BMP Manual. **A post construction stormwater inspection and maintenance plan has been included in the revised Stormwater Memorandum.**

- A noted on the FocalPoint details refers to Project Landscape Plan for planting species, layout, size etc. At this time, it does not appear that a landscaping Plan has been provided. The Applicant should clarify. **The notes have been taken off the plan as they are not applicable for this project.**

- Per chapter 7.3 of Volume III of the Maine DEP Stormwater BMP Manual:

- Two layers of woven geotextile fabric shall be placed between the stone and the Isolator Row chambers. **Two layers of geotextile fabric are now shown on the detail.**

- The connection pipes between the Isolator Row and the access/diversion structures should be 24-inches for the SC-740 chambers (for this case, Pipe SD-2). **Pipes are now identified with a diameter of 24"**

C. Public Infrastructure and Community Safety Standards

1. **Consistency with Master Plans**
   No comments at this time.

2. **Public Safety and Fire Prevention**
   Captain David Petruccelli of the City's Fire Prevention Bureau provided the following comments:
   - Our comments at this point are that the street needs hydrants. Hydrants should be approximately 500 feet apart. There are two hydrants on Alice each approximately 700+/- from where Pamela Road will intersect. There is also a hydrant around the corner on Abby Lane about 250 feet from Pamela. The next hydrant is up at Crestview. **Three hydrants have been added to the proposed plan as required. See sheet 4 of 12.**

   - Captain Petrucelli has provided a diagram, which is included as Attachment 2. Proposed hydrants should be added to the site plan. **Three hydrants are now shown on the site plan. Details for the hydrants have also been added.**

3. **Availability and Capacity of Public Utilities**
   Mr. David Pargolis-Pineo, Department of Public Services, has provided the following comments:
   - The roadway surface area being drained to proposed catch basins one and two are quite large. We are requesting the applicant place two additional basins at approximate station 3+00. **The stormwater treatment system design will be broken up so that there are two additional catchbasins and Focalpoint Treatment Cells added to the plan.**

   - We would also like the applicant to consider an alternative catch basin casting (not the city standard) to increase gutter drainage capture due to the street grade. This would be a rectangular type casting by Neenah with a "L" or scoop style design. **The proposed catch basins are preceded by a 10 foot wide curb cut to collect stormwater for the FocalPoint biofiltration system. Due to the grade and potential stormwater flows that could by-pass the inlets Neenah Type L High Capacity Grates (or equivalent) will be added.**

- As noted by Woodard and Curran, the applicant is failing to meet the city's Technical Manual standards for catch basin design and castings. If not already on the plans, please add a general note stating that "All proposed infrastructure located within the road right of way shall meet City of Portland Technical Manual standards." **The note has been added to the typical roadway cross section detail on sheet 8 of 12. However, alternative grates are being added to account for the higher flows and grade of the road to ensure capturing as much of the flow as possible.**

Mr. Senus provided the following comments:

- In accordance with Figure II-2 of the City of Portland Technical Manual, catch basins should have a minimum three foot sump; the proposed detail specifies two feet. The Applicant should revise accordingly. **The detail has been revised. A 36-inch sump is shown. See detail on sheet 11 of 12.**

- The catch basin Frame and Grate detail on Sheet 10 of 11 does not meet City Standard; the City's standard is shown on Figure II-7 of the City of Portland Technical Manual. The detail should be revised accordingly. **A detail for the frame and grate has been revised (and includes Neenah Type L High Capacity Grate), see sheet 9 of 12.**

- The Applicant should provide the following details in accordance with the City of Portland Technical Manual for work within the City Right-of-Way:
  - 4' Granite Headstone for Catch Basin Inlet per Figure II-11. **The detail has been provided. See sheet 9 of 12.**

- The Applicant has noted that a wastewater capacity application has been submitted to the Department of Public Services for review, and a copy of the plans has been submitted to the Portland Water District and Central Maine Power for design review. Letters from utilities confirming acceptance of the design should be provided to the City Planning Office upon receipt. **Letters will be forwarded as soon as they are received.**

- In accordance with Figure II-12 of the City of Portland Technical Manual, ¾" crushed stone in typical pipe trench installations shall extend 12-inches above the top of the pipe; the proposed detail specifies six inches. The Applicant should revise accordingly. **The detail has been revised to call for 12 inches of crushed stone above and below the pipe. See sheet 8 of 12.**

- Sheet 3 of 11 includes a pipe schedule that lists pipe materials as "Corrugated HDPE (Smooth Interior)". Corrugated HDPE is not an allowable pipe in the City Right-of-Way; allowable pipes are listed in Section 2.5 of the City of Portland Technical Manual. **The pipe material has been revised to PVC SDR 35.**

Mr. Margolis-Pineo provided the following comments:

- The applicant is showing an eight inch Sch 40 for the gravity sanitary sewer. This pipe is acceptable but so is SDR-35 which may be more cost effective and easier to install. Be aware that per Technical Manual standards, the gravity sewer and manholes will require air and vacuum testing respectfully. **Noted, All sanitary sewer pipe is to be PVC SDR 35.**

- Please provide a detail of the drain manhole to be installed in Alice St. **A drain manhole detail is provided on the detail sheet 11 of 12.**

D. Site Design Standards

1. **Massing, Ventilation, and Wind Impact**
   No comments at this time

2. **Shadows**
   No comments at this time

3. **Snow and Ice Loading**
   No comments at this time

4. **View Corridors**
   No comments at this time

5. **Historic Resources**
   No comments at this time

6. **Exterior Lighting**
   Street lights, as required in Section 10 of the city's Technical Manual, should be added to the site plan. **Street lights have been added to the plans. See sheet 4 of 12 for locations.**

7. **Noise and Vibration**
   No comments at this time

8. **Signage and Wayfinding**
   No comments at this time

9. **Zoning Related Design Standards**
   No comments at this time

Additional Submittals Required

The following additional materials should be provided in a revised submittal:

- Evidence of state and/or federal permits. **The accepted NRPA permit will be forwarded to the City as soon as it's received.**

- A construction management plan. **A construction sequence plan is attached to this application and also located on sheet 6 of 12.**

Note that the Planning Authority may request additional information during the continued review of the proposal according to applicable laws, ordinances and regulations. **Noted**

Planning Staff Recommendation

Based upon the staff review of the preliminary Level II site plan, I recommend that the applicant proceed with submission of a final plan for staff review. Please submit one (1) complete paper set and one (1) digital set of plans and documents to address staff comments. Upon receipt of the revised material, the City of Portland will review the additional plans and information for conformance with applicable ordinances. Please be aware that an application expires within 120 days of the date upon which this written request for additional information was made.

If you have any additional questions or comments please feel free to call me.

Sincerely,
Northeast Civil Solutions, Inc.

Lee Allen, P.E.
Vice President

Cc: Todd Settle, Telos Capital, LLC

Waiver Request

On behalf of Telos Capital, LLC, NCS respectfully requests a waiver to exclude the Flooding Standard requirement from the stormwater design.

Per Maine DEP regulations projects are eligible for waivers when the discharge is in the watershed of the ocean, a great pond of major river segment. Stormwater from the site is collected, filtered and also detained with a FocalPoint Biofiltration system in conjunction with an isolator row per the rules in the Maine DEP BMP manual. After stormwater from the site is collected and treated it is discharged into the City of Portland storm drain system. This segment of stormwater collection has not been indicated to have any capacity issues and discharges into the adjacent Presumpscot River which is less than a mile from the mouth of the river flowing into the Atlantic Ocean.

In comparison to the size of the watershed and existing collection system, the increase in flows due to this project is insignificant.

Construction Management Plan:

Construction sequence for Pamela Road from station 0+00 to 8+00

1. Mobilize and set up necessary construction signs, cones and flaggers for traffic control.
2. Install erosion control measures per Maine erosion and sediment control BMP's manual provided by the bureau of land and water quality at the Maine department of environmental protection to STA 7+50±.
3. Cut vegetation to allow passage for equipment and materials.
4. Inspect all erosion control measures for damage from fallen vegetation and repair as necessary.
5. Install construction entrance prior to any haul activity.
6. Commence excavation. stump/grub and remove topsoil. Stockpile loam on lot #40 in stabilized area.
7. Trench and install utilities, install FocalPoint Biofiltration system and Isolator Row
8. Construct road in 12-inch lifts.
9. Fine Grade roadway, sidewalk and esplanade.
10. Install curb and pave roadway and sidewalk.
11. Loam, seed and stabilize road side-slopes.

Northeast Civil Solutions, Inc.

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Scarborough, Maine 04074
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Memorandum

TO: Lee Allen, P.E.

FROM: Travis Letellier, EIT

DATE: October 14, 2014

RE: Stormwater Analysis - Pamela Road Extension

Northeast Civil Solutions, INC. (NCS) has completed a stormwater design for an extension of Pamela Road in Portland Maine.

The design uses the Focal Point Biofiltration System to treat the stormwater runoff from the proposed new road. The filter area is sized based on each subcatchments tributary area and is based on Chapter 7.5 of the Maine Department of Environmental Protection (DEP) BMP Technical Design Manual.

The tributary area, to be treated, in each lane of the new road is 12,370 square feet or 0.28 acres. This translates, per Maine DEP Chapter 7.5, to a filter with an area of 24 square feet. Each lane has been divided into two curb inlet filters each with a size of 12 square feet (2'-0" wide and 6'-0" long). All four filters will be installed between the curb line and the sidewalk within the grassed esplanade.

Along with the filter system an isolator row must be installed per MDEP Chapter 7.5. The isolator row is sized based on the peak flow in the 1-year storm event which is calculated to be 1.53 cubic feet per second (cfs). This flow will require eight (8) Stormtech SC-740 chambers to be installed. Please see the attached HydroCAD calculations for more details.

Also attached to this memo is the full specification for the Focal Point Biofiltration System along with the operations and maintenance manual. These two documents will provide all the information required to install and maintain the system.

Table 1 – Treatment Table

	Total Area (sf)	Treated Area (sf)	Percentage Treated (%)
Impervious	27,325	24,740	90.5%
Landscaped	8,228	7,192	87.4%

The DEP General Standards require that 75% of the impervious area and 50% of the landscaped area be treated in a linear project. By examination of Table 6, the proposed drainage treatment method utilizing an underdrained soil filter exceeds the general standard requirement.

Post-Construction Stormwater Inspection and Maintenance Plan:

Isolator Row

During the first year, the subsurface structure will be inspected semi-annually and following major storm events.

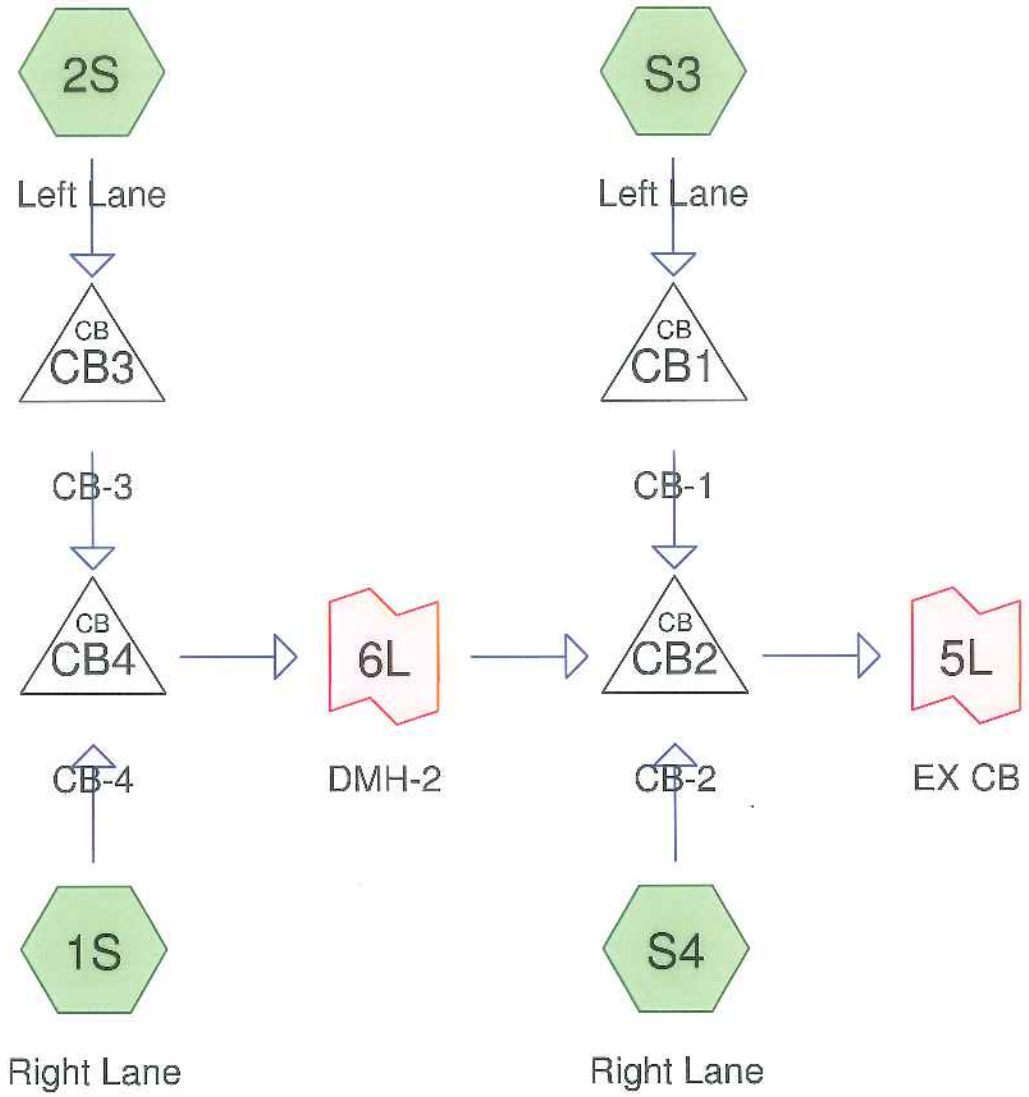
Maintenance Agreement: A legal maintenance agreement between the owner and an approved maintenance operator should be established with the specific descriptions of the responsibility of each for inspecting and maintaining any underdrained filter. The legal agreement establishing the entity should list specific maintenance activities (including timetables) and provide for the funding to cover long-term inspection and maintenance.

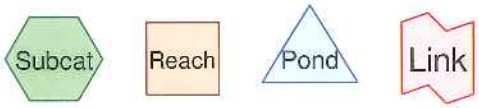
Soil Filter Inspection: Inspection ports will need to be installed within the underdrain gravel layer. At least one port needs to be installed per 500 square feet of subsurface structure. The system should be inspected after every major storm in the first few months to ensure proper function. Thereafter, the filter should be inspected at least once every six months to ensure that it is draining within 24 hours to 36 hours.

Pre-treatment device: Cleaning of the pretreatment device shall be done as needed and identified by the entity holding the maintenance agreement as mandated under contract. Debris and sediment buildup within the Isolator Row fabric shall be removed as needed utilizing a Jet-Vac system. A routine inspection schedule needs to be established for each individual site based on site specific variables such as land use (i.e. road, industrial, commercial, residential, etc.) anticipated pollutant load, percent imperviousness, etc. The filter should be inspected at least once every six months to ensure that it is draining within 24 hours to 36 hours; however the inspection can be adjusted based upon previous observations of sediment deposition. When the average depth of sediment throughout the length of the Isolator Row exceeds 3 inches, clean-out must be performed.

FocalPoint Biofiltration System

See attached Technical Operations and Maintenance Guide





Routing Diagram for POST - single lane flows
Prepared by Microsoft, Printed 10/10/2014
HydroCAD® 10.00-13 s/n 02173 © 2014 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.164	74	>75% Grass cover, Good, HSG C (1S, 2S, S3, S4)
0.548	98	Paved roads w/curbs & sewers, HSG D (1S, 2S, S3, S4)
0.712	**92**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.164	HSG C	1S, 2S, S3, S4
0.548	HSG D	1S, 2S, S3, S4
0.000	Other	
0.712		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.164	0.000	0.000	0.164	>75% Grass cover, Good	1S, 2S, S3, S4
0.000	0.000	0.000	0.548	0.000	0.548	Paved roads w/curbs & sewers	1S, 2S, S3, S4
0.000	**0.000**	**0.164**	**0.548**	**0.000**	**0.712**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	CB1	103.75	103.35	25.0	0.0160	0.010	12.0	0.0	0.0
2	CB2	102.10	102.00	20.0	0.0050	0.010	24.0	0.0	0.0
3	CB3	113.25	113.00	25.0	0.0100	0.010	12.0	0.0	0.0
4	CB4	112.90	107.00	134.0	0.0440	0.010	12.0	0.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Right Lane Runoff Area=5,655 sf 75.23% Impervious Runoff Depth>1.59"
Flow Length=131' Tc=2.1 min CN=92 Runoff=0.28 cfs 0.017 af

Subcatchment 2S: Left Lane Runoff Area=5,388 sf 75.24% Impervious Runoff Depth>1.59"
Flow Length=131' Tc=2.1 min CN=92 Runoff=0.27 cfs 0.016 af

Subcatchment S3: Left Lane Runoff Area=11,096 sf 80.15% Impervious Runoff Depth>1.68"
Flow Length=331' Tc=3.4 min CN=93 Runoff=0.56 cfs 0.036 af

Subcatchment S4: Right Lane Runoff Area=8,893 sf 75.23% Impervious Runoff Depth>1.59"
Flow Length=331' Tc=3.4 min CN=92 Runoff=0.43 cfs 0.027 af

Pond CB1: CB-1 Peak Elev=104.12' Inflow=0.56 cfs 0.036 af
12.0" Round Culvert n=0.010 L=25.0' S=0.0160 '/' Outflow=0.56 cfs 0.036 af

Pond CB2: CB-2 Peak Elev=102.73' Inflow=1.53 cfs 0.096 af
24.0" Round Culvert n=0.010 L=20.0' S=0.0050 '/' Outflow=1.53 cfs 0.096 af

Pond CB3: CB-3 Peak Elev=113.54' Inflow=0.27 cfs 0.016 af
12.0" Round Culvert n=0.010 L=25.0' S=0.0100 '/' Outflow=0.27 cfs 0.016 af

Pond CB4: CB-4 Peak Elev=113.32' Inflow=0.54 cfs 0.034 af
12.0" Round Culvert n=0.010 L=134.0' S=0.0440 '/' Outflow=0.54 cfs 0.034 af

Link 5L: EX CB Inflow=1.53 cfs 0.096 af
Primary=1.53 cfs 0.096 af

Link 6L: DMH-2 Inflow=0.54 cfs 0.034 af
Primary=0.54 cfs 0.034 af

Total Runoff Area = 0.712 ac Runoff Volume = 0.096 af Average Runoff Depth = 1.62"
23.01% Pervious = 0.164 ac 76.99% Impervious = 0.548 ac

Summary for Subcatchment 1S: Right Lane

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.28 cfs @ 12.04 hrs, Volume= 0.017 af, Depth> 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.50"

Area (sf)	CN	Description
4,254	98	Paved roads w/curbs & sewers, HSG D
1,401	74	>75% Grass cover, Good, HSG C
5,655	92	Weighted Average
1,401		24.77% Pervious Area
4,254		75.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	5	0.0200	0.73		**Sheet Flow, A-B Sheet** Smooth surfaces n= 0.011 P2= 3.00"
1.1	6	0.0200	0.09		**Sheet Flow, B-C Sheet** Grass: Short n= 0.150 P2= 3.00"
0.8	100	0.0650	2.13		**Sheet Flow, C-D Sheet** Smooth surfaces n= 0.011 P2= 3.00"
0.1	20	0.0650	5.18		**Shallow Concentrated Flow, D-E Shallow** Paved Kv= 20.3 fps
2.1	131	Total			

Summary for Subcatchment 2S: Left Lane

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.27 cfs @ 12.04 hrs, Volume= 0.016 af, Depth> 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.50"

Area (sf)	CN	Description
4,054	98	Paved roads w/curbs & sewers, HSG D
1,334	74	>75% Grass cover, Good, HSG C
5,388	92	Weighted Average
1,334		24.76% Pervious Area
4,054		75.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	5	0.0200	0.73		**Sheet Flow, A-B Sheet** Smooth surfaces n= 0.011 P2= 3.00"
1.1	6	0.0200	0.09		**Sheet Flow, B-C Sheet** Grass: Short n= 0.150 P2= 3.00"
0.8	100	0.0650	2.13		**Sheet Flow, C-D Sheet** Smooth surfaces n= 0.011 P2= 3.00"
0.1	20	0.0650	5.18		**Shallow Concentrated Flow, D-E Shallow** Paved Kv= 20.3 fps
2.1	131	Total			

Summary for Subcatchment S3: Left Lane

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.56 cfs @ 12.05 hrs, Volume= 0.036 af, Depth> 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.50"

Area (sf)	CN	Description
8,893	98	Paved roads w/curbs & sewers, HSG D
2,203	74	>75% Grass cover, Good, HSG C
11,096	93	Weighted Average
2,203		19.85% Pervious Area
8,893		80.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	5	0.0200	0.73		**Sheet Flow, A-B Sheet** Smooth surfaces n= 0.011 P2= 3.00"
1.1	6	0.0200	0.09		**Sheet Flow, B-C Sheet** Grass: Short n= 0.150 P2= 3.00"
0.8	100	0.0650	2.13		**Sheet Flow, C-D Sheet** Smooth surfaces n= 0.011 P2= 3.00"
1.4	220	0.0175	2.69		**Shallow Concentrated Flow, D-E Shallow** Paved Kv= 20.3 fps
3.4	331	Total			

Summary for Subcatchment S4: Right Lane

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.43 cfs @ 12.05 hrs, Volume= 0.027 af, Depth> 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.50"

Area (sf)	CN	Description
6,690	98	Paved roads w/curbs & sewers, HSG D
2,203	74	>75% Grass cover, Good, HSG C
8,893	92	Weighted Average
2,203		24.77% Pervious Area
6,690		75.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	5	0.0200	0.73		**Sheet Flow, A-B Sheet** Smooth surfaces n= 0.011 P2= 3.00"
1.1	6	0.0200	0.09		**Sheet Flow, B-C Sheet** Grass: Short n= 0.150 P2= 3.00"
0.8	100	0.0650	2.13		**Sheet Flow, C-D Sheet** Smooth surfaces n= 0.011 P2= 3.00"
1.4	220	0.0175	2.69		**Shallow Concentrated Flow, D-E Shallow** Paved Kv= 20.3 fps
3.4	331	Total			

Summary for Pond CB1: CB-1

[57] Hint: Peaked at 104.12' (Flood elevation advised)

Inflow Area =	0.255 ac, 80.15% Impervious, Inflow Depth > 1.68" for 1-Year event			
Inflow =	0.56 cfs @ 12.05 hrs, Volume=	0.036 af		
Outflow =	0.56 cfs @ 12.05 hrs, Volume=	0.036 af, Atten= 0%, Lag= 0.0 min		
Primary =	0.56 cfs @ 12.05 hrs, Volume=	0.036 af		

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 104.12' @ 12.05 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	103.75'	**12.0" Round Culvert** L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 103.75' / 103.35' S= 0.0160 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=0.55 cfs @ 12.05 hrs HW=104.12' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.55 cfs @ 2.08 fps)

Summary for Pond CB2: CB-2

[57] Hint: Peaked at 102.73' (Flood elevation advised)

Inflow Area =	0.712 ac, 76.99% Impervious, Inflow Depth > 1.62" for 1-Year event			
Inflow =	1.53 cfs @ 12.05 hrs, Volume=	0.096 af		
Outflow =	1.53 cfs @ 12.05 hrs, Volume=	0.096 af, Atten= 0%, Lag= 0.0 min		
Primary =	1.53 cfs @ 12.05 hrs, Volume=	0.096 af		

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 102.73' @ 12.05 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	102.10'	**24.0" Round Culvert** L= 20.0' Ke= 0.900 Inlet / Outlet Invert= 102.10' / 102.00' S= 0.0050 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=1.51 cfs @ 12.05 hrs HW=102.72' (Free Discharge)
└─**1=Culvert** (Barrel Controls 1.51 cfs @ 2.72 fps)

Summary for Pond CB3: CB-3

[57] Hint: Peaked at 113.54' (Flood elevation advised)

Inflow Area =	0.124 ac, 75.24% Impervious, Inflow Depth > 1.59" for 1-Year event			
Inflow =	0.27 cfs @	12.04 hrs, Volume=	0.016 af	
Outflow =	0.27 cfs @	12.04 hrs, Volume=	0.016 af, Atten= 0%, Lag= 0.0 min	
Primary =	0.27 cfs @	12.04 hrs, Volume=	0.016 af	

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 113.54' @ 12.04 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	113.25'	**12.0" Round Culvert** L= 25.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 113.25' / 113.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.26 cfs @ 12.04 hrs HW=113.53' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.26 cfs @ 1.42 fps)

Summary for Pond CB4: CB-4

[57] Hint: Peaked at 113.32' (Flood elevation advised)
[79] Warning: Submerged Pond CB3 Primary device # 1 INLET by 0.07'

Inflow Area =	0.254 ac, 75.23% Impervious, Inflow Depth > 1.59" for 1-Year event			
Inflow =	0.54 cfs @	12.04 hrs, Volume=	0.034 af	
Outflow =	0.54 cfs @	12.04 hrs, Volume=	0.034 af, Atten= 0%, Lag= 0.0 min	
Primary =	0.54 cfs @	12.04 hrs, Volume=	0.034 af	

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 113.32' @ 12.04 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	112.90'	**12.0" Round Culvert** L= 134.0' Ke= 0.900 Inlet / Outlet Invert= 112.90' / 107.00' S= 0.0440 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=0.52 cfs @ 12.04 hrs HW=113.31' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.52 cfs @ 1.72 fps)

Summary for Link 5L: EX CB

Inflow Area = 0.712 ac, 76.99% Impervious, Inflow Depth > 1.62" for 1-Year event
Inflow = 1.53 cfs @ 12.05 hrs, Volume= 0.096 af
Primary = 1.53 cfs @ 12.05 hrs, Volume= 0.096 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link 6L: DMH-2

Inflow Area = 0.254 ac, 75.23% Impervious, Inflow Depth > 1.59" for 1-Year event
Inflow = 0.54 cfs @ 12.04 hrs, Volume= 0.034 af
Primary = 0.54 cfs @ 12.04 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

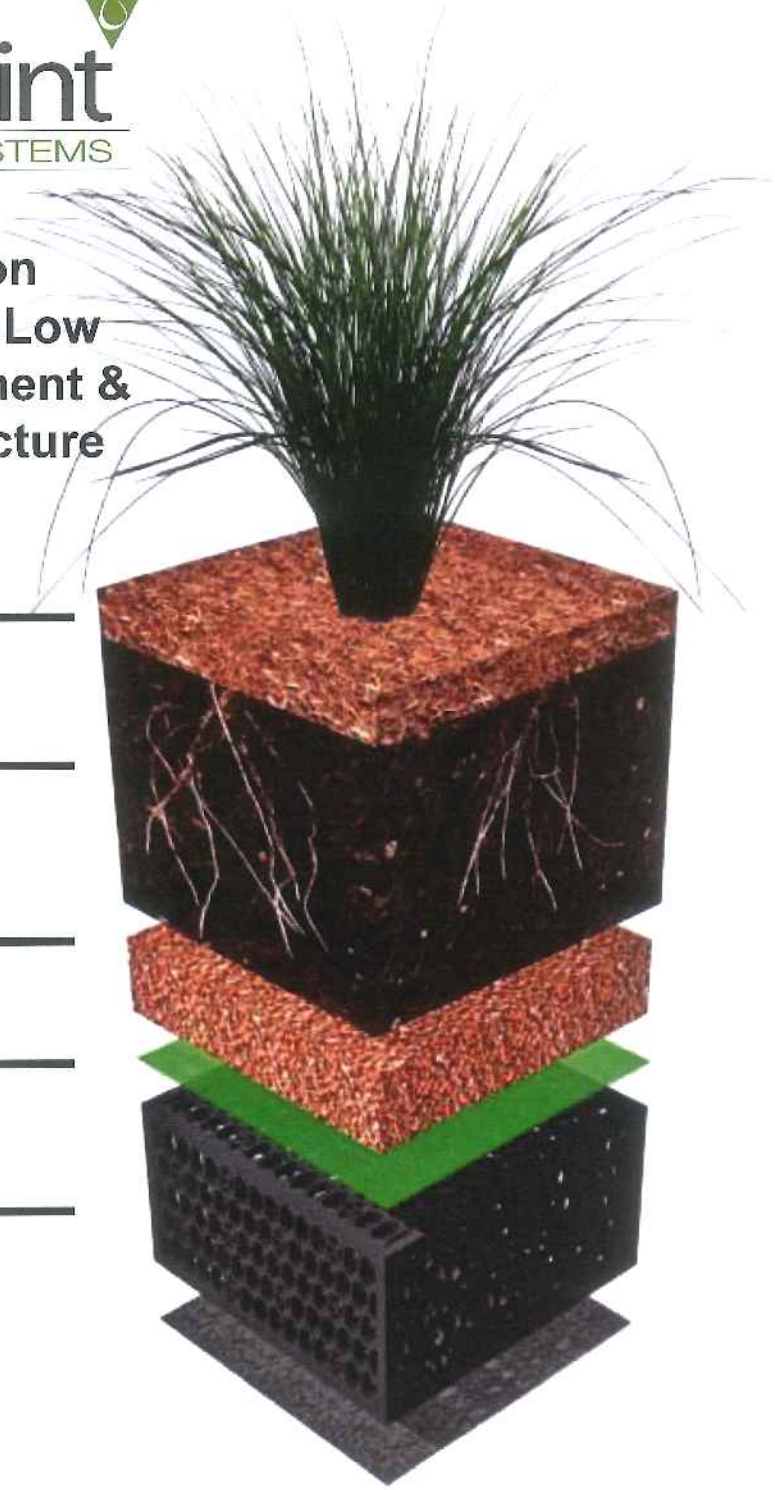
FocalPoint

BIOFILTRATION SYSTEMS

- Stormwater Quality Treatment
- Smaller Footprints
- Reduced Infrastructure Cost
- Reduced Overall Maintenance Costs

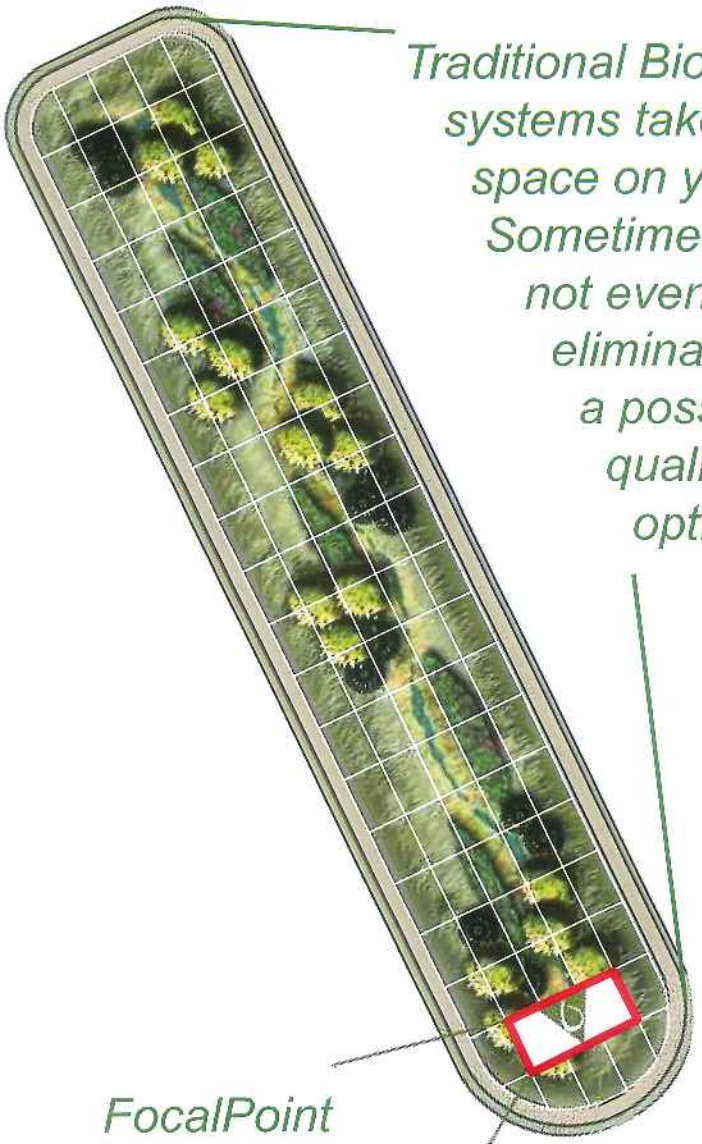
FocalPoint
BIOFILTRATION SYSTEMS

2nd Generation Biofiltration for Low Impact Development & Green Infrastructure



FocalPoint is a high-performance, non-proprietary biofiltration system that combines high-flow media with a high performance underdrain, along with other pre-matched components to improve the performance of traditional systems.

FocalPoint
BIOFILTRATION SYSTEMS



Traditional Biofiltration systems take up lots of space on your site. Sometimes, they may not even fit, eliminating them as a possible water quality BMP option.

FocalPoint Systems are up to 95% smaller!

FocalPoint provides all the pollutant removal benefits you'd expect from a biofiltration system, but it delivers them at lightning speed. With flow rates over 100 inches per hour, FocalPoint flows roughly 20 times faster than traditional systems.

That means FocalPoint footprints can be up to 95% smaller than traditional systems.

Want the benefits of Biofiltration in a system that actually fits on your site? FocalPoint can help.

FocalPoint
BIOFILTRATION SYSTEMS

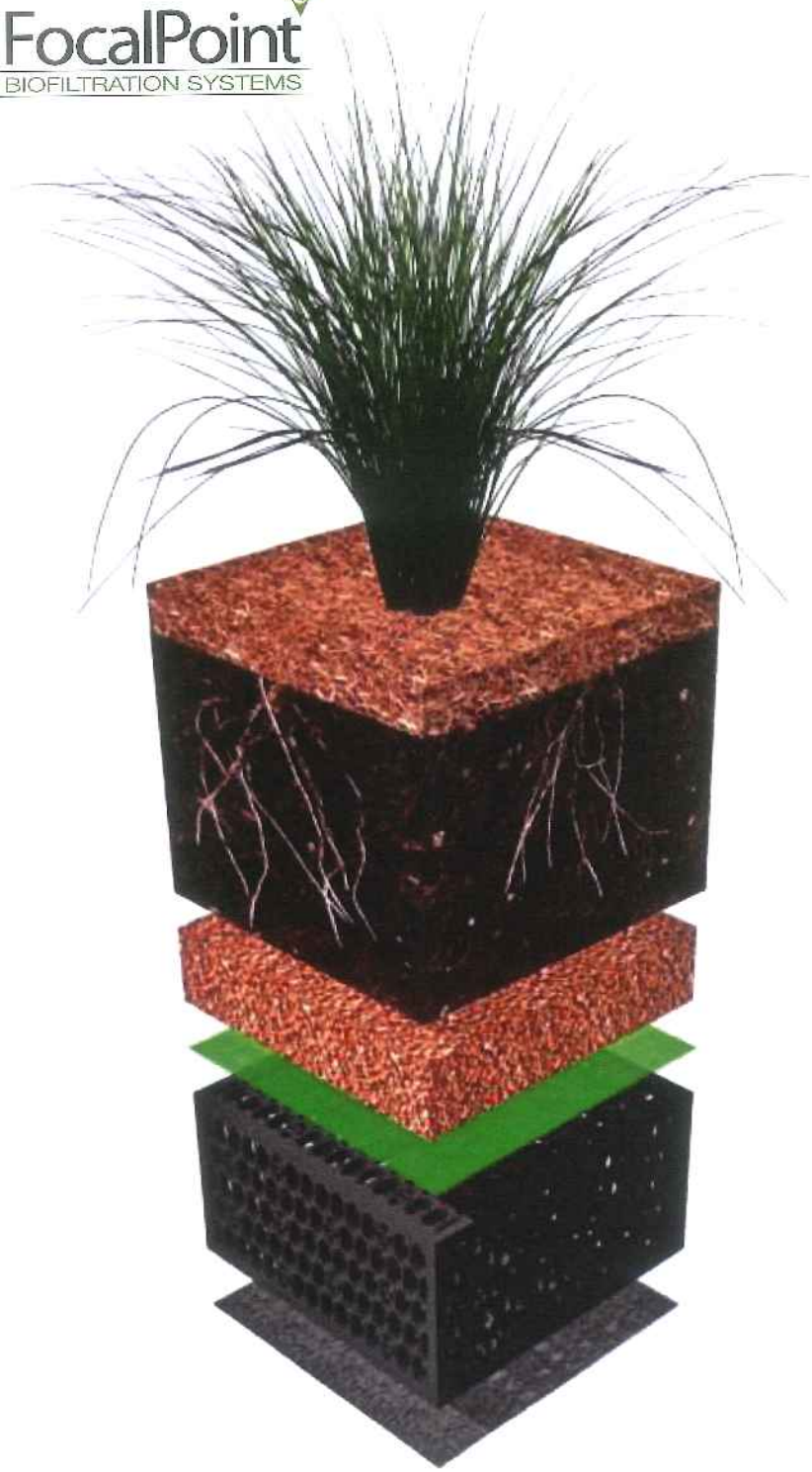
The testing apparatus has been installed, and testing is about to begin.

Performance-Based

FocalPoint blends highly engineered components into an open-source, non-proprietary specification that is purely performance-based.

- Each System Tested After Installation
- Testing Performed After Site is Stabilized to Ensure the Final Product is Functioning Properly
- Specification Requires Systems that Do NOT Pass to be Removed & Replaced

FocalPoint
BIOFILTRATION SYSTEMS

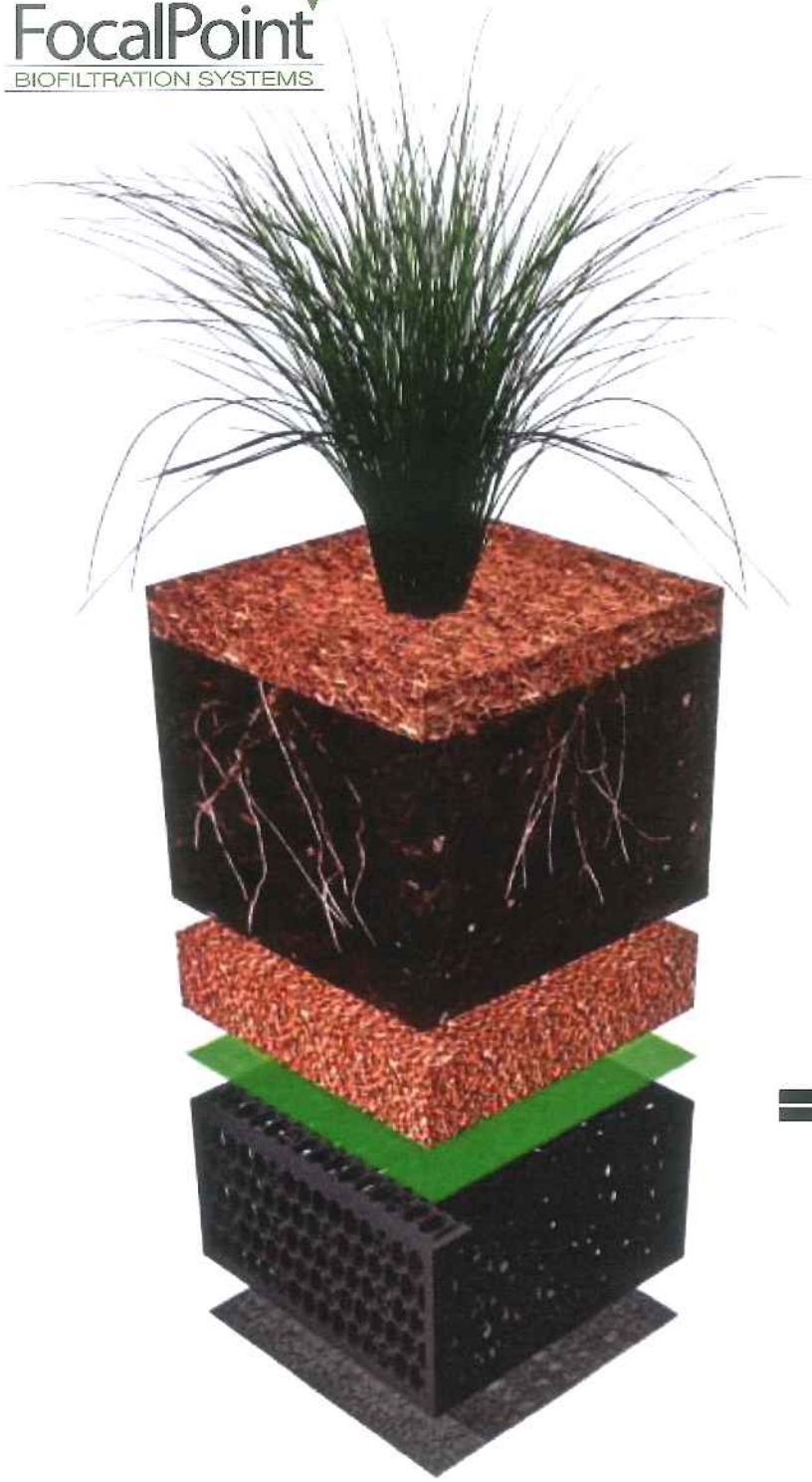


High Flow Media

Overcomes the challenges of Clogging & Flooding and Large Space requirements Associated with 1st Generation Systems.

- Flows at 100" Per Hour
- Flows Faster with age as roots create pathways through media that enlarge over time
- Resistant To Clogging

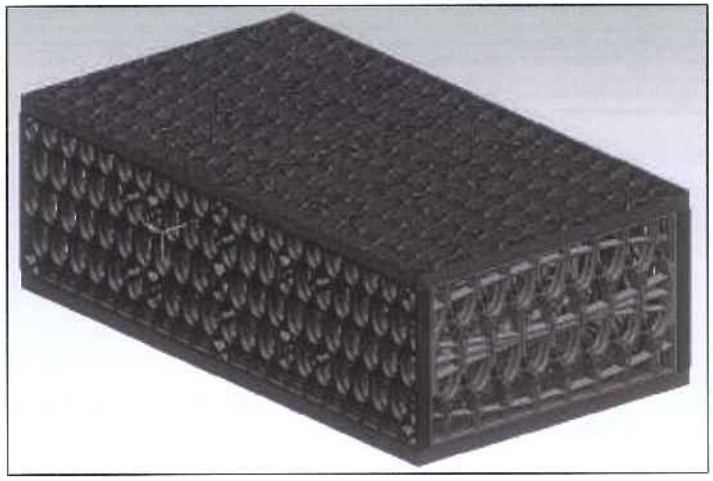
FocalPoint
BIOFILTRATION SYSTEMS



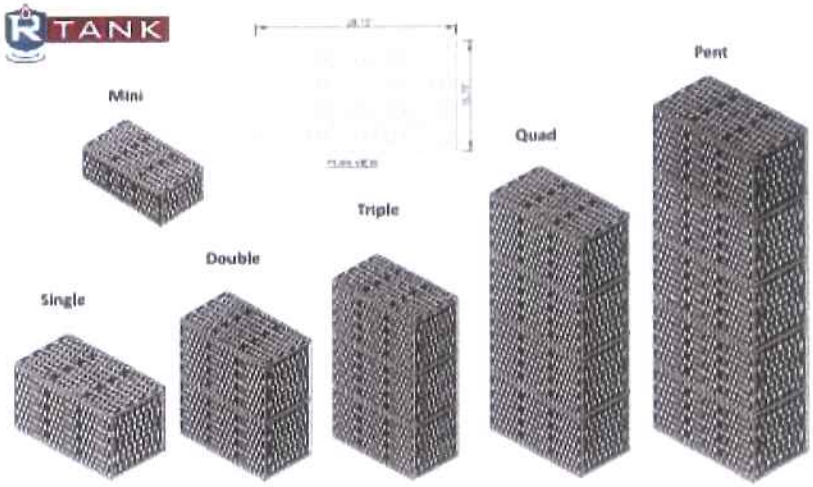
High-Performance Under-Drain

Overcomes the Limited Collection Capacity of Traditional Stone and Pipe Underdrains.

- 95% Open Surface Area will collect water significantly faster



- The FocalPoint Underdrain System can be extended below for additional volume



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BIOFILTRATION SYSTEMS

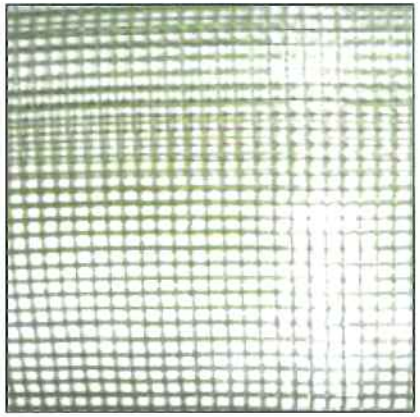
MULCH

- Acts as a Pre-Treatment Mechanism
- Traps Trash, Sediments & Particulates
- **Removal & Replacement of Mulch Every 6-12 Months Represents Entire Maintenance of System!**
- Schedule will Depend on Site Characteristics
- Extend Maintenance Cycles with Upstream Pretreatment

FocalPoint
BIOFILTRATION SYSTEMS

SEPARATION LAYER

The FocalPoint System separates the High Flow Media from the underdrain using a combination of clean stone and open weave mesh



=

No Geotextile

= No Clogging

FocalPoint
BIOFILTRATION SYSTEMS

Urban SWN / LID Applications

The placement and weir separation kept the FocalPoint System away from the tree roots and facilitated both street trees and biofiltration.

FocalPoint between two v-notch weirs, in an area that required 1/20th of the space a typical biofiltration system.

FocalPoint
BIOFILTRATION SYSTEMS

Clogged Bioretention Remediation

Utilized as a high efficiency drain at the low point of the clogged bio-cell, FocalPoint restored the function of the system without full excavation and replacement.

FocalPoint
BIOFILTRATION SYSTEMS

Commercial / Residential Applications

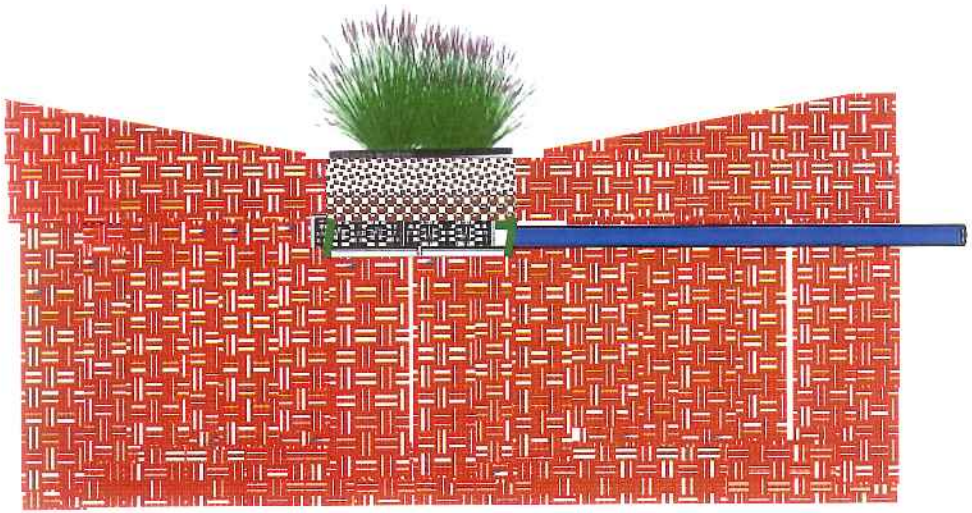
Water Quality with Reduced Infrastructure and Maintenance Costs

FocalPoint
BIOFILTRATION SYSTEMS

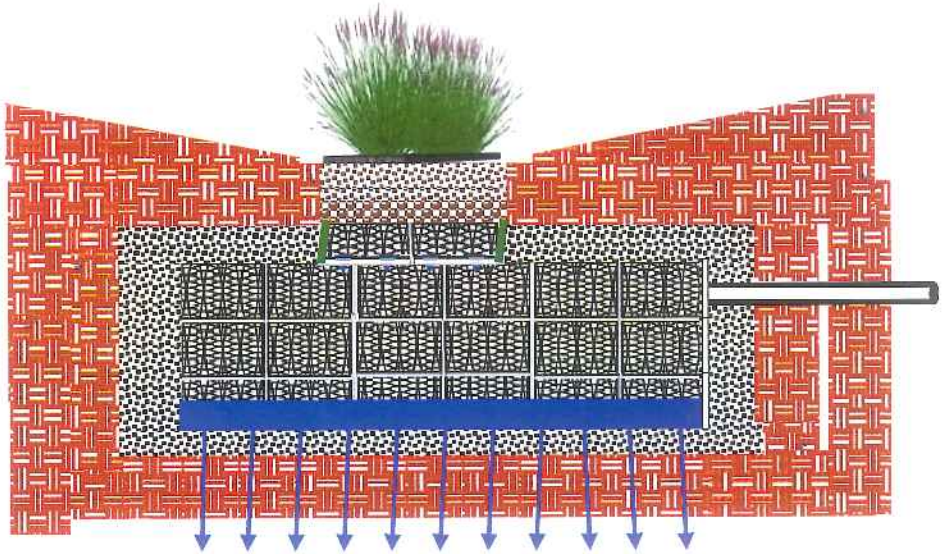
Highway Applications

Water Quality with Reduced Infrastructure and Maintenance Costs

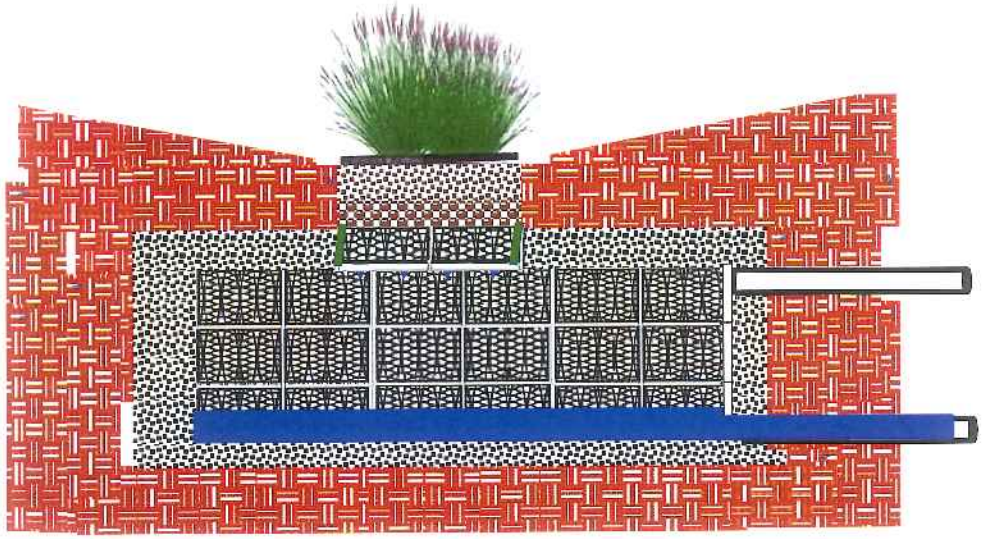
FocalPoint can be used for a variety of approaches to stormwater management and is easy to install for urban retrofit applications



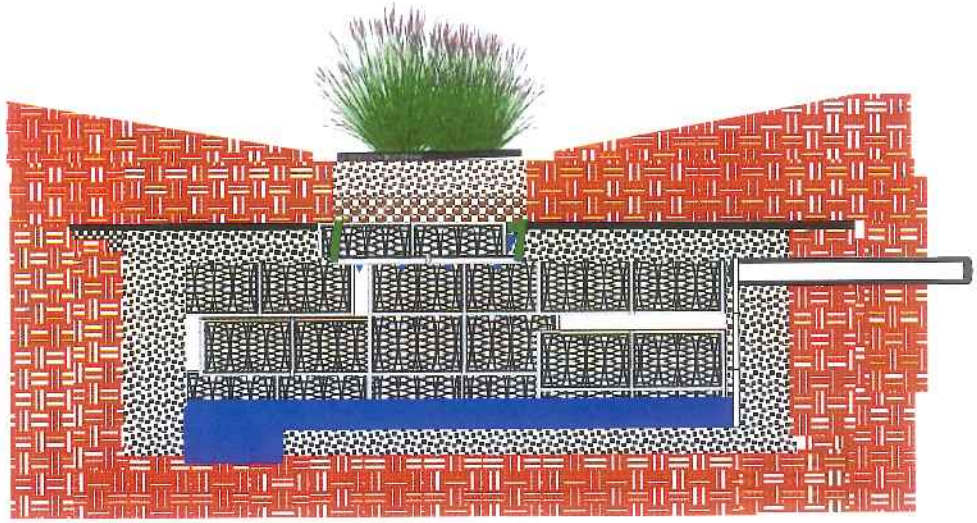
In-line Treat and Discharge



Infiltration



Detention



Harvesting

FocalPoint
BIOFILTRATION SYSTEMS

PLANT SELECTION

Intensive Bioswale – High End Retail, Urban, High End Residential, MultiFamily

Semi-Intensive Bioswale – Suburban Roadway, Commercial, Retail, Residential

Extensive Bioswale – Industrial, Rural Roadway, Commercial

SPECIFICATION
FocalPoint High Performance Modular Biofiltration System

1. **Description**
   Furnish and install pre-engineered stormwater treatment system(s), complete in place. The following general specifications describe the components and installation requirements for a FocalPoint High Performance Modular Biofiltration System (HPMBS) for filtration of stormwater that utilizes physical, chemical and biological mechanisms of a soil, plant and microbe complex to remove pollutants typically found in urban stormwater runoff. The modular treatment system in which the biologically active biofiltration media is used shall be a complete, integrated system designed to be placed in Square Foot or per Unit increments per the approved drawings to treat contaminated runoff from impervious surfaces. Work shall include all design work, signed and sealed by a licensed professional engineer, labor, materials, equipment and incidentals required to install stormwater treatment systems, pipe connections and appurtenances in accordance with the plans and these specifications.

2. **Materials**
   Provide materials that comply with the details shown on the plans and in accordance with the following. HPMBS is comprised of the following components:

   A. Plant Component
   1. Manufacturer shall provide a regionalized list of acceptable plants.
   2. Plants, as specified in the approved drawings/manufacturer's plant list, shall be installed at the time the HPMBS is commissioned for use.
   3. Plants and planting are typically included in landscape contract.

   B. Biofilter Component
   1. This component employs a high performance cross-section in which each element is highly dependent on the others to meet the performance specification for the complete system. It is important that this entire cross-section be provided as a complete system, and installed as such.
   2. As indicated in the approved drawings, the elements of the Biofilter include:
      a) A mulch protective layer (if specified).
      b) An advanced high infiltration rate biofiltration planting media bed which utilizes physical, chemical and biological mechanisms of the soil, plant, and microbe complex, to remove pollutants found in stormwater runoff.
      c) A separation layer which utilizes the concept of 'bridging' to separate the biofiltration media from the underdrain without the use of geotextile fabrics.
      d) A wide aperture mesh layer utilized to prevent bridging stone from entering the underdrain/storage element.
      e) A modular, high infiltration rate 'open cell' underdrain system which is designed to directly infiltrate or ex-filtrate water through its surface.
      f) A modular, high infiltration rate 'open cell' storage system (if specified) which is integrated with the underdrain system to provide additional volume capacity for detention, retention and/or infiltration to sub-soils.

   C. Energy Dissipation Component

1. An Energy Dissipation Component is typically specified to slow and spread out water as it enters the system. This component is dependent upon the design in the approved drawings, but typically consists of a rock gabion, rock filter dam or dense vegetation element, such as native grasses, either surrounding the Biofiltration Component or located immediately upstream of it.
2. Rock filled gabions (if specified) integrated at the upstream end or surrounding the HPMBS biofilter planting media bed, shall meet or exceed the following minimum standards and requirements:
   a) Gabions systems shall be welded wire mesh gabions conforming to ASTM A974-97
   b) Gabions shall be manufactured from, at minimum, 11 Gauge material. 3"x3" mesh is recommended and shall be coated with one of the following options:
      1) Galvanized for typical applications.
      2) Plastic coated after galvanizing with fuse-bonded P.V.C. (polyvinyl chloride) coating for applications in highly polluted, corrosive, or water-saturated environments.
      3) Galfan coated (Zinc-5% Aluminum-Mischmetal Alloy Coated) for applications in corrosive and/or abrasive environments.
      4) Stainless steel for applications in highly corrosive and abrasive environments.
   c) Base of gabions shall be constructed below scour depth, per the approved drawings.
   d) Gabions shall be filled by hand placement or small power equipment placement of coarse aggregate.
   e) Pre-formed stiffeners shall be installed across corners of gabions, 12" from top/bottom corner before filling. Two rows of stiffeners are required for front, back and side faces on 3' gabions and single row is required on 1.5' gabions.
   f) Spiral binders shall be used to enclose corners and joints.

D. Pretreatment Component

1. Pretreatment, when specified, is typically accomplished by locating the Biofiltration Component within or downstream of, a traditional vegetated BMP such as a vegetated swale, vegetated depression, traditional bioretention system, vegetated filter strip, sediment forebay, etc. These BMPs provide primary TSS removal when desirable.

E. Observation and Maintenance Component

1. An Observation and Maintenance Port shall be installed per the approved drawings to provide for easy inspection of the underdrain/storage element, and cleanout access if needed.

F. Extreme Event Overflow (by others)

1. An Extreme Event Overflow should be located external to, but near the Biofiltration element to provide bypass when needed. This may be an overland flow bypass structure, grated inlet, safe overland surface flow, or any configuration that serves the purpose. In the case of an inlet, it must be designed to minimize the likelihood of clogging by vegetative material. Typical inlet solutions involve inclined or dome style inlet grates.

Materials used for the HPMBS stormwater treatment units and appurtenances (both above and below ground) must be capable of withstanding aggressive biological, chemical and loading environments, typical of the geographic area in which the units are being installed, including freeze-thaw weather cycles, earth pressure and hydrostatic pressures.

3. Construction, Quality Assurance and Work Methods

The quality and composition of all system components and all other appurtenances and their assembly process shall be subject to inspection upon delivery of the system to the work site. Installation is to be performed only by skilled work people with satisfactory record of performance on earthworks, pipe, chamber, or pond/landfill construction projects of comparable size and quality.

A. Plants

1. Plants must be compatible with the HPMBS media and the associated highly variable hydrologic regime. Plants are typically facultative with fibrous roots systems such a native grasses and shrubs.
2. All plant material shall comply with the type and size required by the approved drawings and shall be alive and free of obvious signs of disease.

B. Mulch (if specified)

1. Mulch shall be aged, double-shredded hardwood, with fines removed, and shall comply with the approved drawings.
2. Bagged Mulch is not recommended, as it typically contains a high percentage of fines that can damage the system. However, if no other options are available, bags must be opened and dumped outside of the HPMBS footprint, and manually screened to remove fines.

C. Biofiltration Media

1. Biologically active biofiltration media shall be visually inspected to ensure appropriate volume, texture and consistency with the approved drawings, and must bear a batch number marking from the manufacturer which certifies performance testing of the batch to meet or exceed the required infiltration rate.
2. Media shall be homogenously blended to provide full functionality by a highly controlled and accurate blending process.
3. Manufacturer shall have a minimum of 3 years' experience and a minimum of 500 installed and operational high performance, high flow rate bioretention system units.
4. Within 90 days after project completion, the infiltration rate shall be confirmed at the manufacturer or vendor's expense, by a wetted condition hydraulic conductivity test.
   a) Failure to pass this test will result in removal and replacement of all media in the system at no cost to the project owner/operator.
   b) Test must utilize the equipment and follow the standard operating procedures found in the Harris County Texas manual entitled, Low Impact Development & Green Infrastructure Design Criteria for Stormwater Management (2011).
   c) Replacement media, if required, must be provided from a different batch than the original material.
5. Vendor shall provide, at no additional cost to the project owner/operator, maintenance of the biofiltration system for a period of one year. Vendor shall make available an extended maintenance contract if desired by project owner/operator.
6. Composition and characteristics of the Biofiltration Media must meet or exceed the following minimum standards as demonstrated by testing acceptable to the project engineer:

Aggregate Characteristics (TYPICAL)	
Combined Silt & Clay	<5%
Sand – Fine	<5%
Sand – Medium	2% - 20%

Sand – Coarse	5% - 35%
Sand – Very Coarse	10% - 55%
Gravel	10% - 70%
Infiltration Rate	>100 inches per hour
Organic *	5% - 30%
*** Organic Specification**	
Listed by Organic Materials Review Institute	
100% natural peat (no composted, sludge, yard or leaf waste)	
% passing 2.0 mm sieve	95% to 100%
% passing 1.0mm sieve	>80%
Total Carbon	> 85%
Carbon to Nitrogen Ratio	15:1 to 23:1
Lignin Content	49% to 52%
Humic Acid	> 18%
pH	6.0 to 7.0
Moisture Content	30% to 50%

D. Underdrain/Storage System

1. Underdrain shall be accessible for Observation and Maintenance via a vertical standpipe which provides visual access to the bottom of the underdrain/storage structure as indicated in the Manufacturer's detail drawings and Installation guide. This access point may also be used to flush and vacuum the system in the event the underdrain accumulates sediment from external penetration.
2. Modular underdrain/storage components shall be manufactured in an ISO certified facility and be manufactured from at least 90% post-consumer recycled materials. Underdrain/storage components shall meet or exceed the following characteristics:

Property	Value
Surface Void Area	≥85%
Unit Weight	3.25 lbs/cf
Service Temperature	-14° to 167°
Unconfined Crush Strength	32.48 psi
180 Day Creep Test	
Load Applied – Initial and Sustained	11.16 psi
Creep Sustained – After 180	0.20 inches
Creep Sustained – After 180	1.13%
Projected Creep – 40 years	1.72%

E. Separation Micro-grid Mesh

1. Separation Micro-grid Mesh shall be composed of high-tenacity monofilament polypropylene yarns that are woven together to produce an open mesh geotextile which shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis and acids. The mesh shall meet or exceed the following characteristics:

Properties	Test Method	Unit	Min Avg Roll Value	
			KN/m	lbs/ft
MD-Ultimate Strength	ASTM D6637		21.6	1480
MD-Creep Limited Strength	ASTM D5262		13.5	925
CMD-Ultimate Strength	ASTM D6637		21.4	1465
Long Term Design Strength	-		10.2	701
Aperture Size (machine direction)	-	mm (in)	2.54 (0.10)	
Aperture Size (cross machine direction)	-	mm (in)	2.54 (0.10)	

F. Bridging Stone

1. Bridging Stone shall be 3/8" pea gravel, or other diameter as sized by bridging analysis, to prevent migration of filter media, as specified by manufacturer. In no case shall there be any particles larger than 12mm and not more than 5% shall be less than 2mm.
2. Stone must be washed and free from sediment, soil and contaminants.

G. Delivery, Storage and Handling

1. Protect all materials from damage during delivery and store UV sensitive materials under tarp to protect from sunlight including all plastics, when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris.
2. Biofiltration media shall be segregated from any other aggregate materials and shall be protected against contamination, including contamination from any stormwater runoff from areas of the site which are not stabilized.

H. Submittals

1. Product Data. Submit manufacturer's product data and approved Installation Manual as well as manufacturer's Operations and Maintenance Manual for the system. It will be the responsibility of the system owner/operator or their contractor to ensure the system is operated and maintained in accordance with the manual.
2. Certification. Manufacturer shall submit a letter of certification that the complete system meets or exceeds all technical and packaging requirements. Biofiltration media packaging must bear a batch number marking from the manufacturer which matches a letter from the manufacturer certifying performance testing of the batch to meet or exceed the required infiltration rate.
3. Drawings. Manufacturer shall provide dimensional drawings including details for construction, materials, specifications and pipe connections.
4. Manufacturer's Warranty. Manufacturer shall provide a warranty for all components of the HPMBS for a period of one year provided the unit is installed, operated and maintained in accordance with the manual. Improper operation, maintenance or accidental or illegal activities (i.e. dumping of pollutants, vandalism, etc.) will void the

warranty. Biofiltration media shall be warranted to pass the post-installation infiltration test as described in this document.

5. Substitutions. Any proposed equal alternative product substitution to this specification must be submitted for review and approved prior to bid opening. Review package should include third party reviewed performance data of biofiltration media. All components must meet or exceed Quality Assurance and Performance Criteria indicated herein.

I. Project Conditions

1. Review manufacturer's recommended installation procedures and coordinate installation with other work affected, such as grading, excavation, utilities, construction access and erosion control to prevent all non-installation related construction traffic over the completed HPMBS installation.
2. Cold Weather
   a) Do not use frozen materials or materials mixed or coated with ice or frost.
   b) Do not build on frozen ground or wet, saturated or muddy subgrade.
   c) Care must be taken when handling plastics when air temperature is at 40 degrees or below as plastic becomes brittle.
3. Protect partially completed installation against damage from other construction traffic when work is in progress and following completion of backfill by establishing a perimeter with highly visible construction tape, fencing, or other means until construction is complete.
4. Soil stabilization of the surrounding site must be complete before the Biofiltration System can be brought online. Soil stabilization occurs when 90% of all surface areas within the drainage area served by the HPMBS has been paved, constructed on or vegetated. Temporary erosion control and/or sedimentation prevention measures shall be implemented to reduce the possibility of sediments being transported into the Biofiltration System. Significant sediment loads can damage the HPBMS and lead to failure if not prevented or remediated promptly.

J. Products

1. Acceptable HPBMS
   FocalPoint High Performance Biofiltration System
   Acceptable Manufacturer
   Convergent Water Technologies, Inc.
   (800) 711-5428
   www.convergentwater.com
2. Distributor/Vendor
   ACF Environmental
   2831 Cardwell Rd
   Richmond, VA
   (800) 711 5428
   Corey Simonpietri
   (832) 456-1000

K. Packaging

1. HPMBS is assembled on site.

2. Modular underdrain/storage unit is shipped flat and modules are assembled prior to installation.
3. Biofiltration media is delivered in super sacks each labeled with manufacturer's batch number and/or in bulk with accompanying manufacturer's certification.
4. Other components are delivered in bulk.

L. Execution

1. Excavation and Backfill
   a) Base of excavation shall be smooth, level and free of lumps or debris, and compacted unless infiltration of stormwater into subgrade is desired. A thin layer (3") of compacted base material is recommended to establish a level working platform (may not be needed in sandy soils). If the base of the excavation is pumping or appears excessively soft, a geotechnical engineer should be consulted for advice. In many cases, a stabilization geotextile and 6" of compactable material that drains well will be sufficient to amend the bearing capacity of the soil.
   b) Most applications require 8 oz. Non-Woven Geotextile to line the entire excavation, sides and bottom, to separate in situ soils and the HPMBS. (Applications requiring water to infiltrate the in situ sub-soils should use a bridging stone rather than geotextile to provide a separation layer between the HPMBS underdrain and the in situ soils).
   c) Absolutely no geotextiles should be used in the water column.
   d) Geotextile, should only be placed on the bottom if specified. In all cases, geotextile should be placed up the sides of the excavation.
   e) If the completed HPMBS is not to be immediately activated in a fully stabilized drainage area, the geotextile lining the excavation should be sized to extend well beyond the top of the excavation. Doing so will allow the excess fabric to be wrapped over the top of the filter bed after installation, as described below.
   f) If the HPMBS is to be covered and activated at a later date, no mulch should be installed at this time. Instead, the filter media bed should be capped by a cut-to-size piece of impermeable liner material prior to securing the excess geotextile, described above, over the top of the completed HPMBS. This 'cap and seal' (see Installation Guide for details) will protect the system until such time as the drainage area is stabilized and the HPMBS can be commissioned and brought online.
   g) Specified backfill material must be free from lumps, debris and any sharp objects that could penetrate the geotextile. Material is used for backfill along the sides of the system as indicated in engineering detail drawings.
   h) Stake and install HPMBS systems to match the final line and grade as shown on the plans or as directed by the Engineer. The Engineer may direct the Contractor to shift the stormwater treatment unit location(s), if necessary, to secure a more desirable location(s).
2. Inspection
   a) Examine prepared excavation for smoothness, compaction and level. Check for presence of high water table, which must be kept at levels below the bottom of the under drain structure at all times. If the base is pumping or appears excessively soft, a geotechnical engineer should be consulted for advice.
   b) Installation commencement constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found to be

unsatisfactory, contact Project Manager or Engineer for resolution prior to installation.

M. Cleanup and Protection during Construction Activity

1. Perform cleaning during the installation and upon completion of the work.
2. Remove from site all excess materials, debris, and equipment. Repair any damage to adjacent materials and surfaces resulting from installation.
3. If surrounding drainage area is not fully stabilized, a protective covering of impermeable liner material and geotextile fabric should be securely placed over the top of the system, as described above, to protect the Biofiltration Media.
4. Construction phase erosion and sedimentation controls shall be placed to protect the inlet(s) to the Biofiltration System. Excessive sedimentation, particularly prior to establishment of plants may damage the HPMBS.
5. Strictly follow manufacturer's Installation guidelines with respect to protection of the HPMBS between Installation and Commissioning phases.

N. Commissioning

1. Commissioning should only be carried out once the contributing drainage area is fully stabilized. If Commissioning must be carried out sooner, it is imperative that appropriate erosion and sediment controls be placed to prevent the entry of excessive sediment/pollutant loads into the system.
2. Commissioning entails removing the protective covering from the Biofiltration Media, planting the plant material in accordance with the approved drawings, and placing mulch if specified.
    a. 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.
    b. 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.
    c. Strictly follow manufacturer's planting guidance.
3. Cover the exposed root ball top with mulch. Mulch should not touch the plant base because it can hold too much moisture and invite disease and insects. Evenly place 3 inches of aged, double-shredded hardwood mulch (if specified) on the surface of the media.
4. Plantings shall be watered-in at installation and temporary irrigations shall be provided, if specified.
5. A permanent, serialized and numbered Identification Marker shall be affixed and secured to the top of the Observation/Maintenance Port and the location recorded for public records associated with the site.

O. Operations and Maintenance

1. Maintenance Requirements
    a. Each correctly installed HPMBS is to be maintained by the vendor for a minimum period of one year. The cost of this service is to be included in the price of the system.

b. Annual maintenance consists of two (2) scheduled visits unless otherwise specified.
c. Each maintenance visit consists of the following:
    (1) Complete system inspection
    (2) Removal of foreign debris, silt, plant material, trash and mulch (if needed)
    (3) Evaluation of biofiltration media
    (4) Evaluation of plant health
    (5) Inspection of underdrain/storage system via Observation/Maintenance Port
    (6) Properly dispose of all maintenance refuse items (trash, mulch, etc.)
    (7) Take photographs documenting plant growth and general system health
    (8) Update and store maintenance records
    (9) To ensure long term performance of the HPMBS, continuing maintenance should be performed per the manufacturer's Operations and Maintenance Manual.
d. If sediment accumulates beyond an acceptable level in the underdrain/storage system, it is highly likely that the system has been seriously damaged by penetration. This should be investigated and repaired. Following repair, it will be necessary to flush the underdrain. This can be done by pumping water into the Observation/Maintenance Port or adjacent overflow structure, allowing the turbulent flows through the underdrain to re-suspend the fine sediments. If multiple Observation/Maintenance Ports have been installed, water should be pumped into each port to maximize flushing efficiency. Sediment-laden water can be pumped out and either captured for disposal or filtered through a geotextile filter bag, if permitted by the locality.

2. Submit 3 full sets of manufacturer's literature and Operation and Maintenance Manual for the selected stormwater treatment system for review and approval. Literature shall include documentation as to warranties. Provide documentation demonstrating that the manufacturer has at experience and the capability to perform the work.

4. Measurement

Given the integrated nature of the HPMBS, measurement and payment will be based not on the individual component prices, but on the size of the completed Biofiltration Media bed. The external dimension as indicated in the approved plans and executed in the installation will be measured in Square Feet

5. Payment

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid per the Square Foot or Each of the HPMBS units installed.

FocalPoint

BIOFILTRATION SYSTEMS

HIGH PERFORMANCE MODULAR BIOFILTRATION SYSTEM (HPMBS)

Operations & Maintenance

ACF ENVIRONMENTAL

Customer Focused, Environmentally Committed

GENERAL DESCRIPTION

The following general specifications describe the general operations and maintenance requirements for the FocalPoint® High Performance Modular Biofiltration System (HPMBS). The system utilizes physical, chemical and biological mechanisms of a soil, plant and microbe complex to remove pollutants typically found in urban stormwater runoff. The treatment system is a fully equipped, modular, constructed in place system designed to treat contaminated runoff.

Stormwater enters the FocalPoint® HPMBS, is filtered by the High Flow Biofiltration Media and passes through to the underdrain/storage system where the treated water is detained, retained or infiltrated to sub-soils, prior to discharge to the storm sewer system of any remaining flow.

Higher flows bypass the FocalPoint® HPMBS via a downstream inlet or other overflow conveyance. Maintenance is a simple, inexpensive and safe operation that does not require confined space entry, pumping or vacuum equipment, or specialized tools. Properly trained landscape personnel can effectively maintain FocalPoint® HPMBS by following instructions in this manual.

BASIC OPERATIONS

FocalPoint® is a modular, high performance biofiltration system that often works in tandem with other integrated management practices (IMP). Contaminated stormwater runoff enters the biofiltration bed through a conveyance swale, planter box, or directly through a curb cut or false inlet. Energy is dissipated by a rock or vegetative dissipation device and is absorbed by a 3-inch layer of aged, double shredded hardwood mulch, with fines removed, (when specified) on the surface of the biofiltration media.

As the water passes through the mulch layer, most of the larger sediment particles and heavy metals are removed through sedimentation and chemical reactions with the organic material in the mulch. Water passes through the biofiltration media where the finer particles are removed and numerous chemical reactions take place to immobilize and capture pollutants in the soil media.

The cleansed water passes into the underdrain/storage system and remaining flows are directed to a storm sewer system or other appropriate discharge point. Once the pollutants are in the soil, bacteria begin to break down and metabolize the materials and the plants begin to uptake and metabolize the pollutants. Some pollutants such as heavy metals, which are chemically bound to organic particles in the mulch, are released over time as the organic matter decomposes to release the metals to the feeder roots of the plants and the cells of the bacteria in the soil where they remain and are recycled. Other pollutants such as phosphorus are chemically bound to the soil particles and released slowly back to the plants and bacteria and used in their metabolic processes. Nitrogen goes through a variety of very complex biochemical processes where it can ultimately end up in the plant/bacteria biomass, turned to nitrogen gas or dissolves back into the water column as nitrates depending on soil temperature, pH and the availability of oxygen. The pollutants ultimately are retained in the mulch, soil and biomass with some passing out of the system into the air or back into the water.

DESIGN AND INSTALLATION

Each project presents different scopes for the use of FocalPoint® HPMBS. To ensure the safe and specified function of this stormwater BMP, Convergent Water Technologies and/or its Value Added Resellers (VAR) review each application before supply. Information and design assistance is available to the design engineer during the planning process. Correct FocalPoint® sizing is essential to optimum performance. The engineer shall submit calculations for approval by the local jurisdiction when required. The contractor and/or VAR is responsible for the correct installation of FocalPoint® HPMBS units as described in approved plans. A comprehensive installation manual is available at www.convergentwater.com.

MAINTENANCE

Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons for maintenance include:

- Avoid legal challenges from your jurisdiction's maintenance enforcement program.
- Prolong the lifespan of your FocalPoint® HPMBS.
- Avoid costly repairs.
- Help reduce pollutant loads leaving your property.

Simple maintenance of the FocalPoint® HPMBS is required to continue effective pollutant removal from stormwater runoff before any discharge into downstream waters. This procedure will also extend the longevity of the living biofiltration system. The unit will recycle and accumulate pollutants within the biomass, but may also subjected to other materials entering the surface of the system. This may include trash, silt and leaves etc. which will be contained above the mulch and/or biofiltration media layer. Too much silt may inhibit the FocalPoint's® HPMBS flow rate, which is a primary reason for system maintenance. Removal of accumulated silt/sediment and/or replacement of the mulch layer (when specified), is an important activity that prevents over accumulation of such silt/sediment.

When to Maintain?

Convergent Water Technologies and/or its VAR includes a 1-year maintenance plan with each system purchased. Annual included maintenance consists of two (2) scheduled maintenance visits. Additional maintenance may be necessary depending on sediment and trash loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated for full operation. Full operation is defined as when the site is appropriately stabilized, the unit is installed and activated (by VAR), i.e., when mulch (if specified) and plantings are added.

Activation should be avoided until the site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed). Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands. The fall visit helps the system by removing excessive leaf litter.

A first inspection to determine if maintenance is necessary should be performed at least twice annually after storm events of greater than (1) one inch total depth (subject to regional climate). Please refer to the maintenance checklist for specific conditions that indicate if maintenance is necessary.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required. Regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the VAR/Maintenance contractor and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the VAR/Maintenance contractor of any damage to the plant(s), which constitute(s) an integral part of the biofiltration technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance of the FocalPoint® HPMBS to the VAR/Maintenance contractor (i.e. no pruning or fertilizing).

EXCLUSION OF SERVICES

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant(s) in the FocalPoint® HPMBS.

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the VAR/Maintenance contractor maintenance contract. Should a major contamination event occur, the Owner must block off the outlet pipe of the FocalPoint® (where the cleaned runoff drains to, such as drop-inlet) and block off the point where water enters of the FocalPoint® HPMBS. The VAR/Maintenance contractor should be informed immediately.

MAINTENANCE VISIT SUMMARY

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of FocalPoint® HPMBS and surrounding area
2. Removal of debris, trash and mulch
3. Mulch replacement
4. Plant health evaluation (including measurements) and pruning or replacement as necessary
5. Clean area around FocalPoint® HPMBS
6. Complete paperwork, including date stamped photos of the tasks listed above.

MAINTENANCE TOOLS, SAFETY EQUIPMENT AND SUPPLIES

Ideal tools include: camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working in close proximity to traffic and also safety hats and shoes.

MAINTENANCE VISIT PROCEDURE

Inspection of FocalPoint® HPMBS and surrounding area

Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

- Standing Water yes | no
- Is Bypass Inlet Clear? yes | no
- Damage to HPMBS System yes | no
- to Overflow conveyance yes | no

Removal of Silt / Sediment / Clay

Dig out silt (if any) and mulch and remove trash & foreign items.

- Silt / Clay Found? yes | no
- Cups / Bags Found? yes | no
- Leaves? yes | no
- Volume of material removed _____ (volume or weight)

Removal of debris, trash and mulch

After removal of mulch and debris, measure distance from the top of the FocalPoint® HPMBS engineered media soil to the flow line elevation of the adjacent overflow conveyance. If this distance is greater than that specified on the plans (typ. 6" - 12"), add media (not top soil or other) to recharge to the distance specified.

- Distance to media surface to flow line of overflow conveyance (inches) _____
- # of Buckets of Media Added _____

Mulch Replacement

Most maintenance visits require only replacement mulch (if utilized) which must be, aged, double shredded hardwood mulch with fines removed. For smaller projects, one cubic foot of mulch will cover four square feet of biofiltration bed, and for larger projects, one cubic yard of mulch will cover 108 square feet of biofiltration bed. Some visits may require additional FocalPoint® HPMBS engineered soil media available from the VAR/Contractor.

- Add double shredded, aged hardwood mulch which has been screened to remove fines, evenly across the entire biofiltration media bed to a depth of 3".
- Clean accumulated sediment from energy dissipation system at the inlet to the FocalPoint® HPMBS to allow for entry of trash during a storm event.

Plant health evaluation and pruning or replacement as necessary

Examine the plant's health and replace if dead or dying.
Prune as necessary to encourage growth in the correct directions

- Height above Grate (feet) _____
- Width at Widest point (feet) _____
- Health alive | dead
- Damage to Plant yes | no

Clean area around FocalPoint® HPMBS

- Clean area around unit and remove all refuse to be disposed of appropriately.

Complete paperwork

- Deliver Maintenance Report and photographs as appropriate.
- Some jurisdictions may require submission of maintenance reports in accordance with approvals.
- It is the responsibility of the Owner to comply with local regulations.

FocalPoint

BIOFILTRATION SYSTEM

FocalPoint Warranty

Seller warrants goods sold hereunder against defects in materials and workmanship only, for a period of (1) year from date the Seller activates the system into service. Seller makes no other warranties, express or implied.

Seller's liability hereunder shall be conditioned upon the Buyer's installation, maintenance, and service of the goods in strict compliance with the written instructions and specifications provided by the Seller. Any deviation from Seller's instructions and specifications or any abuse or neglect shall void warranties.

In the event of any claim upon Seller's warranty, the burden shall be upon the Buyer to prove strict compliance with all instructions and specifications provided by the Seller.

Seller's liability hereunder shall be limited only to the cost or replacement of the goods. Buyer agrees that Seller shall not be liable for any consequential losses arising from the purchase, installation, and/or use of the goods.

Maintenance Checklist

Element	Problem	What To Check	Should Exist	Action
Inlet	Excessive sediment or trash accumulation	Accumulation of sediment or trash impair free flow of water into FocalPoint	Inlet free of obstructions allowing free flow into FocalPoint System	Sediments or trash should be removed
Mulch Cover	Trash and floatable debris accumulation	Excessive trash or debris accumulation.	Minimal trash or other debris on mulch cover	Trash and debris should be removed and mulch cover raked level. Ensure that bark nugget
Mulch Cover	Ponding of water on mulch cover	Ponding in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils	Stormwater should drain freely and evenly over mulch cover.	Contact VAR for advice.
Plants	Plants not growing, or in poor condition	Soil/mulch too wet, evidence of spill. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact VAR for advice.
Plants	Plant growth excessive	Plants should be appropriate to the species and location of FocalPoint		Trim/prune plants in accordance with typical landscaping and