

AquaShield™ Bio-Filter™ Stormwater Biofiltration System

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PURPOSE

The AquaShield™ Bio-Filter™ Stormwater Biofiltration System is designed to provide innovative and sustainable green infrastructure solutions to meet the challenges presented by Low Impact Development (LID) practices. Selecting the proper LID technology involves a step by step selection process based on a series of preferred practices as illustrated in the technology selection pyramid below in Figure 1.

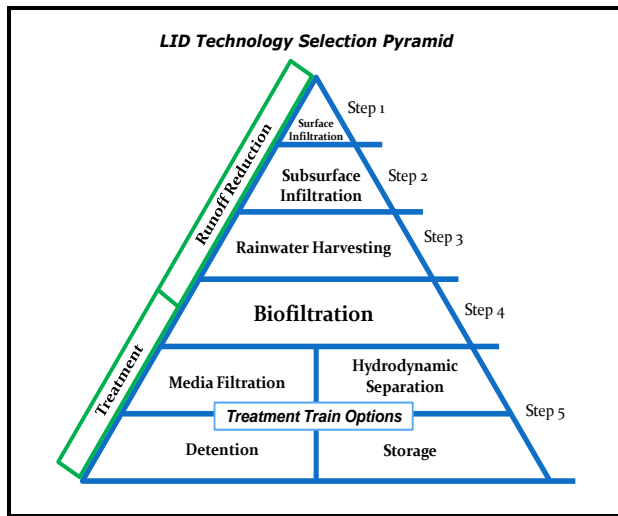


Figure 1. LID Technology Selection Pyramid.

Urban designs do not always allow for the use of surface or subsurface infiltration, nor is rainwater harvesting always feasible or acceptable (steps 1 through 3). The next step in the technology selection process includes the AquaShield™ Bio-Filter™ system which offers a modular bio-filtration approach that spans the fundamental LID goals of stormwater runoff reduction and treatment. The AquaShield™ Bio-Filter™ can be used as either a standalone technology to provide a conventional LID design approach; or, can also be utilized within a treatment train design to allow for a more unconventional design. Other LID technologies

can be used in conjunction with the Bio-Filter™ system to provide unique site design innovations.

MODE of OPERATION

Elements of both pretreatment and biofiltration are incorporated into the Bio-Filter™ system. The design includes a trash shelf, pre-treatment chamber, biofiltration chamber, internal bypass, and outlet chamber (Figure 2).

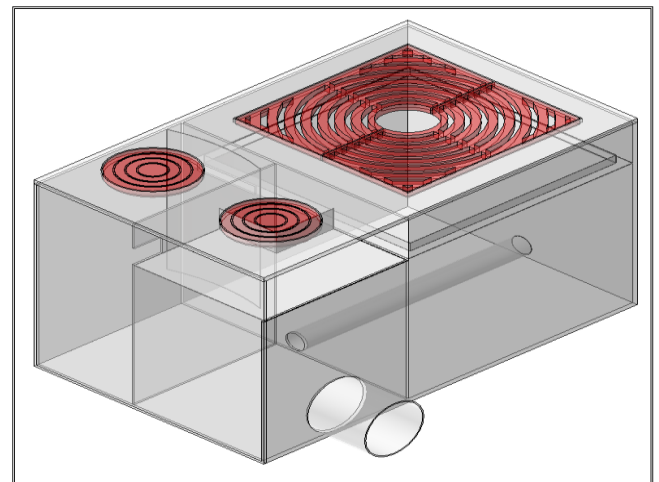


Figure 2. AquaShield™ Bio-Filter™ System.

Operation begins when water enters the device, commonly through a curb inlet, and flows onto the trash shelf. The water quality treatment flow (WQ_f) enters the pretreatment chamber where floatables and coarse sediment are captured and retained. The WQ_f then enters the biofiltration chamber and is evenly distributed across the top of the engineered soil filtration media. Water flows downward through the biomedica and plant root ball to remove fine sediment, metals, residual oil and phosphorus. The treated water then enters an underdrain pipe placed within a basal gravity bed. Water is conveyed via the underdrain pipe to the adjacent outlet chamber positioned underneath the trash shelf. The Bio-Filter™ also includes a unique internal bypass

mechanism designed not only to accommodate flows that exceed the WQ_f , but also to minimize the device's installation footprint by eliminating the need for any external bypass structures. Internal bypass occurs when the head level rises within the unit such that flows in excess of the WQ_f will spill across the overflow weir on the trash shelf and downward into the underlying outlet chamber.

DESIGN FEATURES

The modular Bio-Filter™ is constructed of durable polymer coated steel (PCS) to provide long term operations and structural functionality. Available model sizes range from 4 x 4 ft to 6 x 8 feet in area (16 to 48 ft²). No heavy lifting equipment is needed for installation. AquaShield™ biofiltration soil media can be utilized with 18 or 24 inches of depth. Each unit also includes two 15-inch diameter access ports to the trash shelf, pretreatment chamber and underdrain area to facilitate inspection and maintenance activities. A non-skid surface material is also used for the system. Structural integrity of each unit is leak tested at the fabrication facility prior to shipping.

PERFORMANCE TESTING

A comprehensive testing program has been independently performed by a NELAP certified laboratory to demonstrate the performance capabilities of the engineered soil biofiltration media. Testing was designed to determine the removal efficiency of the bio-media against Total Suspended Solids (TSS) and insoluble (total) forms of copper and zinc. A PVC test cartridge measuring 36 inches long and 6 inches diameter contained the following components listed from top to bottom: (a) 6 inches freeboard space, (b) 3 inches mulch, (c) 24 inches biomedica, (d) permeable geotextile fabric layer, and (e) 3 inches washed stone. A nylon mesh was fixed at the base to retain the cartridge contents. The test sediment was ground silica SIL-CO-SIL® 106 having a reported median particle size (d_{50}) of 22 microns (0.022 mm). Following pre-flushing and collecting sample blanks, a 50 gallon stock solution containing the test sediment and metals was passed through the filter cartridge via gravity flow at an average loading rate of 1.4 gpm/ft², or 135 inches per hour.

Results of the laboratory testing program are summarized in Table 1. An average TSS influent concentration was 100 mg/L. Average copper and zinc influent concentrations were 0.029 and 0.162 mg/L. The biomedica demonstrates approximately 95% TSS removal efficiency. Additionally, total copper and total zinc removal efficiencies of 71 and 97%, respectively were

achieved during comprehensive testing of the bio-filtration media. Phosphorus removal efficiency testing is enhanced through plant uptake processes.

Table 1. Bio-Filter™ Performance Testing Results

Contaminants	Avg. Influent (mg/L)	Avg. Effluent (mg/L)	Avg. RE (%)
TSS	100	5.5	94.5
Total Copper	0.029	0.008	71.4
Total Zinc	0.162	0.005	96.9

OPERATIONS & MAINTENANCE

AquaShield™ provides the media for the Bio-Filter™ system. Regional climatic conditions and site-specific design considerations should be understood to select the most suitable plant for the device. The system is activated on-site when the selected vegetation is planted by others within the bio-filtration chamber and the unit is connected to the conveyance piping network.

Maintenance frequency will ultimately be determined by site stormwater runoff conditions and plant growth. Inspections of the trash shelf, pretreatment chamber and underdrain area can be accomplished via the two access ports. Inspections of the filter media can be performed through the removable grates. AquaShield™ recommends periodic inspections following installation to determine a site-specific maintenance cycle both the device and plant structure. The biofiltration chamber only requires limited media replacement to include the top mulch layer and the top few inches of the soil filter media, being careful not to disturb the root ball or impair the plant's stability. Replacement biomedica is available from AquaShield™.

BENEFITS

- Provides green stormwater infrastructure in a sustainable water quality treatment device,
- Achieves high TSS and heavy metals removal at flow rates up to 135 in/hr,
- Modular installation provides for simple and quick installation,
- Internal bypass eliminates need for external bypass structure(s),
- Easy to maintain from the surface,
- Developed and backed by AquaShield™, a leader in stormwater treatment solutions.

For more information, contact your local AquaShield™ representative or call us at (888) 344-9044.