

SECTION (____)
Filtterra® – Vault Configuration
Bioretention System Standard Specification

1.0 GENERAL

- 1.1 This item shall govern the furnishing and installation of the Filtterra® Bioretention System by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.
- 1.2 Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the bioretention system, appurtenances and incidentals in accordance with the Drawings and as specified herein.
- 1.3 Bioretention system shall utilize the physical, chemical and biological mechanisms of an engineered biofiltration media, plant and microbe complex to remove pollutants typically found in urban stormwater runoff. The treatment system shall be a fully equipped, pre-constructed, drop-in-place unit designed for applications in the urban landscape to treat contaminated runoff from impervious surfaces.
- 1.4 Bioretention system shall be capable of stand-alone stormwater treatment.
- 1.5 Bioretention plants shall be incorporated into the system with plant material extending into the treatment zone of the engineered media at time of Activation.
- 1.6 The bioretention system shall be of a type that has been installed and in use for a minimum of five (5) consecutive years preceding the date of installation of the system. The Manufacturer shall have been, during the same consecutive five (5) year period, engaged in the engineering design and production of systems deployed for the treatment of stormwater runoff and which have a history of successful production, acceptable to the Engineer of Record and/or the approving Jurisdiction. The Manufacturer of the Filtterra Bioretention System shall be, without exception:

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- 1.7 Applicable provisions of any Division shall govern work in this section.
- 1.8 American Society for Testing and Materials (ASTM) Reference Specifications
 - 1.8.1 ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
 - 1.8.2 ASTM C858: Standard Specification of Underground Precast Concrete Utility Structures

- 1.8.3 ASTM C990: Standard Specification for Joints for Precast Box Sections Using Preformed Flexible Joint Sealants
- 1.8.4 ASTM C109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
- 1.9 Manufacturer or authorized supplier to submit shop drawings for bioretention System with the vault, engineered biofiltration media and accessory equipment. Drawings shall include principal dimensions, engineered biofiltration media placement, location of piping and unit foundation.
 - 1.9.1 Manufacturer or authorized supplier shall submit installation instructions to the contractor.
 - 1.9.2 Manufacturer or authorized supplier shall submit Operations and Maintenance Manual to the contractor.
 - 1.9.3 Before installation of the bioretention system, Contractor shall obtain the written approval of the Engineer of Record for the system drawings.
- 1.10 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

- 2.1 Internal components including engineered biofiltration media, underdrain stone, PVC underdrain piping, and mulch must be included as part of the bioretention system and shall be provided by Contech Engineered Solutions LLC. Note that vegetation is an essential component of bioretention systems, and shall be provided at time of Activation by the contractor.
 - 2.1.1 Engineered biofiltration media shall consist of both organic and inorganic components. Stormwater shall be directed to flow vertically through the media profile, saturating the full media profile without downstream flow control.
 - 2.1.2 Underdrain stone shall be of size and shape to provide adequate bridging between the media and stone for the prevention of migration of fine particles. Underdrain stone must also be able to convey the design flow rate of the system without restriction and be approved for use in the Filterra Bioretention System by Contech Engineered Solutions LLC.
 - 2.1.3 PVC Underdrain Piping shall be SDR35 with perforation pattern designed to

convey system design flow rate without restriction.

- 2.1.4 Mulch shall be double shredded wood or bark mulch approved for use with the Filterra Bioretention System by Contech Engineered Solutions LLC.
- 2.2 Precast concrete vault shall be provided by Manufacturer or authorized supplier according to ASTM C857 and C858.
 - 2.2.1 Vault joint sealant shall be Conseal CS-101 or approved equal. Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
 - 2.2.2 If interior concrete baffle walls are provided, baffle walls shall be cast-in or sealed to the interior vault walls and floor with a polyurethane construction sealant rated for use below the waterline, SikaFlex 1a or equal. Contractor to provide sealant material and installation unless completed prior to shipment.
- 2.3 Tree grates and access covers shall be cast iron. Tree grate frames shall be galvanized steel.
- 2.4 Curb Nosing (where applicable) shall be galvanized steel and where specified shall be cast into a top slab designed to support a minimum of H5 loading at the curb.
- 2.5 All contractor-provided components shall meet the requirements of this section, the plans specifications and contract documents. In the case of conflict, the more stringent specification shall apply.
 - 2.5.1 Crushed rock base material shall be six-inch minimum layer of ¾-inch minus rock. Compact undisturbed sub-grade materials to 95% of maximum density at +/-2% of optimum moisture content. Unsuitable material below sub-grade shall be replaced to engineer's approval.
 - 2.5.2 Concrete shall have an unconfined compressive strength at 28 days of at least 3000 psi, with ¾-inch round rock, a 4-inch slump maximum, and shall be placed within 90 minutes of initial mixing.
 - 2.5.3 Silicone Sealant shall be pure RTV silicone conforming to Federal Specification Number TT S001543A or TT S00230C or Engineer approved.
 - 2.5.4 Grout shall be non-shrink grout meeting the requirements of Corps of Engineers CRD-C588. Specimens molded, cured and tested in accordance with ASTM C-109 shall have minimum compressive strength of 6,200 psi. Grout shall not exhibit visible bleeding.
 - 2.5.5 Backfill material shall be ¾-inch minus crushed rock, or approved equal.
 - 2.5.6 Vegetation shall comply with the type and size required by the approved drawings and shall be alive and free of obvious signs of disease. Vegetation shall be of species listed in approved Filterra Plant list or otherwise approved by Manufacturer. Vegetation shall be supplied by Contractor prior to Activation.

3.0 PERFORMANCE

3.1 Treatment Capabilities shall be verified via third-party report following either TAPE or TARP protocols.

3.1.1 Engineered biofiltration media minimum treatment flow rate shall be 140"/hr. The system shall be designed to ensure that high flow events shall bypass the engineered biofiltration media preventing erosion and resuspension of pollutants.

3.1.2 The system shall remove a minimum of 85% Total Suspended Solids (TSS).

3.1.3 The system shall remove a minimum of 62% Total Phosphorus (TP).

3.1.4 The system shall remove a minimum of 34% Total Nitrogen (TN).

3.2 The system shall have General Use Level Designation from Washington Department of Ecology for Basic (TSS), Phosphorus, Enhanced (Metals), and Oil/Grease and have Certification by New Jersey Department of Environment.

3.3 Quality Assurance and Quality Control procedures shall be followed for all batches of engineered biofiltration media produced. Engineered biofiltration media shall be certified by the Manufacturer for performance and composition.

3.3.1 Media particle size distribution and composition shall be verified as per relevant ASTM Standards.

3.3.2 Media pollutant removal performance shall be verified as per relevant ASTM Standards as well as a minimum of one scientific method approved by the USEPA.

3.3.3 Media hydraulic performance shall be verified as per relevant ASTM Standards.

3.3.4 Media fertility shall be verified as per a minimum of one published scientific method.

3.4 The Manufacturer shall ensure through third party full scale field testing of installed units that the design flow rate of the system is not reduced over time. Studies shall be performed on a minimum of 10 systems of various ages, maintenance frequencies, and land uses. At least 80% of the tested systems shall have been installed 2.5 or more years. At least 50% of the systems shall have previous maintenance intervals greater than 2 times the manufacturer's recommendation.

4.0 EXECUTION

4.1 Set precast vault on crushed rock base material that has been placed in maximum 6-inch lifts, loose thickness, and compacted to at least 95-percent of the maximum dry density as determined by the standard Proctor compaction test, ASTM D698, at moisture content of +/- 2% of optimum water content.

- 4.2 Inlet and outlet pipes shall be attached to provided couplers or grouted in and connected to precast concrete vault according to Engineer's requirements and specifications.
- 4.3 All throat and grate protection covers shall remain in place until the system is activated.
- 4.4 Contractor to cast-in-place throat inlet to convey stormwater into bioretention System according to Engineer's requirements and specifications.
- 4.5 Engineered biofiltration media shall be delivered installed in the vault, unless otherwise agreed upon with the Manufacturer. Contractor shall take appropriate action to protect the media from sediment and other debris during construction. The method ultimately selected shall be at Contractor's discretion and Contractor's risk.
- 4.5.1 If media is shipped separately from vault, Manufacturer or a Manufacturer's certified representative shall install media into the vault or be present to supervise installation in order to ensure proper installation.
- 4.6 The bioretention system shall not be placed in operation (activated) until the project site is clean and stabilized (construction erosion control measures no longer required). The project site includes any surface that contributes storm drainage to the system. All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, manholes and pipes shall be free of dirt and sediment. Activation shall be provided by Manufacturer or authorized supplier, and includes planting of the vegetation provided by the Contractor.
- 4.7 Each correctly installed system shall include a Final Inspection performed by Manufacturer or authorized supplier upon request between 6-12 months after Activation. The cost of this service shall be included in the price of the system and include the following.
- 4.7.1 System inspection to help owner establish proper routine maintenance intervals.
- 4.7.2 Routine maintenance: removal of foreign debris, silt, loose plant material and trash; mulch removal; engineered biofiltration media evaluation; plant health evaluation and pruning; replacement of mulch; disposal of all maintenance refuse items; and updating of maintenance records.
- 4.8 To ensure long term performance of the bioretention system, continuing annual maintenance programs should be performed or purchased by the owner per the latest Filterra Bioretention System Operation and Maintenance manual.