



SorbtiveFILTER Specification for Stormwater Quality Precast Filter Treatment Device

PART 1 – GENERAL

1.1 Description

SorbtiveFILTER stormwater quality precast filter units shall consist of gravity flow controlled Sorbtive cartridges for stormwater filtration. Each cartridge is filled with SorbtiveMEDIA, which is an engineered granular filtration media, produced from natural aggregates with a specialized oxide-coating designed to capture sediment, sediment-bound pollutants and high levels of dissolved pollutants from stormwater runoff. One or more Sorbtive cartridges which can be recharged with fresh SorbtiveMEDIA are housed within the precast structure. One or more SorbtiveBRICKS are also housed within the precast structure to provide draindown function and to capture sediment, sediment-bound pollutants and dissolved pollutants from the stormwater runoff.

The SorbtiveFILTER shall be installed by the contractor as a complete operable system as specified and in accordance with all plan requirements and contract documents.

1.2 Manufacturer

The SorbtiveFILTER and all components, including Sorbtive cartridges, SorbtiveMEDIA and SorbtiveBRICKS shall be supplied by Imbrium Systems or assigned distributors or licensees. Imbrium Systems can be reached at:

United States: 1-888-279-8826
Canada 1-800-565-4801
International: 1-416-960-9900
www.imbriumsystems.com

1.3 Submittals

- 1.3.1 Shop drawings are to be submitted with each order to the contractor and consulting engineer.
- 1.3.2 Shop drawings are to detail the precast concrete components required and the sequence for installation and include;
 - Precast configuration with primary dimensions
 - PVC piping placement
 - Sorbtive Cartridges, SorbtiveMEDIA and placement
 - SorbtiveBRICK placement
 - Any accessory equipment called out in shop drawings
- 1.3.3 SorbtiveFILTER Inspection and Maintenance documentation submitted upon request.

1.4 Work Included

- 1.4.1 Specification requirements for constructing underground stormwater quality treatment devices.
- 1.4.2 Supply of precast concrete sections, SorbtiveFILTER cartridges, SorbtiveMEDIA, SorbtiveBRICK, and the manufacturer's quality assurance program.
- 1.4.3 Installation of the appropriate precast system, SorbtiveFILTER cartridges, SorbtiveMEDIA, SorbtiveBRICK.

1.5 Reference Standards

ASTM D-4097	Specification for Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
ASTM C857 & ASTM C858	Specification for Precast Reinforced Concrete Vaults
AASHTO M 199	Specification for Precast Reinforced Concrete Manhole Sections
ASTM C478	Specifications for Precast Reinforced Concrete Manhole Sections
ASTM C76	Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C1433	Specification for Reinforced Concrete Vaults
AASHTO M198	Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
ASTM C443	Specifications for Watertight Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
AASHTO H-20 & ASTM A48	Specification for Gray cast Iron Frames and Covers
ASTM D4101	Specification for Copolymer steps construction
ASTM D1785	Specification for PVC pipe and fittings
ASTM C497	Specification for Ladder Load Requirements
ASTM C891	Specification for Installation of Underground Precast Concrete Utility Structures

PART 2 – PRODUCTS

2.1 Internal Components

- 2.1.1 All components of the SorbtiveFILTER including the pre-cast concrete structure and the associated under-drain manifold, Sorbtive cartridges, SorbtiveMEDIA and SorbtiveBRICK shall be supplied by Imbrium Systems.
- 2.1.1.1 Manifold: Schedule 40 PVC pipe and fitting components will be used to construct the Underdrain manifold system, cartridge connections and draindown manifold and shall meet ASTM D1785
- 2.1.1.2 Inlet Flow and Floatables Control Pipes and Orifice Caps will be constructed from Schedule 40 PVC, and sized to 18 gpm (1.14 L/s) per cartridge at system design head, unless otherwise specified in shop drawings and shall meet ASTM D1785. Orifice sizes shall be determined by Imbrium Systems, with caps pre-drilled when supplied.
- 2.1.1.3 Cartridges shall be SorbtiveFILTER cartridges supplied or source approved by Imbrium Systems. Cartridges will be able to be filled and retain a minimum 3 ft³ of SorbtiveMEDIA.
- 2.1.1.4 Filter media shall be SorbtiveMEDIA supplied by Imbrium Systems, or an approved alternative source consisting of;
- ASTM No. 10 granular particle ranging between a No. 20 to a No. 4 Mesh, unless otherwise specified
 - Bulk density range of 42 to 48 lb/ft³ (673 to 769 kg/m³)
 - Proven performance ability through independent field testing, to capture and retain an average of 40% dissolved phosphorus without decomposing or desorbing phosphorus, or leaching metals.
- 2.1.1.5 Draindown Bricks shall be SorbtiveBRICKS supplied by Imbrium Systems, or an approved alternative source consisting of Sorbtive-treated porous concrete, designed to capture sediment, sediment-bound pollutants and dissolved phosphorus while functioning to drain down the Cartridge Bay.

2.2 Precast Concrete Structure Components

All pre-cast concrete materials shall be manufactured and supplied from a prequalified plant that is certified by the Plant Prequalification Program. All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet state and/or municipal specifications and referenced ASTM standards as required within this document.

- 2.2.1 All precast concrete components shall be provided according to ASTM C76, ASTM C478, ASTM C857, ASTM C858, ASTM C1433 and meet a minimum AASHTO H-20 truck loading and all applicable local regulatory specifications.
- 2.2.2 Vault Joint Sealant shall be used to ensure watertightness. Conseal CS101, CS 102 or an approved equal shall be used.
- 2.2.3 Manhole Joint Seal shall be water tight and meet ASTM C443 or a butyl seal per local requirements.
- 2.2.4 Precast Baffle Walls if provided separately or in a secondary pour shall be sealed to the interior floor and walls with SikaFlex 1a or an approved equal.
- 2.2.5 Fiberglass Baffle Walls if provided shall be constructed in accordance with the following standard: ASTM D4097 and sealed to the interior floor and walls with SikaFlex 1a or an approved equal.
- 2.2.6 Frames and Covers shall be gray cast iron that meets ASTM A48 and AASHTO H-20 loading requirements. At least one cover shall be embossed with "Imbrium Systems" or "SorbtiveFILTER".
- 2.2.7 Doors and Hatches if provided shall meet H-20 loading requirements at a minimum for incidental traffic. All door and hatch frames and covers shall have a diamond plate finish and be equipped with a recessed lift handle and locking mechanism.
- 2.2.8 Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured. Steps shall meet the requirements of ASTM C478 and AASHTO M199.
- 2.2.9 Ladders if provided shall be constructed of aluminum and steel reinforced copolymer polypropylene that conform to ASTM D4101, and bolted in place. Ladders shall meet all ASTM C497 load requirements.

2.3 Contractor-Provided Components

All contractor-provided components shall meet the requirements detailed in this section, the plan specifications and the contract documents at a minimum. If a higher standard is indicated on plans or contract documents, it shall govern.

- 2.3.1 Sub-Base Material shall be a minimum of a twelve inch thick layer of 3/4-inch (19 mm) minus rock or 'Granular B', placed in a maximum of 12 inch (300 mm) lifts, and be compacted to at least 95% of maximum dry density (Standard Proctor Density per ASTM D698),. Unsuitable material below sub-grade shall be replaced per engineer's recommendations.
- 2.3.2 Ready-mix Concrete brought to site shall achieve a minimum of 3000 psi (25 MPa) unconfined compressive strength at 28 days, with ¾ inch (19 mm) rock, maximum 4-inch slump and shall be placed within 90-minutes of initial mixing.
- 2.3.3 Grout shall be non-shrink grout meeting the requirements of the 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.

- 2.3.4 Silicone Sealant shall be pure RTV silicone conforming to Federal Specification Number TT S001543A or TT S00230C or an engineer approved equal.
- 2.3.5 Backfill shall be ¾ inch (19 mm) minus rock, or approved equal at 95% compaction (as determined by Standard Proctor Density).

PART 3 – PERFORMANCE

3.1 General

- 3.1.1 Function - The stormwater quality filter treatment device has no moving internal components and functions based on gravity flow, unless otherwise specified.
- 3.1.2 Pollutants - The stormwater quality filter treatment device removes oil, debris, trash, sediment, sediment-bound pollutants, metals and nutrients (including dissolved pollutants) from stormwater during frequent wet weather events.
- 3.1.3 Treatment Flow Rate and Bypass - The stormwater quality treatment device typically operates off-line. The device can also be outfitted with an internal by-pass that is capable of directing flows in excess of the treatment flow rate around the Cartridge Bay, ensuring continuous positive treatment and minimizing resuspension.
- 3.1.4 Treatment Flow Rate – The stormwater quality treatment device will treat 100% of the required water quality treatment flow based on a maximum treatment flow rate of 18 gpm (1.14 L/s) per cartridge. Maximum surface loading rate (SLR) with a SorbtiveFILTER cartridge loaded with SorbtiveMEDIA is 2.09 gpm per ft² (1.42 L/s per m²).
- 3.1.5 Pollutant Load – The stormwater quality filter treatment device is designed to have a minimum pollutant load capacity of 115 pounds (52 kg) of sediment and 0.15 pounds (0.07 kg) of phosphorus per cartridge.

3.2 Field Test Performance

At a minimum, the stormwater quality filter device utilizing SorbtiveMEDIA shall have been field tested with a minimum of 15-storm TARP type qualifying events and be conducted generally following the TARP or TAPE field test protocol.

- 3.2.1 Sediment Removal - The stormwater quality filter treatment device shall have demonstrated an average annual sediment removal of at least 85% (as quantified by Suspended Sediment Concentration (SSC) testing), and a minimum removal of 80% of sediment with particle sizes less than 75 microns as measured by Total Suspended Sediment (TSS) testing.
- 3.2.2 Total Phosphorus (TP) Removal - The stormwater quality filter treatment device shall have demonstrated an average annual Total Phosphorus (TP) removal of at least 75%.
- 3.2.3 Total Dissolved Phosphorus (TDP) Removal - The stormwater quality filter treatment device shall have demonstrated an average annual Total Dissolved Phosphorus (TDP) removal of at least 40%.
- 3.2.4 Performance Longevity / Maintenance – the stormwater quality filter treatment device will have demonstrated the ability to capture at least 115 pounds (52 kg) of sediment per cartridge and at least 0.15 pounds (0.07 kg) of phosphorus per cartridge at a SLR of 2.09-gpm per ft² (1.42 L/s per m²) with minimal system head loss and an ability to operate beyond one year prior to maintenance.

PART 4 – EXECUTION

4.1 General

- 4.1.1 The installation of the pre-cast concrete stormwater quality filter treatment device shall conform to ASTM C891 and to all applicable national, state, state highway, municipal and local specifications.

4.2 Excavation

- 4.2.1 Excavation for the installation of the stormwater quality filter treatment device should conform to state and/or municipal specifications.
- 4.2.2 The stormwater quality filter treatment device should not be installed on frozen ground. Excavation should allow for adequate compaction around the structure. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.
- 4.2.3 In areas with a high water table, continuous dewatering should be provided to ensure that the excavation is stable and free of water.

4.3 Installation of Precast Structure

- 4.3.1 Installation of the precast structure shall conform to ASTM C891 and to any required state highway, municipal or local specifications.
- 4.3.2 Set precast structure on sub-base material, and structure floor shall slope ¼-inch (6 mm) maximum across the width and slope downstream 1-inch (25 mm) per 12-foot (3658 mm) of length. Structure top finish grade shall be even with surrounding finish grade surface unless otherwise noted on plans.
- 4.3.3 Openings or knockouts in precast vaults shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of the pipe or flexible boot connections, per local requirements.
- 4.3.4 Inlet and Outlet Pipes shall be stubbed in and connected to precast structure according to engineer's requirements and specifications. If non-shrink grout is used, Contractor shall grout all inlet and outlet pipes flush with or protruding up to 2-inches (50 mm) into interior of structure. If required, approved pipe seals (flexible boot connections, where applicable) shall be used so that the structure is watertight.

4.4 Anti-Floatation (where required)

- 4.4.1 When determined by the engineer and where required, Anti-Floatation Ballasts shall be placed to the dimensions specified by the engineer and noted on the data block. To provide future system infrastructure flexibility Ballasts shall not encase the inlet and/or outlet piping and there shall be at least 12 inches (300 mm) clearance from outside diameter of pipes.

4.5 Backfilling

- 4.5.1 Backfill material should conform to state highway, municipal or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300 mm) in depth and be compacted to at least 95% of maximum dry density (Standard Proctor Density per ASTM D698) and/or to all applicable state and/or municipal specifications.

4.6 Clean Up

- 4.6.1 Remove all excess materials, rocks, roots, or foreign material, leaving the site and stormwater quality filter treatment device in a clean, complete condition approved by the engineer and if required, inspector. All filter components including the PVC Inlet Flow and Floatables Control, Cartridge Pipe Connectors, Underdrain Manifold, and SorbtiveBRICK drain down line shall be free of any foreign materials including concrete.

4.7 System Activation

- 4.7.1 All SorbtiveFILTER Cartridges and SorbtiveBRICKS will generally be delivered with the structure.

- 4.7.1.1 SorbtiveMEDIA shall be housed within each SorbtiveFILTER cartridge.

- 4.7.1.2 SorbtiveFILTER cartridges shall be placed and connected to the Underdrain Manifold via a 2-inch (51mm) diameter PVC Sch. 40 Connector Pipe.

- 4.7.1.3 SorbtiveBRICKS shall be secured and sealed to the structure on both the Precast Floor and Baffle Wall, using plastic tie-downs.

- 4.7.2 Contractor shall take appropriate action to protect SorbtiveFILTER Cartridges and SorbtiveBRICKS from sediment and other debris during construction. Methods for protection include, but are not limited to:

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- 4.7.2.1 Remove SorbtiveFILTER Cartridges and SorbtiveBRICKS and store appropriately. Reinstall all items in preparation for operation according to section 4.7.1 and 4.73. (see below)

- 4.7.2.2 Contractor may leave SorbtiveFILTER Cartridges and SorbtiveBRICKS in the structure if all inlets and outlets (pipes and inlet grates) are completely plugged to prevent stormwater or water entry into the structure.

The method ultimately selected shall be at the Contractor's discretion and Contractor's risk.

- 4.7.3 All SorbtiveFILTER Cartridges and SorbtiveBRICKS shall not be placed in operation until the SorbtiveFILTER structure is clean and free of foreign materials including sediment, trash and debris, and the project site is clean and stabilized. The project site includes any surface that contributes drainage to the SorbtiveFILTER. All impervious surfaces (including but not limited to pavement, sidewalks, roofs, channels) shall be clean and free of dirt and debris. All catch basins, manholes, pipes shall be free of dirt, sediments, and debris.

- 4.7.4 Imbrium Systems will be contacted to assist with system activation and/or inspection of the SorbtiveFILTER system for proper installation once the site is clean and stabilized.

4.8 Frame and Cover Installation

- 4.8.1 The grade adjustment units should either be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer and/or be completed in accordance with applicable local and municipal requirements. Frames for the cover should be set in a full bed of mortar at the elevation specified.

PART 5 – QUALITY ASSURANCE PACKAGE

5.1 Site Inspection

- 5.1.1 The manufacturer shall include a quality assurance package including an installation inspection upon request.

- 5.1.2 The manufacturer shall inspect the installation and have available a detailed report upon request to the municipality, consulting engineer and the owner identifying the conformance of the installation. Report details are to include:
- A. Global Positioning System (GPS) coordinates for tracking
 - B. Site Owner's Contact Information, including name, company name, address and phone number
 - C. Stormwater quality treatment system model number
 - D. Recommended sediment depth and estimated time period before servicing is required
 - E. Statement identifying status of the installation and conformance to manufacturer's installation recommendation.