



# ecoStorm® plus Stormwater Filtration System specifications

High-efficiency separator with passive filtration technology

## Part 1.00 – General

### 1.01 Description

A. Work included:

Royal Environmental Systems shall reserve the right to certify manufacturers and installers for quality, equipment, and their ability to produce and install the treatment system with appurtenances in accordance with the detail drawings and this specification.

### 1.02 Quality control inspection

A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the engineer. Such inspection may be made at the place of manufacture, the work site after delivery, or both locations. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. Any section that has been damaged after delivery may be rejected and, if already installed, shall be acceptably repaired (if permitted) or removed and replaced, entirely at the contractor's expense.

B. All pipe-to-pipe coupled connections will be the responsibility of the contractor and shall be installed in accordance with the guidelines of that municipality in which the technology is installed.

### 1.03 Submittals

A. *Shop drawings:*

The contractor shall submit to the engineer for approval six sets of shop drawings and the corresponding hydraulic sizing and calibration for the specific site for which the stormwater filter treatment system has been designed.

If applicable, the specified stormwater filter treatment system will be required to include any and all preliminary testing data regarding third-party verification of specific and pertinent pollutant(s) removal efficiencies.

## Part 2.00 – Products

### 2.01 Materials and design

A. The treatment system shall be made of pre-cast concrete and to Royal Environmental Systems' specification(s). The structure shall be manufactured to comply with ASTM Designation C-478.

B. Sections shall have gasketed, watertight joints per ASTM C-443.

C. Pipe openings shall be provided with a flexible rubber sleeve per ASTM C-923 and shall be sized to accept pipes of the specified size(s) and material(s).

- D. Structures shall be designed and installed to conform with ASTM C-969 acceptance testing of installed concrete pipe and manholes. Internal components shall be made of stainless steel, fiberglass, and PVC SDR 35 or SDR 26 pipe and fittings. The PVC 90° bend is to be solvent welded to the inlet pipe. The PVC tee shall be connected to the outlet pipe **without any form of glue or adhesive to allow for removal at filter replacement time.**
- E. The treatment structure access frame and cover shall be labeled as an ecoStorm<sup>®</sup> plus water quality structure. Casting shall have a 30” or larger clear opening and shall be Pamrex-type casting with an “ecoStorm plus” embossed button or approved equal. All other castings and lids shall be in accordance with governing jurisdictions’ requirements.
- F. All sections shall be cured by an approved method. Sections shall not be shipped until the concrete has attained a compressive strength of 4,000 psi.
- G. The filter block support system shall be grade 304 stainless steel channel “C3x5” supports, anchored and bolted to the structure wall with ½” diameter stainless steel wedge anchor bolts. All filter support components shall be installed per the Royal Environmental Systems Bracket Support Document.
- H. The ecoStorm plus filtration media blocks shall be delivered to the site in specially designed crates for placement on the filter block support system.

## 2.02 Performance

- A. The ecoStorm plus Stormwater Filtration System shall include a 48” diameter drop structure with a 4’ sump to pre-treat the influent water. The drop structure must be watertight below the inlet invert to maintain a permanent pool. The permanent pool, in conjunction with a submerged outlet, will aid in the retention of floatable, light liquids and solids. The 4’ sump below the outlet invert provides a collection chamber for settleable solids. Sediment storage capacity shall be at minimum 25 cubic feet.
- B. The ecoStorm plus Stormwater Filtration System shall have no mechanical parts. The ecoStorm plus porous concrete filtration technology shall be capable of removing up to 80% total suspended solids (TSS). TSS removal efficiency shall be based on scaled laboratory testing using Sil-Co-Sil 106 silica gradation as manufactured by US Silica with a D50 of approximately 23 microns. The ecoStorm plus porous concrete filtration technology shall be capable of removing soluble phosphorus and heavy metals (i.e. copper, zinc, lead). The sediment storage chamber shall be isolated from treatment flow path. The sediment storage chamber shall be located beneath the cyclonic separator to prevent re-suspension of collected sediment. Sediment storage capacity shall be at minimum 35 cubic feet.
- C. The specified stormwater filter treatment system shall be hydraulically designed for the specific site in which it will be installed. The calibration and design of the specified system shall account for peak treatment flow rates (supplied by owner/engineer) that correspond with regional rainfall data.
- D. The structural stormwater filter treatment system shall consist of one 5’ diameter, pre-cast concrete structure. The structure shall have an on-center, mechanically fastened inlet, which induces a swirling flow pattern with an internal 90° bend. This inlet will be located above the cyclonic separator and below the porous concrete filter. The catchment sump below the cyclonic separator will accumulate, store and retain captured/settled solids. The volume of the sump and opening to the sump have been engineered to prevent washout of separated solid pollutants under peak design flow until which time the maximum storage volume of solid contaminants is reached. The porous concrete filtration technology utilizes up-stream total dynamic head (TDH) pressure to pass influent treatment flows up through the porous concrete filter. The outlet pipe above the porous concrete filter is equipped with a tee to prevent the discharge of any floatable debris.
- E. All internal piping shall be PVC SDR 35 or SDR 26 and sized for the defined peak flow rate.

### 2.03 Filter production and quality control

*All ecoStorm plus porous concrete filters shall be manufactured by Royal Environmental Systems of Stacy, Minnesota, and installed strictly per Royal Environmental Systems' installation guidelines. A number of test cylinders will be poured with each porous concrete filter manufactured. Test cylinders will be utilized to ensure each filter produced is within the design guidelines.*

### 2.04 Manufacturer

The structural portion of the ecoStorm plus Stormwater Filtration System shall be manufactured by Royal Environmental Systems of Stacy, Minnesota, or an authorized manufacturer approved by Royal Environmental Systems to produce the ecoStorm plus Stormwater Filtration System.

## Part 3.00 – Execution

### 3.01 Installation

- A. The structural stormwater treatment system shall be constructed according to the sizes shown on the drawings and as specified herein. Install at elevations and locations shown on the drawings or as otherwise directed by the engineer. Adapters from internal SDR 35 or SDR 26 PVC pipe to external buried upstream and downstream pipes shall be supplied by others.
- B. Place the pre-cast base units on a granular sub-base in accordance with the governing city's requirements. The granular sub-base shall be leveled prior to setting, and the pre-cast base sections of the stormwater treatment system shall be checked with a horizontal level at four quadrants after setting. If the slope exceeds 0.25%, the base section shall be removed and the granular, excavation floor material shall be re-leveled.
- C. The ecoStorm plus Stormwater Filtration System is designed to be watertight. The final installation must guarantee a watertight structure with an exfiltration test. For the system to operate correctly, a constant waterline elevation above the top of the filter must be achieved. Failure to achieve a watertight structure will be grounds for rejection.

**END OF SECTION**