

## Technical Memorandum

**To:** BCWMC Technical Advisory Committee (TAC)  
**From:** Barr Engineering Co.  
**Subject:** Stormwater Manufactured Treatment Devices  
**Date:** May 22, 2019  
**Project:** 23/27-0051.45 2019 008  
**c:** Laura Jester, BCWMC Administrator

### 1.0 Problem Statement

The Commission has seen an increase in the use of proprietary stormwater manufactured treatment devices (MTDs) for development and redevelopment projects. There are not widely accepted levels of treatment or pollutant removal efficiencies associated with these devices and while most proprietary MTDs undergo testing and third party review, the conditions that they are tested under may not be consistent with the conditions in the Bassett Creek watershed. At their April 18, 2019 meeting, the BCWMC directed the TAC to provide direction to the Commission and BCWMC Engineer regarding review and acceptance of proprietary stormwater manufactured treatment devices (MTDs).

### 2.0 Background

The BCWMC adopted the Minnesota Pollution Control Agency's (MPCA) minimal impact design standards (MIDS) in 2015, per policies in the BCWMC's 2015 – 2025 Watershed Management Plan (Plan). MIDS includes water performance quality goals for development and redevelopment projects that create more than one acre of new and/or fully reconstructed impervious surface. The BCWMC modified their water quality performance goals in 2017 for linear projects.

The BCWMC Requirements for Improvements and Development Proposals (Requirements) document states that non-linear development and redevelopment projects that create more than one acre of new and/or fully reconstructed impervious surfaces, on sites without restrictions, must meet the BCWMC water quality performance goals. These goals (from MIDS) include onsite retention of 1.1 inches of runoff from the new and fully reconstructed impervious surfaces. Sites with restrictions, such as shallow depth to bedrock, contaminated soils, shallow groundwater, tight clay soils, existing site constraints or zoning requirements, etc., may follow the flexible treatment options (FTO) approach. The most common outcome of the FTO approach is a revised water quality performance goal of FTO #2, which requires onsite retention to the maximum extent practicable and removal of 60% of the total phosphorus load from the new and fully reconstructed impervious surfaces at the site. For the purposes of this discussion, we assumed that stormwater MTDs are designed and implemented as part of the stormwater management system to meet the FTO #2 water quality performance goal.

The BCWMC Requirements document states that to meet the BCWMC water quality performance goals or FTO, BMPs must be designed in accordance with the Minnesota Stormwater Manual or as otherwise approved by the BCWMC. The Minnesota Stormwater Manual does not provide design guidance for stormwater MTDs and does not currently provide certification or approval of stormwater MTDs. Therefore, the applicant must demonstrate, to the satisfaction of the BCWMC Engineer and the Commission, that

their proposed stormwater MTD is designed appropriately and provides pollutant removals, in conjunction with the rest of the stormwater management system, that meet the BCWMC water quality performance goals or FTO. The project review fee schedule includes a \$1,000 add-on fee for projects involving review of alternative BMPs (i.e., BMPs not included in the Minnesota Stormwater Manual).

### 3.0 Types of stormwater treatment

Stormwater BMPs can provide stormwater treatment to reduce or limit downstream pollutant loading in several ways and many stormwater MTDs utilize a combination of the following practices:

- **Pretreatment:** upstream sedimentation, screening, and/or energy dissipation to protect and extend the long-term functionality of the downstream BMP
- **Infiltration:** stormwater enters the soil at the source; sediment and pollutants remain onsite.
- **Sedimentation:** as part of stormwater detention, sediment and non-dissolved (particulate) pollutants settle to the bottom of the water column
- **Filtration:** stormwater is routed through a filtering medium to trap sediment and pollutants but allow stormwater to pass through
- **Biofiltration:** similar to filtration, but additional pollutant removal is provided by evapotranspiration from the vegetation
- **Chemical Treatment:** chemicals are used to target and trap, settle, or breakdown specific pollutants.

### 4.0 Conventional Stormwater BMPs

The MPCA's Minnesota Stormwater Manual provides estimated median pollutant removal percentages for conventional stormwater BMPs as shown in Table 1.

**Table 1: Conventional stormwater BMPs and estimated median pollutant removal efficiencies**

| Practice                     | Treatment Type                    | Pollutant Removal Efficiencies (%) |                       |                             |                           |
|------------------------------|-----------------------------------|------------------------------------|-----------------------|-----------------------------|---------------------------|
|                              |                                   | Total Suspended Solids (TSS)       | Total Phosphorus (TP) | Particulate Phosphorus (PP) | Dissolved Phosphorus (DP) |
| Infiltration <sup>1</sup>    | Infiltration                      | 100 <sup>2</sup>                   | 100 <sup>2</sup>      | 100 <sup>2</sup>            | 100 <sup>2</sup>          |
| Biofiltration                | Biofiltration                     | 80                                 | 44-71                 | 80                          | 0-60                      |
| Sand filter                  | Filtration                        | 85                                 | 50                    | 91                          | 0                         |
| Iron enhanced sand filter    | Filtration and Chemical Treatment | 85                                 | 77                    | 91                          | 60                        |
| Dry Swale                    | Pretreatment                      | 68                                 | 44-71                 | 80                          | 0-60                      |
| Wet Swale                    | Pretreatment                      | 68                                 | 0                     | 0                           | 0                         |
| Stormwater Pond <sup>3</sup> | Sedimentation                     | 84                                 | 50                    | 91                          | 0                         |
| Stormwater Wetland           | Sedimentation and Biofiltration   | 73                                 | 38                    | 69                          | 0                         |
| Permeable Pavement           | Infiltration or Filtration        | 74                                 | 45                    | 82                          | 0                         |
| Green Roof                   | Pretreatment                      | 85                                 | 0                     | 0                           | 0                         |

<sup>1</sup> BMPs designed to infiltrate stormwater runoff, such as infiltration basins/trenches, bioinfiltration, permeable pavement with no underdrain, tree trenches with no underdrain, and BMPs with raised underdrains.

<sup>2</sup> Pollutant removal is 100 percent for the volume infiltrated and 0 percent for the stormwater bypassing the BMP. For filtered stormwater, see values for the other BMPs in the table.

<sup>3</sup> Dry ponds do not receive credit for volume or pollutant removal.

## 5.0 Stormwater Manufactured Treatment Devices on the Market

There are many options on the market for stormwater MTDs. Two manufacturers that appear to be active in Minnesota are Bio Clean Environmental and Contech Engineered Solutions. Table 2 lists a number of manufacturers that provide MTDs for filtration, biofiltration, or chemical treatment. MTDs designed primarily for pretreatment, infiltration, or sedimentation practices are not included in the table.

**Table 2: Manufacturers and stormwater MTDs**

| Manufacturer                     | MTD  | Treatment Type                    |
|----------------------------------|--|-----------------------------------|
| AquaShield                       | Aqua-Filter with Perlite Media             | Filtration and Chemical Treatment |
| AquaShield                       | BioFilter                                  | Biofiltration                     |
| BaySaver Technologies            | BayFilter with Enhanced Media Cartridges   | Filtration and Chemical Treatment |
| Bio Clean Environmental Services | Kraken Filter                              | Filtration                        |
| Bio Clean Environmental Services | Modular Wetland Systems                    | Biofiltration                     |
| Bio Clean Environmental Services | Water Polisher                             | Filtration                        |
| Contech Engineered Solutions     | Filterra                                   | Biofiltration                     |
| Contech Engineered Solutions     | Jellyfish Filter                           | Filtration                        |
| Contech Engineered Solutions     | StormFilter with PhosphoSorb Media         | Filtration and Chemical Treatment |
| Cultec                           | StormFilter 330                            | Filtration                        |
| Environmental 21                 | ESK Koala                                  | Filtration                        |
| Environmental 21                 | PuriStorm                                  | Filtration                        |
| Hydro International              | Bioinfiltrator                             | Biofiltration                     |
| Hydro International              | Up-Flo Filter with CPZ Media               | Filtration and Chemical Treatment |
| Lane Enterprises                 | StormKleener                               | Filtration                        |
| Oldcastle Infrastructure         | BioMod                                     | Biofiltration                     |
| Oldcastle Infrastructure         | BioPod                                     | Biofiltration                     |
| Oldcastle Infrastructure         | PerkFilter with ZPC Media                  | Filtration and Chemical Treatment |
| Rotondo Environmental Solutions  | StormGarden                                | Biofiltration                     |
| StormTree                        | Tree Filter                                | Biofiltration                     |
| StormTree                        | DrainGarden                                | Biofiltration                     |
| StormwaterRx                     | Aquip                                      | Filtration                        |
| SunTree Technologies             | Nutrient Removing Filtration System (NRFS) | Filtration and Chemical Treatment |
| SunTree Technologies             | NutriMax Engineered Wetlands               | Biofiltration                     |
| SunTree Technologies             | SkimBoss UpFlow Filter                     | Filtration and Chemical Treatment |

## 6.0 Specific Examples from BCWMC Development Reviews

As part of the review process for development and redevelopment projects in the Bassett Creek watershed, the BCWMC Engineer has reviewed stormwater MTDs for the following projects:

- Ridgedale Active Adults [Avidor] Apartments - Minnetonka (BCWMC #2018-16)
  - Contech Engineered Solutions – StormFilter with PhosphoSorb Media
  - Bio Clean Environmental Services – Kraken Filter
- Ridgedale Executive Apartments - Minnetonka (BCWMC 2018-28)

- Bio Clean Environmental Services – Kraken Filter
- Marsh Run Apartments- Minnetonka (BCWMC #2019-06)
  - Contech Engineered Solutions – Jellyfish Filter
  - Contech Engineered Solutions – StormFilter with PhosphoSorb Media

## 7.0 Third Party Testing Overview

Manufacturers of stormwater MTDs often subject their devices to third party testing to establish or verify treatment and pollutant removal efficiency. Third-party entities provide varying levels of verification or certification (Table 3) and pollutant removal efficiencies also vary between manufacturer claims, laboratory testing, and field testing (Table 4).

**Table 3: Third party entities, programs, and approvals**

| Entity   | Program  | Approval                                 | Approval Qualifications  | Approval Level                |
|--|--|--|--|-------------------------------|
| State of Washington Department of Ecology (WADOE)                  | Technology Assessment Protocol – Ecology (TAPE)                  | Pilot Use Level Designation (PULD)       | Laboratory Testing Data  | N/A                           |
|  |  | Conditional Use Level Designation (CULD) | Laboratory Testing Data and Field Testing Data                         | N/A                           |
|  |  | General Use Level Designation (GULD)     | Laboratory Testing Data and Field Testing Data following TAPE protocol | Removal of 50% TP and 80% TSS |
| New Jersey Corporation for Advanced Technology (NJCAT)             | Technology Verification Program                                  | Verification                             | Laboratory Testing and Assessment of Data Quality (QA/QC)              | N/A                           |
| State of New Jersey Department of Environmental Protection (NJDEP) | Process for Approval of Use for MTDs                             | Certification                            | NJCAT Verification   | Removal of 80% TSS            |
| Canadian Environmental Technology Verification (ETV) Program       | General Verification Protocol (GVP) and General Test Protocol    | Verification and Certification           | Laboratory Testing Data and Field Testing Data                         | N/A                           |
| Environmental Protection Agency (EPA)                              | Environmental Technology Verification (ETV) Program <sup>1</sup> | Verification                             | Unknown  | Unknown                       |

<sup>1</sup> Program Dissolved in 2014

Table 4: Devices and removal efficiencies

| Manufacturer and MTD  | Removal Efficiency (%) <sup>1</sup>            |           |    |           |                          |    |    |                 |               |           |    |    |                          |            |                     |    |
|---|--|-----------|----|-----------|--------------------------|----|----|-----------------|---------------|-----------|----|----|--------------------------|------------|---------------------|----|
|   | Manufacturer's Performance Claims <sup>3</sup> |           |    |           | Laboratory Testing       |    |    |                 | Field Testing |           |    |    | WADOE TAPE Certification |            | NJDEP Certification |    |
|   | TSS  | TP        | PP | DP        | TSS                      | TP | PP | DP              | TSS           | TP        | PP | DP | TSS                      | TP         | TSS                 | TP |
| AquaShield Aqua-Filter with Perlite Media   | -  | -         | -  | -         | 91                       | 92 | -  | -               | 92            | 69        | -  | -  | CIP                      | CIP        | 80                  | -  |
| AquaShield BioFilter  | -  | -         | -  | -         |                          |    |    |                 |               |           |    |    | -                        | -          | -                   | -  |
| BaySaver Technologies BayFilter with Enhanced Media Cartridges                            | 80   | 65        | -  | -         | 81.5                     | -  | -  | 55              | 80            | 64        | -  | -  | 80                       | 50         | 80                  | -  |
| <b>Bio Clean Environmental Services Kraken Filter <sup>2</sup></b>                        | <b>89</b>                                      | <b>72</b> | -  | -         | <b>83 <sup>4</sup></b>   | -  | -  | -               | <b>91</b>     | <b>75</b> | -  | -  | <b>CIP</b>               | <b>CIP</b> | <b>80</b>           | -  |
| Bio Clean Environmental Services Modular Wetland Systems                                  | 85   | 64        | -  | 67        | 91                       | -  | -  | -               | 85            | 65        | -  | -  | 80                       | 50         | -                   | -  |
| Bio Clean Environmental Services Water Polisher   | 85   | 70        | -  | -         | -                        | -  | -  | -               | -             | -         | -  | -  | -                        | -          | -                   | -  |
| Contech Engineered Solutions Filterra   | 86   | 70        | -  | -         | 83                       | -  | -  | 50 <sup>5</sup> | 85            | 73        |    |    | 80                       | 50         | 80                  | -  |
| <b>Contech Engineered Solutions Jellyfish Filter <sup>2</sup></b>                         | <b>89</b>                                      | <b>59</b> | -  | -         | <b>86 <sup>6</sup></b>   | -  | -  | -               | <b>89</b>     | <b>59</b> | -  | -  | <b>CIP</b>               | <b>CIP</b> | -                   | -  |
| <b>Contech Engineered Solutions StormFilter with PhosphoSorb Media <sup>2</sup></b>       | <b>89</b>                                      | <b>82</b> | -  | <b>50</b> | <b>88 <sup>4,6</sup></b> | -  | -  | <b>50</b>       | <b>85</b>     | <b>75</b> | -  | -  | <b>80</b>                | <b>50</b>  | <b>80</b>           | -  |
| Cultec StormFilter 330  | 70   | -         | -  | -         | -                        | -  | -  | -               | -             | -         | -  | -  | -                        | -          | -                   | -  |
| Environmental 21 ESK Koala  | -  | -         | -  | -         | -                        | -  | -  | -               | -             | -         | -  | -  | -                        | -          | -                   | -  |
| Environmental 21 PuriStorm  | -  | -         | -  | -         | -                        | -  | -  | -               | -             | -         | -  | -  | -                        | -          | -                   | -  |
| Hydro International Bioinfiltrator  | -  | -         | -  | -         | -                        | -  | -  | -               | -             | -         | -  | -  | -                        | -          | -                   | -  |
| Hydro International Up-Flo Filter with CPZ Media  | -  | -         | -  | -         | 87 <sup>4</sup>          | -  | -  | -               | 90            | -         | -  | -  | -                        | -          | 80                  | -  |
| Lane Enterprises StormKleener   | 80   | -         | -  | -         | 81                       | -  | -  | -               | 86            |           |    |    | -                        | -          | 80                  | -  |
| Oldcastle Infrastructure BioMod   | -  | -         | -  | -         |                          |    |    |                 |               |           |    |    | -                        | -          | -                   | -  |
| Oldcastle Infrastructure BioPod   | -  | -         | -  | -         | 81                       | 97 | -  | -               | 84            | 64        | -  | -  | 80                       | 50         | 80                  | -  |
| Oldcastle Infrastructure PerkFilter with ZPC Media  | 80   | 60        |    |           | 82 <sup>6</sup>          | -  | -  | -               | 85            | 62        | -  | -  | 80                       | 50         | 80                  | -  |
| Rotondo Environmental Solutions StormGarden   | -  | -         | -  | -         | 81                       | 18 | -  | 5.4             | 85            | 54        |    |    | CIP                      | CIP        | -                   | -  |
| StormTree DrainGarden   | -  | -         | -  | -         | 94                       | 38 | -  | -               | -             | -         | -  | -  | -                        | -          | -                   | -  |
| StormTree Tree Filter   | 85   | 63        |    |           | 94                       | 38 | -  | -               | -             | -         | -  | -  | CIP                      | CIP        | -                   | -  |
| StormwaterRx Aquip  | -  | -         | -  | -         | -                        | -  | -  | -               | 98            | 60        | -  | -  | CIP                      | CIP        | -                   | -  |
| SunTree Technologies Nutrient Removing Filtration System with Biosorption Activated Media | 95   | 95        | -  | -         | 67                       | -  | -  | -               | 61            | -         | -  | -  | -                        | -          | 50                  | -  |
| SunTree Technologies NutriMax Engineered Wetlands   | 83   | 57        | -  | -         | -                        | -  | -  | -               | -             | -         | -  | -  | -                        | -          | -                   | -  |
| SunTree Technologies SkimBoss UpFlow Filter   | 81   | 79        | -  | -         | -                        | -  | -  | -               | -             | -         | -  | -  | -                        | -          | -                   | -  |

<sup>1</sup> Removal efficiencies either reported as average or median values, depending on reporting. When both are provided, the median value was generally used.

<sup>2</sup> Manufacturers and MTDs in **bold** have been submitted to the BCWMC for review

<sup>3</sup> Manufacturers' performance claims obtained from brochures or websites

<sup>4</sup> Suspended sediment concentration (SSC) removal efficiency, not TSS removal efficiency

<sup>5</sup> Orthophosphate removal efficiency, not DP removal efficiency

<sup>6</sup> Sil-Co-Sil 106 use to simulate TSS

CIP = Certification in Progress

## 8.0 Modeling Alternatives and Assumptions

The BCWMC Requirements document states that the MIDS calculator, P8, WINSLAMM, or other BCWMC-approved approaches may be used to demonstrate compliance with BCWMC water quality goals or FTOs. The MPCA's Minnesota Stormwater Manual lists 28 models or tools that include water quality modeling, but the MIDS calculator, P8, or hand calculations are the most commonly submitted documentation for compliance with the BCWMC's water quality goals or FTOs.

### 8.1 MIDS Calculator

The MIDS calculator was developed to assist designers and regulators in determining conformance to the MIDS performance goals. The MIDS calculator is a tool used to determine stormwater runoff volume and pollutant reduction capabilities of various low impact development BMPs. The MIDS calculator estimates the stormwater runoff volume reductions for various BMPs based on the MIDS performance goal (retain 1.1 inches of runoff from impervious surfaces) and annual pollutant load reductions for total phosphorus and total suspended solids. The MIDS calculator divides the total phosphorus concentration into dissolved and particulate phosphorus at a ratio of 45% and 55%, respectively. This means that an applicant must treat or retain a portion of the dissolved phosphorus to achieve 60% total phosphorus removal.

Stormwater BMPs that are not specifically included in the MIDS calculator, such as stormwater MTDs, can be added to the calculator using the "other" BMP option. The "other" BMP option allows user-defined stormwater volume and pollutant reduction amounts to be entered. However, the MPCA's Minnesota Stormwater Manual states that the user must provide evidence and support for each of the stormwater volume and pollutant reduction amounts entered in the "other" BMP. Thus, the applicant must provide evidence and support for their pollutant reduction claims.

The issue that arises during most development and redevelopment reviews is that the removal efficiency breakdown between particulate phosphorus and dissolved phosphorus is not provided by manufacturers, laboratory testing, field testing, or third party entities; therefore, applicants do not have adequate information to use in the MIDS calculator.

### 8.2 Program for Predicting Polluting Particle Passage thru Pits, Puddles, and Ponds (P8)

The P8 model predicts the generation and transport of stormwater runoff pollutants in urban watersheds. In P8, continuous water-balance and mass-balance calculations are performed on a user-defined system consisting of watersheds, devices, particle classes, and water quality components.

The default settings in P8 include five particle classes based on the velocity at which the particle classes settle. These settling velocities range from 0.03 – 15 feet per hour for particulate particle classes. Dissolved pollutants are assumed to have a settling velocity of zero.

Water quality component concentrations are computed from the concentrations of each particle class and the particle compositions (mg/kg). Particle compositions have been calibrated so that median runoff concentrations correspond to values reported by the Nationwide Urban Runoff Program (NURP). Using the default particle size distribution (PSD) for a median site (NURP50 PSD) results in a division of the total phosphorus concentration into dissolved and particulate phosphorus at a ratio of 70% and 30%,

respectively. The applicant still must provide evidence and support for the pollutant reduction claims, however, this means that an applicant does not necessarily need to treat or retain a portion of the dissolved phosphorus in order to achieve 60% TP removal.

## **9.0 Options for BCWMC review of Stormwater MTDs**

Table 5 includes options for BCWMC review of stormwater MTDs. Following each option are the BCWMC Engineer's recommendations and/or comments.

**Table 5: Options for BCWMC review of stormwater MTDs**

| No. | Option  | Comments  |
|-----|---|---|
| 1   | Require that stormwater MTDs be certified or approved by the MPCA, and listed in the stormwater manual with recommended pollutant removal efficiencies, prior to acceptance.  | <p><u>Recommended (as a long term option):</u></p> <ul style="list-style-type: none"> <li>This option removes the burden of accepting stormwater MTDs and verifying their pollutant removal efficiencies from the BCWMC and places it on the MPCA. If the MPCA were to develop and provide statewide guidance, protocols, or certifications for MTDs, this has the potential to greatly simplify the development/redevelopment review process for BCWMC and others (e.g., other watershed organizations and cities).</li> <li>We recommend the BCWMC send a letter to the MPCA, formally requesting that they evaluate MTDs and include development protocols in the Minnesota Stormwater Manual.</li> </ul> <p><u>Not Recommended (as a short term option):</u></p> <ul style="list-style-type: none"> <li>We understand the MPCA has solicited input regarding evaluating stormwater MTDs. However, it is unknown if the MPCA will take this on and development of protocols, guidance, or a certification program would likely be a number of years away from publication.</li> <li>Selecting this option now would essentially prohibit the use of stormwater MTDs in the Bassett Creek watershed to meet BCWMC water quality performance goals or FTOs, which may limit the stormwater treatment options for developers in the watershed.</li> </ul> |
| 2   | Accept pollutant removal efficiencies of stormwater MTDs as indicated in applicant submittal, as long as the MTDs are designed in accordance with the manufacturer's recommendations and the submittal is provided with a professional engineer's (PE) stamp.   | <p><u>Not recommended:</u></p> <ul style="list-style-type: none"> <li>Pollutant removal efficiencies provided by manufacturers are based on site conditions that may not be consistent with site conditions in the Bassett Creek watershed; namely a different proportion of particulate phosphorus and dissolved phosphorus loading.</li> <li>This difference in site conditions can lead to pollutant removal efficiencies in the Bassett Creek watershed that are lower than those reported by the manufacturers and third party testing entities.</li> <li>Most applicants are unaware of the discrepancy and may not understand or be concerned with the effect on the watershed.</li> </ul>   |
| 3   | Require that applicants provide verification or certification of stormwater MTDs from a specific, or one of a group of specific, third-party entities, such as WADOE-TAPE-GULD, NJDEP/NJCAT, or Canadian ETV program. The BCWMC will accept the verified or certified pollutant removal efficiencies as applied to the development/redevelopment site, as long as the MTDs are designed in accordance with the manufacturer's recommendations.  | <p><u>Not recommended:</u></p> <ul style="list-style-type: none"> <li>Similar to option 2, verified or certified pollutant removal efficiencies provided by third-party entities are still based on site conditions that may not be consistent with site conditions in the Bassett Creek watershed; namely a different proportion of particulate phosphorus and dissolved phosphorus loading.</li> <li>This difference in site conditions can lead to pollutant removal efficiencies in the Bassett Creek watershed that are lower than those reported by the manufacturers and third party testing entities.</li> <li>In addition, most applicants are unaware of the discrepancy and may not understand or be concerned with the effect on the watershed.</li> </ul>  |
| 4   | Same as options 2 or 3, <u>but also</u> require monitoring of all proprietary stormwater MTDs.  | <p><u>Not recommended:</u></p> <ul style="list-style-type: none"> <li>Same as option 2 or 3, and member cities have expressed that monitoring places an undesirable burden on them to develop and implement a monitoring program that is accurate, fair, and reproducible.</li> <li>This would also require staffing and funding resources, which could be more effectively spent in other ways. We would prefer an overall program led by the MPCA, based on monitoring, as a long-term solution, see option 1.</li> <li>Alternatively, a group of watershed districts and watershed management organizations could implement a monitoring program.</li> </ul>   |
| 5   | Same as option 3, but also require a breakdown of particulate and dissolved phosphorus removal efficiencies. The BCWMC will accept the verified or certified pollutant removal efficiencies for particulate and dissolved phosphorus as applied to the development/ redevelopment site, as long as the MTDs are designed in accordance with the manufacturer's recommendations.   | <p><u>Recommended (but may not be feasible):</u></p> <ul style="list-style-type: none"> <li>The verified or certified pollutant removal efficiencies with a breakdown of particulate and dissolved phosphorus provided by third-party entities allows for an accurate application of pollutant removal efficiencies for the site conditions in the Bassett Creek watershed.</li> <li>This may be infeasible because third party entities currently do not provide verification or certification to this level.</li> </ul>   |
| 6   | Same as option 3, but also require that applicants provide the MTD testing data used for the verification or certification, including the particulate phosphorus loading, the particulate phosphorus removal efficiency, the dissolved phosphorus loading, and dissolved phosphorus removal efficiency. The BCWMC will review and accept the median pollutant removal efficiencies from the MTD testing data used for the verification or certification as applied to the respective particulate and dissolved phosphorus loading values for the development/ redevelopment site, as long as the MTDs are designed in accordance with the manufacturer's recommendations. | <p><u>Recommended (as alternative to option 5):</u></p> <ul style="list-style-type: none"> <li>This requires the MTD to be verified or certified by a third party entity, but allows the BCWMC to evaluate the MTD testing data, including the respective particulate and dissolved phosphorus loading and removal efficiencies to ensure that the pollutant removal efficiencies are accurately applied for the site conditions in the Bassett Creek watershed.</li> </ul>   |



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**Attachments:**

Brochures for select stormwater MTDs previously reviewed by BCWMC

Brochures for select stormwater MTDs previously reviewed by BCWMC

Bio Clean Environmental Services – Kraken Filter



# Kraken<sup>™</sup> Filter

A Stormwater Filtration Solution

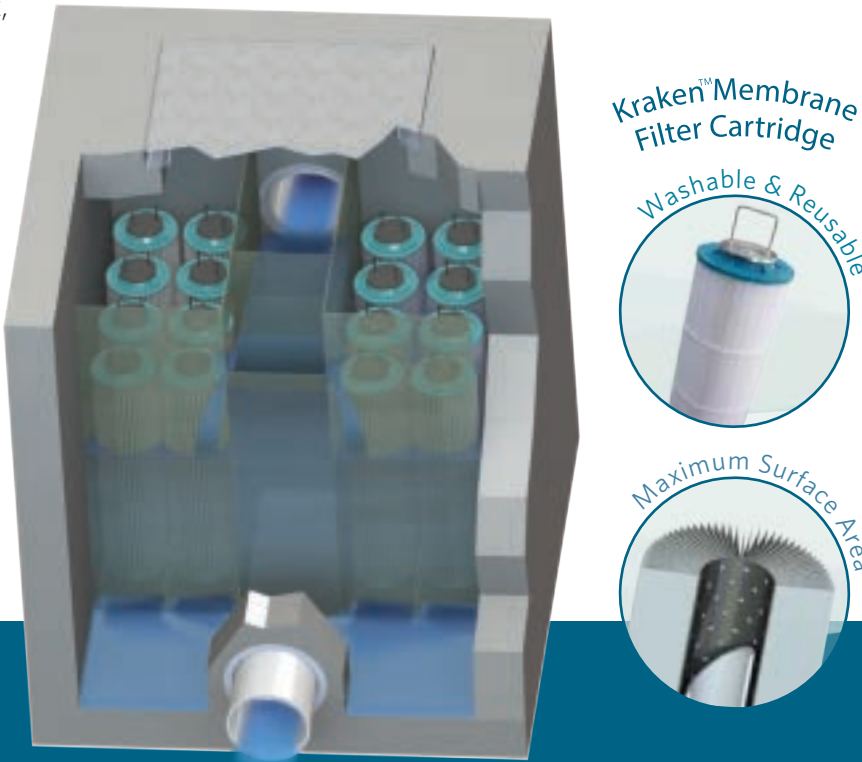


# OVERVIEW

The Bio Clean Kraken™ Filter is a state-of-the-art system utilizing advanced membrane filtration, ensuring a high level of removal for not only TSS, but also metals, trash, nutrients, and hydrocarbons. The Kraken™ membrane filter cartridge provides high flow rates and over 170 sq. ft. of surface area. This much surface area allows it to operate at a loading rate of only 0.05 gpm/sq. ft. to ensure maximum performance and minimum maintenance. The Kraken™ Filter’s low loading rate successfully overcomes high maintenance requirements and frequent clogging issues often found in other filter systems advertising high loading rates.

Each membrane filter cartridge is lightweight, washable, reusable, and more sustainable than typical granular-filled media cartridges. By eliminating the need to purchase new granular media and dispose of spent media, the Kraken™ Filter provides lower life cycle and maintenance costs.

Each filter cartridge is equipped with easy-to-grab handles and is pressure fitted, allowing it to be quickly removed, cleaned, and reattached without the use of tools.



## PERFORMANCE

**85-89%** REMOVAL OF TOTAL SUSPENDED SOLIDS (TSS)

**72%** REMOVAL OF PHOSPHORUS

## ADVANTAGES

- NO GRANULAR MEDIA TO REPLACE
- HIGH FLOW RATES AND MAXIMUM SURFACE AREA
- LOADING RATE OF 0.05 GPM / SQ. FT. FOR MINIMAL MAINTENANCE
- MEMBRANE FILTER CARTRIDGES CAN BE EASILY REMOVED AND CLEANED BY HAND
- BUILT-IN PRETREATMENT CHAMBER CAPTURES TRASH, SEDIMENTS, DEBRIS, AND HYDROCARBONS
- FILTER CARTRIDGE DRIES OUT BETWEEN STORM EVENTS TO PREVENT BIOFILM GROWTH WHICH CAN CAUSE CLOGGING AND OTHER PERFORMANCE ISSUES
- NJDEP ONLINE INSTALLATION APPROVED

# APPROVALS

The Kraken™ Filter has received NJCAT Verification for 89% TSS removal and NJDEP Certification at an 80% TSS removal rate. In addition, the Kraken™ Filter NJCAT Verification is also for online installations.



# TAPE PERFORMANCE

The Kraken™ Filter completed its TAPE field testing in the spring of 2016. The Kraken™ has met the performance benchmarks for basic treatment (TSS) and phosphorus. The system features washable and reusable cartridges to reduce overall maintenance costs.



| POLLUTANT              | AVERAGE INFLUENT CONCENTRATION (mg/L) | AVERAGE EFFLUENT CONCENTRATION (mg/L) | REMOVAL EFFICIENCY |
|------------------------|---------------------------------------|---------------------------------------|--------------------|
| Total Suspended Solids | 73.1                                  | 7.0                                   | 85%                |
| Total Phosphorus       | 0.151                                 | 0.034                                 | 72%                |
| Suspended Solids Conc. | 151.3                                 | 6.9                                   | 89%                |
| Nitrogen (TKN)         | 1.5                                   | 1.0                                   | 31%                |
| Fecal Coliform         | 692                                   | 355                                   | 60%                |
| Motor Oil              | 4.6                                   | 0.7                                   | 81%                |
| Total Zinc             | 0.158                                 | 0.054                                 | 54.3%              |
| Total Copper           | 0.042                                 | 0.017                                 | 52%                |
| Diesel Range Organics  | 1.2                                   | 0.4                                   | 65%                |

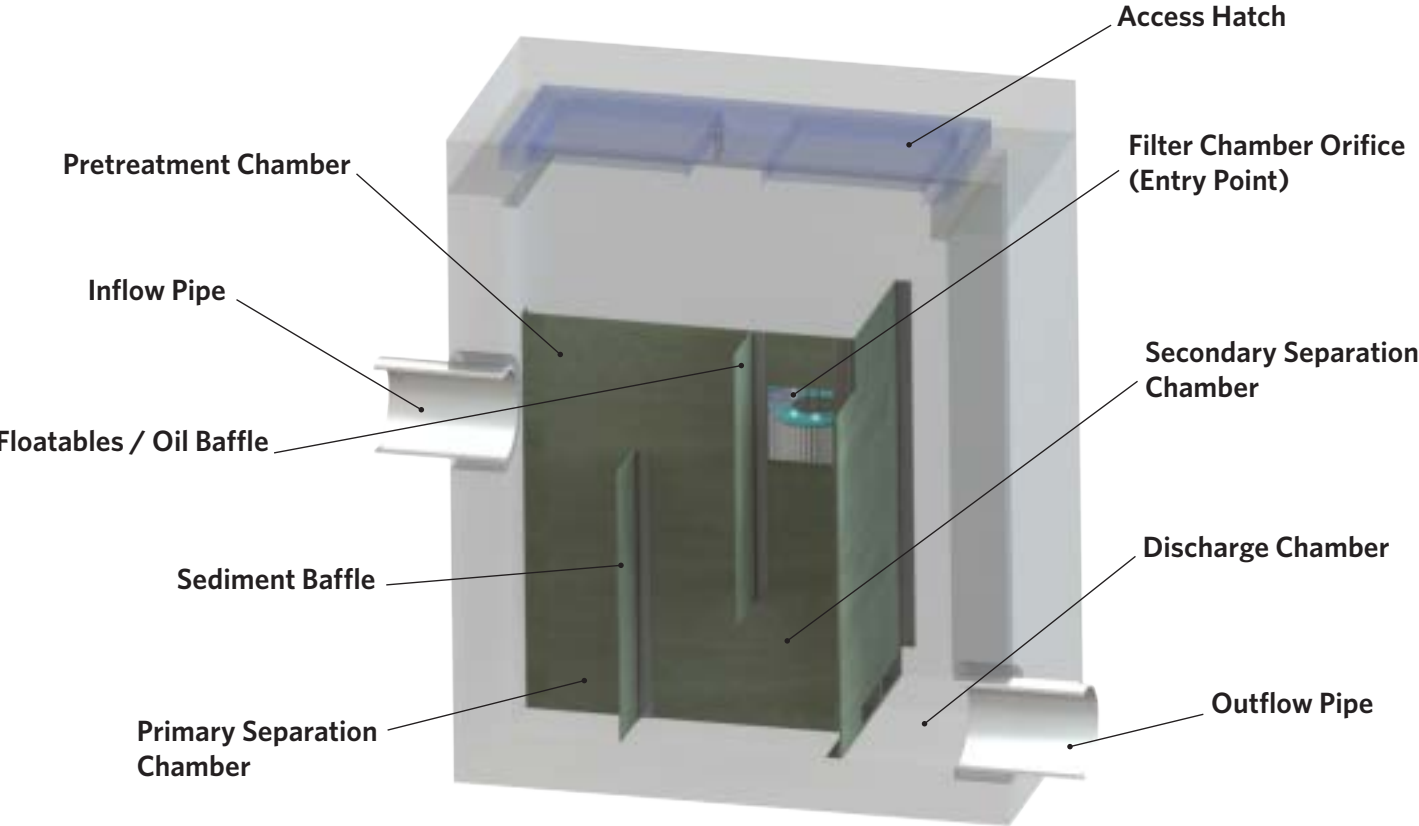
# SPECIFICATIONS

Based on Max Cartridge Capacity

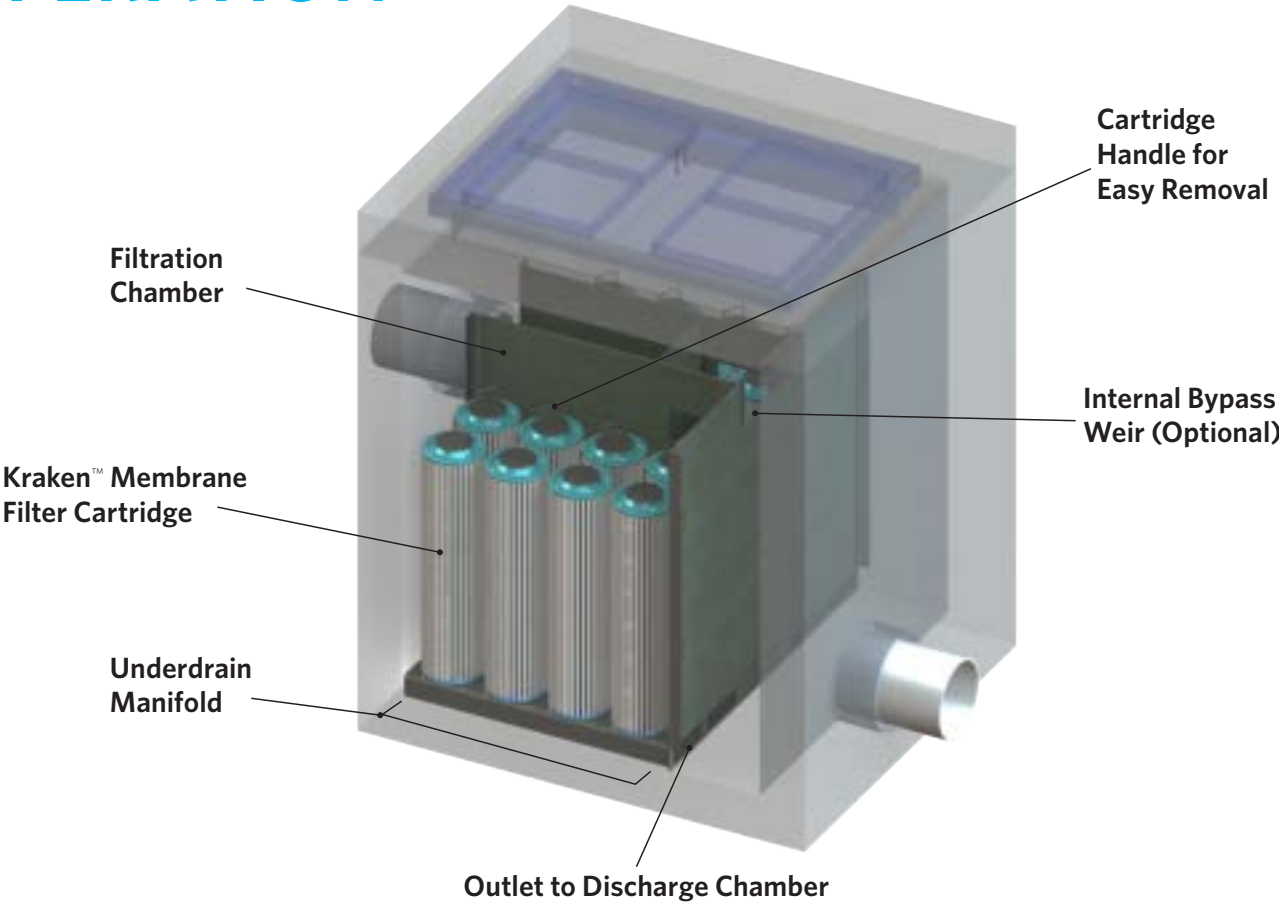
| MODEL #  | STRUCTURE SIZE (ft. x ft.) | CARTRIDGE CAPACITY | MAX MEDIA SURFACE AREA (sq. ft.) | TREATMENT FLOW CAPACITY (cfs) |
|----------|----------------------------|--------------------|----------------------------------|-------------------------------|
| KF-4-4   | 4' x 4'                    | 9 to 16            | 2720                             | 0.30                          |
| KF-4-6   | 4' x 6'                    | 17 to 24           | 4080                             | 0.46                          |
| KF-4-8   | 4' x 8'                    | 25 to 32           | 5440                             | 0.61                          |
| KF-8-8   | 8' x 8'                    | 33 to 48           | 8160                             | 0.91                          |
| KF-8-10  | 8' x 10'                   | 49 to 65           | 11220                            | 1.25                          |
| KF-8-12  | 8' x 12'                   | 66 to 78           | 13260                            | 1.48                          |
| KF-8-14  | 8' x 14'                   | 79 to 96           | 16320                            | 1.82                          |
| KF-8-16  | 8' x 16'                   | 97 to 114          | 19380                            | 2.16                          |
| KF-10-16 | 10' x 16'                  | 115 to 152         | 25840                            | 2.88                          |

See design manual for list of all models. Many other models and structure sizes are available for higher flows. Please contact us for more details.

# OPERATION

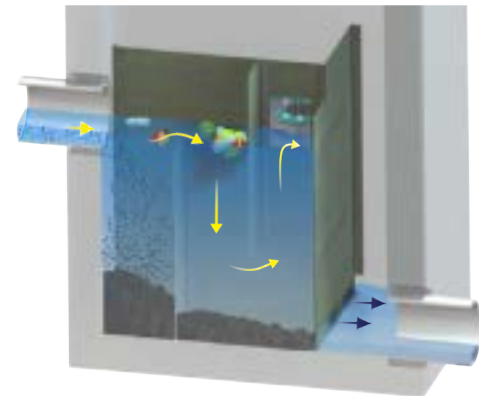


# OPERATION



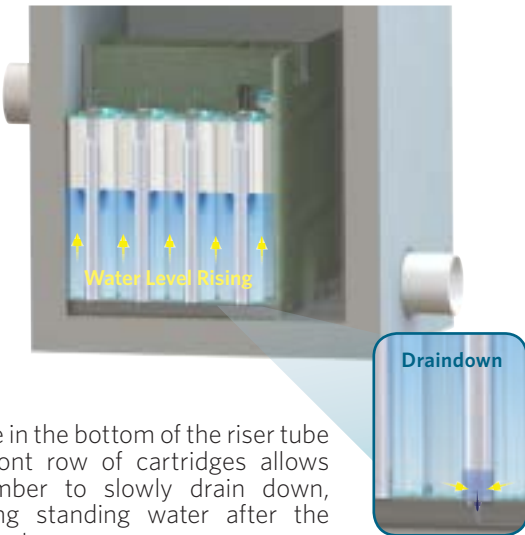
## 1 PRETREATMENT

To reduce loading on the membrane cartridge, runoff is initially passed through the pretreatment chamber to capture trash, hydrocarbons, and sediments. Once runoff is pretreated, it is directed to the filter chambers for primary treatment.



## 2 MEMBRANE FILTRATION FILL-UP

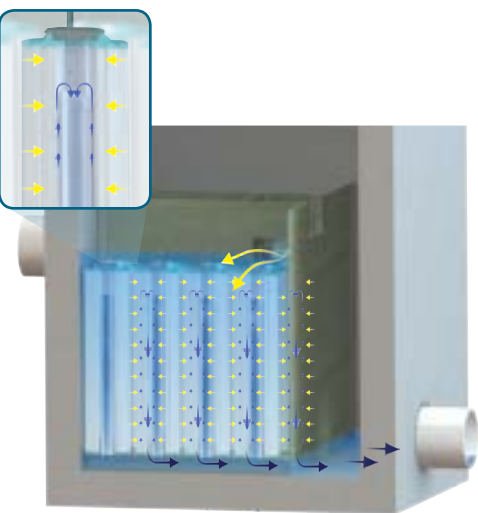
During the fill-up process, a riser tube prevents flow through the membrane cartridge until the water level nears the top of the cartridge. This ensures loading is evenly distributed over the vertical height of the cartridge maximizing efficiency.



An orifice in the bottom of the riser tube in the front row of cartridges allows the chamber to slowly drain down, eliminating standing water after the storm event.

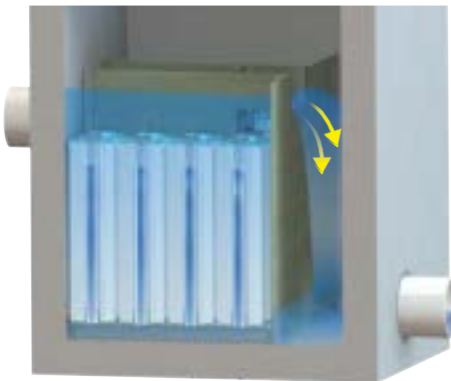
## 3 MEMBRANE FILTRATION PEAK CAPACITY

As the water level reaches the top of the membrane cartridges, flow through will begin. The riser tube creates an upward flow path within each cartridge to increase performance. Treated water then passes down the riser tube and collects in the underdrain manifold and flows to the discharge chamber.



## 4 BYPASS

An optional internal bypass is available with most system configurations. When flows exceed the treatment capacity of the system, the water level rises and goes into bypass. High flows are conveyed from the pretreatment chamber directly to the discharge chamber to prevent scouring of fine sediments captured within the filtration chamber.





# INSTALLATION



Small footprint reduces installation and shipping costs.

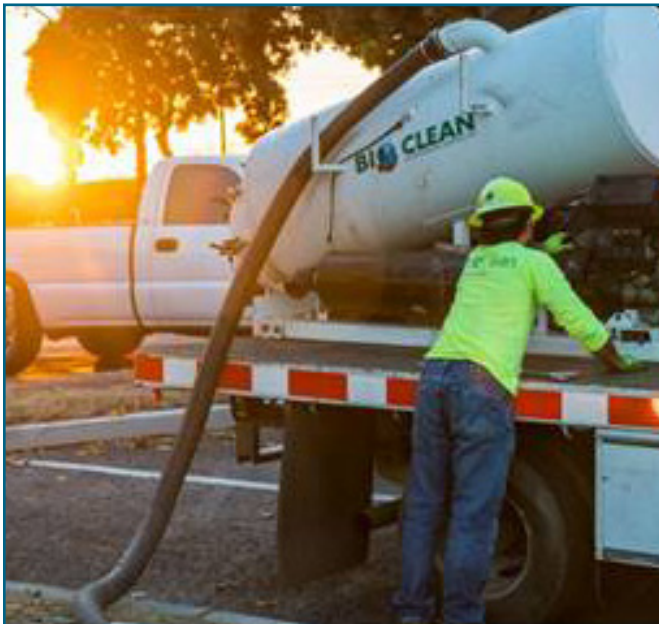


No deep sump chamber (as found with tentacle-type systems) and reduces excavation costs.

# MAINTENANCE



Lowest lifecycle cost of any media filter with fast and simple maintenance procedures.



Easily cleaned with a standard vacuum truck, and reusable cartridge can be cleaned with a standard garden hose.







5796 Armada Drive Suite 250  
Carlsbad, CA 92008  
855.566.3938  
[stormwater@forterrabp.com](mailto:stormwater@forterrabp.com)  
[biocleanenvironmental.com](http://biocleanenvironmental.com)

Brochures for select stormwater MTDs previously reviewed by BCWMC

Contech Engineered Solutions – Jellyfish Filter



# Jellyfish<sup>®</sup> Filter

## Stormwater Treatment





# The experts you need to solve your stormwater challenges



**Contech is the leader in stormwater solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.**

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

## Your Contech Team



### **STORMWATER CONSULTANT**

*It's my job to recommend the best solution to meet permitting requirements.*



### **STORMWATER DESIGN ENGINEER**

*I work with consultants to design the best approved solution to meet your project's needs.*



### **REGULATORY MANAGER**

*I understand the local stormwater regulations and what solutions will be approved.*



### **SALES ENGINEER**

*I make sure our solutions meet the needs of the contractor during construction.*

**Contech is your partner in stormwater management solutions**



## Setting new standards in Stormwater Treatment – Jellyfish® Filter

*The Jellyfish Filter has been tested in the field and laboratory, and has received approval from numerous stormwater regulatory agencies.*

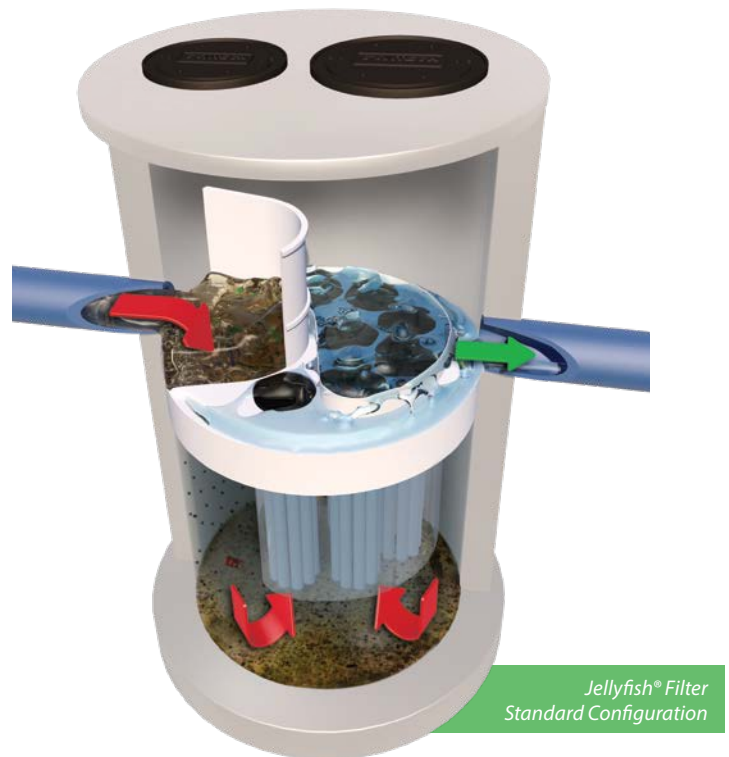
The Jellyfish Filter is a stormwater quality treatment technology featuring high flow pretreatment and membrane filtration in a compact stand-alone system. Jellyfish removes floatables, trash, oil, debris, TSS, fine silt-sized particles, and a high percentage of particulate-bound pollutants; including phosphorus, nitrogen, metals and hydrocarbons. The high surface area membrane cartridges, combined with up-flow hydraulics, frequent, passive backwashing, and rinseable/reusable cartridges ensure long-lasting performance.

*Jellyfish® Filter*

# How the Jellyfish® Filter Treats Stormwater

## Tested in the field and laboratory ...

- Stormwater enters the Jellyfish through the inlet pipe and traps floating pollutants behind the maintenance access wall and below the cartridge deck.
- Water is conveyed below the cartridge deck where a separation skirt around the cartridges isolates oil, trash and debris outside the filtration zone.
- Water is directed to the filtration zone and up through the top of the cartridge where it exits via the outlet pipe.
- The membrane filters provide a very large surface area to effectively remove fine sand and silt-sized particles, and a high percentage of particulate-bound pollutants such as nitrogen, phosphorus, metals, and hydrocarbons while ensuring long-lasting treatment.
- As influent flow subsides, the water in the backwash pool flows back into the lower chamber. This passive backwash extends cartridge life.
- The draindown cartridge(s) located outside the backwash pool enables water levels to balance.



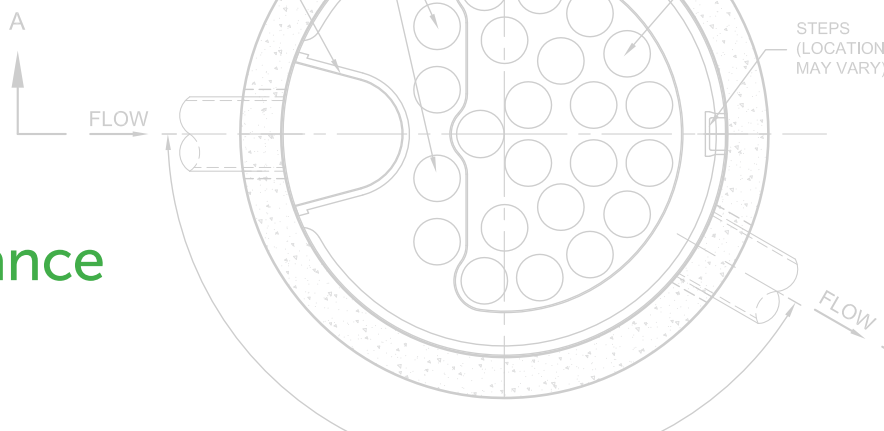
Learn More:  
[www.ContechES.com/jellyfish](http://www.ContechES.com/jellyfish)



Pretreat bioretention or infiltration with Jellyfish to extend service life.



# Jellyfish® Filter Performance Testing Results



## APPLICATION TIPS

- The Peak Diversion Jellyfish provides treatment and high-flow bypass in one structure, eliminating the need for a separate bypass structure.
- LID and GI are complemented by filtration solutions, as they help keep sites free from fine sediments that can impede performance, remove unsightly trash, and provide a single point of maintenance.
- Selecting a filter with a long maintenance cycle and low maintenance cost will result in healthy waterways and happy property owners.



*The pleated tentacles of the Jellyfish® Filter provide a large surface area for pollutant removal.*

| POLLUTANT OF CONCERN         | % REMOVAL |
|------------------------------|-----------|
| Total Trash                  | 99%       |
| Total Suspended Solids (TSS) | 89%       |
| Total Phosphorus (TP)        | 59%       |
| Total Nitrogen (TN)          | 51%       |
| Total Copper (TCu)           | > 50%     |
| Total Zinc (TZn)             | > 50%     |



Sources:

TARP II Field Study – 2012 JF 4-2-1 Configuration  
MRDC Floatables Testing – 2008 JF6-6-1 Configuration

# Jellyfish® Filter Features and Benefits

| FEATURE  | BENEFITS  |
|--|---|
| High surface area membrane filtration                                | Low flux rate promotes cake filtration and slows membrane occlusion |
| High design treatment flow rate per cartridge (up to 80 gpm (5 L/s)) | Compact system with a small footprint, lower construction cost      |
| Low driving head (typically 18 inches or less (457 mm))              | Design flexibility, lower construction cost                         |
| Lightweight cartridges with passive backwash                         | Easy maintenance and low life-cycle cost                            |

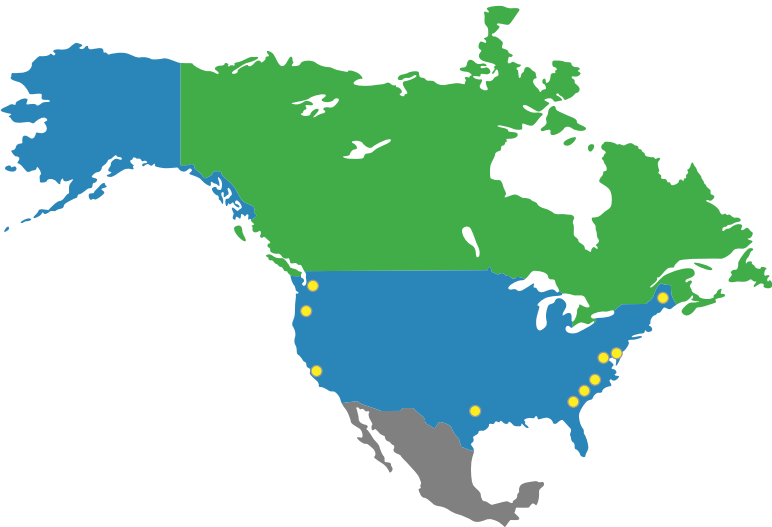


The Jellyfish Filter can be configured in a manhole, catch basin, or vault.

## Select Jellyfish® Filter Certifications and Verifications

The Jellyfish Filter has been reviewed by numerous state and federal programs, including:

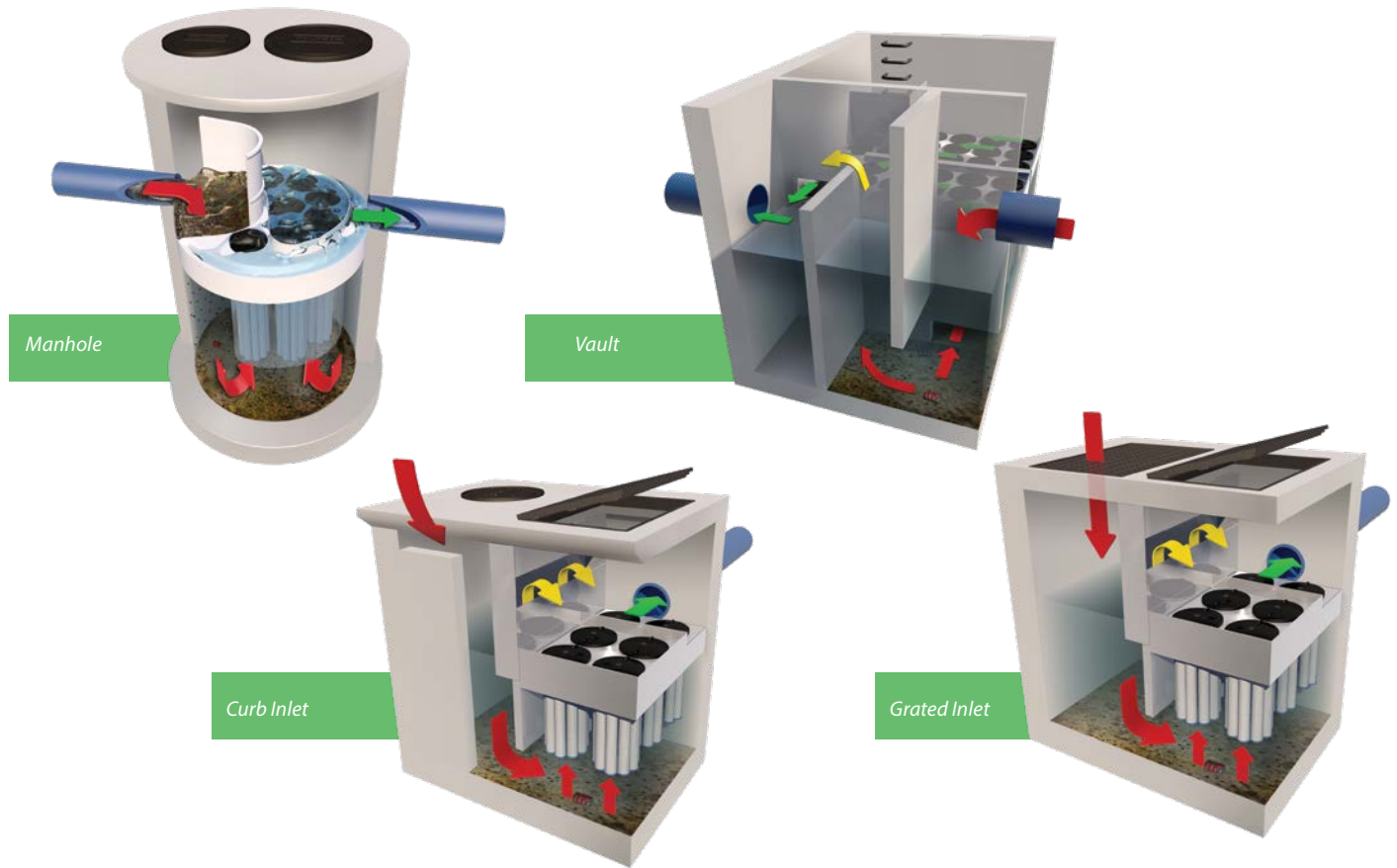
- New Jersey Corporation for Advanced Technology (NJCAT) – Field Performance per TARP Tier II Protocol
- Washington State Department of Ecology (TAPE – CULD)
- Maryland Department of the Environment (MD DOE)
- Canada ISO 14034 Environmental Management - Environmental Technology Verification (ETV)
- Texas Commission on Environmental Quality (TCEQ)
- Virginia Department of Environmental Quality (VA DEQ)



# Jellyfish® Filter Configurations

## Multiple system configurations to optimize your site ....

The Jellyfish Filter can be manufactured in a variety of configurations: manhole, catch basin, vault, fiberglass tank, or custom configurations. Typically, 18 inches (457 mm) of driving head is designed into the system. For low drop sites, the designed driving head can be less.



## Jellyfish® Filter Maintenance

- Jellyfish Filter cartridges are light weight and reusable
- Maintenance of the filter cartridges is performed by removing, rinsing and reusing the cartridge tentacles.
- Vacuum extraction of captured pollutants in the sump is recommended at the same time.
- Full cartridge replacement intervals differ by site due to varying pollutant loading and type, and maintenance frequency. Replacement is anticipated every 2-5 years.
- Contech® has created a network of Certified Maintenance Providers to provide maintenance on stormwater BMP's.



*The Jellyfish® Filter tentacle is light and easy to clean.*



# A partner you can rely on



STORMWATER  
SOLUTIONS



PIPE  
SOLUTIONS



STRUCTURES  
SOLUTIONS

Few companies offer the wide range of high-quality stormwater resources you can find with us — state-of-the-art products, decades of expertise, and all the maintenance support you need to operate your system cost-effectively.

## THE CONTECH WAY

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

## TAKE THE NEXT STEP

For more information: [www.ContechES.com](http://www.ContechES.com)

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## Brochures for select stormwater MTDs previously reviewed by BCWMC

Contech Engineered Solutions – StormFilter with Phosphosorb Media



**CONTECH<sup>®</sup>**  
ENGINEERED SOLUTIONS

# The Stormwater Management StormFilter<sup>®</sup>





# The experts you need to solve your stormwater challenges



**Contech is the leader in stormwater solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.**

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

## Your Contech Team



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*It's my job to recommend the best solution to meet permitting requirements.*



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### **SALES ENGINEER**

*I make sure our solutions meet the needs of the contractor during construction.*

**Contech is your partner in stormwater management solutions**



## Flexible Stormwater Filtration Technology

*An 8' x 24' Stormwater Management StormFilter with 60 cartridges is used to remove pollutants from runoff at Surfers Point Beach in Ventura, California.*

As stormwater quality regulations become more stringent, engineers need a filtration device that can tackle the most challenging pollutants and provide the flexibility to meet the needs of a variety of sites.

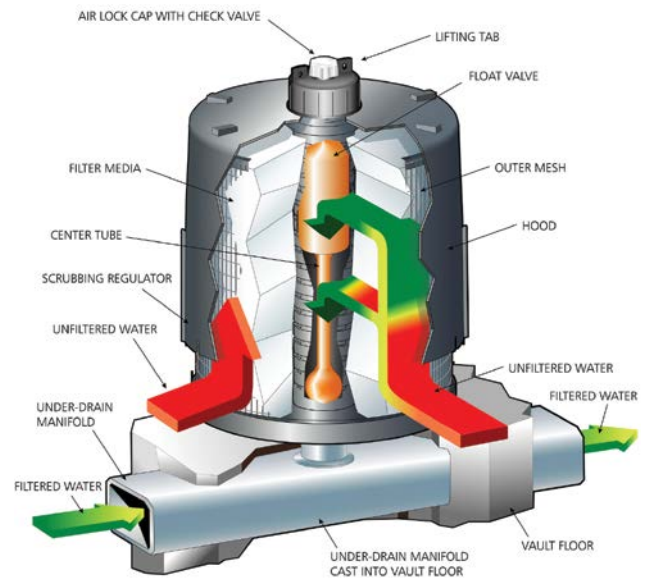
The Stormwater Management StormFilter® is an underground stormwater treatment device comprised of one or more structures that house rechargeable, media-filled cartridges that trap particulates and adsorb pollutants from stormwater runoff such as total suspended solids, hydrocarbons, nutrients, metals, and other common pollutants. With media options to target multiple or specific pollutants, multiple system configurations, and field and laboratory performance verified by the most stringent stormwater technology evaluation organizations; the StormFilter provides engineers the most flexible and most reliable manufactured treatment technology available.

The Stormwater Management  
**StormFilter®**



# How the StormFilter Treats Stormwater

During a storm, runoff passes through the filtration media and starts filling the cartridge center tube. The air inside the hood is purged through a one-way check valve as the water rises. When water reaches the top of the float, buoyant forces pull the float free and allow filtered water to exit the cartridge. A siphon is established within each cartridge that draws water uniformly across the full height of the media bed ensuring even distribution of pollutants and prolonged media longevity. After the storm, the water level in the structure starts falling. A hanging water column remains under the cartridge hood until the water level reaches the scrubbing regulators at the bottom of the hood. Air then rushes through the regulators, breaking the siphon and creating air bubbles that agitate the surface of the filter media, causing accumulated sediment to settle on the treatment bay floor. This unique surface-cleaning mechanism prevents surface blinding and further extends cartridge life.



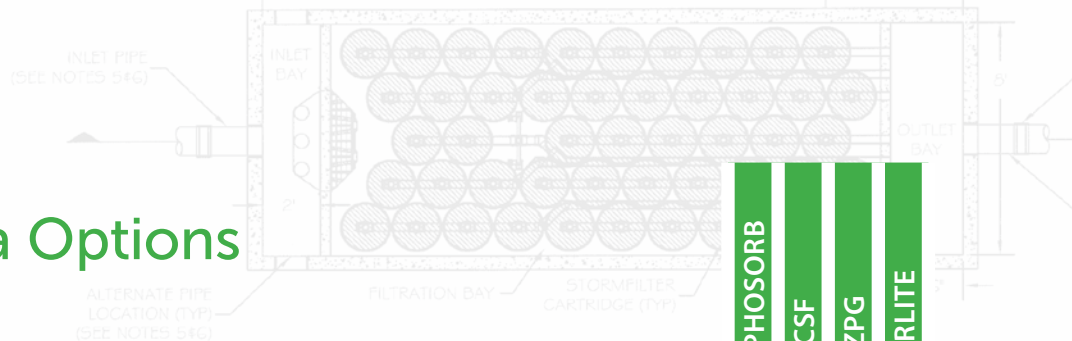
Learn More:  
[www.ContechES.com/stormfilter](http://www.ContechES.com/stormfilter)

The StormFilter has a 20+ year history of successful installations and over 200,000 cartridges installed worldwide.

| FEATURE   | BENEFIT  |
|---|--|
| Siphon actuated, high surface area media cartridges | Stormwater is drawn evenly through the filter media providing efficient, effective stormwater treatment    |
| Multiple cartridge heights                          | Flexibility to meet site-specific hydraulic needs and reduce system size and costs                         |
| Multiple media options                              | Ability to target specific pollutants of concern including TSS, phosphorus, heavy metals, and hydrocarbons |
| Internal peak bypass and multiple configurations    | Design flexibility to meet your unique site requirements   |
| Maintenance intervals of one to five years          | Fewer maintenance events and reduced long-term ownership costs   |
| Performance verified by both the WA DOE and NJ DEP  | Superior pollutant capture with confidence   |
| Arrives to the jobsite fully assembled              | Factory build ensures quality and a simple, fast installation onsite                                       |

Design flexibility to meet your unique site requirements

# StormFilter Media Options



## Flexibility to target site-specific pollutants ...

- PhosphoSorb® is a lightweight media built from a Perlite-base that removes total phosphorus (TP) by adsorbing dissolved-P and filtering particulate-P simultaneously.
- CSF® Leaf Media is created from deciduous leaves processed into granular, organic media. CSF is most effective for removing soluble metals, TSS, oil and grease, and buffering acid rain.
- Perlite is naturally occurring puffed volcanic ash. Effective for removing TSS, oil, and grease.
- Zeolite is a naturally occurring mineral used to remove soluble metals, ammonium, and some organics.
- GAC (Granular Activated Carbon) has a micro-porous structure with an extensive surface area to provide high levels of adsorption. It is primarily used to remove oil and grease and organics such as PAHs and phthalates.

|                  | PHOSPHOSORB | CSF | ZPG | PERLITE |
|------------------|-------------|-----|-----|---------|
| Sediments        | ✓           | ✓   | ✓   | ✓       |
| Oil and Grease   | ✓           | ✓   | ✓   | ✓       |
| Soluble Metals   | ✓           | ✓   | ✓   |         |
| Organics         |             | ✓   | ✓   |         |
| Nutrients        | ✓           | ✓   | ✓   |         |
| Total Phosphorus | ✓           |     |     |         |

*Note: Indicated media are most effective for associated pollutant type. Other media may treat pollutants, but to a lesser degree.*

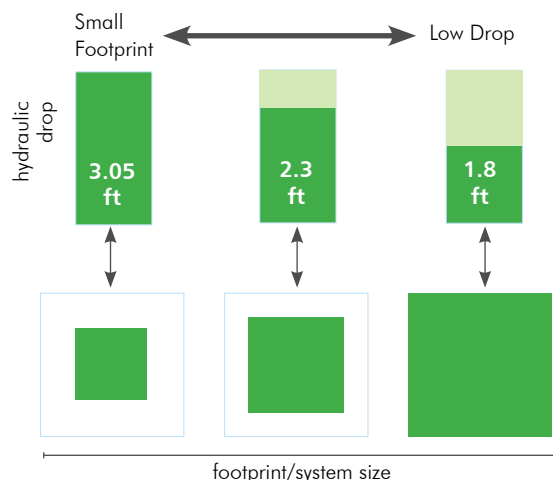
*ZPG™ media is a proprietary blend of zeolite, perlite, and GAC, and is also available.*

# Cartridge Options

## Flexibility to reduce size and costs ...

Every site is different, and one size does not fit all. Multiple cartridge heights give you design flexibility to design the StormFilter specifically for your site and reduce the cost of the system for the owner.

- 27" cartridge – Capitalizing on sites with at least 3.05 feet of available driving head, media surface area is maximized to allow the greatest treatment rate per cartridge; best for sites with footprint constraints
- 18" cartridge - The original StormFilter cartridge size provides a middle ground and operates with 2.3 feet of driving head
- Low Drop – Provides filtration treatment with only 1.8 feet of headloss; best for sites with limited by hydraulic constraints



| CARTRIDGE FLOW RATES |                       |                           |                       |
|----------------------|-----------------------|---------------------------|-----------------------|
| Cartridge Height     | 2 gpm/ft <sup>2</sup> | 1.67* gpm/ft <sup>2</sup> | 1 gpm/ft <sup>2</sup> |
| 12" LD               | 10 gpm                | 8.35 gpm                  | 5 gpm                 |
| 18"                  | 15 gpm                | 12.53 gpm                 | 7.5 gpm               |
| 27"                  | 22.5 gpm              | 18.79 gpm                 | 11.25 gpm             |

\* For use with Phosphosorb media as per WA DOE GULD approval.

| MASS LOAD CAPACITY |                       |                           |                       |
|--------------------|-----------------------|---------------------------|-----------------------|
| Cartridge Height   | 2 gpm/ft <sup>2</sup> | 1.67* gpm/ft <sup>2</sup> | 1 gpm/ft <sup>2</sup> |
| 12" LD             | 15 lbs                | 18 lbs                    | 24 lbs                |
| 18"                | 22.5 lbs              | 27 lbs                    | 36 lbs                |
| 27"                | 33.8 lbs              | 40.45 lbs                 | 54 lbs                |

\* For use with Phosphosorb media as per WA DOE GULD approval.

# Configurations

## Flexibility to accommodate flows, project footprints, and hydraulics ...

The structures that house the filter cartridges can be constructed in a variety of ways to accommodate a wide range of flows, project footprints, and variable hydraulic conditions. Standard configurations include catch basin, manhole, vault, curb inlet, and linear grate.

- **The Peak Diversion StormFilter** provides treatment and high flow bypass in one precast vault, eliminating the need for an external bypass or junction structures.
- **The Volume StormFilter** is designed to meet volume-based treatment regulations and can be combined with upstream storage to treat and drawdown the water quality volume within the required drain down time.
- **The Cast-in-Place StormFilter** structures allow the highest degree of flexibility and are available for installations within buildings or other areas where precast structures cannot be accommodated. On-site Contractor assistance is provided to ensure the finished product meets Contech's standards for fit and function.



# Select StormFilter Approvals

The StormFilter has been verified by some of the most stringent stormwater technology evaluation organizations in North America, including:

- Washington State Department of Ecology (TAPE)  
GULD – Basic, Phosphorus
- New Jersey Department of Environmental Protection (NJ DEP)
- North Carolina Department of Environmental Quality (NC DEQ)
- Maryland Department of the Environment (MD DOE)
- Texas Commission on Environmental Quality (TCEQ)
- Virginia Department of Environmental Quality (VA DEQ)
- Maine Department of Environmental Protection (ME DEP)
- St. Louis Metropolitan Sewer District

Verified by some of the most stringent organizations

# StormFilter Maintenance



## APPLICATION TIPS

- Clogging is a major factor in the failure of filter systems. Look for systems that offer mechanisms that prevent clogging, extend service life, and reduce life-cycle cost.
- A compact design reduces construction, installation, and life-cycle cost, so look for systems that offer the most flexibility in design and construction.
- All media filters will eventually need to be replaced. Look for filters that have lightweight cartridges and provide easy access for maintenance.



*An easy-to-access treatment system can make all the difference in maintenance expenses.*

Every manufactured filtration device will eventually need routine maintenance. The question is how often and how much it will cost. Proper evaluation of long-term maintenance costs should be a consideration when selecting a manufactured treatment device. The StormFilter has been optimized to reduce long-term maintenance costs with proven, repeatable performance in the laboratory and in the field.

- **Reduce Life Cycle Costs** - StormFilter has been designed for predictable maintenance intervals ranging from 1 to 5 years, resulting in fewer maintenance events and reduced life-cycle costs compared to other filtration devices.

- **Easy to maintain** - All StormFilter structures provide access for inspection, media replacement, and washing of the structure. Visual indicators for maintenance are observable from the surface.
- **Cartridge replacement program** provides refurbished cartridges that are shipped to your site ready to install. Contech arranges for empty cartridges to be picked up and shipped back, reducing cartridge costs and environmental impact.
- **Maintenance support** - Contech has created a network of Certified Maintenance Providers to provide StormFilter maintenance at the lowest possible cost.



# A partner you can rely on



STORMWATER  
SOLUTIONS



PIPE  
SOLUTIONS



STRUCTURES  
SOLUTIONS

Few companies offer the wide range of high-quality stormwater resources you can find with us — state-of-the-art products, decades of expertise, and all the maintenance support you need to operate your system cost-effectively.

## THE CONTECH WAY

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

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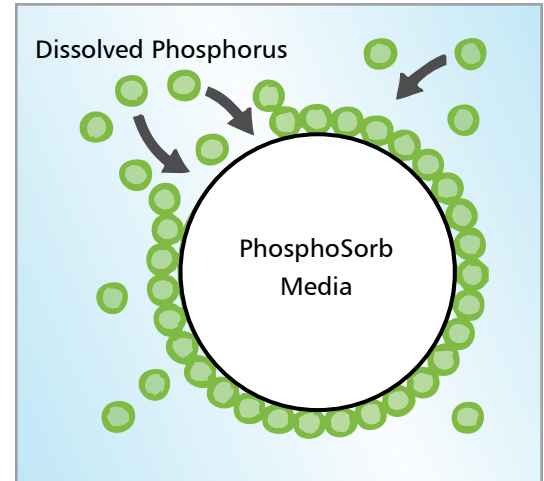
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800-338-1122 | [www.ContechES.com](http://www.ContechES.com)

# Introducing PhosphoSorb® Media

**Effectively target TSS and Total Phosphorus in one lightweight media**

Manufactured in an environmentally-friendly manner, PhosphoSorb is a lightweight media built from a Perlite base. This innovative, engineered filtration media removes total phosphorus (TP) from stormwater runoff by absorbing dissolved-P and filtering particulate-P simultaneously. Field tests of the PhosphoSorb media showed a load reduction of 89% TSS and 82% total phosphorus with an average influent concentration of 380 mg/L and 0.33 mg/L respectively.



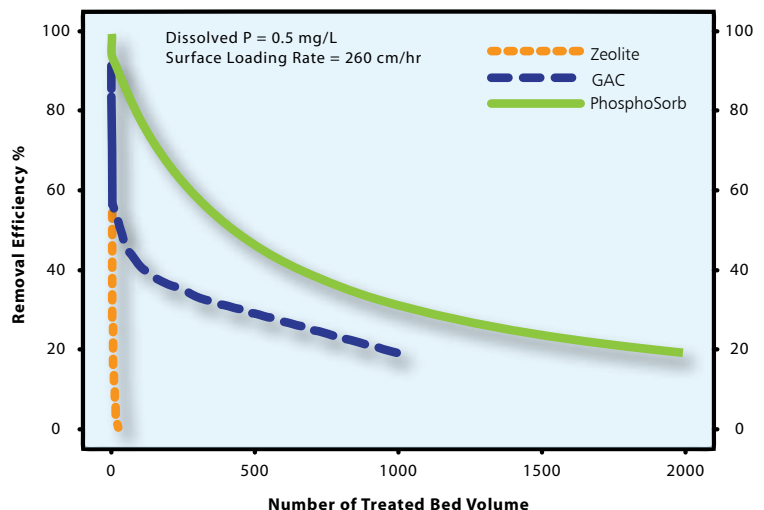
## Physical Characteristics of PhosphoSorb:

| Nominal Size (mm) | Bulk Density Lbs/ft <sup>3</sup> | Effective Bed Porosity (%) | Specific Surface Area (m <sup>2</sup> /g) |
|-------------------|----------------------------------|----------------------------|---|
| 1.4-6.3           | 20-25                            | 65%-80%                    | 20-30                                     |



## Key Benefits:

- Removes both TSS and TP from stormwater runoff
- Removal of both soluble and total Phosphorus can exceed 50%
- Low impact product life cycle – no production by-products
- Lightweight media – easy to handle, ship and deploy
- Flexible deployment – for use in the Stormwater Management StormFilter® and as a biofiltration soil amendment



In laboratory testing, PhosphoSorb removed 50% of the first 1,000 treated empty bed volumes (EBVs) of 0.5 mg/L influent dissolved P solution, and lasted for at least 2,000 treated EBVs.