#### **DATA REPORT**

# Literature Review of Existing Treatment Technologies for Industrial Stormwater

Prepared for

Science Applications International Corporation

and

Washington State Department of Ecology

#### Note:

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# Literature Review of Existing Treatment Technologies for Industrial Stormwater

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## **1.0 Introduction**

The Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA) are working to clean up contaminated sediments and control sources of recontamination in the Lower Duwamish Waterway (LDW) under an Administrative Order on Consent with the City of Seattle, King County, the Port of Seattle, and The Boeing Company. The LDW site is an approximately 5.5-mile portion of the Lower Duwamish River which flows into Elliott Bay. The sediments along the river contain a wide range of contaminants due to years of industrial activity and runoff from residential areas. These contaminants include polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), chlorinated dioxins and furans, metals, and phthalates.

Ecology is leading contaminant source control efforts in the LDW in cooperation with the City of Seattle, the Port of Seattle, King County, the City of Tukwila, and EPA. Source control is the process of finding and controlling releases of contaminants to the LDW. In order to support Ecology's source control efforts, Herrera Environmental Consultants (Herrera) conducted a literature review to identify technologies that could be used to treat industrial or municipal stormwater for the contaminants of concern in sediments within the LDW. In addition, Herrera has also compiled information on technologies that could be used to treat contaminated groundwater for this same suite of contaminants.

This report summarizes information on the specific stormwater treatment technologies that were identified through this review. It includes a methods section that describes the procedures that were used to compile information about each treatment technology. The compiled information for each treatment technology is then summarized in a results section under the following general categories:

- Vendor information
- Treatment performance
- System design
- Installation and operation and maintenance (O&M) costs

Finally, a discussion section provides guidance on the appropriate application(s) for each general category of treatment technology and identifies logistical issues for monitoring their performance. The discussion section also identifies key data gaps in our understanding of treatment system performance and recommends future research to fill these data gaps.

It should be noted that this review is not intended to constitute a formal analysis of "all known, available, and reasonable methods of treatment", or AKART analysis as defined in Ecology (2010a). An AKART analysis consists of a review of all available technologies for a well-characterized waste stream (such as industrial process wastewaters or fully-characterized and quantified stormwater runoff), and an evaluation of the economic impact of such technologies for the specified site or business. This project, as currently conceived, would not be considered a complete AKART analysis, nor could it be approved by Ecology as such.

This report was prepared by Herrera under Ecology's "Hazardous Substances Site Investigation & Remediation for the Toxics Cleanup Program Contract No. C0700034" between Science Applications International Corporation (SAIC) and Ecology. Herrera is a subcontractor to SAIC under this contract.

## 2.0 Methods

As described above, Herrera conducted a literature review to identify technologies that could be used to treat industrial or municipal stormwater for the contaminants of concern in sediments within the LDW. This review was intended to identify a broad range of possible technologies for different treatment applications within the LDW, including:

- Runoff treatment at end-of-pipe or point of compliance
- Treatment at the point of entry for runoff to stormwater conveyance system
- Above ground treatment of runoff prior to its point of entry to the conveyance system (e.g., roof-runoff interception)

Since the stormwater treatment technologies in the LDW will typically be used for retrofit applications, this review was not limited to technologies that have been approved through the Technology Assessment Protocol – Ecology (TAPE) process (Ecology 2008). This study primarily focused on proprietary stormwater treatment technologies that are not listed in Volume V of the Stormwater Management Manual for Western Washington (Ecology 2005). Most of the non-proprietary stormwater treatment technologies listed in Volume V of the Stormwater Management Manual for Western Washington (Ecology 2005) were removed from further research for this study due to aboveground footprint or infiltration requirements as summarized in the Step 3 (Screening Criteria) section below. If in the rare instance a large footprint best management practice (BMP) such as a wet pond or an infiltrating BMP such as bioretention or a media filter drain are deemed appropriate for a site, the reader should refer to Volume V of the Stormwater Management Manual for Western Washington (Ecology 2005); the Low Impact Development Technical Guidance Manual for Puget Sound (PSAT 2005); or the Washington State Department of Transportation Highway Runoff Manual (WSDOT 2010) for additional information on the BMP of interest. Only two non-proprietary stormwater treatment systems are included in this report: underground sand filters (e.g., Delaware Sand Filters and DC Sand Filters) since they may be applicable to retrofits in the LDW. Finally, source control BMPs such as street sweeping and catch basin cleaning discussed in Volume IV of the Stormwater Management Manual for Western Washington (Ecology 2005) are also not the focus of this study, but are critical for pollution prevention in the LDW.

The actual literature review and data compilation steps that were performed in conjunction with this effort are as follows:

- 1. Identify candidate treatment technologies
- 2. Categorize treatment technologies
- 3. Screen treatment technologies for potential application in the LDW
- 4. Compile detailed information on each treatment technology
- 5. Identify logistical issues for monitoring of each treatment technology

Each of these steps is described in more detail below.

#### **Step 1. Identify Candidate Treatment Technologies**

A candidate list of stormwater treatment technologies was compiled using the following resources:

- Web search
- Technologies approved through TAPE (Ecology 2008) and/or New Jersey Corporation for Advanced Technology (NJCAT) using the Technology Acceptance and Reciprocity Partnership [TARP] protocol (TARP 2003).
- Caltrans Treatment BMP Technology Report (Caltrans 2008)
- Stormwater Management Manual for Western Washington (Ecology 2005)

#### **Step 2. Categorize Treatment Technologies**

Stormwater treatment technologies were then classified as one of two main types:

- Active treatment systems: systems that require electricity to operate
- Passive treatment systems: systems that do not require electricity to operate and are generally lower cost alternatives when compared to active treatment systems

Within the active treatment system category, treatment systems were further classified into one of the following subcategories (see Figure 1):

- Chemical filtration
- Chemical treatment
- Electrocoagulation
- Filtration
- Ion exchange
- Reverse osmosis

Filtration was further categorized as one of the following types based on the technology description:

- Disc
- Media
- Pressure

Within the passive treatment system category, treatment systems were classified into one of the following subcategories (see Figure 1):

- Bioretention/filtration
- Drain inlet insert
- Hydrodynamic separation
- Media filtration
- Oil/water separator

Drain inlet inserts and media filtration systems were further categorized based on the technology description. Drain inlet inserts can generally be considered one of the following types (see Figure 1):

- Absorbent boom/fabric
- Media filtration
- Media filtration (cartridge)
- Combination system (screen and absorbent boom/fabric)
- Combination system (screen and media filtration)

Media filtration can generally be considered one of the following types (see Figure 1):

- Above ground (pump required)
- Cartridge
- Combination system (with hydrodynamic separation)
- Combination system (with oil/water separator)
- Up-flow

# Step 3. Screen Treatment Technologies for Potential Application in the LDW

Technologies were subsequently screened for potential application in the LDW based on a list of screening criteria. These screening criteria reflect the unique logistical issues for treating stormwater in the LDW given the presence of historical sediment contamination, flat site topography, high groundwater table, and a broad list of target contaminants in runoff.

The screening criteria for active treatment systems are as follows:

- Systems must be designed for long-term (i.e., permanent) installation.
- Systems must be designed to treat a relatively wide range of flows and concentrations that are associated with stormwater runoff.

The screening criteria for passive treatment systems are as follows:

- Systems must have a minimal aboveground footprint due to the limited space available for retrofits (e.g., larger aboveground systems such as constructed wetlands, wet ponds, and Austin sand filters were removed).
- Systems must not rely on infiltration for treatment due to high water table and presence of historical soil and/or groundwater contamination (e.g., treatment technologies such as infiltration trenches, bioretention, and proprietary systems that provide storage for underground infiltration were removed).
- Systems must be able to effectively handle a large petroleum or chemical spill from industrial activities (e.g., porous pavement was removed).
- Systems should remove pollutants of concern; those systems with a focus on gross litter and debris removal were not considered (e.g., proprietary systems that have a trash basket catch basin insert design were removed).
- System design should be for a permanent installation; those systems with a construction site or temporary installation focus were not considered (e.g., catch basin filter sock designs were removed).
- Systems must be readily available; those systems with inactive vendor websites or discontinued product lines were not included.

# Step 4. Compile Detailed Information on Each Treatment Technology

Once the list of potential active and passive stormwater treatment technologies was narrowed down to those that could potentially be useful in the LDW, the following steps were taken to collect information on each of the systems:

- Review and compile publically available information from vendor websites
- Send questionnaire to vendors
- Conduct follow-up phone contacts with vendors

The vendor questionnaire requested the following specific information:

- Manufacturer name
- Technology name
- Contact information (name, e-mail, phone, website)
- Treatment type/application

- Number of installations in the state of Washington
- Estimated installation cost [range]
- Estimated annual O&M cost [range]
- Design flow rate [range]
- System footprint [range]
- Required head loss [range]
- Internal or external bypass
- Above or below grade
- Median influent concentration [see parameter list below]
- Median effluent concentration [see parameter list below]
- Median percent removal [see parameter list below]

Based on the contaminants of concern in the LDW and the required monitoring parameters in the National Pollutant Discharge Elimination System (NPDES) Industrial Stormwater General Permit (Ecology 2010b), treatment performance data for the following parameters were requested from the each vendor:

- Total suspended solids (TSS) [required for Timber Product Industry (24xx), Paper and Allied Products (26xx), and discharges to 303(d)-listed waters; many pollutants can also be associated with sediment particles, thus TSS removal can also be an indicator of pollutant removal of other parameters]
- Total phosphorus [required for Chemical and Allied Products (28xx), Food and Kindred Products (20xx), and discharges to 303(d)-listed waters]
- Total petroleum hydrocarbons (TPH) [required for Primary Metals (33xx), Metals Mining (10xx), Automobile Salvage and Scrap Recycling (5015 and 5093), and Metals Fabricating (34xx)]
- Oil and grease [this parameter is measured instead of TPH in some portions of the country]
- Total and dissolved copper [total copper is required for all Industrial Stormwater permittees]
- Total and dissolved lead [total lead is required for Primary Metals (33xx), Metals Mining (10xx), Automobile Salvage and Scrap Recycling (5015 and 5093), Metals Fabricating (34xx), and discharges to 303(d)-listed waters]
- Total and dissolved zinc [total zinc is required for all Industrial Stormwater permittees]
- Semivolatile organic compounds (SVOCs) [contaminant of concern in the LDW]

- Polycholrinated biphenyls (PCBs) [contaminant of concern in the LDW]
- Dioxins [contaminant of concern in the LDW]
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) [contaminant of concern in the LDW]

Additional monitoring parameters (turbidity, pH, and oil sheen) are required by the NPDES Industrial Stormwater General Permit for all industries; however, these parameters were not listed as contaminants of concern in the LDW or are not commonly used for determining pollutant removal performance; thus, data for these parameters were not requested from the vendors. Specific industrial groups are also required to collect additional monitoring parameters (ammonia total as nitrogen, biochemical oxygen demand [BOD<sub>5</sub>], chemical oxygen demand [COD], nitrate/nitrite as nitrogen, and additional metals); however, since these parameters are not required for multiple industries and were not listed as contaminants of concern in the LDW, they were not included as part of this literature review.

Information compiled for each technology was summarized on a two-page Technology Summary Sheets that provides a picture or diagram of each system, and a consistent framework for presenting data on system design, treatment performance, installation costs, O&M costs, and the number of installations in Washington. In addition, more detailed product brochures, drawings, specifications, and O&M information that were obtained from the vendors for each technology were compiled for reference within this document.

#### 3.0 Results

Using the methods identified in the previous section, a total of 91 passive and 18 active systems were identified for possible use in treating industrial or municipal stormwater for the contaminants of concern in sediments within the LDW. Tables 1 and 2 identify these passive and active systems, respectively, with their associated treatment subcategories and vendor contact information. The Technology Summary Sheets that were prepared for each system are provided in Appendix A. The appendix includes a divider to separate information for passive and active systems; the Technology Summary sheets for individual systems are then organized alphabetically by system name.

Information presented in the Technology Summary Sheets was derived in part from questionnaire responses from the vendors for each system (see description of questionnaires in *Methods* section). Questionnaire responses were received from vendors for 58 percent of the passive systems and 67 percent of the active systems; these questionnaire responses are documented in Appendix B. The appendix includes a divider to separate information for passive and active systems; questionnaire responses for individual systems are then organized alphabetically by system name.

When no questionnaire response was obtained from a vendor for a specific treatment system, efforts were made to obtain the required information for this report based on a review of publically available information on that system from the vendor. Limited information was obtained through these reviews for 15 percent of the passive systems and 11 percent of the active system. Publically available product information (e.g., brochures, drawings, specifications, and O&M information) for all the treatment systems identified in Tables 1 and 2 has been compiled in Appendix C (provided electronically on CD). The appendix includes a divider to separate information for passive and active systems; product information for individual systems is then organized alphabetically by system name.

In addition to the appendices described above, the following summary tables are provided in the main body of this report to facilitate rapid comparisons of different treatment system attributes:

- Table 3. Treatment system removal performance for total metals.
- Table 4. Treatment system removal performance for dissolved metals.
- Table 5. Treatment system removal performance for TSS.
- Table 6.Treatment system removal performance for total petroleum hydrocarbons and<br/>oil and grease.
- Table 7.
   Treatment system removal performance for total phosphorus.
- Table 8.Treatment system removal performance for SVOCs, PCBs, dioxins, and<br/>cPAHs.

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- Table 9.
   Design information for passive systems.
- Table 10. Design information for active systems.
- Table 11. Installation and annual operation and maintenance costs for passive treatment systems.
- Table 12. Installation and annual operation and maintenance costs for active treatment systems.

The information contained in Tables 3 through 12 has also been compiled in a separate Microsoft Excel® file to allow rapid sorting and review of the system treatment attributes; this file is designated Appendix D to this document and is provided electronically on CD.

In reviewing the aforementioned tables and appendices, it is important to note that most of the associated data were supplied by the treatment system vendors and have not been verified by an independent third-party. In a few select cases, independent verification of some treatment system attributes has occurred through TAPE and/or NJCAT. System attributes that are verified through TAPE may include removal performance for basic (TSS), enhanced (dissolved metals), phosphorus, and oil treatment. Typical system maintenance schedules are also verified through TAPE. NJCAT only verifies removal performance for TSS. Neither program verifies installation and annual operation and maintenance costs. The specific treatment systems that have been verified through TAPE and/or NJCAT are identified in Table 13. More detailed information on the systems that have been verified through TAPE is available through Ecology's website for emerging stormwater treatment technologies:

http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html. Detailed information on treatment systems that have been verified through NJCAT may also be obtained through the following website for the State of New Jersey Department of Environmental Protection: http://www.njstormwater.org/treatment.html.

## 4.0 Discussion

This section provides guidance on the appropriate application(s) for each general category of treatment technology, identifies logistical issues for monitoring performance, identifies key data gaps in our understanding of treatment system performance, and recommends future research to fill these data gaps.

#### 4.1 Treatment Technology Applications

In general, land use in drainage basins to the LDW is predominantly industrial, although there are some limited areas of mixed residential/commercial land use in adjacent neighborhoods (e.g., South Park and Georgetown). Because industrial areas in the LDW are largely built-out (i.e., all the available space is either paved or occupied by buildings), many of the non-proprietary stormwater treatment technologies identified in the *Stormwater Management Manual for Western Washington* (Ecology 2005) are impractical due to their large aboveground footprint. Instead, proprietary treatment technologies that have been specifically designed for retrofit applications will generally be more useful for treating the contaminants of concern in the LDW. To overcome the numerous design restraints in built-out environments, these systems are typically designed to have a small footprint, have low head-loss requirements, and are easily scalable. Because of these attributes, these technologies can be more easily installed in a variety of sites and applications.

The most common treatment applications in industrial areas are the treatment of roof runoff (e.g., for treatment of zinc from galvanized metal roofs) or the treatment of stormwater from pollution generating impervious surfaces at the inlet to the storm drain system or at end-of-pipe. Pumping and treating groundwater, though not technically stormwater, is also a common application in industrial areas. A large variety of treatment technologies is generally available for these applications, including both passive and active systems. In general, passive treatment systems are less expensive to install, operate, and maintain than active systems; however, they typically do not provide as high a level of treatment in comparison to active systems. For the same level of treatment, a passive system usually occupies more space than an active system. The higher level of treatment achieved by active systems typically involves a multi-step process to optimize performance; due to this increased complexity, active systems often require a higher level of operator knowledge and have increased O&M costs.

Description of the most common treatment applications for the general treatment technology categories defined in this report are provided below. Table 14 also identifies common treatment applications for the specific treatment systems that are identified in Tables 1 and 2.

#### 4.1.1 Passive Treatment

1. *Biofiltration/Filtration* – Bioretention systems (e.g., rain gardens) have been shown to achieve a high level of pollutant removal (Davis et al. 2009; Hsieh and

Davis 2005). Manufacturers have taken this technology and adapted it to the ultraurban environment. These systems have a relatively small footprint and in general are not easily scalable. The majority of bioretention systems are easy to maintain. Bioretention systems are most commonly used to treat stormwater from pollution generating impervious surfaces either at the inlet to the storm drain system or at the end-of-pipe.

- 2. Drain Inlet Insert These systems are small devices that occupy a catch basin or are inserted into the inlet of a storm drain. Because they are not scalable and occupy existing inlets, it is difficult to correctly size these technologies. They are relatively inexpensive, require minimal head loss, and need to be distributed throughout the site to treat large areas. Drain inserts are most commonly used to treat stormwater from pollution generating impervious surfaces at the inlet to the storm drain system; however, some of these systems are also configured to treat roof runoff.
- 3. Hydrodynamic Separation These devices can treat high flows in a very small footprint. Maintenance is similar to standard catch basin cleaning. Because these systems are not filters, they do not target dissolved pollutants and, in general, cannot remove fine silt and clay sized particles (Kim and Sansalone 2008). Hydrodynamic separators require minimal head loss. Hydrodynamic separation systems are most commonly used to treat stormwater from pollution generating impervious surfaces at end-of-pipe.
- 4. *Media Filtration* Media filters are scalable systems that require head loss (varies from system to system) to drive the water through the filter media. They achieve a relatively high level of treatment for dissolved and particulate pollutants (Geosyntec and Wright Water 2008) but are generally more expensive to maintain than other passive treatment types. Media filtration systems are most commonly used to treat stormwater from pollution generating impervious surfaces either at the inlet to the storm drain system or at the end-of-pipe.
- 5. *Oil/Water Separators* These systems target hydrocarbons with simple baffle technologies. They do not target other pollutants but are effective at reducing high concentrations of hydrocarbons and can provide some limited TSS and metals removal via sedimentation. These systems are most commonly used to treat stormwater from pollution generating impervious surfaces at the inlet to the storm drain system.

#### 4.1.2 Active Treatment

1. *Chemical Filtration* – Media filtration is more effective if the average particle size in the stormwater is large. Chemical filtration entails the addition of a flocculent to the stormwater prior to filtration in order to enhance the filtration process. Because the large particles cannot penetrate the media, surface occlusion is an

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issue. Many systems use a backflush device to prevent surface occlusion. As with most active treatment devices, water is pumped into these systems and thus head loss restrictions are not an issue. In addition, most active treatment systems are above ground installations and consequently require a large footprint on the site (though less than conventional stormwater ponds). Chemical filtration systems can be used to treat stormwater from pollution generating impervious surfaces at end-of-pipe using a pump system; they are also commonly used to treat contaminated groundwater.

- 2. *Chemical Treatment* To target specific analytes, these technologies are simple devices that add a chemical to the influent stormwater. Chemical treatment systems can be used to treat stormwater from pollution generating impervious surfaces at end-of-pipe using a pump system; they are also commonly used to treat contaminated groundwater.
- 3. *Electrocoagulation* This technology applies a charge to the influent stream to generate flocculation. The device then settles or filters the floc to generate a clean waste stream. Removal of settled floc is a required and frequent maintenance procedure. This is an effective treatment method that can target dissolved and particulate pollutants, though operation and maintenance can be onerous. Electrocoagulation systems can be used to treat stormwater from pollution generating impervious surfaces at end-of-pipe using a pump system; they are also commonly used to treat contaminated groundwater.
- 4. *Filtration* Pressurized filtration enhances the filtration process by increasing the pressure of the water as it moves through the filter. The filtration process is usually followed by a backflushing process to clean the media. As with all system with a backflush, the collected solids must be removed on a regular basis. Filtration systems can be used to treat stormwater from pollution generating impervious surfaces at end-of-pipe using a pump system; they are also commonly used to treat contaminated groundwater.
- 5. *Ion Exchange* Ion exchange is a polishing step that specifically targets polar dissolved constituents. Pretreatment is required prior to ion exchange as suspended solids will clog the exchange columns. Ion exchange systems can be used to treat stormwater from pollution generating impervious surfaces at end-of-pipe using a pump system; they are also commonly used to treat contaminated groundwater.
- 6. *Reverse Osmosis* These systems are highly effective at removing dissolved contaminants. Using a pump, these systems can be used to treat stormwater from pollution generating impervious surfaces at end-of-pipe and contaminated groundwater. These systems also require pre-treatment as particulate matter can foul the ion selective membrane and reduce performance.

#### 4.2 Logistical Issues for Monitoring Treatment System Performance

In order to ensure that source control efforts in the LDW are effective, some monitoring of stormwater treatment system performance may be required pursuant to future permit requirements or other regulatory drivers. At a minimum, this monitoring would likely involve sampling to characterize contaminant concentrations in treatment system effluent to ensure they are below levels that could contribute to sediment recontamination in the LDW. Influent samples might also be required to determine the actual pollutant removal efficiency of the treatment system.

In general, the following logistical issues are frequently encountered when collecting samples to characterize influent and effluent contaminant concentrations for propriety treatment systems that are designed for retrofit applications:

- The conveyance system for stormwater entering and leaving the treatment system is below grade and not directly accessible; therefore, there is no convenient collection point for influent and/or effluent samples. This situation is most often encountered with systems that are designed to treat stormwater from pollution generating impervious surfaces at end-of-pipe (e.g., biofiltration/filtration, hydrodynamic separation, and media filtration systems).
- Effluent from the stormwater treatment system is discharged directly into a conveyance pipe containing water from another up-gradient source; therefore, it is difficult to obtain a representative effluent sample that is uncontaminated by this other source. This situation is most often encountered with systems that are designed to treat stormwater from pollution generating impervious surfaces at the inlet to the storm drain system (e.g., drain inlet inserts).
- The stormwater treatment system is configured in a manner that allows bypass water to mix directly with treated effluent; therefore, it is difficult to obtain a representative effluent sample that is not contaminated by the bypass water. This situation is frequently encountered with systems that are designed to treat stormwater from pollution generating impervious surfaces at the inlet to the storm drain system (e.g., drain inlet inserts) and at end-of-pipe (e.g., biofiltration/filtration, hydrodynamic separation, and media filtration systems).
- Influent enters the stormwater system as diffuse sheet flow; therefore, the flow is not sufficiently concentrated to facilitate collection of an influent sample. This situation is most often encountered with systems that are designed to treat stormwater from pollution generating impervious surfaces at the inlet to the storm drain system (e.g., drain inlet inserts).

It is often possible to identify sampling procedures to overcome these logistical issues. For example, in situations where there is no convenient collection point for effluent samples at the direct outlet for a treatment system, it is often possible to collect samples at a downgradient access point in the stormwater conveyance system if no additional stormwater inputs have occurred from sources other than the treatment system. However, these sampling strategies typically need to be worked out on a case-by-case basis given the wide variety of treatment system configurations that exist and unique attributes of the stormwater conveyance system at any given monitoring site. Given this consideration, it is not practical to offer generalized sampling strategies to overcome the logistical issues for monitoring that are identified above.

#### 4.3 Data Gaps

Although there are many stormwater treatment technology options, not all of them have been rigorously field tested. This is primarily due to the fact that field testing is expensive and many government agencies do not require field data to approve systems for use in their jurisdictions. Table 13 presents those systems which have gone through the TAPE or TARP field testing process, but even for these rigorously tested systems, there exists a lack of data related to the removal of toxic pollutants. Specifically, few have been tested for any metals besides copper and zinc, SVOCs, PCBs, dioxins, and cPAHs removal. This data gap exists for a number of reasons:

- 1. Removal of these toxics from stormwater is not the primary concern for the majority of the market.
- 2. Collection and analysis of these parameters is expensive.
- 3. Influent concentrations are highly variable, and thus achieving target reduction goals consistently is difficult.

The lack of rigorous field or laboratory testing by independent third parties is another major data gap that needs to be addressed before informed decisions can be made regarding selection of proprietary stormwater treatment systems. There is an obvious conflict of interest when companies test their own products and report the results as fact. In order to address this issue, many more jurisdictions have begun to require third-party verified data to support the performance claims of treatment technology vendors. Still others have been establishing their own verification protocols because the existing protocols (e.g., TAPE and TARP), do not address issues which can be locally important. For instance, TAPE and TARP do not require long-term monitoring to assess system performance over time, or maintenance past the 1- to 2-year time scale. Stormwater managers in Oregon have identified this as a data gap and have begun the process of establishing a monitoring protocol for long-term maintenance and system lifecycle assessments. However, until this monitoring protocol begins to produce results, the long-term performance of these systems and lifecycle expectations will remain a data gap.

#### 4.4 Recommended Future Research

Though there any many treatment technologies on the market, few have been rigorously tested under variable field conditions. Even fewer have been subjected to long-term testing to quantify system lifecycles and long-term O&M requirements. It is recommended that more of these studies be conducted by third party entities so that objective results are available for a wide variety of systems. This is a difficult prospect for treatment technology manufacturers because of their rapid research and development timelines and the large investment required for long-term studies. Due to this consideration, local jurisdictions and/or Industrial Stormwater permittees may need to take on this monitoring themselves in order to reach more informed decisions on which treatment technologies are appropriate and effective for various stormwater treatment applications. As mentioned above, stormwater managers in Oregon have already initiated this process. In Washington, the Port of Seattle also has a long history of monitoring stormwater treatment system performance, including various downspout media filter configurations and oyster shell augmented filtration swales.

Though rigorous field studies exist for a select few treatment technologies, these studies have primarily addressed metals, nutrients, and solids removal. Very little data exist for the removal of toxic pollutants. It is recommended that future studies analyze other metals in addition to copper and zinc (e.g., mercury, cadmium, and chromium), SVOCs, PCBs, dioxins, and cPAHs. Such studies would need to occur in industrial areas because treatment cannot be verified unless influent concentrations are elevated. Alternatively, because of the expense and difficulty of conducting studies of toxics in stormwater, research on toxic pollutant affinity for various particle sizes could be conducted. Such a study would segregate and analyze various particle size fractions for concentrations of SVOCs, PCBs, dioxins, and cPAHs. This approach has been used by researchers to relate metals to particle size classes (Ran et al. 2000; Ranville et al. 1999); a similar approach could be used here for toxic organic chemicals. Once a relationship between particle size and pollutant concentration is developed, removal of various particle size categories by treatment technologies can be used as a proxy for removal of difficult-to-measure toxics.

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#### **FIGURES AND TABLES**

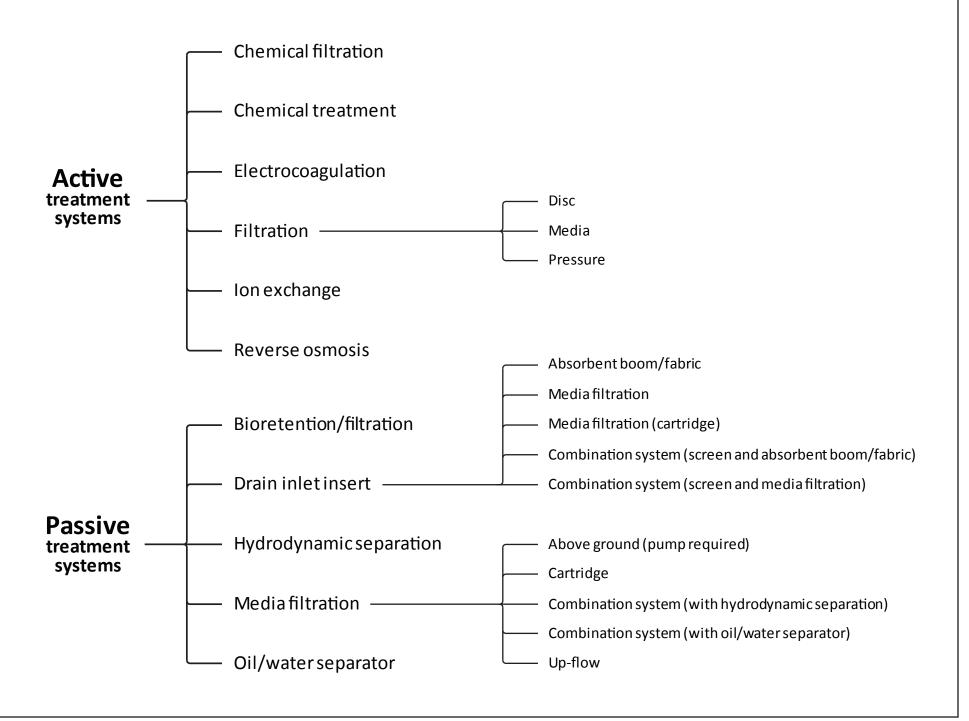


Figure 1. Treatment type categories for active and passive treatment systems.

Treatment Type	Treatment System Name	Manufacturer/Vendor Name	Website	Contact Phone No.
Bioretention/Filtration				
	Filterra® Curb Inlet System	Filterra, DBAAmericast, Inc.	www.filterra.com	877-345-1450
	Filterra® Roof Drain System	Filterra, DBAAmericast, Inc.	www.filterra.com	877-345-1450
	Modular Wetland System – Linear	Modular Wetland Systems, Inc./BioClean Environmental Services, Inc.	www.biocleanenvironmental.com	760-433-7640
	Silva Cell	DeepRoot Partners	www.deeproot.com	800 458 7668
	TREEPOD® Biofilter	Kristar Enterprises, Inc.	www.kristar.com	800-579-8819
	UrbanGreen BioFilter	CONTECH Stormwater Solutions Inc.	www.contech-cpi.com	800-548-4667
Drain Inlet Insert				
Absorbent Boom/Fabric	ADsorb-It	Eco-Tec, Inc.	www.adsorb-it.com	888-668-8982
	Enviro-Drain®	Enviro-Drain, Inc.	www.enviro-drain.com	206-363-0316
	EnviroSafe <sup>™</sup> Storm Safe HF10	Transpo Industries, Inc.	www.transpo.com	503-674-9180
	Ultra-Urban Filter <sup>™</sup>	Abtech Industries	abtechindustries.com	480-874-4000
Media Filtration	EcoVault™ Baffle Box	EcoSense International	www.ecosenseint.com	321-449-0324
	EnviroSafe <sup>TM</sup>	Transpo Industries, Inc.	www.transpo.com	503-674-9180
	HUBER Hydro Filt	Huber Technology, Inc.	www.huber-technology.com	425-392-0491
	Hydro-Kleen <sup>™</sup>	ACF Environmental, Inc.	www.acfenvironmental.com	800-448-3636
	Raynfiltr <sup>TM</sup>	Environmental Filtration, Inc.	www.raynfiltr.org	800-333-5234
Media Filtration (Cartridge)	StormBasin™	Fabco Industries, Inc.	www.fabco-industries.com	631-393-6024
Wedia Philadoli (Caltridge)	StormPod <sup>TM</sup>	Fabco Industries, Inc.	www.fabco-industries.com	631-393-6024
	Storini ou	Revel Environmental Manufacturing, Inc./CONTECH Stormwater Solutions		031-373-0024
	Triton Drop Inlet Insert	Inc.	www.contech-cpi.com	800-548-4667
Combination System (Screen and Absorbent	Bio Clean Curb Inlet Basket	BioClean Environmental Services, Inc.	www.biocleanenvironmental.com	760-433-7640
Boom/Fabric)	Bio Clean Downspout Filter	BioClean Environmental Services, Inc.	www.biocleanenvironmental.com	760-433-7640
,	Bio Clean Flume Filter	BioClean Environmental Services, Inc.	www.biocleanenvironmental.com	760-433-7640
	Bio Clean Grate Inlet Skimmer Box	BioClean Environmental Services, Inc.	www.biocleanenvironmental.com	760-433-7640
	Bio Clean Trench Drain Filter	BioClean Environmental Services, Inc.	www.biocleanenvironmental.com	760-433-7640
	Clean Way Downspout Filtration Unit	Clean Way	www.cleanwayusa.com	800-723-1373
	DrainPac <sup>™</sup>	United Storm Water, Inc.	www.unitedstormwater.com	877-71-STORM
	EnviroTrap Catch Basin Insert	Environment 21	www.ENV21.com	800-809-2801
	FloGard® Downspout Filter	Kristar Enterprises, Inc.	www.kristar.com	800-579-8819
	FloGard® LoPro Matrix Filter	Kristar Enterprises, Inc.	www.kristar.com	800-579-8819
	FloGard® LoPro Trench Drain Filter	Kristar Enterprises, Inc.	www.kristar.com	800-579-8819
	FloGard+PLUS®	Kristar Enterprises, Inc.	www.kristar.com	800-579-8819
	FloGard® Trash & Debris Guard	Kristar Enterprises, Inc.	www.kristar.com	800-579-8819
	Inceptor®	Stormdrain Solutions	www.stormdrains.com	877-OUR-PIPE
	StormClean Catch Basin Insert	Clean Way	www.cleanwayusa.com	800-723-1373
	StormClean Curb Inlet Insert	Clean Way	www.cleanwayusa.com	800-723-1373
	StormClean Wall Mount Filtration Unit	Clean Way	www.cleanwayusa.com	800-723-1373
	Storm PURE <sup>TM</sup>	Nyloplast/Hancor, Inc.	www.hancor.com	253-255-6302
	SwaleGard® Pre-filter	Kristar Enterprises, Inc.	www.kristar.com	800-579-8819
Combination Statem (Courses and Mad'	Aqua-Guardian™ Catch Basin Insert	AquaShieldTM, Inc.	www.aquashieldinc.com	888-344-9044
Combination System (Screen and Media	ClearWater BMP		-	800-758-8817
Filtration)		ClearWater Solutions, Inc.	www.clearwaterbmp.com	
	Coanda Curb Inlet Filter	Coanda, Inc.	www.coanda.com	714-389-2113
	Coanda Downspout Filter	Coanda, Inc.	www.coanda.com	714-389-2113

#### Table 1. Passive treatment systems that could be used to treat industrial stormwater in the Lower Duwamish basin.

Гreatment Туре	Treatment System Name	Manufacturer/Vendor Name	Website	<b>Contact Phone No.</b>
Drain Inlet Inserts (cont.)				
	RSF (Rapid Stormwater Filtration) 100	EcoSol Wastewater Filtration Systems	www.ecosol.com.au	+61 8 8262 2528 (Australia)
	RSF (Rapid Stormwater Filtration) 1000	EcoSol Wastewater Filtration Systems	www.ecosol.com.au	+61 8 8262 2528 (Australia)
	RSF (Rapid Stormwater Filtration) 4000	EcoSol Wastewater Filtration Systems	www.ecosol.com.au	+61 8 8262 2528 (Australia)
Iydrodynamic Separation				
	Aqua-Swirl Concentrator	AquaShieldTM, Inc.	www.aquashieldinc.com	888-344-9044
	BaySeparator®	BaySaver Technologies, Inc.	www.BaySaver.com	301-829-6470
	CDS <sup>TM</sup> Stormwater Treatment System	CONTECH Stormwater Solutions Inc.	www.contech-cpi.com	800-548-4667
	Downstream Defender	Hydro International, Inc.	www.hydro-international.biz	207-756-6200
	FloGard® Dual-Vortex Hydrodynamic Separator	Kristar Enterprises, Inc.	www.kristar.com	800-579-8819
	HydroGuard	Hydroworks	www.hydroworks.com	888-290-7900
	Nutrient Separating Baffle Box	BioClean Environmental Services, Inc.	www.biocleanenvironmental.com	760-433-7640
	Stormceptor®	Imbrium Systems Corp	www.imbriumsystems.com	503-706-6193
	StormTrooper®	Park USA	www.park-usa.com	888-611-PARK
	StormTrooper® EX Extra-Duty	Park USA	www.park-usa.com	888-611-PARK
	Terre Kleen <sup>TM</sup>	Terre Hill Concrete Products	www.terrehill.com	800-242-1509
	UniScreen	Environment 21	www.ENV21.com	800-809-2801
	UniStorm	Environment 21	www.ENV21.com	800-809-2801
	V2B1 Treatment System	Environment 21	www.ENV21.com	800-809-2801
	Vortechs System	CONTECH Stormwater Solutions Inc.	www.contech-cpi.com	800-548-4667
	vorteens bystem	configuration solutions inc.	www.concen-epi.com	000-540-4007
Media Filtration				
Above ground (pump required)	Aquip® Enhanced Stormwater Filtration System	StormwateRx	www.stormwaterx.com	503-233-4660
Cartridge	BayFilter®	BaySaver Technologies, Inc.	www.BaySaver.com	301-829-6470
	EcoSense <sup>™</sup> Stormwater Filtration Systems	EcoSense International	www.ecosenseint.com	321-449-0324
	Perk Filter <sup>TM</sup>	Kristar Enterprises, Inc.	www.kristar.com	800-579-8819
	PuriStorm	Environment 21	www.ENV21.com	800-809-2801
	Sorbtive <sup>™</sup> FILTER	Imbrium Systems Corp	www.imbriumsystems.com	503-706-6193
	Stormfilter using ZPG Media	CONTECH Stormwater Solutions Inc.	www.contech-cpi.com	800-548-4667
	StormSafe <sup>™</sup> Helix	Fabco Industries, Inc.	www.fabco-industries.com	631-393-6024
and Filter	Perimeter Sandfilter (Delaware Sandfilter)	Rotondo Environmental Solutions, LLC	www.rotondo-es.com	703-212-4830
	Underground Sandfilter (DC Sandfilter)	Rotondo Environmental Solutions, LLC	www.rotondo-es.com	703-212-4830
Combination System	Aqua-Filter System	AquaShieldTM, Inc.	www.aquashieldinc.com	888-344-9044
with Hydrodynamic Separation)	ecoStorm + ecoStorm Plus®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	www.watertectonics.com	866-402-2298
	Go-Filter	AquaShieldTM, Inc.	www.aquashieldinc.com	888-344-9044
	60-1 iidi		พ พ พ .aquasmetume.com	000-344-2044
Combination System	CrystalCombo Hybrid Polisher	CrystalStream Technologies	http://crystalstream.com	800-748-6945
with Oil/Water Separator)	HydroFilter	Hydroworks	www.hydroworks.com	888-290-7900
Jp-Flow	Bio Clean Water Polisher	BioClean Environmental Services, Inc.	www.biocleanenvironmental.com	760-433-7640
2h-1 10 M	Jellyfish <sup>TM</sup> Filter	Imbrium Systems Corp	www.inbriumsystems.com	503-706-6193
	-		-	
	Up-Flo <sup>TM</sup> Filter	Hydro International, Inc.	www.hydro-international.biz	207-756-6200

#### Table 1. Passive treatment systems that could be used to treat industrial stormwater in the Lower Duwamish basin.

Treatment Type	Treatment System Name	Manufacturer/Vendor Name	Website	Contact Phone No.
Oil/Water Separator				
	ADS® Water Quality Unit	Advanced Drainage Systems, Inc	www.adspipe.com	800-821-6710
	BioSTORM	Bio-Microbics, Inc.	www.biomicrobics.com	800-753-3278
	Clara® Gravity Stormwater Separator Vault	StormwateRx	www.stormwaterx.com	503-233-4660
	CrystalClean Separator	CrystalStream Technologies	http://crystalstream.com	800-748-6945
	ecoLine A®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	www.watertectonics.com	866-402-2298
	ecoLine B®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	www.watertectonics.com	866-402-2298
	ecoSep®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	www.watertectonics.com	866-402-2298
	ecoTop®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	www.watertectonics.com	866-402-2298
	First Flush 1640FF	ABT, Inc.	www.abtdrains.com	800-438-6057
	Hancor Storm Water Quality Unit	Hancor, Inc.	www.hancor.com	253-255-6302
	Kleerwater <sup>TM</sup>	Brown-Minneapolis Tank Co./Kleerwater Technologies, LLC	www.kleerwater.net	800-999-TANK (8265)
	PSI Separator	PSI International, Inc.	www.psinternational.com	605-332-1885
	SNOUT®	Nyloplast/Hancor, Inc.	www.hancor.com	253-255-6302
	VortClarex	CONTECH Stormwater Solutions Inc.	www.contech-cpi.com	800-548-4667

#### Table 1. Passive treatment systems that could be used to treat industrial stormwater in the Lower Duwamish basin

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Treatment Type	Treatment System Name	Manufacturer/Vendor Name	Website	Contact Phone No.
Chemical Filtration				
	Baker Tank with Sand Filter	BakerCorp	www.bakercorp.com	425-347-8811
	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>TM</sup>	Clear Creek Systems	www.clearcreeksystems.com	661-979-2525
	Purus® Stormwater Polishing System	StormwateRx	www.stormwaterx.com	503-233-4660
Chemical Treatment				
	ACISTBox® pHATBox® Wetsep	Water Tectonics, Inc. Water Tectonics, Inc. Waste & Environmental Technologies Ltd.	www.watertectonics.com www.watertectonics.com http://wetsep.com	866-402-2298 866-402-2298 (65) 64560040
Electrocoagulation				
	High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System	Kaselco OilTrap Environmental	www.kaselco.com www.oiltrap.com	361-594-3327 360-943-6495
	Redbox WaveIonics <sup>TM</sup>	Morselt Borne BV Water Tectonics, Inc.	www.morselt.com www.watertectonics.com	317-449-0324 866-402-2298
Filtration				
Disc	Arkal Filter (Spin Klin System)	Arkal Filtration Systems/PEP (U.S. Distributor)	www.arkal-filters.com	(972)-4-6775140 (Israel)
Media	Fuzzy Filter WaterTrak Pressurized Media Filter WaterTrak Ultrafiltration	Schreiber Aquatech Aquatech	www.aquatech.com www.aquatech.com	724-746-5300 724-746-5300
Pressure	Arkal Media Filter	Arkal Filtration Systems/PEP (U.S. Distributor)	www.arkal-filters.com	(972)-4-6775140 (Israel)
Ion Exchange				
	Wastewater Ion Exchange System (WWIX)	Siemens Water Technologies Inc.	www.siemens.com	860-593-2063
	WaterTrak Ion Exchange	Aquatech	www.aquatech.com	724-746-5300
Reverse Osmosis				
	WaterTrak Reverse Osmosis	Aquatech	www.aquatech.com	724-746-5300

#### Table 2. Active treatment systems that could be used to treat industrial stormwater in the Lower Duwamish basin.

11-05046-003 Tables 1 & 2 - Passive and Active systems list.xls

Herrera Environmental Consultants

			Total Coppe	er		Total Lead	l		Total Zinc		
		Median	Median		Median	Median		Median	Median		
		Influent	Effluent	Median	Influent	Effluent	Median	Influent	Effluent	Median	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	Notes
Passive Treatment Technologies											
Bioretention/Filtration											
	Filterra® Curb Inlet System	0.0081	0.0034	54%	NA	NA	NA	0.384	0.102	56%	
	Filterra® Roof Drain System	0.0081	0.0034	54%	NA	NA	NA	0.384	0.102	56%	
	Modular Wetland System – Linear	0.04	NA	>50%	NA	NA	NA	0.24	NA	>79%	
	Silva Cell	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	TREEPOD® Biofilter	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	UrbanGreen BioFilter	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Drain Inlet Insert											
Absorbent Boom/Fabric	ADsorb-It	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Enviro-Drain®	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	EnviroSafe <sup>TM</sup> Storm Safe HF10	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Ultra-Urban Filter™	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Media Filtration	EcoVault™ Baffle Box	NT A	NT A	NT A	NI A	NT A	NA	NI A	NA	NT A	
Media Filtration	Ecovault <sup>M</sup> Balle Box EnviroSafe <sup>TM</sup>	NA ND	NA ND	NA ND	NA ND	NA ND		NA ND	NA ND	NA ND	
	HUBER Hydro Filt	ND	ND ND	ND ND	ND	ND ND	ND	ND ND	ND	ND	
	HUBER Hydro Filt Hydro-Kleen™	ND	ND ND	ND ND	ND	ND ND	ND ND	ND ND	ND	ND	
	Raynfiltr <sup>TM</sup>	NA	ND	NA	ND NA	NA	ND NA	ND NA	ND	ND	
	Kayınnu	INA	NA	INA	NA	INA	INA	INA	NA	NA	
Media Filtration (Cartridge)	StormBasin <sup>™</sup>	NA	NA	NA	0.018	0.0049	73%	0.335	0.175	48%	
	StormPod <sup>TM</sup>	NA	NA	NA	0.018	0.0049	73%	0.335	0.175	48%	
	Triton Drop Inlet Insert	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Combination System (Screen and Absorbent	Bio Clean Curb Inlet Basket	NA	NA	NA	NA	NA	NA	24.3	10.4	79%	Units reported by vendor appear to be anomalous
Boom/Fabric)	Bio Clean Downspout Filter	NA	NA	76%	NA	NA	96%	NA	NA	69%	
	Bio Clean Flume Filter	NA	NA	NA	NA	NA	17%	NA	NA	NA	
	Bio Clean Grate Inlet Skimmer Box	1.9	0.1	95%	1.5	0.2	87%	13.7	0.73	95%	Units reported by vendor appear to be anomalous
	Bio Clean Trench Drain Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Clean Way Downspout Filtration Unit	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	DrainPac <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	EnviroTrap Catch Basin Insert	0.08	0.07	00	0.70	0.69	1 4 07	0.2	0.24	2007	Testing is not complete for metals; therefore, these values are
	FloGard® Downspout Filter	0.08 NA	0.07 NA	9% NA	0.79 NA	0.68 NA	14% NA	0.3 10	0.24 6	20% 60%	estimated. Units reported by vendor appear to be anomalous
	FloGard® Downspout Filter	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	10 10	6	60% 60%	Units reported by vendor appear to be anomalous Units reported by vendor appear to be anomalous
	FloGard® LoPro Mainx Filter	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	10 10	6	60% 60%	Units reported by vendor appear to be anomalous Units reported by vendor appear to be anomalous
	FloGard+PLUS®	NA	NA	NA	NA	NA	NA NA	10	6	60%	Units reported by vendor appear to be anomalous
	FloGard® Trash & Debris Guard	NA	NA	NA	NA	NA	NA NA	NA	0 NA	00% NA	onno reported by vendor appear to be anomatous
	Inceptor®	ND	NA	NA ND	NA	NA	NA ND	NA	NA	NA	
	StormClean Catch Basin Insert	ND	ND	ND ND	ND	ND ND	ND ND	ND	ND	ND	
	StormClean Curb Inlet Insert	ND	ND	ND ND	ND	ND ND	ND ND	ND	ND	ND	
	StormClean Wall Mount Filtration Unit	ND	ND ND	ND	ND	ND	ND	ND	ND	ND	
	Storm PURE <sup>TM</sup>	ND	ND ND	ND	ND	ND	ND	ND	ND	ND	
	SwaleGard® Pre-filter	NA	NA	NA	NA	NA	NA	10	6		Units reported by vendor appear to be anomalous
			11/1	11/1		1117	11/1	10	0	00 /0	onto reported by vendor appear to be anomatous

# Table 3. Treatment removal performance for total metals.

			Total Coppe	er		Total Lead	1		Total Zinc	:	
		Median	Median		Median	Median		Median	Median		
		Influent	Effluent	Median	Influent	Effluent	Median	Influent	Effluent	Median	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	Notes
Drain Inlet Insert (continued)											
Combination System (Screen and Media	Aqua-Guardian <sup>™</sup> Catch Basin Insert	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Filtration)	ClearWater BMP	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Coanda Curb Inlet Filter	NA	NA	NA	NA	NA	NA	48	15	69%	Units reported by vendor appear to be anomalous
	Coanda Downspout Filter	NA	NA	NA	NA	NA	NA	48	15	69%	Units reported by vendor appear to be anomalous
	RSF (Rapid Stormwater Filtration) 100	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 4000	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hydrodynamic Separation											
ily di odynamic Separation	Aqua Shield Aqua-Swirl Concentrator	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	BaySeparator®	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	CDS <sup>™</sup> Stormwater Treatment System	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Downstream Defender	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	FloGard® Dual-Vortex Hydrodynamic Separator	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	HydroGuard	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Nutrient Separating Baffle Box	0.017	0.01	41%	0.014	0.0065	54%	0.088	0.038	57%	
	Stormceptor®	NA	NA	NA	NA	0.0005 NA	NA	0.088 NA	0.058 NA	NA	
	StormTrooper®	ND	ND	NA	ND	NA	ND	ND	ND	NA	
	StormTrooper® EX Extra-Duty	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Terre Kleen <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Terre Ricent	ND	ND	ND	ND	ND	ND	ND	ND	ND	Testing is not complete for metals; therefore, these values are
	UniScreen	0.08	0.06	20%	0.79	0.56	27%	0.3	0.18	40%	estimated.
		0.00	0.00	2070	0.19	0.50	2770	0.5	0.10	1070	Testing is not complete for metals; therefore, these values are
	UniStorm	0.08	0.06	20%	0.79	0.56	27%	0.3	0.18	40%	estimated.
											Testing is not complete for metals; therefore, these values are
	V2B1 Treatment System	0.08	0.05	40%	0.79	0.35	55%	0.5	0.09	70%	estimated.
	Vortechs System	NA	NA	NA	NA	NA	NA	NA	NA	NA	
		_									
Media Filtration		0.152	0.000	040	0.02	0.000	700	0.425	0.0(1	050	
Above ground (pump required)	Aquip® Enhanced Stormwater Filtration System	0.152	0.008	94%	0.03	0.006	79%	0.425	0.061	85%	
Cartridge	BayFilter®	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	EcoSense <sup>TM</sup> Stormwater Filtration Systems	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Perk Filter <sup>™</sup>	0.052	0.02	62%	0.15	0.05	68%	0.25	0.1	61%	
	<b>D</b> 10										Testing is not complete for metals; therefore, these values are
	PuriStorm	0.08	0.04	50%	0.79	0.28	65%	0.5	0.06	80%	estimated.
	Sorbtive <sup>™</sup> FILTER	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Stormfilter using ZPG Media	0.04	0.03	47%	0.12	0.04	24%	0.23	0.13	62%	
	StormSafe <sup>™</sup> Helix	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Sand Filter	Perimeter Sandfilter (Delaware Sandfilter)	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Underground Sandfilter (DC Sandfilter)	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Combination System	Aqua Shield Aqua-Filter System	NA	NA	NA	NA	NA	NA	NA	NA	NA	
(with Hydrodynamic Separation)	ecoStorm + ecoStorm Plus®	0.019	0.009	53%	0.005	0.002	60%	0.17	0.073	57%	
( , , , , , , , , , , , , , , , , , , ,	Go-Filter	NA	NA	NA	NA	NA	NA	NA	0.075 NA	NA	
	50-1 mei	11/4		11/1			11/1	11/1		11/1	
Combination System	CrystalCombo Hybrid Polisher	ND	ND	ND	ND	ND	ND	ND	ND	ND	
(with Oil/Water Separator)	HydroFilter	ND	ND	ND	ND	ND	ND	ND	ND	ND	
			<b>.</b>				27.4				
Up-Flow	Bio Clean Water Polisher	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Jellyfish™ Filter	78	0.3	99%	35 ND	5 ND	86%	1.45	0.6	59%	Zinc concentrations are in mg/L.
	Up-Flo <sup>™</sup> Filter	ND	ND	ND	ND	ND	ND	ND	ND	ND	

			Total Coppe	r		Total Lead	l		Total Zinc		
		Median	Median		Median	Median		Median	Median		1
		Influent	Effluent	Median	Influent	Effluent	Median	Influent	Effluent	Median	
Freatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	Notes
Dil/Water Separator											
	ADS® Water Quality Unit	ND	ND	74%	ND	ND	74%	ND	ND		Information obtained from product literature
	BioSTORM	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Clara® Gravity Stormwater Separator Vault	0.516	0.078	29.5	0.088	0.072	25.8	2.82	1.21	32	
	CrystalClean Separator	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	ecoLine A®	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	ecoLine B®	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	ecoSep®	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	ecoTop®	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	First Flush 1640FF	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Hancor Storm Water Quality Unit	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Kleerwater <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	PSI Separator	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	SNOUT®	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	VortClarex	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Active Treatment Technologies											
Chemical Filtration											
	Baker Tank with Sand Filter	150	75	50%	500	200	40%	2500	1000	50%	Units reported by vendor appear to be anomalous
	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Purus® Stormwater Polishing System	NA	NA	NA	NA	NA	NA	0.28	0.083	86%	
Chemical Treatment											
	ACISTBox®	0.341	0.0179	95	0.25	0.05	80	2.12	1.04	51	
	pHATBox®	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Wetsep	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Electrocoagulation											
	High-Flo Electrocoagulation	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	OilTrap ElectroPulse Water Treatment System	12.1	0.072	99.4%	14.1	0.039	99.7%	151	0.34	99.9%	Units reported by vendor appear to be anomalous
	Redbox	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	WaveIonics <sup>TM</sup>	4.8	0.0074	100%	0.253	0.003	99%	0.516	0.0315	94%	
litration											
Disc	Arkal Filter (Spin Klin System)	ND	ND	ND	ND	ND	ND	ND	ND	99.9%	Information obtained from product literature
Media	Fuzzy Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	WaterTrak Pressurized Media Filter	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	WaterTrak Ultrafiltration	ND	ND	ND	ND	ND	ND	ND	ND	ND	
ressure	Arkal Media Filter	ND	ND	ND	ND	ND	ND	ND	ND	99.9%	Information obtained from product literature
Fricker and											
on Exchange	Wastawatar Jan Exchange System (WW/IV)	N A	NT A	NT A	NA	NT A	NT A	NT A	NT A	NA	
	Wastewater Ion Exchange System (WWIX)	NA	NA	NA	NA	NA	NA	NA	NA		
	WaterTrak Ion Exchange	ND	ND	ND	ND	ND	ND	ND	ND	ND	
leverse Osmosis											
	WaterTrak Reverse Osmosis	ND	ND	ND	ND	ND	ND	ND	ND	ND	

NA = not available; vendor filled out treatment system questionnaire, but did not provide all data

ND = no data; vendor did not fill out treatment system questionnaire

		I	Dissolved Cop	per		Dissolved Le	ad		Dissolved Zin	nc
		Median	Median	-	Median	Median		Median	Median	
		Influent	Effluent	Median	Influent	Effluent	Median	Influent	Effluent	Mediar
Treatment Type	Treatment System Name	( <b>mg/L</b> )	( <b>mg/L</b> )	Removal (%)	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (
Passive Treatment Technologies										
Bioretention/Filtration										
	Filterra® Curb Inlet System	0.0056	0.0033	44%	NA	NA	NA	0.194	0.082	54%
	Filterra® Roof Drain System	0.0056	0.0033	44%	NA	NA	NA	0.194	0.082	54%
	Modular Wetland System – Linear	0.757	0.0552	93%	0.543	0.1	81%	0.95	0.185	80%
	Silva Cell	NA	NA	90%	NA	NA	NA	NA	NA	90%
	TREEPOD® Biofilter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	UrbanGreen BioFilter	NA	NA	NA	NA	NA	NA	NA	NA	NA
Drain Inlet Insert										
Absorbent Boom/Fabric	ADsorb-It	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Enviro-Drain®	ND	ND	ND	ND	ND	ND	ND	ND	ND
1	EnviroSafe <sup>TM</sup> Storm Safe HF10	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Ultra-Urban Filter™	NA	NA	NA	NA	NA	NA	NA	NA	NA
Media Filtration	EcoVault™ Baffle Box	NA	NA	NA	NA	NA	NA	NA	NA	NA
	EnviroSafe <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND
	HUBER Hydro Filt	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hydro-Kleen <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Raynfiltr <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA
Media Filtration (Cartridge)	StormBasin™	NA	NA	NA	NA	NA	NA	NA	NA	NA
(Caranage)	StormPod <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Triton Drop Inlet Insert	NA	NA	NA	NA	NA	NA	NA	NA	NA
Combination System (Screen and Absorbent	Bio Clean Curb Inlet Basket	NA	NA	NA	NA	NA	NA	NA	NA	NA
Boom/Fabric)	Bio Clean Downspout Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bio Clean Flume Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bio Clean Grate Inlet Skimmer Box	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bio Clean Trench Drain Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Clean Way Downspout Filtration Unit	ND	ND	ND	ND	ND	ND	ND	ND	ND
		ND	ND	ND	ND	ND	ND	ND	ND	ND
	EnviroTrap Catch Basin Insert	NA	NA	NA	NA	NA	NA	NA	NA	NA
	FloGard® Downspout Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	FloGard® LoPro Matrix Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	FloGard® LoPro Trench Drain Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	FloGard+PLUS®	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	FloGard® Trash & Debris Guard	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Inceptor®	ND	ND	ND	ND	ND	ND	ND	ND	ND
	StormClean Catch Basin Insert	ND	ND	ND	ND	ND	ND	ND	ND	ND
1	StormClean Curb Inlet Insert	ND	ND	ND	ND	ND	ND	ND	ND	ND
	StormClean Wall Mount Filtration Unit	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Storm PURE <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND
	SwaleGard® Pre-filter	NA	NA	NA	NA	NA	ND NA	NA	ND	NA
			INA	11/4	11/2	INA	INA	1174	INA	INA

# Table 4. Treatment removal performance for dissolved metals.

edian	
oval (%)	Notes
54%	
54%	
30%	
00%	
NA	
NA	
NA	
ND	
ND	
NA	
NA	
ND	
ND	
ND	
NA	
NA	
NA	
NA	
NA	
ND	
ND	
NA	
ND	
NA	

		I	Dissolved Cop	per		Dissolved Lea	ad		Dissolved Zin	ıc	
		Median	Median		Median	Median		Median	Median		
		Influent	Effluent	Median	Influent	Effluent	Median	Influent	Effluent	Median	
Treatment Type	Treatment System Name	(mg/L)	( <b>mg/L</b> )	Removal (%)	(mg/L)	(mg/L)	Removal (%)	( <b>mg/L</b> )	(mg/L)	Removal (%)	Notes
Drain Inlet Insert (cont)											
Combination System (Screen and Media	Aqua-Guardian™ Catch Basin Insert	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Filtration)	ClearWater BMP	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Coanda Curb Inlet Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Coanda Downspout Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	RSF (Rapid Stormwater Filtration) 100	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 4000	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hydrodynamic Separation											
	Aqua Shield Aqua-Swirl Concentrator	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	BaySeparator®	ND	ND	42%	ND	ND	ND	ND	ND	38%	Information obtained from product literature
	CDS <sup>TM</sup> Stormwater Treatment System	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Downstream Defender	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	FloGard® Dual-Vortex Hydrodynamic Separator	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	HydroGuard	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Nutrient Separating Baffle Box	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Stormceptor®	NA	NA	28%	NA	NA	42%	NA	NA	35%	
	StormTrooper®	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	StormTrooper® EX Extra-Duty	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Terre Kleen <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	UniScreen	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	UniStorm	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	V2B1 Treatment System	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Vortechs System	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Media Filtration											
Above ground (pump required)	Aquip® Enhanced Stormwater Filtration System	0.084	0.006	93%	0.008	0.007	51%	0.196	0.06	73%	
Cartridge	BayFilter®	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Cartridge	EcoSense <sup>TM</sup> Stormwater Filtration Systems	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Perk Filter <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	PuriStorm	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Sorbtive <sup>TM</sup> FILTER	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Stormfilter using ZPG Media	0.0046	0.0042	11%	NA	NA	NA	0.060	0.053	15%	
	StormSafe™ Helix	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Sand Filter	Perimeter Sandfilter (Delaware Sandfilter)	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Sand Filter	Underground Sandfilter (Delaware Sandfilter)	ND ND	ND ND	ND ND	ND ND	ND ND	ND ND	ND ND	ND ND	ND ND	
Combination System	Aqua Shield Aqua-Filter System	NA	NA	NA	NA	NA	NA	NA	NA	NA	
(with Hydrodynamic Separation)	ecoStorm + ecoStorm Plus®	NA	NA	NA	NA	NA	NA	0.066	0.042	36%	
	Go-Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Combination System	CrystalCombo Hybrid Polisher	ND	ND	ND	ND	ND	ND	ND	ND	ND	
(with Oil/Water Separator)	HydroFilter	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Up-Flow	Bio Clean Water Polisher	0.57	0.12	79%	0.38	0.01	98%	0.75	0.16	78%	
op 110w	Jellyfish <sup>TM</sup> Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Up-Flo™ Filter	ND	ND	ND	ND	ND	ND	ND	ND	ND	

			Dissolved Cop	per		Dissolved Le	ad		Dissolved Zi	nc
1		Median	Median		Median	Median		Median	Median	
1		Influent	Effluent	Median	Influent	Effluent	Median	Influent	Effluent	Media
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal
Oil/Water Separator										
I	ADS® Water Quality Unit	ND	ND	74%	ND	ND	74%	ND	ND	74%
	BioSTORM	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Clara® Gravity Stormwater Separator Vault	NA	NA	NA	NA	NA	NA	NA	NA	NA
	CrystalClean Separator	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ecoLine A®	NA	NA	NA	NA	NA	NA	NA	NA	NA
	ecoLine B®	NA	NA	NA	NA	NA	NA	NA	NA	NA
	ecoSep®	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ecoTop®	ND	ND	ND	ND	ND	ND	ND	ND	ND
	First Flush 1640FF	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Hancor Storm Water Quality Unit	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Kleerwater <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA
	PSI Separator	ND	ND	ND	ND	ND	ND	ND	ND	ND
	SNOUT®	ND	ND	ND	ND	ND	ND	ND	ND	ND
1	VortClarex	NA	NA	NA	NA	NA	NA	NA	NA	NA
1										
Active Treatment Technologies										
Chemical Filtration										
I	Baker Tank with Sand Filter	20	10	50%	40	20	50%	400	40	90%
	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Purus® Stormwater Polishing System	NA	NA	NA	NA	NA	NA	0.06	0.0074	88%
Chemical Treatment										
	ACISTBox®	NA	NA	NA	NA	NA	NA	0.817	0.744	9%
	pHATBox®	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Wetsep	0.007	0.001	86%	0.018	< 0.001	94%	NA	NA	NA
Electrocoagulation										
U U	High-Flo Electrocoagulation	NA	NA	NA	NA	NA	NA	NA	NA	NA
	OilTrap ElectroPulse Water Treatment System	8.2	0.072	99%	10.9	0.039	100%	78.6	0.34	99.99
	Redbox	NA	NA	99%	NA	NA	99%	NA	NA	99%
	WaveIonics <sup>TM</sup>	0.0235	0.005	79%	0.0157	0.0031	80%	0.12	0.02	83%
Filtration										
Disc	Arkal Filter (Spin Klin System)	ND	ND	ND	ND	ND	ND	ND	ND	ND
			nD		110	ΠD			ΠD	ND
Media	Fuzzy Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	WaterTrak Pressurized Media Filter	ND	ND	ND	ND	ND	ND	ND	ND	ND
	WaterTrak Ultrafiltration	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pressure	Arkal Media Filter	ND	ND	ND	ND	ND	ND	ND	ND	ND
1105010			ND		ND	ND	IND	nD	ND	IND
Ion Exchange										
	Wastewater Ion Exchange System (WWIX)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	WaterTrak Ion Exchange	ND	ND	ND	ND	ND	ND	ND	ND	ND
Reverse Osmosis										
	WaterTrak Reverse Osmosis	ND	ND	ND	ND	ND	ND	ND	ND	ND

NA = not available; vendor filled out treatment system questionnaire, but did not provide all data

ND = no data; vendor did not fill out treatment system questionnaire

dian	
al (%)	Notes
	Information obtained from product literature
A	
A	
D	
A	
A	
D	
D	
A	
D	
A	
D	
D	
A	
%	Units reported by vendor appear to be anomalous
A	entes reported by vendor appear to be anonatous
%	
, -	
%	
A	
A	Zinc concentrations are in mg/L.
A	
9%	
%	
%	
D	
A	
D	
D	
D	
D	
A	
A D	
5	
D	

		Total S	uspended Sol	ids (TSS)	
		Median	Median	. /	1
		Influent	Effluent	Median	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	Notes
Passive Treatment Technologies					·
Bioretention/Filtration					
	Filterra® Curb Inlet System	27.5	4.2	85%	
	Filterra® Roof Drain System	27.5	4.2	85%	
	Modular Wetland System – Linear	270	3	98%	
	Silva Cell	NA	NA	80%	
	TREEPOD® Biofilter	NA	NA	NA	
	UrbanGreen BioFilter	NA	NA	NA	
Drain Inlet Insert					
Absorbent Boom/Fabric	ADsorb-It	V	V	80-99%	
	Enviro-Drain®	ND	ND	ND	
	EnviroSafe <sup>TM</sup> Storm Safe HF10	ND	ND	ND	
	Ultra-Urban Filter™	NA	NA	80%	mm range.
		1111	1 12 1		
Media Filtration	EcoVault <sup>™</sup> Baffle Box	NA	NA	NA	
	EnviroSafe™	ND	ND	ND	
	HUBER Hydro Filt	ND	ND	ND	
	Hydro-Kleen <sup>TM</sup>	ND	ND	ND	
	Raynfiltr <sup>TM</sup>	NA	NA	NA	
Media Filtration (Cartridge)	StormBasin <sup>TM</sup>	112	3	98%	
	StormPod <sup>™</sup>	112	3	98%	
	Triton Drop Inlet Insert	NA	NA	NA	
Combination System (Screen and Absorber	nt				*Mass Delance was used for the Sugranded Solid- Detection Test - 14 - 5
Boom/Fabric)	Bio Clean Curb Inlet Basket	NA	NA	93%*	*Mass Balance was used for the Suspended Solids Retention Test and therefore Sand gradation was used for the testing.
	Bio Clean Downspout Filter	NA	NA	93%*	*Mass Balance was used for the Suspended Solids Retention Test and therefore
	Bio Cican Downspout Filter	INA	INA		Sand gradation was used for the testing.
	Bio Clean Flume Filter	73	51.6	29%	
1	Bio Clean Grate Inlet Skimmer Box	978	329	66%	Units reported by vendor appear to be anomalous
1	Bio Clean Trench Drain Filter	NA	NA	NA	
	Clean Way Downspout Filtration Unit	ND	ND	ND	
	DrainPac <sup>TM</sup>	ND	ND	ND	
	EnviroTrap Catch Basin Insert	250	175	30%	The TSS removal efficiency is also dependent upon the Particle Size Distribu a d50 of 180 microns was used.
	FloGard® Downspout Filter	100	20	80%	
	FloGard® LoPro Matrix Filter	100	20	80%	
	FloGard® LoPro Trench Drain Filter	100	20	80%	
	FloGard+PLUS®	100	20	80%	
	FloGard® Trash & Debris Guard	NA	NA	NA	
	Inceptor®	ND	ND	ND	
	StormClean Catch Basin Insert	ND	ND	ND	
	StormClean Curb Inlet Insert	ND	ND	ND	
	StormClean Wall Mount Filtration Unit	ND	ND	ND	
	Storm PURE <sup>TM</sup>	ND	ND	ND	
	SwaleGard® Pre-filter	100	ND 20	ND 80%	
Combination System (Screen and Madia	Aqua-Guardian <sup>™</sup> Catch Basin Insert	43	5	80%	
Combination System (Screen and Media	ClearWater BMP	45 ND	ND	80% ND	

# Table 5. Treatment removal performance for total suspended solids.

herefore mg/L and number of samples does not apply. An OK-90 herefore mg/L and number of samples does not apply. An OK-90

istribution (PSD). For this product, the assumption of a PSD with

			uspended Sol	ids (TSS)	1
		Median	Median		
		Influent	Effluent	Median	
Treatment Type Drain Inlet Insert (cont.)	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	Notes
	Coanda Curb Inlet Filter	1,500	1,376	8%	Units reported by vendor appear to be anomalous
Combination System (Screen and Media Filtration)			1,376	8% 8%	
Filtration)	Coanda Downspout Filter	1,500			Units reported by vendor appear to be anomalous
	RSF (Rapid Stormwater Filtration) 100	ND	ND	65%	Information obtained from product literature
	RSF (Rapid Stormwater Filtration) 1000	ND	ND	49%	Information obtained from product literature
	RSF (Rapid Stormwater Filtration) 4000	ND	ND	91%	Information obtained from product literature
Hydrodynamic Separation					
	Aqua Shield Aqua-Swirl Concentrator	137	12	86%	
	BaySeparator®	ND	ND	80%	Information obtained from product literature
	CDS <sup>TM</sup> Stormwater Treatment System	154	26	95%	
	Downstream Defender	ND	ND	50%	Information obtained from product literature
	FloGard® Dual-Vortex Hydrodynamic Separator	202	80	60%	
	HydroGuard	ND	ND	70%	Information obtained from product literature
	Nutrient Separating Baffle Box	366	48	87%	r
	Stormceptor®	159	59	53%	
	StormTrooper®	ND	ND	ND	
	StormTrooper® EX Extra-Duty	ND	ND	ND	
	Terre Kleen <sup>TM</sup>	ND	ND	78%	Information obtained from product literature
		ND	ND	1070	The TSS removal efficiency is also dependent upon the Particle Size Dist
	UniScreen	250	175	80%	a d50 of 110 microns was used.
		200	175	0070	The TSS removal efficiency is also dependent upon the Particle Size Dist
	UniStorm	250	175	80%	a d50 of 110 microns was used.
	V2B1 Treatment System	ND	ND	63.8%	Information obtained from product literature
	Vortechs System	108	28	93%	L L L L L L L L L L L L L L L L L L L
Media Filtration					
		20	2.20	0.2 %	
Above ground (pump required)	Aquip® Enhanced Stormwater Filtration System	30	3.39	83%	
				00.7	
Cartridge	BayFilter®	ND	ND	80%	Information obtained from product literature
	EcoSense™ Stormwater Filtration Systems	NA	NA	NA	
	Perk Filter <sup>TM</sup>	70	11	82%	
	PuriStorm	250	175	0.00	The TSS removal efficiency is also dependent upon the Particle Size Dist
1		250	175	80%	a d50 of 60 microns was used.
	Sorbtive <sup>TM</sup> FILTER	ND	ND	84%	Information obtained from product literature
	Stormfilter using ZPG Media	83	23	82%	
	StormSafe <sup>™</sup> Helix	NA	NA	NA	
Sand Filter	Perimeter Sandfilter (Delaware Sandfilter)	ND	ND	ND	
	Underground Sandfilter (DC Sandfilter)	ND	ND	ND	
	onderground sandrifter (DC sandrifter)		ND	ND	
Combination System	Aqua Shield Aqua-Filter System	43	5	80%	
(with Hydrodynamic Separation)	ecoStorm + ecoStorm Plus®	200	26	87%	
	Go-Filter	NA	NA	NA	
Combination System	CrystalCombo Hybrid Polisher	ND	ND	ND	
(with Oil/Water Separator)	HydroFilter	ND	ND	ND	
Up-Flow	Bio Clean Water Polisher	84.6	12.4	85%	
	Jellyfish <sup>™</sup> Filter	74	8	89%	
1	Up-Flo <sup>™</sup> Filter	ND	ND	91%	Information obtained from product literature

Distribution (PSD). For this product, the assumption of a PSD with Distribution (PSD). For this product, the assumption of a PSD with

Distribution (PSD). For this product, the assumption of a PSD with

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[			1 1 1 9 1		
			Suspended Sol	ids (TSS)	
		Median	Median	Madian	
Treatment Trung	Treatment System Name	Influent	Effluent	Median	Natar
Treatment Type Oil/Water Separator	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	Notes
Oil/ water Separator	ADS@ Water Quality Unit	ND	ND	80%	Information obtained from meduat literature
	ADS® Water Quality Unit BioSTORM	ND 227	ND 7.9	80% 95.3%	Information obtained from product literature
	Clara® Gravity Stormwater Separator Vault	284.5 ND	173.5	47% ND	
	CrystalClean Separator ecoLine A®	ND	ND NA	ND	
			NA		
	ecoLine B®	NA	NA	NA	
	ecoSep®	ND	ND	ND	
	ecoTop®	ND	ND	ND	
	First Flush 1640FF	NA	NA	NA	
	Hancor Storm Water Quality Unit	ND	ND	ND	
	Kleerwater <sup>™</sup>	NA	NA	NA	
	PSI Separator	ND	ND	ND	
	SNOUT®	ND	ND	ND	
	VortClarex	NA	NA	NA	
Active Treatment Technologies					
Chemical Filtration					
	Baker Tank with Sand Filter	200	10	95%	
	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup>	NA	NA	NA	
	Purus® Stormwater Polishing System	NA	NA	NA	
Chemical Treatment					
	ACISTBox®	NA	NA	NA	
	pHATBox®	NA	NA	NA	
	Wetsep	112	<2	98%	
Electrocoagulation					
	High-Flo Electrocoagulation	NA	NA	NA	
	OilTrap ElectroPulse Water Treatment System	600	10	98%	Units reported by vendor appear to be anomalous
	Redbox	NA	NA	99%	
	WaveIonics <sup>TM</sup>	200	5	98%	
Filtration					
Disc	Arkal Filter (Spin Klin System)	ND	ND	ND	
Madia	Every Eilter	10	2	70.050	
Media	Fuzzy Filter WaterTrale Processized Madia Filter	10 ND	2 ND	70-95%	
	WaterTrak Pressurized Media Filter	ND	ND	ND	
	WaterTrak Ultrafiltration	ND	ND	ND	
Pressure	Arkal Media Filter	ND	ND	ND	
Ion Exchange					
	Wastewater Ion Exchange System (WWIX)	NA	NA	NA	
	WaterTrak Ion Exchange	ND	ND	ND	
Reverse Osmosis	WaterTrak Pavarea Comosia	ND	ND	ND	
mg/L = milligrams per liter	WaterTrak Reverse Osmosis	ND	ND	ND	1

NA = not available; vendor filled out treatment system questionnaire, but did not provide all data

ND = no data; vendor did not fill out treatment system questionnaire

V = varies

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			ТРН			Oil and Grea	se	
		Median	Median		Median	Median		
		Influent	Effluent	Median	Influent	Effluent	Median	
Treatment Type	Treatment System Name	( <b>mg/L</b> )	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	
Passive Treatment Technologies								
Bioretention/Filtration				a <b>-</b> ~			100	
	Filterra® Curb Inlet System	43.4	1.2	97%	6.2	5.0 U	>18%	
	Filterra® Roof Drain System	43.4	1.2	97%	6.2	5.0 U	>18%	
	Modular Wetland System – Linear	19	0	>99%	4	U	>99%	
	Silva Cell	NA	NA	NA	NA	NA	NA	
	TREEPOD® Biofilter	NA	NA	NA	NA	NA	NA	
	UrbanGreen BioFilter	NA	NA	NA	NA	NA	NA	
Drain Inlet Insert								
Absorbent Boom/Fabric	ADsorb-It	V	V	99-100%	V	V	99-100%	
	Enviro-Drain®	ND	ND	ND	ND	ND	ND	
	EnviroSafe <sup>™</sup> Storm Safe HF10	ND	ND	ND	ND	ND	ND	
	Ultra-Urban Filter <sup>TM</sup>	>100	<10	90%	>100	<10	85%	
Media Filtration	EcoVault™ Baffle Box	NA	NA	NA	NA	NA	NA	
	EnviroSafe <sup>TM</sup>	ND	ND	ND	ND	ND	ND	
	HUBER Hydro Filt	ND	ND	ND	ND	ND	ND	
	Hydro-Kleen <sup>TM</sup>	ND	ND	ND	ND	ND	ND	
	Raynfiltr <sup>TM</sup>	NA	NA	NA	NA	NA	NA	
Media Filtration (Cartridge)	StormBasin™	NA	NA	NA	59.5	<5	>90%	
	StormPod <sup>TM</sup>	NA	NA	NA	59.5	<5	>90%	
	Triton Drop Inlet Insert	NA	NA	NA	NA	NA	NA	
Combination System (Screen and Absorbent	Rio Clean Curb Inlat Rockat	NA	NA	NA	NA	NA	NA	
Boom/Fabric)	Bio Clean Downspout Filter	NA	NA	NA	223.5		NA 87%	Units reported by vendor app
	-					29.5 62	87% 83%	
	Bio Clean Flume Filter	223	29.5	87%	360			Units reported by vendor app
	Bio Clean Grate Inlet Skimmer Box	NA	NA	NA	189	10.43	95%	Units reported by vendor app
	Bio Clean Trench Drain Filter	NA	NA	NA	NA	NA	NA	
	Clean Way Downspout Filtration Unit	ND	ND	ND	ND	ND	ND	
	DrainPac <sup>™</sup> EnviroTrap Catch Basin Insert	ND 400	ND 150	ND 63%	ND 400	ND 150	ND 63%	Any oil based removal deper
	Enviro Trap Catch Basin Insert	400	150	03%	400	150	03%	accurate, analyzed data is un 0.89 are used. The removal
	FloGard® Downspout Filter	35	7	80%	35	7	80%	0.09 are used. The removal
	FloGard® LoPro Matrix Filter	35	, 7	80%	35	, 7	80%	
	FloGard® LoPro Trench Drain Filter	35	, 7	80%	35	, 7	80%	
	FloGard+PLUS®	35	, 7	80%	35	, 7	80%	
	FloGard® Trash & Debris Guard	NA	, NA	NA	NA	NA	NA	
	Inceptor®	ND	ND	ND	ND	ND	ND	
	StormClean Catch Basin Insert	ND	ND	ND	ND	ND	ND	
	StormClean Curb Inlet Insert	ND	ND	ND	ND	ND	ND	
	StormClean Wall Mount Filtration Unit	ND	ND	ND	ND	ND	ND	
	Storm PURE <sup>TM</sup>	ND ND	ND ND	ND	ND	ND	ND	
	SwaleGard® Pre-filter	35	ND 7	ND 80%	35	7	ND 80%	
	Swattalue I It-lift	35	1	0070	55	1	0070	

### Table 6. Treatment removal performance for total petroleum hydrocarbons and oil and grease.

Notes

appear to be anomalous appear to be anomalous appear to be anomalous

epends on the droplet size and specific gravity of the oil. For this product, s unavailable; therefore a mean oil droplet size of 100 micron and a spgr of val efficiencies are estimated.

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			TPH			Oil and Grea	nse	
		Median	Median		Median	Median		
True a frances for True a	Treestowert Cristian Name	Influent	Effluent	Median	Influent	Effluent	Median	
Treatment Type Drain Inlet Insert (cont)	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	
Combination System (Screen and Media	Aqua-Guardian™ Catch Basin Insert	NA	NA	NA	NA	NA	NA	
Filtration)	ClearWater BMP	NA	NA	NA	NA	NA	NA	
i numon)	Coanda Curb Inlet Filter	NA	NA	NA	NA	NA	NA	
	Coanda Downspout Filter	NA	NA	NA	NA	NA	NA	
	RSF (Rapid Stormwater Filtration) 100	ND	ND	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 1000	ND	ND	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 4000	ND	ND	ND	ND	ND	ND	
		112		T(D)			TIE .	
Hydrodynamic Separation	Aqua Shield Aqua-Swirl Concentrator	NA	NA	NA	NA	NA	NA	
	BaySeparator®	NA	NA	ND	NA	NA	NA 80%	Information obtained from pr
	CDS <sup>TM</sup> Stormwater Treatment System	NA	NA	NA	ND 22	5	64%	information obtained from pr
	Downstream Defender	NA	NA	NA	NA	NA	NA	
	FloGard® Dual-Vortex Hydrodynamic Separator	NA	NA	NA	NA	NA	NA	
	HydroGuard	ND	NA	NA	NA	NA	NA	
	-				4	ND	>99%	
	Nutrient Separating Baffle Box	NA 29	NA	NA 73%		ND NA	>99% NA	
	Stormceptor® StormTrooper®	ND	4 ND	73% ND	NA ND	NA ND	NA	
			ND ND					
	StormTrooper® EX Extra-Duty Terre Kleen™	ND	ND	ND	ND	ND	ND ND	
		ND	ND	ND	ND	ND		A
	UniScreen	400	150	63%	400	150	63%	Any oil based removal depen accurate, analyzed data is una 0.89 are used. The removal e
	UniStorm	400	150	63%	400	150	63%	Any oil based removal depen accurate, analyzed data is una
	V2B1 Treatment System	400	150	63%	400	150	63%	0.89 are used. The removal e Any oil based removal depen accurate, analyzed data is una
	Vortechs System	NA	NA	NA	NA	NA	NA	0.89 are used. The removal e
Media Filtration								
Above ground (pump required)	Aquip® Enhanced Stormwater Filtration System	NA	NA	NA	9.9	3	70%	
Cartridge	BayFilter®	ND	ND	ND	ND	ND	80%	Information obtained from pr
Cartridge	EcoSense <sup>™</sup> Stormwater Filtration Systems	NA	NA	NA	NA	NA	NA	information obtained from pr
	Perk Filter <sup>TM</sup>	20	5	75%	20	5	75%	
	PuriStorm	400	80	80%	400	80	80%	Any oil based removal depen accurate, analyzed data is una
								0.89 are used. The removal e
	Sorbtive™ FILTER	ND	ND	ND	ND	ND	ND	
	Stormfilter using ZPG Media	NA	NA	NA	NA	NA	NA	
	StormSafe <sup>™</sup> Helix	NA	NA	NA	NA	NA	NA	
Sand Filter	Perimeter Sandfilter (Delaware Sandfilter)	ND	ND	ND	ND	ND	ND	
	Underground Sandfilter (DC Sandfilter)	ND	ND	ND	ND	ND	ND	
Combination System	Aqua Shield Aqua-Filter System	NA	NA	NA	NA	NA	NA	
(with Hydrodynamic Separation)	ecoStorm + ecoStorm Plus®	NA	NA	NA	NA	NA	NA	
	Go-Filter	NA	NA	NA	NA	NA	NA	
Combination System	CrystalCombo Hybrid Polisher	ND	ND	ND	ND	ND	ND	
(with Oil/Water Separator)	HydroFilter	ND	ND ND	ND ND	ND ND	ND ND	ND	
	riyator nici	ND	ND	цр	ΝD	ND		
Up-Flow	Bio Clean Water Polisher	1.4	0	>99%	69.8	6.5	91%	
4								
	Jellyfish™ Filter	NA	NA	NA	NA	NA	NA	

Notes

product literature

pends on the droplet size and specific gravity of the oil. For this product, unavailable; therefore a mean oil droplet size of 100 micron and a spgr of al efficiencies are estimated.

pends on the droplet size and specific gravity of the oil. For this product, unavailable; therefore a mean oil droplet size of 100 micron and a spgr of al efficiencies are estimated.

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n product literature

pends on the droplet size and specific gravity of the oil. For this product, unavailable; therefore a mean oil droplet size of 100 micron and a spgr of al efficiencies are estimated.

			TPH			Oil and Grea	ise	
		Median	Median		Median	Median		
1		Influent	Effluent	Median	Influent	Effluent	Median	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	
Oil/Water Separator								
	ADS® Water Quality Unit	ND	ND	ND	ND	ND		Information obtained from pro
	BioSTORM	NA	NA	NA	NA	NA	NA	
	Clara® Gravity Stormwater Separator Vault	NA	NA	NA	NA	NA	NA	
1	CrystalClean Separator	ND	ND	ND	ND	ND	ND	
1	ecoLine A®	NA	NA	NA	NA	NA	NA	
	ecoLine B®	NA	NA	NA	NA	NA	NA	
1	ecoSep®	ND	ND	ND	ND	ND	ND	
	ecoTop®	ND	ND	ND	ND	ND	ND	
	First Flush 1640FF	NA	NA	NA	NA	NA	NA	
1	Hancor Storm Water Quality Unit	ND	ND	ND	ND	ND	ND	
1	Kleerwater <sup>TM</sup>	NA	NA	NA	NA	NA	NA	
1	PSI Separator	ND	ND	ND	ND	ND	ND	
1	SNOUT®	ND	ND	ND	ND	ND	ND	
	VortClarex	NA	NA	NA	NA	NA	NA	
Active Treatment Technologies								·
Chemical Filtration								
1	Baker Tank with Sand Filter	NA	NA	NA	NA	NA	NA	
1	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup>	NA	NA	NA	NA	NA	NA	
	Purus® Stormwater Polishing System	NA	NA	NA	NA	NA	NA	
Chemical Treatment								
	ACISTBox®	3.12	0.38	88%	NA	NA	NA	
	pHATBox®	NA	NA	NA	NA	NA	NA	
	Wetsep	NA	NA	NA	NA	NA	NA	
Electrocoagulation								
	High-Flo Electrocoagulation	NA	NA	NA	NA	NA	NA	
1	OilTrap ElectroPulse Water Treatment System	78	0.27	100%	136	<5.0	>96.3%	Units reported by vendor appe
1	Redbox	NA	NA	NA	NA	NA	NA	
	WaveIonics <sup>TM</sup>	45.6	0.25	99%	197	4.76	98%	Units reported by vendor appe
Filtration								
Disc	Arkal Filter (Spin Klin System)	ND	ND	ND	ND	ND	ND	
Media	Fuzzy Filter	NA	NA	NA	NA	NA	NA	
	WaterTrak Pressurized Media Filter	ND	ND	ND	ND	ND	ND	
	WaterTrak Ultrafiltration	ND	ND	ND	ND	ND	ND	
Pressure	Arkal Media Filter	ND	ND	ND	ND	ND	ND	
Ion Exchange								
	Wastewater Ion Exchange System (WWIX)	NA	NA	NA	NA	NA	NA	
	WaterTrak Ion Exchange	ND	ND	ND	ND	ND	ND	
Reverse Osmosis								
	WaterTrak Reverse Osmosis	ND	ND	ND	ND	ND	ND	<u> </u>

NA = not available; vendor filled out treatment system questionnaire, but did not provide all data

ND = no data; vendor did not fill out treatment system questionnaire

TPH = Total Petroleum Hydrocarbons

U = at or below detection limit

V = varies

Notes	
m product literature	
r appear to be anomalous	
r appear to be anomalous	

		Tot	al Phosphoru	s (TP)	
		Median	Median		
		Influent	Effluent	Median	
Treatment Type	Treatment System Name	( <b>mg/L</b> )	(mg/L)	Removal (%)	Notes
Passive Treatment Technologies					
Bioretention/Filtration					
	Filterra® Curb Inlet System	0.15	0.14	7%	during TAPE study. 69.5% efficiency ratio
	Filterra® Roof Drain System	0.15	0.14	7%	during TAPE study. 69.5% efficiency ratio
	Modular Wetland System – Linear	NA	NA	NA	
	Silva Cell	NA	NA	68%	
	TREEPOD® Biofilter	NA	NA	NA	
UrbanGreen BioFilter		NA	NA	NA	
Drain Inlet Insert					
Absorbent Boom/Fabric	ADsorb-It	NA	NA	NA	
	Enviro-Drain®	NA	NA	NA	
	EnviroSafe <sup>™</sup> Storm Safe HF10	NA	NA	NA	
	Ultra-Urban Filter™	NA	NA	NA	
Media Filtration	EcoVault™ Baffle Box	NA	NA	NA	
	EnviroSafe™	NA	NA	NA	
	HUBER Hydro Filt	ND	ND	ND	
	Hydro-Kleen <sup>TM</sup>	ND	ND	ND	
	Raynfiltr™	NA	NA	NA	
Media Filtration (Cartridge)	StormBasin <sup>TM</sup>	0.57	0.3	47%	
······································	StormPod <sup>TM</sup>	0.57	0.3	47%	
	Triton Drop Inlet Insert	NA	NA	NA	
Combination System (Screen and	Bio Clean Curb Inlet Basket	85.8	73.4	71-96%	anomalous
Absorbent Boom/Fabric)	Bio Clean Downspout Filter	NA	NA	NA	aionalous
	Bio Clean Flume Filter	NA	NA	NA	
	Bio Clean Grate Inlet Skimmer Box	18.6	0.452	98%	anomalous
	Bio Clean Trench Drain Filter	NA	0.452 NA	NA	uionulous
	Clean Way Downspout Filtration Unit	ND	NA	ND	
	DrainPac <sup>TM</sup>	ND ND	ND	ND	
	EnviroTrap Catch Basin Insert	ND ND	ND ND	ND	
	Enviro frap Catch Dasin filsen	ND	ND	ND	

# Table 7. Treatment removal performance for total phosphorus.

		Tot	al Phosphoru	s (TP)	
		Median	Median		
		Influent	Effluent	Median	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	Notes
Drain Inlet Insert (cont.)					
	FloGard® Downspout Filter	NA	NA	NA	
	FloGard <sup>®</sup> LoPro Matrix Filter	NA	NA	NA	
	FloGard® LoPro Trench Drain Filter	NA	NA	NA	
	FloGard+PLUS®	NA	NA	NA	
	FloGard® Trash & Debris Guard	NA	NA	NA	
	Inceptor®	ND	ND	ND	
	StormClean Catch Basin Insert	ND	ND	ND	
	StormClean Curb Inlet Insert	ND	ND	ND	
	StormClean Wall Mount Filtration Unit	ND	ND	ND	
	Storm PURE <sup>TM</sup>	ND	ND	ND	
	SwaleGard® Pre-filter	NA	NA	NA	
			27.4		
Combination System (Screen and Media	Aqua-Guardian <sup>™</sup> Catch Basin Insert	NA	NA	NA	
Filtration)	ClearWater BMP	ND	ND	ND	
	Coanda Curb Inlet Filter	NA	NA	NA	
Combination System (Screen and Media	Coanda Downspout Filter	NA	NA	NA	
Filtration)	RSF (Rapid Stormwater Filtration) 100	NA	NA	40%	
	RSF (Rapid Stormwater Filtration) 1000	NA	NA	30%	
	RSF (Rapid Stormwater Filtration) 4000	NA	NA	30%	
Hydrodynamic Separation					
	Aqua Shield Aqua-Swirl Concentrator	NA	NA	80%	
	BaySeparator®	NA	NA	19.4%	
	CDS <sup>™</sup> Stormwater Treatment System	NA	NA	NA	
	Downstream Defender	NA	NA	NA	
	FloGard® Dual-Vortex Hydrodynamic Separator	NA	NA	NA	
	HydroGuard	NA	NA	NA	
	Nutrient Separating Baffle Box	1.49	0.44	70%	
	Stormceptor®	0.275	0.175	21.8%	
	StormTrooper®	ND	ND	ND	
	StormTrooper® EX Extra-Duty	ND	ND	ND	
	Terre Kleen™	NA	NA	NA	
	UniScreen	ND	ND	ND	
	UniStorm	ND	ND	40%	Information obtained from product literature

		Tot	al Phosphoru	s (TP)	
		Median	Median		]
		Influent	Effluent	Median	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	Notes
Hydrodynamic Separation (cont)					
	V2B1 Treatment System	ND	ND	40%	Information obtained from product literature
	Vortechs System	NA	NA	NA	
Media Filtration					
Above ground (pump required)	Aquip® Enhanced Stormwater Filtration System	NA	NA	NA	
Cartridge	BayFilter®	NA	NA	>50%	
	EcoSense <sup>TM</sup> Stormwater Filtration Systems	NA	NA	NA	
	Perk Filter <sup>TM</sup>	NA	NA	NA	
	PuriStorm	ND	ND	ND	
	Sorbtive <sup>™</sup> FILTER	ND	ND	>77%	Information obtained from product literature
	Stormfilter using ZPG Media	NA	NA	NA	
	StormSafe <sup>™</sup> Helix	NA	NA	NA	
Sand Filter	Perimeter Sandfilter (Delaware Sandfilter)	ND	ND	ND	
	Underground Sandfilter (DC Sandfilter)	ND	ND	ND	
Combination System	Aqua Shield Aqua-Filter System	NA	NA	NA	
(with Hydrodynamic Separation)	ecoStorm + ecoStorm Plus®	NA	NA	NA	
	Go-Filter	NA	NA	NA	
Combination System	CrystalCombo Hybrid Polisher	ND	ND	ND	
(with Oil/Water Separator)	HydroFilter	ND	ND	ND	
Up-Flow	Bio Clean Water Polisher	2.07	0.63	70%	
	Jellyfish <sup>™</sup> Filter	NA	NA	50%	
	Up-Flo <sup>TM</sup> Filter	NA	NA	NA	
Oil/Water Separator					
	ADS® Water Quality Unit	NA	NA	>43%	
	BioSTORM	NA	NA	NA	
	Clara® Gravity Stormwater Separator Vault	NA	NA	NA	
	CrystalClean Separator	ND	ND	ND	
	ecoLine A®	NA	NA	NA	
	ecoLine B®	NA	NA	NA	

		Tot	al Phosphoru	s (TP)	
		Median	Median		
		Influent	Effluent	Median	
Treatment Type	Treatment System Name	(mg/L)	( <b>mg/L</b> )	Removal (%)	Notes
Oil/Water Separator (cont.)					
	ecoSep®	ND	ND	ND	
	ecoTop®	ND	ND	ND	
	First Flush 1640FF	NA	NA	NA	
	Hancor Storm Water Quality Unit	ND	ND	ND	
	Kleerwater <sup>TM</sup>	NA	NA	NA	
	PSI Separator	ND	ND	ND	
	SNOUT®	ND	ND	ND	
	VortClarex	NA	NA	NA	
Active Treatment Technologies	3				
Chemical Filtration					
	Baker Tank with Sand Filter	NA	NA	NA	
	Chitosan-Enhanced Sand Filtration Using				
	FlocClear <sup>TM</sup>	NA	NA	NA	
	Purus® Stormwater Polishing System	NA	NA	NA	
Chemical Treatment					
	ACISTBox®	NA	NA	NA	
	pHATBox®	NA	NA	NA	
	Wetsep	13.4	1.9	86%	
Electrocoagulation					
	High-Flo Electrocoagulation	NA	NA	NA	
	OilTrap ElectroPulse Water Treatment System	NA	NA	NA	
	Redbox	NA	NA	NA	
	WaveIonics <sup>TM</sup>	NA	NA	NA	
Filtration					
Disc	Arkal Filter (Spin Klin System)	NA	NA	NA	
Media	Fuzzy Filter	NA	NA	NA	
	WaterTrak Pressurized Media Filter	ND	ND	ND	
	WaterTrak Ultrafiltration	ND	ND	ND	
Pressure	Arkal Media Filter	NA	NA	NA	

		Tot	tal Phosphoru	s (TP)	
		Median	Median		
		Influent	Effluent	Median	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	Notes
Ion Exchange					
	Wastewater Ion Exchange System (WWIX)	NA	NA	NA	
	WaterTrak Ion Exchange	ND	ND	ND	
Reverse Osmosis					
	WaterTrak Reverse Osmosis	ND	ND	ND	

NA = not available; vendor filled out treatment system questionnaire, but did not provide all data

ND = no data; vendor did not fill out treatment system questionnaire

			SVOCs			PCBs			Dioxins	
Treatment Type	Treatment System Name	Median Influent (mg/L)	Median Effluent (mg/L)	Median Removal (%)	Median Influent (mg/L)	Median Effluent (mg/L)	Median Removal (%)	Median Influent (mg/L)	Median Effluent (mg/L)	Median Removal (%)
Passive Treatment Technologies		(	(	1101110 (111 (70)	(	(		(	(	100100 ( 10 ( 70 )
Bioretention/Filtration										
	Filterra® Curb Inlet System	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Filterra® Roof Drain System	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Modular Wetland System – Linear	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Silva Cell	NA	NA	NA	NA	NA	NA	NA	NA	NA
	TREEPOD® Biofilter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	UrbanGreen BioFilter	NA	NA	NA	NA	NA	NA	NA	NA	NA
Drain Inlet Insert										
Absorbent Boom/Fabric	ADsorb-It	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	Enviro-Drain®	ND	ND	ND	ND	ND	ND	ND	ND	ND
	EnviroSafe <sup>™</sup> Storm Safe HF10	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Ultra-Urban Filter <sup>™</sup>	180	>4.4	40%	NA	NA	NA	NA	NA	NA
Media Filtration	EcoVault <sup>™</sup> Baffle Box	NA	NA	NA	NA	NA	NA	NA	NA	NA
	EnviroSafe <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND
	HUBER Hydro Filt	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hydro-Kleen <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Raynfiltr <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA
Media Filtration (Cartridge)	StormBasin <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA
	StormPod <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Triton Drop Inlet Insert	NA	NA	NA	NA	NA	NA	NA	NA	NA
Combination System (Screen and	Bio Clean Curb Inlet Basket	NA	NA	NA	NA	NA	NA	NA	NA	NA
Absorbent Boom/Fabric)	Bio Clean Downspout Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bio Clean Flume Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bio Clean Grate Inlet Skimmer Box	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bio Clean Trench Drain Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Clean Way Downspout Filtration Unit	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DrainPac <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND
	EnviroTrap Catch Basin Insert	400	150	0.625	400	150	0.625	400	150	0.625
	FloGard® Downspout Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	FloGard® LoPro Matrix Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA
	FloGard® LoPro Trench Drain Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA

NA

ND

ND

ND

ND

ND

NA

NA

ND

NA

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NA

#### Table 8. Treatment removal performance for SVOCs, PCBs, dioxins, and CPAHs.

Filtration)

Combination System (Screen and Media

FloGard+PLUS®

Storm PURETM

ClearWater BMP

SwaleGard® Pre-filter

Coanda Curb Inlet Filter

Inceptor®

FloGard® Trash & Debris Guard

StormClean Catch Basin Insert

StormClean Wall Mount Filtration Unit

Aqua-Guardian<sup>TM</sup> Catch Basin Insert

StormClean Curb Inlet Insert

CPA	Hs	
Median	Median	
Influent	Remova	
(mg/L)	l (%)	Notes
(8)	- ( , , , )	110005
NA	NA	
NA	NA	
ND	ND	
ND	ND	
>100	605	Units reported by vendor appear to
2100	005	be anomalous
NA	NA	
ND	ND	
ND	ND	
ND	ND	
NA	NA	
ND	ND	
ND	ND	
400	63%	Any oil based removal depends on the droplet size and specific gravity
		of the oil. For this product,
		accurate, analyzed data is
		unavailable; therefore a mean oil
		droplet size of 100 micron and a
		spgr of 0.89 are used. The removal
25	70	efficiencies are estimated.
35	7% 7%	
35	7% 7%	
35	7% 7%	
35 NA	7%	
NA	NA	
ND	ND	
ND 35	ND 7%	
NA ND	NA ND	
NA	ND NA	
1117	INA	

			SVOCs			PCBs			Dioxins		CPA		
		Median	Median		Median	Median		Median	Median		Median	Median	
		Influent	Effluent	Median	Influent	Effluent	Median	Influent	Effluent	Median	Influent	Remova	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	(mg/L)	l (%)	Notes
Drain Inlet Insert (cont)		NT A	NT A	NT A	NT A	NT A	NT A	NT A	NT A	NT A	NT A	27.4	
	Coanda Downspout Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	RSF (Rapid Stormwater Filtration) 100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 4000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hydrodynamic Separation													
	Aqua Shield Aqua-Swirl Concentrator	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	BaySeparator®	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	CDS <sup>TM</sup> Stormwater Treatment System	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Downstream Defender	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	FloGard® Dual-Vortex Hydrodynamic Separator	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	HydroGuard	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Nutrient Separating Baffle Box	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Stormceptor®	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	StormTrooper®	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	StormTrooper® EX Extra-Duty	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Terre Kleen <sup>TM</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	UniScreen	400	150	63%	400	150	63%	400	150	63%	400	63%	Any oil based removal depends on
													the droplet size and specific gravity
													of the oil. For this product,
													accurate, analyzed data is
													unavailable; therefore a mean oil
													droplet size of 100 micron and a
													spgr of 0.89 are used. The removal
	11.0	100	150	()()	100	150	(0)	400	150	(0)	100	()()	efficiencies are estimated.
	UniStorm	400	150	63%	400	150	63%	400	150	63%	400	63%	Any oil based removal depends on
													the droplet size and specific gravity
													of the oil. For this product,
													accurate, analyzed data is
													unavailable; therefore a mean oil
													droplet size of 100 micron and a
													spgr of 0.89 are used. The removal
													efficiencies are estimated.
	V2B1 Treatment System	400	150	63%	400	150	63%	400	150	63%	400	63%	Any oil based removal depends on
													the droplet size and specific gravity
													of the oil. For this product,
													accurate, analyzed data is
													unavailable; therefore a mean oil
													droplet size of 100 micron and a
													spgr of 0.89 are used. The removal
													efficiencies are estimated.
	Vortechs System	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	efficiencies are estimated.
	vorteens system	1121	1471	14/1	1474	1471	1111	1171	1171	11/1	1471	INA	
Media Filtration													
Above ground (pump required)	Aquip® Enhanced Stormwater Filtration System	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Cartridge	BayFilter®	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Caruluge	•		ND NA	ND NA				ND NA	ND NA		ND NA		
	EcoSense <sup>TM</sup> Stormwater Filtration Systems	NA			NA	NA	NA			NA		NA 7507	
	Perk Filter <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	20	75%	Units reported by vendor appear to
													be anomalous
	PuriStorm	400	80	80%	400	80	80%	400	80	80%	400	80%	Any oil based removal depends on
													the droplet size and specific gravity
		1											of the oil. For this product,
													accurate, analyzed data is
													unavailable; therefore a mean oil
		1											droplet size of 100 micron and a
													spgr of 0.89 are used. The removal
													efficiencies are estimated.
													ernelencies are estimated.

1		SVOCs		PCBs			Dioxins			CPAHs			
		Median	Median		Median	Median		Median	Median		Median	Median	
		Influent	Effluent	Median	Influent	Effluent	Median	Influent	Effluent	Median	Influent	Remova	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)	(mg/L)	( <b>mg/L</b> )	Removal (%)	(mg/L)	(mg/L)	Removal (%)	(mg/L)	l (%)	Notes
Cartridge (cont'd)	Sorbtive <sup>TM</sup> FILTER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Stormfilter using ZPG Media	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.12	42%	
	StormSafe <sup>TM</sup> Helix	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Sand Filter	Perimeter Sandfilter (Delaware Sandfilter)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Underground Sandfilter (DC Sandfilter)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Combination System	Aqua Shield Aqua-Filter System	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
(with Hydrodynamic Separation)	ecoStorm + ecoStorm Plus®	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Go-Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
												1.1.1	
Combination System	CrystalCombo Hybrid Polisher	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
(with Oil/Water Separator) Up-Flow	HydroFilter	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Bio Clean Water Polisher	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Jellyfish™ Filter	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Up-Flo™ Filter	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Oil/Water Separator													
	ADS® Water Quality Unit	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1	BioSTORM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Clara® Gravity Stormwater Separator Vault	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	CrystalClean Separator												
	ecoLine A®	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1	ecoLine B®	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	ecoSep®												
1	ecoTop®												
	First Flush 1640FF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1	Hancor Storm Water Quality Unit												
1	Kleerwater <sup>TM</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	PSI Separator												
1	SNOUT®												
	VortClarex	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Active Treatment Technologies													
Chemical Filtration													
	Baker Tank with Sand Filter												
	Daker Fallk with Salid Filler	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Į		NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	
	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>TM</sup>	NA	NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	
				NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chemical Treatment	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup> Purus® Stormwater Polishing System	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	
Chemical Treatment	Chitosan-Enhanced Sand Filtration Using FlocClear™ Purus® Stormwater Polishing System ACISTBox®	NA NA 0.0199	NA NA 0.00002	NA NA 99.9%	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA 0.00028	NA NA 93%	
Chemical Treatment	Chitosan-Enhanced Sand Filtration Using FlocClear™ Purus® Stormwater Polishing System ACISTBox® pHATBox®	NA NA 0.0199 NA	NA NA 0.00002 NA	NA NA 99.9% NA	NA NA NA NA	NA NA NA	NA NA NA NA	NA NA NA NA	NA NA NA NA	NA NA NA NA	NA NA 0.00028 NA	NA NA 93% NA	
	Chitosan-Enhanced Sand Filtration Using FlocClear™ Purus® Stormwater Polishing System ACISTBox®	NA NA 0.0199	NA NA 0.00002	NA NA 99.9%	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA 0.00028	NA NA 93%	
Chemical Treatment Electrocoagulation	Chitosan-Enhanced Sand Filtration Using FlocClear™ Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep	NA NA 0.0199 NA NA	NA NA 0.00002 NA NA	NA NA 99.9% NA NA	NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA	NA NA NA NA NA	NA NA 0.00028 NA NA	NA NA 93% NA NA	
	Chitosan-Enhanced Sand Filtration Using FlocClear™ Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation	NA NA 0.0199 NA NA NA	NA NA 0.00002 NA NA NA	NA NA 99.9% NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA 0.00028 NA NA NA	NA NA 93% NA NA	
	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup> Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System	NA NA 0.0199 NA NA NA 28	NA NA 0.00002 NA NA NA 0.43	NA NA 99.9% NA NA 98.4%	NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA NA	NA NA 0.00028 NA NA NA	NA NA 93% NA NA NA	Units reported by vendor appear to
	Chitosan-Enhanced Sand Filtration Using FlocClear™ Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System Redbox	NA NA 0.0199 NA NA NA 28 NA	NA NA 0.00002 NA NA NA 0.43 NA	NA NA 99.9% NA NA 98.4% NA	NA NA NA NA NA NA	NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA NA NA	NA NA 0.00028 NA NA NA NA	NA NA 93% NA NA NA NA	Units reported by vendor appear to
	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup> Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System	NA NA 0.0199 NA NA NA 28	NA NA 0.00002 NA NA NA 0.43	NA NA 99.9% NA NA 98.4%	NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA NA	NA NA 0.00028 NA NA NA	NA NA 93% NA NA NA	Units reported by vendor appear to
Electrocoagulation	Chitosan-Enhanced Sand Filtration Using FlocClear™ Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System Redbox	NA NA 0.0199 NA NA NA 28 NA	NA NA NA NA 0.00002 NA NA 0.43 NA 0.00002	NA NA 99.9% NA NA 98.4% NA	NA NA NA NA NA NA	NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA NA NA	NA NA 0.00028 NA NA NA NA	NA NA 93% NA NA NA NA	Units reported by vendor appear to
	Chitosan-Enhanced Sand Filtration Using FlocClear™ Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System Redbox	NA NA 0.0199 NA NA NA 28 NA	NA NA 0.00002 NA NA NA 0.43 NA	NA NA 99.9% NA NA 98.4% NA	NA NA NA NA NA NA	NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA	NA NA NA NA NA NA NA NA	NA NA 0.00028 NA NA NA NA	NA NA 93% NA NA NA NA	Units reported by vendor appear to
Electrocoagulation Filtration Disc	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup> Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System Redbox WaveIonics <sup>™</sup> Arkal Filter (Spin Klin System)	NA NA 0.0199 NA NA 28 NA 2.34 ND	NA NA NA NA NA 0.43 NA 0.00002 ND	NA NA 99.9% NA NA 98.4% NA 100%	NA NA NA NA NA NA 0.0024	NA NA NA NA NA NA 0.00011	NA NA NA NA NA NA 95.5%	NA NA NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA NA	NA NA 0.00028 NA NA NA NA 0.091 ND	NA NA NA NA NA 99.98%	Units reported by vendor appear to
Electrocoagulation Filtration Disc	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup> Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System Redbox WaveIonics <sup>™</sup> Arkal Filter (Spin Klin System) Fuzzy Filter	NA NA 0.0199 NA NA 28 NA 2.34 ND NA	NA NA NA NA NA 0.43 NA 0.00002 ND NA	NA NA 99.9% NA NA 98.4% NA 100% ND NA	NA NA NA NA NA 0.0024 ND NA	NA NA NA NA NA NA 0.00011 ND NA	NA NA NA NA NA NA 95.5% ND NA	NA NA NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA NA NA	NA NA NA NA NA NA NA 0.091 ND NA	NA NA NA NA NA 99.98% ND NA	Units reported by vendor appear to
Electrocoagulation	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup> Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System Redbox WaveIonics <sup>™</sup> Arkal Filter (Spin Klin System) Fuzzy Filter WaterTrak Pressurized Media Filter	NA NA 0.0199 NA NA 28 NA 2.34 ND NA ND	NA NA NA NA NA 0.43 NA 0.00002 ND NA ND	NA NA 99.9% NA NA NA 98.4% NA 100% ND NA ND	NA NA NA NA NA NA 0.0024 ND NA ND	NA NA NA NA NA NA NA 0.00011	NA NA NA NA NA NA 95.5% ND NA ND	NA NA NA NA NA NA NA NA NA ND	NA NA NA NA NA NA NA NA NA NA ND	NA NA NA NA NA NA NA NA NA NA NA ND	NA NA NA NA NA NA NA NA 0.091 ND NA ND	NA NA NA NA NA NA 99.98% ND NA ND	Units reported by vendor appear to
Electrocoagulation Filtration Disc	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup> Purus® Stormwater Polishing System ACISTBox® pHATBox® Wetsep High-Flo Electrocoagulation OilTrap ElectroPulse Water Treatment System Redbox WaveIonics <sup>™</sup> Arkal Filter (Spin Klin System) Fuzzy Filter	NA NA 0.0199 NA NA 28 NA 2.34 ND NA	NA NA NA NA NA 0.43 NA 0.00002 ND NA	NA NA 99.9% NA NA 98.4% NA 100% ND NA	NA NA NA NA NA 0.0024 ND NA	NA NA NA NA NA NA 0.00011 ND NA	NA NA NA NA NA NA 95.5% ND NA	NA NA NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA NA NA	NA NA NA NA NA NA NA 0.091 ND NA	NA NA NA NA NA 99.98% ND NA	Units reported by vendor appear to

			SVOCs			PCBs	CBs		Dioxins		CPAHs		
		Median Influent	Median Effluent	Median	Median Influent	Median Effluent	Median	Median Influent	Median Effluent	Median	Median Influent	Median Remova	
Treatment Type	Treatment System Name	(mg/L)	(mg/L)	Removal (%)		(mg/L)	Removal (%)	(mg/L)	(mg/L)	Removal (%)	(mg/L)	l (%)	Notes
Ion Exchange													
	Wastewater Ion Exchange System (WWIX)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	WaterTrak Ion Exchange	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Reverse Osmosis													
	WaterTrak Reverse Osmosis	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

mg/L = milligrams per liter

NA = not available; vendor filled out treatment system questionnaire, but did not provide all data

ND = no data; vendor did not fill out treatment system questionnaire

PCBs = polychlorinated biphenyls

SVOCs = semivolatile organic compounds

#### System Footprint (sf) **Design Flow Rate (gpm) Required Head Loss (feet)** Internal or External Above High High High **Treatment System Name** Low Low Low Treatment Type Bypass G **Bioretention/Filtration** Filterra® Roofdrain System 8.5 72 2.5 2.5 >50 16 Internal/External Filterra® System 8.5 72 2.5 Internal/External >50 16 2.5 Modular Wetland System - Linear 22.4 120 84 2 4 16 Internal 20 in/hr NA Internal/External Silva Cell 3 in/hr NA NA NA TREEPOD® Biofilter 16 72 24 84 0 0.5 Internal UrbanGreen BioFilter 60 0 0 3 Internal/External 4 6 **Drain Inlet Insert** Absorbent Boom/Fabric Adsorb-It 80/SF 100/SF V V NA NA NA Enviro-Drain® 2 NA NA 71 0 0 NA EnviroSafe<sup>TM</sup> Storm Safe HF10 900 9000 0 0 NA NA External Ultra-Urban Filter<sup>™</sup> 190 500 0 0 0.5 1.5 Internal Media Filtration EcoVault<sup>TM</sup> Baffle Box 1,346 48,000 NA NA V V Internal/External EnviroSafe<sup>TM</sup> 115 230 0 0 NA NA External HUBER Hydro Filt ND ND 0 0 ND ND ND Hydro-Kleen<sup>™</sup> ND ND ND ND ND ND ND Raynfiltr<sup>TM</sup> 0 900 NA 0 0 NA NA Media Filtration (Cartridge) StormBasin<sup>TM</sup> 50 2.500 200 1.25 2.5 Internal/External 4 50 2.5 StormPod<sup>TM</sup> 2,500 1.25 Internal/External 4 200 100 0 NA Internal/External Triton Drop Inlet Insert 5,404 0 NA 381 0 Bio Clean Curb Inlet Basket 898 0 0.5 2 External Combination System (Screen and 1.57 CF Absorbent Boom/Fabric) Bio Clean Downspout Filter 249 1,145 0.31 CF 1 2 Internal Bio Clean Flume Filter 116 583 0.083 0.5 Internal/External 6 1 Bio Clean Grate Inlet Skimmer Box 224 8,980 0 0 0.5 2 Internal 28 12 Internal/External Bio Clean Trench Drain Filter 86 0 0 4 ND ND Clean Way Downspout Filtration Unit ND ND ND ND ND DrainPac<sup>™</sup> ND ND ND ND ND ND ND EnviroTrap Catch Basin Insert 0 2700 0.5 NA NA 0 NA FloGard® Downspout Filter 30 325 0.5 1.0 0.5 0 Internal FloGard® LoPro Matrix Filter 45 800 0.75 0.5 16 0 Internal 200 FloGard® LoPro Trench Drain Filter 500 0.25 1.0 20 0 Internal FloGard+PLUS® 100 2,000 0.25 1.0 10 0 Internal FloGard® Trash & Debris Guard 50 500 0.5 4 0 0.25 Internal ND ND ND ND Inceptor® ND ND ND ND ND ND StormClean Catch Basin Insert ND ND ND ND StormClean Curb Inlet Insert ND ND ND ND ND ND ND StormClean Wall Mount Filtration Unit ND ND ND ND ND ND ND Storm PURETM ND ND ND ND ND ND ND 100 SwaleGard® Pre-filter 800 4 16 0 0.5 Internal

### Table 9. System design information for passive treatment systems.

ove or Below	
Grade	Bypass Notes
Both	System footprint obtained from Western Washington
Dom	Engineering Design Assistance Kit
Both	System footprint obtained from Western Washington
Doui	Engineering Design Assistance Kit
Both	External bypass in some situations
Below	
Both	
Below	
Below	Per individual application
Below	Information obtained from product literature
Below	Information obtained from product literature
Below	r
Below	
Below	Information obtained from product literature
Below	mormation obtained nom product merature
Below	
Below	
D -1	
Below	
Below	
Below	
Below	
	Installed in catch basin - does not affect basin hydraulics
Above	High flow unimpeded - UPC approved and tested
Above	Internal bypass up to specific flow - configured to allow for
	high flow external bypass
Below	High flow rate
Below	Internal bypass up to specific flow - configured to allow for
	high flow external bypass
Above	
Below	
Below	
Above	
Below	
Below	
Below	
Above	
Below	
Above	

		Design Flow	v Rate (gpm)	System Fo	otprint (sf)	Required He	ad Loss (feet)	Internal or External	Above or Below	
Treatment Type	Treatment System Name	Low	High	Low	High	Low	High	Bypass	Grade	Bypass Notes
Drain Inlet Insert (cont)										
Combination System (Screen and	Aqua-Guardian™ Catch Basin Insert	5/400*	100/940*	NA	NA	0	0	Internal/External	Below	x/x = flow thru perlite/flow thru perlite + filter cloth
Media Filtration)	ClearWater BMP	200	200	5	6	NA	NA	External	Above	Information obtained from product literature
	Coanda Curb Inlet Filter	50	360,000	2	2000	1.5	3	Internal	Above	Optional internal bypass is provided.
	Coanda Downspout Filter	50	360,000	2	2000	1.5	3	Internal	Above	Optional internal bypass is provided.
	RSF (Rapid Stormwater Filtration) 100	1,784	7,000	0	0	0.5	0.5	Internal	Below	Information obtained from product literature
	RSF (Rapid Stormwater Filtration) 1000	12,000	18,162	0	0	0.5	0.5	Internal	Below	Information obtained from product literature
	RSF (Rapid Stormwater Filtration) 4000	837	68,270	0	0	0.5	0.5	Internal	Below	Information obtained from product literature
ydrodynamic Separation										
	Aqua Shield Aqua-Swirl Concentrator	100	2,600	NA	NA	0.25	0.25	Internal/External	Below	
	BaySeparator®	450	1,350	0	0	NA	NA	NA	Below	Information obtained from product literature
	CDS <sup>TM</sup> Stormwater Treatment System	20	44,900	NA	NA	0.1	0.1	Internal/External	Below	
	Downstream Defender	500	7,800	0	0	0.5	0.9	NA	Below	Information obtained from product literature
	FloGard® Dual-Vortex Hydrodynamic Separator	150	6,500	7	113	0	3	Internal	Below	
	HydroGuard	360	3,232	0	0	0	2	NA	Below	Information obtained from product literature
	Nutrient Separating Baffle Box	148	8,858	0	0	0	0	Internal	Below	External bypass in some situations
	Stormceptor®	0	11,000	NA	NA	0.22	0.22	Internal	Below	
	StormTrooper®	ND	ND	ND	ND	ND	ND	ND	Below	
	StormTrooper® EX Extra-Duty	ND	ND	ND	ND	ND	ND	ND	Below	
	Terre Kleen <sup>TM</sup>	1.5	100	0	0	NA	NA	Internal	Below	Information obtained from product literature
	UniScreen	0	15700	20	135	0	0.5	Both	Above	
	UniStorm	0	15700	20	135	0	0.5	Both	Above	
	V2B1 Treatment System	0	63000	20	800	0	0.5	Both	Above	
	Vortechs System	50	22,450	NA	NA	0.1	0.1	Internal/External	Below	
Iedia Filtration										
bove ground (pump required)	Aquip® Enhanced Stormwater Filtration System	10	350	14	320	4	7	External	Above	
artridge	BayFilter®	15	30	0	0	ND	ND	ND	Below	Information obtained from product literature
5	EcoSense <sup>TM</sup> Stormwater Filtration Systems	25	1,662	NA	NA	V	V	Internal	Below	Hooded
	Perk Filter <sup>TM</sup>	12	1,000	10	150	1.7	3.5	Internal	Below	
	PuriStorm	0	2000	9	600	0	0.5	Both	Above	
	Sorbtive <sup>™</sup> FILTER	ND	ND	ND	ND	ND	ND	ND	Below	
	Stormfilter using ZPG Media	2	44,900	8	6,050	1.8	12	Internal/External	Below	
	StormSafe <sup>™</sup> Helix	3	9	160	250	0	3	Internal/External	Below	
and Filter	Perimeter Sandfilter (Delaware Sandfilter)	ND	ND	ND	ND	ND	ND	ND	Below	
	Underground Sandfilter (DC Sandfilter)	ND	ND	ND	ND	ND	ND	ND	Below	

		Design Flov	v Rate (gpm)	System Fo	otprint (sf)	Required Hea	d Loss (feet)	Internal or External	Above or Below	
Treatment Type	Treatment System Name	Low	High	Low	High	Low	High	Bypass	Grade	Bypass Notes
Media Filtration (cont)										
Combination System	Aqua Shield Aqua-Filter System	25	>960	NA	NA	0.8	0.8	Internal/External	Below	
(with Hydrodynamic Separation)										Head loss based on:
										- Current monitoring configuration: 1 ecoStorm upstream of
										2 ecoStorm plus units.
										- 360 gpm through the system, 180 gpm per filter.
	ecoStorm + ecoStorm Plus®	NA	180	NA	NA	0.41 (a)	NA	Internal/External	Below	- Site specific model calibrated onsite at known flow rates.
										- Headloss negating effects of drop structure were neglected
										(located between the ecoStorm and ecoStorm plus units).
										- Filters assumed to be at the point of required maintenance (twice the head loss measured for new filters).
	Go-Filter	50	675	NA	NA	0.5	0.5	Internal/External	Below	(twice the head loss measured for new filters).
	00-Fillel	50	075	NA	NA	0.5	0.5	Internal/External	Delow	
Combination System	CrystalCombo Hybrid Polisher	ND	ND	ND	ND	ND	ND	ND	Below	
(with Oil/Water Separator)	HydroFilter	ND	ND	ND	ND	ND	ND	ND	Below	
_										
Up-Flow	Bio Clean Water Polisher	191	528	0	0	1	2	Internal	Below	High Flow Unimpeded
	Jellyfish <sup>TM</sup> Filter	60	2,300	12	113	1	2	Internal/External	Below	
	Up-Flo™ Filter	147	448	0	0	1.7	2.5	Internal	Below	Information obtained from product literature
Oil/Water Separator										
	ADS® Water Quality Unit	1,800	126,000	0	0	NA	NA	External	Below	
	BioSTORM	225	4,800	45	162	0.5	0.17	External	Below	
	Clara® Gravity Stormwater Separator Vault	5	1,120	0	150	0.5	1.5	Internal	Below	
	CrystalClean Separator	ND	ND	ND	ND	ND	ND	ND	Below	
	ecoLine A®	25	626	12	70	6	6	V	Below	
	ecoLine B®	50	1,110	NA	NA	6	6	V	Below	
	ecoSep®	ND	ND	ND	ND	ND	ND	ND	Below	
	ecoTop®	ND	ND	ND	ND	ND	ND	ND	Below	
	First Flush 1640FF	449 ND	538	0 ND	0 ND	0 ND	0 ND	NA	Below	
	Hancor Storm Water Quality Unit Kleerwater™	ND 25	ND 10,000	ND NA	ND NA	ND 0	ND 0	ND External	Below Below	
		25 ND	10,000 ND	NA ND	NA ND	0 ND	0 ND	External ND	Below	
	PSI Separator SNOUT®	ND ND	ND ND	ND ND	ND ND	ND ND	ND ND	ND ND	Below	
	VortClarex	ND 100	ND 2,000		ND 0	ND 0.1	ND 0.1	ND Internal/External	Below	
	voncialex	100	2,000	U	U	0.1	0.1	miternal/External	DEIUW	

CF = cubic feet

gpm = gallons per minute

in/hr = inches per hour

NA = not available; vendor filled out Treatment System Summary form, but did not provide all data

ND = no data; vendor did not fill out Treatment System Summary form

SF = square foot

V = varies

Table 10. System design information for active treatment systems.

		Design Flo	w Rate (gpm)	System Fo	otprint (sf)	(feet)		Internal or External	Above or Below	
Treatment Type	Treatment System Name	Low	High	Low	High	Low	High	Bypass	Grade	Notes
Chemical Filtration										
	Baker Tank with Sand Filter	15	>1000	1000	2500	NA	NA	NA	Above	
	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup>	< 25	> 2,000	< 25	> 2,000	NA	NA	External	Above	Offline facility
	Purus® Stormwater Polishing System	5	210	10	90	70	120	External	Above	
Chemical Treatment										
Chemical Treatment	ACISTBox®	100	> 1,000	200	> 2,000	NA	NA	NA	Above	
	ACISIBOX®	100	> 1,000	200	> 2,000	NA	NA	NA	Above	
										(a) Packaged in 4' -6' (w) x 2.5' (d) x 4' (t) industrial steel
										box w/hinged top opening lid. Additional storage space for
	pHATBox®	250	350	10	24	NA (a)	NA (a)	NA	Above	additive will depend on volume of additive storage (up to 35
										gal drums in box, larger must go external) - plus secondary
										containment).
	Wetsep	20	260	NA	NA	40	40	External	NA	
Electrocoagulation										
	High-Flo Electrocoagulation	2.5	> 1,200	40	4,000	2	20	External	Above	
	OilTrap ElectroPulse Water Treatment System	5	500	40	1,500	5	15	Internal/External	Above	
	Redbox	0.5	150	NA	NA	NA	NA	NA	Above	
	WaveIonics <sup>TM</sup>	50	> 1,000	200	> 4,000	NA	NA	NA	Above	
Filtration										
Disc	Arkal Filter (Spin Klin System)	100	4400	16	16	0.1	14	NA	Above	Information obtained from product literature
DISC	Aikai Fiitei (Spiii Kiiii System)	100	4400	10	10	0.1	14	NA	Above	information obtained from product interature
Media	Fuzzy Filter	70	Unlimited	NA	NA	35	35	External	Above	
	WaterTrak Pressurized Media Filter	27	905	43	119	ND	ND	ND	Above	Information obtained from product literature
	WaterTrak Ultrafiltration	38	377	31	62	ND	ND	ND	Above	Information obtained from product literature
					-					
Pressure	Arkal Media Filter	44	150	16	16	3	28	NA	Above	Information obtained from product literature
					-					1
Ion Exchange										
	Wastewater Ion Exchange System (WWIX)	1	5000	NA	NA	20	20	NA	Above	
	WaterTrak Ion Exchange	23	866	65	113	ND	ND	ND	Above	Information obtained from product literature
Reverse Osmosis										
Reverse Osmosis	WaterTrak Deverse Osmania	65	275	142	242	350	350	ND	Abova	Information obtained from product literature
	WaterTrak Reverse Osmosis	03	275	143	243	550	550	ND	Above	mormation obtained from product interature

gpm = gallons per minute

NA = not available; vendor filled out Treatment System Summary form, but did not provide all data

ND = no data; vendor did not fill out Treatment System Summary form

SF = square foot

## Table 11. Installation and annual operation and maintenance costs for passive treatment systems.

		Installa	tion Cost	Annual O	&M Cost	
Treatment Type	Treatment System Name	Low	High	Low	High	Notes
Bioretention/Filtration						
	Filterra® Curb Inlet System	\$1,200	\$7,500	\$300	\$3,000	
	Filterra® Roof Drain System	\$1,200	\$7,500	\$300	\$3,000	
	Modular Wetland System – Linear	\$12,000	\$25,000	\$8.26/gal	\$10.50/gal	
	Silva Cell	\$4,000-5,600	\$10,000-14,000	\$100-200	100-200	Depends on selected tree species (small or large)
	TREEPOD® Biofilter	\$10,000	\$50,000	\$400	\$750	
	UrbanGreen BioFilter	\$10,000	\$250,000	\$0.0001/gal	\$0.0003/gal	
Drain Inlet Insert						
Absorbent Boom/Fabric	ADsorb-It	\$0.91/SF	\$0.91/SF	\$0.91/SF	\$0.91/SF	
	Enviro-Drain®	ND	ND	ND	ND	
	EnviroSafe <sup>™</sup> Storm Safe HF10	ND	ND	ND	ND	
	Ultra-Urban Filter™	\$400	\$1,700	NA	NA	
Media Filtration	EcoVault™ Baffle Box	\$25,000	\$125,000	\$200	\$1,800	
	EnviroSafe <sup>TM</sup>	ND	ND	ND	ND	
	HUBER Hydro Filt	ND	ND	ND	ND	
	Hydro-Kleen <sup>™</sup>	ND	ND	ND	ND	
	Raynfiltr <sup>TM</sup>	\$531	\$554	NA	NA	
Media Filtration (Cartridge)	StormBasin <sup>™</sup>	\$750	\$2,000	\$200	\$800	
	StormPod <sup>TM</sup>	\$750	\$2,000	\$200	\$800	
	Triton Drop Inlet Insert	\$300	\$2,500	\$0.000002/gal	\$0.00008/gal	
Combination System (Screen and	Bio Clean Curb Inlet Basket	\$445	\$1,600	\$0.20/gal	\$0.40/gal	
Absorbent Boom/Fabric)	Bio Clean Downspout Filter	\$1,035	\$1,200	\$0.16/gal	\$0.22/gal	
	Bio Clean Flume Filter	\$660	\$1,302	\$0.23/gal	\$0.74/gal	
	Bio Clean Grate Inlet Skimmer Box	\$635	\$1,800	\$0.15/gal	\$0.40/gal	
	Bio Clean Trench Drain Filter	\$660	\$1,302	\$0.23/gal	\$0.74/gal	
	Clean Way Downspout Filtration Unit	ND	ND	ND	ND	
	DrainPac™	ND	ND	ND	ND	
	EnviroTrap Catch Basin Insert	\$200	\$1000	\$0	\$1000	
	FloGard® Downspout Filter	\$1,500	\$3,500	\$75	\$250	
	FloGard® LoPro Matrix Filter	\$400	\$1,000	\$75	\$300	
	FloGard® LoPro Trench Drain Filter	\$600	\$3,000	\$75	\$350	
	FloGard+PLUS®	\$250	\$1,800	\$75	\$350	
	FloGard® Trash & Debris Guard	\$450	\$1,500	\$50	\$200	
	Inceptor®	ND	ND	ND	ND	

		Install	ation Cost	Annual (	)&M Cost	
Treatment Type	Treatment System Name	Low	High	Low	High	Notes
Drain Inlet Insert (cont)						
	StormClean Catch Basin Insert	ND	ND	ND	ND	
	StormClean Curb Inlet Insert	ND	ND	ND	ND	
	StormClean Wall Mount Filtration Unit	ND	ND	ND	ND	
	Storm PURE <sup>TM</sup>	ND	ND	ND	ND	
	SwaleGard® Pre-filter	\$4,500	\$4,500	\$75	\$300	
Combination System (Screen and	Aqua-Guardian <sup>™</sup> Catch Basin Insert	V	V	V	V	
Media Filtration)	ClearWater BMP	ND	ND	ND	ND	
	Coanda Curb Inlet Filter	\$2,000	\$3,500	\$0	\$0	
	Coanda Downspout Filter	\$2,000	\$3,500	\$0	\$0	
	RSF (Rapid Stormwater Filtration) 100	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 1000	ND	ND	ND	ND	
	RSF (Rapid Stormwater Filtration) 4000	ND	ND	ND	ND	
Hydrodynamic Separation						
	Aqua Shield Aqua-Swirl Concentrator	V	V	V	V	
	BaySeparator®	ND	ND	ND	ND	
	CDS <sup>TM</sup> Stormwater Treatment System	\$10,000	\$2,500,000	\$0.00001/gal	\$0.00001/gal	
	Downstream Defender	ND	ND	ND	ND	
	FloGard® Dual-Vortex Hydrodynamic Separator	\$10,000	\$100,000	\$300	\$3,500	
	HydroGuard	ND	ND	ND	ND	
	Nutrient Separating Baffle Box	\$10,000	\$200,000	\$0.33/gal	\$0.84/gal	
	Stormceptor®	\$3,000	\$15,000	\$500	\$5,000	
	StormTrooper®	ND	ND	ND	ND	
	StormTrooper® EX Extra-Duty	ND	ND	ND	ND	
	Terre Kleen <sup>TM</sup>	ND	ND	ND	ND	
	UniScreen	\$2000	\$15000	0	\$2000	
	UniStorm	\$2000	\$15000	0	\$2000	
	V2B1 Treatment System	\$2000	\$15000	0	\$2000	
	Vortechs System	\$20,000	\$500,000	\$0.00001/gal	\$0.00004/gal	
Media Filtration						
Above ground (pump required)	Aquip® Enhanced Stormwater Filtration System	\$5,000	\$150,000	\$0.0003/gal	\$0.003/gal	
Cartridge	BayFilter®	ND	ND	ND	ND	
_	EcoSense <sup>™</sup> Stormwater Filtration Systems	\$400	\$2,000	\$100	\$500	
	Perk Filter <sup>TM</sup>	\$10,000	\$200,000	\$1,200	\$10,000	
	PuriStorm	\$3000	\$25000	\$0	\$10000	
	Sorbtive <sup>™</sup> FILTER	ND	ND	ND	ND	
	Stormfilter using ZPG Media	\$10,000	\$2,500,000	\$0.00008/gal	\$0.00024/gal	

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		Installa	ntion Cost	Annual C	A Cost	
Treatment Type	Treatment System Name	Low	High	Low	High	Notes
Media Filtration (cont)						
	StormSafe <sup>™</sup> Helix	\$20,000	\$60,000	\$2,000	\$6,000	
Sand Filter	Perimeter Sandfilter (Delaware Sandfilter)	ND	ND	ND	ND	
	Underground Sandfilter (DC Sandfilter)	ND	ND	ND	ND	
Combination System (with Hydrodynamic Separation)	Aqua Shield Aqua-Filter System	v	V	v	V	
	ecoStorm + ecoStorm Plus®	\$8,900 (a)	\$37,500 (a)	NA (b)	NA (b)	<ul> <li>(a) Cost varies based on combination of units, number of units, and final design requirements.</li> <li>(b) \$500 - \$1000 per cleaning/backflush event; Minimum of 1X per year to monthly for stormwater.</li> </ul>
	Go-Filter	v	V	V	V	
Combination System	CrystalCombo Hybrid Polisher	ND	ND	ND	ND	
(with Oil/Water Separator)	HydroFilter	ND	ND	ND	ND	
Up-Flow	Bio Clean Water Polisher Jellyfish™ Filter Up-Flo™ Filter	\$25,000 NA ND	\$125,000 NA ND	\$5.24/gal NA ND	\$7.85/gal NA ND	
	op-110 1 mor					
Oil/Water Separator						
	ADS® Water Quality Unit BioSTORM	\$500	\$2,000	\$400	\$4,000	
	Clara® Gravity Stormwater Separator Vault	\$20,000	\$52,000	\$0.0005/gal	\$0.01/gal	

		Installa	tion Cost	Annual O	&M Cost	
Treatment Type	Treatment System Name	Low	High	Low	High	Notes
Oil/Water Separator (cont.)						
	CrystalClean Separator	ND	ND	ND	ND	
	ecoLine A®	\$6,700	\$44,250	NA	NA	Gravity flow system has no moving parts or power requirement. Oil coalescing media pack can be removed, rinsed, and replaced. In the event of damage to the coalescing media, new coalescing panels can be purchased for a low cost.
	ecoLine B®	\$8,200	\$81,900	NA	NA	Gravity flow system has no moving parts or power requirement. Oil coalescing media pack can be removed, rinsed, and replaced. In the event of damage to the coalescing media, new coalescing panels can be purchased for a low cost.
	ecoSep®	ND	ND	ND	ND	
	ecoTop®	ND	ND	ND ND	ND	
	First Flush 1640FF	\$5,000	\$10,000	\$500	\$3,000	
	Hancor Storm Water Quality Unit	ND	ND	ND	\$3,000 ND	
	Kleerwater <sup>TM</sup>	V	V	V	V	
	PSI Separator	ND	ND	ND	ND	
	SNOUT®	ND	ND	ND	ND	
	VortClarex	\$10,000	\$300,000	\$0.00008/gal	\$0.001/gal	

gal = gallon

NA = not available; vendor filled out treatment system questionaire, but did not provide all data

ND = no data; vendor did not complete treatment system questionaire

SF = square foot

V = varies

## Table 12. Installation and annual operation and maintenance costs for active treatment systems.

		Install	ation Cost	Annual O	AM Cost	
Treatment Type	Treatment System Name	Low	High	Low	High	Notes
Chemical Filtration						
	Baker Tank with Sand Filter	NA	NA	NA	NA	
	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup>	\$15,000	>\$250,000	<\$0.001/gal	>0.003/gal	
	Purus® Stormwater Polishing System	\$10,000	\$140,000	\$0.0024/gal	\$0.0047/gal	
<b>Chemical Treatment</b>						
	ACISTBox®	\$25,000	\$400,000	NA	NA	Depends on buffering
	pHATBox®	\$19,500	\$28,500	NA	NA	capacity of waterstream, flow rate, total volume processed, specific pH adjustment additive selected, and final pH point required.
	Wetsep	\$1,000	\$2,500	\$100/day	\$250/day	icquireu.
Electrocoagulation						
	High-Flo Electrocoagulation	\$2,500	\$2,200,000	\$0.0005/gal	\$0.01/gal	
	OilTrap ElectroPulse Water Treatment System	\$25,000	\$500,000	\$0.002/gal	\$0.005/gal	
	Redbox WaveIonics™	\$42,000 \$60,000	\$1,000,000 \$850,000	\$1,000 \$0.0008/gal	\$20,000 \$0.008/gal	
Filtration						
Disc	Arkal Filter (Spin Klin System)	ND	ND	ND	ND	
Media	Fuzzy Filter	NA	NA	NA	NA	
	WaterTrak Pressurized Media Filter	ND	ND	ND	ND	
	WaterTrak Ultrafiltration	ND	ND	ND	ND	
Pressure	Arkal Media Filter	ND	ND	ND	ND	
Ion Exchange						
	Wastewater Ion Exchange System (WWIX)	\$3,000	\$250,000	\$3,000	\$500,000	
	WaterTrak Ion Exchange	ND	ND	ND	ND	
Reverse Osmosis						
	WaterTrak Reverse Osmosis	ND	ND	ND	ND	

gal = gallon

NA = not available; vendor filled out treatment system questionaire, but did not provide all data

ND = no data; vendor did not complete treatment system questionaire

## Table 13. TAPE and NJCAT approvals for passive stormwater treatment technologies.

Freatment Type	Treatment System Name		Technology Asse	essment Protocol - I	Ecology (TAPE)		New Jersey Corporation for	Advanced Technology (NJCAT)
		Pretreatment	Basic	Enhanced	Phosphorus	Oil	50% TSS Removal	80% TSS Removal
Bioretention/Filtration								
	Filterra® Curb Inlet System		GULD	GULD		GULD		
	Silva Cell		GULD	GULD				
Hydrodynamic Separation								
	Aqua Shield Aqua-Swirl Concentrator	GULD					Х	
	BaySeparator®	CULD					Х	
	CDS <sup>™</sup> Stormwater Treatment System	GULD	GULD			PULD	Х	
	Downstream Defender	GULD					Х	
	FloGard® Dual-Vortex Hydrodynamic Separator						Х	
	HydroGuard						Х	
	Nutrient Separating Baffle Box						Х	
	Stormceptor®						Х	
	Terre Kleen <sup>TM</sup>						Х	
	V2B1 Treatment System	PULD					Х	
	Vortechs System	GULD					Х	
Media Filtration								
Cartridge	BayFilter®		CULD	CULD	CULD			Х
-	Perk Filter <sup>TM</sup>		GULD		GULD			
	Stormfilter using ZPG Media		GULD					Х
Combination System	Aqua Shield Aqua-Filter System		PULD	PULD	PULD	PULD		Х
(with Hydrodyanamic Separation)	ecoStorm + ecoStorm Plus®		CULD					
	Jellyfish™ Filter		PULD					Х
	Up-Flo™ Filter		PULD					Х
Oil/Water Separator								
-	ecoSep®					PULD		

CULD = Conditional Use Level Designation

GULD = General Use Level Designation

PULD = Pilot Use Level Designation

TSS = Total Suspended Solids

Treatment Type	Treatment System Name	Treatment of Roof Runoff	Treatment at Inlet to Storm Drain System	Treatment at End-of-pipe	Treatment of Pumped Groundwater
Bioretention/Filtration					
	Filterra® Roofdrain System	•			
	Filterra® System		•		
	Modular Wetland System – Linear		•	•	
	Silva Cell		•		
	TREEPOD® Biofilter		•	•	
	UrbanGreen BioFilter		•	•	
Drain Inlet Insert					
Absorbent Boom/Fabric	Adsorb-It		•		
	Enviro-Drain®		•		
	EnviroSafe™ Storm Safe HF10		•		
	Ultra-Urban Filter™		•		
Media Filtration	EcoVault™ Baffle Box		•		
	EnviroSafe™		•		
	HUBER Hydro Filt		•		
	Hydro-Kleen <sup>™</sup>		•		
	Raynfiltr™		•		
Media Filtration (Cartridge)	StormBasin™		•		
	StormPod™		•		
	Triton Drop Inlet Insert		•		
Combination System (Screen and	Bio Clean Curb Inlet Basket		•		
Absorbent Boom/Fabric)	Bio Clean Downspout Filter	•			
	Bio Clean Flume Filter		•		

		Treatment of Roof		Treatment at	Treatment of Pumped
Treatment Type	Treatment System Name	Runoff	Storm Drain System	End-of-pipe	Groundwater
Drain Inlet Insert (cont)					
	Bio Clean Grate Inlet Skimmer Box		•		
	Bio Clean Trench Drain Filter		•		
	Clean Way Downspout Filtration Unit	•			
	DrainPac™		•		
	EnviroTrap Catch Basin Insert		•		
	FloGard® Downspout Filter	•			
	FloGard® LoPro Matrix Filter		•		
	FloGard® LoPro Trench Drain Filter		•		
	FloGard+PLUS®		•		
	FloGard® Trash & Debris Guard		•		
	Inceptor®		•		
	StormClean Catch Basin Insert		•		
	StormClean Curb Inlet Insert		•		
	StormClean Wall Mount Filtration Unit		•		
	Storm PURE™		•		
	SwaleGard® Pre-filter		•		
Combination System (Screen and	Aqua-Guardian™ Catch Basin Insert		•		
Media Filtration)	ClearWater BMP		•		
	Coanda Curb Inlet Filter		•		
	Coanda Downspout Filter	•			
	RSF (Rapid Stormwater Filtration) 100		•		
	RSF (Rapid Stormwater Filtration) 1000		•		
	RSF (Rapid Stormwater Filtration) 4000		•		
Hydrodynamic Separation					
	Aqua Shield Aqua-Swirl Concentrator			•	
	BaySeparator®			•	
	CDS <sup>™</sup> Stormwater Treatment System			•	
	Downstream Defender			•	

Treatment Type	Treatment System Name	Treatment of Roof Runoff	Treatment at Inlet to Storm Drain System	Treatment at End-of-pipe	Treatment of Pumped Groundwater
Hydrodynamic Separation (cont)	Hydrodynamic Separation (cont)				
FloGard® Dual-Vortex Hydrodynamic Separator				•	
	HydroGuard			•	
	Nutrient Separating Baffle Box			•	
	Stormceptor®			•	
	StormTrooper®			•	
	StormTrooper® EX Extra-Duty			•	
	Terre Kleen™			•	
	UniScreen UniStorm			•	
	V2B1 Treatment System			•	
	Vortechs System			•	
Media Filtration					
Above ground (pump required)	Aquip® Enhanced Stormwater Filtration System			•	
Cartridge	BayFilter®			•	
	EcoSense <sup>™</sup> Stormwater Filtration Systems		•		
	Perk Filter <sup>TM</sup>		•	•	
	PuriStorm		•	•	
	Sorbtive <sup>™</sup> FILTER			•	
	Stormfilter using ZPG Media		•	•	
	StormSafe™ Helix			•	
Combination System	Aqua Shield Aqua-Filter System			•	
(with Hydrodyanamic Separation)	ecoStorm + ecoStorm Plus®			•	
	Go-Filter			•	

		Treatment of Roof	Treatment at Inlet to	Treatment at	Treatment of Pumped
Treatment Type	Treatment System Name	Runoff	Storm Drain System	End-of-pipe	Groundwater
Media Filtration (cont)					
Combination System	CrystalCombo Hybrid Polisher			•	
(with Oil/Water Separator)	HydroFilter			•	
Up-Flow	Bio Clean Water Polisher			•	
1	Jellyfish™ Filter			•	
	Up-Flo™ Filter			•	
Oil/Water Separator					
	ADS® Water Quality Unit			•	
	BioSTORM		•	•	
	Clara® Gravity Stormwater Separator Vault		•	•	
	CrystalClean Separator			•	
	ecoLine A®			•	•
	ecoLine B®			•	
	ecoSep®			•	
	ecoTop®			•	•
	First Flush 1640FF		•	•	
	Hancor Storm Water Quality Unit			•	
	Kleerwater <sup>TM</sup>			•	
	PSI Separator			•	
	SNOUT®		•		
	VortClarex		•	•	
Chemical Filtration					
	Baker Tank with Sand Filter			•	•
	Chitosan-Enhanced Sand Filtration Using			•	
	FlocClear <sup>TM</sup>			•	·
	Purus® Stormwater Polishing System			•	•
Chemical Treatment					
	ACISTBox®			•	•
	pHATBox®			•	•
	Wetsep			•	•

Treatment Type	Treatment System Name	Treatment of Roof Runoff	Treatment at Inlet to Storm Drain System	Treatment at End-of-pipe	Treatment of Pumped Groundwater
Electrocoagulation					
	High-Flo Electrocoagulation			•	•
	OilTrap ElectroPulse Water Treatment System			•	•
	WaveIonics™			•	•
	Redbox			•	•
Filtration					
Disc	Arkal Filter (Spin Klin System)			•	•
Media	Fuzzy Filter			•	•
Filtration (cont)					
	WaterTrak Pressurized Media Filter			•	•
	WaterTrak Ultrafiltration			•	•
Pressure	Arkal Media Filter			•	•
Ion Exchange					
	Wastewater Ion Exchange System (WWIX)			•	•
	WaterTrak Ion Exchange			•	•
Reverse Osmosis					
	WaterTrak Reverse Osmosis			•	•

Technology Summary Sheets

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ABT, Inc.
Abtech Industries
ACF Environmental, Inc.
Advanced Drainage Systems, Inc
AquaShieldTM, Inc.
AquaShieldTM, Inc.
AquaShieldTM, Inc.
AquaShieldTM, Inc.
BaySaver Technologies, Inc.
BaySaver Technologies, Inc.
BioClean Environmental Services, Inc.
BioClean Environmental Services, Inc.
BioClean Environmental Services, Inc.
BioClean Environmental Services, Inc.
BioClean Environmental Services, Inc.
BioClean Environmental Services, Inc.
BioClean Environmental Services, Inc.
Bio-Microbics, Inc.
Brown-Minneapolis Tank Co./
Kleerwater Technologies, LLC
Clean Way
Clean Way
Clean Way
Clean Way
ClearWater Solutions, Inc.
Coanda, Inc.
Coanda, Inc.
CONTECH Stormwater Solutions Inc.
CONTECH Stormwater Solutions Inc.
CONTECH Stormwater Solutions Inc.
CONTECH Stormwater Solutions Inc.
CONTECH Stormwater Solutions Inc.
CrystalStream Technologies
CrystalStream Technologies
DeepRoot Partners
EcoSense International
EcoSense International
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EcoSol Wastewater Filtration Systems
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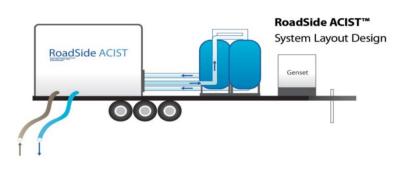
# Active



## Treatment Technology Summary Report

Manufacturer/Vendor: Name of Technology: Technology Type: WaterTectonics ACIST Chemical Treatment

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 100

 high:
 >1000

System Footprint (sq. ft.): 200-2000 Required Head Loss (ft): NA Internal or External Bypass:

None - auto recirculation
Application

Stormwater/Process Water/ Wastewater/Ground Water

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):			3.12		0.0199			0.00028
Median Effluent (mg/L):			0.38		0.00002			0.00002
Median Removal (%):			88		99.9			93

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	0.341	0.25	2.12			0.817	
Median Effluent (mg/L):	0.0179	0.05	1.04			0.744	
Median Removal (%):	95	80	51			9	

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΓΑΡΕ						
	•		•		i	
	50% TSS Ren	noval	80% TS	S Removal		

#### Local Installations

# of Installations in Washington:

5

#### **Estimated** Costs

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$25,000 low: high: <u>\$400,000</u> high:



Manufacturer/Vendor:
Name of Technology:
Technology Type:

WaterTectonics
ACIST
Chemical Treatment

#### **Treatment Notes**

Field by operator; in-line real-time with sensors/data loggers for turbidity and pH; in-house and independent party grab/composite sampling; in-house and 3rd party independent analytical laboratory testing.

#### **Additional Notes**

Provided under DOE issued GULD as Chitosan-Enhanced Sandfiltration (CESF), a stand alone system. Water Tectonics expands CESF application for removal of LNAPL, NWTPH, cPAH/PAH's, and metals by system modification to include oil/water separation, enhanced pre-treatment, post SF micron filtration, and granular activated carbon and/or other media adsorption. As a stand-alone technology it is designated for turbidity and pH. If raw water turbidity is >600 NTU, pretreatment is required. CESF has limited to no ability to remove turbidity consisting of rock dust, rock flour, or other rock source fines that have not been geochemically weathered over time. Chitosan performance is typically compromised by acidic or alkaline pH conditions out side the neutral range. Performance data presented is from from full-scale use at temporary projects where RSA CESF technology was used in accordance with GULD specifications with modifications for enhanced removal components (e.g., granular activated carbon). Untreated construction water ranging from >25 NTU to > 5000 NTU (with pretreatment if over 600 NTU) have all been reduced to <10 NTU, but typically to <5 NTU. Flow ranges for various conventional system sizes range from 100 to over 1000 gpm for 24/7 continuous operations.

HERRERA

## Treatment Technology Summary Report

Manufacturer/Vendor: Name of Technology: Technology Type: Arkal Filtration Systems/PEP (U.S. Distributor) Arkal Filter (Spin Klin System) Filtration(Disc)

#### Schematic



#### System Design Information

 Design Flow Rate (gpm):

 low:
 100

 high:
 4400

System Footprint (sq. ft.):

16 Required Head Loss (ft): 0.1,14 Internal or External Bypass:

Application

#### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Me	tals	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):			ND				
Median Effluent (mg/L):			ND				
Median Removal (%):			99.9				

\* Blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	moval	80% TS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:



## Treatment Technology Summary Report

Manufacturer/Vendor: Name of Technology: Technology Type: Arkal Filtration Systems/PEP (U.S. Distributor) Arkal Filter (Spin Klin System) Filtration(Disc)

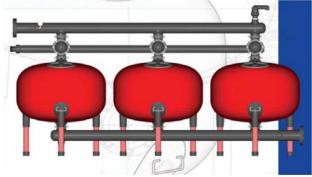
**Treatment Notes** 

**Additional Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: Arkal Filtration Systems/PEP (U.S. Distributor) Arkal Media Filter Filtration(Pressure)

#### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 44

 high:
 150

System Footprint (sq. ft.):

16 Required Head Loss (ft): 3,28 Internal or External Bypass:

Application

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):			ND				
Median Effluent (mg/L):			ND				
Median Removal (%):			99.9				

\* Blank cells indicate no information was received from vendor

#### Approvals

TAPE				Phosphorus	Oil	Other Approvals:
	50% TSS Rem	noval	80% TSS	80% TSS Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated** Costs

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:



Manufacturer/Vendor: Name of Technology: Technology Type: Arkal Filtration Systems/PEP (U.S. Distributor) Arkal Media Filter Filtration(Pressure)

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: BakerCorp Baker Tank with Sand Filter Filtration(Media)

### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 15

 high:
 1,000+

System Footprint (sq. ft.): 1000-2500 Required Head Loss (ft): NA Internal or External Bynass

Internal or External Bypass: NA

Application

Stormwater/Process Water/ Wastewater/Groundwater

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	200							
Median Effluent (mg/L):	10							
Median Removal (%):	95							

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	150	500	2500	20	40	400	
Median Effluent (mg/L):	75	200	1000	10	20	40	
Median Removal (%):	50	40	50	50	50	90	

\* Blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
APE						
	50% TSS Removal					
	50% TSS Ren	noval	80% TSS	S Removal		

## Local Installations

# of Installations in Washington:

1

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type:

BakerCorp
Baker Tank with Sand Filter
Filtration(Media)

#### **Treatment Notes**

TSS, total metals, and dissolved metals removal will depend upon the degree that they will absorb to particulate matter. The values provided for these parameters are based upon a study done by Dungeness Environmental during 2009-2010. Dungeness Environmental does not have relevant data for the organics listed in this table. For any questions, please contact Chris Palczewski at Dungeness Environmental: 425-481-0600 or cpalczewski@dungenessenviro.com. Thank you.



Manufacturer/Vendor: Name of Technology: Technology Type: Clear Creek Systems, Inc. Chitosan-Enhanced Sand Filtration Using FlocClear Chemical Filtration

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 < 25</td>

 high:
 > 2,000

System Footprint (sq. ft.): < 25 -> 2,000 Required Head Loss (ft):

NA

Internal or External Bypass: External - Offline Facility

Application

Stormwater/Process water/ Groundwater/Wastewater

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
* Plank colls indicate no infe		a na aaliyaad fu					

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
					_	
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

> 15 on the West Coast

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$15,000 low: < \$0.001/gal high: >\$250,000 high: >\$0.003/gal



 Manufacturer/Vendor:
 Clear Creek Systems, Inc.

 Name of Technology:
 Chitosan-Enhanced Sand Filtration Using FlocClear

 Technology Type:
 Chemical Filtration

### **Treatment Notes**

Attached data was collected from grab samples that were analyzed by an accredited laboratory.



Manufacturer/Vendor: Name of Technology: Technology Type: Schreiber LLC Fuzzy Filter Filtration(Media)

### Schematic



## System Design Information

Design Flow Rate (gpm):low:70high:unlimited

System Footprint (sq. ft.):

Required Head Loss (ft): 3.5

Internal or External Bypass: External

Application Stormwater/Process Water/ Wastewater/Ground water

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	10							
Median Effluent (mg/L):	2							
Median Removal (%):	70-95							

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
APE						
		-	•	• •		
	50% TSS Ren	noval	80% TSS	S Removal		

## Local Installations

# of Installations in Washington:

0

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor:
Name of Technology:
Technology Type:

Schreiber LLC
Fuzzy Filter
Filtration(Media)

#### **Treatment Notes**

Fuzzy Filter removes suspende solids 4 microns and above. The media is compressible so that pore size can be adjusted thru changes in compressioon of the media via the integral actuator connected to a perforated compression plate. Influent solids should be less than 100 mg/l with many typical applications processing water streams containing 20 mg/l and less.



Manufacturer/Vendor: Name of Technology: Technology Type: KASELCO, LLC High-Flo Electrocoagulation Electrocoagulation

### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 2.5

 high:
 1,200+

System Footprint (sq. ft.): 40 - 4000 Required Head Loss (ft): 2,20 Internal or External Bypass: External

Application Stormwater/Process Water/ Groundwater/Wastewater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	als	Diss	olved Metals	
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:						
Median Influent (mg/L):						
Median Effluent (mg/L):						
Median Removal (%):						

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ТАРЕ						
-			•			
	50% TSS Ren	noval	80% TS	6 Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

0 in WA, 2 in Vancouver

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$25,000 low: \$0.0005/gal high: \$2,200,000 high: \$0.01/gal



Manufacturer/Vendor: Name of Technology: Technology Type: KASELCO, LLC High-Flo Electrocoagulation Electrocoagulation

#### **Treatment Notes**

System Performance has been evaluated in lab as well as in field research applications and existing installations. Grab samples are analyzed both internally as well as by a third party lab.

#### **Additional Notes**

Have attached actual test result parameters. We are currently in the process of having detailed third party test evaluations and will supply those results as available.



Manufacturer/Vendor: Name of Technology: Technology Type: OilTrap Environmental Prod OilTrap ElectroPulse Water Treatment System Electrocoagulation

### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 5

 high:
 500

System Footprint (sq. ft.): 40-1500 Required Head Loss (ft): 5,15 Internal or External Bypass: Either

Application

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	600		78	136	28	NA	NA	NA
Median Effluent (mg/L):	10		0.27	<5.0	0.43	NA	NA	NA
Median Removal (%):	98.3		99.6	>96.3	98.4	NA	NA	NA

		Total Meta	als	Disso	olved Metals	;
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:						
Median Influent (mg/L):	12.1	14.1	151	8.2	10.9	78.6
Median Effluent (mg/L):	0.072	0.039	0.34	0.072	0.039	0.34
Median Removal (%):	99.4	99.7	99.9	99.1	99.6	99.9

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Appro
E						
	50% TSS Rem	noval	80% TS	S Removal		

## Local Installations

# of Installations in Washington:

33

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$25,000 low: \$0.002/gal high: \$500,000 high: \$0.005/gal



Manufacturer/Vendor:OilTrap Environmental ProdName of Technology:OilTrap ElectroPulse Water Treatment SystemTechnology Type:Electrocoagulation

#### **Treatment Notes**

Samples were collected as routine grab samples and tested by an EPA certified laboratory.

#### **Additional Notes**

We have not worked with wastewater with PCB or dioxins. We generally see 90%+ in reduction of pesticides also.



Manufacturer/Vendor: Name of Technology: Technology Type:

## WaterTectonics pHATBox Chemical Treatment

## Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 250

 high:
 350

System Footprint (sq. ft.): 10-24 (b) Required Head Loss (ft): N/A Internal or External Bypass: N/A

Application Stormwater

## Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	(c)		(c)	(c)	(c)	(c)	(c)	(c)
Median Effluent (mg/L):	(c)		(c)	(c)	(c)	(c)	(c)	(c)
Median Removal (%):	(c)		(c)	(c)	(c)	(c)	(c)	(c)

		Total Meta	als	Disso	olved Metals	;
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:						
Median Influent (mg/L):	(c)	(c)	(c)	(c)	(c)	(c)
Median Effluent (mg/L):	(c)	(c)	(c)	(c)	(c)	(c)
Median Removal (%):	(c)	(c)	(c)	(c)	(c)	(c)

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
					-	
	50% TSS Ren	noval	80% TSS	5 Removal		

## Local Installations

# of Installations in Washington:

20+

### **Estimated** Costs

Estimated Installation Cost:	low: \$	19,500	high:_\$	28,500
Estimated Annual O&M Cost:	low:	(a)	high:	(a)



Manufacturer/Vendor:
Name of Technology:
Technology Type:

WaterTectonics	
pHATBox	
Chemical Treatn	nent

#### **Treatment Notes**

Field. Real-time with in-line probes. 2-point buffer calibration.

#### **Additional Notes**

(a) Depends on buffering capacity of waterstream, flow rate, total volume processed, specific pH adjustment additive selected, and final pH point required.

(b) Packaged in 4' -6' (w) x 2.5' (d) x 4' (t) industrial steel box w/hinged top opening lid. Additional storage space for additive will depend on volume of additive storage (up to 35-gal drums in box, larger must go external) - plus secondary containment). Unit has inline pH probe for real time monitoring and data logger expandable for dual pH adjustment (multi injection/mixing loops), and flow recording. pH set-point(s) programmable into controller.

(c) Adjusts pH. System performance data - not applicable.

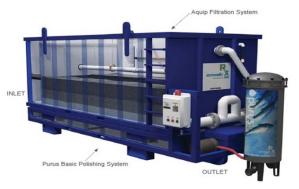
Additional Notes:

-Effective for controlling alkaline waters from cement/concrete operations using carbon dioxide. -Suitable for inclusion as pH adustment component in variety of water treatment systems. -pH set-points (high/low) variable for application.



Manufacturer/Vendor: Name of Technology: Technology Type: StormwateRx LLC Purus Stormwater Polishing System Chemical Filtration

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 5

 high:
 210

System Footprint (sq. ft.): 10,90 Required Head Loss (ft): 70 - 120 Internal or External Bypass: External Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):			YES		YES	YES		YES

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):			0.28			0.06	
Median Effluent (mg/L):			0.083			0.0074	
Median Removal (%):			86			88	

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

YES

## **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$10,000 low: \$0.0024/gal high: <u>\$140,000</u> high: \$0.0047/gal



 Manufacturer/Vendor:
 StormwateRx LLC

 Name of Technology:
 Purus Stormwater Polishing System

 Technology Type:
 Chemical Filtration

#### **Treatment Notes**

These samples were collected as grab samples by StormwateRx, consulting engineers, and facility treatment system operators. All analytical data is from a third party certified analytical lab. Non-detects were assumed to have the value of one half the detection limit.

#### **Additional Notes**

Additional pollutant removal includes bacteria (>99%), PCBs, PAHs and toxic organics.



Manufacturer/Vendor: Name of Technology: Technology Type:

Schematic

Morselt Borne BV Redbox Electrocoagulation



#### System Design Information

 Design Flow Rate (gpm):

 low:
 0.5

 high:
 150

System Footprint (sq. ft.):

Required Head Loss (ft): NA

Internal or External Bypass: NA

Application

Wastewater/Process Water

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):	99							

	Total Metals			Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):				99	99	99	

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ТАРЕ						
	· · · · ·					
	50% TSS Ren	noval	80% TSS	S Removal	[	

### Local Installations

# of Installations in Washington:

## **Estimated** Costs

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$42,000 low: \$1,000 high: \$1,000,000 high: \$20,000



Manufacturer/Vendor: Name of Technology: Technology Type: Morselt Borne BV Redbox Electrocoagulation

#### **Treatment Notes**

Third part analysis has been performed in many cases. Results show very high removal rates, especially for heavy metals.

HERRERA

Manufacturer/Vendor: Name of Technology: Technology Type: Aquatech WaterTrak Ion Exchange Ion Exchange

Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 23

 high:
 866

System Footprint (sq. ft.): 65,113 Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:



Manufacturer/Vendor: Name of Technology: Technology Type: Aquatech WaterTrak Ion Exchange Ion Exchange

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: Aquatech WaterTrak Pressurized Media Filter Filtration(Media)

#### Schematic



### System Design Information

Design Flow Rate (gpm): low: 27 high: 905

System Footprint (sq. ft.): 43,119 Required Head Loss (ft):

Internal or External Bypass:

Application

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

\* Blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						]
					_	
	50% TSS Rer	moval	80% TS	S Removal		
NJCAT						

Local Installations

#	of	Instal	lations	in	Wa	Ishir	ngton
---	----	--------	---------	----	----	-------	-------

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: Aquatech WaterTrak Pressurized Media Filter Filtration(Media)

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: Aquatech WaterTrak Reverse Osmosis Reverse Osmosis



## System Design Information

 Design Flow Rate (gpm):

 low:
 65

 high:
 275

System Footprint (sq. ft.): 143,243 Required Head Loss (ft): 350 Internal or External Bypass:

Application

### Treatment Performance \*

	TSS	TP	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

\* Blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	moval	80% TS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:



Manufacturer/Vendor: Name of Technology: Technology Type: Aquatech WaterTrak Reverse Osmosis Reverse Osmosis

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: Aquatech WaterTrak Ultrafiltration Filtration(Media)

#### Schematic



## System Design Information

Design Flow Rate (gpm):low:38high:377

System Footprint (sq. ft.): 31,62

Required Head Loss (ft):

Internal or External Bypass:

Application

#### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

\* Blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	moval	80% TS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:



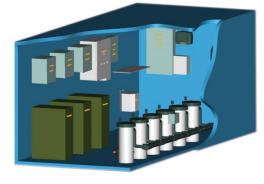
Manufacturer/Vendor: Name of Technology: Technology Type: Aquatech WaterTrak Ultrafiltration Filtration(Media)

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: WaterTectonics Wavelonics Electrocoagulation

### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 50

 high:
 >1000

System Footprint (sq. ft.): 200-4000 Required Head Loss (ft): NA Internal or External Bypass:

NONE-auto recirculation
Application

Stormwater/Process

Water/Wastewater/Ground water

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):		200	45.6	197	2.34	0.0024		
Median Effluent (mg/L):		5	0.25	4.76	0.00002	0.00011		
Median Removal (%):		98	99	98	100	95		

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	4.8	0.253	0.516	0.0235	0.0157	0.12	
Median Effluent (mg/L):	0.0074	0.003	0.0315	0.005	0.0031	0.02	
Median Removal (%):	100	99	94	79	80	83	

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Ren	noval	80% TSS	S Removal		

## Local Installations

# of Installations in Washington:

35+

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$60000 low: \$0.0008/gal high: \$850000 high: \$0.008/gal



Manufacturer/Vendor:
Name of Technology:
Technology Type:

WaterTectonics	
Wavelonics	
Electrocoagulation	

#### **Treatment Notes**

Field via hand-held instruments, Technology's in-line and real-time water quality monitoring system, Oversight Engineers/Project Owners, 3rd party analytical testing laboratories using both instantaneous grab and composting methods (manual and automated). System performance "Median" data presented below does not accommodate analytical data results for parameters report as ND (<MDL's, or <MCL's). All ND data was utilized in the calculations as the value of the MDL or MCL. Influent data is limited in that our Clients typically do not incur cost expenditure to evaluate raw water characteristics once the system has been designed, installed, and made operational. They focus on monitoring effluent quality. Further, effluent data generated by our Clients/System Owners do not typically provide us with DMR's they submit to Ecology or other regulatory agencies. Effluent data points do not reflect technology ability to achieve lower than reported results. Permit discharge limitations have historically varied from site to site, permit to permit , and therefore data reflect treatment efforts and not technology limitations.

#### **Additional Notes**

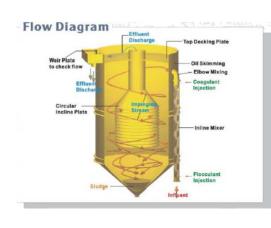
Wavelonics electrocoagulation (EC) reactions will depend on the nature of constituents present, their reaction chemistry, pH sensitivity, and water conductivity. Bacteria disinfection has been demonstrated at laboratory and full-scale applications. Technology viability and optimization is recommended for non-conventional constituents of concern, or for complex matrices where interferences and competing conditions are problematic to conventional advanced treatment processes. System Performance data fields (above) call for "Median" data points that do not allow for presentation of worst-case conditions, nor do they adequately reflect "mean" conditions, both of which are more elevated than the "Median" data presented for influent characteristics. Effluent "median" data do not reflect <MDL or <MCL data as reported by laboratories. However, ND results utilized in the calculation were the numeric value of the actual MDL or MCL. SVOC and cPAH data reflect a summation of all individual constituents in SVOC or cPAH parameter suites as totals. PCB's are totals of all Arochlor congeners. Oil and Grease data reflect both Freon and Hexane extraction analytical methods. Technology has not been used to specifically remove Dioxins and when technology was utilized, Dioxins were not targeted for analytical testing. Other data available upon request for: bacteria; other heavy metals; color from humics, etc.



Manufacturer/Vendor: Name of Technology: Technology Type: Waste & Environmental Technologies Ltd.

Wetsep Chemical Treatment

## Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 20

 high:
 260

System Footprint (sq. ft.):

Required Head Loss (ft): 40 feet

Internal or External Bypass:

External Bypass

Application Stormwater/Wastewater

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	112	13.4						
Median Effluent (mg/L):	<2	1.9						
Median Removal (%):	98	86						

		Total Meta	ls	Disso	lved Metal	s
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:						
Median Influent (mg/L):				7 μg/L	18 μ <b>g/L</b>	
Median Effluent (mg/L):				1 μg/L	<1 µg/L	
Median Removal (%):				86	94	

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
APE						
	50% TSS Ren	noval	80% TSS	6 Removal		

## Local Installations

# of Installations in Washington:

1

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$1000 low: \$100/day high: \$2500 high: \$250/day



Manufacturer/Vendor: Name of Technology: Technology Type: Waste & Environmental Technologies Ltd. Wetsep Chemical Treatment

#### **Treatment Notes**

The data can be stored and downloaded from data logger for flowrate, pH and Turbidity. Grab samples can also be taken at various points in the system to be varified by a third party (i.e. laboratory). Please aslo find the Field Study for the WetSep filtration System

#### **Additional Notes**

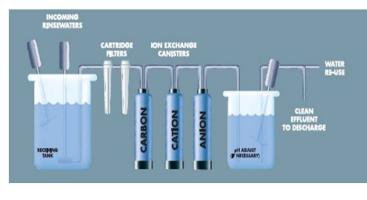
The WetSep system was used in the State of Washington at the Canada/US border crossing. The main Contractor for this job was JE Dunn Construction. The main use of the unit was for treatment of construction waste runoff.



Manufacturer/Vendor: Name of Technology: Technology Type:

### Siemens Waste Water Ion Exchange System (WWIX) Ion Exchange

### Schematic



## System Design Information

Design Flow Rate (gpm):low:1gpmhigh:5000gpm

System Footprint (sq. ft.):

Required Head Loss (ft): 20psi Internal or External Bypass:

None

#### Application

Stormwater/Process Water/ Wastewater/Groundwater

### Treatment Performance \*

	TSS	ТР	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Disso	olved Metals	
Cu	Pb	Zn	Cu	Pb	Zn
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2" <tr< td=""><td></td><td></td></tr<>		

\* Blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Ren	noval	80% TS	S Removal		

## Local Installations

# of Installations in Washington:

>500

### **Estimated** Costs

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$3,000 low: \$3,000

high: <u>\$250,000</u> high: <u>\$500,000</u>



Manufacturer/Vendor: Name of Technology: Technology Type: Siemens Waste Water Ion Exchange System (WWIX) Ion Exchange

#### **Treatment Notes**

For stormwater treatment systems Siemens has media tailored to achieve low discharge levels as low as 1ppb and 12ppt for mercury. Siemens systems are typically sampled by customer and checked with on site test kits or samples shipped to local certified laboratories for evaluation.

Passive



Advanced Drainage Systems, Inc

ADS<sup>®</sup> Water Quality Unit

Oil/Water Separator

RESERS

Manufacturer/Vendor: Name of Technology: Technology Type:

### Schematic

### System Design Information

 Design Flow Rate (gpm):

 low:
 1800

 high:
 126000

System Footprint (sq. ft.):

0 Required Head Loss (ft):

Internal or External Bypass:

Application

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND	NA		ND				
Median Effluent (mg/L):	ND	NA		ND				
Median Removal (%):	80	>43		80				

		Total Meta	als	Disso	lved Meta	ls
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:						
Median Influent (mg/L):	ND	ND	ND	ND	ND	ND
Median Effluent (mg/L):	ND	ND	ND	ND	ND	ND
Median Removal (%):	74	74	74	74	74	74

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approv
PE						
	50% TSS Ren	noval	80% TSS	S Removal		

### Local Installations

# of Installations in Washington:

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: Advanced Drainage Systems, Inc ADS® Water Quality Unit Oil/Water Separator

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: Eco-Tec, Inc ADsorb-it Drain Inlet Inset (Absorbent Boom/Fabric)

#### Schematic

### System Design Information

Design Flow Rate (gpm):low:80/SFhigh:100/SF

System Footprint (sq. ft.): Varies Required Head Loss (ft): NA Internal or External Bypass: Per individual application

Application Stormwater, Groundwater, Wastewater, Process Water

Treatment Performance \*

Oil / Water Separator Adsorb-it<sup>®</sup> Polishing Filter Pack US Navy Manchester Fuel Depot

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	Varies		Varies	Varies				
Median Effluent (mg/L):	Varies		Varies	Varies				
Median Removal (%):	80-99		99-100	99-100				

	Total Meta	ais	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
Varies	Varies	Varies	Varies	Varies	Varies	
	Varies		Varies Varies Varies	Varies     Varies     Varies	Varies     Varies     Varies     Varies	

blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil
ТАРЕ					
		·			
	50% TSS Rer	noval	80% TS	S Removal	
NJCAT					

### Local Installations

# of Installations in Washington:

61

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$0.91/SF low: \$0.91/SF high: \$0.91/SF high: \$0.91/SF



Manufacturer/Vendor:
Name of Technology:
Technology Type:

Eco-Tec, Inc	
ADsorb-it	
Drain Inlet Inset (Absorbent Boom/Fabric)	

#### **Treatment Notes**

A variety of sampling methods have been implemented over the years based on specific installations of the ADsorb-it Filtration Fabric and associated application specific product configurations manufactured from the ADsorb-it Fabric. ADsorb-it is designed to be versatile in its installation for diverse filtration applications, thus it can be configured for Downspout, Drain Inlet Inset, Below Ground Vault, Above Ground Vault, Shoreline, Oil Water Separator, and General Stormwater applications. ADsorb-it is approved by the Department of Ecology (Ecology) for use as a Catch Basin Insert and is used by Ecology for spill response and general oil/water related issues.

#### **Additional Notes**

As can be seen on our web site at www.eco-tec-inc.com, miles of ADsorb-it Fabric were deployed along the Gulf Coast Shoreline as an Oil Fence to provide effective removal of advancing oils from the BP Deepwater Horizon Release. Additional testing data can be accessed on our web site simply by clicking on "Test Data" in the left hand column. As a note, ADsorb-it is highly effective at removing hydrocarbons, including fats, oils and greases (FOG) from water, thus any other contaminants that would be attached to the hydrocarbon such as PCBs would be removed in conjuncton with hydrocarbon / FOG removal. ADsorb-it is an environmentally compatible product in that it is: Made from waste fibers from the textile manufacturing industry, it effectively removes hydrocarbons and associated / attached contaminants from the environment, it can be cleaned and reused indefinitely, it can be disposed of as a fuel source with a higher BTU per pound value than coal and less than 1% residual ash.



Manufacturer/Vendor: Name of Technology: Technology Type: AquaShield, Inc. Aqua-Filter Media Filtration(Combination System (with Hydrodyanamic Separation))

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 25

 high:
 960+

System Footprint (sq. ft.): NA Required Head Loss (ft): 0.8 Internal or External Bypass: Both

Application Stormwater/ Process Water

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:	160							
Median Influent (mg/L):	43							
Median Effluent (mg/L):	5							
Median Removal (%):	80							

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic Enhanced Phosphorus Oil			Other Approvals:	
TAPE		PULD	PULD	PULD	PULD	
	50% TSS Ren	noval	80% TSS	6 Removal		
NJCAT				Х		

# of Installations in Washington:

13

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: Site-specific

high: <u>Site-specific</u> high: <u>Site-specific</u>



Manufacturer/Vendor: Name of Technology: Technology Type: AquaShield, Inc. Aqua-Filter Media Filtration(Combination System (with Hydrodyanamic Separation))

#### **Treatment Notes**

Independent lab by grab samples. Field by auto-composite sampling, 6 sample pairs per TARP qualifying storm.

#### **Additional Notes**

Aqua-Filter filtration cartridge has been verified by NJCAT. AF--5.3 model is currently undergoing independent TARP Tier II field testing in Maryland averaging 96% TSS removal. Anticipate completion in 2012. AF-4.2 model field tested at Univeristy of New Hampshire Stormwater Center, 80% TSS removal efficiency (see above parameters).



Manufacturer/Vendor: Name of Technology: Technology Type: AquaShield, Inc. Aqua-Guardian Drain Inlet Insert(Combination System (Screen and Media Filtration))

#### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 5/400\*

 high:
 100/940\*

System Footprint (sq. ft.): NA Required Head Loss (ft): 0 Internal or External Bypass: Both

Application Stormwater

#### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:	160							
Median Influent (mg/L):	43							
Median Effluent (mg/L):	5							
Median Removal (%):	80							

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	<b>F0% T</b> 55 <b>D</b> or		90% TC	C. Domoval		
NJCAT	50% TSS Ren	novai	80% 133	S Removal		
			Lo	cal Installatior	15	
# of Instal	lations in Washingt	on:		15		
			E	stimated Costs	5	

Estimated Installation Cost: Estimated Annual O&M Cost: low: Site-specific

high: <u>Site-specific</u> high: <u>Site-specific</u>



Manufacturer/Vendor: Name of Technology: Technology Type: AquaShield, Inc. Aqua-Guardian Drain Inlet Insert(Combination System (Screen and Media Filtration))

#### **Treatment Notes**

\* x/x = flow thru perlite/flow thru perlite + filter cloth. See Aqua-Filter, since this device uses same media. Independent lab by grab samples. Field by auto-composite sampling, 6 sample pairs per TARP qualifying storm.

#### **Additional Notes**

See Aqua-Filter since this device uses same filter media. Aqua-Filter filtration cartridge has been verified by NJCAT. AF-5.3 model is currently undergoing independent TARP Tier II field testing in Maryland averaging 96% TSS removal. Anticipate completion in 2012. AF-4.2 model field tested at Univeristy of New Hampshire Stormwater Center, 80% TSS removal efficiency (see above parameters).



Manufacturer/Vendor: Name of Technology: Technology Type: AquaShield, Inc. Aqua-Swirl Hydrodynamic Separation

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 100

 high:
 2,600

System Footprint (sq. ft.):

Required Head Loss (ft): 0.25

Internal or External Bypass:

Both Application

Stormwater/Process Water

### Treatment Performance \*

	TSS	ТР	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:	192							
Median Influent (mg/L):	137							
Median Effluent (mg/L):	12							
Median Removal (%):	86							

	Total Meta	IS	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
			Cu Pb Zn			

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ	GULD					
	50% TSS Ren	noval	90% TC	S Removal		
	50% 155 Ker	novai	80% 13	s Removal		
NJCAT	X					
			Lo	cal Installation	S	
# of Instal	lations in Washingt	on:		82		

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: Site-specific

high: Site-specific
high: Site-specific



Manufacturer/Vendor:	AquaShield, Inc.
Name of Technology:	Aqua-Swirl
Technology Type:	Hydrodynamic Separation

#### **Treatment Notes**

Lab tested by Tennessee Tech University using autosamplers. Field by auto-composite sampling, 6 sample pairs per TARP.

#### **Additional Notes**

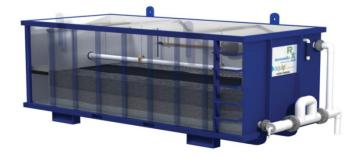
Independent field testing underway per TARP Tier II in Maryland, anticipate completion in 2011. 16 storms and 14 inches of rain sampled to date. Sample parameters above are for field test. Lab testing verified by NJCAT.



Manufacturer/Vendor: Name of Technology: **Technology Type:** 

StormwateRx LLC Aquip Enhanced Filtration System Media Filtration(Above ground (pump required))

#### Schematic



### System Design Information

Design Flow Rate (gpm): low: 10 high: 350

System Footprint (sq. ft.): 14 - 320 **Required Head Loss (ft):** 4 - 7 Internal or External Bypass: External Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	30			9.9				
Median Effluent (mg/L):	3.39			3				
Median Removal (%):	83		YES	70	YES	YES		YES

	Total Met	als	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
0.152	0.03	0.425	0.084	0.008	0.196	
0.008	0.006	0.061	0.006	0.007	0.06	
94	79	85	93	51	73	
	0.152	Cu         Pb           0.152         0.03           0.008         0.006	0.152         0.03         0.425           0.008         0.006         0.061	Cu         Pb         Zn         Cu           0.152         0.03         0.425         0.084           0.008         0.006         0.061         0.006	Cu         Pb         Zn         Cu         Pb           0.152         0.03         0.425         0.084         0.008           0.008         0.006         0.061         0.006         0.007	

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals
TAPE						
			•	· ·		
	50% TSS Ren	noval	80% TS	S Removal		
NJCAT						
			Le	ocal Installatio	ns	

# of Installations in Washington:

30

#### **Estimated Costs**

**Estimated Installation Cost: Estimated Annual O&M Cost:**  low: \$5,000 low: \$0.0003/gal high: \$150,000 high: \$0.003/gal



 Manufacturer/Vendor:
 StormwateRx LLC

 Name of Technology:
 Aquip Enhanced Filtration System

 Technology Type:
 Media Filtration(Above ground (pump required))

#### **Treatment Notes**

These samples were collected as grab samples by StormwateRx, consulting engineers, and facility treatment system operators. All analytical data is from a third party certified analytical lab. Non-detects were assumed to have the value of one half the detection limit.

#### **Additional Notes**

Non-detects were assumed to have the value of one half the detection limit.

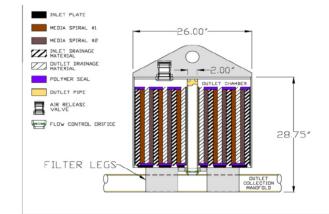
Aquip removes PCBs, PAHs and other toxic organics through particle filtration and absorption to one of the filtration media in the bed. VOC and SVOC removal is through absorption and biological degradation.

The Aquip is a secondary defense against oil and grease and removes TPH and soluble oils through biodegredataion, absorption and bio-mechanical means.



Manufacturer/Vendor: Name of Technology: Technology Type:

#### Schematic



BaySaver Technologies, Inc.

Media Filtration(Cartridge)

BayFilter<sup>®</sup>

#### System Design Information

 Design Flow Rate (gpm):

 low:
 15

 high:
 30

System Footprint (sq. ft.): 0

Required Head Loss (ft):

Internal or External Bypass:

Application

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND	NA		ND				
Median Effluent (mg/L):	ND	NA		ND				
Median Removal (%):	80	>50		80				

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"   <			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE		CULD	CULD	CULD		
			•			
	50% TSS Ren	noval	80% TS	S Removal		

### Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: BaySaver Technologies, Inc. BayFilter® Media Filtration(Cartridge)

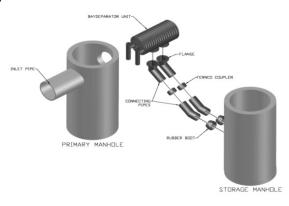
**Treatment Notes** 

**Additional Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: BaySaver Technologies, Inc. BaySeparator® Hydrodynamic Separation

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 450

 high:
 1350

System Footprint (sq. ft.): 0

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND	NA		ND				
Median Effluent (mg/L):	ND	NA		ND				
Median Removal (%):	80	19		80				

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):				ND		ND	
Median Effluent (mg/L):				ND		ND	
Median Removal (%):				42		38	
* la la value a lla tradica da constanta	·						

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil
ТАРЕ	CULD				
			-		
	50% TSS Rer	noval	80% TSS	S Removal	

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: BaySaver Technologies, Inc. BaySeparator<sup>®</sup> Hydrodynamic Separation

**Treatment Notes** 

**Additional Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: Bio Clean Environmental Bio Clean Curb Inlet Basket Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

### Schematic

#### System Design Information

Design Flow Rate (gpm): low: <u>381</u> high: 898

System Footprint (sq. ft.): 0 Required Head Loss (ft): 0.5-2 Internal or External Bypass: External Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	NA	85.8	NA	NA	NA	NA	NA	NA
Median Effluent (mg/L):	NA	73.4	NA	NA	NA	NA	NA	NA
Median Removal (%):	93*	14	NA	NA	NA	NA	NA	NA

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	NA	NA	24.3	NA	NA	NA	
Median Effluent (mg/L):	NA	NA	10.4	NA	NA	NA	
Median Removal (%):	NA	NA	79	NA	NA	NA	

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-						· · · · · · · · · · · · · · · · · · ·
	50% TSS Removal		80% TS	S Removal		
NJCAT						

### Local Installations

# of Installations in Washington:

0 WA

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$445 low: \$0.20/gal high: \$1,600 high: \$0.40/gal



 Manufacturer/Vendor:
 Bio Clean Environmental

 Name of Technology:
 Bio Clean Curb Inlet Basket

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

The Curb Inlet Basket has been in use since the mid 90's. Several field and laboratory studies have been performed on the system. For this reason several reports are being listed below.

--Univerisity of Southern California Independent Field Testing (Turbidity in NTUs)

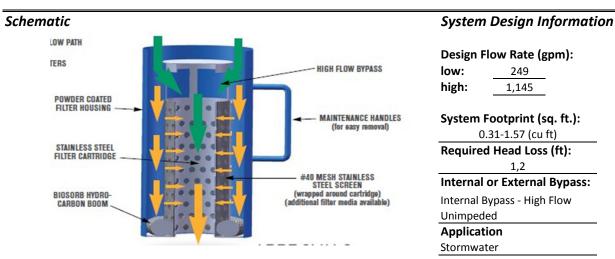
--Suspended Solids Retention Testing Full Scale Lab Testing

#### **Additional Notes**

\*Mass Balance was used for the Suspended Solids Retention Test and therefore mg/L and number of samples does not apply. An OK-90 Sand gradation was used for the testing.



Manufacturer/Vendor: Name of Technology: Technology Type: Bio Clean Environmental Bio Clean Downspout Filter Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))



# Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	NA	NA		223.5	NA	NA	NA	NA
Median Effluent (mg/L):	NA	NA		29.5	NA	NA	NA	NA
Median Removal (%):	93*	NA		87	NA	NA	NA	NA

		Total Metals			Dissolved Metals					
	Cu	Pb	Zn	Cu	Pb	Zn				
Number of samples:										
Median Influent (mg/L):	NA	NA	NA	NA	NA	NA				
Median Effluent (mg/L):	NA	NA	NA	NA	NA	NA				
Median Removal (%):	76	96	69	NA	NA	NA				
* blank cells indicate no info	* blank cells indicate no information was received from vendor									

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
PE						
	-				<u> </u>	
		noval	80% TS	S Removal		
	50% TSS Rer	liovai	00/013	Sitemoval		

### Local Installations

# of Installations in Washington:

17 (Port of Olympia)

### **Estimated Costs**

Estimated Installation Cost:	low:	\$1,035	high:	\$1,200
Estimated Annual O&M Cost:	low:	\$0.16/gal	high:	\$0.22/gal



Manufacturer/Vendor: Name of Technology: Technology Type: Bio Clean Environmental Bio Clean Downspout Filter Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

The Bio Clean Downspout Filter has been used since 2003. It has been tested and approved by IAMPO. The downspout filter has UPC certification. The filter has been tested under the IAMPO to verify treatment and bypass flow rates. The filter also meets the protocol's minimum pollutant removal specification of at least 60% TSS at a concentration of 150 mg/L over a several hour period up to the storage capacity of the product. The filter has also been tested in full scale labratory testing.

--Full Scale Laboratory Testing D-Tek Analytical

--X-Tex-Z-200 Testing for Metals - From Xextex Corporation, USA

#### **Additional Notes**

\*Mass Balance was used for the TSS Tesing and therefore mg/L and number of samples does not apply. Turbidity in NTUs. This filter is made of all stainless steel and is istalled inline with new or existing downspouts. The Bio Clean Downspout Filter is also available with added for ion exchange embedded filter fabric for enhanced removal of metals. The filter is adaptable to downspout sizes 4" to 12".



Manufacturer/Vendor: Name of Technology: Technology Type: Bio Clean Environmental Bio Clean Flume Filter Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

### Schematic



### System Design Information

Design Flow Rate (gpm): low: 116 high: 583

System Footprint (sq. ft.): 1,6 Required Head Loss (ft): 0.083,0.5 Internal or External Bypass: Internal Bypass Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	73	NA	223	360	NA	NA	NA	NA
Median Effluent (mg/L):	51.6	NA	29.5	62	NA	NA	NA	NA
Median Removal (%):	29	NA	87	83	NA	NA	NA	NA

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	NA	NA	NA	NA	NA	NA	
Median Effluent (mg/L):	NA	NA	NA	NA	NA	NA	
Median Removal (%):	NA	17	NA	NA	NA	NA	

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Removal		80% TS	S Removal		
NJCAT						

### Local Installations

# of Installations in Washington:

0 WA

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost:

low:	\$660	_
low:	\$0.23/gal	

high: \$1,302 high: \$0.74/gal



 Manufacturer/Vendor:
 Bio Clean Environmental

 Name of Technology:
 Bio Clean Flume Filter

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

The Bio Clean Flume Filter has been tested indepedently in a full scale laboratory setting.. A series of 5 composite influent and effluent samples were collcted over a period of two days. The Flume Filter Tested utilized a series of three BioSorb Hydrocarbon Booms.

--Full Scale Laboratory Testing D-Tek Analytical

#### **Additional Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Bio Clean Environmental Bio Clean Grate Inlet Skimmer Box Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))





### System Design Information

 Design Flow Rate (gpm):

 low:
 224

 high:
 8,980

System Footprint (sq. ft.): 0 Required Head Loss (ft): 0.5,2 Internal or External Bypass: Internal - High Flow Rate Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	NA	18.6	NA	189	NA	NA	NA	NA
Median Effluent (mg/L):	NA	0.452	NA	10.43	NA	NA	NA	NA
Median Removal (%):	86*	98	NA	95	NA	NA	NA	NA

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	1.9	1.5	13.7	NA	NA	NA	
Median Effluent (mg/L):	0.1	0.2	0.73	NA	NA	NA	
Median Removal (%):	95	87	95	NA	NA	NA	

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

### Local Installations

# of Installations in Washington:

0 WA, 123 OR

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost:

low:	\$635	h
low:	\$0.15/gal	h

nigh: \$1,800 nigh: \$0.40/gal



 Manufacturer/Vendor:
 Bio Clean Environmental

 Name of Technology:
 Bio Clean Grate Inlet Skimmer Box

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

The Grate Inlet Skimmer Basket has been in use since the mid 90's. Several field and laboratory studies have been performed on the system. For this reason several reports are being listed below.

--Longo Toyota - Independent Field Testing

--Suspended Solids Retention Testing Full Scale Lab Testing

--Reedy Creek Improvement District Independent Field Testing

--UC Irvine Independent Testing

--Whitman's Pond

--Creech Engineering

#### **Additional Notes**

\*Mass Balance was used for the Suspended Solids Retention Test and therefore mg/L and number of samples does not apply. An OK-90 Sand gradation was used for the testing.

HERRERA

Manufacturer/Vendor: Name of Technology: Technology Type: Bio Clean Environmental Bio Clean Trench Drain Filter Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### Schematic



### System Design Information

Design Flow Rate (gpm):low:28high:86

System Footprint (sq. ft.): 0 Required Head Loss (ft): 4,12 Internal or External Bypass: Internal Bypass Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	NA	NA	NA	NA	NA	NA	NA	NA
Median Effluent (mg/L):	NA	NA	NA	NA	NA	NA	NA	NA
Median Removal (%):	NA	NA	NA	NA	NA	NA	NA	NA

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	NA	NA	NA	NA	NA	NA	
Median Effluent (mg/L):	NA	NA	NA	NA	NA	NA	
Median Removal (%):	NA	NA	NA	NA	NA	NA	

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
			-			•
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

#### Local Installations

# of Installations in Washington:

0

#### **Estimated Costs**

Estimated Installation Cost:low:\$660highEstimated Annual O&M Cost:low:\$0.23/galhigh

high: \$1,302 high: \$0.74/gal



 Manufacturer/Vendor:
 Bio Clean Environmental

 Name of Technology:
 Bio Clean Trench Drain Filter

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

No testing has been done on the trench drain filter.

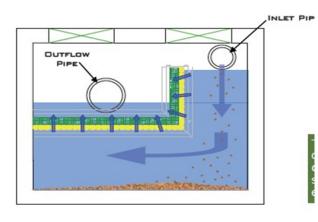
#### **Additional Notes**

The Bio Clean Trench Drain Filter comes standard with BioSorb Hydrocarbon booms or can use BioMediaGREEN. The filter is designed to utilize varoius media based upon pollutants of concern. The Trench Drain Filter can be used in various size trench drains.



Manufacturer/Vendor: Name of Technology: Technology Type: Bio Clean Environmental Bio Clean Water Polisher - Up Flow Filter Hydrodynamic Separation(Up-Flow)

### Schematic



### System Design Information

Design Flow Rate (gpm): low: 191 high: 528 System Footprint (sq. ft.): 0 Required Head Loss (ft): 1,2 Internal or External Bypass: Internal Bypass - High Flow Unimpeded Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	84.6	2.07	1.4	69.8	NA	NA	NA	NA
Median Effluent (mg/L):	12.4	0.63	0	6.5	NA	NA	NA	NA
Median Removal (%):	85	70	>99	91	NA	NA	NA	NA

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	NA	NA	NA	0.57	0.38	0.75	
Median Effluent (mg/L):	NA	NA	NA	0.12	0.01	0.16	
Median Removal (%):	NA	NA	NA	79	98	78	

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:	
TAPE							
	1						
	50% TSS Rer	Removal	80% TS	TSS Removal	Removal		
NJCAT							
			Lo	cal Installati	ons		

# of Installations in Washington:

0

### **Estimated** Costs

Estimated Installation Cost:	low:	\$25,000	high: \$125,000
Estimated Annual O&M Cost:	low:	\$5.24/gal	high: \$7.85/gal



Manufacturer/Vendor:	Bio Clean Environmental
Name of Technology:	Bio Clean Water Polisher - Up Flow Filter
Technology Type:	Hydrodynamic Separation(Up-Flow)

#### **Treatment Notes**

The Bio Clean Water Polisher is a unique upflow media filter designed as a stand alone treatment unit or incorporated with the Nutrient Separating Baffle Box to form a complete treatment train. The Bio Clean Water Polisher utilizes the revolutionary filter media, BioMediaGREEN. The BioMediaGREEN has been independently tested in full scale labaratory testing. Media surface loading rate during the testing averaged 2-5 gpm with minimal head. A series of 8 composite influent and effluent grab samples we collected over a perioud of two days.

BioMediaGREEN Performance Testing by Waves Environmental - Independent Full Scale Lab Testing

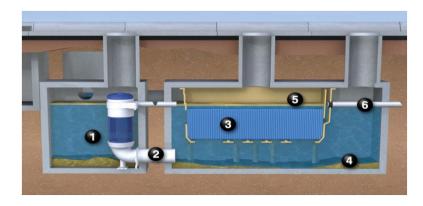
#### **Additional Notes**

The Bio Clean Water Polisher utilizes the revolutionary filter media, BioMediaGREEN. This material is made of billions of small fibers formed into solid blocks. The media composition consists of various oxides to allow for ion exchange and precipitation of dissolved pollutants. The physical structure of the media provides high peformance for the entrapment of particulate pollutants. The media has 80% void space which allows for double the hydraulic retention time when compared to granular media which leads to better overall performance. Another result of the void space is a high hydraulic conductivity. The media surface area loading rate for the media is approximately 7 gpm/sq ft surface area at a head pressure of 18".



Manufacturer/Vendor: Name of Technology: Technology Type: Bio-Microbics, Inc. BioStorm<sup>®</sup> Oil/Water Separator

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 225

 high:
 4,800

System Footprint (sq. ft.): 45 - 162 Required Head Loss (ft): 0.5 - 0.17 Internal or External Bypass: External Application

Stormwater/Groundwater

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	227							
Median Effluent (mg/L):	7.9							
Median Removal (%):	95.3							

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	-		-			
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT	CAT					
			Lo	cal Installation	S	
# of Instal	ations in Washingt	on:		0		
			E	stimated Costs		
Estimated	Installation Cost:		low:	\$500	<b>high:</b> \$2	2,000
Estimated	Annual O&M Cost	:	low:	\$400	high: \$4	4,000



Manufacturer/Vendor:	Bio-Microbics, Inc.
Name of Technology:	BioStorm®
Technology Type:	Oil/Water Separator

#### **Treatment Notes**

TSS results are from grab samples done in a lab setting. Unit was tested from 50% of design flow up to 125%. Numbers reported below are at 100% of design flow.

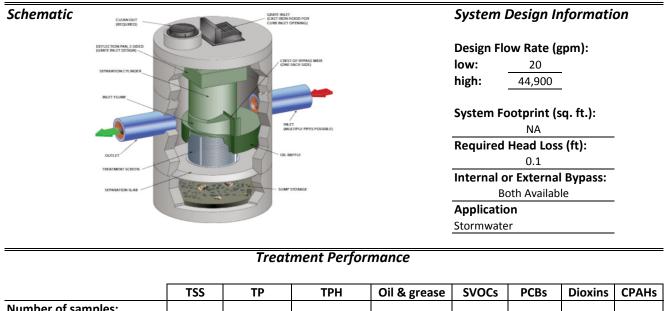
#### **Additional Notes**

Installation costs and O&M costs are estimates for the Washington area and do not include equipment or tank costs. Drawings and further information on the product can be obtained on our website at the following url: http://biomicrobics.com/?p=77



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Stormwater Solutions, Inc.

CDS Hydrodynamic Separation



	155	 	Oli di gi cusc	5000	DIOXIII3	
Number of samples:						
Median Influent (mg/L):	154		22			
Median Effluent (mg/L):	26		5			
Median Removal (%):	95		64			

		Total Metals			Dissolved Metals				
	Cu	Pb	Zn	Cu	Pb	Zn			
Number of samples:									
Median Influent (mg/L):									
Median Effluent (mg/L):									
Median Removal (%):									
* blank cells indicate no info	* blank cells indicate no information was received from vendor								

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ	GULD	GULD			PULD	
	50% TSS Ren	noval	80% TS	S Removal		
NJCAT	Х					
			Lo	cal Installatio	ns	
# of Instal	lations in Washingt	on:	>	250		
			F	stimated Cost		

#### Estimated Installation Cost: Estimated Annual O&M Cost:

low: \$10,000 low: \$0.00001/gal high: \$2.5M high: \$0.00001/gal



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Stormwater Solutions, Inc.

CDS Hydrodynamic Separation

#### **Treatment Notes**

The Manasquan Savings Bank Stormwater Treatment System Field Evalutaion: CDS Unit (2010). Field, Peer-Reviewed, Composite.

#### **Additional Notes**

Oil & Grease laboratory data using sorbents at flow rates of 25, 50, and 75% of design.



Manufacturer/Vendor: Name of Technology: Technology Type: StormwateRx LLC Clara Plug Flow Separator Hydrodynamic Separation

### Schematic

### System Design Information

Design Flow Rate (gpm): low: 5 high: 1120

System Footprint (sq. ft.): 0 - 150 Required Head Loss (ft): 0.5 - 1.5 Internal or External Bypass: Internal

Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	284.5							
Median Effluent (mg/L):	173.5							
Median Removal (%):	47		YES	YES				

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	0.516	0.088	2.82				
Median Effluent (mg/L):	0.078	0.072	1.21				
Median Removal (%):	30	26	32				

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	noval	80% TSS Removal			
NJCAT						
			10	ocal Installati	ons	

### Local Installations

# of Installations in Washington:

2

#### **Estimated** Costs

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$20,000 low: \$0.0005/gal high: \$52,000 high: \$0.001/gal



 Manufacturer/Vendor:
 StormwateRx LLC

 Name of Technology:
 Clara Plug Flow Separator

 Technology Type:
 Hydrodynamic Separation

#### **Treatment Notes**

These samples were collected as grab samples by StormwateRx, consulting engineers, and facility treatment system operators. All analytical data is from a third party certified analytical lab. Non-detects were assumed to have the value of one half the detection limit.

#### **Additional Notes**

The Clara uses four pre-engineered chambers with an internal high-flow bypass to trap pollutants such as heavy solids and oil and grease.



Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

Manufacturer/Vendor: Name of Technology: Technology Type:

Schematic

Clean Way Downspout Filtration Unit

Clean Way

### System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Metals			Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn		
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								
* blank colle indicate no info					1			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-	•					
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor:	Clean Way
Name of Technology:	Clean Way Downspout Filtration Unit
Technology Type:	Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

**Additional Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: ClearWater Solutions, Inc. \* ClearWater BMP Drain Inlet Insert(Combination System (Screen and Media Filtration))

#### Schematic



### System Design Information

Design Flow Rate (gpm):low:200high:200

System Footprint (sq. ft.): 5,6 Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-	•					
	50% TSS Rer	TSS Removal 80% TSS Removal		S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_ high: \_\_\_\_\_ high: \_\_\_\_\_



 Manufacturer/Vendor:
 ClearWater Solutions, Inc. \*

 Name of Technology:
 ClearWater BMP

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Media Filtration))

#### **Treatment Notes**

**Additional Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: Coanda, Inc. Curb Inlet Drain Inlet Insert(Combination System (Screen and Media Filtration))

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 50

 high:
 360,000

System Footprint (sq. ft.): 2-2000 Required Head Loss (ft): 1.5-3

Internal or External Bypass: Internal

Application

Stormwater/Wastewater/ Process Water

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	1500							
Median Effluent (mg/L):	1376							
Median Removal (%):	8							

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):			48				
Median Effluent (mg/L):			15				
Median Removal (%):			69				

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
					-	
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

### Local Installations

# of Installations in Washington:

A handful of private downspouts and area drains.

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost:

low:	\$2,000	high:
low:	\$-0-	high:

i**gh:**<u>\$3,500</u> i**gh:**\$-0-



Manufacturer/Vendor: Name of Technology: Technology Type:

Coanda, Inc.
Curb Inlet
Drain Inlet Insert(Combination System (Screen and Media Filtration))

### **Treatment Notes**

USC (University of Southern California) obtained trash from Los Angeles Sanitation Services and United Stormwater. The Coanda BMP was filled with trash to evaluate the hydraulic performance. The test was conducted by running water from water trucks onto the street. The water then entered the BMP at approximately 635 gallons per minute (gpm). The BMP was evaluated for pollutant removal potential by collecting water quality samples before it reached the BMP and then from under the BMP at different time intervals. The samples were evaluated by USC using chemical analysis to determine the water quality.

### **Additional Notes**

A summary of the USC report can be found at: http://www.coanda.com/products/documents/usc\_research\_project.pdf.

Other case studies have been performed, demonstrating removal of trash, nutrients, metals, pesticides, and bacteria: http://www.coanda.com/products/documents/Rowlett\_Case\_Study\_I.pdf



Manufacturer/Vendor: Name of Technology: Technology Type: Coanda, Inc. Downspouts Drain Inlet Insert(Combination System (Screen and Media Filtration))

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 50

 high:
 360,000

System Footprint (sq. ft.): 2-2000 Required Head Loss (ft): 1.5-3 Internal or External Bypass: Internal

Application Stormwater/Wastewater/ Process water

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	1500							
Median Effluent (mg/L):	1376							
Median Removal (%):	8							

	Total Meta	als	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
		48				
		15				
		69				
	Cu		48 15	Cu         Pb         Zn         Cu           48         15         15         15	Cu         Pb         Zn         Cu         Pb           48         15         15         15         15	

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

### Local Installations

# of Installations in Washington:

A handful of private downspouts and area drains.

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost:

low:	\$2,000	high
low:	\$-0-	high

i**gh:**<u>\$3,500</u> i**gh:**\$-0-



Manufacturer/Vendor: Name of Technology: Technology Type: Coanda, Inc. Downspouts Drain Inlet Insert(Combination System (Screen and Media Filtration))

### **Treatment Notes**

USC (University of Southern California) obtained trash from Los Angeles Sanitation Services and United Stormwater. The Coanda BMP was filled with trash to evaluate the hydraulic performance. The test was conducted by running water from water trucks onto the street. The water then entered the BMP at approximately 635 gallons per minute (gpm). The BMP was evaluated for pollutant removal potential by collecting water quality samples before it reached the BMP and then from under the BMP at different time intervals. The samples were evaluated by USC using chemical analysis to determine the water quality.

### **Additional Notes**

A summary of the USC report can be found at: http://www.coanda.com/products/documents/usc\_research\_project.pdf.

Other case studies have been performed, demonstrating removal of trash, nutrients, metals, pesticides, and bacteria: http://www.coanda.com/products/documents/Rowlett\_Case\_Study\_I.pdf



Manufacturer/Vendor: Name of Technology: Technology Type: CrystalStream Technologies CrystalClean Separator Oil/Water Separator

### Schematic



Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
المتعادية والمتعالية المتعادية والمتعاد العالية							

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: CrystalStream Technologies CrystalClean Separator Oil/Water Separator

### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: CrystalStream Technologies CrystalCombo Hybrid Polisher Media Filtration(Combination System (with Oil/Water Separator))

### Schematic

### System Design Information

Design Flow Rate (gpm): low: high:

\_\_\_\_\_

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Disso	lved Meta	S
Cu	Pb	Zn	Cu	Pb	Zn
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ТАРЕ						
-						
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



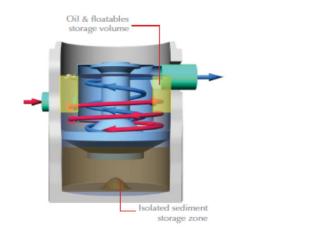
Manufacturer/Vendor: Name of Technology: Technology Type: CrystalStream Technologies CrystalCombo Hybrid Polisher Media Filtration(Combination System (with Oil/Water Separator))

### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Hydro International, Inc. Downstream Defender Hydrodynamic Separation

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 500

 high:
 7800

System Footprint (sq. ft.): 0 Required Head Loss (ft): 0.5-0.9 Internal or External Bypass:

Application

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND							
Median Effluent (mg/L):	ND							
Median Removal (%):	50							

	Total Meta	ls	Disso	lved Meta	s
Cu	Pb	Zn	Cu	Pb	Zn
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: C		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE	GULD					
-						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT	Х					

Local Installations

# of Installations in Washington:

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high: \_\_\_\_\_ high: \_\_\_\_\_



 Manufacturer/Vendor:
 Hydro International, Inc.

 Name of Technology:
 Downstream Defender

 Technology Type:
 Hydrodynamic Separation

### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: United Storm Water, Inc. DrainPac<sup>™</sup> Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

### Schematic



### System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Disso	lved Metal	S
Cu	Pb	Zn	Cu	Pb	Zn
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-	•					
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type:

United Storm Water, Inc. DrainPac<sup>™</sup> Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type:

Schematic

**Royal Environmental Systems** 

**Oil/Water Separator** 

ecoLine a

### System Design Information

 Design Flow Rate (gpm):

 low:
 25

 high:
 626

System Footprint (sq. ft.): 12-70 Required Head Loss (ft): 6.00" with clean coalescer Internal or External Bypass: Site specific design required Application Stormwater/Process Water/ Wastewater/Groundwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	(b)		(b)	(b)	(b)	(b)	(b)	(b)
Median Effluent (mg/L):	(b)		(b)	(b)	(b)	(b)	(b)	(b)
Median Removal (%):	(b)		(b)	(b)	(b)	(b)	(b)	(b)

		Total Met	als	Disso	olved Metal	s
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:						
Median Influent (mg/L):	(b)	(b)	(b)	(b)	(b)	(b)
Median Effluent (mg/L):	(b)	(b)	(b)	(b)	(b)	(b)
Median Removal (%):	(b)	(b)	(b)	(b)	(b)	(b)

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
			•			•
	50% TSS Ren	noval	80% TSS	S Removal		

### Local Installations

# of Installations in Washington:

6

### **Estimated** Costs

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$ 6,700 low: (a) high: \$ 44,250 high: (a)



Manufacturer/Vendor: Name of Technology: Technology Type: Royal Environmental Systems ecoLine a Oil/Water Separator

### **Treatment Notes**

CEN EN 858-1 Test Method for Class I Coalescing Separator Light liquid: Fuel oil, per ISO 8217, designation ISO-F-DMA with density of 0.85 g/cm3\* (Solubility of light liquid nil, unsaponifiable) Water: Potable or purified surface water Water turn over: Minimum four volumes of test units Liquid flux: 25-40 m<sup>3</sup>/m<sup>2</sup>-h (10-15 gpm/ft<sup>2</sup>) Max. residual light liquid: 5 mg/L (Hydrocarbon content analysis by prescribed infrared spectroscopy procedure)

### **Additional Notes**

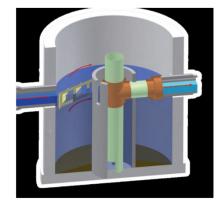
(a) Gravity flow system has no moving parts or power requirement. Oil coalescing media pack can be removed, rinsed, and replaced. In the event of damage to the coalescing media, new coalescing panels can be purchased for a low cost.

(b) Report Form's System performance data fields are not applicable. Product removes free-phase fluids such as floating oil and other petroleum hydrocarbon products (LNAPL - Light Non-Aqueous Phase Liquids).



Manufacturer/Vendor: Name of Technology: Technology Type: Royal Environmental Systems ecoLine b Oil/Water Separator

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 50

 high:
 1110

System Footprint (sq. ft.): N/A Required Head Loss (ft): 6.00" with clean coalescer Internal or External Bypass: Site specific design required

### Application

Stormwater/Process Water/Wastewater/Ground Water

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	(b)		(b)	(b)	(b)	(b)	(b)	(b)
Median Effluent (mg/L):	(b)		(b)	(b)	(b)	(b)	(b)	(b)
Median Removal (%):	(b)		(b)	(b)	(b)	(b)	(b)	(b)

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	(b)	(b)	(b)	(b)	(b)	(b)	
Median Effluent (mg/L):	(b)	(b)	(b)	(b)	(b)	(b)	
Median Removal (%):	(b)	(b)	(b)	(b)	(b)	(b)	

\* blank cells indicate no information was received from vendor

### Approvals

1	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
						•
	50% TSS Ren	noval	80% TSS	S Removal		

### Local Installations

# of Installations in Washington:

7

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$ 8,200 low: (a) high: \$ 81,900 high: (a)



Manufacturer/Vendor: Name of Technology: Technology Type: Royal Environmental Systems ecoLine b Oil/Water Separator

### **Treatment Notes**

CEN EN 858-1 Test Method for Class I Coalescing Separator Light liquid: Fuel oil, per ISO 8217, designation ISO-F-DMA with density of 0.85 g/cm3\* (Solubility of light liquid nil, unsaponifiable) Water: Potable or purified surface water Water turn over: Minimum four volumes of test units Liquid flux: 25-40 m<sup>3</sup>/m<sup>2</sup>-h (10-15 gpm/ft<sup>2</sup>) Max. residual light liquid: 5 mg/L (Hydrocarbon content analysis by prescribed infrared spectroscopy procedure)

### **Additional Notes**

(a) Gravity flow system has no moving parts or power requirement. Oil coalescing media pack can be removed, rinsed, and replaced. In the event of damage to the coalescing media, new coalescing panels can be purchased for a low cost.

(b) Report Form's System performance data fields are not applicable. Product removes free-phase fluids such as floating oil and other petroleum hydrocarbon products (LNAPL - Light Non-Aqueous Phase Liquids).



Schematic

# Treatment Technology Summary Report

 Manufacturer/Vendor:
 EcoSense International Inc.

 Name of Technology:
 EcoSense Stormwater Filtertration systems, Catch basin inserts

 Technology Type:
 Media Filtration(Cartridge)

DEBRIS SCREEN SUPPORT BRACKET SUPPORT BRACKET SNAP RINO DEBRIS SCREEN SUPPORT BRACKET SUPPORT SUPORT SUPPORT S

### System Design Information

 Design Flow Rate (gpm):

 low:
 25

 high:
 1,662\*

System Footprint (sq. ft.):

Required Head Loss (ft): Varies\*

Internal or External Bypass: Internal, Hooded

Application

Stormwater/Process Water/ Wastewater/Groundwater

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Ren	noval	90% TS	S Removal		
NJCAT	50% 155 Kei	lloval	80%13.	Skemoval		
			Lo	cal Installation	s	
					-	
# of Instal	lations in Washingt	on:		0		
			E.	stimated Costs		
Estimated	Installation Cost:		low:	\$400	<b>high:</b> \$2	2,000
Estimated	Annual O&M Cost:		low:	\$100	<b>high:</b> \$5	



 Manufacturer/Vendor:
 EcoSense International Inc.

 Name of Technology:
 EcoSense Stormwater Filtertration systems, Catch basin inserts

 Technology Type:
 Media Filtration(Cartridge)

### **Treatment Notes**

Third party lab and simulated field studies have been done in US, Italy, New Zealand and Canada on filters loaded with Melt Blown Polypropylene only. One study performed Grab samples on canisters loaded with surfactant modified zeolite and impregnated polyester pads. Results will be included with this submittal.

### **Additional Notes**

EcoSense offers two media types for canister filters, but other media may be easily loaded. The system incorporates media filter canisters for low flows and "clean pass" hooded over-flows pipes. Multiple filters and over-flows may be installed depending on space available. Hooded over-flow effectively prevent floatables from bypassing canister filters. Debris, sediment, oils and grease (and contaminant associated) are effectively captured by the system. Debris collection baskets are also available especially designed to remove organic debris and trash. These systems are modular so that depending on catch basin sizes multiple baskets or filters or both may be installed.



Royal Environmental Systems, Inc./Water Tectonics, Inc.

Manufacturer/Vendor: Name of Technology: Technology Type:

Schematic

ecoSep®

Oil/Water Separator

### System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
* blank calls indicate no info					1		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE					PULD	
						· · · · · · · · · · · · · · · · · · ·
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



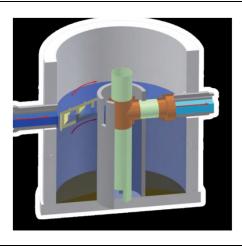
Manufacturer/Vendor: Name of Technology: Technology Type: Royal Environmental Systems, Inc./Water Tectonics, Inc. ecoSep® Oil/Water Separator

### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Royal Environmental Systems ecoStorm & ecoStorm Plus Media Filtration(Combination System (with Hydrodyanamic Separation))

### Schematic



### System Design Information

Design Flow Rate (gpm):low:No Minhigh:180

System Footprint (sq. ft.): N/A Required Head Loss (ft): 0.41' (c) Internal or External Bypass: Internal &/or External Application Stormwater/Process Water/ Wastewater/Ground Water

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	200							
Median Effluent (mg/L):	26							
Median Removal (%):	87							

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	0.019	0.005	0.17			0.066	
Median Effluent (mg/L):	0.009	0.002	0.073			0.042	
Median Removal (%):	53	60	57			36	

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE		CULD				
			•		-	· · · · · · · · · · · · · · · · · · ·
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

### Local Installations

# of Installations in Washington:

9

### **Estimated Costs**

Estimated Installation Cost: lo Estimated Annual O&M Cost: lo

low: \$8,900 (a) low: (b) high: <u>\$37,500 (a)</u> high: (b)



Manufacturer/Vendor: Name of Technology: Technology Type: 

 Royal Environmental Systems

 ecoStorm & ecoStorm Plus

 Media Filtration(Combination System (with Hydrodyanamic Separation))

### **Treatment Notes**

Field monitoring at the McRedmond Park site located in Redmond, WA. Auto sampler for flow-portional composite and time-based discrete collections. Independent analytical laboratory, and 3rd party data validation/statistical analysis of data points and sets.

### **Additional Notes**

ecoStorm and ecoStorm plus can be utilized as separate stand-alone technologies or combined in serial component installation. Combined technologies are currently under TAPE evaluation through WADOE for stormwater. Performance data reflects both stormwater and non-stormwater installations.

(a) Cost varies based on combination of units, number of units, and final design requirements.

(b) \$500 - \$1000 per cleaning/backflush event; Minimum of 1x per yr. to monthly for stormwater.

(c) Headloss based on:

- Current monitoring configuration: 1 ecoStorm upstream of 2 ecoStorm plus units.

- 360 gpm through the system, 180 gpm per filter.

- Site specific model calibrated onsite at known flow rates.

- Headloss negating effects of drop structure were neglected (located between the ecoStorm and ecoStorm plus units).

- Filters assumed to be at the point of required maintenance (twice the headloss measured for new filters).

System Performance Data results shown are for qualifying events only, per Washington State TAPE requirements:

- Per TAPE requirements, removal requirements for influent concentration less than 100 mg/l are that effluent must be less than or equal to 20 mg/l.

- For parameters with no results presented above, they are not being monitored or were present at concentrations are below measurable thresholds.



Royal Environmental Systems, Inc./Water Tectonics, Inc.

Manufacturer/Vendor: Name of Technology: Technology Type:

Schematic

# COTOP BOVE GRADE OILWATER SEPARATOR

ecoTop®

**Oil/Water Separator** 

### System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
* blank calls indicate no info					1		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: Royal Environmental Systems, Inc./Water Tectonics, Inc. ecoTop® Oil/Water Separator

### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type:

Schematic

EcoSense International Inc.

Drain Inlet Insert(Media Filtration)

EcoVault

### System Design Information

 Design Flow Rate (gpm):

 low:
 1,346

 high:
 48,000

System Footprint (sq. ft.): NA Required Head Loss (ft): Varies\* Internal or External Bypass: Either or Both Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Metals			Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn		
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								
* blank cells indicate no info					Ļ			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
APE						
		may al	00% TC	S Removal		-
	50% TSS Ren	novai	00/0133	5 Kemovai		

## Local Installations

# of Installations in Washington:

0

### **Estimated** Costs

Estimated Installation Cost: Estimated Annual O&M Cost: low: <u>\$25,000</u> low: <u>\$200</u> high: <u>\$125,000</u> high: <u>\$1,800</u>



Manufacturer/Vendor: Name of Technology: Technology Type: EcoSense International Inc. EcoVault Drain Inlet Insert(Media Filtration)

### **Treatment Notes**

A study has not been completed on this specific system. Studies have been performed on other manufactures version of the Type II Baffle Box. Minimum Performance claims are based on model studies performed at the Florida Institute of Technology: Pandit and Gopatakrishnan, 1996. The study mentioned was performed with a scale model Type 1 Baffle Box. Improvements such as media filtration and horizontal debris collection system were subsequently added.

### **Additional Notes**

The EcoVault is unique among Type II baffle boxes. The standard model incorporates a high performance media filter into the last internal weir which treats low flows and remove a wide variety of contaminants including bacteria, mobile phosphate, ammonia, dissolved heavy metals and orgainics. TSS removal is expect to be 80% at the flows mentioned above. Course organic materials are captured and stored above the static WL greatly increasing overall nutrient removal. \* Head Loss varies depending on the media filter's top elevation and is directly proportional. Debris loading also effects head loss.



Manufacturer/Vendor: Name of Technology: Technology Type: Enviro-Drain, Inc. Enviro-Drain<sup>®</sup> Drain Inlet Insert(Absorbent Boom/Fabric)

### Schematic



### System Design Information

Design Flow Rate (gpm): low: 2 high: 71

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
* blank calls indicate no info					1		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



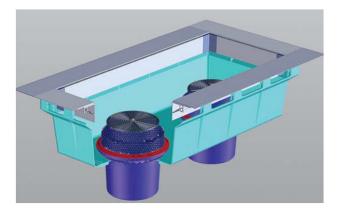
Manufacturer/Vendor: Name of Technology: Technology Type: Enviro-Drain, Inc. Enviro-Drain® Drain Inlet Insert(Absorbent Boom/Fabric)

### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Transpo Industries, Inc. EnviroSafe™ Drain Inlet Insert(Media Filtration)

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 115

 high:
 230

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: Transpo Industries, Inc. EnviroSafe™ Drain Inlet Insert(Media Filtration)

### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Transpo Industries, Inc. EnviroSafe™ Storm Safe HF10 Drain Inlet Insert(Absorbent Boom/Fabric)

### Schematic

### System Design Information

 Design Flow Rate (gpm):

 low:
 900

 high:
 9000

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	als	Disso	lved Metal	s
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:						
Median Influent (mg/L):						
Median Effluent (mg/L):						
Median Removal (%):						
* blank calls indicate no info					•	

\* blank cells indicate no information was received from vendor

Filter tube cut-away

showing helical filters

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TSS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high: \_\_\_\_\_ high: \_\_\_\_\_



 Manufacturer/Vendor:
 Transpo Industries, Inc.

 Name of Technology:
 EnviroSafe™ Storm Safe HF10

 Technology Type:
 Drain Inlet Insert(Absorbent Boom/Fabric)

### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Environment 21 EnviroTrap Catch Basin Insert Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 0

 high:
 2700

System Footprint (sq. ft.): NA Required Head Loss (ft): 0-0.5 Internal or External Bypass: NA Application

Stormwater

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	*250		**400	**400	**400	**400	**400	**400
Median Effluent (mg/L):	*175		**150	**150	**150	**150	**150	**150
Median Removal (%):	*30		**62.5	**62.5	**62.5	**62.5	**62.5	**62.5

		Total Meta	als	Disso	ved Meta	s
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:						
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA
Median Effluent (mg/L):	***0.07	***0.68	***0.24	NA	NA	NA
Median Removal (%):	***9	***13.6	***20	NA	NA	NA
	+	13.0				

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

### Local Installations

# of Installations in Washington:

0

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$200 low: 0 high: \$1,000 high: \$1,000



 Manufacturer/Vendor:
 Environment 21

 Name of Technology:
 EnviroTrap Catch Basin Insert

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

### **Treatment Notes**

\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a d50 of 180 microns was used.

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated. \*\*\*Testing is not complete for metals; therefore, these values are estimated.



Manufacturer/Vendor: Name of Technology: Technology Type: Filterra, DBA Americast, Inc. Filterra Curb Inlet System Bioretention/Filtration

### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 8.5

 high:
 50+

System Footprint (sq. ft.):

Required Head Loss (ft): 2.5 Internal or External Bypass: Can be either

Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:	10	12	12					
Median Influent (mg/L):	27.5	0.15	43.4					
Median Effluent (mg/L):	4.2	0.14	1.2					
Median Removal (%):	84.7	6.7	97.2					

		Total Meta	als	Disso	ved Meta	ls
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:				29		29
Median Influent (mg/L):				0.0056		0.194
Median Effluent (mg/L):				0.0033		0.082
Median Removal (%):				44		54

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals
TAPE		GULD	GULD		GULD	
	50% TSS Ren	noval	80% TSS	6 Removal		

### Local Installations

# of Installations in Washington:

186

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$1,200 low: \$300 high: <u>\$7,500</u> high: <u>\$3,000</u>



Manufacturer/Vendor: Name of Technology: Technology Type: Filterra, DBA Americast, Inc. Filterra Curb Inlet System Bioretention/Filtration

### **Treatment Notes**

For third party field monitoring at the Port of Tacoma Industrial site in WA, samples were collected via automatic flow-weighted composite samplers. Trapezoidal flumes and V-notch weirs with associated bubbler systems were installed to intercept influent and effluent stormwater, respectively, for flow measurements. Water levels within flumes were recorded using 5-minute intervals. A rain guage was installed in association with the units locations to continuously monitor precipitation totals in the drainage areas, and was interfaced with the autosampler and bubbler equipment.

### **Additional Notes**

Data from Technical Evaluation Report (2009) produced by Herrera Environmental Consultants for Washington Department of Ecology. TSS data in the influent range accepted by Ecology(20 mg/L and greater). TP data in the influent range accepted by Ecology (0.1 to 0.5 mg/L). Low TP removal due to anomalous phosphorus data collected at the Port of Tacoma included very low TP influent concentrations and a high fraction of soluble reactive phosphorus. Dissolved copper data in the influent range accepted by Ecology (0.0029 to 0.02 mg/L). Dissolved zinc data in the influent range accepted by Ecology (0.022 to 0.6 mg/L). TPH data in the influent range accepted by Ecology (0.02 to 0.6 mg/L).



Manufacturer/Vendor: Name of Technology: Technology Type: Filterra, DBA Americast, Inc. Filterra Roof Drain System Bioretention/Filtration

#### Schematic



## System Design Information

 Besign Flow Rate (gpm):

 low:
 8.5

 high:
 50+

System Footprint (sq. ft.):

Required Head Loss (ft): 2.5

Internal or External Bypass:

Internal

Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:	10	12	12					
Median Influent (mg/L):	27.5	0.15	43.4					
Median Effluent (mg/L):	4.2	0.14	1.2					
Median Removal (%):	84.7	6.7	97.2					

	Total Metals			Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:				29		29	
Median Influent (mg/L):				0.0056		0.194	
Median Effluent (mg/L):				0.0033		0.082	
Median Removal (%):				44		54	

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
APE		GULD	GULD		GULD	
			-			
	50% TSS Ren	noval	80% TS9	6 Removal		
	J0/0133 Kei	novai	00/0100			

## Local Installations

# of Installations in Washington:

1

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$1,200 low: \$300

high: <u>\$7,500</u> high: <u>\$3,000</u>



Manufacturer/Vendor: Name of Technology: Technology Type: Filterra, DBA Americast, Inc. Filterra Roof Drain System Bioretention/Filtration

#### **Treatment Notes**

For third party field monitoring at the Port of Tacoma Industrial site in WA, samples were collected via automatic flow-weighted composite samplers. Trapezoidal flumes and V-notch weirs with associated bubbler systems were installed to intercept influent and effluent stormwater, respectively, for flow measurements. Water levels within flumes were recorded using 5-minute intervals. A rain guage was installed in association with the units locations to continuously monitor precipitation totals in the drainage areas, and was interfaced with the autosampler and bubbler equipment.

#### **Additional Notes**

Data from Technical Evaluation Report (2009) produced by Herrera Environmental Consultants for Washington Department of Ecology. TSS data in the influent range accepted by Ecology(20 mg/L and greater). TP data in the influent range accepted by Ecology (0.1 to 0.5 mg/L). Low TP removal due to anomalous phosphorus data collected at the Port of Tacoma included very low TP influent concentrations and a high fraction of soluble reactive phosphorus. Dissolved copper data in the influent range accepted by Ecology (0.0029 to 0.02 mg/L). Dissolved zinc data in the influent range accepted by Ecology (0.022 to 0.6 mg/L). TPH data in the influent range accepted by Ecology (0.02 to 0.6 mg/L). TPH data in the influent range accepted by Ecology (10 mg/L or greater).



Manufacturer/Vendor: Name of Technology: Technology Type:

ABT, Inc.
First Flush
Oil/water Separator

### Schematic

### System Design Information

Design Flow Rate (gpm):low:449high:538

System Footprint (sq. ft.): NA Required Head Loss (ft): NA Internal or External Bypass:

Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
* hland, calla indicata na infa	·						

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:							
ΤΑΡΕ													
	50% TSS Ren		90% TC	S Removal									
NJCAT	50% 155 Ken	iuval	00% 15:	5 Kellioval									
	Local Installations												
# of Install	ations in Washingt	on:		0									
	Estimated Costs												

Estimated Installation Cost: Estimated Annual O&M Cost: low: <u>\$5,000</u> low: <u>\$500</u> high: \$10,000 high: \$3,000



Manufacturer/Vendor:
Name of Technology:
Technology Type:

ABT, Inc.	
First Flush	
Oil/water Separator	

#### **Treatment Notes**

Lab test results are provided on the filter media performance and system hydraulic performace based on design capabilites. The installation cost if factoring material and cost of installation together...or an installed cost.



Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. FloGard Plus Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 100

 high:
 2000

System Footprint (sq. ft.): 1,10 Required Head Loss (ft): 0,0.25 Internal or External Bypass: Internal Application

Stormwater

### Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	100		35	35				35
Median Effluent (mg/L):	20		7	7				
Median Removal (%):	80		80	80				7

	Total Met	als	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
		10				
		6				
		60				
	Cu		10 6	Cu         Pb         Zn         Cu           10         6         6         6	Cu         Pb         Zn         Cu         Pb           10         10         6         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10	

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

100

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: <u>\$250</u> low: \$75 high: <u>\$1800</u> high: <u>\$350</u>



 Manufacturer/Vendor:
 Kristar Enterprises, Inc.

 Name of Technology:
 FloGard Plus

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

Lab - UCLA, Univeristy of Hawaii, City of Auckland, NZ, CSUS - OWP. Field Study - University of Hawaii and City of Auckland



Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. FloGard Downspout Filter Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### Schematic



## System Design Information

Design Flow Rate (gpm):low:30high:325

System Footprint (sq. ft.): 0.5,1 Required Head Loss (ft): 0,1.5 Internal or External Bypass: Internal Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	100		35	35				35
Median Effluent (mg/L):	20		7	7				
Median Removal (%):	80		80	80				7

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):			10				
Median Effluent (mg/L):			6				
Median Removal (%):			60				
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\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

0

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: <u>\$1500</u> low: <u>\$</u>75 high: <u>\$3500</u> high: <u>\$250</u>



 Manufacturer/Vendor:
 Kristar Enterprises, Inc.

 Name of Technology:
 FloGard Downspout Filter

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

Lab - UCLA, Univeristy of Hawaii, City of Auckland, NZ, CSUS - OWP. Field Study - University of Hawaii and City of Auckland



Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. FloGard Dual Vortex Seperator Hydrodynamic Separation

#### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 150

 high:
 6,500

System Footprint (sq. ft.): 7 - 113 Required Head Loss (ft): 0 - 3 Internal or External Bypass: Internal Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	202							
Median Effluent (mg/L):	80							
Median Removal (%):	60							

Total Metals			Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu					

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Ren	noval	80% TS	S Removal		
NJCAT	Х					
			Lo	ocal Installatio	ons	
# of Install	ations in Washingt	on:		10		
				Estimated Cos	ts	
Estimated	Installation Cost:		low:	\$10.000	<b>high:</b> \$1	100.000

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$10,000 low: \$300 high: \$100,000 high: \$3,500



 Manufacturer/Vendor:
 Kristar Enterprises, Inc.

 Name of Technology:
 FloGard Dual Vortex Seperator

 Technology Type:
 Hydrodynamic Separation

#### **Treatment Notes**

Internal lab testing performed by Kristar. Third party lab testing was performed by Alden Research laboratories based in Holden Massachussets. No field studies have been completed at this date.

#### **Additional Notes**

No field studies have been completed at this time. Correlation of TSS removal with other POCs would indicate similar removal of Total metals.



Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. FloGard LoPro Matrix Filter Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### Schematic



#### System Design Information

 Design Flow Rate (gpm):

 low:
 45

 high:
 800

System Footprint (sq. ft.): 0.75,16 Required Head Loss (ft): 0,0.5 Internal or External Bypass: Internal

Application Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	100		35	35				35
Median Effluent (mg/L):	20		7	7				
Median Removal (%):	80		80	80				7

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):			10				
Median Effluent (mg/L):			6				
Median Removal (%):			60				
* blank sells indicate as infe		·			-		

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
			•			
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

10

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: <u>\$400</u> low: \$75 high: <u>\$1000</u> high: \$300



 Manufacturer/Vendor:
 Kristar Enterprises, Inc.

 Name of Technology:
 FloGard LoPro Matrix Filter

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

Lab - UCLA, Univeristy of Hawaii, City of Auckland, NZ, CSUS - OWP. Field Study - University of Hawaii and City of Auckland



Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. FloGard LoPro Trench Drain Filter Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### Schematic



#### System Design Information

Design Flow Rate (gpm):low:200high:500

System Footprint (sq. ft.): 1,20 Required Head Loss (ft): 0,0.25 Internal or External Bypass: Internal Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	100		35	35				35
Median Effluent (mg/L):	20		7	7				
Median Removal (%):	80		80	80				7

	Total Met	als	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
		10				
		6				
		60				
		Cu Pb	Cu         Pb         Zn           10         6	Cu         Pb         Zn         Cu           10         6         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60         60 <td>Cu         Pb         Zn         Cu         Pb           10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10<!--</td--></td>	Cu         Pb         Zn         Cu         Pb           10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10 </td	

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

0

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$600

high: <u>\$3000</u> high: <u>\$350</u>



 Manufacturer/Vendor:
 Kristar Enterprises, Inc.

 Name of Technology:
 FloGard LoPro Trench Drain Filter

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**

Lab - UCLA, Univeristy of Hawaii, City of Auckland, NZ, CSUS - OWP. Field Study - University of Hawaii and City of Auckland



Manufacturer/Vendor: Name of Technology: Technology Type:

#### Kristar Enterprises, Inc. FloGard Trash & Debris Guard Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

### Schematic



## System Design Information

Design Flow Rate (gpm):low:50high:500

System Footprint (sq. ft.): 0.5 - 4 Required Head Loss (ft): 0 - 0.25 Internal or External Bypass: Internal Application

Stormwater

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

Total Metals			Disso	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn		
	Cu						

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	-					•
		noval 80% TS				
	50% TSS Ren	noval	80% TSS	S Removal		

## Local Installations

# of Installations in Washington:

0

## **Estimated** Costs

Estimated Installation Cost: Estimated Annual O&M Cost: low: <u>\$450</u> low: <u>\$</u>50 high: <u>\$1,500</u> high: <u>\$200</u>



 Manufacturer/Vendor:
 Kristar Enterprises, Inc.

 Name of Technology:
 FloGard Trash & Debris Guard

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

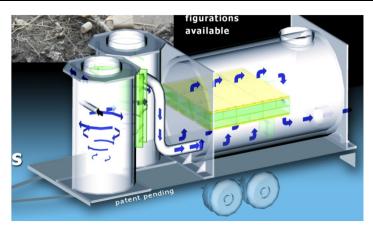
#### **Treatment Notes**

No Data Available



Manufacturer/Vendor: Name of Technology: Technology Type: AquaShield, Inc. Go-Filter Media Filtration(Combination System (with Hydrodyanamic Separation))

#### Schematic



#### System Design Information

Design Flow Rate (gpm):low:50high:675

System Footprint (sq. ft.):

Required Head Loss (ft):

0.5 Internal or External Bypass:

Both
Application
Stormwater/Process water

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

Total Metals			Disso	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn		
	Cu						

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
			•			
	50% TSS Ren	noval	80% TSS	5 Removal		

## Local Installations

# of Installations in Washington:

0

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: <u>Site-specific</u> low: Site-specific high: <u>Site-specific</u> high: <u>Site-specific</u>



Manufacturer/Vendor:	AquaShield, Inc.
Name of Technology:	Go-Filter
Technology Type:	Media Filtration(Combination System (with Hydrodyanamic Separation))

#### **Treatment Notes**

See Aqua-Filter for lab and field testing.

#### **Additional Notes**

Mobile device works on same principle as Aqua-Filter. Useful on construction sites for turbidity reduction in addition to sediment removal. Device components have been verified by NJCAT.



Manufacturer/Vendor: Name of Technology: Technology Type: Hancor, Inc. Hancor Storm Water Quality Unit Oil/Water Separator

BYPASS PIPE LOCATED ON THE SIDE OF THE STORM WATER QUALITY UNIT

SEDIMENT

ACCESS RISERS

### Schematic

### System Design Information

Design Flow Rate (gpm): low:

high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

Total Metals			Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu					

**OIL CHAMBER** 

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-						
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



 Manufacturer/Vendor:
 Hancor, Inc.

 Name of Technology:
 Hancor Storm Water Quality Unit

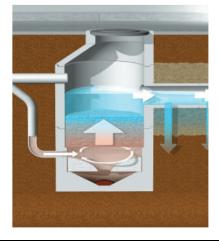
 Technology Type:
 Oil/Water Separator

#### **Treatment Notes**

HERRERA

Manufacturer/Vendor: Name of Technology: Technology Type: Huber Technology, Inc. HUBER Hydro Filt Drain Inlet Insert(Media Filtration)

### Schematic



## System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

0

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

Total Metals			Disso	lved Metals			
Cu	Pb	Zn	Cu	Pb	Zn		
	Cu	1					

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-	•					
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor:HuberName of Technology:HUBERTechnology Type:Drain I

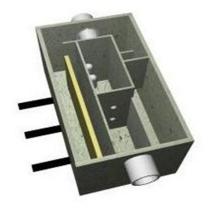
Huber Technology, Inc. HUBER Hydro Filt Drain Inlet Insert(Media Filtration)

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Hydroworks HydroFilter Media Filtration(Combination System (with Oil/Water Separator))

#### Schematic



System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-						
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor:	Hydroworks
Name of Technology:	HydroFilter
Technology Type:	Media Filtration(Combination System (with Oil/Water Separator))

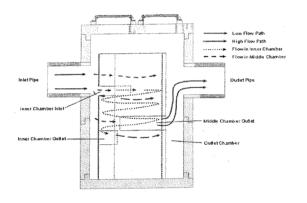
#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type:

Hydroworks
HydroGuard
Hydrodynamic Separation

#### Schematic



#### System Design Information

 Design Flow Rate (gpm):

 low:
 360

 high:
 3232

System Footprint (sq. ft.): 0 Required Head Loss (ft): 0-2 Internal or External Bypass:

Application

### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND							
Median Effluent (mg/L):	ND							
Median Removal (%):	70							

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
wiedian Removal (%):					<u> </u>		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT	Х					

#### Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



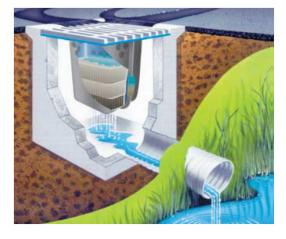
Manufacturer/Vendor: Name of Technology: Technology Type: Hydroworks HydroGuard Hydrodynamic Separation

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: ACF Environmental, Inc. Hydro-Kleen™ Drain Inlet Insert(Media Filtration)

### Schematic



## System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

#### **Treatment Performance**

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: ACF Environmental, Inc. Hydro-Kleen™ Drain Inlet Insert(Media Filtration)

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type:

Stormdrain Solutions
Inceptor®
Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### Schematic

## System Design Information

Design Flow Rate (gpm): low: high:

\_\_\_\_\_

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ТАРЕ						
-						
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



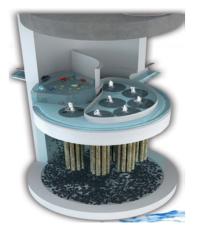
Manufacturer/Vendor: Name of Technology: Technology Type: Stormdrain Solutions Inceptor<sup>®</sup> Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Imbrium Systems Jellyfish Filter Media Filtration(Up-Flow)

#### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 60

 high:
 2300

System Footprint (sq. ft.): 12 - 113 Required Head Loss (ft): 1,2 Internal or External Bypass: Internal or External Bypass Application Stormwater

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	74							
Median Effluent (mg/L):	8							
Median Removal (%):	89							

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	78	35	1.45				
Median Effluent (mg/L):	0.3	5	0.6				
Median Removal (%):	99	86	59				

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
APE		PULD				
-						
	50% TSS Ren	noval	80% TSS	S Removal		

#### Local Installations

# of Installations in Washington:

1

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high: \_\_\_\_\_ high: \_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: Imbrium Systems Jellyfish Filter Media Filtration(Up-Flow)

#### **Treatment Notes**

Performance data is from third-party field study at University of Florida conducted according to the TARP protocol. Samples collected were grab samples of the entire crossection of flow. Twenty-one storm events have been monitored to date.

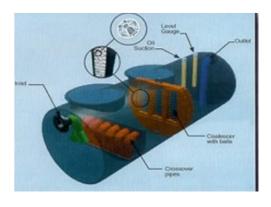
#### **Additional Notes**

Copper concentrations are in micrograms per liter. Zinc concentrations are in milligrams per liter. Lead concentraions are in micrograms per liter. The O&M cost ranges from \$0.001/gal to \$0.003/gal. Installation costs range from \$8000 to \$125,000.



Manufacturer/Vendor: Name of Technology: Technology Type: Brown Minneapolis Tank Kleerwater Oil/Water Separator

#### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 25

 high:
 10,000

System Footprint (sq. ft.):

Required Head Loss (ft): Gravity

Internal or External Bypass: External

Application Stormwater/Wastewater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
* blank calls indicate no info					ł		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: Varies low: Varies high: Varies high: Varies



Manufacturer/Vendor: Name of Technology: Technology Type:

Brown Minneapolis Tank
Kleerwater
Oil/Water Separator

#### **Treatment Notes**

All data collected and verified by third party inspectors and Underwriters Laboratories (UL).

#### **Additional Notes**

• Underwriters Laboratories tested and listed per UL-2215

• Designed for no internal or confined space entry when performing routine maintenance.

• Kleerwater<sup>™</sup> can handle larger influent flows, allowing for smaller separator tanks. With smaller separation tanks, less installation costs.

• Kleerwater<sup>™</sup> separators utilizes Stokes Law for defining rates of rise of oil spheres in a liquid medium

• Unique patented oil separation process enhances oil from water separation efficiencies

• Separation efficiencies down to 5 ppm & lower.

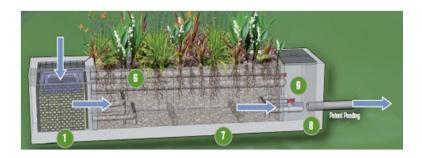
Note:

Kleerwater™will not remove oils with a specific gravity of less than 0.95, dissolved hydrocarbons, or volatile organic compounds. For additional information, please visit www.kleerwater.net



Manufacturer/Vendor: Name of Technology: Technology Type: Modular Wetland Systems, Inc. Modular Wetland Systems - Linear Bioretention/Filtration

## Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 22

 high:
 120

System Footprint (sq. ft.): 16-84 Required Head Loss (ft): 2,4 Internal or External Bypass: Internal (External in Some Situations)

Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	270		19	4	NA	NA	NA	NA
Median Effluent (mg/L):	3		0	ND	NA	NA	NA	NA
Median Removal (%):	98		>99	>99	NA	NA	NA	NA

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	0.04	ND	0.24	0.757	0.543	0.95	
Median Effluent (mg/L):	ND	ND	ND	0.0552	0.1	0.185	
Median Removal (%):	>50		>79	93	81	80	

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
		-				· · · · · · · · · · · · · · · · · · ·
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

0

## **Estimated** Costs

Estimated Installation Cost:low:\$12,000high:\$25,000Estimated Annual O&M Cost:low:\$8.26/galhigh:\$10.50/gal



Manufacturer/Vendor: Name of Technology: Technology Type: Modular Wetland Systems, Inc. Modular Wetland Systems - Linear Bioretention/Filtration

#### **Treatment Notes**

The Modular Wetland System Linear has been used in the field since 2008. The system has be independently tested in the laboratory and field under various conditions. A series of composite grab samples were used in the field and laboratory provide performance analysis on the system.

--Quarter Scale Independent Lab Testing

--Full Scale Independent Field Testing



Manufacturer/Vendor: Name of Technology: Technology Type:

**Bio Clean Environmental** Nutrient Separating Baffle Box Hydrodynamic Separation



## System Design Information

Design Flow Rate (gpm): low: 148 high: 8,858

System Footprint (sq. ft.): 0 **Required Head Loss (ft):** 0 Internal or External Bypass: Internal (External in Some Situations) Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:	2	4	NA	2	NA			NA
Median Influent (mg/L):	366	1.49	NA	4	NA			NA
Median Effluent (mg/L):	48	0.44	NA	n/d	NA			NA
Median Removal (%):	86.8	70	NA	>99	NA			NA

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:	2	NA	0	NA	NA	NA	
Median Influent (mg/L):	0.07	NA	0.318	NA	NA	NA	
Median Effluent (mg/L):	0.042	NA	0.222	NA	NA	NA	
Median Removal (%):	40	NA	30.25	NA	NA	NA	

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	
TAPE					
	50% TSS Rer	noval	80% TSS	6 Removal	

## Local Installations

# of Installations in Washington:

0 WA, 4 UT, 3 OR

## **Estimated Costs**

**Estimated Installation Cost: Estimated Annual O&M Cost:**  low: \$10,000 \$0.33/gal low:

high: \$200,000 high: \$0.84/gal



Manufacturer/Vendor: Name of Technology: Technology Type: Bio Clean Environmental Nutrient Separating Baffle Box Hydrodynamic Separation

#### **Treatment Notes**

The Nutrient Separating Baffle Box has been in use since for over 10 years. Several field and laboratory studies have been performed on the system. For this reason several reports are being listed below. N/A stands for information not available - pollutant not tested in the report

--City of Santa Monica field data is independent and was performed over the course of 1 year.

--Brevard County field testing is independent and was peformed over 4 storm events - Micco & Indiatlantic

-- NJ CAT Full Scale Labratory Testing Tier 1

#### **Additional Notes**

The Nutrient Separating Baffle Box employees screening, three chambered hydrodynamic spearation and absoptive polymer media for the removal of gorss solids, TSS, particulate pollutants and hydrocarbons.



Manufacturer/Vendor: Name of Technology: Technology Type: Rotondo Environmental Solutions, LLC Perimeter Sandfilter (Delaware Sandfilter) Media Filtration (Sand Filter)

### Schematic



## System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

0 Required Head Loss (ft):

Internal or External Bypass:

Application

## Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-	•					
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_



Manufacturer/Vendor:RdName of Technology:PeTechnology Type:M

Rotondo Environmental Solutions, LLC Perimeter Sandfilter (Delaware Sandfilter) Media Filtration (Sand Filter)

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. Perk Filter Media Filtration(Cartridge)

## Schematic



POD SYSTEM CONFIGURATION

## System Design Information

Design Flow Rate (gpm): low: 12 high: 1000

System Footprint (sq. ft.): 10,150 Required Head Loss (ft): 1.7,3.5 Internal or External Bypass: Internal Application

Stormwater

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	70		20	20				20
Median Effluent (mg/L):	11		5	5				5
Median Removal (%):	82		75	75				75

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	0.052	0.15	0.25				
Median Effluent (mg/L):	0.02	0.05	0.1				
Median Removal (%):	62	68	61				

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ		GULD		GULD		
	50% TSS Ren	noval	80% TSS	6 Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

15

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$10000 low: \$1200 high: <u>\$200000</u> high: <u>\$10000</u>



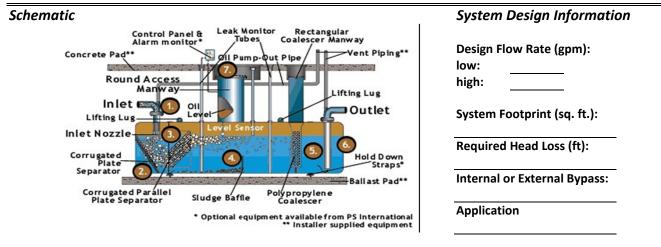
Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. Perk Filter Media Filtration(Cartridge)

#### **Treatment Notes**

Internal lab testing performed by Kristar. Third party lab testing was performed by CSUS - OWP for TSS and subsequent "street Sweeipings" testing for metals and nutrients. Third Party field testing for GULD by Herrera.



Manufacturer/Vendor: Name of Technology: Technology Type: PSI International, Inc. PSI Separator Oil/Water Separator



Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	ls	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	•					
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: PSI International, Inc. PSI Separator Oil/Water Separator

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type:

Environment 21 PuriStorm Media Filtration(Cartridge)

## Schematic



## System Design Information

Design Flow Rate (gpm): low: 0 high: 2000

System Footprint (sq. ft.): 9-600 Required Head Loss (ft): 0-0.5 Internal or External Bypass: Both

Application Stormwater

**Treatment Performance** 

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	*250		**400	**400	**400	**400	**400	**400
Median Effluent (mg/L):	*175		**80	**80	**80	**80	**80	**80
Median Removal (%):	*80		**80	**80	**80	**80	**80	**80

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA	
Median Effluent (mg/L):	***0.04	***0.28	***0.06	NA	NA	NA	
Median Removal (%):	***50	***65	***80	NA	NA	NA	
iviedian Removal (%):		***65		NA	NA	N	

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
			•			
	50% TSS Removal					
	50% TSS Ren	noval	80% TSS	S Removal		

### Local Installations

# of Installations in Washington:

### **Estimated Costs**

**Estimated Installation Cost: Estimated Annual O&M Cost:** 

low:	\$3,000	high:	\$25,0
low:	0	high:	\$10,0

000 000



Manufacturer/Vendor: Name of Technology: Technology Type:

Environment 21
PuriStorm
Media Filtration(Cartridge)

#### **Treatment Notes**

\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a d50 of 60 microns was used.

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated. \*\*\*Testing is not complete for metals; therefore, these values are estimated.



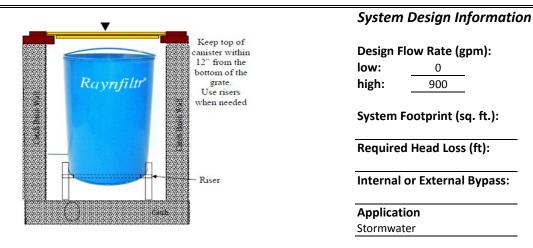
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900

Manufacturer/Vendor: Name of Technology: Technology Type:

Environmental Filtration Inc. Raynfiltr Drain Inlet Insert(Media Filtration

## Schematic



## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: C			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-						
	50% TSS Removal 80% TSS		6 Removal			
NJCAT						

## Local Installations

# of Installations in Washington:

1 (airport)

### **Estimated Costs**

**Estimated Installation Cost: Estimated Annual O&M Cost:**  **low:** \$531 low: high: \$554 high:



Manufacturer/Vendor: Name of Technology: Technology Type: Environmental Filtration Inc. Raynfiltr Drain Inlet Insert(Media Filtration

#### **Treatment Notes**

**Additional Notes** 

Costs per catch basin



Manufacturer/Vendor: Name of Technology: Technology Type: EcoSol Wastewater Filtration Systems RSF (Rapid Stormwater Filtration) 100 Drain Inlet Insert(Combination System (Screen and Media Filtration))

### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 1784

 high:
 7000

System Footprint (sq. ft.):

Required Head Loss (ft): 0.5 Internal or External Bypass:

Application

#### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND	NA						
Median Effluent (mg/L):	ND	NA						
Median Removal (%):	65	40						

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Removal 80%		80% TS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: EcoSol Wastewater Filtration Systems RSF (Rapid Stormwater Filtration) 100 Drain Inlet Insert(Combination System (Screen and Media Filtration))

#### **Treatment Notes**



Drain Inlet Insert(Combination System (Screen and Media Filtration))

Manufacturer/Vendor: Name of Technology: Technology Type:

### Schematic



**EcoSol Wastewater Filtration Systems** 

RSF (Rapid Stormwater Filtration) 1000

## System Design Information

 Design Flow Rate (gpm):

 low:
 12000

 high:
 18162

System Footprint (sq. ft.): 0 Required Head Loss (ft): 0.5 Internal or External Bypass:

Application

### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND	NA						
Median Effluent (mg/L):	ND	NA						
Median Removal (%):	49	30						

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
Median Removal (%):							

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-	•					
	50% TSS Removal		80% TSS	80% TSS Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: EcoSol Wastewater Filtration Systems RSF (Rapid Stormwater Filtration) 1000 Drain Inlet Insert(Combination System (Screen and Media Filtration))

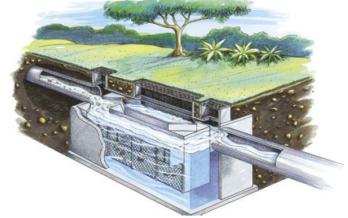
#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type:

### EcoSol Wastewater Filtration Systems RSF (Rapid Stormwater Filtration) 4000 Drain Inlet Insert(Combination System (Screen and Media Filtration))

### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 837

 high:
 68270

System Footprint (sq. ft.): 0 Required Head Loss (ft): 0.5 Internal or External Bypass:

Application

## Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND	NA						
Median Effluent (mg/L):	ND	NA						
Median Removal (%):	91	30						

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: C			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-	•					
	50% TSS Removal		80% TS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_

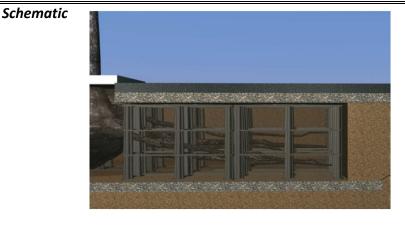


Manufacturer/Vendor: Name of Technology: Technology Type: EcoSol Wastewater Filtration Systems RSF (Rapid Stormwater Filtration) 4000 Drain Inlet Insert(Combination System (Screen and Media Filtration))

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type:



Deep Root Partners, L.P.

Bioretention/Filtration

Silva Cell

## System Design Information

Design Flow Rate (gpm):low:20"/hourhigh:3"/hour

System Footprint (sq. ft.):

Required Head Loss (ft): n/a

Internal or External Bypass:

Optional Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):	80	68						

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):				90+		90+	
*  -       - ! ! + ! f				•			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ		GULD	GULD			
-						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

7

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$4,000-\$5,600 low: \$100-\$200 high: \$10,000-\$14,000 high: \$100-\$200



Manufacturer/Vendor: Name of Technology: Technology Type: Deep Root Partners, L.P. Silva Cell Bioretention/Filtration

#### **Treatment Notes**

Data is based on a literature search. The water quality filtering values are based on research by Davis at University of Maryland and Hunt at the University of North Carolina.

#### **Additional Notes**

Prince Georges County Stormwater Manual, British Columbia Stormwater Manual, State of Washington Department of Ecology



Manufacturer/Vendor: Name of Technology: Technology Type:

## Nyloplast/Hancor, Inc. SNOUT® Oil/Water Separator

## Schematic



## System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

## Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: C			

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Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Removal		80% TS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_



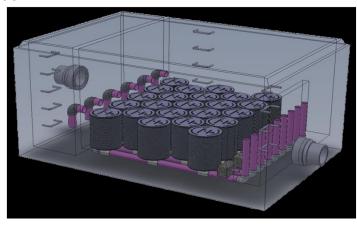
Manufacturer/Vendor: Name of Technology: Technology Type: Nyloplast/Hancor, Inc. SNOUT® Oil/Water Separator

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type:

## Schematic



Imbrium Systems Corp

Media Filtration(Cartridge)

Sorbtive<sup>™</sup> FILTER

## System Design Information

Design Flow Rate (gpm): low:

high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

## Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND	ND						
Median Effluent (mg/L):	ND	ND						
Median Removal (%):	84	>77						

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu	1	Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"   <			

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Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	•					
	50% TSS Rer	noval	80% TSS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_



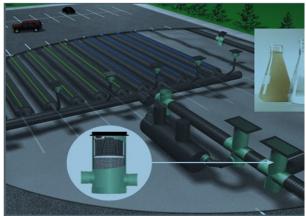
Manufacturer/Vendor: Name of Technology: Technology Type: Imbrium Systems Corp Sorbtive™ FILTER Media Filtration(Cartridge)

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Nyloplast/Hancor, Inc. Storm PURE™ Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### Schematic



## System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

**Treatment Performance** 

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

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Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: Nyloplast/Hancor, Inc. Storm PURE™ Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: FABCO industries Stormbasin/Stormpod Drain Inlet Insert(Media Filtration (Cartridge))

## Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 50

 high:
 >2500

System Footprint (sq. ft.): 4 - 200 Required Head Loss (ft): 1.25 - 2.5 Internal or External Bypass: Both

Application Stormwater

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	111.9	0.57		59.5				
Median Effluent (mg/L):	2.7	0.3		<5				
Median Removal (%):	97.8	47		>90				

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):		0.018	0.335				
Median Effluent (mg/L):		0.0049	0.175				
Median Removal (%):		73	48				

\* blank cells indicate no information was received from vendor

### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Rer	noval	80% TS	S Removal		
			1			

## Local Installations

# of Installations in Washington:

<20

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$750 low: \$200 high: <u>\$2,000</u> high: <u>\$800</u>



Manufacturer/Vendor: Name of Technology: Technology Type: FABCO industries Stormbasin/Stormpod Drain Inlet Insert(Media Filtration (Cartridge))

#### **Treatment Notes**

FABCO stormbasin/stormpod has been tested in the lab and the field by 1st+3rd party's data was collected according to established protocols and consisted of barious methods including grab, auto, semi-auto and single event or composite samples

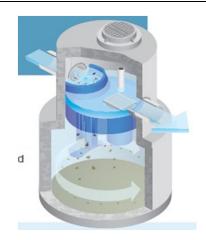
#### **Additional Notes**

FABCO was awarded a competition bid-soil source spec for large scale municupal deployment in the urban/ms4 stormdrain system of nassau county, long island, ny. Since 2009 FABCO was installed over 2000 stormbasins. Our performance approval as part of this spec-sediment TSS removal> 50% d50: 110 um. Hydrocarbons/oil&grease: >80%. .Phosphorus: >50%. Nitrogen >40%. Bacteria. >70%. Stormbasin is a great retrofit device for industrial facilities and is considered a structural BMP for pretreatment, source control or in spcc + swpp plans.



Manufacturer/Vendor: Name of Technology: Technology Type: Imbrium Systems Stormceptor Hydrodynamic Separation

### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 0

 high:
 11000

System Footprint (sq. ft.):

Required Head Loss (ft): 0.22

Internal or External Bypass:

Internal Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:	57	38	15					
Median Influent (mg/L):	159	0.275	29					
Median Effluent (mg/L):	59	0.175	4					
Median Removal (%):	53	21.8	73					

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):				27.5	41.8	35.3	
iviedian Removal (%):				27.5	41.8	3.	

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
-						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT	Х					

## Local Installations

# of Installations in Washington:

510+

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: <u>\$3,000</u> low: <u>\$</u>500

high: <u>\$15,000</u> high: <u>\$5,000</u>



Manufacturer/Vendor:
Name of Technology:
Technology Type:

	mbrium Systems
S	stormceptor
ŀ	lydrodynamic Separation

#### **Treatment Notes**

The data detailed below is aggregate of many field studies (8) as well as lab studies (2) including the NJCAT TARP program. Most studies were conducted 3rd party with both automatic and grab samplers. Individual test reports are available upon request.

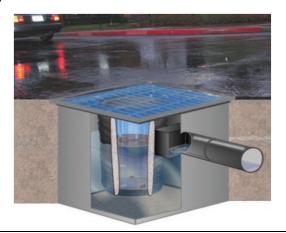
#### **Additional Notes**

Despite the above averages, the Stormceptor system, when sized with PCSWMM for Stormceptor has a 0.94 correlation (r-squared regression value) with field performance when an accurate PSD is used to size the unit. Therefore the Stormceptor can be confidently and accurately sized for TSS removal goals on the order of 80% TSS, if the proper consideration like a true PSD are taken into account. Furthermore, the laboratory evaluation indicates that the Stormceptor unit can achieve DOE level performance at flow rates larger than the indicated treatment flow rate on the DOE GULD. The flow rates listed in the DOE GULD are merely a hydraulic marker within the system that indicates when the unit begins to inhibit scour from the unit.



Manufacturer/Vendor: Name of Technology: Technology Type: Clean Way StormClean Catch Basin Insert Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

### Schematic



## System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"			

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Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_



 Manufacturer/Vendor:
 Clean Way

 Name of Technology:
 StormClean Catch Basin Insert

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Clean Way StormClean Curb Inlet Insert Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

### Schematic

## System Design Information

Design Flow Rate (gpm): low: high:

J \_\_\_\_\_

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

## Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: C			

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ABP READ

PROTECT WOUR

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TSS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_



 Manufacturer/Vendor:
 Clean Way

 Name of Technology:
 StormClean Curb Inlet Insert

 Technology Type:
 Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type:

# StormClean Wall Mount Filtration Unit Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

Y.....

Clean Way

### Schematic

## System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

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Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-						
	50% TSS Rer	noval	80% TSS	S Removal		
NJCAT						

Local Installations

# of Installations in Washington:

**Estimated Costs** 

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_



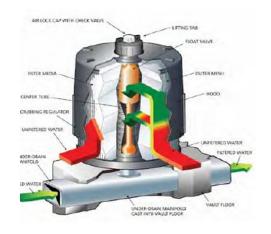
Manufacturer/Vendor:	Clean Way
Name of Technology:	StormClean Wall Mount Filtration Unit
Technology Type:	Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Construction Products Inc. StormFilter - ZPG Media Filtration(Cartridge)

#### Schematic



#### System Design Information

Design Flow Rate (gpm): low: 2 high: 44900

System Footprint (sq. ft.): 8 - 6,050 Required Head Loss (ft): 1.8 - 12 Internal or External Bypass: Both available Application

Stormwater

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	83							0.12
Median Effluent (mg/L):	23							0.062
Median Removal (%):	82							42

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	0.0425	0.12	0.225	0.00464		0.0599	
Median Effluent (mg/L):	0.0335	0.0435	0.12767	0.00423		0.0532	
Median Removal (%):	47	24	62	11		15	

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other A
E		GULD				
						•
			1			
	50% TSS Ren	noval	80% TSS	6 Removal		

## Local Installations

# of Installations in Washington:

> 500

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$10K low: \$0.00008/gal high: \$2.5 M high: \$0.00024/gal



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Construction Products Inc. StormFilter - ZPG Media Filtration(Cartridge)

#### **Treatment Notes**

a) Stormwater Management StormFilter Basic Treatment Application for General Use Level Designation (2005): field,flow-weighted, peer reviewed, composite samples; b) Milwaukee Riverwalk ETV; Third Party, Field, Flow weighted. c) Heritage Marketplace Field Evalution (2004): field, flow-weighted, peer reviewed, composite samples; d) EvTec Lake Union Ultra-Urban Stormwater Technology Evaluation Stormwater Management StormFilter (2008): field, third party, composite.

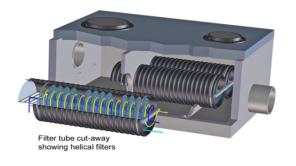
#### **Additional Notes**

TSS reference a; Metals references b & c; cPAHs reference d. cPAHs used Chrysene as the parameter as it was the median performance for the suite of requested analytes. Ranges were 33% to 47% for the entire suite. cPAH data contained 10% more GAC (by volume) than standard ZPG.



Manufacturer/Vendor: Name of Technology: Technology Type: Fabco Industries Stormsafe-helix Media Filtration(Cartridge)

### Schematic



#### System Design Information

Design Flow Rate (gpm): low: 3 high: 9

System Footprint (sq. ft.): 160 - 250 Required Head Loss (ft): 0 - 3 Internal or External Bypass: both

Application

Stormwater

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
wiedian Removal (%):					<u> </u>		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ТАРЕ						
	50% TSS Rer	50% TSS Removal 80% TSS		S Removal		
NJCAT						

### Local Installations

# of Installations in Washington:

none

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$20,000 low: \$2,000 high: <u>\$60,000</u> high: \$6,000



Manufacturer/Vendor:	Fabco Industries
Name of Technology:	Stormsafe-helix
Technology Type:	Media Filtration(Cartridge)

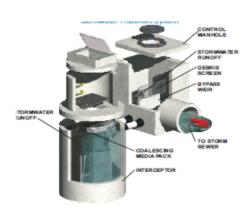
#### **Treatment Notes**

We have conducted lab and field studies as descried in our online reports, we are currently undergoing 3rd party field testing at a wastewater treatment plant, treating 10 acres of stormwater runoff.



Manufacturer/Vendor: Name of Technology: Technology Type: Park USA StormTrooper® Hydrodynamic Separation

#### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 0

 high:
 11000

System Footprint (sq. ft.):

Required Head Loss (ft): 0.22 Internal or External Bypass:

Application

### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

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Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-	•					
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor:
Name of Technology:
Technology Type:

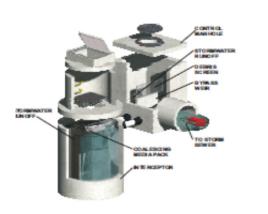
Park USA StormTrooper® Hydrodynamic Separation

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Park USA StormTrooper® EX Extra-Duty Hydrodynamic Separation

#### Schematic



#### System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass:

Application

### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Disso	lved Metal	s
Cu	Pb	Zn	Cu	Pb	Zn
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	6 Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor:	Park USA
Name of Technology:	StormTrooper® EX Extra-Duty
Technology Type:	Hydrodynamic Separation

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. SwaleGard Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

#### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 100

 high:
 800

System Footprint (sq. ft.): <u>4 - 16</u> Required Head Loss (ft): <u>0 - 0.5</u> Internal or External Bypass: Internal Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	100		35	35				35
Median Effluent (mg/L):	20		7	7				
Median Removal (%):	80		80	80				7

	Total Met	als	Disso	olved Meta	s
Cu	Pb	Zn	Cu	Pb	Zn
		10			
		6			
		60			
	Cu		10 6	Cu         Pb         Zn         Cu           10         6         6         6	Cu         Pb         Zn         Cu         Pb           10         10         6         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT						

#### Local Installations

# of Installations in Washington:

2

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$4,500 low: \$75 high: <u>\$4,500</u> high: <u>\$300</u>



Manufacturer/Vendor:kName of Technology:STechnology Type:C

Kristar Enterprises, Inc. SwaleGard Drain Inlet Insert(Combination System (Screen and Absorbent Boom/Fabric))

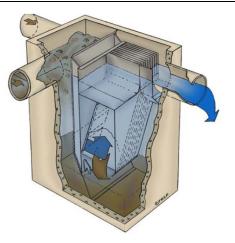
#### **Treatment Notes**

Lab - UCLA, University of Hawaii, City of Auckland, NZ, CSUS - OWP. Field Study - University of Hawaii and City of Auckland



Manufacturer/Vendor: Name of Technology: Technology Type: Terre Hill Concrete Products Terre Kleen™ Hydrodynamic Separation

Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 1.5

 high:
 100

System Footprint (sq. ft.): 0

Required Head Loss (ft):

Internal or External Bypass:

Application

Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND							
Median Effluent (mg/L):	ND							
Median Removal (%):	78							

	Total Meta	ls	Disso	lved Metal	s
Cu	Pb	Zn	Cu	Pb	Zn
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Ren	noval	80% TS	6 Removal		
NJCAT	Х					

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



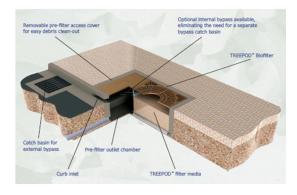
Manufacturer/Vendor: Name of Technology: Technology Type: Terre Hill Concrete Products Terre Kleen™ Hydrodynamic Separation

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. TreePod Biofilter Bioretention/Filtration

#### Schematic



#### System Design Information

Design Flow Rate (gpm): low: 16 high: 72

System Footprint (sq. ft.): 24 - 84 Required Head Loss (ft): 0 - 0.5 Internal or External Bypass: Internal Application

Stormwater

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	TBD		TBD	TBD				TBD
Median Effluent (mg/L):	TBD		TBD	TBD				TBD
Median Removal (%):	TBD		TBD	TBD				TBD

		Total Meta	als	Disso	ved Meta	s
	Cu	Pb	Zn	Cu	Pb	Zn
Number of samples:						
Median Influent (mg/L):	TBD	TBD	TBD	TBD	TBD	TBD
Median Effluent (mg/L):	TBD	TBD	TBD	TBD	TBD	TBD
Median Removal (%):	TBD	TBD	TBD	TBD	TBD	TBD

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
APE						
	50% TSS Ren	noval	80% TSS	S Removal		

#### Local Installations

# of Installations in Washington:

0

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: <u>\$10,000</u> low: <u>\$400</u> high: <u>\$50,000</u> high: <u>\$750</u>



Manufacturer/Vendor: Name of Technology: Technology Type: Kristar Enterprises, Inc. TreePod Biofilter Bioretention/Filtration

#### **Treatment Notes**

Internal Hydraulic testing only completed at this time. UNH field study for performance currently under way.



Manufacturer/Vendor: Name of Technology: Technology Type:

### Schematic



CONTECH Stormwater Solutions, Inc.

Drain Inlet Insert(Media Filtration (Cartridge))

**Triton Drop Inserts** 

### System Design Information

 Design Flow Rate (gpm):

 low:
 100

 high:
 5404

System Footprint (sq. ft.):

Required Head Loss (ft):

Internal or External Bypass: Both available

Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Disso	olved Metals			
Cu	Pb	Zn	Cu	Pb	Zn		
	Cu	Cu Pb	Cu Pb Zn	Cu Pb Zn Cu	Cu     Pb     Zn     Cu     Pb       Image: Second se		

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

### Local Installations

# of Installations in Washington:

> 100

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost:

low: \$300 low: \$0.00002/gal high: \$2,500 high: \$0.00008/gal



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Stormwater Solutions, Inc. Triton Drop Inserts Drain Inlet Insert(Media Filtration (Cartridge))

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type:

#### AbTech Industries Ultra Urban Filter Drain Inlet Inset (Absorbent Boom/Fabric)

#### Schematic



## System Design Information

Design Flow Rate (gpm):low:190high:500

System Footprint (sq. ft.): 0 Required Head Loss (ft):

0.5 - 1.5

Internal or External Bypass:

Internal Bypass

Application Stormwater/Process Water

# Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):			>100	>100	180			>100
Median Effluent (mg/L):			<10	<10	>4.4			>10
Median Removal (%):	*80		90	85	**40			**60

	Total Meta	ls	Disso	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn		
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"				

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Ren	noval	80% TS	S Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

#### **Estimated** Costs

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$400 low: NA high: \$1,700 high: NA



Manufacturer/Vendor: Name of Technology: Technology Type: AbTech Industries Ultra Urban Filter Drain Inlet Inset (Absorbent Boom/Fabric)

#### **Treatment Notes**

Primary analysis of AbTech Industries Ultra Urban Filter (UUF) was conducted in laboratory studies conducted by third parties using grab samples from established test protocols developed by federal and state regulatory entities. Field data was collected during studies conducted by municipalities to evaluate the effectiviness of the UUFs for deployment in the localized watershed. The testing methods used by the municipalities were governed by the state regulatory body, in which that municipality was located.

#### **Additional Notes**

\* Data based on Particle Size Distribution (PSD) and not on mg/L. Samples tested were evaluated using a medium sand in the 0.355-0.300 mm range.

\*\*Reduction of soluble dissolved hydrocarbons occurs when they become partitioned in the dispersed hydrocarbons and are removed simultaneously. Filtration of dissolved phase hydrocarbons through AbTech's UUFs will not occur, in substantial percent volumes, without the presence of dispersed hydrocarbons. Bench scale testing can be conducted on field samples to establish viability in a specific environment or to meet a specific discharge standard.

Total Metals Removal: Based on TSS testing the UUF has the ability to physically separate Total Metals from the water column, but AbTech products have no Chemical or Biological exchange during the filtration of Total Metals.



Manufacturer/Vendor: Name of Technology: Technology Type: Rotondo Environmental Solutions, LLC Underground Sandfilter (DC Sandfilter) Media Filtration (Sand Filter)

#### Schematic



### System Design Information

Design Flow Rate (gpm): low: high:

System Footprint (sq. ft.):

0 Required Head Loss (ft):

Internal or External Bypass:

Application

#### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

	Total Meta	ls	Disso	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn		
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>				

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
-	•					
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high:\_\_\_\_\_ high:\_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: Rotondo Environmental Solutions, LLC Underground Sandfilter (DC Sandfilter) Media Filtration (Sand Filter)

#### **Treatment Notes**



Manufacturer/Vendor: Name of Technology: Technology Type:

Environment 21	
UniScreen	
Hydrodynamic Separation	

#### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 0

 high:
 15,700

System Footprint (sq. ft.): 20-135 Required Head Loss (ft): 0-0.5 Internal or External Bypass: Both

Application Stormwater

### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	*250		**400	**400	**400	**400	**400	**400
Median Effluent (mg/L):	*175		**150	**150	**150	**150	**150	**150
Median Removal (%):	*80		**62.5	**62.5	**62.5	**62.5	**62.5	**62.5

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA	
Median Effluent (mg/L):	***0.06	***0.56	***0.18	NA	NA	NA	
Median Removal (%):	***20	***27	***40	NA	NA	NA	

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
			•			·
	50% TSS Removal 80% TSS					
	50% TSS Ren	noval	80% TSS	6 Removal		

## Local Installations

# of Installations in Washington:

0

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$2,000 low: 0 high: \$15,000 high: \$2,000



Manufacturer/Vendor: Name of Technology: Technology Type: Environment 21 UniScreen Hydrodynamic Separation

#### **Treatment Notes**

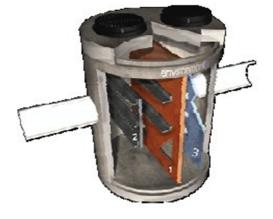
\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a d50 of 150 microns was used.

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated. \*\*\*Testing is not complete for metals; therefore, these values are estimated.



Manufacturer/Vendor: Name of Technology: Technology Type: Environment 21 UniStorm Hydrodynamic Separation

#### Schematic



### System Design Information

 Design Flow Rate (gpm):

 low:
 0

 high:
 15,700

System Footprint (sq. ft.): 20-135 Required Head Loss (ft): 0-0.5 Internal or External Bypass: NA

Application Stormwater

#### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	*250	ND	**400	**400	**400	**400	**400	**400
Median Effluent (mg/L):	*175	ND	**150	**150	**150	**150	**150	**150
Median Removal (%):	*80	80	**62.5	**62.5	**62.5	**62.5	**62.5	**62.5

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA	
Median Effluent (mg/L):	***0.06	***0.56	***0.18	NA	NA	NA	
Median Removal (%):	***20	***27	***40	NA	NA	NA	

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Removal 8					
	50% TSS Ren	noval	80% TS	S Removal		

#### Local Installations

# of Installations in Washington:

0

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$2,000 low: 0 high: \$15,000 high: \$2,000



Manufacturer/Vendor: Name of Technology: Technology Type: Environment 21 UniStorm Hydrodynamic Separation

#### **Treatment Notes**

\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a d50 of 150 microns was used.

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated. \*\*\*Testing is not complete for metals; therefore, these values are estimated.



Manufacturer/Vendor: Name of Technology: Technology Type:

Hydro International, Inc.	
Up-Flo™ Filter	
Media Filtration(up flow)	

#### Schematic System Design Information Inlet grate Design Flow Rate (gpm): low: 147 high: 448 Bypass siphon with floatables baffle System Footprint (sq. ft.): Outlet module 0 Required Head Loss (ft): Media n Drain down port -Outlet pipe 1.7-2.5 Internal or External Bypass: Application

### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	ND							
Median Effluent (mg/L):	ND							
Median Removal (%):	91							

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2" <td< td=""><td></td><td></td></td<>			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE		PULD				
						•
	50% TSS Ren	noval	80% TS	S Removal		

#### Local Installations

# of Installations in Washington:

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low:\_\_\_\_\_ low:\_\_\_\_\_ high: \_\_\_\_\_ high: \_\_\_\_\_



Manufacturer/Vendor: Name of Technology: Technology Type: Hydro International, Inc. Up-Flo™ Filter Media Filtration(up flow)

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Stormwater Solutions, Inc. UrbanGreen BioFilter Bioretention/Filtration

### Schematic



### System Design Information

Design Flow Rate (gpm):low:4high:600

System Footprint (sq. ft.):

Required Head Loss (ft): 3,6 Internal or External Bypass: Both available

Application

Stormwater

Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Meta	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
المراجع والمحالية المراجع المحاط الأحد							

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE						
	50% TSS Removal		80% TSS Removal			
NJCAT						

## Local Installations

# of Installations in Washington:

> 25

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost:

low: \$10k low: \$0.0001/gal high: \$250K high: \$0.0003/gal



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Stormwater Solutions, Inc. UrbanGreen BioFilter Bioretention/Filtration

**Treatment Notes** 



Manufacturer/Vendor: Name of Technology: Technology Type: Environment 21 V2B1 Treatment System Hydrodynamic Separation

#### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 0

 high:
 63000

System Footprint (sq. ft.): 20-800 Required Head Loss (ft): 0-0.5 Internal or External Bypass: Both

Application Stormwater

#### Treatment Performance

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	*250	ND	**400	**400	**400	**400	**400	**400
Median Effluent (mg/L):	*175	ND	**150	**150	**150	**150	**150	**150
Median Removal (%):	*80	40	**62.5	**62.5	**62.5	**62.5	**62.5	**62.5

		Total Meta	als	Dissolved Metals			
	Cu Pb Zn			Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA	
Median Effluent (mg/L):	***0.05	***0.35	***0.09	NA	NA	NA	
Median Removal (%):	***40	***55	***70	NA	NA	NA	

\* blank cells indicate no information was received from vendor

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
TAPE	PULD					
	50% TSS Ren	noval	80% TS	S Removal		

#### Local Installations

# of Installations in Washington:

0

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$2,000 low: 0 high: \$15,000 high: \$2,000



 Manufacturer/Vendor:
 Environment 21

 Name of Technology:
 V2B1 Treatment System

 Technology Type:
 Hydrodynamic Separation

#### **Treatment Notes**

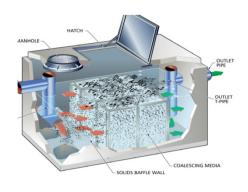
\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a d50 of 110 microns was used.

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated. \*\*\*Testing is not complete for metals; therefore, these values are estimated.



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Stormwater Solutions, Inc. VortClarex Oil/Water Separator

#### Schematic



## System Design Information

 Design Flow Rate (gpm):

 low:
 100

 high:
 2000

System Footprint (sq. ft.):

Required Head Loss (ft): 0.1 Internal or External Bypass: Both available

Application

Stormwater

## Treatment Performance \*

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):								
Median Effluent (mg/L):								
Median Removal (%):								

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Number of samples:							
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							
* Is law is a silla traditionation on the first				•			

\* blank cells indicate no information was received from vendor

Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ						
					-	
	50% TSS Rer	noval	80% TSS	6 Removal		
NJCAT						

## Local Installations

# of Installations in Washington:

>25

#### **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$10K low: \$0.00008/gal high: \$300K high: \$0.001/gal



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Stormwater Solutions, Inc. VortClarex Oil/Water Separator

**Treatment Notes** 



HIGH FLOW CONTROL

OUTLET CHAMBER

LOW FLOW CONTROL

OUTLET PIPE

Manufacturer/Vendor: Name of Technology: Technology Type:

SWIRL CHAM

CONTECH Stormwater Solutions, Inc. Vortechs Hydrodynamic Separation

#### Schematic

#### System Design Information

 Design Flow Rate (gpm):

 low:
 50

 high:
 22450

System Footprint (sq. ft.): NA Required Head Loss (ft): 0.1 Internal or External Bypass: Both Available

Application Stormwater

## Treatment Performance \*

FLOATABLES BAFFLE WALL

	TSS	ТР	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Number of samples:								
Median Influent (mg/L):	108							
Median Effluent (mg/L):	28							
Median Removal (%):	93							

	Total Meta	ls	Dissolved Metals			
Cu	Pb	Zn	Cu	Pb	Zn	
	Cu		Total Metals       Cu     Pb     Zn       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: Colspan="2"       Image: C			

\* blank cells indicate no information was received from vendor

FLOATABLES CHAMBE

#### Approvals

	Pretreatment	Basic	Enhanced	Phosphorus	Oil	Other Approvals:
ΤΑΡΕ	GULD					
	50% TSS Rer	noval	80% TS	S Removal		
NJCAT	Х					

## Local Installations

# of Installations in Washington:

> 100

## **Estimated Costs**

Estimated Installation Cost: Estimated Annual O&M Cost: low: \$20K low: \$0.000001/gal high: \$500K high: \$0.00004/gal



Manufacturer/Vendor: Name of Technology: Technology Type: CONTECH Stormwater Solutions, Inc. Vortechs Hydrodynamic Separation

#### **Treatment Notes**

The WAWA Route 37 Stormwater Treatment System TARP TIER II Field Evalaution: Vortechs (2010). Field, Peer Reviewed, Composite.

Technology Questionnaire Responses

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FloGard® Dual-Vortex Hydrodynamic Separator	Kristar Enterprises, Inc.	372
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FloGard® LoPro Trench Drain Filter	Kristar Enterprises, Inc.	374
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ellyfish™ Filter	Imbrium Systems Corp	378
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Aodular Wetland System – Linear	Modular Wetland Systems, Inc./	380
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Iutrient Separating Baffle Box	BioClean Environmental Services, Inc.	381
erk Filter <sup>TM</sup>	Kristar Enterprises, Inc.	383
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aynfiltr™	Environmental Filtration, Inc.	385
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tormBasin <sup>TM</sup>	Fabco Industries, Inc.	387
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SwaleGard® Pre-filter	Kristar Enterprises, Inc.	391

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**Passive Treatment Systems** 

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Environment 21 Environment 21	UniStorm	
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### Appendix B Index (by Manufacturer/Vendor Name)

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Royal Environmental Systems, Inc./Water Tectonics, Inc.	ecoStorm + ecoStorm Plus®	365
StormwateRx	Aquip® Enhanced Stormwater Filtration System	349
StormwateRx	Clara® Gravity Stormwater Separator Vault	359

# Active

Manufacturer:	Water	Tectonics	_	Contact N	ame:	Jim Mo	thersbaugh	_
Name of Technology:	ACI	ACISTBox Contact Email		mail:	jim@water	rtectonics.com	_	
# of Installations in				Contact P	hone:	866-4	402-2298	_
Washington:		5	_	Contact W	/ebsite:	www.wate	rtectonics.com	—
		Treatm	ent Type/App	lication	(check all	that apply)		
Downspout	Oil/Water Sep	paration	Filtration (med	ia)		Ion exchange	e column	✓ Stormwater
Drain Inlet Insert	Settling		Filtration (fabri	ic)		Reverse osm	osis	Groundwater
Below Ground Vault	Hydrodynami	c Separation	Filtration (biofi	Itration)		Electrocoagu	lation	✓ Wastewater
✓ Above Ground Vault	Floatables Ba	ffle	✓ Filtration (chen	nically enhance	ed)	Chemical Tre	atment	Process water
			Estim	nated Cos	ts			
Estimated Installation (	Cost (unit cost	and const	ruction cost):		low:	\$ 25,000	high	: \$ 400,000
Estimated Annual O&N					low:		high	
			System Hy	draulics/	'Design			
Design Flow Rate (gpm)	):		low:	100	high:	>1000		
System aboveground for	ootprint (sq ft)	):	low:	200	high:	>2000		
Required head loss (ft):			low:	N/A	high:	N/A		
Internal or External Byp	bass:	None - auto	recirculation					
			System	Perform	ance			
Priofly docaribo bow do	ta wara calla	tod (field	lab third parts	arah camu	ala auta i	composito at	c )	
Briefly describe how da Field by operator; in-line rea						-		anling: in-house and 3rd
party independent analytica				i pri, ill-llous		bendent party gr	ab/composite san	iping, in-nouse and sid
···· / ···· ·· /···	,,	0						
	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	_
Median Influent (mg/L)		3.12		0.0199			0.00028	_
Median Effluent (mg/L)	:	0.38		0.00002			0.00002	_
Median Removal (%):		88%		99.9%			93%	
		Total Me	tals	Die	solved M	otals		
	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L)		0.25	2.12	Cu	10	0.817		
Median Effluent (mg/L)		0.25	1.04			0.744		
Median Removal (%):	95%	80%	51%			9%		
		Not	es, Comments	, Additio	nal Refe	rences		
Provided under DOE issued (					-			
LNAPL, NWTPH, cPAH/PAH's	s, and metals by	system modif	ication to include o	il/water sep	aration, enh	nanced pre-treat	ment, post SF mic	ron filtration, and granular

LNAPL, NWTPH, cPAH/PAH's, and metals by system modification to include oil/water separation, enhanced pre-treatment, post SF micron filtration, and granular activated carbon and/or other media adsorption. As a stand-alone technology it is designated for turbidity and pH. If raw water turbidity is >600 NTU, pretreatment is required. CESF has limited to no ability to remove turbidity consisting of rock dust, rock flour, or other rock source fines that have not been geochemically weathered over time. Chitosan performance is typically compromised by acidic or alkaline pH conditions out side the neutral range. Performance data presented is from from full-scale use at temporary projects where RSA CESF technology was used in accordance with GULD specifications with modifications for enhanced removal components (e.g., granular activated carbon). Untreated construction water ranging from >25 NTU to > 5000 NTU (with pretreatment if over 600 NTU) have all been reduced to <10 NTU, but typically to <5 NTU. Flow ranges for various conventional system sizes range from 100 to over 1000 gpm for 24/7 continuous operations.

Ц	-	D	D	-	D	
П	E	K	K	E	ĸ	A

Manufacturer:	nufacturer: BakerCorp Contact Name: Tim Ferris					Ferris				
Name of Technology			vith Chitosan		Contact E	maile	tferris@bakercorp.com			
Name of Technology: # of Installations in	E	nhanced Sa	nd Filtration	_	Contact Email: Contact Phone:			3-6136		
Washington:		1	L		Contact W			orp.com		
				_	tion ( )					
Downspout	√ Oil/V	<b>I rec</b> Vater Sepa		ype/Applicat	-	all that a				Stormwater
Drain Inlet Insert	_			✓ Filtration (me				ange column		
	Sett	0	Companying	Filtration (fab				osmosis	$\checkmark$	Groundwater
Below Ground Vault	_		Separation	Filtration (bio	filtration)		_	pagulation	$\checkmark$	Wastewater
Above Ground Vault	E Floa	tables Baff	le	✓ Filtration (che	emically enhance	ed)	Chemica	l Treatment	$\checkmark$	Process water
				Estimated	d Costs					
Estimated Installation	Cost (uni	t cost a	nd constru	ction cost):		low		high:		
Estimated Annual O&N	/I Cost (\$	/gallon	treated):			low		high: high:		
			SI	ıstem Hydraı	ulics/Desig	n				
Design Flow Rate (gpm	):		-,		: 15gpm		1,000gpm+			
System aboveground for		(sq ft):			: 1,000sq ft		2,500sq ft			
Required head loss (ft)	:			_	:	high				
Internal or External By	pass:	_			_					
				System Per	ormance					
				oysten reij	onnunee					
Briefly describe how da	ata were	collecte	ed (field, la	b, third party,	grab sample	e, auto-co	mposite, e	tc.)		
	1			1	1		1			
		TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs		
Median Influent (mg/L)		200								
Median Effluent (mg/L) Median Removal (%):		10 95								
Wedian Kemoval (76).		95								
			Total Me	tals	Diss	olved Me	tals			
		Cu	Pb	Zn	Cu	Pb	Zn			
Median Influent (mg/L)		150	500	2500	20	40	400			
Median Effluent (mg/L)	):	75	200	1000	10	20	40			
Median Removal (%):		50	40	50	50	50	90			
			Nata: C		1141					
TCC total matrix and dealers				omments, Ad		-		then The P		and all for the second
TSS, total metals, and dissol parameters are based upon					,					

parameters are based upon a study done by Dungeness Environmental during 2009-2010. Dungeness Environmental does not have relevant data for the organics listed in this table. For any questions, please contact Chris Palczewski at Dungeness Environmental: 425-481-0600 or cpalczewski@dungenessenviro.com. Thank you.

HE	RF	REF	RA
	. IX I		

Manufacturer:	Clear Creek Sy	Clear Creek Systems, Inc.			Contact Name: Ja			ason Ziemer		
Name of Technology:	ne of Technology: Multiple Technologies			Contact Email:			jziemer@clearcreeksystems.com			
# of Installations in				Contact Ph	one:	253 67				
Washington:	> 15 on the \	Vest Coast		Contact W	ebsite:	www.clearcree				
	Trea	tment Type,	/Applicati	on (check	all that a	pply)				
✓ Downspout	✓ Oil/Water Separ	ation 🗸	Filtration (medi	a)		✓ Ion exchange	ange column	Stormwater		
Drain Inlet Insert	✓ Settling		Filtration (fabri	c)		✓ Reverse	osmosis	Groundwater		
Below Ground Vault	Hydrodynamic S	Separation	Filtration (biofil	tration)		Electroco	agulation	✓ Wastewater		
Above Ground Vault	Floatables Baffle	· ·	Filtration (chen	nically enhanced	i)	Chemica	l Treatment	✓ Process water		
			Estimated	Costs						
Estimated Installation (	Cost (unit cost an	d constructio	n cost):		low	15,000	high:	>250,000		
Estimated Annual O&N	1 Cost (\$/gallon t	reated):			low	< 0.001	high:	> 0.003		
		Syste	m Hydraul	ics/Desig	n					
Design Flow Rate (gpm)	):		low:	< 25	high	> 2,000				
System aboveground for	• • • • •		low:	< 25	high	> 2,000				
Required head loss (ft):			low:	NA	high	NA				
Internal or External Byp	bass:	External - Offli	ne Facility							
		Sys	stem Perfo	rmance						
Duiofly, doorsila a la sur da			tud a sub a s				ha <b>)</b>			
Briefly describe how da Attached data was collected						mposite, ei	(C.)			
	nom grab samples	that were analyz	ed by an accre		Ji y.					
	TSS	ТРН О	il & grease	SVOCs	PCBs	Dioxins	CPAHs			
Median Influent (mg/L)			in de gricase	50003	1 003	DIOXIII3	CIAIIS			
Median Effluent (mg/L)										
Median Removal (%):										
	C	Total Metals	7	Г	olved Me	1				
Median Influent (mg/L)	Cu	Pb	Zn	Cu	Pb	Zn				
Median Effluent (mg/L)						┨───┤				
Median Removal (%):	•									
	I	Į				ļl				
	٨	lotes, Comn	nents, Add	itional Re	ference	5				
Clear Creek Systems, Inc. (CC		-	-				, mixed medi	a absorption, ion		
exchange, oil/water seperat	ors, UV, RO, chemica	al treatment and	chemically enl	nanced sand f	iltration. C	ur treatment	systems are	sized for specific site		
requirements using the Wes							-			
	tern Washington Hy	drology Model 3	. We select the	appropriate	treatment	technology fo	or a specific s	site by conducting		

either laboratory or field treatability and pilot testing. For this reason we have included a broad range of flow rates, costs and footprint requirements. We have attached some data and a Power Point presentation that further explains our approach and capabilities. In addition, much more information about CCS can be found at www.clearcreeksystems.com. We have attached some data for your review, but most of our clients have not released us to share the data that has been collected at their sites.



Manufacturer:	Schrei	ber LLC	Contact Name:			William k	Kunzman		
Name of Technology:	Name of Technology: Fuzzy Filter			Contact Email:			erwater.com		
<b>Technology Category:</b>				Contact Pl	hone:	205-65	5-7466		
Technology Process:				Contact W	/ebsite:	www.schreibe	erwater.com		
# of Installations in Was	shington:	0							
	Trea	tment Type	Applic	ation (ch	eck all the	at apply)			
Downspout	Oil/Water S			n (media)			ange column	✓ Storr	nwater
Drain Inlet Insert	Settling	- [	- Filtratior	ı (fabric)		Reverse	osmosis	Grou	ndwater
Below Ground Vault	Hydrodynai	nic Separation		(biofiltration)			agulation		ewater
Above Ground Vault	Floatables I	Baffle	_	n (chemically e	nhanced)	Chemical	Treatment		ess water
			Estimat	ed Costs					
Estimated Installation C	Cost:	low:		high:					
Estimated Annual O&M	Cost:	low:		high:		-			
		S	ystem H	lydraulic	s				
Design Flow Rate (gpm)	:	low:	70	high:	unlimited				
Required head loss (ft):	_	3.5				-			
Internal or External Byp	ass:	extern	al						
		Sy	stem Pe	erforman	се				
Breifly describe how da	ta were cole	cted (field, la	b, third p	oarty, grab	sample, a	uto-compo	osite, etc.)	1	
Fuzzy Filter removes suspe	ende solids 4 n	nicrons and ab	ove. The r	nedia is con	npressible	so that pore	size can be	adjusted t	thru
changes in compressioon of		-			-	-	-		
should be less than 100 mg			-	-		-	-		
particle distribution analys									
filtration of contaminated		collected within	n chemica	l plants. We	also have	several CSO	installatio	ns, one of v	which can
process 85 MGD for the cit	ty of Atlanta.								
Parameter:	TSS	ТР	Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	ТРН	cPAHs	PCBs
# of sample:									
Median Influent (mg/L):	10								
Median Effluent (mg/L):	2								
% Removal:	70-95%								
	٨	lotes, Comr	nents, A	Aditiona	l Referei	nces			
Fuzzy Filter removes suspe	ende solids 4 n	nicrons and ab	ove. The r	nedia is con	npressible s	so that pore	size can be	adjusted	thru

changes in compression of the media via the integral actuator connected to a perforated compression plate. Influent solids should be less than 100 mg/l with many typical applications processing water streams containing 20 mg/l and less. Attached is a particle distribution analysis for removal of suspended solids from river water. Two recent projects under contruction include filtration of contaminated storm water collected within chemical plants. We also have several CSO installations, one of which can process 85 MGD for the city of Atlanta.



Manufacturer:	KAS	SELCO, LLC	_	Contact N	ame:	Dou	glas Herber	_
Name of Technology:	High-Flo E	lectocoagulation	_	Contact Er	nail:	<u>dherber(</u>	@kaselco.com	_
# of Installations in				Contact Pl	none:	361	-594-3327	_
Washington:	0 in WA,	2 in Vancouver	_	Contact W	ebsite:	www.k	kaselco.com	_
		Treatm	ent Type/App	lication (	check all t	hat apply)		
Downspout	✓ Oil/Water Se	eparation	Filtration (med	lia)		Ion excha	inge column	✓ Stormwater
Drain Inlet Insert	Settling		Filtration (fabri	ic)		Reverse c	osmosis	Groundwater
Below Ground Vault	Hydrodynan	nic Separation	Filtration (biofi			Electroco	agulation	✓ Wastewater
Above Ground Vault	Floatables E	affle	Filtration (cher	nically enhance	d)	Chemical	Treatment	Process water
			Estim	ated Cost	s			
Estimated Installation	Cost (unit cos	t and constr	uction cost):		low:	\$25,000	high	\$2,200,000
Estimated Annual O&I	-		-			\$0.0005	high	
			System Hy	draulics/	Desian			
Design Flow Rate (gpm	n):		low:	-	high:	1,200+ (	Can link systems	in narallel for
System aboveground f		t):	low:	40	high:		arger capacity	, in parallel for
Required head loss (ft)		- <i>1</i> -	low:	2	high:	20		
Internal or External By		E	xternal		0			
			System	Performa	nce			
			System	<i>i</i> cijoima	nee			
Briefly describe how d	ata were colle	ected (field, l	ab, third party,	grab samp	le, auto-c	omposite,	etc.)	
System Performance has be	een evaluated in	lab as well as ir	n field research app	lications and	existing ins	tallations. Gi	rab samples are a	inalyzed both internally as well
as by a third party lab.								
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	7
Median Influent (mg/L	.):							]
Median Effluent (mg/L	.):							
Median Removal (%):								
		Total Me	tals	Diss	olved Me	tals		
	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L				Gu				
Median Effluent (mg/L	-							
Median Removal (%):	·		1					
	I	•	- <b>-</b>	·		·I		
		Not	es, Comments	, Addition	al Refer	ences		
Have attached actual test r	esult parameters				-		aluations and will	supply those results as
available.								

HERRERA	
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Manufacturer:	OilTrap Environ	mental Prd.		Contact N	lame:	Mike	e Davis	
Name of Technology:	OilTrap E	lectroPulse	_	Contact E	mail:	mike@oi	iltrap.com	
# of Installations in			_	Contact P	hone:	360.94	43.6495	
Washington:		33	_	Contact V	Vebsite:	www.oil	trap.com	
	Tre	atment T	ype/Applicati	on (checl	k all that a	pply)		
Downspout	Oil/Water Sep		Filtration (med			_	nange column	Stormwater
Drain Inlet Insert	Settling		Filtration (fabri	c)		Reverse	osmosis	Groundwater
Below Ground Vault	Hydrodynami	c Separation	Filtration (biofi			Electroc	oagulation	Wastewater
Above Ground Vault	Floatables Ba	ffle	Filtration (chen	nically enhanc	ed)	Chemica	al Treatment	Process water
			Estimated	Costs				
Estimated Installation	Cost (unit cost :	and constru	ction cost).		low:	25,000	high	500000
Estimated Annual O&N	•				low:		high:	0.005
		SI	vstem Hydrau	lics/Desi	an			
Design Flow Rate (gpm	):	•,	low:	5	high:	500		
System aboveground for	•		low:	40	high:	-		
Required head loss (ft)			low:	5	high:		-	
Internal or External By	pass:		either				-	
			System Perfo	ormance				
Briefly describe how da	ata were collect	ted (field, la	b, third party, g	rab sampl	e, auto-co	mposite, e	tc.)	
Samples were collected as r						. ,		
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L)	): 600	78	136	28	Unknown	Unknown	Unknown	
Median Effluent (mg/L)	): 10	0.27	<5.0	0.43	Unknown	Unknown	Unknown	
Median Removal (%):	98.3	99.6	>96.3	98.4	Unknown	Unknown	Unknown	
		Total Me	tals	Dis	solved Me	tals	Ţ	
	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L)	): 12.1	14.1	151	8.2	10.9	78.6		
Median Effluent (mg/L	-	0.039	0.34	0.072	0.039	0.34	Ì	
Median Removal (%):	99.4	99.7	99.9	99.1	99.6	99.9	I	
		Notes, Co	omments, Add	litional R	eference	s		
I have not worked with was	tewater with PCB (	or dioxins. We	generally see 90%	+ in reduction	on of pesticid	es also.		

Manufacturer:	Water	Tectonics	_	Contact N	ame:	Jim M	lothersbaugh	
Name of Technology:	pH	ATBox	-	Contact Er	nail:	jim@wat	ertectonics.com	_
# of Installations in				Contact Pl		866	5-402-2298	
Washington:		40 +	_	Contact W	/ebsite:	www.wat	tertectonics.com	_
	_		nt Type/Appli	<b>cation</b> (c	heck all th	hat apply)		
Downspout	Oil/Water Se	paration	Filtration (medi	a)		lon exchar	nge column	Stormwater
Drain Inlet Insert	Settling		Filtration (fabri	c)		Reverse os	smosis	Groundwater
Below Ground Vault	Hydrodynam	ic Separation	Filtration (biofil	tration)		Electrocoa	gulation	✓ Wastewater
✓ Above Ground Vault	Floatables Ba	affle	Filtration (chem	nically enhance	d)	Chemical 1	Freatment	✓ Process water
			Estima	ited Cost	s			
Estimated Installation	Cost (unit cost	and constru	ction cost):		low:	\$ 19,500	hig	<b>;h:</b> \$ 28,500
Estimated Annual O&N	-		-		low:	(a)	hig	
			System Hyd	raulics/D	Design			
Design Flow Rate (gpm	n):		low:	250	high:	350		
System aboveground f		:	low:	10 (b)	high:	-		
Required head loss (ft)			low:	N/A	high:	N/A		
Internal or External By	pass:		N/A					
			System P	Performai	nce			
Driefly describe how d		tad (field la	L third party o				- 1	
Briefly describe how da Field. Real-time with in-line		-		rap sampi	e, auto-co	mposite, et	с.)	
field. Near time with ite	: probes: 2 point.		511.					
	TCC	TDU		SVOC.	DCDa	Diavina	CDALLA	
Median Influent (mg/L	TSS	TPH (c)	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs (c)	
Median Effluent (mg/L		(c) (c)	(c) (c)	(c) (c)	(c) (c)	(c) (c)	(c) (c)	-
Median Removal (%):	(c)	(c)	(c)	(c)	(c)	(c)	(c)	-
							. ,	
		Total Met	tals	Dis	solved Me	etals		
	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L		(c)	(c)	(c)	(c)	(c)		
Median Effluent (mg/L		(c)	(c)	(c)	(c)	(c)		
Median Removal (%):	(c)	(c)	(c)	(c)	(c)	(c)		
		Notes	, Comments,	Addition	al Refere	ences		
(a) Depends on buffering ca	pacity of waterstr						selected, and final	pH point required.
(b) Packaged in 4' -6' (w) x 2							-	
storage (up to 35-gal drums	in box, larger mu	st go external)	- plus secondary co	ntainment).	Unit has in-	line pH probe f	for real time monit	oring and data logger
expandable for dual pH adju	ustment (multi inje	ection/mixing lo	pops), and flow rec	ording. pH s	et-point(s) p	programmable	into controller.	

expandable for dual pH adjustment (multi injection/mixing (c) Adjusts pH. System performance data - not applicable.

Additional Notes:

-Effective for controlling alkaline waters from cement/concrete operations using carbon dioxide. -Suitable for inclusion as pH adustment component in variety of water treatment systems. -pH set-points (high/low) variable for application.

H	ER	RE	RA

Manufacturer:	Stormv	vateRx LLC		Contact N	ame:	Ayn G	eneres	
Name of Technology:		shing System	_	Contact Er	nail:		nwaterx.com	
# of Installations in			_	Contact Pl	none:	800.68	0.3543	
Washington:		YES	_	Contact W	ebsite:	www.storm	waterx.com	
	Tre	eatment T	ype/Applicati	on (check	all that a	pply)		
Downspout	Oil/Water Sep		Filtration (medi			_	ange column	Stormwater
Drain Inlet Insert	Settling		Filtration (fabri	c)		Reverse	osmosis	Groundwater
Below Ground Vault	Hydrodynami	c Separation	Filtration (biofil	tration)		Electroco	oagulation	Wastewater
Above Ground Vault	Floatables Ba	ffle	Filtration (chen	nically enhance	ed)	Chemica	l Treatment	Process water
			Estimated	Costs				
Estimated Installation (	Cost (unit cost a	and constru	iction cost):		low	: 10000	high:	140000
Estimated Annual O&N	1 Cost (\$/gallor	treated):			low	0.0024	high:	0.0047
		S	ystem Hydrau	lics/Desig	ŋn			
Design Flow Rate (gpm)	):		low:	5	high	210		
System aboveground for			low:	10	high			
Required head loss (ft):			low:	70	high	120		
Internal or External Byp	bass:	E	xternal					
			System Perfo	ormance				
					_			
Briefly describe how da These samples were collected								Il applytical data is
from a third party certified a	0 1	,	, 00		'	,		li dildiylicdi üdld is
	,							
	тсс	ТРН		SVOCa	DCBa	Diovine		
Median Influent (mg/L)	TSS	IPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Effluent (mg/L)								
Median Removal (%):	/-	YES		YES	YES		YES	
<u> </u>			+			• •		
		Total Me	1		olved Me	1		
Madian Influent (mad)	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L)			0.28			.060		
Median Effluent (mg/L)	):		0.083			0.0074		
Median Removal (%):			86		<u> </u>	88		
		Notes, Co	omments, Add	itional R	eference	S		
Additional pollutant remova	l includes bacteria							
		**						

Herrera Herrera

Manufacturer:	Morselt	Borne BV		Contact Na	me:	Harry	Assink	_	
Name of Technology:	Rec	xodb		Contact En		info@moi		_	
Technology Category:				Contact Ph		317426		-	
Technology Process:				Contact W	ebsite:	www.mor	<u>selt.com</u>	-	
# of Installations in Wa									
_	_	atment Ty	pe/Appli	cation (cl	neck all tha				
Downspout	Oil/Water S	eparartion	Filtration	(media)		Ion exchange	column	Storr	nwater
Drain Inlet Insert	Settling		Filtration	(fabric)		Reverse osm	osis	Grou	ndwater
Below Ground Vault	Hydrodyna	mic Separation	Filtration	(biofiltration)	~	] Electrocoagu	ation	✓ Wast	ewater
Above Ground Vault	Floatables	Baffle	Filtration	(chemically en	hanced)	Chemical Tre	atment	✓ Proce	ess water
			Estimo	ited Costs					
Estimated Installation	Cost:	low:	\$42,000	high:	\$1,000,000				
Estimated Annual O&N	/I Cost:	-	\$1,000	high:	\$20,000	_			
			System	Hydraulic	.s				
Design Flow Rate (gpm	ı):	low:	0.5	high:	150				
Required head loss (ft)	-	n.a.		<u> </u>		-			
Internal or External By	pass:	n.a.							
			System P	Performan	ice.				
			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						
Breifly describe how da	ata were cole	cted (field, la	ıb, third p	arty, grab s	sample, aut	o-composit	e, etc.)		
Parameter:	TSS	ТР	Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	ТРН	cPAHs	PCBs
# of sample: Median Influent (mg/L): Median Effluent (mg/L):									
median Ennuent (mg/L):									
% Removal:	99		99	99	99	99			
		Notes, Con							
		-	nments,	Additiond	ıl Referen	ces	nanufactu	ring.	



Manufacturer:	Siemen	IS		Contact N	ame:	Ada	m Szcz	esniak			
Name of Technology:	WWIX			Contact Er	nail:	adam.szo	zesniak@	asiemens.co	<u>m</u>		
Technology Category:				Contact Pl	none:	860-593-2063					
Technology Process:	Regulated Metals	Removal		Contact W	ebsite:	siemens.	com/wat	<u>er</u>			
# of Installations in Wasl	nington:	>500									
	Treatm	ent Type/	Applic	ation (ch	eck all the	at appl	y)				
Jownspout	Oil/Water Separ	artion 🗸	] Filtration	(media)		√ Ion	exchan	ge column	$\checkmark$	Stormw	ater
✓ Drain Inlet Insert	Settling		] Filtration	(fabric)		✓ Rev	verse os	mosis	$\checkmark$	Ground	water
✓ Below Ground Vault	Hydrodynamic S	Separation	] Filtration	(biofiltration)		Ele	ctrocoag	julation	1	Wastew	ater
✓ Above Ground Vault	Floatables Baffle	e 🗸	] Filtration	(chemically er	nhanced)	√ Ch	emical T	reatment	$\checkmark$	Process	water
		E	stimat	ed Costs							
Estimated Installation Co		low:	3,000	high:	250,000	_					
Estimated Annual O&M	Cost:	low:	3,000	high:	500,000	-					
		Sy	stem H	lydraulic	5						
Design Flow Rate (gpm):		low:	1gpm	high:	5000gpm	_					
Required head loss (ft):		20psi									
Internal or External Bypa	ISS:	None									
		Sys	tem Pe	rforman	ce						
						_					
Breifly describe how dat Siemens manufactures an e										mbran	
technologies and ion excah			-	-				-			
low discharge levels as low		-			-						
on site test kits or samples	shipped to local	certified lab	oratories	for evaluat	ion.						
	<b></b>	<b>TD</b>		D: 7.		D'-		<b>T</b> DU	- D.A		
Parameter: # of sample:	TSS	TP [	Dis. Cu	Dis. Zn	Dis. Cd	Dis.	PD	ТРН	сРА	HS	PCBs
Median Influent (mg/L):											
Median Effluent (mg/L):											
% Removal:											
	Not	es, Comm	ents, A	dditiona	l Referei	nces					



Manufacturer:	Water	Tectonics		Contact N	lame:	Jim Mothersb	augh	
Name of Technology:	Way	velonics		Contact E	mail:	jim@waterteo	tonics.com	
# of Installations in				Contact P	hone:	866-402-2298		
Washington:		35+		Contact V	Vebsite:	www.waterte	ctonics.com	
	Tre	eatment Ty	pe/Applicat	ion (checl	k all that d	apply)		
Downspout	✓ Oil/Water Sep	parartion	✓ Filtration (mee	dia)		Ion exch	nange column	Stormwater
Drain Inlet Insert	✓ Settling		Filtration (fab	ric)		Reverse	osmosis	Groundwater
Below Ground Vault	Hydrodynami	c Separation	Filtration (biof	iltration)		✓ Electroc	oagulation	✓ Wastewater
Above Ground Vault	✓ Floatables Ba	ffle	Filtration (che	mically enhance	ed)	Chemica	al Treatment	Process water
			Estimated	Costs				
Estimated Installation Co	ost:	low:	60000	high:	850000			
Estimated Annual O&M	Cost:	low:	0.0008	high:	0.008	-		
		Sys	stem Hydrau	lics/Desi	gn			
Design Flow Rate (gpm):	:	low:	50	high:	>1000			
System footprint (sq ft):		low:	200	high:	>4000	-		
Required head loss (ft):		low:	NA	high:	NA			
Internal or External Bypa	ass:	NONE-aut	o recirculation fo	r retreat		-		
			System Perf	ormance				
			- , ,					
Breifly describe how dat							-	
Field via hand-held instrumen				,	• • •			
analytical testing laboratories presented below does not acc	-	-						
calculations as the value of th								
characteristics once the syste					,		•	
generated by our Clients/Syst	em Owners do r	not typically pro	vide us with DMI	R's they subm	nit to Ecolog	y or other re	gulatory age	ncies. Effluent data
points do not reflect technolo	gy ability to ach	ieve lower than	n reported results	. Permit discl	narge limita	tions have hi	storically var	ied from site to site,
permit to permit , and therefore	ore data reflect f	treatment effor	ts and not techno	ology limitatio	ons.			
	NTU's	TSS	TPH0	O&G	SVOCs	PCBs	Dioxins	
Median Influent (mg/L):		200	45.6	197	2.34	0.0024	DIOXIIIS	ĺ
Median Effluent (mg/L):		5	0.25	4.76	0.00002	0.00011		
Median Removal (%):	100	98	99	98	100	9505		
	· · · · · · · · · · · · · · · · · · ·						1	
		Total Met		_	solved Me	1		l
A a dia a la flaca at (as a /l.).	Cu	Pb	Zn	Cu	Pb	Zn	CPAHs	
Median Influent (mg/L):		0.253	0.516	0.0235	0.0157	0.12	0.081	
Median Effluent (mg/L):		0.003	0.0315	0.005	0.0031	0.02	0.00002	
Median Removal (%):	100	99	94	79	80	83	99.98	
		Notes, Cor	nments, Ado	ditional R	eference	25		
Wavelonics electrocoagulatio	n (EC) technolog				-		components	(see Treatment
Type/Application, above) utili	zed for pre-trea	tment and/or p	olishing. EC facili	tates the coa	gulation of s	suspended so	olids fines and	d/or dissolved species
that are suitable for removal l			-					
constituents present, their rea								
full-scale applications. Techno	ology viability an	d optimization	is recommended	tor non-conv	entional co	nstituents of	concern. or	tor complex matrices

constituents present, their reaction chemistry, pH sensitivity, and water conductivity. Bacteria disinfection has been demonstrated at laboratory and full-scale applications. Technology viability and optimization is recommended for non-conventional constituents of concern, or for complex matrices where interferences and competing conditions are problematic to conventional advanced treatment processes. Although a technology for application to a broad-spectrum of constituents, EC does not rely on treatment chemicals (e.g. polymers), it generates low solids volumes, is full-automated to reduce O&M labor, and cost-effectively converts AC power to DC. Power consumption is driven primarily by demand and loads of pumps, common to any mechanical water conveyance system plus optional control area HVAC. System Performance data fields (above) call for "Median" data points that do not allow for presentation of worst-case conditions, nor do they adequately reflect "mean" conditions, both of which are more elevated than the "Median" data presented for influent characteristics. Effluent "median" data do not reflect <MDL or <MCL data as reported by laboratories. However, ND results utilized in the calculation were the numeric value of the actual MDL or MCL. SVOC and cPAH data reflect a summation of all individual constituents in SVOC or cPAH parameter suites as totals. PCB's are totals of all Arochlor congeners. Oil and Grease data reflect both Freon and Hexane extraction analytical methods. Technology has not been used to specifically remove Dioxins and when technology was utilized, Dioxins were not targeted for analytical testing. Other data available upon request for: bacteria; other heavy metals; color from humics, etc.



Manufacturer:		nvironmenta	1						
	Techno	logies Ltd.	_	Contact N	lame:	Dr. A	lvin Ip	_	
Name of Technology:	We	etSep	_	Contact E	mail:	<u>alvin@was</u>	tech.com.hk	_	
Technology Category:	Above Gr	round Vault	_	Contact P	hone:	(852) 26	02-0308	_	
Technology Process:	Water	Freatment	_	Contact V	Vebsite:	www.wast	ech.com.hk		
# of Installations in Wa	shington:		1						
	_	-	pe/Applic	ation (cl	neck all tha	_			
Downspout	✓ Oil/Water Sepa	arartion	Filtration	ı (media)		lon excha	nge column	✓ Storm	nwater
Drain Inlet Insert	Settling		Filtration	n (fabric)		Reverse o	smosis	Grou	ndwater
Below Ground Vault	<ul> <li>Hydrodynamic</li> </ul>	Separation	Filtration	(biofiltration)	)	Electrocoa	gulation	✓ Waste	ewater
Above Ground Vault	Floatables Baff	fle	✓ Filtration	n (chemically e	enhanced)	Chemical	Freatment	Proce	ss water
			Estimat	ed Costs					
Estimated Installation			\$1000	high:					
Estimated Annual O&N	A Cost:	low	: \$100/day	high:	\$250/day				
			System H	-					
Design Flow Rate (gpm		low		high:	260				
Required head loss (ft)			feet						
Internal or External By	pass:	Externa	l Bypass						
			System Pe	erforman	се				
Breifly describe how da	ata wara colacte	ad (field Ial	hird nart	v grah sa		-composite	etc)		
								taken at var	ious
The data can be stored an	nd downloaded fr	om data logg	er for flowra					taken at var	ious
The data can be stored an points in the system to be	nd downloaded fro e varified by a thir	om data logg d party (i.e. l	ger for flowra aboratory).					taken at var	ious
The data can be stored an points in the system to be	nd downloaded fro e varified by a thir	om data logg d party (i.e. l	ger for flowra aboratory).					taken at var	ious
The data can be stored an points in the system to be	nd downloaded fro e varified by a thir	om data logg d party (i.e. l	ger for flowra aboratory).					taken at var	ious
The data can be stored an points in the system to be	nd downloaded fro e varified by a thir	om data logg d party (i.e. l	ger for flowra aboratory).					taken at var	ious
The data can be stored an points in the system to be Please also find the Field S	nd downloaded fro e varified by a thir Study for the Wet	om data logg d party (i.e. l Sep filtration	er for flowra aboratory). n System		Turbidity. G	rab samples	can also be	taken at var	
he data can be stored an points in the system to be Please also find the Field S Parameter:	nd downloaded fro e varified by a thir	om data logg d party (i.e. l	ger for flowra aboratory).	te, pH and					ious PCBs
The data can be stored an points in the system to be Please also find the Field s Parameter: # of sample:	nd downloaded fr e varified by a thir Study for the Wet	om data logg d party (i.e. l Sep filtration	er for flowra aboratory). n System Dis. Cu	te, pH and	Turbidity. G Dis. Cd	rab samples Dis. Pb	can also be		
The data can be stored an points in the system to be Please also find the Field s Parameter: # of sample: Median Influent (mg/L):	nd downloaded fr e varified by a thir Study for the Wet <b>SS</b> 112	om data logg d party (i.e. l Sep filtration <b>TP</b> 13.4	ger for flowra aboratory). n System <b>Dis. Cu</b> 7 μg/L	te, pH and	Turbidity. G Dis. Cd 0.3 μg/L	rab samples Dis. Pb 18 μg/L	can also be		
The data can be stored an points in the system to be Please also find the Field S Parameter: # of sample: Median Influent (mg/L): Median Effluent (mg/L):	nd downloaded fr e varified by a thir Study for the Wet	om data logg d party (i.e. l Sep filtration	er for flowra aboratory). n System <b>Dis. Cu</b> 7 μg/L 1 μg/L	te, pH and	Turbidity. G Dis. Cd 0.3 μg/L <0.2 μg/L	rab samples Dis. Pb 18 μg/L <1 μg/L	can also be		
The data can be stored an points in the system to be Please also find the Field S Parameter: # of sample: Median Influent (mg/L): Median Effluent (mg/L):	nd downloaded fra e varified by a thir Study for the Wet SS 112 <2 98%	om data logg d party (i.e. l Sep filtration <b>TP</b> 13.4 1.9 86%	per for flowra aboratory). System Dis. Cu 7 μg/L 1 μg/L 86%	Dis. Zn	Turbidity. G Dis. Cd 0.3 μg/L <0.2 μg/L 50%	Tab samples <b>Dis. Pb</b> 18 μg/L <1 μg/L 94%	can also be		
The data can be stored an points in the system to be Please also find the Field S Parameter: # of sample: Median Influent (mg/L): Median Effluent (mg/L): % Removal:	nd downloaded fr e varified by a thir Study for the Wet SS 112 <2 98%	om data logg d party (i.e. l Sep filtration TP 13.4 1.9 86% <b>Votes, Cor</b>	per for flowra aboratory). System Dis. Cu 7 μg/L 1 μg/L 86% mments, A	Dis. Zn	Dis. Cd 0.3 μg/L <0.2 μg/L 50%	<b>Dis. Pb</b> 18 μg/L <1 μg/L 94%	can also be	cPAHs	PCBs
The data can be stored an points in the system to be Please also find the Field S Parameter: # of sample: Median Influent (mg/L): Median Effluent (mg/L): % Removal: The WetSep system was u	nd downloaded fr e varified by a thir Study for the Wet Study for the Wet SS 112 <2 98% Mused in the State of	om data logg d party (i.e. l Sep filtration TP 13.4 1.9 86% Votes, Cor of Washingto	er for flowra aboratory). System Dis. Cu 7 μg/L 1 μg/L 86% mments, A mat the Can	Dis. Zn dditiond	Dis. Cd 0.3 μg/L <0.2 μg/L 50% der crossing	Dis. Pb 18 μg/L <1 μg/L 94% 94% 5. The main (19)	can also be	cPAHs	PCBs
The data can be stored an points in the system to be Please also find the Field S Parameter: # of sample: Median Influent (mg/L): Median Effluent (mg/L): % Removal:	nd downloaded fr e varified by a thir Study for the Wet Study for the Wet SS 112 <2 98% Mused in the State of	om data logg d party (i.e. l Sep filtration TP 13.4 1.9 86% Votes, Cor of Washingto	er for flowra aboratory). System Dis. Cu 7 μg/L 1 μg/L 86% mments, A mat the Can	Dis. Zn dditiond	Dis. Cd 0.3 μg/L <0.2 μg/L 50% der crossing	Dis. Pb 18 μg/L <1 μg/L 94% 94% 5. The main (19)	can also be	cPAHs	PCBs
The data can be stored an points in the system to be Please also find the Field S Parameter: # of sample: Median Influent (mg/L): Median Effluent (mg/L): % Removal:	nd downloaded fr e varified by a thir Study for the Wet Study for the Wet SS 112 <2 98% Mused in the State of	om data logg d party (i.e. l Sep filtration TP 13.4 1.9 86% Votes, Cor of Washingto	er for flowra aboratory). System Dis. Cu 7 μg/L 1 μg/L 86% mments, A mat the Can	Dis. Zn dditiond	Dis. Cd 0.3 μg/L <0.2 μg/L 50% der crossing	Dis. Pb 18 μg/L <1 μg/L 94% 94% 5. The main (19)	can also be	cPAHs	PCBs
The data can be stored an points in the system to be Please also find the Field S Parameter: # of sample: Median Influent (mg/L): Median Effluent (mg/L): % Removal: The WetSep system was u	nd downloaded fr e varified by a thir Study for the Wet Study for the Wet SS 112 <2 98% Mused in the State of	om data logg d party (i.e. l Sep filtration TP 13.4 1.9 86% Votes, Cor of Washingto	er for flowra aboratory). System Dis. Cu 7 μg/L 1 μg/L 86% mments, A mat the Can	Dis. Zn dditiond	Dis. Cd 0.3 μg/L <0.2 μg/L 50% der crossing	Dis. Pb 18 μg/L <1 μg/L 94% 94% 5. The main (19)	can also be	cPAHs	PCBs

Passive

R	3	н	F	P	P	F	D/	
U	5		с.	ĸ	K	С	K/	•

Manufacturer:	Eco-Tec, Inc	Contact Name	e:	Herb Pe	earse	
Name of Technology:	ADsorb-it	Contact Email	l:	herb@eco-te	ec-inc.com	
# of Installations in		Contact Phone	e:	253-884	-6804	
Washington:	61	_ Contact Webs	site:	www.eco-te	<u>c-inc.com</u>	
	Treatment T	ype/Application (check all	that a	oply)		
J Downspout	✓ Oil/Water Separation	Filtration (media)		Ion exchar	nge column	✓ Stormwater
✓ Drain Inlet Insert	Settling	✓ Filtration (fabric)		Reverse o	smosis	Groundwater
Below Ground Vault	Hydrodynamic Separation	Filtration (biofiltration)		Electrocoa	igulation	✓ Wastewater
Above Ground Vault	Floatables Baffle	Filtration (chemically enhanced)		Chemical	Treatment	✓ Process water
		Estimated Costs				
Estimated Installation Cost (unit cost and construction cost):       Iow: \$0.91/SF       high: \$0.91/SF         Estimated Annual O&M Cost (\$/gallon treated):       Iow: \$0.91/SF       high: \$0.91/SF						
	Sj	stem Hydraulics/Design				
Design Flow Rate (gpm	•	low: 80/SF	high:	100/SF		
System aboveground f		low: Varies	high:	Varies		
Required head loss (ft)		low: NA	high:	NA		
Internal or External By	pass: Per individ	dual application				
		System Performance				
<b>Briefly describe how data were collected (field, lab, third party, grab sample, auto-composite, etc.)</b> A variety of sampling methods have been implemented over the years based on specific installations of the ADsorb-it Filtration Fabric and associated application specific product configurations manufactured from the ADsorb-it Fabric. ADsorb-it is designed to be versatile in its installation for diverse filtration applications, thus it can be configured for Downspout, Drain Inlet Inset, Below Ground Vault, Above Ground Vault, Shoreline, Oil Water Separator, and General Stormwater applications. ADsorb-it is approved by the Department of Ecology (Ecology) for use as a Catch Basin Insert and is used by Ecology for spill response and general oil/water related issues.						

	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	Varies	Varies	Varies				
Median Effluent (mg/L):	Varies	Varies	Varies				
Median Removal (%):	80-99	99-100	99-100				

	Total Metals			Dissolved Metals		
	Cu	Pb	Zn	Cu	Pb	Zn
Median Influent (mg/L):						
Median Effluent (mg/L):						
Median Removal (%):	Varies	Varies	Varies	Varies	Varies	Varies

#### Notes, Comments, Additional References

Please see the attached report from the City of Tacoma as well as the VMS Full Scale and Field Tests for TSS removal. The 'filter blanket" referred to in the City of Tacoma Report is the ADsorb-it Fabric Product #EDB24-5, Contour Ditch Boom. Attached to this email is additional testing / application data and photographs to present a general spectrum of possible applications. As can be seen on our web site at www.eco-tec-inc.com, miles of ADsorb-it Fabric were deployed along the Gulf Coast Shoreline as an Oil Fence to provide effective removal of advancing oils from the BP Deepwater Horizon Release. Additional testing data can be accessed on our web site simply by clicking on "Test Data" in the left hand column. As a note, ADsorb-it is highly effective at removing hydrocarbons, including fats, oils and greases (FOG) from water, thus any other contaminants that would be attached to the hydrocarbon such as PCBs would be removed in conjuncton with hydrocarbon / FOG removal. ADsorb-it is an environmentally compatible product in that it is: Made from waste fibers from the textile manufacturing industry, it effectively removes hydrocarbons and associated / attached contaminants from the environment, it can be cleaned and reused indefinitely, it can be disposed of as a fuel source with a higher BTU per pound value than coal and less than 1% residual ash.

Name of Technology: Technology Category: Technology Process: # of Installations in Was	Below Ground Vault Vortex + Filtration			Contact Name: Contact Email: Contact Phone: Contact Website:		Mark Miller mmiller@aquashieldinc.co 888-344-9044 www.aquashieldinc.com	<u>mc</u>
		Treat	ment Type/A	Application	(check all	that apply)	
Downspout	✓ Oil/Water		Filtration (medi		. [	Ion exchange column	Stormwater
Drain Inlet Insert	Settling		Filtration (fabric	c)		Reverse osmosis	Groundwater
Below Ground Vault	✓ Hydrodyna	amic Separation				Electrocoagulation	Wastewater
Above Ground Vault	✓ Floatables	Baffle		nically enhanced)		Chemical Treatment	Process water
			Es	timated Co.	sts		
Estimated Annual O&M	Cost:	low:	Site-specific	high: s	ite-specific		
Design Flow Rate (gpm) Required head loss (ft): Internal or External Byp	_		25 0.8 3oth	high:	960+	_	
			Syste	em Perform	ance		
				<b>v</b> 1			
1				<b>v</b> 1			cPAHs PCB
Breifly describe how da Independent lab by grab s				<b>v</b> 1			

Å

Aqua-Filter filtration cartridge has been verified by NJCAT. AF--5.3 model is currently undergoing independent TARP Tier II field testing in Maryland averaging 96% TSS removal. Anticipate completion in 2012. AF-4.2 model field tested at Univeristy of New Hampshire Stormwater Center, 80% TSS removal efficiency (see above parameters).



# HERRERA Manufacturer Technology Report

Manufacturer:	AquaShie	ld, Inc.		Contact N	ame:	M	ark Miller	
Name of Technology:	Aqua-Gu	ardian		Contact E	mail:	mmiller@	aquashieldinc.co	m
Technology Category:	Drain Inle	t Insert		Contact Pl	none:	888	-344-9044	
Technology Process:	Filtrat	ion		Contact W	ebsite:	www.ac	uashieldinc.com	
# of Installations in Was	hington:		15					
	Treat	ment Tvi	pe/Applicat	ion (check	all that ann	(v)		
Downspout	Oil/Water Se		Filtration (m	-	un that appl		nge column 🔽	Stormwater
Drain Inlet Insert	Settling		_					
	_	nic Separation	Filtration (fal	,		Reverse o		Groundwater
Below Ground Vault		·				Electrocoa		Wastewater
Above Ground Vault	Floatables B	affie	Filtration (ch	emically enhance	ed)		Treatment	Process wate
			Estimated	l Costs				
Estimated Installation C	ost:	low:	Site-specific	high:	Site-specifi	с		
Estimated Annual O&M		low:	Site-specific	high:	Site-specifi			
			System Hy					
Design Flow Rate (gpm)	:	low:	5/400*	high:	100/940*	* x/x = flo		
Required head loss (ft):			0	_		-	w thru perlite	5 +
Internal or External Byp	ass:	В	Both	_		filter cloth	1	
		5	System Perf	ormance				
			, ,					
Breifly describe how da	ta were colect	ed (field, l	ab, third part	y, grab sam	ple, auto-co	mposite, etc	)	
See Aqua-Filter, since this	device uses sam	ie media. Ir	ndependent lab	by grab sam	oles. Field by	auto-compos	te sampling,	6 sample
pairs per TARP qualifying s	torm.							
Parameter:	TSS	ТР	Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	TPH cPA	ls PCBs
# of sample:	160							
Median Influent (mg/L):	43							
Median Effluent (mg/L):	5							
% Removal:	80							
	No	otes. Con	nments, Ado	ditional Re	ferences			
See Aqua-Filter since thi		-	-			has heen ve	rified by NI	AT AF-
5.3 model is currently u			-		-		-	
Anticipate completion in			ld tested at U	niveristy of I	New Hampsh	hire Stormwa	ater Center,	80% TSS
removal efficiency (see	above paramet	ters).						

|--|--|

Manufacturer:	AquaSh	nield, Inc.		Contact Na	me:		Mark Miller		
Name of Technology:		a-Swirl	-	Contact En		mn	niller@aguashieldinc.com		
Technology Category:		ound Vault	-	Contact Ph	one:		888-344-9044		
Technology Process:	-	namic Sep.	-	Contact W	ebsite:	v	vww.aguashieldinc.com		
# of Installations in Was	shington:		82					_	
		Trom	treast Turna	_ (Annlicatio	10 Jahaalaa	II 44			
Downspout	✓ Oil/Water	r Separartion	<b>tment Type/</b> Filtration (me		п (спеск а	_		Storr	mwater
Drain Inlet Insert		Separartion		eula)		_	change column	_	
	Settling		Filtration (fat	oric)		_	se osmosis	Grou	ndwater
Below Ground Vault	✓ Hydrodyr	namic Separation	Filtration (bio	ofiltration)		Electro	ocoagulation	Wast	ewater
Above Ground Vault	✓ Floatable	s Baffle	Filtration (ch	emically enhanced	1)	Chem	ical Treatment	V Proc	ess water
			E	Estimated C	Costs				
Estimated Installation C	ost:	low:	Site-specific	high:	Site-specifi	c			
Estimated Annual O&M	Cost:	low:	Site-specific	high:	Site-specifi	с			
			Sy	vstem Hydr	aulics				
Design Flow Rate (gpm)	:	low:	-	high:	2600				
Required head loss (ft):		(	0.25						
Internal or External Byp	ass:	I	Both	_					
			Sus	tem Perfor	mance				
			- / -	·· · <b>,</b> ·					
Breifly describe how da	ta were cole	ected (field,	lab, third part	y, grab samp	ole, auto-co	mposite,	etc.)		
Lab tested by Tennessee T									
Parameter:	TSS	ТР	Dis. Cu	Dis. Zn	Dis. Cd	Dis. I	Pb TPH	cPAHs	PCBs
# of sample:	192								
Median Influent (mg/L):	137								
Median Effluent (mg/L):	12								
% Removal:	86								
			otes, Comm						
Independent field testin	g underway	per TARP Tie	er II in Marylar	nd, anticipate	completio	n in 2011.	16 storms and 14 inches	s of rain sam	pled to
date. Sample parameter	s above are	for field test	. Lab testing v	erified by NJ	CAT.				

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Manufacturer:	Stormw	vateRx LLC		Contact N	ame:	Ayn G	eneres	
Name of Technology:	Aquip Enhanc	ed Filtration Sys.	-	Contact E	mail:		nwaterx.com	
# of Installations in			-	Contact P	hone:	800.68	0.3543	
Washington:		30	-	Contact W	/ebsite:	www.storm	waterx.com	
	Tre	atment T	ype/Applicati	on (check	all that a	pply)		
✓ Downspout	✓ Oil/Water Sep	aration	Filtration (medi	ia)		Ion exch	ange column	Stormwater
Drain Inlet Insert	✓ Settling		Filtration (fabrie	c)		Reverse	osmosis	Groundwater
Below Ground Vault	Hydrodynami	c Separation	Filtration (biofil			Electroco	pagulation	Wastewater
Above Ground Vault	✓ Floatables Bat	ffle	Filtration (chem	nically enhance	ed)	Chemica	I Treatment	Process water
			Estimated	Costs				
Estimated Installation Co	ost (unit cost a	and constru	ction cost):		low:	5000	high:	150000
Estimated Annual O&M	Estimated Annual O&M Cost (\$/gallon treated):       Iow:       0.0003       high:       0.003							0.003
		Sy	stem Hydraul	lics/Desig	<u>yn</u>			
Design Flow Rate (gpm):	1		low:	10	high:	350		
	System aboveground footprint (sq ft): low: 14 high: 320							
Required head loss (ft):			low:	4	high:	7		
Internal or External Bypa	355:	E>	kternal					
			System Perfo	ormance				
					• • • • •		- 1	
Briefly describe how data These samples were collected								Il applytical data is
from a third party certified an								ill andiytical uata is
	тсс	TDU		SVOC	DCPa	Diavina		
Median Influent (mg/L):	<b>TSS</b> 30	TPH	<b>Oil &amp; grease</b> 9.9	SVOCs	PCBs	Dioxins	CPAHs	
Median Effluent (mg/L):			3					
Median Removal (%):	83	YES	70	YES	YES		YES	
	I		++		<u> </u>	<del>ا</del> ـــــــــــا		
		Total Met	als	Diss	solved Me	tals		
	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L):		0.03	0.425	0.084	0.008	0.196		
Median Effluent (mg/L):		0.006	0.061	0.006	0.007	0.06		
Median Removal (%):	94	79	85	93	51	73		
		Notes, Ca	mments, Add	litional R	eference	c		
Non-detects were assumed to				1000000	<i>cjerence</i>	5		
Aquip removes PCBs, PAHs an	nd other toxic org	anics through	particle filtration a	nd absorptic	on to one of	the filtration	media in the	e bed. VOC and SVOC
removal is through absorption	n and biological d	legradation.						

The Aquip is a secondary defense against oil and grease and removes TPH and soluble oils through biodegredataion, absorption and bio-mechanical means.

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Manufacturer: Name of Technology: # of Installations in Washington:	Bio Clean Environmental Bio Clean Curb Inlet Basket 0 WA	Contact Name: Contact Email: Contact Phone: Contact Website:	Greg Kern <u>gkent@biocleanenvirc</u> 760-433-76 <u>www.biocleanenviror</u>	onmental.net 540
	Treatn	nent Type/Application (check all	that apply)	
Downspout	Oil/Water Separation	Filtration (media)	Ion exchange column	Stormwater
Drain Inlet Insert	Settling	Filtration (fabric)	Reverse osmosis	Groundwater
Below Ground Vault	Hydrodynamic Separation	Filtration (biofiltration)	Electrocoagulation	Wastewater
Above Ground Vault	Floatables Baffle	Filtration (chemically enhanced)	Chemical Treatment	Process water
		Estimated Costs		
	Cost (unit cost and construction cost): // Cost (\$/gallon treated - based on pe		low: 445 low: \$ 0.20	high: 1,600 high: \$ 0.40
		System Hydraulics/Design		
Design Flow Rate (gpm	):	low: 381	high: 898	
System aboveground for		low: 0	high: 0	
Required head loss (ft)	:	low: 0.5	high: 2	
Internal or External By	pass:	External - Installed in Catch Basin	- Does Not Affect Basin Hydraulio	CS
		System Performance		

Briefly describe how data were collected (field, lab, third party, grab sample, auto-composite, etc.)

The Curb Inlet Basket has been in use since the mid 90's. Several field and laboratory studies have been performed on the system. For this reason several reports are being listed below.

--Univerisity of Southern California Independent Field Testing (Turbidity in NTUs)

--Suspended Solids Retention Testing Full Scale Lab Testing

University of Southern Califorr	nia						
	Turbidity	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	42	not tested	not tested	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	12.75	not tested	not tested	not tested	not tested	not tested	not tested
Median Removal (%):	70	not tested	not tested	not tested	not tested	not tested	not tested
		Total Metals		D	issolved Met	als	Nutrients
	Cu	Pb	Zn	Cu	Pb	Zn	TP
Median Influent (mg/L):	not tested	not tested	24.3	not tested	not tested	not tested	85.8
Median Effluent (mg/L):	not tested	not tested	10.4	not tested	not tested	not tested	73.4
Median Removal (%):	not tested	not tested	79	not tested	not tested	not tested	14
Suspended Solids Retention Te	est						
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	n/a	not tested	not tested	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	n/a	not tested	not tested	not tested	not tested	not tested	not tested
Median Removal (%):	93*	not tested	not tested	not tested	not tested	not tested	not tested
		Total Metals		D	issolved Met	als	Nutrients
	Cu	Pb	Zn	Cu	Pb	Zn	ТР
Median Influent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	not tested
Median Removal (%):	not tested	not tested	not tested	not tested	not tested	not tested	not tested

Notes, Comments, Additional References

\*Mass Balance was used for the Suspended Solids Retention Test and therefore mg/L and number of samples does not apply. An OK-90 Sand gradation was used for the testing. The Bio Clean Curb Inlet Basket is available with the patented Easy Maintenance Shelf System which reduces maintenance time and slows down water velocity for added settling and pollutant removal. To see this system in action visit: http://www.biocleanenvironmental.com/product/video/?path=content/product/curb\_inlet\_baskets/Curb\_Inlet\_Basket-Product\_Video.flv&w=768&h=576

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Manufacturer:	Bio Cl	ean Environmental		Contact Name	2:	Gree	g Kent	
Name of Technology:	Bio Clea	an Downspout Filter	_	Contact Email	:		environmental.net	-
# of Installations in			_	Contact Phon	e:	760-43	33-7640	-
Washington:	17 Port of O	lympia (Upcoming 2011)	_	Contact Webs	ite:	www.biocleane	nvironmental.net	-
		Treatment	Type/Applicati	on (check all t	hat apply)			
Downspout	Oil/Water Separation		Filtration (media)			Ion exchange colum	n	Stormwater
Drain Inlet Insert	Settling		Filtration (fabric)			Reverse osmosis		Groundwater
Below Ground Vault	Hydrodynamic Separat	tion	Filtration (biofiltra	ation)	Г	Electrocoagulation		Wastewater
Above Ground Vault	Floatables Baffle		Filtration (chemic	ally enhanced)		Chemical Treatment		Process water
			Estimated	Costs				
Estimated Installation ( Estimated Annual O&N	•	onstruction cost): ted - based on peak treatm	ent flow rate):		low: low:	1,035 \$ 0.16	high: high:	
			System Hydrau	lics/Desian			-	
Design Flow Rate (gpm	):	-	low:	249	high:	1,145		
System aboveground for	•		low:		high:	1.57 (cu ft)	-	
Required head loss (ft)			low:	1	high:	2	-	
Internal or External By	bass:		Internal Bypass -	High Flow Unim	_ peded - UPC Aj	proved and Teste	- ed	
			System Perfo	ormance				
			<i>cystem : cije</i>					
Briefly describe how da	ta were collected (fie	eld, lab, third party, grab sa	ample, auto-comp	oosite, etc.)				
to verify treatment and by	pass flow rates. The fill apacity of the product. ting D-Tek Analytical	nce 2003. It has been tested and ter also meets the protocol's no The filter has also been tested and the filter has also been tested been	ninimum pollutant	removal specific			ncentration of 150	
Full Scale Laboratory Testi		- a.can	01.0	0100	<b>D</b> ( <b>D</b> )	Dia tao	00411	
Vedian Influent (mg/L)	TSS n/a	Turbidity (sil-co-sil 106) 429	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	-
Median Effluent (mg/L)		251	223.5 29.5	not tested not tested	not tested	not tested not tested	not tested not tested	-
Median Removal (%):	93*	41	87	not tested	not tested	not tested	not tested	-
incular nemoval (75).	35	11	6,	not tested	not tested	not tested	not tested	1
		Total Metals		0	Dissolved Met	als	Nutrients	1
	Cu	Pb	Zn	Cu	Pb	Zn	TP	]
Vedian Influent (mg/L)		not tested	not tested	not tested	not tested	not tested	not tested	1
Median Effluent (mg/L)		not tested	not tested	not tested	not tested	not tested	not tested	4
Median Removal (%):	not tested	not tested	not tested	not tested	not tested	not tested	not tested	1
(-TEX FABRIC TESTING - F	or Metals Removal							4
-TEX FABRIC TESTING - I	TSS	Turbidity (Sil-Co-Sil 106)	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	1
/ledian Influent (mg/L)		not tested	not tested	not tested	not tested	not tested	not tested	1
Vedian Effluent (mg/L)		not tested	not tested	not tested	not tested	not tested	not tested	1
Median Removal (%):	not tested	not tested	not tested	not tested	not tested	not tested	not tested	1
			•					1
		Total Metals			Dissolved Met		Nutrients	4
	Cu	Pb	Zn	Cu	Pb	Zn	TP	1
Median Influent (mg/L)		not kwonw	not kwonw	not tested	not tested	not tested	not tested	4
Median Effluent (mg/L)		not kwonw	not kwonw	not tested	not tested	not tested	not tested	4
Median Removal (%):	76	96	69	not tested	not tested	not tested	not tested	

Notes, Comments, Additional References

\*Mass Balance was used for the TSS Tesing and therefore mg/L and number of samples does not apply. Turbidity in NTUs. This filter is made of all stainless steel and is istalled inline with new or existing downspouts. The Bio Clean Downspout Filter is also available with added for ion exchange embedded filter fabric for enhanced removal of metals. The filter is adaptable to downspout sizes 4" to 12".

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Manufacturer:	Bio Clean Environmental	Contact Name:	Greg Kent	
Name of Technology:	Bio Clean Flume Filter	Contact Email:	gkent@biocleanenvironmental.	.net
# of Installations in		Contact Phone:	760-433-7640	
Washington:	0 WA	Contact Website:	www.biocleanenvironmental.ne	<u></u>
	Treatment T	ype/Application (check all that	apply)	
Downspout	Oil/Water Separation	Filtration (media)	Ion exchange column	Stormwater
Drain Inlet Insert	Settling	Filtration (fabric)	Reverse osmosis	Groundwater
Below Ground Vault	✓ Hydrodynamic Separation	Filtration (biofiltration)	Electrocoagulation	Wastewater
Above Ground Vault	Floatables Baffle	Filtration (chemically enhanced)	Chemical Treatment	Process water
		Estimated Costs		
	Cost (unit cost and construction M Cost (\$/gallon treated - based	l on peak treatment flow rate		1,302 \$ 0.74
Destan Eleve Data (ann		ystem Hydraulics/Design		
Design Flow Rate (gpm	•		high: 583	
System aboveground for Required head loss (ft)			high: 6 high: 0.5	
Negunea neua 1000 ()			iiigiii 0.5	
Internal or External By	pass: Internal B	ypass Up to Specific Flow - Configured	to Allow for High Flow External	Bypass
		System Performance		
Briefly describe how da	ata were collected (field, lab, th	ird party, grab sample, auto-comp	oosite, etc.)	
The Bio Clean Flume Filte	r has been tested indepedently in a	a full scale laboratory setting A series	of 5 composite influent and effl	luent samples were
		utilized a series of three BioSorb Hydro	•	
Full Scale Laboratory Te	1	-		

Full Scale Laboratory Testing							
	TSS						
	(Sil-Co-Sil 106)	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	73	223	360	NA	NA	NA	NA
Median Effluent (mg/L):	51.6	29.5	62	NA	NA	NA	NA
Median Removal (%):	29	87	83	NA	NA	NA	NA
							-
	Тс	otal Metals		Dissolved Metals			Nutrients
	Cu	Pb	Zn	Cu	Pb	Zn	ТР
Median Influent (mg/L):	NA	NA	NA	NA	NA	NA	NA
Median Effluent (mg/L):	NA	NA	NA	NA	NA	NA	NA
Median Removal (%):	NA	17	NA	NA	NA	NA	NA

#### Notes, Comments, Additional References

The Bio Clean Flume Filter comes standard with BioSorb Hydrocarbon booms. The filter is designed to utilize varoius media based upon pollutants of concern. The Flume Filter is designed to be used in unique conditions in which sheet flow needs to be treated and no fall is available for other types of technologies.

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Manufacturer: Name of Technology:		n Environmental ate Inlet Skimmer Box	-	Contact Name Contact Email			; Kent environmental.net	
# of Installations in Washington:	0.1	VA, 123 OR		Contact Phone Contact Webs			33-7640 nvironmental.net	
washington.			nt Type/Applic				innental.net	
<ul> <li>Downspout</li> <li>Drain Inlet Insert</li> <li>Below Ground Vault</li> <li>Above Ground Vault</li> </ul>	<ul> <li>Oil/Water Separation</li> <li>Settling</li> <li>Hydrodynamic Separ</li> <li>Floatables Baffle</li> </ul>		<ul> <li>Filtration (media)</li> <li>Filtration (fabric)</li> <li>Filtration (biofiltra</li> <li>Filtration (chemic</li> </ul>	ation)		Ion exchange columr Reverse osmosis	1	Stormwater Groundwater Wastewater Process water
			Estimat	ed Costs				
Estimated Installation C Estimated Annual O&M	•				low: low:	635 \$ 0.15	high: high:	1,800 \$ 0.40
Design Flow Rate (gpm) System aboveground fo Required head loss (ft):	otprint (sq ft):		System Hydr Iow: Iow: Iow:	aulics/Design 224 0 0.5	n high: high: high:	8,980 0 2		
Internal or External Byp	bass:			Internal -	High Flow Rat	e		
			System Pe	erformance				
Briefly describe how da	ta were collected (f	ield lab third party of	rah samala auto	-composite of	tc )			
The Grate Inlet Skimmer B listed below. Suspended Solids Retent Improvement District Inde UC Irvine Independent T Whitman's Pond Creech Engineering	ion Testing Full Scale ependent Field Testing	Lab Testing	eral field and labora	atory studies hav	ve been perfori	,	ota - Independent F	1 0
Longo Toyota - Independe	ent Field Testing							
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L) Median Effluent (mg/L)		not tested not tested	189 10.43	not tested not tested	not tested	not tested not tested	not tested not tested	
Median Removal (%):	not tested	not tested	95	not tested	not tested	not tested	not tested	
		T-+-104-+-1-	·			- la	Nutrianta	
	Cu	Total Metals Pb	Zn	Cu	Dissolved Met Pb	als Zn	Nutrients TP	
Median Influent (mg/L)		1.5	13.7	not tested	not tested	not tested	not tested	
Median Effluent (mg/L)		0.2	0.73	not tested	not tested	not tested	not tested	
Median Removal (%):	95	87	95	not tested	not tested	not tested	not tested	
Suspended Solids Retention			-					
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L) Median Effluent (mg/L)		not tested not tested	not tested not tested	not tested not tested	not tested	not tested not tested	not tested not tested	
Median Removal (%):	86*	not tested	not tested	not tested	not tested	not tested	not tested	
	Cu	Total Metals Pb	Zn	Cu	Dissolved Met Pb	zais Zn	Nutrients TP	
Median Influent (mg/L)		not tested	not tested	not tested	not tested	not tested	not tested	
Median Effluent (mg/L)		not tested	not tested	not tested	not tested	not tested	not tested	
Median Removal (%):	not tested	not tested	not tested	not tested	not tested	not tested	not tested	
Reedy Creek Improvemen	t District							
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L)		not tested	not known	not tested	not tested	not tested	not tested	
Median Effluent (mg/L) Median Removal (%):	not known 74	not tested not tested	not known 54	not tested not tested	not tested not tested	not tested not tested	not tested not tested	
incoluit hemoval (70).	74	not testeu	4°C	not testeu	not tested	not testeu	not testeu	
		Total Metals		C	Dissolved Met	als	Nutrients	
Madian Influence (	Cu	Pb	Zn	Cu	Pb	Zn	ТР	
Median Influent (mg/L) Median Effluent (mg/L)		not tested not tested	not tested	not tested	not tested	not tested	not known	
Median Removal (%):	i not tested not tested	not tested	not tested not tested	not tested not tested	not tested not tested	not tested not tested	not known 57	

UC Irvine							
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	not known	not tested	not known	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	not known	not tested	not known	not tested	not tested	not tested	not tested
Median Removal (%):	53	not tested	90	not tested	not tested	not tested	not tested
		Total Metals		0	issolved Met	als	Nutrients
	Cu	Pb	Zn	Cu	Pb	Zn	TP
Vledian Influent (mg/L):	not known	not known	not known	not tested	not tested	not tested	not tested
Vledian Effluent (mg/L):	not known	not known	not known	not tested	not tested	not tested	not tested
Vledian Removal (%):	7	98	11	not tested	not tested	not tested	not tested
							į
Whitman's Pond			010	21/22		<u> </u>	
	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Viedian Influent (mg/L):	978	not tested	not tested	not tested	not tested	not tested	not tested
Vledian Effluent (mg/L):	329	not tested	not tested	not tested	not tested	not tested	not tested
Vledian Removal (%):	66	not tested	not tested	not tested	not tested	not tested	not tested
		Total Metals			oissolved Met	ala	Nutrionto
	<u>Cu</u>		7				Nutrients
	Cu	Pb	Zn	Cu	Pb	Zn	TP
Median Influent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	18.6
Median Effluent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	0.452
Vledian Removal (%):	not tested	not tested	not tested	not tested	not tested	not tested	98
Crooch Engineering							
Creech Engineering	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	not known	not tested	not tested	not tested	not tested	not tested	not tested
Vedian Effluent (mg/L):	not known	not tested	not tested	not tested	not tested	not tested	not tested
Vedian Removal (%):	73	not tested	not tested	not tested	not tested	not tested	not tested
		Total Metals		0	issolved Met	als	Nutrients
	Cu	Pb	Zn	Cu	Pb	Zn	TP
Viedian Influent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	not known
Viedian Effluent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	not known
Vedian Removal (%):	not tested	not tested	not tested	not tested	not tested	not tested	79

Notes, Comments, Additional References

\*Mass Balance was used for the Suspended Solids Retention Test and therefore mg/L and number of samples does not apply. An OK-90 Sand gradation was used for the testing. The Bio Clean Grate Inlet Skimmer Basket is backed by a 5 year unlimited warranty. It's the only catch basin filter to utilize multiple levels of screens to maxmize performance and treatment flow rate. The product is manufactured from marine grade fiberglass and stainless steel. It contains no cheap net, plastics or fabrics which can rip, tare and break under field conditions. For more information visit: http://www.biocleanenvironmental.com/product/grate\_inlet\_skimmer\_box

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Manufacturer: Name of Technology:	Bio Clean Environmental Bio Clean Trench Drain Filter	Contact Name: Contact Email:	Greg Kent	
# of Installations in		Contact Phone:	760-433-7640	
Washington:	0 WA	Contact Website:	www.biocleanenvironmental.net	_
	Treatme	nt Type/Application (check all that	t apply)	
Downspout	Oil/Water Separation	Filtration (media)	Ion exchange column	Stormwater
Drain Inlet Insert	Settling	Filtration (fabric)	Reverse osmosis	Groundwater
Below Ground Vault	Hydrodynamic Separation	Filtration (biofiltration)	Electrocoagulation	Wastewater
Above Ground Vault	Floatables Baffle	Filtration (chemically enhanced)	Chemical Treatment	Process water
		Estimated Costs		
	Cost (unit cost and construction cost): // Cost (\$/gallon treated - based on peak t	reatment flow rate):	low:         660         hig           low:         \$         0.23         hig	<b>sh:</b> 1,302 <b>sh:</b> \$ 0.74
		System Hydraulics/Design		
Design Flow Rate (gpm	-	low: 28	high: 86	
System aboveground f Required head loss (ft)		low: 0	high: 0 high: 12	
Internal or External By		ternal Bypass Up to Specific Flow - Configu	·	s
		System Performance		
Briefly describe how d	ata were collected (field, lab, third party,	grab sample, auto-composite, etc.)		
No testing has been done	on the trench drain filter.			

Full Scale Laboratory Testing							
	TSS (Sil-Co-Sil 106)	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	not tested
Median Removal (%):	not tested	not tested	not tested	not tested	not tested	not tested	not tested
	Total Metals						
		Total Metals		D	issolved Met	tals	Nutrients
	Cu	Total Metals Pb	Zn	Cu	issolved Met Pb	tals Zn	Nutrients TP
Median Influent (mg/L):	Cu not tested		<b>Zn</b> not tested	-			
Median Influent (mg/L): Median Effluent (mg/L):		Pb		Cu	Pb	Zn	TP

#### Notes, Comments, Additional References

The Bio Clean Trench Drain Filter comes standard with BioSorb Hydrocarbon booms or can use BioMediaGREEN. The filter is designed to utilize varoius media based upon pollutants of concern. The Trench Drain Filter can be used in various size trench drains.

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#### Manufacturer Technology Report

Manufacturer: Name of Technology: # of Installations in Washington:	Bio Clean Environmental Bio Clean Water Polisher - Up Flow Filter 0	Contact Name: Contact Email: Contact Phone: Contact Website:	Greg Kent gkent@biocleanenvironmental.net 760-433-7640 www.biocleanenvironmental.net	-
	Treatment	Type/Application (check all that a	ipply)	
Downspout	Oil/Water Separation	Filtration (media)	Ion exchange column	Stormwater
Drain Inlet Insert	Settling	Filtration (fabric)	Reverse osmosis	Groundwater
Below Ground Vault	Hydrodynamic Separation	Filtration (biofiltration)	Electrocoagulation	Wastewater
Above Ground Vault	Floatables Baffle	Filtration (chemically enhanced)	Chemical Treatment	Process water
		Estimated Costs		
	Cost (unit cost and construction cost): 1 Cost (\$/gallon treated - based on peak treatn	nent flow rate):	low:         25,000         high:           low:         \$         5.24         high:	
		System Hydraulics/Design		
Design Flow Rate (gpm	):	low: 191	high: 528	
System aboveground for		low: 0	high:0	
Required head loss (ft)	:	low: 1	high: 2	
Internal or External By	bass:	Internal Bypass - High F	low Unimpeded	

System Performance

#### Briefly describe how data were collected (field, lab, third party, grab sample, auto-composite, etc.)

The Bio Clean Water Polisher is a unique upflow media filter designed as a stand alone treatment unit or incorporated with the Nutrient Separating Baffle Box to form a complete treatment train. The Bio Clean Water Polisher utilizes the revolutionary filter media, BioMediaGREEN. The BioMediaGREEN has been independently tested in full scale labaratory testing. Media surface loading rate during the testing averaged 2-5 gpm with minimal head. A series of 8 composite influent and effluent grab samples we collected over a perioud of two days. --BioMediaGREEN Performance Testing by Waves Environmental - Independent Full Scale Lab Testing

Full Scale Laboratory Testing							
	TSS (Sil-Co-Sil 106)	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	84.6	1.4	69.8	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	12.4	0	6.5	not tested	not tested	not tested	not tested
Median Removal (%):	85	>99	91	not tested	not tested	not tested	not tested
		Total Metals		D	issolved Met	als	Nutrients
	Cu	Total Metals Pb	Zn	D Cu	issolved Met Pb	als Zn	Nutrients TP
Median Influent (mg/L):	Cu not tested		Zn not tested				
Median Influent (mg/L): Median Effluent (mg/L):		Pb		Cu	Pb	Zn	TP

#### Notes, Comments, Additional References

The Bio Clean Water Polisher utilizes the revolutionary filter media, BioMediaGREEN. This material is made of billions of small fibers formed into solid blocks. The media composition consists of various oxides to allow for ion exchange and precipitation of dissolved pollutants. The physical structure of the media provides high peformance for the entrapment of particulate pollutants. The media has 80% void space which allows for double the hydraulic retention time when compared to granular media which leads to better overall performance. Another result of the void space is a high hydraulic conductivity. The media surface area loading rate for the media is approximately 7 gpm/sq ft surface area at a head pressure of 18".

Washington:         Downspout       Oil         Drain Inlet Insert       Sei         Below Ground Vault       Hy         Above Ground Vault       Flore	Bio-Microbics, Inc. BioSTORM 0 Treatment 7 VWater Separartion ettling vdrodynamic Separation patables Baffle	Type/Applicati  Filtration (medi  Filtration (fabrid  Filtration (biofil  Filtration (biofil  Filtration (biofil)  Filtration (biofil	ia) c)	one: ebsi <u>teww</u> .	800-75: biomicrobic: pply) Ion excha Reverse of	Ies@biomin 3-3278 5.com Inge column osmosis	✓ Stormwater ✓ Groundwater
□       Drain Inlet Insert       ✓       Set         ☑       Below Ground Vault       □       Hy         □       Above Ground Vault       □       Flor	<b>Treatment</b> Water Separartion ettling ydrodynamic Separation	Type/Applicati  Filtration (medi  Filtration (fabrid  Filtration (biofil  Filtration (biofil  Filtration (biofil)  Filtration (biofil	Contact We ia)	ebsi <u>tew</u> .	biomicrobic: pply) Ion excha	s.com	
□ Downspout       ✓ Oil,         □ Drain Inlet Insert       ✓ Sei         ✓ Below Ground Vault       □ Hy         □ Above Ground Vault       □ Flore	<b>Treatment</b> Water Separartion ettling ydrodynamic Separation	Type/Applicati  Filtration (medi  Filtration (fabrid  Filtration (biofil  Filtration (biofil  Filtration (biofil)  Filtration (biofil	<b>ON (check d</b> ia) c)		pply)	inge column osmosis	
□       Drain Inlet Insert       ✓       Set         ☑       Below Ground Vault       □       Hy         □       Above Ground Vault       □       Flor	l/Water Separartion ettling ydrodynamic Separation	Filtration (medi Filtration (fabrie Filtration (biofil Filtration (biofil	ia) c)	all that a	Ion excha	osmosis	
□       Drain Inlet Insert       ✓       Set         ☑       Below Ground Vault       □       Hy         □       Above Ground Vault       □       Flor	l/Water Separartion ettling ydrodynamic Separation	Filtration (medi Filtration (fabrie Filtration (biofil Filtration (biofil	ia) c)	·	Ion excha	osmosis	
Below Ground Vault     Hy       Above Ground Vault     Flore	drodynamic Separation	Filtration (biofil	,				Groundwater
Above Ground Vault Flo		Filtration (biofil	,				
	batables Baffle		,			agulation	Wastewater
			nically enhanced	)	Chemical	Treatment	Process water
		Estimated					
Estimated Installation Cost:	lov	<b>v:</b> 500	high:	2000			
Estimated Annual O&M Cost:	lov		high:	4000	•		
		ystem Hydrau		<u> </u>			
Design Flow Rate (gpm):	lov		high:	4800			
System footprint (sq ft):	lov		high:	162			
Required head loss (ft):	lov	<b>v:</b> 0.5	high:	0.17			
Internal or External Bypass:		external					
Breifly describe how data were TSS results are from grab samples do design flow.					-	-	l below are at 100%
		0110				25.411.	
Madian Influent (mg/1);	TSS TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L): Median Effluent (mg/L):	227 7.9				├		
	95.3		┟────┼				
1			LL		LL	ļ	
1							
1	Total Me			olved Me			
Median Removal (%):		etals Zn	Disso Cu	olved Me Pb	tals Zn		
Median Removal (%):	Total Me						
Median Removal (%):	Total Me						
Median Removal (%):	Total Me						
Median Removal (%): Median Influent (mg/L): Median Effluent (mg/L): Median Removal (%):	Total Mo Cu Pb		Cu	Pb	Zn		

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darcys@contech-cpi.cc         503-258-3105         contech-cpi.com         hat apply)         □ Ion exchange column         □ Reverse osmosis         □ Electrocoagulation         □ Chemical Treatment         □ Process water         ○ W:         \$10K         high:         \$2.5M         high:         \$0.00001
contech-cpi.com         hat apply)         Ion exchange column         Reverse osmosis         Groundwater         Electrocoagulation         Chemical Treatment         Process water         Stormwater         Stormwater         Stormwater         Bilder         Stormwater         Bilder         Stormwater         Stormwater         Stormwater         Bilder         Stormwater         Stormwa
hat apply)         Ion exchange column       Stormwater         Reverse osmosis       Groundwater         Electrocoagulation       Wastewater         Chemical Treatment       Process water         Ow:       \$10K
Ion exchange column       Stormwater         Reverse osmosis       Groundwater         Electrocoagulation       Wastewater         Chemical Treatment       Process water         W:       \$10K
Reverse osmosis  Electrocoagulation  Chemical Treatment  Process water  Sw: \$10K  high: \$2.5M
Electrocoagulation Wastewater Chemical Treatment Process water
Chemical Treatment Process water
рw:\$10Кhigh:\$2.5М
\$0.00001         high:         \$0.00001
<b>gh:</b> 44900
gh: NA
gh:
<b>o-composite, etc.)</b> Id, Peer-Reviewed, Composite.
ld, Peer-Reviewed, Composite.
ld, Peer-Reviewed, Composite.
ld, Peer-Reviewed, Composite.           s         Dioxins         CPAHs         SSC<50 um           35         35
Id, Peer-Reviewed, Composite.
Id, Peer-Reviewed, Composite.  S Dioxins CPAHs 35 9
Id, Peer-Reviewed, Composite.
gh: NA

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Manufacturer:	Stormv	vateRx LLC		Contact N	ame:	Ayn G	eneres	
Name of Technology:	Clara Gravity Sto	ormwater Separator	-	Contact Er	mail:	ayng@storn	nwaterx.com	
# of Installations in			-	<b>Contact Pl</b>	hone:	800.68	0.3543	
Washington:		2	_	Contact W	/ebsite:	www.storm	waterx.com	
	Tre	atment T	/pe/Applicati	on (check	all that a	vlaa		
Downspout	✓ Oil/Water Sep	-	Filtration (med			_	ange column	Stormwater
Drain Inlet Insert	Settling		Filtration (fabri			Reverse	0	Groundwater
Below Ground Vault	✓ Hydrodynami	c Separation	Filtration (biofil				pagulation	
	✓ Floatables Ba						0	Wastewater
Above Ground Vault	Filoatables Ba	IIIe	Filtration (chen	nically enhance	ed)		l Treatment	Process water
			Estimated	Costs				
Estimated Installation C	ost (unit cost a	and construe	ction cost):		low:	20000	high:	52000
Estimated Annual O&M	Cost (\$/gallor	treated):	·		low:	0.0005	high:	0.001
			atom Iludvar	line /Denie			-	
Design Flow Rate (gpm)		sy	stem Hydrau low:			1120		
System aboveground for			low:	5	high: high:			
Required head loss (ft):	otprint (sq rt).		low:	0.5	high:			
Internal or External Bypa	266.	In	ternal	0.5	ingii.	1.5		
	ass.		lema					
Briefly describe how dat These samples were collected from a third party certified ar	d as grab samples	s by Stormwate	eRx, consulting eng	ineers, and f	acility treatr	nent system	operators. A	ll analytical data is
	тсс	TDU		SVOC	DCRe	Diavina		
Median Influent (mg/L):	<b>TSS</b> 284.5	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Effluent (mg/L):								
Median Removal (%):	47.0	YES	YES					
						!!		
		Total Met	als	Diss	olved Me	tals		
	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L):	0.516	0.088	2.82					
Median Effluent (mg/L):	0.078	0.072	1.21					
Median Removal (%):	29.5	25.8	32.0					
		-	mments, Add					
The Clara uses four pre-engin	eered chambers	with an intern	al high-flow bypass	s to trap pollu	utants such a	as heavy soli	ds and oil and	d grease.

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Manufacturer: Name of Technology:	Coanda, Inc. Coanda Effec		Co	ntact Na ntact Em	ail:	Steve Esmond sesmond@coanda.com	
# of Installations in Washington:	A handful of private dow and area drains.	nspouts		ntact Pho ntact We		(714) 272-1997 http://www.coanda.com/	
	Treatı	nent Ty	pe/Applicatio	n (check	all that	apply)	
✓ Downspout	Oil/Water Separartion	✓	Filtration (media)			Ion exchange column	Stormwater
✓ Drain Inlet Insert	Settling		Filtration (fabric)			Reverse osmosis	Groundwater
✓ Below Ground Vault	Hydrodynamic Separat	ion	- Filtration (biofiltration	on)		Electrocoagulation	✓ Wastewater
✓ Above Ground Vault	Floatables Baffle		Filtration (chemicall	y enhanced)		Chemical Treatment	✓ Process water
			Estimated (	Costs			
Estimated Installation Co	it:	low:	\$2,000	high:	\$3,500		
Estimated Annual O&M C	ost:	low:	\$-0-	high:	\$-0-	No installation has required	maintenance to date
		Sys	stem Hydrauli	cs/Desi	gn		
Design Flow Rate (gpm):		low:	50	high:	360,000	_	
System footprint (sq ft):		low:	2	high:	2,000	_	
Required head loss (ft):		low:	1.5	high:	3	_	
Internal or External Bypa	Option	al internal	bypass is provided.				

#### System Performance

#### Breifly describe how data were colected (field, lab, third party, grab sample, auto-composite, etc.)

USC (University of Southern California) obtained trash from Los Angeles Sanitation Services and United Stormwater. The Coanda BMP was filled with trash to evaluate the hydraulic performance. The test was conducted by running water from water trucks onto the street. The water then entered the BMP at approximately 635 gallons per minute (gpm). The BMP was evaluated for pollutant removal potential by collecting water quality samples before it reached the BMP and then from under the BMP at different time intervals. The samples were evaluated by USC using chemical analysis to determine the water quality.

	TS	COD	TOC	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	1500	1262	1137				
Median Effluent (mg/L):	1376	1081	996				
Median Removal (%):	8%	14%	12%				

	Total Metals			Dissolved Metals		
	Cu	Pb	Zn	Cu	Pb	Zn
Median Influent (mg/L):			48			
Median Effluent (mg/L):			15			
Median Removal (%):			69%			

#### Notes, Comments, Additional References

A summary of the USC report can be found at: http://www.coanda.com/products/documents/usc\_research\_project.pdf.

Other case studies have been performed, demonstrating removal of trash, nutrients, metals, pesticides, and bacteria: http://www.coanda.com/products/documents/Rowlett\_Case\_Study\_I.pdf

Herrera 🕹	Man	ufactur	er Teo	chnolog	ıy Rep	ort						
Manufacturer:	Hydro Internat	ional		Contact Na	me.	Fred Kraekel						
Name of Technology:		Downstream Defender <sup>®</sup> Contact Email:					fkraekel@hil-tech.com					
Technology Category:	Below Ground			Contact Ph		207-321-3733						
Technology Process:	Filter			Contact W		www.hydro-inter						
# of Installations in Wa	shington:											
	Trea	tment Tvr	ne/∆nn	lication	check al	l that apply)						
Downspout	✓ Oil/Water Separation		Filtration		check un	I Ion exchang	e column	Sto	ormwater			
Drain Inlet Insert	Settling					_						
	Hydrodynamic	Senaration 🗆	Filtration			Reverse osn			oundwater			
Below Ground Vault			Filtration	(biofiltration)		Electrocoage			stewater			
Above Ground Vault	✓ Floatables Baffl	e 🗌	Filtration	(chemically en	hanced)	Chemical Tr	eatment	Pro Pro	ocess water			
			Estim	nated Cos	ts							
Estimated Installation (	Cost:	low:		high:								
Estimated Annual O&N	1 Cost:	low:		high:		_						
System Hydraulics												
Design Flow Rate (gpm): low: high:												
Required head loss (ft):						_						
Internal or External By												
			vstem	Performa	ince							
			ystem		inec.							
Breifly describe how da	ta were colecte						te, etc.)					
		Contac	t Hydro I	nternationa	l for detai	ils.						
Parameter:	TSS	тр р	is. Cu	Dis. Zn	Dis. Cd	Dis. Pb	трн	cPAHs	PCBs			
# of sample:		_										
Median Influent (mg/L):												
Median Effluent (mg/L):												
% Removal:												
	Λ	lotes, Com	ments	, Addition	nal Refe	erences						
The Downstream Defen	ide <mark>r®</mark> is an advar	nced Hydrod	ynamic	Vortex Sep	arator th	nat is specifica	lly designed	l to provid	e high			
removal efficiencies of	urban runoff pol	lutants over	a wide	range of flo	ow rates.	. It is commo	nly used in s	tormwate	r			

removal efficiencies of urban runoff pollutants over a wide range of flow rates. It is commonly used in stormwater applications as either pretreatment or as a stand-alone treatment system. The unique flow-modifying internal components distinguish the Downstream Defender from simple swirl-type devices and conventional oil/grit separators by minimizing turbulence and head losses, enhancing separation, and preventing washout of previously stored pollutants. The high removal efficiencies and inherent low head losses of the Downstream Defender allow for a small footprint, making it a compact and economical solution for non-point source pollution. Contact Hydro International at 1-800-848-2706 or visit the website www. hydro-international.biz for more information.



Manufacturer:	Royal Environmen	tal Systems		Contact Name: Jim M				
Name of Technology:	ecoLine	Α	_	Contact Er	nail:	jim@wate	rtectonics.com	_
# of Installations in				Contact Pl		866-	402-2298	_
Washington:	6		_	Contact W	ebsite:	www.wate	ertectonics.com	_
	ī	Treatmen	t Type/Applic	ation (che	ck all tha	t apply)		
Downspout	<ul> <li>Oil/Water Separation</li> </ul>		Filtration (med			Ion exchange	e column	Stormwater
Drain Inlet Insert	Settling		Filtration (fabri	c)		Reverse osmo	osis	Groundwater
Below Ground Vault	Hydrodynamic Sepa	ration	Filtration (biofil	Itration)		Electrocoagu	lation	✓ Wastewater
Above Ground Vault	Floatables Baffle		Filtration (chen	nically enhance	d)	Chemical Tre	atment	Process water
			Estimat	ed Costs				
Estimated Installation Cost (u	nit cost and constructiv	on cost):			low	<b>r:</b> \$ 6,700	high	<b>i:</b> \$ 44.250
Estimated Annual O&M Cost (					low		high	
			Custom Iluda	ling /Da				
Desire Flow Data (mark)			System Hydro	-		626		
Design Flow Rate (gpm): System aboveground footprin	+ (ca f+).		low:	25 12	high			
Required head loss (ft):	(sq it):		low: low:		<b>high</b> /ith clean c			
Internal or External Bypass:	S	ite specific d	esign required	0.00 W		ourescer		
				-				
			System Pe	rformanc	e			
Briefly describe how data wer	e collected (field, lab,	third party	. grab sample, au	uto-compo	site. etc.)			
CEN EN 858-1 Test Method for Class			8		,,			
Light liquid: Fuel oil, per ISO 8217, de	-	density of 0.8	5 g/cm3* (Solubility	of light liquid	d nil, unsapo	nifiable)		
Water: Potable or purified surface wa								
Water turn over: Minimum four volu Liquid flux: 25-40 m <sup>3</sup> /m <sup>2</sup> -h (10-15 gpi								
Max. residual light liquid: 5 mg/L (Hy		hy prescribed	infrared spectrosco	ny procedure	<i>.</i> )			
		by presenace	initial cu spectrosed	procedure	-)			
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	7
Median Influent (mg/L):	(b)	(b)	(b)	(b)	(b)	(b)	(b)	
Median Effluent (mg/L):	(b)	(b)	(b)	(b)	(b)	(b)	(b)	_
Median Removal (%):	(b)	(b)	(b)	(b)	(b)	(b)	(b)	
	Т	otal Metal		Dis	solved Me	tals		
	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L):	(b)	(b)	(b)	(b)	(b)	(b)		
Median Effluent (mg/L):	(b)	(b)	(b)	(b)	(b)	(b)		
Median Removal (%):	(b)	(b)	(b)	(b)	(b)	(b)		
		Notes,	Comments, A	dditional	Referen	ces		
(a) Gravity flow system has no movin		ent. Oil coales	cing media pack can	be removed,	rinsed, and	replaced. In the	event of damage t	o the coalescing media, new
coalescing panels can be purchased f	or a low cost.							
(b) Report Form's System performan	ice data fields are not applic	able. Produc	t removes free-phas	e fluids such	as floating o	il and other petr	oleum hydrocarbo	on products (LNAPL - Light Non-
Aqueous Phase Liquids).			P		0	1		

Manufacturer T	echnology Report
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Manufacturer: Name of Technology: # of Installations in Washington:	Royal Envir	ronmental Systems ecoLine B 7	_ 0	Contact Name: Contact Email: Contact Phone: Contact Website:		jim@watert 866-40	nersbaugh ectonics.com 02-2298 tectonics.com				
		Trea	tment Type/Ap	plication (check all that o	apply)						
Downspout	Oil/Water Separation		Filtration (media)	)		Ion exchange column	ı	Stormwater			
Drain Inlet Insert	Settling		Filtration (fabric)	1		Reverse osmosis		Groundwater			
Below Ground Vault	Hydrodynamic Separatio	n	Filtration (biofiltr	ation)		Electrocoagulation		✓ Wastewater			
Above Ground Vault	Floatables Baffle		Filtration (chemi	cally enhanced)		Chemical Treatment		Process water			
	Estimated Costs										
Estimated Installation Cost (unit cost and construction cost):       low: \$ 8,200       high: \$ 8         Estimated Annual O&M Cost (\$/gallon treated):       low: (a)       high: (a)											
System Hydraulics/Design											
Design Flow Rate (gpm	):		low:	50	high:	1110					
System aboveground for	high:	N/A									
Required head loss (ft)			low:	6.00" with clean coalescer	high:	N/A					
Internal or External By	pass:	Site specific des	sign required								
			System	n Performance							
Briefly describe how da CEN EN 858-1 Test Method Light liquid: Fuel oil, per ISO Water: Potable or purified s Water turn over: Minimum Liquid flux: 25-40 m <sup>3</sup> /m <sup>2</sup> -h (	for Class I Coalescing Sepa 8217, designation ISO-F-D urface water four volumes of test units	arator		<b>-composite, etc.)</b> f light liquid nil, unsaponifiable)							
Max. residual light liquid: 5		it analysis by prescribed	d infrared spectroscop	y procedure)							
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	[			
Median Influent (mg/L		(b)	(b)	(b)	(b)	(b)	(b)				
Median Effluent (mg/L		(b)	(b)	(b)	(b)	(b)	(b)				
Median Removal (%):	(b)	(b)	(b)	(b)	(b)	(b)	(b)				
	[	Total Metals	;	Dissolv	ed Metals						
	Cu	Pb	Zn	Cu	Pb	Zn					
Median Influent (mg/L	<b>):</b> (b)	(b)	(b)	(b)	(b)	(b)					
Median Effluent (mg/L	): (b)	(b)	(b)	(b)	(b)	(b)					
Median Removal (%):	(b)	(b)	(b)	(b)	(b)	(b)					

Notes, Comments, Additional References
(a) Gravity flow system has no moving parts or power requirement. Oil coalescing media pack can be removed, rinsed, and replaced. In the event of damage to the coalescing media, new coalescing panels can be purchased for a low cost.

(b) Report Form's System performance data fields are not applicable. Product removes free-phase fluids such as floating oil and other petroleum hydrocarbon products (LNAPL - Light Non-Aqueous Phase Liquids).

HERRERA	
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Manufacturer:	EcoSense Interna	ational Inc.	Contact N	ame:	Randy Burc	len	_	
Name of Technology:	EcoSense Stormwate	er Filtration systems, Ca	tte Contact Er	nail:	randy.burden@	ecosenseint.c	<u>om</u>	
Technology Category:			Contact Pl	none:	321-449-03	324 / 321-5	5	
Technology Process:	Oil/ Grease / sediment	/ debris removal	_Contact W	ebsite:	www.ecose	enseint.co	<u>m</u>	
# of Installations in Wa	shington:	0	_					
	Treatmo	ent Type/Appli	cation (ch	eck all tha	ıt apply)			
J Downspout	✓ Oil/Water Separa	rtion 🔽 Filtration	n (media)		Ion excha	ange column	✓ Storn	nwater
✓ Drain Inlet Insert	Settling	✓ Filtration	n (fabric)		Reverse	osmosis	Groui	ndwater
Below Ground Vault	Hydrodynamic Se	eparation Filtration	n (biofiltration)		Electroco	agulation	√ Wast	ewater
✓ Above Ground Vault	✓ Floatables Baffle	Filtratio	n (chemically enl	nanced)	Chemical	Treatment	 ✓ Proce	ess water
		Estima	ted Costs					
Estimated Installation (	Cost:	<b>low:</b> \$400.00	high:	\$2,000	_			
Estimated Annual O&N	1 Cost:	low: \$100.00	high:	\$500.00	-			
		System	Hydraulics	5				
Design Flow Rate (gpm)	):	low: 25	high:	1662*	_			
Required head loss (ft):		Varies*	_		-			
Internal or External Byp	bass: I	nternal, Hooded	_					
		System P	erformand	ce				
		-	-					
Breifly describe how da								
Third party Lab and simula			-					
Polypropylene only. One polyester pads. Results w			isters loaded	with surfa	ctant modifi	ed zeolite	and impreg	gnated
polyestel paus. Results w	in be included with							
Parameter:	TSS	TP Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	ТРН	cPAHs	PCBs
# of sample:			2.0. 2		2.01.1.0			
Median Influent (mg/L):								
Median Effluent (mg/L):								
% Removal:								
	Note	es, Comments, A	Additional	Referen	nces			
EcoSense offers two medi			-	-	-			
canisters for low flows and			-			-	-	-
space available. Hooded of								
(and contaminant association							-	-
designed to remove orgar or filters or both may be in	nic debris and trash	. These systems are	e modular so	that deper	nding on cate	ch basin si:	zes multiple	e baskets
TOT THEFTS OF NOTE MAY BE H					0			
or mers or both may be n		·		·	U			
or mers or both may be h				·	0			

<b>HERRERA</b>	M	lanufact	turer Techi	nology	Repor	t			
Manufacturer:	Royal Envi	ronmental Sy	/stems	Contact N	lame:	Jim Mothe	thersbaugh		
Name of Technology:	ecoStorm	& ecoStorm I	Plus	Contact Email: jir		jim@wate	rtectonics.	com	
# of Installations in				Contact P		866-402-2			
Washington:	9	Contact Website: <u>www.wa</u>		www.wate	ertectonics	.com			
			tment Type/A	Applicatio	on (chec	k all that a	pply)		
Downspout	✓ Oil/Water Se	paration	✓ Filtration (med	dia)		lon exch	ange column	Stormwater	
Drain Inlet Insert	✓ Settling		Filtration (fabr	ric)		Reverse	osmosis	Groundwater	
Below Ground Vault	✓ Hydrodynam	ic Separation	Filtration (biof	iltration)		Electroc	pagulation	✓ Wastewater	
Above Ground Vault	✓ Floatables B	affle	Filtration (cher	mically enhanc	ed)	Chemica	l Treatment	✓ Process water	
			Es	stimated	Costs				
Estimated Installation C	ost (unit cos	t and consti	ruction cost):		low	: 8900 (a)	high:	37500 (a)	
Estimated Annual O&M Cost (\$/gallon treated):						: (b)	high:	(b)	
			System	Hydraul	ics/Desi	gn			
Design Flow Rate (gpm)			low:	No Min	high				
System aboveground fo	otprint (sq ft	:):	low:	/	high				
Required head loss (ft):				0.41' (c)	high	:			
Internal or External Byp	ass:	Internal	&/or External	-					
			Syst	em Perfo	rmance				
			-	-					
Briefly describe how da				-					
Field monitoring at the McRe analytical laboratory, and 3rd					•	nal composit	e and time-l	based discrete collections. Independent	
analytical laboratory, and sid	party uata valit			politics and se					
	TSS	ТРН		SVOCs	PCBs	Diovina	CPAHs	1	
Median Influent (mg/L)		IPA	Oil & grease	30005	PCDS	Dioxins	СРАПЗ	-	
Median Effluent (mg/L)			_					-	
Median Removal (%):	87%							-	
	0//0				I	1 1		1	
		Total Me	tals	Diss	olved Me	etals			
	Cu	Pb	Zn	Cu	Pb	Zn			
Median Influent (mg/L)		0.005	0.17			0.066			
Median Effluent (mg/L)	0.009	0.002	0.073			0.042			
Median Removal (%):	53%	60%	57%			36%			
		٨	lotes, Comme	ents, Add	itional R	Reference	s		
ecoStorm and ecoStorm plus	can be utilized a							n. Combined technologies are currently under	
TAPE evaluation through WAI	DOE for stormw	ater. Perform	ance data reflects l	both stormw	ater and no	n-stormwate	r installatior	ns.	

(a) Cost varies based on combination of units, number of units, and final design requirements.

(b) \$500 - \$1000 per cleaning/backflush event; Minimum of 1x per yr. to monthly for stormwater.

(c) Headloss based on:

- Current monitoring configuration: 1 ecoStorm upstream of 2 ecoStorm plus units.

- 360 gpm through the system, 180 gpm per filter.

- Site specific model calibrated onsite at known flow rates.

- Headloss negating effects of drop structure were neglected (located between the ecoStorm and ecoStorm plus units).

- Filters assumed to be at the point of required maintenance (twice the headloss measured for new filters).

System Performance Data results shown are for qualifying events only, per Washington State TAPE requirements:

- Per TAPE requirements, removal requirements for influent concentration less than 100 mg/l are that effluent must be less than or equal to 20 mg/l.

- For parameters with no results presented above, they are not being monitored or were present at concentrations are below measurable thresholds.

Herrera Herrera	Manuf	acturer Te	chnolog	у Rерс	ort				
Manufacturer:	EcoSense Internatio	onal II	Contact Na	ame:	Randy Bu	rden			
Name of Technology:	EcoVault Baffle B	OX	Contact En	nail:	/.burden@ecc	osenseint			
Technology Category:	Below Ground Va		Contact Ph		-449-0324 / 3	21-544-9			
Technology Process:	Type II Baffle Bo	X	Contact W	ebsite:	www.ecosens	eint.com			
# of Installations in Was	hington:	0	_						
	Treatmen	t Type/Appli	cation (che	ck all tha	t apply)				
Downspout	✓ Oil/Water Separartion	n 🗸 Filtratio	on (media)		✓ Ion exchange	je column	Stormv	vater	
Drain Inlet Insert	✓ Settling	✓ Filtratio	on (fabric)		Reverse osr	nosis	Ground	lwater	
✓ Below Ground Vault	Hydrodynamic Separ		on (biofiltration)		Electrocoag	ulation	Wastev	water	
Above Ground Vault	✓ Floatables Baffle		on (chemically enh	nanced)	Chemical Tr	reatment		s water	
		Fstime	ated Costs						
		_							
Estimated Installation Co		low: \$25,000.00		\$125,000					
Estimated Annual O&M	Lost:	low: \$200.00		\$1,800.00					
		System	Hydraulics	]					
Design Flow Rate (gpm):	:	low: 1346	high:	48,000	-				
Required head loss (ft):		Varies*	_						
Internal or External Bypa	ass: Eit	her or Both	_						
System Performance Breifly describe how data were colected (field, lab, third party, grab sample, auto-composite, etc.)									
II Baffle Box. Minimum Per and Gopatakrishnan, 1996.	A study has not been completed on this specific system. Studies have been performed on other manufactures version of the Type II Baffle Box. Minimum Performance claims are based on model studies performed at the Florida Institute of Technology: Pandit and Gopatakrishnan, 1996. The study mentioned was performed with a scale model Type 1 Baffle Box. Improvements such as media filtration and horizontal debris collection system were subsequently added.								
Parameter:	TSS TP	Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	трн	cPAHs	PCBs	
# of sample:									
Median Influent (mg/L):									
Median Effluent (mg/L): % Removal:									
% Kelliovai.	Notas	Commonts	Additional	Deferer					
The EcoVault is unique amo		Comments,		-		nce media	filter into	the last	
internal weir which treats l				-					
dissolved heavy metals and		-			-	-	-		
are captured and stored ab									
three filter components inc	-					•			
impregnated with Granulat depending on the media fil							* Head Los	ss varies	

Herrera
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Median Removal (%):

#### Manufacturer Technology Report

Manufacturer: Name of Technology: # of Installations in Washington:	Env	•	<i>pe/Applicati</i> ✓ Filtration (med	•	nail: none: /ebsite:	· <u> </u>	<u>21.com</u>	- - - - - - Stormwater
Drain Inlet Insert	Settling		Filtration (fabri	c)		Reverse	osmosis	Groundwater
Below Ground Vault	Hydrodynam	ic Separation	Filtration (biofi	tration)		Electroc	oagulation	Wastewater
Above Ground Vault	Floatables Ba	iffle	Filtration (cher	nically enhance	d)	Chemica	al Treatment	Process water
			Estimated	Costs				
Estimated Installation Cost	:	low:	\$200	high:	\$1,000			
Estimated Annual O&M Co	st:	low:	0	high:	\$1,000	_		
		Sys	stem Hydrau	lics/Desig	n			
Design Flow Rate (gpm):		low:	0	high:	2,700	_		
System footprint (sq ft):		low:	NA	high:	NA	_		
Required head loss (ft):		low:	0	high:	0.5	_		
Internal or External Bypass	:		NA					
System Performance Breifly describe how data were colected (field, lab, third party, grab sample, auto-composite, etc.) Field studies are incomplete at this time and are still under evaluation.								
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L):	*250	**400	**400	**400	**400	**400	**400	
Median Effluent (mg/L):	*175	**150	**150	**150	**150	**150	**150	

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA	
Median Effluent (mg/L):	***0.07	***0.68	***0.24	NA	NA	NA	
Median Removal (%):	***9	***13.6	***20	NA	NA	NA	

\*\*62.5

#### Notes, Comments, Additional References

\*\*62.5

\*\*62.5

\*\*62.5

\*\*62.5

\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a d<sub>50</sub> of 180 microns was used.

\*\*62.5

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated.

\*\*\*Testing is not complete for metals; therefore, these values are estimated.

\*30

🚸 Herrera	Manufad	cturer Tech	nology Report			
Manufacturer: Name of Technology:	ricast, Inc. t System	Contact Name Contact Email		Will Harris wharris@filterra.com		
Technology Category:	Below Ground	,	Contact Phone	·	909-790-5239	
Technology Process:	biofiltratio	on	Contact Webs	ite:	www.filterra.com	
# of Installations in Wa	shington:	186				
	Treatmo	ent Type/Appl	lication (check all th	at apply)		
Downspout	Oil/Water Separartion		Filtration (media)		Ion exchange column	Stormwater
Drain Inlet Insert	Settling		Filtration (fabric)		Reverse osmosis	Groundwater
Below Ground Vault	Hydrodynamic Separati	on 🗸	Filtration (biofiltration)		Electrocoagulation	Wastewater
Above Ground Vault	Floatables Baffle		Filtration (chemically enhance	ed)	Chemical Treatment	Process water
		Estim	ated Costs			
Estimated Installation (	Cost:	<b>low:</b> \$	1,200 <b>high:</b> _\$7	,500		
Estimated Annual O&N	1 Cost:	low:	\$300 <b>high:</b> \$3	,000		
		System	n Hydraulics			
Design Flow Rate (gpm)	):	low:	8.5 high: 5	50+		
Required head loss (ft):		2.5				
Internal or External By	bass:	Can be either				

#### System Performance

#### Breifly describe how data were colected (field, lab, third party, grab sample, auto-composite, etc.)

For third party field monitoring at the Port of Tacoma Industrial site in WA, samples were collected via automatic flow-weighted composite samplers. Trapezoidal flumes and V-notch weirs with associated bubbler systems were installed to intercept influent and effluent stormwater, respectively, for flow measurements. Water levels within flumes were recorded using 5-minute intervals. A rain guage was installed in association with the units locations to continuously monitor precipitation totals in the drainage areas, and was interfaced with the autosampler and bubbler equipment.

Parameter:	TSS	ТР	Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	ТРН	cPAHs	PCBs		
# of sample:	10	12	29	29			12				
Median Influent (mg/L):	27.5	0.15	0.0056	0.194			43.4				
Median Effluent (mg/L):	4.2	0.14	0.0033	0.082			1.2				
% Removal:	84.7	6.7	44	54			97				
Notes, Comments, Additional References											

Please refer to the attached Filterra Curb Inlet Model Overview Sheet for further information. Please note that the Filterra Curb Inlet Model can be designed and built with or without an internal high flow bypass compartment. Data from Technical Evaluation Report (2009) produced by Herrera Environmental Consultants for Washington Department of Ecology. TSS data in the influent range accepted by Ecology(20 mg/L and greater). TP data in the influent range accepted by Ecology (0.1 to 0.5 mg/L). Low TP removal due to anomalous phosphorus data collected at the Port of Tacoma included very low TP influent concentrations and a high fraction of soluble reactive phosphorus. Dissolved copper data in the influent range accepted by Ecology (0.02 to 0.02 mg/L). TPH data in the influent range accepted by Ecology (10 mg/L or greater).

Manufacturer	Technol	loav	Report
		- 37	

HERRERA

Manufacturer:	Filterra, DBA Americast	, Inc.	Contact Name:	Will Harris	
Name of Technology:	Filterra Roof Drain Syst	tem	Contact Email:	wharris@filterra.com	
Technology Category:	Downspout		Contact Phone:	909-790-5239	
Technology Process:	Biofiltration		Contact Website:		
# of Installations in Was	shington:	1			
	Treatment 1	Type/Applicat	ion (check all that a	pply)	
Downspout	Oil/Water Separartion	Filtra	ition (media)	Ion exchange column	✓ Stormwater
Drain Inlet Insert	Settling	Filtra	ition (fabric)	Reverse osmosis	Groundwater
Below Ground Vault	Hydrodynamic Separation	✓ Filtra	tion (biofiltration)	Electrocoagulation	Wastewater
✓ Above Ground Vault	Floatables Baffle	Filtra	tion (chemically enhanced)	Chemical Treatment	Process water
		Estimated	l Costs		
Estimated Installation C	Cost:	low: \$1,200	<b>high:</b> \$7,500	)	
Estimated Annual O&M	I Cost:	low: \$300	<b>high:</b> \$3,000	)	
		System Hy	draulics		
Design Flow Rate (gpm)	):	low: 8.5	high: 50+		
Required head loss (ft):		2.5			
Internal or External Byp	Dass: In	ternal			
		System Perf	ormance		
Breifly describe how da	ta were colected (field, lab,	, third party, gra	b sample, auto-com	oosite, etc.)	

For third party field monitoring at the Port of Tacoma Industrial site in WA, samples were collected via automatic flow-weighted composite samplers. Trapezoidal flumes and V-notch weirs with associated bubbler systems were installed to intercept influent and effluent stormwater, respectively, for flow measurements. Water levels within flumes were recorded using 5-minute intervals. A rain guage was installed in association with the units locations to continuously monitor precipitation totals in the drainage areas, and was interfaced with the autosampler and bubbler equipment.

Parameter:	TSS	ТР	Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	TPH	cPAHs	PCBs
# of sample:	10	12	29	29			12		
Median Influent (mg/L):	27.5	0.15	0.0056	0.194			43.4		
Median Effluent (mg/L):	4.2	0.14	0.0033	0.082			1.2		
% Removal:	84.7	6.7	44	54			97.2		
		Notes, Comr	nents, Addit	ional Ref	erences				

Please refer to the attached Filterra Roof Drain System Model Overview Sheet for further information. Please note that the Filterra Roof Drain System can be designed and built with or without an internal high flow bypass compartment. System can be also designed and built for either above ground or below ground applications. Data from Technical Evaluation Report (2009) produced by Herrera Environmental Consultants for Washington Department of Ecology. TSS data in the influent range accepted by Ecology(20 mg/L and greater). TP data in the influent range accepted by Ecology (0.1 to 0.5 mg/L). Low TP removal due to anomalous phosphorus data collected at the Port of Tacoma included very low TP influent concentrations and a high fraction of soluble reactive phosphorus. Dissolved copper data in the influent range accepted by Ecology (0.0029 to 0.02 mg/L). Dissolved zinc data in the influent range accepted by Ecology (0.02 to 0.6 mg/L). TPH data in the influent range accepted by Ecology (10 mg/L or greater).

Manufacturer	Technology	Report
wanajactarci	reennonogy	nepore

HERRERA

Manufacturer:	ABT, Inc.		Contact Name:	Brad Sh	ort		
Name of Technology:	First Flush 164	OFF	Contact Email:	bshort@abtdrains	.com		
Technology Category:	Below Ground	Vault	<b>Contact Phone:</b>	949-633-	6111		
Technology Process:	Gravity-Flow the	rough	Contact Website:	www.abtdrai	ns.com		
# of Installations in Was	hington:	0					
	Treatme	nt Type/Applic	cation (check all t	hat apply)			
Downspout	Oil/Water Separart	ion Filtration	n (media)	Ion exchang	ge column	✓ Storm	water
✓ Drain Inlet Insert	Settling	✓ Filtration	n (fabric)	Reverse os	nosis	Groun	dwater
Below Ground Vault	Hydrodynamic Sep		n (biofiltration)	Electrocoag	ulation	☐ Waste	water
Above Ground Vault	Floatables Baffle		n (chemically enhanced)	Chemical T			ss water
		Estima	ted Costs				
Estimated Installation C	ost:	<b>low:</b> \$5,000	<b>high:</b> 10,000	)			
Estimated Annual O&M		low: \$500	high: \$3,000				
		System I	Hydraulics				
Design Flow Rate (gpm)	:	low: 449	<b>high:</b> 538				
Required head loss (ft):							
Internal or External Byp	ass: See de	etail for bypass.	-				
		System Pr	erformance				
		System	erjormanee				
Breifly describe how dat	ta were colected	(field, lab, third p	party, grab sample	, auto-compos	ite, etc.)		
Lab test results are provide installation cost if factoring available from ABT. Install	g material and cost	of installation toge			-	-	
Parameter: # of sample:	TSS T	'P Dis. Cu	Dis. Zn Dis. Co	d Dis. Pb	ТРН	cPAHs	PCBs
Median Influent (mg/L): Median Effluent (mg/L):							
% Removal:							
	Notes	s, Comments, A	Additional Refer	ences			



Manufacturer:	Kristar Enterp	rises, Inc.		Contact Na	ame:	Michael Kimberlai	n	
Name of Technology:	FloGard Down	nspout Filter	-	Contact Er	nail:	mkimberlain(	@kristar.com	
# of Installations in			-	Contact Ph	none:	(800) 579-8819		
Washington:	0		-	Contact W	ebsite:	www.kristar.	<u>com</u>	
		Treatm	ent Type/Ap	plication	(check al	l that apply)		
✓ Downspout	✓ Oil/Water Se		Filtration (med	-		Ion exchange c	olumn	Stormwater
Drain Inlet Insert	Settling		Filtration (fabri	ic)		Reverse osmos	is	Groundwater
Below Ground Vault	Hydrodynan	nic Separation	Filtration (biofi			Electrocoagulat		Wastewater
Above Ground Vault	Floatables B	affle		nically enhance	4)	Chemical Treat		Process water
				-				
			Esti	mated Co	sts			
Estimated Installation C	Cost:	low:	\$1,500	high:	\$3,500			
Estimated Annual O&N	l Cost:	low:	\$75	high:	\$250	_		
			Sustem H	ydraulics,	/Design			
Design Flow Rate (gpm)	).	low:	-	high:	325			
System footprint (sq ft)		low:		high:	1			
Required head loss (ft):		low:		high:	0.5			
Internal or External Byp			ternal		0.5			
				-				
			Systen	n Perform	ance			
Breifly describe how da								
Lab - UCLA, Univeristy of Hav	waii, City of Aucl	kland, NZ, CSUS	- OWP. Field Stud	y - University	of Hawaii a	nd City of Aucklan	d	
	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L)	: 100	35	35				35	
Median Effluent (mg/L)		7	7					
Median Removal (%):	80	80	80				7	
	-							
	<u> </u>	Total Met	r	i	solved M			
Median Influent (mg/L)	Cu	Pb	<b>Zn</b>	Cu	Pb	Zn		
Median Effluent (mg/L)			10					
Median Removal (%):	•		6 60					
			00	<u> </u>				
		Not	es, Comment	ts, Additio	nal Refe	erences		

<b>HERRERA</b>	Manufacturer Technology Report
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Manufacturer:		Kristar Enterprises,	, Inc.		hael Kimberlain	_				
Name of Technology:		Flo Gard Dual Vortex Se	parator		Contact Ema	ail:	<u>mkimbe</u>	rlain@kristar.com	_	
# of Installations in					Contact Pho	one:		300) 579-8819	_	
Washington:		10		Contact Website:			<u></u>	w.kristar.com	-	
		7	reatm	ent Type/Ap	oplication	(check all t	hat apply)			
Downspout	$\checkmark$	Oil/Water Separartion	ı	Filtration (med	ia)		Ion exchange colu	imn	✓ Stor	mwater
Drain Inlet Insert	$\checkmark$	Settling		Filtration (fabri	ic)		Reverse osmosis		Grou	Indwater
✓ Below Ground Vault	$\checkmark$	Hydrodynamic Separa	ation	Filtration (biofi	Itration)		Electrocoagulation	ı	Was	tewater
Above Ground Vault	$\checkmark$	Floatables Baffle		Filtration (chen	nically enhanced)		Chemical Treatme	ent	Proc	ess water
				Est	imated Cos	sts				
Estimated Installation (	Cost	:	low:	\$10,000	high:	\$100,000				
Estimated Annual O&N	1 Co	st:	low:	\$300	high:	\$3,500	_			
				System I	Hydraulics/	Design				
Design Flow Rate (gpm)	):		low:	150	high:	6,500				
System footprint (sq ft)	):		low:	7	high:	113				
Required head loss (ft):	:		low:	0	high:	3				
Internal or External By	oass	:	Inte	ernal						
				Syste	m Perform	ance				
				-	-					
Breifly describe how da					<u> </u>					
Internal lab testing performe been completed at this date		Kristar. Third part	y lab tes	ting was perform	ed by Alden Re	search labora	itories based in l	Holden Massachussets.		idies have
been completed at this date									No field st	
									NO TIEID SU	
									No field St	
		TSS TI	PH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs		
Median Influent (mg/L)	):	<b>TSS TI</b> 202	PH	Oil & grease	SVOCs	PCBs	Dioxins			
Median Effluent (mg/L)	):		РН	Oil & grease	SVOCs	PCBs	Dioxins			
	):	202	РН	Oil & grease	SVOCs	PCBs	Dioxins			
Median Effluent (mg/L)	):	202 80 60								
Median Effluent (mg/L)	):	202 80 60 Tota	PH al Meta			PCBs solved Meta Pb				
Median Effluent (mg/L)	): ):	202 80 60 Tota	al Meta	als	Diss	olved Meta	als			
Median Effluent (mg/L) Median Removal (%):	):	202 80 60 Tota	al Meta	als	Diss	olved Meta	als			

#### Notes, Comments, Additional References

No field studies have been completed at this time. Correlation of TSS removal with other POCs would indicate similar removal of Total metals.



Manufacturer:	Kristar Enterpr	ises, Inc.		Contact N	ame:	Michael Kimberlair	1	
Name of Technology:	FloGard LoPro	Matrix Filter	-	Contact Er	nail:	mkimberlain@	<u>økristar.com</u>	
# of Installations in				Contact Pl	none:	(800) 579-8819		
Washington:	10		-	Contact W	ebsite:	www.kristar.c	<u>com</u>	
		Treatm	ent Type/Ap	plication	(check all	that apply)		
Downspout [	✓ Oil/Water Sep	parartion	Filtration (med	ia)		Ion exchange c	olumn	Stormwater
✓ Drain Inlet Insert [	Settling		Filtration (fabri	ic)		Reverse osmosi	S	Groundwater
Below Ground Vault	Hydrodynam	ic Separation	Filtration (biofi	Itration)		Electrocoagulat	ion	Wastewater
Above Ground Vault	✓ Floatables Ba	affle	Filtration (cher	nically enhance	d)	Chemical Treat	ment	Process water
			Estii	mated Co.	sts			
Estimated Installation Co	st:	low:	\$400	high:	\$1,000			
Estimated Annual O&M (		low:		high:	\$300			
			System H	vdraulics	/Desian			
Design Flow Rate (gpm):		low:	-	high:	800			
System footprint (sq ft):		low:	0.75	high:	16			
Required head loss (ft):		low:	0	high:	0.5			
Internal or External Bypa	ss:	In	ternal	-				
Internal or External Bypa	ss:	In		- - Dorform	anco			
Internal or External Bypa	ss:	In		n Perform	ance			
			Systen	-		nposite, etc.)		
Internal or External Bypa Breifly describe how data Lab - UCLA, Univeristy of Hawa	a were colec	ted (field, lal	<i>Systen</i> b, third party, g	rab sample	e, auto-cor		1	
Breifly describe how data	a were colec	ted (field, lal	<i>Systen</i> b, third party, g	rab sample	e, auto-cor		1	
Breifly describe how data	a were colec	ted (field, lal	<i>Systen</i> b, third party, g	rab sample	e, auto-cor		1	
Breifly describe how data	a were colec	ted (field, lal	<i>Systen</i> b, third party, g	rab sample	e, auto-cor		1	
Breifly describe how data	a were colec	ted (field, lal	<i>Systen</i> b, third party, g	rab sample	e, auto-cor		СРАНѕ	
Breifly describe how data	a were colec iii, City of Auckl	ted (field, lal	Systen b, third party, g - OWP. Field Study	g <b>rab sample</b> y - University	e, auto-cor of Hawaii an	d City of Auckland		
Breifly describe how data Lab - UCLA, Univeristy of Hawa Median Influent (mg/L):	a were colec iii, City of Auckl	ted (field, lal land, NZ, CSUS	Systen b, third party, g - OWP. Field Study Oil & grease	g <b>rab sample</b> y - University	e, auto-cor of Hawaii an	d City of Auckland	CPAHs	
Breifly describe how data Lab - UCLA, Univeristy of Hawa Median Influent (mg/L): Median Effluent (mg/L):	a were colec iii, City of Auckl TSS 100	ted (field, lal land, NZ, CSUS TPH 35	Systen b, third party, g OWP. Field Study Oil & grease 35	g <b>rab sample</b> y - University	e, auto-cor of Hawaii an	d City of Auckland	CPAHs	
Breifly describe how data Lab - UCLA, Univeristy of Hawa Median Influent (mg/L): Median Effluent (mg/L):	a were colec iii, City of Auckl TSS 100 20	ted (field, la land, NZ, CSUS TPH 35 7	Systen b, third party, g - OWP. Field Study Oil & grease 35 7 80	y - University	e, auto-cor of Hawaii an PCBs	d City of Auckland	<b>CPAHs</b> 35	
Breifly describe how data Lab - UCLA, Univeristy of Hawa Median Influent (mg/L): Median Effluent (mg/L):	a were colec iii, City of Auckl TSS 100 20	ted (field, la land, NZ, CSUS TPH 35 7 80	Systen b, third party, g - OWP. Field Study Oil & grease 35 7 80	y - University	e, auto-cor of Hawaii an	d City of Auckland	<b>CPAHs</b> 35	
Breifly describe how data Lab - UCLA, Univeristy of Hawa Median Influent (mg/L): Median Effluent (mg/L): Median Removal (%):	TSS 100 20 80	ted (field, lai land, NZ, CSUS TPH 35 7 80 Total Met	Systen b, third party, g - OWP. Field Study Oil & grease 35 7 80 als	srab sample y - University SVOCs	e, auto-cor of Hawaii an PCBs solved Me	d City of Auckland	<b>CPAHs</b> 35	
Breifly describe how data Lab - UCLA, Univeristy of Hawa Median Influent (mg/L): Median Effluent (mg/L): Median Removal (%):	TSS 100 20 80	ted (field, lai land, NZ, CSUS TPH 35 7 80 Total Met	Systen b, third party, g - OWP. Field Study Oil & grease 35 7 80 als Zn	srab sample y - University SVOCs	e, auto-cor of Hawaii an PCBs solved Me	d City of Auckland	<b>CPAHs</b> 35	
Breifly describe how data	TSS 100 20 80	ted (field, lai land, NZ, CSUS TPH 35 7 80 Total Met	Systen b, third party, g - OWP. Field Study Oil & grease 35 7 80 als Zn 10	srab sample y - University SVOCs	e, auto-cor of Hawaii an PCBs solved Me	d City of Auckland	<b>CPAHs</b> 35	



Manufacturer:	Krista	r Enterprises, Ir	ıc.		Contact Na	ame:	Michael Kimberl	ain	
Name of Technology:	FloGa	rd LoPro Trench	Drain Filter		Contact En	nail:	<u>mkimberlair</u>	<u>@kristar.com</u>	_
# of Installations in					Contact Ph	one:	(800) 579-8819		
Washington:	0			_	Contact W	ebsite:	www.kristar	<u>com</u>	
			Treatm	ent Type/Ap	pplication	(check al	ll that apply)		
Downspout	✓ Oil/V	Vater Separart		Filtration (me	•		Ion exchange	column	Stormwater
✓ Drain Inlet Insert	Settl	ing		Filtration (fab	ric)		Reverse osmo	osis	Groundwater
Below Ground Vault	Hydr	odynamic Sep	aration	Filtration (bio	,		Electrocoagul		Wastewater
Above Ground Vault		tables Baffle			mically enhanced	Ð	Chemical Trea		Process water
				Esti	imated Cos	sts			
Estimated Installation 0	Cost:		low:	\$600	high:	\$3,000			
Estimated Annual O&N	I Cost:		low:	\$75	high:	\$350			
				System H		/Desian			
Design Flow Rate (gpm	):		low:	-	high:	500			
System footprint (sq ft)			low:		_ bigh:	20			
Required head loss (ft):			low:	0	high:	0.25			
Internal or External By	bass:		In	ternal					
				Custo	m Perform	~ ~ ~ ~			
				Syster	n Perjonn	unce			
Breifly describe how da	ita were	colected	(field. la	b. third party.	grab sample	. auto-co	omposite. etc.)		
Lab - UCLA, Univeristy of Hav									
		rss	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L)		100	35	35	51003	. 603	DIONIII	35	$\neg$
Median Effluent (mg/L)		20	7	7					$\neg$
Median Removal (%):		80	80	80				7	-
		•			1		· ·		
		T	otal Met	als	Dis	solved M	letals		
		Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L)				10					
Median Effluent (mg/L)	):			6	↓				
Median Removal (%):				60					
			Not	es, Commen	ts, Additio	nal Refe	erences		



Manufacturer:	Kristar	Enterprises, Inc.	Contact Name:				Michael Kimberla	Michael Kimberlain		
Name of Technology:	F	oGard+Plus	_		Contact Em	nail:	mkimberlain	@kristar.com		
# of Installations in			_		<b>Contact Ph</b>	one:	(800) 579-8819			
Washington:		100	Contact Website:			www.kristar.com				
		Treatn	nent	Tvpe/Ap	olication	(check a	ll that apply)			
Downspout	Oil/Water	Separartion		iltration (medi			Ion exchange	column	$\checkmark$	Stormwater
✓ Drain Inlet Insert	Settling			iltration (fabrio	c)		Reverse osmo	sis		Groundwater
Below Ground Vault	Hydrodyna	amic Separation		iltration (biofil			Electrocoagula	ation		Wastewater
Above Ground Vault	✓ Floatables	Baffle			nically enhanced	)	Chemical Trea	tment		Process water
			_	Estir	nated Cos	ts				
Estimated Installation C	ost:	low		\$250	high:	\$1,800				
Estimated Annual O&M		low	-	\$75	high:	\$350				
					ydraulics/	-				
Design Flow Rate (gpm)		low:		100	high:	2,000				
System footprint (sq ft)		low:		1	high:	10				
Required head loss (ft):		low:		0	high:	0.25				
Internal or External Byp	ass:	Ir	nternal							
Breifly describe how da Lab - UCLA, Univeristy of Hav								nd		
	TSS	ТРН	Oil a	& grease	SVOCs	PCBs	Dioxins	СРАНѕ		
Median Influent (mg/L)	: 100	35		35				35		
Median Effluent (mg/L)		7		7						
Median Removal (%):	80	80		80				7		
		Total Met	tals		Dise	olved N	letals			
	Cu	Pb		Zn	Cu	Pb	Zn			
Median Influent (mg/L)		-		10						
Median Effluent (mg/L)				6						
Median Removal (%):				60						
	ŧ			ļ	I					
		Not	tos C	omment	s, Additio	nal Pof	oroncos			
		1400	(23) 0	Sinnent.	<i>5, </i> ¬uuiti0	iui nej				

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Manufacturer: Name of Technology:	-	terprises, Inc.	-	Contact Name: Contact Email:		chael Kimberlain	kristar com		
tof Installations in	FIOGAIU ITAS	i & Debits Guard	-	Contact Phone:		00) 579-8819	<u>KIIStal.com</u>		
Washington:		0		Contact Website	<u> </u>	ww.kristar.c	om		
0.1			-	-lissting ()					
Downspout	✓ Oil/Water Sep		Filtration (medi	plication (chec		<b>t apply)</b> on exchange co	lumn	ſ	✓ Stormwater
Drain Inlet Insert	Settling					-		г Г	Groundwater
Below Ground Vault	Hydrodynami	c Separation	Filtration (fabric			Reverse osmosis Electrocoagulati		L	
	<ul> <li>✓ Floatables Ba</li> </ul>		Filtration (biofil			-		L	Wastewater
Above Ground Vault		me		nically enhanced)		Chemical Treatn	ient	l	Process wate
			Estir	nated Costs					
stimated Installation C	ost:	low:	\$450	high: \$1,5	00				
stimated Annual O&M	Cost:	low:	\$50	<b>high:</b> \$2	0				
			System H	ydraulics/Desi	an				
Design Flow Rate (gpm)		low:		<b>high:</b> 50	-				
		low:	0.5	high:					
				high. 0	25				
Required head loss (ft):		low:	0	<b>high:</b> 0.					
Required head loss (ft): nternal or External Byp Breifly describe how dat	ass:	In	ternal System	n Performance		site, etc.)			
Required head loss (ft): nternal or External Byp Breifly describe how dat	ass:	In	ternal System	n Performance		site, etc.)			
Required head loss (ft): nternal or External Byp Breifly describe how dat	ass: a were colect	in	ternal System	n Performance rab sample, auto	-compos				
Required head loss (ft): Internal or External Byp Breifly describe how dat to Data Available	ass: a were colect	In	ternal System	n Performance	-compos	site, etc.) Dioxins	CPAHs		
Required head loss (ft): nternal or External Byp Breifly describe how dat to Data Available Median Influent (mg/L):	ass: a were colect	in	ternal System	n Performance rab sample, auto	-compos		CPAHs		
equired head loss (ft): nternal or External Byp reifly describe how dat o Data Available Median Influent (mg/L): Median Effluent (mg/L):	ass: a were colect	in	ternal System	n Performance rab sample, auto	-compos		СРАНѕ		
Required head loss (ft): nternal or External Byp Breifly describe how dat No Data Available Median Influent (mg/L): Median Effluent (mg/L):	ass: a were colect	red (field, la	b, third party, g	n Performance rab sample, auto SVOCs PC	-compos 3s D	Dioxins	CPAHs		
Required head loss (ft): nternal or External Byp Breifly describe how dat No Data Available Median Influent (mg/L): Median Effluent (mg/L):	ass: a were colect	TPH	b, third party, g	Performance       rab sample, auto       SVOCs       PC       Dissolved	-compos 3s D	Dioxins	CPAHs		
Required head loss (ft): Internal or External Byp Breifly describe how dat Io Data Available Median Influent (mg/L): Median Effluent (mg/L): Median Removal (%):	ass: a were colect TSS	red (field, la	b, third party, g	n Performance rab sample, auto SVOCs PC	-compos 3s D	Dioxins	СРАНѕ		
Required head loss (ft): nternal or External Byp Breifly describe how dat No Data Available Median Influent (mg/L): Median Effluent (mg/L): Median Removal (%):	ass: a were colect TSS	TPH	b, third party, g	Performance       rab sample, auto       SVOCs       PC       Dissolved	-compos 3s D	Dioxins	СРАНѕ		
Required head loss (ft): Internal or External Byp Breifly describe how dat No Data Available Median Influent (mg/L): Median Effluent (mg/L): Median Influent (mg/L):	ass: a were colect TSS	TPH	b, third party, g	Performance       rab sample, auto       SVOCs       PC       Dissolved	-compos 3s D	Dioxins	CPAHs		
System footprint (sq ft): Required head loss (ft): Internal or External Byp Breifly describe how dat No Data Available Median Influent (mg/L): Median Removal (%): Median Effluent (mg/L): Median Effluent (mg/L):	ass: a were colect TSS	TPH	b, third party, g	Performance       rab sample, auto       SVOCs       PC       Dissolved	-compos 3s D	Dioxins	CPAHs		
Required head loss (ft): Internal or External Byp Breifly describe how dat No Data Available Median Influent (mg/L): Median Removal (%): Median Effluent (mg/L):	ass: a were colect TSS	TPH Total Met	b, third party, g	Performance       rab sample, auto       SVOCs       PC       Dissolved	-compos	Dioxins Zn	CPAHs		

Herrera 🕐	Ма	nufacti	urer Tech	nology I	Report				
Manufacturer:	AquaShie	ld Inc		Contact Na	me:	Mark Miller			
Name of Technology:	Go-Fi			Contact En		mmiller@aquas	shieldinc.com	—	
Technology Category:	Above Grou	und Vault		Contact Ph	one:	888-344-9044		_	
Technology Process:	Vortex + F	iltration		Contact W	ebsite:	www.aquashiel	dinc.com	_	
# of Installations in Was	hington:		0	_				_	
		Treat	ment Type/	Applicatio	n (check all	that apply)			
Downspout	✓ Oil/Water Se		Filtration (me		•	Ion exchange col	umn	✓ Storm	nwater
Drain Inlet Insert	Settling		Filtration (fab	ric)		Reverse osmosis		Grour	ndwater
Below Ground Vault	✓ Hydrodynar	nic Separation	Filtration (biof			Electrocoagulatio		☐ Waste	
Above Ground Vault	✓ Floatables B	affle	Filtration (che		))	Chemical Treatm			ess water
			F	stimated C	osts				
Estimated Installation Co		low:	Site-specific		Site-specific				
Estimated Annual O&M	Cost:	low:	Site-specific	high:	Site-specific	_			
			Sy.	stem Hydr	aulics				
Design Flow Rate (gpm):		low:	50	high:	675				
Required head loss (ft):		C	).5	_					
Internal or External Bypa	ass:	B	oth	_					
			Syst	tem Perfor	mance				
				-					
Breifly describe how dat		ed (field, la	ab, third party	y, grab samp	le, auto-con	nposite, etc.)			
See Aqua-Filter for lab and	field testing.								
Parameter:	TSS	ТР	Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	ТРН	cPAHs	PCBs
# of sample:									
Median Influent (mg/L):									
Median Effluent (mg/L):									
% Removal:									
			otes, Comm	-					
Mobile device works on s				n constructi	on sites for t	urbidity reductio	on in addition to	sediment ren	noval.
Device components have	e been verified	by NJCAT.							

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			10.

Manufacturer:		Imbriu	m Systems		Contact Na	ame:	Joel G	arbon	
Name of Technology:			ish Filter	_	Contact Er	nail:	jgarbon@imbri	iumsystms.com	
# of Installations in					Contact Pl	none:	503-70	6-6193	
Washington:			1	_	Contact W	ebsite:	www.imbriums	systems.com	
		Tre	eatment T	ype/Applicat	i <b>on</b> (check	all that a	pply)		
Downspout	$\checkmark$	Oil/Water Sep	paration	✓ Filtration (med	lia)		Ion exch	ange column	Stormwater
Drain Inlet Insert	$\checkmark$	Settling		Filtration (fabr	ic)		Reverse	osmosis	Groundwater
Below Ground Vault	$\checkmark$	Hydrodynami	c Separation	Filtration (biof	iltration)		Electroco	agulation	Wastewater
✓ Above Ground Vault	$\checkmark$	Floatables Ba	ffle	Filtration (che	mically enhance	d)	Chemica	l Treatment	Process water
				Estimatea	Costs				
Estimated Installation	Cost	(unit cost a	and constru	ction cost):		low:		high:	
Estimated Annual O&N	/I Cos	st (\$/gallor	n treated):			low:		high:	
			Sj	ystem Hydrau	lics/Desig	ın			
Design Flow Rate (gpm				low:	60	high:			
System aboveground fo		rint (sq ft):		low:		high:			
Required head loss (ft)		-	totomal au	low:	1	high:	2		
Internal or External By	pass.		Internal or	External Bypass					
				System Perf	ormance				
Priofly describe how da	-+ 14	ero colloc	had (field in	h third party of	rah cample	outo-co		ha )	
Briefly describe how date Performance data is from the									octed were grab
samples of the entire crosse							i protocee	diffpres cone	
		TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L	):	74					Bionine	Critic	
Median Effluent (mg/L		8							
Median Removal (%):	-	89							
			Total Me	tala	Dies	olved Me	tals		
		Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L	):	78	35	1.45					
Median Effluent (mg/L		0.3	5	0.6					
Median Removal (%):	-	99	86	59					
-				omments, Add					
Copper concentrations are i O&M cost ranges from \$0.0							concentraion	s are in micr	ograms per liter. The
Owivi cost ranges from \$0.0	U1/ga	1 to \$0.003/g	di. Ilistaliatioi	i costs range from	\$8000 10 \$125	5,000.			

Oil/Water Separartion Settling Hydrodynamic Separation Floatables Baffle	high: Nominal stem Hydraulics low: 25 gpm high: 10,000 g	✓       Ion exchange column       ✓       Stormwate         ☐       Reverse osmosis       ☐       Groundwate         ☐       Electrocoagulation       ✓       Wastewate         ☐       Chemical Treatment       Process was
Treatment Type/         Oil/Water Separation         Settling         Hydrodynamic Separation         Floatables Baffle         E         Iow:       Varies by s         st:       Iow:         Nominal         Sy.         E       E	Application (check all that appl         Filtration (media)         Filtration (fabric)         Filtration (biofiltration)         Filtration (chemically enhanced)         Stimated Costs         size       high: Varies by installation         high: Nominal         stem Hydraulics         low:       25 gpm         high: 10,000 gp	✓       Ion exchange column       ✓       Stormwate         ☐       Reverse osmosis       ☐       Groundwate         ☐       Electrocoagulation       ✓       Wastewate         ☐       Chemical Treatment       Process was
Treatment Type/         Oil/Water Separation         Settling         Hydrodynamic Separation         Floatables Baffle         E         Iow:       Varies by s         st:       Iow:         Nominal         Sy.         E       E	Filtration (media)     Filtration (fabric)     Filtration (biofiltration)     Filtration (chemically enhanced)      Filtration (chemically en	□ Ion exchange column       ✓ Stormwate         □ Reverse osmosis       □ Groundwate         □ Electrocoagulation       ✓ Wastewate         □ Chemical Treatment       □ Process wate
Oil/Water Separartion Settling Hydrodynamic Separation Floatables Baffle	Filtration (media)     Filtration (fabric)     Filtration (biofiltration)     Filtration (chemically enhanced)      Filtration (chemically en	□ Ion exchange column       ✓ Stormwate         □ Reverse osmosis       □ Groundwate         □ Electrocoagulation       ✓ Wastewate         □ Chemical Treatment       □ Process wate
Settling Hydrodynamic Separation Floatables Baffle	Filtration (fabric) Filtration (biofiltration) Filtration (chemically enhanced) Filtration (chemica	Reverse osmosis       Groundwate         Electrocoagulation       Wastewate         Chemical Treatment       Process was
Hydrodynamic Separation Floatables Baffle  Iow: Varies by s st: Iow: Nominal  Sy.	Filtration (biofiltration) Filtration (chemically enhanced) size high: Varies by installation high: Nominal stem Hydraulics low: 25 gpm high: 10,000 g	Electrocoagulation  Kastewate  Chemical Treatment  Process was
Floatables Baffle  Floatables Baffle  St: Iow: Varies by s  st: Iow: Nominal  Sy.  E	Filtration (chemically enhanced)  Stimated Costs  Size high: Varies by installation high: Nominal  Stem Hydraulics low: 25 gpm high: 10,000 g	Chemical Treatment Process wa
E Iow: Varies by s st: Iow: Nominal Sy	size       high: Varies by installation         high: Nominal         rstem Hydraulics         low:       25 gpm         high: 10,000 gp	
st: low: Varies by s st: low: Nominal Sy	size       high: Varies by installation         high: Nominal         stem Hydraulics         low: 25 gpm       high: 10,000 g	n size
st: low: Nominal Sy	high: Nominal stem Hydraulics low: 25 gpm high: 10,000 g	n size
	stem Hydraulics low: 25 gpm high: 10,000 g	
:E	low: 25 gpm high: 10,000 g	
		pm
	Gravity	<u> </u>
	External	
Syst	tem Performance	
TSS TP	Dis. Cu Dis. Zn Dis. Co	d Dis. Pb TPH cPAHs PCB
Notes Comm	ents Additional References	
	ente, ruantional hejerentes	
er influent flows, allowing for sma res Stokes Law for defining rates of on process enhances oil from wat to 5 ppm & lower. alarms available for preset level a uction: carbon steel. onfigurations available ittent influent flow rates. nove oils with a specific gravity of	aller separator tanks. With smaller sep of rise of oil spheres in a liquid mediun ter separation efficiencies alarm notifications	n
	TSS TP Notes, Comm sted and listed per UL-2215 onfined space entry when perfor er influent flows, allowing for sm res Stokes Law for defining rates on process enhances oil from wa to 5 ppm & lower. alarms available for preset level uction: carbon steel. unfigurations available ittent influent flow rates.	Notes, Comments, Additional References ested and listed per UL-2215 onfined space entry when performing routine maintenance. er influent flows, allowing for smaller separator tanks. With smaller sep zes Stokes Law for defining rates of rise of oil spheres in a liquid mediur on process enhances oil from water separation efficiencies to 5 ppm & lower. alarms available for preset level alarm notifications Juction: carbon steel. Infigurations available ittent influent flow rates. Howe oils with a specific gravity of less than 0.95, dissolved hydrocarbon

Median Influent (mg/L):

Median Effluent (mg/L):

Median Removal (%):

0.04

n/d

>50

n/d

n/d

#### Manufacturer Technology Report

<b>MERKERA</b>	wiand		mology hep					
Manufacturer:	Modular We	tland Systems, Inc.		Contact Name	2:	Greg	g Kent	
Name of Technology:	Modular Wet	land System - Linear	-	<b>Contact Email</b>	:	gkent@bioclean	environmental.net	_
# of Installations in			_	Contact Phone	e:	760-43	33-7640	-
Washington:		0 WA	-	Contact Webs	site:	www.biocleane	nvironmental.net	-
		Treatme	ent Type/Appli	cation (check	all that app	y)		
Downspout	Oil/Water Separation	1	Filtration (media)			Ion exchange colum	n	Stormwater
Drain Inlet Insert	Settling		Filtration (fabric)			Reverse osmosis		Groundwater
Below Ground Vault	Hydrodynamic Sepa	ration	Filtration (biofiltra	ation)		Electrocoagulation		Wastewater
Above Ground Vault	Floatables Baffle		Filtration (chemic	ally enhanced)		Chemical Treatment		Process water
			Estimo	ited Costs				
Estimated Installation Co Estimated Annual O&M	•		treatment flow	rate):	low:	12,000 \$ 8.26	high: high:	
			System Hyd	raulics/Desig	gn			
Design Flow Rate (gpm):			low:		high:	120		
System aboveground foo	tprint (sq ft):		low:	16	high:	84	_	
Required head loss (ft):			low:	2	high:	4	<u>-</u>	
Internal or External Bypa	ss:			Internal (Exter	nal in Some Si	tuations)	-	
			System P	erformance				
			- /					
Briefly describe how data	a were collected (	field, lab, third party	, grab sample, aι	uto-composite,	etc.)			
The Modular Wetland Syste composite grab samples we Full Scale Independent Fie	ere used in the field						Scale Independent	
Quarter Scale Lab Testing								1
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L):	270	19	4	not tested	not tested	not tested	not tested	
Median Effluent (mg/L):	3	0	n/d	not tested	not tested	not tested	not tested	
Median Removal (%):	98	>99	>99%	not tested	not tested	not tested	not tested	
		Total Metals	1		Dissolved Me			
	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L):	not tested	not tested	not tested	0.757	0.543	0.95		
Median Effluent (mg/L):	not tested	not tested	not tested	0.0552	0.1	0.185		
Median Removal (%):	not tested	not tested	not tested	93	81	80		
Full Scale Field Testing								
	TSS	TPH - Motor Oil	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L):	45.67	0.83	not tested	not tested	not tested	not tested	not tested	
Median Effluent (mg/L):	8.24	0	not tested	not tested	not tested	not tested	not tested	
Median Removal (%):	82	>99	not tested	not tested	not tested	not tested	not tested	
				1				
		Total Metals	-		Dissolved Me		Nutrients	
	Cu	Pb	Zn	Cu	Pb	Zn		

Notes, Comments, Additional References

not tested

0.24

n/d

>79

The Modular Wetland System Linear is a 4 stage treatment train that includes screening, separation, media filtration and biofiltration. This combination of treatment processes offers the most comprehensive range of stormwater treatment available. The treatment train concept employed helps to minimize overall maintenance costs.



Manufacturer: Name of Technology: # of Installations in Washington:	Nutrient Sep	Environmental arating Baffle Box 4 UT, 3 OR	- - -	Contact Name Contact Email Contact Phone Contact Webs	: e: ite:	gkent@biocleane 760-43 www.biocleane	g Kent environmental.net 33-7640 nvironmental.net	
			ent Type/Appli		all that app			
Downspout	Oil/Water Separation		Filtration (media)		L	Ion exchange colum	n	Stormwater
Drain Inlet Insert	Settling		Filtration (fabric)			Reverse osmosis		Groundwater
Below Ground Vault	Hydrodynamic Separ	ation	Filtration (biofiltr	ation)		Electrocoagulation		Wastewater
Above Ground Vault	Floatables Baffle		Filtration (chemic	ally enhanced)		Chemical Treatment		Process water
			Estima	ted Costs				
Estimated Installation Estimated Annual O&N	•	,	k treatment flow	/ rate):	low: low:	.,	high: high:	,
			System Hyd	raulics/Desig	<u>yn</u>			
Design Flow Rate (gpm	):		low:	148	high:	8,858		
System aboveground f	ootprint (sq ft):		low:	0	high:	0	-	
Required head loss (ft)	:		low:	0	high:	0	-	
Internal or External By	pass:			Internal (Extern	nal in Some Si	tuations)		
			Svstem P	erformance				
Briefly describe how days of the Nutrient Separating Breports are being listed b	affle Box has been in	•				been performed c	on the system. For t	this reason several
City of Santa Monica fie Brevard County field tes NJ CAT Full Scale Labra	ting is independent a			,	ntic			
Santa Monica Independe	nt Field Data							
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L	): 366	not tested	4	not tested	not tested	not tested	not tested	

	ld Data TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Vedian Influent (mg/L):	366	not tested	4	not tested	not tested	not tested	
Median Effluent (mg/L):	48						not tested
Median Removal (%):	-	not tested	n/d	not tested	not tested	not tested	not tested
viedian Removal (%):	86.8	not tested	>99%	not tested	not tested	not tested	not tested
٦		Total Metals		C	issolved Met	als	Nutrients
-	Cu	Pb	Zn	Cu	Pb	Zn	ТР
Median Influent (mg/L):	0.07	not tested	0.318	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	0.042	not tested	0.222	not tested	not tested	not tested	not tested
Median Removal (%):	40	not tested	30.25	not tested	not tested	not tested	not tested
							1
Brevard County Stormwater M	Ionitoring - Micco	Basin					
,	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	16.55	not tested	not tested	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	8.63	not tested	not tested	not tested	not tested	not tested	not tested
Median Removal (%):	47.9	not tested	not tested	not tested	not tested	not tested	not tested
			•				•
		Total Metals		D	issolved Met	als	Nutrients
-	Cu	Pb	Zn	Cu	Pb	Zn	TP
Median Influent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	0.055
Median Effluent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	0.0425
Median Removal (%):	not tested	not tested	not tested	not tested	not tested	not tested	23
Brevard County Storwater Mor	nitoring - Indiatla	ntic					
	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	32.9	not tested	not tested	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	7.6	not tested	not tested	not tested	not tested	not tested	not tested
Median Removal (%):	76.9	not tested	not tested	not tested	not tested	not tested	not tested
							•
		Total Metals		D	issolved Met	als	Nutrients
	Cu	Pb	Zn	Cu	Pb	Zn	TP
Mandlers Influence (man/1)	not tested	not tested	not tested	not tested	not tested	not tested	1.49
iviedian influent (mg/L):			h a t t a t t a	not tested	not tested	not tested	0.44
Median Influent (mg/L): Median Effluent (mg/L):	not tested	not tested	not tested	not testeu	not testeu	not testeu	0.44

	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	varies	not tested	not tested	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	varies	not tested	not tested	not tested	not tested	not tested	not tested
Median Removal (%):	67.3	not tested	not tested	not tested	not tested	not tested	not tested
		Total Metals		D	issolved Met	als:	Nutrients
	Cu	Pb	Zn	Cu	Pb	Zn	TP
Median Influent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	not tested	not tested	not tested	not tested	not tested	not tested	not tested
Median Removal (%):	not tested	not tested	not tested	not tested	not tested	not tested	not tested
Atlantic Beach Baffle Box Teas	sting - 5th St						
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	85	not tested	not tested	not tested	not tested	not tested	not tested
Median Effluent (mg/L):	27	not tested	not tested	not tested	not tested	not tested	not tested
Median Removal (%):	68	not tested	not tested	not tested	not tested	not tested	not tested
		Total Metals		D	issolved Met	als	Nutrients
	Cu	Pb	Zn	Cu	Pb	Zn	TP
Median Influent (mg/L):	0.017	0.014	0.088	not tested	not tested	not tested	0.31
Median Effluent (mg/L):	0.01	0.0065	0.038	not tested	not tested	not tested	0.21
Median Removal (%):	41	54	57	not tested	not tested	not tested	32

Notes, Comments, Additional References

The Nutrient Separating Baffle Box employees screening, three chambered hydrodynamic spearation and absoptive polymer media for the removal of gross solids, TSS, particulate pollutants and hydrocarbons. To see how the system operates visit:

http://www.biocleanenvironmental.com/video/?path=/content/product/ns\_baffle\_box/NS\_Baffle\_Box-Product\_Video.flv&w=768&h=576

THE PATENTED SEPARATION AND DRY STATE STORAGE OF GROSS SOLIDS SUCH AS LEAVES AND GRASS CLIPPINGS MINIMIZES NUTRIENT LOADS SEE FOLLOWING ARTICLE http://www.biocleanenvironmental.com/content/product/ns\_baffle\_box/Brochure%20-%20Leaching%20Article%20-%20NSBB.pdf

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Manufacturer:	Kristar Ent	terprises, Inc.		Contact Na	me:	Mich	ael Kimberlain	
Name of Technology:	Per	k Filter	-	Contact Em	ail:	mkimberl	ain@kristar.com	
# of Installations in			_	Contact Ph	one:	(80	00) 579-8819	_
Washington:		15	_	Contact We	ebsite:	www	.kristar.com	_
		Treatr	ment Type/A	oplication	(check all t	hat apply)		
Downspout 🗸	Oil/Water Sep	parartion	✓ Filtration (med	ia)		Ion exchange colun	nn	Stormwater
Drain Inlet Insert	Settling		Filtration (fabri	ic)		Reverse osmosis		Groundwater
✓ Below Ground Vault	Hydrodynami	c Separation	Filtration (biofi	Itration)		Electrocoagulation		Wastewater
Above Ground Vault	Floatables Ba	ıffle	Filtration (chen	nically enhanced		Chemical Treatmen	t	Process water
			Est	imated Co	sts			
Estimated Installation Cos	t:	low:	\$10,000	high:	\$200,000			
Estimated Annual O&M Co		low:		high:	\$10,000	_		
			System I	Hydraulics	/Design			
Design Flow Rate (gpm):		low:	-	high:	1,000			
System footprint (sq ft):		low:		high:	1,000	_		
Required head loss (ft):		low:		high:	3.5	_		
			iternal		5.5	_		
Internal or External Bypas	5:	In	iternai					
Internal or External Bypas Breifly describe how data Internal lab testing performed b	were colec	<b>ted (field, la</b> ird party lab te	<i>Syster</i> ab, third party,		e, auto-com		reet Sweeipings" tes	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b	were colec	<b>ted (field, la</b> ird party lab te	<i>Syster</i> ab, third party,	grab sample	e, auto-com		reet Sweeipings" tes	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b	were colec y Kristar. Thi ng for GULD I	t <b>ed (field, la</b> ird party lab te by Herrera.	Syster	grab sample ed by CSUS - C	e, auto-com DWP for TSS an	d subsequent "st		ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi	were colec	<b>ted (field, la</b> ird party lab te	<i>Syster</i> ab, third party,	grab sample	e, auto-com		reet Sweeipings" tes CPAHs 20	ting for metals and
Internal or External Bypas	were colec y Kristar. Thi ng for GULD I	ted (field, la ird party lab te by Herrera. TPH	Syster ab, third party, esting was perform Oil & grease	grab sample ed by CSUS - C	e, auto-com DWP for TSS an	d subsequent "st	СРАНѕ	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi Median Influent (mg/L): Median Effluent (mg/L):	were colec y Kristar. Thi ng for GULD b TSS 70	ted (field, la ird party lab te by Herrera. TPH 20	System ab, third party, esting was perform Oil & grease 20	grab sample ed by CSUS - C	e, auto-com DWP for TSS an	d subsequent "st	<b>CPAHs</b> 20	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi Median Influent (mg/L): Median Effluent (mg/L):	were colec y Kristar. Thi ng for GULD b TSS 70 11	tted (field, la ird party lab te by Herrera. TPH 20 5 75	System ab, third party, esting was perform Oil & grease 20 5 75	grab sample ed by CSUS - C SVOCs	e, auto-com DWP for TSS an PCBs	Dioxins	<b>CPAHs</b> 20 5	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi Median Influent (mg/L):	were colec y Kristar. Thi ng for GULD b TSS 70 11 82	tted (field, la ird party lab te by Herrera. TPH 20 5 75 Total Met	System ab, third party, esting was perform Oil & grease 20 5 75 tals	grab sample ed by CSUS - C SVOCs	e, auto-com OWP for TSS an PCBs solved Meta	Dioxins	<b>CPAHs</b> 20 5	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi Median Influent (mg/L): Median Effluent (mg/L): Median Removal (%):	were colec y Kristar. Thi ng for GULD H TSS 70 11 82 Cu	tted (field, la ird party lab te by Herrera. TPH 20 5 75 Total Met Pb	System ab, third party, esting was perform Oil & grease 20 5 75 tals Zn	grab sample ed by CSUS - C SVOCs	e, auto-com DWP for TSS an PCBs	Dioxins	<b>CPAHs</b> 20 5	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi Median Influent (mg/L): Median Effluent (mg/L): Median Influent (mg/L):	were colec y Kristar. Thi ng for GULD H TSS 70 11 82 Cu 0.052	tted (field, la ird party lab te by Herrera. TPH 20 5 75 Total Met Pb 0.15	System ab, third party, esting was perform Oil & grease 20 5 75 tals Zn 0.25	grab sample ed by CSUS - C SVOCs	e, auto-com OWP for TSS an PCBs solved Meta	Dioxins	<b>CPAHs</b> 20 5	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi Median Influent (mg/L): Median Effluent (mg/L): Median Influent (mg/L): Median Effluent (mg/L):	were colec y Kristar. Thi ng for GULD H TSS 70 11 82 Cu 0.052 0.02	tted (field, la ird party lab te by Herrera. TPH 20 5 75 Total Met Pb 0.15 0.05	System ab, third party, esting was perform Oil & grease 20 5 75 tals 2n 0.25 0.1	grab sample ed by CSUS - C SVOCs	e, auto-com OWP for TSS an PCBs solved Meta	Dioxins	<b>CPAHs</b> 20 5	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi Median Influent (mg/L): Median Effluent (mg/L): Median Influent (mg/L):	were colec y Kristar. Thi ng for GULD H TSS 70 11 82 Cu 0.052	tted (field, la ird party lab te by Herrera. TPH 20 5 75 Total Met Pb 0.15	System ab, third party, esting was perform Oil & grease 20 5 75 tals Zn 0.25	grab sample ed by CSUS - C SVOCs	e, auto-com OWP for TSS an PCBs solved Meta	Dioxins	<b>CPAHs</b> 20 5	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi Median Influent (mg/L): Median Effluent (mg/L): Median Influent (mg/L): Median Effluent (mg/L):	were colec y Kristar. Thi ng for GULD H TSS 70 11 82 Cu 0.052 0.02	tted (field, la ird party lab te by Herrera. TPH 20 5 75 75 Total Met Pb 0.15 0.05 68	System ab, third party, esting was perform Oil & grease 20 5 75 tals 2n 0.25 0.1	grab sample ed by CSUS - C SVOCs Dis Cu	PCBs	Dioxins Dioxins als Zn	<b>CPAHs</b> 20 5	ting for metals and
Internal or External Bypas Breifly describe how data Internal lab testing performed b nutrients. Third Party field testi Median Influent (mg/L): Median Effluent (mg/L): Median Influent (mg/L): Median Effluent (mg/L):	were colec y Kristar. Thi ng for GULD H TSS 70 11 82 Cu 0.052 0.02	tted (field, la ird party lab te by Herrera. TPH 20 5 75 75 Total Met Pb 0.15 0.05 68	System ab, third party, esting was perform Oil & grease 20 5 75 tals Cn 0.25 0.1 61	grab sample ed by CSUS - C SVOCs Dis Cu	PCBs	Dioxins Dioxins als Zn	<b>CPAHs</b> 20 5	ting for metals and

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Manufacturer:	ufacturer: Environment 21, LLC Contact Name						nti	
Name of Technology:	Pui	iStorm		Contact E	mail:	dino@env	<u>21.com</u>	
# of Installations in				Contact P	hone:	585-815-4714		
Washington:		0	_	Contact W	/ebsite:	www.env2	<u>1.com</u>	
	Tre	eatment Ty	/pe/Applicati	on (check	all that a	pply)		
Downspout	✓ Oil/Water Sep		Filtration (med	-		<u> </u>	ange column	Stormwater
Drain Inlet Insert	✓ Settling		✓ Filtration (fabri	c)		Reverse	osmosis	Groundwater
✓ Below Ground Vault	Hydrodynam	ic Separation	Filtration (biofi	tration)		Electroc	oagulation	Wastewater
Above Ground Vault	✓ Floatables Ba	iffle	Filtration (cher	nically enhance	ed)	Chemica	al Treatment	Process water
			Estimated	Costs				
Estimated Installation Co	st:	low:	\$3,000	high:	\$25,000			
Estimated Annual O&M	Cost:	low:	0	high:	\$10,000	-		
		Sy	stem Hydrau	lics/Desig	<u>yn</u>			
Design Flow Rate (gpm):		low:	0	high:	2,000	_		
System footprint (sq ft):		low:	9	high:	600			
Required head loss (ft):		low:	0	high:	0.5			
Internal or External Bypa	SS:		Both					
			System Perfo	ormance				
					_			
Breifly describe how data				ab sample	, auto-cor	nposite, et	ic.)	
Field studies are not in progre	ss at this time.	Future studies	are planned.					
	TSS	ТРН		SVOC-	PCBs	Dioxins	CPAHs	
Median Influent (mg/L):	*250	**400	Oil & grease **400	<b>SVOCs</b> **400	**400	**400	**400	
Median Effluent (mg/L):	*250	**80	**80	**80	**400	**400	**80	
Median Removal (%):	*80	**80	**80	**80	**80	**80	**80	

		Total Met	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA
Median Effluent (mg/L):	***0.04	***0.28	***0.06	NA	NA	NA
Median Removal (%):	***50	***65	NA	NA	NA	

#### Notes, Comments, Additional References

\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a d<sub>50</sub> of 60 microns was used.

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated.

\*\*\*Testing is not complete for metals; therefore, these values are estimated.



Manufacturer:	Environmen	tal Filtration, Inc.		Contact N	lame:	Lyle Cle	menson	_
Name of Technology:	Ra	aynfiltr		Contact E	mail:	<u>cei@pco</u>	nline.com	_
# of Installations in				Contact P	hone:	763-42	25-1167	
Washington:	1 (	airport)		Contact W	Vebsite:	www.ray	/nfiltr.org	
	Tre	eatment Ty	pe/Applicat	ion (check	all that a	pply)		
✓ Downspout	Oil/Water Se	-	Filtration (med				ange column	Stormwater
✓ Drain Inlet Insert	Settling		─ Filtration (fabr	ic)		Reverse	osmosis	Groundwater
Below Ground Vault	Hydrodynam	ic Separation	Filtration (biof			Electroc	oagulation	Wastewater
Above Ground Vault	Floatables Ba	affle	Filtration (chei	mically enhance	ed)	Chemica	Il Treatment	Process water
			Estimated	Costs				
Estimated Installation Cost	-	low:	531	high:		-		
Estimated Annual O&M Co	st:	low:		high:		-		
		Sys	stem Hydrau	lics/Desig	gn			
Design Flow Rate (gpm):		low:	0	high:	900	_		
System footprint (sq ft):		low:		high:		_		
Required head loss (ft):		low:		high:		_		
Internal or External Bypass	:			-				
			System Perf	ormance				
Breifly describe how data were colected (field, lab, third party, grab sample, auto-composite, etc.)								
	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	]

	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

		Total Met	als	Dissolved Metals		
	Cu	Pb	Zn	Cu	Pb	Zn
Median Influent (mg/L):						
Median Effluent (mg/L):						
Median Removal (%):						

Notes, Comments, Additional References

Costs per catch basin

<b>HERRERA</b>	Manufacturer Technology Report
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Technology Category: Technology Process:	Deep Root Partners, L.P Silva Cell Below Ground Vault	Contact Name:       Contact Email:       Contact Phone:       Contact Website	Brenda Guglielmina prenda@deeproot.cor	- ] -
# of Installations in Was	hington:	7		-
	Treatment Ty	pe/Application (check all	that apply)	
<ul> <li>Downspout</li> <li>Drain Inlet Insert</li> <li>Below Ground Vault</li> <li>Above Ground Vault</li> </ul>	<ul> <li>Oil/Water Separartion</li> <li>Settling</li> <li>Hydrodynamic Separation</li> <li>Floatables Baffle</li> </ul>	<ul> <li>Filtration (media)</li> <li>Filtration (fabric)</li> <li>Filtration (biofiltration)</li> <li>Filtration (chemically enhanced)</li> </ul>	<ul> <li>Ion exchange column</li> <li>Reverse osmosis</li> <li>Electrocoagulation</li> <li>Chemical Treatment</li> </ul>	Stormwater Groundwater Wastewater Process water
		Estimated Costs		
Estimated Installation Co Estimated Annual O&M		: 4,000-\$5,6C high: 0,000-\$ : \$100-\$200 high: \$100-\$		
Design Flow Rate (gpm): Required head loss (ft): Internal or External Bypa	n	System Hydraulics : 20"/hour high: 3"/ho /a ional	ur	
		System Performance		
erature search. The water o	quality filtering values are	e based on research by Davis at	University of Maryland an	d Hunt at the Universi
Parameter: # of sample: Median Influent (mg/L):	TSS TP	Dis. Cu Dis. Zn Dis. C	Cd Dis. Pb TPH	cPAHs PCBs
# of sample: Median Influent (mg/L): Median Effluent (mg/L):		· · · ·		cPAHs PCBs
# of sample: Median Influent (mg/L):	80% 68%	Dis. Cu     Dis. Zn     Dis. Cu       90%+     90%+     90%       mments, Additional Refer	+	cPAHs PCBs

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			100

Manufacturer:	FABCO industries	Contact Name:	Scott Gorneau
Name of Technology:	Stormbasin/Stormpod	Contact Email:	Sgorneau@fabco-industries.com
# of Installations in		Contact Phone:	207.831.2795
Washington:	<20	Contact Website:	www.fabco-industries.com
	Treatment Typ	pe/Application (check all that a	ipply)
✓ Downspout	Oil/Water Separartion	✓ Filtration (media)	☐ Ion exchange column
✓ Drain Inlet Insert	Settling	✓ Filtration (fabric)	Reverse osmosis Groundwater
✓ Below Ground Vault	Hydrodynamic Separation	Filtration (biofiltration)	Electrocoagulation Wastewater
✓ Above Ground Vault	Floatables Baffle	✓ Filtration (chemically enhanced)	Chemical Treatment Process water
		Estimated Costs	
Estimated Installation Cost:	low:	750 <b>high:</b> 2000	_
Estimated Annual O&M Cos	st: low:	200 high: 800	-
	Sys	tem Hydraulics/Design	
Design Flow Rate (gpm):	low:	50 <b>high:</b> >2500	
System footprint (sq ft):	low:	4 <b>high:</b> 200	_
Required head loss (ft):	low:	1.25 high: 2.5	_
Internal or External Bypass	bo	oth	

#### System Performance

#### Breifly describe how data were colected (field, lab, third party, grab sample, auto-composite, etc.)

FABCO stormbasin/stormpod has been tested in the lab and the field by 1st+3rd party's data was collected according to established protocols and consisted of barious methods including grab, auto, semi-auto and single event or composite samples

	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	Total P	Total N
Median Influent (mg/L):	111.9		59.5					0.57	4
Median Effluent (mg/L):	2.7		<5					0.3	1.5
Median Removal (%):	97.8		>90					47	63

	Total Metals			Dissolved Metals			Bacteria		
	Cu	Pb	Zn	Cu	Pb	Zn	ECOLI	Fecal	Enter
Median Influent (mg/L):		0.018	0.335				1550	1600	430
Median Effluent (mg/L):		0.0049	0.175				270	430	230
Median Removal (%):		73	48				83	73	47

#### Notes, Comments, Additional References

FABCO was awarded a competition bid-soil source spec for large scale municupal deployment in the urban/ms4 stormdrain system of nassau county, long island, ny. Since 2009 FABCO was installed over 2000 stormbasins. Our performance approval as part of this spec-sediment TSS removal> 50% d50: 110 um. Hydrocarbons/oil&grease: >80%. .Phosphorus: >50%. Nitrogen >40%. Bacteria. >70%. Stormbasin is a great retrofit device for industrial facilities and is considered a structural BMP for pretreatment, source control or in spcc + swpp plans.

Manufacturer	Technol	loav	Report
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HERRERA

Manufacturer: Name of Technology: Technology Category: Technology Process:	Imbrium Stormo Below Gro Sedime	ceptor und Vault		Contact N Contact E Contact P Contact V	mail: hone:	Justin Arno Jarnott@Imbrid (403) 389-9 www.imbriums	umSystems.co )593	- <u>m</u> -	
# of Installations in Was		510							
			pe/Applic		eck all th	_		_	
Downspout	✓ Oil/Water Se	eparartion	Filtration	ı (media)		lon exch	ange column	J Storn	nwater
✓ Drain Inlet Insert	✓ Settling		Filtration	(fabric)		Reverse	osmosis	Grour	ndwater
✓ Below Ground Vault	✓ Hydrodynan	nic Separation	Filtration	(biofiltration)		Electroco	agulation	Waste	ewater
Above Ground Vault	Floatables B	affle	Filtration	ı (chemically e	nhanced)	Chemica	Treatment	Proce	ess water
			Estimat	ed Costs					
Estimated Installation C	ost:	low:	\$3,000	high:	\$15,000				
Estimated Annual O&M		low:	\$500	high:		-			
			Sustanal	Ludraulia		-			
Design Flow Data (gam)		low	System F						
Design Flow Rate (gpm): Required head loss (ft):		low: 0.2		high:	11000	-			
Internal or External Bypa	<u> </u>	Inter							
		inter	IIdi						
		9	System Pe	erforman	се				
Breifly describe how dat The data detailed below is studies were conducted 3rd	aggregate of r	nany field st	udies (8) as	well as lab	studies (2)	including th	e NJCAT TA	ARP program	
Parameter: # of sample:	<b>TSS</b> 57	<b>TP</b> 38	Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	<b>TPH</b> 15	cPAHs	PCBs
Median Influent (mg/L):	159	0.275					29		
Median Effluent (mg/L):	59	0.175					4		
% Removal:	53	21.8	27.5	35.3		41.8	73		
	N	otes, Con	nments, A	dditiona	l Refere	nces			
Despite the above average squared regression value) v		ormance wh	en an accur	ate PSD is ι	sed to size	the unit. Th	erefore th	e Stormcep	tor can be

confidently and accurately sized for TSS removal goals on the order of 80% TSS, if the proper consideration like a true PSD are taken into account. Furthermore, the laboratory evaluation indicates that the Stormceptor unit can achieve DOE level performance at flow rates larger than the indicated treatment flow rate on the DOE GULD. The flow rates listed in the DOE GULD are merely a hydraulic marker within the system that indicates when the unit begins to inhibit scour from the unit.



Manufacturer:		CONTECH Construction Products Inc.	5	Cor	ntact Name:	Sean Darcy	
Name of Technology:	-	StormFilter - ZPG	_	Сог	ntact Email:	darcys@contech-cpi.com	
# of Installations in	-		_	Cor	ntact Phone:	503-258-3105	
Washington:		> 500	_	Сог	ntact Website:	contech-cpi.com	
		Treatment T	ype	/Application	(check all that	apply)	
✓ Downspout		Oil/Water Separation	$\checkmark$	Filtration (media)		✓ Ion exchange column	Stormwater
Drain Inlet Insert	$\checkmark$	Settling		Filtration (fabric)		Reverse osmosis	Groundwater
Below Ground Vault		Hydrodynamic Separation		Filtration (biofiltration	on)	Electrocoagulation	Wastewater
✓ Above Ground Vault	$\checkmark$	Floatables Baffle		Filtration (chemicall	y enhanced)	Chemical Treatment	Process water
				Estimated Co	sts		
Estimated Installation C Estimated Annual O&M		st (\$/gallon treated):			low low	0	\$2.5 M 0.00024
		Sj	yste	m Hydraulics	/Design		
Design Flow Rate (gpm)				low:	2 high		
System aboveground fo	otpi	rint (sq ft):		low:	8 high		
Required head loss (ft): Internal or External Byp	2001	Deth	avail	low:	1.8 <b>high</b>	12	
internal of External byp	d55:	Both	avai	able			
			Sy	stem Perform	nance		
Briefly describe how dat		. ,		1 1.0			<u> </u>
<ul> <li>a) Stormwater Management</li> <li>composite samples; b) Milwa</li> </ul>			•			, , , , , , , , , , , , , , , , , , ,	
weighted, peer reviewed, cor StormFilter (2008): field, third	mpos	site samples; d) EvTec Lake			, ,		

	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):	83						0.12
Median Effluent (mg/L):	23						0.062
Median Removal (%):	82						42

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Median Influent (mg/L):	0.0425	0.12	0.225	0.00464		0.0599	
Median Effluent (mg/L):	0.0335	0.0435	0.12767	0.00423		0.0532	
Median Removal (%):	47	24	62	11		15	

#### Notes, Comments, Additional References

TSS reference a; Metals references b & c; cPAHs reference d. cPAHs used Chrysene as the parameter as it was the median performance for the suite of requested analytes. Ranges were 33% to 47% for the entire suite. cPAH data contained 10% more GAC (by volume) than standard ZPG.

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Manufacturer:	Fabco	Industries		<b>Contact N</b>	ame:	Scott G	iornean	
Name of Technology:	Storn	nsafe-Helix		Contact E	mail:	Sgorneau@fab	co-industries.co	<u>m</u>
# of Installations in				Contact P	hone:	207-83	1-2795	
Washington:		none		Contact W	/ebsite:	www.fabco-ind	dustries.com	
	Tr	eatment Tv	pe/Applicati	on (check	all that a	(vlaa		
Downspout	-	-	Filtration (med				ange column	Stormwater
Drain Inlet Insert	Settling		Filtration (fabr				osmosis	Groundwater
Below Ground Vault	 ] Hydrodynam	ic Separation	Filtration (biofi				pagulation	Wastewater
Above Ground Vault	Floatables B	affle	Filtration (cher	<i>.</i>	ed)	Chemica	l Treatment	Process water
			Estimated	Costs				
Estimated Installation Cos	t:	low:	20000	high:	60000			
Estimated Annual O&M Co	ost:	low:	2000	high:	6000	-		
		Sys	stem Hydrau	lics/Desig	<u>yn</u>			
Design Flow Rate (gpm):		low:	3	high:	9			
System footprint (sq ft):		low:	160	high:	250			
Required head loss (ft):		low:	0	high:	3			
Internal or External Bypas	s:	k	ooth					
			System Perfo	ormance				
Breifly describe how data					-		•	
We have conducted lab and fiel			nline reports, we a	ire currently	undergoing	3rd party fie	ld testing at a	a wastewater
treatment plant, treating 10 acr	es of stormwa	ater runoff.						
	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	

	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

	Total Metals			Dis	solved Me	Bateria		
	Cu	Pb	Zn	Cu	Pb	Zn	Total coli	Fecal
Median Influent (mg/L):							4388	3948
Median Effluent (mg/L):							1360	934
Median Removal (%):							69	76

#### Notes, Comments, Additional References

The Stormsafe-helix technology was released in 2010. The system is designed to treat high flow rates and is generally preceeded by a pretreatment device like a hydrodynamic separator. We offer two configurations of filters that target pathogen or oil&grease, applications include: pathogen/bacteria impaired water bodies. wastewater treatment palnts w/ stormwater discharges. beach outfalls, industrial discharges.



Manufacturer:	Kristar F	nterprises, Inc.		Contact Na	me:	Mich	nael Kimberlain	
Name of Technology:	-	iard Pre-filter	-	Contact En			lain@kristar.com	
# of Installations in			-	Contact Ph	one:	-	00) 579-8819	
Washington:		2		Contact W	ebsite:	-	.kristar.com	
-			-		<u> </u>			
	✓ Oil/Water Set		nent Type/Ap	-	(check all			C Starmunstar
Downspout	_	eparartion	Filtration (med	dia)	l	Ion exchange co	olumn	✓ Stormwater
✓ Drain Inlet Insert	Settling		✓ Filtration (fabr	ric)	I	Reverse osmosi	s	Groundwater
Below Ground Vault	Hydrodynam	nic Separation	Filtration (biof	iltration)	I	Electrocoagulat	ion	Wastewater
Above Ground Vault	✓ Floatables B	affle	Filtration (che	mically enhanced	i) (i	Chemical Treatr	ment	Process water
			Esti	mated Cos	sts			
Estimated Installation C	ost:	low:	\$4,500	high:	\$4,500			
Estimated Annual O&M		low:		high:	\$300	_		
						_		
			-	lydraulics/	-			
Design Flow Rate (gpm)		low:		high:	800	_		
Syctom toothrint iso the	i i i i i i i i i i i i i i i i i i i	low:		_ high:_	16	_		
System footprint (sq ft)								
Required head loss (ft):		low:		high:	0.5	_		
	ass:		iternal	high:  n Perform				
Required head loss (ft):	ta were colec	ted (field, la	sternal Syster b, third party, a	n Performo	<i>ance</i> , auto-con		1	
Required head loss (ft): Internal or External Byp Breifly describe how da	ta were colec	ted (field, la	b, third party, f - OWP. Field Stud	n Performo	<i>ance</i> , auto-con		CPAHs	
Required head loss (ft): Internal or External Byp Breifly describe how da Lab - UCLA, Univeristy of Hav	ta were colect vaii, City of Auck	In ted (field, la kland, NZ, CSUS TPH	b, third party, f - OWP. Field Stud	m Performa grab sample ly - University a	ance :, auto-con of Hawaii an	d City of Auckland	CPAHs	
Required head loss (ft): Internal or External Byp Breifly describe how da Lab - UCLA, Univeristy of Hav Median Influent (mg/L)	ta were colect vaii, City of Auck TSS 100	In cted (field, la kland, NZ, CSUS	b, third party, f - OWP. Field Stud	m Performa grab sample ly - University a	ance :, auto-con of Hawaii an	d City of Auckland		
Required head loss (ft): Internal or External Byp Breifly describe how da Lab - UCLA, Univeristy of Hav	ta were colect vaii, City of Auck TSS 100	In ted (field, la kland, NZ, CSUS TPH 35	b, third party, g - OWP. Field Stud Oil & grease 35	m Performa grab sample ly - University o	ance :, auto-con of Hawaii an	d City of Auckland	CPAHs	
Required head loss (ft): Internal or External Byp Breifly describe how da Lab - UCLA, Univeristy of Hav Median Influent (mg/L) Median Effluent (mg/L)	ta were colec vaii, City of Auck TSS 100 20	ted (field, la dand, NZ, CSUS	b, third party, g - OWP. Field Stud Oil & grease 35 7	m Performa grab sample ly - University o	ance :, auto-con of Hawaii an	d City of Auckland	CPAHs 35	
Required head loss (ft): Internal or External Byp Breifly describe how da Lab - UCLA, Univeristy of Hav Median Influent (mg/L) Median Effluent (mg/L)	ta were colec vaii, City of Auck TSS 100 20	ted (field, la dand, NZ, CSUS	b, third party, g - OWP. Field Stud Oil & grease 35 7 80	m Performa grab sample ly - University a SVOCs	ance :, auto-con of Hawaii an	Dioxins	CPAHs 35	
Required head loss (ft): Internal or External Byp Breifly describe how da Lab - UCLA, Univeristy of Hav Median Influent (mg/L) Median Effluent (mg/L) Median Removal (%):	ta were colec vaii, City of Auck TSS 100 20 80 Cu	ted (field, la dand, NZ, CSUS TPH 35 7 80	b, third party, g - OWP. Field Stud Oil & grease 35 7 80	m Performa grab sample ly - University a SVOCs	ance ance of Hawaii an PCBs	Dioxins	CPAHs 35	
Required head loss (ft): Internal or External Byp Breifly describe how da Lab - UCLA, Univeristy of Hav Median Influent (mg/L) Median Removal (%): Median Influent (mg/L)	ta were colec vaii, City of Auck TSS 100 20 80 Cu	ted (field, la dand, NZ, CSUS TPH 35 7 80 Total Met	Syster b, third party, g - OWP. Field Stud Oil & grease 35 7 80 tals Zn 10	m Performo grab sample ly - University o SVOCs	ance ance of Hawaii an PCBs solved Me	Dioxins tals	CPAHs 35	
Required head loss (ft): Internal or External Byp Breifly describe how da Lab - UCLA, Univeristy of Hav Median Influent (mg/L) Median Effluent (mg/L) Median Removal (%):	ta were colec vaii, City of Auck TSS 100 20 80 Cu	ted (field, la dand, NZ, CSUS TPH 35 7 80 Total Met	Syster b, third party, g - OWP. Field Stud Oil & grease 35 7 80 tals Zn	m Performo grab sample ly - University o SVOCs	ance ance of Hawaii an PCBs solved Me	Dioxins tals	CPAHs 35	

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Manufacturer:		Kristar En	terprises, Inc.		Contact Na	me:	N	1ichael Kimberlain		
Name of Technology:		TreePc	d Biofilter	-	Contact En	nail:	<u>mkimb</u>	erlain@kristar.com	_	
# of Installations in					Contact Ph	one:		(800) 579-8819	_	
Washington:	-		0	-	Contact W	ebsite:	WV	vw.kristar.com	_	
			Treatr	nent Type/A	Application	(check all t	hat apply)			
Downspout	$\checkmark$	Oil/Water Sep		Filtration (me			Ion exchange co	blumn	$\checkmark$	Stormwater
Drain Inlet Insert	$\checkmark$	Settling		Filtration (fat	oric)		Reverse osmosi	5		Groundwater
Below Ground Vault		Hydrodynami	c Separation	Filtration (bid	,		Electrocoagulati	on		Wastewater
✓ Above Ground Vault	$\checkmark$	Floatables Ba	ffle	Filtration (ch	emically enhanced	i) 🗌	Chemical Treatr	nent		Process water
					timated Co	osts				
Estimated Installation C	`oct		low:	-	high:	\$50,000				
Estimated Annual O&M			low:		high:	\$750	_			
						•				
				System	Hydraulics	s/Design				
Design Flow Rate (gpm)			low:	16	high:	72				
System footprint (sq ft):			low:	24	high:	84				
Required head loss (ft):			low:	0	high:	0.5				
Internal or External Byp	ass	:	In	ternal	_					
				Syst	em Perforn	nance				
Breifly describe how da	ta v	vere colec	ted (field, la	-	-		posite, etc.)			
Breifly describe how data Internal Hydraulic testing onl				ab, third party	, grab sampl	e, auto-com				
				ab, third party	, grab sampl	e, auto-com				
				ab, third party	, grab sampl	e, auto-com				
				ab, third party	, grab sampl	e, auto-com				
				ab, third party	r, grab sampl	e, auto-com		СРАНѕ		
	ly co	mpleted at t	this time. UNH	ab, third party field study for p	r, grab sampl	e, auto-com rently under w	vay.	CPAHs TBD		
Internal Hydraulic testing onl	ly co	mpleted at t	this time. UNH TPH	ab, third party field study for p Oil & grease	r, grab sampl	e, auto-com rently under w	vay.			
Internal Hydraulic testing onl Median Influent (mg/L):	ly co	mpleted at t TSS TBD	this time. UNH <b>TPH</b> TBD	ab, third party field study for p Oil & grease	r, grab sampl	e, auto-com rently under w	vay.	TBD		
Internal Hydraulic testing onl Median Influent (mg/L): Median Effluent (mg/L):	ly co	TSS TBD TBD	TPH TBD TBD TBD TBD	Ab, third party field study for p Oil & grease TBD TBD TBD	e SVOCs	e, auto-com rently under v PCBs	Dioxins	TBD TBD		
Internal Hydraulic testing onl Median Influent (mg/L): Median Effluent (mg/L):	ly co	TSS TBD TBD TBD TBD	TPH TBD TBD TBD TBD TBD	ab, third party field study for p Oil & grease TBD TBD TBD	e SVOCs	e, auto-com rently under v PCBs ssolved Met	Dioxins	TBD TBD		
Internal Hydraulic testing onl Median Influent (mg/L): Median Effluent (mg/L): Median Removal (%):	iy co : :	TSS TBD TBD TBD TBD TBD	TPH TBD TBD TBD TBD TBD TBD	ab, third party field study for p Oil & grease TBD TBD TBD TBD TBD	e SVOCs	e, auto-com rently under v PCBs ssolved Met Pb	Dioxins als Zn	TBD TBD		
Internal Hydraulic testing onl Median Influent (mg/L): Median Effluent (mg/L): Median Removal (%): Median Influent (mg/L):	i i	TSS TBD TBD TBD TBD TBD TBD	TPH TBD TBD TBD TBD Total Met Pb TBD	Ab, third party field study for p Oil & grease TBD TBD TBD TBD TBD	syocs     Svocs     Dis     Cu     TBD	e, auto-com rently under v PCBs ssolved Met Pb TBD	Dioxins Dioxins als TBD TBD	TBD TBD		
Internal Hydraulic testing onl Median Influent (mg/L): Median Effluent (mg/L): Median Removal (%):	i i	TSS TBD TBD TBD TBD TBD	TPH TBD TBD TBD TBD TBD TBD	ab, third party field study for p Oil & grease TBD TBD TBD TBD	e SVOCs	e, auto-com rently under v PCBs ssolved Met Pb	Dioxins als Zn	TBD TBD		

Notes, Comments, Additional References



# HERRERA Manufacturer Technology Report

Manufacturer:	REM, Inc. (Revel Env Manufacturi		Contact N	ame:	Marcel Sloa	ne		
Name of Technology:	TRITON Drop Inle	et Insert	Contact E	mail:	marcel@remfil	ters.com	-	
Technology Category:			Contact P		(925) 858-80		-	
Technology Process:			Contact W	/ebsite:	remfilters.co	om	-	
# of Installations in Wasl	nington:	Estimated: 100						
			oplication (c	heck all t	hat apply)			
Downspout	Oil/Water Separ	artion 🗸 Fil	tration (media)		lon exchai	nge column	✓ Storm	nwater
✓ Drain Inlet Insert	Settling		tration (fabric)		Reverse o	smosis	Grour	ndwater
Below Ground Vault	Hydrodynamic S	Separation 🗌 Fil	tration (biofiltration)		Electrocoa	gulation	Waste	ewater
Above Ground Vault	Floatables Baffle	e 🗌 Fil	tration (chemically e	nhanced)	Chemical <sup>-</sup>	Treatment	Proce	ss water
		Est	imated Costs	5				
Estimated Installation Co	ost:	low: \$10	0 high:	\$700	_			
Estimated Annual O&M	Cost:	<b>low:</b> \$40	high:	\$120	_			
		Svst	em Hydrauli	cs				
Design Flow Rate (gpm):		low: 76		9233				
Required head loss (ft):		.5"			_			
Internal or External Bypa	Inter	rnal 721 gpm to	23,000 gpm		_			
		Syste	m Performar	nce				
			-					
Breifly describe how dat								
Treatment flow rates will va of the specific catch basin.			-	-				
								Surations
								1
Parameter:	TSS	TP Dis.	Cu Dis. Zn	Dis. Cd	Dis. Pb	ТРН	cPAHs	PCBs
# of sample: Median Influent (mg/L):								
Median Effluent (mg/L):								
% Removal:								
	Not	es, Commen	ts, Addition	al Refere	ences			
See attached University of (	California, Irvine	Testing Protoco	ls and Results	-				

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Manufacturer: AbTech Industries				Contact Name	e:	Jonathan Thatcher				
Name of Technology:		Ultra Urban Filter		Contact Email: j			jthatcher@abtechindustries.com			
# of Installations in				Contact Phon	e:	(480) 874-4000				
Washington:				Contact Web	site:	abtechindustrie	s.com			
		Treatment 1	Гуре,	Application (check all	that a	pply)				
Downspout	$\checkmark$	Oil/Water Separation	$\checkmark$	Filtration (media)		lon excha	nge column	Stormwater		
✓ Drain Inlet Insert		Settling		Filtration (fabric)		Reverse of	smosis	Groundwater		
Below Ground Vault		Hydrodynamic Separation		Filtration (biofiltration)		Electroco	agulation	Wastewater		
Above Ground Vault		Floatables Baffle		Filtration (chemically enhanced)		Chemical	Treatment	✓ Process water		
			I	Estimated Costs						
Estimated Installation C	Cost	(unit cost and constru	uctior	i cost):	low:	\$400	high:	\$1,700		
Estimated Annual O&M	l Cos	st (\$/gallon treated):			low:		high:			
		S	ystei	m Hydraulics/Design						
Design Flow Rate (gpm)	):			low: 190	high:	500				
System aboveground for	otp	rint (sq ft):		low: 0	high:					
Required head loss (ft):				low: 0.5	high:	1.5				
Internal or External Byp	ass:	Inte	rnal By	rpass						
			Sys	tem Performance						

#### Briefly describe how data were collected (field, lab, third party, grab sample, auto-composite, etc.)

Primary analysis of AbTech Industries Ultra Urban Filter (UUF) was conducted in laboratory studies conducted by third parties using grab samples from established test protocols developed by federal and state regulatory entities. Field data was collected during studies conducted by municipalities to evaluate the effectiviness of the UUFs for deployment in the localized watershed. The testing methods used by the municipalities were governed by the state regulatory body, in which that municipality was located.

	TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs
Median Influent (mg/L):		>100	>100	180			>100
Median Effluent (mg/L):		<10	<10	>4.4			>10
Median Removal (%):	*80%	90%	85%	**40%			**60%

		Total Met	als	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn	
Median Influent (mg/L):							
Median Effluent (mg/L):							
Median Removal (%):							

#### Notes, Comments, Additional References

\* Data based on Particle Size Distribution (PSD) and not on mg/L. Samples tested were evaluated using a medium sand in the 0.355-0.300 mm range. \*\*Reduction of soluble dissolved hydrocarbons occurs when they become partitioned in the dispersed hydrocarbons and are removed simultaneously. Filtration of dissolved phase hydrocarbons through AbTech's UUFs will not occur, in substantial percent volumes, without the presence of dispersed hydrocarbons. Bench scale testing can be conducted on field samples to establish viability in a specific environment or to meet a specific discharge standard.

Total Metals Removal: Based on TSS testing the UUF has the ability to physically separate Total Metals from the water column, but AbTech products have no Chemical or Biological exchange during the filtration of Total Metals.

HERRERA
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Manufacturer:	Environ	Environment 21, LLC Contact Name:				Dino Pezzimenti					
Name of Technology:	Un	iScreen		Contact Er	mail:	dino@env	21.com				
# of Installations in			Contact Phone:			585-815-4714					
Washington:		0		Contact W	/ebsite:	www.env2	<u>1.com</u>				
	Tr	eatment Tv	pe/Applicati	on (check	all that a	(vlaa					
Downspout	✓ Oil/Water Se		Filtration (med	•		· <u> </u>	ange column	Stormwater			
Drain Inlet Insert [	✓ Settling		Filtration (fabri	c)		Reverse	osmosis	Groundwater			
Below Ground Vault	Hydrodynam	ic Separation	Filtration (biofi	tration)		Electroc	oagulation	Wastewater			
Above Ground Vault	✓ Floatables Ba	affle	Filtration (chen	nically enhance	ed)	Chemica	al Treatment	Process water			
			Estimated	Costs							
Estimated Installation Cos	st:	low:	\$2,000	high:	\$15,000						
Estimated Annual O&M C	ost:	low:	0	high:	\$2,000	_					
System Hydraulics/Design											
Design Flow Rate (gpm):		low:	0	high:	15,700	_					
System footprint (sq ft):		low:	20	high:	135	_					
Required head loss (ft):		low:	0	high:	0.5	_					
Internal or External Bypas	55:	B	oth								
			System Perfo	ormance							
	_										
Breifly describe how data				ab sample	, auto-cor	nposite, et	ic.)				
Field studies are not in progres	s at this time.	Future studies a	ire planned.								
L											
	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs				
Median Influent (mg/L):	*250	**400	**400	**400	**400	**400	**400				
Median Effluent (mg/L):	*175	**150	**150	**150	**150	**150	**150				
Median Removal (%):	*80	**62.5	**62.5	**62.5	**62.5	**62.5	**62.5				

		Total Met	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA
Median Effluent (mg/L):	***0.06	***0.56	***0.18	NA	NA	NA
Median Removal (%):	***20	***27	***40	NA	NA	NA

#### Notes, Comments, Additional References

\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a d<sub>50</sub> of 150 microns was used.

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated.

\*\*\*Testing is not complete for metals; therefore, these values are estimated.

Manufacturer:	Environr	nent 21, LLC		Contact N	ame:	Dino Pezzimer	nti					
Name of Technology:	Un	iStorm		Contact Er	mail:	<u>dino@env</u>	21.com					
# of Installations in			Contact Phone:			585-815-4714						
Washington:		0		Contact W	/ebsite:	www.env2	21.com					
	Treatment Type/Application (check all that apply)											
Downspout	Oil/Water Sep		Filtration (med	•		· <u> </u>	nange column	Stormwater				
□ Drain Inlet Insert ✓	Settling		Filtration (fabri	c)		Reverse	osmosis	Groundwater				
Below Ground Vault	Hydrodynam	c Separation	Filtration (biofil	tration)		Electroc	oagulation	Wastewater				
Above Ground Vault	Floatables Ba	ffle	Filtration (chen	nically enhance	ed)	Chemica	al Treatment	Process water				
			Estimated	Costs								
Estimated Installation Cost		low:	\$2,000	high:	\$15,000							
Estimated Annual O&M Co	st:	low:	0	high:	\$2,000	_						
System Hydraulics/Design												
Design Flow Rate (gpm):		low:	0	high:	15,700	_						
System footprint (sq ft):		low:	20	high:	135	_						
Required head loss (ft):		low:	0	high:	0.5	_						
Internal or External Bypass	:	I	NA									
			System Perfo	ormance								
Breifly describe how data v	vere colect	ed (field lab	third narty gr	ah samnle	auto-coi	nnosite et	tr )					
Field studies are not in progress a			1 1 1	ab sumple	, auto coi	inposite, et	,					
		I										
	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs					
Median Influent (mg/L):	*250	**400	**400	**400	**400	**400	**400					
Median Effluent (mg/L):	*175	**150	**150	**150	**150	**150	**150					
Median Removal (%):	*80	**62.5	**62.5	**62.5	**62.5	**62.5	**62.5					

		Total Met	Dissolved Metals			
	Cu	Pb	Zn	Cu	Pb	Zn
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA
Median Effluent (mg/L):	***0.06	***0.56	***0.18	NA	NA	NA
Median Removal (%):	***20	***27	***40	NA	NA	NA

#### Notes, Comments, Additional References

\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a  $d_{50}$  of 150 microns was used.

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated.

\*\*\*Testing is not complete for metals; therefore, these values are estimated.

Herrera Herrera	М	anufacti	urer To	echnolo	gy Rep	oort			
Manufacturer:	Hydro Int	ernational		Contact N	lame:	Fred Kraekel			
Name of Technology:		Filter®		Contact E		fkraekel@hil-te	ch.com		
Technology Category:	Below Gro	ound Vault		Contact P	hone:	207-321-373	3		
Technology Process:	Fil	ter		Contact V	Vebsite:	www.hydro-int	ernational.biz		
# of Installations in Wa	shington:			_					
	Tr	eatment 1	Гуре/Ар	oplication	(check a	ll that apply)			
Downspout	✓ Oil/Water S	eparartion	Filtrati	ion (media)		Ion exchar	ge column	✓ Sto	rmwater
Drain Inlet Insert	✓ Settling		Filtrati	ion (fabric)		Reverse os	mosis	Gro	undwater
Below Ground Vault	Hydrodyna	nic Separation	Filtrati	ion (biofiltration)	)	Electrocoa	gulation	🗌 Wa	stewater
Above Ground Vault	✓ Floatables I	Baffle	Filtrati	ion (chemically e	enhanced)	Chemical T	reatment	Pro	cess water
			Esti	imated Co	sts				
Estimated Installation (	Cost:	low:		high:		_			
Estimated Annual O&N	1 Cost:	low:		high:		_			
			Syste	em Hydrai	ulics				
Design Flow Rate (gpm	):	low:		high:		_			
Required head loss (ft):	_			_					
Internal or External Byp	pass:								
			Syster	m Perform	nance				
Briefly describe how da	ata were colle	cted (field,	lab, thire	d party, gral	b sample,	auto-compo	site, etc.)		
,				o Internation					
Parameter: # of sample: Median Influent (mg/L): Median Effluent (mg/L): % Removal:	TSS	ТР	Dis. Cu	Dis. Zn	Dis. Cd	Dis. Pb	ТРН	cPAHs	PCBs
		Notes, C	ommen	ts, Additio	onal Ref	erences			
The Lin Ele Filter® is a a	high rate				-		المرامم المرا	hand acces	isted

The Up-Flo Filter<sup>®</sup> is a a high rate, upflow filtration system designed to remove fine suspended sediment and associated pollutants like nutrients and heavy metals, depending on the type of media used. The modular, subsurface filtration system is housed in a 4-ft diameter manhole or precast vault that can be retrofitted into an existing storm drain manhole or supplied as a complete system. The design incorporates gravitational separation of floating and settling materials, screening, and filtration of stormwater flows. A siphon-activated bypass conveys flows larger than the design filtration rate for on-line installations. Pollutant removals include TSS, nutrients (i.e. phophorus), synthetic organics, pesticides, herbicides and heavy metals (iron, chromium, copper and lead). The Up-Flo FIlter was issued a PULD by Washington DOE. Contact Hydro International at 1-800-848-2706 or visit the website www. hydro-international.biz for more information.

H	ER	RE	RA

Manufacturer:	CONTECH Cons	truction Products	Inc.	Contact N	ame:	Sean	Darcy	
Name of Technology:	UrbanGr	een BioFilter	_	Contact E	mail:	darcys@cont	ech-cpi.com	
# of Installations in			_	Contact P		503-25	8-3105	
Pacific Northwest:		> 25	_	Contact W	/ebsite:	contech	-cpi.com	
	Tr	eatment T	ype/Applicati	ion (check	call that a	unnlu)		
Downspout	Oil/Water Sep		Filtration (med		( un that a	_	ange column	Stormwater
Drain Inlet Insert	Settling		Filtration (fabri			Reverse	-	Groundwater
Below Ground Vault	Hydrodynam	c Separation	Filtration (labri			_	pagulation	Wastewater
Above Ground Vault	Floatables Ba	-		,	n		Il Treatment	Process water
		IIIe	Filtration (chen	-	ed)			
			Estimated	Costs				
Estimated Installation C			ction cost):		low:	· · · · · · · · · · · · · · · · · · ·	high:	\$250K
Estimated Annual O&M	Cost (\$/galloi	n treated):			low:	0.0001	high:	0.0003
		S	ystem Hydrau	lics/Desig	gn			
Design Flow Rate (gpm)			low:	4	high:			
System aboveground fo	otprint (sq ft):		low:		high:			
Required head loss (ft):	· ·				high:	6		
Internal of External byp								
			System Perfe	ormance				
The first state is a second at			• • • • • • • • • • • •	t				
Briefly describe how dat	ta were collec	ted (field, la	ib, third party, g	rab sample	e, auto-co	mposite, e	tc.)	
an altan Influent (ma/1)	TSS	TPH	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L): Median Effluent (mg/L):								
Median Removal (%):								
Wiedian Kenioval (70).								
		Total Me	tals	Diss	olved Me	tals		
	Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L):								
Median Effluent (mg/L)								
Median Removal (%):								
		Notos C		litional D				
		Notes, co	omments, Add	litionai k	ejerence	'S		

	HERRE	RA
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Manufacturer:		Environment 21, LL	С		Contact N	ame:	Dino Pezzimer	nti	
Name of Technology:		V2B1			Contact E	mail:	dino@env	<u>21.com</u>	
# of Installations in					Contact P	hone:	585-815-4714		
Washington:		0			Contact W	/ebsite:	www.env2	<u>1.com</u>	
		Treatme	nt Typ	oe/Applicati	on (check	all that a	pply)		
Downspout	$\checkmark$	Oil/Water Separartion	[	Filtration (med	ia)		Ion exch	ange column	Stormwater
Drain Inlet Insert	$\checkmark$	Settling	[	Filtration (fabr	ic)		Reverse	osmosis	Groundwater
✓ Below Ground Vault	$\checkmark$	Hydrodynamic Separati	on [	Filtration (biofi	ltration)		Electroc	oagulation	Wastewater
Above Ground Vault	$\checkmark$	Floatables Baffle	[	Filtration (cher	nically enhance	ed)	Chemica	al Treatment	Process water
				Estimated	Costs				
Estimated Installation C	ost:		low:	\$2,000	high:	\$15,000			
Estimated Annual O&M	Cos	st:	low:	0	high:	\$2,000	-		
			Sys	tem Hydrau	lics/Desig	ŋn			
Design Flow Rate (gpm)	:		low:	0	high:	63,000	_		
System footprint (sq ft):			low:	20	high:	800	_		
Required head loss (ft):			low:	0	high:	0.5	_		
Internal or External Byp	ass:	:	Bo	oth	-				
			S	System Perfo	ormance				
Breifly describe how da						-	nposite, et	ic.)	
Third party lab studies are co	omple	ete and the field studi	ies are p	planned to begin	within one y	ear.			
		TSS TPI	4	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L)	:	*250 **40	00	**400	**400	**400	**400	**400	
Median Effluent (mg/L)		*175 **15	50	**150	**150	**150	**150	**150	
Median Removal (%):		*80 **62	.5	**62.5	**62.5	**62.5	**62.5	**62.5	

		Total Met	als	Diss	olved Metals		
	Cu	Pb	Zn	Cu	Pb	Zn	
Median Influent (mg/L):	***0.08	***0.79	***0.3	NA	NA	NA	
Median Effluent (mg/L):	***0.05	***0.35	***0.09	NA	NA	NA	
Median Removal (%):	***40	***55	***70	NA	NA	NA	

#### Notes, Comments, Additional References

\*The TSS removal efficiency is also dependent upon the Particle Size Distribution (PSD). For this product, the assumption of a PSD with a d<sub>50</sub> of 110 microns was used.

\*\*Any oil based removal depends on the droplet size and specific gravity of the oil. For this product, accurate, analyzed data is unavailable; therefore a mean oil droplet size of 100 micron and a spgr of 0.89 are used. The removal efficiencies are estimated.

\*\*\*Testing is not complete for metals; therefore, these values are estimated.



Manufacturer:	C		struction Products		Contact Na		500	. Danne	
Name of Technology:			lnc. tClarex	-	Contact In		darcys@contec	n Darcy	
# of Installations in	_	VUI	luidex	_	Contact Pl			158-3105	
Pacific Northwest:		:	>25		Contact W			h-cpi.com	
				-					
				Type/Applica		ck all that			
Downspout	_	Dil/Water Sep	baration	✓ Filtration (medi	ia)		lon excha	ange column	✓ Stormwater
Drain Inlet Insert	V 9	Settling		Filtration (fabri	c)		Reverse	osmosis	Groundwater
Below Ground Vault	L F	Hydrodynami	c Separation	Filtration (biofil	tration)		Electroco	agulation	Wastewater
Above Ground Vault	F	loatables Ba	ffle	Filtration (chen	nically enhance	d)	Chemical	Treatment	Process water
				Estimate	d Costs				
Estimated Installation (	Cost (ι	unit cost a	and construe	ction cost):		low	\$10K	high:	\$300K
Estimated Annual O&N	1 Cost	(\$/gallor	treated):			low	0.00008	high:	0.001
			S	System Hydra	ulics/Des	ign			
Design Flow Rate (gpm)	-			low:	100	high	2000		
System aboveground for		nt (sq ft):		low:		high	·		
Required head loss (ft):				low:	0.1	high			
Internal or External Byp	pass:		Both	available					
				System Per	formance	?			
Briefly describe how da		re conect	leu (fielu, fa	o, third party, g		<i>; auto-co</i>	mposite, ei		
		TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	
Median Influent (mg/L)	):								
Median Effluent (mg/L)									
Median Removal (%):									
	_								
	_		Total Met		-	olved Me			
		Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L)									
Median Effluent (mg/L)	):								
Median Removal (%):									
			Notos (		ا مانان ما	Deferrer			
			Notes, C	`omments, Ad	aitional	kejeren	ces		



Manufacturer:	(		struction Products, Inc.	,	Contact Na	ame:	Sean D	larcy	
Name of Technology:	-		chs System	-	Contact Er		darcys@contech-		-
# of Installations in	-	vortes	and by seem	-	Contact Ph		503-258		-
Washington:	_	;	> 100	_	Contact W	ebsite:	contech-o		-
			Treatment	Type/Applica	tion (che	ck all tha	t annly)		
Downspout	$\checkmark$	Oil/Water Se		Filtration (med			Ion exchan	ge column	Stormwater
Drain Inlet Insert		Settling		Filtration (fabri			Reverse os		Groundwater
Below Ground Vault		0	ic Separation	Filtration (biofil			Electrocoac		
_		Floatables Ba			-				Wastewater
Above Ground Vault	<b></b>		ine	Filtration (chen	,	d)	Chemical T	reatment	Process water
				Estimate	ed Costs				
Estimated Installation C	ost (	unit cost	and construe	ction cost):		low	\$20K	high:	\$500K
Estimated Annual O&M	Cost	t (\$/gallo	n treated):			low	\$0.00001	high:	\$0.00004
				System Hydra	ulics/Des	sign			
Design Flow Rate (gpm)	:		·	low:	50	high	22450		
System aboveground fo		int (sq ft)	:	low:	NA	high			
Required head loss (ft):				low:	0.1	high			
Internal or External Byp	ass:		Both	Available					
				System Per	formance	2			
		TSS	ТРН	Oil & grease	SVOCs	PCBs	Dioxins	CPAHs	SSC<50 um
Median Influent (mg/L)	:	108		On & grease	50003	1 603	DIOXIIIS	CIAIIS	24
Median Effluent (mg/L)		28							8
Median Removal (%):		93							70
	г							1	
			Total Met		_	solved N			
		Cu	Pb	Zn	Cu	Pb	Zn		
Median Influent (mg/L) Median Effluent (mg/L)									
Median Removal (%):	•								
incular nemotal (70).								L	
			Notes (	Comments, Ad	ditional	Referen	res		
			10103, (		antionur	nejeren			

# **Technology Product Information**

#### Appendix C Index (by Treatment System Name)

					Graphic/	O&M		
Treatment System Name	Manufacturer/Vendor Name	Brochure	Drawings	Specs	Schematic	Manual	Testing	Other
Active Treatment Systems								
ACISTBox®	Water Tectonics, Inc.	Х						
Arkal Filter (Spin Klin System)	Arkal Filtration Systems/PEP (U.S. Distributor)					Х		
Arkal Media Filter	Arkal Filtration Systems/PEP (U.S. Distributor)	Х						
Baker Tank with Sand Filter	BakerCorp	Х		Х				
Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup>	Clear Creek Systems					Х	Х	
Fuzzy Filter	Schreiber	Х		Х	Х		Х	
High-Flo Electrocoagulation	Kaselco			Х			Х	
OilTrap ElectroPulse Water Treatment System	OilTrap Environmental	Х		Х			Х	
pHATBox®	Water Tectonics, Inc.	Х						
Purus® Stormwater Polishing System	StormwateRx	Х						
Redbox	Morselt Borne BV	Х						
Wastewater Ion Exchange System (WWIX)	Siemens Water Technologies Inc.	Х						
WaterTrak Ion Exchange	Aquatech	Х				Х		
WaterTrak Pressurized Media Filter	Aquatech	Х				Х		
WaterTrak Reverse Osmosis	Aquatech	Х				Х		
WaterTrak Ultrafiltration	Aquatech	Х				Х		
WaveIonics <sup>TM</sup>	Water Tectonics, Inc.	Х					Х	
Wetsep	Waste & Environmental Technologies Ltd.	Х		Х	Х			
Passive Treatment Systems								
ADS® Water Quality Unit	Advanced Drainage Systems, Inc	Х	Х			Х	Х	Х
Adsorb-It	Eco-Tec, Inc.	Х	Х				Х	Х
Aqua Shield Aqua-Filter System	AquaShieldTM, Inc.	Х		Х		Х		Х
Aqua Shield Aqua-Swirl Concentrator	AquaShieldTM, Inc.	Х			Х	Х		Х
Aqua-Guardian <sup>TM</sup> Catch Basin Insert	AquaShieldTM, Inc.	Х				Х		Х
Aquip® Enhanced Stormwater Filtration System	StormwateRx	Х			Х			
BayFilter®	BaySaver Technologies, Inc.		Х	Х			Х	Х
BaySeparator®	BaySaver Technologies, Inc.		Х	Х			Х	Х
Bio Clean Curb Inlet Basket	BioClean Environmental Services, Inc.	Х	Х	Х			Х	
Bio Clean Downspout Filter	BioClean Environmental Services, Inc.	Х	Х				Х	
Bio Clean Flume Filter	BioClean Environmental Services, Inc.	Х						Х
Bio Clean Grate Inlet Skimmer Box	BioClean Environmental Services, Inc.	Х						Х
Bio Clean Trench Drain Filter	BioClean Environmental Services, Inc.	Х						Х
Bio Clean Water Polisher	BioClean Environmental Services, Inc.	Х	Х					
BioSTORM	Bio-Microbics, Inc.	Х	Х			Х		Х
CDS <sup>TM</sup> Stormwater Treatment System	CONTECH Stormwater Solutions Inc.	Х	Х	Х		Х		
Clara® Gravity Stormwater Separator Vault	StormwateRx	Х			Х			
Clean Way Downspout Filtration Unit	Clean Way	X						Х
ClearWater BMP	ClearWater Solutions, Inc.	X	Х			Х		
Coanda Curb Inlet Filter	Coanda, Inc.	X	X	Х			Х	
Coanda Downspout Filter	Coanda, Inc.	X						

#### Appendix C Index (by Treatment System Name)

					Graphic/	O&M		
Treatment System Name	Manufacturer/Vendor Name	Brochure	Drawings	Specs	Schematic	Manual	Testing	Other
Passive Treatment Systems (cont.)								
CrystalClean Separator	CrystalStream Technologies	Х	Х				Х	Х
CrystalCombo Hybrid Polisher	CrystalStream Technologies	Х			Х		Х	Х
Downstream Defender	Hydro International, Inc.	Х	Х	Х		Х		Х
DrainPac <sup>TM</sup>	United Storm Water, Inc.		Х	Х		Х	Х	Х
ecoLine A®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	Х	Х					
ecoLine B®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	Х	Х		Х	Х		Х
EcoSense <sup>TM</sup> Stormwater Filtration Systems	EcoSense International	Х			Х		Х	
ecoSep®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	Х	Х	Х		Х		Х
ecoStorm ®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	Х	Х	Х	Х	Х		Х
ecoStorm Plus®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	Х	Х	Х	Х	Х		Х
ecoTop®	Royal Environmental Systems, Inc./Water Tectonics, Inc.	Х	Х	Х				
EcoVault <sup>TM</sup> Baffle Box	EcoSense International	Х					Х	
Enviro-Drain®	Enviro-Drain, Inc.	Х	Х					
EnviroSafe <sup>TM</sup>	Transpo Industries, Inc.	Х						
EnviroSafe <sup>TM</sup> Storm Safe HF10	Transpo Industries, Inc.	Х				Х		
EnviroTrap Catch Basin Insert	Environment 21	Х	Х	Х			Х	
Filterra® Roofdrain System	Filterra, DBAAmericast, Inc.		Х		Х	Х		Х
Filterra® System	Filterra, DBAAmericast, Inc.		Х		Х	Х		Х
First Flush 1640FF	ABT, Inc.	Х	Х					
FloGard+PLUS®	Kristar Enterprises, Inc.	Х	Х			Х		Х
FloGard® Downspout Filter	Kristar Enterprises, Inc.	Х	Х			Х		
FloGard® Dual-Vortex Hydrodynamic Separator	Kristar Enterprises, Inc.	Х	Х			Х		
FloGard® LoPro Matrix Filter	Kristar Enterprises, Inc.	Х	Х			Х		
FloGard® LoPro Trench Drain Filter	Kristar Enterprises, Inc.	Х	Х			Х		
Flo-Gard® Trash & Debris Guard	Kristar Enterprises, Inc.	Х	Х			Х		
Go-Filter	AquaShieldTM, Inc.	Х						Х
Hancor Storm Water Quality Unit	Hancor, Inc.	Х		Х		Х	Х	Х
HUBER Hydro Filt	Huber Technology, Inc.	Х			Х			
HydroFilter	Hydroworks				Х			
HydroGuard	Hydroworks	Х	Х			Х	Х	Х
Hydro-Kleen <sup>™</sup>	ACF Environmental, Inc.	Х			Х			Х
Inceptor®	Stormdrain Solutions	Х					Х	Х
Jellyfish <sup>TM</sup> Filter	Imbrium Systems Corp	X	Х	Х		Х		X
•	Brown-Minneapolis Tank Co./							
Kleerwater <sup>TM</sup>	Kleerwater Technologies, LLC	Х		Х	Х			Х
	Modular Wetland Systems, Inc./							
Modular Wetland System – Linear	BioClean Environmental Services, Inc.	Х	Х	Х		Х	Х	х
Nutrient Separating Baffle Box	BioClean Environmental Services, Inc.	X	X	X		23	X	21
Perimeter Sandfilter (Delaware Sandfilter)	Rotondo Environmental Solutions, LLC	<i>1</i> <b>1</b>	X	~			21	
Perk Filter <sup>TM</sup>	Kristar Enterprises, Inc.	Х	X			Х		
PSI Separator	PSI International, Inc.	~	Δ		Х	X		Х

#### Appendix C Index (by Treatment System Name)

					Graphic/	O&M		
Treatment System Name	Manufacturer/Vendor Name	Brochure	Drawings	Specs	Schematic	Manual	Testing	Other
Passive Treatment Systems (cont.)								
PuriStorm	Environment 21	Х	Х					
Raynfiltr <sup>TM</sup>	Environmental Filtration, Inc.	Х	Х					
RSF (Rapid Stormwater Filtration) 100	EcoSol Wastewater Filtration Systems	Х	Х	Х			Х	Х
RSF (Rapid Stormwater Filtration) 1000	EcoSol Wastewater Filtration Systems	Х	Х	Х			Х	Х
RSF (Rapid Stormwater Filtration) 4000	EcoSol Wastewater Filtration Systems	Х	Х	Х			Х	Х
Silva Cell	DeepRoot Partners	Х		Х	Х	Х		Х
SNOUT®	Nyloplast/Hancor, Inc.	Х						
Sorbtive <sup>TM</sup> FILTER	Imbrium Systems Corp	Х	Х			Х	Х	Х
Storm PURE <sup>TM</sup>	Nyloplast/Hancor, Inc.	Х						
StormBasin <sup>TM</sup>	Fabco Industries, Inc.	Х	Х			Х	Х	Х
Stormceptor®	Imbrium Systems Corp	Х	Х	Х		Х		Х
StormClean Catch Basin Insert	Clean Way	Х	Х					Х
StormClean Curb Inlet Insert	Clean Way	Х						Х
StormClean Wall Mount Filtration Unit	Clean Way	Х						Х
Stormfilter using ZPG Media	CONTECH Stormwater Solutions Inc.	Х	Х	Х		Х	Х	
StormPod <sup>TM</sup>	Fabco Industries, Inc.	Х	Х			Х	Х	Х
StormSafe <sup>TM</sup> Helix	Fabco Industries, Inc.	Х			Х	Х		
StormTrooper®	Park USA	Х	Х					Х
StormTrooper® EX Extra-Duty	Park USA	Х	Х					Х
SwaleGard® Pre-filter	Kristar Enterprises, Inc.	Х	Х			Х		
Terre Kleen <sup>TM</sup>	Terre Hill Concrete Products		Х	Х				Х
<b>FREEPOD®</b> Biofilter	Kristar Enterprises, Inc.	Х	Х			Х		
	Revel Environmental Manufacturing, Inc./							
Triton Drop Inlet Insert	CONTECH Stormwater Solutions Inc.	Х	Х	Х		Х	Х	
Ultra-Urban Filter <sup>TM</sup>	Abtech Industries	Х						
Underground Sandfilter (DC Sandfilter)	Rotondo Environmental Solutions, LLC		Х					
UniScreen	Environment 21	Х	Х	Х			Х	
UniStorm	Environment 21	Х	Х	Х		Х	Х	
Up-Flo <sup>™</sup> Filter	Hydro International, Inc.	Х	Х	Х		Х	Х	
UrbanGreen BioFilter	CONTECH Stormwater Solutions Inc.	X	X	X		X		Х
V2B1 Treatment System	Environment 21	Х	Х	Х			Х	
VortClarex	CONTECH Stormwater Solutions Inc.	Х	Х	Х		Х		
Vortechs System	CONTECH Stormwater Solutions Inc.	X	X	X		X	Х	Х

#### Appendix C Index (by Manufacturer/Vendor Name)

					Graphic/	O&M		
Treatment System Name	Manufacturer/Vendor Name	Brochure	Drawings	Specs	Schematic	Manual	Testing	Other
Active Treatment Systems								
Aquatech	WaterTrak Ion Exchange	Х				Х		
Aquatech	WaterTrak Pressurized Media Filter	Х				Х		
Aquatech	WaterTrak Reverse Osmosis	Х				Х		
Aquatech	WaterTrak Ultrafiltration	Х				Х		
Arkal Filtration Systems/PEP (U.S. Distributor)	Arkal Filter (Spin Klin System)					Х		
Arkal Filtration Systems/PEP (U.S. Distributor)	Arkal Media Filter	Х						
BakerCorp	Baker Tank with Sand Filter	Х		Х				
Clear Creek Systems	Chitosan-Enhanced Sand Filtration Using FlocClear <sup>™</sup>					Х	Х	
Kaselco	High-Flo Electrocoagulation			Х			Х	
Morselt Borne BV	Redbox	Х						
OilTrap Environmental	OilTrap ElectroPulse Water Treatment System	Х		Х			Х	
Schreiber	Fuzzy Filter	Х		Х	Х		Х	
Siemens Water Technologies Inc.	Wastewater Ion Exchange System (WWIX)	Х						
StormwateRx	Purus® Stormwater Polishing System	Х						
Waste & Environmental Technologies Ltd.	Wetsep	Х		Х	Х			
Water Tectonics, Inc.	ACISTBox®	Х						
Water Tectonics, Inc.	pHATBox®	Х						
Water Tectonics, Inc.	WaveIonics <sup>TM</sup>	Х					Х	
Passive Treatment Systems								
ABT, Inc.	First Flush 1640FF	Х	Х					
Abtech Industries	Ultra-Urban Filter <sup>™</sup>	Х						
ACF Environmental, Inc.	Hydro-Kleen <sup>TM</sup>	Х			Х			Х
Advanced Drainage Systems, Inc	ADS® Water Quality Unit	Х	Х			Х	Х	Х
AquaShieldTM, Inc.	Aqua Shield Aqua-Filter System	Х		Х		Х		Х
AquaShieldTM, Inc.	Aqua Shield Aqua-Swirl Concentrator	Х			Х	Х		Х
AquaShieldTM, Inc.	Aqua-Guardian <sup>™</sup> Catch Basin Insert	Х				Х		Х
AquaShieldTM, Inc.	Go-Filter	Х						Х
BaySaver Technologies, Inc.	BayFilter®		Х	Х			Х	Х
BaySaver Technologies, Inc.	BaySeparator®		Х	Х			Х	Х
BioClean Environmental Services, Inc.	Bio Clean Curb Inlet Basket	Х	Х	Х			Х	
BioClean Environmental Services, Inc.	Bio Clean Downspout Filter	Х	Х				Х	
BioClean Environmental Services, Inc.	Bio Clean Flume Filter	X						Х
BioClean Environmental Services, Inc.	Bio Clean Grate Inlet Skimmer Box	Х						Х
BioClean Environmental Services, Inc.	Bio Clean Trench Drain Filter	X						X
BioClean Environmental Services, Inc.	Bio Clean Water Polisher	X	Х					
BioClean Environmental Services, Inc.	Nutrient Separating Baffle Box	X	X	Х			Х	
Bio-Microbics, Inc.	BioSTORM	X	X			Х		Х
Brown-Minneapolis Tank Co./								
Kleerwater Technologies, LLC	Kleerwater <sup>TM</sup>	Х		Х	Х			Х

#### Appendix C Index (by Manufacturer/Vendor Name)

Treatment System Name	Manufacturer/Vendor Name		Graphic/ O&M							
		Brochure	Drawings	Specs	Schematic		Testing	Other		
Passive Treatment Systems (cont.)				•			0			
Clean Way	Clean Way Downspout Filtration Unit	Х						Х		
Clean Way	StormClean Catch Basin Insert	Х	Х					Х		
Clean Way	StormClean Curb Inlet Insert	Х						Х		
Clean Way	StormClean Wall Mount Filtration Unit	Х						Х		
ClearWater Solutions, Inc.	ClearWater BMP	Х	Х			Х				
Coanda, Inc.	Coanda Curb Inlet Filter	Х	Х	Х			Х			
Coanda, Inc.	Coanda Downspout Filter	Х								
CONTECH Stormwater Solutions Inc.	CDS <sup>TM</sup> Stormwater Treatment System	Х	Х	Х		Х				
CONTECH Stormwater Solutions Inc.	Stormfilter using ZPG Media	Х	Х	Х		Х	Х			
CONTECH Stormwater Solutions Inc.	UrbanGreen BioFilter	Х	Х	Х		Х		Х		
CONTECH Stormwater Solutions Inc.	VortClarex	Х	Х	Х		Х				
CONTECH Stormwater Solutions Inc.	Vortechs System	Х	Х	Х		Х	Х	Х		
CrystalStream Technologies	CrystalClean Separator	Х	Х				Х	Х		
CrystalStream Technologies	CrystalCombo Hybrid Polisher	Х			Х		Х	Х		
DeepRoot Partners	Silva Cell	Х		Х	Х	Х		Х		
EcoSense International	EcoSense <sup>TM</sup> Stormwater Filtration Systems	Х			Х		Х			
EcoSense International	EcoVault <sup>™</sup> Baffle Box	Х					Х			
EcoSol Wastewater Filtration Systems	RSF (Rapid Stormwater Filtration) 100	Х	Х	Х			Х	Х		
EcoSol Wastewater Filtration Systems	RSF (Rapid Stormwater Filtration) 1000	Х	Х	Х			Х	Х		
EcoSol Wastewater Filtration Systems	RSF (Rapid Stormwater Filtration) 4000	Х	Х	Х			Х	Х		
Eco-Tec, Inc.	Adsorb-It	Х	Х				Х	Х		
Enviro-Drain, Inc.	Enviro-Drain®	Х	Х							
Environment 21	EnviroTrap Catch Basin Insert	Х	Х	Х			Х			
Environment 21	PuriStorm	Х	Х							
Environment 21	UniScreen	Х	Х	Х			Х			
Environment 21	UniStorm	Х	Х	Х		Х	Х			
Environment 21	V2B1 Treatment System	Х	Х	Х			Х			
Environmental Filtration, Inc.	Raynfiltr <sup>TM</sup>	Х	Х							
Fabco Industries, Inc.	StormBasin™	Х	Х			Х	Х	Х		
Fabco Industries, Inc.	StormPod <sup>TM</sup>	Х	Х			Х	Х	Х		
Fabco Industries, Inc.	StormSafe <sup>™</sup> Helix	Х			Х	Х				
Filterra, DBAAmericast, Inc.	Filterra® Roofdrain System		Х		X	X		Х		
Filterra, DBAAmericast, Inc.	Filterra® System		X		X	X		X		
Hancor, Inc.	Hancor Storm Water Quality Unit	Х		Х		X	Х	X		
Huber Technology, Inc.	HUBER Hydro Filt	X			Х					
Hydro International, Inc.	Downstream Defender	X	Х	Х		Х		Х		
Hydro International, Inc.	Up-Flo <sup>TM</sup> Filter	X	X	X		X	Х			
Hydroworks	HydroFilter				Х					
Hydroworks	HydroGuard	Х	Х			Х	Х	Х		
Imbrium Systems Corp	Jellyfish <sup>™</sup> Filter	X	X	Х		X		X		

#### Appendix C Index (by Manufacturer/Vendor Name)

	Manufacturer/Vendor Name							
Treatment System Name		Brochure	Drawings	Specs	Graphic/ Schematic		Testing	Other
Passive Treatment Systems (cont.)								
Imbrium Systems Corp	Sorbtive <sup>™</sup> FILTER	Х	Х			Х	Х	Х
Imbrium Systems Corp	Stormceptor®	Х	Х	Х		Х		Х
Kristar Enterprises, Inc.	FloGard+PLUS®	Х	Х			Х		Х
Kristar Enterprises, Inc.	FloGard® Downspout Filter	Х	Х			Х		
Kristar Enterprises, Inc.	FloGard® Dual-Vortex Hydrodynamic Separator	Х	Х			Х		
Kristar Enterprises, Inc.	FloGard® LoPro Matrix Filter	Х	Х			Х		
Kristar Enterprises, Inc.	FloGard® LoPro Trench Drain Filter	Х	Х			Х		
Kristar Enterprises, Inc.	Flo-Gard® Trash & Debris Guard	Х	Х			Х		
Kristar Enterprises, Inc.	Perk Filter <sup>TM</sup>	Х	Х			Х		
Kristar Enterprises, Inc.	SwaleGard® Pre-filter	Х	Х			Х		
Kristar Enterprises, Inc.	TREEPOD® Biofilter	Х	Х			Х		
Modular Wetland Systems, Inc./								
BioClean Environmental Services, Inc.	Modular Wetland System – Linear	Х	Х	Х		Х	Х	Х
Nyloplast/Hancor, Inc.	SNOUT®	Х						
Nyloplast/Hancor, Inc.	Storm PURE <sup>TM</sup>	Х						
Park USA	StormTrooper®	Х	Х					Х
Park USA	StormTrooper® EX Extra-Duty	Х	Х					Х
PSI International, Inc.	PSI Separator				Х	Х		Х
Revel Environmental Manufacturing, Inc./								
CONTECH Stormwater Solutions Inc.	Triton Drop Inlet Insert	Х	Х	Х		Х	Х	
Rotondo Environmental Solutions, LLC	Perimeter Sandfilter (Delaware Sandfilter)		Х					
Rotondo Environmental Solutions, LLC	Underground Sandfilter (DC Sandfilter)		Х					
Royal Environmental Systems, Inc./Water Tectonics, Inc.	ecoLine A®	Х	Х					
Royal Environmental Systems, Inc./Water Tectonics, Inc.	ecoLine B®	Х	Х		Х	Х		Х
Royal Environmental Systems, Inc./Water Tectonics, Inc.	ecoSep®	Х	Х	Х		Х		Х
Royal Environmental Systems, Inc./Water Tectonics, Inc.	ecoStorm ®	Х	Х	Х	Х	Х		Х
Royal Environmental Systems, Inc./Water Tectonics, Inc.	ecoStorm Plus®	Х	Х	Х	Х	Х		Х
Royal Environmental Systems, Inc./Water Tectonics, Inc.	ecoTop®	Х	Х	Х				
Stormdrain Solutions	Inceptor®	Х					Х	Х
StormwateRx	Aquip® Enhanced Stormwater Filtration System	Х			Х			
StormwateRx	Clara® Gravity Stormwater Separator Vault	Х			Х			
Terre Hill Concrete Products	Terre Kleen <sup>™</sup>		Х	Х				Х
Transpo Industries, Inc.	EnviroSafe <sup>TM</sup>	Х						
Transpo Industries, Inc.	EnviroSafe <sup>TM</sup> Storm Safe HF10	Х				Х		
United Storm Water, Inc.	DrainPac™		Х	Х		Х	Х	Х

# The contents of this appendix are provided on a CD

# Excel Versions of Tables 3 through 12

# The contents of this appendix are provided on a CD