May 8, 2009

Michael Adackapara
Sana Ana Regional Water Quality Control Board

RE: ORDER NO. R8-2009-0030

Dear Mr. Adackapara,

Thank you for the opportunity to comment on the latest proposed changes to the Orange County permit section XII.C. The proposed changes substantially change the meaning of the permit and I am glad that the Board decided to allow some time to consider their implication prior to adoption.

First, I wish to make a simple but important point regarding the definition of low impact development and to explore its implications in the context of this tentative permit. It was very interesting that the debate for the latter half of the hearing centered on the question of whether or not “filters” or “biofilters” are LID. To even ask this question shows a fundamental misunderstanding of what low impact development is. Put simply, it is a design **approach** that seeks to mimic predevelopment hydrology in the developed condition. LID can not be adequately defined as a specific list of runoff reducing BMPs. To be clear, runoff reduction BMPs play an important role in an LID strategy, but their implementation should be a near final step in a site design process that exhausts conservation and runoff prevention opportunities prior to their consideration.

This pivotal distinction is supported in LID definitions from the EPA, NRDC, the LID center and others.

For example, the first sentence on the EPA’s LID page states:

> *“LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible.”*[1]

The NRDC report entitled “Out of the Gutter – Reducing Runoff in the District of Columbia” describes LID as follows:

> *Low-Impact Development (LID)—a new way of thinking about stormwater management— is a highly effective strategy for controlling contaminated urban runoff.*

[1] Environmental Protection Agency. (2009) Low Impact Development Page. Retrieved from: http://www.epa.gov/nps/lid/

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LID employs lot-level techniques that reduce the impact of development through the use of multiple systems that retain, detain, filter, treat, use, and reduce stormwater runoff.[2]

If LID is properly reframed as a design strategy, full implementation of LID requires that the principles and BMP selection hierarchy outlined in the tentative permit in finding 61 and draft 3 of section XII.C be followed. The assertion by NRDC that LID is feasible on all sites also makes sense when LID is viewed as a design process. However, LID feasibility on all sites is not realistic when LID is defined as mandatory retention of the design capture volume. Every site can and should follow the LID design process outlined in this permit which dictates that a site designer prioritize runoff prevention first through careful site design, then implement runoff reduction practices where feasible. Once those mitigation options are exhausted, any portion of the design storm that can't be reasonably retained must be treated using the most effective treatment controls that are feasible.

From this perspective, the language proposed for section XII.C.1 makes sense. It is intended to make it clear that LID "principles" be implemented immediately, as opposed to after feasibility criteria are developed. Clearly, this is possible and will have a beneficial impact on receiving water health.

The changes proposed in section XII.C.3 are also consistent with the LID approach as described above. However, the word "bio-filter" should be replaced with "filter".

The term bio-filter presumably refers to those structural treatment controls that include both filtration and some biological process. The term does not indicate any particular level of pollutant or runoff volume reduction. The addition of the word bio-filter as an acceptable means of treatment seems to exclude the use of media filters without a biological component. This is problematic, since some non-vegetated media filters are reliably more effective than some bio-filters. Therefore to allow bio-filters as a category and to exclude non-vegetated filters violates the maximum extent practicable standard.

A 2008 summary report of the International Stormwater BMP Database entitled "Analysis of Treatment System Performance[3]" illustrates this fact. In it, the effectiveness of common BMPs like media filters and bio-filters is reported for conventional stormwater pollutants. The bio-filter category in the database is dominated by vegetated swales and filter strips. The media filter category includes Austin and Delaware sand filters, and various other bed and cartridge based filters without vegetation. The report shows that media filters tend to outperform biofilters for important parameters like TSS and TP. Heavy metal removal rates are not substantially different

[2] NRDC. (2002). Out of the Gutter – Reducing polluted runoff in the District of Columbia. Retrieved from: http://www.nrdc.org/water/pollution/gutter/gutter.pdf

[3] This database is sponsored by EPA, the Water Environment Research Federation, the American Society of Civil Engineers and others. The summary report can be found on-line at www.bmpdatabase.org

between BMP types, although median average effluent concentrations of total zinc and total copper were lower for media filters.

Clearly there are highly effective media filter and biofilter designs that will maximize pollutant load reduction. For example, swale designs that capture the water quality storm, percolate it through vegetation and engineered soil, and finally collect that filtered water in an underdrain prior to release are most effective. This design is fundamentally different than conventional swales and grass filter strips that are designed to convey the design storm over land as shallow, low velocity flow with only incidental infiltration.

Non-vegetated filter design varies dramatically as well. On one end of the spectrum are the catch basin inserts and other BMPs with filter fabric barriers or a token amount of coarse media with virtually no contact time with runoff at design flow rates. On the other end of the spectrum are sand or engineered media filters which typically are designed with minutes to hours of contact time and are highly effective for most pollutants. The obvious challenge for either class of filters is to separate the designs likely to achieve adequate performance from those that are inadequate. This performance-based differentiation will be required regardless of whether or not the filtration options allowed by this permit are limited to those with a biological component. This differentiation can either be added to the permit in section XII.C.2, or to the updated DAMP.

Thankfully there are options for separating potentially suitable BMPs from those that are ineffective or still in the experimental stage without burdening the permittees with the task. For example, the Sacramento Stormwater Quality Partnership (SSQP)[4] has an evaluation program for proprietary treatment BMPs which has identified several suitable stand–alone treatment options. Outside of California, the Washington State Department of Ecology (DOE)[5] and the New Jersey Department of Environmental Protection (DEP)[6] have BMP performance verification programs that require extensive lab and field studies prior to approval for stand-alone treatment. A relatively simple approach to differentiating between filters would be to require that filters be fully approved for stand alone treatment through the Washington DOE, New Jersey DEP or SSQP prior to use.

An alternative language option could be borrowed from the stormwater quality credit criteria from the LEED 2009 rating system which requires:

> *BMPs used to treat runoff must be capable of removing 80% of the average annual postdevelopment total suspended solids (TSS) load based on existing monitoring reports. BMPs are considered to meet these criteria if:*

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[4] Sacramento Stormwater Quality Partnership. Program information available at: http://www.msa.saccounty.net/sactostormwater/SSQP/development/treatment-options.asp

[5] Washington Department of Ecology. Program information available at: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html

[6] New Jersey Department of Environmental Protection. Program information available at: http://www.nj.gov/dep/stormwater/treatment.html

- *They are designed in accordance with standards and specifications from a state or local program that has adopted these performance standards,*

OR

- *There exists infield performance monitoring data demonstrating compliance with the criteria. Data must conform to accepted protocol (e.g., Technology Acceptance Reciprocity Partnership [TARP], Washington State Department of Ecology) for BMP monitoring.*[7]

The Stormwater Management StormFilter™ is a proprietary media filter that has been installed on nearly 100 projects in 17 Cities in Orange County. Each system contains one or more siphon actuated filter cartridges containing media targeting the anticipated pollutants of concern on site. Because the StormFilter is installed below grade and can support traffic loading it is commonly used on retrofit and redevelopment projects where the density of development is very high and where retention of the entire water quality event is infeasible.

Nationally there are more than 60,000 StormFilter cartridges in operation that have been installed in the past 10 years. Throughout that time, numerous field studies have been completed which document the performance and longevity of the system in typical urban applications. The StormFilter is one of a select few systems that has been approved for stand-alone use by the Washington DOE, the New Jersey DEP and by the Sacramento Stormwater Quality Partnership. Caltrans has also rated the effectiveness of the system for conventional stormwater pollutants based on existing monitoring reports in their annual publication entitled, "Treatment BMP Technology Report". The StormFilter entry from that report is attached to this comment letter along with a brief performance summary. Clearly, there is a small subset of urban development and redevelopment projects where this filter satisfies the maximum extent practicable standard.

Section XII.C.2 references the 85th percentile design storm as section XII.B.4.A.1. This reference should be changed to XII.B.4 so that it is inclusive of the flow based design storm. As currently written, the reference does not allow for flow based sizing which is a common method of filter sizing. The flow based design option is no less stringent than the "design capture volume" standard. Both standards ensure treatment of at least 85% of the average annual rainfall depth. Likewise, the reference to the "design capture volume" in the last sentence of this section should be changed to reference the 85th percentile design storm.

In summary, I urge you to replace the word "bio-filter" with "filter" in section XII.C.2 and to update references to the 85th percentile design storm. I would also strongly suggest that the Permittees be required to develop or adopt filter performance criteria and a means for evaluating filters relative to those criteria. If this change is not made, use of non-vegetated filters that have been proven to be highly effective for common pollutants of concern will be prohibited in clear violation of the maximum extent practicable standard.

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[7]United States Green Building Council. (2009) "LEED 2009 for New Construction and Major Renovations". Sustainable Sites Credit 6.2

Thank you again for this opportunity to comment. Please let me know if you have any questions.

Sincerely,

Vaikko P. Allen II, CPSWQ, LEED-AP

Regulatory Relations Manager - Southwest
CONTECH Stormwater Solutions, Inc.
allenv@contech-cpi.com

Treatment BMP Technology Report

April 2008

CTSW-RT-08-167.02.02

Final Report

California Department of Transportation
Division of Environmental Analysis
1120 N Street, Sacramento, California 95814

BMP Fact Sheet
Filtration
Cartridge/Canister

StormFilter™

Description:

The StormFilter™ is a combination of a small water quality inlet (baffle system) with a varying number of float-actuated canister filters. Filter media can vary. High flow bypass spills over the baffle in the first chamber. Pictured at right is the catch basin version of the StormFilter™.

Constituent Removal:

Constituent Group	**Removal Efficiency**	**Level-of-Confidence**
Total Suspended Solids	●	◒
Total Nitrogen	◒	◒
Total Phosphorus	◒	◒
Pesticides	NA	
Total Metals	◒	◒
Dissolved Metals	○	◒
Microbiological	◒	○
Litter	●	◒
BOD	○	○
TDS	○	○

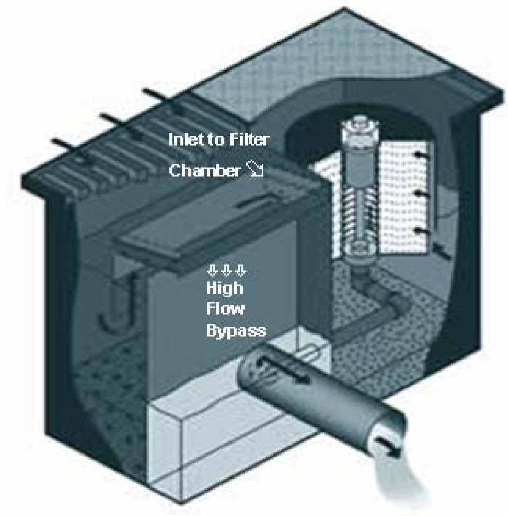
Notes:

Performance varies with media. Scores are based on average results for the media best suited for the constituent. Field data supersedes laboratory data.
Litter removal based on professional judgment.
Microbiological based on test of old model at Kearny Mesa. (See page C-23).
ZPG media at 7.5 gpm at two locations 82% TSS at two locations (Contech, 2004).
No TDS removal,49% Cu, 52% Zn, 38% diss Cu, 26% diss Zn, 49% total N (Contech, 2005).
ZPG media at 15 gpm: 46% TSS (NSF, 2004).
CSF media at 7.5 gpm and 3 storms: 87% TSS, 61% total Zn, 46% phosphorus (Contech, 2003).
Perlite media at 15 gpm: 80% TSS, 60% Cu, 73% Pb, 46% Zn, Inconclusive phosphorus removal (Contech, 2006)

Caltrans Evaluation Status:

Under evaluation for pilot study

Schematic:



Source: www.contech-cpi.com

Key Design Elements:

Flow Restriction (7.5 gpm or 15 gpm).
High flow bypass.
Media type.

Cost Effectiveness Relative to Detention Basins:

Cost Effectiveness:	**Level-of-Confidence**
▗	○

Notes:

Cost effectiveness determination pending further evaluation.

Rating Key for Cost Effectiveness Relative to Detention Basins

Benifit ↑ Cost ↓	Benefit ↑ Cost ↑
Benefit ↓ Cost ↓	Benefit ↓ Cost ↑

Rating Key for Constituent Removal Efficiency and Level-of-Confidence

●	◒	○
High	Medium	Low


Maintenance Issues:

Requirements:

Inspecting the facility, removing litter and sediment and all spent filter cartridges, repairing or replacing inoperative controls, valve or filter canister, and cleaning the filter cartridges and canister if necessary.

Training:

Crews must be trained to repair or replace any cartridge filter or part associated with the facility or contract for maintenance.

Project Development Issues:

Right-of-Way-Requirements:

Space requirements depend on sizing criteria, typically smaller than basins.

Siting Constraints:

Must have sufficient hydraulic head.

Construction:

No unique requirements identified

Advantages:

Smaller footprint than for conventional sedimentation/gravity sand filters.
Noling, et al, report toxicity reduction for high levels of influent metals.

Constraints:

Removal of fine sediment in cartridge filters is not as effective as in open bed media filters.
Proprietary device.
Vector concerns.

Design, Construction, Maintenance and Cost Sources

Contech® Stormwater Solutions, Inc., www.contech-cpi.com/stormwater/products

U.S. Environmental Protection Agency, www.epa.gov/region1/assistance/ceitts/stormwater/techs/stormfilter.html

Literature Sources of Performance Demonstrations:

Contech Storm Water Solutions 2003. "Heritage Marketplace Field Evaluation: Stormwater Management StormFilter with CSF Leaf Media." (available by request of manufacturer)

Contech Storm Water Solutions 2005. "heritage Marketplace Field Evaluation: Stormwater Management StormFilter with ZPG Media" (available by request of manufacturer)

Contech Storm Water Solutions 2004. "Performance of the Stormwater Management StormFilter relative to Ecology Performance Goals for Basin Treatment" (available by request of manufacturer)

Contech Storm Water Solutions 2006. "Greenville Yards Storm water Treatment System Field Evaluation: Storm water Management Storm Filter with Perlite Media at 57 L/min/cart" (available by request of manufacturer)

Calvin, N. and Barry, K. "Successful Demonstration of the Storm water management StormFilter® Enhanced Filtration System for Toxicity Reduction of shipyard Storm water conducted at National Steel and Shipbuilding Company (NASSCO)." Presented at: the Prevention of Pollution from Ships, Shipyards, Drydocks, Ports, and Harbors: 3rd International Symposium on November 5 - 7, 2003 at the University of New Orleans, LA http://www.hartcrowser.com/PDFs/Stormfilter.pdf

NSF International July, 2004. "Environmental Technology Verification Report: Storm water Source Area Treatment Device, the Storm water Management StormFilter® using ZPG Filter Media." www.epa.gov/etv/pdfs/vrvs/600etv06039/600etv06039s.pdf

Certifications, Verifications, or Designations:

ETV - Verification statement issued July 2004 for suspended solids.
TCEQ - Approval of Innovative Technology: Each cartridge must be limited to a maximum flow rate of 7.5 gpm.
TARP - Compliant or similar reliable data on this technology to be able to evaluate pollution removal efficiency claims for TSS, SSC.

Stormwater Management StormFilter® Performance Summary

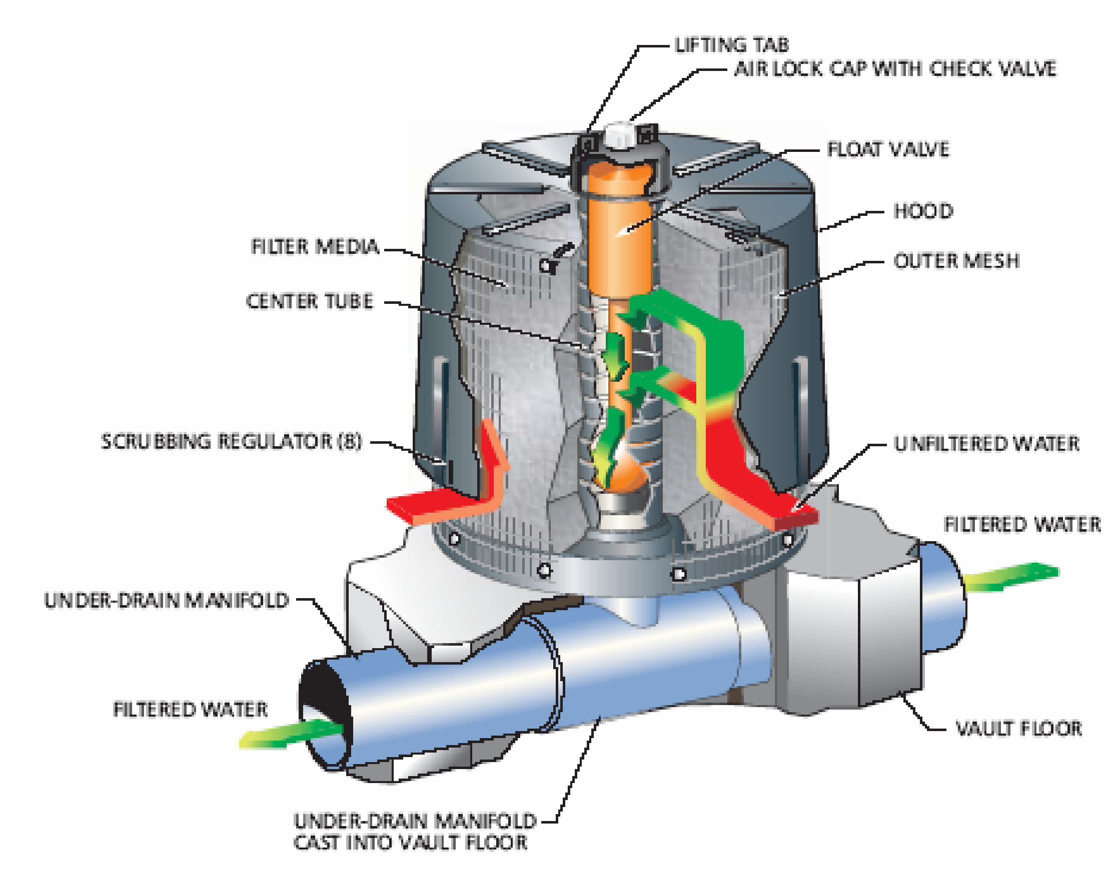


Table of Contents:

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Parameter Brief

Total Suspended Solids (TSS) Removal Using Different Particle Size Distributions with the Stormwater Management StormFilter®

Introduction

Total Suspended Solids (TSS) is commonly used in the stormwater industry as a surrogate pollutant and a measure of Best Management Practice (BMP) performance. Although a practical standard, it is becoming evident that the measurement of TSS can be complex. Historically, parameters such as particle size distribution and specific gravity have not been included as part of BMP performance due to the difficulty of measuring these parameters in the field. For example, in a situation where road-sanding material is being washed into a BMP, the removal of 80% of TSS is easily achieved as the majority of the mass of the particles is composed of large sand and grit particles with a high specific gravity. In other situations, the TSS particles are much finer and have lower specific gravity, such as runoff from parking lots and high travel roads that frequently have "gray" water resulting from suspensions of silts, tire and brake dust, and associated fractions of oil and grease at low concentrations.

TSS Definitions

CONTECH Stormwater Solutions Inc. has been investigating various particle size distributions (PSDs) for BMP acceptance or verification for various agencies: Washington State Department of Ecology (Ecology), New Jersey Corporation for Advanced Technology (NJ CAT), New Jersey State Department of Environmental Protection (NJ DEP), City of Portland, OR Bureau of Environmental Services (BES).

Five different PSDs are presented in Table 1. These particle sizes consist of natural soils (sandy loam and silt loam), manufactured sediment (SIL-CO-SIL 106), and two protocols for evaluating stormwater (APWA and City of Portland BES). The StormFilter was tested with the natural soils and SIL-CO-SIL sediments (finer distribution than the APWA or BES protocols). PSD testing was predominantly conducted in the Stormwater360 laboratory using simulated stormwater in a TSS concentration range between approximately 0 – 350 mg/L.

CONTECH Stormwater Solutions would recommend that a jurisdiction define TSS with a range of PSDs such as the sandy loam, silt loam, or SIL-CO-SIL 106 used in these laboratory investigations, as opposed to a uniform PSD (i.e. 80% removal of 125 microns). Manufactured sediments are commercially available and can easily be used in comparing different BMPs. The PSDs are idealized at a specific gravity of 2.65, while field studies by CONTECH Stormwater Solutions clearly show a high fraction of the TSS as organic in texture (seasonally) with a specific gravity at approximately 1.0. Investigations by CONTECH Stormwater Solutions show that PSDs in the Pacific Northwest tend to be characteristic of silt loams and PSDs in the NE tend to be sandy loams or loamy sands, especially where road sanding is practiced.

Table 1 has a summary of various PSDs that have been investigated by Stormwater360. For further information, Appendix A contains the graphical representation of each sediment type. Table 2 contains the TSS removal performance with these different sediments.

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Table 1. Sediment Particle Size Distributions

Particle Size (microns)	Percent by mass (approximate) Sandy loam [a]	Silt loam [a]	SIL-CO-SIL 106 [b]	APWA 1999 Protocol [c]	Portland BES [c]
500 – 1000	5.0	5.0	0	20.0	10.0
250 – 500	5.0	2.5	0	10.0	10.0
100 – 250	30.0	2.5	0	35.0	25.0
50 –100	15.0	5.0	20.0	10.0	25.0
2 – 50	40.0	65.0	80.0	25.0	30.0
1 – 2	5.0	20.0	0.0	0	0

[a] CONTECH Stormwater Solutions tested Oregon silt and sandy loams for New Jersey Corporation for Advanced Technology verification of TSS performance claims.

[b] CONTECH Stormwater Solutions tested SIL-CO-SIL 106 for Washington State Department of Ecology per the Technology Assessment Protocol – Ecology (2001).

[c] Hypothetical particle size distributions from these testing protocols. Particle sizes were presented in a range available in Appendix A; the table represents the least conservative (coarser) approximate particle size range.

Table 2. TSS removal using differing particle size distributions

Media Type	Cartridge Flow Rate (gpm)	Percent Removal (%) Silt loam [a]	SIL-CO-SIL 106 [a]	Sandy loam [a]
Standard Perlite	15		72 – 78	77 - 80
Standard Perlite	7.5		78 – 83	
Coarse Fine Perlite	15			
Coarse Fine Perlite	7.5	68 – 75	79 – 82	
Fine Perlite	15		73 – 78	
Fine Perlite	7.5		85 – 88	
CSF® leaf [b]	15	68 – 79		
Coarse Perlite/Zeolite [c]	15	63 – 84		
ZPG™	15		80 – 82	
ZPG™	7.5		86 – 89	
Perlite/CSF® leaf	7.5		82 – 86	
Perlite/Metal Rx™	7.5		89 – 92	

[a] Linear regression was used in the data analysis, the table presents the upper and lower 95% confidence limits. Data was collected in the CONTECH Stormwater Solutions laboratory using simulated stormwater for TSS concentrations between 0 – 350 mg/L. Silt and sandy loam performance data was NJCAT-verified.

[b] Performance of the CSF leaf media was tested using both field and laboratory investigations. Laboratory studies used a Palatine loam sediment. Field data is from the Pacific Northwest.

[c] Performance of the coarse perlite / coarse zeolite media was tested using a Palatine loam sediment. Reported in Total Suspended Solids Removal using StormFilter Technology.

References

American Public Works Association (APWA). (1999). Protocol for the acceptance of unapproved stormwater treatment technologies for use in the Puget Sound watershed. Washington: APWA Washington Chapter, Stormwater Managers Committee. Retrieved January 3, 2002 from the Municipal Research and Services Center of Washington website: www.mrsc.org/environment/water/water-s/apwa/protocol.htm

de Ridder, S. A., Darcy, S. I., and Lenhart, J. H. (2002). Silt loam TSS removal efficiency of a stormwater BMP: Coarse/fine perlite StormFilter cartridge at 28 L/min (7.5 gpm). (Report No. PD-01-001.1). Portland, Oregon: Stormwater Management Inc.

de Ridder, S. A., Darcy, S. I., and Lenhart, J. H. (2002). Sandy loam TSS removal efficiency of a stormwater BMP: Coarse perlite StormFilter cartridge at 57 L/min (15 gpm). (Report No. PD-01-002.1). Portland, Oregon: Stormwater Management Inc.

New Jersey Corporation for Advanced Technology. (2002). NJCAT Technology Verification Stormwater Management, Inc. Bordentown, NJ: Author. Retrieved July 31, 2003 from: www.resourcesaver.com/file/toolmanager/O56F24106.doc

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U.S. Silica. (2000, March). Product Data, OK-110 Unground Silica, Plant: Mill Creek, Oklahoma. Retrieved June 12, 2003, from:
www.u-s-silica.com/prod_info/PDS/Mill_Creek/ MiCOK-1102000.PDF

Revision

RS-0091 04/14/06 Rebranded to Contech Stormwater Solutions, Inc.

PD-03-13.4 09/08/05 Added Standard Perlite at 15 and 7.5 gpm, and ZPG at 15 gpm to Table 1. Updated Reference Section.

PD-03-13.3 04/28/05 Added Perlite/CSF leaf & Perlite/MetalRX to Table 1. Updated Reference Section.

PD-03-013.2 12/02/04 Added ZPG™ to Table 1.

PD-03-013.1 12/15/03 Altered Table 1 - SIL-CO-SIL to reflect 20:80:0 (sand:silt:clay)
Added content to section 2, paragraph 3, last sentence.

PD-03-013.0 10/28/03

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APPENDIX A

SIL-CO-SIL 106 Particle Size Distribution

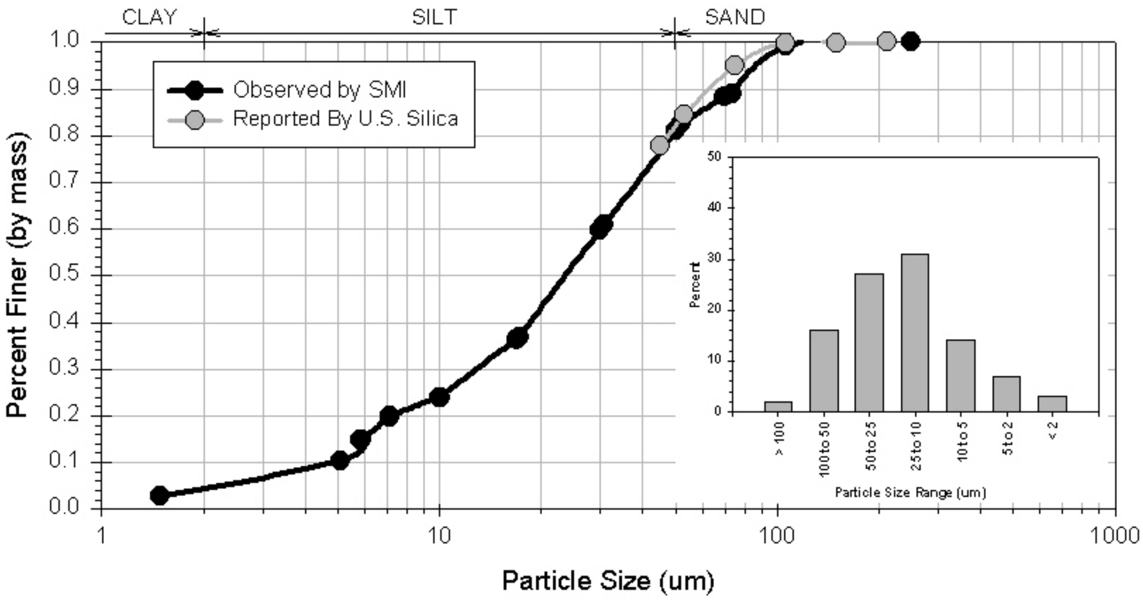

Figure 1. Particle size distribution for SIL-CO-SIL 106. Sand/silt/clay fractions according to USDA definitions are approximately 20%, 80%, and 0% for SIL-CO-SIL 106, indicating that the texture corresponds to a silt material. Specific gravity is 2.65.

Silt Loam Particle Size Distribution

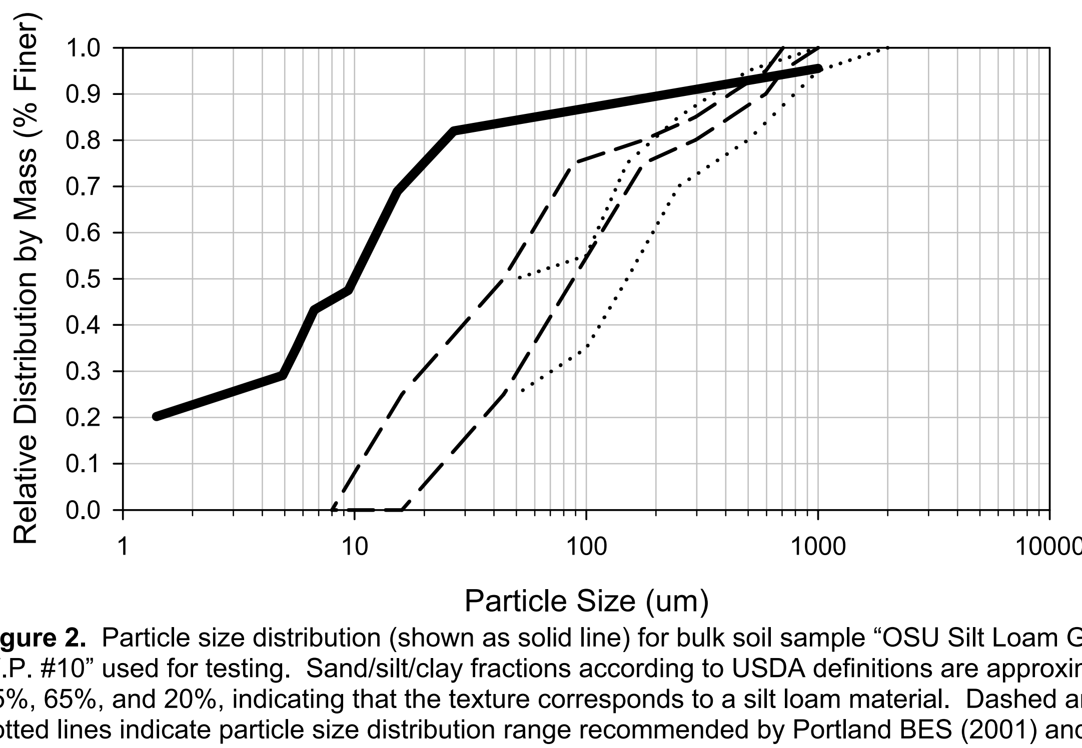

Figure 2. Particle size distribution (shown as solid line) for bulk soil sample "OSU Silt Loam GPS W.P. #10" used for testing. Sand/silt/clay fractions according to USDA definitions are approximately 15%, 65%, and 20%, indicating that the texture corresponds to a silt loam material. Dashed and dotted lines indicate particle size distribution range recommended by Portland BES (2001) and APWA (1999), respectively, for materials used for laboratory evaluation of TSS removal efficiency.

Sandy Loam Particle Size Distribution

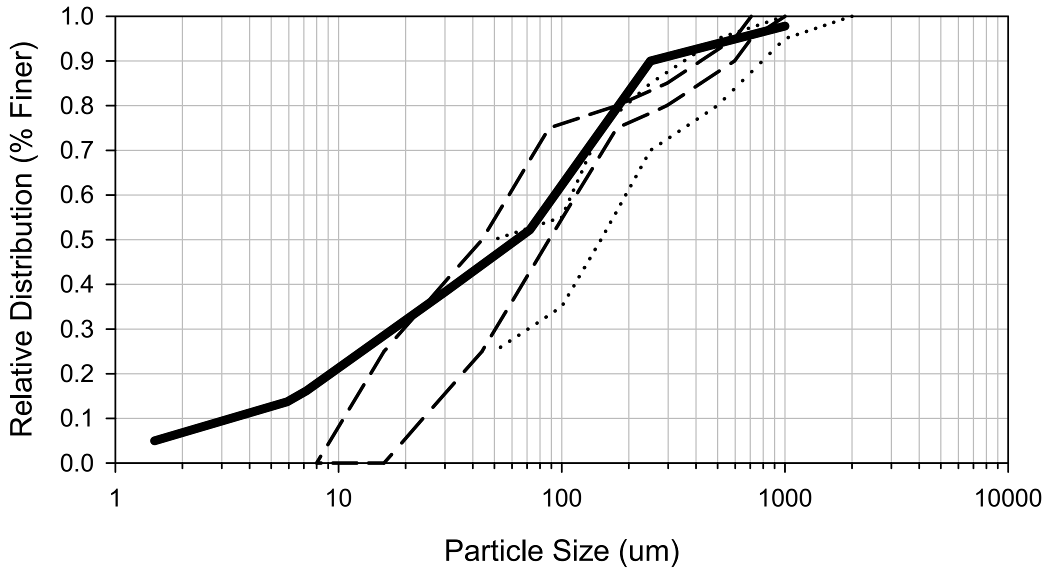

Figure 3. Particle size distribution (shown as solid line) for bulk soil sample "OSU Loam GPS W.P. #13" used for testing. Sand/silt/clay fractions according to USDA definitions are approximately 55%, 40%, and 5%, indicating that the texture corresponds to a sandy loam material. Dashed and dotted lines indicate particle size distribution range recommended by Portland BES (2001) and APWA (1999), respectively, for materials used for laboratory evaluation of TSS removal efficiency.

Parameter Brief

Performance of the Stormwater Management StormFilter® for Removal of Total Phosphorus

Phosphorus in the Urban Environment

Phosphorus loading to freshwater can promote algal blooms and eutrophication that threaten ecosystems by lowering dissolved oxygen levels. As shown in Figure 1, phosphorus cycles through the environment in forms organic, inorganic and soluble forms.

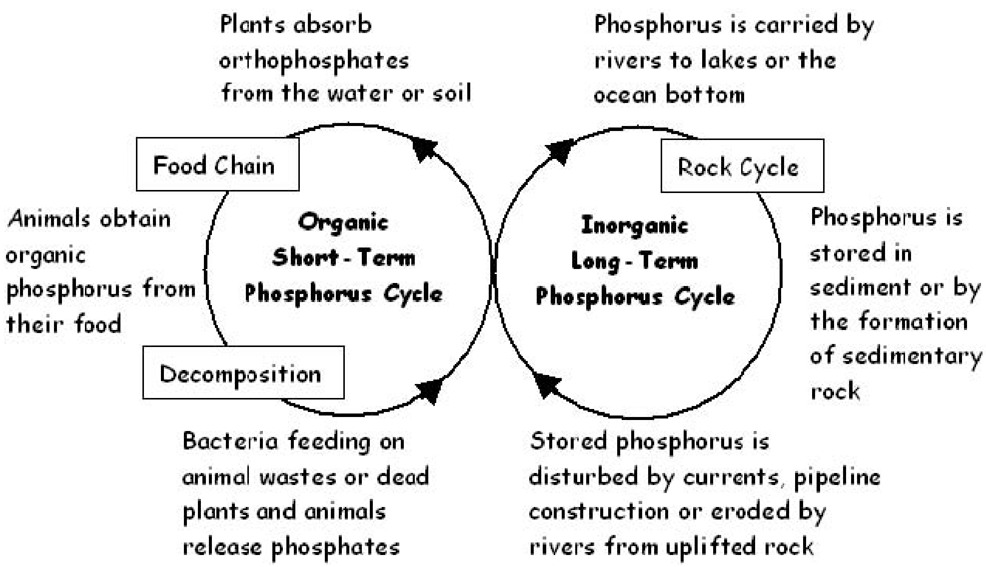

Figure 1. Inorganic and Organic Cycle (RiverWatch, 2001)

Total phosphorus (TP), expressed in milligrams/liter is the sum of inorganic phosphate, organic phosphate, and soluble phosphorus (Ortho-P). Organic phosphates are a part of plants and animals, their wastes or decomposing remains. Inorganic phosphorus originates from decomposing natural materials and man-made products.

Non-point source runoff (stormwater) increases phosphorus concentrations in lakes and streams by transporting sediment and organic matter (bud shatter, leaves, lawn clippings, etc.) from impervious surfaces. Additional phosphorus sources in stormwater are misapplied fertilizers, some detergents, and animal waste from birds and domestic pets.

Phosphorus in urban runoff is typically measured as TP and sometimes Ortho-P is measured as well. The non-soluble portion of the TP is commonly associated with the total suspended solids (TSS). Of this form, the phosphorus can be in an organic or inorganic form. TP concentrations in stormwater are variable but range from 0.01 to 7.3 mg/L (Minton, 2002). Concentrations of Ortho-P in urban runoff are frequently in concentrations ranging from 0.05 to 0.2 mg/L (Wigginton, 1999). USEPA guidelines indicate that Ortho-P concentrations in stream in excess of 0.10 mg/L can trigger algae blooms in fresh water lakes.

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Removal of phosphorus can be accomplished by three mechanisms. The first is removal of organic and inorganic P associated with solids. The second is removal by biological uptake by plants or bacteria. The third is through chemical precipitation such as the reaction of Ortho-P with iron to form iron phosphate in aerobic conditions. Depending on the type of treatment system, organic phosphorus can transform to Ortho-P and be released later. For example, leaves trapped in a sump can decompose or fall senescence of wetland plant can release Ortho-P.

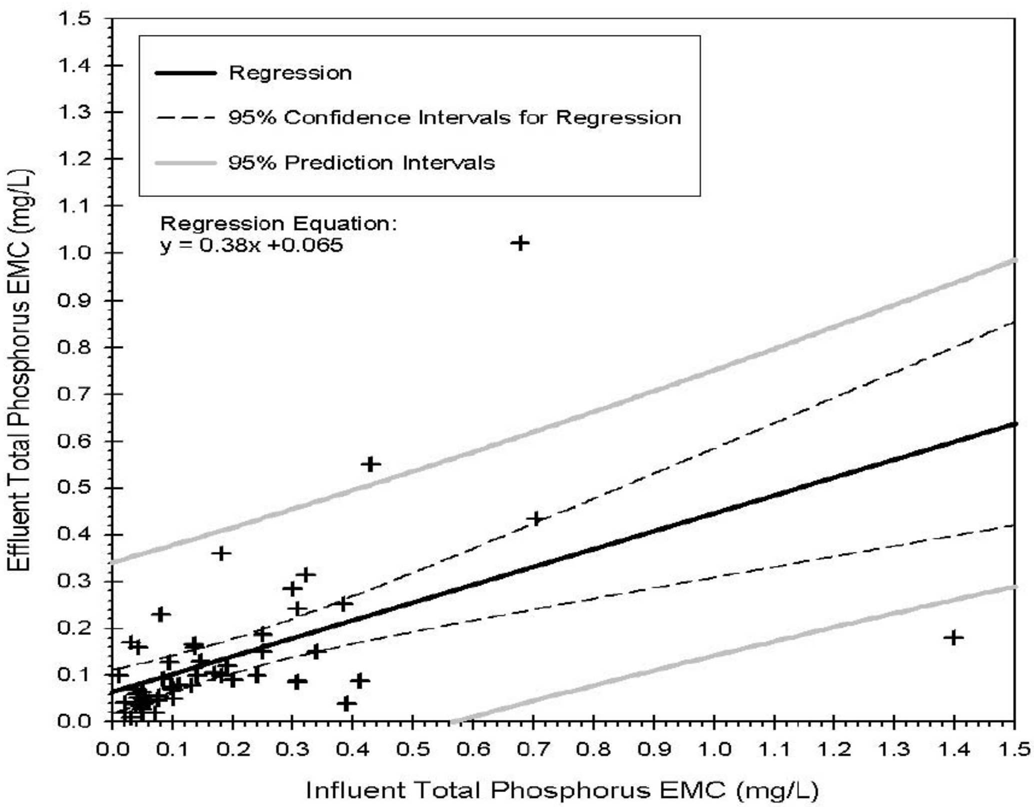

Figure 3. Total phosphorus removal performance summary collected from 9 sites, in multiple geographic locations, with different media. The linear regression produced an equation of y = 0.38x + 0.065, which translates to a 62% removal with a 95% confidence interval of 53% and 78% (lower and upper limits, respectively). Data was statistically significant with a P < 0.001. Data was current as of July 2003.

Results

Performance data for removal of total phosphorus were summarized from ongoing field evaluations. These field evaluations are a combination of first and third party investigations. Data were collected from 9 sites located in different geographic locations (primarily from the West Coast (WA, OR, CA) and a single Midwest site) and configured with different media types at different flow rates. Available reports are listed in the reference section. This performance summary focuses on Total Phosphorus removal only. The following information presented in Figure 3 contains data collected since 2001, mostly during the late spring, summer, and fall for total phosphorus removal by the Stormwater Management StormFilter.

Fifty-five data points are presented in Figure 3. The mean removal efficiency using linear regression was 62% with 95% confidence limits of 53% and 78% (lower and upper limits, respectively). Sixteen data points that were included in the analysis did not have a positive removal. Overall these systems demonstrated statistically significant removal ($P<0.001$; 99% probability of net removal) of Total Phosphorus.

Table 1. General Site Description

Site Description	WQ Flow Rate (cfs)	Unit Size	Media	No. of Cartridges	Location
Shopping Center	0.503	8 x 16	ZPG, CSF	23	Vancouver, WA
Carwash	0.070	CBSF	CSF	2	Vancouver, WA
Hotel	0.165	6 x 8	CSF	5	Vancouver, WA
Mixed Use	1.600	8 x 16 (2)	Perlite/Zeolite	48	Sammamish, WA
Shopping Center	0.033	CBSF	Perlite	1	Vancouver, WA
Commercial Office	0.594	8 x 16 (2)	Perlite/CSF	24;30	Olympia, WA
School	0.297	8 x 16	Perlite/Zeolite	14	Redmond, WA
Resort	1.650	CIP	Perlite/Zeolite	50	California
Roadway	0.300	6 x 12	ZPG	9	Midwest

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Parameter Brief

The Stormwater Management StormFilter® for Removal of Dissolved Metals

Introduction

Urban Stormwater often contains high levels of soluble and particulate heavy metals. Generated from traffic, industrial facilities, and sometimes residential sources, these metals are frequently found in concentrations that are deleterious to aquatic life and other biota that are dependent on aquatic life as a food sources. Two of the most common metals found both in the water column and sediments are zinc and copper. Zinc tends to exhibit toxicity effects in the fresh water environment and copper exhibits toxicity characteristics in the marine environment.

Metals are measured as both total metals and soluble metals. Total metals are the sum of dissolved metals and those metals associated with particulates. Soluble metals are commonly defined as those metals that pass through a 0.45 micron filter. Frequently the soluble metals are in a cationic form in that they posses a net positive charge. However, sometimes the charge of the soluble metal has been satisfied in that it could be associated with sub-micron particles such as ligands or colloids. In this event, the metal may not have a net positive charge.

Cation Exchange

Cation exchange is the exchange of a cation (positively charged atom) for another cation. The process involves the displacement of an atom within the media matrix by an atom within the water column. The displacement occurs if the incoming atom's affinity for the exchange site is higher than that of the current occupying atom. In general, the physically smaller the ion (when hydrated) and the greater the positive charge the more tightly it will be held by the media.

Predictions can be made using a periodic table of elements for commonly found metals in stormwater runoff. Staying within the same row of the table and proceeding left to right produces an increasing affinity for cation exchange. This trend is promoted due to the metal atom remaining in the same valence state (charge) while the overall diameter of the atom decreases. Since the diameter decreases, the "apparent charge" of the atom increases, thus producing the driving mechanism for cation exchange. For most purposes the following affinity series is true:

$$Al^{3+} > H^{+} > Zn^{2+} > Cu^{2+} > Ni^{2+} > Fe^{2+} > Cr^{2+} > Ca^{2+} > Mg^{2+} > K^{+} > Na^{+}$$

Primary Exchange Ions within CONTECH Stormwater Solutions Filtration Media

The media-bound ions utilized with cation exchange filtration are calcium (Ca), magnesium (Mg), potassium (K) and sodium (Na) with calcium and magnesium being the primary exchange ions due to their abundance within the media matrix.

As presented above, zinc, copper and iron (as well as others) will force the displacement of the calcium and magnesium ions from the media.

Media promoting cation exchange and measured cation exchange capacity (CEC):

- CSF® media (93.8 meq/100-grams)
- Zeolite (125 meq/100 grams)

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Performance Summary

Table 1. Soluble Metals Removal using organic media (CSF®, Metal Rx).

		Soluble Copper		Soluble Zn	
Site	Media	Removal	Influent (ug/l)	Removal	Influent (ug/l)
Nassco Shipyard	CSF	54%	61-401	64%	191-124
Charleston Boatyard	CSF	49%	11,000 (Total)	48%	3,560 (Total)
East Side Plating	Metal Rx	92%	58-268	43%	ND-569 (Total)

Table 2. Total Metals Removal

		Configuration (Removal efficiency)			
Parameter	Influent (mg/l)	CSF Standard Grade 15 gpm	CSF Standard Grade 7.5 gpm	Perlite/Zeolite Coarse Grade 15 gpm	Perlite/Zeolite Fine Grade 15 gpm
Total Copper	11	42%	49%	41%	54%
Total Lead	0.096	43%	47%	42%	60%
Total Zinc	3.56	41%	48%	31%	51%
Total Chromium	0.0384	49%	61%	57%	67%

Performance data has been summarized from field investigations (Table 1) and from laboratory (Table 2) investigations using captured stormwater runoff from the Charleston Boatyard.

References

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Parameter Brief

The Stormwater Management StormFilter® for Removal of Oil and Grease

Oils and Greases (O&G) are commonly found in stormwater runoff from automobiles and associated anthropogenic activities. O&G appears in many different forms in stormwater runoff: free, dissolved, emulsified, and attached to sediments. Total Petroleum Hydrocarbons (TPH) is the usual analytical measure of fuels, oils and grease (O&G) for stormwater. Typically the concentrations of TPH associated with runoff from streets and parking lots do not exceed concentrations that range from 2.7 to 27 mg/l (FHWA, 1996).

Frequently studies are conducted using high concentrations of oil, e.g. 5,000 mg/l in and 250 mg/l out, with claims of 95% removal. These concentrations are not representative of those associated with most stormwater runoff. In the event of these high concentrations, then an oil/water separation technology would be required as pretreatment.

Removal of TPH by media within the StormFilter cartridge is accomplished through adsorption. Adsorption is the attraction and adhesion of a free or dissolved contaminant to the media surface. This occurs at the surface as well as within the pores of the media granule. Adsorption requires that a contaminant come in contact with an active surface site on the media and time must be allowed for the contaminant to adhere. These reactions are usually promoted by polar interactions between the media and the pollutant. Adsorption can also occur within the dead end pores and channels of the media but is generally slower than a surface reaction due to limits of the contaminants diffusion into the pore. (Note: The contaminant's molecular size will limit diffusion in that the media's pore opening must be larger than the dissolved contaminant.) Commonly adsorbed pollutants include: gasoline, oil, grease, TNT, polar organics or organically bound metals and nutrients.

The media provided by CONTECH Stormwater Solutions Inc. for the removal of oils and grease are targeted to remove concentrations of 25 mg/l or less. Media promoting adsorption reactions are the CSF® leaf media, perlite, and granular activated carbon. For concentrations that continually are higher than 10 mg/l, an oil removing accessory such as a sorbent cartridge hood cover is recommended.

References

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BY:

January 26, 2005

Jim Lenhart, V.P.
Stormwater Management, Inc.
12021-B NE Airport Way
Portland, OR 97220

Dear Mr. Lenhart:

Subject: Designation of the StormFilter for General Statewide Use

On behalf of the Department of Ecology, I would like to congratulate you and your company for achieving a General Use Level Designation (GULD) for your StormFilter technology as a basic stormwater treatment. Our determination is based on your November 1, 2004 engineering report, prior submittals, and assessments by the Technical Review Committee and Ecology staff. We acknowledge the professional effort exhibited by your staff during the past several years in demonstrating the scale-up viability of this technology.

We plan to publish the GULD document on the web along with appropriate links to pertinent information on the StormFilter. In the near future, we also plan to add appropriate design and related information on the StormFilter in its Stormwater Management Manuals.

If you need additional information, please do not hesitate to call me at (360) 407-6405.

Sincerely,

David C. Peeler
Water Quality Program Manager

DP:DW:mw

cc: Dewey Weaver, Supervisor, WQ Program
Mark Blosser, PE, Chair-Technical Review Committee
Dave Pollock, CEO, SMI, Portland, OR

January 2005
GENERAL USE LEVEL DESIGNATION
FOR BASIC (TSS) TREATMENT
Stormwater Management, Inc.'s StormFilter
Using Zeolite-Perlite-Granular
Activated Carbon Media
And Operating at 7.5 GPM per Cartridge

Ecology Decision: Based on SMI's application submissions and recommendations by the Technical Review Committee (TRC), Ecology hereby issues a General Use Level Designation (GULD) for the SMI StormFilter:

- **As a basic stormwater treatment practice for total suspended solids (TSS) removal,**
- **Using ZPG™ media (zeolite/perlite/granular activated carbon), with the size distribution described below,**
- **Sized at a design rate of 7.5 GPM per cartridge (except as stated in Condition #1, below), and**
- **Internal bypassing needs to be consistent with the design guidelines in SMI's current design manual.**

This designation has no expiration date, but it may be amended or revoked by Ecology, and is subject to the conditions specified below.

Applicant: Stormwater Management, Inc., (SMI), Manufacturer and Vendor
James H. Lenhart, PE, Senior Vice President and Responsible Corporate Officer
(800) 548-4667

Address of Applicant: 12021-B NE Airport Way, Portland, OR 97220

Application Documents:

The applicant's master report, titled, "The Stormwater Management StormFilter Basic Treatment Application for General Use Level Designation in Washington", Stormwater Management, Inc., November 1, 2004, includes the following reports:

- (Public) "Evaluation of the Stormwater Management StormFilter Treatment System: Data Validation Report and Summary of the Technical Evaluation Engineering Report (TEER) by Stormwater Management Inc., October 29, 2004" Ecology's technology assessment protocol requires the applicant to hire an independent consultant to complete the following work:

    1. Complete the data validation report.
    2. Prepare a TEER summary, including a testing summary and conclusions compared with the supplier's performance claims.
    3. Provide a recommendation of the appropriate technology use level.
    4. Recommend relevant information to be posted on Ecology's website.

5. Provide additional testing recommendations, if needed."

This report, authored by Dr. Gary Minton, Ph. D., P.E., Resource Planning Associates, satisfies the Ecology requirement.

- (Public) "Performance of the Stormwater Management StormFilter Relative to the Washington State Department of Ecology Performance Goals for Basic Treatment," is a summary of StormFilter performance that strictly adheres to the criteria listed in the Guidance for Evaluating Emerging Stormwater Treatment Technologies, Technology Assessment Protocol – Ecology (TAPE).
- "Heritage Marketplace Field Evaluation: Stormwater Management StormFilter with ZPG Media," is a report showing all of the information collected at Site A as stated in the SMI Quality Assurance Project Plan (QAPP). This document contains detailed information regarding each storm event collected at this site, and it provided a detailed overview of the data and project.
- "Lake Stevens Field Evaluation: Stormwater Management StormFilter with ZPG Media," is a report that corresponds to Site E as stated in the SMI QAPP. This document contains detailed information regarding each storm collected at this site, and includes a detailed overview of the data and project.
- (Public) "Evaluation of the Stormwater Management StormFilter for the removal of SIL-CO-SIL 106, a standardized silica product: ZPG at 7.5 GPM" is a report that describes laboratory testing at full design flow.
- "Factors Other Than Treatment Performance."
- "State of Washington Installations."

Above-listed documents noted as "public" are available by contacting SMI.

Applicant's Use Level Request: That Ecology grant a General Use Level Designation for Basic Treatment for the StormFilter using ZPG™ media (zeolite/perlite/granular activated carbon) at 7.5 GPM in accordance with Ecology's 2001 Stormwater Manual (SMI's September 28, 2004 letter).

Applicant's Performance Claim: The combined data from the two field sites reported in this TEER (Heritage Marketplace and Lake Stevens) indicate that the performance of a StormFilter system configured for inline bypass with ZPG media and a 28 liters per minute per cartridge (7.5 GPM) filtration rate meets Ecology performance goals for Basic Treatment.

Technical Review Committee Recommendations: The TRC, based on the weight of the evidence and using its best professional judgment, finds that

- StormFilter, using ZPG media and operating at no more than 7.5 GPM per cartridge, is expected to provide effective stormwater treatment achieving Ecology's Basic Treatment TSS removal performance goals, as demonstrated by field and laboratory testing performed in accordance with the protocol; and,
- StormFilter® is deemed satisfactory with respect to factors other than treatment performance (e.g., maintenance; see the protocol's Appendix B for complete list).

Findings of Fact:

- Influent TSS concentrations and particle size distributions were generally within the range of what would be considered "typical" for western Washington (silt to silt loam).
- Thirty-two (32) storm events were sampled at two sites for storms from April 2003 to March 2004, of which twenty-two (22) were deemed "qualified" and were therefore included in the data analysis set.
- Statistical analysis of these 22 storm events verifies the data set's adequacy.
- Analyzing all 22 qualifying events, the average influent and effluent concentrations and aggregate pollutant load reduction are 114 mg/L, 25 mg/L, and 82%, respectively.
- Analyzing all 22 qualifying events based on the *estimated average* flow rate during the event (versus the *measured peak* flow rate), and more heavily weighting those events near the design rate (versus events either far above or well below the design rate) does not significantly affect the reported results.
- For the 7 qualifying events with influent TSS concentrations greater than 100 mg/L, the average influent and effluent concentrations and aggregate pollutant load reduction are 241 mg/L, 34 mg/L, and 89%, respectively. If the 2 of 7 events that exceed the maximum 300 mg/L specified in Ecology's guidelines are excluded, the average influent and effluent concentrations and aggregate pollutant load reduction are 158 mg/L, 35 mg/L, and 78%, respectively.
- For the 15 qualifying events with influent TSS concentrations less than 100 mg/L, the average influent and effluent concentrations and aggregate pollutant load reduction are 55 mg/L, 20 mg/L, and 61%, respectively. If the 6 of 15 events that fall below the minimum 33 mg/L TSS specified in Ecology's guidelines are excluded, the average influent and effluent concentrations and aggregate pollutant load reduction are 78 mg/L, 26 mg/L, and 67%, respectively.
- For the 8 qualifying events with peak discharge exceeding design flow (ranging from 120 to 257% of the design rate), results ranged from 52% to 96% TSS removal, with an average of 72%.
- Due to the characteristics of the hydrographs, generally the field results reflect flows below (ranging between 20 and 60 percent of) the tested facilities' design rate. During these sub-design flow rate periods, some of the cartridges operate at or near their *individual* full design flow rate (generally between 4 and 7.5 GPM) because their float valves have opened. Float valves remain closed on the remaining cartridges, which operate at their base "trickle" rate of 1 to 1.5 GPM.
- Laboratory testing using U.S. Silica's Sil-Co-Sil 106 fine silica product showed an average 87% TSS removal for testing at 7.5 GPM per cartridge (100% design flow rate).
- Other relevant testing at I-5 Lake Union, Greenville Yards (New Jersey), and Ski Run Marina (Lake Tahoe) facilities shows consistent TSS removals in the 75 to 85% range. *Note that I-5 Lake Union was operated at 50%, 100%, and 125% of design flow*.
- SMI's application included a satisfactory "Factors other than treatment performance" discussion.

  Note: Ecology's 80% TSS removal goal applies to 100 mg/l and greater influent TSS. Below 100 mg/L influent TSS, the goal is 20 mg/L effluent TSS.

Use Conditions. StormFilters shall be designed, installed, and maintained to comply with these conditions:

1. StormFilter systems containing ZPG (zeolite/perlite/granular activated carbon) mix are approved for basic treatment at 7.5 GPM maximum flow rate per cartridge at the 15-minute water quality design flow rate (as specified in Ecology's 2001 Stormwater Manual), as calculated using an acceptable continuous simulation runoff model (such as the latest versions of the Western Washington Hydrology Model or MGSFlood). Note that if the method outlined in Ecology's 1992 Stormwater Manual (single-event runoff model, such as Santa Barbara Unit Hydrograph, and 6-month storm peak flow) is used, this approval applies at 15 GPM per cartridge. This approval applies to urban land uses where stormwater influent TSS concentrations are expected to be 500 mg/L or less and TSS particles are not unusually fine (in the clay size range).

2. For StormFilter systems to be located downstream of a stormwater detention facility, the StormFilter size shall be calculated using both the flow-based and mass-based methods as described in the *Product Design Manual Version 3.1 (February 2004)*, or most current version, and the designer shall select the result yielding the larger number of cartridges.

3. StormFilter systems shall be installed in such a manner that flows exceeding 7.5 GPM per cartridge are bypassed or will not resuspend captured sediments. StormFilter systems shall be designed in accordance with the performance goals in Ecology's 2001 Stormwater Manual and SMI's *Product Design Manual Version 3.1 (February 2004)*, or most current version, unless otherwise specified. The design, pretreatment, land use application, and maintenance criteria in SMI's Design Manual must be closely followed.

4. Pretreatment of TSS and oil and grease may be necessary, and shall be provided in accordance with the most-current versions of the SMI's *Product Design Manual* or the applicable Ecology Stormwater Manual, and using the performance criteria and pretreatment practices provided on Ecology's "Evaluation of Emerging Stormwater Treatment Technologies" website.

5. StormFilter systems are typically designed to be maintained on an annual basis, which shall serve as the default maintenance frequency. Maintenance includes removing accumulated sediment from the vault, and replacing spent cartridges with recharged cartridges.

   In lieu of annual maintenance, inspections can be used to determine a site-specific maintenance schedule and/or requirements. When inspections are performed, the following findings shall serve as maintenance triggers:

   (a) Accumulated vault sediment depths exceed an average of 2 inches, or
   (b) Accumulated sediment depths on the tops of the cartridges exceed an average of 0.5 inches, or
   (c) Standing water remains in the vault between rain events.

   Note: If excessive floatables (trash and debris) are present, perform a minor maintenance consisting of gross solids removal, not cartridge replacement.

6. SMI shall maintain readily available those reports listed under “Application Documents” (above) as public, as well as the documentation submitted with its previous conditional use designation application. SMI shall provide links to this information from its corporate website, and make this information available upon request, at no cost and in a timely manner.

7. ZPG™ media used shall conform with the following specifications:

   Each cartridge contains a total of approximately 2.6 cubic feet of media. The ZPG™ cartridge consists of an outer layer of perlite that is approximately 1.3 cubic feet in volume and an inner layer, consisting of a mixture of 90% zeolite and 10% granular activated carbon, which is approximately 1.3 cubic feet in volume.

   Perlite Media: Perlite media shall be made of natural siliceous volcanic rock free of any debris or foreign matter. The expanded perlite shall have a bulk density ranging from 6.5 to 8.5 lbs per cubic foot and particle sizes ranging from 0.09” (#8 mesh) to 0.38” (3/8” mesh).

   Zeolite Media: Zeolite media shall be made of naturally occurring clinoptilolite. The zeolite media shall have a bulk density ranging from 44 to 50 lbs per cubic foot and particle sizes ranging from 0.13” (#6 mesh) to 0.19” (#4 mesh). Additionally, the cation exchange capacity (CEC) of zeolite shall range from approximately 1.0 to 2.2 meq/g.

   Granular Activated Carbon: Granular activated carbon (GAC) shall be made of lignite coal that has been steam-activated. The GAC media shall have a bulk density ranging from 28 to 31 lbs per cubic foot and particle sizes ranging from a 0.09” (#8 mesh) to 0.19” (#4 mesh).

Technology Description:

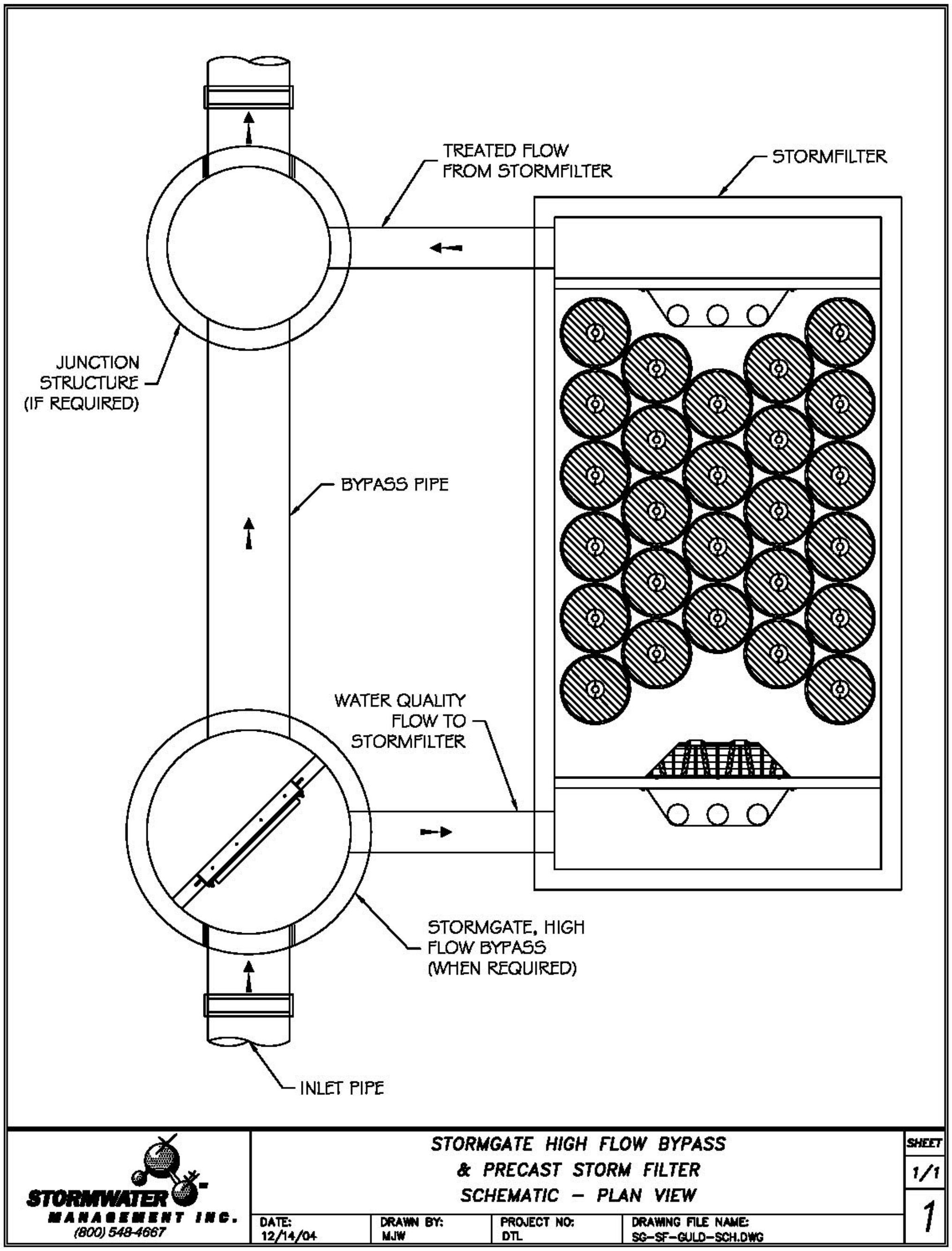
The Stormwater Management StormFilter® (StormFilter), a flow-through stormwater filtration system, improves the quality of stormwater runoff from the urban environment by removing pollutants. The StormFilter is used to treat runoff from a wide variety of sites including, but not limited to: retail and commercial development, residential streets, urban roadways, freeways, and industrial sites such as shipyards, foundries, etc.

Operation:

The StormFilter is typically comprised of a vault that houses rechargeable, media-filled, filter cartridges. Various media may be used, but this designation covers only the zeolite-perlite-granulated activated carbon (ZPG™) medium. Stormwater from storm drains is percolated through these media-filled cartridges, which trap particulates and may remove pollutants such as dissolved metals, nutrients, and hydrocarbons. During the filtering process, the StormFilter system also removes surface scum and floating oil and grease. Once filtered through the media, the treated stormwater is directed to a collection pipe or discharged to an open channel drainage way.

A bypass schematic for flow rates exceeding the water quality design flow rate is shown below.

Figure 1. SMI StormFilter Configuration with Bypass



StormFilter Configurations:

The StormFilter is offered in five basic configurations: precast, linear, catch basin, cast-in-place, and corrugated metal pipe form. The precast, linear, and catch basin models use premanufactured units to ease the design and installation process; cast-in-place units are customized for larger flows and may be either uncovered or covered underground units. The corrugated metal pipe units can be customized to meet special site requirements.

The typical precast StormFilter unit is composed of three bays: the inlet bay, the filtration bay, and the outlet bay. Stormwater first enters the inlet bay of the StormFilter vault through the inlet pipe. Stormwater in the inlet bay is then directed through the flow spreader, which traps some floatables, oils, and surface scum, and over the energy dissipater into the filtration bay where treatment will take place. Once in the filtration bay, the stormwater begins to pond and percolate horizontally through the media contained in the StormFilter cartridges. After passing through the media, the treated water in each cartridge collects in the cartridge's center tube from where it is directed into the outlet bay by an underdrain manifold. The treated water in the outlet bay is then discharged through the single outlet pipe to a collection pipe or to an open channel drainage way. In some applications where heavy grit loads are anticipated, pretreatment by settling may be necessary.

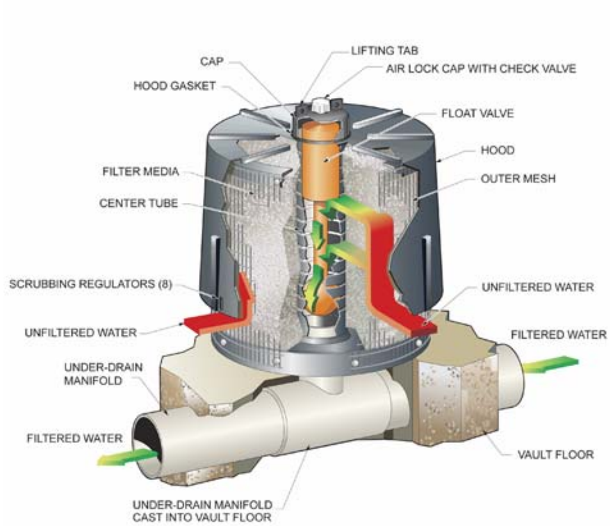


Figure 2. The StormFilter Cartridge

Cartridge Operation:

As the water level in the filtration bay begins to rise, stormwater enters the StormFilter cartridge. Stormwater in the cartridge percolates horizontally through the filter media and passes into the cartridge's center tube, where the float in the cartridge is in a closed (downward) position. As the water level in the filtration bay continues to rise, more water passes through the filter media and into the cartridge's center tube. The air in the cartridge is displaced by the water and purged from beneath the filter hood through the one-way check valve located in the cap. Once the center tube is filled with water (approximately 18 inches deep), there is enough buoyant force on the float to open the float valve and allow the treated water to flow into the underdrain manifold. As the treated water drains, it tries to pull in air behind it. This causes the check valve to close, initiating a siphon that draws polluted water throughout the full surface area and volume of the filter. Thus, the entire filter cartridge is used to filter water throughout the duration of the storm, regardless of the water surface elevation in the filtration bay. This continues until the water surface elevation drops to the elevation of the scrubbing regulators. At this point, the siphon begins to break and air is quickly drawn beneath the hood through the scrubbing regulators, causing energetic bubbling between the inner surface of the hood and the outer surface of the filter. This bubbling agitates and cleans the surface of the filter, releasing accumulated sediments on the surface, flushing them from beneath the hood, and allowing them to settle to the vault floor.

Adjustable cartridge flow rate:

Inherent to the design of the StormFilter is the ability to control the individual cartridge flow rate with an orifice-control disk placed at the base of the cartridge. Depending on the treatment requirements and on the pollutant characteristics of the influent stream as specified in the SMI *Product Design Manual*, the flow rate may be adjusted through the filter cartridges. By decreasing the flow rate through the filter cartridges, the influent contact time with the media is increased and the water velocity through the system is decreased, thus increasing both the level of treatment and the solids removal efficiencies of the filters, respectively (de Ridder, 2002).

Recommended research and development:

Ecology encourages SMI to pursue continuous improvements to the StormFilter. To that end, the following actions are recommended:

- Determine, through laboratory testing, the relationship between accumulated solids and flow rate through the cartridge containing the ZPG™ media.
- Determine the system's capabilities to meet Ecology's enhanced, phosphorus, and oil treatment goals.
- Develop easy-to-implement methods of determining that a StormFilter facility requires maintenance (cleaning and filter replacement).

For Additional Information:

Applicant e-mail address: Contact Sean Darcy, seand@stormwaterinc.com
(800) 548-4667 or info@stormwaterinc.com

Applicant Web link: www.stormwaterinc.com

Ecology web link: http://www.ecy.wa.gov/programs/wq/stormwater/new_tech/

Ecology Contact: Stan Ciuba, P.E., Water Quality Program
sciu461@ecy.wa.gov
(360) 407-6435

Technical Review Committee: Mark Blosser, P.E., City of Olympia,
TRC Chairperson,
mblosser@ci.olympia.wa.us
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Bradley M. Campbell
Commissioner

December 22, 2004

James H. Lenhart, P.E.
Senior Vice President
Stormwater Management, Inc. (SMI)
12021-B NE Airport Way
Portland, OR 97220

Re: Extension Approval to Conditional Interim Certification for the Stormwater Management StormFilter®.

Dear Mr. Lenhart:

The New Jersey Department of Environmental Protection (NJDEP) received your correspondence requesting an extension to the conditional interim certification of the Stormwater Management StormFilter® (StormFilter). The expiration date for the current interim certification is December 31, 2004. This interim conditional certification was given in accordance with the Energy and Environmental Technology Verification (EETV) Act at N.J.S.A. 13:1D-134 et seq. After careful consideration, the NJDEP approves the request to extend the conditional interim certification, which will now expire on December 30, 2006.

The conditional interim approval was based on the New Jersey Corporation for Advanced Technology (NJCAT) verification report. According to the report, the StormFilter System, with influent concentrations of 300 mg/l or less and where Total Suspended Solids (TSS) particle sizes are expected to be similar to those tested, should be able to meet the basic treatment goal of 80% removal of TSS. Based on the NJCAT verification report and the recent information submitted by Stormwater Management regarding the analyses from the treatment of four storm events at Greenville Yards, the NJDEP has decided on the following:

1) The StormFilter can be used as a stand alone unit for the period of time that the interim certification remains in effect.
2) This conditional interim certification is for the current design of the StormFilter, and any modification will require a new review before use.

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3) All maintenance requirements must be implemented, and any training must be provided for personnel assigned to perform the maintenance, to ensure that the technology functions in accordance with the conditions of this conditional interim certification.
4) The StormFilter shall be designed in accordance with New Jersey's water quality standards and SMI's *Product Design Manual Version 3.0 (April 2002)*, or current edition, unless otherwise specified. The design, pretreatment, land use application, and maintenance criteria in SMI's Design Manual must be closely followed.

As part of the interim conditional approval, the StormFilter is currently being field tested, and the results will be analyzed and submitted for consideration in order to receive a final certification from the NJDEP. This phase of testing must satisfy the requirements of the Technology Acceptance and Reciprocity Partnership (TARP) Stormwater Best Management Practice Demonstration Tier II Protocol. For any questions regarding this correspondence, please contact Ravi Patraju of my staff at (609) 292-0125.

Marty Rosen,

Chief, Bureau of Sustainable Communities
and Innovative Technologies

Enclosure

c: Ernest Hahn, Assistant Commissioner, Land Use Management
Sam Wolfe, Assistant Commissioner, Environmental Regulation
Jeanne Herb, Director, Policy, Planning, and Science
Larry Baier, Director, Watershed Management Program
Narinder Ahuja, Director, Division of Water Quality
Mark Mauriello, Director, Land Use Regulations
Eileen Murphy, Director, Division of Science, Research, and Technology
Rhea Brekke, Executive Director, New Jersey Corporation for Advanced Technology

NJ Verified
Corporation for Advanced Technology

Technology Verification Fact Sheet
Stormwater Management, Inc.

June 19, 2002

Performance Claims

The technical performance claims made by Stormwater Management, Inc. are:

Claim 1 – **The StormFilter cartridge at 15 gallons per minute (gpm) using a coarse perlite media has been shown to have a TSS removal efficiency of 79% with 95% confidence limits of 78% and 80% respectively for a sandy loam comprised of 55% sand, 40% silt, 5% clay (USDA) in laboratory studies using simulated storm water.**

Claim 2 – **The StormFilter cartridge at 7.5 gallons per minute (gpm) using a fine and coarse perlite media has been shown to have a TSS removal efficiency of 71% with 95% confidence limits of 68% and 75% respectively for a silt loam comprised of 15% sand, 65% silt, 20% clay (USDA) in laboratory studies using simulated storm water.**

Claim 3 – **The StormFilter cartridge at 15 gpm using CSF® leaf media has a TSS removal efficiency of 73% with 95% confidence limits of 68% and 79%, respectively when evaluating field and laboratory data.**

Technology Description

Stormwater Management Inc., Portland, Oregon, has developed an innovative storm water treatment system - called StormFilter, to meet the requirements of the National Pollutant Discharge Elimination System (NPDES). To receive a NPDES permit, a municipality or specific industry has to develop a storm water management plan and identify Best Management Practices for storm water treatment and discharge. Best Management Practices are measures, systems, processes or controls that reduce pollutants at the source to prevent the pollution of storm water runoff discharge from the site. The StormFilter is a passive, flow through, storm water filtration system, improving the quality of storm water runoff by removing non point source pollutants, including total suspended solids (TSS), oil and grease, soluble metals, nutrients, organics, and trash and debris. It has been installed to treat storm water runoff from a wide variety of sites including retail and commercial developments, residential streets, urban roadways, freeways and industrial sites such as shipyards, foundries, etc.

The StormFilter is typically comprised of a vault that houses rechargeable, media-filled filter cartridges. Storm water from storm drains is percolated through media-filled cartridges, which removes particulates and adsorbs materials such as dissolved metals and hydrocarbons. Surface scum, floating oil and grease are also removed. After passing through the filter media, the storm water flows into a collection pipe or discharges to an open channel drainage way. Inherent in the design of the StormFilter is the ability to control the individual cartridge flow rate with an orifice disk placed at the base of the cartridge. The maximum flow rate through each cartridge can be adjusted to between 5 and 15 gpm.

The StormFilter is sized to treat the peak flow of a design storm as it passes through the system. The peak flow is determined by calculations based on the contributing watershed hydrology and using a design storm magnitude. The design storm is usually based on the requirements set by the local regulatory agency. The particular size of a StormFilter is determined by the number of filter cartridges required to treat the peak water flow.

Technology Application

The StormFilter utilizes a variety of media to target and remove pollutants from storm water runoff. It is designed to offer a versatile approach to removing site-specific pollutants. By selecting a specific filter media, desired levels of sediments, soluble phosphorus, nitrates, soluble metals, and oil and grease can be removed. In many cases, a combination of media is used to effectively remove storm water pollutants.

Verification

Based on the evaluation of the results from laboratory studies and field data, it appears that sufficient data is available to support Stormwater Management Claims 1, 2, and 3.

Limitations

StormFilter is best utilized for the removal of suspended solids in storm water. The StormFilter uses filter cartridges housed in concrete vaults to produce a self-contained storm water filtering system. The design life of the structure is typically 50 years. Cartridge life is guaranteed as long as the maintenance contract is upheld. Typical life of a cartridge has been budgeted at 20 years. Each cartridge is designed to treat a peak flow of 5 to15 gpm. Since storm water flows by gravity, the StormFilter typically requires 2.3 feet of head differential between the invert of the inlet and the invert of the outlet.

Water tightness of the concrete vault should be considered in the design. Most external joints are not subject to water from the inside or high groundwater from the outside. Internal joints should be sealed with grout and inspected during maintenance.

Backwater can be a problem if downstream hydraulic calculations are not performed properly. Backwater will reduce the hydraulic potential across the filter reducing flow rate through the cartridge. Backwater may also saturate media for long periods of time.

Baseflows should be bypassed to ensure proper functioning of the cartridges and the filtration media. If baseflows occur, the filtration media may become exhausted prematurely. This will affect the life of the cartridges and maintenance may be required more often. Low flow bypasses can be installed retroactively.

Excessive solids loading, hydrocarbon loading, and/or debris should be addressed during the design phase to assess if pretreatment is needed. Heavy solids loading without pretreatment can cause clogging of the cartridges. Maintenance frequency increases if this occurs.

The StormFilter design incorporates some ponding of water which can be a breeding site for mosquitoes. Also, if the cartridges plug due to inadequate maintenance, additional standing water will result.

Inspections should be performed during mid-season to determine sediment loading on the system. This involves mobilization to the site, documentation of media and vault conditions and measurements of accumulated sediments. Other inspections are performed during the year if a field crew is in the area of the filter and as time permits.

Net Environmental Benefit

The New Jersey Department of Environmental Protection (NJDEP or Department) encourages the development of innovative environmental technologies (IET) and has established a performance partnership between their verification/certification process and NJCAT's third party independent technology verification program. The Department in the IET data and technology verification/certification process will work with any New Jersey-based company that can demonstrate a net beneficial effect (NBE) irrespective of the operational status, class or stage of an IET. The NBE is calculated as a mass balance of the IET in terms of its inputs of raw materials, water and energy use and its outputs of air emissions, wastewater discharges, and solid waste residues. Overall the IET should demonstrate a significant reduction of the impacts to the environment when compared to baseline conditions for the same or equivalent inputs and outputs.

Once StormFilter has been recommended and verified for interim use within the State of New Jersey, Stormwater Management will then proceed to install and monitor systems in the field for the purpose of achieving goals set by the Tier II Protocol and final certification. At that time a net environmental benefit evaluation will be completed. However, it should be noted that the StormFilter technology requires no input of raw material, has no moving parts, and therefore, uses no water or energy.

Disclaimer

The New Jersey Department of Environmental Protection reserves the right to revise or terminate it's certification of the NJCAT verification at any time as a response to any complaints, violations of this verification's conditions, modifications of the Department's use criteria, any person's failure to comply with any conditions or requirement related to the use of the product, or other reasons.

This verification does not constitute an endorsement by the State of New Jersey or the New Jersey Department of Environmental Protection and may not be used for that purpose. This verification is granted only to the activity as specified and as conditioned herein. The procedures as outlined are verified without deviation from the information provided to the Department on which this verification is based.

New Jersey Corporation for Advanced Technology (NJCAT) Program

NJCAT is a not-for-profit corporation intended to promote the retention and growth of technology-based businesses in the emerging fields of energy and environmental technologies. NJCAT provides innovators with the regulatory, commercial and technical assistance required to bring promising new ideas to market successfully. Specifically, NJCAT functions to:

- Advance policy strategies and regulatory mechanisms to promote technology commercialization
- Identify, evaluate and recommend specific technologies for which the regulatory and commercialization process should be facilitated
- Facilitate funding and commercial relationships/alliances to bring technologies to market and new business to the state, and
- Assist in the identification of markets and applications for commercialized technologies.

The Technology Verification Program specifically encourages collaboration between vendors and users of technology. Through this program, teams of academic and business professionals form to implement a comprehensive evaluation of vendor specific performance claims. The result of successfully completing this program is documentation of independent third party confirmation of claims that provides valuable information to business and governmental decision-makers.