

Attachment 1

Manufactured Treatment Device (MTD) Registration

- 1. Manufactured Treatment Device Name:** Perk Filter by Oldcastle/KriStar

- 2. Company Name:** Oldcastle/KriStar Stormwater Solutions
Mailing Address: 7921 Southpark Plaza, Suite 200
City: Littleton
State: Colorado
Zip: 80120

- 3. Contact Name:** Jay Holtz, PE
Mailing Address: 7921 Southpark Plaza, Suite 200
City: Littleton
State: Colorado
Zip: 80120
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- 4. Technology**
Specific Size/Capacity of MTD Assessed: From a small 2' x 5' Catch Basin unit with one 12" cartridge and a capacity of 6.8 gpm up to a large 8' x 18' precast vault unit with thirty-one 30" cartridges (a 12" and an 18" cartridge stacked) and a capacity of 930 gpm (additional cartridges may be placed in larger precast or cast-in-place vaults to provide even more capacity).
Range of Drainage Areas Served by MTD: Units are sized to serve any size drainage area.
Sizing Criteria: 2.5 gpm/sf of cartridge surface area (to achieve 57% TP reduction) or 1.5 gpm/sf (to achieve 71% TP reduction).
Intended Application: Online or offline. Note that even in the online configuration, bypass flow is routed under rather than through the filter chamber.
Media Used: Zeolite, Perlite, and Granular Activated Carbon (ZPC).

- 5. Warranty Information** (describe, or provide web address):
Oldcastle/KriStar Stormwater Solutions warrants its products to be free from defects in material and workmanship for a period of one year from the date of original purchase.

- 6. Treatment Type**
 Hydrodynamic Structure
 Filtering Structure
 Manufactured Bioretention System
Provide Infiltration Rate (in/hr):
 Other (describe):

7. Water Quality Treatment Mechanisms (check all that apply)

- Sedimentation/settling
- Infiltration
- Filtration (specify filter media)
- Adsorption/cation exchange
- Chelating/precipitation
- Chemical treatment
- Biological uptake
- Other (describe):

8. Performance Testing and Certification (check all that apply):

Performance Claim (include removal efficiencies for treated pollutants, flow criteria, drainage area):

- 83% median removal efficiency for Total Suspended Solids (TSS) from stormwater runoff at a hydraulic loading rate of 1.5 gpm/sf
- 71% median removal efficiency for Total Phosphorus (TP) from stormwater runoff at a hydraulic loading rate of 1.5 gpm/sf

Specific size/Capacity of MTD assessed: 6' x 11' vault with eleven 30" cartridge stacks (0.417 cfs)

Has the MTD been "approved" by an established granting agency, e.g. New Jersey Department of Environmental Protection (NJDEP), Washington State Department of Ecology (WDOE), etc.?

- No
- Yes

For each approval, indicate (1) the granting agency, (2) use level if awarded, (3) the protocol version under which performance testing occurred (if applicable), (4) the date of award, and attach award letter.

- (1) Granting agency: Washington Department of Ecology (WDOE);
- (2) Use level: General Use Level Designation (GULD);
- (3) Protocol version under which performance testing occurred: Technology Assessment Protocol – Ecology (TAPE);
- (4) Date of award: January 2013;
- (5) Documentation: WDOE Decision and Conditions of Use attached

Was an established testing protocol followed?

- No
- Yes

Provide (1) the name of testing protocol followed, and (2) list any protocol deviations:

(1) Protocol followed: WDOE TAPE protocol - January 2008 rev.;

(2) Deviations: None

Provide the information below and provide a performance report (attach report):

For lab tests:

- i. Summarize the specific settings for each test run (flow rates, run times, loading rates) and performance for each run: The WDOE GULD approval process is based on field data. Laboratory data was not required nor provided for this approval.
- ii. If a synthetic sediment product was used, include information about the particle size distribution of the test material: N/A
- iii. If less than full-scale setup was tested, describe the ratio of that tested to the full-scale MTD: N/A

For field tests:

- i. Provide the address, average annual rainfall and characterized rainfall pattern, and the average annual number of storms for the field-test location:

Location: Washington State Ferries Bainbridge Island Terminal

270 Olympic Drive SE, Bainbridge Island, Washington

Average annual rainfall: 38.09 inches

Rainfall pattern: SCS Type 1A

Average annual number of storms: 132

- ii. Provide the total contributing drainage area for the test site, percent of impervious area in the drainage area, and percentages of land uses within the drainage area (acres):

Drainage area: The Perk Filter system originally sized to serve 1.69 acres but the actual drainage was later determined to be 3.38 acres.

Percent impervious: 100%

Land use: Vehicular traffic embarking and disembarking the ferry and parking.

- iii. Describe pretreatment, bypass conditions, or other special circumstances at the test site:

The Perk Filter is equipped with a pretreatment chamber where heavy solids settle out and floatables and some oil and grease are trapped behind a baffle incorporated in the inlet/bypass assembly. The system may be used online or offline. Bypass flow does not go through the treatment chamber where the filter cartridges are located even in the online configuration. Instead, bypass flow is directed by the inlet/bypass assembly to the outlet gallery below the false floor that supports the filter cartridges. Since the Perk Filter at the Washington State Ferries Bainbridge Island Terminal was designed for a 1.69 acre drainage area and the actual drainage area was about twice that size, the Perk Filter experienced

higher flows and loadings than planned and was in bypass more than anticipated. In spite of this, the system performed well and met the requirements for GULD certification.

- iv. Provide the number of storms monitored and describe the monitored storm events (amount of precipitation, duration, etc.):

Data was collected for 82 storm events, from May 2009 through February 2010. Twenty-two of these storm events were sampled and used for the technical evaluation. Annual precipitation at the test site during the test period was 36.75 inches which is within the normal range of rainfall for this location based on the 61 year rainfall record. The 22 storm events sampled met TAPE guidelines for minimum precipitation depth (except one), minimum antecedent dry period, minimum storm duration, and minimum storm intensity.

- v. Describe whether or not monitoring examined seasonal variation in MTD performance:

The Perk Filter was monitored for close to a year. Sampling was conducted during each of the four seasons and sample data was used to assess the performance of the system. However, seasonal variation in Perk Filter performance was not specifically examined.

- vi. If particle size distribution was determined for monitored runoff and/or sediment collected by the MTD, provide this information:

The particle size distribution was analyzed according to TAPE guidelines for 17 of the 22 storm events sampled. The average particle size distribution was as follows:

Medium sand (6%)
Silt (25%)
Clay (29%)
Colloids (39%)

9. MTD History:

How long has this specific model/design been on the market?:

The Perk Filter was developed in 2006 and 2007 and brought to market in 2008.

List no more than three locations where the assessed model size(s) has/have been installed in Virginia. If applicable, provide permitting authority. If known, provide latitude & longitude:

1. Project Name: Green Turtle Restaurant/Potomac Station (Parcel B)
Installation City, County, and State: Leesburg, Loudoun County, Virginia
Approving Agency: City of Leesburg
Size of Perk Filter Vault: 6' x 7' Perk Filter Vault
Number of Perk Filter Cartridges: 5 x 18" cartridges (0.20 cfs)

2. Project Name: 3131 9th Road Condominiums
Installation City, County, and State: Arlington, Arlington County, Virginia
Approving Agency: Arlington County
Size of Perk Filter Vault: Custom 4.5' x 3' Perk Filter Catch Basin
Number of Perk Filter Cartridges: 1 x 18" cartridge with prefilter (0.04 cfs)

List no more than three locations where the assessed model size(s) has/have been installed outside of Virginia. If applicable, provide permitting authority. If known, provide latitude & longitude:

1. Project Name: Providence Children's Academy
Installation City, County, and State: Charlotte, Mecklenburg County, North Carolina
Approving Agency: City of Charlotte
Size of Perk Filter Vault: 8' x 13' Perk Filter Vault
Number of Perk Filter Cartridges: 14 x 18" cartridges (0.56 cfs)
2. Project Name: Central Ramp - Phase 1 Drainage Improvements/Snohomish County Airport
Installation City, County, and State: Everett, Snohomish County, Washington
Approving Agency: Snohomish County Public Works
Size of Perk Filter Vault: 8' x 47' Box Culvert Perk Filter Vault
Number of Perk Filter Cartridges: 74 x 30" cartridges (12" and 18" stacked) (2.80 cfs)
3. Project Name: Chick-Fil-A
Installation City, County, and State: Chamblee, DeKalb County, Georgia
Approving Agency: City of Chamblee
Size of Perk Filter Vault: 8' x 11' Perk Filter Vault
Number of Perk Filter Cartridges: 12 x 30" cartridges (12" and 18" stacked) (0.48 cfs)

10. Maintenance:

What is the generic inspection and maintenance plan/procedure? (attach necessary documents):

Oldcastle/KriStar recommends inspection of the Perk Filter at 6-month intervals. The need for partial or full maintenance should be considered upon inspection. Partial maintenance is recommended if sediment loading is heavy but the cartridges are still working. Partial maintenance consists of removing sediment from the vault without replacing cartridges. Full maintenance is recommended if cartridges are plugged and not working. Full maintenance consists of removing media from spent cartridges, removing the empty cartridge assemblies from the vault, removing sediment from the vault, and installing refreshed cartridges. Maintenance frequency will depend on actual pollutant loading, however owners can typically expect at least 12 months of service from a Perk Filter unit before maintenance is required. The Perk Filter Operation and Maintenance Manual is attached.

Is there a maintenance track record/history that can be documented?

- No, no track record.
- Yes, track record exists; (provide maintenance track record, location, and sizing of three to five MTDs installed in Virginia [preferred] or elsewhere):

1. Location: St. Elizabeth Seton Church, Pleasanton, California

One Perk Filter:

- 2' x 11' catch basin system with three 18" filter cartridges (54 gpm)

Installation date: 2009

Inspection dates: 10/6/09, 10/15/10, 10/6/11, 10/12/12, and 10/21/13

Maintenance required: No maintenance required per inspection

2. Location: Villa Granada, Santa Clara, California

One Perk Filter:

- 2' x 8' catch basin system with two 18" filter cartridges (36 gpm)

Installation date: 2010

Inspection dates: 8/18/11, 4/6/12, 12/5/12, 4/2/13, 8/19/13, and 12/5/13

Maintenance required: No maintenance required per inspection

3. Location: Pacific/DSL Number 2, Sunnyvale, California

Three Perk Filters:

- 6' x 11' vault system with ten 24" filter cartridges (240 gpm)
- 6' x 9' vault system with eight 18" filter cartridges (144 gpm)
- 8' x 11' vault system with twelve 12" filter cartridges (144 gpm)

Installation date: 2010

Inspection dates: 12/21/10, 6/17/11, 12/1/11, 6/27/12, 12/20/12, 6/13/13, and 12/10/13

Maintenance required: Maintenance required after first inspection only (due to high sediment loading due to site stabilization after construction)

4. Location: Pacific/DSL Number 2, Sunnyvale, California

Two Perk Filters:

- 8' x 18' vault system with twenty-five 18" filter cartridges (450 gpm)
- 8' x 18' vault system with twenty-eight 18" filter cartridges (504 gpm)

Installation date: 2010

Inspection dates: 10/11/11, 9/27/12, and 9/11/13

Maintenance required: Maintenance required after first inspection only (due to high sediment loading due to site stabilization after construction)

Recognizing that maintenance is an integral function of the MTD, provide the following: amount of runoff treated, the water quality of the runoff, and what is the expected maintenance frequency for this MTD in Virginia, per year:

Based on Perk Filter loading test data, if the influent TSS concentration is 80 mg/l, a single 18" Perk Filter cartridge may be expected to treat about 10,000 cf of stormwater before replacement is necessary. In Virginia, the maintenance frequency is expected to be once every one or two years, but the actual maintenance frequency for a specific system will be driven by the pollutant loading characteristics of the drainage area.

Total life expectancy of MTD when properly operated in Virginia and, if relevant, life expectancy of media:

The expected design life of concrete Perk Filter vaults is 50 years. The expected design life of the plastic and stainless steel internal components and hardware including filter cartridge assemblies is 25 years. The filter media will need to be replaced every one or two years depending on pollutant loading characteristics.

For media or amendments functioning based on cation exchange or adsorption, how long will the media last before breakthrough (indicator capacity is nearly reached) occurs:

The cation exchange capacity of the ZPC media is about 1.85 meq/gram for the zeolite component. Based on the amount of zeolite in an 18" cartridge, there are a total of about 20,000 meq available for adsorption of dissolved phosphorus and metals. Since influent pollutant concentrations are highly variable and not all cation exchange sites may be available for targeted complexing, it is difficult to determine the maintenance frequency required for phosphorus and metals removal. That said, phosphorus removal data showed an increasing linear trend over the 10-month monitoring period conducted to support Washington DOE approval. Thus, the maintenance indicators for phosphorus and metals loading may be considered the same as those for total suspended solids.

For media or amendments functioning based on cation exchange or adsorption, how has the longevity of the media or amendments been quantified prior to breakthrough (attach necessary performance data or documents):

No breakthrough testing has been performed to date.

Is the maintenance procedure and/or are materials/components proprietary?

- Yes, proprietary
 No, not proprietary

Note: The maintenance materials (renewed cartridges and media) are proprietary, but anyone can provide the labor and necessary equipment to remove and replace the cartridges and clean sediment from the vault. Oldcastle/KriStar will even provide maintenance training at cost.

Maintenance complexity (check all that apply):

Confined space training required for maintenance

Liquid pumping and transportation

Specify method: Vacuum Truck

Solids removal and disposal

Specify method: Landfill

Other noteworthy maintenance parameter (describe): None

11. Comments

Include any additional explanations or comments: None

12. Certification

Signed by the company president or responsible officer of the organization:

"I certify that all information submitted is to the best of my knowledge and belief true, accurate, and complete."

Signature: _____



Name: Jay Holtz, PE

Title: Engineering Manager, Oldcastle/KriStar Stormwater Solutions

Date: August 19, 2014

NOTE: All information submitted to the department will be made publically accessible to all interested parties. This MTD registration form will be posted on the Virginia Stormwater BMP Clearinghouse website.