


Proprietary Filtration Devices Technical Standard 1010


Finalized September 2020

NASECA Annual Conference – Feb 2021

Eric Rortvedt
WDNR Storm Water Engineer
Eric.Rortvedt@wisconsin.gov



1



Proprietary Filtration Device (PFD) Definition

Proprietary Flow Through Storm Water Filtration Device (PFD) means either a media filter or membrane that storm water passes through to remove pollutants

PFD may also include baffles, settling chamber or by-pass mechanism


4



DNR Technical Standards

- Developed under the Standards Oversight Council (SOC) process
- Standards developed with input from various agency experts and private sector experts
- Uniform standards as recognized/utilized by agencies statewide including DSPS, DATCP, NRCS, WI Land+Water and UW-Extension
- DNR custodian for its EC & SWM technical standards

2



Purpose

- PFD is used to reduce pollutant discharge to waters of the state and might be used to help pretreat storm water before infiltration
- Standard used to predict annual average pollutant removal of Total Suspended Solids (TSS) and Total Phosphorus (TP)
- Standard applies to a PFD and not sole use of a proprietary media
- Standard is not a general product approval and is not intended to address biofiltration devices

5




Proprietary Filtration Devices Team

Kate Brunner, SOC (Coordinator)
Eric Rortvedt, WDNR (Team Leader)
Chris Allen, Contech Engineered Solutions
Jim Bachhuber
Roger Bannerman
Adrienne Cizek, Stormwater Solutions Engineering
Jay Holtz, Oldcastle
Judy Horwath, USGS
Jan Kucher, UW-Madison
Phillip Taylor, Hydro International
Nick Vande Hey, McMahon Engineers & Architects
John Voorhees, AECOM



<https://socwisconsin.org/1010-proprietary-filtration-devices/>

3



Conditions Where Standard Applies

- Intended for storm water treatment to meet NR 151.122 annual mass reduction standard
- Not intended for end-of-pipe effluent concentration limit such as a wastewater permit
- PFD more likely to be used in redevelopment site where there is insufficient space for an above ground system
- PFD not suitable for controlling sediment from construction site and PFD filter needs to be kept off-line until drainage area to PFD is stabilized

6

General Location Criteria

- Filter media shall be at least one foot above season high groundwater or have other protection to prevent groundwater from affecting media (does not apply to membranes intended to be wet)
- Granular filter media needs to have a regular dry out period to allow media to aerate between runoff events
- Protected from backwater from a storm up to 10-yr, 24-hr event

7

Determine the Number of Filters Needed Based on Maintenance

Filters needed = (overall drainage area to PFD) / (individual filter cartridge max allowable drainage area)

Example:


- Drainage area to filter is 1.1 acres
- Filter cartridge max allowable drainage area is 0.060 acre (Based on NJDEP certification)

Filters = 1.1 ac / 0.06 ac = 18.3 (round up)
19 filters (based on maintenance)

10

Design Criteria Filter Sizing Objectives


- **Maintenance Life:** Minimum filtration design life of 12 months before filter becomes spent
 - Spent means a 10% flow rate drop from its Maximum Treatment Flow Rate (MTFR)
- **Filter flow capacity:** By design to meet annual average pollutant removal goal



8

Filter Flow Capacity Needs

- Maximum Treatment Flow Rate (MTFR) needs are based on:
 - Site pollutant removal needed
 - Wisconsin annual rainfall
 - PFD-specific treatment performance



11

Design Life before Maintenance


- Standard utilizes **New Jersey Department of Environmental Protection (NJDEP)** certification of PFD with respect to maximum allowable drainage area per filter cartridge based on treating 600 lb/ac TSS load before becoming spent
- 600 lb/ac load is comparable to annual WI parking lot runoff
- Site-specific conditions affect actual filter life so filters may become spent or in less than 12 months

9

Methods to Determine PFD Sizing

- Options to determine Maximum Treatment Flow Rate (MTFR) needs:
 - Option 1: Calculation process laid out in Standard 1010
 - Option 2: Use an approved model

12



Option 1: Calculation Process Laid Out in Standard 1010

Example calculations included in the standard

Spreadsheet available to calculate NURP adjusted filter efficiency

Lucy Rortve

13

NURP Adjusted Efficiency

Particle Size (microns)	NURP PSD (% by mass)	Average Influent PSD from Field Samples (% by mass)
<4	29	X
4 – 62.5	58	Y
> 62.5	13	

* Spreadsheet developed to calculate overall adjusted filter efficiency


16

Overall Site Treatment Equation

Site Treatment Required = (% Runoff Filtered / 100) x Filter Efficiency

Where:

- Site treatment required such as 40% TSS control
- next overall adjusted filter efficiency must be determined
- then minimum % runoff filtered can be determined using a graph in the standard



14

Switch to Spreadsheet

17

Method to Predict TSS Filter Efficiency

- Utilizes PFD field test data used to obtain a GULD approval from **Washington State Technology Assessment Protocol – Ecology (TAPE)**
- Field testing pollutant removal efficiency is lowered based on how much the influent particle size distribution is smaller than a NURP distribution
- Safety factor adjustment up to 10% reduction when less than 15 influent or effluent PSDs


15

Overall Site Treatment Equation

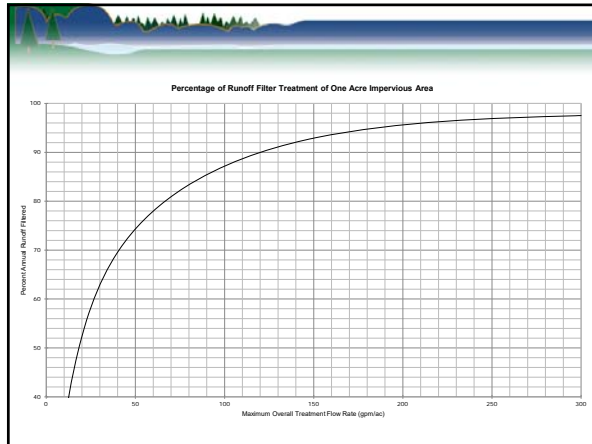
Site Treatment Required = (% Runoff Filtered / 100) x Filter Efficiency

Where:

- Site treatment required such as 40% TSS control
- next overall adjusted filter efficiency must be determined
- then minimum % runoff filtered can be determined using a graph in the standard (next slide)



18



19

Overall Filter Needs

For the example, filter needs were:

- 19 filters (based on **maintenance**)
- 10 filters (based on **flow capacity**)

The higher filter number between maintenance and flow is needed. Therefore, **19 filters are needed**

Commonly filter maintenance needs control, except when higher treatment levels, then flow capacity is more likely to control

22

Determine the Number of Filters Needed Based on Flow


Minimum % annual runoff filtered = (TSS reduction needed * 100%) / (overall adj TSS filter efficiency) * (percent site treated)

Example:

- 1.4 ac parking lot redevelopment where 1.1 ac treated and 0.3 ac untreated
- Redevelopment site requires 40% TSS control
- Assume overall adj filter eff = 60%
- Assume filter cartridge MTR of 10 gpm

= (40% * 100%) / [60% * (1.1 ac / 1.4 ac)] = 85%

20



Total Phosphorus Filtration Efficiency

- PFD with GULD Phosphorus approval is given credit for the overall average TP removal reported, which will be at least 50%
- PFD with TAPE GULD Basic (TSS) approval may take credit for 25% TP removal

23

Determine the Number of Filters Needed Based on Flow (cont.)

Using Standard 1010, Figure 1: If 85% of the annual runoff must be treated (calculated prior slide), then based on the graph, 87 gpm MTR is needed per acre of drainage area treated.

Determine minimum total filter MTR needed for 1.1 acres of treated area:

(87 gpm/ac) * 1.1 acres of treated area = 96 gpm

With each having a MTR of 10 gpm, determine filters needed:

96 gpm / 10 gpm = 9.6
10 filters (based on flow)

21


Design Requirements

- **Flow Routing** – Prevent flow in excess of MTR from passing through the filter media by flow bypass, overflow or limiter
- **Oil and Grease Pretreatment** – Runoff from vehicle parking area, drive up window areas, vehicle maintenance or repair areas.
 - Excessive oil or grease can lead to premature filter clogging
- **Sediment pretreatment** – To prevent large sediment particles from reaching the filter such as from winter sanding

24

Design Requirements (cont.)

- **Access for maintenance**
- **Requirements for reporting performance predictions** – Information to determine the NURP adjusted filter efficiency for TSS and modeling design
- **Installation** – Must be consistent with field testing and modeling assumptions



25

Questions

Eric Rortvedt
 WDNR Storm Water Engineer
Eric.Rortvedt@wisconsin.gov
 (608)273-5612 (voice mail)

28

Operation & Maintenance

- **Site-specific O&M plan**
 - Quarterly inspection at least for the first 12 months of operation under normal operational conditions
 - Inspection frequency may be reduced to no less than once every 12 months provided quarterly inspections confirm no maintenance needed in less than 12 months of normal operation
 - Inspection also needed whenever a significant source of sediment, oil, grease or petroleum has drained to the PFD



26

Operation and Maintenance

- **Site-specific O&M plan (cont.)**
 - Remove accumulated sediment in bottom of the device as recommended in the OEM manual but no less than once every 12 months
 - Replace the media filters as recommended in the OEM manual, except that media filters shall be replaced every 12 months. However, if it is clear that a media filter is not close to reaching the OEM manual replacement indicators of requiring replacement, then it may continue to be used but shall be replaced after a maximum of 24 months no matter what O&M replacement indicators suggest



27