11.3 MANUFACTURED TREATMENT DEVICES (NON-GI)

Manufactured Treatment Devices (MTDs) are proprietary stormwater treatment systems used to address the stormwater quality impacts of land development, and they rely upon a variety of mechanisms to remove pollutants from stormwater runoff. This chapter solely address those MTDs that do not meet the definition of green infrastructure at N.J.A.C. 7:8-1.2, and for which a waiver or variance from N.J.A.C. 7:8-5.3 is required. For MTDs that do meet the green infrastructure definition, see *Chapter 9.5: Green Infrastructure Manufactured Treatment Devices*.

When selecting an MTD for a particular site, the peak flow rate of the Water Quality Design Storm, the contributory drainage area and the physical size limits of its installation area must be known in advance. An MTD must have a Department-issued certification letter in order to be accepted for use and be sized in accordance with its published verification report. Provided the required waiver or variance is granted and all of the design criteria in this chapter is followed, the total suspended solids (TSS) removal rate is either 50 or 80%, depending upon the individual certification of the device, which may be found at:

http://www.njstormwater.org/treatment.html.

N.J.A.C. 7:8 Stormwater Management Rules – Applicable Design and Performance Standards		
	Green Infrastructure	Not Allowed
	Stormwater Runoff Quantity	Not Allowed
GR	Groundwater Recharge	Not Allowed
%	Stormwater Runoff Quality	Only with a waiver or variance from N.J.A.C. 7:8-5.3, 50 or 80% TSS, depending upon posted NJDEP certification

Introduction

An MTD is a proprietary device used to treat stormwater runoff. There are two types of MTDs currently certified by the Department: hydrodynamic sedimentation (HDS) devices and filtration devices.

- HDS devices are flow-through structures that remove pollutants by settling either by creating a swirling vortex, through the use of a baffle system or laminar plates or a combination of those mechanisms.
- Filtration devices remove pollutants by passing stormwater runoff through filter media.

Only with a waiver or variance from N.J.A.C. 7:8-5.3 may an MTD, designed in accordance with this chapter, be used to satisfy the standards for stormwater runoff quality, since this BMP does not meet the definition of green infrastructure.

Finally, all MTDs must have a maintenance plan and must be reflected in a deed notice recorded in the county clerk's office to prevent alteration or removal.

Applications

Only if a waiver or variance from the green infrastructure requirements of N.J.A.C. 7:8-5.3 is obtained may non-GI MTDs be used to meet the stormwater runoff quality requirement. The total suspended solids (TSS) removal rate for MTDs is based on NJDEP certification of each device. To merit the NJDEP certified TSS removal rate, MTDs must be correctly sized to treat the Water Quality Design Storm (WQDS) and be designed in accordance with all of the design criteria specified in this chapter. The most current MTD certifications with sizing information can be found on the Department's stormwater website at:

http://www.njstormwater.org/treatment.html.

Note that this certification list is subject to change. As technologies evolve, additional MTDs may become certified and get added to the list. Conversely, existing certifications may expire and be removed from the list. Therefore, it is important to check the website regularly when considering using an MTD in any type of site design.

Design Criteria

Basic Requirements

Presented below are general design criteria for MTDs; however, each MTD has additional design criteria based on the type of device and the model. All of the following design criteria must be incorporated into the design in order to receive the certified TSS removal rate. For a full list of design criteria for a specific MTD, refer to the certification documents found online at:

http://www.njstormwater.org/treatment.html.

Flow Rate

- All MTDs must be selected based on the peak flow rate of the Water Quality Design Storm (WQDS) for the entire contributory drainage area to the MTD, which may have size restrictions. For more information on specific limitations refer the certification letter for that specific MTD.
- When calculating the flow rate using Natural Resource Conservation Service (NRCS) methodology, the DelMarVa unit hydrograph may not be used. The standard unit hydrograph with a peak rate factor of 484 must be used in this calculation.
- When calculating the flow rate using the Rational Method, the intensity of the WQDS must be determined using the Rainfall Intensity-Duration Curve located in *Chapter 5: Stormwater Management Quantity and Quality Standards and Computations*. The correct intensity value to use is directly correlated to the computed time of concentration. As such, noting that the WQDS is defined as 1.25 inches of rain falling over a 2-hour time period, it is incorrect to utilize an average intensity of 0.625 inches/hour when sizing MTDs, because MTDs are based on peak flowrates, as opposed to runoff volumes. For the same reason, use of the Modified Rational Method is not allowable when sizing MTDs.
- Future connections to a system that includes an MTD are prohibited if the proposed maximum stormwater quality treatment flow rate of the existing MTD would be exceeded.

Configuration

- The MTD must be designed and installed with the same configuration utilized during the testing for verification by NJCAT.
- Designs for HDS MTDs may not include grate inlets directly into the unit unless they were specifically tested with this type of inlet.
- In designs for HDS MTDs, inflow and outflow pipe angles must follow the testing configuration. Unless other angles are specifically tested during the verification, only inlet and outlet pipes of 180 degrees (straight line) are acceptable.

Structural

- The minimum separation from the seasonal high water table (SHWT) is dependent upon the MTD that is chosen.
- All devices subject to vehicular loading must be designed for at least HS-20 traffic loading at the surface.
- All joints and connections must be watertight.
- The manhole cover, or other approved permanent marker, must clearly indicate that it is a pollutant-trapping device.

Safety

All MTDs must be designed to safely convey overflows to down-gradient drainage systems. The design of the overflow structure must be sufficient to provide safe, stable discharge of stormwater runoff in the event of an overflow. Safe and stable discharge minimizes the possibility of adverse impacts, including erosion and flooding in down-gradient areas. Therefore, discharge in the event of an overflow must be consistent with the Standards for Off-Site Stability found in the *Standards for Soil Erosion and Sediment Control* in New Jersey.

Outflow

Blind connections to down-gradient facilities are prohibited. Any connection to down-gradient stormwater management facilities must include access points such as inspections ports and manholes, for visual inspection and maintenance, as appropriate, to prevent blockage of flow and ensure operation as intended. All entrance points must adhere to all Federal, State, County and municipal safety standards such as those for confined space entry.

Tailwater

The effects of tailwater must be considered based upon the MTD manufacturer's recommendations.

Access Requirements

An access roadway must be included in the design to facilitate monitoring and maintenance. If the access roadway is constructed of impervious material, take note that it may be subject to the groundwater recharge, stormwater runoff quality and/or stormwater runoff quantity requirements at N.J.A.C. 7:8-5.4, 5.5 and 5.6, respectively.

Sizing an MTD

The examples on the following pages illustrate how to size an MTD to treat the runoff generated by the WQDS.

Example 1: The following parameters apply:

Area =	1 acre
CN Value =	98 (100% Impervious)
T_c=	6 minutes
Unit Hydrograph Peak Rate Factor =	484 (SCS)

Step 1: Runoff Calculations

Using the Natural Resource Conservation Service (NRCS) methodology, the Water Quality Design Storm runoff peak flow rate was calculated to be 2.93 cfs.

Step 2: Selecting the appropriate MTD model

The website http://www.njstormwater.org/treatment.html contains a table, shown on the following pages, of the MTDs certified at the time of publication of this chapter. Clicking on the word *Certification* in the appropriate cell of the table will open the certification letter for that MTD, which includes either an example on how to size the MTD or a table with model numbers and allowable flow rates for each model. The information presented in the certification letter must be used to size the MTD.

Current Listing of Department Approved Stormwater MTDs

MTDs NOT Considered GI

Devices Certified by NJDEP	MTD Laboratory Test Certifications	Superseded Certifications	Certified TSS Removal Rate	Maintenance Plan	Expiration Date
Aqua-Filter™ Stormwater Filtration System Model AF-3.48 Round with Perlite Media by AquaShield, Inc.	Certification		80%	Plan	
Aqua-Filter™ Stormwater Filtration System with Perlite Media by AquaShield, Inc.	Certification	Superseded	80%	Plan	
Aqua-Swirl By AquaShield, Inc.	Certification	Superseded	50%	Plan	6/30/2022
Aqua-Swirl XCelerator Stormwater Treatment System By AquaShield, Inc.	Certification	Superseded	50%	Plan	7/23/2024
BayFilter™ Enhanced Media Cartridge by BaySaver Technologies, LLC	Certification	Superseded	80%	Plan	

Table is continued on the next page

MTDs NOT Considered GI

Devices Certified by NJDEP	MTD Laboratory Test Certifications	Superseded Certifications	Certified TSS Removal Rate	Maintenance Plan	Expiration Date
BaySaver Barracuda by BaySaver Technologies, LLC	Certification		50%	Plan	9/18/2022
Cascade Separator™ by CONTECH Engineering Solutions LLC.	Certification	Superseded	50%	Plan	10/01/2024
Continuous Deflective Separator (CDS) Unit by CONTECH Stormwater Solutions, Inc.	Certification	Superseded	50%	Plan	6/30/2022
Debris Separating Baffle Box by BioClean Environmental Services, Inc.	Certification		50%	Plan	6/11/2024
Downstream Defender by Hydro International, Inc.	Certification	Superseded	50%	Plan	6/30/2022
Dual Vortex Separator by Oldcastle Infrastructure	Certification	Superseded	50%	Plan	6/30/2022
First Defense HC (FDHC) Stormwater Treatment Device by Hydro International, Inc.	Certification	Superseded	50%	Plan	6/30/2022
Hydroworks® HydroFilter by Hydroworks® LLC.	Certification		80%	Plan	
HydroStorm Hydrodynamic Separator by Hydroworks® LLC.	Certification		50%	Plan	3/27/2023
Jensen Deflective Separator (JDS) by Jensen Stormwater Systems	Certification		50%	Plan	2/28/2024
Kraken Stormwater Filtration System by BioClean Environmental Service, Inc.	Certification	Superseded	80%	Plan	
Nutrient Separating Baffle Box® (NSBB) with Hydro-Variant Technology Stormwater Treatment Device by Suntree Technologies, Inc.	Certification		50%	Plan	6/30/2022

Table is continued on the next page

Current Listing of Department Approved Stormwater MTDs (*cont'd.*)

MTDs NOT Considered GI

Devices Certified by NJDEP	MTD Laboratory Test Certifications	Superseded Certifications	Certified TSS Removal Rate	Maintenance Plan	Expiration Date
Ocean Guardian by S&M Precast, Inc.	Certification		50%	Plan	6/5/2025
PerkFilter™ Media Filtration System by Oldcastle Infrastructure	Certification	Superseded	80%	Plan	
SciClone™ Hydrodynamic Separator by BioClean Environmental Services, Inc.	Certification		50%	Plan	12/21/2022
SiteSaver Stormwater Treatment Device by StormTrap, LLC	Certification	Superseded	50%	Plan	3/14/2024
StormKleener™ Cartridge System by Lane Enterprises	Certification		80%	Plan	
StormPro Stormwater Treatment Device by Environment 21, LLC	Certification	Superseded	50%	Plan	6/30/2022
Stormwater Management StormFilter by CONTECH Stormwater Solutions, Inc.	Certification	Superseded	80%	Plan	
Terre Kleen™ Hydrodynamic Separator by Terre Hill Stormwater Systems	Certification		50%	Plan	6/30/2022
Up-Flo® Filter EMC (Extended Maintenance Cartridge)	Certification		80%	Plan	
Up-Flo® Filter with 285R Filter Ribbon Media by Hydro International	Certification	Superseded	80%	Plan	
Up-Flo® Filter with 450R Filter Ribbon Media by Hydro International	Certification		80%	Plan	

For this example, the following MTD models certified for 50% TSS Removal would be acceptable (this only includes MTDs certified as of the date of publication of this chapter and is not intended to either exclude MTDs that are certified afterward or allow the use of MTDs with certifications that have subsequently expired):

MTDs Certified for 50% TSS Removal		
MTD	**Model**	**Maximum Water Quality Treatment Flow Rate (cfs)**
Aqua-Swirl	AS-8	3.74
Aqua-Swirl XCelerator	XC-6	3.31
BaySaver Barracuda	S8	5.00
Cascade Separator	CS-6	4.05
CDS	CDS-8	3.70
Debris Separating Baffle Box	5-10	4.40
Downstream Defender	8-ft	4.49
Dual Vortex Separator	DVS-84	3.06
FDHC	6-ft	3.38
HydroStorm	HS8	3.52
JDS	JDS96-4848	3.70
NSBB	5-10	3.89
Ocean Guardian	(2) OG-120	3.68*
SciClone	SC-9	3.54
SiteSaver	STSS-3	3.24
StormPro	V816	5.17
Terre Kleen	TK27	3.34

For the Ocean Guardian device marked * above, a minimum of 2 units would be required to treat the water quality flow rate in this example. In any case where the water quality flow rate exceeds the maximum treatment capacity of an MTD, the flow can be diverted into multiple appropriately sized MTDs.

Take note that a separate table may be found on the following page for those MTDs certified for 80% TSS Removal.

MTDs Certified for 80% TSS Removal				
MTD Name	**Model**	**Maximum Stormwater Runoff Quality Treatment Flow Rate (MTFR) per Unit (cfs)**	**Number of Units Required**	**Total MTFR (cfs)**
Aqua-Filter (AF-3.48)	AF-3.48	0.25	12	3.00
Aqua-Filter	AF-10.14	2.97	1	2.97
BayFilter	22.5 gpm cartridge	0.0501	59	2.96
Hydroworks	HF B20-18-3	1.51	2	3.02
Kraken	KF-8-12	1.48	2	2.96
PerkFilter	18 gpm cartridge	0.0401	74	2.97
StormKleener	8'x10' vault –352 gpm units	0.784	4	3.14
StormFilter	15 gpm cartridge	0.0334	88	2.94
Up-Flo Filter EMC	12.4 gpm cartridge	0.0276	107	2.95
Up-Flo Filter (with 285R Filter Ribbon)	UFF-ZV-19-285R units	0.635	5	3.17
Up-Flo Filter (with 450R Filter Ribbon)	UFF-ZV-75-450R units	3.34	1	3.34

In any case where the WQDS flow rate exceeds the maximum treatment capacity of an MTD, the flow can be diverted into multiple appropriately sized MTDs. The maximum drainage areas for any filtration MTD must also be evaluated. However, these generally only become a factor if the MTD is located downstream of a detention structure.

Alternatively, Example 1 can be calculated using the Rational Method.

Example 2: The following parameters apply:

Area =	1 acre
C Value =	0.99 (100% Impervious)
T_c=	10 minutes (min. value on the IDF curve)
Intensity =	3.2 inches/hour

Step 1: Runoff Calculations

First the Tc must be determined. In this example, the T_c is 10 minutes. This T_c must then be used to determine the intensity, which is done using the rainfall Intensity-Duration Curve for the WQDS located in *Chapter 5.* Using the curve, the intensity is determined to be 3.2 inches/hour. Once the intensity is determined, the flow rate can be calculated with the following equation:

$$Q = C\ x\ i\ x\ A$$

Substituting the values noted above yields the following result:

$$Q = 0.99\ x\ 3.2\ x\ 1 = 3.17\ cfs$$

Step 2: Selecting the appropriate MTD model

The method for selecting the appropriate MTD model remains unchanged from Example 1. As you can see, in this case, the Rational Method produces a slightly higher peak flowrate, which will require some of the MTD units to be slightly larger than what would be required if the calculations were performed with NRCS methodology as shown in Example 1. Therefore, while using the Rational Method is simpler, it may be advantageous to use NRCS methodology in many cases. Furthermore, the Rational Method may only be used for drainage areas of less than 20 acres.

Considerations

If an MTD is being considered for an outfall retrofit, it is essential to calculate the current Water Quality Design Storm flow rate based on the entire inflow drainage area at the outfall before selecting the MTD. Additionally, the annual cost of components may be a deciding factor in the selection process when considered over the life cycle of an MTD unit. For more information on components which require periodic replacement, refer to the Operations and Maintenance Manual for the MTD being evaluated for suitability.

Maintenance

Regular and effective maintenance is crucial to ensure effective MTD performance; in addition, maintenance plans are required for all stormwater management facilities associated with a major development. There are a number of required elements in all maintenance plans, pursuant to N.J.A.C. 7:8-5.8; these are discussed in more detail in *Chapter 8: Maintenance and Retrofit of Stormwater Management Measures*. Furthermore, maintenance activities are required through various regulations, including the New Jersey Pollutant Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A. Specific maintenance requirements for MTDs are presented below; these requirements must be included in MTD's maintenance plan.

General Maintenance

- All structural components must be inspected, at least once annually, for cracking, subsidence, spalling, erosion and deterioration.
- Components expected to receive and/or trap debris and sediment must be inspected for clogging at least twice annually, as well as after every storm exceeding 1 inch of rainfall.
- During inspections, the MTD must be examined for standing water. If standing water is present in the MTD, and standing water is not a component of the MTD design, corrective action must be taken and the maintenance manual must be revised to prevent similar failures in the future.
- Sediment removal should take place when all runoff has drained from the MTD.
- Disposal of debris, trash, sediment and other waste material must be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations.
- The maintenance plan must indicate the maximum allowable level of oil, sediment and debris accumulation. These levels must be monitored during inspections to ensure that removal of these materials is performed when necessary.
- In addition to the requirements for maintenance listed above, maintenance in accordance with the MTD manufacturer's recommendations must be included in the maintenance manual and performed as indicated.

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