

9.5 MANUFACTURED TREATMENT DEVICES (GI)

Manufactured treatment devices (MTDs) are proprietary stormwater treatment systems used to address the stormwater runoff quality impacts of land development and rely upon a variety of mechanisms to remove pollutants from stormwater runoff. There are two types of MTDs currently certified by the Department: hydrodynamic sedimentation (HDS) devices and filtration devices. Most of these devices are not approved for use as a green infrastructure BMP (See *Chapter 11.3: Manufactured Treatment Devices (Non-GI)*) because they do not manage stormwater close to its source either by infiltration into subsoil, treatment by vegetation or soil or storage for reuse. A subset of MTDs rely upon specialized technology and incorporate an engineered, high-flow rate filter media to remove stormwater pollutants, allowing for a smaller footprint than conventional bioretention systems. Some of the designs include one or more plants within the unit to form a plant/soil/microbe complex for the purpose of pollutant removal. Only such specialized MTDs meet the definition of green infrastructure. Currently, MTDs approved for use as green infrastructure BMPs have a total suspended solids (TSS) removal rate of 80%. The individual certifications may be found in the table labeled *Green Infrastructure (GI) MTDs* posted online at: <http://www.njstormwater.org/treatment.html>. Take note that there are additional MTDs listed on the website, but those that are not considered GI are listed in a separate table, and this chapter does not apply to them.

N.J.A.C. 7:8 Stormwater Management Rules – Applicable Design and Performance Standards		
	Green Infrastructure	Yes
	Stormwater Runoff Quantity	Not Allowed
	Groundwater Recharge	Not Allowed
	Stormwater Runoff Quality	80% TSS

Introduction

When selecting a GI MTD for a particular site, the peak flow rate of the Water Quality Design Storm (WQDS), the contributory drainage area and the physical size limits of the MTD installation area must be known in advance. A GI MTD must be sized in accordance with its published verification report and have a Department-issued certification letter in order to be accepted for use to meet the green infrastructure requirement specified in N.J.A.C. 7:8-5.3. A GI MTD 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



Pursuant to N.J.A.C. 7:8-5.2(a)(2), the minimum design and performance standards for groundwater recharge, stormwater runoff quality and stormwater runoff quantity at N.J.A.C. 7:8-5.4, 5.5 and 5.6 shall be met by incorporating green infrastructure in accordance with N.J.A.C. 7:8-5.3.



The total suspended solids (TSS) removal rate for GI MTDs is 80% pursuant to New Jersey Center for Advanced Technology (NJCAT) verification and NJDEP certification of each device. To merit the NJDEP certified TSS removal rate, a GI MTD must be sized in accordance with its published verification report and have a Department-issued certification letter in order to be accepted for use to meet the green infrastructure requirement specified in N.J.A.C. 7:8-5.3. The current GI 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 GI 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 GI MTDs; however, each GI MTD has additional design criteria based on the type of device and the model. For a full list of design criteria for a specific GI MTD, refer to the certification documents on the Department's website listed above.

Contributory Drainage Area

- Pursuant to N.J.A.C. 7:8-5.3(b), the maximum contributory drainage area is 2.5 acres. For more information on specific limitations, refer the certification letter for that specific MTD.

Flow Rate

- All GI 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, subject to the above-stated maximum contributory drainage area limitation.
- 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 use an average intensity of 0.625 inches/hour when sizing any MTD, because MTDs are based on peak flowrates, as opposed to stormwater 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 a GI MTD are prohibited if the proposed maximum stormwater runoff quality treatment flow rate of the existing MTD would be exceeded.

Configuration

A GI MTD must be installed in the field using the same configuration under which it was tested for NJCAT verification. NJDEP certified GI MTDs can be found online at the link published in the Applications section on the preceding page, and NJCAT verification reports can be found online at:

<http://www.njcat.org/verification-process/technology-verification-database.html>.

The configuration used in the verification testing can be found in the NJCAT verification documents.

Structural

- The minimum separation from the seasonal high water table (SHWT) is dependent upon the GI 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.
- If present, the manhole cover, or other approved permanent marker, must clearly indicate that it is a pollutant-trapping device.

Safety

All GI 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 GI 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 stormwater runoff quality, quantity and groundwater recharge requirements at N.J.A.C. 7:8-5.4, 5.5 and 5.6.

Sizing a GI MTD

The examples below illustrate how to size a GI MTD to treat the stormwater runoff generated by the impervious cover in the contributory drainage area that is produced by the Water Quality Design Storm (WQDS).

Example 1:

A site expansion project includes the construction of an additional building which will require a 1 acre vehicular parking lot and accompanying access driveway. More than one-quarter acre of regulated motor vehicle impervious surface is proposed; therefore, the stormwater runoff quality standards of N.J.A.C. 7:8-5.2(a) apply to this site. To address the 80% TSS removal rating requirement, a GI MTD is proposed. Design a GI MTD that will treat the stormwater runoff quality flow for this stormwater system. Assume the stormwater runoff quantity control and groundwater recharge requirements will be met by another stormwater management practice placed down-gradient of the GI MTD.

The following parameters apply:

Area of the New Impervious Surface=	1 acre
CN Value =	98 (100% Impervious)
T _c =	6 minutes
Unit Hydrograph Peak Rate Factor =	484 (SCS)

Step 1: Stormwater Runoff Calculations

Using the Natural Resource Conservation Service (NRCS) methodology presented in *Chapter 5: Stormwater Runoff Water Quantity Standards and Computations*, the WQDS stormwater runoff peak flow rate was calculated to be 2.93 cfs.

Step 2: Selecting the Appropriate Green Infrastructure MTD Model

The website <http://www.njstormwater.org/treatment.html> contains a table, portions of which are shown on the following page, with a column indicating the GI MTDs so marked are certified at the time of publication of this chapter for use as a GI BMP. 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 GI 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 GI MTD.

Current Listing of Department Approved Green Infrastructure (GI) Stormwater MTDs

Green Infrastructure (GI) MTDs				
Devices Certified by NJDEP	MTD Laboratory Test Certifications	Superseded Certifications	Certified TSS Removal Rate	Maintenance Plan
Aqua-Ponic™ Stormwater Biofiltration System	Certification		80%	Plan
Biopod™ Biofilter with StormMix Media by Oldcastle Infrastructure	Certification	Superseded	80%	Plan
EcoPure BioFilter by Advanced Drainage Systems, Inc.	Certification		80%	Plan
Filtterra Bioretention System by Contech Engineered Solutions	Certification	Superseded	80%	Plan
Filtterra® HC Bioretention System by Contech Engineered Solutions	Certification		80%	Plan
StormScape™ Filter by Hydro International	Certification		80%	Plan
StormVault BioFiltration with Sierra Blend by Jensen	Certification		80%	Plan

Source: <https://njstormwater.org/treatment.html>, dated February 18, 2021.

For this example, the following MTDs would be acceptable (this only includes MTDs certified for use as meeting the green infrastructure design standard 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). Each of the models have a maximum treatment flow rate that is much lower than the WQDS peak flow rate calculated on the previous page. Therefore, multiple units would be required. To calculate the number of units, divide the WQDS peak flow rate by the rate for a single unit and round up the result to the next whole number. Refer to the Sizing Notes on the following page for more details on each of the MTDs listed in the table at the top of the following page.

Green Infrastructure MTDs Certified for 80% TSS Removal				
MTD Name	Model	Maximum Stormwater Runoff Quality Treatment Flow Rate (MTFR) per Unit	Number of Units Required	Total MTFR (cfs)
Aqua-Ponic	AP-10	1.23	3	3.69
Biopod	6 x 12	0.288	11	3.17
EcoPure	8 x 16	0.535	6	3.21
Filtterra	7 x 13	0.295	10	2.95
Filtterra HC	6 x 8	0.333	9	3.00
StormScape	6 x 12	0.234	13	3.04
StormVault	8 x 8	0.290	11	3.19

Alternatively, Example 1 may be calculated using the Rational Method, following the discussion on the use of the Rational Method found in *Chapter 5*.

Example 2:

Using the Rational Method, size a GI MTD to address the stormwater runoff water quality requirement for a proposed development which includes 1 acre of new regulated motor vehicle impervious surface. Assume the stormwater runoff quantity control and groundwater recharge requirements will be met by another stormwater management practice placed down-gradient of the GI MTD.

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: Stormwater Runoff Calculations

Since the time of concentration, T_c, has been provided in the example statement, it is then used to determine the intensity of the WQDS. The rainfall Intensity-Duration Curve for the WQDS is located in *Chapter 5: Computing Stormwater Runoff Rates and Volumes*. From the curve, the intensity is determined to be 3.2 inches/hour. Next, the peak flow rate (cfs) can be calculated with the equation for the Rational Method:

$$Q_p = C i A, \text{ where}$$

- C = runoff coefficient (Dimensionless), which describes the level of imperviousness of the drainage area and reflect the ability of a soil to infiltrate precipitation before excess precipitation becomes stormwater runoff and sometimes the slope of the drainage area
- i = uniform rate of rainfall intensity for a rainfall duration longer or equal to the time of concentration T_c (in/hr)
- A = drainage area (ac)

Substituting the values noted above yields the following result:

$$Q_p = 0.99 \times 3.2(\text{in/hr}) \times 1(\text{ac}) = 3.17 \text{ cfs}$$

Step 2: Selecting the Appropriate Green Infrastructure MTD Model

The method for selecting the appropriate MTD model remains unchanged from Example 1. Notice that the Rational Method produces a slightly higher peak flowrate for 1 ac of impervious cover, as compared to the NRCS methodology for the same size area. The increased the peak flow rate will require that some of the MTD units be slightly larger than what would be required if the calculations were performed with NRCS methodology, as shown in Example 1.

Once again, the peak flow rate calculated in Step 1 is divided by the maximum treatment flow rate of the selected MTD to calculate the number of units required with the answer rounded up to the next whole number. The same models listed in Example 1 are selected for this example.

Green Infrastructure 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-Ponic	AP-10	1.23	3	3.69
Biopod	6 x 12	0.288	12	3.46
EcoPure	8 x 16	0.535	6	3.21
Filtterra	7 x 13	0.295	11	3.25
Filtterra HC	6 x 8	0.333	10	3.33
StormScape	6 x 12	0.234	14	3.28
StormVault	8 x 8	0.290	11	3.19

Compared to the NRCS methodology, the Rational Method would need more units to meet the required stormwater runoff quality peak flow rate. Therefore, while using the Rational Method is simpler, it may be advantageous to use NRCS methodology. Furthermore, the Rational Method may only be used for drainage areas of less than 20 acres with uniform surface cover and topography.

Considerations

If a GI MTD is being considered for an outfall retrofit, it is essential to calculate the current WQDS stormwater runoff flow rate based on the entire contributory inflow drainage area at the outfall before selecting the GI MTD.

Additionally, the annual cost of components may be a deciding factor in the selection process when considered over the life cycle of a GI MTD unit. For more information on components which require periodic replacement, refer to the Operations and Maintenance Manual for the GI MTD being evaluated for suitability.

Maintenance

Regular and effective maintenance is crucial to ensure effective GI 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 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 a green infrastructure MTD's maintenance plan. Detailed inspection and maintenance logs must be maintained.

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, **or more frequently if specified in the MTD Operations and Maintenance Manual**, 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.
- A detailed, written log of all preventative and corrective maintenance performed on the MTD must be kept, including a record of all inspections and copies of maintenance-related work orders. Additional maintenance guidance can be found at:

https://www.njstormwater.org/maintenance_guidance.htm.

Vegetated Areas

- When using a GI MTD with vegetation, bi-weekly inspections are required when establishing/restoring vegetation.
- A minimum of one inspection during the growing season and one inspection during the non-growing season is required to ensure the health, density and diversity of the vegetation.
- Mowing/trimming of vegetation must be performed on a regular schedule based on specific site conditions; perimeter grass should be mowed at least once a month during growing season.
- Vegetative cover must be maintained at 85%; damage must be addressed through replanting in accordance with the original specifications.
- Vegetated areas must be inspected at least once annually for erosion, scour and unwanted growth; any unwanted growth should be removed with minimum disruption to the remaining vegetation.
- All use of fertilizers, pesticides, mechanical treatments and other means to ensure optimum vegetation health must not compromise the intended purpose of the MTD.

References

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