New England Stormwater Retrofit Manual

This manual has been developed by VHB and the University of New Hampshire Stormwater Center with financial support from the SNEP Network and technical support from other SNEP Network partners, state agencies, and EPA Region 1.
The latest version of the manual may be accessed online at the following hyperlink along with other supplementary documents: https://snepnetwork.org/stormwater-retrofit-manual/#

Retrofit Definition

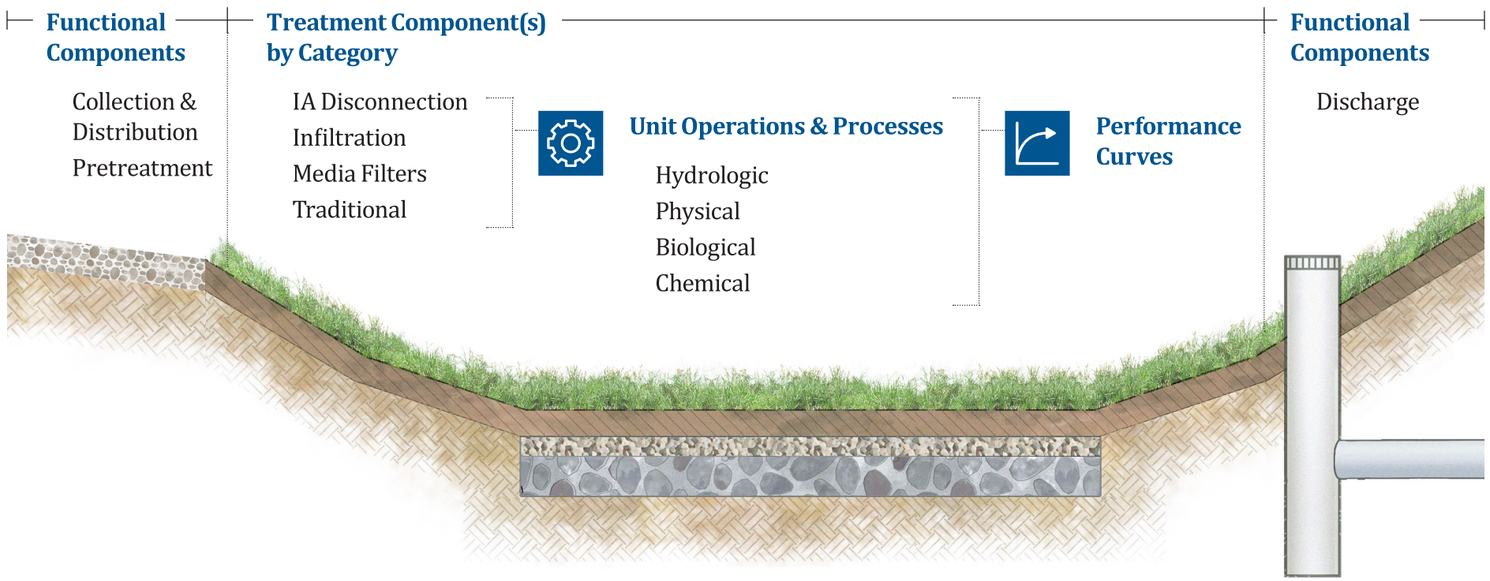
The addition of stormwater controls on a currently developed site

This manual...

- ≈ Provides research-based guidance on planning, siting, and designing retrofit stormwater control measures (SCMs) to manage stormwater in existing or reconstructed development situations where regulatory requirements do not dictate prescribed specifications.
- ≈ Discusses both the Opportunistic Approach (incorporation of SCMs into already planned and needed construction projects) and Planning Approach (proactively planning retrofits and prioritizing sites where retrofits are possible and beneficial) to identifying and installing stormwater retrofits.
- ≈ Promotes the use of the Performance Curves (see opposite page for more info) to optimize SCM selection and sizing.
- ≈ Reviews SCM unit operations and processes for treatment so that designers are empowered to be flexible and creative with their designs.
- ≈ Provides unique design guidance custom for the retrofit scenario when prescriptive regulatory guidance may be too restrictive.

Situations where this manual will assist include...

- ≈ Implementing stormwater controls as part of maintenance and planned construction.
- ≈ Demonstrating stormwater treatment to the maximum extent practicable (MEP).
- ≈ Implementing stormwater controls to meet total maximum daily load (TMDL) targets.
- ≈ Identifying and prioritizing stormwater management interventions to protect or improve a local water resource.
- ≈ Enhancing existing structural SCMs for improved performance controls (e.g., increased pollutant load and runoff volume reductions).
- ≈ Understanding cost/benefit for various control measures and options.



Performance Curves Overview

What Are The Curves?

The Stormwater Control Measure (SCM) Performance Curves were developed by EPA and serve as a tool that helps quantify water quality benefits of various structural stormwater controls. The curves relate the depth of runoff treated of various controls to pollutant reduction.

SCMs With Curves

The following SCMs have curves developed to date for Total Phosphorus, Total Nitrogen, Total Suspended Solids (TSS), Zinc, Bacteria, and Effective Impervious Cover:

- Infiltration Trench
- Infiltration Basin
- Bio-Filtration
- Bio-Filtration with ISR*
- Sand Filter
- Gravel Wetland
- Porous Pavement
- Wet Pond
- Extended Dry Detention
- Grass Swale
- Impervious Area Disconnection
- Impervious Area Disconnection Through Storage

* Internal Storage Reservoir

Curves have not been developed for all pollutants for each SCM. See Appendices B and C for more information. Infiltration controls have multiple curves to represent varying infiltration rates.

Curve Development

The curves were developed by EPA to represent long-term cumulative pollutant removal performance of several structural controls as a function of their size. The curves were generated using a long-term simulation model developed using EPA's Stormwater Management Model (SWMM) and a structural control analysis tool called Best Management Practice (BMP) Decision Support System in order to simulate the hydrology and pollutants during rain events in the New England area. Twenty-three years of rainfall data from Boston was used as the input rainfall timeseries and the models were calibrated and tested using performance data for in-situ controls collected by the University of New Hampshire Stormwater Center (UNHSC). EPA developed curves for five water quality constituents: Total Phosphorus, Total Nitrogen, Total Suspended Solids, Total Zinc, and Bacteria.

Design Storage Volume (DSV) & Runoff Depth From Impervious Area (Runoff Depth)

The DSV of an SCM is the total volume of stormwater that a SCM is designed to effectively hold and treat. The Runoff Depth from Impervious Area (IA) may be calculated as:

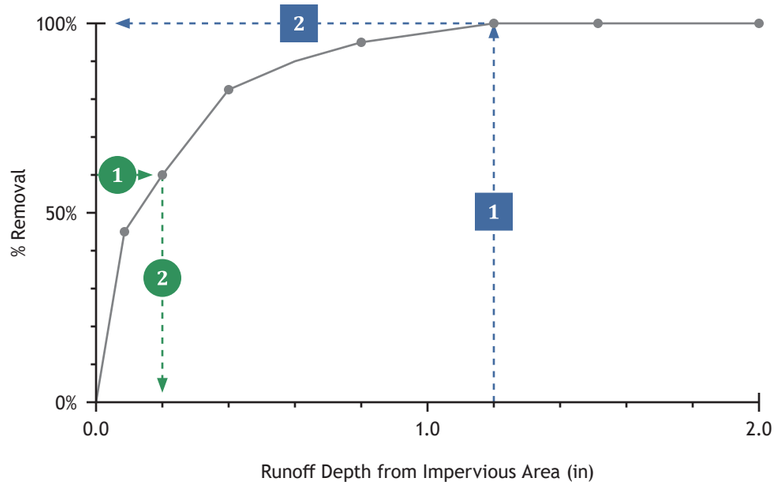
$$\text{Runoff Depth from Impervious Area (in)} = \frac{\text{DSV (ft}^3\text{)}}{\text{IA (ft}^2\text{)}} \times 12 \frac{\text{in}}{\text{ft}}$$



How to Use the Curves

The curves can be used to understand the relationship between DSV (as Runoff Depth from Impervious Area) of a given SCM and the percent pollutant reduction achieved by the SCM, using linear interpolation between values when needed. Generally, the greater the design storage volume, the higher the percent removal of the pollutant. The curves can be used to either determine the percent reduction based on a known DSV **(blue path below)** or the required DSV to achieve a desired percent reduction **(green path below)**.

The curves serve as a quick and simple tool to compare various SCMs for a site and allow a designer to readily choose which SCM is best for a site given both required treatment and sizing constraints. They also help designers understand when it may be less effective to continue to make a given SCM bigger by identifying the "knee" on the curve.



1. If a designer is working on a site where a pollutant reduction of 60% is desired...
2. ...the designer would use the curves to determine that a Runoff Depth from Impervious Area of approximately 0.2 inches achieves the desired reduction
1. If a designer determines that their SCM provides a DSV equivalent to 1.2 inches from the Impervious Area...
2. ...the designer would use the curves to determine a 98% pollutant reduction from this SCM