

Guidance for Estimating Pre- and Post-Development Stormwater Pollutant Loads

New Hampshire
Department of Environmental Services
Revision Date: May 3, 2010

This Guidance is updated periodically to accommodate advances in stormwater management and pollutant loading methodology. Users should verify that they are using the most recent version.



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PURPOSE OF THIS GUIDANCE

The purpose of this document is to provide guidance for estimating stormwater pollutant loads to surface waters (such as lakes, ponds, rivers, streams, tidal waters and wetlands) with an emphasis on using the Simple Method. Estimating pre and post-development stormwater pollutant loads is important to understanding the potential impacts of land disturbance activities and land use changes on surface water quality, as well as to determine if a proposed project is in compliance with federal and state permit requirements and the New Hampshire Surface Water Quality regulations (Env-Wq 1700).

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Goal of Pollutant Loading Analyses

As indicated below, the goal of a pollutant loading analysis depends on whether the surface waters receiving stormwater from the proposed activity have an approved Total Maximum Daily Load (TMDL) study. Information on the New Hampshire Department of Environmental Services (DES) TMDL program may be found at <http://des.nh.gov/organization/divisions/water/wmb/tmdl/index.htm>.

➤ Without an Approved TMDL

For surface waters without an approved TMDL, the goal of the pollutant loading analyses is to satisfy the antidegradation requirements of the NH Surface Water Quality regulations (Env-Wq 1700) by quantitatively demonstrating that the proposed activity or development will not result in the additional loading of pollutants to surface waters. In other words, post-development loads must be no greater than pre-development loads. For an overview of the antidegradation provisions of the New Hampshire Surface Water Quality regulations (Env-Wq 1708) please see the NHDES Antidegradation fact sheet at <http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-23.pdf>.

➤ With an Approved TMDL

If a TMDL has been conducted, the goal is to quantitatively demonstrate that pollutant loadings from the activity are in compliance with the pollutant load reductions specified in the TMDL.

LOAD REDUCTION MODELS

Load reduction models are computer-based modeling programs used to estimate stormwater pollutant loads. Examples include the SIMPLE METHOD, STEPL, AVGWLF, WINNSLAMM, P8 Urban Catchment Model, and the Region 5 model. Such models are typically used to estimate loadings for pollutants that can be removed by structural stormwater best management practices (BMPs) such as phosphorus, nitrogen, and sediment. Examples of structural stormwater BMPs include infiltration basins or trenches, grass treatment swales, wet extended detention ponds, and submerged gravel wetlands. An overview of stormwater BMPs is provided in Chapter 7, Volume 1 of the NH Stormwater Manual¹ available at: http://des.nh.gov/organization/divisions/water/stormwater/documents/wd-08-20a_ch7.pdf.

Most pollutant load reduction models are NOT used to estimate loadings from conservative/non-reactive pollutants, such as chloride, that cannot be removed by structural BMPs. Excess chloride, and other non-reactive pollutants, can be toxic to aquatic life in fresh surface waters. A primary source of chloride in many watersheds is from road and parking lot de-icing agents (i.e., road salt). The only way to reduce chlorides in surface waters is to reduce the amount of chlorides applied to the land.

¹ New Hampshire Stormwater Manual, Volumes 1, 2 and 3. December 2008. Revision 1.0. New Hampshire Department of Environmental Services. Copies can be downloaded from <http://des.nh.gov/organization/divisions/water/stormwater/manual.htm>

POINTS OF ANALYSIS (PoAs)

The purpose of a loading analysis is to prevent degradation of surface waters or to show compliance with reductions specified in an approved TMDL. Consequently, a loading analysis should be done wherever stormwater from the project discharges to a surface water; these are called Points of Analysis or PoAs. In addition, a loading analysis should also be conducted at the point where each surface water receiving stormwater from the activity crosses the project property line. DES understands there may be situations where it may not be necessary to conduct loading analyses for each and every point where stormwater discharges to a surface water. In such cases, one should use best professional judgment or consult with DES.

THE SIMPLE METHOD

At this time DES recommends using the “Simple Method” load reduction model for comparing pre-development to post-development loads for most pollutants. DES has developed a Microsoft Excel spreadsheet based on the Simple Method that may be used if desired. A description of the Simple Method is provided in Chapter 8, Volume 1 of the NH Stormwater Manual and is available at: (see http://des.nh.gov/organization/divisions/water/stormwater/documents/wd-08-20a_ch8.pdf).

DES may allow the use of other models such as STEPL, AVGWLF, etc., provided that a running version of the model and supporting documentation is submitted to DES in advance.

Those using the DES Simple Method spreadsheet model should be aware that they do so at their own risk.

Although we believe the model functions as intended, DES is not responsible for the use or interpretation of this information, or for any inaccuracies. If errors are discovered they should be brought to the attention of DES.

The Simple Method uses the following to estimate pollutant loads:

Stormwater Pollutants

Although the Antidegradation provisions (Env-Wq 1708) of the New Hampshire Surface Water Quality regulations apply to all pollutants, there is currently insufficient data to accurately model all pollutants using load reduction models. However, a review of literature suggests there is sufficient data, in most cases, to estimate the loading of **Total Suspended Solids (TSS)**, **Total Nitrogen (TN)** and **Total Phosphorus (TP)**, which are pollutants typically found in stormwater. Therefore, TSS, TN and TP are currently the only pollutants which need to be modeled.

If the loading goals are achieved for these pollutants, DES will assume that the loading goals for other pollutants (except the conservative / non-reactive pollutants such as chlorides) will also be achieved. In other words, DES is currently using TSS, TN and TP as surrogates for all other stormwater pollutants that can be removed by structural BMPs. As data for other pollutants become available in the future, inclusion of those pollutants will likely be required as part of the pollutant loading analyses.

Average Annual Precipitation

The Simple Method requires input of the average annual precipitation which should be the average annual precipitation value (in inches) for the community closest to their project. Precipitation data for various NH municipalities is available at http://www.erh.noaa.gov/gyx/climo/NH_STATS_NEW.htm.

Event Mean Concentrations (EMC)

The Simple Method requires input of stormwater event mean concentrations (EMCs) for each pollutant of concern and land use. Typical EMCs for various land uses are provided in Appendix D, Volume 1 of the NH Stormwater Manual which is available at http://des.nh.gov/organization/divisions/water/stormwater/documents/wd-08-20a_apxd.pdf.

BMP Removal Efficiencies

The Simple Method requires input of BMP removal efficiencies for each pollutant of concern and BMP of interest. BMP removal efficiencies for TSS, TN and TP and many different types of BMPs are provided in Appendix E, Volume 1 of the NH Stormwater Manual, which is available at http://des.nh.gov/organization/divisions/water/stormwater/documents/wd-08-20a_apxe.pdf). DES will consider other BMP removal efficiencies if sufficient documentation is provided.

When a sub-watershed is treated by BMPs placed in series, the BMP with the highest removal efficiency for a particular pollutant is the efficiency that is to be used in the model for computing annual loadings for that pollutant. DES may consider other formulas for computing removal efficiencies for BMPs in series if there is adequate supporting documentation such as actual sampling results of BMPs in series.

As mentioned below (see BMP Design and Maintenance Requirements), DES may require use of lower removal efficiencies if BMPs are not designed in accordance with the Alteration of Terrain regulations (Env-Wq 1500).

Tips for Using the DES Simple Method Spreadsheet

- Read the instructions (a separate worksheet) included in the Simple Method Spreadsheet.
- The DES Simple Method Spreadsheet can accommodate up to 25 sub-watersheds and is approximately 5 MB in size.
- The number of pre-development and post-development sub-watersheds can be different.
- Each sub-watershed can have multiple land uses assigned to them.
- Sub-watersheds that flow to different BMPs of the same type (i.e. one flows to one grass treatment swale and the other discharges to another grass treatment swale) can be kept separate or grouped together in the analysis. Sub-watersheds that flow to different types of BMPs (i.e., one flows to a grass treatment swale and another flows to an infiltration basin) cannot be grouped together.
- The percent impervious for impervious areas such as roofs, paved surfaces, etc. should be input as 100 percent impervious (unless they are disconnected or being treated by an infiltration BMP in which case the percent impervious should be 0 percent as discussed below). The percent impervious for pervious areas should be input as 0 percent. The same rules apply when calculating the composite percent impervious for general land use categories such as Residential, Commercial, Industrial or Highway (i.e., use 100 percent impervious for impervious areas and 0 percent impervious for pervious areas). The worksheets provided in the DES Simple Method Spreadsheet should be used to calculate the percent impervious for each land use in each sub-area. Allowable methods to disconnect impervious surfaces are discussed in Chapter 6, Volume 1 of the NH Stormwater Manual which is available at http://des.nh.gov/organization/divisions/water/stormwater/documents/wd-08-20a_apxe.pdf.
- The percent impervious for each sub-area that is treated by an infiltration BMP (and which is designed according to the Alteration of Terrain regulations - Env-Wq 1500), or which is on Group A or B soils and is disconnected (see Chapter 6, Volume 1 of the NH Stormwater Manual) may be set to 0 percent in the analysis. This is because the purpose of infiltration BMPs and disconnection is to infiltrate the stormwater runoff; by setting the percent impervious in the model to 0 percent, the volume of runoff (and associated pollutant loading) is greatly reduced. In addition, the BMP removal efficiencies for the selected infiltration BMP may be input in the model which serves to further reduce the pollutant loading.
- The Spreadsheet includes a routine that calculates load reductions for TP and TN if low nutrient fertilizer is used (see the Instructions provided in the spreadsheet for more information).

BMP DESIGN AND MAINTENANCE REQUIREMENTS

The BMP removal efficiencies discussed above assume that all BMPs are sized, and will be constructed and maintained, in accordance with the DES Alteration of Terrain Program administrative rules (Env-Wq

1500). A copy of the Alteration of Terrain Program administrative rules may be downloaded from:
http://des.nh.gov/organization/commissioner/legal/rules/documents/env-wq1500cert_w_toc.pdf.

If BMPs are not designed in accordance with DES Alteration of Terrain Program, DES may require use of lower removal efficiencies in the loading analysis.

DEED RESTRICTIONS AND EASEMENTS

Assumptions used in pollutant loading analyses must often be accompanied by legally enforceable documents, such as deed restrictions or easements that are filed with the NH Registry of Deeds, to ensure the assumptions remain in effect in perpetuity. Examples include, but are not limited to, land that is going to remain undisturbed, limitations on fertilizer applications, maintenance of disconnected impervious areas, maintenance of BMPs that are the responsibility of the land owner such as rain gardens, etc. Deed restrictions and easements are discussed in Chapter 2, Volume 1 of the NH Stormwater Manual with sample templates provided in Appendix A and B. A copy of the manual is available at http://des.nh.gov/organization/divisions/water/stormwater/documents/wd-08-20a_apxe.pdf.

SUBMITTAL REQUIREMENTS

The following must be submitted **electronically** to DES with hard copies also provided if requested:

- a. A running version of the model.
(If the DES Simple Method MS Excel spreadsheet model is used, please provide a running version of each MS Excel spreadsheet used in the analysis.)
- b. A copy of all input files needed to run the model.
(This is not needed if a running version of each DES Simple Method MS Excel spreadsheet used in the analysis is provided to DES as noted above.)
- c. Plans for pre and post-development conditions showing the following:
 - 1) Project boundaries.
 - 2) All surface waters, (including wetlands) that receive stormwater runoff from the project.
 - 3) All sub-watersheds used in the loading analysis clearly labeled and delineated.
 - 4) All land uses used in the loading analysis (i.e., commercial, industrial, residential, forested, etc) clearly labeled and delineated.
 - 5) Location of all Points of Analysis (PoA) used in the loading analyses which each PoA clearly labeled.
 - 6) All impervious and pervious areas clearly identified.
 - 7) All soil types clearly identified and delineated.
 - 8) Grading with contours preferably at 2 foot intervals.
 - 9) The stormwater drainage system including the location and type of BMPs used in the loading analysis clearly shown and labeled.
 - 10) Arrows showing the direction of flow.
- d. Schematics for pre and post-development conditions that show where each sub-watershed used in the loading analysis flows to with each sub-watershed, BMP, PoA and surface water clearly labeled and identified.
- e. Aerial photo of pre-development conditions (if available).
- f. A table (preferably an MS Excel spreadsheet) which shows the following for each sub-watershed used in the loading analysis for pre and post-development conditions (note – the worksheets included in the Simple Method spreadsheet can be used to satisfy this requirement):
 - 1) Sub-watershed number or label.
 - 2) Land use.
 - 3) The BMP (including the type and label used in the loading analysis) that is treating stormwater from the sub-watershed.
 - 4) Whether the BMP is designed as an infiltration BMP in accordance with DES Alteration of Terrain regulations (Env-Wq 1500).
 - 5) The Point of Analysis (PoA) number.

6) The area (in acres) that is:

Pervious Undisturbed (such as forested areas or meadows).
Pervious Disturbed that is lawn or landscaped (i.e., areas that will be fertilized regularly).
Pervious Pavement that infiltrates all stormwater and does not have underdrains.
Pervious Disturbed Other (specify).
Pervious Total.
Pervious Pavement with underdrain.
Impervious Roof.
Impervious Road,
Impervious Parking/Drives.
Impervious Sidewalk.
Impervious Surface Water.
Impervious Other (specify).
Total Impervious.
Total Area.

7) Total Composite Percent Impervious Cover

- g. Summaries of pre- vs post-development loads for each PoA and each pollutant of concern.
- h. Design details and sizing calculations for all BMPs used in the loading analysis that comply with the Alteration of Terrain regulations (Env-Wq 1500).
- i. The permit numbers and status of all DES permits including the Alteration of Terrain and Wetland permits.
- j. A BMP Inspection and Maintenance Plan that complies with the Alteration of Terrain regulations (Env-Wq 1500).
- k. Copies of DES approved deed restrictions and/or easements filed with the NH Registry of Deeds to ensure that assumptions used in the Pollutant Loading analyses remain in effect in perpetuity.
- l. A certification signed and stamped by a Professional Engineer licensed to practice engineering in the State of New Hampshire stating that the stormwater pollutant loading analyses, BMP designs and BMP Inspection and Maintenance plans for the proposed Activity comply with the criteria specified in this guidance document.

CONTACT INFORMATION

Should you have any questions regarding this guidance please contact:

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