

SCM 3.4.1 SPREADSHEET DISCONNECTION OF IMPERVIOUS SURFACE WITH FILTER STRIP INSTRUCTIONS

Draft, July 20, 2026

Introduction

The Department of Environmental Protection (DEP) has developed the SCM 3.4.1 Spreadsheet (Spreadsheet) to calculate volume and water quality management (WQM) credits when disconnection of impervious surface is proposed as part of new land development or as a retrofit to implement Section 3.4.1 of the Pennsylvania Post-Construction Stormwater Management (PCSM) Manual. Disconnection means routing runoff from impervious surfaces into vegetated areas for infiltration and evapotranspiration (ET) benefits rather than directly into storm sewers or surface waters. The vegetated areas are called vegetated filter strips (VFSs).

The Spreadsheet was designed using the latest version of Microsoft Excel® and is in Excel macro workbook (XLSM) format.

Users should check DEP's website periodically for updates to the spreadsheet and instructions by visiting www.dep.pa.gov/constructionstormwater and selecting "E&S Resources". In general, DEP/CCD will accept older versions of the spreadsheet no more than 6 months following the revision date of the spreadsheet. DEP/CCD also reserves the right to request completion of the latest version of the spreadsheet for any project.

Questions on the use of the spreadsheet can be directed to the Bureau of Clean Water at RA-EPCHAPTER102@pa.gov.

General Information

It is important that the user follow these instructions carefully. Omission of data in any cell designed for data entry may result in the failure of important calculations.

If prompted by Excel after opening the spreadsheet, enable editing and macros. *Note that you may need to add additional Trusted Locations in the Trust Center Settings of Excel in order to run the macros.* These locations may include server drives and/or locations where you intend to save the file for use. The following steps may be taken:

1. Excel Options > Trust Center > Trust Center Settings > Trusted Locations
2. Check the box to "Allow Trusted Locations on my network"
3. Select "Add new location"
4. Browse to select the folder (or server) where the file will be saved, check the "Subfolders of this location are also trusted" box, and then OK.

The top of the worksheet contains a "Clear Form" button. The user may click on the "Clear Form" button at any time to delete **all** data from the current worksheet. All cells available for data entry or selection from a drop-down menu are highlighted. **The user may use the Tab, arrow, or Enter keys to move from cell to cell. Using the mouse to click from cell to cell may result in validation errors.**

Care must be taken to enter the data in the correct order identified in these instructions to avoid potential errors with the calculations and logic. For example, skipping a cell may prevent a calculation or produce an error message. The spreadsheet is protected. Formulas are not visible but are explained in this document. Validation that exists in the spreadsheet is highlighted and explained in this document.

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Completing the Spreadsheet

General Section



pennsylvania
DEPARTMENT OF ENVIRONMENTAL
PROTECTION

SCM 3.4.1

Disconnection of Impervious Surface with Filter Strip

CLEAR FORM

Project Name:

SCM ID:

☐ Residential

Impervious Type:

2-year/24-hour precipitation depth: in

☒ Chapter 102

☐ Runoff is Concentrated

- **Project Name** – Enter the Project (Site) Name as reported on the NOI, application, and/or plan submitted to DEP/CCD.
- **SCM ID** – Enter the SCM ID as is identified on plan drawings and PCSM Module 2 (for Chapter 102 projects) or a Volume Management Plan (for MS4s). A legal instrument, easement or other recording will be needed to ensure long-term protection.
- **Residential** – Check the box if the project involves residential land use. The purpose of this box is to distinguish residential vs. non-residential impervious for the purpose of calculating WQM credits (i.e., there are different Event Mean Concentrations (EMCs) for residential impervious and non-residential impervious land covers).
- **Impervious Type** – Select “Roof” or “Roadway/Parking Lot” from the dropdown list to characterize the type of impervious surface that will be disconnected.
- **2-Year/24-Hour Precipitation Depth** – Enter the 90th upper confidence interval statistic for the 2-year/24-hour precipitation depth using [NOAA Atlas 14](#) or other published sources, in inches.
- **Chapter 102** – Check the box next to “Chapter 102” if the SCM is being implemented to comply with Chapter 102 PCSM requirements, otherwise uncheck the box.
- **Runoff is Concentrated** – Check the box if runoff from the impervious surface will be concentrated in downspouts, storm sewers, or other conveyance prior to discharge to a VFS. If “Roof” is selected for Type of Impervious Being Treated, the box is automatically checked and cannot be unchecked. This box determines whether the Sheet Flow Standard or Concentrated Flow Standard will be used for design standards, as set forth in Section 3.4.1 of the PCSM Manual.

Design Standards Section

☒ **Design Standards**

Variation:

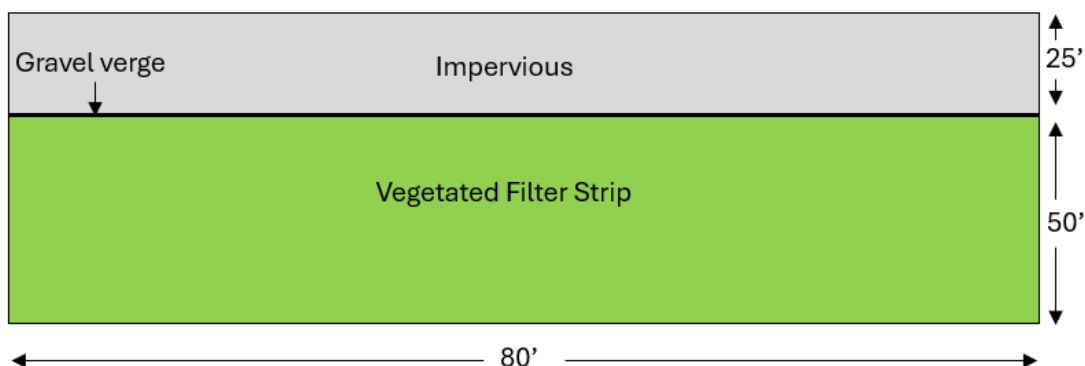
Parameter	Standard	Design Value
Disconnected Impervious Width (perpendicular to flow) (ft)		
Disconnected Impervious Length (in direction of flow), maximum (ft)	100	
Disconnected Impervious Area, maximum (SF)	2,000	
Disconnected Impervious Slope, maximum (%)	10.0%	

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- **Variation** – If a variation of the Disconnection of Impervious Surface with Filter Strip SCM applies, select the variation from the dropdown list.
 - **Trail Disconnection** – Select this variation if the disconnection is associated with a walking or biking path or trail (not for vehicular traffic).
 - **Simple Downspout Disconnection** – Select this variation if the disconnection is associated with residential roofs with downspouts. This option is available only when the “Runoff is Concentrated” box is checked.

If none of the variations apply select “None”.

- **Disconnected Impervious Width (perpendicular to flow) (ft)** – Enter the width of the disconnected impervious surface, perpendicular to runoff flows, in feet. There is no standard associated with this parameter.
- **Disconnected Impervious Length (in direction of flow), maximum (ft)** – Enter the length of the disconnected impervious surface, in the direction of flow, in feet. In the figure below, the length of impervious is 25 feet and the width is 80 feet.



The maximum impervious length for sheet flow is 100 feet and there is no maximum impervious length for concentrated flow. If the box for “Runoff is Concentrated” is not checked and a value exceeding 100 feet is entered as a design value, the box for “Runoff is Concentrated” will be checked automatically and the Concentrated Flow Standard will apply.

- **Disconnected Impervious Area, maximum (SF)** – The area of impervious will be calculated as the product of the entered impervious width and impervious length, in square feet (SF). If the impervious area is not square or rectangular it is acceptable to modify the length and/or width in order to produce an accurate area. The maximum area that can be treated by a single VFS is 2,000 SF, unless the Simple Downspout Disconnection variation is selected, in which case the maximum standard is 500 SF. A deduction in volume management credit is applied if the maximum standard is exceeded, as follows:

$$\text{Design Impervious Area} = (\text{Impervious Area Standard} * 110\%) / (\text{Impervious Area Standard} * 110\%)$$

- **Disconnected Impervious Slope, maximum (%)** – Enter the slope of the disconnected impervious surface in the direction of runoff flow. For sheet flow the maximum standard is 10%. If a value greater than 10% is entered, the box for “Runoff is Concentrated” will be checked automatically and the Concentrated Flow Standard will apply.
- **Vegetated Filter Strip (VFS) Length (in direction of flow), minimum (ft)** – Enter the VFS length in the direction of flow. In the figure above the VFS length is 50 feet. The standard is 5% of the Disconnected Impervious Area (e.g., 100 feet for an impervious area of 2,000 SF), with an absolute minimum of 20 feet. For the Trail Disconnection variation, the standard is the Disconnected Impervious Length, at minimum. For the

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Simple Downspout Disconnection variation, the standard is 20 feet, at minimum. The maximum VFS length is 200 feet.

- **A retentive grading berm with a minimum height of 6 inches will be placed along the width of the filter strip at approximately 100 feet downslope** – If the VFS Length exceeds 100 feet, a retentive grading berm with a minimum height of 6 inches should be placed along the width of the filter strip at approximately 100 feet downslope to reduce the likelihood of runoff concentrating. Enter TRUE if a berm will be provided, otherwise enter FALSE. A deduction of 50% is applied if a berm is needed but will not be provided (i.e., answer is FALSE).
- **VFS Width (perpendicular to flow), minimum (ft)** – Enter the planned width of the VFS (perpendicular to flow), in feet. In the figure above the VFS width is 80 feet. For sheet flow the standard is the Disconnected Impervious Width. For concentrated flow the standard is the greater of 50% of the Disconnected Impervious Length and 2.5% of the Disconnected Impervious Area. For Simple Downspout Disconnection the standard is 10 feet. A deduction is applied as follows if the design value does not meet the minimum standard:

$$(\text{VFS Width Standard} * 90\%) - \text{VFS Design Width} / (\text{VFS Width Standard} * 90\%)$$

- **VFS Average Slope (in any direction), maximum (%)** – Enter the average slope of the VFS (the higher of the slope across the width and length of the VFS). The standard is 6%. A maximum of 10% slope can be entered.
- **Runoff Velocity at 10-year/24-hour storm, maximum (fps)** – If the VFS Average Slope is greater than 6%, enter the runoff velocity at the 10-year/24-hour storm event, in fps. A deduction in volume management credit is applied if the maximum standard is exceeded, as follows:

$$\text{Design Velocity} - (\text{Velocity Standard} * 110\%) / (\text{Velocity Standard} * 110\%)$$

- **A level spreader will be installed to distribute concentrated flows** – This standard applies to all VFSs and variations but will be displayed as “A level spreader will be installed to maintain sheet flow conditions” when the “Runoff is Concentrated” box is unchecked and “A splash block or equivalent will be used to prevent erosion” when the Simple Downspout Disconnection variation is selected. A 100% deduction is applied when the design value is FALSE for this standard. If a gravel verge will be implemented select TRUE.
- **Level Spreader Width, minimum (ft)** – Enter the width of the level spreader. The standard for sheet flow is the Disconnected Impervious Width and the standard for concentrated flow is the VFS Width (except for the Simple Downspout Disconnection variation). A deduction is applied as follows if the design value does not meet the minimum standard:

$$(\text{Level Spreader Width Standard} * 90\%) - \text{Level Spreader Design Width} / (\text{Level Spreader Width Standard} * 90\%)$$

- **A gravel verge will be installed with a minimum 2-inch drop below impervious, width of 12 inches and depth of 24 inches** – If the “Runoff is Concentrated” box is not checked this standard will be displayed. A deduction of 100% applies if the entered response is FALSE.
- **The VFS will terminate prior to a surface water or stable conveyance to surface water** – Select TRUE if the VFS will terminate prior to a surface water or stable conveyance to surface water, otherwise select FALSE.
- **The distance from impervious to a surface water or stable conveyance to surface water exceeds 100 feet** – If the answer to the previous statement is TRUE this statement will be displayed. Measure from the edge of impervious to the nearest surface water or stable conveyance. For example if the filter strip is 50 feet long and the distance between the edge of impervious and a surface water is 80 feet, select TRUE, otherwise select FALSE.
- **A retentive grading berm with a minimum height of 6 inches will be placed along the width of the filter strip at the terminus of the filter strip** – If the answer to the previous statement is TRUE this statement will be displayed. In situations where the distance between impervious and a surface water or stable conveyance exceeds 100 feet, a retentive grading berm with a minimum height of 6 inches should be placed along the width

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of the filter strip at its terminus. Alternatively, a vegetated channel may be designed in accordance with DEP's E&S Manual (if a channel is designed, select TRUE). In addition, where the length of a VFS exceeds 100 feet and a berm will be placed at the 100-foot length (as addressed in the standard above), a second berm is not needed at the terminus of the VFS unless the distance between the first berm and the surface water or stable conveyance exceeds 100 feet (TRUE may be selected for this scenario). Otherwise, if a berm is not proposed (i.e., the answer is FALSE) and is needed, a 50% deduction applies.

VFS Infiltration Rate Section

☒ **VFS Infiltration Rate**

Predominant HSG Soil Type in VFS Area:

Infiltration Test Method:

Minimum No. Tests:

Saturated Hydraulic Conductivity (Ksat) Results for SCM:

Actual No. Tests:

Test No.	Field Ksat Result (in/hr)	Air Temp During Test (°F)	Temp-Adjusted Ksat (in/hr)	Ksat for Geomean (in/hr)

Geometric Mean (in/hr):

- **Predominant HSG Soil Type in VFS Area** – Select the predominant HSG Soil Type within the VFS area (A, B, C, or D). This information is used to determine runoff associated with the VFS for crediting purposes. For the Simple Downspout Disconnection variation, the infiltration details are only shown if the Type is D (and a message will be displayed that “Infiltration testing is required”).
- **Infiltration Test Method** – Select the infiltration testing method used from the dropdown list.
- **Minimum No. Tests** – If “Double Ring Infiltrometer” is selected as the Infiltration Test Method, 1 test per 1,000 SF of VFS area (1 minimum) is recommended as the minimum number of tests; if other methods are used, 2 tests per 1,000 SF of VFS area is recommended. For filter strips exceeding 2,000 SF, the number of tests may be reduced by 50% if a soils scientist or other professional with soils expertise determines soil conditions can be characterized by the initial tests (as long as at least 1 test is completed).
- **Actual No. Tests** – Select the actual number of infiltration tests completed from the dropdown list.
- **Saturated Hydraulic Conductivity (Ksat) Results for SCM** – Enter the Test ID No., the Ksat result determined in the field (inches/hour), and the air temperature (or preferably water temperature) at the time of the test. A temperature-adjusted Ksat is calculated. If the field Ksat result is not zero (0), the “Ksat for Geomean” result is the same as the temperature-adjusted Ksat. If the field Ksat result is 0, the “Ksat for Geomean” is set to 0.1. A geometric mean of all “Ksat for Geomean” results is calculated and displayed. If the geometric mean is less than 0.5 inch/hour, a checkbox and message are displayed: “Soils in the Vegetated Filter Strip area will be amended and/or restored to meet a minimum Ksat of 0.5 in/hr”. If the geometric mean is less than 0.5 inch/hour and the box is not checked (i.e., amendment and/or restoration is not proposed), no volume management credit is provided.

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Geometric Mean (in/hr):

☐ *Soils in the Vegetated Filter Strip area will be amended and/or restored to meet a minimum Ksat of 0.5 in/hr*

Volume and Water Quality Management Credit Section

☒ **Volume and Water Quality Management Credit**

Analysis Method: Design Storm - NRCS

Segment No.	Land Cover	Length (ft)	Width (ft)	Direct Precipitation (in)	Runoff as Precipitation (in)	Runoff + Direct Precipitation (in)	Area Weighting	Segment Runoff (in)	Area-Weighted Segment Runoff (in)
1	Impervious				0.00				

- **Analysis Method** – Select the method used to analyze the SCM's performance by checking the appropriate radio button. If "Default" is checked, credit calculations are performed in the Spreadsheet using the NRCS Curve Number method (see "Filter Strip Volume Calculation Table" below). Check the button for "Other Design Storm Model" if a different model is used that evaluates the 2-year/24-hour storm precipitation depth but does not rely on the Curve Number method (e.g., Green-Ampt, Horton, others). Check the button for "Continuous Simulation" if a dynamic model is used to evaluate SCM performance through a long-term precipitation data set (e.g., EPA's SWMM). If a selection is made that is not "Default", Volume Management Credit must be manually entered, which must be supported by the submission of model inputs and outputs. An input box will be displayed for manual entry of the credit determined by modeling:

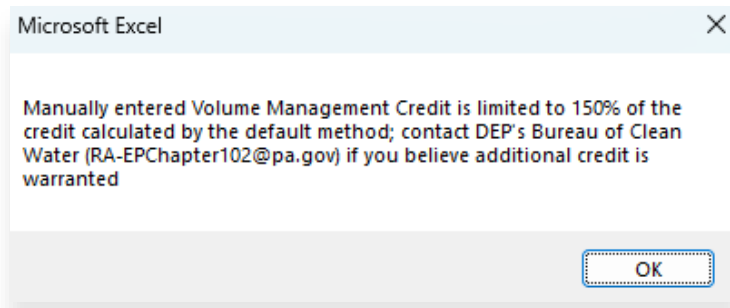
Enter Volume Management Credit
✕

Enter Volume Management Credit determined through other models. Attach model input and output. Deductions for design standard deviations and residential impervious may be applied.

OK
Cancel

Enter a valid whole number and click "OK". The entered value will be displayed as Volume Management Credit, less any deductions for design standard deviations or for residential impervious. If a number is entered that exceeds 150% of the credit calculated by the default method, a message is displayed and a value equal to 1.5 times the credit calculated by the default method is populated into the Volume Management Credit cell.

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Note that if the Simple Downspout Disconnection variation is selected in the Design Standards section, Analysis Method is not displayed.

- **Filter Strip Volume Calculation Table** – Where the default analysis method is selected, and for disconnections other than the Simple Downspout Disconnection variation, volume management credit is calculated following the procedures in Section 3.4.1 of the PCSM Manual in which the VFS is broken into 20-foot long strips (except possibly the last strip) and an iterative approach is used to determine the total runoff depth at the last strip. The only user-entry needed in this table is the selection of land cover for the VFS (see image to the right). In the highlighted cells select from Meadow, Woods, or Open Space. If Woods is selected as the first strip, a 25% deduction is applied (the VFS may include Woods following at least 20 feet of Meadow or Open Space). The Volume Management Disconnection Credit is determined using the Curve Number method as follows:

Land Cover
Impervious

2-Year/24-Hour Runoff for Total Area (Impervious + VFS) – 2-Year/24-Hour Runoff from final strip

If the Simple Downspout Disconnection variation is selected, the Filter Strip Volume Calculation Table is not shown. The Simple Downspout Disconnection Credit is displayed, which is 0.3 inch per square foot of impervious (roof) being disconnected. The number of similar disconnections can be selected if there are multiple disconnections with the exact same design values (e.g., housing development).

Simple Downspout Disconnection Credit (0.3 in / SF roof): _____ No. similar disconnections: _____

Disconnection Credit (CF):	
Deductions (CF):	
Volume Management Credit (CF):	
WQM Credit, TSS (lbs):	
WQM Credit, TP (lbs):	
WQM Credit, TN (lbs):	

- **Disconnection Credit (CF)** – If the default analysis method is selected, the Disconnection (Volume) Credit is calculated and shown if 1) a geometric mean Ksat has been calculated and 2) if all entries in the Design Standards Section are complete. If another analysis method is used, the user must manually enter the Disconnection Credit and attach model inputs and outputs to support the credit. The maximum Disconnection Credit that can be entered is 150% of the credit calculated using the Default method. If the user believes a larger credit should be provided, contact DEP's Bureau of Clean Water (RA-EPChapter102@pa.gov) for assistance.
- **Deductions (CF)** – If there are deductions due to deviations from design standards, the deductions are shown.

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- **Volume Management Credit (CF)** – The Volume Management Credit is the Disconnection Credit minus Deductions.
- **WQM Credit (lbs)** – WQM credit for Total Suspended Solids (TSS), Total Phosphorus (TP), and Total Nitrogen (TN) are determined through the following steps:

1. Calculate pollutant loads entering the VFS from impervious areas using the following equation:

$$Q_{\text{runoff}} (\text{CF}) * \text{EMC} (\text{mg/L}) * 6.24 \times 10^{-5} (\text{conversion factor})$$

Where:

Q_{runoff} = Runoff volume from impervious areas (as entered in the Design Standards Section) at the 2-year/24-hour storm, calculated using the Curve Number method and assuming a CN value of 98; and

EMC = See table below.

Land Cover	TSS EMC	TP EMC	TN EMC
Residential roof	19	0.11	1.5
Residential roadway/parking lot	65	0.29	2.05
Non-residential roof	9	0.14	2.1
Non-residential roadway/parking lot	142	0.32	3

2. Calculate pollutant loads discharged from the VFS by using the following equation:

$$(Q_{\text{runoff}} (\text{CF}) - \text{Volume Management Credit (CF)}) * \text{MOC} (\text{mg/L}) * 6.24 \times 10^{-5}$$

Where:

MOC = Median Outflow Concentration – TSS 23 mg/L, TP 0.23 mg/L, and TN 1.27 mg/L for VFSs (see Attachment G, Table G-3 of the PCSM Manual).

3. The pollutant loads calculated in Step 2 are subtracted from the loads calculated in Step 1. This difference is multiplied by a percent deduction, if applicable, to determine WQM credit.

When the default analysis method is not used, WQM credits are increased or decreased in proportion to the ratio of the manually entered Volume Management Credit to the Volume Management Credit calculated by the default method.

The user of the spreadsheet should enter their name and company after reading the certification statement.

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Revision History

Date	Version	Revision Reason
7/20/2026	1.0	Revised Draft