

SCM 3.4.2 SPREADSHEET RIPARIAN FOREST BUFFERS (RFBs) INSTRUCTIONS

Draft, March 23, 2026

Introduction

The Department of Environmental Protection (DEP) has developed the SCM 3.4.2 Spreadsheet (Spreadsheet) to calculate volume and water quality management credits when riparian forest buffers (RFBs) meeting the criteria at 25 Pa. Code § 102.14(b) are proposed as an SCM. For non-forested riparian buffers and for RFBs with an average width less than 150 feet the SCM 3.3.1 Spreadsheet should be used.

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



SCM 3.4.2
Riparian Forest Buffers

CLEAR FORM

SCM ID: SCM Type:

2-year/24-hour Precipitation Depth: in SCM Drainage Area: ac

Has the Riparian Forest Buffer area been investigated in the field? Yes No

Are color photographs of the Riparian Forest Buffer area attached? Yes No

Do preferential flow paths through the SCM currently exist? Yes No

Will flow be concentrated upslope of the Riparian Forest Buffer? Yes No

- **SCM ID** – Enter the SCM ID as is identified on plan drawings and PCSM Module 2. A legal instrument, easement or other recording will be needed to ensure long-term protection.
- **SCM Type** – Select the type of RFB from the dropdown list. The RFB must be identified on plan drawings and PCSM Module 2 and be located within the project site.
 - **Protected RFB (Existing)** – Select this option if there is an existing RFB meeting the criteria of § 102.14(b) that will be protected and used as an SCM.
 - **Converted RFB** – Select this option if there is an existing RFB that does not meet the criteria of § 102.14(b) that will be enhanced to meet § 102.14(b) or an existing riparian buffer that will be converted to an RFB meeting § 102.14(b).
 - **Newly Established RFB** – Select this option if a new RFB meeting § 102.14(b) will be established.
- **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.
- **SCM Drainage Area** – Enter the proposed post-construction drainage area of the SCM, in acres.
- **Has the Riparian Forest Buffer area been investigated in the field?** DEP expects that each RFB (including areas that will be converted to or established as an RFB) will be evaluated in the field by individual(s) who have experience with the management of stormwater by vegetated land features. If “Yes” is selected, go to the next question. If “No” is selected the following message will be displayed, “A field investigation for preferential flow paths and color photographs are required.”
- **Are color photographs of the Riparian Forest Buffer area attached?** If “Yes” is selected, go to the next question. If “No” is selected the following message will be displayed, “Attach color photographs of the Riparian Forest Buffer area.”
- **Do preferential flow paths through the SCM currently exist?** Preferential flow paths are pathways that will concentrate runoff through the RFB, even if runoff enters as sheet flow. If “No” is selected, go to the next question. If “Yes” is selected, remedial action will be necessary. Select the proposed remedial action from the

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dropdown menu: “Eliminate preferential flow paths”, “Stabilize preferential flow paths to prevent erosion up to the 10-yr/24-hr storm”, or “Other”. If “Other” is selected provide a description of the proposed remedial action. Remedial actions should be documented on plan drawings.

- **Will flow be concentrated upslope of the Riparian Forest Buffer?** Select “Yes” if stormwater within the SCM drainage area will be collected by a conveyance system or otherwise captured by another SCM prior to the RFB, otherwise select “No”. If “Yes” is selected, select either “Level Spreader” or “Other” from the dropdown menu to indicate how flow will be distributed across the length of the RFB SCM. If “Other” is selected, enter a description.

Drainage Area Section

Post-Construction Drainage Area

Rows:

Post-Construction Drainage Area Cover Type	Area (ac)	HSG	Off-Site	2-Year/24-Hour Runoff (CF)
			<input type="checkbox"/>	

Runoff Volume (CF):
TSS Load (lbs):
TN Load (lbs):
TP Load (lbs):

<i>Post-Construction Values</i>		
Total	Off-Site	Project Site

Select the number of rows for the Pre- and Post-Construction Drainage Area tables by selecting the number from the dropdown list next to “Rows:”.

- **Pre-Construction Drainage Area** – Select the Pre-Construction Drainage Area Cover Types from the dropdown lists and enter their areas and Hydrologic Soil Group (HSG) Soil Types for the SCM’s drainage area in the pre-construction condition to calculate the pre-construction 2-year/24-hour runoff and pollutant loads. If the area is located outside of the project site boundary check the box in the “Off-Site” column.

Pre-Construction runoff volumes, Total Suspended Solids (TSS) loads, Total Nitrogen (TN) loads, and Total Phosphorus (TP) loads are calculated for the total drainage area, any off-site areas, and the project site (the difference between total drainage area and off-site area). This information is used to determine credits. A description of how runoff volume and loads are calculated is contained in DEP’s [PCSM Spreadsheet Instructions](#).

NOTE 1 – The land cover “Impervious as Meadow” may be selected to implement the regulatory requirement that 20% of existing impervious to be disturbed is treated as meadow (20% presumption). Regardless of whether this land cover is used in the 3.4.2 Spreadsheet, the overall stormwater analysis for the site must apply the 20% presumption in DEP’s PCSM Spreadsheet (unless exempt).

- **Post-Construction Drainage Area** – Select the Post-Construction Drainage Area Cover Types from the dropdown lists and enter their areas and HSG Soil Types for the SCM’s drainage area in the pre-construction condition to calculate the post-construction 2-year/24-hour runoff and pollutant loads. If the area is located outside of the project site boundary check the box in the “Off-Site” column.

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Post-construction runoff volumes, TSS loads, TN loads, and TP loads are calculated for the total drainage area, any off-site areas, and the project site (the difference between total drainage area and off-site area). This information is used to determine credits.

RFB Design Standards Section

<input checked="" type="checkbox"/>	<u>RFB Design Standards</u>	Soil Type within RFB:	HSG	<input type="text"/>
Parameter		Standard	Design Value	
Maximum Storm Event Routed to SCM				
RFB Length (ft)				
RFB Drainage Area Length (ft)				
SCM Inflow Length, Minimum (ft)				
RFB Average Width, Minimum (ft)		150		
RFB Area (ac)				

- **Soil Type within RFB** – Enter the predominant HSG Soil Type within the RFB (A, B, C, or D). This information is used to determine runoff associated with the RFB for crediting purposes.
- **Maximum Storm Event Routed to RFB** – Select from the dropdown list the storm event that will be routed to the RFB. Unless there is a diversion around the RFB the user should select “> 10-Year/24-Hour Storm”.
- **RFB Length (ft)** – Enter the length, in feet, of the RFB, within the project site.
- **RFB Drainage Area Length (ft)** – Enter the maximum length of the RFB Drainage Area, parallel to the RFB, in feet, within the project site.
- **RFB Inflow Length (ft)** – Enter the length that runoff from the RFB Drainage Area is distributed over prior to entering the RFB. The RFB Inflow Length may not exceed the RFB Length.
- **RFB Average Width, Minimum (ft)** – Enter the average width of the RFB based on field measurements or LIDAR. The standard is 150 feet and a value less than 150 feet cannot be entered.
- **RFB Area (SF)** – RFB Area is the product of RFB Inflow Length and RFB Average Width and represents the area receiving stormwater runoff from the RFB Drainage Area. RFB Area is used to determine whether other design standards are applicable, as described below.
- **Average Slope within RFB (ft/ft)** – The average slope within the RFB should be less than or equal to 15%. If the average slope exceeds 15%, storms greater than the 10-year/24-hour event must be diverted in order to generate credit. If a diversion is implemented the maximum slope is 25%. If the average slope exceeds 6%, velocity and flow depth standards become applicable (see below).
- **Peak inflow velocity @ 2-year/24-hour storm (fps)** – When the average slope exceeds 6% or when impervious within the RFB Drainage Area exceeds 25% of the RFB Area, the user must calculate and enter the peak inflow velocity (at the location where runoff enters the RFB) at the 2-year/24-hour storm. The standard is 1.5 feet per second (fps). An allowance of 10% is provided. When the velocity is more than 110% of the standard, a deduction applies, as follows:

$$\text{Runoff Velocity} - (\text{Runoff Velocity Standard} \times 1.1) / (\text{Runoff Velocity Standard} \times 1.1)$$

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- **Peak inflow velocity @ 10-year/24-hour storm (fps)** – When the average slope exceeds 6% or when impervious within the RFB Drainage Area exceeds 25% of the RFB Area, the user must calculate and enter the peak inflow velocity (at the location where runoff enters the RFB) at the 2-year/24-hour storm. The standard is 2 fps. An allowance of 10% is provided. When the velocity is more than 110% of the standard, a deduction applies as described above for peak inflow velocity @ 2-year/24-hour storm.
- **Flow depth @ 10-year/24-hour storm (ft)** – When the average slope exceeds 6% or when impervious within the RFB Drainage Area exceeds 25% of the RFB Area, the user must calculate and enter the flow depth at the 10-year/24-hour storm. The standard is 0.1 foot (i.e., sheet flow). An allowance of 10% is provided. When the velocity is more than 110% of the standard, a deduction applies as described above for peak inflow velocity @ 2-year/24-hour storm.
- **Runoff duration following storm routed to RFB, Maximum (hrs)** – If runoff will be concentrated in the RFB Drainage Area (i.e., if the question “Will flow be concentrated upslope of the Riparian Forest Buffer?” in the General Section is answered “Yes”), the user will be prompted to enter the duration that flow is routed to the RFB following the 24-hour storm. The precipitation associated with the maximum storm routed to the RFB (up to the 100-year/24-hour storm) should be used. The standard is 48 hours. An allowance of 10% is provided. When the velocity is more than 110% of the standard, a deduction applies as described above for peak inflow velocity @ 2-year/24-hour storm.
- **Method used for long-term protection of RFB** – Select either “Deed Restriction”, “Conservation Easement” or “Other” from the dropdown list. If “Other” is selected provide a description.
- **Pretreatment** – Select one of the following for pretreatment:
 - **Meadow** – A meadow with a minimum width of 20 feet and a length equal to the RFB Length may be provided. The average slope of the meadow may not exceed 5% (a value greater than 5% cannot be entered). If the width or length of the meadow is less than 90% of the standard, a deduction is calculated as described for RFB Inflow Length above.
 - **Vegetated Filter Strip** – A filter strip with a minimum width of 20 feet and a length equal to the RFB Length may be provided. In addition, at the end of the filter strip a retentive grading berm with a height of at least 0.5 foot (6 inches) must be provided (a value less than 0.5 foot cannot be entered). If the width or length of the filter strip is less than 90% of the standard, a deduction is calculated as described for RFB Inflow Length above.
 - **Level Spreader** – A level spreader with a length equal to the RFB Length may be provided. In addition, to ensure sheet flow to the RFB, the flow depth over the level spreader may not exceed 0.1 foot at the 10-year/24-hour storm event. Attach calculations. If the length of the filter strip is less than 90% of the standard, a deduction is calculated as described for RFB Inflow Length above. If the flow depth exceeds 110% of the standard, a deduction is calculated as described for peak runoff velocity, above.
- **Uniform Canopy Cover (%)** – Enter the actual (measured) percent Uniform Canopy Cover for an existing RFB using the procedures established in Appendix B of DEP’s *Riparian Forest Buffer Guidance* (ID No. 386-5600-001). For converted and newly established RFBs enter the planned canopy cover upon maturity.
- **Riparian Forest Buffer Species Composition** – Enter from the dropdown list the top 3 tree or shrub species in terms of percent composition within the RFB (existing or planned). If a species is not identified in the dropdown list, select “Other” (located at the bottom of the list) and manually enter the species in the cell provided. Entry of Percent (%) is optional. When a species is selected from the dropdown list, the inundation (flood) tolerance is populated. If a species is manually entered the user must select the inundation tolerance from the dropdown list using published sources. Trees and shrubs are placed into one of three categories for inundation tolerance: Tolerant, Intermediate, and Intolerant.

For an existing or converted RFB, each species within the top 3 that is categorized as intolerant results in a 10% deduction in management credit. For a newly established RFB, no credit is available when an intolerant species is selected within the top 3.

Management Credit Section

Management Credit

Does the SCM Drainage Area contain residential land use? Yes No

	Project Site Δ 2	Deductions	Credits
Runoff Volume (CF):			
TSS Load (lbs):			
TN Load (lbs):			
TP Load (lbs):			

- **Does the RFB Drainage Area contain residential land use?** Select “Yes” if residential land use is within the SCM Drainage Area and answer the question below, otherwise select “No”.
- **Does the maximum impervious area allowed under local ordinances currently exist on the residential lot(s)?** If “No” is selected a deduction in credit of 10% is applied to account for future impervious. There is no deduction if “Yes” is selected.
- **Volume Management Credits** – Credits are the lesser of the following:
 1. The net change in runoff volume for the Project Site comparing the pre-construction drainage area to the post-construction drainage area at the 2-year/24-hour storm event, minus any deductions (off-site stormwater is excluded); or
 - 2a. The difference in runoff between impervious and the RFB land cover (Woods (Good Condition)) up to 100% of the RFB area for the 2-year/24-hour storm event. The disconnected impervious area is considered part of the SCM, and the RFB and disconnected impervious areas can be added together and modeled as the same land use and soil type of that of the RFB in the post-construction condition.
 - 2b. However, if the volume calculated in #2a is less than the volume represented by a 100% increase in the pre-construction runoff volume from the RFB Drainage Area, a 100% increase in the pre-construction runoff volume is used to compare with the net change (#1).
- **Water Quality Management Credits** – The net change in TSS, TP, and TN pollutant loads are calculated using methods explained in [DEP’s PCSM Spreadsheet Instructions](#). The net change is used for water quality management credits unless the volume determined by the standard loading factor is less than the net change in volume, in which case water quality credits are reduced in proportion to the reduction in volume credits.

Example – A 12-acre forested site adjacent to a stream with HSG B soils is developed for a commercial building and parking lot. Ten (10) acres will be disturbed, and 2 acres will remain as a forested buffer and will receive post-construction stormwater as an RFB SCM. The length and average width of the RFB is 400 feet and 175 feet, respectively (1.61 acres). Five (5) acres will drain to the RFB in the post-construction condition, including 3 acres of impervious.

Volume Management Credit, Step 1 – Determine the net change in runoff volume up to the 2-year/24-hour storm for the SCM contributing drainage area. The precipitation depth is 3 inches.

Pre-Construction:

Cover Type	Area (ac)	HSG	2-Year24-Hour Runoff (CF)
Forested (Good Condition)	5	B	3,536

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Post-Construction:

Cover Type	Area (ac)	HSG	2-Year24-Hour Runoff (CF)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	2	B	2,651
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	3	N/A	30,146

The net change is 29,261 CF (30,146 CF + 2,651 CF – 3,536 CF).

Volume Management Credit, Step 2a – Determine the difference in runoff between a 100% increase in the RFB area and the increased RFB area as impervious.

RFB Land Cover	Area (ac)	HSG	2-Year24-Hour Runoff (CF)
Woods (Good Condition)	3.22	B	2,273

Impervious Land Cover	Area (ac)	HSG	2-Year24-Hour Runoff (CF)
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	3.22	N/A	32,296

The difference is 30,023 CF (32,296 CF – 2,273 CF).

Volume Management Credit, Step 2b – Determine the volume represented by a 100% increase in the pre-construction drainage area: 3,536 CF (determined in Step 1) x 2 = 7,072 CF.

Volume Management Credit, Step 3 – The volume management credit for the RFB is the lesser of the following:

- Step 1 (net change) – 29,261 CF
- The maximum of Step 2a (30,023 CF) and Step 2b (7,072 CF).

For this example, the volume management credit is the net change of 29,261 CF.

Water quality management credit in this example would be the net changes in TSS, TP, and TN pollutant loads comparing pre- to post-construction conditions, at the 2-year/24-hour storm, since volume management credit is based on the net change. If the volume calculated in Steps 2a or 2b would have been less than the volume calculated in Step 1, water quality management credits would be reduced in proportion to the decrease in volume management credits.

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

Revision History

Date	Version	Revision Reason
3/23/2026	1.0	Original Draft