

PCSM SPREADSHEET



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- **What is it?**
- **How it was Developed , Navigation, Overall Setup and Use**
- **Walk Through Various Tabs, Cells**
- **Example Problem(s)**
- **Refer / Use handouts as we go through the presentation.**
- **Will not Discuss Rate Tab at this time.**



What is it?

- **Excel Binary Workbook (XLSB) to perform Stormwater calculations for NPDES Permits**
- **Developed by DEP Central Office- Bureau Clean Water in cooperation with Villanova University.**
- **Needs to be used for Water Quality Component at a Minimum.**
- **Latest Version 1.8**
- **Read the Instruction Document !**



- **Download Spreadsheet and Instructions from DEP Website:**
- **DEP-Business-Water-Bureau of Clean Water-Stormwater Management-Construction Stormwater – E&S Resources**
- **<https://www.dep.pa.gov/Business/Water/CleanWater/StormwaterMgmt/Stormwater%20Construction/Pages/E-S%20Resources.aspx>**




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DEP PCSM Spreadsheet

- [DEP PCSM Spreadsheet](#) (XLSB) (Version 1.8, December 2020) – This spreadsheet developed by DEP is intended to assist with stormwater analyses required by Chapter 102 for PCSM Plans. The spreadsheet is a macro-enabled Excel binary file. [Instructions](#) and [training](#)  for the spreadsheet are available to assist users. **Last updated 12/21/2020. Note –** **It is recommended that users check this site periodically for the latest updates to the spreadsheet.** Updates are made as calculation or functional errors are identified and corrected. A new version number will be provided only when changes or enhancements are made to the spreadsheet, not when errors are corrected.



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The Basics

- **Embedded Calculations in the Spreadsheet**
- **TR-55 Methodology –Pre/Post Volume similar to Worksheet 4**
- **Water Quality Analysis is New – Reduce Post Pollutants to Predevelopment Levels**
- **Validation Rules for the various entry cells – will explain as we go.**
- **Navigation/Error messages can be problematic. Tabs/arrow and enter keys work to various levels on the various sheets. Be Patient and try another way!**



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The Basics

- Will sometimes pop up error message before applicable data is entered. Usually an issue with using “Enter” to move instead of “Tab” or “Arrow”.
- Allows for overriding certain calculations- provide justification for deviations and attach applicable calculations
- Can add other BMP’s not covered (Street Sweeping, Trees. Etc.)-provide and attach supplementary calculations (Worksheet 13)
- Add explanation notes/attachments if entry values are not obvious



The Basics

- Need to Complete Tabs (General, Volume, WQ) in order.
- Complete *one entire spreadsheet for each discharge point* from the project.
- Instructions infer one spreadsheet per surface water but this does not take into account potential localized Q,V,WQ increases.
- Spreadsheet is set up to input data from the *disturbed area* for the project. BMP rate and volume inflow / outflow data may be different .
- **READ THE INSTRUCTIONS**



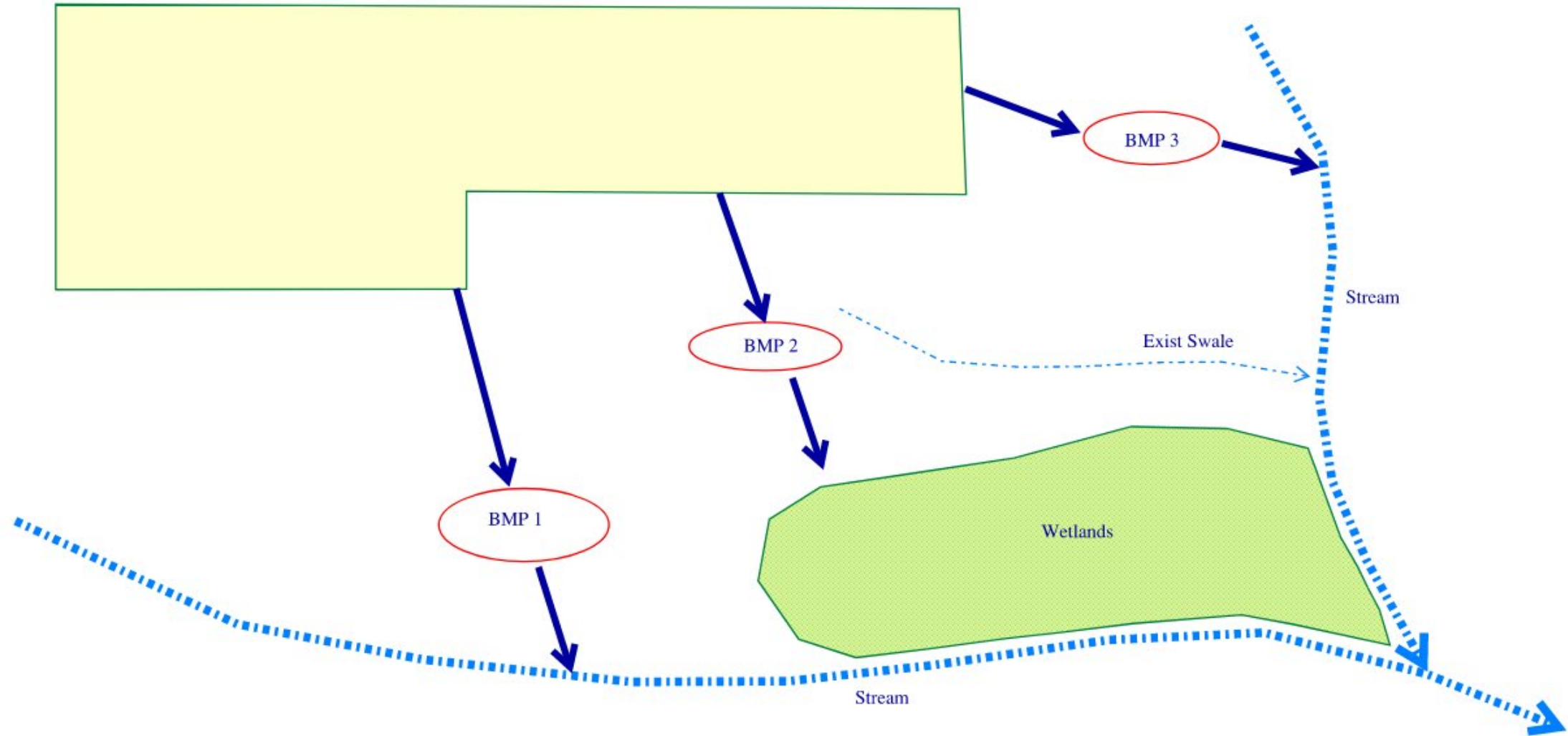
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How Many Spreadsheets?

Case 1



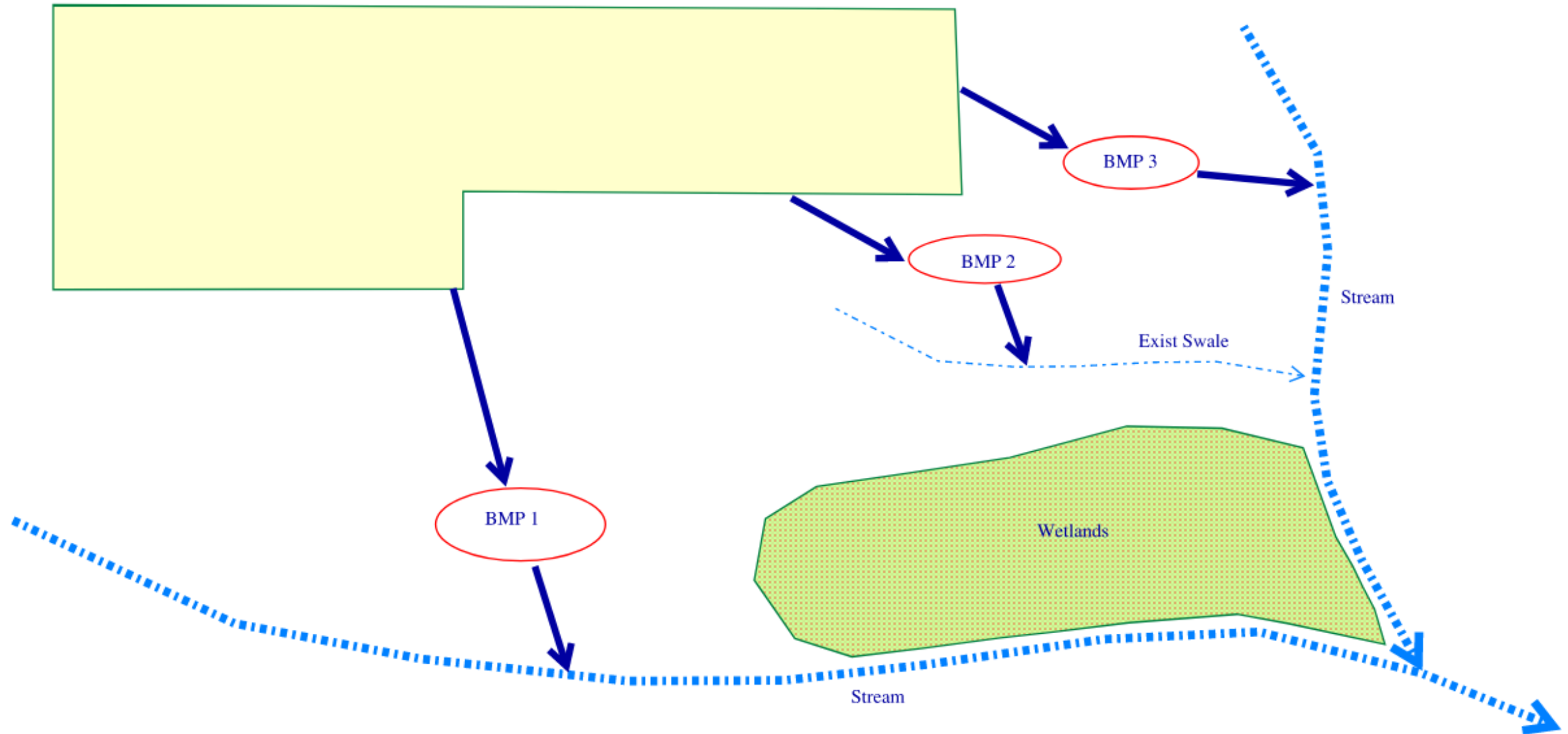
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How Many Spreadsheets?

Case 2



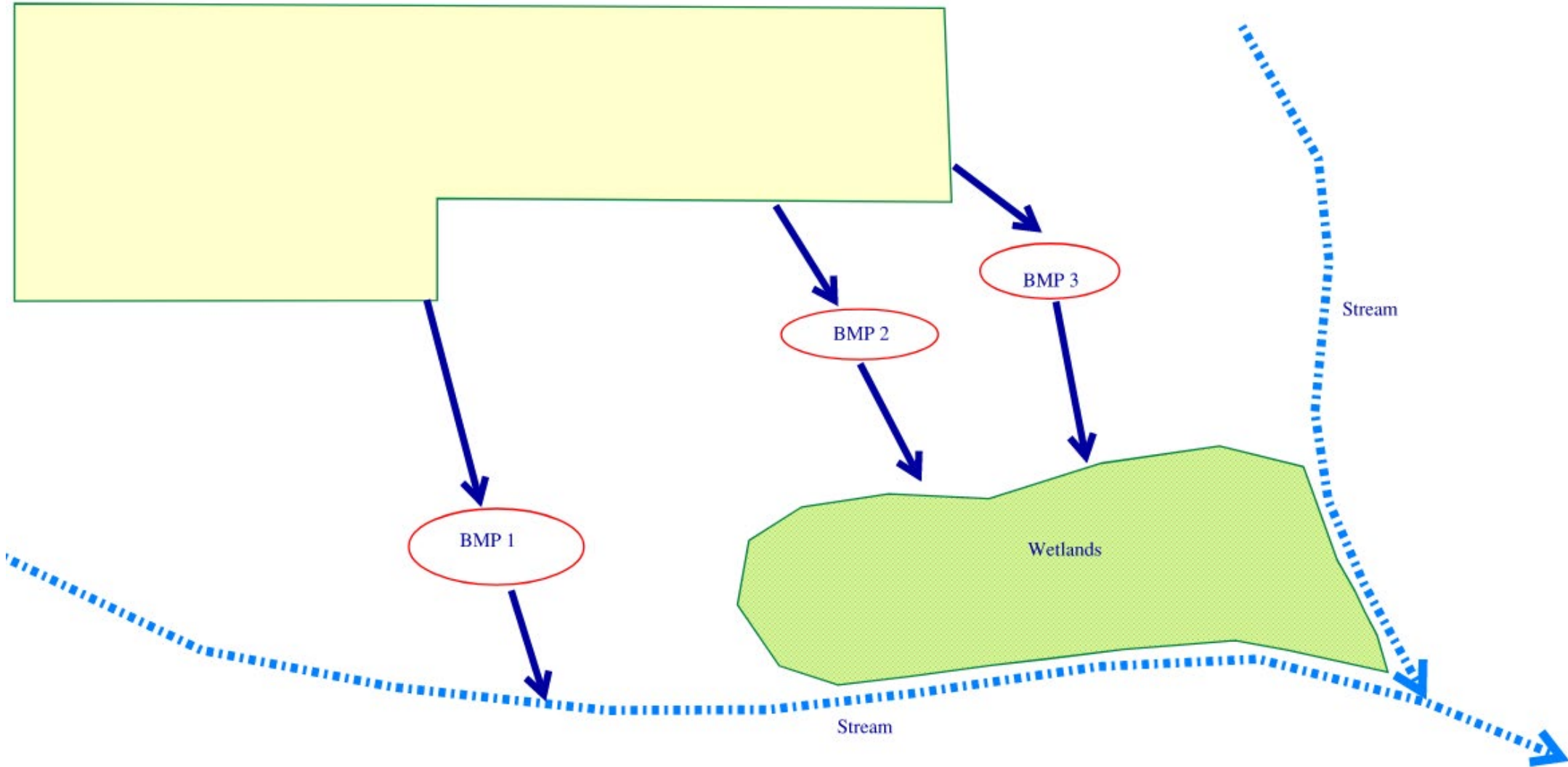
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How Many Spreadsheets?

Case 3



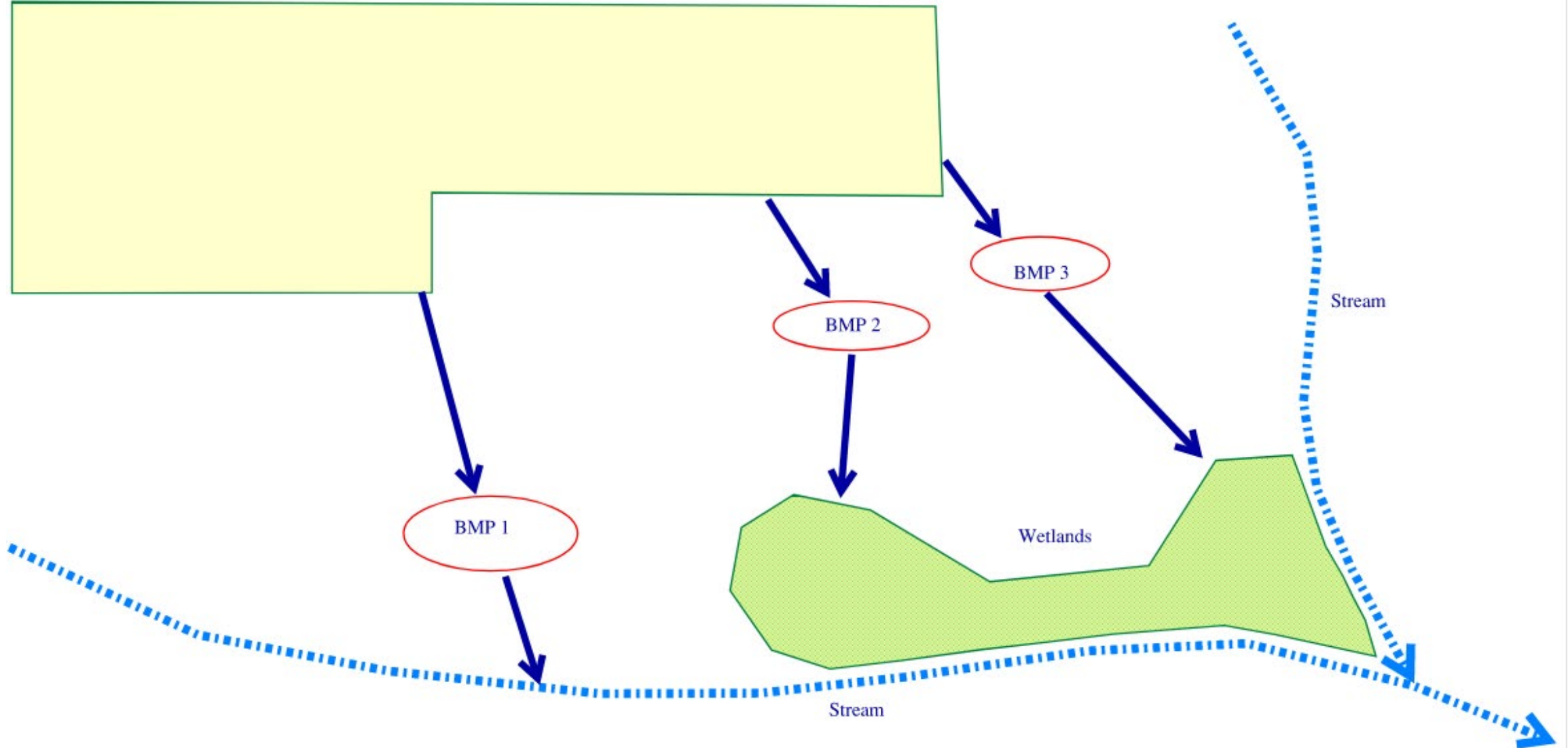
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How Many Spreadsheets?

Case 4



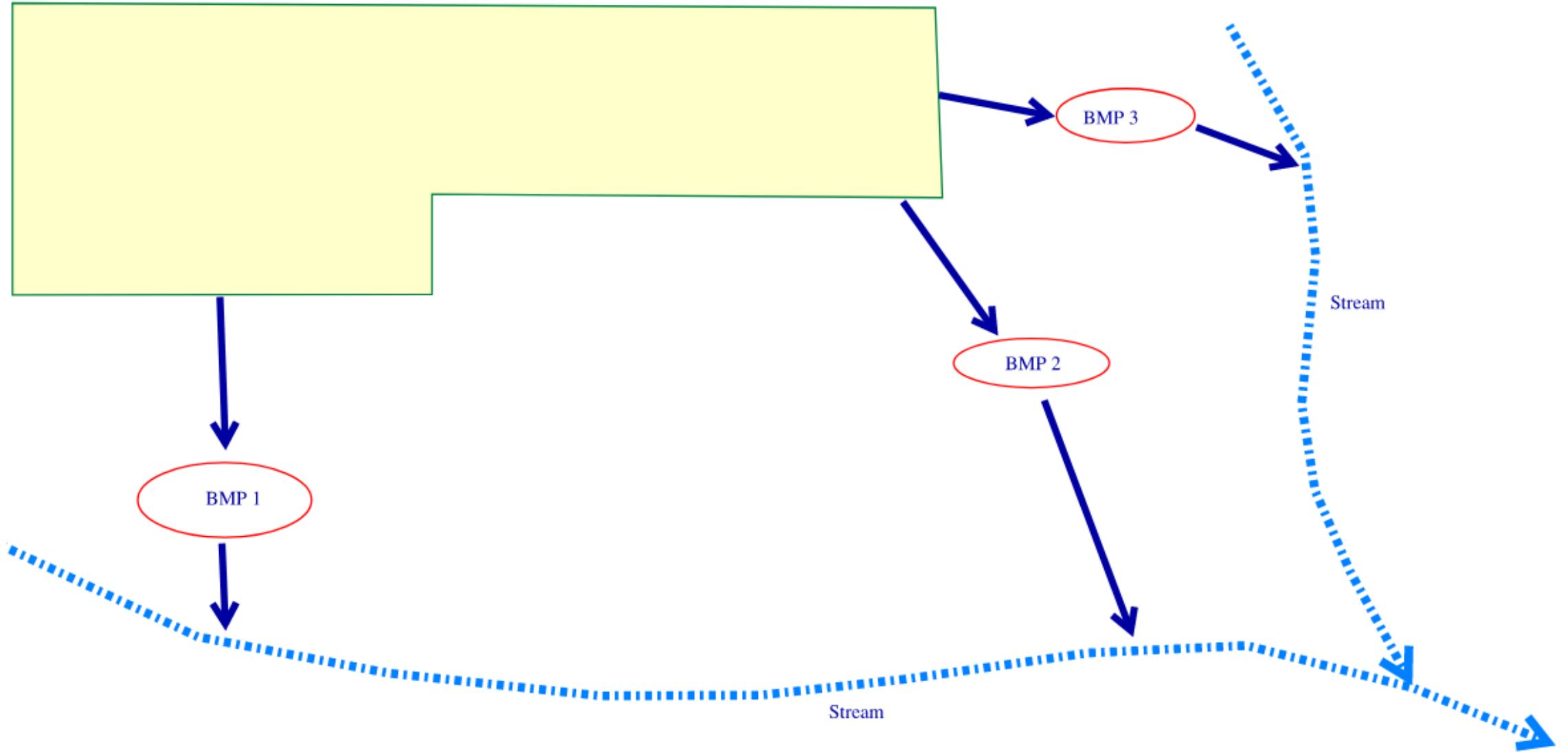
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How Many Spreadsheets?

Case 5



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Instructions

Instructions

General

Volume

Rate

Quality

If prompted by Excel after opening the DEP Post-Construction Stormwater Management (PCSM) Spreadsheet, enable editing and macros. This spreadsheet consists of five hyperlink tabs: Instructions, General, Volume, Rate and Quality. Each tab has a corresponding worksheet. To begin, click on the General tab. **NOTE - The spreadsheet is intended for the evaluation of volume, rate, and water quality for discharges to a single receiving water.** If for example there are 3 post-construction discharge points to Mud Run and 3 post-construction discharge points to Clear Creek, two spreadsheets should be completed (one each for Mud Run and Clear Creek).

Only those cells that are highlighted are available for data entry by the user:



Click on the button below to open detailed instructions on the use of the DEP PCSM Spreadsheet:

OPEN INSTRUCTIONS

If you have questions concerning use of this spreadsheet, contact the Bureau of Clean Water at:

RA-EPChapter102@pa.gov



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General Information

Instructions **General** Volume Rate Quality

Project Name: 1 Application Type: 2

County: 3 Municipality: 4

Project Type: 5 New Project Minor / Major Amendment

Area: acres 6 Total Earth Disturbance: acres 7
(In Watershed)

No. of Post-Construction Discharge Points: 8 Start DP Numbering at: 9

Discharge Point (DP) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural BMP(s)
<input type="text" value="001"/> 10	<input type="text" value="26.36"/> 12	<input type="text" value="19.86"/> 13	<input type="text" value="1.65"/> 14	<input type="text" value="10.96"/> 15	Discharge to Non-Surface Waters 16	HQ-CWF, MF 17	<input type="text" value="Yes"/> 18
Undetained Areas 11	<input type="text" value="10.26"/>	<input type="text" value="7.73"/>	<input type="text" value="2.56"/>	<input type="text" value="2.56"/>	Brodhead Creek	HQ-CWF, MF	
Totals:	<input type="text" value="36.62"/> A	<input type="text" value="27.59"/> B	<input type="text" value="4.21"/> C	<input type="text" value="13.52"/> D			

- 1 - Enter Project Name-Match Name on Application
- 2 - Pull Down Menu - Application Type (Individual or General (PAG-02), ESCGP, E&S Permit)
- 3 - Pull Down on County-Use County With Most Disturbance
- 4 - Municipal Pull Down Based on County Input-Pick Municipality with most Disturbance
- 5 - Pull Down of Project Type. Pick the best one that fits.
- 6 - Total Project Site Area in Watershed - This can be your watershed Area from Rate Calculations (Undisturbed Subareas) or if 1 Discharge Point, Should equal Project Area on Your Application at minimum. VALIDATION CELL for COLUMN 12 AND DA INFLOW TO BMP's
- 7 - Earth Disturbance in this Discharge Point VALIDATION CELL for COLUMN 13
- 8 - Number Of Discharge Points in Watershed. Preferably One for Simplicity
- 9 - 3 Digit Number. Consistent with Plan Labels.
- 10- This row reflects values to the PCSM BMP's in that Discharge Point
- 11 - This row reflects values of Disturbed Areas which DO NOT go through PCSM BMP's
- 12 - Drainage Area to BMP or Undetained Areas. VALIDATION CELL for drainage area to BMP's
- 13 -Earth Disturbance Within Area
- 14 and 15 - Existing and Proposed Impervious within Area
- 16 - Receiving Water - Pull Down or Type in Surface Water name
- 17 - Ch 93 Classification
- 18 - Should be yes if BMP's (input into Volume Tab) provided for this Discharge Point.

A - Should Match Box 6. Cannot Exceed or you get Error Message

B - Total of All Discharge Points on Project should Equal Total ED for entire Project (All areas accounted for between Spreadsheets)

C, D - Difference between C and D should match Pre/Post Impervious on Volume Tab. Difference on all Spreadsheets should match Change in Impervious on NOI/Application.

Volume Tab-Impervious Surfaces

- There are a variety of impervious surfaces to select from for the predevelopment and postdevelopment land covers.
- Impervious surface selection will affect water quality calculations.
- Pre and post volume calculations same as worksheet 4.
- **READ THE INSTRUCTIONS**



Impervious Surfaces

- **Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)** – select this impervious land cover for all parking lots, roofs, and driveways that are not associated with commercial, industrial or institutional sites. For example, roofs on residential and agricultural structures would fall into this category.
- **Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)** – select this impervious land cover for all streets and roads that are **paved, are curbed,** and direct stormwater to storm sewers, including such streets and roads located on commercial, industrial and institutional sites.
- **Impervious Areas: Streets and Roads - Paved; Open Ditches (Including ROW)** – select this impervious land cover for all streets and roads that are paved but are **not curbed,** and direct stormwater to **roadside ditches,** including such streets and roads located on commercial, industrial and institutional sites.
- **Impervious Areas: Streets and Roads - Gravel (Including ROW)** – select this impervious land cover for all gravel roads, including such roads located on commercial, industrial and institutional sites.
- **Impervious Areas: Streets and Roads - Dirt (Including ROW)** – select this impervious land cover for all dirt roads, including such roads located on commercial, industrial and institutional sites.
- **Impervious Areas: Commercial** – select this impervious land cover for all impervious surfaces (including **roofs, parking lots, walkways,** etc.) on commercial sites except for streets and roads, in which one or more of the selections above should be made.
- **Impervious Areas: Industrial** – select this impervious land cover for all impervious surfaces on industrial sites except for streets and roads, in which one or more of the selections above should be made.
- **Impervious Areas: Institution** – select this impervious land cover for all impervious surfaces on institutional sites (e.g., college campuses) except for streets and roads, in which one or more of the selections above should be made.

Residential , Agricultural Projects

Urban Roads, Commercial Main Driveways

Roads With Shoulders , roadside swales



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Volume Management

Project: Test Project

Instructions **General** *Volume* **Rate** **Quality**

inches Alternative 2-Year / 24-Hour Storm Event inches

Alternative Source:

Pre-Construction Conditions:

No. Rows: Exempt from Meadow in Good Condition Automatically Calculate CN, Ia, Runoff and Volume

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Impervious Areas: Commercial <input type="text" value="4"/>	2.01	A	98	0.041	3.02	22,015
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	1.36	A	98	0.041	3.02	14,896
Impervious as Meadow <input type="text" value="5"/>	0.84	C	71	0.817	0.91	2,770
Forested (Good Condition)	14.91	C	70	0.857	0.86	46,402
Pervious as Meadow	8.47	B	58	1.448	0.36	11,037
TOTAL (ACRES):	27.59				TOTAL (CF):	97,119

Post-Construction Conditions:

No. Rows:

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Impervious Areas: Industrial	11.47	C	98	0.041	3.02	125,629
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	2.05	C	98	0.041	3.02	22,453
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	12.86	B	61	1.279	0.46	21,687
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	1.21	A	30	4.667	0.00	0
TOTAL (ACRES):	27.59				TOTAL (CF):	169,769

NET CHANGE IN VOLUME TO MANAGE (CF):

1 - Enter 2 year Rainfall amount from NOAA or Alternate 2 yr rainfall. Justify if not using NOAA and cite source

2 - See Discussion on next Slide

3 - Allows for User to manually Enter CN, Ia, Runoff and Volume. Need to provide justification

4 - Enter Land Use. Note Options are limited in pull down menu

5 - Entry for 20% reduction in Impervious. Separate this Meadow component from existing meadow

A- Total of Post Development Area cannot Exceed Earth Disturbance Total on General Tab (Item # 7)

Exempt From Meadow in Good Condition

By default, the box for ***Exempt from Meadow in Good Condition*** is unchecked. This box may be checked only for those projects that do not need to consider pre-development non-forested pervious area as meadow in good condition (25 Pa. Code § 102.8(g)(2)(i)), and 20% of existing impervious surface to be disturbed as meadow in good condition (25 Pa. Code § 102.8(g)(2)(ii)). Such projects would include the repair, reconstruction or restoration of roadways or rail lines, or construction, repair, reconstruction or restoration of utility infrastructure when the site will be returned to existing condition. The box for ***Exempt from Meadow in Good Condition*** may also be checked when an applicant is proposing a demonstration that treating 20% of existing impervious surface as meadow in good condition is not practicable due to public health, safety or environmental limitations under existing site conditions (and such demonstration is attached to the NOI or application). The effect of checking this box is to allow for additional pre-construction land cover options, as explained below.

Site Restoration Projects



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Volume PCSM BMP's

In Drop Down Menu

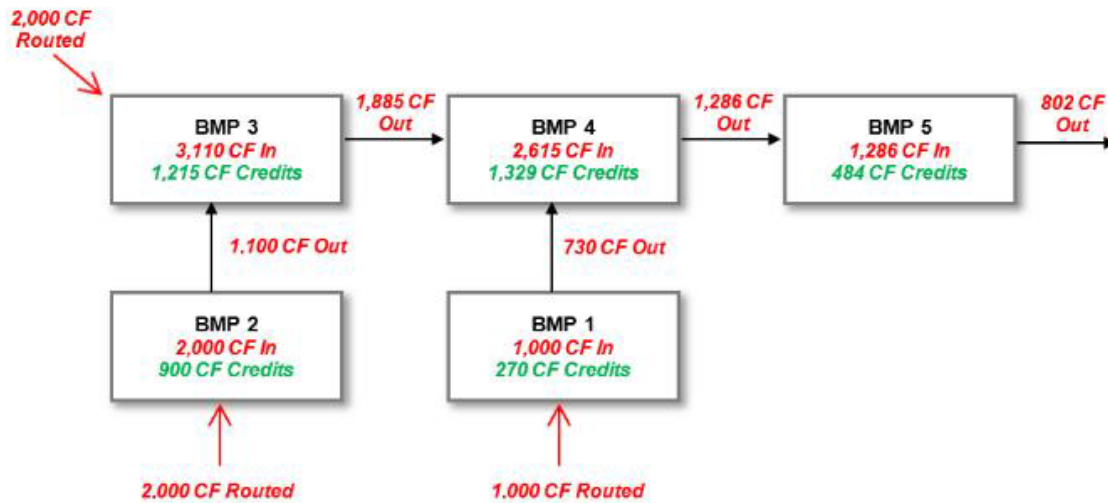
- Porous Pavement with Inf. Bed
- Inf. Basin
- Inf. Bed
- Inf. Trench
- Rain Garden/ Bioretention
- Dry Well / Seepage Pit
- Constructed Filter
- Vegetative Swale
- Infiltration Berm
- Capture/ Reuse
- Wet Pond/ Retention Basin
- Dry Extended Detention Basin
- WQ Filter / Hydrodynamic Device
- Floodplain Restoration
- Vegetative Roof
- Riparian Forest Buffer
- Riparian Buffer

Add all BMP's used in this list into Volume Tab even if provided for WQ only . Will Auto Calculate Pollutant Removal on WQ Tab



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BMP's in Series:



The spreadsheet enforces a rule that downstream BMPs in series must receive volume routed to it that is at least as large as the outflow from upstream BMPs. The following (abbreviated) table illustrates how this scenario appears in the Structural BMPs table:

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)
001	1	Vegetated Swale	-	to BMP No. 4	4.00	1,000
001	2	Rain Garden / Bioretention	-	to BMP No. 3	3.00	2,000
001	3	Vegetated Swale	-	to BMP No. 4	2.00	3,100
001	4	Infiltration Basin	-	to BMP No. 5	0.00	2,615
001	5	Infiltration Basin	-	Off-Site	0.00	1,286

NOTE 27 – A BMP that is in series with another BMP for the same discharge point should have a **volume routed to the BMP that is no less than the preceding BMP in the series, minus infiltration and ET credits.** Volume that is permanently removed by infiltration or ET cannot be counted as volume contributing to a subsequent BMP in a series. Applicants should develop a water balance for complex BMPs in series scenarios (see Example 5).

Draw a diagram and include it to explain the routing scenario (See Example)

Example : 2 BMP's in Series (A goes into B)

Watersheds contributing DIRECTLY into each BMP = Subarea A, Subarea B

Inflow into BMP A = Subarea A Volume

BMP A Credits = Infiltration Volume A + ET Credits A

BMP B inflow = Subarea B Volume + (Subarea A volume – BMP A Credits)



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Adding BMP's-Volume Tab:

Tree Planting Credit

Number of new deciduous trees that will be planted within disturbed area:

22	1
10	

CREDIT (CF):

132

Number of new evergreen trees that will be planted within disturbed area:

CREDIT (CF):

100

Other (attach calculations):

Description: Soil Amendments, Roof Leader Disconnection

2 CREDIT (CF):

259

Structural BMP Volume Credits:

No. Structural BMPs:

5

Start BMP Numbering at:

1

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegetated?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Vegetated Swale	-	to BMP No. 2	0.65	3,300	2,500	0.00	1	Yes	0.5	0	0	429
001	2	Vegetated Swale	-	to BMP No. 3	0.87	5,652	3,200	0.00	1	Yes	0.5	0	0	549
001	3	Infiltration Basin	-	Off-Site	10.49	115,000	39,526	0.67	56	Yes	0.5	36,526	60,360	6,779
001	4	Constructed Filter	-	Off-Site	1.85	12,523	1,500	0.50	24	No	0.5	12,523	1,350	
001	5	Rain Garden / Bioretention	-	Off-Site	0.25	2,100	1,000	0.25	48	Yes	2.0	500	725	526
Totals:												62,435	8,282	

3	4	5	6	7	8	9	10	11	12	13	14	15
												INFILTRATION & ET CREDITS (CF): 70,717
												NET CHANGE IN VOLUME TO MANAGE (CF): 72,650
												TOTAL CREDITS (CF): 71,208

VOLUME REQUIREMENT NOT SATISFIED

BMP'S NEED TO MEET THE KEY DESIGN ELEMENTS

IF INFLOW VOLUMES ARE DIFFERENT THAN THE VOLUMES FROM THE RATE ANALYSIS
PROVIDE CALCUATIONS (WORKSHEET 4)

1- Input Trees Planted for Credit-Show on PCSM Plans

2- Other Volume Credits not covered -Provide Credits and justification

3-Discharge Point #. If not entered, no calculations performed

4-BMP ID - Show # on Plans

5-Pull Down List of BMP's

6-MRC?-DO NOT SELECT YES- SEE NEXT SLIDE

7-BMP's in Series or Off-site (discharge to POI)

8-Drainage Area to BMP (Direct-Do not include Area from upstream BMP's)

9-Volume to BMP (Pay Attention in Series)

10-Area of BMP at FIRST OUTLET

11-Infiltration Rate with Factor of Safety

12 =(Depth of Water at First Outlet/ infiltration Rate)

13-Yes if BMP on surface and vegetated (not stone)

14-Depth of topsoil/ amendments in BMP

15- Volume at FIRST OUTLET or Volume Routed, WHICHEVER IS LESS

A= Total Drainage Area cannot exceed Area used to Calculate the Post Development Volume

B= Total Volume Cannot exceed Post Development Volume - issue is usually due to including undisturbed volume from Rate control or issue with BMP's in series



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INFILTRATION CREDITS

Infiltration Credit (CF) = Infiltration Rate (in/hr) x 0.9 (factor of safety) / 12 in/ft) x 12 hrs (infiltration during storm) x Infiltration Area (ft²) + (the lesser of Storage Volume or (Infiltration Period (hrs) – 12 hrs x (Infiltration Rate (in/hr) x 0.9 (factor of safety) / 12 in/ft) x Infiltration Area (ft²)), where Infiltration Credit may not exceed the Volume Routed to the BMP.

- **Yellow Component-Infiltration Occurring During the Storm**
- **Green Component- Infiltration after Storm Ends – (Volume left in the BMP)**
- **The Green Component is how the loading ratio is taken into account. High dewatering times (high depth of water + slow infiltration rate) will result in green component being less than storage volume. If dewatering time is > 96 hours, need to expand footprint and lower depth of ponded water.**



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ET CREDITS

ET Credit (CF) = ET Volume Reduction (%) (from Table 1) x Media Depth (ft) x Infiltration Area (ft²), where ET Credit plus Infiltration Credit may not exceed Volume Routed to BMP.

NOTE 36 – This calculation assumes that all infiltrating area is vegetated.

DEP recognizes that this method is a simplification of the site-specific and regional factors that go into estimating potential ET. If an applicant wishes to pursue estimation of ET Credit in a different or more comprehensive manner, a separate analysis may be conducted and attached to the permit application or Volume Worksheet.

Table 1: Total Void Space (ET) Credit Used by Spreadsheet for Vegetated Systems

Media Depth (ft)	ET Volume Reduction (% Volume)	Media Depth (ft)	ET Volume Reduction (% Volume)
0.5	34.3	2.8	25.5
0.6	33.6	2.9	25.4
0.7	32.9	3.0	25.3
0.8	32.2	3.1	25.2
0.9	31.5	3.2	25.1
1.0	30.7	3.3	25
1.1	30	3.4	25
1.2	29.3	3.5	24.9
1.3	28.5	3.6	24.9



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Managed Release Concept (MRC)

- Design the MRC using the procedures in the MRC design guidance. Input the MRC as a Rain Garden in the Spreadsheet.
- For the 2 year storm routing, the **volume you credit should be the volume that is discharging out the underdrain** (based on Max WSEL or volume at first orifice). Do not count any runoff which may outflow from your first outflow orifice (any flow out the first orifice is not being treated for water quality.)
- For the spreadsheet, **Input the Volume credit (from above) into the spreadsheet as the inflow volume into the MRC.** Fill in the rest of the table and hopefully you should get zero outflow from the MRC, which should translate into zero pollutant outflow on the quality spreadsheet. You may need to manipulate the dewatering time and infiltration rate to get zero outflow.



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Water Quality Tab

- **Builds off of the Volume Tab Data for Predevelopment vs Post Development Runoff Volumes and Land Cover**
- **Use Worksheet 13 procedure for BMP's not covered in Volume BMP pull down list (Street Sweeping)**
- **Pollutant Loads based on Outflow Volume and concentrations in Instructions.**
- **READ THE INSTRUCTIONS**



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Outflow Concentrations

Outflow Concentrations (Conc.) (mg/L) – Median BMP outflow concentrations are utilized from the [International Stormwater BMP Database, 2016 Summary Statistics, Final Report](#) (The Water Environment & Reuse Foundation). As additional research is completed and new data are available, DEP will update BMP Outflow Concentrations accordingly. The following table presents the outflow concentrations used in the Quality Worksheet for the standard BMPs:

BMP	Median Outflow TSS	Median Outflow TP	Median Outflow TN
Porous Pavement w/Infiltration Bed	26	0.11	1.19
Infiltration Basin	10	0.24	1.04
Infiltration Bed	24.3	0.19	1.19
Infiltration Trench	24.3	0.19	1.19
Rain Garden / Bioretention	10	0.24	1.04
Dry Well / Seepage Pit	24.3	0.19	1.19
Constructed Filter	9	0.09	1.05
Vegetated Swale	24	0.2	0.85
Vegetated Filter Strip	19	0.17	1.13
Infiltration Berm & Retentive Grading	24	0.2	0.85
Vegetated Roof	19	0.17	1.13
Capture and Reuse	N/A	N/A	N/A
Constructed Wetland	12	0.1	1.31
Wet Pond / Retention Basin	11.7	0.09	1.2
Dry Extended Detention Basin	24.3	0.19	1.19
Water Quality Filters & Hydrodynamic Devices	9	0.09	1.05
Floodplain Restoration	10	0.24	1.04
Soil Amendment	19	0.17	1.13
Riparian Buffer	10	0.24	1.04

Pollutant Loads (lbs) – Pollutant Loads in BMP Outflows are calculated by the equation:

$$\text{Median BMP Outflow Concentration (mg/L)} \times (\text{Outflow (CF)} / 43,560 \text{ CF/acre-ft}) \times 2.72 \text{ (conversion factor)}$$



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WQ Tab

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Impervious Areas: Commercial	Commercial	2.01	A	22,015	61.7	0.22	2.02	84.85	0.30	2.78
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	1.36	A	14,896	65.0	0.29	2.05	60.46	0.27	1.91
Impervious as Meadow	Grassland/Herbaceous	0.84	C	2,770	48.8	0.22	2.30	8.44	0.04	0.40
Forested (Good Condition)	Deciduous Forest/Evergreen Forest/Mixed Forest	14.91	C	46,402	45.0	0.13	1.05	130.39	0.38	3.04
Pervious as Meadow	Grassland/Herbaceous	8.47	B	11,037	48.8	0.22	2.30	33.63	0.15	1.59
TOTAL (ACRES):		27.59			TOTALS:			317.76	1.14	9.71

- Calculations Performed Automatically for Volume Tab Calculations
- Note Requirement is to Reduce Post Development Pollutants back to Predevelopment Conditions. This is different than previous requirements of 85% -85%-50% reduction of Post Development Pollutant Loadings

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Impervious Areas: Industrial	Industrial	11.47	C	125,629	81.0	0.24	2.01	635.41	1.88	15.77
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	Urban Highway	2.05	C	22,453	142.0	0.32	3.00	199.09	0.45	4.21
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	12.86	B	21,687	78.0	0.25	1.25	105.63	0.34	1.69
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	Grassland/Herbaceous	1.21	A	0	48.8	0.22	2.30	0.00	0.00	0.00
TOTAL (ACRES):		27.59			TOTALS:			940.13	2.67	21.67

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS): **622.37** **1.53** **11.96**



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Un-detained Areas:

Characterize Undetained Areas (for Untreated Stormwater)

No. Rows:

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Impervious Areas: Industrial	0.67	C	98	0.041	3.02	7,338
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	0.29	C	98	0.041	3.02	3,176
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	8.27	B	61	1.279	0.46	13,947
Meadow-Continuous Grass, Protected from Grazing and Generally Mowed for Hay	1.03	A	30	4.667	0.00	0

Characterize Undetained Areas (for Untreated Stormwater) – This optional but recommended function allows the user to define the land cover of post-construction undetained areas, within the area of disturbance, for a more accurate estimate of the pollutant loads draining off-site through untreated stormwater. Users can

check the box and complete the table by selecting Land Cover, Area (acres), and Soil Type within post-construction undetained areas, similar to how runoff volumes are estimated in the Volume Worksheet. The pollutant loads for each land cover are determined using Equation 7 and are summed. These pollutant loads are reported under "Pollutant Loads for Untreated Stormwater" (see below), unless this function is not used.

If not used, a general estimate of pollutant loads in untreated stormwater is determined as follows:

Step 1 – The volume of untreated stormwater is estimated by subtracting the Total Volume Routed to Structural BMPs and Non-Structural BMP Volume Credits from the Total Post-Construction Volume. It is noted that for BMPs in series in which downstream BMPs receive stormwater from additional drainage area (i.e., beyond the drainage area of prior BMPs in series), this additional volume is considered treated stormwater.

Step 2 – Volume-weighted Event Mean Pollutant Concentrations are calculated and used to represent the average pollutant concentrations in stormwater runoff site-wide, regardless if the runoff is collected for treatment. Pollutant loads in untreated stormwater are then calculated using Equation 7, utilizing the runoff volume from Step 1 and the Volume-weighted Event Mean Pollutant Concentrations in Step 2.

While this function is optional, in many cases its use will be beneficial as the general approach can overestimate pollutant loads from undetained areas, and is necessary to claim Pervious Undetained Area Credit (below).



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Pervious Undetained Credit

Non-Structural BMP Water Quality Credits:

- Pervious Undetained Area Credit

TSS	TP	TN
10.62	0.04	0.30

Pervious Undetained Area Credit – DEP provides this credit to promote the minimization of impervious areas and in recognition that it may not be feasible or necessary to route all post-construction stormwater flows to structural BMPs. Based on available research, DEP is applying reductions of 25%, 20%, and 15% from the Event Mean Pollutant Concentrations for TSS, TP, and TN for all post-construction land covers that are not impervious, as follows:

- TSS Credit: $48.8 \text{ mg/L} \times 0.25 = 12.2 \text{ mg/L}$
- TP Credit: $0.22 \text{ mg/L} \times 0.2 = 0.044 \text{ mg/L}$
- TN Credit: $2.3 \text{ mg/L} \times 0.15 = 0.345 \text{ mg/L}$

When the box next to **Pervious Undetained Area Credit** is checked, assuming the Characterization of Undetained Areas box is checked and the table has been completed, the credit, in lbs, is calculated by (Equation 8):

$(\text{Runoff Volume for Pervious (non-Impervious) Undetained Area (CF)} / 43,560 \text{ CF/acre-ft}) \times \text{TSS, TP, and TN Credits (mg/L)} \times 2.72 \text{ (conversion factor)}$



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Other WQ Credits

- Other (attach calculations)

Description:

Street Sweeping

TSS	TP	TN
186.00	0.21	1.58

NOTE 41 – Street sweeping may be claimed as a water quality “Other Credit” by attaching pollutant load reduction calculations to the spreadsheet or application where the calculations are consistent with the Stormwater BMP Manual or utilize other technically sound methods.

NOTE 42 – When water quality filters or other stormwater treatment devices are used for pretreatment of stormwater prior to other structural BMPs, pollutant removal from the filters or devices are not automatically reflected in the Structural BMP Water Quality Credits table. Water quality credit is only calculated for those structural BMPs that discharge off-site. Upstream BMPs in series provide water quality benefit in the Structural BMP Water Quality Credits table only to the extent that volume is reduced. In the case of water quality filters and other devices, volume reduction does not take place, so the user must use a different approach to reflect water quality credit. A user can incorporate water quality credit for such filters or devices by reporting pollutant load reduction as an “Other Credit” or the user may manually adjust BMP Outflow Concentrations, as discussed below (in either case supporting calculations must be attached).



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WQ Summary

Structural BMP Water Quality Credits:

Use default BMP Outflows and Median BMP Outflow Concentrations

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
001	1	Vegetated Swale	-	0.65	3,300	429		2,871	-	-	-	-	-	-
001	2	Vegetated Swale	-	0.87	5,652	549		5,103	-	-	-	-	-	-
001	3	Infiltration Basin	-	10.49	115,000	67,139		47,861	10.00	0.24	1.04	29.89	0.72	3.11
001	4	Constructed Filter	-	1.85	12,523	1,350		11,173	9.00	0.09	1.05	6.28	0.06	0.73
001	5	Rain Garden / Bioretention	-	0.25	2,100	1,251		849	10.00	0.24	1.04	0.53	0.01	0.06

POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):

POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):

NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):

NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):

POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):

	TSS	TP	TN
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	36.69	0.79	3.90
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	133.21	0.39	2.60
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):	196.62	0.25	1.88
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	0.00	0.94	4.62
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	317.76	1.14	9.71

Outflow from Volume Reduction BMP's
Undetained (Volume * Concentrations)
Previous Undetained + Others
Total From Site

WATER QUALITY REQUIREMENT SATISFIED



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Rate Control-Limitations

If the following two items are true, the applicant does not need to complete the Rate Worksheet or otherwise complete an analysis of peak rates: 1) the **Total Earth Disturbance** area is less than 5 acres; and 2) the area of **post-construction impervious surface within the watershed is less than or equal to one acre.** Note that **this exception applies on a surface water basis rather than a discharge point basis** (i.e., if there are multiple discharge points to a surface water but the spreadsheet is completed for a single discharge point, the user should not assume that a small site exception applies to either the single discharge point or all discharge points to the surface water, regardless of the message displayed).

The Rate Worksheet utilizes the design standard that applicants must manage the net change in peak rate for the 2-, 10-, 50- and 100-year/24-hour storm events. Peak rates are determined using the Graphical Peak Discharge Method in TR-55. **The Rate Worksheet is intended for drainage areas less than 5 acres or for sites that contain simple land cover conditions** (i.e., those projects where the limitations of the Graphical Peak Discharge Method do not apply). Any applicant with a project utilizing hydrological **calculations that involve pond routings** or otherwise involve multiple land covers may report a summary of peak rates in this worksheet but **should not use the calculations in this worksheet to determine peak rates.** In such cases the output of hydrologic modeling software should be attached to the permit application to demonstrate rate control requirements have been met.



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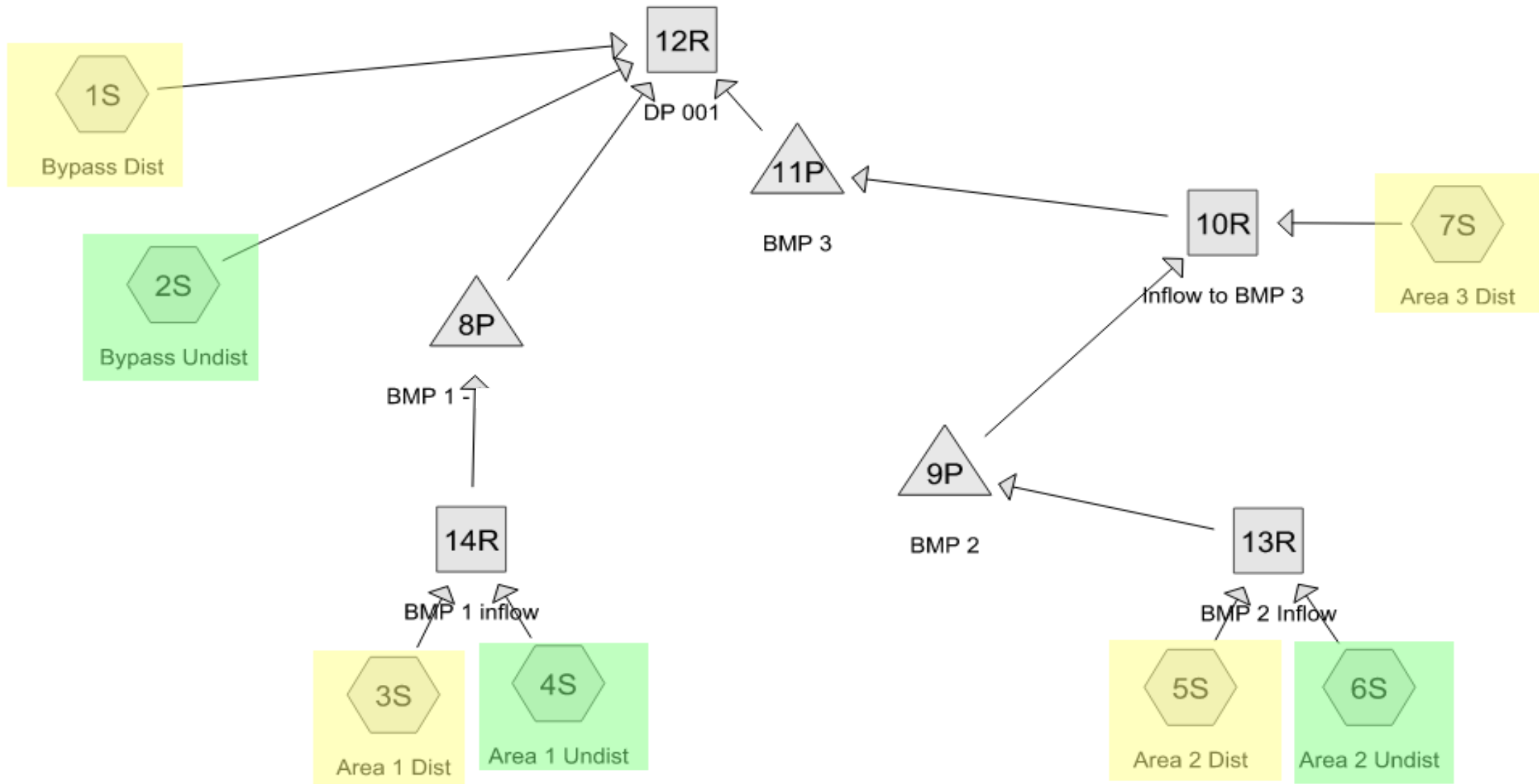


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Example



Rate Analysis

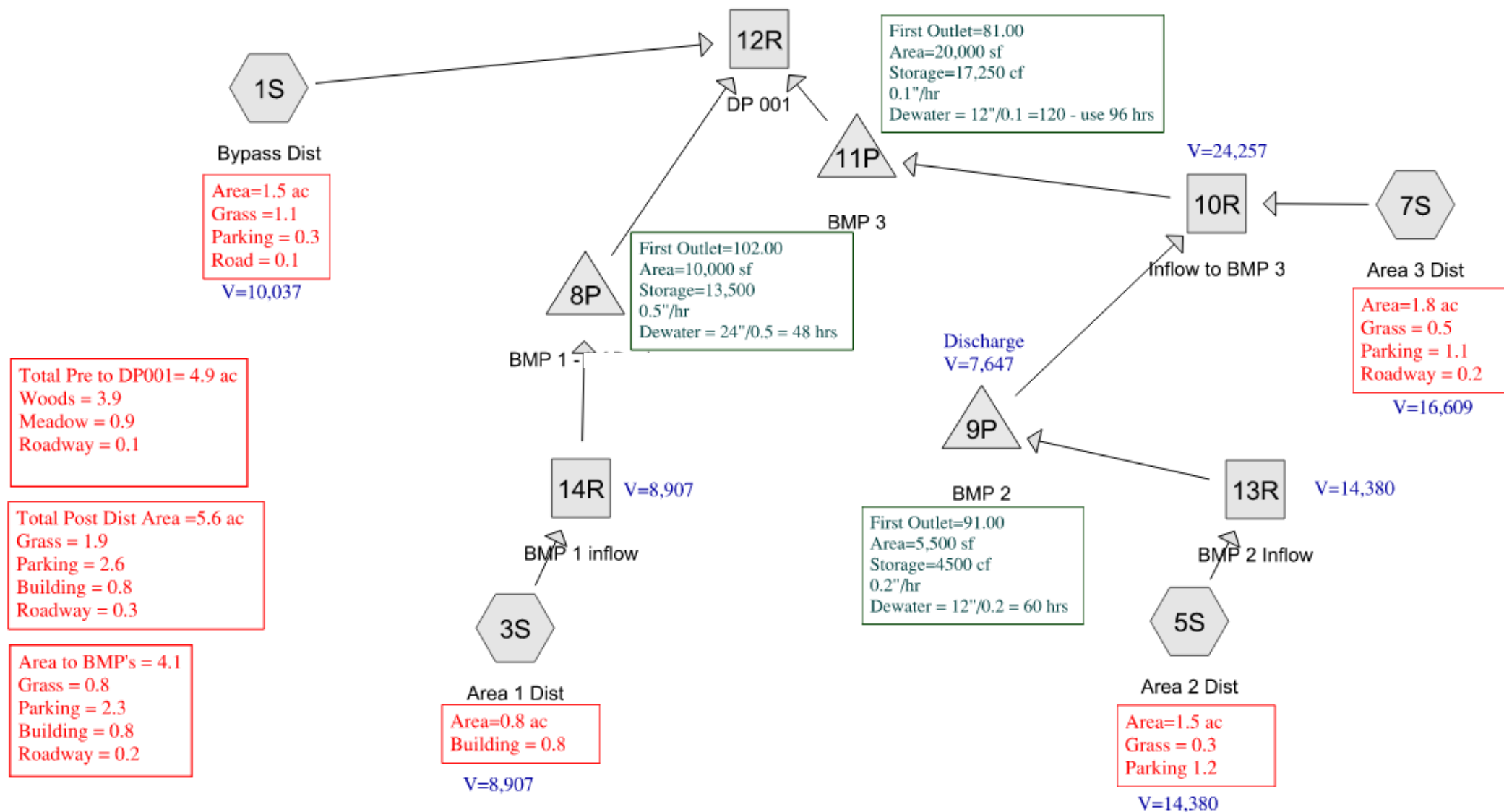


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Volume, WQ Analysis



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General Tab

General Information

- Instructions
- General
- Volume
- Rate
- Quality

Project Name: <input style="width: 90%;" type="text" value="MCCD Workshop Example"/>	Application Type: <input style="width: 90%;" type="text" value="Individual NPDES Application"/>
County: <input style="width: 90%;" type="text" value="Monroe"/>	Municipality: <input style="width: 90%;" type="text" value="Eldred Township"/>
Project Type: <input style="width: 90%;" type="text" value="Commercial Building"/>	<input checked="" type="radio"/> New Project <input type="radio"/> Minor / Major Amendment
Area: <input style="width: 100px;" type="text" value="5.60"/> acres <i>(In Watershed)</i>	Total Earth Disturbance: <input style="width: 100px;" type="text" value="5.60"/> acres <i>(In Watershed)</i>
No. of Post-Construction Discharge Points: <input style="width: 100px;" type="text" value="1"/>	Start DP Numbering at: <input style="width: 100px;" type="text" value="001"/>

Discharge Point (DP) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural BMP(s)
001	4.10	4.10	0.00	3.30	Discharge to Non-Surface Waters	HQ-CWF, MF	Yes
Undetained Areas	1.50	1.50	0.10	0.40	Brodhead Creek	HQ-CWF, MF	
Totals:	5.60	5.60	0.1	3.7			



Volume Tab

Volume Management

Project: MCCD Workshop Example

Instructions **General** **Volume** Rate Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): inches Alternative 2-Year / 24-Hour Storm Event: inches
 Alternative Source:

Pre-Construction Conditions: No. Rows: Exempt from Meadow in Good Condition Automatically Calculate CN, Ia, Runoff and Volume

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	0.08	D	98	0.041	3.07	891
Impervious as Meadow	0.02	D	78	0.564	1.35	98
Forested (Good Condition)	3.90	D	77	0.597	1.28	18,174
Pervious as Meadow	0.90	D	78	0.564	1.35	4,401
TOTAL (ACRES):		4.90			TOTAL (CF):	23,564

Post-Construction Conditions: No. Rows:

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	1.90	D	80	0.500	1.48	10,202
Impervious Areas: Commercial	2.60	D	98	0.041	3.07	28,948
Impervious Areas: Commercial	0.80	D	98	0.041	3.07	8,907
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	0.30	D	98	0.041	3.07	3,340
TOTAL (ACRES):		5.60			TOTAL (CF):	51,397

NET CHANGE IN VOLUME TO MANAGE (CF):



Volume BMP's

- Tree Planting Credit
- Other (attach calculations):

Structural BMP Volume Credits: No. Structural BMPs: **3** Start BMP Numbering at: **1**

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegetated?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Rain Garden / Bioretention	-	Off-Site	0.80	8,907	10,000	0.50	48	Yes	0.5	8,907	8,907	0
001	2	Infiltration Bed	-	to BMP No. 3	1.50	14,380	5,500	0.20	60	No		4,500	4,950	
001	3	Infiltration Basin		Off-Site	1.80	24,257	20,000	0.10	96	Yes	0.5	17,250	14,400	3,430
Totals:												28,257	3,430	

This Value is from the HydroCad Printout
 Could have used $16,609 + (14,380 - 4950) = 26,039$

INFILTRATION & ET CREDITS (CF): **31,687**

NET CHANGE IN VOLUME TO MANAGE (CF): **27,833**

TOTAL CREDITS (CF): **31,687**

VOLUME REQUIREMENT SATISFIED



WQ Tab

Water Quality

Project: MCCD Workshop Example

PRINT

Instructions General Volume Rate **Quality**

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	Urban Highway	0.08	D	891	142.0	0.32	3.00	7.90	0.02	0.17
Impervious as Meadow	Grassland/Herbaceous	0.02	D	98	48.8	0.22	2.30	0.30	0.00	0.01
Forested (Good Condition)	Deciduous Forest/Evergreen Forest/Mixed Forest	3.90	D	18,174	45.0	0.13	1.05	51.07	0.15	1.19
Pervious as Meadow	Grassland/Herbaceous	0.90	D	4,401	48.8	0.22	2.30	13.41	0.06	0.63
TOTAL (ACRES):		4.90			TOTALS:			72.67	0.23	2.00

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	1.90	D	10,202	78.0	0.25	1.25	49.69	0.16	0.80
Impervious Areas: Commercial	Commercial	2.60	D	28,948	61.7	0.22	2.02	111.56	0.40	3.65
Impervious Areas: Commercial	Commercial	0.80	D	8,907	61.7	0.22	2.02	34.33	0.12	1.12
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	Urban Highway	0.30	D	3,340	142.0	0.32	3.00	29.62	0.07	0.63
TOTAL (ACRES):		5.60			TOTALS:			225.20	0.75	6.20

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS): **152.52** **0.52** **4.19**



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WQ BMP's

Characterize Undetained Areas (for Untreated Stormwater) No. Rows:

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	1.1	D	80	0.500	1.48	5,907
Impervious Areas: Commercial	0.3	D	98	0.041	3.07	3,340
Impervious Areas: Streets and Roads - Paved; Curbs and Storm Sewers (Excluding ROW)	0.1	D	98	0.041	3.07	1,113

Non-Structural BMP Water Quality Credits:

Pervious Undetained Area Credit

TSS	TP	TN
4.50	0.02	0.13

Other (attach calculations)

Description:

TSS	TP	TN
95.09	0.24	0.36

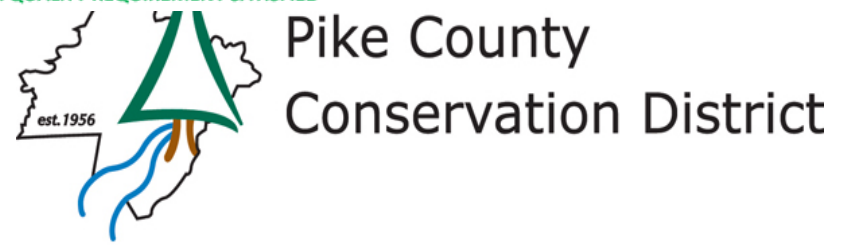
Structural BMP Water Quality Credits:

Use default BMP Outflows and Median BMP Outflow Concentrations

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
001	1	Rain Garden / Bioretention	-	0.80	8,907	8,907		0	10.00	0.24	1.04	0.00	0.00	0.00
001	2	Infiltration Bed	-	1.50	14,380	4,950		9,430	-	-	-	-	-	-
001	3	Infiltration Basin		1.80	24,257	17,830		6,427	10.00	0.24	1.04	4.01	0.10	0.42

POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	4.01	0.10	0.42
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	51.51	0.16	1.09
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):	99.59	0.26	0.49
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	0.00	0.00	1.02
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	72.67	0.23	2.00

WATER QUALITY REQUIREMENT SATISFIED



Street Sweeping

WORKSHEET 13.1. POLLUTANT REDUCTION THROUGH BMP APPLICATION*

* FILL THIS WORKSHEET OUT FOR EACH BMP TYPE WITH DIFFERENT POLLUTION REMOVAL EFFICIENCIES. SUM POLLUTANT REDUCTION ACHIEVED FOR ALL BMP TYPES ON FINAL SHEET

BMP TYPE: **Street Sweeping**

DISTURBED AREA CONTROLLED BY BMPs (AC)	2.60
--	------

DISTURBED AREAS CONTROLLED BY THIS BMP TYPE:

	LAND COVER CLASSIFICATION	POLLUTANT			COVER (Acres)	RUNOFF VOLUME (AF)	POLLUTANT LOAD**		
		TSS EMC (mg/L)	TP EMC (mg/L)	Nitrate - Nitrite EMC (mg/L as N)			TSS*** (LBS)	TP*** (LBS)	NO ₃ (LBS)
Pervious Surfaces	Forest	39	0.15	0.17	0.00	0.00	0.00	0.00	0.00
	Meadow	47	0.19	0.30	0.00	0.00	0.00	0.00	0.00
	Fertilized Planting Area	55	1.34	0.73	0.00	0.00	0.00	0.00	0.00
	Native Planting Area	55	0.40	0.33	0.00	0.00	0.00	0.00	0.00
	Lawn, Low-Input	180	0.40	0.44	0.15	0.02	7.80	0.02	0.02
	Lawn, High-Input	180	2.22	1.46	0.00	0.00	0.00	0.00	0.00
	Golf Course Fairway/Green	305	1.07	1.84	0.00	0.00	0.00	0.00	0.00
	Grassed Athletic Field	200	1.07	1.01	0.00	0.00	0.00	0.00	0.00
Impervious Surface	Rooftop	21	0.13	0.32	0.00	0.00	0.00	0.00	0.00
	High Traffic Street / Highway	261	0.40	0.83	0.00	0.00	0.00	0.00	0.00
	Medium Traffic Street	113	0.33	0.58	0.00	0.00	0.00	0.00	0.00
	Low Traffic / Residential Street	86	0.36	0.47	0.00	0.00	0.00	0.00	0.00
	Res. Driveway, Play Courts, etc.	60	0.46	0.47	0.00	0.00	0.00	0.00	0.00
	High Traffic Parking Lot	120	0.39	0.60	0.00	0.00	0.00	0.00	0.00
	Low Traffic Parking Lot	58	0.15	0.39	2.60	0.66	104.07	0.27	0.70
TOTAL LOAD:							111.87	0.29	0.72
BMP POLLUTANT REMOVAL EFFICIENCIES FROM APPENDIX A (%)							85	85	50
POLLUTANT REDUCTION ACHIEVED BY THIS BMP TYPE (LBS):							95.09	0.24	0.36

POLLUTANT REDUCTION ACHIEVED BY ALL BMP TYPES (LBS):			
REQUIRED REDUCTION FROM WORKSHEET 12 (LBS):	0.00	0.00	0.00

** Pollutant Load = [EMC, mg/L] x [Volume, AF] x [2.7, Unit Conversion]

*** TSS and TP calculations only required for projects not meeting CG1/CG2 or not controlling less than 90% of the disturbed area



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Questions



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