Brief Stormwater Topics

Westmoreland Conservation District

Engineers Workshop

March 19 & 20 2026

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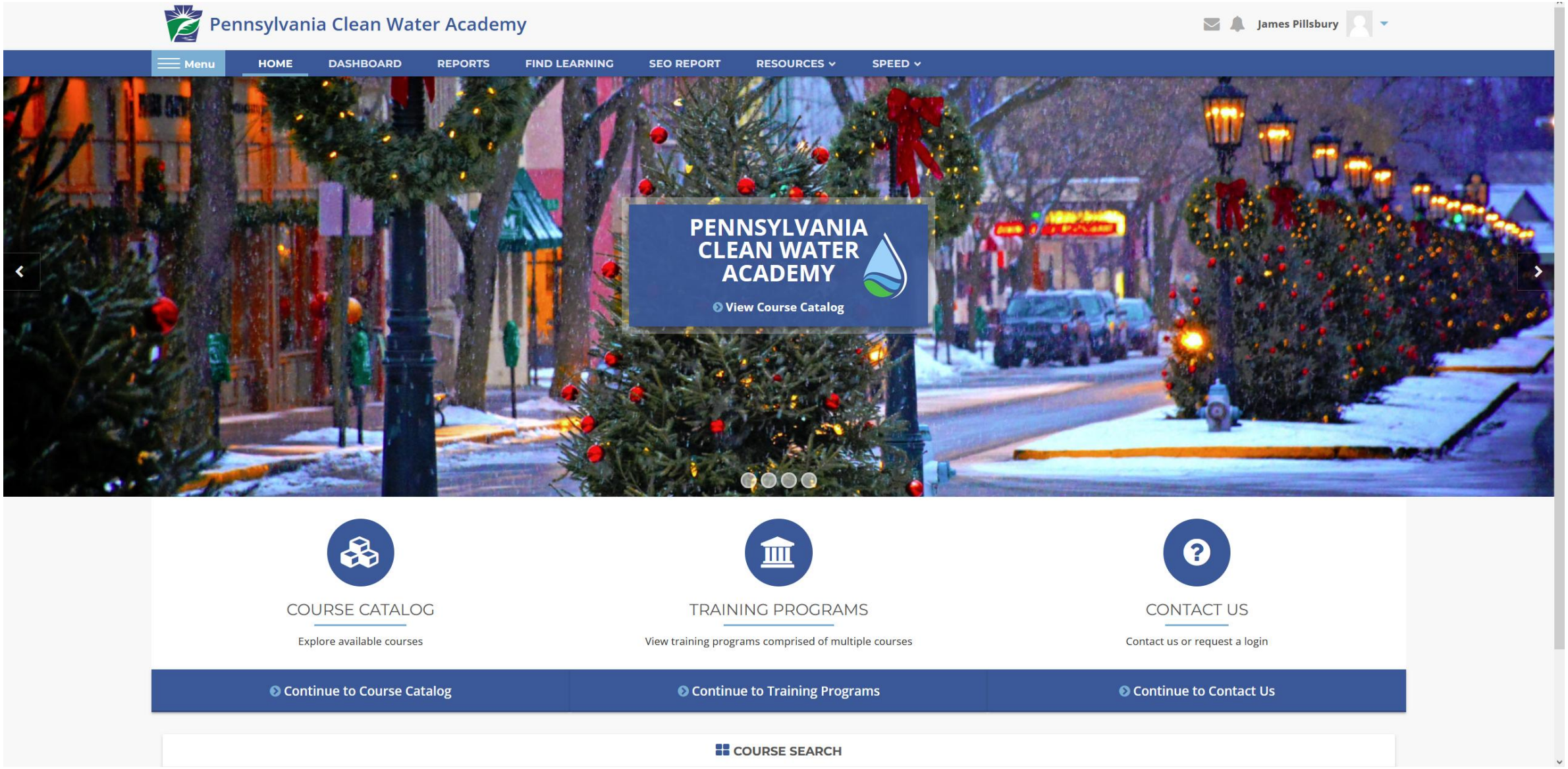
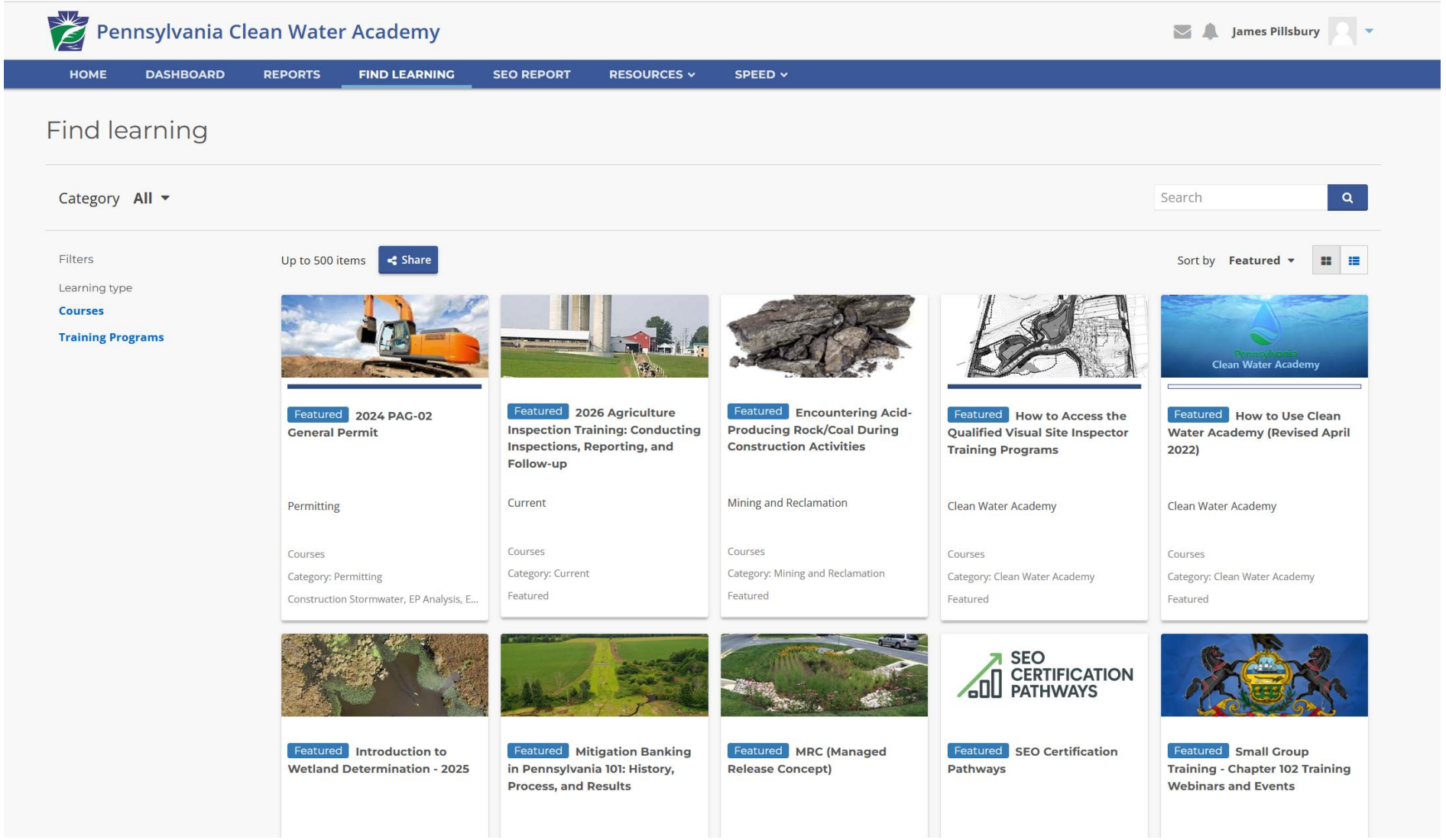
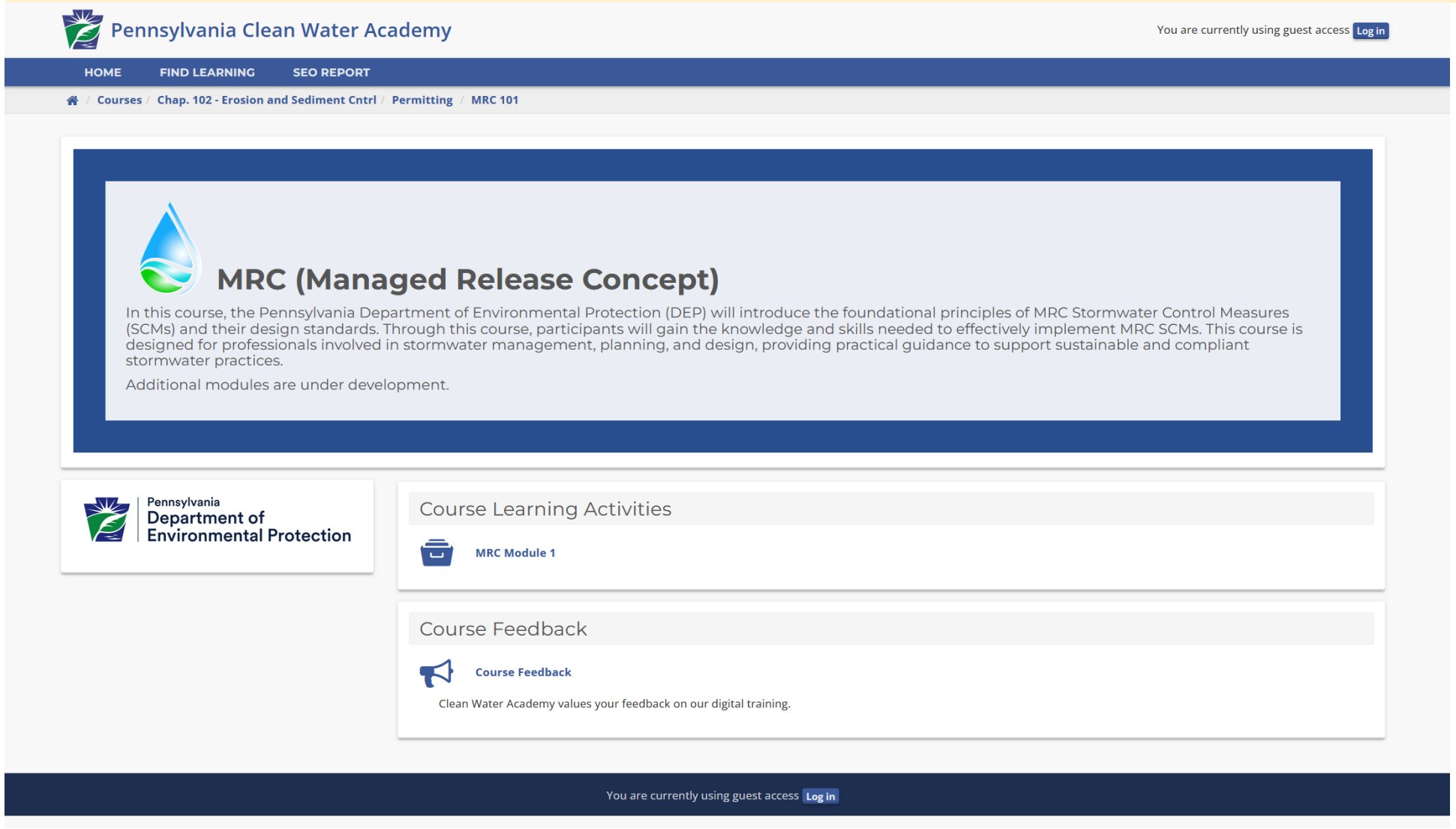
PA DEP's learning and resource tools—available to all!



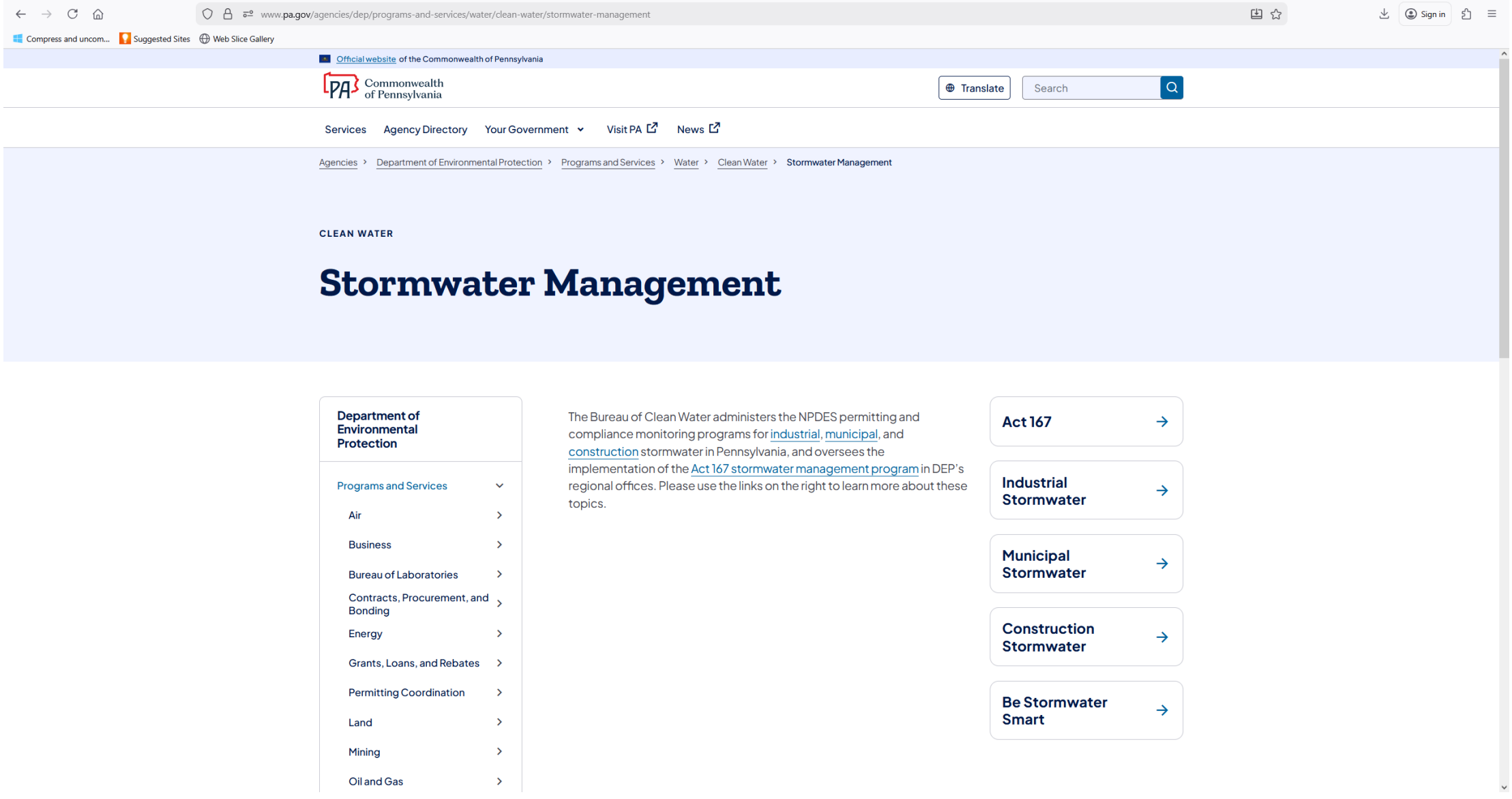
Create an account and the CWA keeps track of what you learn



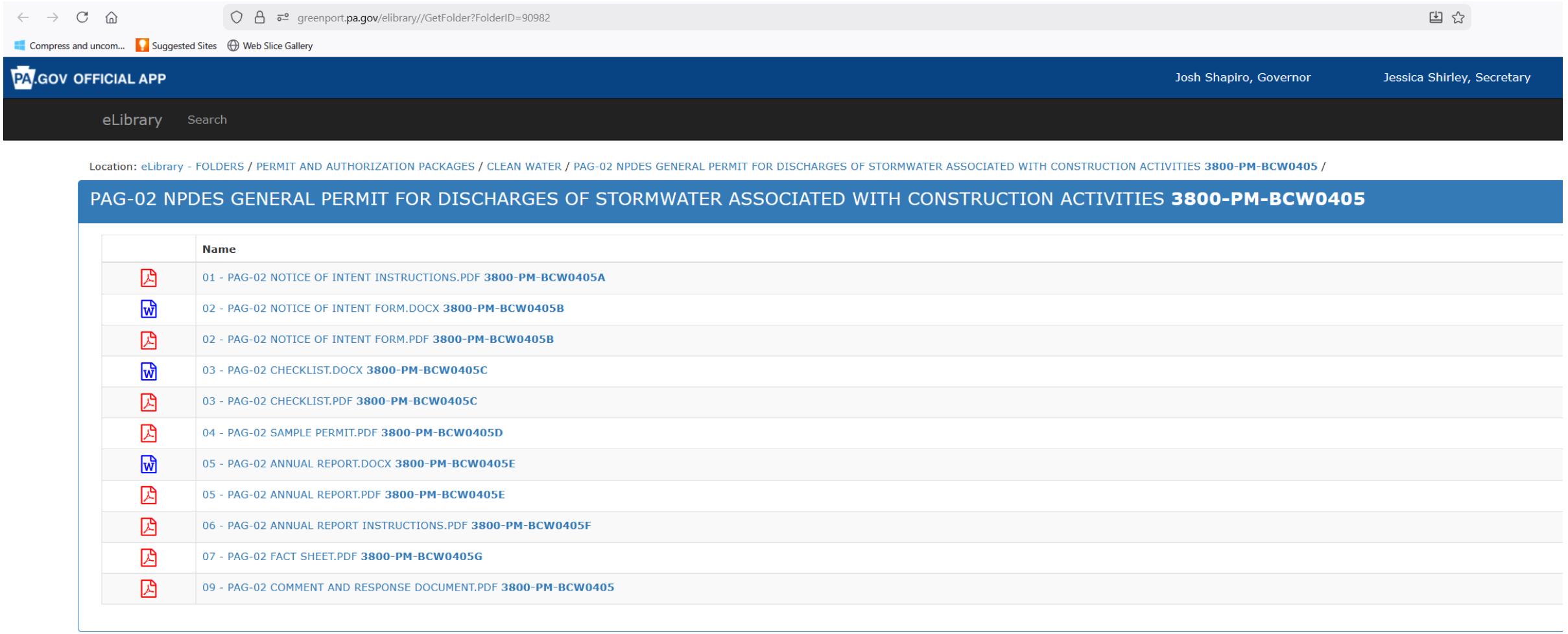
Clean Water Academy courses cover many relevant topics



PA DEP's website has links for you



PA DEP's e-library contains all the latest documents



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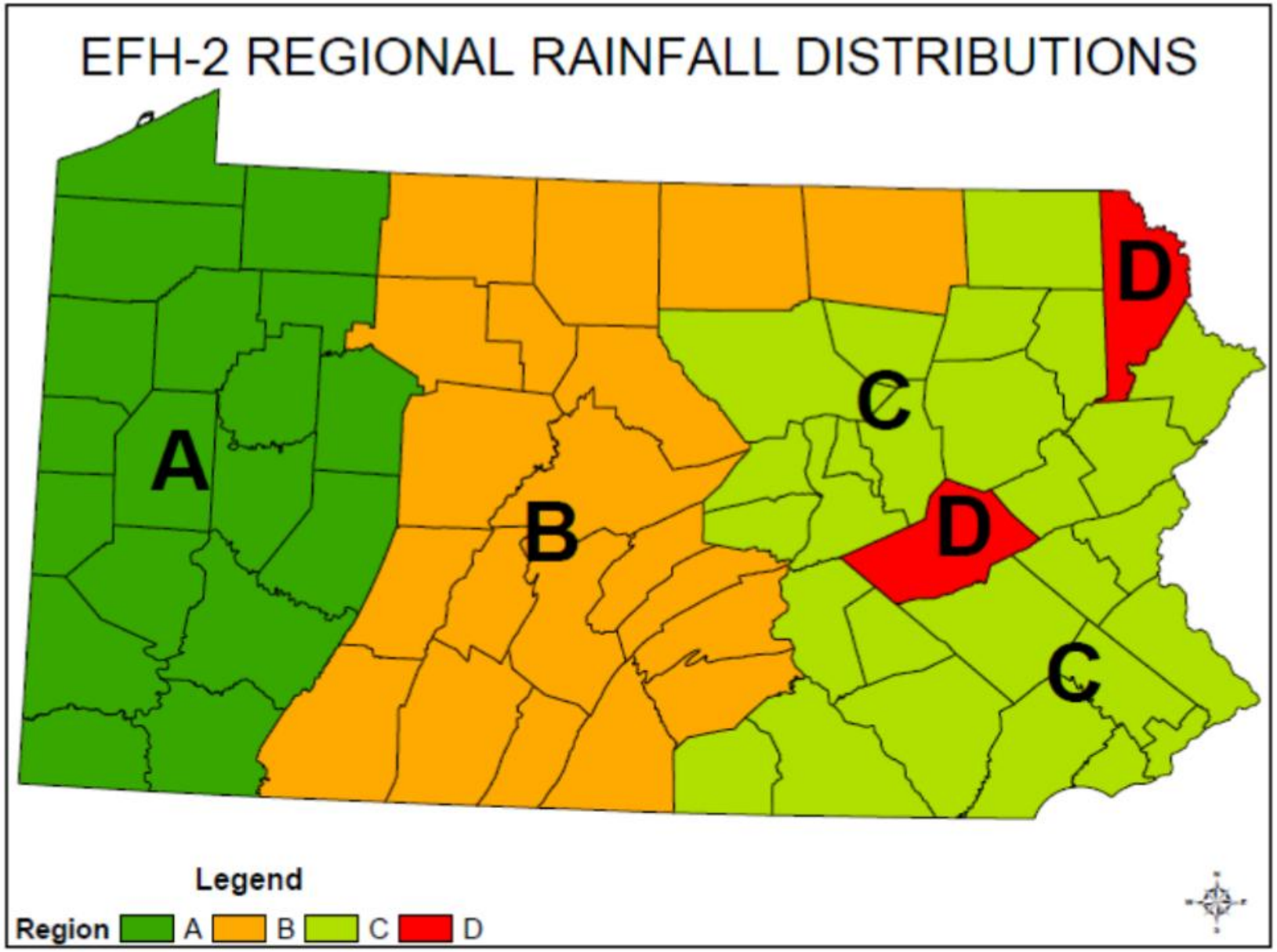
SCS Type II routing vs. NOAA Routing

- Routing models are used when calculating peak runoff, runoff volume, storm duration, etc.
- For many years the USDA NRCS Type II routing was the standard
- NOAA and NRCS have determined that the use of the SCS Type II routing is not appropriate with NOAA precipitation data
- Please use the NOAA Type A storm when routing

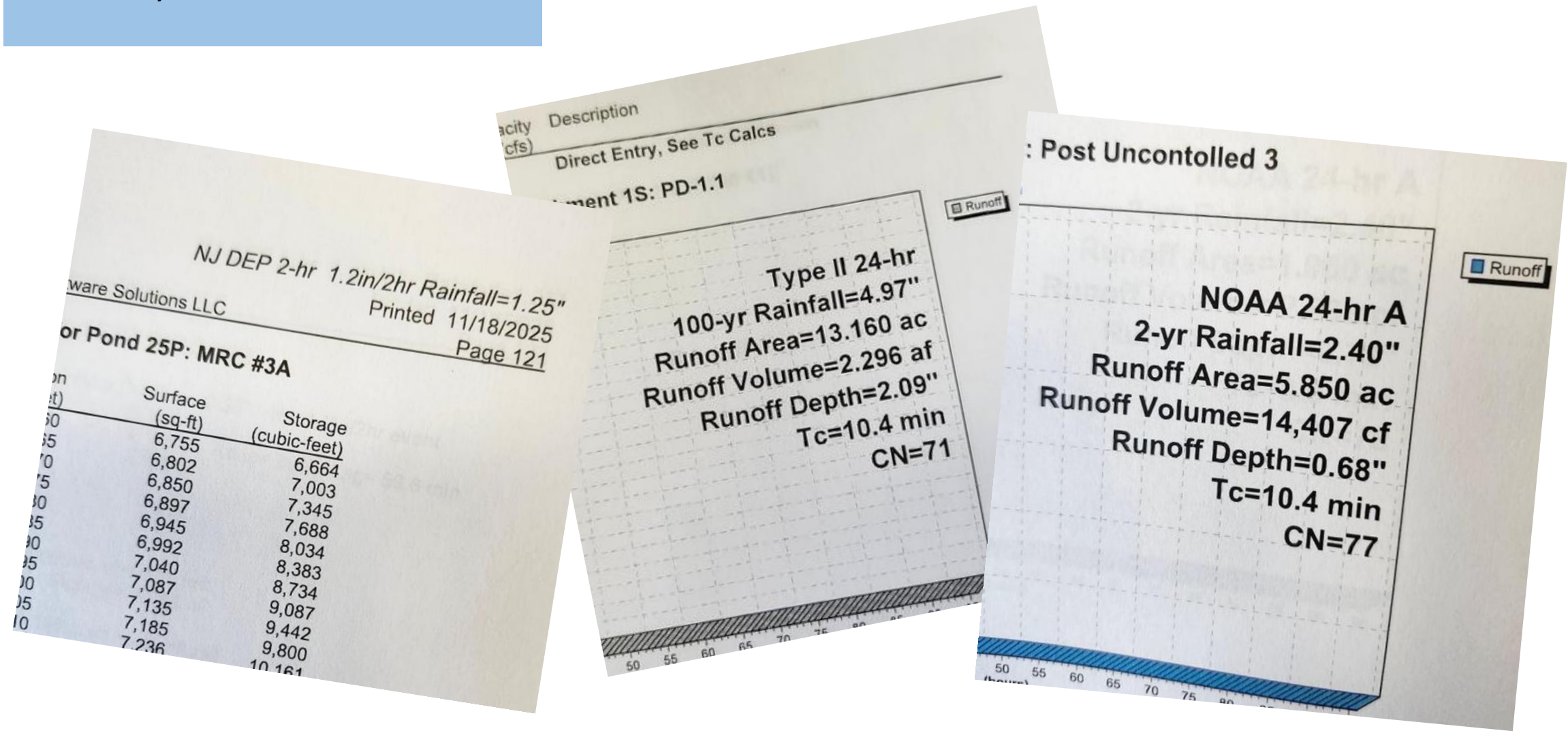
USDA NRCS

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

This Supplement to EFH-2 concerns use of rainfall data developed by the National Oceanic and Atmospheric Administration Atlas 14 (NOAA 14) and rainfall distributions based on the NOAA 14 data. These rainfall data and rainfall distributions will replace rainfall data from Weather Bureau Technical Paper 40 (TP-40) and the standard NRCS rainfall distributions Type II and Type III.



Check your software!!



One example of SCS Type 2 vs. NOAA, peak flows for 2 and 10 year storms

Acres	SCS Type II	NOAA
14	22.2	21.8
21	19.2	18.4
46	15.5	16.8

10 year storm

Acres	SCS Type II	NOAA
46	34.9	37.0

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Average? Geometric Mean?

- Certain regulations require you to provide an average of data
- Certain regs indicate you need to do the “geometric mean” of data
- One of these situations is with infiltration testing

Average vs. Geometric Mean

The average of these numbers is…

0.3 + 0.8 + 0.7 + 9.1 = 10.9

10.9 / 4 = **2.725**

The geometric mean of these numbers

0.3 x 0.8 x 0.7 x 9.1 = 1.5288

1.5288 ^ 0.25 = **1.112**

Which of these two mathematical processes gives a number more representative of what's happening on the site?

Infiltration tests…

- Note that an “outlier” data point shows that you ought to do more infiltration tests
- The previous slide’s data—0.3, 0.8, 0.7, 9.1 has an outlier
- The test was probably done in loose or fractured soil
- Does the outlier signify a problem with the site or with the testing?

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Weighted Curve Numbers

- If an area has a mix of impervious and pervious (for example, a housing plan) then it is possible to calculate a weighted Curve Number (CN) for the whole area
- DEP's guidance says that "a weighted CN is generally unacceptable for volume analysis due to the large error associated with averaging of initial abstractions for storms less than or equal to the 2-year/24 hour event. Curve numbers for impervious and non-compacted pervious areas must be separate for this analysis."

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DEP PCSM Spreadsheet
Version 2.1, January 2026

Volume Management

Project: Sample Site

Instructions | General | *Volume* | Rate | Quality

CLEAR FORM

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **2.37** inches

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

Alternative Source:

Pre-Construction Conditions: *No. Rows:* **1**

☐ *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)
Meadow	11.06	D	78	0.564	0.70	28,301
TOTAL (ACRES):	**11.06**				**TOTAL (CF):**	**28,301**

Post-Construction Conditions: *No. Rows:* **3**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
DP-001	3.85	D	83	0.500	0.80	11,183
DA-1 Undetained	7.10	D	83	0.410	0.96	24,709
DA-2 Undetained	0.11	D	80	0.564	0.70	281
TOTAL (ACRES):	**11.06**				**TOTAL (CF):**	**36,173**

NET CHANGE IN VOLUME TO MANAGE (CF): **7,872**

Weighted CN

7,872 c.f.

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DEP PCSM Spreadsheet
Version 2.1, January 2026

Volume Management

Project: Sample Site

Instructions | General | *Volume* | Rate | Quality

CLEAR FORM

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **2.37** inches

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

Alternative Source:

Pre-Construction Conditions: *No. Rows:* 1 ☐ *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)
Pervious as Meadow	11.06	D	78	0.564	0.70	28,301
TOTAL (ACRES):	**11.06**				**TOTAL (CF):**	**28,301**

Post-Construction Conditions: *No. Rows:* 5

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%)	3.25	D	80	0.500	0.80	9,440
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.60	D	98	0.041	2.14	4,664
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	5.75	D	80	0.500	0.80	16,702
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	1.35	D	98	0.041	2.14	10,495
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.11	D	80	0.500	0.80	320
TOTAL (ACRES):	**11.06**				**TOTAL (CF):**	**41,621**

NET CHANGE IN VOLUME TO MANAGE (CF): **13,320**

Separate CN's

13,320 c.f.

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Turnpike forebay at Sideling Hill service plaza.

Note pavers, plantings, soil mix.

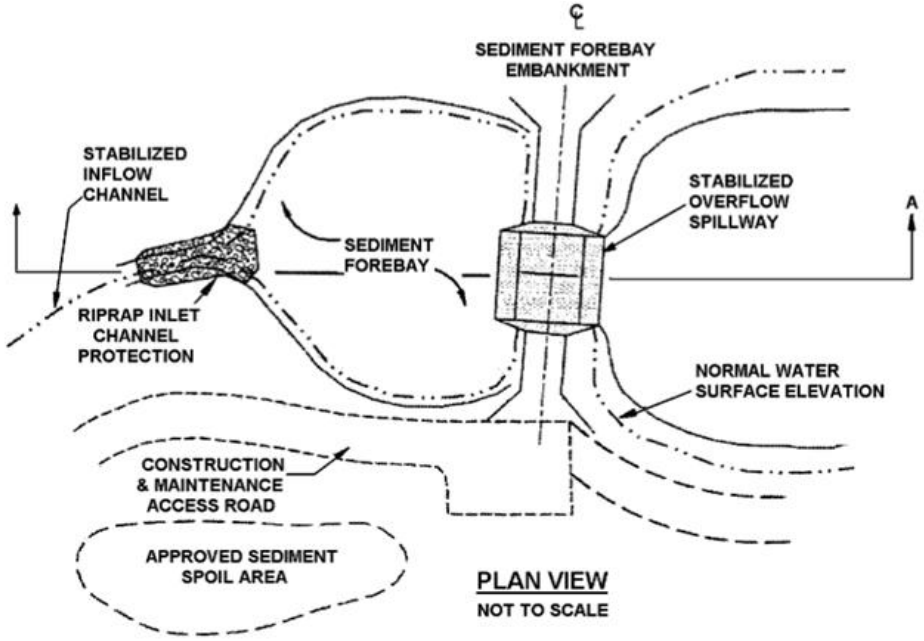
Forebays reduce flow velocity, allowing sediment and debris to settle.

- Forebays should be located at “major inflow” locations to an SCM
- Major inflows are those receiving flow from more than ¼ acre of impervious surface, or more than 1.5 acres of pervious surface

- Forebay volume for general detention basins: 10 to 15% of the volume of the 2year, 24 hour storm
- Forebay volume for infiltration SCMs: 15% of the managed volume for a drainage area < 20,000 s.f. and 25% of the managed volume for a drainage area > 20,000 s.f.

See PA DEP DRAFT SWM Manual, Appendix J

Forebays help prolong the life of a stormwater control measure



- Length to width ratio of a forebay– 2:1 or greater
- Keep flow velocity in a forebay under 2 feet per second
- Forebays should dewater in less than 72 hours

Use of a Forebay as MRC pre-treatment

- If the maximum flow routed to the MRC SCM is < 2 year, 24 hours, a forebay is not needed but can be used.
- If the maximum flow routed to the MRC SCM is > 2 year, 24 hours, a forebay is required.
- The volume standard for an MRC forebay is 0.25 inches of runoff per equivalent impervious acre.
- Depth of the MRC forebay should be at least 1.5 feet to allow for sediment to settle

PennDOT forebay along I-70

Forebays must be maintained!

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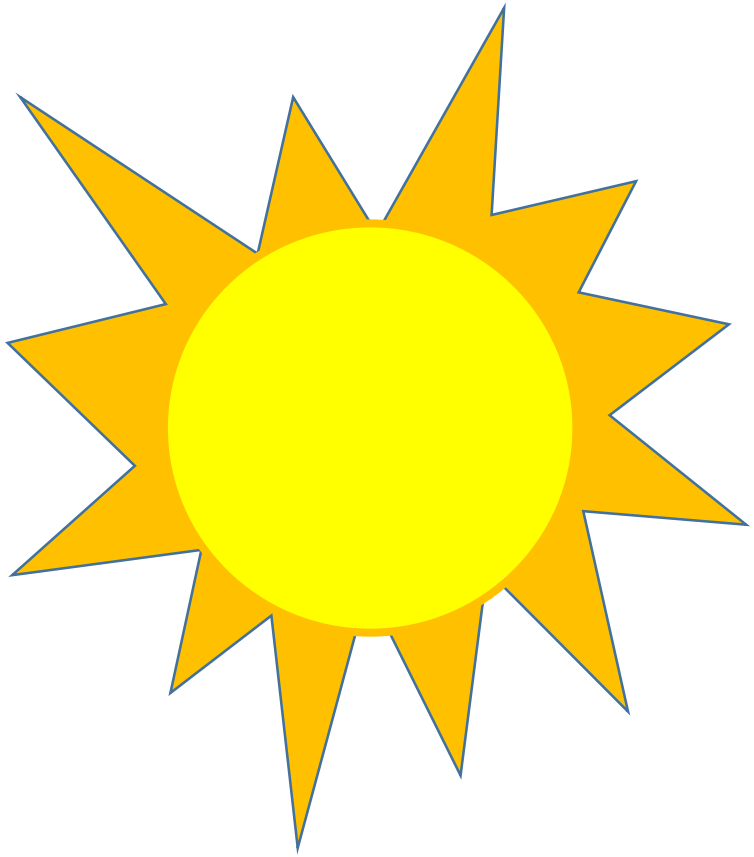
Solar panel farms



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Bureau of Clean Water

Chapter 102 Permitting for Solar Panel Projects

Frequently Asked Questions (FAQ)
Revised, February 19, 2026
Version 1.3

Background

Responsible development of solar photovoltaic installations (solar panel projects) involves balancing the growth of this industry in Pennsylvania with the need to protect natural resources and manage stormwater runoff. This FAQ document was developed to clarify the Department of Environmental Protection's (DEP's) interpretations concerning applicability and implementation of National Pollutant Discharge Elimination System (NPDES) permits for stormwater discharges associated with construction activities, including erosion and sediment control (E&S) and post-construction stormwater management (PCSM), for solar panel projects. This document provides recommended guidance for ground level solar projects with at least one (1) acre of earth disturbance. References to additional guidance are found in Attachment A.

Nothing in this document affects regulatory requirements. The interpretations herein are not an adjudication or a regulation. There is no intent on the part of DEP to give the interpretations in this document that weight or deference. This document provides a framework within which DEP and delegated county conservation districts (CCDs) will exercise administrative discretion in the future. DEP reserves the discretion to deviate from the interpretations in this document if circumstances warrant.

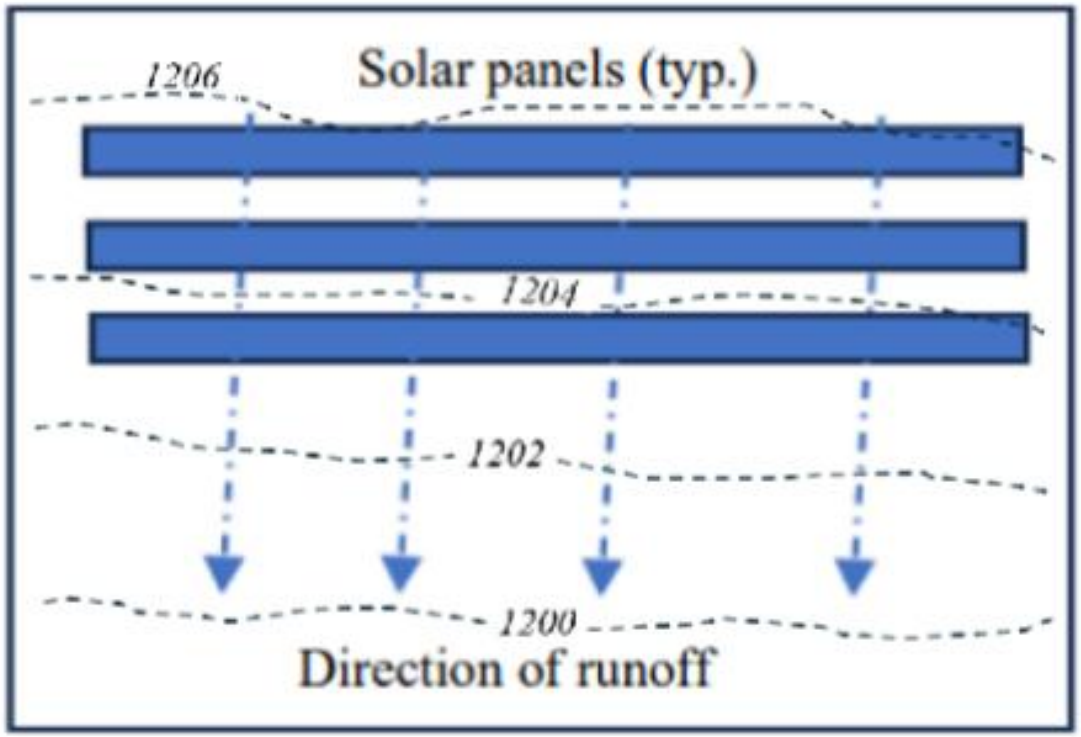
For additional information on solar energy, visit DEP's Solar Energy Resource Hub.

Earth Disturbance during Solar Panel installation

- Access roads
- Laydown areas
- Cut and fill in cases where the slope is steep
- Removal of trees & vegetation
- Connection to Utility
- Stormwater SCMs

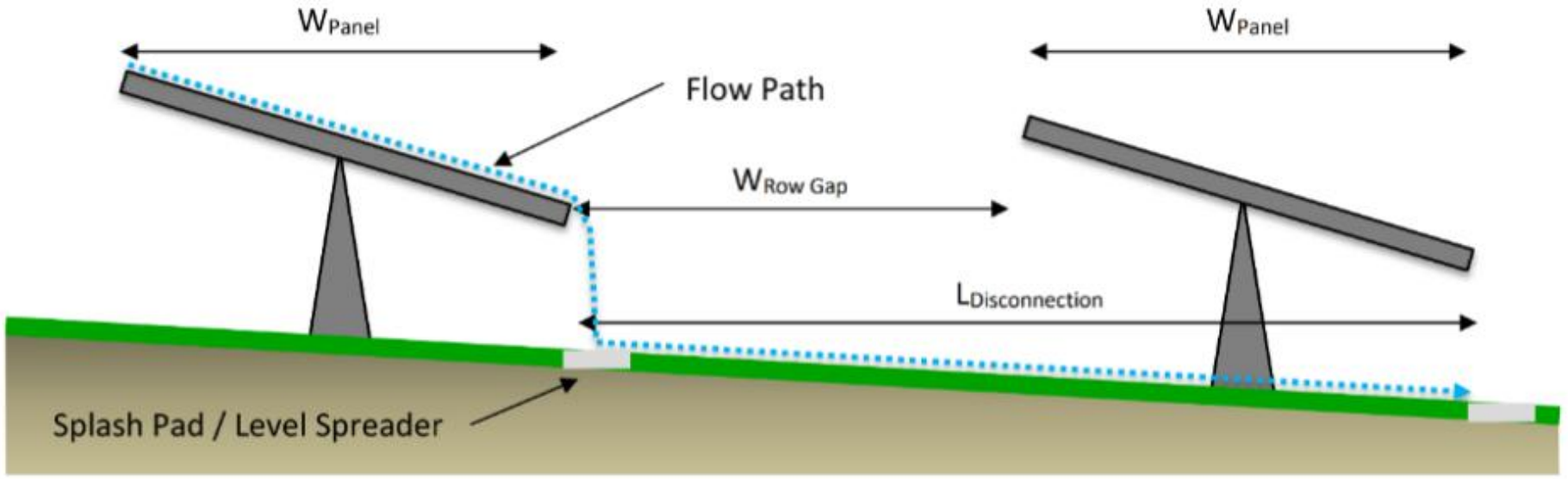
Stormwater management and solar panel farms: general

- Minimize earth disturbance
- Drip edge vegetation below the panels
- Panels follow the contours of the land
- Good vegetation established
- Utility connections



Goal: The gap between rows of panels should be equal to or greater than the width of the panels themselves

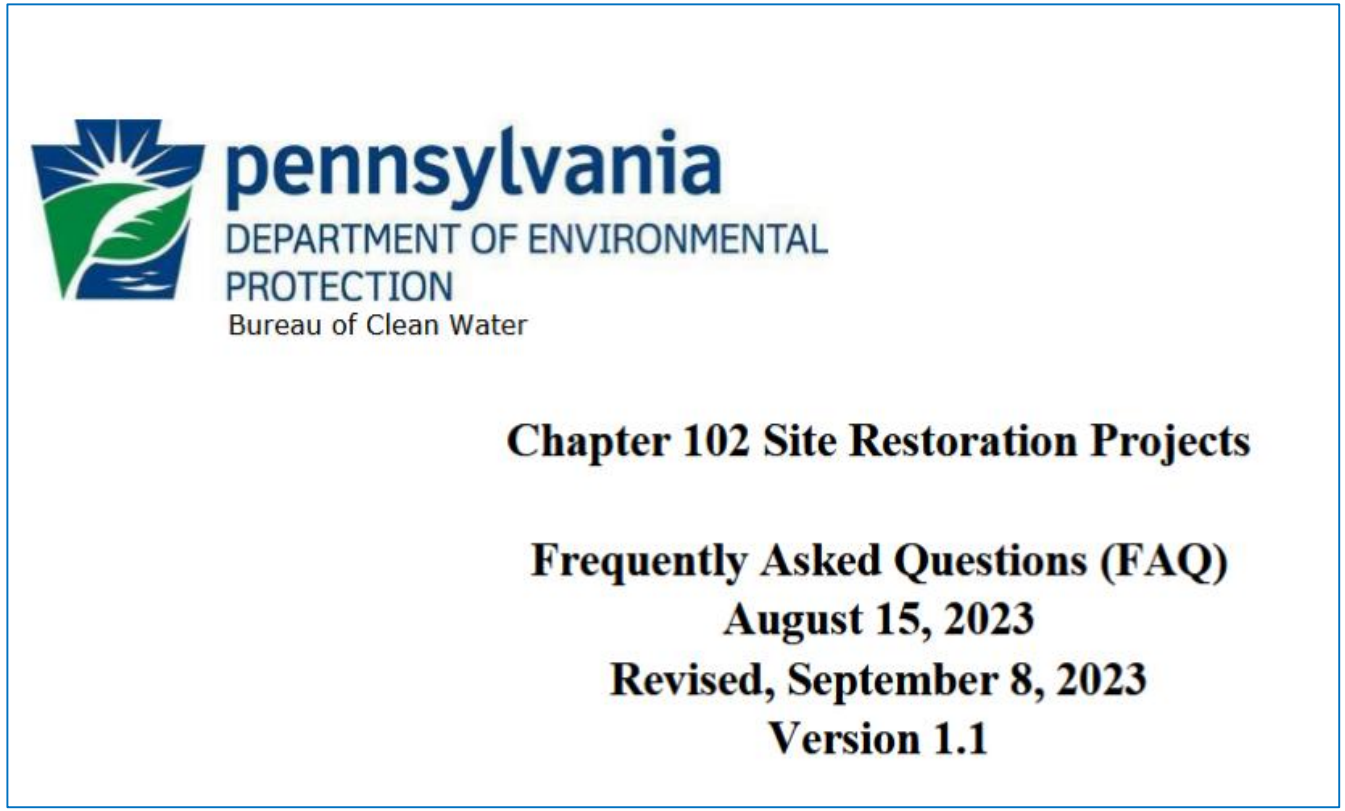
Figure 4.B: Schematic Profile of Solar Panel Array Providing Impervious Area Disconnection



Source: Ohio EPA, April 2022

Solar Panel farm: is it *Site Restoration*?

- Protect water bodies
- Panels on the contour
- 90% perennial vegetative cover beneath
- Distance between panels
- Ground slope < 10%
- Protect soil from compaction



If your solar panel project is **not** Site Restoration

- Certain portions of a site may qualify while others do not
- Panels are not located on the contour
- Ground slope is > 10%

Penn State

If your solar panel farm, or a portion of it, does not meet Site Restoration criteria in the FAQ, then you should use the University of Minnesota's PV-SMaRT tool to calculate a Curve Number for the site

Figure 5.B: PV-SMaRT Tool

Soil Texture	Silt Loam
Soil Depth (inches)	20
Bulk Density (g/cm^3)	1.3
Vegetation Present	Turf Grass
Are Solar Panels Present?	YES
Panel Width (feet)	15
Panel Spacing (feet)	15
Array Orientation	Combination
Percent Slope	10

BLUE CELLS REQUIRE USER INPUT

MAROON CELLS REPRESENT TOOL OUTPUTS

Runoff Curve Number	91.8
24-Hr Precip Event (inches)	3.24
Expected Runoff (inches)	2.37

Use the results from the PV-SMaRT tool in the PCSM spreadsheet

Pre-Construction Conditions: *No. Rows:* 1 ☐ *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)
Row Crop (Contoured, Good Management)	5.95	N/A	76		1.04	22,462
TOTAL (ACRES):	**5.95**				**TOTAL (CF):**	**22,462**

Post-Construction Conditions: *No. Rows:* 1

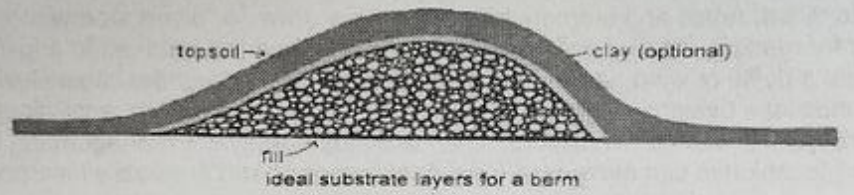
Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Solar Panels with Newly Established Pollinator	5.95	N/A	83		1.45	31,318
TOTAL (ACRES):	**5.95**				**TOTAL (CF):**	**31,318**

NET CHANGE IN VOLUME TO MANAGE (CF): **8,856**

Use BMP 6.4.10, Infiltration Berm and Retentive Grading

DEP recommends this stormwater control measure for solar panel farms.

BMP 6.4.10: Infiltration Berm & Retentive Grading



ideal substrate layers for a berm

An Infiltration Berm is a mound of compacted earth with sloping sides that is usually located along a contour on relatively gently sloping sites. Berms can also be created through excavation/removal of upslope material, effectively creating a Berm with the original grade. Berms may serve various stormwater drainage functions including: creating a barrier to flow, retaining flow and allowing infiltration for volume control, and directing flows. Grading may be designed in some cases to prevent rather than promote stormwater flows, through creation of "saucers" or "lips" in site yard areas where temporary retention of stormwater does not interfere with use.

Key Design Elements

- Maintain a minimum 2-foot separation to bedrock and seasonally high water table, provide distributed infiltration area (5:1 impervious area to infiltration area - maximum), site on natural, uncompacted soils with acceptable infiltration capacity, and follow other guidelines described in Protocol 2: Infiltration Systems Guidelines
- Berms should be relatively low, preferably no more than 24

Potential Applications

Residential: Yes
Commercial: Yes
Ultra Urban: Limited
Industrial: Yes
Retrofit: Yes
Highway/Road: Yes

Stormwater Functions

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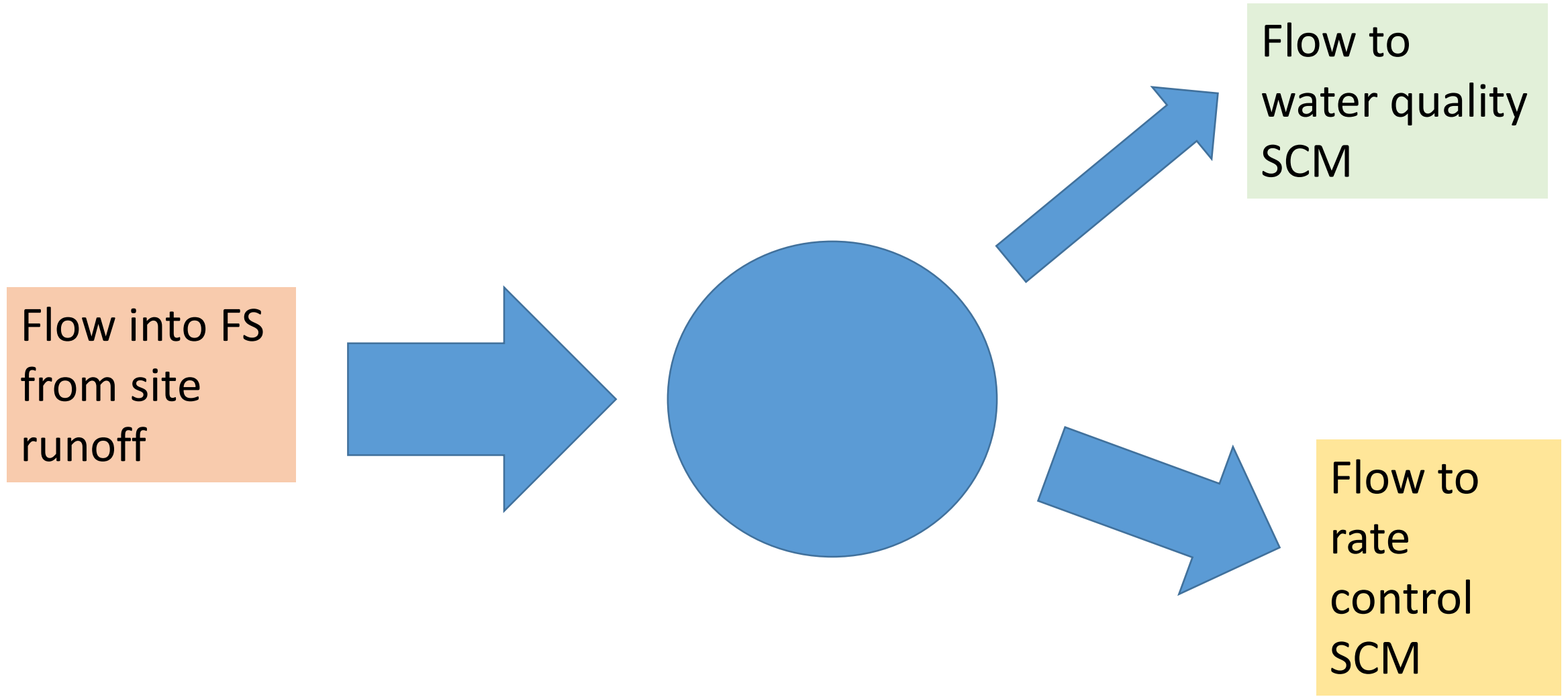
Flow Splitters

- Used to prevent overloading of an infiltration SCM or an MRC SCM
- Generally, route flow less than or equal to the 2 year 24 hour storm to the water quality SCM
- Higher flows directed to the rate control SCM
- Be aware of depths, backwater, tributary areas
- Be aware of debris

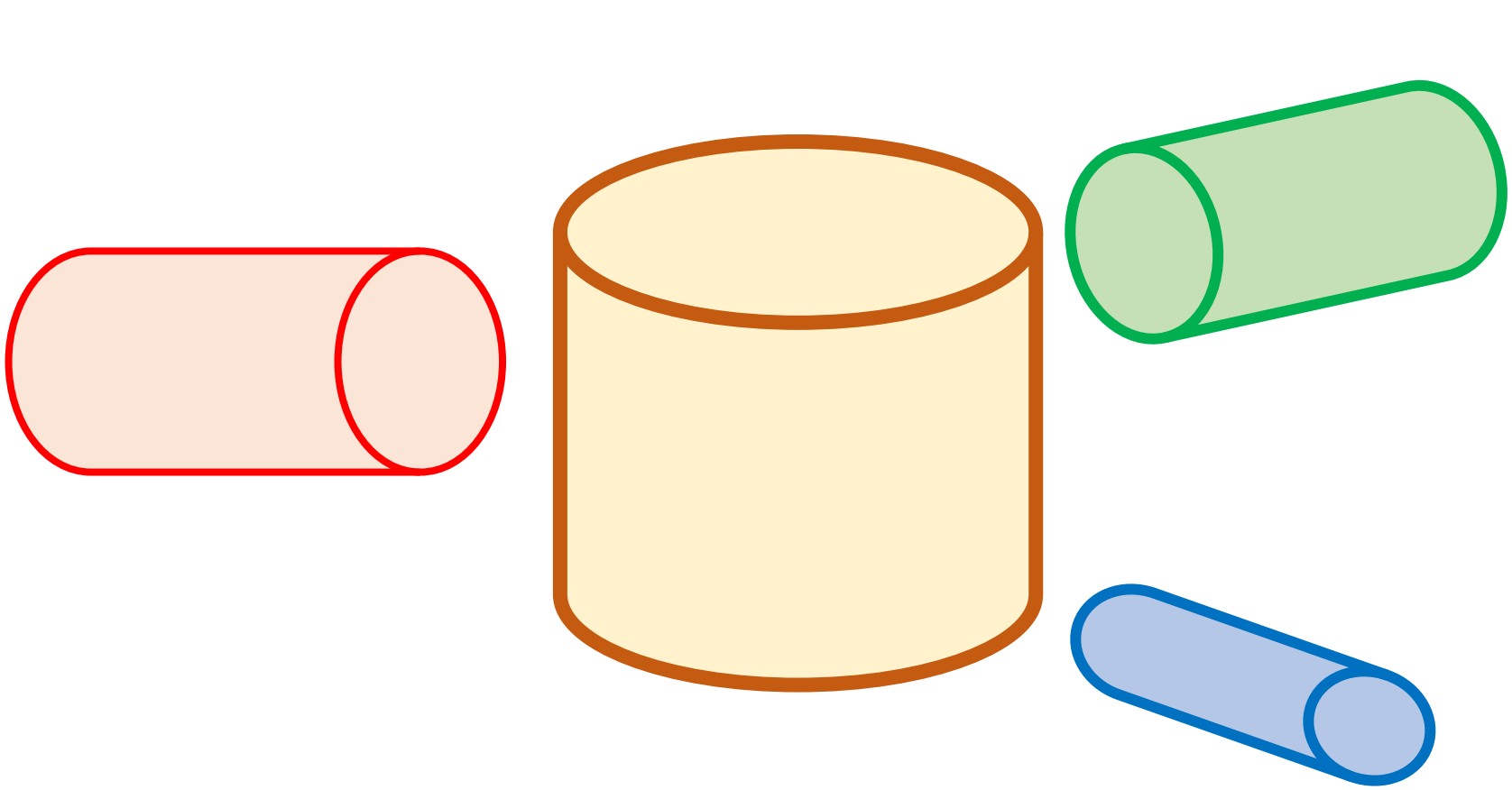
Flow Splitter

Flow splitter schematic

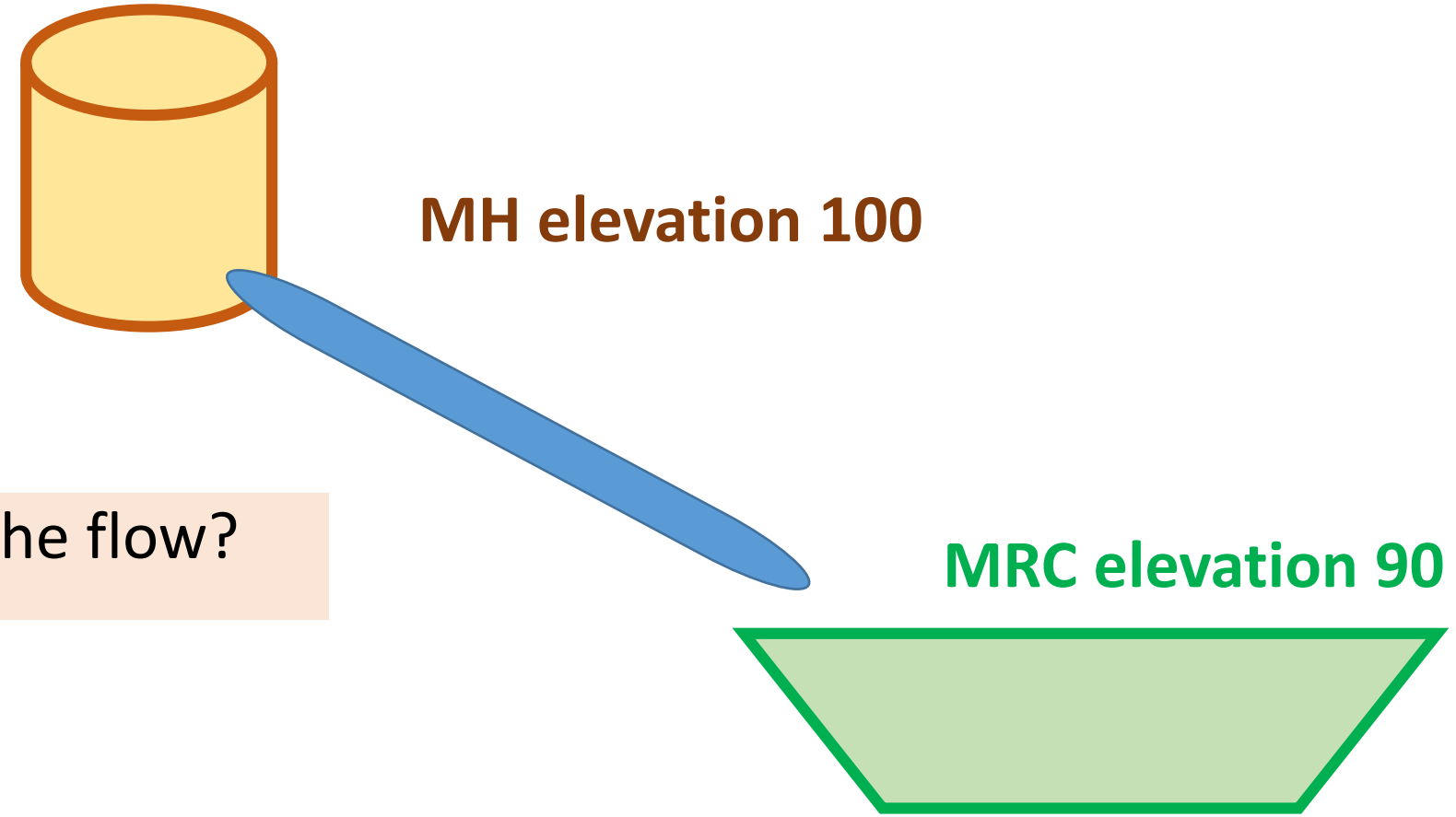


How to control flow: Pipes come in, Pipes go out

Using elevation and pipe size to control flow:



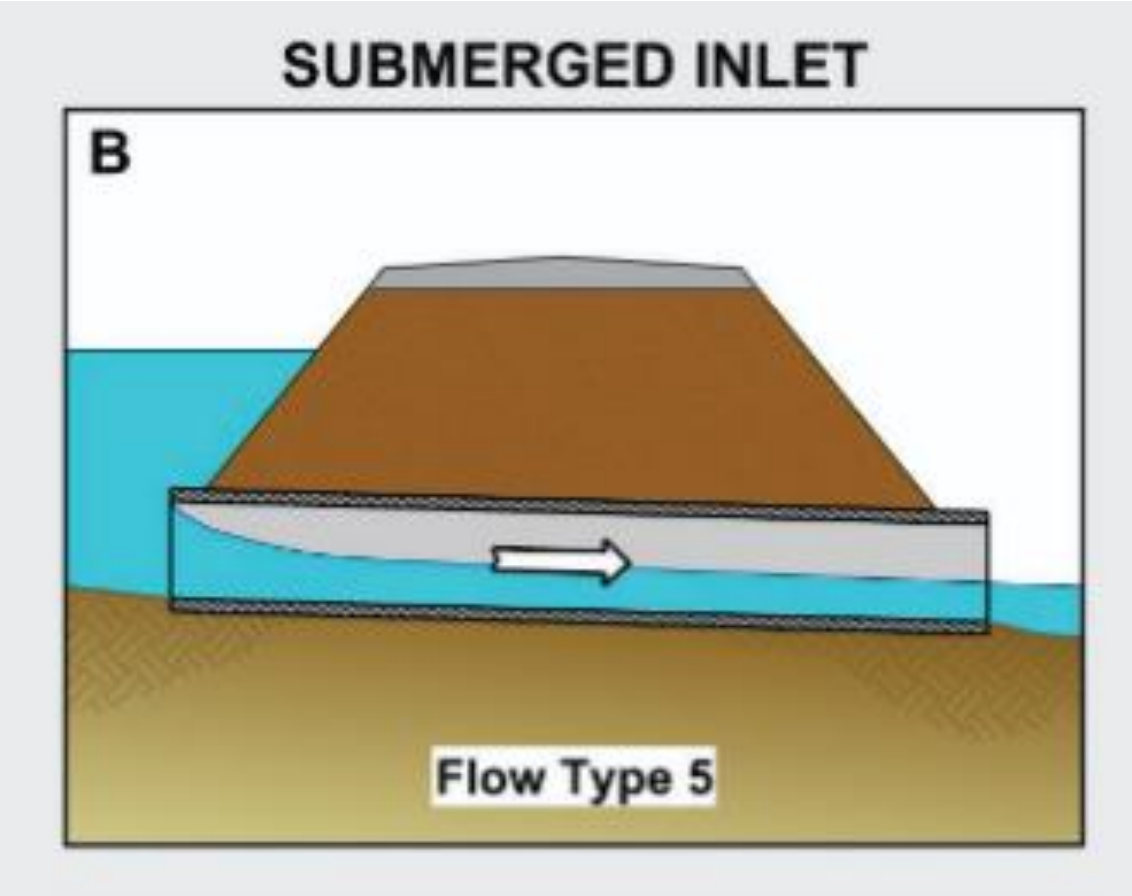
The problem with relying on pipe size alone:



How can you shut off the flow?

Orifice equation shows how much water enters the pipe

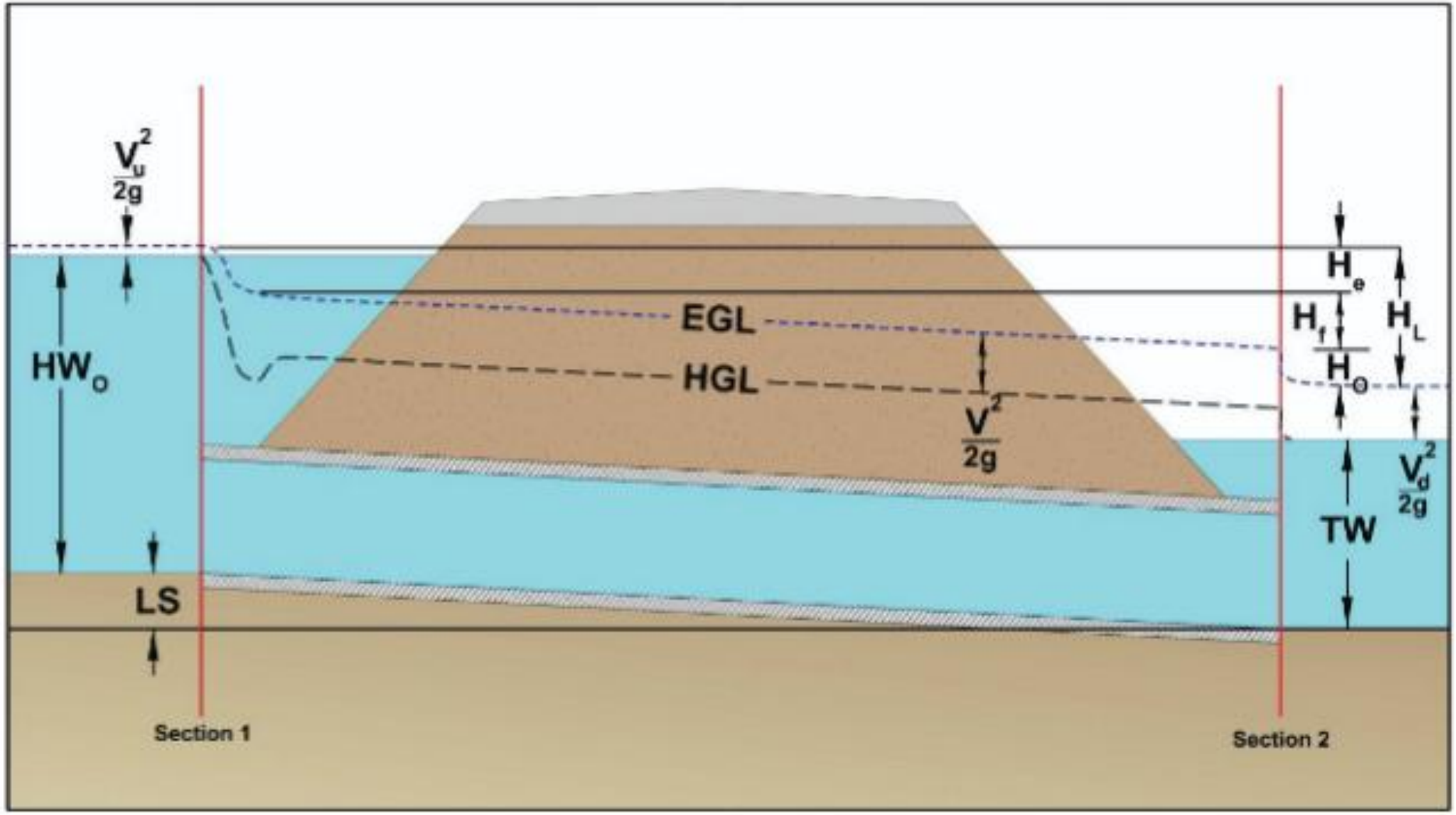
$$Q = C_d A \sqrt{2gh}$$



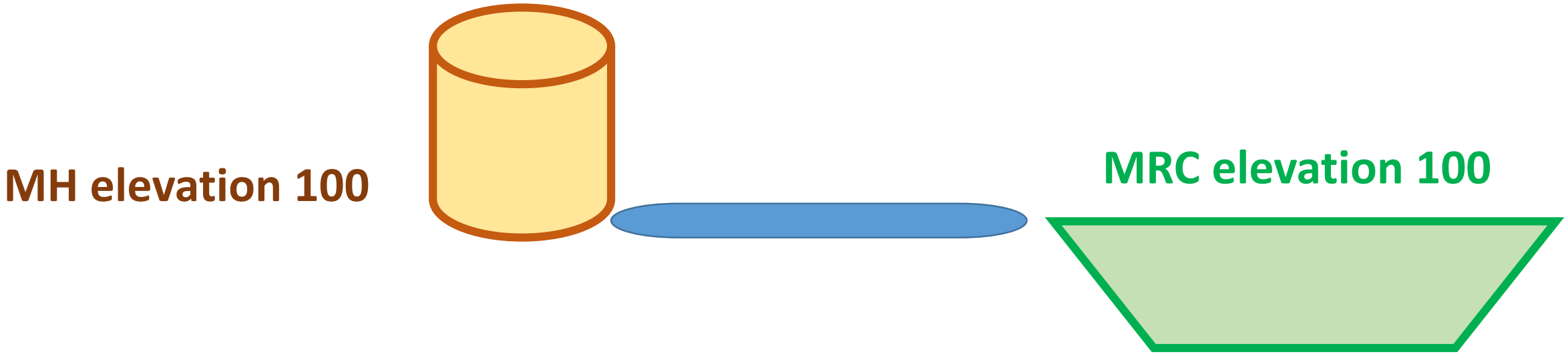
As depth (h) increases, flow (Q) increases—there's no way to stop it

Federal Highway Administration, Hydraulic Design of Highway Culverts

You can “shut the flow off” if the tailwater rises to meet the headwater

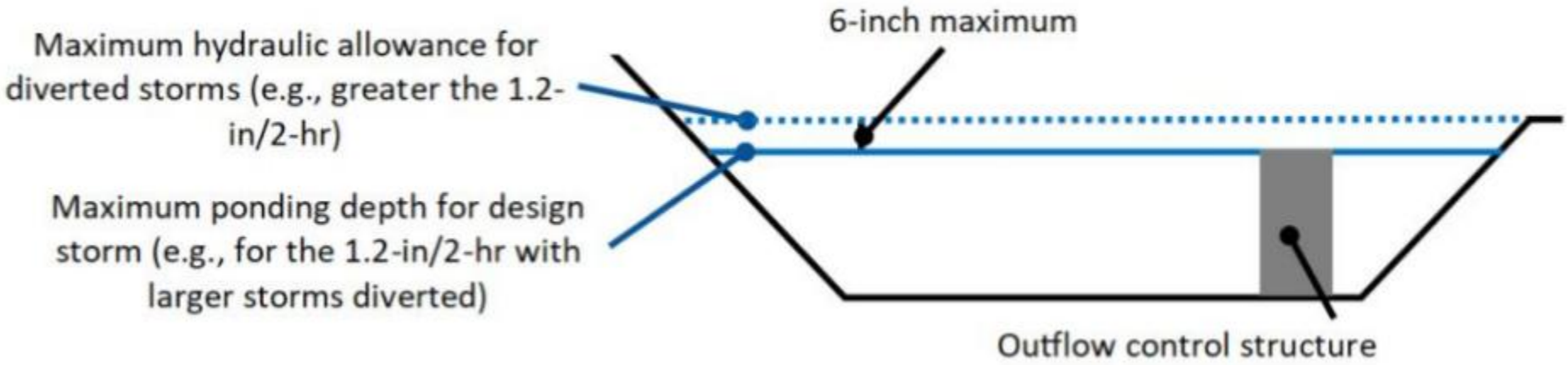


Tailwater: the only practical way to shut off the flow.



Your hydraulics and hydrology computer program ought to be able to model the manhole and the MRC device

PA DEP guidance allows a six inch variance in the depth of water in an MRC, for the purposes of diverting flows from larger storms.



See PA DEP MRC
FAQ # 41

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Notice to new property owners

As the engineer, you may be involved in filling out this form or providing info to property purchasers

3800-FM-BCW0271i Rev. 4/2025
Notification Form

Pennsylvania Department of Environmental Protection

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NOTICE TO NEW PROPERTY OWNERS OF PCSM SCMs AND O&M REQUIREMENTS "NEW PROPERTY OWNER NOTIFICATION FORM"

The property that you are purchasing or that you own contains one or more post-construction stormwater management (PCSM) stormwater control measures (SCMs) that require long-term operation and maintenance (O&M) to continue performing their intended functions. The long-term O&M requirements have been recorded as part of a covenant that affects this property. You have the right to enter into an agreement with a third party to perform long-term O&M. Note – Completion of long-term O&M may be enforced by your municipality under the terms of local ordinances.

PROJECT SITE INFORMATION

Project Site Name: _____ Permit No.: _____

Permittee Name: _____ Date of Sale: _____

Will the sale of property also include a transfer of the Chapter 102 permit? ☐ Yes ☐ No

PROPERTY CONTAINING PCSM SCM(s)

Municipality: _____ County: _____

Plot Book Volume: _____ Page: _____

Tax Parcel # / UPI: _____ Owner: _____

Address: _____ Phone: _____

City, State, ZIP: _____ Email: _____

PCSM SCM INFORMATION

Name / Description of SCM: _____

Location of SCM on Property: _____

Describe Access to SCM: _____

Impervious Area Treated: _____ acre(s) _____ square feet

☐ The PCSM SCM has been identified in a legal instrument that has been recorded with the County Recorder of Deeds.

Notification to Municipalities concerning discharges to MS4 and combined sewer

3800-FM-BCW0271f Rev. 3/2024
MS4/CSS Notification Form

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NOTIFICATION OF PROPOSED STORMWATER DISCHARGES TO MS4s AND CSSs FOR CHAPTER 102 PERMITS

GENERAL INFORMATION (COMPLETED BY APPLICANT)

Applicant Name: _____ Contact Name: _____

Applicant Address: _____ Contact Phone: _____

Applicant City, State, ZIP: _____ County: _____

Project Site Name: Municipality:

SEWER SYSTEM AND DISCHARGE INFORMATION (COMPLETED BY APPLICANT)

Stormwater will be discharged to a(n): ☐ MS4 ☐ CSS ☐ During Construction ☐ After Construction

Name of MS4 or CSS Owner: _____ Discharge Point ID: _____

Proposed Change(s) in Stormwater Runoff ***Peak Discharge Rate*** (cfs): ☐ No Change

☐ Increase @ ☐ 2-yr _____ ☐ 10-yr _____ ☐ 50-yr _____ ☐ 100-yr _____

☐ Decrease @ ☐ 2-yr _____ ☐ 10-yr _____ ☐ 50-yr _____ ☐ 100-yr _____

Proposed Change in Stormwater Runoff ***Volume*** up to the 2-year/24-hour storm (CF): ☐ No Change

☐ Increase _____ ☐ Decrease _____

Proposed Change in Stormwater ***Quality (Pollutant Loads)*** up to the 2-year/24-hour storm (lbs): ☐ No Change

Construction certification

This is why you need to be present on site for the Critical Stages

3800-FM-BCW0271j Rev. 12/2025
SCM Certification Form

Pennsylvania Department of Environmental Protection

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

Chapter 102 SCM Construction Certification Form

General Project and SCM Information

Project Site Name:		Permit No.:	
Permittee Name:		Expiration Date:	
SCM Name:		SCM ID No.:	
Designer Name:		Municipality:	
Designer Firm:		County:	
Recording Date:		SCM Latitude:	
Drainage Area:	acres	SCM Longitude:	
Impervious Area:	acres	Date Complete:	

☐ New SCM ☐ Modified SCM Person(s) responsible for long-term O&M:

Report all inspections of the SCM and provide the information requested in the table below or as an attachment.

Inspection Date	Critical Stage(s)	Inspector Name	Inspector Firm

Construction Information

☐ Photographs of each critical stage with date/time stamps and appropriate captions are attached (**required**).

Explain any deviations made during construction in comparison to the approved PCSM Plan and if the deviations were approved by DEP/CCD.

Any Questions?

Westmoreland Conservation District