Draft PCSM Manual Overview

Monroe County Conservation District

Pike County Conservation District

- Manual Development and Approval
- PCSM Objectives
- SCM's (Stormwater Control Measures i.e., BMP's) for each objective
- Volume Analysis
- Water Quality Analysis
- Peak Rate Analysis
- Other Changes, requirements in Manual

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Manual Development

- Developed by Villanova University and NTM Engineering
- Published in PA Bulletin for Public Comment
- Public Comment period ended April 28, 2023
- Expecting thousands of comments
- Comment Response document to be developed
- Approval and Implementation ?

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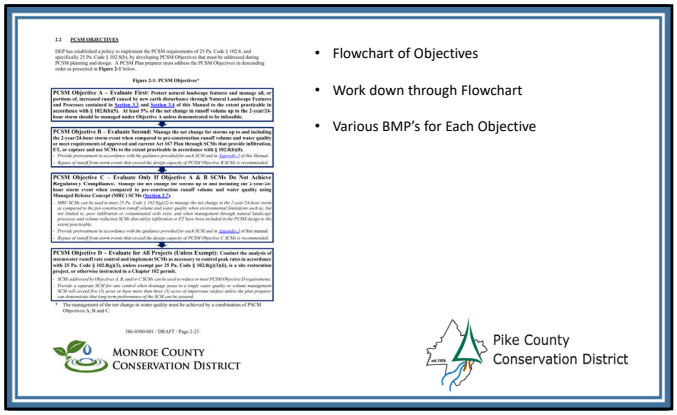

2.2 PCSM OBJECTIVES

DEP has established a policy to implement the PCSM requirements of 25 Pa. Code § 102.8, and specifically 25 Pa. Code § 102.8(b), by developing PCSM Objectives that must be addressed during PCSM planning and design. A PCSM Plan preparer must address the PCSM Objectives in descending order as presented in **Figure 2-1** below.

Figure 2-1: PCSM Objectives*

PCSM Objective A – Evaluate First: Protect natural landscape features and manage all, or portions of, increased runoff caused by new earth disturbance through Natural Landscape Features and Processes contained in Section 3.3 and Section 3.4 of this Manual to the extent practicable in accordance with § 102.8(b)(5). At least 5% of the net change in runoff volume up to the 2-year/24-hour storm should be managed under Objective A unless demonstrated to be infeasible.

PCSM Objective B – Evaluate Second: Manage the net change for storms up to and including the 2-year/24-hour storm event when compared to pre-construction runoff volume and water quality or meet requirements of approved and current Act 167 Plan through SCMs that provide infiltration, ICT, or capture and use SCMs to the extent practicable in accordance with § 102.8(b)(8).

- *Provide pretreatment in accordance with the guidance provided for each SCM and in Appendix J of this Manual.*
- *Bypass of runoff from storm events that exceed the design capacity of PCSM Objective B SCMs is recommended.*

PCSM Objective C – Evaluate Only If Objective A & B SCMs Do Not Achieve Regulatory Compliance. Manage the net change for storms up to and including the 2-year/24-hour storm event when compared to pre-construction runoff volume and water quality using Managed Release Concept (MRC) SCMs (Section 3.7).

- *MRC SCMs can be used to meet 25 Pa. Code § 102.8(g)(2) to manage the net change in the 2-year/24-hour storm as compared to the pre-construction runoff volume and water quality when environmental limitations such as, but not limited to, poor infiltration or contaminated soils exist, and when management through natural landscape features or infiltration/runoff reduction SCMs that utilize infiltration or ET have been included in the PCSM design to the extent practicable.*
- *Provide pretreatment in accordance with the guidance provided for each SCM and in Appendix J of this manual.*
- *Bypass of runoff from storm events that exceed the design capacity of PCSM Objective C SCMs is recommended.*

PCSM Objective D – Evaluate for All Projects (Unless Exempt): Conduct the analysis of stormwater runoff rate control and implement SCMs as necessary to control peak rates in accordance with 25 Pa. Code § 102.8(g)(3), unless exempt per 25 Pa. Code § 102.8(g)(3)(ii), is a site restoration project, or otherwise instructed in a Chapter 102 permit.

- *SCMs addressed by Objectives A, B, and/or C SCMs can be used to reduce or meet PCSM Objective D requirements.*
- *Provide a separate SCM for rate control when drainage areas to a single water quality or volume management SCM will exceed five (5) acres or have more than three (3) acres of impervious surface unless the plan preparer can demonstrate that long-term performance of the SCM can be retained.*

* The management of the net change in water quality must be achieved by a combination of PSCM Objectives A, B and C.

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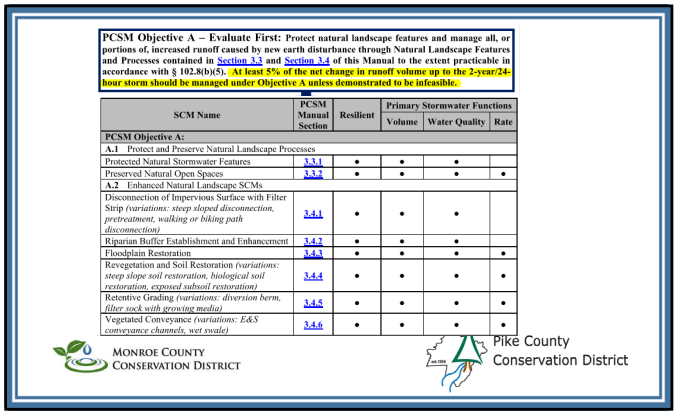
- Flowchart of Objectives
- Work down through Flowchart
- Various BMP's for Each Objective



PCSM Objective A – Evaluate First: Protect natural landscape features and manage all, or portions of, increased runoff caused by new earth disturbance through Natural Landscape Features and Processes contained in Section 3.3 and Section 3.4 of this Manual to the extent practicable in accordance with § 102.8(b)(5). At least 5% of the net change in runoff volume up to the 2-year/24-hour storm should be managed under Objective A unless demonstrated to be infeasible.

SCM Name	PCSM Manual Section	Resilient	Primary Stormwater Functions		
			Volume	Water Quality	Rate
PCSM Objective A:					
A.1 Protect and Preserve Natural Landscape Processes					
Protected Natural Stormwater Features	3.3.1	•	•	•	
Preserved Natural Open Spaces	3.3.2	•	•	•	•
A.2 Enhanced Natural Landscape SCMs					
Disconnection of Impervious Surface with Filter Strip *(variations: steep sloped disconnection, pretreatment, walking or biking path disconnection)*	3.4.1	•	•	•	
Riparian Buffer Establishment and Enhancement	3.4.2	•	•	•	
Floodplain Restoration	3.4.3	•	•	•	•
Revegetation and Soil Restoration *(variations: steep slope soil restoration, biological soil restoration, exposed subsoil restoration)*	3.4.4	•	•	•	•
Retentive Grading *(variations: diversion berm, filter sock with growing media)*	3.4.5	•	•	•	•
Vegetated Conveyance *(variations: E&S conveyance channels, wet swale)*	3.4.6	•	•	•	•

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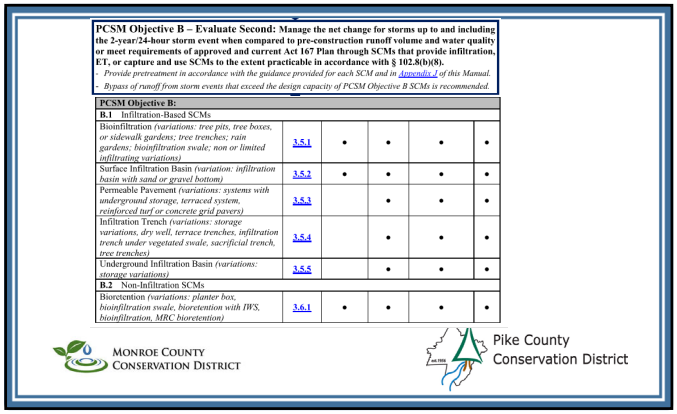

PCSM Objective B – Evaluate Second: Manage the net change for storms up to and including the 2-year/24-hour storm event when compared to pre-construction runoff volume and water quality or meet requirements of approved and current Act 167 Plan through SCMs that provide infiltration, ICT, or capture and use SCMs to the extent practicable in accordance with § 102.8(b)(8).

- *Provide pretreatment in accordance with the guidance provided for each SCM and in Appendix J of this Manual.*
- *Bypass of runoff from storm events that exceed the design capacity of PCSM Objective B SCMs is recommended.*

PCSM Objective B:					
B.1 Infiltration-Based SCMs					
Bioinfiltration *(variations: tree pits, tree boxes, or sidewalk gardens; tree trenches; rain gardens; bioinfiltration swale; non or limited infiltrating variations)*	3.5.1	•	•	•	•
Surface Infiltration Basin *(variation: infiltration basin with sand or gravel bottom)*	3.5.2	•	•	•	•
Permeable Pavement *(variations: systems with underground storage, terraced system, reinforced turf or concrete grid pavers)*	3.5.3		•	•	•
Infiltration Trench *(variations: storage variations, dry well, terrace trenches, infiltration trench under vegetated swale, sacrificial trench, tree trenches)*	3.5.4		•	•	•
Underground Infiltration Basin *(variations: storage variations)*	3.5.5		•	•	•
B.2 Non-Infiltration SCMs					
Bioretention *(variations: planter box, bioinfiltration swale, bioretention with IWS, bioinfiltration, MRC bioretention)*	3.6.1	•	•	•	•

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PCSM Objective B – Evaluate Second: Manage the net change for storms up to and including the 2-year/24-hour storm event when compared to pre-construction runoff volume and water quality or meet requirements of approved and current Act 167 Plan through SCMs that provide infiltration, ET, or capture and use SCMs to the extent practicable in accordance with § 102.8(b)(8).

- *Provide pretreatment in accordance with the guidance provided for each SCM and in Appendix J of this Manual.*
- *Bypass of runoff from storm events that exceed the design capacity of PCSM Objective B SCMs is recommended.*

Green Roof *(variations: dual media assembly, dual media assembly with synthetic retention layer, modular tray systems)*	3.6.2		•		
Regenerative Step Pool Systems *(variations: wetland seepage system, constructed riffle)*	3.6.3			•	
Stormwater Capture and Use *(variations: active/adaptive systems, downspout planter box, rain barrels)*	3.6.4		•		
Blue Roof *(variations: combination green and blue roofs, check dams, active/adaptive systems)*	3.6.5	•	•		•
Engineered Stormwater Treatment Wetland *(variations: shallow emergent wetlands, phytoremediation wetlands, subsurface flow wetlands, active/adaptive systems)*	3.6.6	•	•	•	•
Water Quality Filtration and Treatment *(including sand and media filters, manufactured treatment devices, and street sweeping)*	3.6.7				

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PCSM Objective C – Evaluate Only If Objective A & B SCMs Do Not Achieve Regulatory Compliance: Manage the net change for storms up to and including the 2-year/24-hour storm event when compared to pre-construction runoff volume and water quality using Managed Release Concept (MRC) SCMs (Section 3.7).

- *MRC SCMs can be used to meet 25 Pa. Code § 102.8(g)(2) to manage the net change in the 2-year/24-hour storm as compared to the pre-construction runoff volume and water quality when environmental limitations such as, but not limited to, poor infiltration or contaminated soils exist, and when management through natural landscape processes and volume reduction SCMs that utilize infiltration or ET have been included in the PCSM design to the extent practicable.*
- *Provide pretreatment in accordance with the guidance provided for each SCM and in Appendix J of this manual.*
- *Bypass of runoff from storm events that exceed the design capacity of PCSM Objective C SCMs is recommended.*

PCSM Objective C:					
MRC Bioretention *(variations: MRC bioswale)*	3.7.1	•	•	•	•
MRC Storage Systems *(variations: storage component variations: pipe, manufactured storage, tank/cistern and chamber; permeable pavement with IWS; vegetation component variations: manufactured treatment device, downstream vegetated component)*	3.7.2	•		•	•
MRC for Use in Karst Geography (MRC Karst)	3.7.3	•		•	•

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PCSM Objective D – Evaluate for All Projects (Unless Exempt): Conduct the analysis of stormwater runoff rate control and implement SCMs as necessary to control peak rates in accordance with 25 Pa. Code § 102.8(g)(3), unless exempt per 25 Pa. Code § 102.8(g)(3)(ii), is a site restoration project, or otherwise instructed in a Chapter 102 permit.

- *SCMs addressed by Objectives A, B, and/or C SCMs can be used to reduce or meet PCSM Objective D requirements.*
- *Provide a separate SCM for rate control when drainage areas to a single water quality or volume management SCM will exceed five (5) acres or have more than three (3) acres of impervious surface unless the plan preparer can demonstrate that long-term performance of the SCM can be assured.*

PCSM Objective D:					
Wet Basin *(variations; wet basin retrofit, active/adaptive systems)*	3.8.1	•	•		•
Naturalized Detention Basin *(variations: naturalized basin retrofit, naturalized basin with micro-pool, sand filter naturalized basin detention basin, detention basin, active/adaptive systems)*	3.8.2				•
Underground Detention *(variations: storage variations, active/adaptive systems)*	3.8.3				•

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Volume Management Analysis

- Design Storm Approach
- Continuous Simulation Approach
- Water Balance Approach (Certain SCM's)

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Design Storm Approach

- NOAA Data
- *Upper 90% Confidence Interval* for 2 year 24 hour
  - (higher value in parenthesis)
- Less complex projects
- PCSM Spreadsheet Process
- Post Volume<= Pre Volume

PDS-based point precipitation frequency es

Duration	Average			
	1	2	4	10
5-min	0.329 (0.294-0.367)	0.394 (0.353-0.441)	0.470 (0.425-0.532)	0.542 (0.483-0.650)
10-min	0.515 (0.461-0.573)	0.619 (0.555-0.692)	0.745 (0.664-0.832)	0.865 (0.753-0.944)
15-min	0.634 (0.568-0.706)	0.763 (0.683-0.853)	0.921 (0.822-1.03)	1.06 (0.932-1.17)
30-min	0.947 (0.758-0.945)	1.03 (0.823-1.15)	1.27 (1.14-1.42)	1.47 (1.31-1.64)
60-min	1.04 (0.931-1.16)	1.27 (1.14-1.42)	1.61 (1.44-1.80)	1.88 (1.69-2.10)
2-hr	1.26 (1.13-1.40)	1.53 (1.38-1.71)	1.94 (1.74-2.17)	2.27 (2.04-2.54)
3-hr	1.40 (1.27-1.56)	1.70 (1.53-1.89)	2.12 (1.91-2.35)	2.48 (2.22-2.75)
6-hr	1.69 (1.53-2.01)	2.15 (1.96-2.41)	2.66 (2.40-2.96)	3.10 (2.79-3.46)
12-hr	2.24 (2.02-2.52)	2.71 (2.44-3.04)	3.34 (3.01-3.76)	3.92 (3.54-4.39)
24-hr	2.67 (2.46-2.96)	3.39 (2.90-3.58)	3.98 (3.65-4.39)	4.67 (4.28-5.15)

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Capture and Re-Use

Design Storm Hydrologic Analysis Methodology for Stormwater Capture and Use SCMs and for SCMs in combination with Stormwater Capture and Use SCMs – While a water balance approach is strongly recommended for Stormwater Capture and Use SCMs, experience has shown that a tank designed to capture the 1.2-inch rainfall event with an additional storage volume provided that is equivalent to the NOAA 90% Upper Confidence Interval 1-year/10-minute rainfall event can meet regulatory requirements for managing the net change in runoff volume. The system should be designed to make storage available for the 1-year/10-minute storage volume within 3 days of any rainfall event, and on average be designed to use or release at less than 0.05 cubic feet per second (cfs) runoff per acre from the 1.2-inch/2-hour rainfall event within one month. The peak rate from the post-construction 2-year/24-hour storm event should be managed back to the pre-construction 1-year/24-hour storm peak rate to achieve geomorphologic protection either as part of the Stormwater Capture and Use SCM or through another SCM.

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Continuous Simulation

- Continuous Record of Rainfall for recent 15 years
  - Closest Rain Gage or Same PennDOT Region
- Rank rainfall events low to high
- Median value or 50% exceedance value= 2 yr 24 hr storm
- Computer Models:
  - EPA SWMM, XP-SWMM,PCSWMM, Recarga

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Water Balance Approach

- Capture and Re-Use SCM's
- Continuous Record of Rainfall for recent 15 years
  - Closest Rain Gage or Same PennDOT Region
- 90% of all 1.2" rainfall events from all storms less than 24 hours are removed
- Post 2 year reduced to 1 year predevelopment
- Compute Models
  - SPAW, USGS Thornwaite and Mathers, EPA SWMM

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Water Quality Approach

- PCSM Spreadsheet
- TSS, TP, TN 2 year pollutant loads reduced to predevelopment pollutant loads
- MRC's, Stormwater Capture and Reuse, Engineered Treatment Wetlands
  - meet design requirements-meet water quality

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Peak Rate Approach

- Design Storm Approach
- Storm of Record Approach

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Design Storm Approach

- NOAA Data
- Use Mean Precipitation (bold) values

PDS-based point precipitation frequency es

Duration	Average			
	1	2	5	10
5-min	**0.329** (0.294-0.367)	**0.394** (0.353-0.441)	**0.476** (0.425-0.532)	**0.542** (0.483-0.605)
10-min	**0.616** (0.551-0.575)	**0.619** (0.555-0.692)	**0.745** (0.664-0.832)	**0.845** (0.753-0.944)
15-min	**0.634** (0.568-0.708)	**0.763** (0.683-0.853)	**0.921** (0.822-1.03)	**1.05** (0.932-1.17)
30-min	**0.847** (0.758-0.945)	**1.03** (0.923-1.15)	**1.27** (1.14-1.42)	**1.47** (1.31-1.64)
60-min	**1.04** (0.933-1.16)	**1.27** (1.14-1.42)	**1.61** (1.44-1.80)	**1.88** (1.68-2.10)
2-hr	**1.26** (1.13-1.40)	**1.53** (1.38-1.71)	**1.94** (1.74-2.17)	**2.27** (2.04-2.54)
3-hr	**1.40** (1.27-1.56)	**1.70** (1.53-1.89)	**2.12** (1.91-2.35)	**2.48** (2.22-2.75)
6-hr	**1.80** (1.63-2.01)	**2.16** (1.96-2.41)	**2.66** (2.40-2.96)	**3.10** (2.78-3.45)
12-hr	**2.24** (2.02-2.52)	**2.71** (2.44-3.04)	**3.35** (3.01-3.76)	**3.92** (3.50-4.39)
24-hr	**2.67** (2.46-2.95)	**3.20** (2.95-3.54)	**3.98** (3.65-4.39)	**4.67** (4.26-5.13)

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Storm of Record Approach

- Utilize Record Data which falls within the confidence interval

For a project site in southeastern Pennsylvania, the NOAA Atlas-14 2-year through 100-year/24-hour data (including the 90% confidence upper and lower intervals) are shown in **Table 2-1**.

Table 2-1: 2-, 10-, 50-, and 100-year/24-hour precipitation depths for southeastern Pennsylvania

Return frequency for the 24-hour storm event	*Precipitation depth (inches)*		
	Median	Lower 90% confidence interval	Upper 90% confidence interval
2-year	3.28	3.01	3.58
10-year	4.82	4.41	5.26
50-year	6.69	6.06	7.27
100-year	7.60	6.85	8.26

Rainfall depth for several 24-hour rainfall events from the Pennsylvania State Climatologist for Philadelphia (located in southeastern Pennsylvania) can be seen in **Table 2-2**.

Table 2-2: 24-hour precipitation depth and corresponding date for a location in southeastern Pennsylvania

24-hour storm date	*Precipitation (inches)*	*Chosen to represent:*
7/28/2013	8.02	100-year/24-hour storm event
9/16/1999	6.63	50-year/24-hour storm event
8/14/2011	4.84	10-year/24-hour storm event
10/25/1980	3.82	2-year/24-hour storm event

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Residential Impervious (2.1)

As a result, DEP's policy is that for residential subdivisions, the PCSM Plan should either:

- Include 110% (or higher) of the projected impervious surface area per lot in the stormwater analysis to account for future impervious additions (e.g., if 1,000 square feet of impervious is projected, use 1,100 square feet in the stormwater analysis); or
- Restrict future impervious through a deed restriction that is completed at the time of sale, the proof of which is provided to DEP/CCD with the Notice of Termination (NOT). The deed restriction must prohibit the installation of any future impervious surface without additional stormwater management being provided.

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Contractor Qualifications (2.1)

Contractors engaged to construct infiltration SCMs should have verifiable experience in the construction of similar facilities. The contractor that is selected to construct an infiltration SCM should have constructed at least three successful infiltration SCMs in the past two years. If the contractor cannot demonstrate this experience, construction confirmation testing for infiltration capacity is required for each infiltration SCM. Qualifications of the contractor should be verified by the owner and provided to DEP/CCD at the pre-construction meeting. The owner should discuss the qualifications of the contractor with the licensed professional.

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Construction Soil Testing (2.1)

In accordance with 25 Pa. Code §102.8(k), a licensed professional or designee must provide oversight at critical stages of construction. Proper construction of these critical stages (as identified in **Chapter 3** for each SCM) is particularly important for infiltration SCMs. If the owner engages an experienced contractor and enters into an agreement with a licensed professional to regularly report to the owner, and if the owner regularly enforces the recommendations of the licensed professional, then construction confirmation testing for infiltration capacity is waived (except for E&S BMP conversions to PCSM BMPs as discussed above). Construction confirmation testing for infiltration capacity is considered good engineering practice for sites where there is concern of compaction during construction, or where the saturated hydraulic conductivity is less than 0.57 inch/hour (upper range of HSG C soils). A full list of conditions where construction confirmation testing for infiltration capacity is necessary or recommended is provided in **Appendix B, Table B-8**.

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Volume to Wetlands (2.1)

Typically, land development results in net increases in stormwater runoff volume, comparing pre- and post-construction conditions. However, in some cases there may be net decreases, particularly when there are changes in drainage areas. A decrease in runoff to a sensitive natural feature such as a wetland up to the 2-year/24-hour storm event can negatively impact the feature. DEP may require an applicant to demonstrate that a reduction in flow to such features will not produce an adverse impact or otherwise require changes to avoid these impacts. An example of this is when SCMs implemented upstream result in decreasing runoff entering a downstream natural wetland.

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Headwater Streams (2.4.4)

For reasons described in **Section 2.4.6, Stream Stability Analysis**, when the contributing watershed of the receiving surface water body is smaller than one-half square mile (0.5 mi^2), as measured from the furthest downstream POA, the total drainage area to any single POA should not exceed 10% of the contributing watershed. If the drainage area exceeds 10%, the PCSM Plan preparer should attempt to establish multiple POAs, if feasible, to reduce the drainage area to the 10% threshold.

2.4.6 Stream Stability Analysis

A stream stability analysis is necessary for any stream where stormwater discharges are anticipated to overburden the stream, most notably in headwater streams that are typically the least tolerant to increases in magnitude, duration, or frequency of discharges.

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Headwater Streams (2.4.6)

Discharges are anticipated to potentially overburden a receiving stream when the project site area is 10% or more of the stream's watershed area at any and all locations where flow from the project site enters the stream (see Section 2.4.7 and Section 2.4.8 for limitations on discharge to lakes/ponds and wetlands, respectively). In addition, a stream stability analysis is generally necessary when an applicant proposes post-construction increases in runoff rate and/or volume through an alternative design standard demonstration. In general, project sites with areas less than 10% of a watershed's area in which rate and volume management requirements of Chapter 102 will be met are not anticipated to overburden a receiving stream, unless the stream is known to have existing pronounced bank erosion, highly urbanized confined channels, or documented flooding. However, DEP, at its discretion, may determine that any stream receiving stormwater discharges from earth disturbance activities needs further investigation and protection.

If a stream stability analysis is warranted in accordance with the criteria above, an analysis should generally be performed using Hydrologic Engineering Center River Analysis System (HEC-RAS), International River Interface Cooperative (iRIC), or other software capable of performing a sediment transport analysis. The analysis should include the stream channel and overbank from approximately 100 feet upstream of any discharge locations (or from a suitable control section above the project unaffected by backwater) to approximately 500 feet downstream from any discharge (or downstream to a location in the stream below the project where the area of the project site is less than 7.5% of the watershed area draining to that location).

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Lakes and Ponds (2.4.7)

For discharges to lakes and ponds, the change in water surface elevation due to any regulated land disturbance is limited to 6 inches of ponding depth for a maximum of 24 hours. Increased inundation cannot extend onto lands owned by other entities unless a drainage easement allows increased inundation and inundation cannot harm infrastructure. If a project site area is 10% or more than the size of the pond's or lake's watershed, a stream stability analysis is necessary for the stream below the outfall of the pond or lake, if applicable, and an assessment of the potential impact on the lake's ecosystem should be performed. Initial conditions should be established in general conformance with the procedures contained in the *Pennsylvania Lacustrine Condition Level 2 Rapid Assessment Protocol* (DEP 2017b).

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Wetlands (2.4.8)

Ideally, there should be little or no net change, comparing pre-construction to post-construction conditions, in the volume, pollutant loading, and rate of stormwater runoff entering a natural wetland, and the residence time of that water. Significant increases or decreases in stormwater volume, for example, can alter the hydrologic regime and function of a natural wetland, and may prompt the need for a permit under Chapter 105 due to the hydraulic alteration. To protect natural wetlands, PCSM Plan preparers should attempt to meet the criteria in **Table 2-3**. When one or more of these criteria cannot be met, DEP may require that a qualified wetlands scientist evaluate the wetlands and report on the potential functional impacts of the proposed hydraulic changes as part of the Chapter 102 application review process.

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Wetlands (2.4.8)

Table 2-3: Criteria for the protection of natural wetlands in PCSM design

Criteria	Exceptional Value Wetlands or Connected to HQ or CWF Waters*	Other Wetlands
Manage net change in volume and pollutant loading up to 2-year/24-hour storm event and rate up to the 100-year/24-hour storm event at all points of analysis into the wetland.	✓	✓
Ensure that there will be no significant change in runoff or infiltration characteristics that would reduce flow volume during small storms (such as a reduction in drainage area).	✓	✓
Ensure no temporary increase in ponding depth within the wetland exceeding 25% over existing ponding depth for the 2-year to 100-year/24-hour storms.**	✓	
Ensure no temporary increase in ponding depth within the wetland exceeding 50% over existing ponding depth for the 2-year to 100-year/24-hour storms.**		✓
Provide a minimum of 50 feet of riparian buffer for thermal protection for the wetland or demonstrate that thermal protection is provided.	✓	✓

* Exceptional value wetlands, as defined at 25 Pa. Code § 105.17, and wetlands hydraulically connected to surface waters with an existing or designated use of HQ or Cold Water Fishes (CWF).

** Subject to case-by-case considerations including, but not limited to, threatened and endangered species that may be impacted by short-term increases in ponding depth.

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Questions ?

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