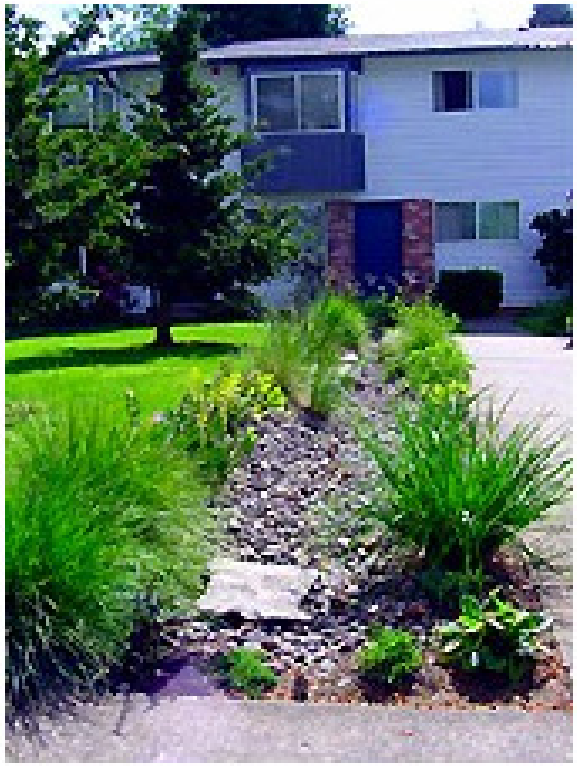
Post Construction Stormwater Management Checklist Program



Anahid Damerau, CPESC, CPSWQ
Christopher Smith, P.E.
Department of Environmental Protection
Stormwater Section
Watershed Management Program

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

The Goals of PCSM

- Protect the receiving water from degradation
- Maintain groundwater recharge
- Prevent downstream increases in runoff volume and frequent flooding
- Replicate the natural hydrologic cycle on site before development

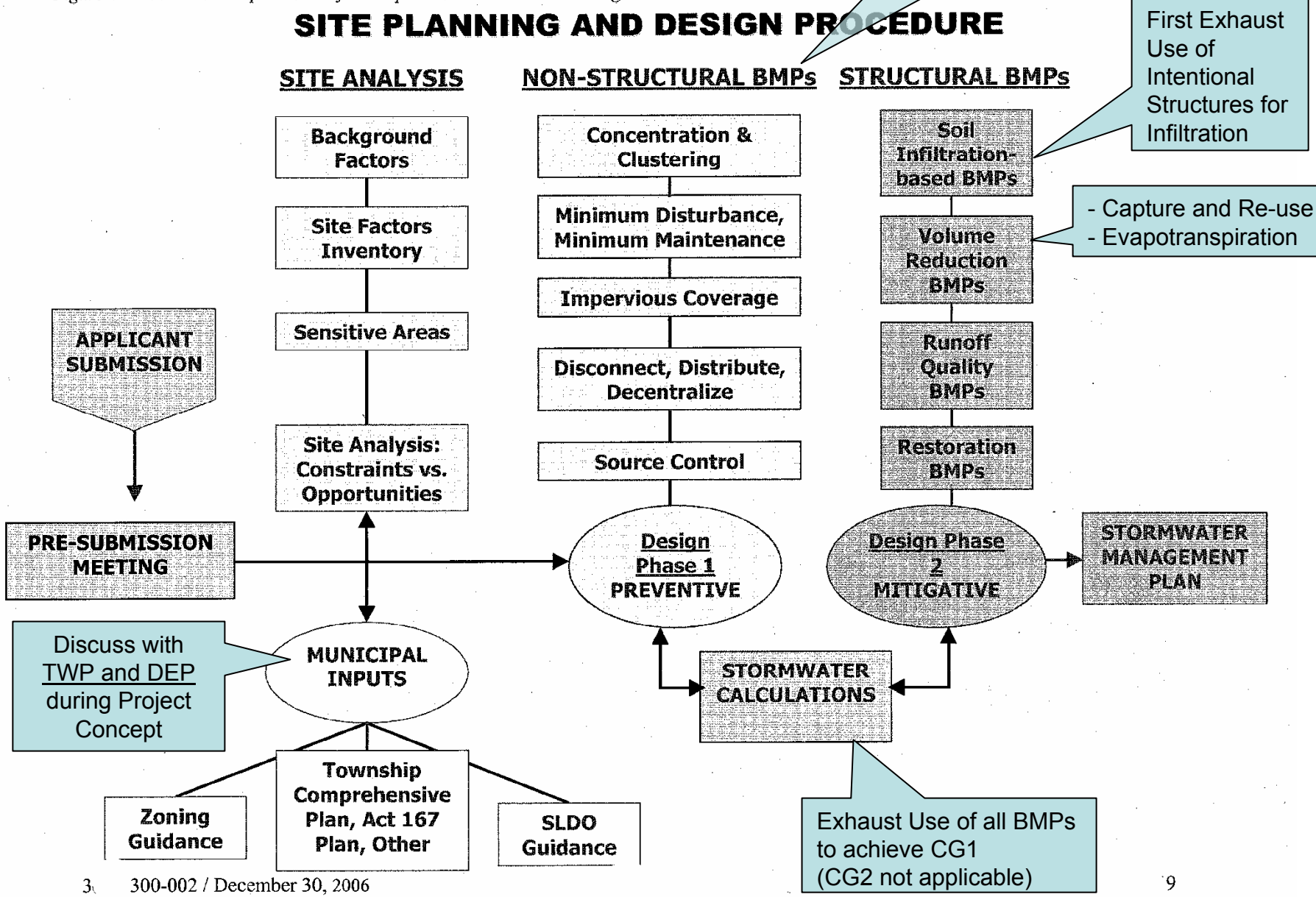
Degraded watercourse

N.O.I. Checklist

See Ch. 4 – BMP Manual

7.	Complete Post Construction Stormwater Management Plan. (3 copies) Location: Drawings (D), Narrative (N).			☐	☐
	a. Written Narrative *(Must be separate from E&S Plan and labeled "PCSM" or Post-Construction Stormwater Management"" and be the final plan for construction)* Written Narrative Includes the following:	Location **N**	Page _____	☐	☐
	i. Site Description & Analysis	Location **N**	Page _____	☐	☐
	ii. Soil types and descriptions (including hydric soils)	Location **N**	Page _____	☐	☐
	iii. Pre-development and post-development drainage area runoff calculations for each drainage area	Location **N**	Page _____	☐	☐
	iv. Routing Analysis to demonstrate peak control for the 1-year through 100-year storm events *(Routing should consider the benefits of BMPs)*	Location **N**	Page _____	☐	☐
	v. Calculations for permanent stormwater BMPs *(including volume of water treated through BMPs)*	Location **N**	Page _____	☐	☐
	vi. Curve Numbers and/or land use coefficients	Location **N**	Page _____	☐	☐
	vii. Infiltration/Geotechnical report and soil infiltration test pit results	Location **N**	Page _____	☐	☐

Figure 4-1 Recommended procedures for comprehensive stormwater management.



Site Analysis – Chapter 4 BMP Manual

Ch 93 for each P.O.I.

Ch 303(d) (impaired stream) see EmapPA

(Figure 4-2) Checklist summary for use with Site Planning and Design Procedure

SITE ANALYSIS

Background Site Factors

Describe hydrologic context and other natural elements

- Chapter 93 stream use designation?
  - Special Protection Waters (EV, HQ)?
  - Fishery / Aquatic Life Use (WWF, CWF, TSF)?
- Any Chapter 303d/impaired stream listing classifications?
- Aquatic biota sampling?
- Existing water quality sensitivities downstream (water supply source?)?
- Location of any known downstream flooding?
- Includes any Special Areas?
  - Such as Previously Mined AMD/AML areas?
  - Brownfields?
  - Source Water Protection areas
  - Urban Areas?
  - Carbonate/Limestone?
  - Slide Prone Areas
  - Other

Site Factors Inventory

Describe the size and shape of the site

- Special constraints/opportunities?
- Special site border conditions and adjacent uses?

Describe the existing developed features of the site, if any

- Existing structures/improvements, structures to be preserved?
- Existing cover/uses?
- Existing impervious areas?
- Existing pervious maintained areas?
- Existing public sewer and water?
- Existing storm drainage systems at/adjacent to site?
- Existing wastewater, water systems onsite?

Describe important natural features of site

- Existing hydrology (drainage swales, intermittent, perennial)?
- Existing topography, contours, subbasins?
- Soil series found on site and their Hydrologic Soil Group ratings?
- Areas of vegetation (trees, scrub, shrub)?
- Special Value Areas?
  - Wetlands, hydric soils?
  - Floodplains/alluvial soils?
  - High quality woodlands, other woodlands and vegetation?
  - Riparian buffers?
  - Naturally vegetated swales/drainageways?
- Sensitive Areas?
  - Steep slopes?
  - Special geologic conditions (limestone?)?
  - Shallow bedrock (less than 2ft)?
  - High water table (less than 2ft)?
- PNDI areas or species?

Site Factors Analysis

Characterize the constraint-zones at site

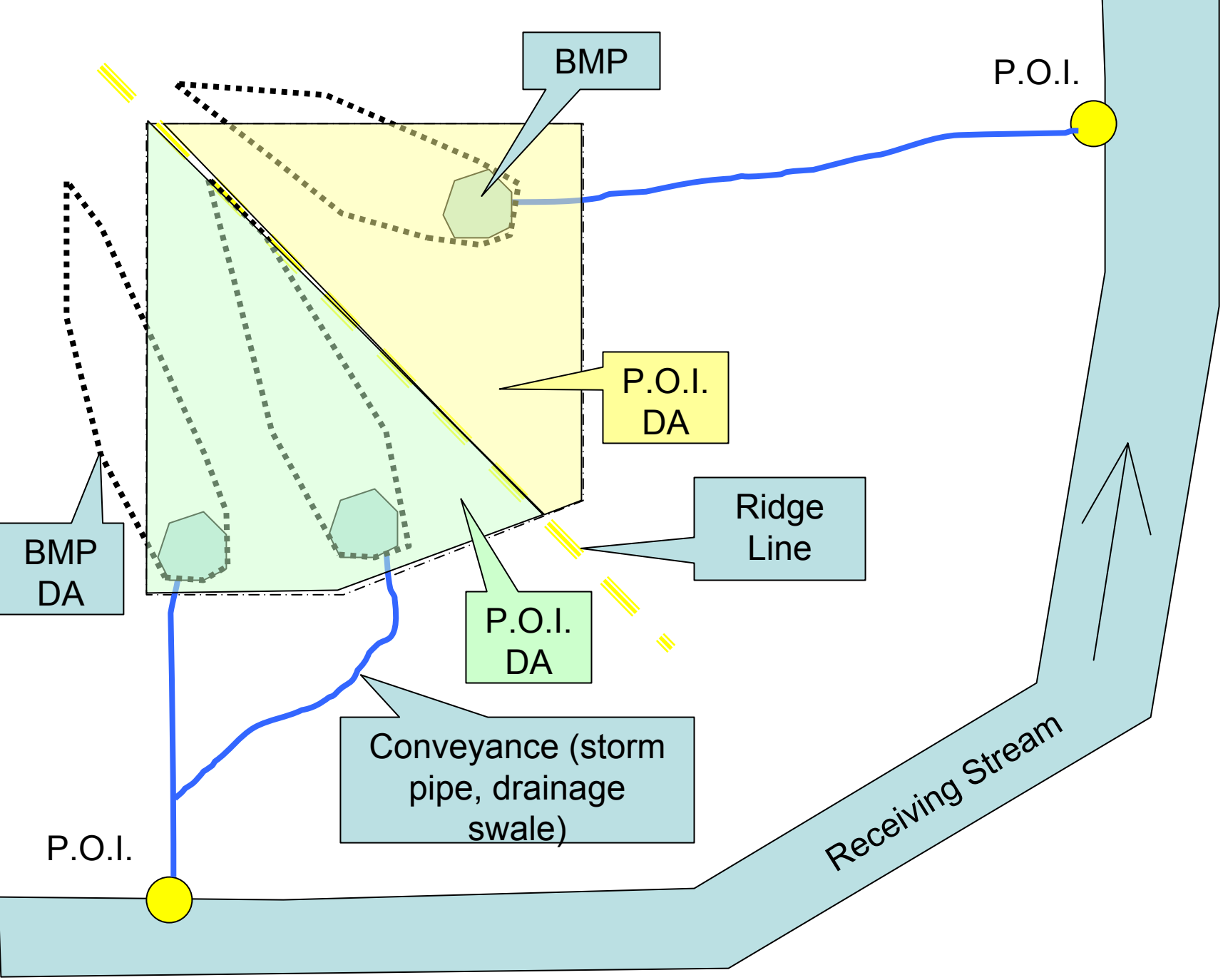
- Avoid development on or near special and sensitive natural features

Characterize the opportunity-zones at site

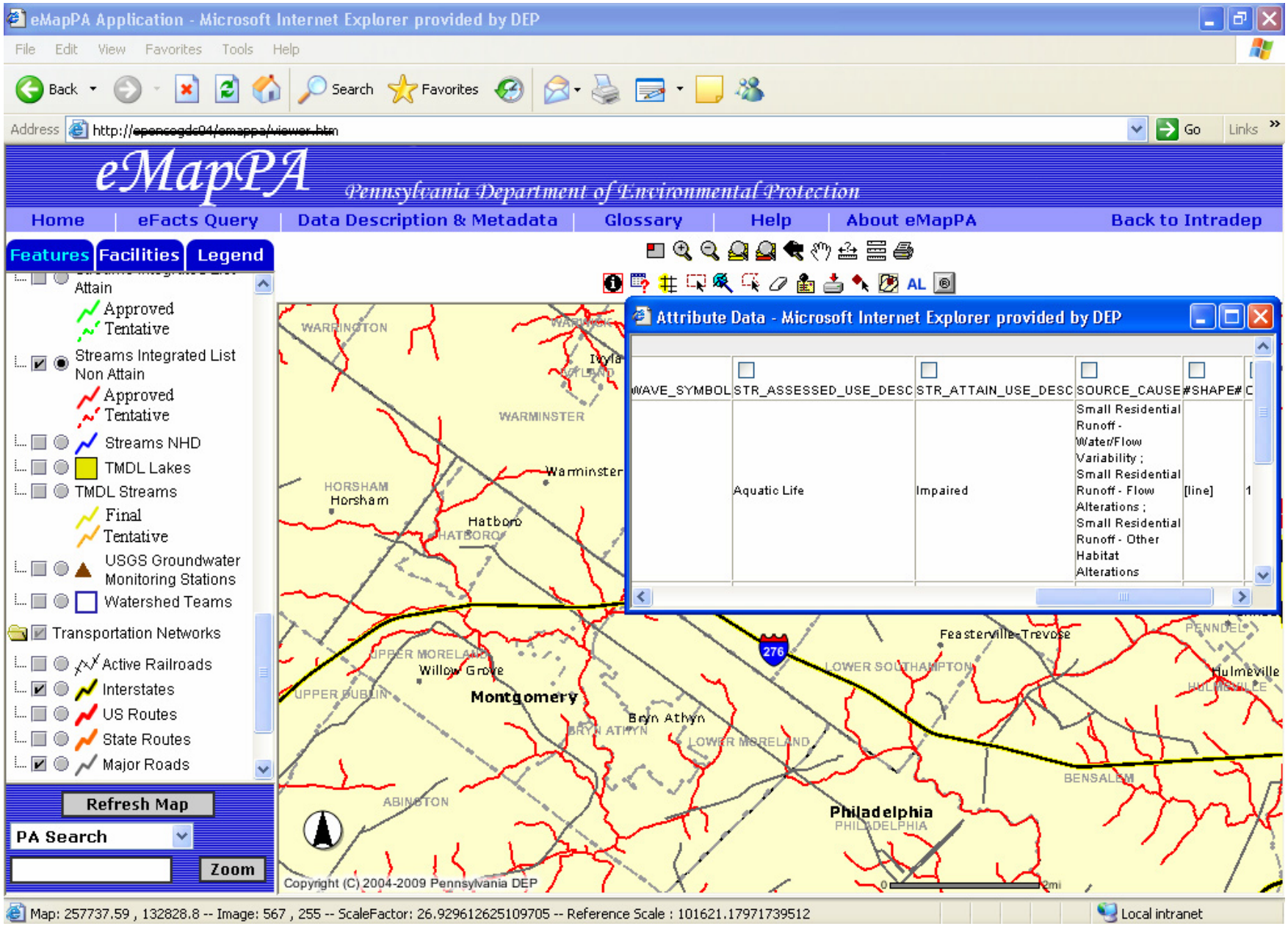
- Location of well-draining soils
- Location and quality of existing vegetation
- Has a Potential Development Area been defined?
- Does building program fit the constraints and opportunities of natural features?

BACKGROUND SITE CONDITIONS

This is the first of 3 pages in Chapter 4 that should be considered during the site planning and design (see flowchart)


BMP
P.O.I.
P.O.I.
DA
BMP
DA
Ridge
Line
P.O.I.
DA
Conveyance (storm
pipe, drainage
swale)
P.O.I.
Receiving Stream

http://www.emappa.dep.state.pa.us/emappa/viewer.htm



Site Analysis – Chapter 4 BMP Manual

(Figure 4-2) Checklist summary for use with Site Planning and Design Procedure

SITE ANALYSIS

Background Site Factors

Describe hydrologic context and other natural elements

- Chapter 93 stream use designation?
  - Special Protection Waters (EV, HQ)?
  - Fishery / Aquatic Life Use (WWF, CWF, TSF)?
- Any Chapter 303d/impaired stream listing classifications?
- Aquatic biota sampling?
- Existing water quality sensitivities downstream (water supply source?)?
- Location of any known downstream flooding?
- Includes any Special Areas?
  - Such as Previously Mined AMD/AML areas?
  - Brownfields?
  - Source Water Protection areas
  - Urban Areas?
  - Carbonate/Limestone?
  - Slide Prone Areas
  - Other

Site Factors Inventory

Describe the size and shape of the site

- Special constraints/opportunities?
- Special site border conditions and adjacent uses?

Describe the existing developed features of the site, if any

- Existing structures/improvements, structures to be preserved?
- Existing cover/uses?
- Existing impervious areas?
- Existing pervious maintained areas?
- Existing public sewer and water?
- Existing storm drainage systems at/adjacent to site?
- Existing wastewater, water systems onsite?

Describe important natural features of site

- Existing hydrology (drainage swales, intermittent, perennial)?
- Existing topography, contours, subbasins?
- Soil series found on site and their Hydrologic Soil Group ratings?
- Areas of vegetation (trees, scrub, shrub)?
- Special Value Areas?
  - Wetlands, hydric soils?
  - Floodplains/alluvial soils?
  - High quality woodlands, other woodlands and vegetation?
  - Riparian buffers?
  - Naturally vegetated swales/drainageways?
- Sensitive Areas?
  - Steep slopes?
  - Special geologic conditions (limestone?)?
  - Shallow bedrock (less than 2ft)?
  - High water table (less than 2ft)?
- PNDI areas or species?

Site Factors Analysis

Characterize the constraint-zones at site

- Avoid development on or near special and sensitive natural features

Characterize the opportunity-zones at site

- Location of well-draining soils
- Location and quality of existing vegetation
- Has a Potential Development Area been defined?
- Does building program fit the constraints and opportunities of natural features?

BACKGROUND SITE CONDITIONS

Regulated Substances

This is the first of 3 pages in Chapter 4 that should be considered during the site planning and design (see flowchart)

Regulated Substances and Infiltration

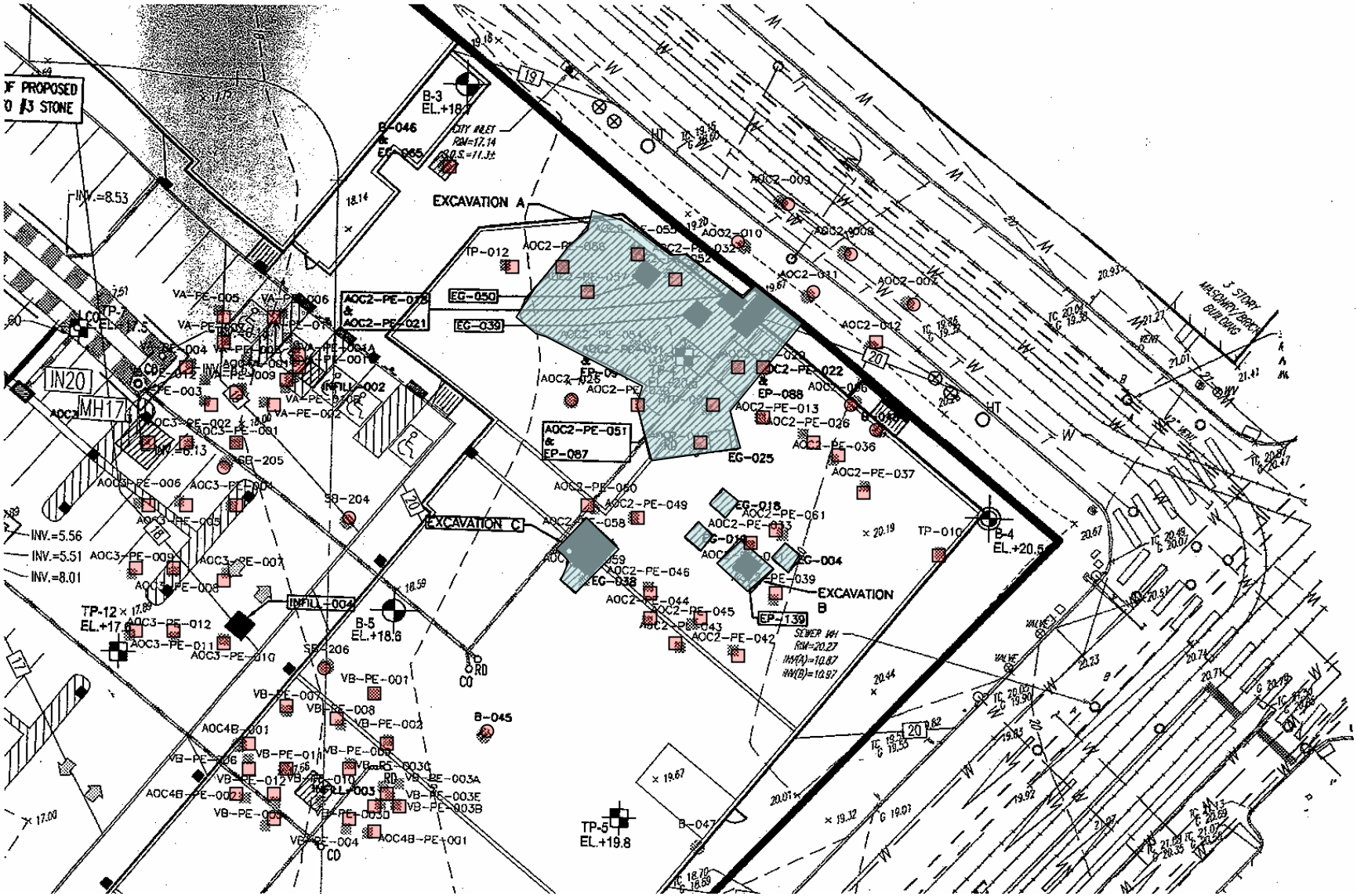
- Based on Environmental Due Diligence per Application
- PaCode.com Title 25 Chapter 250 Land Recycling Program
  - Soil to groundwater pathway numeric values
    - SPLP (Leaching procedure)
    - Soil Buffer Criteria
- Site Designers should work with the Applicant's Environmental Consultant
- Soil Sample locations & Concentrations should be shown on the PCSM Plan

10. Potential Toxic or Hazardous Pollutants: (Submit the following data if soil contaminant, geology or past or present land use provides a potential for contaminated runoff from the project site) N/A ☐ Use additional sheets if necessary.

Pollutant	Concentration w/Units	Source	Sample Type	Date(s) / Number of Samples
Lead	400 mg/kg			
Arsenic	100 mg/kg *			
Benzene	0.15 mg/kg			

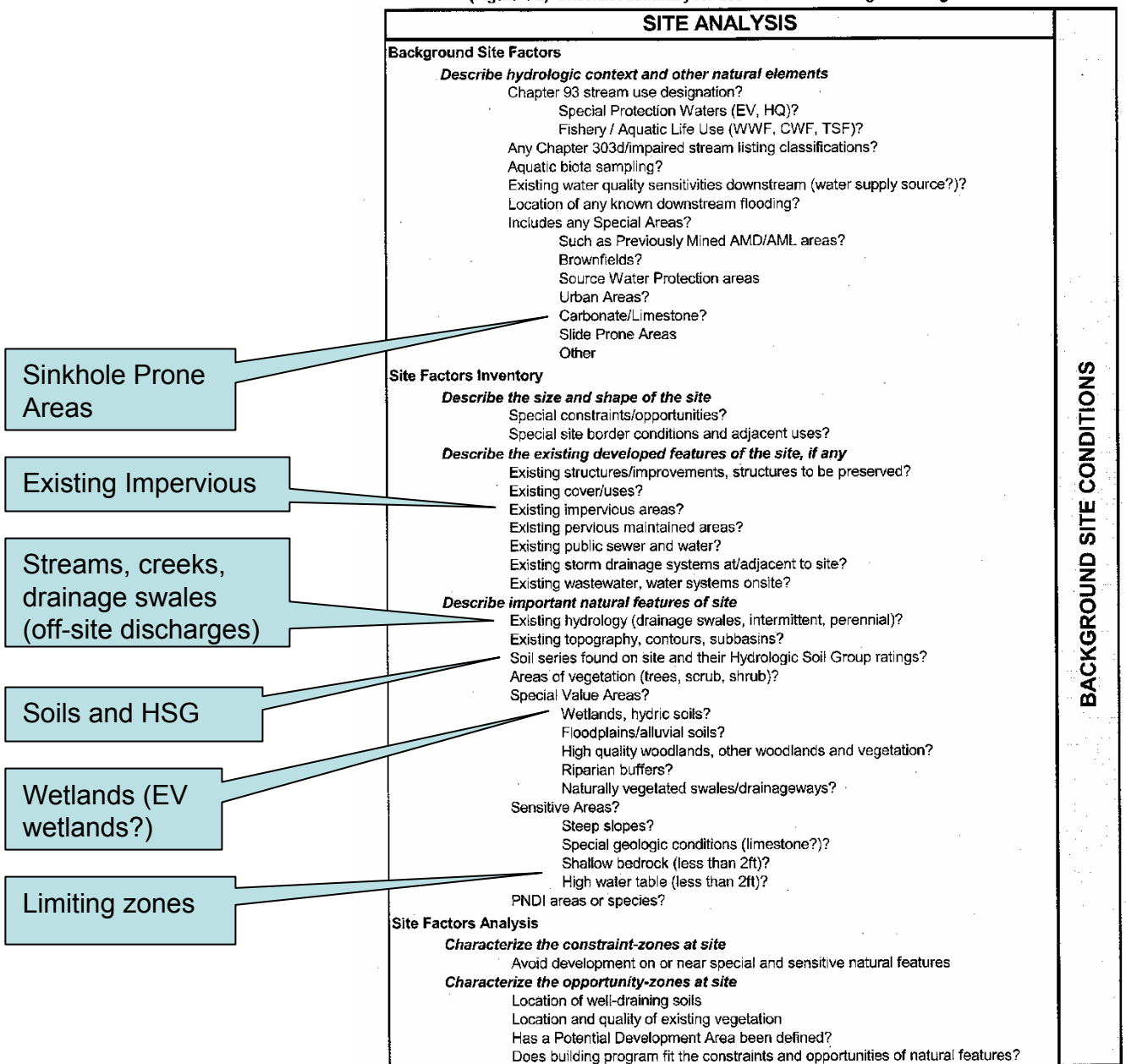
* Exceeds Resid. Statewide Health Stand. for direct contact values only

Plan with Contaminated Soils



Site Analysis – Chapter 4 BMP Manual

(Figure 4-2) Checklist summary for use with Site Planning and Design Procedure



Sinkhole Prone Areas

Existing Impervious

Streams, creeks, drainage swales (off-site discharges)

Soils and HSG

Wetlands (EV wetlands?)

Limiting zones

This is the first of 3 pages in Chapter 4 that should be considered during the site planning and design (see flowchart)

N.O.I. Checklist

7.	Complete Post Construction Stormwater Management Plan. (3 copies) Location: Drawings (D), Narrative (N).			☐	☐
	a. Written Narrative *(Must be separate from E&S Plan and labeled "PCSM" or Post-Construction Stormwater Management"" and be the final plan for construction)* Written Narrative Includes the following:	Location **N**	Page _____	☐	☐
	i. Site Description & Analysis	Location **N**	Page _____	☐	☐
	ii. Soil types and descriptions (including hydric soils)	Location **N**	Page _____	☐	☐
	iii. Pre-development and post-development drainage area runoff calculations for each drainage area	Location **N**	Page _____	☐	☐
	iv. Routing Analysis to demonstrate peak control for the 1-year through 100-year storm events *(Routing should consider the benefits of BMPs)*	Location **N**	Page _____	☐	☐
	v. Calculations for permanent stormwater BMPs *(including volume of water treated through BMPs)*	Location **N**	Page _____	☐	☐
	vi. Curve Numbers and/or land use coefficients	Location **N**	Page _____	☐	☐
	vii. Infiltration/Geotechnical report and soil infiltration test pit results	Location **N**	Page _____	☐	☐

websoilsurvey.nrcs.usda.gov
To be used as a planning tool – soil limitations can be verified in the field

Web Soil Survey - Microsoft Internet Explorer provided by DEP

File Edit View Favorites Tools Help

Back Search Favorites

Address http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx Go Links

USDA United States Department of Agriculture
Natural Resources Conservation Service

Web Soil Survey

Contact Us | Download Soils Data | Archived Soil Surveys | Soil Survey Status | Glossary | Preferences | Logout | Help | A A A

Area of Interest (AOI) | Soil Map | Soil Data Explorer | Shopping Cart (Free)

View Soil Information By Use: All Uses

Printable Version | Add to Shopping Cart

Intro to Soils | Suitabilities and Limitations for Use | Soil Properties and Qualities | Ecological Site Assessment | Soil Reports

Search

Properties

Soil Chemi
Soil Erosion
Soil Physi
Available
Available
Available
Available
Available
Bulk Dens
Bulk Dens
Bulk Dens
Linear Ex
Liquid Lim
Organic M
Percent C

Map Legend

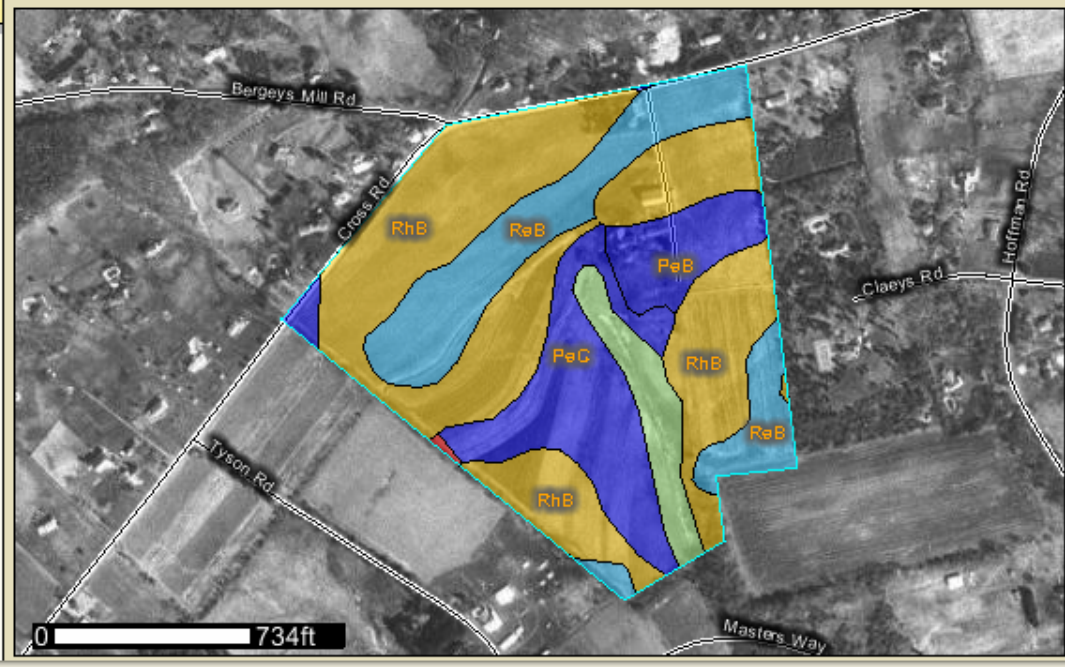
Map Legend

- Area of Interest (AOI)
  - Area of Interest (AOI)
- Soils
  - Soil Survey Areas
  - Soil Map Units
  - Soil Ratings
    - <= 3.827
    - > 3.827 AND <= 4.005
    - > 4.005 AND <= 5.2504
    - > 5.2504 AND <= 6.2786
    - > 6.2786 AND <= 22.7006
    - Not rated or not available
  - Special Point Features
  - Special Line Features
- Political Features
  - States

Legend

Map — Saturated Hydraulic Conductivity (Ksat)

Scale (not to scale)



Done Internet

start | Inbox - Microso... | Attached Image... | Microsoft Power... | Web Soil Surve... | Web Soil Surve... | 9:24 AM

N.O.I. Checklist

7.	Complete Post Construction Stormwater Management Plan. (3 copies) Location: Drawings (D), Narrative (N).			☐	☐
	a. Written Narrative *(Must be separate from E&S Plan and labeled "PCSM" or Post-Construction Stormwater Management"" and be the final plan for construction)* Written Narrative Includes the following:	Location **N**	Page _____	☐	☐
	i. Site Description & Analysis	Location **N**	Page _____	☐	☐
	ii. Soil types and descriptions (including hydric soils)	Location **N**	Page _____	☐	☐
	iii. Pre-development and post-development drainage area runoff calculations for each drainage area	Location **N**	Page _____	☐	☐
	iv. Routing Analysis to demonstrate peak control for the 1-year through 100-year storm events *(Routing should consider the benefits of BMPs)*	Location **N**	Page _____	☐	☐
	v. Calculations for permanent stormwater BMPs *(including volume of water treated through BMPs)*	Location **N**	Page _____	☐	☐
	vi. Curve Numbers and/or land use coefficients	Location **N**	Page _____	☐	☐
	vii. Infiltration/Geotechnical report and soil infiltration test pit results	Location **N**	Page _____	☐	☐

For each P.O.I.
Use WS 4 Calculation Incl. Pre & Post Maps, DAs, and POIs

Runoff volume to each BMP, and Storage Volume and Active Infiltration for each BMP

Curve Numbers – See USDA TR-55

Worksheet 4

Worksheet 4. Change in Runoff Volume for 2-YR Storm Event

PROJECT: _____
Drainage Area: _____
2-Year Rainfall: _____ in

Total Site Area: _____ acres
Protected Site Area: _____ acres
Managed Area: _____ acres

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland								
Meadow								
Impervious								
TOTAL:								

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
TOTAL:								

2-Year Volume Increase (ft3):

2-Year Volume Increase = Developed Conditions Runoff Volume – Existing Conditions Runoff Volume

Runoff (in) = $Q = (P-0.2S)^2 / (P+0.8S)$ where
P = 2-Year Rainfall (in)
S = (1000/ CN)-10
Runoff Volume (CF) = Q x Area x 1/12
Q = Runoff (in)
Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

HYDROLOGY

Project Name
BMP ID Infiltration Facility #2

2-year / 24-hour Rainfall 3.2 inches

USDA TR-55

Area to BMP

Check Loading Ratios based on BMP size (see next slide)

	(1a) Cover Condition	(2a) Area to BMP (sf)	(3a) TR-55 CN Value	(4a) TR-55 S	(5a) TR-55 Runoff Volume (cf)
Post Cover 1	Roof	27,500	98	0.204	6,800
Post Cover 2			98	0.204	0
Post Cover 3			70	4.286	0
	SUM	27,500		SUM	6,800

Check Loading Ratios
(Drainage Area to Bottom of BMP Area)

Impervious Area **4.6 : 1**
(recommended max 5 : 1)

Total Area **4.6 : 1**
(recommended max 8 : 1)

Type II 24-hour Rainfall

For NRCS Type II Storm

Time (hours)	(1b) Fraction * of 24-hour Rainfall Type II Storm	(2b) Post Cover 1 Cumulative Runoff Volume (cf)	(3b) Post Cover 1 Incremental Runoff Volume (cf)	(4b) Post Cover 2 Cumulative Runoff Volume (cf)	(5b) Post Cover 2 Incremental Runoff Volume (cf)	(6b) Post Cover 3 Cumulative Runoff Volume (cf)	(7b) Post Cover 3 Incremental Runoff Volume (cf)	(8b) Post Cover 1 + Cover 2 + Cover 3 Incremental Runoff Volume (cf)
0	0.000	0	0	0	0	0	0	0
1	0.011	75	75	0	0	0	0	75
2	0.022	150	75	0	0	0	0	75
3	0.035	238	88	0	0	0	0	88
4	0.048	326	88	0	0	0	0	88
5	0.064	435	109	0	0	0	0	109
6	0.080	544	109	0	0	0	0	109
7	0.098	666	122	0	0	0	0	122
8	0.120	816	150	0	0	0	0	150
9	0.147	1,000	184	0	0	0	0	184
10	0.181	1,231	231	0	0	0	0	231
11	0.235	1,598	367	0	0	0	0	367
12	0.663	4,509	2,911	0	0	0	0	2,911
13	0.772	5,250	741	0	0	0	0	741
14	0.820	5,576	326	0	0	0	0	326
15	0.850	5,780	204	0	0	0	0	204
16	0.880	5,984	204	0	0	0	0	204
17	0.898	6,107	122	0	0	0	0	122
18	0.916	6,229	122	0	0	0	0	122
19	0.934	6,352	122	0	0	0	0	122
20	0.952	6,474	122	0	0	0	0	122
21	0.964	6,556	82	0	0	0	0	82
22	0.976	6,637	82	0	0	0	0	82
23	0.988	6,719	82	0	0	0	0	82
24	1.000	6,800	82	0	0	0	0	82
							SUM	6,800

The most incremental runoff at hour 12 for a Type II 24-hour Storm

24 hours

Total Runoff Volume (cu. ft.)

* Reference - http://onlinemanuals.txdot.gov/txdotmanuals/hyd/design_rainfall_hyetograph_methods.htm

HYDRAULICS

BMP sized appropriately?

The amount of runoff that is infiltrated in one hour increments

Total Storage Volume of BMP

Void Space 0.40

	(1c) Elev (inches)	(2c) Contour Area (sf)	(3c) Incremental Volume (cf)	(4c) Cumulative Volume (cf)
Top of BMP	12	6,000	600	2,400
	9	6,000	600	1,800
	6	6,000	600	1,200
	3	6,000	600	600
Bottom of BMP	0	6,000	0	0

X

Between 0.1 and 10 inches per hour

Measured Infiltration Rate 1.000 inches per hour

Factor of Safety 2.0

Don't forget – reduction factor if percolation test performed

Design Infiltration Rate 0.500 inches per hour

Maximum Volume able to dewater in 72 hours based on Bottom of BMP (sf) and Design Infiltration Rate: 18,000 cubic feet

Y

Max Volume to dewater in 72 hrs

For Comparison Purposes:

Total Storage Volume plus the product of (0.50 inches per hour / 12) x 6,000 sf x 2 hrs

2,400 plus (0.50 / 12) x 6,000 x 2 hours = 2,900 cubic feet

(Compared with 5,855 cubic feet)

Column (3d) Calculation

the sum of column 2d @ time n and column 6d @ time n-1

Column (4d) Calculation

the lower number between:

the number in column 3d @ time n and

the product of (0.50 inches per hour / 12) x 6,000 sf x 1 hour

(design infiltration rate x contour area at the bottom of the BMP x 1 hour)

	(1d) Time (hours)	(2d) Post Incremental Hydrolgy to BMP from (9b) (cf)	(3d) Stored Volume in BMP plus Incremental Hydrology to BMP (cf)	(4d) Incremental Infiltrated Volume (cf)	(5d) Depth in BMP after Infiltration **(Capped at 12 inches)** (inches)	(6d) Stored Volume after Infiltration (cf)
	0	0	0	0	0.0	0
	1	75	75	75	0.0	0
	2	75	75	75	0.0	0
	3	88	88	88	0.0	0
	4	88	88	88	0.0	0
	5	109	109	109	0.0	0
	6	109	109	109	0.0	0
	7	122	122	122	0.0	0
	8	150	150	150	0.0	0
	9	184	184	184	0.0	0
	10	231	231	231	0.0	0
	11	367	367	250	0.6	117
	12	2,911	3,028	250	12.0	2,400
	13	741	3,141	250	12.0	2,400
	14	326	2,726	250	12.0	2,400
	15	204	2,604	250	11.8	2,354
	16	204	2,558	250	11.5	2,308
	17	122	2,430	250	10.9	2,180
	18	122	2,303	250	10.3	2,053
	19	122	2,175	250	9.6	1,925
	20	122	2,048	250	9.0	1,798
	21	82	1,879	250	8.1	1,629
	22	82	1,711	250	7.3	1,461
	23	82	1,542	250	6.5	1,292
	24	82	1,374	250	5.6	1,124
	25	0	1,124			
	SUM	6,800	SUM	4,731	Infiltrated Volume during the Storm	
			Z	1,124	Plus Storage Volume (controlling number of X, Y, and Z)	

Total Infiltrated Volume 5,855 cubic feet

Total infiltrated volume based on active infiltration, storage volume, and maximum 72-hour dewatering time

N.O.I. Checklist

7.	Complete Post Construction Stormwater Management Plan. (3 copies) Location: Drawings (D), Narrative (N).			☐	☐
	a. Written Narrative *(Must be separate from E&S Plan and labeled "PCSM" or Post-Construction Stormwater Management"" and be the final plan for construction)* Written Narrative Includes the following:	Location **N**	Page _____	☐	☐
	i. Site Description & Analysis	Location **N**	Page _____	☐	☐
	ii. Soil types and descriptions (including hydric soils)	Location **N**	Page _____	☐	☐
	iii. Pre-development and post-development drainage area runoff calculations for each drainage area	Location **N**	Page _____	☐	☐
	iv. Routing Analysis to demonstrate peak control for the 1-year through 100-year storm events *(Routing should consider the benefits of BMPs)*	Location **N**	Page _____	☐	☐
	v. Calculations for permanent stormwater BMPs *(including volume of water treated through BMPs)*	Location **N**	Page _____	☐	☐
	vi. Curve Numbers and/or land use coefficients	Location **N**	Page _____	☐	☐
	vii. Infiltration/Geotechnical report and soil infiltration test pit results	Location **N**	Page _____	☐	☐

Follow App. C Protocol 1 incl. 4 steps – BMP Manual

Sample Soil Test Pit Log

Horizon	Depth (in.)	Color	Texture	Structure	Consistence	Redox Features	Boundary
Ap	0-7	7.5YR 3/3	sil	1 m pl	friable		abrupt smooth
Bt	7-11	7.5YR 4/4	sil	1 m sbk	friable	c p	clear wavy
Btx1	11-26	7.5YR 4/4	sil	2 co pr	firm	m p	clear wavy
Btx2	26-36	5YR 4/4	channery sil	2 co pr	firm	c p	gradual wavy
C1	36-64	5YR 3/3	very channery sil	0 m	friable	c d	gradual wavy
C2	64-81	5YR 3/3	extremely flaggy sil	0 m	friable	c d	
R	81+						

"x" indicates fragipan (or hard pan)

BMP Manual states test pit should be 72 to 90 inches deep

Redox features or mottling

Notes: C1 horizon – seeps/saturation at 44"; Groundwater pooled to 78":

COARSE FRAGMENTS (% of Vol.)
15-35% 35-65% >65%
gravelly very gravelly extr. gravelly
channery very channery extr.channery
cobbly very cobbly

TEXTURE
cos - coarse sand
s - sand
fs - fine sand
vfs - very fine sand
lcos - loamy coarse sand
ls - loamy sand
lfs - loamy fine sand
lvfs - loamy very fine sand

STRUCTURE
Grade
Structureless - 0
Weak - *1*
Moderate - *2*
Strong - *3*
Type
pl - platy
pr - prismatic

REDOX FEATURES
Abundance
f - Few <2%
c - Common 2-20%
m - Many >20%
Contrast
f - Faint
d - Distinct
p - Prominent

Sample Measured Infiltration Test

Depth of Hole (inches): 7
Initial Depth of Water (inches): 6

Test: 1A

Reading #	Time Interval (min)	Drop (inches)
1	30	0.01
2	30	0.01
3	30	0.01
4	30	0.01
5	30	0.01
6	30	0.01
7		
8		

Final Drop (inches): 0.01
Final Time Interval (min): 30
Soil Test Rate (in/hr): 0.02

Test: 1B

Reading #	Time Interval (min)	Drop (inches)
1	30	0
2	30	0
3	30	0
4	30	0
5	30	0
6	30	0
7		
8		

Final Drop (inches): 0
Final Time Interval (min): 30
Soil Test Rate (in/hr): 0.00

Not recommended for infiltration BMPs

Average Soil Test Rate (in/hr): 0.01 in/hr

N.O.I. Checklist (continued)

Required WS 1 through 5 for each Point of Interest

For certain sites Peak Rate Control may not be needed by DEP, but TWP may still require

Preventive BMPs and Vegetated BMPs - Show on Plan and Justify

Required for CG1

Demonstrates Pollutant Loading to each P.O.I.

Demonstrates Pollutant Reduction by BMP

	b. Additional Worksheets **Note: Required Worksheets 1 through 5 are attached after Appendix B. Complete the following worksheets as applicable.**				
	i. Worksheet 6 – Small Site/Small Impervious Area Exception for peak rate Mitigation Calculations ***(If worksheet 6 is not applicable, rate control is required)***	Location **N**	Page _____	☐	☐
	ii. Worksheet 10 – Water Quality Compliance for Nitrate ***(Required if using CG 1)***	Location **N**	Page _____	☐	☐
	iii. Worksheet 11 – BMPs for Pollution Prevention ***(Required if not using CG1 or if applicant is not meeting Nitrate requirements)***	Location **N**	Page _____	☐	☐
	iv. Worksheet 12 – Water Quality Analysis of Pollutant Loading from all Disturbed Areas ***(Required if not using CG1 or if applicant is not meeting Nitrate requirements)***	Location **N**	Page _____	☐	☐
	v. Worksheet 13 – Pollutant Reduction Through BMP Applications ***(Required if not using CG 1 or if applicant is not meeting Nitrate requirements)***	Location **N**	Page _____	☐	☐

Worksheet 3

To receive non-structural volume credit, there are checklists to be followed in Ch. 8

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) _____ Ac.

1.2 Area of Riparian Forest Buffer Protection _____ Ac.

3.1 Area of Minimum Disturbance/Reduced Grading _____ Ac

TOTAL _____ Ac

Site Area	Minus	Protected Area	=	Stormwater Management Area
	-		=	

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn _____ ft^2 x 1/4" x 1/12 = _____ ft^3

Meadow _____ ft^2 x 1/3" x 1/12 = _____ ft^3

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area:

Tree Canopy _____ ft^2 x 1/2" x 1/12 = _____ ft^3

5.1 Disconnect Roof Leaders to Vegetated Areas

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area _____ ft^2 x 1/3" x 1/12 = _____ ft^3

For all other disconnected roof areas

Roof Area _____ ft^2 x 1/4" x 1/12 = _____ ft^3

5.2 Disconnect Non-Roof impervious to Vegetated Areas

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area _____ ft^2 x 1/3" x 1/12 = _____ ft^3

For all other disconnected roof areas

Impervious Area _____ ft^2 x 1/4" x 1/12 = _____ ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* _____ ft

**For use on Worksheet 5*

Worksheet 5

Worksheet 5. Structural BMP Volume Credits

PROJECT: _____

SUB-BASIN: _____

Required Control Volume (ft^3) – *from Worksheet 4*: _____

Non-structural Volume Credit (ft^3) – *from Worksheet 3*: - _____

Structural Volume Reqmt (ft^3) _____

(Required Control Volume minus Non-structural Credit)

Volume from Infiltration, Re-use, or Evapotranspiration

	Proposed BMP	Area (ft^2)	Storage Volume (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other			

Total Structural Volume (ft^3): _____

Structural Volume Requirement (ft^3): _____

DIFFERENCE _____

N.O.I. Section C.2 Table

Complete for each point of interest

2. **SUMMARY TABLE FOR SUPPORTING CALCULATION AND MEASUREMENT DATA** **Please reference the Stormwater Methodology used (i.e. SCS Method) _____**			
	Pre-construction	**Post Construction**	**Net Change**
Design storm frequency _____ Rainfall amount _____ inches			
Impervious area (acres)	1	2	3
Volume of stormwater runoff ☐ acre-feet or ☐ cubic feet without planned stormwater BMPs (check appropriate box)	4	5	6
Volume of stormwater runoff ☐ acre-feet or ☐ cubic feet with planned stormwater BMPs (check appropriate box)		7	8
Stormwater peak discharge rate for the design frequency storm (cubic feet per second)	9	10	11

This should be consistent with the Worksheets

N.O.I. Section C.3 Table

Complete for each point of interest

This should be consistent with the Worksheets

3. **SUMMARY DESCRIPTION OF POST CONSTRUCTION STORMWATER BMPs (consistent with Worksheets 3 and 5 referenced in the Pa. Stormwater BMP Manual)**

Key: **RC = Rate Control** **VC = Volume Control** **WQ = Water Quality**

In the lists below, check the BMPs identified in the PCSM Plan, and their function(s) using the above Key. More than one function may be checked for a BMP. List the stormwater volume and area of runoff to be treated by each BMP type. If any BMP in the PCSM Plan is not listed below, describe it in the space provided after "Other".

BMP	Function(s)	Volume of stormwater treated	Acres treated
☐ Wet ponds	☐ VC ☐ RC ☐ WQ		
☐ Constructed wetlands	☐ VC ☐ RC ☐ WQ		
☐ Retention basins	☐ VC ☐ RC ☐ WQ		
☐ Detention basin	☐ VC ☐ RC ☐ WQ		
☐ Underground detention	☐ VC ☐ RC ☐ WQ		
☐ Dry Extended detention basin	☐ VC ☐ RC ☐ WQ		
☐ Sediment fore bay	☐ VC ☐ RC ☐ WQ		
☐ Infiltration trench	☐ VC ☐ RC ☐ WQ		
☐ Infiltration Berm/Retentive Grading	☐ VC ☐ RC ☐ WQ		
☐ Subsurface Infiltration bed	☐ VC ☐ RC ☐ WQ		
☐ Infiltration basin	☐ VC ☐ RC ☐ WQ		
☐ Pervious pavement	☐ VC ☐ RC ☐ WQ		
☐ Dry well/Seepage pit	☐ VC ☐ RC ☐ WQ		
☐ Bio-infiltration areas	☐ VC ☐ RC ☐ WQ		
☐ Rain gardens/Bio-retention	☐ VC ☐ RC ☐ WQ		
☐ Vegetated swales	☐ VC ☐ RC ☐ WQ		
☐ Constructed filters	☐ VC ☐ RC ☐ WQ		
☐ Protect Sensitive & Special Value Features	☐ VC ☐ RC ☐ WQ		
☐ Protect/Conserve/Enhance Riparian areas	☐ VC ☐ RC ☐ WQ		
☐ Restoration: Buffers/ Landscape/Floodplain	☐ VC ☐ RC ☐ WQ		
☐ Disconnection from storm sewers	☐ VC ☐ RC ☐ WQ		
☐ Rooftop disconnection	☐ VC ☐ RC ☐ WQ		
☐ Vegetated roofs	☐ VC ☐ RC ☐ WQ		
☐ Runoff capture/Reuse	☐ VC ☐ RC ☐ WQ		
☐ Oil/grit separators	☐ WQ		
☐ Water quality inserts/inlets	☐ WQ		
☐ Street sweeping	☐ WQ		
☐ Other _____	☐ VC ☐ RC ☐ WQ		
☐ Other	☐ VC ☐ RC ☐ WQ		

Overall Information Chart for BMPs

Measured Infiltration Rate

Limiting Zone Elevation

Total Drainage Area to BMP

Volume to be Infiltrated or Removed

		Infiltration Information					Drainage Information					BMP Information				
Proposed Infiltration BMP(s) (site specific)		Measured Infiltration Rate *in./hr.*	Factor of Safety *2 min.*	Design Infiltration Rate *in./hr.*	Dewatering Time* *hrs.*	Elevation Soils, Water Table, Rock**	Total Drainage Area to BMP *sq. ft*	Total Impervious Drainage Area to BMP *sq. ft.*	Infiltration BMP Surface Area *sq. ft.*	Total Drainage Area Loading Ratio *8:1 Max*	Impervious Area Loading Ratio *5:1 Max*	Infil. Elevation Top of Bed/ Basin***	Infil. Elevation Bottom of Bed/ Basin***	Elevation Infiltration Test****	Elevation E & S Sediment Basin Bottom (if applies)	Volume to be Infiltrated or Permanently removed***** *cf*
BMP 6.4.1	**Pervious Pvmnt w. Infilt. Bed**															
BMP 6.4.2	**Infiltration Basin**															
BMP 6.4.3	**Subsurface Infiltration Bed**															
BMP 6.4.4	**Infiltration Trench**															
BMP 6.4.5	**Rain Garden/Bioretention**															
BMP 6.4.6	**Dry Well / Seepage Pit**															
BMP 6.4.7	**Constructed Filter**															
BMP 6.4.8	**Vegetated Swale**															
BMP 6.4.9	**Vegetated Filter Strip**															
BMP 6.4.10	**Infilt. Berm & Ret. Grading**															

N.O.I. Checklist (continued)

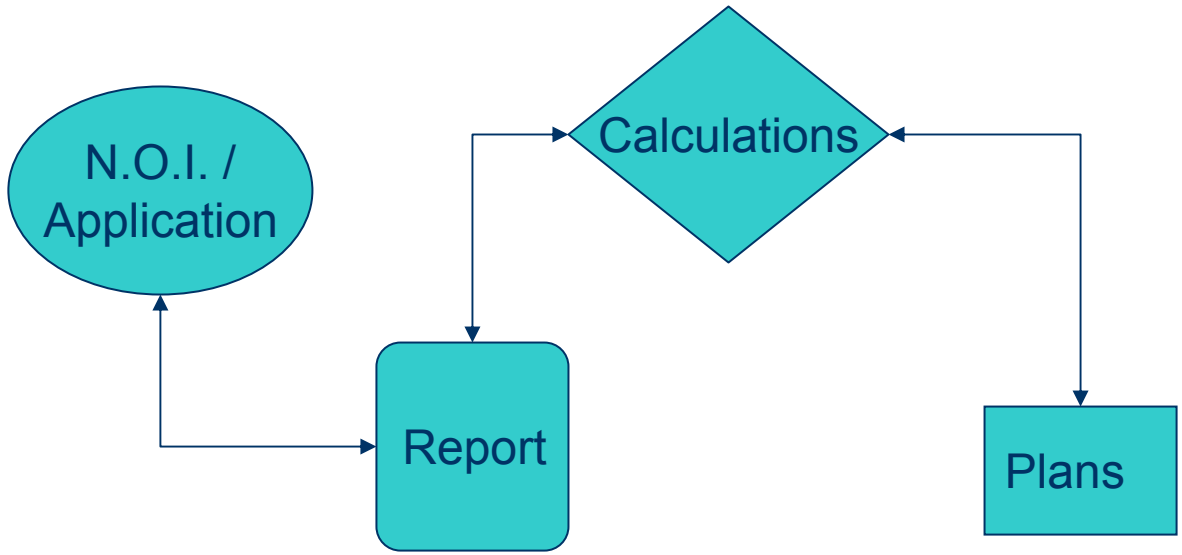
	c. Plans/Drawings *(Must be a stand alone separate plan from the E&S Plan and labeled "PCSM" or Post-Construction Stormwater Management"" and be the final plan for construction)*	Location **D**	Page _____	☐	☐
	i. Construction Details for permanent stormwater BMPs including permanent stabilization	Location **D**	Page _____	☐	☐
	ii. Location of BMPs showing final contours are identified	Location **D**	Page _____	☐	☐
	iii. Location of soil types are identified (including hydric soils)	Location **D**	Page _____	☐	☐
	iv. Location and depths of test pits / infiltration testing sites are identified	Location **D**	Page _____	☐	☐
	d. Ownership, Operations, and Maintenance Procedures *(Must be included on drawings)*	Location **D**	Page _____	☐	☐
	i. Applicant or entity (association, company, agency, etc.) listed as responsible party	Location **D**	Page _____	☐	☐

See Next Slide

PCSM Plan

- Use Grading and Utility Plan as Base Plan
  - Include One Overall PCSM Plan Drawing
  - Include Additional Drawing Sheets at Larger Scale to reflect more information
- Regulated Substances – based on historic land uses/site characterization
  - Location, Depth, Concentration, Regulated Threshold of Substance
- Soil Survey Mapping and Data (to be used as planning tool only)
- Soil Permeability Tests – across the site considering the soil survey
  - Location, Depth, and Measured Rate
- Stormwater Runoff BMPs (located and labeled)
  - Infiltration
  - Capture and Re-use
  - Evapotranspiration w/ PA Native Vegetation (see http://www.plants.usda.gov/)
- Drainage Areas to BMPs (summary of pervious and impervious areas)
- BMP Details for maintenance and replacement
- Operation and Maintenance
  - Responsible Entity, Inspection Schedule, Sequence for Replacement

As always, consistency matters…



PCSM Checklist Program

- Any questions?

Infiltration BMP
with PA Native Vegetation

Vegetated Roof