How PSU Master Watershed Stewards Can Help Municipalities & EAC's Inventory, Assess & Fix Their Stormwater BMPs

(Literally, BMP means "best management practice", but in stormwater context, means a discrete stormwater control or structure, like a detention basin)

Ross Snook, MWS Co-Lead (Jackie O'Neil, presenter on his behalf)

- BS Earth Science, PSU
- Master Watershed Steward – Montgomery County, PA
- Environmental Advisory Board (EAB) Chair, New Hanover Township
- Township Supervisor, New Hanover Township

This project was made possible by 2020 & 2021 PSU Science to Practice (S2P) Grants:

Stormwater Best Management Practices (BMP) Inventory & Mapping
- Pennsylvania -

Purpose:

- Create first-ever comprehensive inventory, performance rating and online GIS map of stormwater BMP controls in Pennsylvania
- Provide essential stormwater BMP education and tools for municipalities and other entities to enhance stormwater management, planning & study

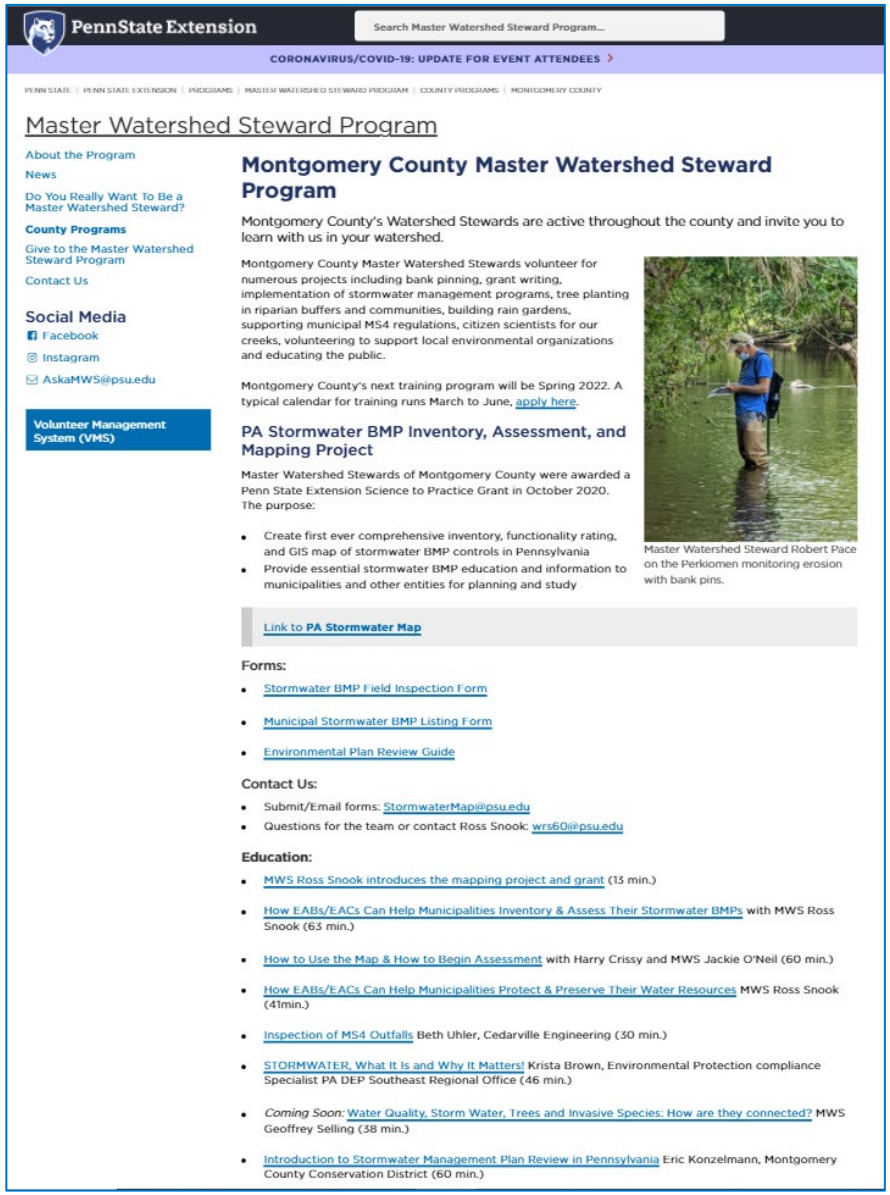
Awarded to:

- **Dr. Cibin Raj (Faculty Co-Leader):**
  PhD. PSU, expertise: stormwater watershed modeling
- **Sascha Meinrath, (Project Oversight):**
  MA Social-Ecological Psychology, Palmer Chair in Telecommunications PSU
- **Harry Crissy, (GIS database, Mapping and Website):**
  MS, MS PSU Extension, LEED accredited
- **William (Ross) Snook (Co-Leader):**
  BS Earth Science PSU, Master Watershed Steward – Montgomery County

We created a 7-step process to help municipalities and others better manage stormwater (SW) in PA

1. Prepare (educate and download standard “guiding” forms)
2. Start an inventory of SW BMP controls in your municipality
3. Locate and measure each SW BMP control
4. Inspect maintenance conditions of each SW BMP
5. Assess the performance of each SW BMP to manage stormwater
6. Fill out & submit your listing of all municipal SW BMPs to the PA map
7. Use your data to determine basin retrofits, fix maintenance issues…

1 Prepare for the stormwater management BMP inventory, assessment & mapping in your town



PennState Extension

Search Master Watershed Steward Program...

CORONAVIRUS/COVID-19: UPDATE FOR EVENT ATTENDEES

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Volunteer Management System (VMS)

Montgomery County Master Watershed Steward Program

Montgomery County's Watershed Stewards are active throughout the county and invite you to learn with us in your watershed.

Montgomery County Master Watershed Stewards volunteer for numerous projects including bank pinning, grant writing, implementation of stormwater management programs, tree planting in riparian buffers and communities, building rain gardens, supporting municipal MS4 regulations, citizen scientists for our creeks, volunteering to support local environmental organizations and educating the public.

Montgomery County's next training program will be Spring 2022. A typical calendar for training runs March to June, apply here.

Master Watershed Steward Robert Pace on the Perkiomen monitoring erosion with bank pins.

PA Stormwater BMP Inventory, Assessment, and Mapping Project

Master Watershed Stewards of Montgomery County were awarded a Penn State Extension Science to Practice Grant in October 2020. The purpose:

- Create first ever comprehensive inventory, functionality rating, and GIS map of stormwater BMP controls in Pennsylvania
- Provide essential stormwater BMP education and information to municipalities and other entities for planning and study

Link to **PA Stormwater Map**

Forms:

- Stormwater BMP Field Inspection Form
- Municipal Stormwater BMP Listing Form
- Environmental Plan Review Guide

Contact Us:

- Submit/Email forms: StormwaterMap@psu.edu
- Questions for the team or contact Ross Snook: wrs60@psu.edu

Education:

- MWS Ross Snook introduces the mapping project and grant (13 min.)
- How EABs/EACs Can Help Municipalities Inventory & Assess Their Stormwater BMPs with MWS Ross Snook (63 min.)
- How to Use the Map & How to Begin Assessment with Harry Crissy and MWS Jackie O'Neil (60 min.)
- How EABs/EACs Can Help Municipalities Protect & Preserve Their Water Resources MWS Ross Snook (41min.)
- Inspection of MS4 Outfalls Beth Uhler, Cedarville Engineering (30 min.)
- STORMWATER, What It Is and Why It Matters! Krista Brown, Environmental Protection compliance Specialist PA DEP Southeast Regional Office (46 min.)
- *Coming Soon:* Water Quality, Storm Water, Trees and Invasive Species: How are they connected? MWS Geoffrey Selling (38 min.)
- Introduction to Stormwater Management Plan Review in Pennsylvania Eric Konzelmann, Montgomery County Conservation District (60 min.)

[>Montco Penn Extension Stormwater BMP Education & Mapping]

A. Become informed

- Watch educational videos

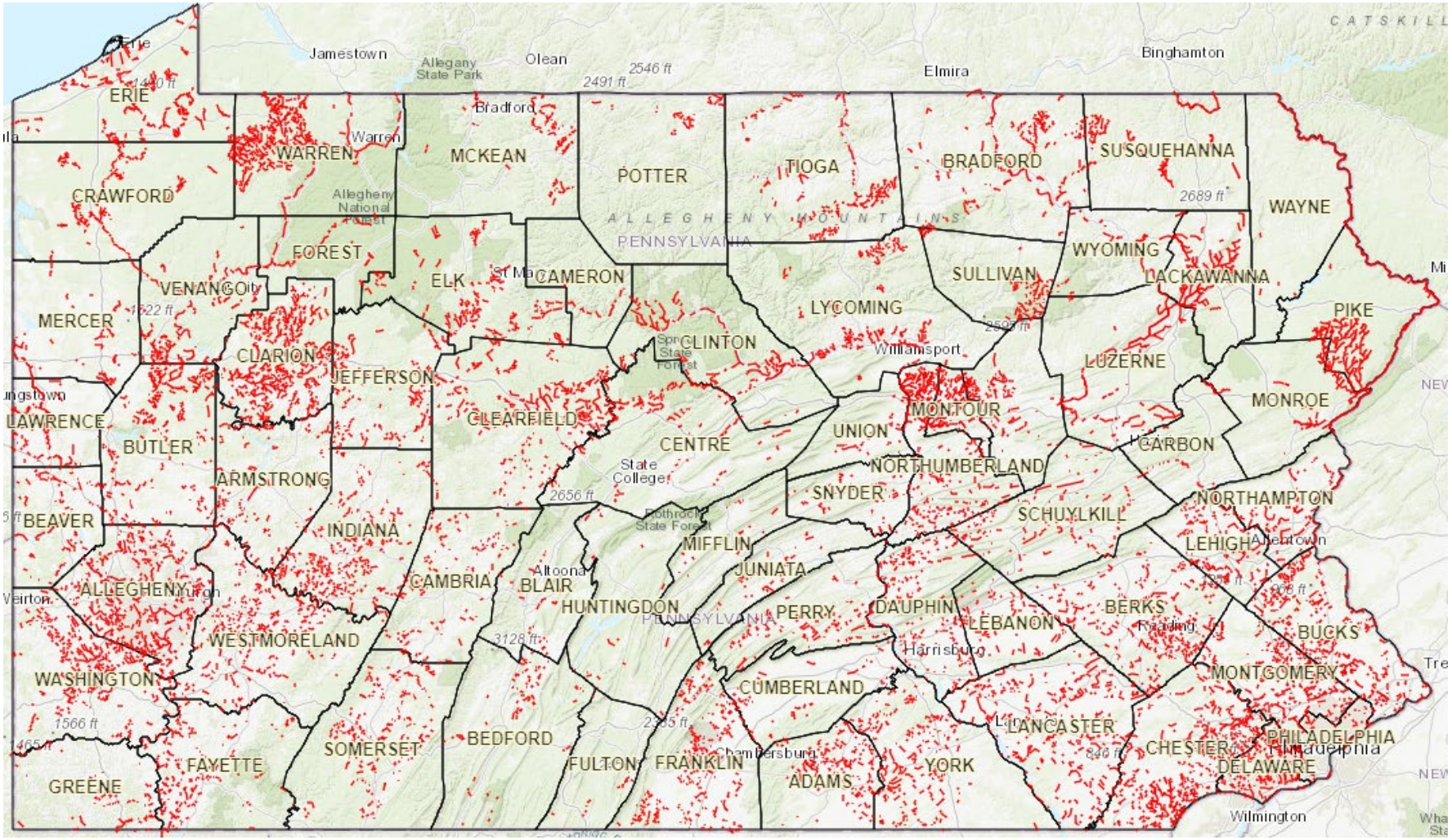
B. Download standard guiding forms

- *Stormwater BMP Control Field inspection form*
- *Municipal Stormwater BMP inventory & assessment list*

Let's walk through some key educational points…

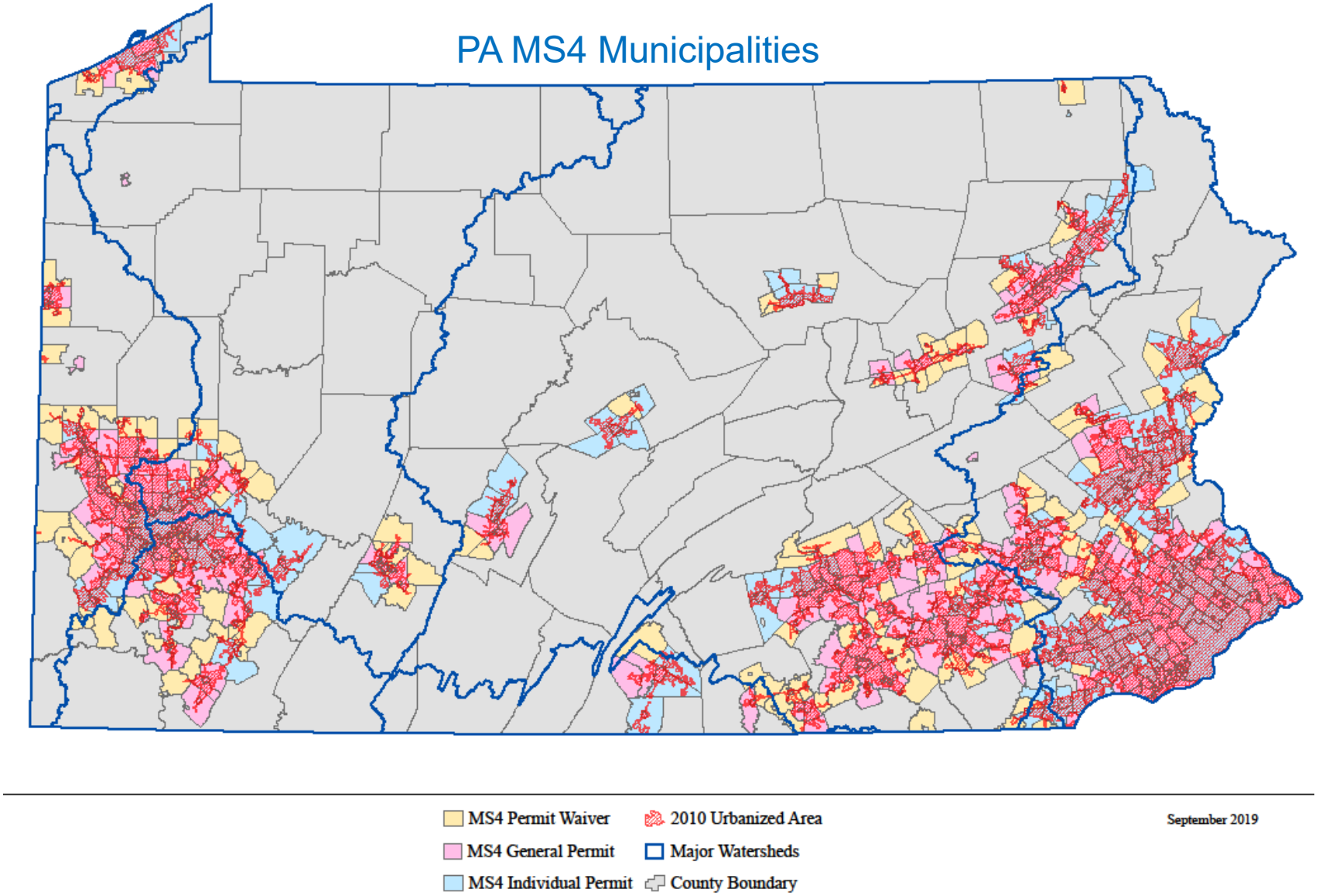
Most of PA's 83,000 stream miles are impaired

by agriculture, mining, development, point source pollution, etc.



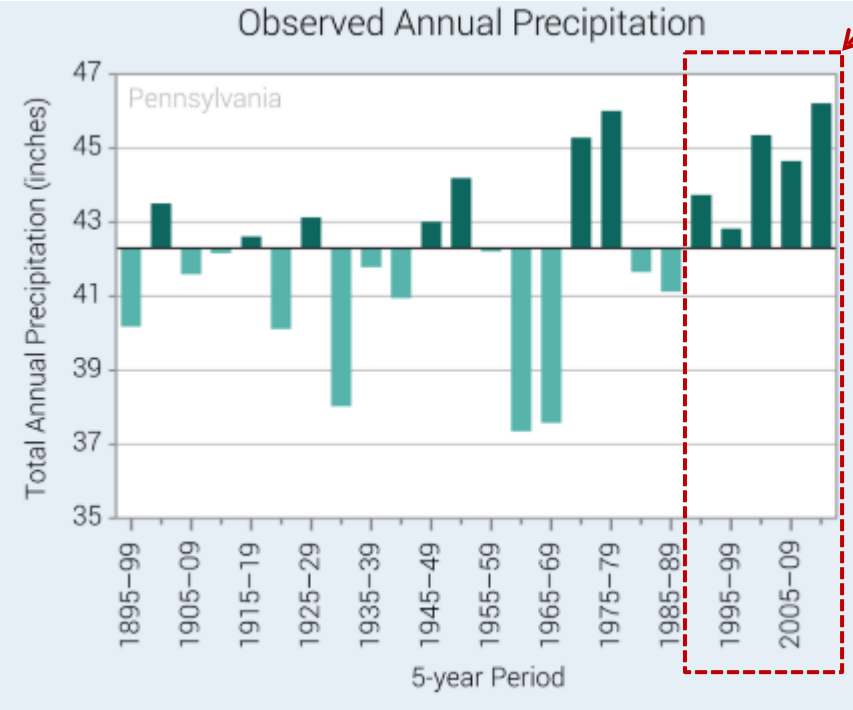
[Pennsylvania Stream Impairment (arcgis.com)]

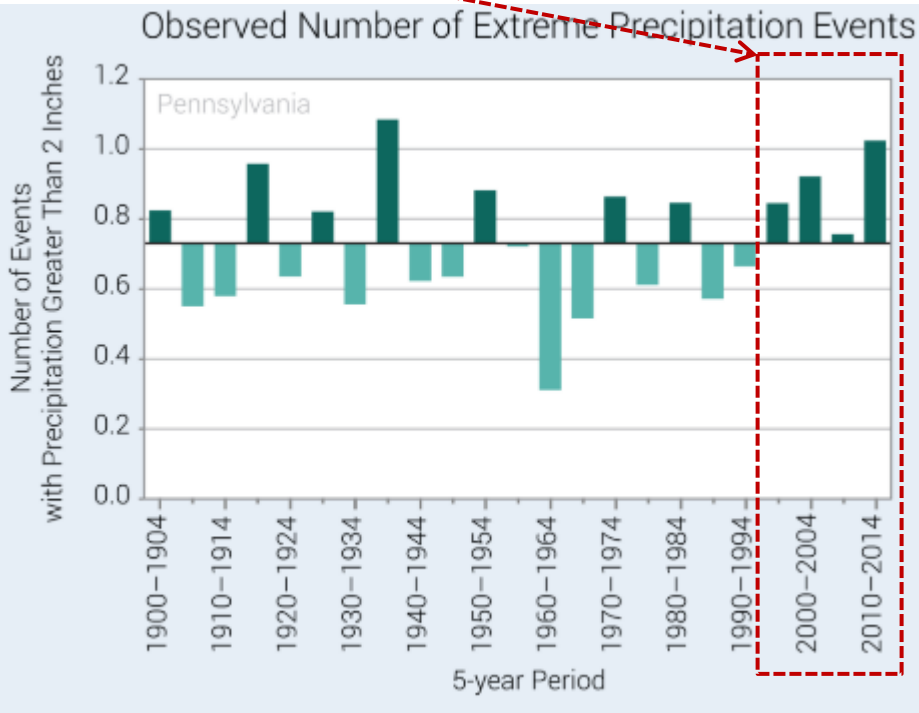
Only streams within PA MS4 municipalities are monitored by DEP, leaving most up to municipalities



Stormwater is any type of precipitation generated during a storm event—it continues to rise in PA

Significant increases, without downturns, since 1995





[>NCIS PA State Summary Precipitation]

Stormwater runoff greatly impacts our water as it erodes soil and carries pollutants to our streams

PA's #1 water pollutant is silt!

Photos: Lower Frederick Township, Montgomery County, PA

How can we also handle increasing runoff from sump pump discharge?

Photos: New Hanover Township, Montgomery County, PA

1. Include sump pump discharge in stormwater calculations
2. Restrict building below the Seasonal High-Water Table (SHWT)

New developments are required to control same stormwater runoff as site did before development

Photo: New Hanover Township, Montgomery County, PA

How can this be accomplished?

Nature controls stormwater best!

Happily, new PA Stormwater BMPs emphasizes natural BMPs over structural

"Sodden" by Nicholas_T CC BY 2.0

"Woodland" by WayShare CC BY-ND 2.0

…But most existing SW BMPs are structural

Structural stormwater BMP controls are built to manage runoff–details are in >PA DEP Stormwater Manual (2006)

Chapter 6 Structural BMPs

A new **Managed Release Concept** (MRC) is being added

This project focuses on the key volume-control basin BMPs, underlined in red

6.4.2 Retention/Infiltration Basins retain runoff then slowly infiltrate & evaporate it over 4 days

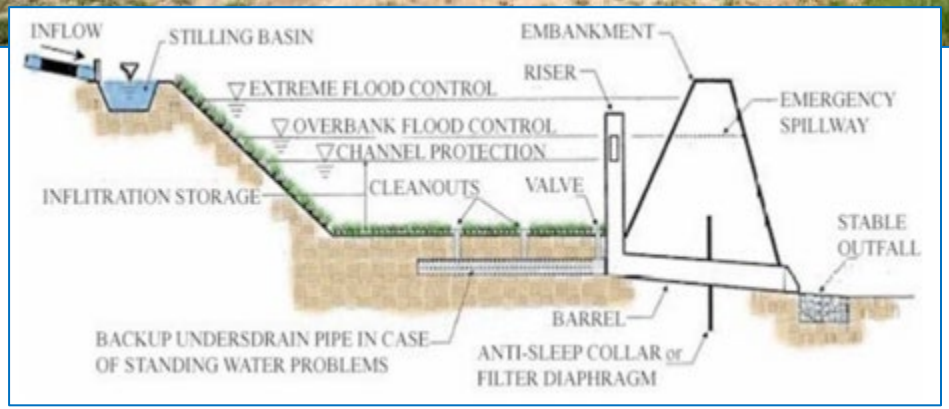
-Retains water after precipitation events—no outlet structure

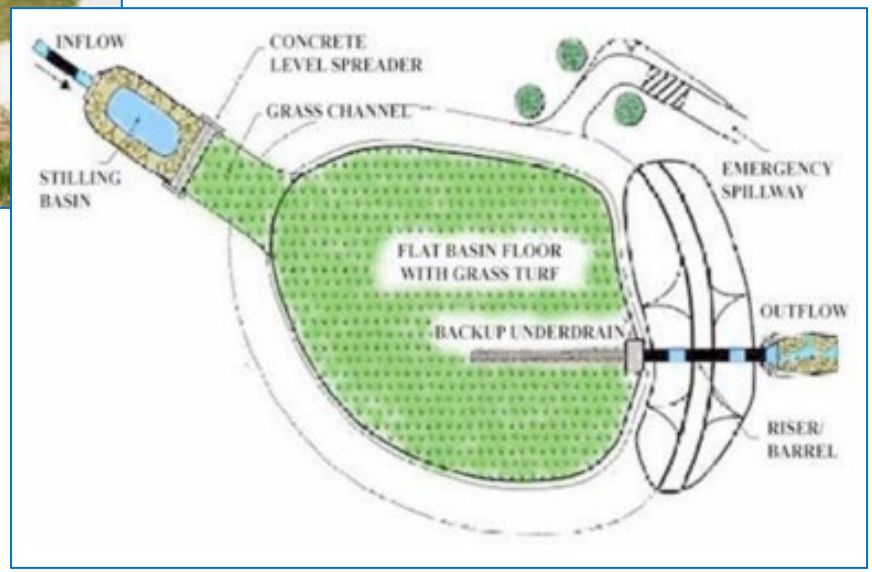
-Shallow areas designed to temporarily hold & infiltrate 1.5” storm runoff

-An engineered overflow structure should be provided for larger storms

-Has a spillway (reinforced notch at top of berm) to direct excess

-Occasionally has stilling basin to reduce velocity and sediment





6.4.4 Rain Gardens pool runoff, then slowly filter, infiltrate & evaporate it using native vegetation

-Normally used for smaller runoff volumes, like roof & sump pump runoff, but can be used effectively in series with other BMPs

-Excavated shallow surface depression filled with infiltrating planting soil

-Planted with deep-rooted native vegetation to capture & treat runoff

-Also provides wildlife & pollinator habitat and aesthetic value

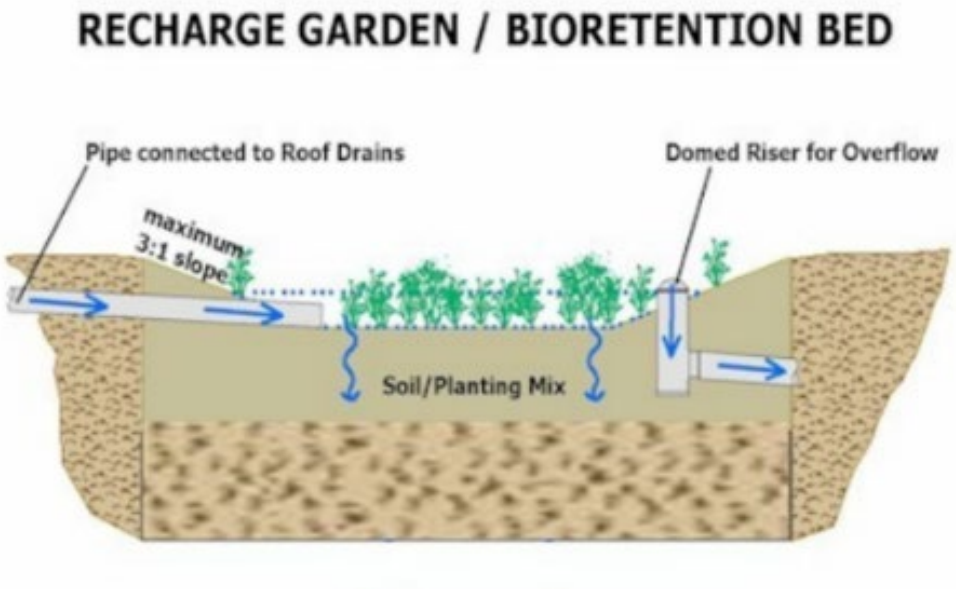


Photo: Borough of Ambler Rain Garden

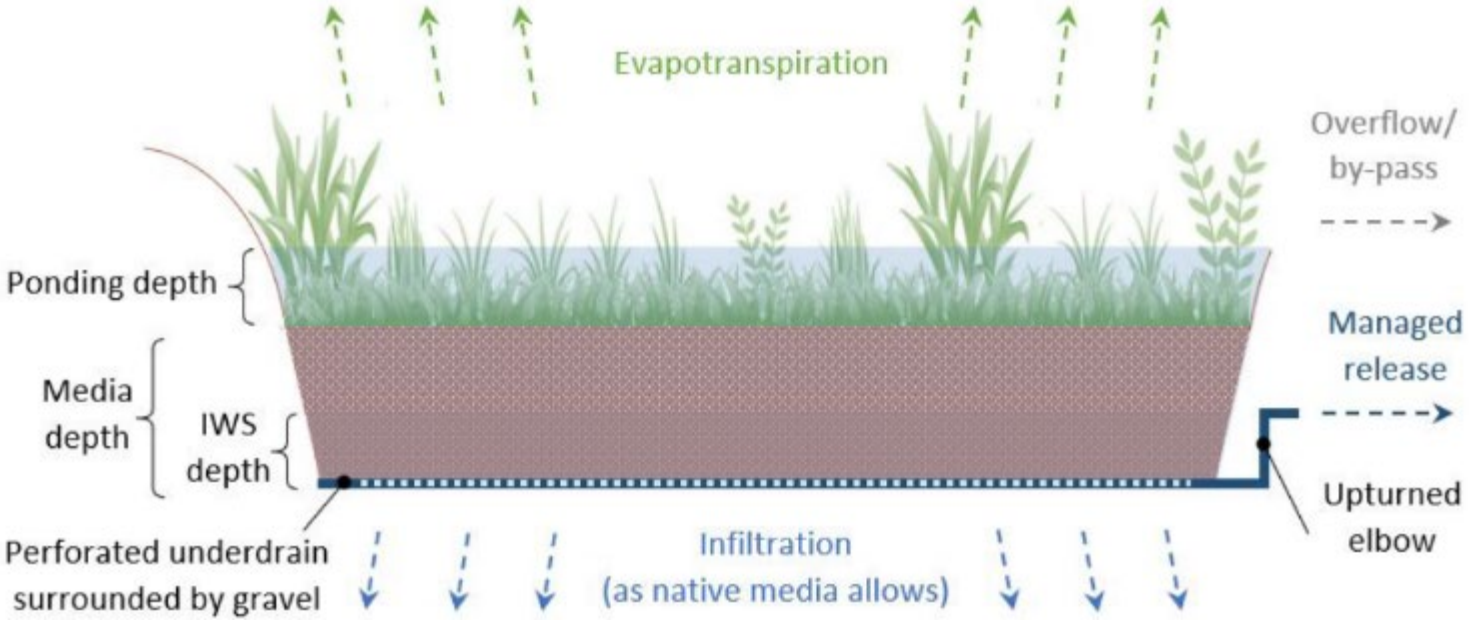
Managed Release Concept (MRC) Basins simulate infiltration

-Normally used where infiltration is unfeasible, so infiltration is simulated

-Runoff from 1.2” rainfall is impounded in vegetation, filtered, then slowly released to an underdrain, covered with amended soils

-Additional runoff is stored above, in a vegetated pond, where some is evaporated and some is slowly infiltrated

-Occasionally coupled with a detention basin for volume control



6.6.2 Wet Ponds retain water in a permanent pool with additional vegetated capacity above the pool

-Normally used in areas with naturally high groundwater table

-Almost always has a permanent pool with a forebay for water quality

-Most have an overflow structure to limit water levels in addition to a reinforced spillway to direct excess

-Sometimes includes aeration to limit algae growth & cool the water

Older Dry Detention Basins were the primary BMP since 1970, designed to handle 100-year storms

- ***Detains 100-yr runoff***, to attenuate runoff peaks and slowly releases water through an outflow sized to drain over 1-3 days
- Has overflow to limit water level & reinforced spillway to direct excess
- Has screen mesh on outflows & overflows to filter debris from discharge
- ***Allows smaller storm runoff to pass-through***

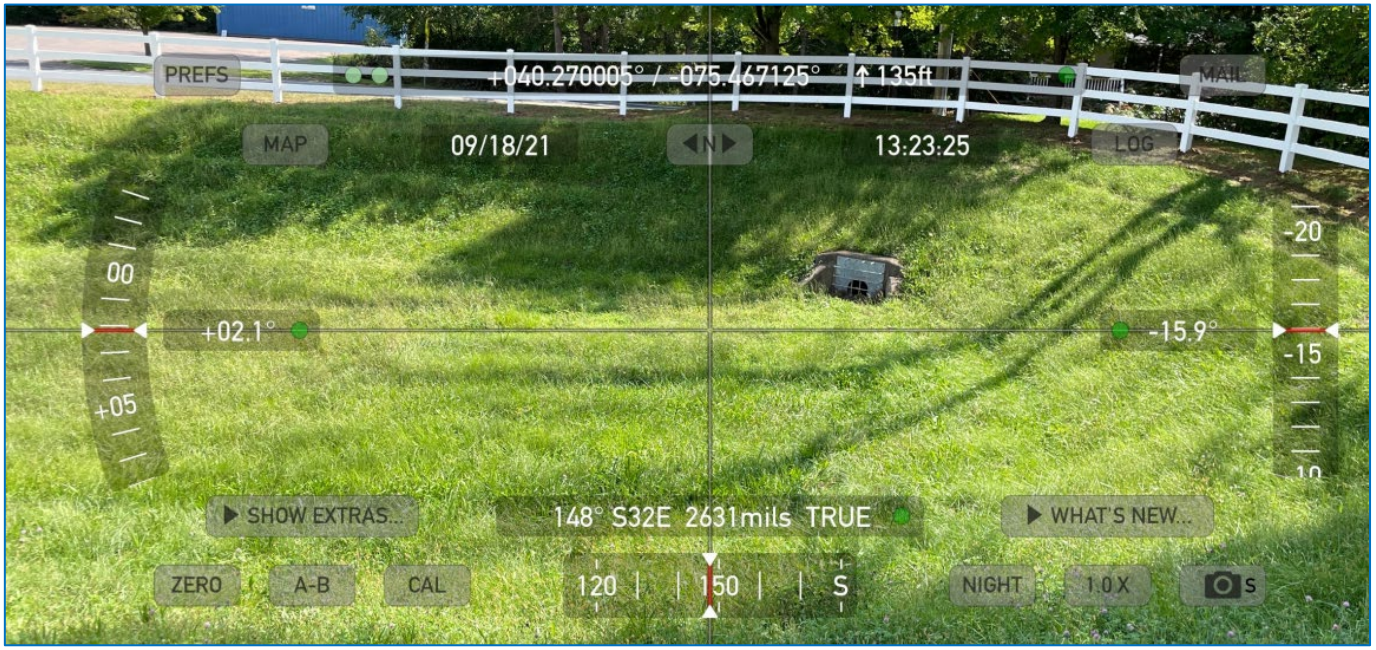


Photo: Lower Frederick Township, Montgomery County, PA

6.6.3 *Extended* Dry Detention Basins attenuate runoff from 1-100yr storms & enhance water quality

Like older detention basins, but extended to:

- ***Detain 1 to 100-year storm runoff*** (But orifice sizes are often too large)
- Usually has naturalized/vegetated basin to enhance water quality

Photo: New Hanover Township, Montgomery County, PA

2 Start an inventory of SW BMP controls collected from your municipal manager & engineer

A. Ask your municipal manager or engineer for any lists they have used to track and inspect BMPs

B. Get lists of BMPs maintained by your municipal maintenance department

C. Use google satellite maps to scan for probable BMPs

D. If you are a MS4 municipality, start with stormwater BMPs reported in your annual MS4 status report (PCSM BMP Inventory) to the DEP

3800-FM-BCW0491 9/2017
Annual MS4 Status Report

PCSM BMP INVENTORY

Table 1. To complete the information needed for MCM #5, BMP #3, list all existing structural BMPs that discharge stormwater to the permittee's MS4 that were installed to satisfy PCSM requirements for earth disturbance activities under Chapter 102, and provide the requested information (see instructions).

BMP No.	BMP Name	DA (ac)	Entity Responsible for O&M	Latitude	Longitude	Date Installed	O&M Requirements	NPDES Permit No.
1	Landmesser Bioretention Basin	11.0	John Landmesser	40°16'36"	75°28'59"	2004	Inspection and removal of sediment or debris	PAG2004603107
2	207 Meng Road Infiltration Bed	1.2	James and Lora Krier	40°15'37"	75°29'23"	2004	Inspections and removal of sediment	PAG2004604206
3	CB Fisher Rain Barrels and Rain Gardens	4.98	BC Fisher Contracting	40°16'58"	75°27'50"	2006	Inspections and removal of sediment or debris	PAG2004606044
	Bechtel Subdivision		Paul and Robin				Inspections and removal	

3 Locate and measure each SW BMP control using the *SW BMP Field Inspection Form*

Stormwater BMP Control - Field Inspection Form (2022 v14) PennState Extension

*Required for all BMPs
**Required for only MS4 BMPs

Field Name	Description	Enter Value
INVENTORY DATA:		
*State Abbreviation	Standard 2-letter State Abbreviation--only PA for now. Required.	
*County Name	County Name, without the word "County". Required--Select 1 from dropdown.	
*Municipality Full Name	Full, legal, unique name of municipality Required--find here: //dced.pa.gov/local-government/municipalstatistics/municipalities	
*BMP #	Unique ID for BMP within municipality. Typically a number; can also be 99.99 or 99.A. Required.	
**Property or Development Name	Name of property or development used by municipality; can be property owner name or place, like a park. Note each property/development can have more than 1 BMP.	
*BMP Category	The major category of structural BMP, listed in chapter 6 of most recent PA DEP SW BMP manual and Other. **DB** = Detention Basin Unnaturalized **DBN** = Detention Basin Naturalized **MRC** = Managed Release Concept Basin **RB** = Retention/Infiltration Basin Unnaturalized **RBN** =Retention/Infiltration Basin Naturalized **RG** = Rain Garden Basin **SS** = Sub Surface **WP**=Wet Pond **O**=Other	
**BMP DEP Type	The type of structural BMP listed in chapter 6 of most recent PA DEP SW BMP manual plus older types and "Other" if not known.	
*BMP Latitude DD	Latitude in decimal format with 6 decimal places (+ or -). Must be in text format with + or – sign. Required. North ex. = +40.283535	
*BMP Longitude DD	Longitude in decimal format w/ 6 decimal places (+ or -).Must be in text format with + or – sign. Required. West ex. = -75.469362	
*In MS4 District?	Select "Y" if BMP is in the municipality's MS4 district. If not, select "N". (Municipal engineer can provide this information.)	
NPDES Permit #	National Pollutant Discharge Elimination Service permit ID, if there is one and can be located, else leave blank.	
Watershed	The local water shed this BMP feeds into. You can find the watershed here: https://mywaterway.epa.gov/	
Year Installed *(yyyy)*	The approximate 4-digit year the BMP was installed.	
Horizontal Orifice Dimensions LxW Inches	If there is an outlet structure: Dimensions LxW of horizontal orifice on structure top in inches.	
	Send to StormwaterMap@PSU.edu with your municipal spreadsheet.	

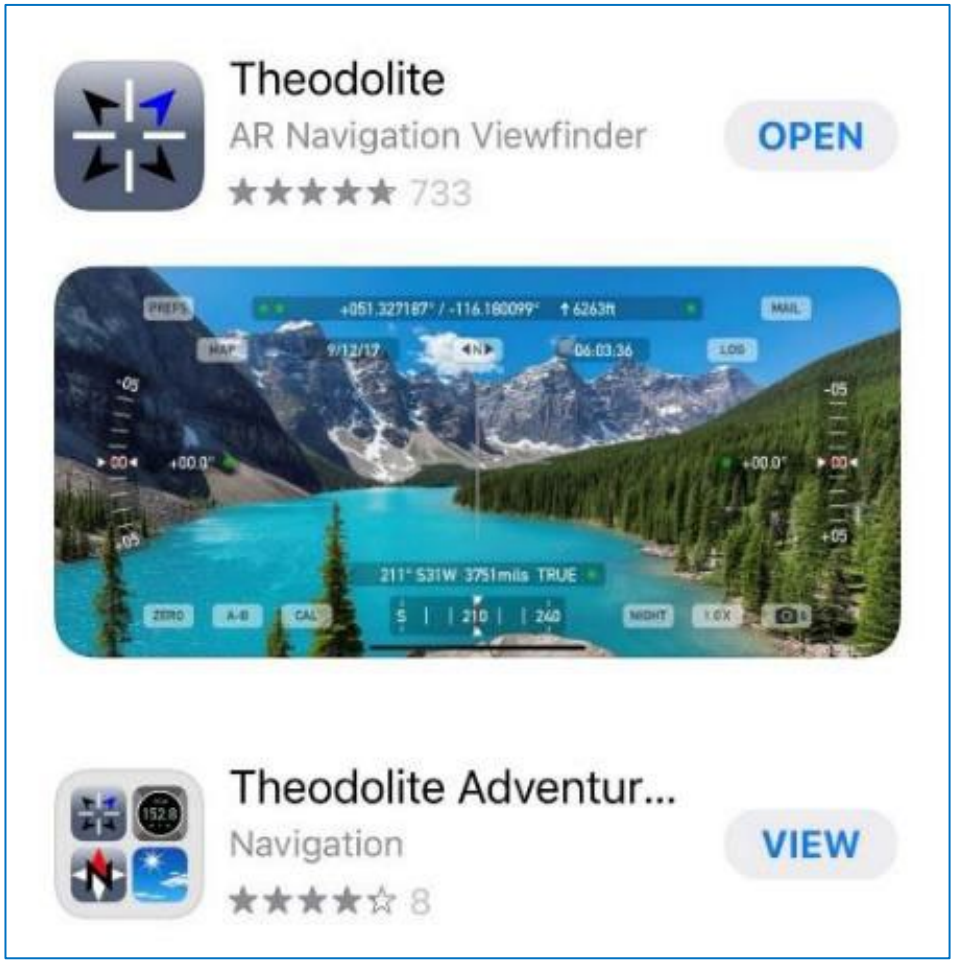
Why?

1. Ensure data is accurate and precise, for instance:
   - Discrete location
   - SW BMP category & type

***Focus on these most impactful, volume-control basin-type stormwater BMPs**

***Focus on core information for a basic inventory (page-1)**

Use an App to find latitude & longitude, and to photograph key BMP features and conditions



-Take pictures in immediate location of basin, to ensure accurate latitude & longitude

Photo: Lower Frederick Township, Montgomery County, PA

4 Inspect conditions of each SW BMP to ensure it is properly maintained

1. Evidence of erosion
2. Stagnant water
3. Inadequate vegetation
4. Accumulated debris/sediment
5. Visible Cracks/damage to pipes or structures
6. Missing or damaged grate on outlet or overflow orifice
7. Spillway not reinforced
8. Clogged orifice
9. Berm failure (collapse, slumped, washed out…)

*Inspection should be done after every significant storm, minimally annually

5 Assess the performance of each SW BMP to manage stormwater as needed

It can take multiple site visits to determine if a SW BMP is performing:

1. Inspect just after significant storm (>1.5” rain) to assess capacity
2. Inspect end of day 1 to ensure water did not drain too quickly
3. Inspect end of day 3 or 4 to ensure basin drains as required

D+ =Detention basin works, empties in 3 days

D- =Detention basin doesn't work

M+ =Managed Release Concept (MRC) works, empties in 3 days

M- =MRC doesn't work, doesn't work

R+ =Retention/Infiltration basin works, empties in 4 days

R- =Retention/Infiltration basin doesn't work

RG+ =Rain garden/bioretention bed works, empties in 4 days

RG- =Rain garden doesn’t work

O =Other type of BMP than above

Blank = Not assessed yet

6 Fill out & submit the list of all municipal SW BMPs to your municipality & PSU SW map team

*Only this inventory data is required to “get on the map”

Municipal Stormwater BMP Control Inventory & Assessment Listing (2022 v14) (As of MM/DD/YYYY)

* = Minimally Required for all BMPs

**= Only Required for MS4 BMPs

INVENTORY DATA:

*State Abbr.	*County Name	*Municipality Name (Full, legal name)	*BMP #	**Property or Development Name	*BMP Major Category: DB =Dentention Basin DBN=Detention Basin Naturalized MRC=Managed Release Concept Basin RB =Retention/Infiltration Basin RBN=Retention/Infiltration Basin Naturalized RG = Rain Garden SS = Sub Surface WP = Wet Pond O =Other	**BMP DEP Type (from PADEP SW Manual Ch. 6 - Structural BMPs--select "Other" if not sure)	*Latitude DD Ex: North = +040.123456	*Long. DD Ex. West = -075.123456	*MS4 ? (y/n)	NPDES Permit # (if applicable)	Watershed	Appx. yyyy Installed
PA												
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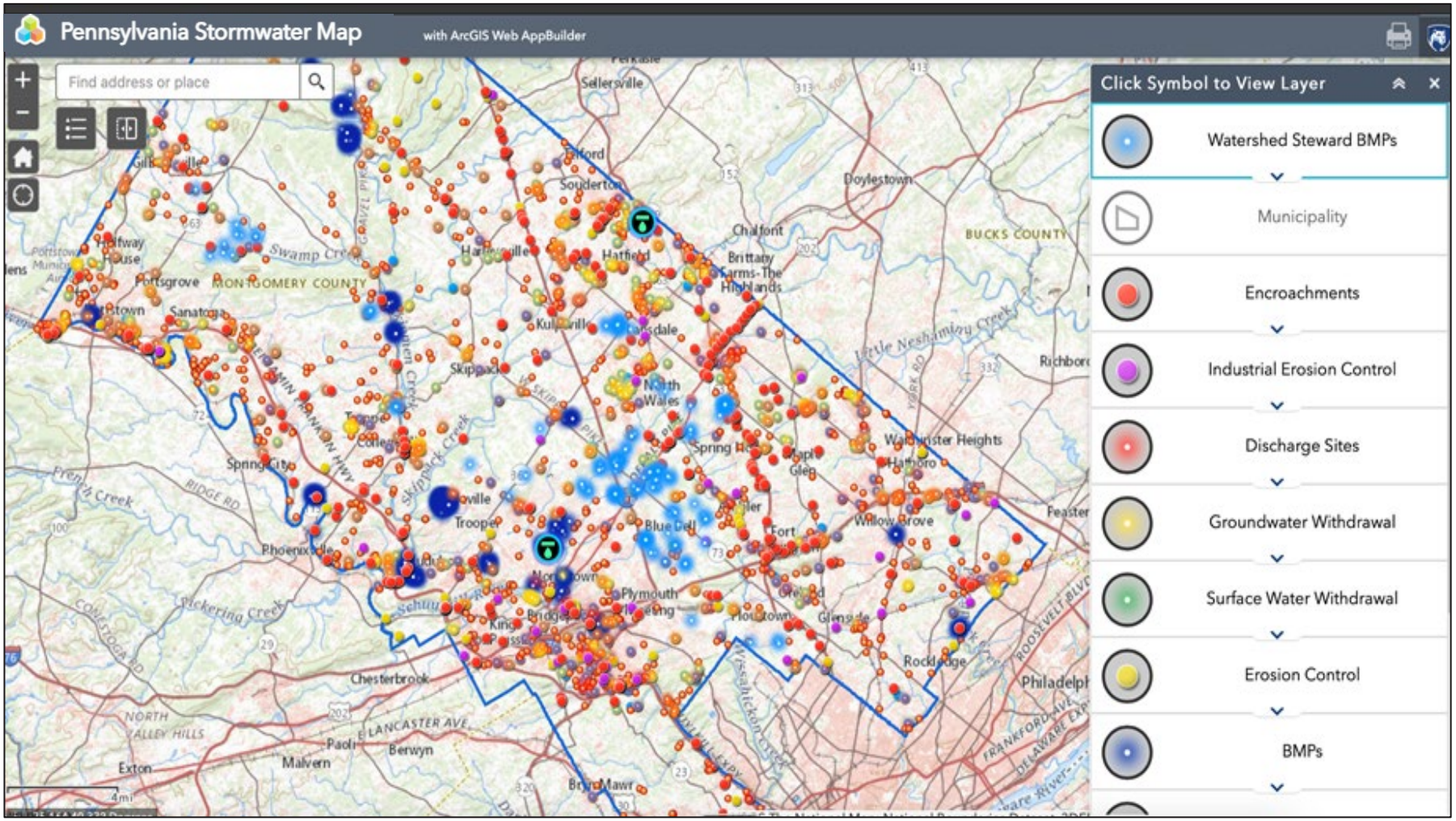
Inventory Data

O & M Data, Key Measurements, Nice-to-Have Measurements

Inspection Data

PSU GIS mapping team will load your info onto the PA Stormwater BMP Map Website:>http://bit.ly/PAStormWaterMap



*Map is work in progress

7a Use your data to determine which basins are potential candidates for retrofits, for example:

Poor-performing older detention basins (rating "D-") with bottom orifice diameter > 1" can be cost-effective candidates for extended detention basins

Source: Photo by PWD Field Team; basin at Foxfield and Pennlyn in Lower Gwynedd Township

Local Guide to retrofitting basins: >PEC_BasinRetrofitGuide.pdf (pecpa.org)

7b Use your data to ensure BMP's are properly maintained, such as these common issues:

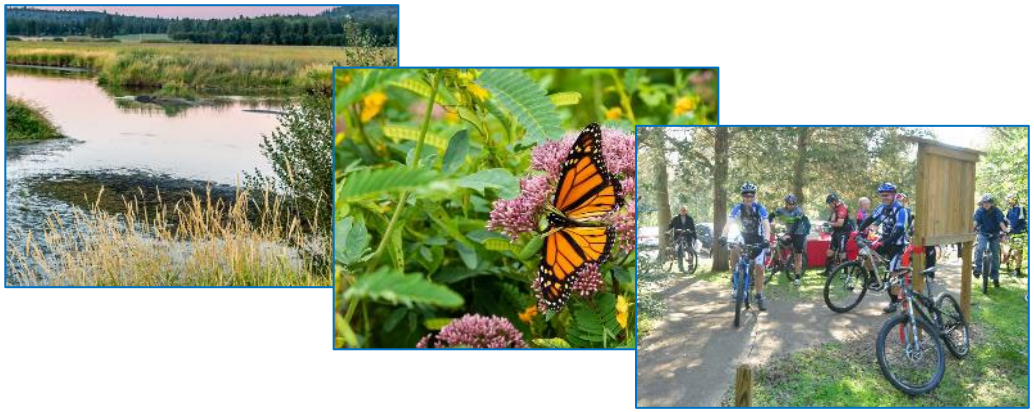
Data: Lower Frederick Township, Montgomery County, PA

Additionally, our EAC has started conducting environmental reviews of new development plans

To protect our *Environmental Resources*

- Clean surface water
- Clean ground water
- Healthy soil
- Open space
- Noninvasive flora
- Noninvasive fauna…

To protect our *Environmental Services*



- Stormwater control
- Water purification
- Food production
- Pollination
- Climate control
- Wildlife habitat
- Recreation…

Framework categorization based on The Natural Capital Project by Gretchen Daily | Photos: licensed under CC BY 2.0

Have questions or want assistance getting started with your municipality's inventory?

William (Ross) Snook

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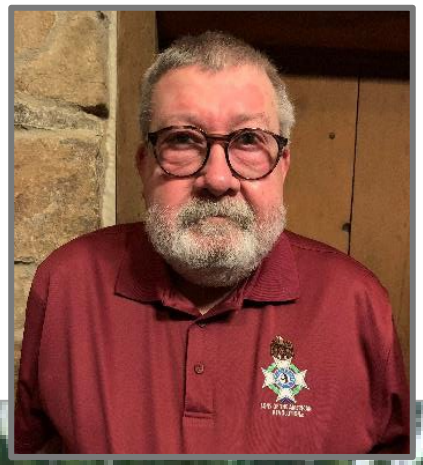

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