MS4 Program Management

TMDL Implementation

Southwest Pennsylvania Commission (SPC)
Community & Recreation Center at Boyce Mayview Park
Upper St. Clair, PA
October 26, 2017

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Land Studies

Agenda

Introduction & Background (9:00-9:15)

Deciphering Issued TMDLs (9:15-9:45)

Developing TMDL Plans (Strategies) (9:45-10:00)

TMDL Plan Implementation and Monitoring (10:00-10:30)

TMDL Plan Updates and Modifications (10:30-10:45)

Innovative Techniques (10:45-11:00)

TMDL Implementation

Introduction & Background

MS4

Municipal

Separate

Storm

Sewer

System

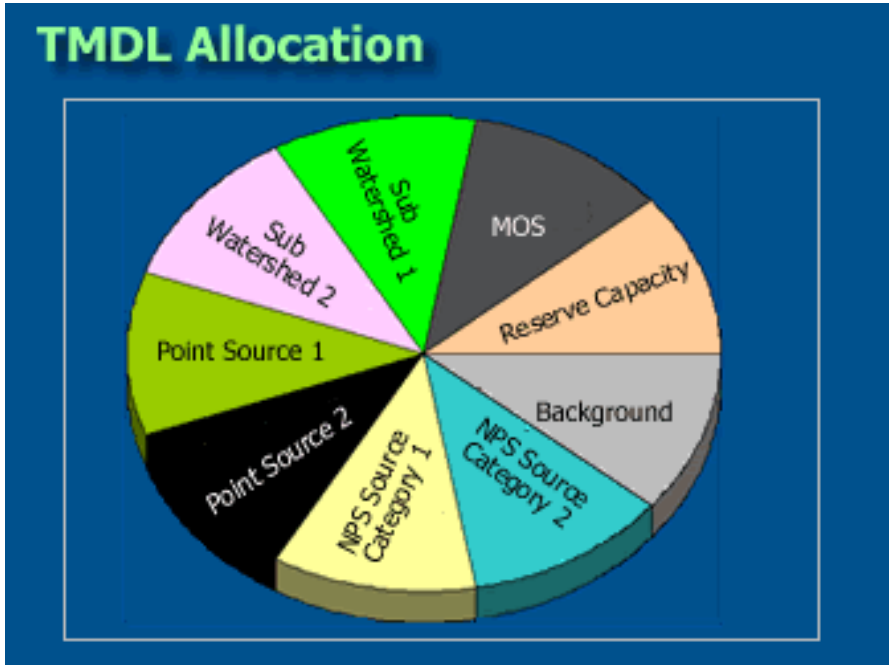
TMDL

Total

Maximum

Daily

Load



Clean Water Act (CWA)

- Primary federal law governing water pollution.

- Primary objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters by
  - Preventing point and nonpoint source pollution sources
  - Providing assistance to publicly-owned treatment works (WWTPs)
  - Maintain the integrity of wetlands

CWA Requirements for Water Quality Standards:

1. Designated Uses
2. Water Quality Criteria
3. Anti-degradation policy

Clean Water Act – It's about the streams

Primary purpose of the CWA:

- Protect the beneficial uses of surface waters (recreational, drinking supply, habitat, etc.)

The primary pollution **control** strategy for point sources is the National Pollutant Discharge Elimination System (NPDES)

NPDES Permit – MS4

Any facility that discharges wastewater directly to surface water must obtain an NPDES Permit (from the USEPA or state) – such as an MS4

Requirements generally found in an MS4 Permit:

- Limitations (mostly narrative) on certain pollutants discharged via the MS4
  - **Why narrative?** Intent was to allow local conditions dictate numeric considerations
- Monitoring Requirements
- Reporting & Recordkeeping
  - "Pollution Prevention Programs"

An open system and discharge concerns need to be defined when considering the waterways use, WQ criteria, and anti-degradation.

The Interface: Outfalls

The point where a conveyance or system of conveyances that disposes stormwater that are owned or operated by a municipality; and is **designed or used for collecting or conveying storm water** to a defined and discernible point from which pollutants are or may be discharged—and that discharges to Waters of the United States—is an ***Outfall.***

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Primary MS4 Permit Requirement

Authorization to Discharge

- "2013 PAG-13" – Limitations on Coverage (part 2.j)
- "2018 PAG-13 (draft)" – Discharges Not Authorized (item 6)

"The discharge is not, or will not, result in compliance with an applicable effluent limitation or water quality standard."

The operator must, at a minimum, develop, implement, and enforce a SWMP designed to reduce the discharge of pollutants from the MS4:

- to the maximum extent practicable (MEP),
- to protect water quality, and
- to satisfy the appropriate water quality requirements of the Clean Water Act. [40 CFR 122.34(a)]

SWMP **Implementation**

Only consider the waterway and discharge point…**establish "pollutants of concern"**

Remember:

- The CWA is about protecting the beneficial uses of surface waters
- The CWA includes WQ Standards Requirements – that are about the stream
  - Designated Uses, WQ criteria, anti-degradation policy
- The NPDES is the mechanism in place to facilitate these requirements (MS4 Permit)

In turn, for SWMP development, a municipality needs to determine:

- "Is my MS4 discharging pollutants that are the same as the impairment of the waterway?"
  - Contributing to the impairment?
- "Is my MS4 discharging any pollutants that could impair the waterway?"

Sample discharges …understand health of the receiving waters

303(d) lists - categories

Category 1: All Uses Attained

Category 2: At least One Use Attained

Category 3: Unassessed

Category 4a: Impaired for One or More Designated Uses; TMDL Complete

Category 4b: Impaired for One or More Designated Uses; expected to meet designated uses in a reasonable amount of time; TMDL Not Needed

Category 4c: Impaired for One or More Designated Uses; Pollution Impairments; TMDL Not Needed

Category 5: Impaired for One or More Designated Uses by any Pollutant; TMDL Required

Category 5a: “Alternative TMDL”

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Impairments-related information (303(d) list)

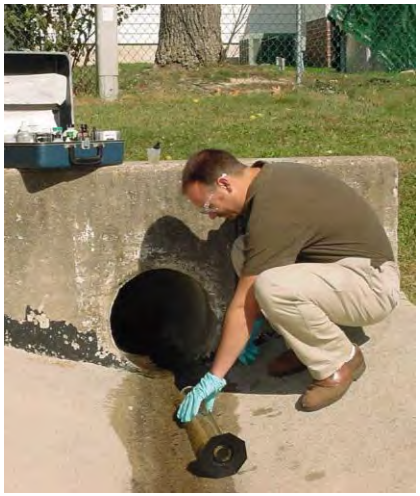
2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report - Streams, Category 5 Waterbodies, Pollutants Requiring a TMDL

Stream Name HUC **Use Assessed (Assessment ID) - Miles** **Source**	**Cause**	**Date Listed**	**TMDL Date**
Conestoga River Unnamed Of (ID:57463171) HUC: 02050306			
Aquatic Life (887) - 0.6 miles			
Agriculture	Nutrients	2002	2015
	Siltation	2002	2015
Conestoga River Unnamed Of (ID:57465487) HUC: 02050306			
Aquatic Life (645) - 0.5 miles			
Agriculture	Nutrients	2002	2015
	Siltation	2002	2015

Basic MS4 Permit-SWMP Requirements

Six (6) Minimum Control Measures (MCMs) that must be implemented:

- MCM 6: Good Housekeeping
- MCM 5: Post-Construction SWM
- MCM 4: Construction Site Runoff Control
- MCM 3: Illicit Discharge & Detection
- MCM 2: Public Involvement & Participation
- MCM 1: Public Education & Outreach



Developed elements of a SWMP

- MCM Plans (non-structural BMP focus)
  - Public Education & Outreach Plan (PEOP), Public Involvement & Participation Plan (PIPP), and so on.

- Impaired Waters Plan (structural BMP focus)
  - TMDL Plan(s), Pollutant Reduction Plans (PRPs), and so on.

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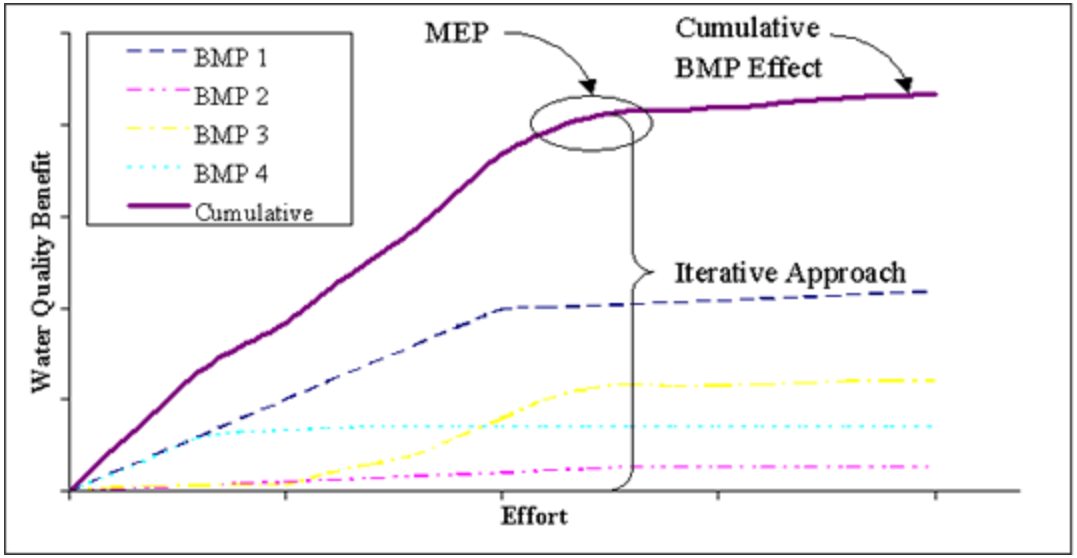
The intent of your SWMP is stay ahead of understanding the nature of your discharges relative to the health of the receiving streams, and implementing non-structural and/or structural BMPs to improve discharges.

Maximum Extent Practicable (MEP)

It is recognized that "pollutant reductions that represent MEP may be different for each small MS4, given the unique local hydrologic and geologic concerns that may exist and the differing possible pollutant control strategies. Therefore, each permittee will determine appropriate BMPs to satisfy each of the six minimum control measures through an evaluative process" (Federal Register, Volume 64, No. 235, page 68754, December 8, 1999.).



Source: CA.gov

The preamble to the Federal Register states: "EPA has intentionally not provided a precise definition of MEP to allow maximum flexibility in MS4 permitting. MS4s need the flexibility to optimize reductions in storm water pollutants on a location-by-location basis…"

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Water Quality Limited Segments

Water quality limited segment

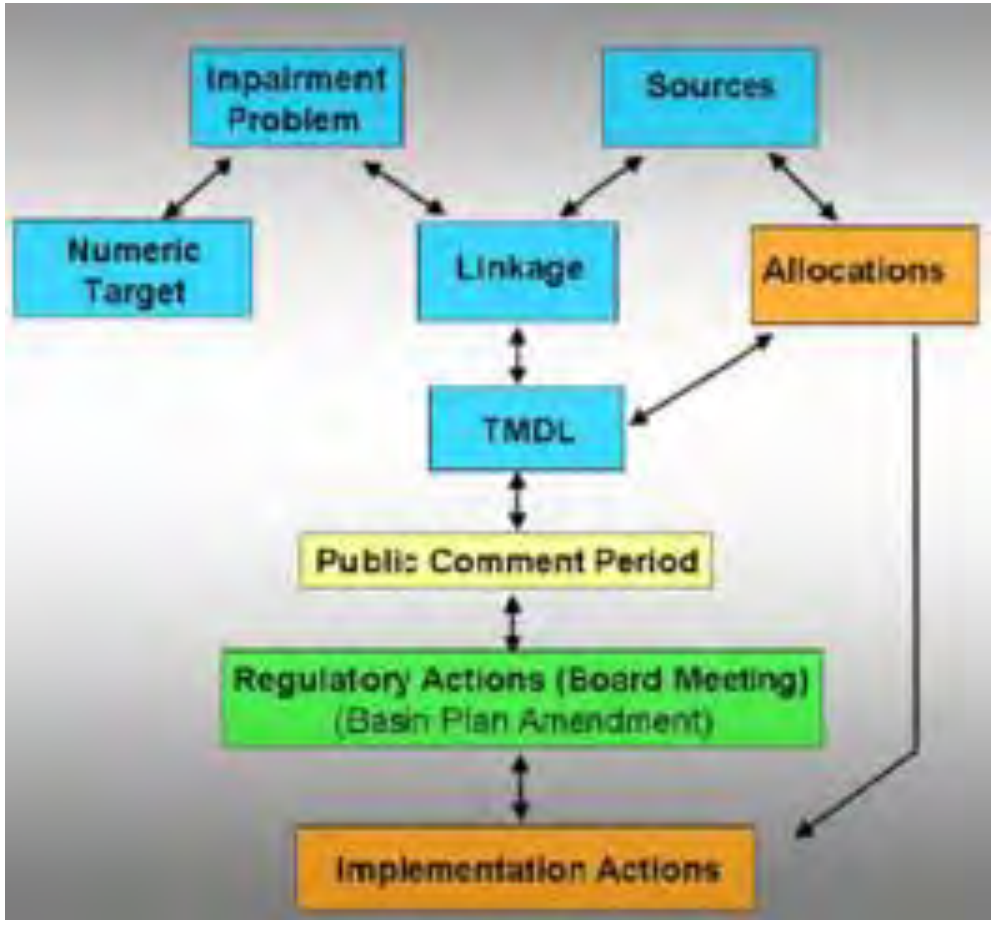
Any segment where it is known that water quality does not meet applicable water quality standards, and/or is not expected to meet applicable water quality standards, even after the application of the technology-based effluent limitations required by sections 301(b) and 306 of the Act.

TMDL Regulations (40 CFR)

§ 130.7 Total maximum daily loads (TMDL) and individual water quality-based effluent limitations.

(a)**General**. The process for identifying water quality limited segments still requiring waste load allocations, load allocations and total maximum daily loads (WLAs/LAs and TMDLs), setting priorities for developing these loads; establishing these loads for segments identified, including water quality monitoring, modeling, data analysis, calculation methods, and list of pollutants to be regulated; submitting the State's list of segments identified, priority ranking, and loads established (WLAs/LAs/TMDLs) to EPA for approval; incorporating the approved loads into the State's WQM plans and NPDES permits; and involving the public, affected dischargers, designated areawide agencies, and local governments in this process shall be clearly described in the State Continuing Planning Process (CPP).

TMDL Development Components



EPA “Protocol”

11.0 Discharges to Water Quality Impaired Waters (MS4 - 3.1)		
The operator must comply with any more stringent effluent limitations in the permit, including permit requirements that modify, or are in addition to, the minimum control measures based on an approved total maximum daily load (TMDL) or equivalent analysis. [40 CFR 122.34(e)(1)]	Determine if a waterbody to which the MS4 discharges has been designated as a 303(d) listed water or a TMDL has been developed for the waterbody. If discharging to an impaired water, verify the SWMP discusses: • How discharges of pollutants of concern will be controlled • How the operator will ensure discharges will not cause or contribute to exceedances of water quality standards • Measures and BMPs that will control these discharges If a TMDL has been developed for	☐ ☐ ☐ ☐

TMDL Implementation

Deciphering Issued TMDLs

Total Maximum Daily Loads (TMDLs)

A Total Maximum Daily Load (TMDL) is a regulatory term in the U.S. **Clean Water Act**, describing a value of the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.

TMDL = WLA + LA + MOS

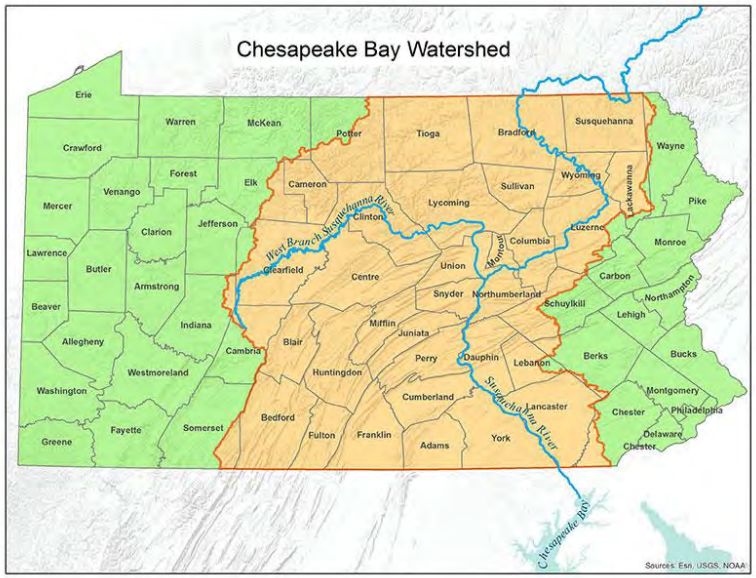
WLA = Waste Load Allocation
LA = Load Allocation
MOS = Margin of Safety

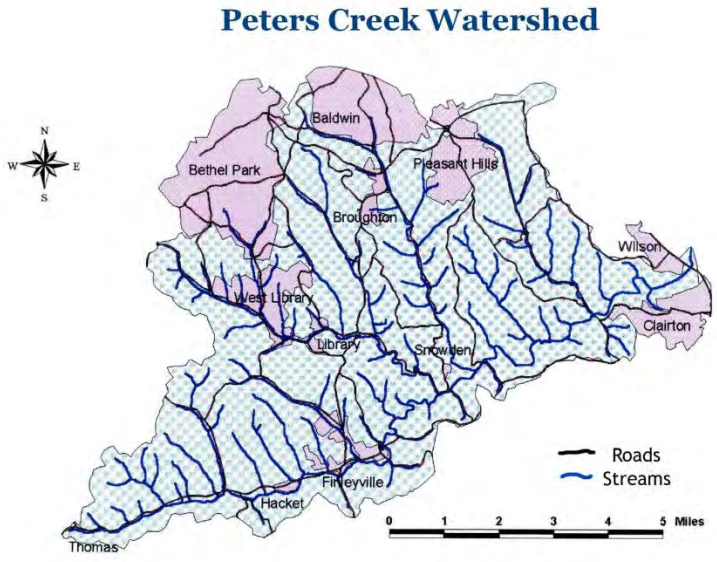
TMDLs

TMDLs may have been developed on one of the following methods:

- Watershed modeling program
  - Reference Watershed Approach

- Real data (WQ monitoring stations, sampling, etc.)





PADEP Approach to TMDLs

PADEP believes there is significant environmental benefit in using TMDLs to define the goal of reducing water pollution in a **watershed**. Although TMDLs have been a requirement in the federal Clean Water Act and part of the federal regulations for several years, developing TMDLs is a relatively new task. The tools developed by EPA and its consultants to carry out the requirements have been mainly theoretical and involve enormous commitments of resources. Mathematical models developed for TMDLs require large amounts of data that rely on huge sampling efforts. The monetary and human resources to use these tools cannot be relied upon to meet the accelerated schedules and vast numbers of TMDLs that must be done.

PADEP believes that TMDLs must be developed on a watershed basis to provide a full picture of and solution to water quality problems.

PADEP Approach to TMDLs cont'd

DEP develops the TMDL by determining reduction goals for pollutants to meet water quality standards. The specific TMDL steps are:

- Data on the watershed are gathered from DEP resources and interested parties
- The data are entered onto spreadsheets, and locations of sampling points are mapped for further consideration
- All sources of point and nonpoint source pollutant loadings are located
- Current loading rates and TMDL endpoints are established using the various methods and models developed by DEP
- The draft TMDL, addressing all elements required by EPA, is prepared
- The draft TMDL is made available for public comment and a public informational meeting is scheduled
- DEP responds to the comments and prepares the final TMDL
- TMDL is submitted to EPA for approval
- EPA approves or disapproves the TMDL and establishes a replacement TMDL within 30 days

303(d) lists - categories

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TMDL-related Information (303(d) list)

2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report - Streams, Category 4a Waterbodies, Approved TMDLs

Stream Name ***Use Designation (Assessment ID)*** ***Source***	***Cause***	***Date Listed***	***TMDL Date***
Lititz Run HUC: 02050306 Aquatic Life (7865) - 5.74 miles Urban Runoff/Storm Sewers	Suspended Solids	1996	2004

TMDL-related information

Total Maximum Daily Load (TMDL)
Lititz Run
Lancaster County

Pennsylvania Department of Environmental Protection
Central Office
Office of Water Management

August 2004

TMDL-related information

The major components of the Lititz Run TMDL are summarized below:

Components	Sediment (lbs/yr)
TMDL (Total Maximum Daily Load)	6,066,464.43
WLA (Wasteload Allocation)	2,773,697.20
MOS (Margin of Safety)	606,646.44
LA (Load Allocation)	2,686,120.79

- Waste Load Allocation (WLA): point sources (WWTP, MS4, industrial, etc.)
- Load Allocation (LA): non-point sources (open space, general agricultural areas, etc.)
- Margin of Safety: 10% “contingency” of overall loading (reserved for uncertainty in data or calculations)

TMDL-related information (WLA)

Table 6. Sediment Waste Load Allocations for MS4 Designated Areas within Lititz Run

Pollutant Source	Acres	Unit Area Loading Rate (lbs/ac/yr)		Pollutant Loading (lbs/yr)	
		Current	Allowable	Current	Allowable (WLA)
Hay/Pasture	814.00	76.66	59.19	62,401.24	48,180.66
Cropland	2,758.00	1,267.93	533.18	3,496,950.94	1,470,510.44
Developed	2,010.00	89.12	449.51	179,131.20	903,511.10

From Table 6:

WLA (sediment) = 351,495 lbs/yr (sewer discharge) + 2,422,202.20 lbs/yr (MS4)
WLA (sediment) = 2,773,697.20 lbs/yr

- This is a "general" TMDL Waste Load Allocation for the MS4
  - The sewer discharge (WWTP) is a specific WLA.

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…just because there is no reduction required, does not mean you should discard a TMDL.

Table 15. Load Allocation by Each Land Use/Source in Conewago Subbasin B.

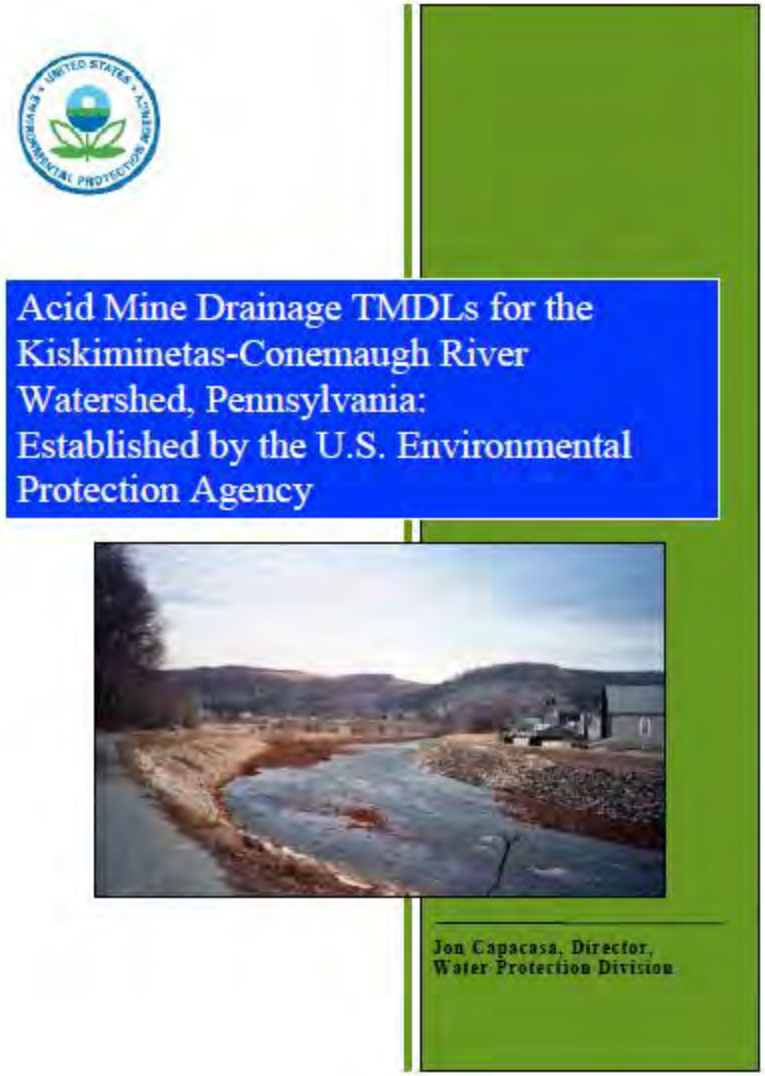
		Phosphorus					Sediment				
Source	Area	Unit Area Loading Rate	Current Annual Average Load	ALA (annual average)	Allowable Loading Rate (lb/ac/yr)	Reduction	Unit Area Loading Rate	Current Annual Average Load	ALA (annual average)	Allowable Loading Rate (lb/ac/yr)	Reduction
	Acres	lbs/ac./yr	lbs/yr	lbs/year		- % -	lbs/ac/yr	lbs/yr	lbs/yr		- % -
Hay/Past	3,042	0.28	844	211	0.07	75	149.15	453,754	420,181	138.12	7
Cropland	6,078	1.76	10,701	5,171	0.85	52	1,352.15	8,218,248	5,258,659	865.20	36
Coniferous For	312	0.01	3	3	0.01	0	6.21	1,935	1,935	6.21	0
Mixed For	473	0.01	5	5	0.01	0	7.05	3,333	3,333	7.05	0
Deciduous For	4,891	0.02	102	102	0.02	0	16.70	81,701	81,701	16.70	0
Lo Int Dev	371	0.02	7	7	0.02	0	37.63	13,952	13,952	37.63	0
Hi Int Dev	154	0.26	40	40	0.26	0	74.35	11,441	11,441	74.35	0
Groundwater			255	255		0					
Point Source			204	1,886		0					
Septic Systems			34	34		0					
Total	**15,321**	**0.80**	**12,195**	**7,714**	**0.50**	**37**	**573.35**	**8,784,364**	**5,791,202**	**378.00**	**34**

No reduction required for several source types…

However, there is a “maximum” loading to consider.

Table 14. TMDLs for Pequea Creek				
Pollutant	**TMDL (lbs/yr)**	**WLA (lbs/yr)**	**LA (lbs/yr)**	**MOS (lbs/yr)**
Subbasin 1				
Phosphorus	35,518	3,908	29,474.2	2,135.8
Sediment	7,248,622	0	6,523,759.8	724,862.2
Subbasin 2				
Phosphorus	41,020	2,938	34,449.0	3,633
Sediment	8,371,424	0	7,534,281.6	837,142.4

Issued TMDLs



Total Maximum Daily Load
For the Chartiers Creek Watershed
Pennsylvania

Prepared for Pennsylvania
Department of Environmental Protection
and
EPA Region 3

Prepared by
Tetra Tech, Inc.
Fairfax, Virginia

April 2003

TMDL-related Information (MS4 Req. Table)

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Allegheny County						
TURTLE CREEK BORO	PAG136196*	No		Monongahela River	Appendix C-PCB (4a), Appendix B-Pathogens (5)	
				Sawmill Run	Appendix E-Siltation (5)	
				Thompson Run	Appendix A-Metals, pH (4a)	
				Turtle Creek	Appendix A-Metals, pH (4a), Appendix E-Siltation (5)	
				Unnamed Tributaries to Humms Run	Appendix A-pH (4a), Appendix E-Siltation (5)	
UPPER ST CLAIR TWP	PAG136270	Yes	TMDL Plan	Painters Run	Appendix A-Metals (4a), Appendix C-Chlordane, PCB (4a), Appendix E-Suspended Solids (4a), Appendix E-Siltation (5)	TDS, Turbidity (5)
				Unnamed Tributaries to Chartiers Creek	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a), Appendix E-Nutrients (5)	Other Habitat Alterations (4c), Turbidity (4a)
				Chartiers Creek	Appendix A-Metals (4a), Appendix C-PCB (4a), Appendix E-Suspended Solids (4a), Appendix E-Organic Enrichment/Low D.O., Siltation (5)	TDS, Turbidity (5)
				Brush Run (Washington)	TMDL Plan-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids, Turbidity (4a)	
				McLaughlin Run	Appendix C-Chlordane, PCB (4a), Appendix E-Nutrients, Siltation (5)	Flow Alterations, Other Habitat Alterations, Water/Flow Variability (4c), Turbidity (5)
				Graesers Run	Appendix E-Nutrients, Siltation (5)	Turbidity (5)
VERONA BORO	PAG136323	No		Indian Creek	Appendix A-Metals (5)	Oil and Grease (5)
				Plum Creek	Appendix A-Metals (4a)	Oil and Grease (5)
				Allegheny River	Appendix C-Chlordane, PCB (4a)	

Issued TMDLs (Brush Run Example)

Nutrient and Sediment TMDL Development for the Unnamed Tributary to Brush Run and Upper Portions of Brush Run Allegheny and Washington Counties, Pennsylvania

The major components of these TMDLs are summarized below:

Component	Sediment (lbs/yr)	Total Phosphorus (lbs/yr)
TMDL (Total Maximum Daily Load)	224,348	786.7
MOS (Margin of Safety)	22,435	78.7
WLA (Wasteload Allocation)	201,913	252.8
LA (Load Allocation)	0	455.3

December 2003

Table 10 - Wasteload and Load Allocations

Component / Source	Sediment (lbs/yr)	Total Phosphorus (lbs/yr)
WLAs	**201,913**	**252.8**
Peters Township	175,384	200.2
Upper Saint Clair Township	23,419	47.1
Bethel Park Township	3,107	5.6
LAs	**0**	**455.3**
Groundwater	0	447.7
Septic Systems	0	7.5
WLA + LA	**201,913**	**708.0**

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AVGWLF

Arc

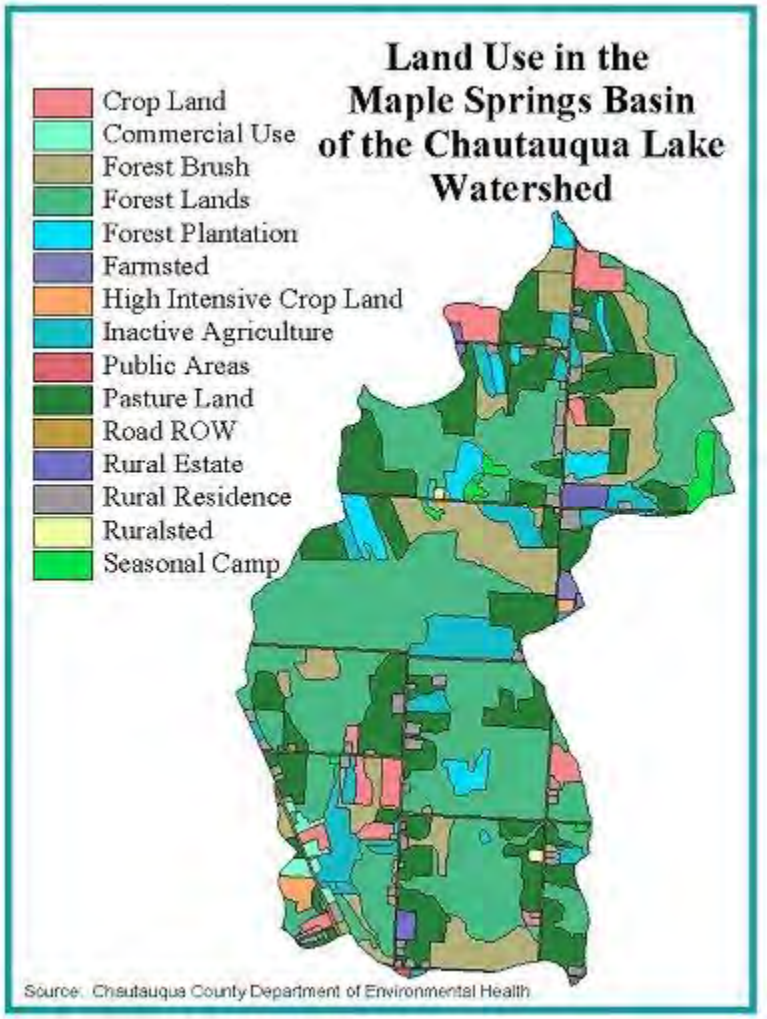
View

Generalized

Watershed

Loading

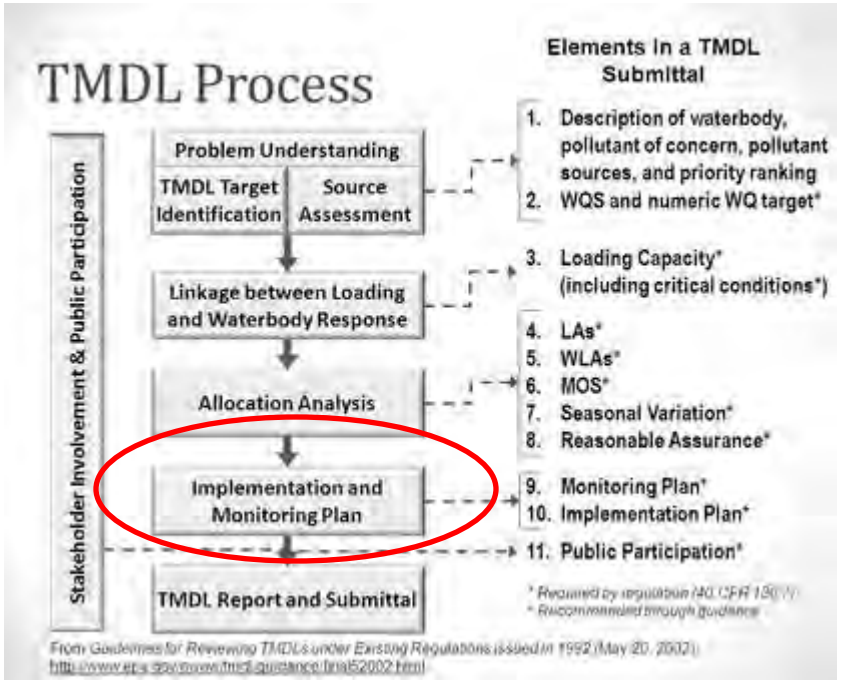
Function



Approved TMDLs

It is important to understand the methodology that was used to develop the original TMDL.

This is necessary for development of strategies and monitoring progress over time.



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TMDL Implementation

From Brush Creek TMDL:

VII. Reasonable Assurance and Recommendations for Implementation

There is reasonable assurance that the goals of this TMDL can be met with proper watershed planning, aggressive implementation of storm water flow and pollutant reduction best management practices (BMPs), and strong political and financial mechanisms. Reasonable assurance that the TMDLs established for sediment will require a comprehensive, adaptive approach that addresses:

- point and nonpoint source pollution,
- existing and potential future sources,
- regulatory and voluntary approaches.

From Lititz Run TMDL:

VIII. Recommendations for Implementation

TMDLs represent an attempt to quantify the pollutant load that may be present in a waterbody and still ensure attainment and maintenance of water quality standards. The Lititz Run TMDL identifies the necessary overall load reductions for sediment currently causing use impairments and distributes those reduction goals to the appropriate nonpoint sources. Reaching the reduction goals established by this TMDL will only occur through BMPs. BMPs that would be helpful in lowering the amount of sediment reaching Lititz Run include: streambank stabilization and fencing; riparian buffer strips; strip cropping; stormwater retention wetlands; and heavy use area protection, among many others.

TMDL Implementation

From Chartiers Creek TMDL:

There are several projects within the Chartiers Creek Watershed that address the affects of abandoned coal mines. The goal of these projects is to improve the water quality in the Chartiers Creek Watershed.

In September 1998, the Scott Conservancy was awarded an EPA 104(b)(3) grant to upgrade the Scrubgrass Treatment System. A Maelstrom Oxidizer was installed in order to increase the efficiency of the treatment and precipitate the iron oxides and hydroxides more rapidly. With this new system installed, the dissolved iron averaged 80.5 mg/l in the influent and 37.3 mg/l in the effluent—a 54% reduction. When the oxidizer was first installed the iron removal rate was increased to about 101 pounds per day or about a 100% increase in efficiency. The project was completed in September 2000.

On October 31, 2001, the Borough of Green Tree was awarded a Growing Greener Grant to develop a comprehensive restoration and protection plan for Whiskey Run. The plan will contain restoration and protection recommendations for AMD discharges, stream bank stabilization and erosion control, and repair of a sanitary sewer line, if found to be a problem. The Grant was completed on June 30, 2002. The final report submittal is pending.

On August 7, 2002, the Allegheny Land Trust was awarded a Growing Greener Grant for the design of a passive treatment system to treat the Wingfield Pines discharge. The mine discharge is alkaline with an average iron concentration of 15 mg/l. The flow averages between 1,500-2,000 gpm. Treatment of this discharge should eliminate approximately 46 tons of iron loading per year. The grant is scheduled to terminate on June 30, 2004.

TMDL Implementation

Developing TMDL Plans (Strategies)

TMDL Plan Development Process - Overview

1. Recognize the established TMDL.
2. Gain an understanding of the loadings.
    - Land use types
3. Develop strategies based on pollutant for reductions.
4. Identify control measures/BMPs for implementation.
    - Including calculated reductions.
5. “Field truth” BMP locations and prioritize.
6. “Pick” enough to match/exceed TMDL reductions.
    - But don’t discard the others, keep them relevant.
7. Calculate costs, build a schedule, acquire any permissions for land access, etc.
8. Build your plan (and approach for implementation).

Recognize the TMDL

It is important to understand the methodology that was used to develop the original TMDL.

Either:

- use the same methodology to develop your strategies/ approach OR
- create an ability to be able to compare your strategies with the original TMDL ("apples-to-apples" comparison)

SIDEBAR: Maintain percent reduction

NOTE – MS4s that calculate existing load(s) through a new modeling effort will need to plan for the same percent reduction in pollutant loads as prescribed by the TMDL. See Example 1 below.

Recognize the TMDL

Due to significant changes in the MapShed modeling procedures as compared to AVGWLF, as well as improved accuracy in current land use data, it was not practical to compare the 2012 MapShed model results to the 2004 AVGWLF model results. However, some assumptions from the 2004 AVGWLF TMDL model were incorporated into the 2004 MapShed model used in this study. Two noteworthy examples of this include:

- Assumptions reported in the 2004 TMDL report regarding the general condition of agricultural lands were reflected in the RUSLE factors in the 2004 MapShed input file, while the 2012 MapShed model used default RUSLE values. This assumption accounts for the general improvement in agricultural practices over the last eight years.
- The" Sediment A" factor, which relates to the erodibility of stream channels, was adjusted to result in a bank erosion sediment load similar to that given by the 2004 AVGWLF model. Based on field experience and measurement of bank erosion rates of numerous systems, we believe that the model underestimates the sediment and nutrient loading resulting from streambank erosion; however, in an effort to remain consistent with the original model, we adjusted the "Sediment A" factor accordingly.

TMDL Plan

2 TMDL Plan Approach

The following approach was used to develop the TMDL Plan for South Whitehall Township.

- A detailed review of the 2004 TMDL for the Little Cedar Creek Watershed was performed.
- MapShed modeling of 2004 conditions was performed for both the 2004 TMDL Reference Watershed, Nancy Run, and the Little Cedar Creek watershed. This step was required due to discrepancies identified in the 2004 TMDL Report (described below).
- Detailed modeling of 2004 and 2014 conditions using MapShed was performed. Detailed modeling included customization of data inputs based on Township input and review of aerial photography.
- An analysis of all modeling results in relationship to the 2004 TMDL.
- The MapShed model was used to generate a future conditions sediment loading rate documenting results of South Whitehall Township's proposed BMP implementation.

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TMDL Plan Development Process - Overview

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7. Calculate costs, build a schedule, acquire any permissions for land access, etc.
8. Build your plan (and approach for implementation).

Long-term vs. short-term objectives

Long-term objectives are concerned about the framework of the overall approach to achieve the TMDL and restore the health and integrity of the stream.

Short-term objectives are 5-year snapshots of immediate implementation activities towards progress of achieving the TMDL.

SIDEBAR: Sediment and/or Nutrients TMDL

C. **TMDL Plan Objectives**: There are two objectives for a TMDL Plan:

1. **Long-Term Reduction** – plan for the reduction of pollutant load(s) to achieve the WLA(s) in the TMDL. The TMDL Plan must describe a general plan as to how WLA(s) will ultimately be achieved.

2. **Short-Term Reduction** – plan for the short-term reduction of pollutant load(s) that will be achieved within the subsequent NPDES permit term (i.e., the 5-year permit term resulting from DEP's issuance of a permit in response to the receipt of the MS4's next submission of an individual permit application).

   MS4s must achieve at least one of the following objectives within the 5-year permit term: 1) the WLA(s) in the TMDL, or 2) if the WLA(s) cannot be achieved, a load reduction of at least 10% for sediment and/or 5% for TP, compared to the existing load for these pollutants. A load reduction of at least 10% for sediment may be used as the objective in lieu of a 5% reduction in TP under the presumptive approach.

TMDL Plan Elements

Little Cedar CreekTMDL Plan
South Whitehall Township
January 5, 2015

Table of Contents

TMDL Plan

Table 9. Load Reductions from BMP Implementation for South Whitehall Township

	Sediment (T/yr)	Nitrogen (lb/yr)	Phosphorus (lb/yr)
2014 Total Loading	170.2	11,204	397
2014 Unit Area Loading per Acre	0.090	5.906	0.209
Total BMP Load Reduction	129.5	567.1	138.3
Future Total Load	40.7	10,636.9	258.7
Future Unit Area Loading per acre	0.021	5.607	0.136
Percent Reduction	76%	5%	35%

Land Studies

Important considerations for “build your plan”

This becomes the active component of the plan…the “how” for implementation.

Target Milestones (Goals)

- and not limited to schedule milestones…also reduction milestones and reporting criteria.

Process for BMP Implementation (design, permitting (if applicable), construction, AND maintenance.

Monitoring criteria/processes and plan updates.

TMDL Outline for Implementation

Total Maximum Daily Load (TMDL)

Little Cedar Creek Watershed
Lehigh County

Pennsylvania Department of Environmental Protection
Northeast Regional Office
Water Management Program

July, 2004

VIII. Recommendations for Implementation

TMDLs represent an attempt to quantify the pollutant load that may be present in a waterbody and still ensure attainment and maintenance of water quality standards. The Little Cedar Creek TMDL identifies the necessary overall load reduction for sediment currently causing use impairments and distribute the reduction goals to the appropriate nonpoint sources. Reaching the reduction goal established by this TMDL will only occur through changes in current land use practices, including the incorporation of more stormwater "best management practices" (BMPs). .

TMDL Implementation

TMDL Plan Implementation and Monitoring

TMDL Plan

3.2 Proposed BMPs

South Whitehall Township proposes to implement the following BMPs to satisfy the requirements of the issued MS4 Permit and achieve reductions in nutrients and sediment loadings delivered to the Chesapeake Bay. Potential locations for these BMPs have been identified on the BMP Implementation Map provided as Appendix E. Specific locations will be chosen during the BMP planning process based on funding availability and landowner cooperation. For example, the Township may choose to skip one year of BMP implementation in order to implement a larger project rather than multiple smaller projects. Sources and methodologies used to estimate nutrient and sediment reductions are included in the BMP descriptions below. Assumptions regarding site specific conditions were necessary to estimate nutrient and sediment reductions.

Table 8. BMP Implementation Schedule

Year	BMP	Amount
2015	Swale stabilization	1250 lf
2015	Stormwater basin retrofit	2500 sf
2016	Stream restoration	450 lf
2017	Stormwater basin retrofit	5000 sf
2018	Stream restoration	450 lf
2019	Stormwater basin retrofit	5000 sf

Land Studies

TMDL Plan

BMP: Stormwater Basin Retrofit, 2500 sf
BMP Identification: Basin Retrofit 2015
Location of BMP: The retrofit location will be determined based on landowner cooperation and funding. The basins identified on the BMP implementation map (Appendix E) are the primary candidates.
Status of BMP Implementation: Planning
Milestones for BMP Implementation

- Planning: January – March 2015
- Conceptual Design: March – April 2015
- Design & Permitting: April – July 2015
- Construction: July – September 2015

Estimated Reductions

- Nitrogen: 12.2 lb
- Phosphorus: 0.7 lb
- Sediment: 0.3 Tons

Rationale for BMP Selection: The BMP selected provides the best ability for South Whitehall Township to achieve significant nitrogen and sediment reductions to the Maximum Extent Practicable. Additionally, this BMP focuses on reducing loading from medium density residential land use, the second highest land use contributing sediment in the watershed.
BMP Operation & Maintenance (O&M): Follow O&M plan included in the design.
Additional BMP Information: BMP nutrient and sediment load reductions were calculated using Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects (Schueler and Lane 2012).

Simple enough – right?!

“Ghost” reductions consideration

A permittee may discover, through sampling, that an MS4 Outfall discharges 100 lbs/year of sediment. The permittee chose to implement a BMP within the system that drains to that outfall. The paperwork calculation or modeling indicates a reduction of 200 lbs/year of sediment will be achieved through implementation of the BMP. This is impossible. If the outfall is discharging no more than 100 lbs/year of sediment, you cannot reduce discharges more than 100 lbs/year (and very difficult to obtain 100% reduction in reality).

Land Studies

- Webcams are available at the following streamgages in Pennsylvania: [illegible]
- Sign up for custom Water Alerts by text or email.

— Predefined displays —
Introduction go

Daily Streamflow Conditions

Select a site to retrieve data and station information.

Monday, October 23, 2017 13:30ET

USGS

Explanation

- High
- > 90th percentile
- 76th - 90th percentile
- 25th - 75th percentile
- 10th - 24th percentile
- < 10th percentile
- Low
- Not ranked

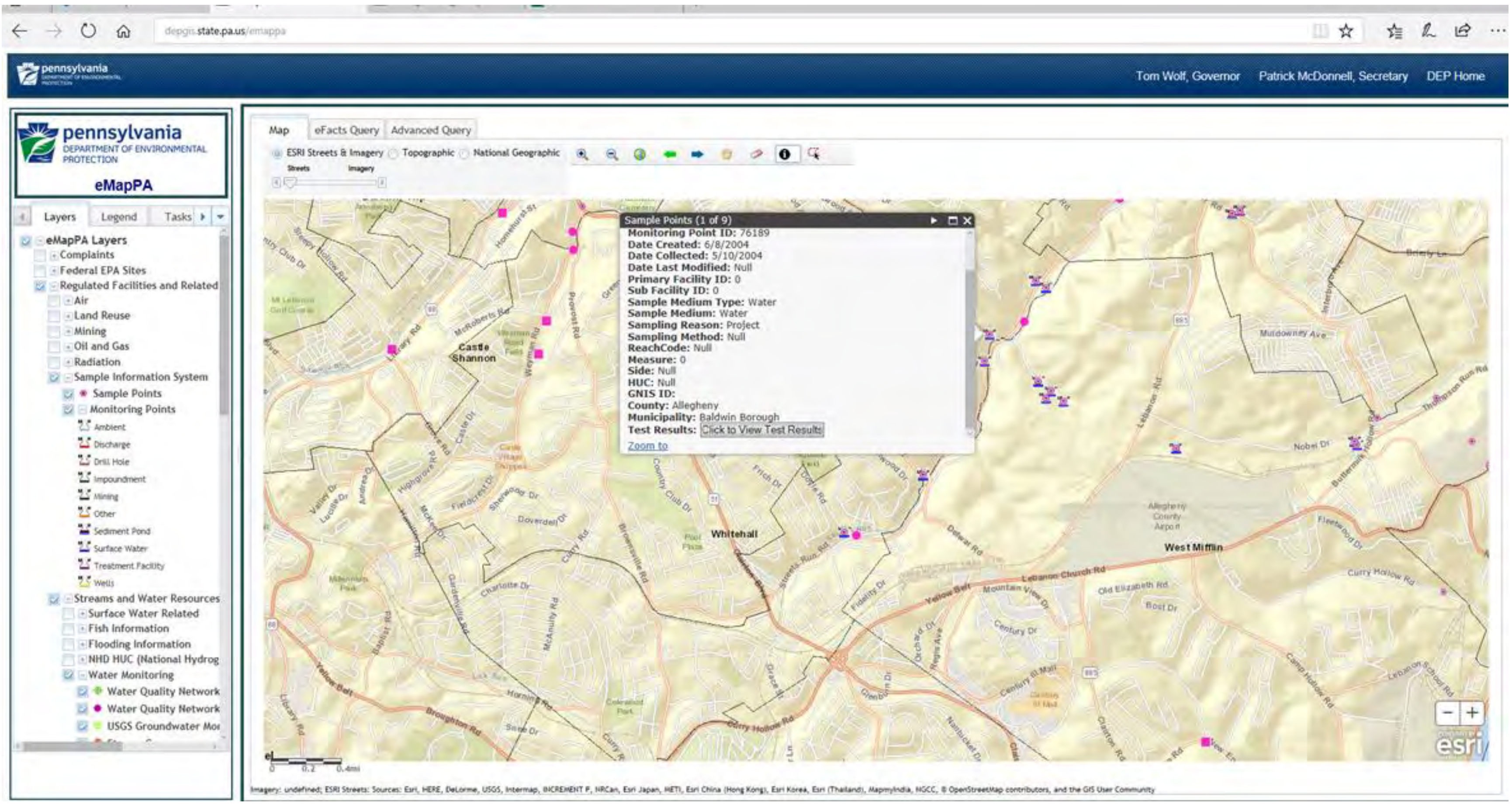
The colored dots on this map depict streamflow conditions as a percentile, which is computed from the period of record for the current day of the year. Only stations with at least 30 years of record are used.
The **gray circles** indicate other stations that were not ranked in percentiles either because they have fewer than 30 years of record or because they report parameters other than streamflow. Some stations, for example, measure stage only.

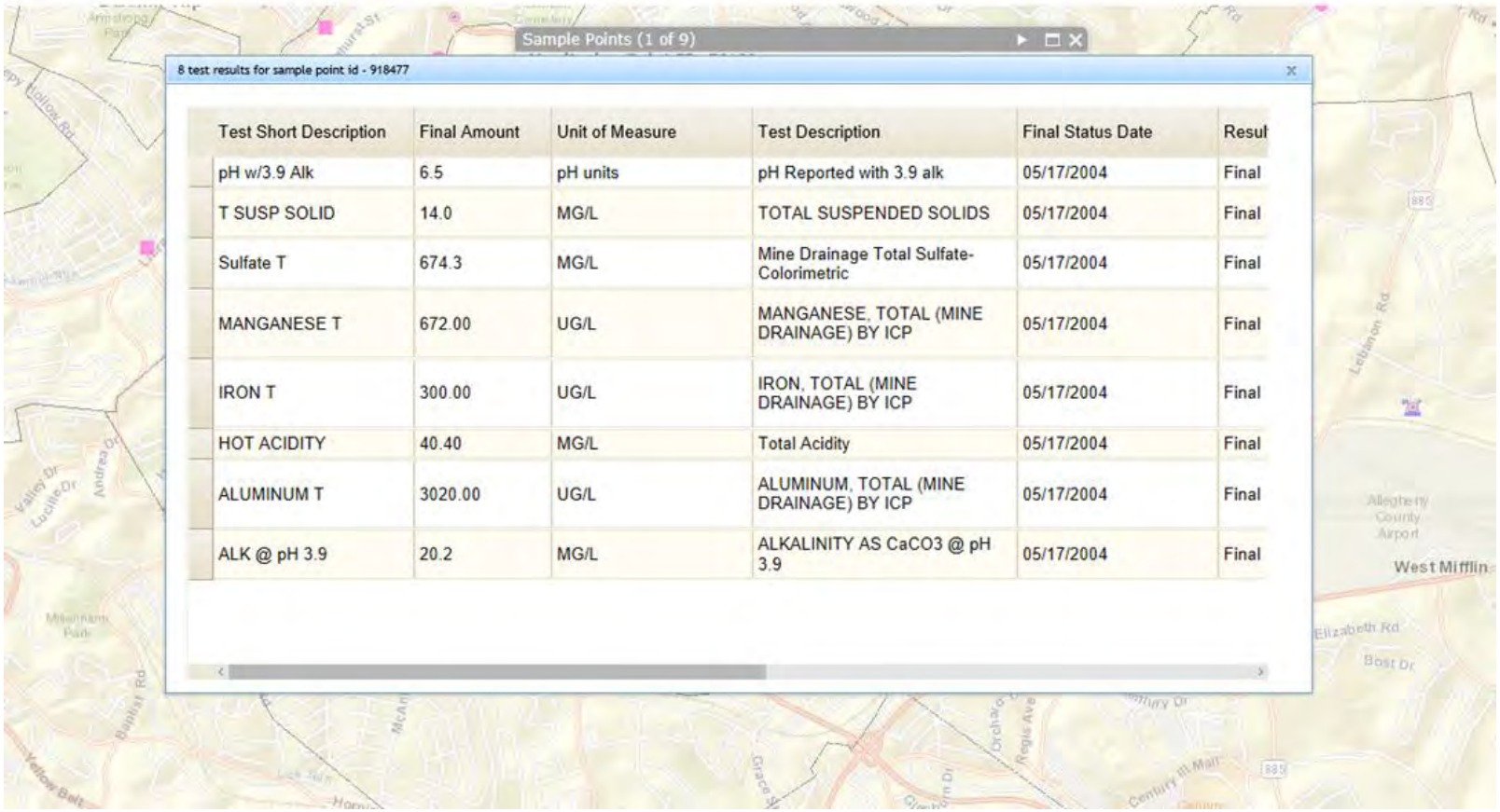
Statewide Streamflow Current Conditions Table

NOTICE (10/3/2017) Data collection and real-time delivery at **01576516 Big Spring Run above Trib near Willow Street, PA** and **015765185 Unnamed Trib to Big Spring Run near Willow Street, PA** will be discontinued beginning November 1, 2017 due to insufficient funding. In addition, **01548303 Straight Run, Site 1, at Marsh Creek, PA** has been discontinued as of October 2, 2017 due to insufficient funding. Users who are willing to contribute funding for the operation of any of these streamgages should contact Marla Stuckey, Assistant Director of the USGS Pennsylvania Water Science Center at 717-730-6950 or by email at mstuckey@usgs.gov.

Real-time data typically are recorded at 15-60 minute intervals, stored onsite, and then transmitted to USGS offices every 1 to 4 hours, depending on the data relay technique used. Recording and transmission times may be more frequent during critical events. Data from real-time sites are relayed to USGS offices via satellite, telephone, and/or radio and are available for viewing within minutes of arrival. All current conditions data are **provisional and subject to revision**.

Build Current Conditions Table	Show a custom current conditions summary table for one or more stations.
Build Time Series	Show custom graphs or tables for a series of recent data for one or more stations.


depgis.state.pa.us/emappa
pennsylvania
Tom Wolf, Governor
Patrick McDonnell, Secretary
DEP Home
pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
eMapPA
Layers
Legend
Tasks
eMapPA Layers
Complaints
Federal EPA Sites
Regulated Facilities and Related
Air
Land Reuse
Mining
Oil and Gas
Radiation
Sample Information System
Sample Points
Monitoring Points
Ambient
Discharge
Drill Hole
Impoundment
Mining
Other
Sediment Pond
Surface Water
Treatment Facility
Wells
Streams and Water Resources
Surface Water Related
Fish Information
Flooding Information
NHD HUC (National Hydrog
Water Monitoring
Water Quality Network
Water Quality Network
USGS Groundwater Mor
Map
eFacts Query
Advanced Query
ESRI Streets & Imagery
Topographic
National Geographic
Streets
Imagery
Sample Points (1 of 9)
Monitoring Point ID: 76189
Date Created: 6/8/2004
Date Collected: 5/10/2004
Date Last Modified: Null
Primary Facility ID: 0
Sub Facility ID: 0
Sample Medium Type: Water
Sample Medium: Water
Sampling Reason: Project
Sampling Method: Null
ReachCode: Null
Measure: 0
Side: Null
HUC: Null
GNIS ID:
County: Allegheny
Municipality: Baldwin Borough
Test Results: Click to View Test Results
Zoom to
Castle Shannon
Whitehall
West Mifflin
Allegheny County Airport
Lebanon Church Rd
Curry Hollow Rd
Brownsville Rd
Mountain View Dr
Century Dr
Nobel Dr
Old Elizabeth Rd
Camp Hollow Rd
Broughton Rd
Charlotte Dr
Doverdell Dr
Yellow Belt
0 0.2 0.4mi
esri
Imagery: undefined; ESRI Streets: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community



Test Short Description	Final Amount	Unit of Measure	Test Description	Final Status Date	Resul
pH w/3.9 Alk	6.5	pH units	pH Reported with 3.9 alk	05/17/2004	Final
T SUSP SOLID	14.0	MG/L	TOTAL SUSPENDED SOLIDS	05/17/2004	Final
Sulfate T	674.3	MG/L	Mine Drainage Total Sulfate-Colorimetric	05/17/2004	Final
MANGANESE T	672.00	UG/L	MANGANESE, TOTAL (MINE DRAINAGE) BY ICP	05/17/2004	Final
IRON T	300.00	UG/L	IRON, TOTAL (MINE DRAINAGE) BY ICP	05/17/2004	Final
HOT ACIDITY	40.40	MG/L	Total Acidity	05/17/2004	Final
ALUMINUM T	3020.00	UG/L	ALUMINUM, TOTAL (MINE DRAINAGE) BY ICP	05/17/2004	Final
ALK @ pH 3.9	20.2	MG/L	ALKALINITY AS CaCO3 @ pH 3.9	05/17/2004	Final

Point is…need a bit of "koom-ba-ya" in evaluating and selecting BMPs.

Lititz Run TMDL

Table 6. Sediment Waste Load Allocations for MS4 Designated Areas within Lititz Run

Pollutant Source	Acres	Unit Area Loading Rate (lbs/ac/yr)		Pollutant Loading (lbs/yr)	
		Current	Allowable	Current	Allowable (WLA)
Hay/Pasture	814.00	76.66	59.19	62,401.24	48,180.66
Cropland	2,758.00	1,267.93	533.18	3,496,950.94	1,470,510.44
Developed	2,010.00	89.12	449.51	179,131.20	903,511.10

From Table 6:

WLA (sediment) = 351,495 lbs/yr (sewer discharge) + 2,422,202.20 lbs/yr (MS4)
WLA (sediment) = 2,773,697.20 lbs/yr

- This is a "general" TMDL Waste Load Allocation for the MS4
  - The sewer discharge (WWTP) is a specific WLA.

Land Studies

Lititz Run TMDL – Monitoring

Monitoring

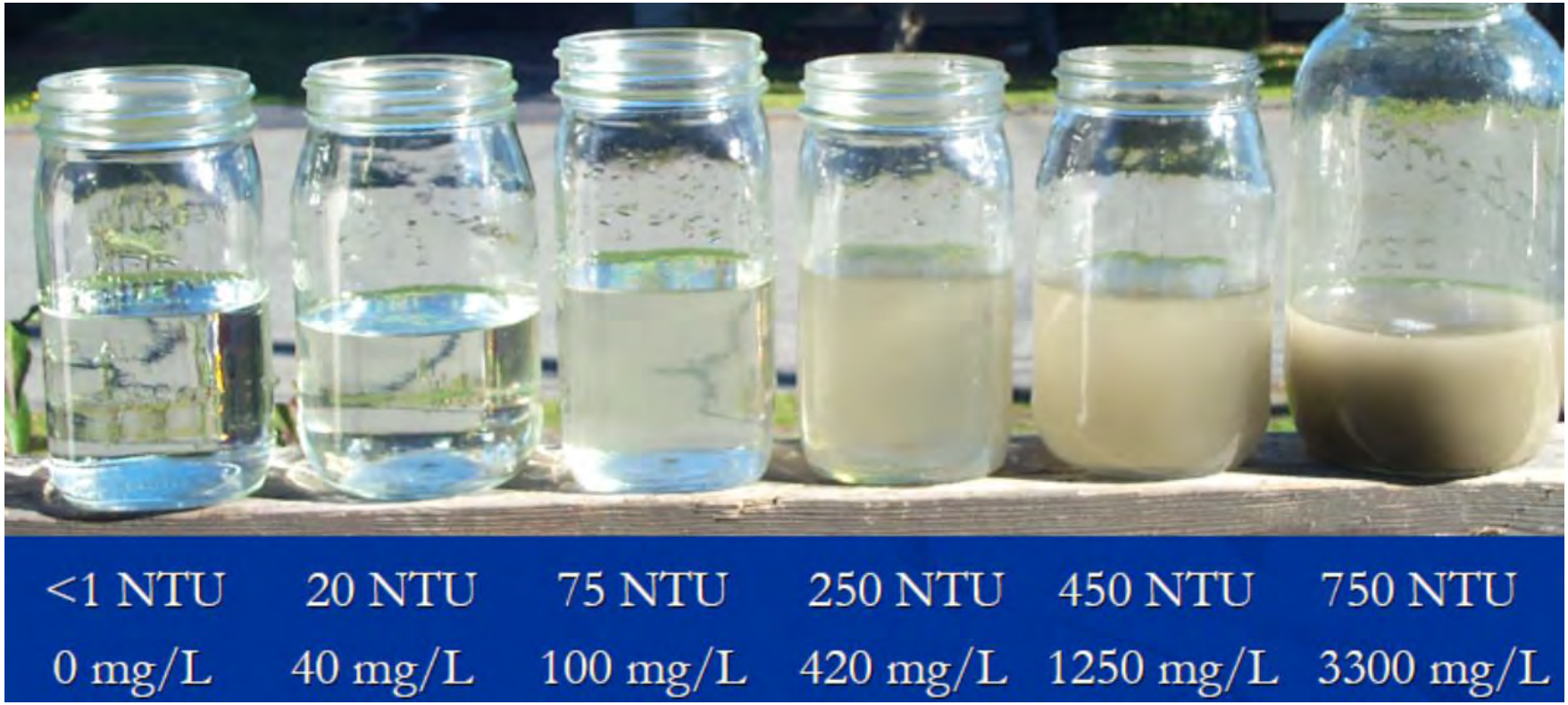
Since 1996, Warwick High School students, with assistance from the Lancaster County Conservation District, have monitored various biological and chemical parameters of Lititz Run. Overall, trends have been positive for most of the parameters monitored. Dissolved oxygen levels have increased, suspended sediment has decreased, nitrate has decreased and temperature has remained constant. The average Macroinvertebrate Aggregated Index for Streams (MAIS) scores at sites sampled in Lititz Run have also increased since sampling began in 1997, indicating a positive biological response to improved water quality. The reduction in nitrate concentrations at baseflow corresponds to the reduced groundwater nitrate levels seen in well data. This supports the groundwater load reduction reported by MapShed.

Stream Sampling

2016 Stream Monitoring													
Testing Location	**Test**	**Jan.**	**Feb.**	**March**	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
New Street Park	Dissolved Oxygen (mg/l)	N/A	16.50	13.00	16.50	16.50	16.50	7.30	8.82	N/A	N/A	N/A	16.50
	Nitrates (mg/l)	N/A	7.90	7.80	6.60	7.80	4.20	5.90	4.80	N/A	N/A	N/A	2.50
	Phosphates (mg/l)	N/A	0.31	0.13	0.13	0.22	0.00	0.24	0.27	N/A	N/A	N/A	0.39
	Water Temp (°F)	N/A	51	55	55	67	67	75	73	N/A	N/A	N/A	37
	Air Temp (˚F)	N/A	47	57	54	79	75	94	89	N/A	N/A	N/A	40
	Turbidity (NTUs)	N/A	24	6	5	8	20	19	15	N/A	N/A	N/A	25

2014 Stream Monitoring													
Testing Location	**Test**	**Jan.**	**Feb.**	**March**	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Santo Domingo (New St. & Locust St.)	Dissolved Oxygen (mg/l)	16.50	16.50	12.60	11.90	16.50	16.50	8.70	8.40	9.00	9.90	12.40	12.60
	Nitrates (mg/l)	4.90	7.80	5.30	5.80	7.30	5.90	8.90	4.40	3.80	5.50	5.50	11.70
	Phosphates (mg/l)	0.31	0.35	0.57	0.27	0.21	0.20	0.36	0.37	0.46	0.23	0.21	0.99
	Turbidity (NTUs)	42	19	15	5	5	10	10	20	3	11	27	8
	Air Temp (˚F)	37	33	32	64	78	82	76	75	63	52	53	32
	Water Temp (˚F)	42	38	40	52	62	61	62	63	58	48	45	34

Turbidity


<1 NTU
20 NTU
75 NTU
250 NTU
450 NTU
750 NTU
0 mg/L
40 mg/L
100 mg/L
420 mg/L
1250 mg/L
3300 mg/L

New Street Park

VIII. Recommendations for Implementation

TMDLs represent an attempt to quantify the pollutant load that may be present in a waterbody and still ensure attainment and maintenance of water quality standards. The Lititz Run TMDL identifies the necessary overall load reductions for sediment currently causing use impairments and distributes those reduction goals to the appropriate nonpoint sources. Reaching the reduction goals established by this TMDL will only occur through BMPs. BMPs that would be helpful in lowering the amount of sediment reaching Lititz Run include: streambank stabilization and fencing; riparian buffer strips; strip cropping; stormwater retention wetlands; and heavy use area protection, among many others.

New Street Park

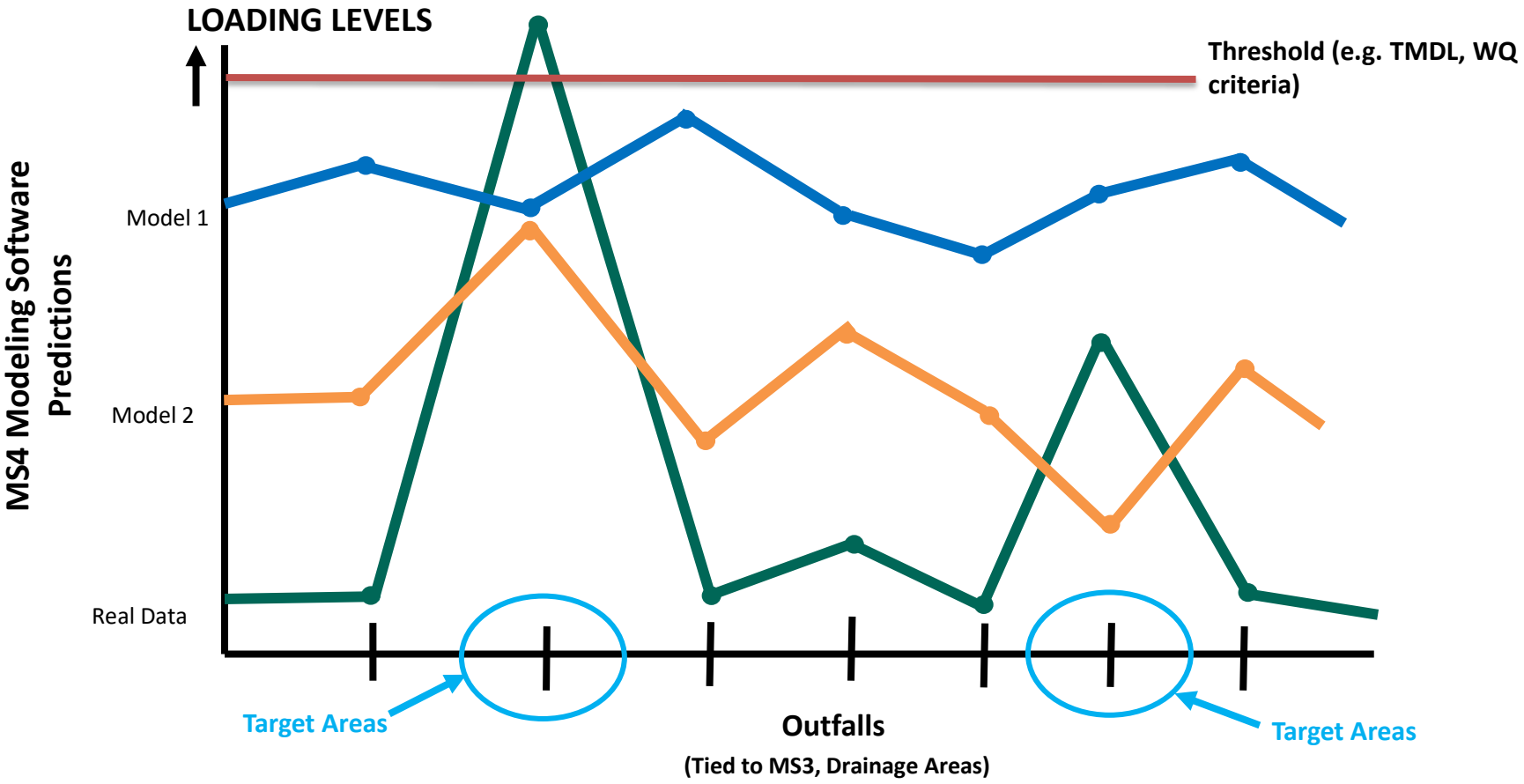
Restored floodplain…no streambank erosion in this location.

Outfall Sampling

Lititz Borough - Outfall Discharacterization Data/Results

OUTFALL			Wet Chemistry (mg/L)						Microbiology (col/100mL)		NOTES
	pH	Temp (°C)	Ammonia-N	Nitrate/ Nitrite-N	Total Kjeldahl Nitrogen	Total Nitrogen	Total Phosphorus	Total Suspended Solids (TSS)	Fecal Coliform	Total Coliform	
100P	7.31	21.5	0.678	1.2	3.0	4.20	0.75	65	73000	>2419.6	
109P	7.81	21.9	0.364	5.4	2.1	7.50	0.19	28	61000	>2419.6	
110P	7.26	22.1	0.585	0.50	1.4	1.90	ND	7	22000	>2419.6	
119P	7.79	21.7	0.661	0.60	1.7	2.30	0.24	27	46000	>2419.6	
120P	7.81	21.9	0.638	0.62	2.0	2.62	0.28	41	54000	>2419.6	
122P	7.71	21.3	0.558	0.84	1.5	2.34	0.19	ND	31000	>2419.6	
203	7.92	15.4	1.23	0.38	3.9	4.28	0.76	74	230000	>2419.6	
204	7.65	15.2	0.93	0.30	2.7	3.0	0.34	70	2500	>2419.6	
206	8.10	15.9	0.77	0.28	2.7	2.98	0.46	110	22000	>2419.6	
209	8.62	15.2	1.37	0.50	5.4	5.90	0.86	22	8280	>2419.6	

Targeting Areas based on real data



Strategic BMP Placement

Models are very cost-effective and somewhat simple tools (if the data is loaded correctly) to gain a snapshot of conditions in a watershed…

It provides an overall view of the probable conditions and types of problem areas that may be present.

However, there is at times a disconnect between reality and modeling. If you want to be successful with actually improving stream health, need to get boots on the ground.

Quantitative Monitoring – Pre and Post Implementation

- Will help determine if adjustments are needed
- Will most likely reveal ideal BMP implementation locations
- One of the best indicators of performance.
- Measure the collective whole of outfalls.

TMDL Achieved! But has the waterway been restored?

TMDL Implementation

TMDL Plan Updates and Modifications

Long-term vs. short-term objectives

Long-term objectives are concerned about the framework of the overall approach to achieve the TMDL and restore the health and integrity of the stream.

Short-term objectives are 5-year snapshots of immediate implementation activities towards progress of achieving the TMDL.

TMDL Plan Update

Lititz Run TMDL Plan / Lititz Borough and Warwick Township Pollutant Reduction Plan

Lititz, PA
Date: August 29, 2017

Prepared for:
Lititz Borough
7 South Broad Street
Lititz, PA 17543

Warwick Township
315 Clay Road
Lititz, PA 17543

Manheim Township
1840 Municipal Drive
Lancaster, PA 17601

TMDL Plan Update

BMP 1 Lititz Run Road Stream Restoration and Buffer

The Lititz Run Road Stream Restoration is a will be implemented on 1,700 LF of Lititz Run in Warwick Township. Both streambanks will be restored. The restoration will take place on Warwick Sewer Authority Property and private property. The actively eroding streambanks are vertical and 3 feet high. The stabilization project will include the creation of low floodplain benches and gentle grading of stream side slopes established with native vegetation. According to the DEP PRP Instructions a 115 lb. /ft. sediment load reduction can be applied to this project resulting in 195,500 lbs. of sediment reduction. This project is located in the UA.

BMP 2: Millport Conservancy Stream Restoration and Buffer

The Millport Conservancy Stream Restoration and Buffer that will be implemented on 1400 LF of Lititz Run in Warwick Township. Both streambanks will be restored. The restoration will take place at the Millport Conservancy and continue onto adjacent private property. The actively eroding streambanks are vertical and 3 feet high. The stabilization project will include the creation of low floodplain benches and gentle grading of stream side slopes established with native vegetation. According to the DEP PRP Instructions a 115 lb. /ft. sediment load reduction can be applied to this project resulting in 161,000 lbs. of sediment reduction.

BMP 3: Route 501 Stream Restoration

The Route 501 Stream Restoration will be done in conjunction with a paving project in

Annual Report – what to report

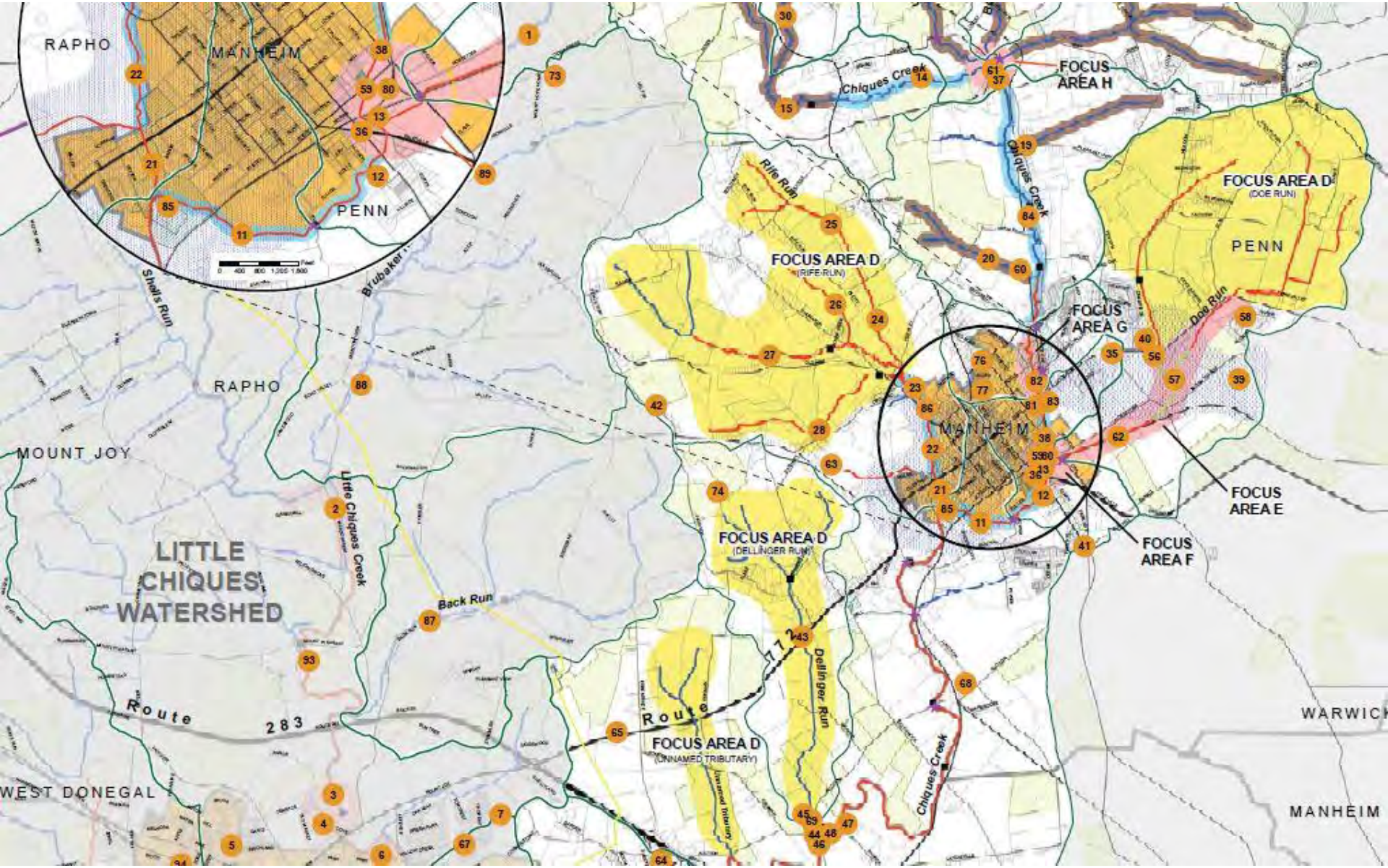
---Status of implementation---

- BMPs installed
- Maintenance conducted
- Schedule update (broad)
- “Field truth” results that have changed the plan and overall approach
- Monitoring results that have changed the plan and overall approach

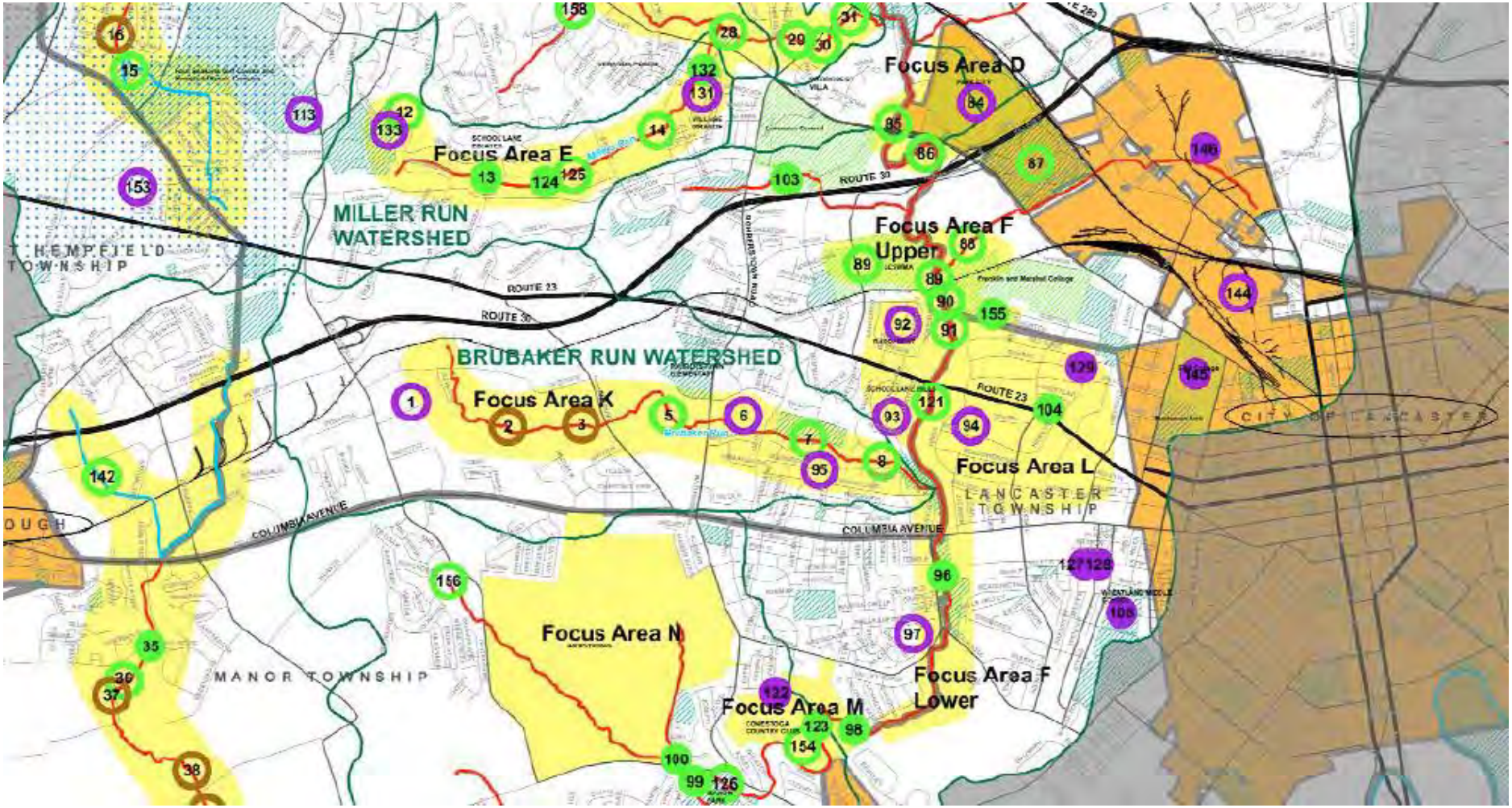
TMDL Implementation

Innovative Techniques

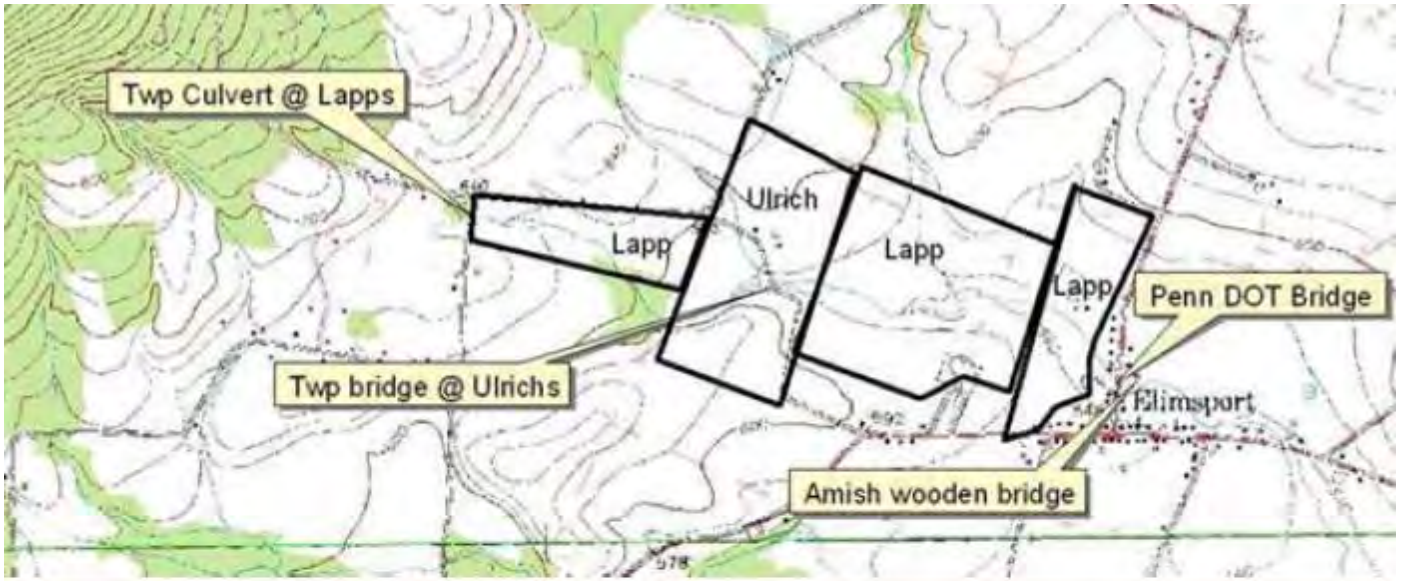
Watershed Action Plan



Watershed Action Plan



Regional WQ Monitoring



Lycoming Water Quality Monitoring Plan

Nutrient Management

Challenge
As part of their Nutrient Management Strategy, Lycoming County contracted with LandStudies and the Lycoming College Clean Water Institute (CWI) to evaluate the effectiveness of agricultural best management practice (Ag BMPs) in a small watershed by monitoring water quality before and after BMP implementation.

Solution
LandStudies collaborated with the CWI and the Lycoming County Conservation District to develop a sampling layout on White Deer Hole Creek based on the locations of cooperating farms and planned BMPs. LandStudies contributed and assisted in the usage of Leveloggers to collect continuous water level and temperature data

Programming Levelogger

Field Analysis – Ag "Assist"

Floodplain Restoration Site Feasibility Analysis

Muddy Run-Mill Creek and Eshleman Run-Pequea Creek Subwatersheds

West Lampeter Township, Lancaster County, PA

July 25, 2014

Prepared for:

West Lampeter Township
852 Village Road
Lampeter, PA 17537

Prepared by:

LandStudies, Inc.
315 North Street
Lititz, PA 17543
717-627-4440
www.landstudies.com

In Cooperation with:

ELA Group
743 S. Broad Street
Lititz, PA 17543

FPR Feasibility Analysis

	POINTS	Groff	Houser	Blank	Vo Tech	Herr
Criteria		Score	Score	Score	Score	Score
Geomorphic Site Assessment	30.0	30.0	30.0	30.0	22.0	17.0
Visibility	5.0	5.0	5.0	3.0	3.0	0.0
Length of Stream Available	15.0	15.0	8.0	15.0	8.0	10.0
Land Available for FPR	15.0	12.0	10.0	15.0	10.0	10.0
Developed infrastructure	15.0	12.0	12.0	15.0	10.0	12.0
Urbanized Area	10.0	0.0	0.0	0.0	10.0	0.0
LFT Report Categorization	10.0	10.0	7.0	7.0	7.0	3.0
TOTAL POINTS	100.0	84.0	72.0	85.0	70.0	52.0

Offsets. An MS4 may propose stormwater pollutant reduction BMPs outside of the TMDL and/or PRP Planning Area for possible approval as offsets toward meeting TMDL and/or PRP load reduction requirements. Such projects must be located within the jurisdiction of the developer of the TMDL Plan and/or PRP, and treat or manage stormwater that would drain to the impaired waters of interest under a TMDL Plan or PRP. In all cases where offsets are proposed, an individual permit is required.

Final Thoughts and Questions?

Michael T. LaSala, CPMSM, CSI
mike@landstudies.com
717-627-4440

Land Studies