RUTGERS UNIVERSITY
Water Resources Program
New Jersey Agricultural Experiment Station

The Watershed Improvement Plan

Charting a Course for Barnegat Bay
Cleaner Water, Stronger Communities

March 17, 2026

Christopher C. Obropta, Ph.D., P.E.
obropta@rutgers.edu
www.water.rutgers.edu

Rutgers Cooperative Extension

Rutgers Cooperative Extension (RCE) helps the diverse population of New Jersey adapt to a rapidly changing society and improves their lives through an educational process that uses science-based knowledge.

Water Resources Program

Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.

What is the MS4 Permit?

- Municipal Separate Storm Sewer System = MS4
- Five-year General permit (1/1/23 thru 12/31/27)
- The MS4 permitting program was created in 2004 and is required by both federal and state regulations to address water quality and flooding issues in municipal stormwater systems.

A primary objective of the MS4 stormwater program

… shall be to implement best management practices and other measures that are designed to reduce the discharge of pollutants from the permittee's MS4, municipal maintenance yards and other ancillary operations to the maximum extent practicable pursuant to N.J.A.C. 7:14A-25.6(a)1 and 40 CFR 122.34(a), to protect water quality, and to satisfy the applicable water quality requirements of the Clean Water Act.

Why is this important?

- Nearly 95% of waterways impaired in NJ
- Lack of stormwater management for developments
  - prior to 1983 (no management)
  - prior to 2004 (poor WQ management)
- Stormwater infrastructure needs to be maintained to reduce pollutant load to local waterways and reduce flooding

Summary of MS4 Requirements

Section A: Stormwater Management Program

Section B: Minimum Standards for Public Involvement

Section C: Minimum Standards for Local Public Education

Section D: Minimum Standards for Construction Site Stormwater Runoff

Section E: Minimum Standards for Post Construction Stormwater Management in New Development and Redevelopment

Section F: Minimum Standards for Pollution Prevention/ Good Housekeeping for Municipal Operators

As of January 1, 2023

Summary of MS4 Requirements

Section G: Minimum Stands for MS4 Mapping, and Scouring, and Illicit Discharge Detection and Elimination

Section H: Watershed Improvement Plan

Section I: Additional Measures and Optional Measures

Section J: Recordkeeping

Section K: Annual Report and Certification

As of January 1, 2023

Section H:
Watershed Improvement Plan

- Designed to improve water quality problems
- Focused on reducing the MS4 contribution of pollutants to waterbodies with listed impairments and TMDLs
- Reducing or eliminating flooding with priority given based on human health and safety, environmental impacts, and frequency of occurrence
- Plan shall be developed with input from residents, businesses, neighboring towns, other dischargers

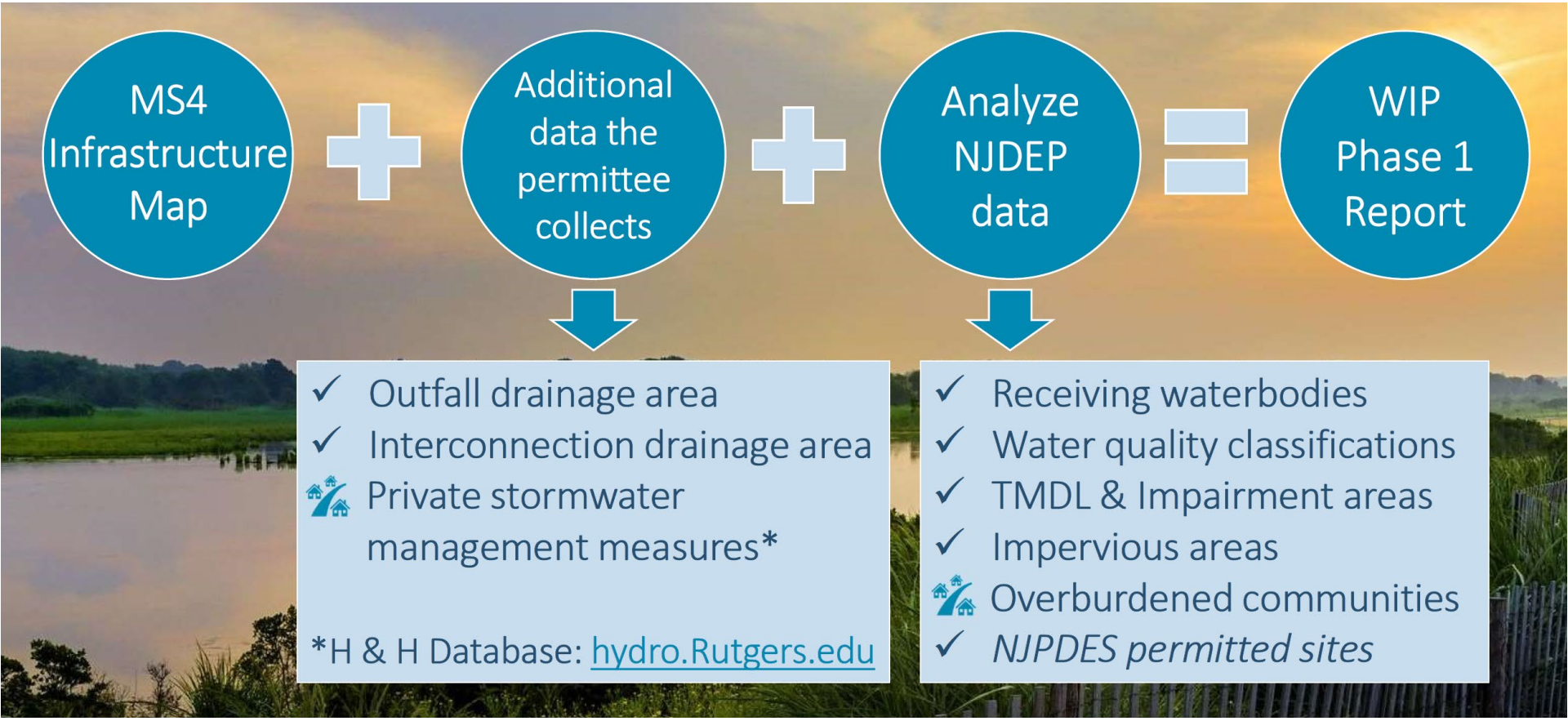
Section H:
Watershed Improvement Plan

Phase 1 – Prepare and submit the Watershed Inventory Report; conduct outreach (January 1, 2026)

Phase 2 – Prepare and submit the Watershed Assessment Report; conduct outreach (January 1, 2027)

Phase 3 – Prepare and submit the Watershed Improvement Plan Report; conduct outreach (December 1, 2027)

Phase 1
Watershed Inventory Report (WIP)



Due of January 1, 2026

Phase 1
MS4 Infrastructure Map

Delineates the location of the following stormwater features that are <u>owned or operated</u> by the permittee

i. MS4 outfalls

ii. MS4 ground water discharge

iii. MS4 interconnections

iv. Storm drain inlets

v. MS4 manholes

vi. MS4 conveyances

vii. MS4 pump stations

viii. Stormwater facilities

ix. Property boundaries of maintenance yard

Due of January 1, 2026

Phase 1
Drainage Area Delineation

- Area that flows to each outfall

"Outfall" means any point source which discharges directly to waters of the United States …"

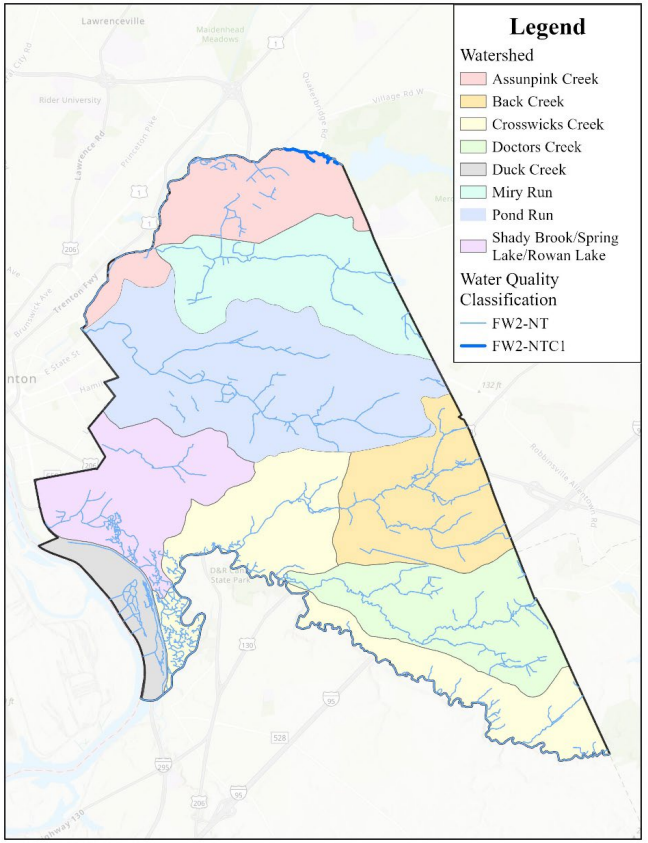
- Area that drains from a MS4 interconnection

"MS4 interconnection" means any point at which an MS4 flows into or from another MS4.

Due of January 1, 2026

Phase 1
Water Quality Classification of Receiving Water

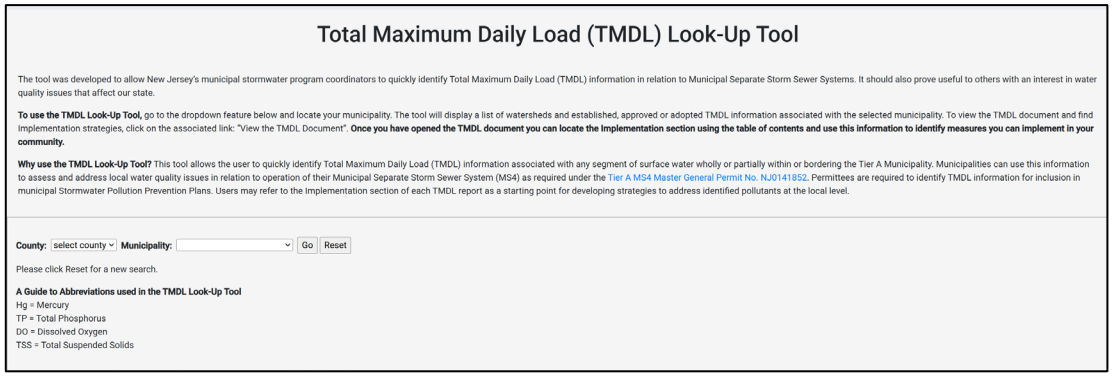
- Example classifications:
  - Freshwater
    - FW1 – (no man-made wastewater)
    - FW2-TP, FW2-TM, FW2-NT (other freshwater)
  - Saline waters
    - SE – Saline estuary
    - SC – Saline Coastal
  - PL – Pinelands waters



Due of January 1, 2026

Phase 1
Total Maximum Daily Load (TMDL) Areas

- TMDL is a pollutant budget for an impaired waterbody
- Use the TMDL look-up tool to identify study reports



Total Maximum Daily Load (TMDL) Look-Up Tool

The tool was developed to allow New Jersey's municipal stormwater program coordinators to quickly identify Total Maximum Daily Load (TMDL) information in relation to Municipal Separate Storm Sewer Systems. It should also prove useful to others with an interest in water quality issues that affect our state.

To use the TMDL Look-Up Tool, go to the dropdown feature below and locate your municipality. The tool will display a list of watersheds and established, approved or adopted TMDL information associated with the selected municipality. To view the TMDL document and find implementation strategies, click on the associated link: "View the TMDL Document". **Once you have opened the TMDL document you can locate the Implementation section using the table of contents and use this information to identify measures you can implement in your community.**

Why use the TMDL Look-Up Tool? This tool allows the user to quickly identify Total Maximum Daily Load (TMDL) information associated with any segment of surface water wholly or partially within or bordering the Tier A Municipality. Municipalities can use this information to assess and address local water quality issues in relation to operation of their Municipal Separate Storm Sewer System (MS4) as required under the Tier A MS4 Master General Permit No. NJ0141852. Permittees are required to identify TMDL information for inclusion in municipal Stormwater Pollution Prevention Plans. Users may refer to the Implementation section of each TMDL report as a starting point for developing strategies to address identified pollutants at the local level.

County: select county **Municipality:** Go Reset

Please click Reset for a new search.

A Guide to Abbreviations used in the TMDL Look-Up Tool
Hg = Mercury
TP = Total Phosphorus
DO = Dissolved Oxygen
TSS = Total Suspended Solids

- Examples – PCBs, Total Phosphorus, Fecal Coliform, Mercury (air deposition)
- Water Quality Impairments
  - Areas with high concentrations but no study complete

Due of January 1, 2026

Phase 1
Additional Mapping

- Overburdened Communities
  - Areas with:
    - > 35% Low-income households
    - > 40% minority or tribal community
    - > 40% limited English proficiency
- Impervious Cover
  - Areas of roads, buildings, and other paved areas
- Outfalls and infrastructure not owned/operated

Due of January 1, 2026

Phase 2
Watershed Assessment Report

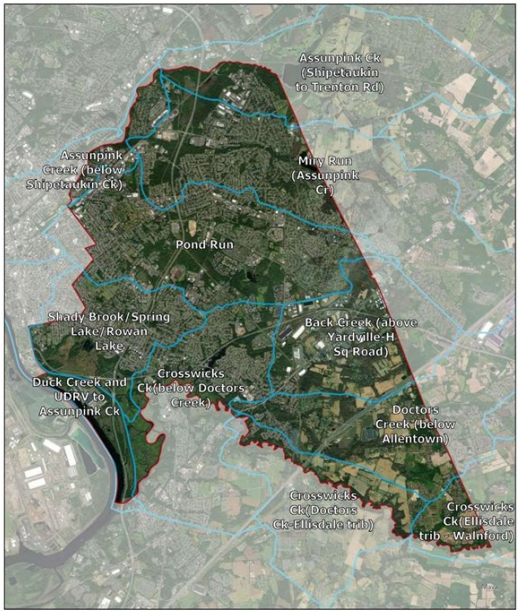
Report shall summarize and include an electronic map of the items listed below

1. An assessment of **potential water quality improvement projects** by sub-watershed and parameter
2. An estimate of the **percent reduction in loading of the TMDL/impaired parameters** due to project(s) in i. above
3. A summary of **feedback from public information** sessions
4. An **estimate of funding needs** for each project, and identification of potential funding sources, including the New Jersey Water Bank (NJWB); the formation of an SWU, using 319 grants, FEMA BRIC grants
5. An estimate of an **implementation schedule**

Due of January 1, 2027

Phase 2
Watershed Assessment Report

RUTGERS UNIVERSITY
Water Resources Program
New Jersey Agricultural Experiment Station



Hamilton Township (Mercer County)
Watershed Assessment Report

Developed by the Rutgers Cooperative Extension Water Resources Program

Funded by Hamilton Township, Mercer County, New Jersey

April 2, 2025

Table 1: Hamilton Subwatershed Areas

HUC 14	Subwatershed Name	Hamilton Area (acres)	Total Area (acres)
2040105230050	Assunpink Ck (Shipetaukin to Trenton Rd)	1,017	6,182
2040105240030	Miry Run (Assunpink Cr)	3,721	8,555
2040105240040	Pond Run	5,954	6,405
2040105240060	Assunpink Creek (below Shipetaukin Ck)	798	3,051
2040201030010	Duck Creek and UDRV to Assunpink Ck	902	2,124
2040201050050	Crosswicks Ck(Ellisdale trib - Walnford)	754	4,383
2040201050070	Crosswicks Ck(Doctors Ck-Ellisdale trib)	1,099	4,144
2040201060030	Doctors Creek (below Allentown)	3,012	5,596
2040201070010	Back Creek (above Yardville-H Sq Road)	3,009	4,171
2040201070020	Crosswicks Ck(below Doctors Creek)	2,657	5,518
2040201070030	Shady Brook/Spring Lake/Rowan Lake	2,824	3,150

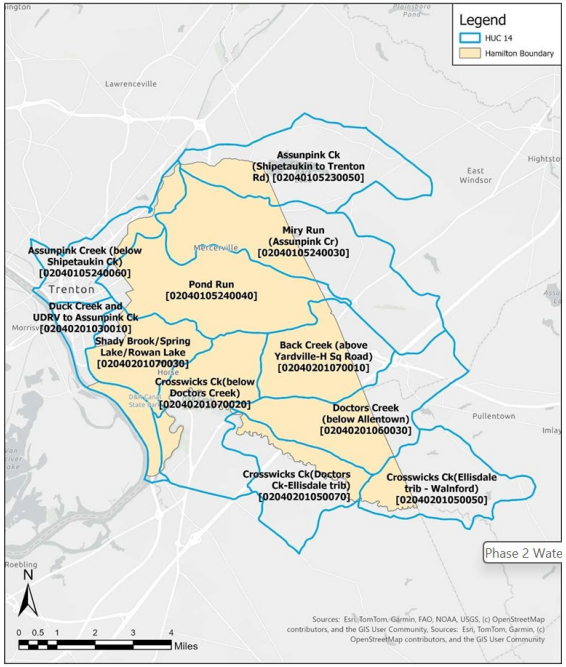


Figure 1: Hamilton Subwatersheds

Due of January 1, 2027

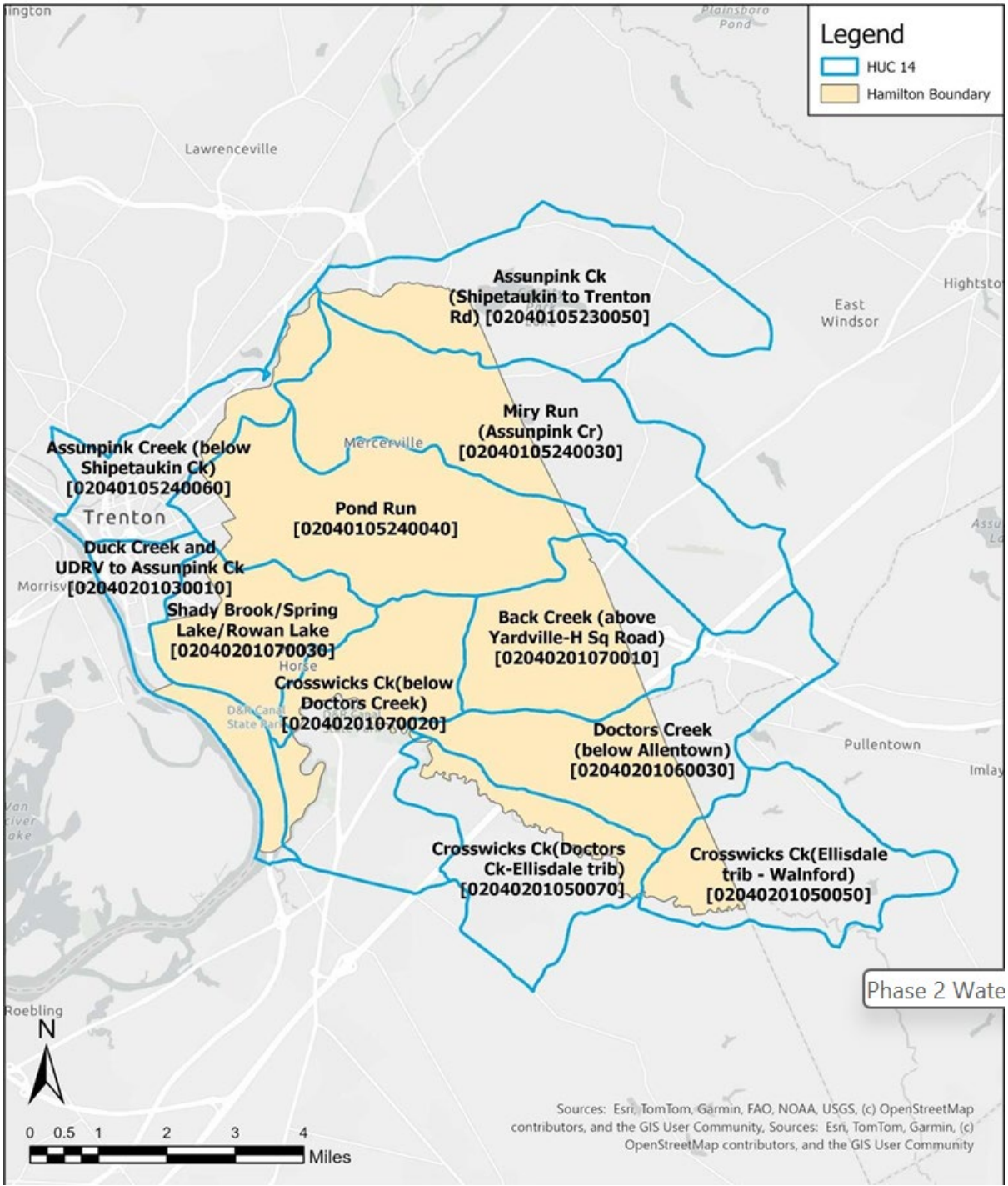
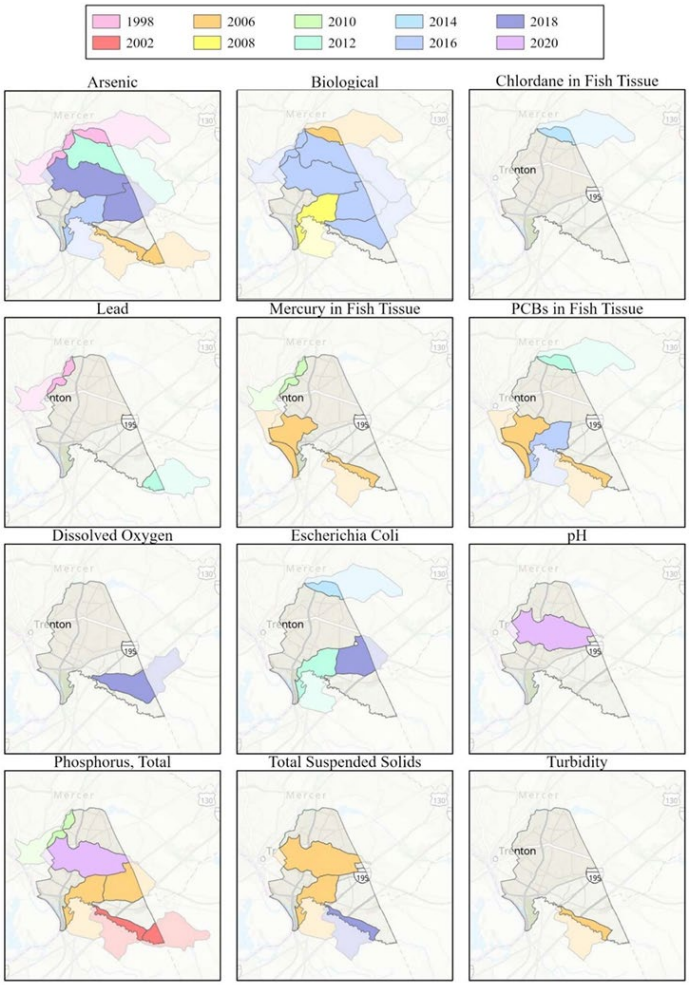

Legend
HUC 14
Hamilton Boundary
Assunpink Ck (Shipetaukin to Trenton Rd) [02040105230050]
Miry Run (Assunpink Cr) [02040105240030]
Assunpink Creek (below Shipetaukin Ck) [02040105240060]
Pond Run [02040105240040]
Duck Creek and UDRV to Assunpink Ck [02040201030010]
Shady Brook/Spring Lake/Rowan Lake [02040201070030]
Back Creek (above Yardville-H Sq Road) [02040201070010]
Crosswicks Ck(below Doctors Creek) [02040201070020]
Doctors Creek (below Allentown) [02040201060030]
Crosswicks Ck(Doctors Ck-Ellisdale trib) [02040201050070]
Crosswicks Ck(Ellisdale trib - Walnford) [02040201050050]
Lawrenceville
Mercerville
Trenton
East Windsor
Pullentown
Roebling
N
0 0.5 1 2 3 4
Miles
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Sources: Esri, TomTom, Garmin, (c) OpenStreetMap contributors, and the GIS User Community

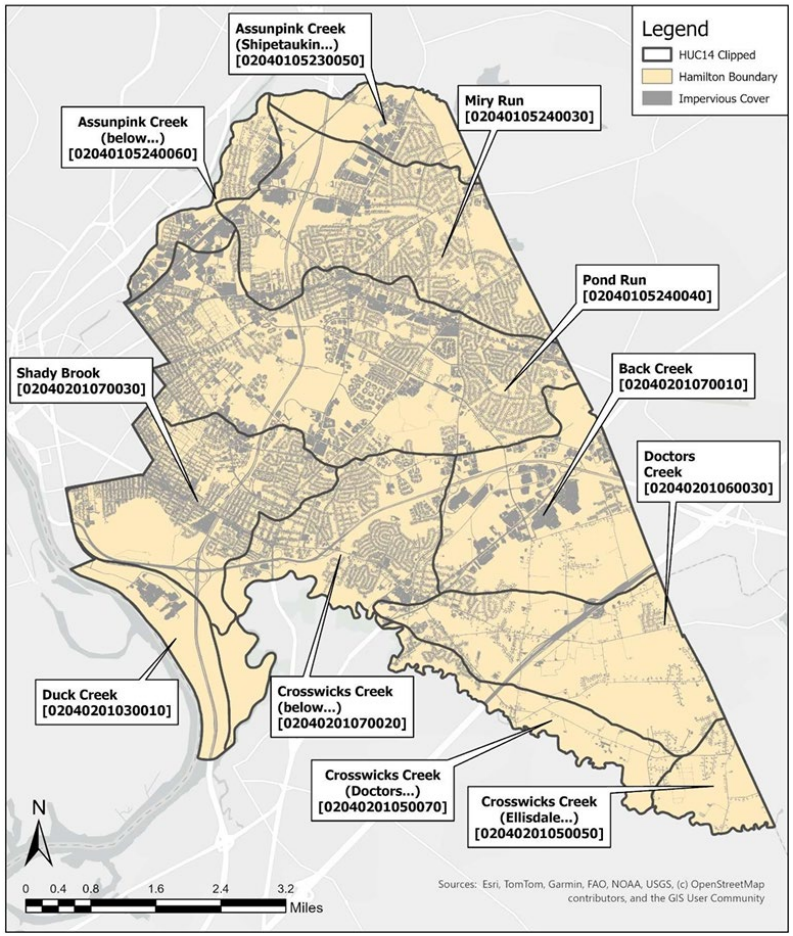
Table 1: Hamilton Subwatershed Areas

HUC 14	Subwatershed Name	Hamilton Area (acres)	Total Area (acres)
2040105230050	Assunpink Ck (Shipetaukin to Trenton Rd)	1,017	6,182
2040105240030	Miry Run (Assunpink Cr)	3,721	8,555
2040105240040	Pond Run	5,954	6,405
2040105240060	Assunpink Creek (below Shipetaukin Ck)	798	3,051
2040201030010	Duck Creek and UDRV to Assunpink Ck	902	2,124
2040201050050	Crosswicks Ck(Ellisdale trib - Walnford)	754	4,383
2040201050070	Crosswicks Ck(Doctors Ck-Ellisdale trib)	1,099	4,144
2040201060030	Doctors Creek (below Allentown)	3,012	5,596
2040201070010	Back Creek (above Yardville-H Sq Road)	3,009	4,171
2040201070020	Crosswicks Ck(below Doctors Creek)	2,657	5,518
2040201070030	Shady Brook/Spring Lake/Rowan Lake	2,824	3,150

Phase 2
Watershed Assessment Report

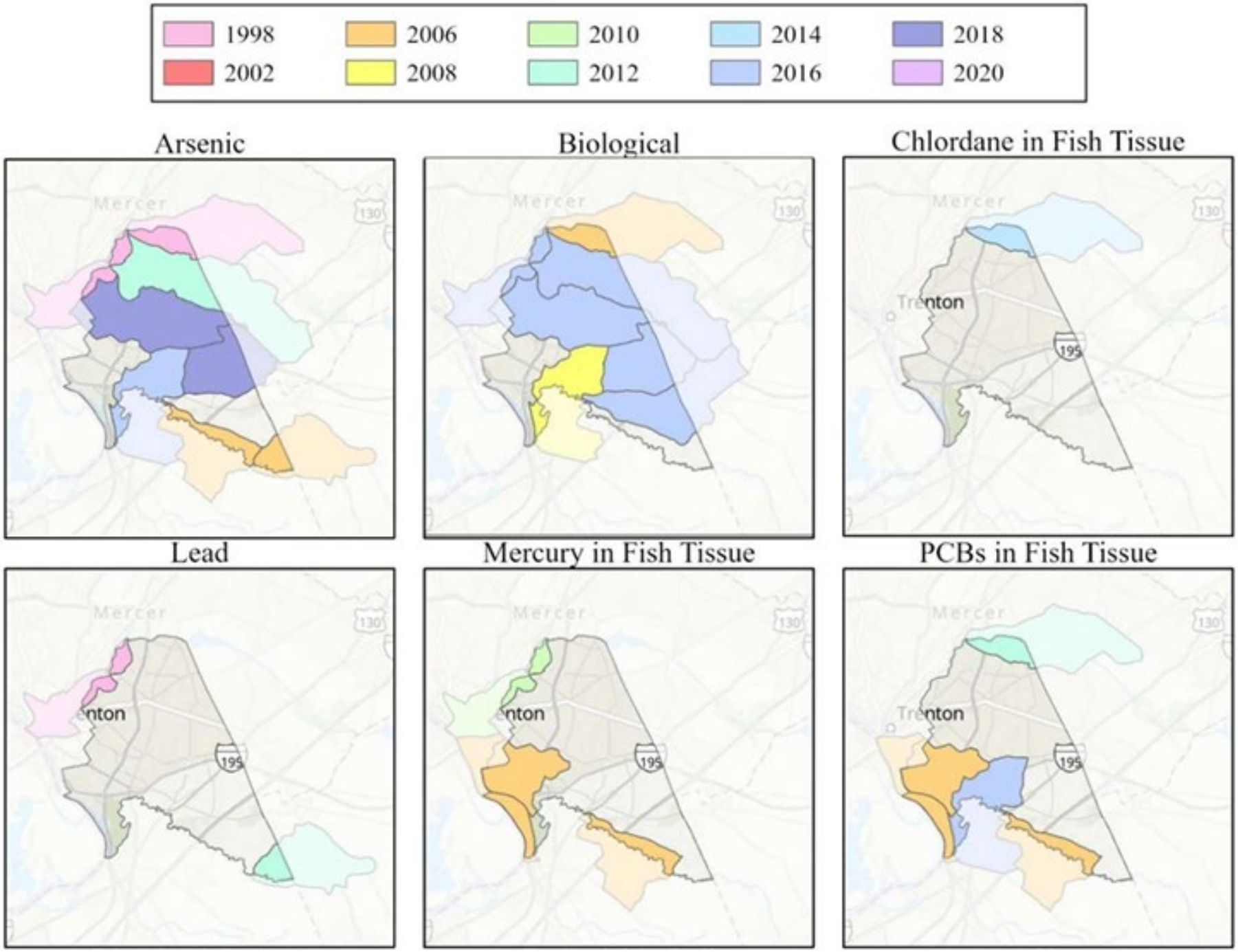


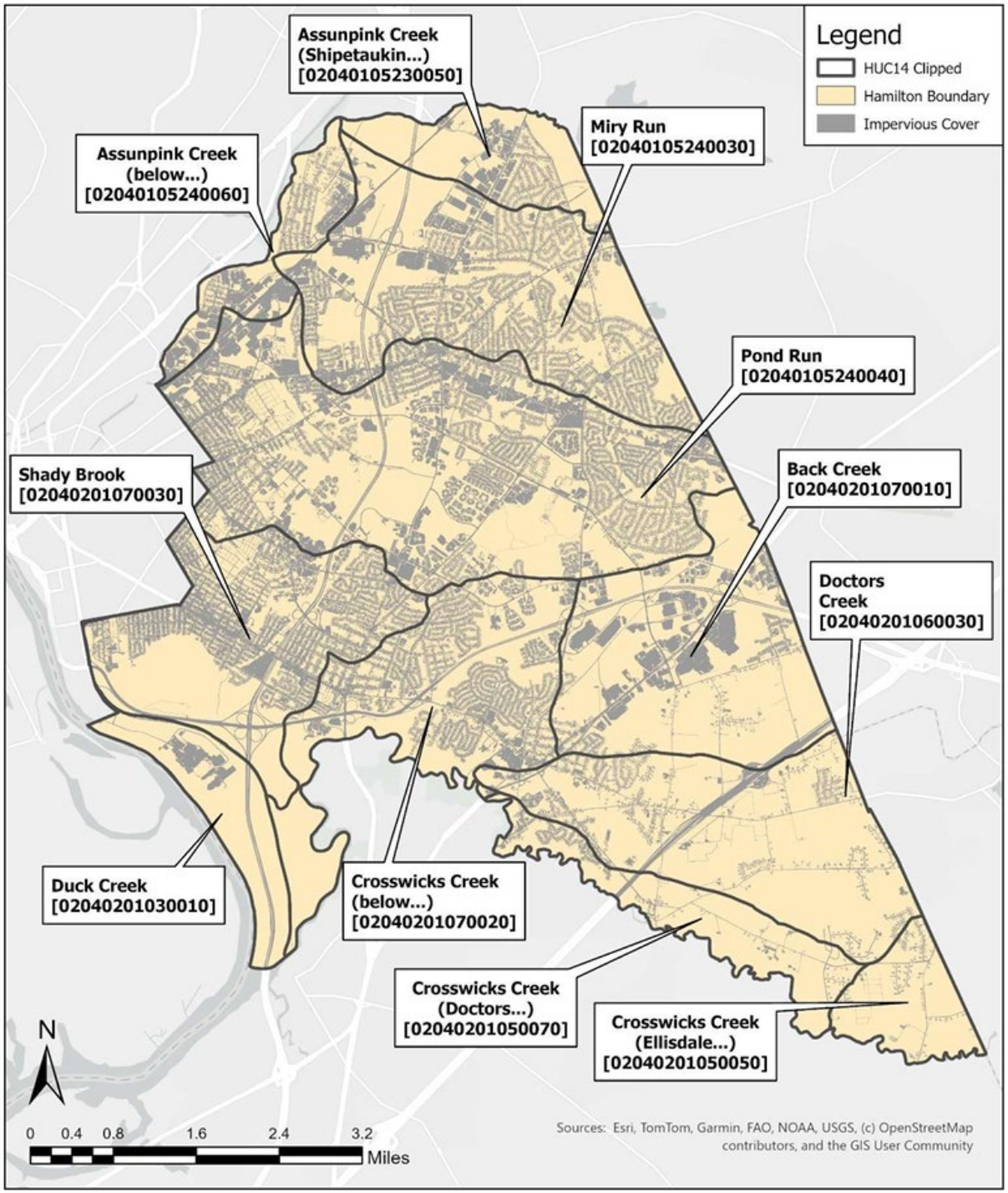
303(d) Impaired Waters by Year First Listed



Impervious Cover

Due of January 1, 2027


1998
2002
2006
2008
2010
2012
2014
2016
2018
2020
Arsenic
Biological
Chlordane in Fish Tissue
Lead
Mercury in Fish Tissue
PCBs in Fish Tissue
Mercer
130
Trenton
195


Legend
HUC14 Clipped
Hamilton Boundary
Impervious Cover
Assunpink Creek (Shipetaukin...) [02040105230050]
Miry Run [02040105240030]
Assunpink Creek (below...) [02040105240060]
Pond Run [02040105240040]
Shady Brook [02040201070030]
Back Creek [02040201070010]
Doctors Creek [02040201060030]
Duck Creek [02040201030010]
Crosswicks Creek (below...) [02040201070020]
Crosswicks Creek (Doctors...) [02040201050070]
Crosswicks Creek (Ellisdale...) [02040201050050]
N
0 0.4 0.8 1.6 2.4 3.2
Miles
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

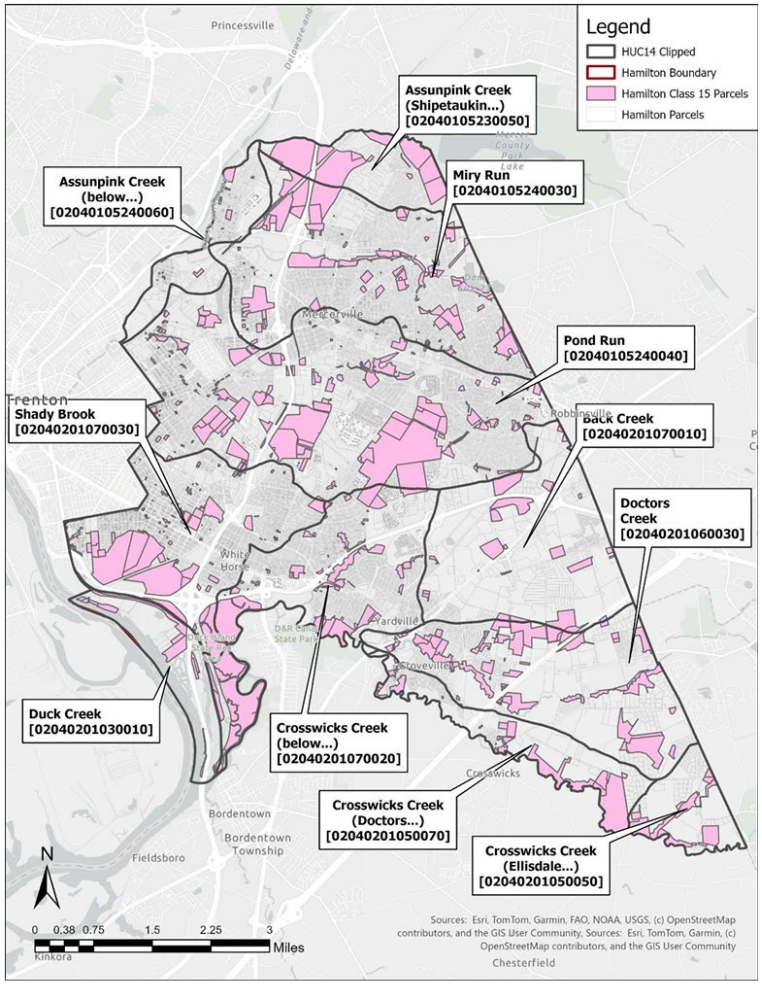
Phase 2
Watershed Assessment Report

Areal Loading Coefficients and Coliform EMC

Land Cover	TP [lbs/acre/yr]	TN [lbs/acre/yr]	TSS [lbs/acre/yr]	EMC [CFU/100 mL]
High, Medium Density Residential	1.4	15	140	7,750
Low Density, Rural Residential	0.6	5	100	7,750
Commercial	2.1	22	200	4,500
Industrial	1.5	16	200	2,500
Urban, Mixed Urban, Other Urban	1	10	120	4,500
Agriculture	1.3	10	300	10,000
Forest, Water, Wetlands	0.1	3	40	3,100
Barrenland/ Transitional Area	0.5	5	60	3,100

TSS Target Load Reductions (lb/yr)

HUC14	Pond Run*	Crosswicks Ck*	Crosswicks Ck*2
	2040105240040	2040201050070	2040201070020
Total	742,622	169,386	281,443
Ag +Urban	690,394	153,173	242,651
Manage %	20%	20%	20%
Target Load Reductions	**138,079**	**30,635**	**48,530**
Allowable Load	604,543	138,751	232,913



Tax Except Parcels (Class 15)

Due of January 1, 2027

Areal Loading Coefficients and Coliform EMC

Land Cover	TP [lbs/acre/yr]	TN [lbs/acre/yr]	TSS [lbs/acre/yr]	EMC [CFU/100 mL]
High, Medium Density Residential	1.4	15	140	7,750
Low Density, Rural Residential	0.6	5	100	7,750
Commercial	2.1	22	200	4,500
Industrial	1.5	16	200	2,500
Urban, Mixed Urban, Other Urban	1	10	120	4,500
Agriculture	1.3	10	300	10,000
Forest, Water, Wetlands	0.1	3	40	3,100
Barrenland/ Transitional Area	0.5	5	60	3,100

TSS Target Load Reductions (lb/yr)

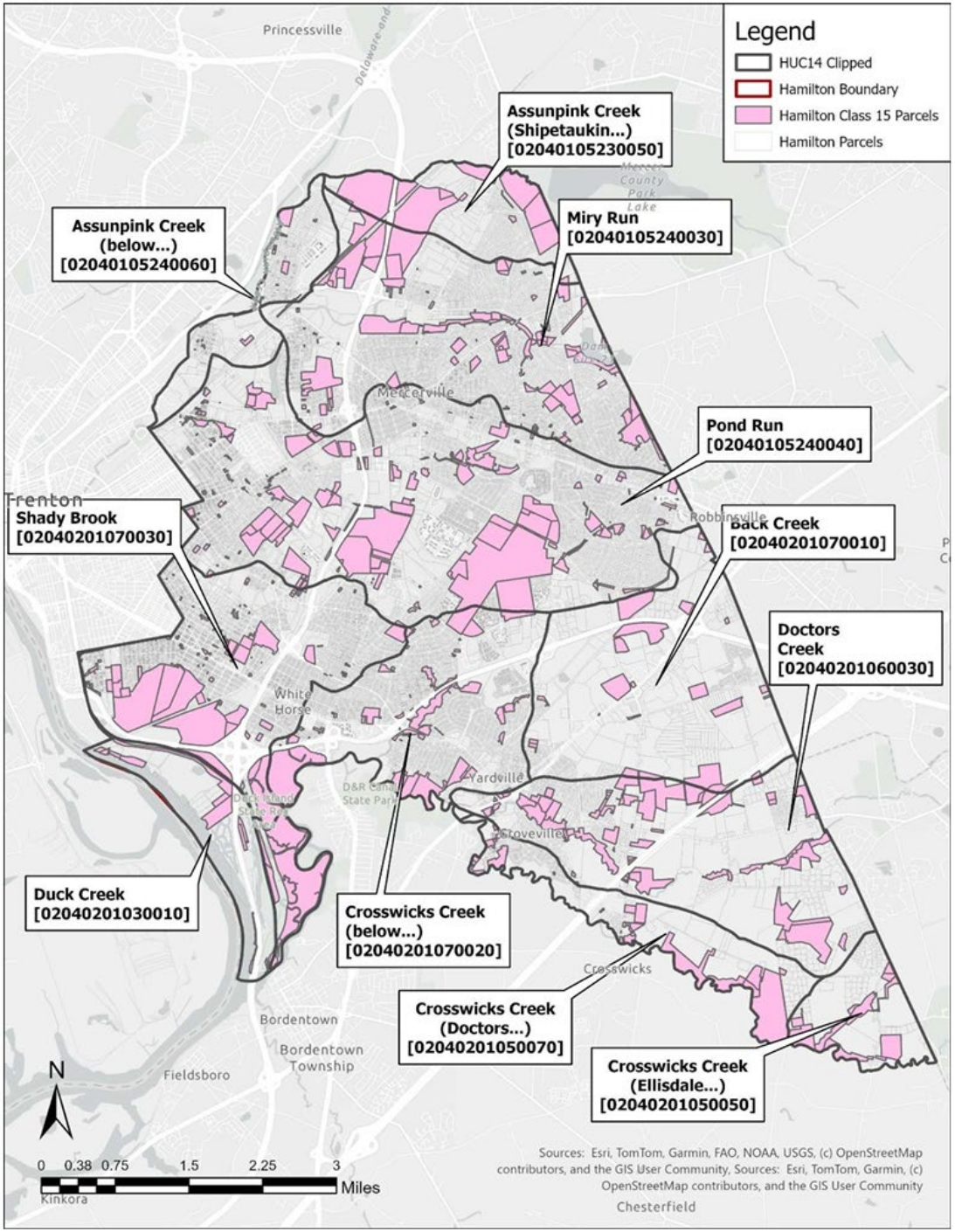
HUC14	Pond Run*	Crosswicks Ck*	Crosswicks Ck*2
	20401052400040	2040201050070	2040201070020
Total	742,622	169,386	281,443
Ag +Urban	690,394	153,173	242,651
Manage %	20%	20%	20%
Target Load Reductions	**138,079**	**30,635**	**48,530**
Allowable Load	604,543	138,751	232,913

Phase 2
Watershed Assessment Report

How to we find project locations?

- Look at Class 15 Parcels
- Prioritize areas with TMDLs
- Right of Way areas
- Private sites
- Public information session input
- Primary method = implementation of BMPs
  - New Green Infrastructure like Bioretention Systems
  - Retrofit: Detention Basins -> Bioretention Systems

Due of January 1, 2027


Legend
HUC14 Clipped
Hamilton Boundary
Hamilton Class 15 Parcels
Hamilton Parcels
Assunpink Creek (Shipetaukin...) [02040105230050]
Assunpink Creek (below...) [02040105240060]
Miry Run [02040105240030]
Pond Run [02040105240040]
Shady Brook [02040201070030]
Back Creek [02040201070010]
Doctors Creek [02040201060030]
Duck Creek [02040201030010]
Crosswicks Creek (below...) [02040201070020]
Crosswicks Creek (Doctors...) [02040201050070]
Crosswicks Creek (Ellisdale...) [02040201050050]
Princessville
Mercerville
Trenton
White Horse
Yardville
Groveville
Robbinsville
Crosswicks
Bordentown
Bordentown Township
Fieldsboro
Kinkora
Chesterfield
N
0 0.38 0.75 1.5 2.25 3
Miles
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Sources: Esri, TomTom, Garmin, (c) OpenStreetMap contributors, and the GIS User Community

Phase 2
Watershed Assessment Report

Cost of Proposed Management Strategies for Phosphorus Removal

Action	Management Strategy	Cost	Cost per lb/yr
1	Leaf collection and street sweeping (Leaf collection procedure to be reviewed to comply and street sweeping to follow. Street sweeping to be increased to twice a week [once every other week] with appropriate technology). This is an annual cost.	$1,090,635 [$259,896]	$3,125 [$891]
3	Bioretention systems for unmanaged areas (~111 acres of BMPs managing water quality storm with one foot of storage) [~$750,000/acre]	$83,250,000	$88,563
4	Converting existing detention basins to bioretention basins (66 basins need to be transformed) [~$40,000 each]	$2,640,000	$5,106
5	Repair and/or replacement of 29 septic systems [~$9,000 each]	$261,000	$1,426
	Total construction cost estimate =	$86,151,000	
	Total annual maintenance cost	$1,090,635 [$259,896]	

Phase 2 Watershed Assessment Re...

Cost of Proposed Management Strategies for Fecal Coliform Removal

Action	Management Strategy	Cost	Cost per CFU *10^12/yr
1	Street sweeping (Street sweeping to be increased to twice a week [once every other week]with appropriate technology). This is an annual cost.	$1,090,635 [$259,896]	$371 [$177]
2	Bioretention systems for unmanaged areas (~786 acres of BMPs managing water quality storm with one foot of storage) [~$750,000/acre]	$589,500,000	$19,277
3	Converting existing detention basins to bioretention basins (212 basins need to be transformed) [~$40,000 each]	$8,480,000	$1,648
	Total construction cost estimate =	$597,980,000	
	Total annual maintenance cost estimate =	$1,090,635 [$259,896]	

Implementation Schedule

Step	Management Strategy	Time Frame
1	Review leaf collection and street sweeping program. The township should begin soliciting grant funding for advanced street sweepers as needed.	0 to 6 months
2	Develop and deliver the educational programming, particularly focusing on encouraging residents to adopt pollution reduction strategies, build rain gardens, and install rainwater harvesting systems to help reduce stormwater flows to the waterways; seek funding to support rain garden installation by private property owners.	6 to 18 months
3	Develop detention basin retrofit designs that can be submitted for grant funding to implement.	6 to 18 months
4	Prepare designs for green infrastructure projects and submit these designs for funding.	6 to 24 months
5	Adopt a septic system registration program where homeowners must inspect and pump their systems on a regular basis (once every three years).	12 to 24 months
6	Continue developing retrofit designs and green infrastructure projects on a regular basis trying to achieve a certain amount each year to reach target reductions in a reasonable timeframe.	24 months+
7	Implement a sampling plan to establish effectiveness of implementation efforts	24 months+

Due of January 1, 2027

Cost of Proposed Management Strategies for Phosphorus Removal

Action	Management Strategy	Cost	Cost per lb/yr
1	Leaf collection and street sweeping (Leaf collection procedure to be reviewed to comply and street sweeping to follow. Street sweeping to be increased to twice a week [once every other week] with appropriate technology). This is an annual cost.	$1,090,635 [$259,896]	$3,125 [$891]
3	Bioretention systems for unmanaged areas (~111 acres of BMPs managing water quality storm with one foot of storage) [~$750,000/acre]	$83,250,000	$88,563
4	Converting existing detention basins to bioretention basins (66 basins need to be transformed) [~$40,000 each]	$2,640,000	$5,106
5	Repair and/or replacement of 29 septic systems [~$9,000 each]	$261,000	$1,426
	Total construction cost estimate =	$86,151,000	
	Total annual maintenance cost	$1,090,635 [$259,896]	

Phase 2 Watershed Assessment Re...

Cost of Proposed Management Strategies for Fecal Coliform Removal

Action	Management Strategy	Cost	Cost per CFU *10^12/yr
1	Street sweeping (Street sweeping to be increased to twice a week [once every other week]with appropriate technology). This is an annual cost.	$1,090,635 [$259,896]	$371 [$177]
2	Bioretention systems for unmanaged areas (~786 acres of BMPs managing water quality storm with one foot of storage) [~$750,000/acre]	$589,500,000	$19,277
3	Converting existing detention basins to bioretention basins (212 basins need to be transformed) [~$40,000 each]	$8,480,000	$1,648
	Total construction cost estimate =	$597,980,000	
	Total annual maintenance cost estimate =	$1,090,635 [$259,896]	

Implementation Schedule

Step	Management Strategy	Time Frame
1	Review leaf collection and street sweeping program. The township should begin soliciting grant funding for advanced street sweepers as needed.	0 to 6 months
2	Develop and deliver the educational programming, particularly focusing on encouraging residents to adopt pollution reduction strategies, build rain gardens, and install rainwater harvesting systems to help reduce stormwater flows to the waterways; seek funding to support rain garden installation by private property owners.	6 to 18 months
3	Develop detention basin retrofit designs that can be submitted for grant funding to implement.	6 to 18 months
4	Prepare designs for green infrastructure projects and submit these designs for funding.	6 to 24 months
5	Adopt a septic system registration program where homeowners must inspect and pump their systems on a regular basis (once every three years).	12 to 24 months
6	Continue developing retrofit designs and green infrastructure projects on a regular basis trying to achieve a certain amount each year to reach target reductions in a reasonable timeframe.	24 months+
7	Implement a sampling plan to establish effectiveness of implementation efforts	24 months+

Phase 3
Watershed Improvement Plan

- Summary of proposed location and load reductions of water quality improvement project
- Summary of public comments
- Summary of how projects will coordinate with other regulatory requirements, such as:

- Flood protection
- Endangered habitat/species
- Surface & ground drinking water protection
- Climate change/resiliency
- Green infrastructure/SWM requirements
- Wildlife corridors
- Green acres
- Environmental justice
- Combined Sewer Overflow Long Term Control Plans
- Wetlands
- Riparian buffers
- Forest corridors
- Related ongoing projects
- Pinelands Commission
- Highlands Council
- Delaware River Basin Commission

Due of December 1, 2027

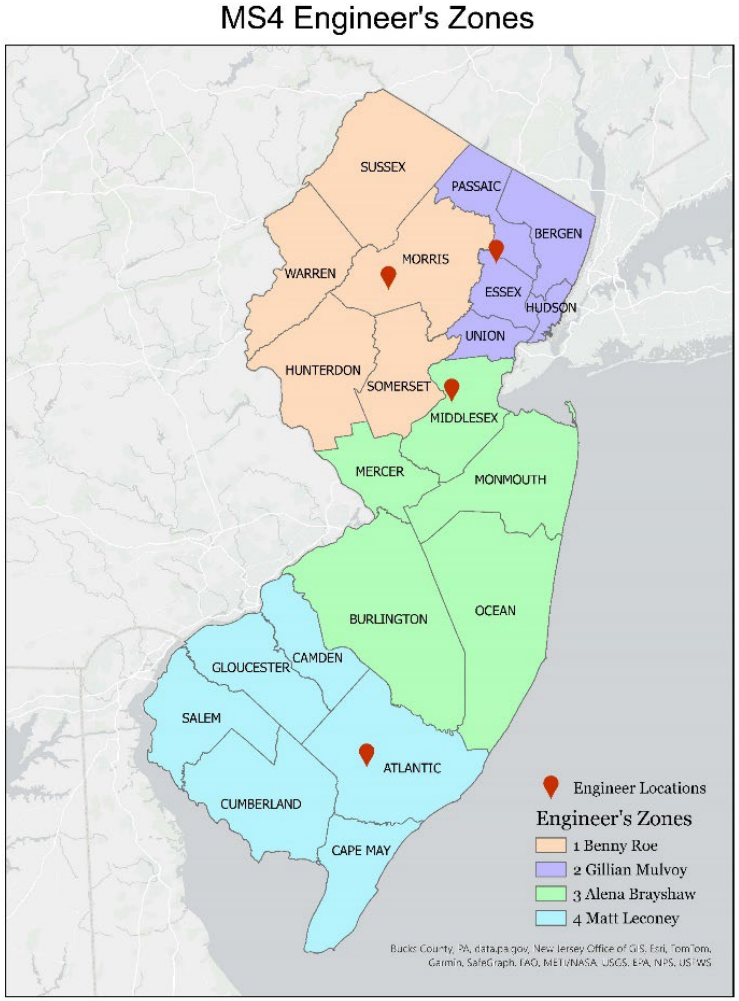
Phase 3
Watershed Improvement Plan

- Proposed implement schedule of the water quality improvement projects
- Schedule of public information sessions to be held
- Problems identified that are outside the jurisdiction of the permittee
- Cost, by project and year, and the funding opportunities to be sought
- Plan should be followed according to schedule set forth
- Plan should be updated biennially

Due of December 1, 2027

MS4 Technical Assistance Program

- Three-year agreement w/ NJDEP to support MS4 communities statewide
- Four Regional Engineers
- Provide technical support to all municipalities
- Focus on former Tier B municipalities
- Expand to existing Tier A as capacity is available



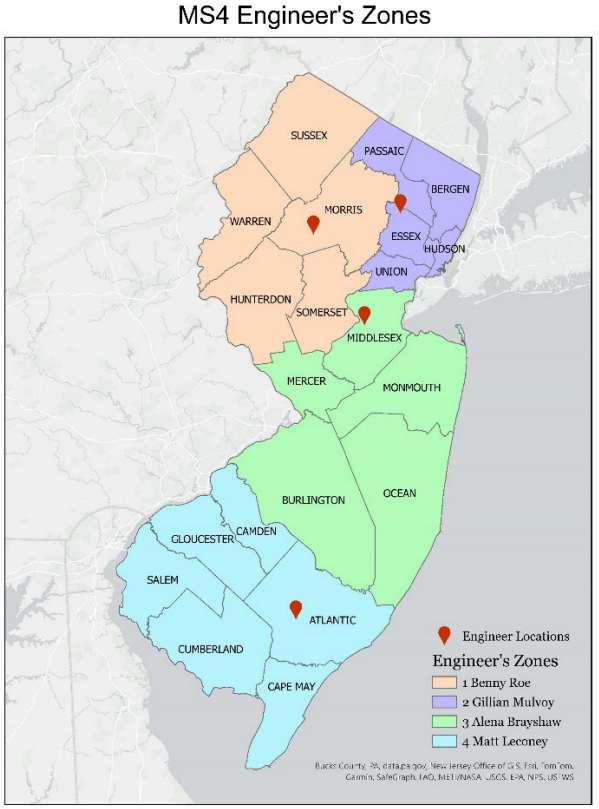
For the Watershed Assessment Report

We are preparing the “Sources of Pollution Section”

- Land Use Analysis by HUC14
- Impervious Cover Analysis by HUC14
- Septic System Analysis by HUC14
- NJPDES Point Source Location Map
- Tax exempt parcel mapping and site visit sheets

MS4 Technical Assistance Program

- Contact us!
  - Northwest – Benny Roe
    - benny.roe@rutgers.edu
  - Northeast – Gillian Mulvoy
    - gillian.mulvoy@rutgers.edu
  - Central – Alena Brayshaw
    - alena.brayshaw@rutgers.edu
  - South – Matthew Leconey
    - matthew.leconey@rutgets.edu



QUESTIONS?

Rutgers Cooperative Extension
Water Resources Program

Chris Obropta
Email: obtropta@envsci.rutgers.edu

www.water.rutgers.edu

RUTGERS
New Jersey Agricultural Experiment Station