

How to Prepare a Watershed Inventory Report

April 23, 2025

Rutgers Cooperative Extension Water Resources Program
MS4 Technical Assistance Program

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RUTGERS UNIVERSITY

Water Resources Program

New Jersey Agricultural Experiment Station



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.
- The MS4 Tier A Permit was recently updated with the new permit becoming effective on January 1, 2023.

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.

Watershed Improvement Plan

- Watershed Inventory Report (due January 1, 2026)
 - MS4 Infrastructure Mapping (due January 1, 2026)
- Watershed Assessment Report (due January 1, 2027)
- Watershed Improvement Plan (due December 1, 2027)

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

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)

MS4 Infrastructure Map

The permittee shall develop, update, and maintain an MS4 Infrastructure Map that delineates the location of the following stormwater features that are owned or operated by the permittee



i. MS4 outfalls (receiving surface water name, type of outfall);



ii. MS4 ground water discharge points (type); [infiltration BMPs, other infiltration/direct discharge]



iii. MS4 interconnections (type, upstream entity, downstream entity); [*between municipalities, county, or others*]



iv. Storm drain inlets (type, catch basin present, label present, retrofitted);

() = required attribute fields

[] = additional clarification

MS4 Infrastructure Map



v. MS4 manholes;



vi. MS4 conveyance (type, direction of flow); *[pipes and swales]*



vii. MS4 pump stations; *[stormwater only]*



viii. Stormwater facilities (type); and *[stormwater basins, other stormwater BMPs]*



ix. Property boundaries of maintenance yard(s) and other ancillary operations (type). *[Parcels]*

() = required attribute fields

[] = additional clarification

Phase 1 – Prepare and submit the Watershed Inventory Report (WIR)

Report shall summarize and include an electronic map of the items listed below (Due January 1, 2026)

- ~~i. All stormwater outfalls owned/operated by the permittee;~~
- ii. The drainage area for each outfall(s); [GIS analysis or manual delineation]
- iii. *~The receiving waterbodies of those outfalls;*
- iv. *~The water quality classification of all receiving waterbody segments;*
- ~~v. All stormwater interconnections from the municipality into another entities' storm or sanitary sewer system;~~

~~Text~~ = required by MS4 Map

~ = data is available from DEP

[] = additional clarification

More Mapping Requirements

- vi. The drainage area for each interconnection into another entities' storm or sanitary sewer system; **[GIS analysis or manual delineation]**
- ~~vii. All stormwater connection points into the municipality from another entities' storm sewer system;~~
- ~~viii. All storm drain inlets owned/operated by the permittee;~~
- ix. *~Area associated with each TMDL for waters that lie within or bordering the municipality;*
- x. *~Area associated with each water quality impairment for waters that lie within or bordering the municipality;*

~~Text~~ = required by MS4 Map

[] = additional clarification

~ = data is available from DEP

More Mapping Requirements

xi. ~Overburdened communities;

xii. ~Impervious areas; and

xiii. The location and ownership of all **stormwater outfalls** and **basins/infrastructure not owned/operated** by the permittee.
[see hydro.rutgers.edu database]

~~Text~~ = required by MS4 Map
~ = data is available from DEP

[] = additional clarification

Wait, so what do I really need for the WIR?



- ✓ Outfall drainage area
- ✓ Interconnection drainage area
- ✓  Private stormwater management measures*

*H & H Database: hydro.Rutgers.edu

- ✓ Receiving waterbodies
- ✓ Water quality classifications
- ✓ TMDL & Impairment areas
- ✓ Impervious areas
- ✓  Overburdened communities
- ✓ *NJPDES permitted sites*

Wait, so what do I really need for the WIR?

- Elements required in the MS4 Map
 - Outfalls, interconnections, inlets/CBs
- **Must be collected or determined**
 - Drainage areas for outfalls (owned and operated only), drainage area for interconnections out, outfalls (not owned and operated), Stormwater facilities (not owned and operated)
- Data from NJDEP
 - Receiving water bodies, WQ classification, TMDLs, WQ impairments, Overburdened communities, impervious area
 - Data needs to be in the report, but does not need to be submitted

Key Resources

- [NJDEP's WIP page](#)

See next slide

Home / Municipal Stormwater Regulation Program / Watershed Improvement Plan

Watershed Improvement Plan



Templates

DRAFT Phase 1 – Watershed Inventory Report Template
Watershed Assessment Report – Phase 2 – <i>Coming Soon</i>
Watershed Improvement Plan – Phase 3 – <i>Coming Soon</i>



New Jersey Watershed Evaluation Tool (NJ-WET)

NJ-WET



Resources

*WIP Project Matrix (See * below)
WIP Project Descriptions – <i>Coming Soon</i>
Pollutants of Concern
TMDL Lookup Tool
NJDEP Open Data
H&H Database
**MS4 Technical Assistance Program for Municipalities – Rutgers Cooperative Extension (See ** below)

[DRAFT WIR Report Available](#)
Includes guidance/clarification

[Useful Tool](#) can use to help make
maps for report

Key Resources



Resources

*WIP Project Matrix (See * below)

WIP Project Descriptions – *Coming Soon*

Pollutants of Concern

TMDL Lookup Tool

NJDEP Open Data

H&H Database

**MS4 Technical Assistance Program for Municipalities – Rutgers Cooperative
Extension (See ** below)

[Pollutant of Concern
descriptions](#)

[TMDL Lookup Tool](#) (for actual
TMDL Reports)

[Source for all state GIS datasets](#)

[Database of stormwater
facilities](#)

That's us! See our website
(water.rutgers.edu)

Key Resources

- [NJDEP's MS4 page](#)

Tier A MS4 Stormwater Permit

The Tier A Municipal Stormwater General Permit authorizes the discharge of stormwater from small municipal separate storm sewers. The permit was issued in response to USEPA's phase II rules. The Tier A permit addresses stormwater quality issues related to both new and existing development.

For information regarding the Department's 2023 Tier A MS4 Stormwater Grant Program please visit <https://www.nj.gov/dep/wlm/grants/swgrant.html>

[Permit](#)

[Presentation](#) clarifies requirements

[Presentation](#) greatly clarifies fields and data needed for MS4 Inf. Map

Tier A Permit

Templates and Forms

Annual Report and Certification Online Links and Tutorials

Guidance Document

- [Final Minor Modification Tier A Stormwater Master General Permit \(effective 11/1/2023\)](#) 
- [Final Renewal Tier A Stormwater Master General Permit \(effective 1/1/2023 without comments\) – Revised 12/9/2022](#) 
- [Response to Comments for the above Permit](#) 
- [*NEW 11/15/2024* Deliverables Timeline](#) 
- [Draft 2023 Renewal Tier A Stormwater Master General Permit](#) 
- [2023 Tier A Stormwater Master General Permit Fact Sheet](#) 
- [March 26, 2025 Combined SPC Training Slides](#) 
- [March 26, 2025 Combined SPC Training- Notes Version](#) 
- [March 26, 2025 MS4 Technical Assistance Slides](#) 
- [March 26, 2025 MS4 Technical Assistance- Notes Version](#) 
- [SPC Training- Tier A and Public Complex December 4th, 2024 Recording](#)
- [Stormwater Program Coordinator Training Certification List](#) 

Additional Resources

- EPA impaired waters list
 - Includes clear of list priority values for WQ Impairments and year first listed
 - <https://www.epa.gov/tmdl/new-jersey-impaired-waters-list>
- DEP DataMiner [NJPDES Permitting Program]
 - May help identify stormwater facilities or GW discharges
 - <https://njems.nj.gov/DataMiner/>
 - See Stormwater Construction Permits (5G3)

General data collection methods

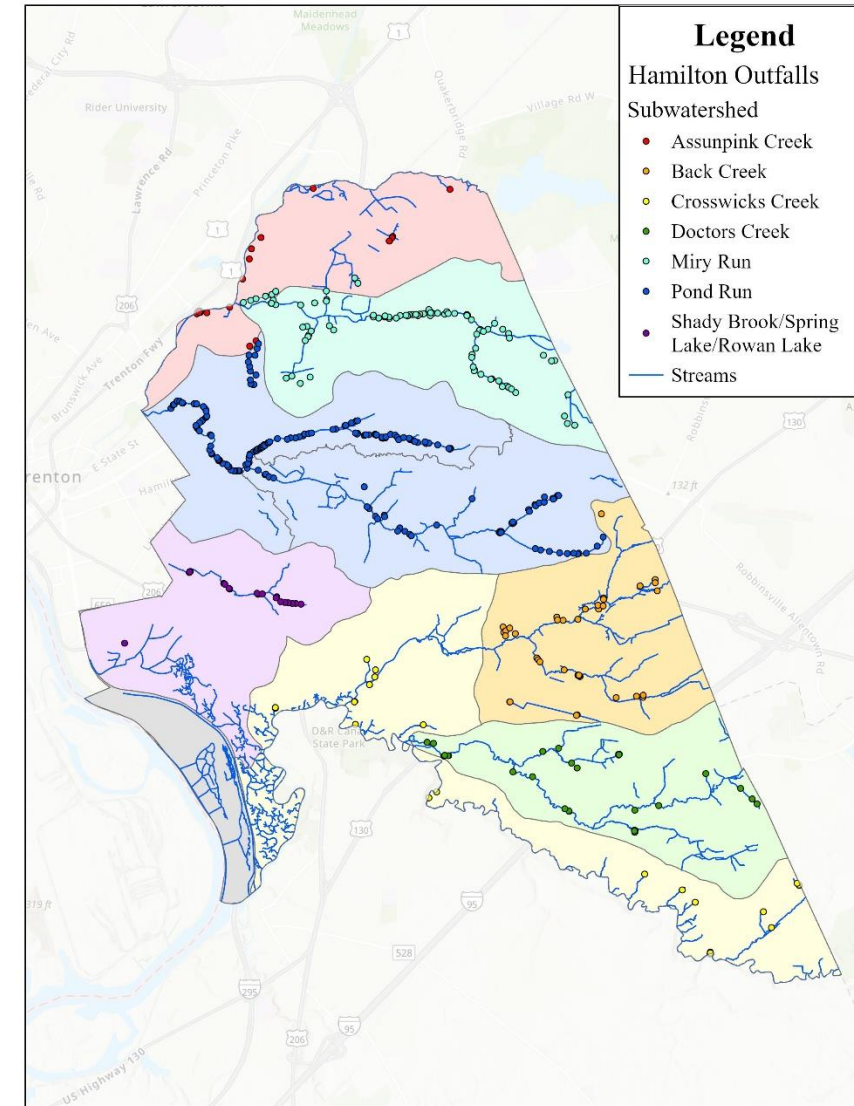
- Leverage existing datasets
 - E.g. Stormwater facilities (hydro.rutgers.edu)
- Field data collection
 - ArcGIS Field Maps
 - [State Mapping Assistance](#) tools (w/ free ArcGIS Online licenses)



Watershed Inventory Report

i. Outfalls

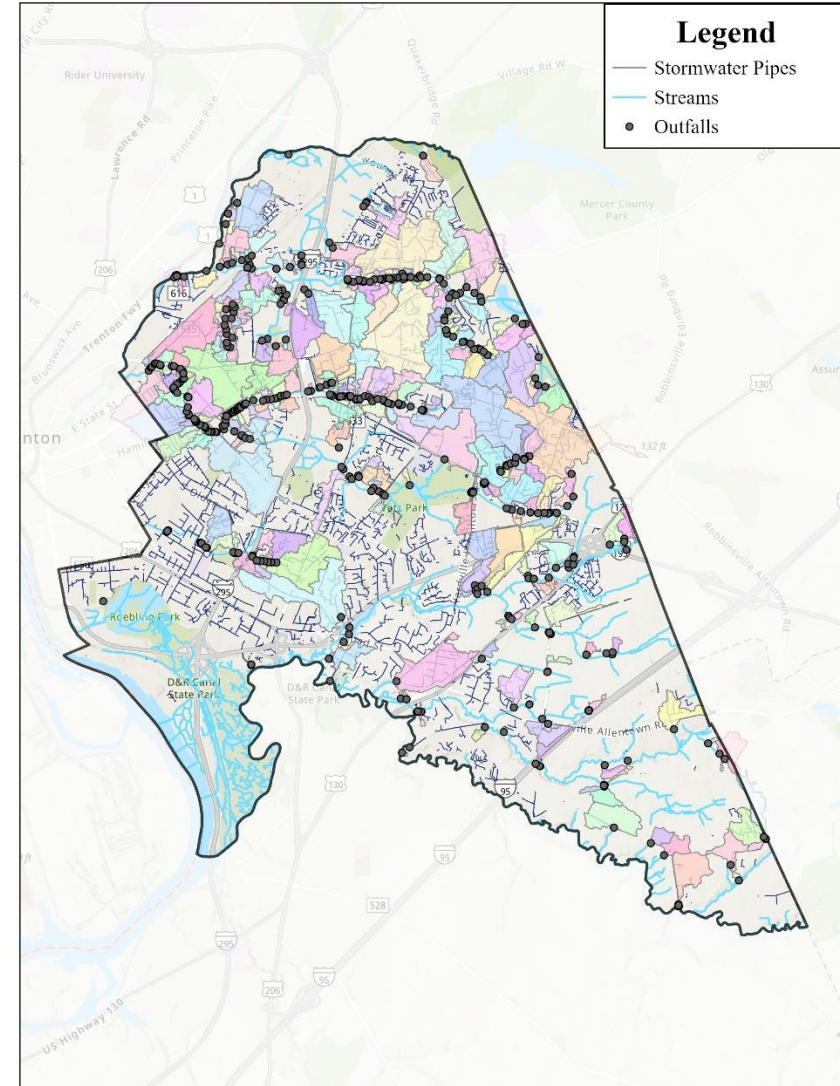
- Dataset should already exist
- If not:
 - Review existing construction plans/ CAD data
 - Interpret from pipe network data
 - Conduct field data collection
 - Check [DEP's dataset](#) / NJ-WET
- Required fields
 - receiving water surface name (see iii)
 - Type of outfall (pipe, open channel, other)





ii. Drainage Areas for Outfalls

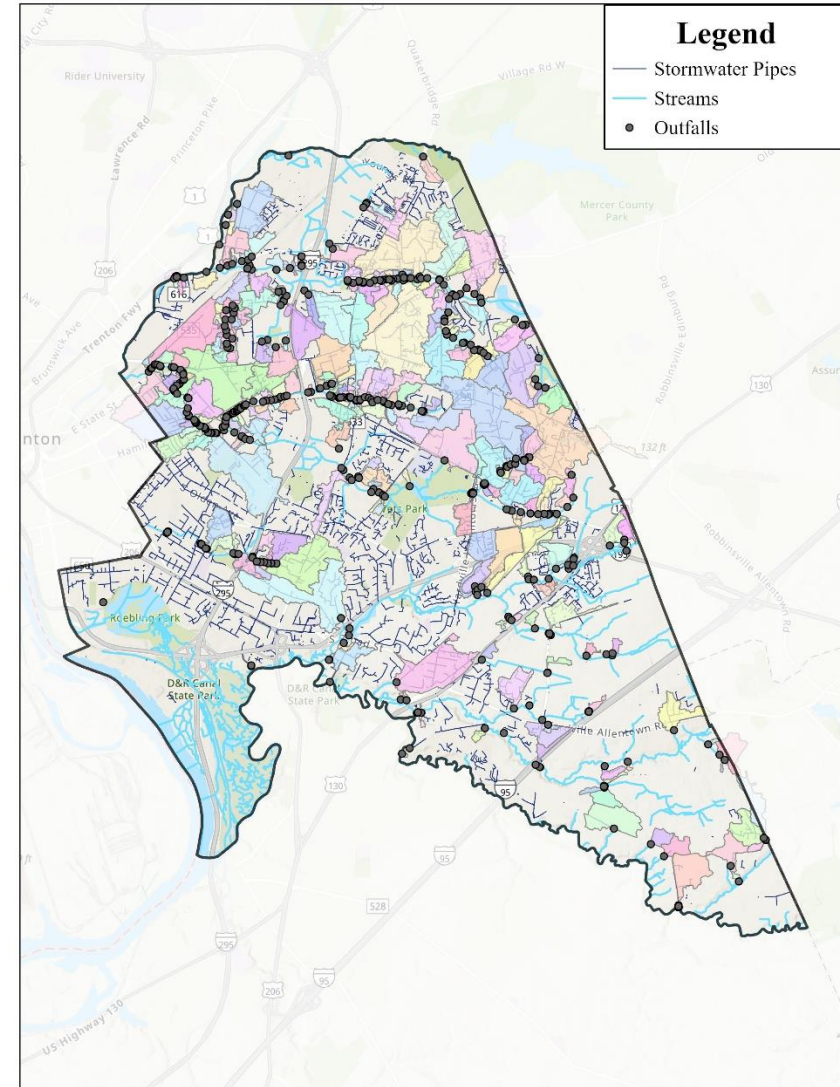
- Only needed for those owned and operated by permittee
- Use topographic data, inlets, and pipe network to delineate
 - Delineate by GIS ArcHydro Tools
 - Consider utility network operation (more complex but more accurate, future proof)
 - [Arc Hydro Guide](#), [Presentation](#)
 - Consider burning operation of pipe network (less complex, but less accurate)
 - We have internal guide we are working on to share
 - Delineate by hand (CAD/GIS)
 - May be feasible in smaller towns with limited GIS capability





ii. Drainage Areas for Outfalls (cont.)

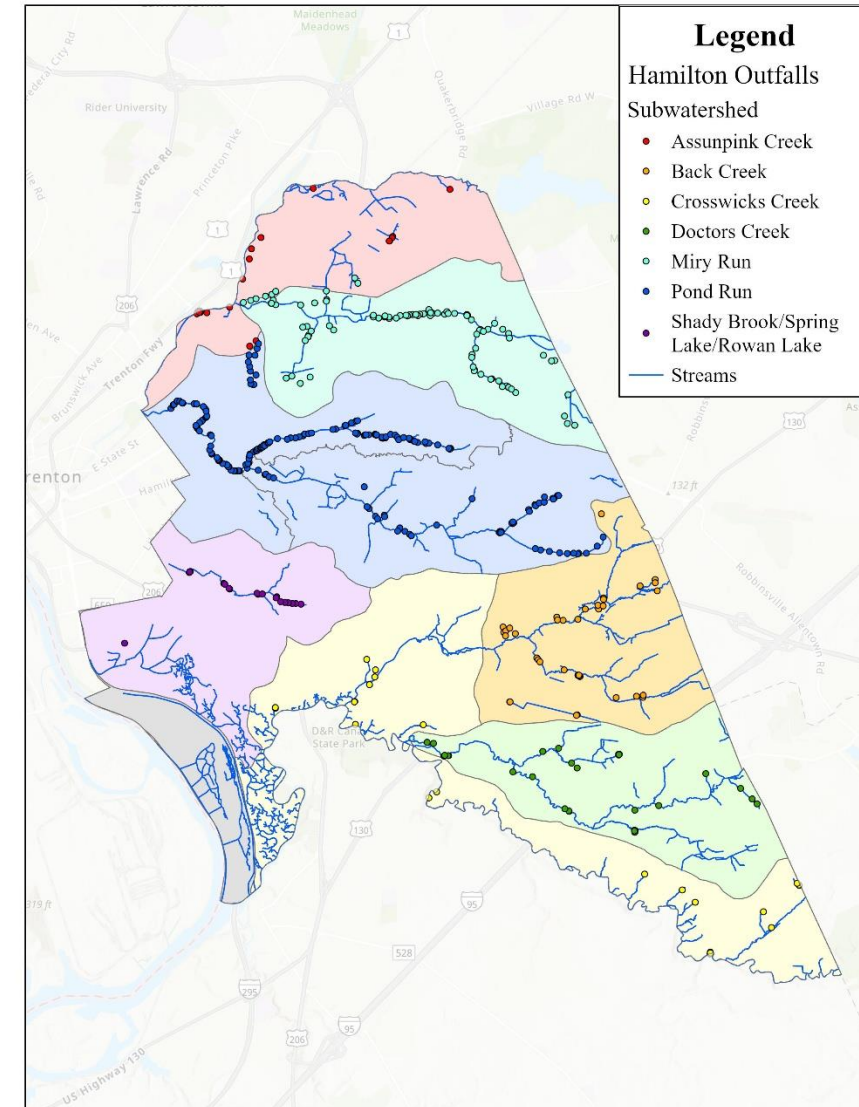
- Recommendation for topographic data
 - [USGS National Map](#) (1m DEM)
 - 1m data preferred for accuracy, but may have high processing times, so lower resolution could be used
 - [NOAA Data Access Viewer](#) (USGS CoNED or latest dataset)





iii. Outfall: Receiving Water Surface Body

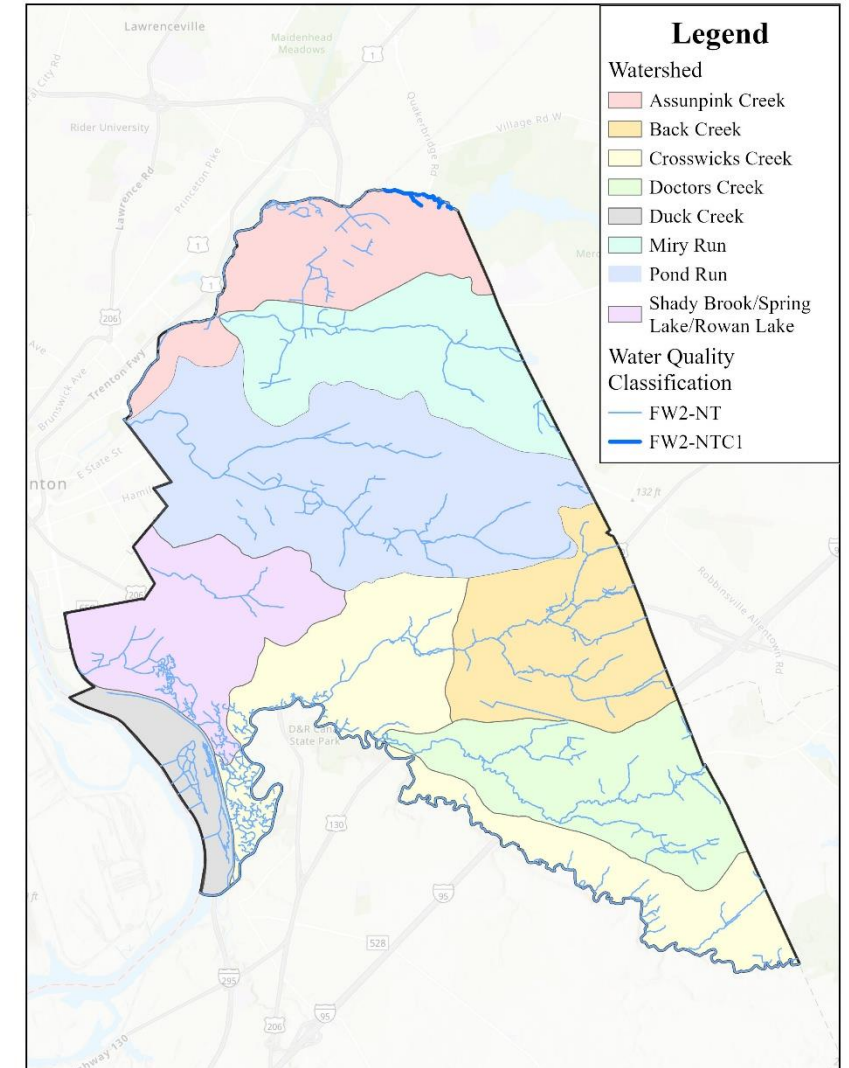
- How to find?
 - Use NJ-WET (turn off TMDL & Impairments)
 - “Surface Water Quality Classification of NJ” layer
 - <https://gisdata-njdep.opendata.arcgis.com/datasets/njdep::surface-water-quality-classification-of-new-jersey/explore?location=40.181537%2C-74.697577%2C14.43>
 - Pull data from layer to append to outfall data





iv. WQ Classification of Receiving Water

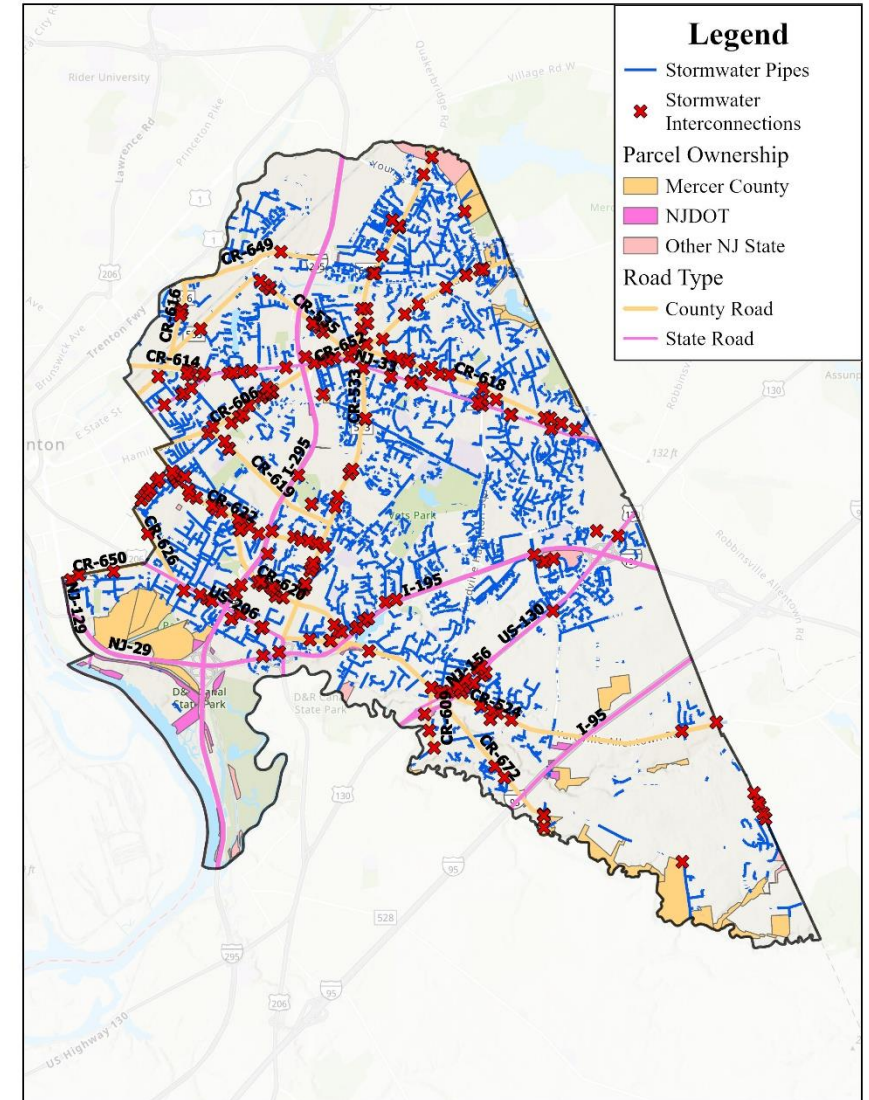
- How to find?
 - Use NJ-WET (turn off TMDL & Impairments)
 - Field is included in the “Surface Water Quality Classification of NJ” dataset
 - <https://gisdata-njdep.opendata.arcgis.com/datasets/njdep::surface-water-quality-classification-of-new-jersey/explore?location=40.181537%2C-74.697577%2C14.43>
 - Example classifications: FW1, FW2-TP, FW2-TM, FW2-NT, SE, SC, PL





v & vii. Stormwater interconnections

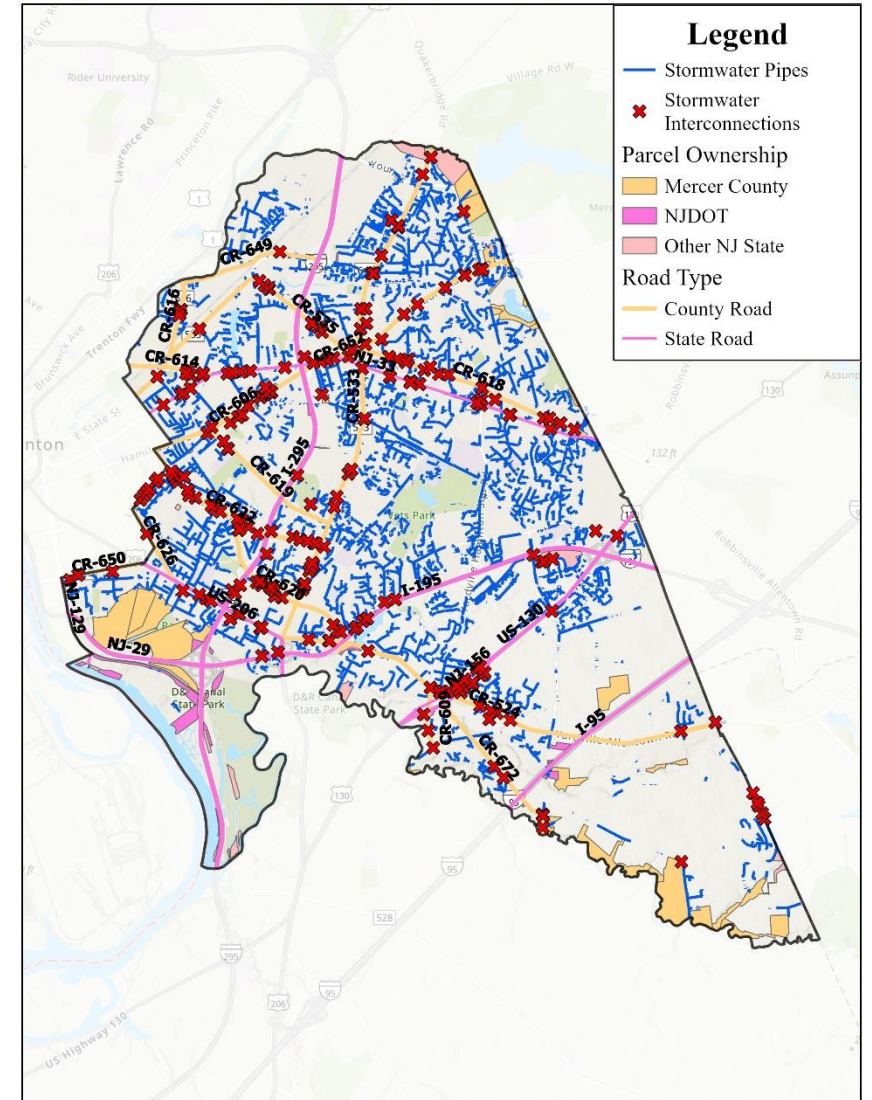
- How to find?
 - Use existing datasets to identify
 - **Parcels:** Isolate county, state, and private parcels
 - **Roads:** Isolate county and state roads
 - **Pipe network:** Forms basis for identifying interconnection points.
 - Define interconnection points
 - Everywhere a county, state, or private parcel intersects with the right of way
 - Everywhere a state or county highway intersects with a municipal roadway
 - Don't need to identify every single pipe connection, just main interconnection regions.





v & vii. Stormwater interconnections

- Establish interconnection direction
 - If pipe has correct direction use that
 - Otherwise interpret from pipe network
- Add fields to data
 - Upstream entity (water is coming from)
 - Downstream entity (water is flowing into)
 - Type (Pipe, Open Channel, Other)



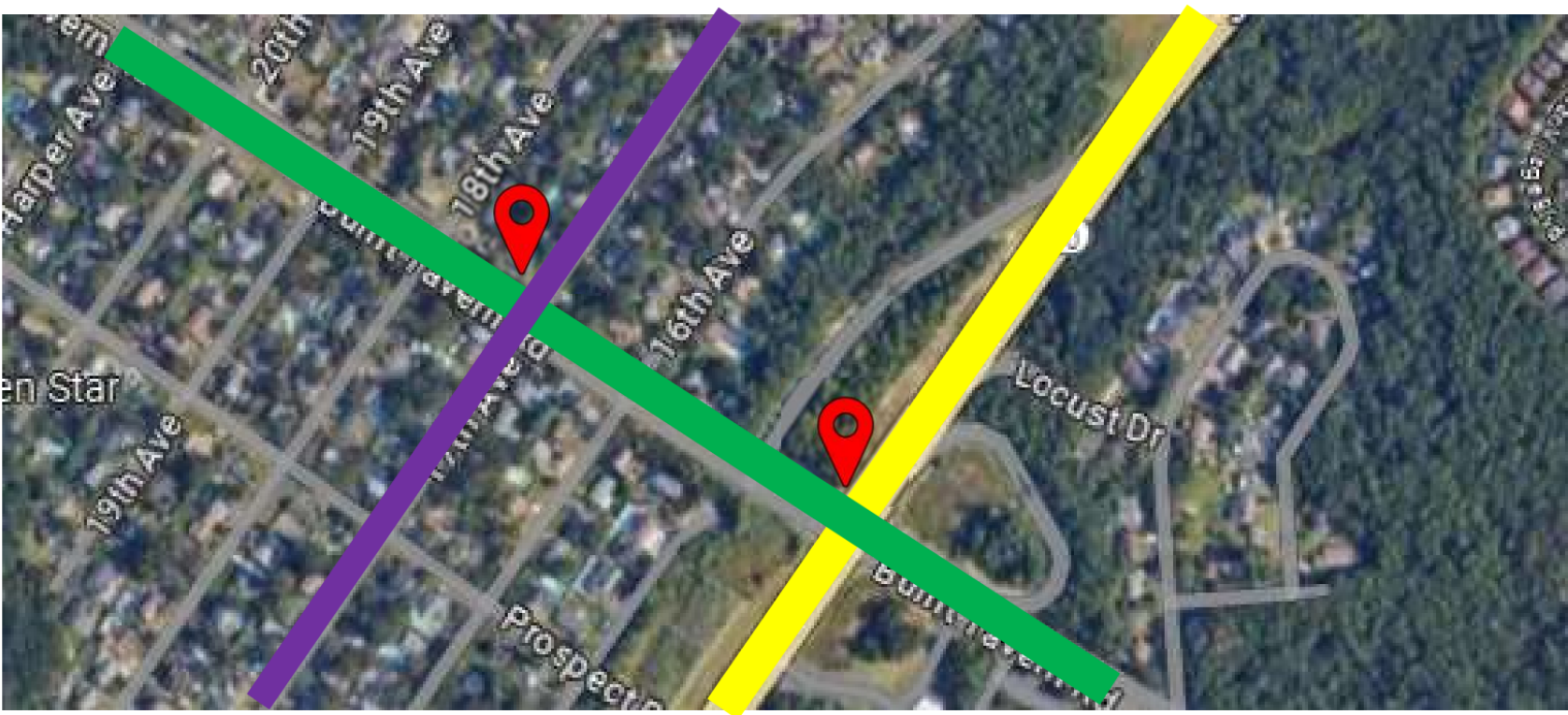
MS4 Interconnections

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

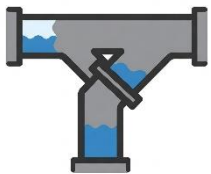
Required Attributes:

- ✓ Type
- ✓ Upstream Entity
- ✓ Downstream Entity

**Submit as a point layer*

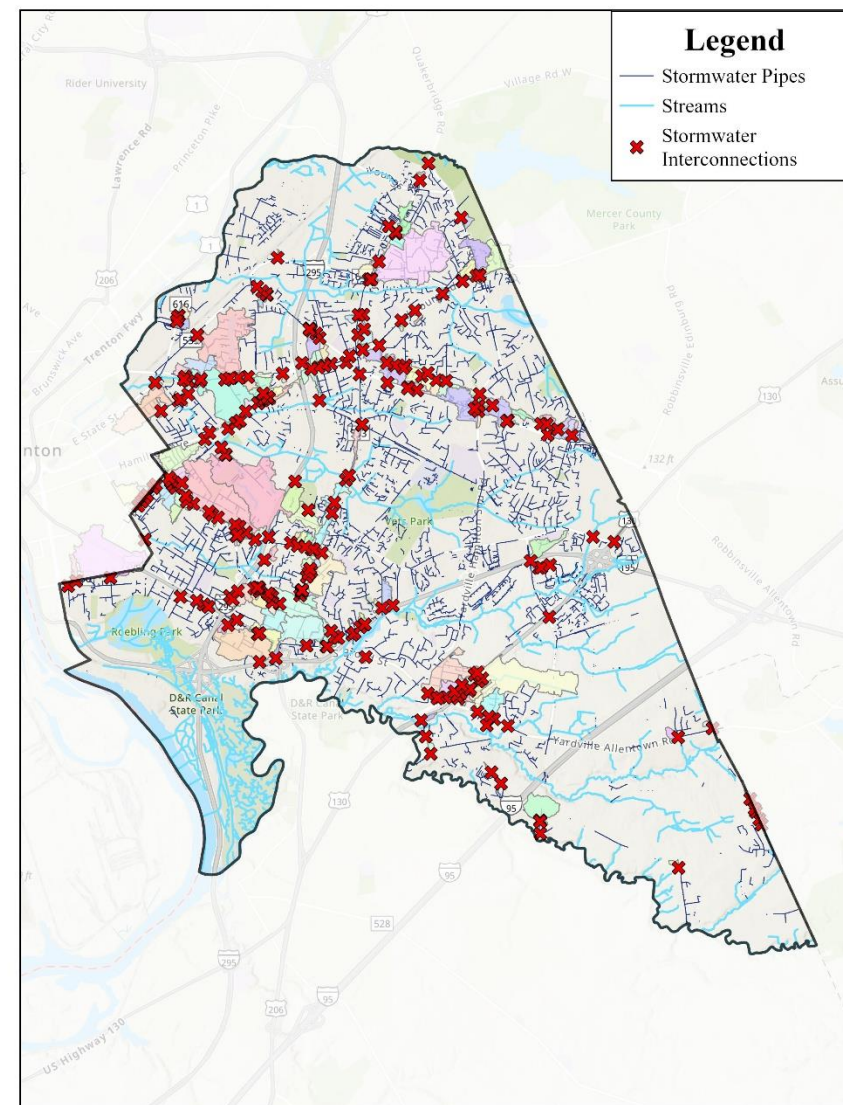


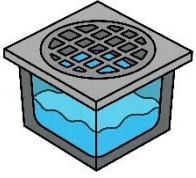
Local ID	Type	Upstream Entity	Downstream Entity
01	Pipe	Mercer County	Hamilton Township
02	Open Channel	Hamilton Township	NJDOT
03	Other – Described in comments	TCNJ	Mercer County



vi. Drainage Areas for Interconnections

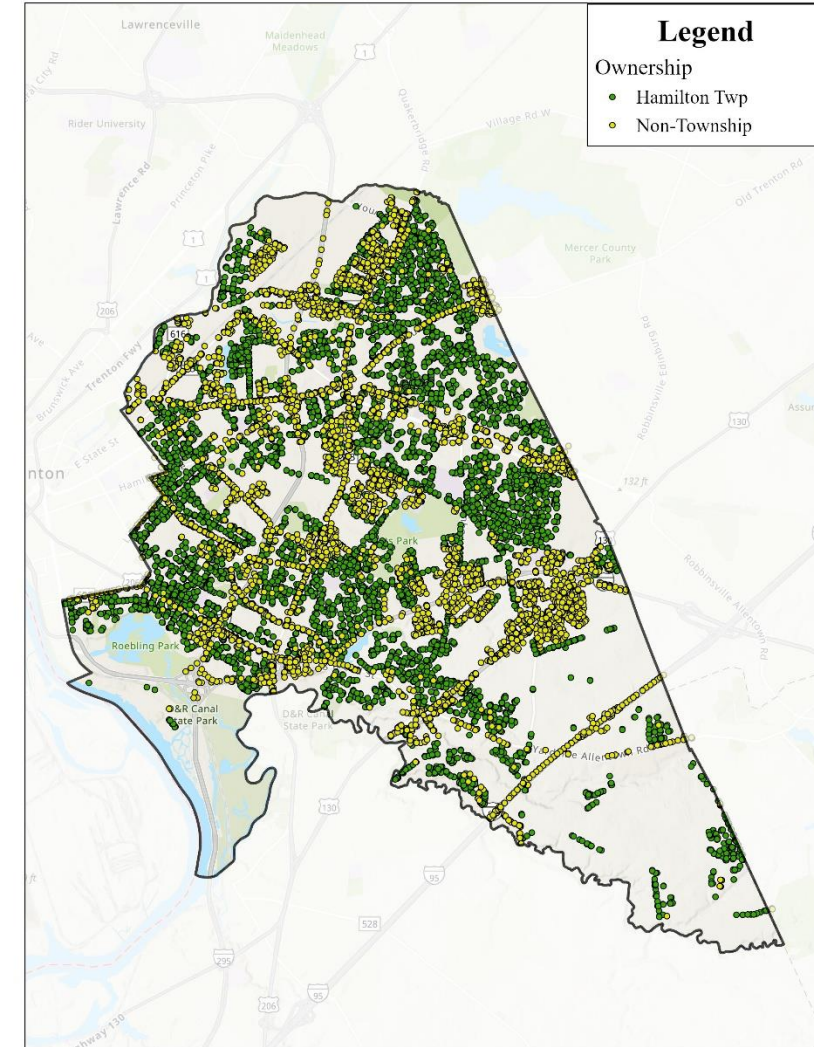
- Only for those flowing OUT of the municipality into another MS4 system
- See procedure for outfalls
 - May need to refine points on intersection at roads to get appropriate DAs





viii. Storm Drain Inlets / CBs

- Dataset should already exist
- If not:
 - Review existing construction plans/ CAD data
 - Interpret from pipe network data
 - Conduct field data collection
 - Check [DEP's dataset](#) / NJ-WET
- Required fields
 - type, catch basin present, label present, retrofitted



Storm Drain Inlets

"Storm drain inlet" means the point of entry into the MS4.

Required Attributes:

✓

Type

✓

Catch Basin Present?

✓

Label Present?

✓

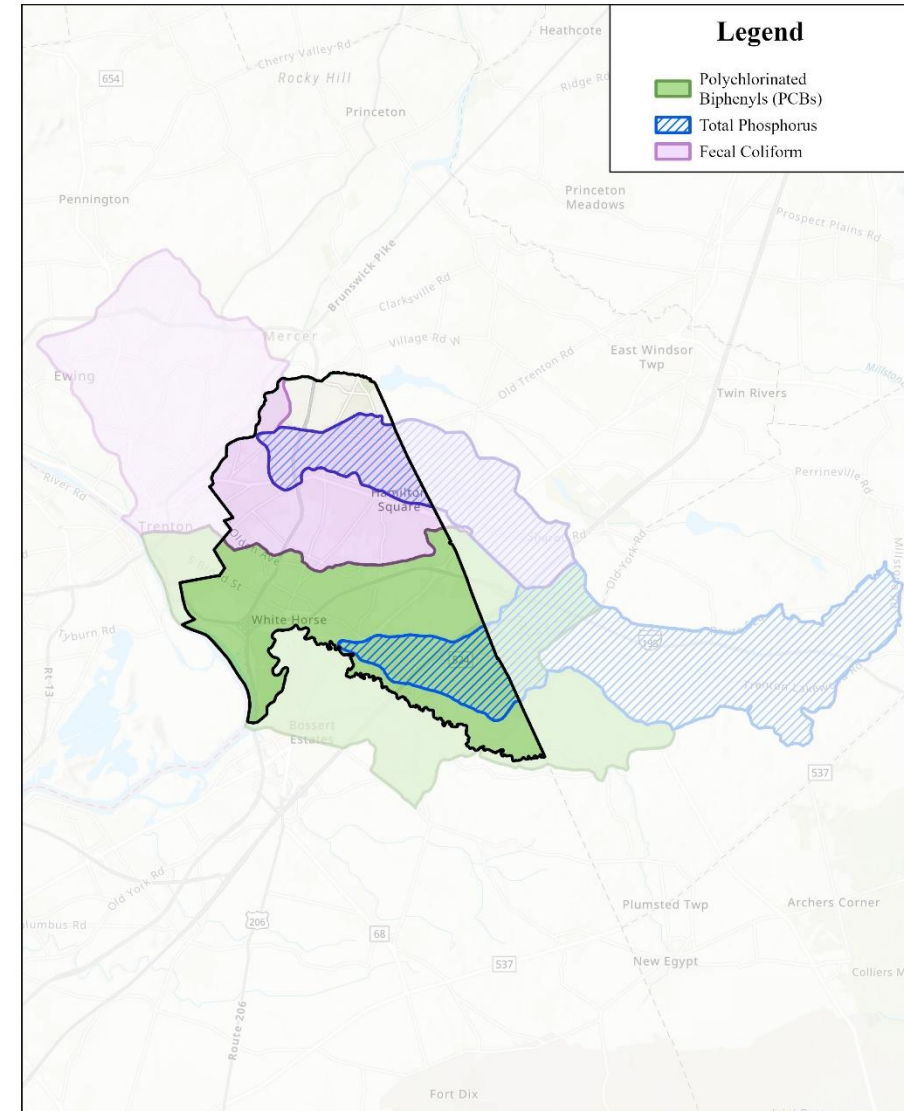
Retrofitted?

**Submit as a point layer*

Local ID	Type	Catch Basin Present?	Label Present?	Retrofitted?
01	Type A - Single Grate Inlet	Yes	Yes	Yes
02	Type B or C - Combination Inlet	Yes	Yes	No
03	Type D - Barrier Curb Combination Inlet	Yes	No	Yes
04	Type E - Dual Grate Inlet	No	Yes	Yes
05	Curb Cut	Yes	Yes	No
06	Trench Drain	No	No	No
07	Other	No	No	No

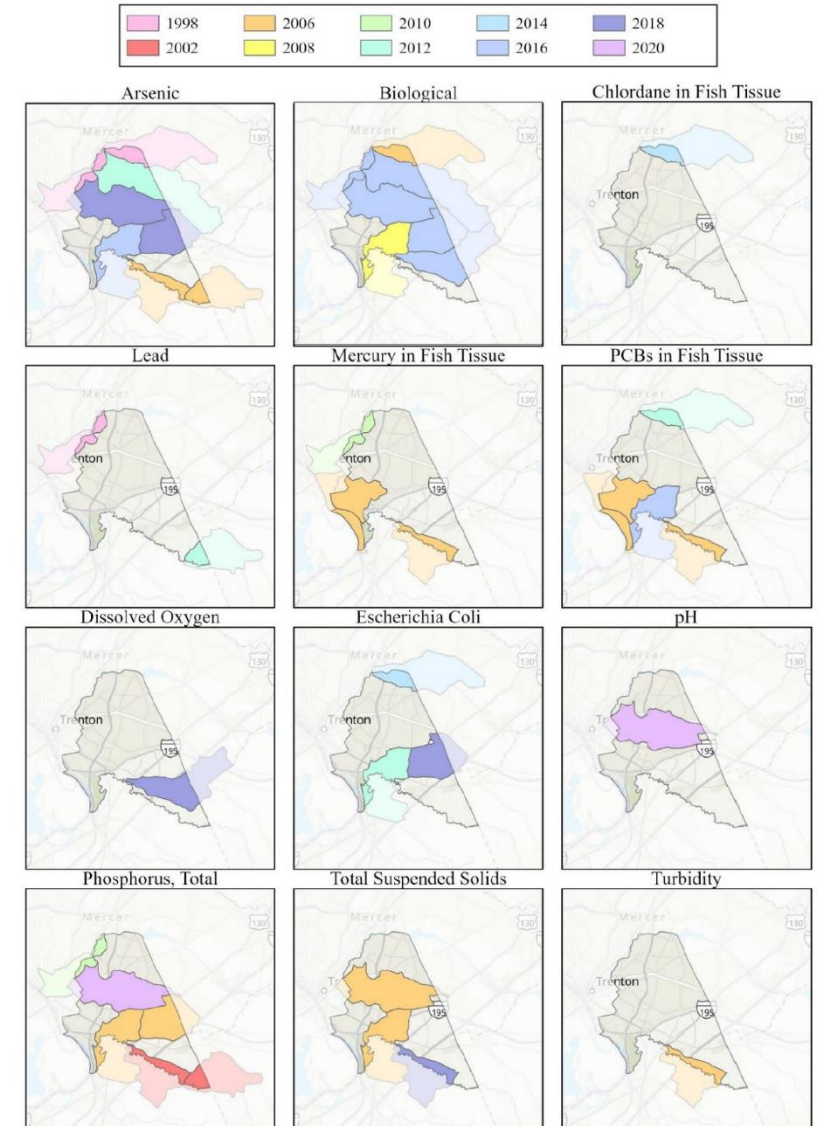
ix. TMDL Areas

- TMDL (total maximum daily load)
 - Areas with studies completed
- Use the [TMDL look-up tool](#) to identify study reports
- Can simply use NJ-Wet and export map
- Use these layers (for self made maps)
 - [TMDL \(Streamsheds\)](#)
 - [TMDL \(Streamsheds\) Pre-2008](#)
 - [TMDL \(Lakesheds\)](#)
 - [TMDL \(Shellfish\)](#)



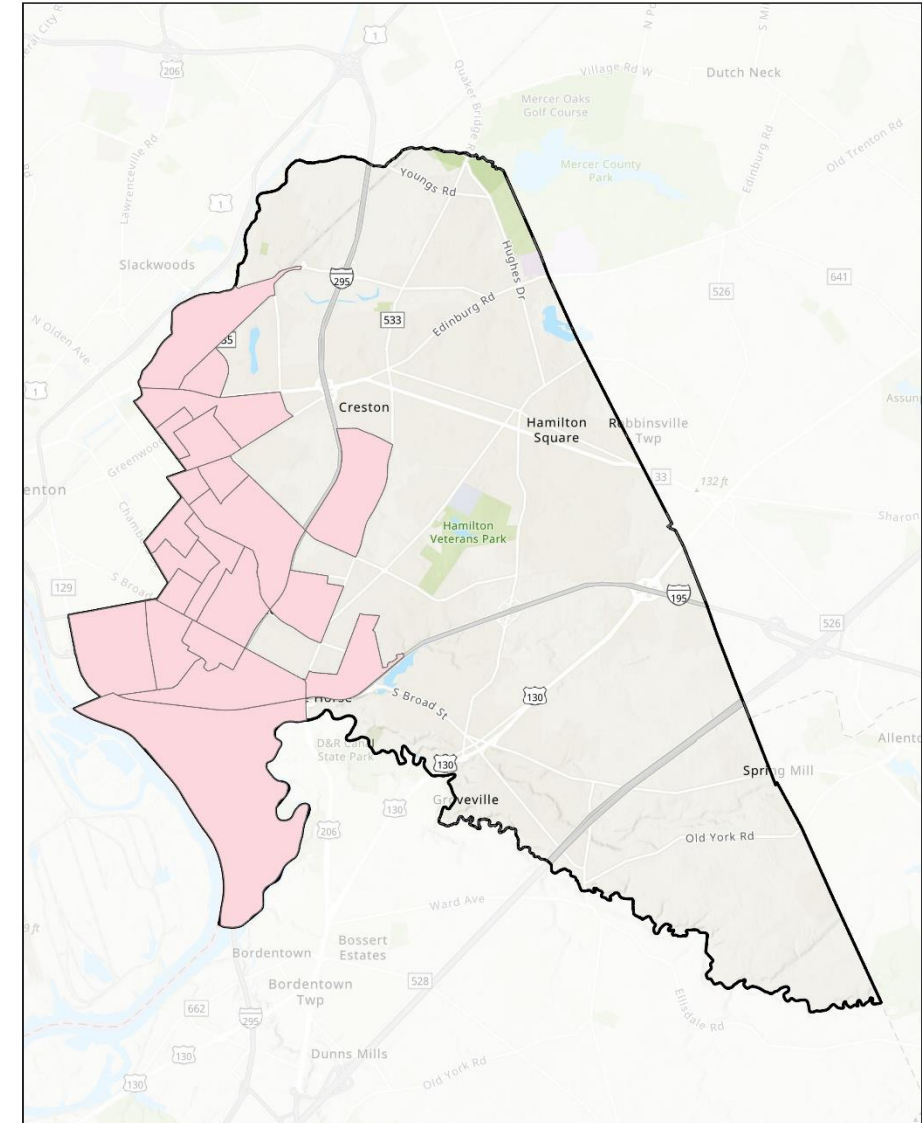
x. Water Quality Impairment Areas

- WQ Impairments
 - Areas with high concentrations but no study complete
 - Use NJ-WET
 - Turn off TMDL layers to more easily select and to make maps
 - Use layer and parameter table
 - <https://gisdata-njdep.opendata.arcgis.com/maps/0feb58f7b6d24e6eb04c20d70ae6006d/about>



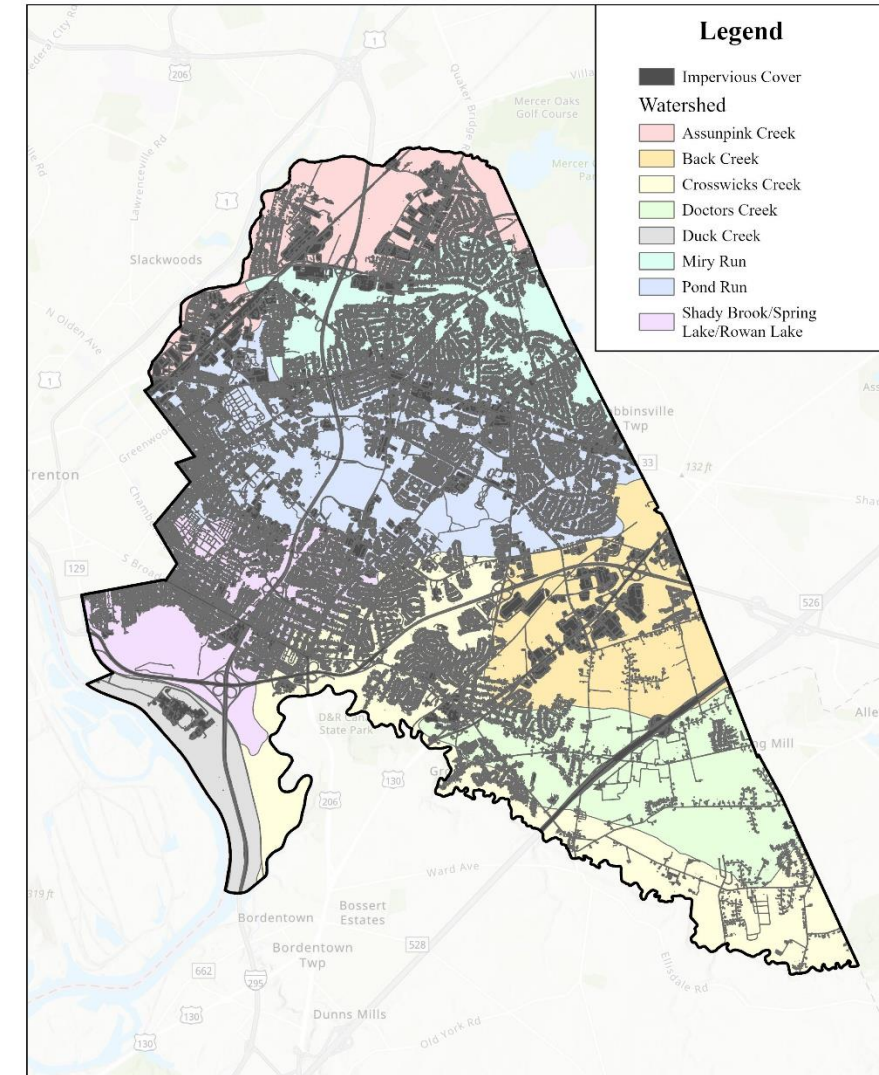
xi. Overburdened Communities

- Use NJ-Wet to make map
 - Turn off the impervious cover layer
- Use the layer to make your own map
 - https://gisdata-njdep.opendata.arcgis.com/datasets/fc6f290a805345e29d64659ab5b7bfbe_19/explore?location=40.122305%2C-74.738754%2C9.25



xii. Impervious Cover

- Use NJ-Wet to make map
 - Turn off the overburdened communities layer
- Use the layer to make your own map
 - <https://gisdata-njdep.opendata.arcgis.com/search?q=impervious%20cover%20county%202015>
 - Download based on county dataset



xiii. Outfalls and infrastructure not owned/operated

- Only outfalls and stormwater facilities are required
 - Can include in township owned and operated datasets for facilities and outfalls respectively, just add an ownership field to show township vs. other ownership

Non-Municipally Owned or Operated Stormwater Facilities (for Tier A permittees only)

This section will require Tier A permittees to detail the information below for non-municipally owned or operated structural stormwater management measures as follows:

- | | |
|--|---|
| • <i>Bioretention Systems (large-scale)</i> | • <i>Sand Filters (large-scale)</i> |
| • <i>Blue Roofs</i> | • <i>Small-scale Bioretention Systems</i> |
| • <i>Cisterns</i> | • <i>Small-scale Infiltration Basins</i> |
| • <i>Dry Wells</i> | • <i>Small-scale Sand Filters</i> |
| • <i>Extended Detention Basins</i> | • <i>Standard Constructed Wetlands</i> |
| • <i>Grass Swales</i> | • <i>Stormwater Outfalls</i> |
| • <i>Green Roofs</i> | • <i>Subsurface Gravel Wetlands</i> |
| • <i>Infiltration Basins (large-scale)</i> | • <i>Vegetative Filter Strips</i> |
| • <i>Manufactured Treatment Devices (MTDs)</i> | • <i>Wet Ponds</i> |
| • <i>Pervious Paving Systems</i> | |

**Permittees may exclude acquiring information for the following non-municipally owned or operated stormwater infrastructure: storm drain inlets, catch basins, and conveyance.*



xiii. Outfalls and infrastructure not owned/operated

- How do I find them?
 - [Hydro.rutgers.edu](http://hydro.rutgers.edu) database
 - Can extract spreadsheet w/ lat/long to import into GIS (see downloads)
 - Look at Land Use Codes
 - 1499 (stormwater basin)
 - 5300 (Artificial lakes) – includes some retention basins
 - LULC 2020 Dataset: <https://gisdata-njdep.opendata.arcgis.com/maps/2deaaa3cadd94166bdbff92a44ade284>
 - Look at [NJDEP DataMiner](#) [Stormwater Construction Permits (5G3)]
 - Look at urban land use built after 1983
 - Erase the [1986 land use](#) urban area from the 2020 urban area. Look for any areas without basins found from previous methods and scan aerial

MS4 Map Data not covered in WIR



ii. MS4 ground water discharge points (type);

- Include all infiltration BMPs
- Include any other known discharges, review stormwater permits



v. MS4 manholes;

- Have it or you don't dataset, field data collection or review plans/CAD

vi. MS4 conveyance (type, direction of flow);



- Have it or you don't dataset, field data collection or review plans/CAD
 - If not feasible, try to extract from catch basins and manhole datasets
- Type field [Pipe, Open Channel, other], direction of flow derived from drawn direction if correct (try Line Bearing GIS tool) [N, SE, NW]

MS4 Map Data not covered in WIR



vii. MS4 pump stations;

- Not common, only include stormwater pumps



viii. ~Stormwater facilities (type); and

- See section on not owned/operated for type field



ix. Property boundaries of maintenance yard(s) and other ancillary operations (type).

- Simply extract the parcels for the facilities and submit them

() = required attribute fields

Phase 2 –Watershed Assessment Report

Report shall summarize and include an electronic map of the items listed below (Due January 1, 2027)

- i. An assessment of **potential water quality improvement projects** by sub-watershed and parameter
- ii. An estimate of the **percent reduction in loading of the TMDL/impaired parameters** due to project(s) in i. above
- iii. A summary of **feedback from public information** sessions
- iv. 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
- v. An estimate of an **implementation schedule**

Recommended Elements to Include

- Review of TMDL reports to understanding the proposed load reduction targets
- Identify sources of problems
 - Impervious cover, point sources, septic systems, leaf litter, wildlife
- Estimate loadings for pollutants of concern
 - based on the TMDL report, land use runoff coefficient, or other means
- Estimate load reductions needed to achieve TMDLs as written

Recommended Elements to Include

- Identify impact of existing management systems
- Review of potential projects, consider:
 - Improvements to: Leaf collection, Street sweeping
 - Stormwater facilities (bioretention systems, porous pavements, etc.) in areas with no stormwater management
 - Improvement of existing facilities (e.g. detention basins to bioretention system) to retrofit them for high pollutant removal
- Example projects to use as basis for Phase 3
- NOTE: NJDEP is working on a template, and we will work on further detailed guidance as well.

Phase 3 –Watershed Improvement Plan Report

Report shall prepare and submit a Watershed Improvement Plan Report (Due December 1, 2027) that includes:

- i. A summary of proposed locations and load reductions of water quality improvement projects, both public and private, to be implemented
- ii. A summary of the public comments received, and the changes made to the Final Plan

iii. A summary of how the projects will be coordinated 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

- iv. The proposed implementation schedule for the water quality improvement projects
- v. A schedule of the public information sessions to be held
- vi. Problems identified that are outside the jurisdiction of the permittee, if any. These can be related to pollutant loading due to agricultural properties, or other lands not under the jurisdiction of the municipality, and opportunities to address them
- vii. Costs, broken down by project and year, the funding opportunities that will be sought
- viii. This plan shall describe how stormwater related problems in overburdened communities have been prioritized.

Additional guidance to come

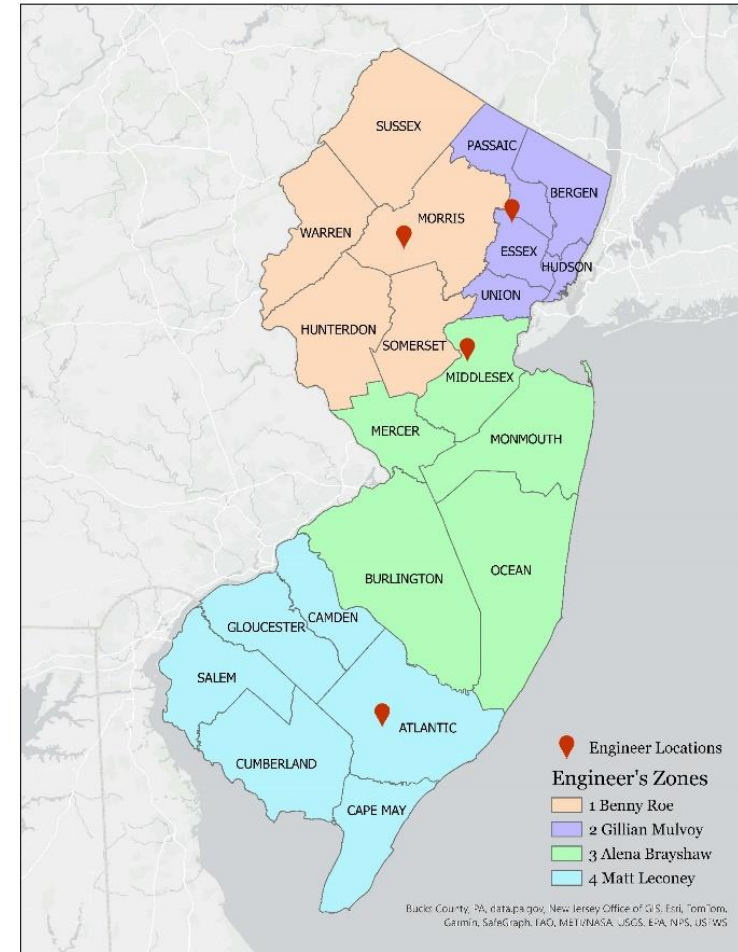
Regional Collaboration

- The Department fully supports municipalities and other MS4 permittees collaborating regionally to prepare their WIPs
- Some potential partnership ideas:
 - 2 or more MS4s that discharge to the same or adjacent waterbodies or HUC 14s that share a TMDL or impairment
 - Managed by a watershed group or similar organization
 - Managed by an existing regional authority

How can we help?

- 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

MS4 Engineer's Zones



Primary Support Tasks

- 1. Preparation of the Watershed Inventory Report/ MS4 Infrastructure Map (Due January 1, 2026)**
2. Preparation of the Watershed Assessment Plan (Due January 1, 2027)
3. Preparation of the Watershed Improvement Plan (Due December 1, 2027)
- 4. Inspections of stormwater management facilities, inlets, catch basins, pipes, outfall**
- 5. Implementation of an Illicit Discharge Detection and Elimination program**
- 6. Other MS4 Compliance**
7. Other tasks upon request

Watershed Inventory Report Tasks

- a. Review existing infrastructure data and provide audit of what is there, what is missing, and how to obtain missing information
- b. Assist with establishing a data collection system for infrastructure for towns not owned and operated by the township
- c. Provide dataset of stormwater facilities not owned and operated by the township
 - Can be merged if dataset of existing facilities is provided
 - Groundwater discharge points (Infiltrating BMPs)

Watershed Inventory Report Tasks

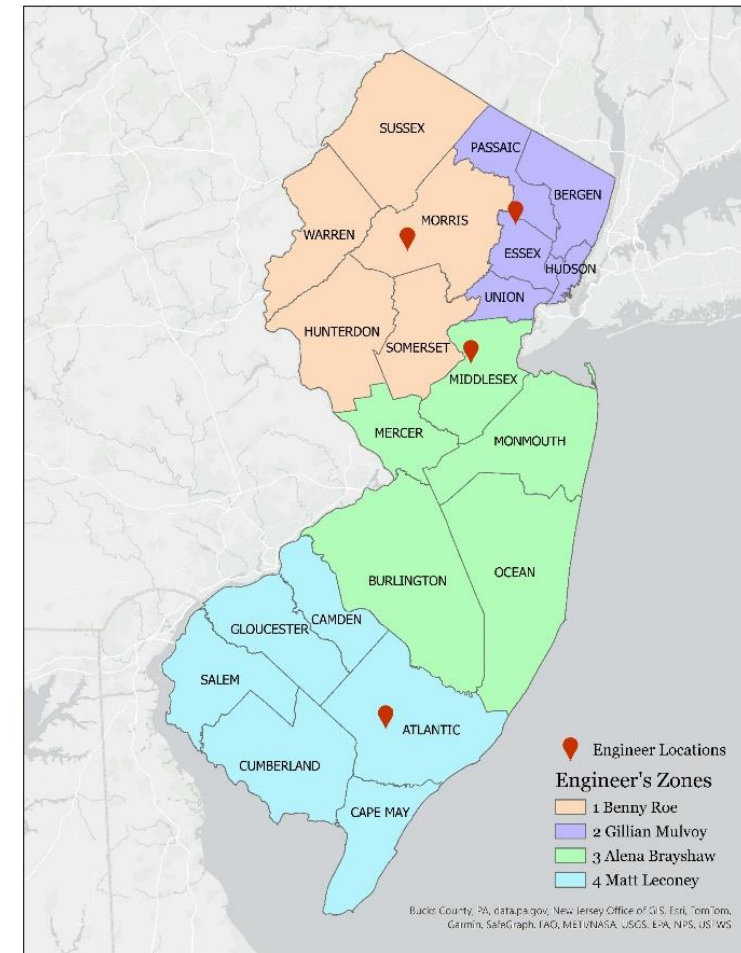
- d. Identify interconnections (stormwater pipe data must be provided)
- e. Drainage area delineations (provided outfall dataset, interconnections, pipe network, and catch basins)
- f. Prepare summary of water quality impairments and TMDLs
- g. Prepare maps for report (required data provided as needed)

Contact Us

- **Northwest:** Benny Roe
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 - alena.brayshaw@rutgers.edu
- **South:** Matthew Leconey
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Questions?

MS4 Engineer's Zones



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