

# **Watershed Inventory Report**

*Phase 1 of the Watershed Improvement Plan*

**BYRAM TOWNSHIP  
SUSSEX COUNTY, NEW JERSEY**

**NJPDES: NJG0149209  
Stormwater Program Coordinator: Mike Orgera**

**PREPARED FOR:**

Byram Township  
10 Mansfield Drive  
Stanhope, NJ 07461

**PREPARED BY:**



Harold E. Pellow & Associates, Inc.  
Consulting Engineers  
17 Plains Road  
Augusta, New Jersey 07822-9704

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**Cory L. Stoner, P.E., C.M.E  
New Jersey Professional Engineer License #24GE04102700**

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## **Acronyms & Definitions**

### **1. Acronyms**

- i. *"BMP" – Best Management Practice*
- ii. *"DO" – Dissolved Oxygen*
- iii. *"EPA" – U.S. Environmental Protection Agency*
- iv. *"GIS" – Geographic Information System*
- v. *"HUC 14" – Hydrologic Unit Code 14*
- vi. *"MS4" – Municipal Separate Storm Sewer System*
- vii. *"MTD" – Manufactured Treatment Device*
- viii. *"NJPDES" – New Jersey Pollutant Discharge Elimination System*
- ix. *"NJ-WET" – New Jersey Watershed Evaluation Tool*
- x. *"TDS" – Total Dissolved Solids*
- xi. *"TMDL" – Total Maximum Daily Load*
- xii. *"TSS" – Total Suspended Solids*
- xiii. *"WIP" – Watershed Improvement Plan*

### **2. Definitions**

- i. *"HUC 14" or "hydrologic unit code 14" means an area within which water drains to a particular receiving surface water body, also known as a sub-watershed, which is identified by a 14-digit hydrologic unit boundary designation, delineated within New Jersey by the United States Geological Survey. (N.J.A.C. 7:9B)*
- ii. *"Impervious Surface" means any structure, surface, or improvement that reduces or prevents absorption of stormwater into land, including, but not limited to, porous paving, paver blocks, gravel, crushed stone, decks, patios, elevated structures, and other similar structures, surfaces, or improvements (Per Article XV Highlands Area Code, Section 240-95)*
- iii. *"Municipal separate storm sewer" (or MS4 conveyance) means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains) as defined in more detail at N.J.A.C. 7:14A-1.2.*
- iv. *"Outfall" means any point source which discharges directly to waters of the United States and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other waters of the United States and are used to convey waters of the United States.*
- v. *"Storm drain inlet" means the point of entry into the storm sewer system.*
- vi. *"Stormwater" means water resulting from precipitation (including rain and snow) that runs off the land's surface, is transmitted to the subsurface, is captured by separate storm sewers or other sewerage or drainage facilities or is conveyed by snow removal equipment.*

- vii. *"Stormwater facility" means stormwater infrastructure including, but not limited to, catch basins, infiltration basins, detention basins, green infrastructure (GI), filter strips, riparian buffers, infiltration trenches, sand filters, constructed wetlands, wet basins, bioretention systems, low flow bypasses, Manufactured Treatment Devices (MTDs), and stormwater conveyances.*
- viii. *"Stormwater management basin" means a stormwater management basin as defined in N.J.A.C. 7:8.*
- ix. *"Stormwater management measure" means a stormwater management measure as defined in N.J.A.C. 7:8.*
- x. *"Stormwater runoff" means water flow on the surface of the ground or in storm sewers, resulting from precipitation.*
- xi. *"Total maximum daily load" or "TMDL" means a total maximum daily load formally established pursuant to Section 7 of the Water Quality Planning Act (N.J.S.A. 58:11A-7) and Section 303(d) of the Clean Water Act, 33 U.S.C. §§12512 et seq. A TMDL is the sum of individual waste-load allocations for point sources, load allocations for nonpoint sources of pollution, other sources such as tributaries or adjacent segments, and allocations to a reserve or margin of safety for an individual pollutant.*
- xii. *"Waters of the State" means the ocean and its estuaries, all springs, streams and bodies of surface or ground water, whether natural or artificial, within the boundaries of the State of New Jersey or subject to its jurisdiction" (see N.J.A.C. 7:9B-1.4).*



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## **Introduction**

As part of the NJPDES Tier A stormwater permit issued to Byram Township, a Watershed Improvement Plan (WIP) is to be developed which is meant to improve water quality of receiving waters situated throughout the municipality and adjacent communities. As part of WIP, the Township aims to enhance watershed health by modeling pollutant loads, assessing water quality, and prioritizing management measures across the various lakes and streams. A specific goal of the plan is to improve water quality by reducing contributing pollutants from entering impaired streams assigned with maximum pollutant parameter loading and pollutant reduction percentages. This plan is to be accomplished in three distinct phases, the first of which includes the preparation of this Watershed Inventory Report which will record and analyze existing ultimate stormwater outfalls into receiving waters. The careful analysis of these discharge locations, including the mapping of contributing drainage areas affecting the discharge, will lead to future targeted regulation of land use in these isolated areas which will hopefully mitigate the pollutant loading potential. As part of this initial WIP effort, the following items will be reviewed and electronically mapped:

- i. All stormwater outfalls owned/operated by the permittee;
- ii. The drainage area for each outfall(s);
- 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 MS4 or highway system;
- vi. The drainage area for each interconnection into another MS4 or highway system;
- vii. All stormwater connection points into the municipality from another storm 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. Each water quality impairment for waters that lie within or bordering the municipality;
- xi. Impervious areas; and
- xii. The location and ownership of all stormwater outfalls and basins/infrastructure not owned/operated by the permittee.

As required, the following items which are key elements of the overall plan, have been reviewed:

### **Location**

Byram Township is a Tier A municipality located in Sussex County, New Jersey. It lies predominantly within the Musconetcong River Watershed, with smaller portions of the Wallkill and Pequest River Watersheds in the North and Eastern sections of the Township (HUC 11). It shares these watershed areas with Sparta, Andover, Green, Allamuchy, and Mount Olive Township. It also shares a border with Andover, Hopatcong and Stanhope Borough as well.

### **Population and Demographics**

According to the 2020 U.S. Census, its population was 8,028, with a demographic profile of ~86 % White, ~11.9 % Hispanic/Latino, and a mix of other races; ~19.5 % of the population is under 18 years old and ~13.7 % is over 65 years old (census.gov).

### **Land use type(s)**

There are 14 different zones for Byram Township. These zones being a mix of lakes, forest preserves, and residential zones, with most of the Township's acres falling under the Highlands Preservation Area designation.

#### Area(s) Prone to Flooding

Flood-prone areas include low-lying streets, inlet/outfall zones around its network of over two dozen lakes and creeks like Lubbers Run and the Ghost Pony Brook.

#### Sub-watersheds

The Musconetcong, Wallkill and Pequest Watersheds can be broken up into 11 sub-watershed areas known as HUC-14s. These areas are listed in the following table:

**TABLE #1: Byram Township – Hydrologic Unit Code (HUC 14) List**

• Cranberry Lake / Jefferson Lake & tributaries	HUC 14: 02040105150060
• Lake Lenape tributary	HUC 14: 02040105070010
• Lubbers Run (above/incl Dallis Pond)	HUC 14: 02040105150040
• Lubbers Run (below Dallis Pond)	HUC 14: 02040105150050
• Musconetcong River (Saxton Falls to Waterloo)	HUC 14: 02040105150080
• Musconetcong River (Wills Bk to Lk Hopatcong)	HUC 14: 02040105150030
• Musconetcong River (above Waterloo)	HUC 14: 02040105150070
• Musconetcong River (Waterloo)	HUC 14: 02040105150110
• New Wawayanda Lake/Andover Pond tributary	HUC 14: 02040105070020
• Trout Brook/Lake Tranquility	HUC 14: 02040105070050
• Wallkill River/Lake Mohawk (above Sparta Sta)	HUC 14: 02020007010010

## **Stormwater Outfall(s)**

### Stormwater Outfalls Owned/Operated by Byram Township

- There are 263 total MS4 outlets located in Byram Township with 193 owned/operated by the municipality. Of those 193 MS4 municipal outlets, 119 are considered ultimate stormwater outfalls which direct stormwater into receiving waters of the state. Below is a breakdown of how many Byram Township owned and operated outfalls flow into each sub-watershed. Note that 6 of the 11 sub-watersheds located in Byram Township are impacted directly by these outfalls.

TABLE #2: Receiving Subwatersheds	Number of Outfalls	Percent
New Wawayanda Lake/Andover Pond tributary HUC 14: 2040105070020	24	20%
Cranberry Lake / Jefferson Lake & tributaries HUC 14: 2040105150060	32	27%
Lubbers Run (below Dallis Pond) HUC 14: 2040105150050	39	33%
Lubbers Run (above/incl Dallis Pond) HUC 14: 2040105150040	13	11%
Musconetcong R(above Waterloo) HUC 14: 2040105150070	5	4.5%
Wallkill R/Lake Mohawk(above Sparta Sta) HUC 14: 2020007010010	5	4.5%
Total: 6	119	100%

\*Data was collected from NJDEP's and Harold Pellow & Associates GIS databases 2025

### Receiving Surface Waters

- The outfalls of Byram drain into fourteen primary waterbodies. Unnamed tributaries flowing into Lubbers Run comprised of the most outfalls (15%) to a receiving surface water. Out of all the lakes in Byram Township, Cranberry Lake has the most outfalls with 14. There are two unnamed ponds that have five outfalls draining into them.

TABLE #3: Receiving Surface Waters	Number of Outfalls	Percent
Andover Junction UNT	13	11%
Cowboy Creek UNT	3	3%
Cranberry Lake	14	12%
Forest Lake	11	9%
Ghost Pony Brook	8	7%
Johnson Lake Tributary	11	9%
Kofferls Pond	1	1%
Lake Lackawanna	10	8%
Lubbers Run	17	14%
Lubbers Run UNT	18	15%
Musconetcong River	3	3%
Unnamed Ponds	5	4%
Wallkill River	1	1%
Wallkill River UNT	4	3%
Total: 14	119	100%

\*Data was collected from NJDEP's and Harold Pellow & Associates GIS databases 2025

#### Water Quality Classifications

- Over half of the outfalls fell under the FW2-TMC1 designation which was the primary designation for water bodies like Lubbers Run, Lubbers Run UNT, and Cranberry Lake among others. Note there were also 16 outfalls that had No Classification under the NJDEP, these outfalls all drained to either an unnamed water body or Forest Lake.

TABLE #4: Water Quality Classification	Number of Outfalls	Percent
FW2-NT	24	20%
FW2-NTC1	14	12%
FW2-TM	3	3%
FW2-TMC1	62	52%
No Classification	16	13%
Total: 5	119	100%

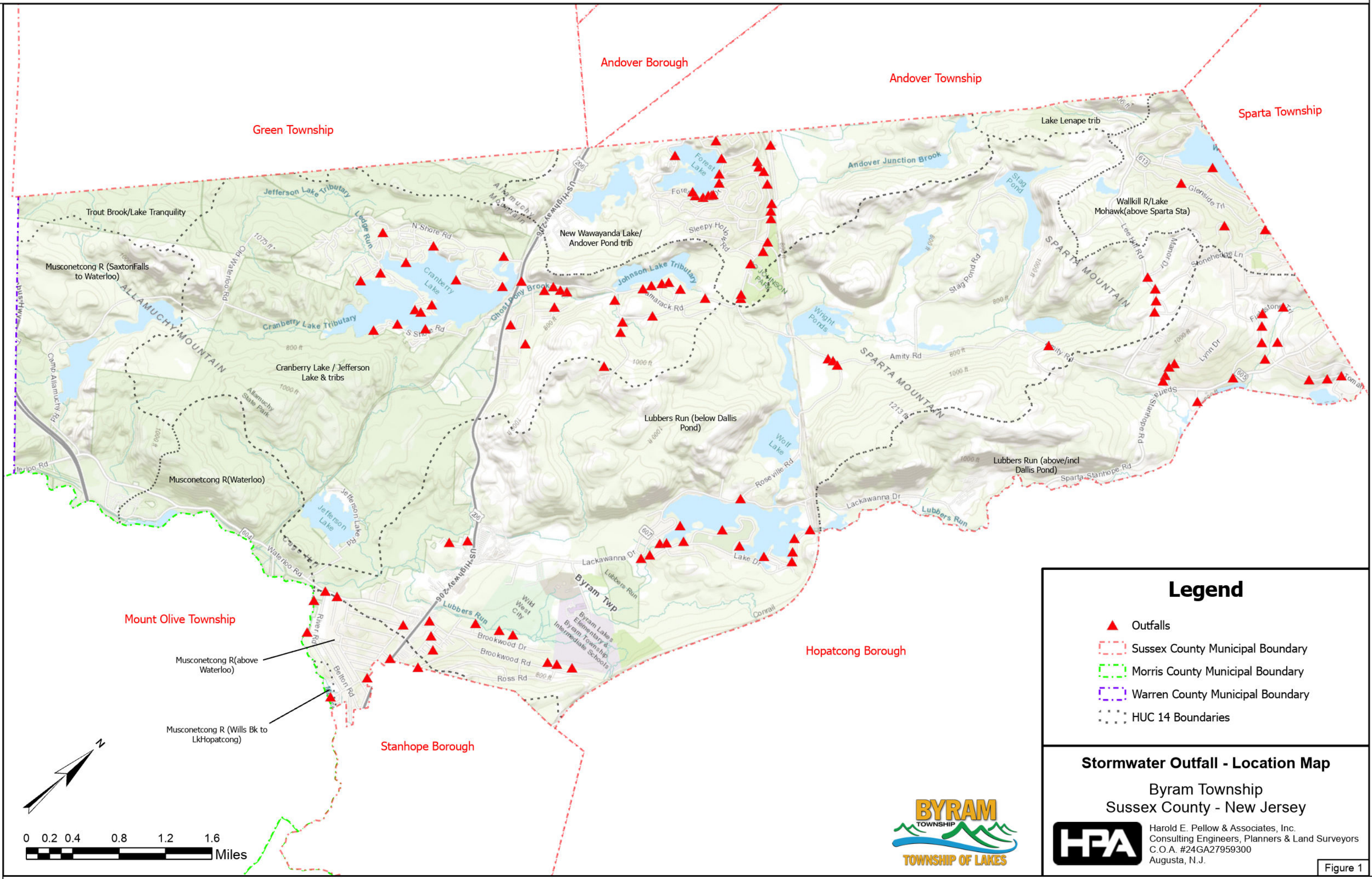
\*Data was collected from NJDEP's and Harold Pellow & Associates GIS databases 2025

**TABLE # 5: Summary Receiving Surface Water Bodies & Water Quality Classifications**

<i>Number of Outfalls</i>	Receiving Surface Water	Water Quality Classification
13	Andover Junction UNT	FW2-TMC1
3	Cowboy Creek UNT	FW2-NTC1
14	Cranberry Lake	FW2-TMC1
11	Forest Lake	No Classification
8	Ghost Pony Brook	FW2-NT
11	Johnson Lake Tributary	FW2-NT
1	Kofferls Pond	FW2-NTC1
10	Lake Lackawanna	FW2-NTC1
17	Lubbers Run	FW2-TMC1
18	Lubbers Run UNT	FW2-TMC1
3	Musconetcong River	FW2-TM
5	Unnamed Pond	No Classification
1	Walkill River	FW2-NT
4	Walkill River UNT	FW2-NT
Total: 119	14	5

\*Data was collected from NJDEP's and Harold Pellow & Associates GIS databases 2025





**Legend**

- ▲ Outfalls
- Sussex County Municipal Boundary
- Morris County Municipal Boundary
- Warren County Municipal Boundary
- HUC 14 Boundaries

**Stormwater Outfall - Location Map**

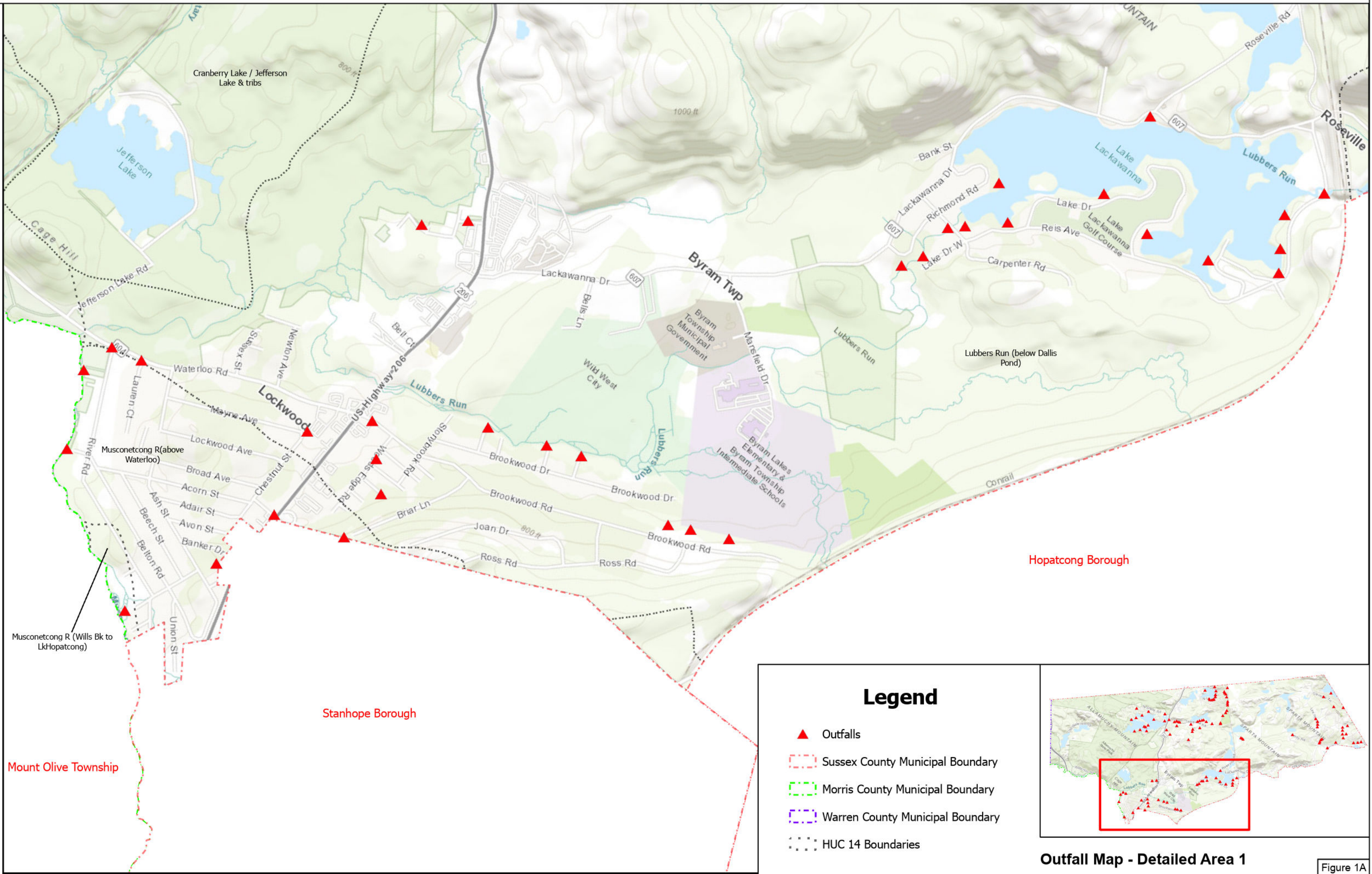
Byram Township  
Sussex County - New Jersey



Harold E. Pellow & Associates, Inc.  
Consulting Engineers, Planners & Land Surveyors  
C.O.A. #24GA27959300  
Augusta, N.J.

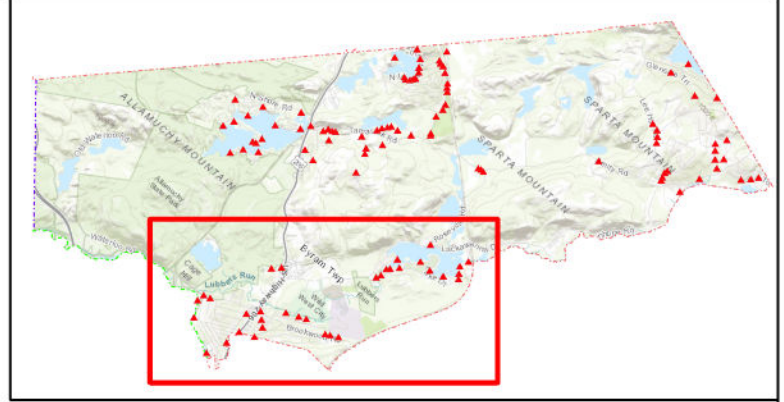






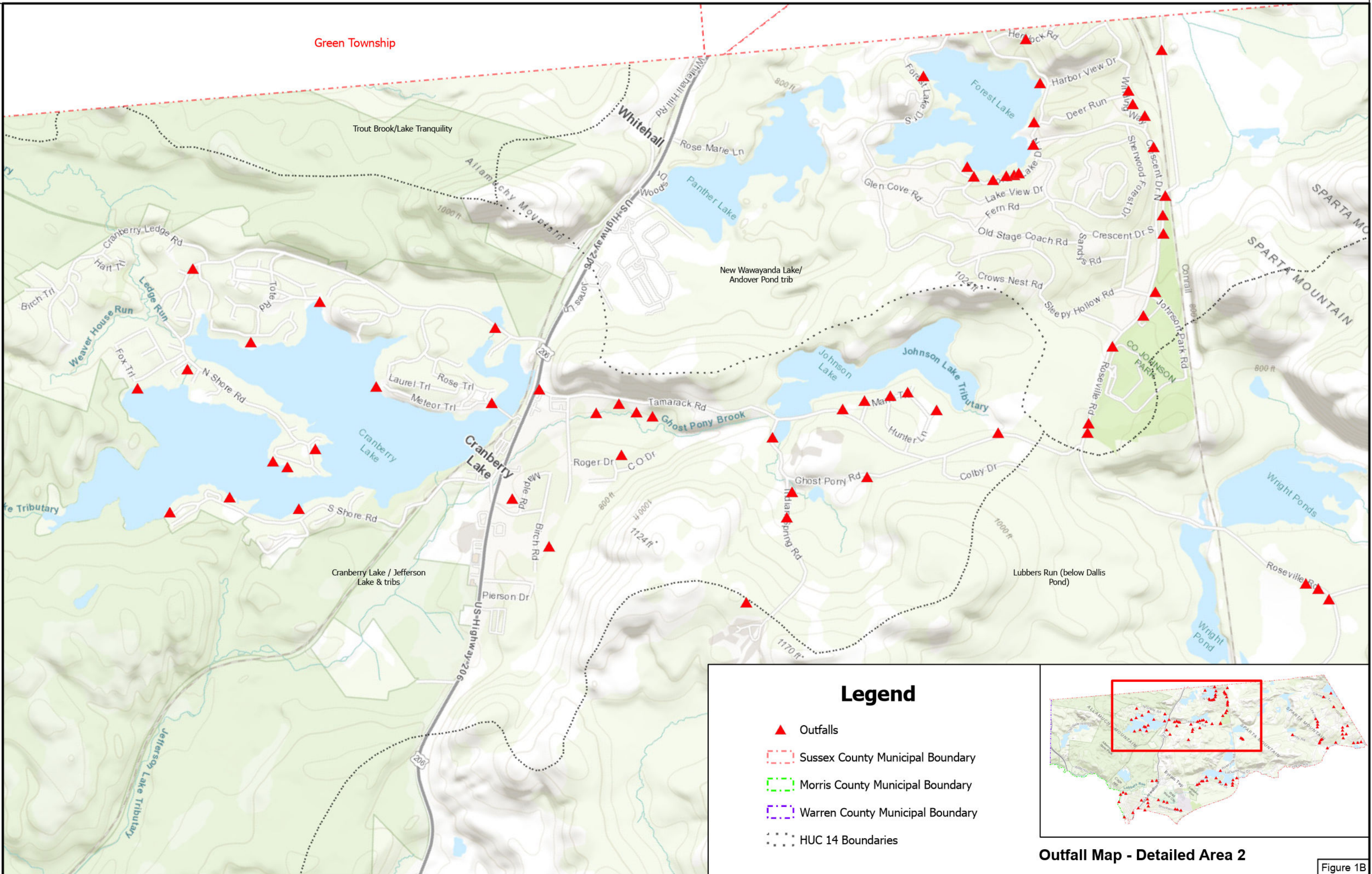
**Legend**

- ▲ Outfalls
- - - Sussex County Municipal Boundary
- - - Morris County Municipal Boundary
- - - Warren County Municipal Boundary
- ... HUC 14 Boundaries



**Outfall Map - Detailed Area 1**





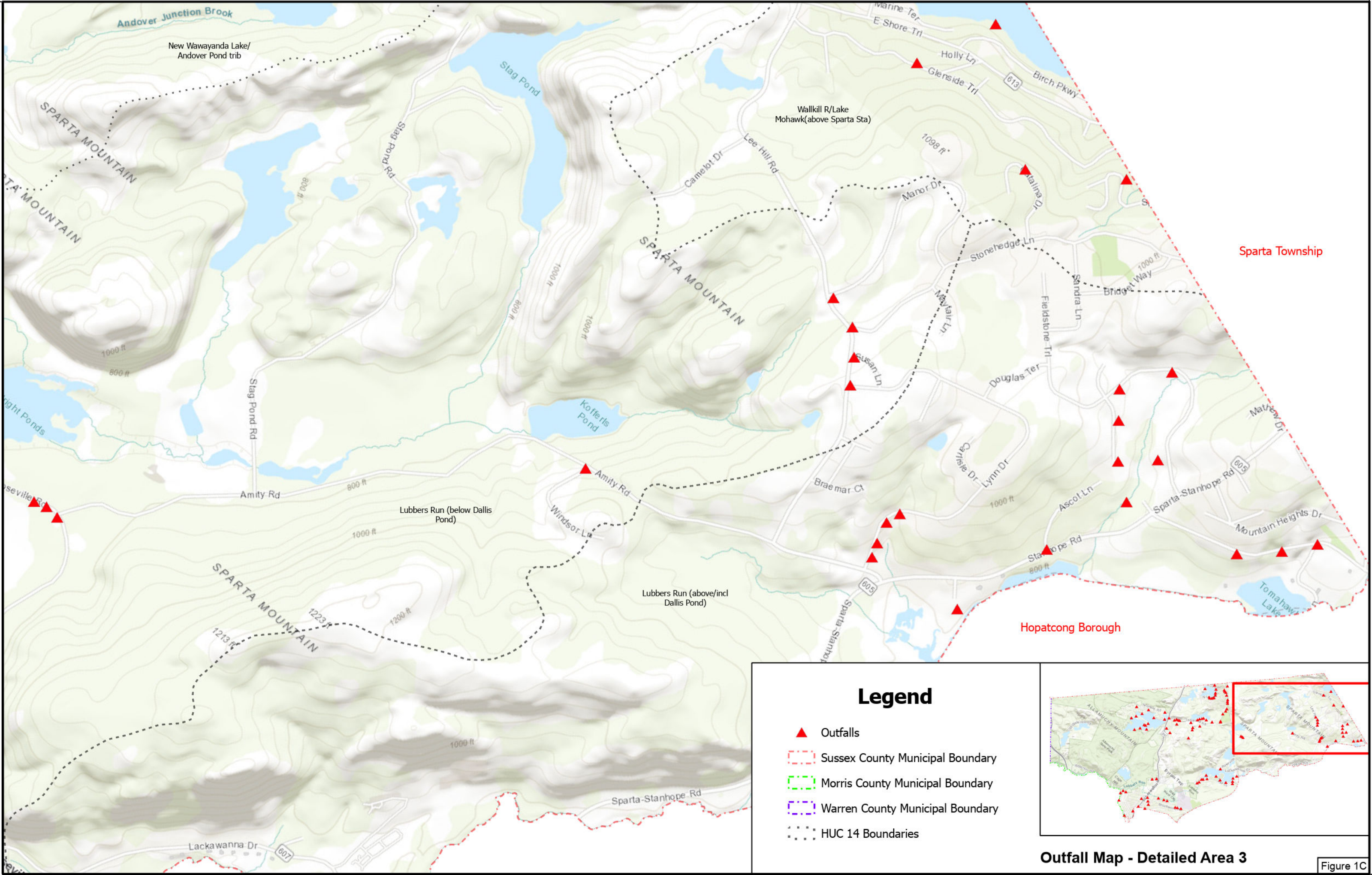
### Legend

- ▲ Outfalls
- Sussex County Municipal Boundary
- Morris County Municipal Boundary
- Warren County Municipal Boundary
- HUC 14 Boundaries

**Outfall Map - Detailed Area 2**

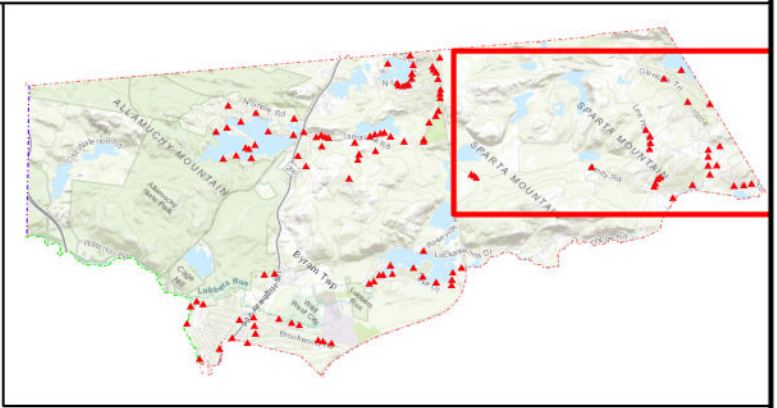
Figure 1B





**Legend**

- ▲ Outfalls
- Sussex County Municipal Boundary
- Morris County Municipal Boundary
- Warren County Municipal Boundary
- HUC 14 Boundaries



**Outfall Map - Detailed Area 3** Figure 1C



## **Stormwater Interconnection(s)**

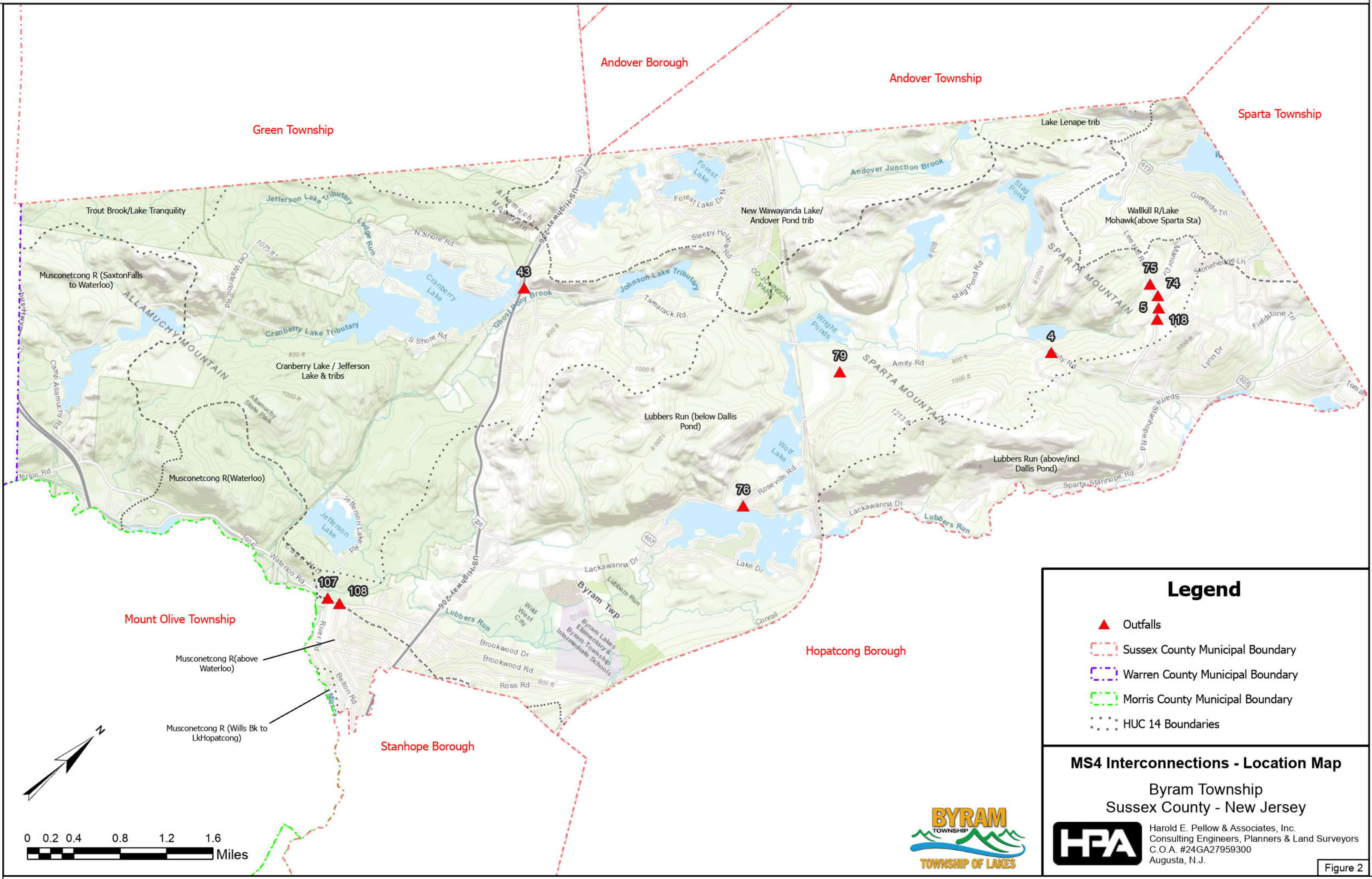
An MS4 stormwater interconnection refers to a specific point in the existing drainage system where one MS4 discharges into another. Essentially, it's a connection between different stormwater drainage systems controlled by different entities. These interconnections facilitate the flow of stormwater from one system to another, potentially leading to a larger water body. Understanding these interconnections is crucial for managing stormwater runoff and preventing pollution, especially with the increasing frequency and intensity of storm events due to climate change. The WIP document emphasizes watershed-level planning and includes requirements for addressing water quality impairments and corrective actions to reduce flooding, further highlighting the importance of understanding and managing stormwater interconnections.

As part of this interconnection analysis, review of available mapping as well as field reconnaissance was utilized to locate interconnections within Byram Township. Both interconnections into and out of the municipal MS4 were noted and detailed in the following mapping and tables:

**TABLE #6: MS4 Interconnections Summary**

<b>Local ID</b>	<b>Type</b>	<b>Upstream Entity</b>	<b>Downstream Entity</b>	<b>Description</b>
4	Pipe	Byram Township	Sussex County	CR 671
5	Pipe	Byram Township	Sussex County	CR 671
43	Pipe	Byram Township	State NJDOT	US 206
74	Pipe	Byram Township	Sussex County	CR 671
75	Pipe	Byram Township	Sussex County	CR 671
76	Pipe	Byram Township	Sussex County	CR 607
79	Pipe	Byram Township	Sussex County	CR 671
107	Pipe	Byram Township	Sussex County	CR 604
108	Pipe	Byram Township	Sussex County	CR 605
118	Pipe	Byram Township	Sussex County	CR 671





**Legend**

- ▲ Outfalls
- Sussex County Municipal Boundary
- Warren County Municipal Boundary
- Morris County Municipal Boundary
- HUC 14 Boundaries

**MS4 Interconnections - Location Map**

Byram Township  
Sussex County - New Jersey



Harold E. Pellow & Associates, Inc.  
Consulting Engineers, Planners & Land Surveyors  
C.O.A. #24GA27959300  
Augusta, N.J.



Figure 2



## **Drainage Area(s) for Stormwater Outfalls and Stormwater Interconnections**

In order to assess the magnitude and effects of drainage flow at an individual outfall or interconnect, drainage areas for each specific point of study were analyzed and sketched. Utilizing Topographic elevation contour lines for New Jersey assembled for use in Geographic Information System from NJDEP, specific for Byram Township, contributing drainage areas limits were calculated and mapped at each unique outfall or interconnection point. The establishment of such drainage areas provides both an empirical value to the size of contributing lands as well as a defined limit of surficial qualities of those contributing lands. The ultimate goal of future phases for this watershed improvement plan is to utilize the general drainage areas mapped for each outfall/interconnect and overlay said areas on the probable pollutant mapping in order to inventory the specific pollutants associated with each individual discharge or interconnect. By establishing the pollutant/drainage area relationship, targeted mitigation may be established. Note that only drainage areas that are owned and operated by the Township of Byram or are part of an interconnection are featured in the Table #7 below.

**TABLE #7: MS4 and Interconnection Drainage Area Summary**

\*Data was collected from NJDEP and NJ-WET along with Harold & Pellow Associates GIS database

<b>Drainage Area ID</b>	<b>Drainage Area Total (acres)</b>	<b>Interconnection or Outfall</b>	<b>Primary Contributing Drainage Area</b>
1	5.61	Outfall	Commercial
2	0.98	Outfall	Commercial
3	1.60	Outfall	Public
6	6.84	Outfall	Residential
7	0.85	Outfall	Residential
8	1.22	Outfall	Residential
9	7.35	Outfall	Residential
10	24.22	Outfall	Residential
11	3.92	Outfall	Residential
12	0.53	Outfall	Residential
13	2.61	Outfall	Residential
14	0.75	Outfall	Residential
15	0.72	Outfall	Residential
16	0.77	Outfall	Residential
17	0.50	Outfall	Residential
18	0.80	Outfall	Public
19	1.35	Outfall	Residential
20	1.39	Outfall	Residential
21	1.57	Outfall	Residential
22	1.79	Outfall	Residential
23	1.40	Outfall	Residential
24	1.52	Outfall	Public
25	0.81	Outfall	Public
26	0.78	Outfall	Public
27	0.88	Outfall	Residential
28	0.46	Outfall	Residential
29	0.80	Outfall	Public

<b>Drainage Area ID</b>	<b>Drainage Area Total (acres)</b>	<b>Interconnection or Outfall</b>	<b>Primary Contributing Drainage Area</b>
30	1.17	Outfall	Public
31	1.36	Outfall	Public
32	1.03	Outfall	Public
33	0.74	Outfall	Public
34	7.15	Outfall	Public
35	0.26	Outfall	Public
36	0.97	Outfall	Residential
37	2.23	Outfall	Residential
38	16.88	Outfall	Residential
39	0.29	Outfall	Residential
40	1.61	Outfall	Residential
41	0.44	Outfall	Commercial
42	1.79	Outfall	Residential
44	0.42	Outfall	Residential
45	0.40	Outfall	Residential
46	0.54	Outfall	Residential
47	2.11	Outfall	Residential
48	0.60	Outfall	Residential
49	1.23	Outfall	Residential
50	0.54	Outfall	Public
51	0.61	Outfall	Public
52	0.41	Outfall	Public
53	0.09	Outfall	Public
54	0.14	Outfall	Public
55	0.10	Outfall	Public
56	11.82	Outfall	Public
57	82.55	Outfall	Public
58	3.93	Outfall	Residential
59	2.58	Outfall	Residential
60	1.96	Outfall	Residential
61	2.36	Outfall	Commercial
62	4.75	Outfall	Commercial
63	11.74	Outfall	Residential
64	2.04	Outfall	Residential
65	5.96	Outfall	Residential
66	12.46	Outfall	Residential
67	1.20	Outfall	Residential
68	4.75	Outfall	Residential
69	2.90	Outfall	Residential
70	24.22	Outfall	Residential
71	3.86	Outfall	Residential
72	0.98	Outfall	Residential

<b>Drainage Area ID</b>	<b>Drainage Area Total (acres)</b>	<b>Interconnection or Outfall</b>	<b>Primary Contributing Drainage Area</b>
73	0.85	Outfall	Residential
77	0.33	Outfall	Residential
78	0.56	Outfall	Residential
80	2.29	Outfall	Residential
81	0.52	Outfall	Residential
82	3.38	Outfall	Residential
83	5.50	Outfall	Residential
84	2.48	Outfall	Public
85	0.94	Outfall	Residential
86	0.53	Outfall	Residential
87	0.54	Outfall	Residential
88	1.25	Outfall	Residential
89	59.60	Outfall	Residential
90	4.73	Outfall	Residential
91	6.51	Outfall	Residential
92	0.91	Outfall	Residential
93	1.82	Outfall	Residential
94	1.18	Outfall	Residential
95	0.72	Outfall	Residential
96	1.81	Outfall	Residential
97	1.25	Outfall	Residential
98	2.40	Outfall	Residential
99	1.07	Outfall	Residential
100	3.13	Outfall	Residential
101	1.15	Outfall	Residential
102	9.74	Outfall	Public
103	6.55	Outfall	Public
104	9.00	Outfall	Public
105	5.50	Outfall	Residential
106	0.73	Outfall	Commercial
109	7.05	Outfall	Residential
110	0.97	Outfall	Public
111	0.28	Outfall	Commercial
112	0.66	Outfall	Commercial
113	0.88	Outfall	Residential
114	2.41	Outfall	Residential
115	0.53	Outfall	Commercial
116	0.50	Outfall	Residential
117	1.32	Outfall	Residential
119	0.45	Outfall	Public

<b>Drainage Area ID</b>	<b>Drainage Area Total (acres)</b>	<b>Interconnection or Outfall</b>	<b>Primary Contributing Drainage Area</b>
4	1.26	Interconnect	Residential
5	1.09	Interconnect	Residential
43	0.79	Interconnect	Commercial
74	0.66	Interconnect	Residential
75	10.95	Interconnect	Residential
76	1.26	Interconnect	Residential
79	1.97	Interconnect	Residential
107	0.53	Interconnect	Public
108	3.14	Interconnect	Public
118	0.34	Interconnect	Residential

## **Stormwater Inlet(s)**

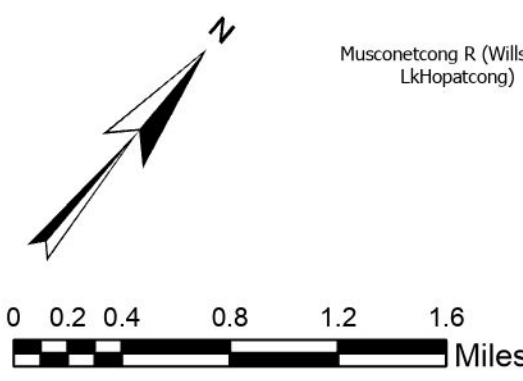
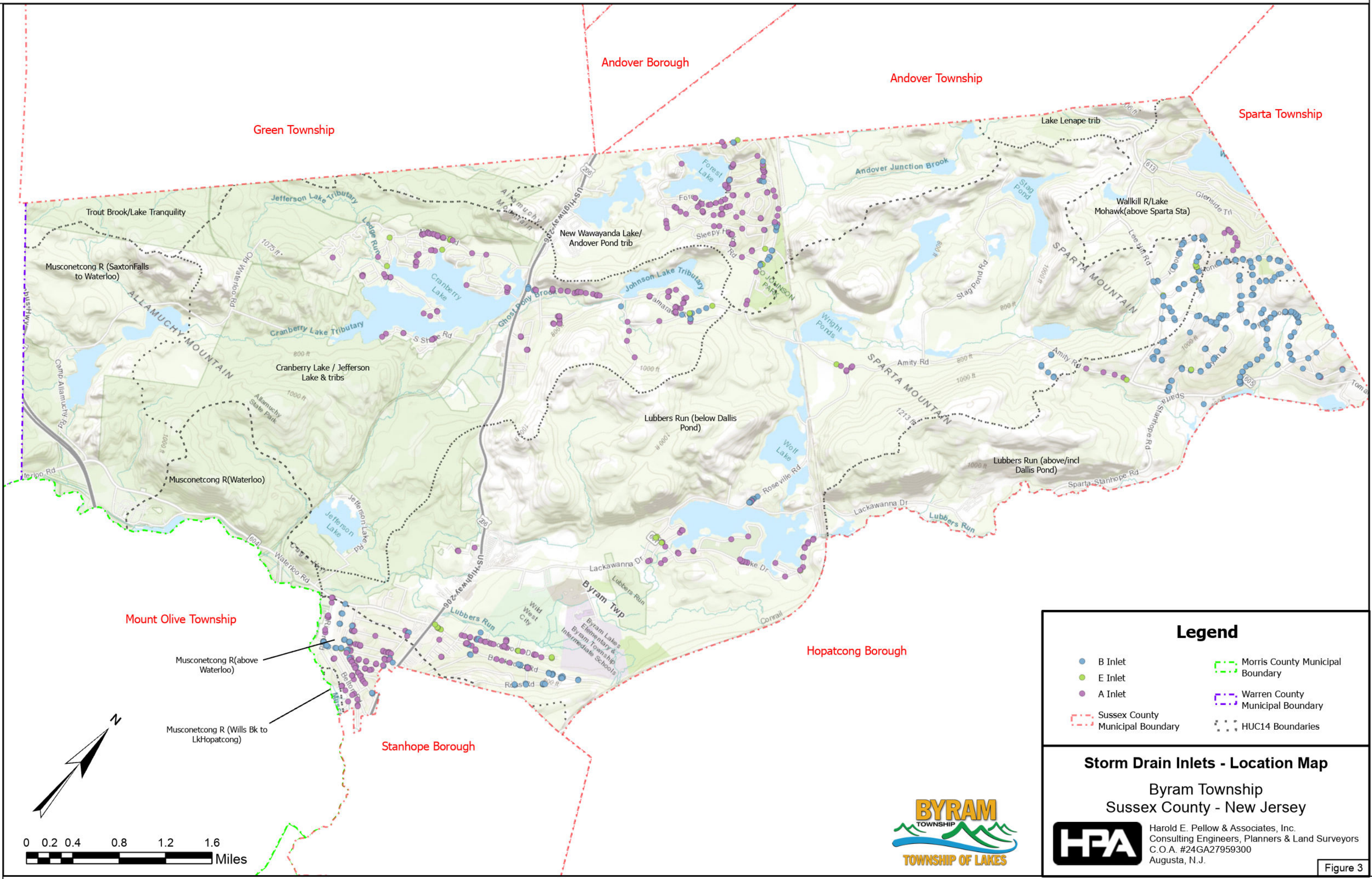
### Stormwater Inlets Owned/Operated by Byram Township

- There are 766 total inlets located in Byram Township owned/operated by the municipality. Below is a breakdown of the inlets by type and subwatershed. As mentioned previously with the stormwater outfall tables, 6 of the 11 sub-watersheds located in Byram Township are impacted directly by these inlets.

Table #8: Inlet Type	Number of Inlets	Percent
A	339	44%
B	341	45%
E	32	4%
N	54	7%
Total: 4	766	100%

TABLE #9: Receiving Subwatersheds	Number of Inlets	Percent
New Wawayanda Lake/Andover Pond tributary HUC 14: 2040105070020	108	14%
Cranberry Lake / Jefferson Lake & tributaries HUC 14: 2040105150060	124	16%
Lubbers Run (below Dallis Pond) HUC 14: 2040105150050	156	21%
Lubbers Run (above/incl Dallis Pond) HUC 14: 2040105150040	204	27%
Musconetcong R(above Waterloo) HUC 14: 2040105150070	110	14%
Wallkill R/Lake Mohawk(above Sparta Sta) HUC 14: 2020007010010	64	8%
Total: 6	766	100%





### Legend

B Inlet	Morris County Municipal Boundary
E Inlet	Warren County Municipal Boundary
A Inlet	HUC14 Boundaries
Sussex County Municipal Boundary	

### Storm Drain Inlets - Location Map

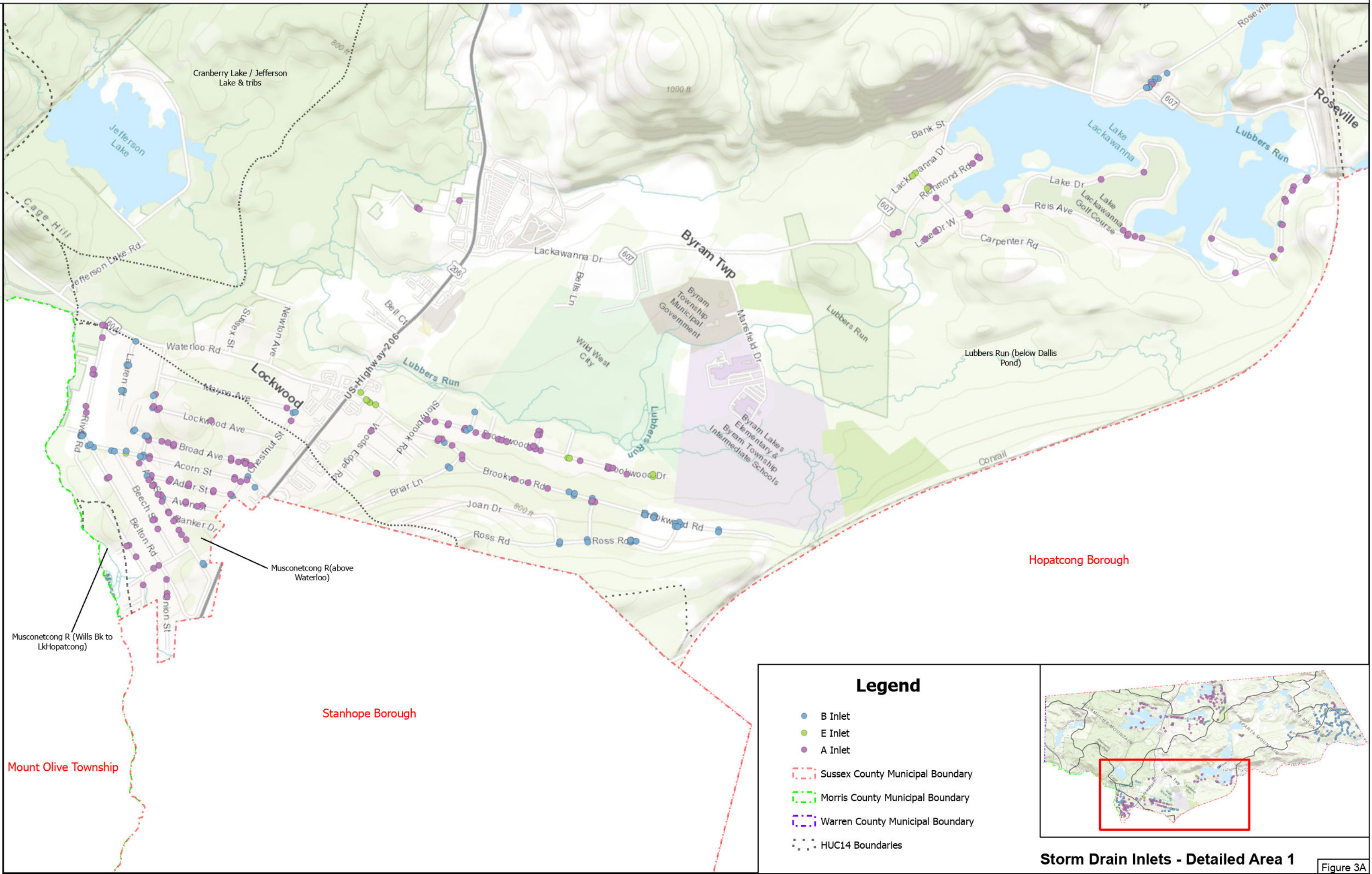
Byram Township  
Sussex County - New Jersey

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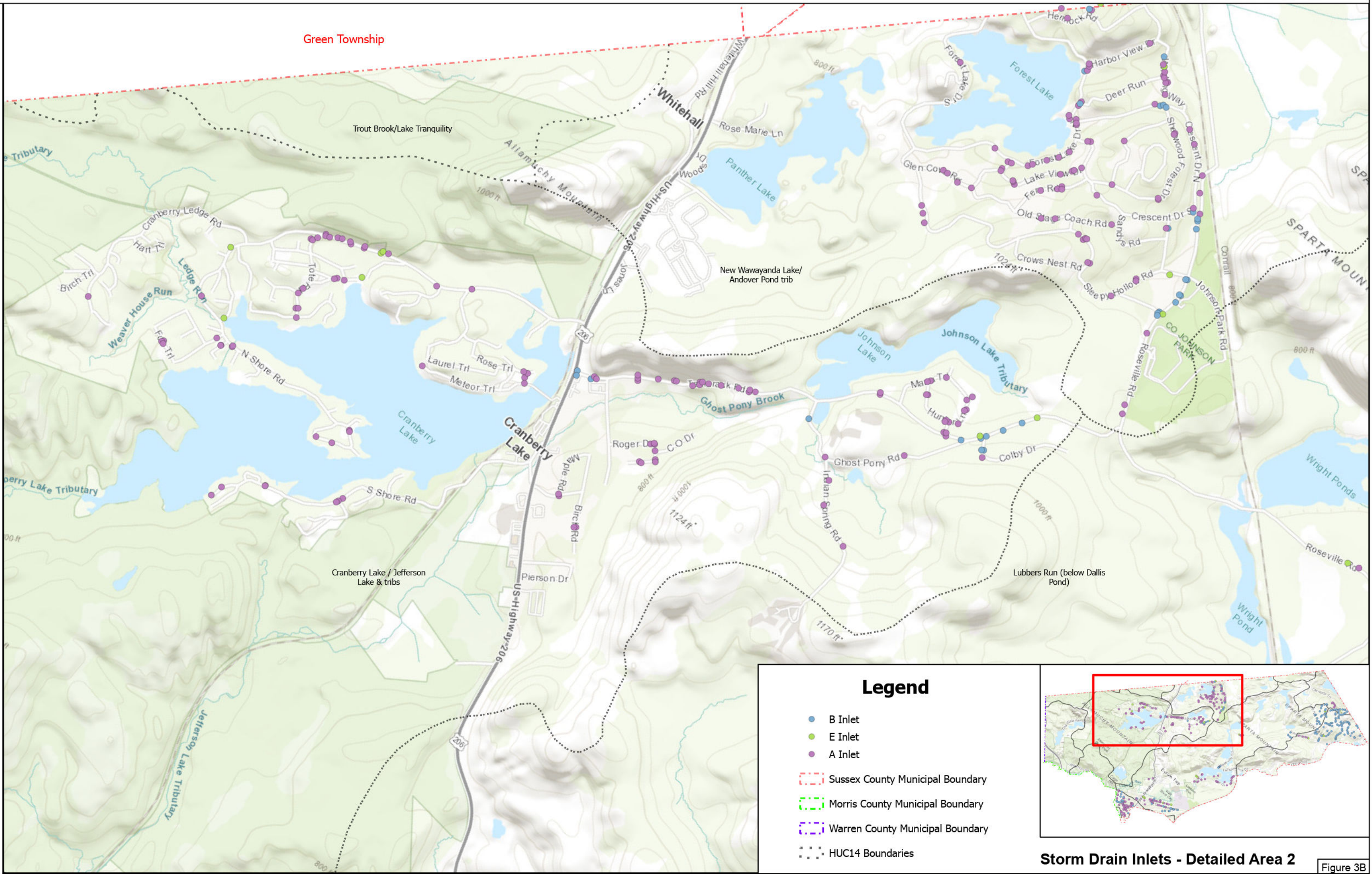


Figure 3



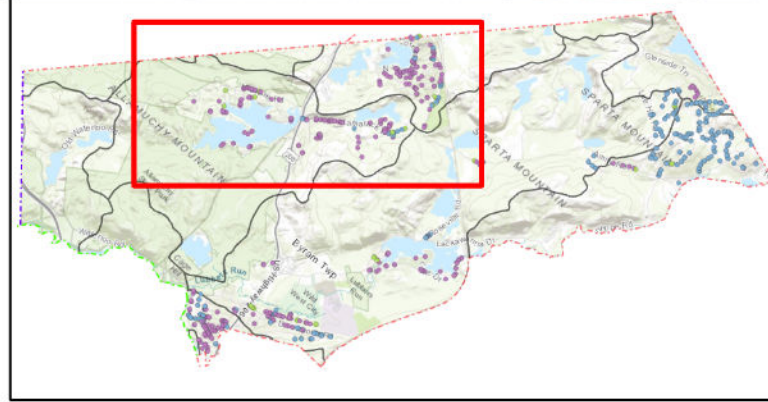






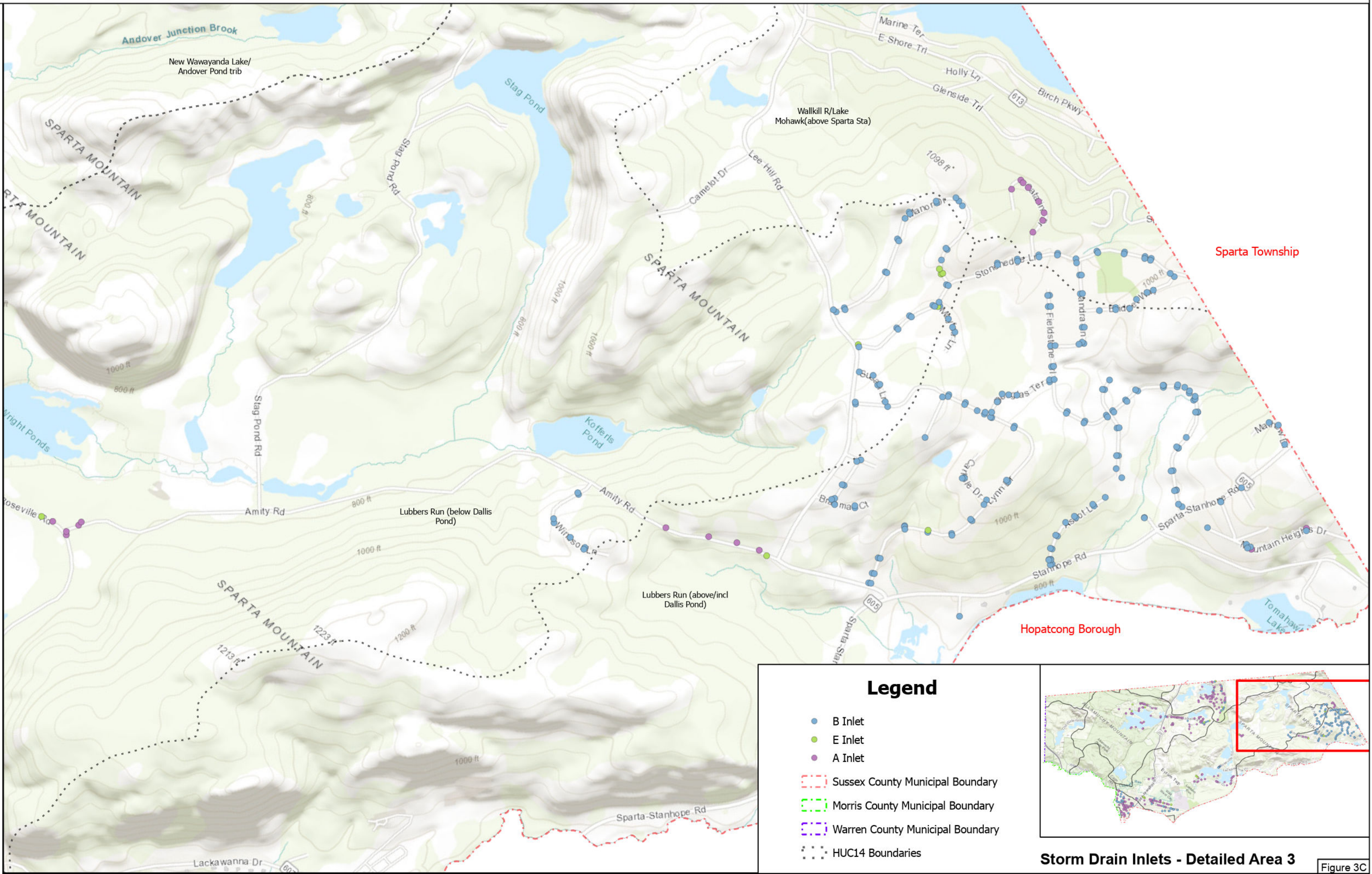
**Legend**

- B Inlet
- E Inlet
- A Inlet
- ▬ Sussex County Municipal Boundary
- ▬ Morris County Municipal Boundary
- ▬ Warren County Municipal Boundary
- ▬ HUC14 Boundaries



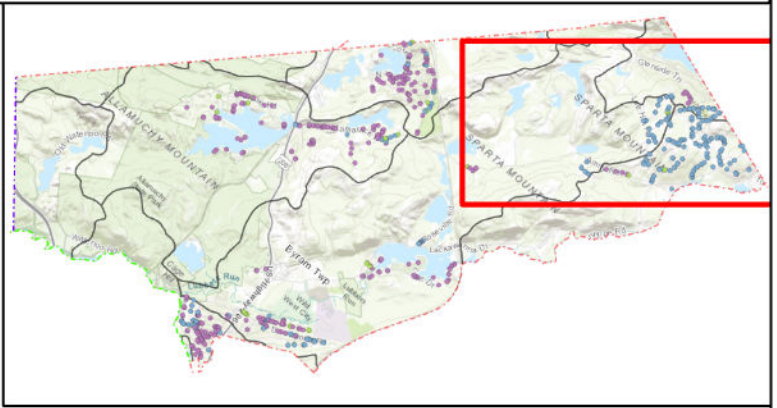
**Storm Drain Inlets - Detailed Area 2** Figure 3B





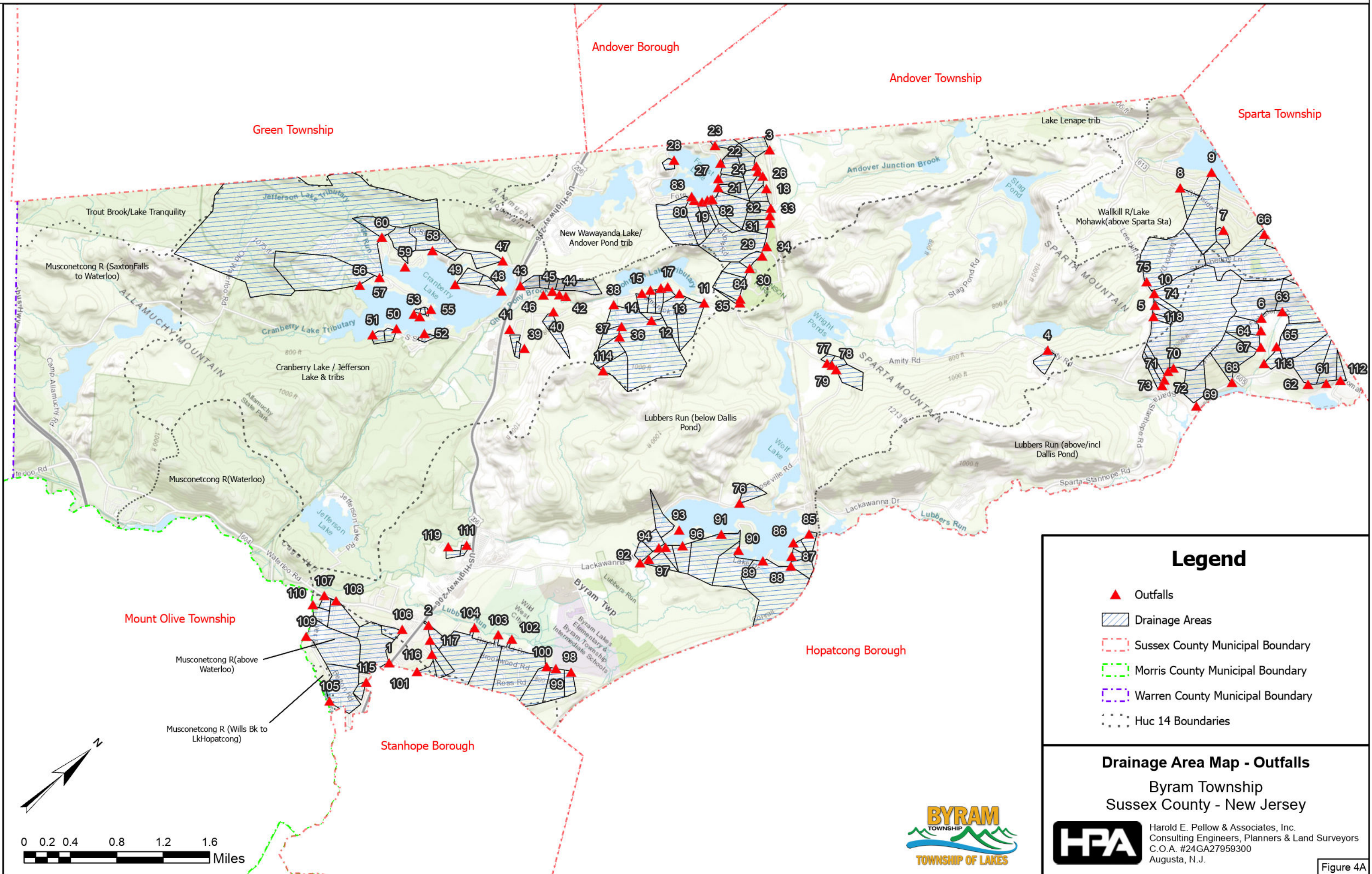
**Legend**

- B Inlet
- E Inlet
- A Inlet
- Sussex County Municipal Boundary
- Morris County Municipal Boundary
- Warren County Municipal Boundary
- HUC14 Boundaries



**Storm Drain Inlets - Detailed Area 3** Figure 3C





**Legend**

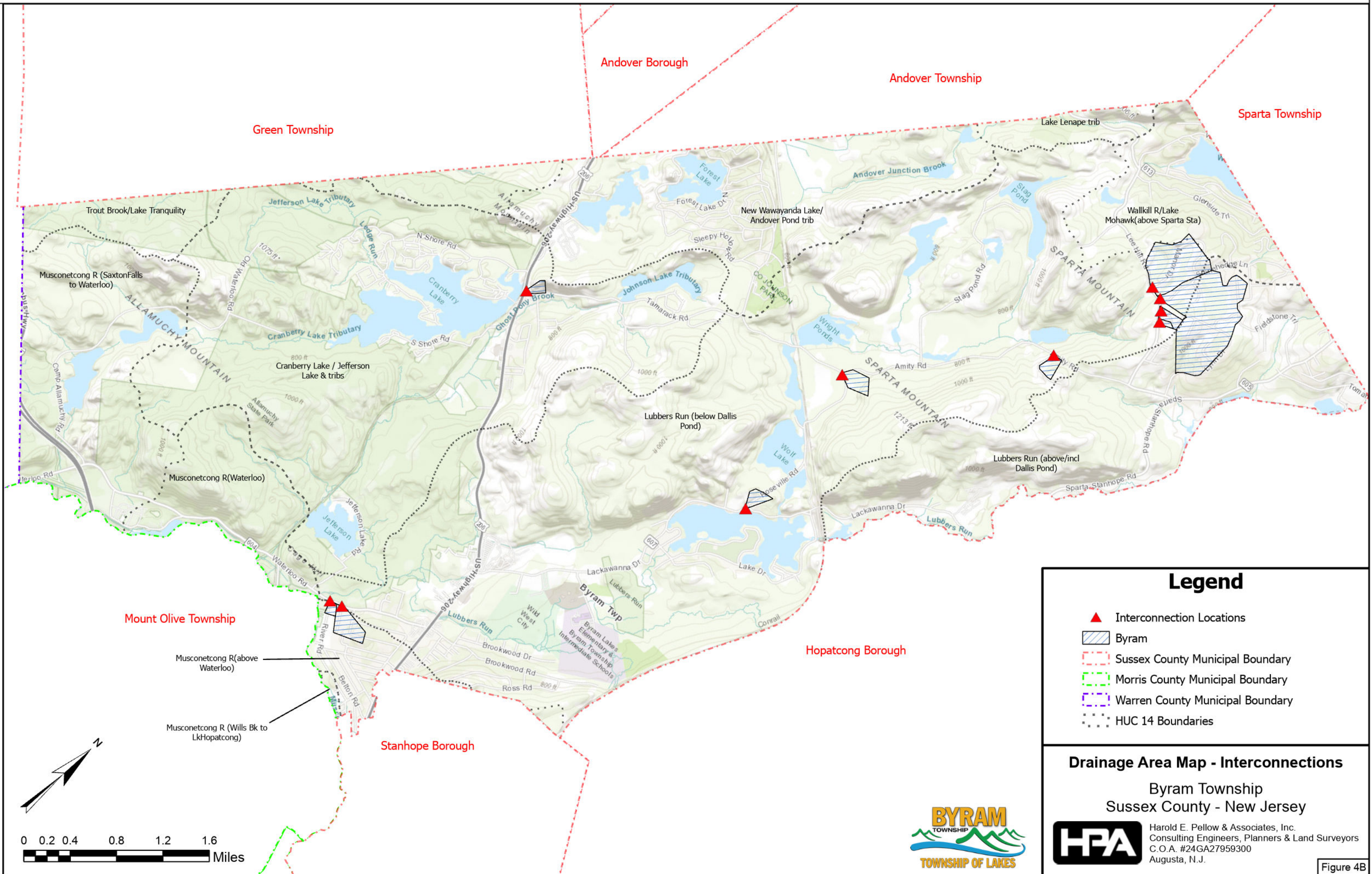
- ▲ Outfalls
- ▨ Drainage Areas
- - - Sussex County Municipal Boundary
- - - Morris County Municipal Boundary
- - - Warren County Municipal Boundary
- ⋯ Huc 14 Boundaries

**Drainage Area Map - Outfalls**  
Byram Township  
Sussex County - New Jersey

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**Legend**

- ▲ Interconnection Locations
- ▨ Byram
- - - Sussex County Municipal Boundary
- - - Morris County Municipal Boundary
- - - Warren County Municipal Boundary
- ... HUC 14 Boundaries

**Drainage Area Map - Interconnections**

Byram Township  
Sussex County - New Jersey



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## **TMDLs and Water Quality Impairments**

A TMDL is the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. A TMDL determines a pollutant reduction target and allocates load reductions necessary to the source(s) of the pollutant.

Each pollutant causing a waterbody to be impaired or threatened is referred to as a waterbody/pollutant combination, and typically a TMDL is developed for each waterbody/pollutant combination. For example, if one waterbody is impaired or threatened by three pollutants, three TMDLs might be developed for the waterbody. However, in other cases, a single TMDL document may be developed to address several waterbody/pollutants combinations.

The objective of a TMDL is to determine the loading capacity of the waterbody and to allocate that load among different pollutant sources so that the appropriate control actions can be taken and water quality standards achieved. The TMDL process is important for improving water quality because it serves as a link in the chain between water quality standards and implementation of control actions designed to attain those standards.

TMDLs are developed using a range of techniques, from simple mass balance calculations to complex water quality modeling approaches. The degree of analysis varies based on a variety of factors including the waterbody type, complexity of flow conditions and pollutant causing the impairment.

All contributing sources of the pollutants (point and nonpoint sources) are identified, and they are allocated a portion of the allowable load that usually contemplates a reduction in their pollution discharge in order to help solve the problem. Natural background sources, seasonal variations and a margin of safety are all taken into account in the allocations.

The approach normally used to develop a TMDL for a particular waterbody or watershed consists of five activities:

- Selection of the pollutant(s) to consider.
- Estimation of the waterbody's assimilative capacity (i.e., loading capacity).
- Estimation of the pollutant loading from all sources to the waterbody.
- Analysis of current pollutant load and determination of needed reductions to meet assimilative capacity.
- Allocation (with a margin of safety) of the allowable pollutant load among the different pollutant sources in a manner such that water quality standards are achieved.

Local citizens sometimes know more about what is happening in their watersheds and this knowledge can be a valuable aspect of TMDL development. The public often contributes useful data and information about an impaired waterbody. The public can often offer insights about their community that may ensure the success of one pollutant reduction strategy over another. Citizen information and participation can improve the quality of TMDLs that are developed and can ultimately speed cleanup of impaired waters or secure protection of threatened waters. Public/stakeholder roles in the TMDL process will be included in future phases of the WIP process.

**TABLE #10: TMDLs and Impairments for Sub-watersheds within or bordering Byram Township**

Listed below are all the potential TMDL and impairment parameters related to stormwater that may affect sub-watersheds within the permittee's jurisdiction.

HUC 14	Subwatershed Name	TMDL(s)	Impairment(s)
02040105150060	Cranberry Lake / Jefferson Lake & tributaries	<i>Lakesheds</i> <i>Total Phosphorus</i> <i>Streamsheds</i> <i>Mercury (PCBS in fish tissue)</i>	<i>Aquatic life</i> <i>Fish Consumption</i>
02040105070010	Lake Lenape tributary	<i>Streamsheds</i> <i>Total Phosphorus</i> <i>Fecal Coliform (Escherichia Coli (E.COLI))</i>	<i>Aquatic life</i> <i>Recreation</i>
02040105150040	Lubbers Run (above/incl Dallis Pond)	<i>Lakesheds</i> <i>Fecal Coliform (Escherichia Coli (E.COLI))</i>	<i>Recreation</i>
02040105150050	Lubbers Run (below Dallis Pond)	<i>Lakesheds</i> <i>Fecal Coliform (Escherichia Coli (E.COLI))</i>	<i>Recreation</i>
02040105150080	Musconetcong R (Saxton Falls to Waterloo)	<i>None</i>	<i>none</i>
02040105150030	Musconetcong R (Wills Bk to Lk Hopatcong)	<i>Streamsheds</i> <i>Mercury (PCBS in fish tissue)</i> <i>Fecal Coliform (Escherichia Coli (E.COLI))</i>	<i>Fish Consumption</i> <i>Recreation</i>
02040105150070	Musconetcong R (above Waterloo)	<i>Streamsheds</i> <i>Mercury (PCBS in fish tissue)</i>	<i>Fish Consumption</i>
02040105150110	Musconetcong R (Waterloo)	<i>None</i>	<i>none</i>



02040105070020	New Wawayanda Lake/Andover Pond tributary	<i>Lakesheds</i> <i>Fecal Coliform (Escherichia Coli (E.COLI))</i> <i>Streamsheds</i> <i>Total Phosphorus</i> <i>Mercury (PCBS in fish tissue)</i>	<i>Recreation</i> <i>Aquatic life</i> <i>Fish Consumption</i>
02040105070050	Trout Brook/Lake Tranquility	<i>Streamsheds</i> <i>Mercury (PCBS in fish tissue)</i>	<i>Fish Consumption</i>
2020007010010	Wallkill R/Lake Mohawk (above Sparta Sta)	<i>Lakesheds</i> <i>Fecal Coliform (Escherichia Coli (E.COLI))</i>	<i>Recreation</i>

\*Data was collected from NJDEP and NJ-WET along with Harold & Pellow Associates GIS database. *The highlighted rows indicate the 6 Sub-watersheds that are directly impacted by Byram Township owned and operated drainage systems*

## **Pollutants of Concern**

\*All pollutant descriptions come from the NJDEP “Pollutants of Concern” article found on their website.

### **Pathogens (Enterococcus, E. Coli, Fecal Coliform, Total Coliform)**

Pathogens, including enterococcus, E. Coli, fecal coliform, and total coliform, enter the receiving waters when stormwater comes into contact with sources of these pathogens, such as pet waste, animal waste from geese and other wildlife, some farming activities, illicit discharges, failing sewage conveyance systems and septic systems, combined sewage overflows, and sanitary sewer overflows (SSOs). While sewage treatment plants contribute a steady input of treated sewage to their receiving waters, stormwater runoff is the primary contributor to pathogen loads in the surface waters of the state. Many of these pathogens affect the designated uses of the receiving waters and are harmful to human or animal health when ingested causing intestinal disease. Pathogens can attack the immune system and cause infections that may result in abdominal issues, respiratory problems, fever, headache, skin rashes, etc. (Water Quality Topics: Pathogens | US EPA). When receiving surface waters include shellfish harvesting as a designated use, pathogens also pose additional concerns. Proximity to potential sources such as marinas, development served by septic systems and concentrated stormwater outfall locations warrant precautionary closures of shellfish waters on a seasonal or full-time basis. The National Shellfish Sanitation Program has established criteria for pathogens that are used to determine support of the shell fishing use.

### **Phosphorous/Total Phosphorous**

Phosphorus is a key nutrient for plant growth and is often the limiting nutrient in a freshwater setting. Total phosphorous is the sum of particulate and dissolved phosphorous which includes the total amount of phosphorous in both organic and inorganic forms. High concentrations of phosphorus in receiving waters may result from stormwater runoff due to poor agricultural practices, urban areas, leaking septic systems, illicit discharges or SSOs. Additional stormwater runoff sources of phosphorous include the breakdown of plant and leaf litter (including grass clippings), soil particles, pet and animal waste, fertilizer from lawns, and atmospheric deposition of phosphorus particles. Contribution from runoff from lawns and roads accounts for the greatest loading in many receiving waters. An excess of phosphorus into a water body can have a detrimental effect on designated uses related to both public health and aquatic health. For instance, too much phosphorus in a surface water can cause increased growth of algae and large aquatic plants (a process called eutrophication)

causing significant swings in pH and dissolved oxygen, which can in turn result in the violation of surface water quality criteria for these parameters and adversely affect the aquatic community. Additionally, high levels of phosphorus can also lead to HABs, that produce toxins which can be harmful to human and animal health. The presence of excessive plant biomass can also interfere with other designated uses, such as swimming or boating. When algae are present in large amounts, drinking water purveyors must also increase the use of disinfectants and oxidants to treat the algae, which can lead to an increase in disinfection byproducts such as trihalomethanes, listed as likely carcinogens by EPA.

**MS4 permit conditions that regulate parameters associated with Pathogens & Phosphorous include:**

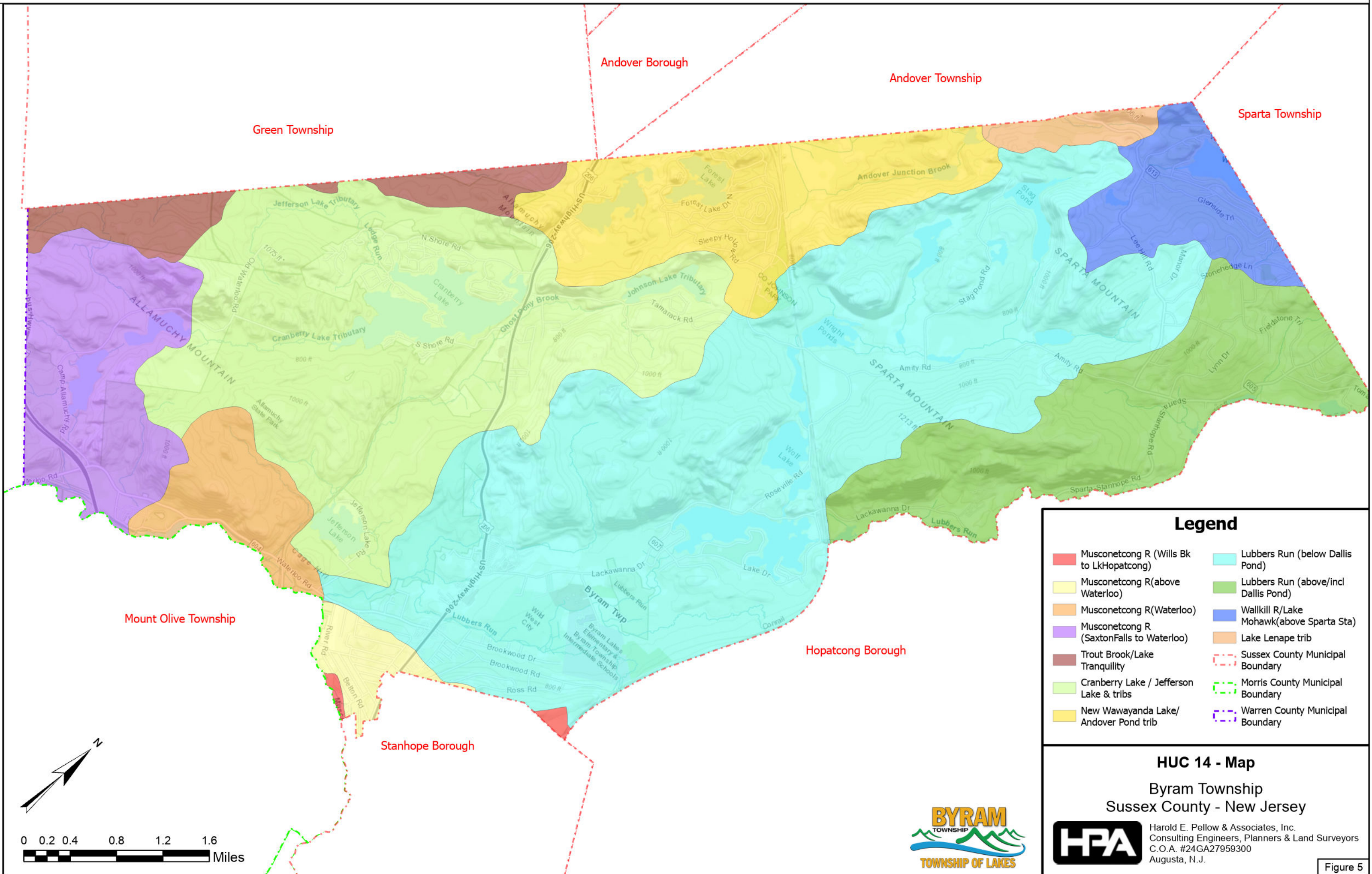
- Pet Waste Ordinance
- Wildlife Feeding Ordinance
- Litter Control Ordinance
- Improper Disposal of Waste Ordinance
- Yard Waste Ordinance
- Street Sweeping Program
- Herbicide Application Management
- Roadside Vegetative Waste Management
- Roadside Erosion Control
- Inspection and Maintenance of Stormwater Facilities
- Stream Scouring Program
- Illicit Discharge Detection and Elimination Program

**Polychlorinated Biphenyls (PCBs)**

The term 'PCBs' (Polychlorinated Biphenyls) represents a broad class of toxic industrial chemicals first discovered and synthesized in the late 19th century. Their novel chemical properties led to widespread industrial production and usage peaking between the 1930's and late-1960's. Some products may continue to contain PCBs, including electrical equipment, motor and hydraulic oils, oil-based paint, and some plastics. The recognition of PCB associated health hazards were first noted in the 1960's and their production finally banned in 1979. PCBs can accumulate in the leaves and above-ground parts of plants and food crops. They are also taken up into the bodies of small organisms and fish. As a result, people who ingest fish may be exposed to PCBs that have bioaccumulated in the fish they are ingesting. Their oily nature allows them to accumulate in fatty animal tissues and bioaccumulate up the global food chain where they contribute to organ damage and carcinogenesis in higher-tiered species. PCBs are easily carried away as TSS by stormwater runoff from products containing the compounds which are exposed to stormwater and known and unknown contaminated areas. PCBs have a moderate level of volatility, which means that their vapors are also readily carried aloft by the wind. They are then deposited on exposed surfaces via air deposition.

**MS4 permit conditions that regulate this parameter:**

- Improper Disposal of Waste Ordinance
- Yard Waste Ordinance
- Roadside Vegetative Waste Management
- Inspection and Maintenance of Stormwater Facilities
- BMPs at Municipal Maintenance Yards
- Illicit Discharge Detection and Elimination Program



**Legend**

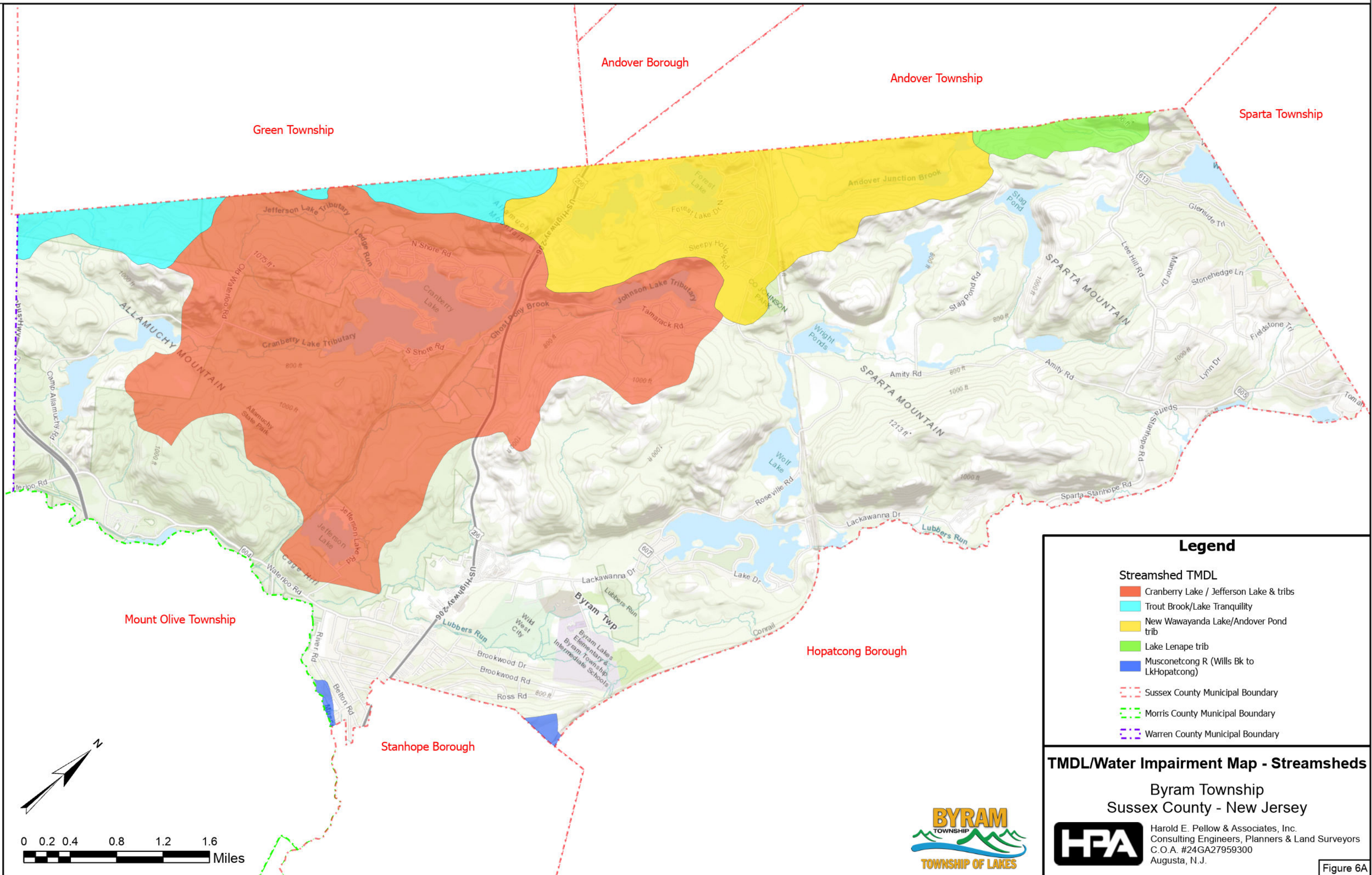
Musconetcong R (Wills Bk to LkHopatcong)	Lubbers Run (below Dallis Pond)
Musconetcong R(above Waterloo)	Lubbers Run (above/incl Dallis Pond)
Musconetcong R(Waterloo)	Wallkill R/Lake Mohawk(above Sparta Sta)
Musconetcong R (SaxtonFalls to Waterloo)	Lake Lenape trib
Trout Brook/Lake Tranquility	Sussex County Municipal Boundary
Cranberry Lake / Jefferson Lake & tribs	Morris County Municipal Boundary
New Wawayanda Lake/ Andover Pond trib	Warren County Municipal Boundary

**HUC 14 - Map**  
**Byram Township**  
**Sussex County - New Jersey**

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Consulting Engineers, Planners & Land Surveyors  
C.O.A. #24GA27959300  
Augusta, N.J.

Figure 5





### Legend

#### Streamshed TMDL

- Cranberry Lake / Jefferson Lake & tribs
- Trout Brook/Lake Tranquility
- New Wawayanda Lake/Andover Pond trib
- Lake Lenape trib
- Musconetcong R (Wills Bk to LkHopatcong)

- Sussex County Municipal Boundary
- Morris County Municipal Boundary
- Warren County Municipal Boundary

### TMDL/Water Impairment Map - Streamsheds

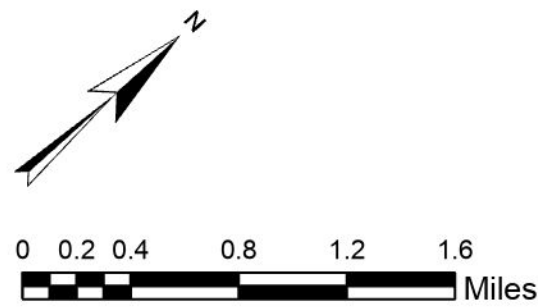
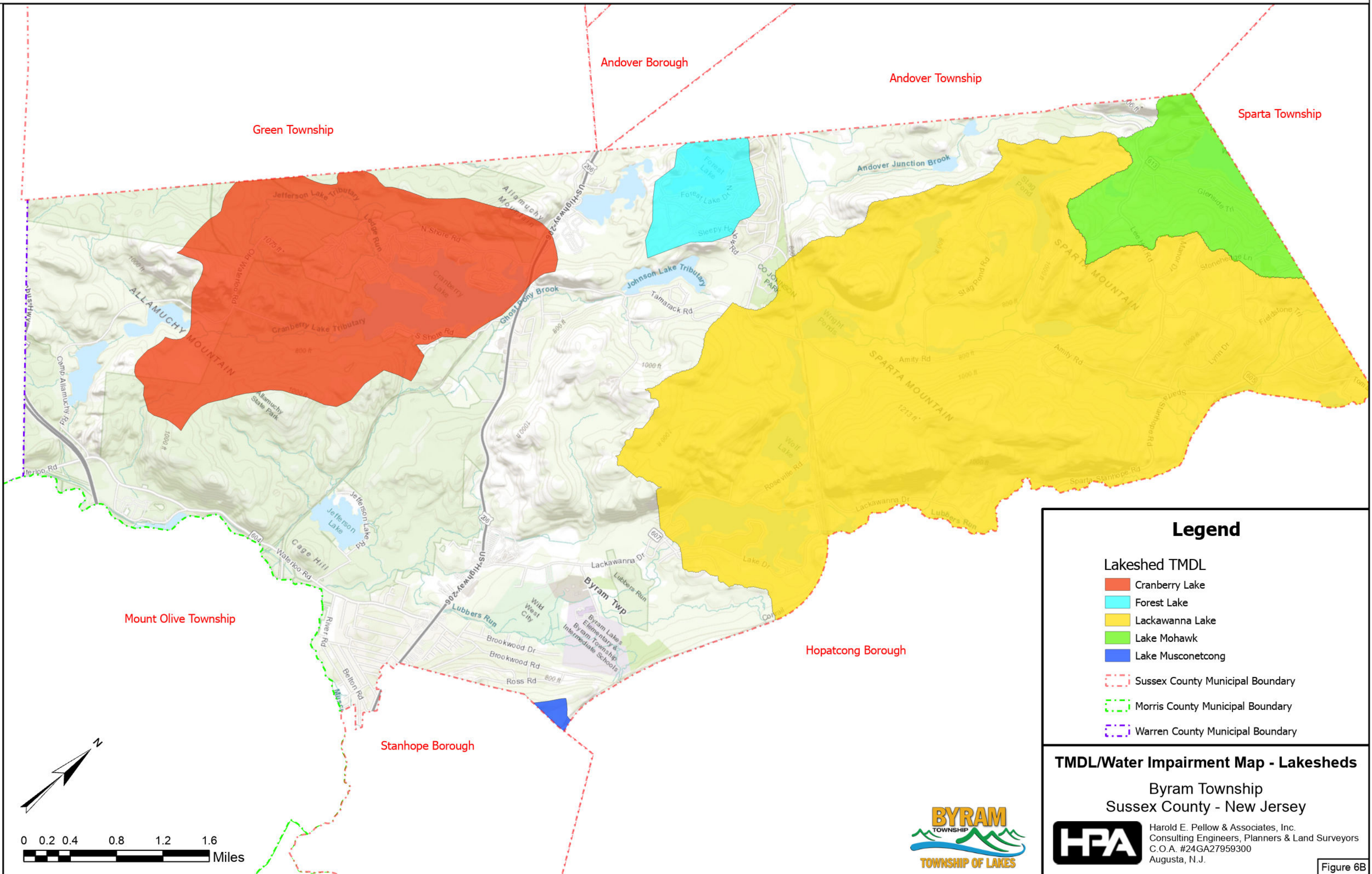
Byram Township  
Sussex County - New Jersey



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Augusta, N.J.







- Legend**
- Lakeshed TMDL**
- Cranberry Lake
  - Forest Lake
  - Lackawanna Lake
  - Lake Mohawk
  - Lake Musconetcong
- Municipal Boundaries**
- Sussex County Municipal Boundary
  - Morris County Municipal Boundary
  - Warren County Municipal Boundary

**TMDL/Water Impairment Map - Lakesheds**

**Byram Township**  
**Sussex County - New Jersey**



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## **Impervious Area**

Pervious and impervious are terms that are used to describe the ability or inability of water to flow through a surface. When rainfall hits a surface, it can soak into the surface or flow off the surface. Pervious surfaces are those which allow stormwater to readily soak into the soil and recharge groundwater. When rainfall drains from a surface, it is called "stormwater" runoff. An impervious surface can be any structure, surface, or improvement that reduces or prevents absorption of stormwater into land, including, but not limited to, porous paving, paver blocks, gravel, crushed stone, decks, patios, elevated structures and other similar structures, surfaces, or improvements. As impervious areas increase, so does the volume of stormwater runoff.

New Jersey has many problems due to stormwater runoff, including:

- **Pollution:** According to the 2010 New Jersey Water Quality Assessment Report, 90% of the assessed waters in New Jersey are impaired, with urban-related stormwater runoff listed as the most probable source of impairment (USEPA, 2013). As stormwater flows over the ground, it picks up pollutants including animal waste, excess fertilizers, pesticides, and other toxic substances. These pollutants are then able to enter waterways.
- **Flooding:** Over the past decade, the state has seen an increase in flooding. Communities around the state have been affected by these floods. The amount of damage caused also has increased greatly with this trend, costing billions of dollars over this time span.
- **Erosion:** Increased stormwater runoff causes an increase in the velocity of flows in our waterways. The increased velocity after storm events erodes stream banks and shorelines, degrading water quality. This erosion can damage local roads and bridges and cause harm to wildlife.

Located in Sussex County in northern New Jersey, Byram Township covers approximately 22.7 square miles south of Lafayette. Byram Township is dominated by forest land uses. A total of 17.4% of the municipality's land use is classified as urban. Of the urban land in Byram Township, medium density residential is the dominant land use. The literature suggests a link between impervious cover and stream ecosystem impairment starting at approximately 10% impervious surface cover (Schueler, 1994; Arnold and Gibbons, 1996; May et al., 1997). Impervious cover may be linked to the quality of lakes, reservoirs, estuaries, and aquifers (Caraco et al., 1998), and the amount of impervious cover in a watershed can be used to project the current and future quality of streams. Based on the scientific literature, Caraco et al. (1998) classified urbanizing streams into the following three categories: sensitive streams, impacted streams, and non-supporting streams. Sensitive streams typically have a watershed impervious surface cover from 0-10%. Impacted streams have a watershed impervious cover ranging from 11-25% and typically show clear signs of degradation from urbanization. Non-supporting streams have a watershed impervious cover of greater than 25%; at this high level of impervious cover, streams are simply conduits for stormwater flow and no longer support a diverse stream community. The New Jersey Department of Environmental Protection's (NJDEP) 2023 land use/land cover geographical information system (GIS) data layer categorizes Byram Township into many unique land use areas, assigning a percent impervious cover for each delineated area. These impervious cover values were used to estimate the impervious coverage for Byram Township. Based upon the 2023 NJDEP land use/land cover data, approximately 4.1% of Byram Township has impervious cover. This level of impervious cover suggests that the streams in Byram Township are likely sensitive streams. Below is a table detailing the impervious cover analysis of the Township.

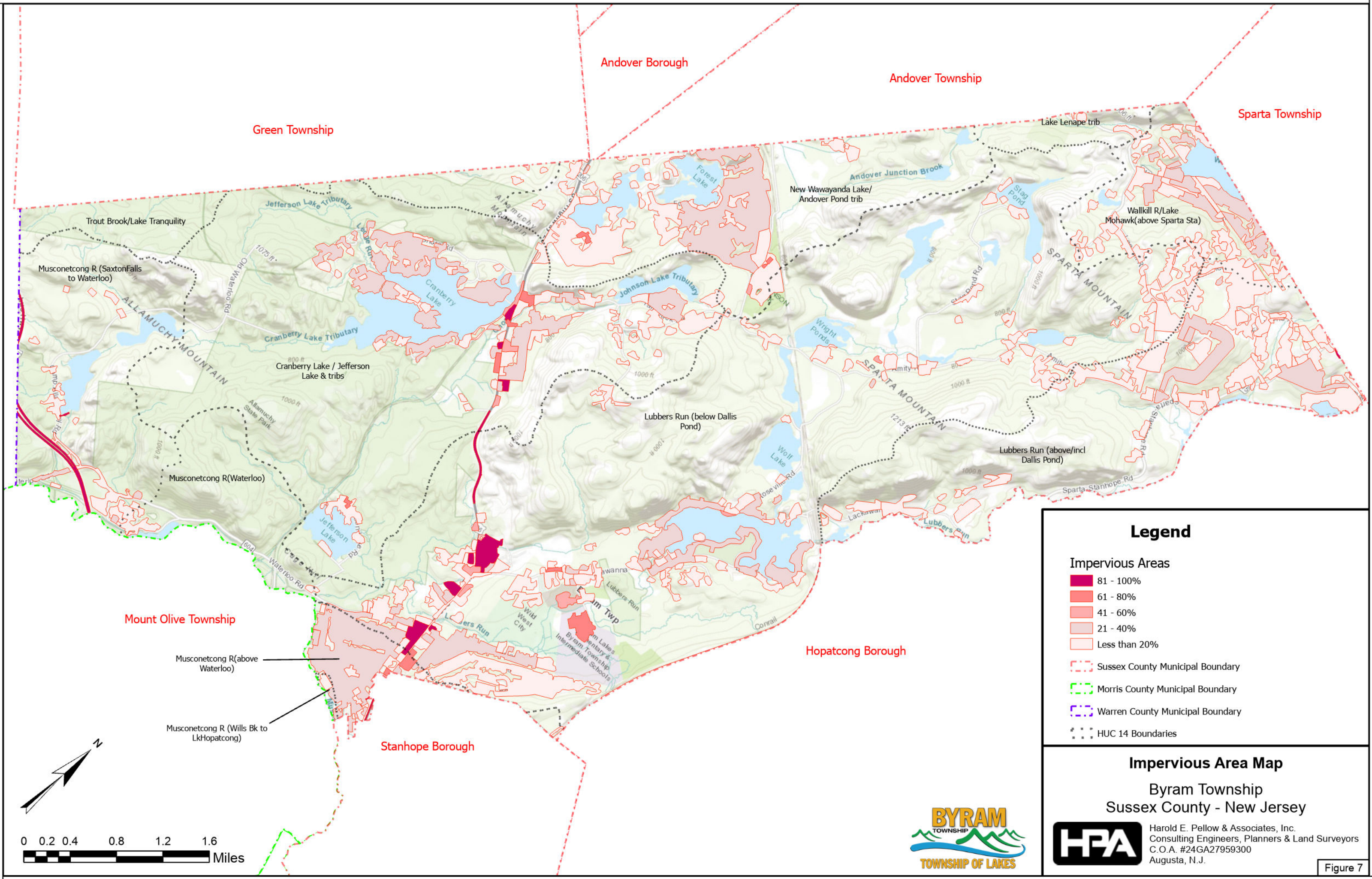
**TABLE #11: Impervious Area within Byram Township**

Listed below are the impervious areas and percentages of the overall drainage areas for the receiving waters affected.

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi <sup>2</sup> )	(ac)	(mi <sup>2</sup> )	(ac)	(mi <sup>2</sup> )	(ac)	(mi <sup>2</sup> )	(%)
Cranberry Lake / Jefferson Lake	3,334.1	5.21	3,043.6	4.76	290.5	0.45	104.8	0.16	3.4%
Lake Lenape	175.8	0.28	150.7	0.24	25.1	0.04	1.4	0.00	0.9%
Lubbers Run	6,991.2	10.92	6,614.2	10.34	377.0	0.59	251.1	0.39	3.8%
Musconetcong River	1,754.5	2.74	1,668.9	2.61	85.7	0.13	76.3	0.12	4.6%
New Wawayanda Lake / Andover Pond	1,323.6	2.07	1,212.6	1.90	111.1	0.17	76.9	0.12	6.3%
Trout Brook / Lake Tranquility	414.6	0.65	414.1	0.65	0.6	0.00	0.4	0.00	0.1%
Wallkill River	563.4	0.88	518.6	0.81	44.8	0.07	46.2	0.07	8.9%
Total	14,557.2	22.75	13,622.5	21.29	934.7	1.46	557.1	0.87	4.1%

\*Impervious areas analysis taken from *Highlands Council Impervious Surface GIS Data Set 2020*, *NJDEP GIS data 2023* and *Rutgers University Impervious Cover Assessment for Byram Township, Sussex County, New Jersey 2016*





**Legend**

**Impervious Areas**

- 81 - 100%
- 61 - 80%
- 41 - 60%
- 21 - 40%
- Less than 20%

- Sussex County Municipal Boundary
- Morris County Municipal Boundary
- Warren County Municipal Boundary
- HUC 14 Boundaries

**Impervious Area Map**

Byram Township  
Sussex County - New Jersey



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Consulting Engineers, Planners & Land Surveyors  
C.O.A. #24GA27959300  
Augusta, N.J.



Figure 7



## **Non-Municipally Owned or Operated Stormwater Facilities**

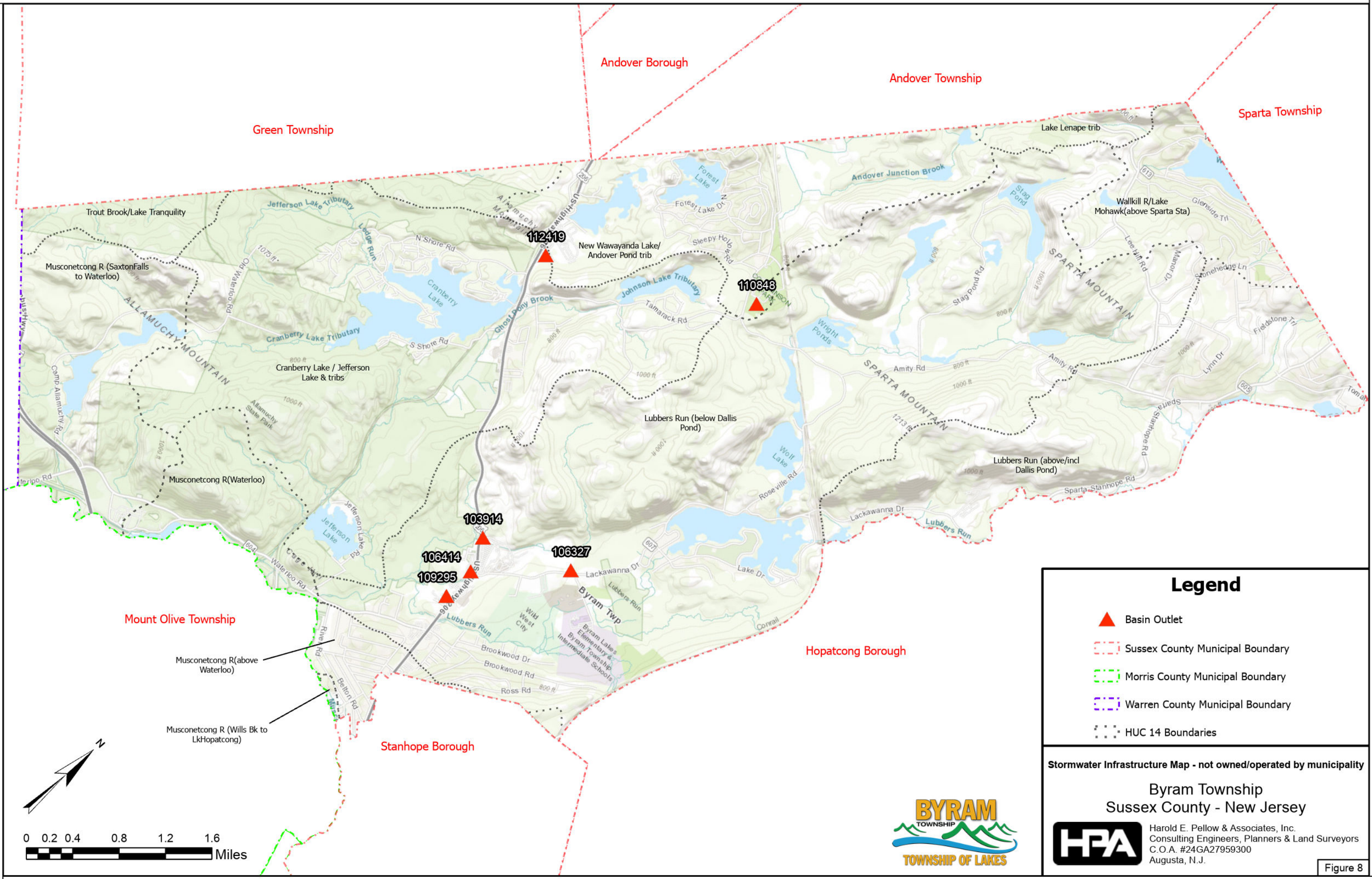
As part of the preparation for this initial phase of the Watershed Improvement Plan, certain privately owned stormwater management infrastructure improvements were researched to confirm location and ownership of such improvements. Past records of major stormwater project improvements as authorized by the municipal Land Use Board as well as certified projects reviewed by the Soil Conservation District which required authorization of a construction general permit (5G3) with associated basin summary forms, were logged and recorded in the following table and figure.

**TABLE #12: Non-municipally owned/operated Stormwater Facilities in Byram Township**

Basin_ID	Project_Name	HUC14	Project_Address	Basin Type
106327	JTK Associates	2040105150050	Lackawana Dr, Stanhope	Detention
109295	RPM Foreign Auto Parts	2040105150050	53 US 206	Detention
106414	CVS Pharmacy	2040105150050	77 Route 206	Detention
112419	Tamarack Park	2040105070020	Jones Lane	Infiltration
103914	Byram Plaza Improvements	2040105150050	9080 Rt 206	Detention
110848	Improvements to C.O. Johnson Park	2040105070020	Roseville Rd	Detention

\*Non-Municipally Owned or Operated Stormwater Facilities data was taken from the H&H database





**Legend**

- Basin Outlet
- Sussex County Municipal Boundary
- Morris County Municipal Boundary
- Warren County Municipal Boundary
- HUC 14 Boundaries

Stormwater Infrastructure Map - not owned/operated by municipality

Byram Township  
Sussex County - New Jersey



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C.O.A. #24GA27959300  
Augusta, N.J.



## **Conclusion**

The Watershed Inventory Report, Phase 1 of the Watershed Improvement Plan, identifies stormwater infrastructure, as required in the MS4 permits. It also summarizes water quality data, including stream classifications, TMDLs, and water quality impairments. The data that accompanies this inventory report has been compiled as an electronic map and will be submitted to the NJDEP Online via the online Document Submittal Service. The information from this inventory report will be used to make informed decisions during the creation of the Watershed Assessment Report, Phase 2 of the Watershed Improvement Plan. During this next Phase, the municipality will actively solicit feedback from stakeholders at public information sessions. These sessions will seek to review and analyze the data collected in the first phase of this plan in order to create templates of stormwater mitigation for the future phases. The ultimate work done in Phase 2 will identify areas of potential concern and where potential water quality improvement projects may be implemented to address the highlighted water quality and quantity issues identified in this inventory report.



## **Data Requirements, Resources & References**

The New Jersey Department of Environmental Protection requires these 13 points of data with their corresponding data source to be analyzed in Phase 1 of the watershed inventory report. Note that point 11, Overburdened communities, does not apply to Byram Township. The highlighted rows indicate the electronic data that is submitted to the Department via the Facility Submittal Service using NJDEP Online. The non-highlighted rows in the table below are summarized from the data acquired from Byram Township's MS4 Infrastructure Map or from the Department's publicly available data.

**TABLE #13: Required Electronic Data Submission Format**

<b><i>Required Data</i></b>	<b><i>Data Source</i></b>
1. All stormwater outfalls owned/operated by the permittee	MS4 Infrastructure Map
2. Drainage area for each permittee owned/operated outfall	Topography ArcGIS Solutions/ArcHydro
3. Receiving waterbodies of those outfalls	NJ-WET NJDEP Open Data
4. Water quality classification of all receiving waterbody segments	NJ-WET NJDEP Open Data
5. All stormwater interconnections from the permittee's MS4 system into another entities' storm or sanitary sewer system	MS4 to MS4 interconnections acquired in MS4 Infrastructure Map, private interconnection(s) needed
6. The drainage area for each interconnection into another entities' storm or sanitary sewer system	Topography ArcGIS Solutions/ArcHydro
7. All stormwater interconnections into the permittee's system from another entities' storm sewer system	MS4 to MS4 interconnections acquired in MS4 Infrastructure Map, private interconnection(s) needed
8. All storm drain inlets owned/operated by the permittee	MS4 Infrastructure Map
9. Area associated with each TMDL for waters that lie within or bordering the permittee's property(s)/jurisdiction	NJ-WET NJDEP Open Data
10. Area associated with each water quality impairment for waters that lie within or bordering the permittee's property(s)/jurisdiction	NJ-WET NJDEP Open Data
11. Overburdened communities	NJ-WET NJDEP Open Data EJMAP
12. Impervious areas	NJ-WET NJDEP Open Data Rutgers Impervious Surface Assessment Report
13. Location and ownership of all stormwater infrastructure not owned or operated by the permittee	H&H Database

\*The highlighted rows indicate that electronic data is required to be submitted to the Department via the Facility Submittal Service using NJDEP Online. Acceptable electronic data submittal formats are as follows:

- Georeferenced shapefile(s),
- Geodatabase(s), or
- AutoCAD file(s) (with all other non-applicable data stripped out).



*The following resources are compiled to highlight the current WIP guidance and available datasets.*

#### New Jersey Watershed Evaluation Tool (NJ-WET)

*NJ-WET was developed by the Bureau of NJPDES Stormwater Permitting and Water Quality Management to assist permittees in the development and implementation of their WIPs. Users can download the following data and create unique PDF maps of the following:*

- *Receiving surface waterbodies of outfalls*
- *Water quality classification of all receiving surface waterbody segments*
- *Sub-watersheds associated with TMDLs*
- *Sub-watersheds associated with water quality impairments*
- *Overburdened communities*
- *Impervious areas*

*Link to NJ-WET: <https://experience.arcgis.com/experience/f40f65d807bb4372bd92b48bb98f1972>*

#### NJDEP Open Data

*NJDEP Open Data is a site hosted by the Bureau of GIS which congregates a multitude of publicly available data for download and manipulation. Some examples of datasets available for download that may assist in the development and implementation of the WIP are:*

- *Receiving surface waterbodies of outfalls*
- *Water quality classification of all receiving surface waterbody segments*
- *Sub-watersheds associated with TMDLs*
- *Overburdened communities*
- *Impervious areas*
- *Land use cover*
- *Elevation*
- *Hydrography*

*Link to NJDEP Open Data: <https://gisdata-njdep.opendata.arcgis.com/>*

#### MS4 WIP Guidance Webpage

*The Bureau of NJPDES Stormwater Permitting and Water Quality Management hosts guidance on the webpage that captures the following:*

- *Pollutants of Concern Summaries – Provides detailed descriptions of each water quality parameter of concern from MS4s and the related effects on the environment*
- *WIP Matrix – Provides examples of projects that would address different pollutant parameters*
- *Project Descriptions – Provides a narrative description of each project from the accompanying WIP Matrix*

*Link to MS4 WIP guidance: <https://dep.nj.gov/njpdes-stormwater/municipal-stormwater-regulation-program/watershed-improvement-plan-guidance/>*

#### TMDL Lookup Tool

*The TMDL Lookup Tool allows users to search by county and municipality to obtain links to the specific TMDL reports generated for each sub-watershed within the selected municipal boundary.*

*Link to TMDL Lookup Tool: <https://dep.nj.gov/njpdes-stormwater/municipal-stormwater-regulation-program/tmdl/>*

#### New Jersey's Integrated Water Quality Assessment Reports – 303(d) List

*The 303(d) list is required under Section 303(d) of the federal Clean Water Act, which mandates that states submit to USEPA, on a biennial basis, a list of waters that do not support their designated uses because they are not meeting surface water quality standards despite the implementation of technology-based effluent limits. All such waters must be identified on the 303(d) List of Water Quality Limited Waters ("303(d) List"). States must prioritize 303(d)-listed waters for Total Maximum Daily Load (TMDL) development and identify those high priority waters for which they anticipate establishing TMDLs in the next two years. The 303(d) List must be submitted to USEPA by April 1 of every even-numbered year. Since 2002, New Jersey has developed and submitted its 303(d) List and Two-Year TMDL Schedule as part of the Integrated Report.*

*Link to the Department's information: <https://dep.nj.gov/wms/bears/water-quality-assessment/>*

#### New Jersey Environmental Justice Mapping, Assessment, and Protection Tool (EJMAP)

*This tool was designed to support the NJDEP's efforts to implement the State's Environmental Justice (EJ) Law through its regulatory and permitting processes. More information on overburdened communities and data related to this may be found [here](#).*

*Link to NJDEP's EJ Map: <https://experience.arcgis.com/experience/548632a2351b41b8a0443cfc3a9f4ef6>*

#### H&H Database

*The New Jersey Hydrologic Modeling Database, or "H&H Database," is the culmination of several decades of data collection effort by NJ Soil Conservation Districts and the NJ Department of Agriculture (NJDA). The data contained in the database was originally submitted to NJ soil conservation districts as part of the permit review process and are part of the public record. While every effort has been made to review the data for accuracy and correctness, the final responsibility for accuracy rests with the original designer(s). Site plans and design data are subject to all applicable copy write and intellectual property rights laws. The data available in this database can provide a starting point for permittees to identify potential private stormwater management measures within the permittee's jurisdiction.*

*Link to H&H Database: <https://hydro.rutgers.edu/about/>*