



**Impervious Cover Assessment
for
Byram Township, Sussex County, New Jersey**

*Prepared for Byram Township by the
Rutgers Cooperative Extension Water Resources Program*

December 9, 2016

Introduction

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 (Figure 1). An impervious surface can be any material that has been placed over soil that prevents water from soaking into the ground. Impervious surfaces include paved roadways, parking lots, sidewalks, and rooftops. As impervious areas increase, so does the volume of stormwater runoff.



Figure 1: Stormwater draining from a parking lot

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.

The primary cause of the pollution, flooding, and erosion problems is the quantity of impervious surfaces draining directly to local waterways. New Jersey is one of the most developed states in the country. Currently, the state has the highest percent of impervious cover in the country at 12.1% of its total area (Nowak & Greenfield, 2012). Many of these impervious surfaces are directly connected to local waterways (i.e., every drop of rain that lands on these impervious surfaces ends up in a local river, lake, or bay without any chance of being treated or soaking into the ground). To repair our waterways, reduce flooding, and stop erosion, stormwater runoff from impervious surfaces has to be better managed. Surfaces need to be disconnected with green infrastructure to prevent stormwater runoff from flowing directly into New Jersey's waterways. Disconnection redirects runoff from paving and rooftops to pervious areas in the landscape.

Green infrastructure is an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure projects capture, filter, absorb, and reuse stormwater to maintain or mimic natural systems and to treat runoff as a resource. As a general principal, green infrastructure practices use soil and vegetation to recycle stormwater runoff through infiltration and evapotranspiration. When used as components of a stormwater management system, green infrastructure practices such as bioretention, green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these technologies can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits (USEPA, 2013).

The first step to reducing the impacts from impervious surfaces is to conduct an impervious cover assessment. This assessment can be completed on different scales: individual lot, municipality, or watershed. Impervious surfaces need to be identified for stormwater management. Once impervious surfaces have been identified, there are three steps to better manage these surfaces.

1. ***Eliminate surfaces that are not necessary.*** For example, a paved courtyard at a public school could be converted to a grassed area.
2. ***Reduce or convert impervious surfaces.*** There may be surfaces that are required to be hardened, such as roadways or parking lots, but could be made smaller and still be functional. A parking lot that has two-way car ways could be converted to one-way car ways. There also are permeable paving materials such as porous asphalt, pervious concrete, or permeable paving stones that could be substituted for impermeable paving materials (Figure 2).
3. ***Disconnect impervious surfaces from flowing directly to local waterways.*** There are many ways to capture, treat, and infiltrate stormwater runoff from impervious surfaces. Opportunities may exist to reuse this captured water.



Figure 2: Rapid infiltration of water through porous pavement is demonstrated at the USEPA Edison New Jersey test site

Byram Township Impervious Cover Analysis

Located in Sussex County in northern New Jersey, Byram Township covers approximately 22.7 square miles south of Lafayette. Figures 3 and 4 illustrate that 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 (Figure 5).

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) 2007 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 2007 NJDEP land use/land cover data, approximately 3.8% of Byram Township has impervious cover. This level of impervious cover suggests that the streams in Byram Township are likely sensitive streams.

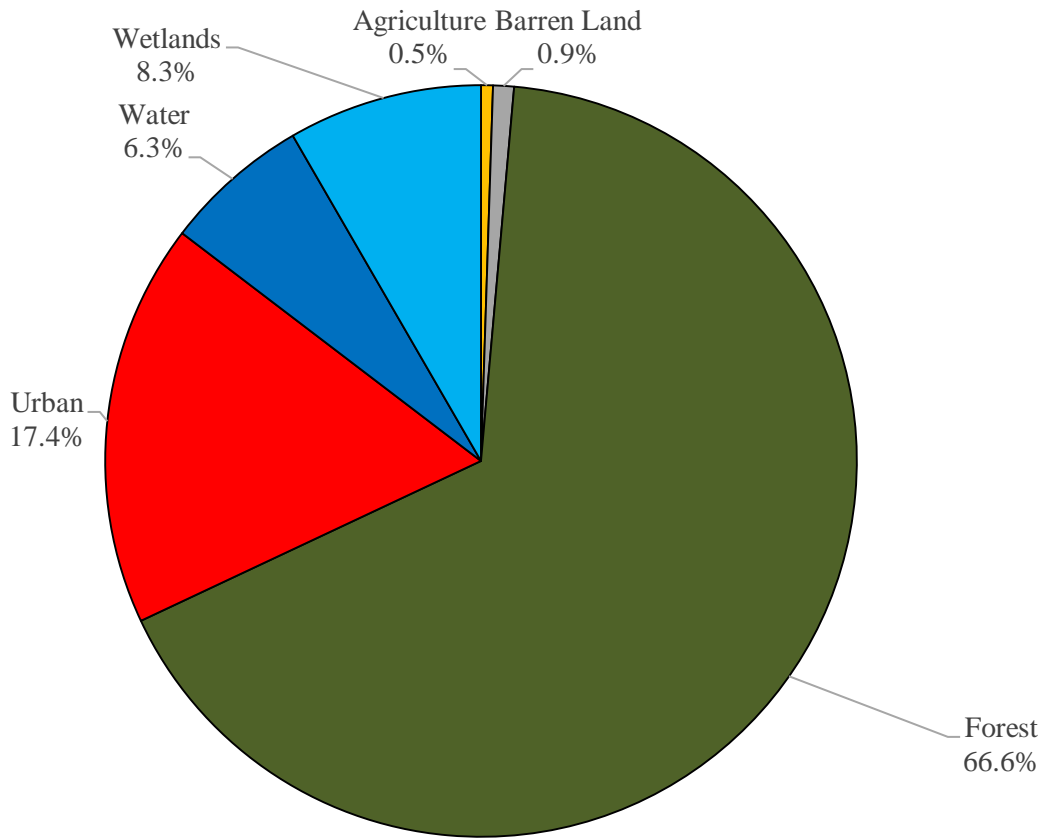


Figure 3: Pie chart illustrating the land use in Byram Township

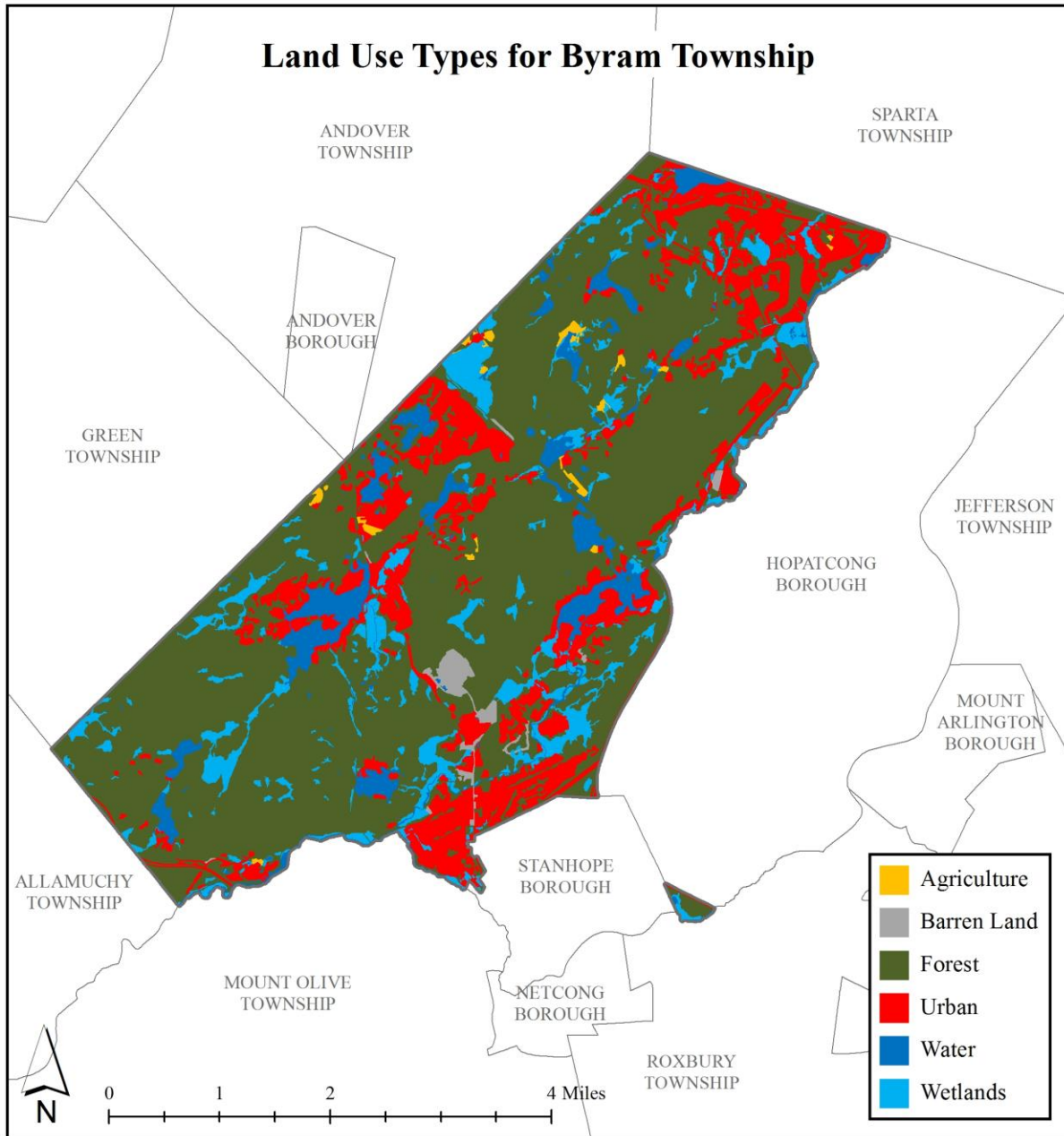


Figure 4: Map illustrating the land use in Byram Township

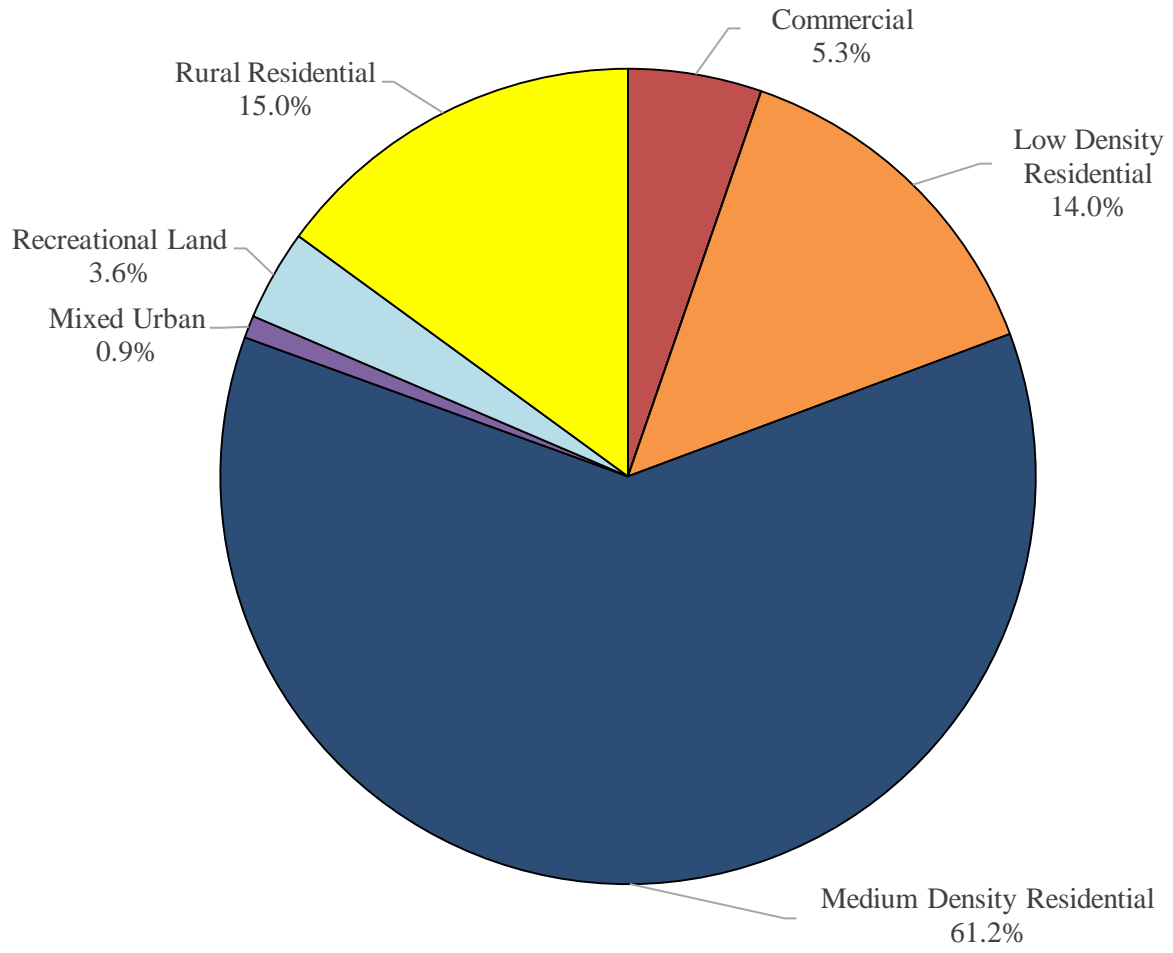


Figure 5: Pie chart illustrating the various types of urban land use in Byram Township

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each subwatershed within Byram Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 0% in the Trout Brook / Lake Tranquility subwatershed to 8.9% in the Wallkill River subwatershed. Evaluating impervious cover on a subwatershed basis allows the municipality to focus impervious cover reduction or disconnection efforts in the subwatersheds where frequent flooding occurs.

In developed landscapes, stormwater runoff from parking lots, driveways, sidewalks, and rooftops flows to drainage pipes that feed the sewer system. The cumulative effect of these impervious surfaces and thousands of connected downspouts reduces the amount of water that can infiltrate into soils and greatly increases the volume and rate of runoff that flows to waterways. Stormwater runoff volumes (specific to Byram Township, Sussex County) associated with impervious surfaces were calculated for the following storms: the New Jersey water quality design storm of 1.25 inches of rain, an annual rainfall of 44 inches, the 2-year design storm (3.2 inches of rain), the 10-year design storm (4.7 inches of rain), and the 100-year design storm (7.6 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Byram Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Wallkill River subwatershed was harvested and purified, it could supply water to 14 homes for one year¹.

¹ Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Byram Township

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(%)
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%

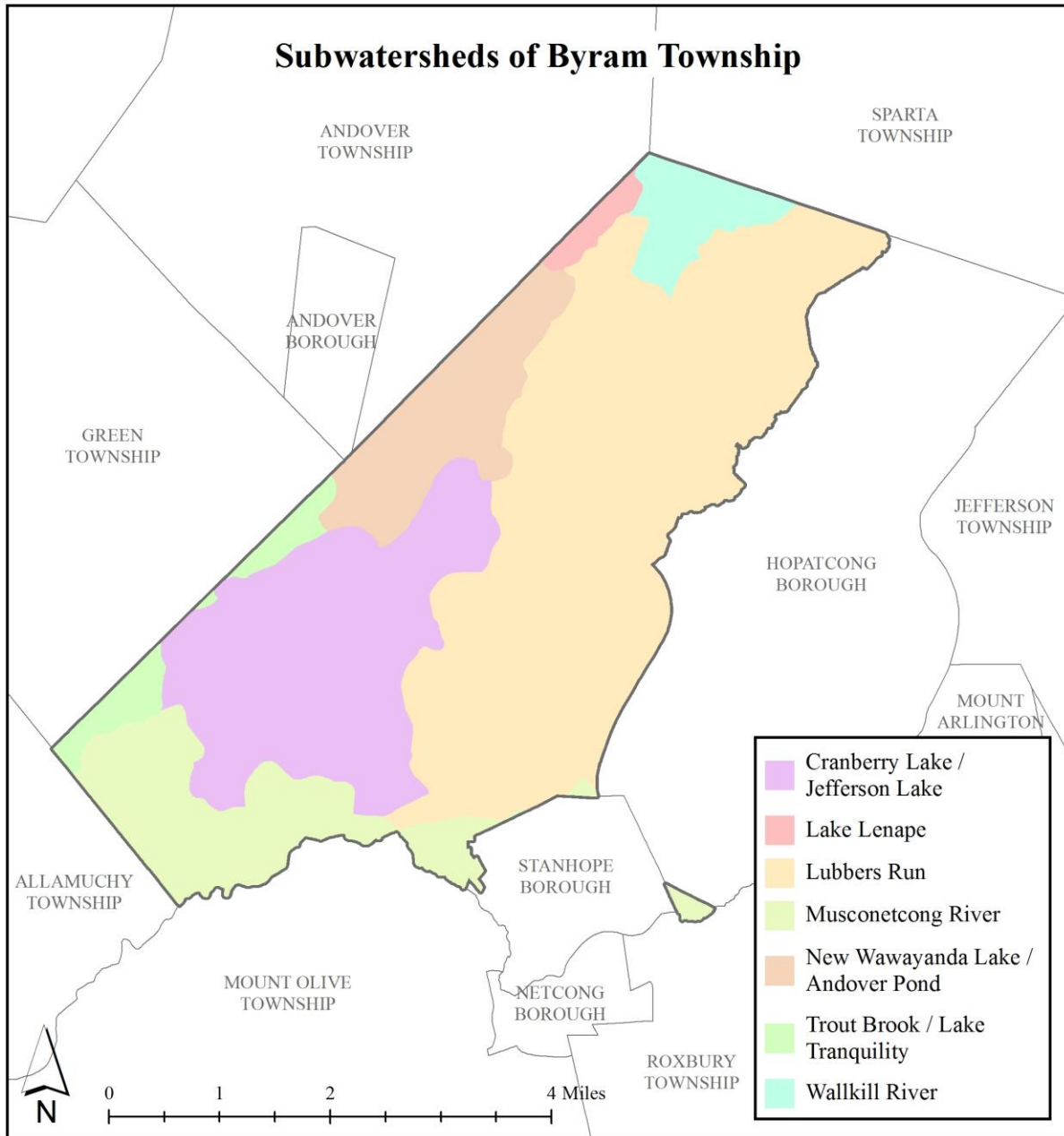


Figure 6: Map of the subwatersheds in Byram Township.

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Byram Township

Subwatershed	Total Runoff Volume for the 1.25" NJ Water Quality Storm (MGal)	Total Runoff Volume for the NJ Annual Rainfall of 44" (MGal)	Total Runoff Volume for the 2-Year Design Storm (3.2") (MGal)	Total Runoff Volume for the 10-Year Design Storm (4.7") (MGal)	Total Runoff Volume for the 100-Year Design Storm (7.6") (MGal)
Cranberry Lake/ Jefferson Lake	3.6	125.3	9.1	13.4	21.6
Lake Lenape	0.0	1.6	0.1	0.2	0.3
Lubbers Run	8.5	300.1	21.8	32.1	51.8
Musconetcong River	2.6	91.1	6.6	9.7	15.7
New Wawayanda Lake/ Andover Pond	2.6	91.9	6.7	9.8	15.9
Trout Brook/ Lake Tranquility	0.0	0.5	0.0	0.1	0.1
Wallkill River	1.6	55.2	4.0	5.9	9.5
Total	18.9	665.7	48.3	71.2	114.9

The next step is to set a reduction goal for impervious area in each subwatershed. Based upon the Rutgers Cooperative Extension (RCE) Water Resources Program's experience, a 10% reduction would be a reasonably achievable reduction for these subwatersheds in Byram Township. While it may be difficult to eliminate paved areas or replace paved areas with permeable pavement, it is relatively easy to identify impervious surfaces that can be disconnected using green infrastructure practices. For all practical purposes, disconnecting an impervious surface from a storm sewer system or a water body is an "impervious area reduction". The RCE Water Resources Program recommends that all green infrastructure practices that are installed to disconnect impervious surfaces should be designed for the 2-year design storm (3.2 inches of rain over 24-hours). Although this results in management practices that are slightly over-designed by NJDEP standards, which require systems to be designed for the New Jersey water quality storm (1.25 inches of rain over 2-hours), these systems will be able to handle the increase in storm intensities that are expected to occur due to climate change. By designing these management practices for the 2-year design storm, these practices will be able to manage 95% of the annual rainfall volume. The recommended annual reductions in runoff volumes are shown in Table 3.

As previously mentioned, once impervious surfaces have been identified, the next steps for managing impervious surfaces are to 1) eliminate surfaces that are not necessary, 2) reduce or convert impervious surfaces to pervious surfaces, and 3) disconnect impervious surfaces from flowing directly to local waterways.

Elimination of Impervious Surfaces

One method to reduce impervious cover is to "depave." Depaving is the act of removing paved impervious surfaces and replacing them with pervious soil and vegetation that will allow for the infiltration of rainwater. Depaving leads to the re-creation of natural space that will help reduce flooding, increase wildlife habitat, and positively enhance water quality as well as beautify neighborhoods. Depaving also can bring communities together around a shared vision to work together to reconnect their neighborhood to the natural environment.

Table 3: Impervious cover reductions by subwatershed in Byram Township

Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction ² (MGal)
Cranberry Lake / Jefferson Lake	10.5	12.5
Lake Lenape	0.1	0.2
Lubbers Run	25.1	30.0
Musconetcong River	7.6	9.1
New Wawayanda Lake / Andover Pond	7.7	9.2
Trout Brook / Lake Tranquility	0.0	0.1
Wallkill River	4.6	5.5
Total	55.7	66.6

² Annual Runoff Volume Reduction =

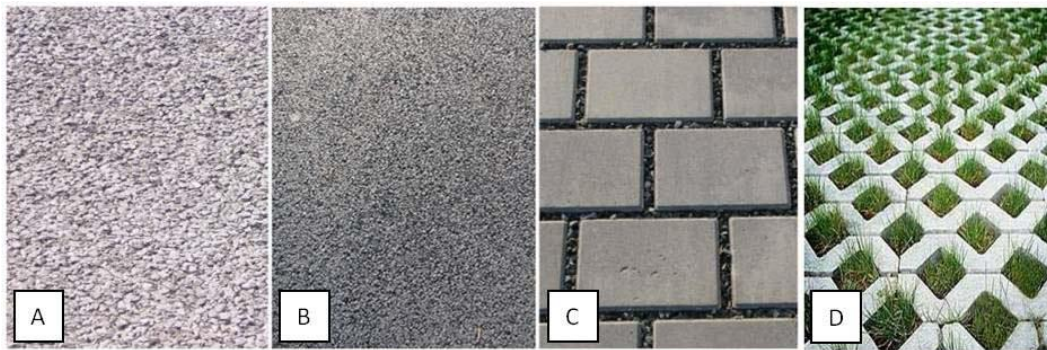
Acres of IC x 43,560 ft²/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft³) x (1 MGal/1,000,000 gal)

All BMPs should be designed to capture the first 3.2 inches of rain from each storm. This would allow the BMP to capture 95% of the annual rainfall of 44 inches.

Pervious Pavement

There are four different types of permeable pavement systems that are commonly being used throughout the country to reduce the environmental impacts from impervious surfaces. These surfaces include pervious concrete, porous asphalt, interlocking concrete pavers, and grid pavers.

“Permeable pavement is a stormwater drainage system that allows rainwater and runoff to move through the pavement’s surface to a storage layer below, with the water eventually seeping into the underlying soil. Permeable pavement is beneficial to the environment because it can reduce stormwater volume, treat stormwater water quality, replenish the groundwater supply, and lower air temperatures on hot days (Rowe, 2012).”



Permeable surfaces: (A) pervious concrete, (B) porous asphalt, (C) interlocking concrete pavers, (D) grid pavers (Rowe, 2012)

Pervious concrete and porous asphalt are the most common of the permeable surfaces. They are similar to regular concrete and asphalt but without the fine materials. This allows water to quickly pass through the material into an underlying layered system of stone that holds the water allowing it to infiltrate into the underlying uncompacted soil.

Impervious Cover Disconnection Practices

By redirecting runoff from paving and rooftops to pervious areas in the landscape, the amount of directly connected impervious area in a drainage area can be greatly reduced. There are many cost-effective ways to disconnect impervious surfaces from local waterways.

- **Simple Disconnection**: This is the easiest and least costly method to reduce stormwater runoff for smaller storm events. Instead of piping rooftop runoff to the street where it enters the catch basin and is piped to the river, the rooftop runoff is released onto a grassed

area to allow the water to be filtered by the grass and soak into the ground. A healthy lawn typically can absorb the first one to two inches of stormwater runoff from a rooftop. Simple disconnection also can be used to manage stormwater runoff from paved areas. Designing a parking lot or driveway to drain onto a grassed area, instead of the street, can dramatically reduce pollution and runoff volumes.

- Rain Gardens: Stormwater can be diverted into shallow landscaped depressed areas (i.e., rain gardens) where the vegetation filters the water, and it is allowed to soak into the ground. Rain gardens, also known as bioretention systems, come in all shapes and sizes and can be designed to disconnect a variety of impervious surfaces (Figure 7).



Figure 7: Rain garden outside the RCE of Gloucester County office which was designed to disconnect rooftop runoff from the local storm sewer system

- Rainwater Harvesting: Rainwater harvesting includes the use of rain barrels and cisterns (Figures 8a and 8b). These can be placed below downspouts to collect rooftop runoff. The collected water has a variety of uses including watering plants and washing cars. This practice also helps cut down on the use of potable water for nondrinking purposes. It is important to divert the overflow from the rainwater harvesting system to a pervious area.



Figure 8a: Rain barrel used to disconnect a downspout with the overflow going to a flower bed



Figure 8b: A 5,000 gallon cistern used to disconnect the rooftop of the Department of Public Works in Clark Township to harvest rainwater for nonprofit car wash events

Examples of Opportunities in Byram Township

To address the impact of stormwater runoff from impervious surfaces, the next step is to identify opportunities in the municipality for eliminating, reducing, or disconnecting directly connected impervious surfaces. To accomplish this task, an impervious cover reduction action plan should be prepared. Aerial photographs are used to identify sites with impervious surfaces in the municipality that may be suitable for inclusion in the action plan. After sites are identified, site visits are conducted to photo-document all opportunities and evaluate the feasibility of eliminating, reducing or disconnecting directly connected impervious surfaces. A brief description of each site discussing the existing conditions and recommendations for treatment of the impervious surfaces is developed. After a number of sites have been selected for inclusion in the action plan, concept plans and detailed green infrastructure information sheets are prepared for a selection of representative sites.

For Byram Township, three sites have been included in this assessment. Examples of concept plans and detailed green infrastructure information sheets are provided in Appendix A. The detailed green infrastructure information sheets describe existing conditions and issues, proposed solutions, anticipated benefits, possible funding sources, potential partners and stakeholders, and estimated costs. Additionally, each project has been classified as a mitigation opportunity for recharge potential, total suspended solids removal, and stormwater peak reduction. Finally, these detailed green infrastructure information sheets provide an estimate of gallons of stormwater captured and treated per year by each proposed green infrastructure practice. The concept plans provide an aerial photograph of the site and details of the proposed green infrastructure practices.

Conclusions

Byram Township can reduce flooding and improve its waterways by better managing stormwater runoff from impervious surfaces. This impervious cover assessment is the first step toward better managing stormwater runoff. The next step is to develop an action plan to eliminate, reduce, or disconnect impervious surfaces where possible and practical. Many of the highly effective disconnection practices are inexpensive. The entire community can be engaged in implementing these disconnection practices.

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Appendix A

Examples of Impervious Cover Reduction Action Plan Projects Concept Plans and Detailed Green Infrastructure Information Sheets

Byram Township
 Impervious Cover Assessment
CO Johnson Park, 130 Roseville Road



A



B



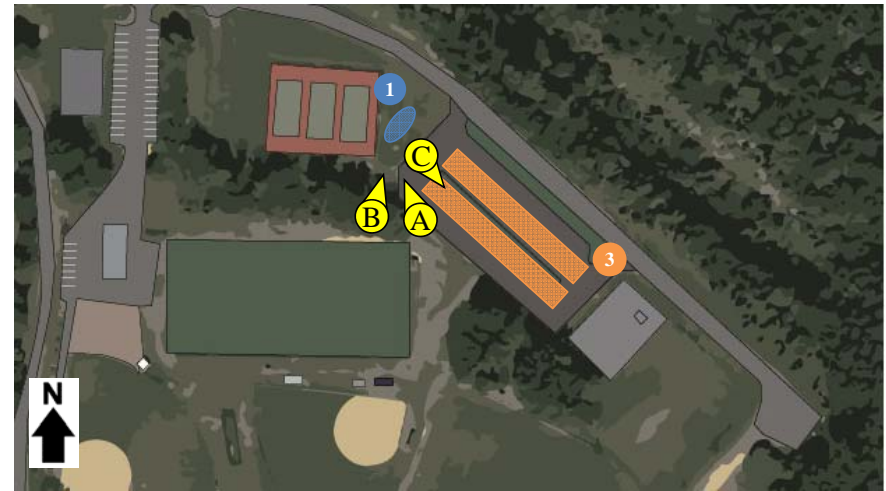
C



PROJECT LOCATION:



SITE PLAN:



- 1 **BIORETENTION SYSTEMS:** A bioretention system should be installed on the grassed area next to the parking lot. This will capture, treat, and infiltrate stormwater runoff from the parking. It will help mitigate the erosion issues in this area as well.
- 2 **EDUCATIONAL PROGRAM:** The RCE Water Resources Program, *Stormwater Management in Your Schoolyard*, can be delivered at CO Johnson Park to educate the students about stormwater management and engage them in building the bioretention systems.
- 3 **POROUS PAVEMENT:** The parking space areas can be replaced with grass pavers/ porous pavement to allow infiltration of additional runoff from the parking lot. Porous pavement promotes groundwater recharge and filters stormwater.

1 BIORETENTION SYSTEM



2 EDUCATIONAL PROGRAM



3 POROUS PAVEMENT



CO Johnson Park
Green Infrastructure Information Sheet

<p>Location: 130 Roseville Road Byram Township, NJ 07821</p>	<p>Municipality: Byram Township</p> <p>Subwatershed: New Wawayanda Lake</p>
<p>Green Infrastructure Description: bioretention systems (rain gardens) youth education program porous pavement</p>	<p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Mitigation Opportunities: recharge potential: yes TSS removal potential: yes stormwater peak reduction potential: yes</p>	<p>Stormwater Captured and Treated Per Year: rain garden: 312,660 gallons porous pavement: 770,970 gallons</p>
<p>Existing Conditions and Issues: Due to the steep slope, the grassy area in between the tennis court and the eastern parking lot is experiencing erosion problems. Vegetation has been unable to grow in the eroded areas and the structural stability of the fence has been compromised. The parking lot is full of gravel and runoff flows towards that northeast corner of the parking lot which is leading to erosion of the hill.</p>	
<p>Proposed Solution(s): A bioretention system can be implemented in this grassy area. This bioretention system would be designed in order to receive the runoff from the parking lot. The inlet channels will be lined with river stone to allow controlled flow of runoff to help prevent erosion. The parking space areas can be replaced with grass pavers/ porous pavement to allow infiltration of additional runoff from the parking lot. Porous pavement promotes groundwater recharge and filters stormwater.</p>	
<p>Anticipated Benefits: Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.2 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. This bioretention system would provide additional benefits such as erosion control, aesthetic appeal, and wildlife habitat. Rutgers Cooperative Extension could additionally present the <i>Stormwater Management in Your Schoolyard</i> program to students and include them in bioretention system planting efforts to enhance the program. The porous pavement would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.2 inches of rain over 24 hours) for most of the properties asphalt. These systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs grants from foundations home and school associations</p>	

CO Johnson Park
Green Infrastructure Information Sheet

Partners/Stakeholders:

Byram Township
Local community groups (Boy Scouts, Girl Scouts, etc.)
Rutgers Cooperative Extension

Estimated Cost:

The rain garden is 3,000 square feet in size. At \$5 per foot, the estimated cost of the rain garden is \$15,000. The porous pavement is 16,830 square feet in size. At \$25 per foot, the estimated cost of porous pavement is \$387,090.

Byram Township
 Impervious Cover Assessment
*Byram Township Volunteer Fire House,
 225 U.S. Highway 206*

PROJECT LOCATION:



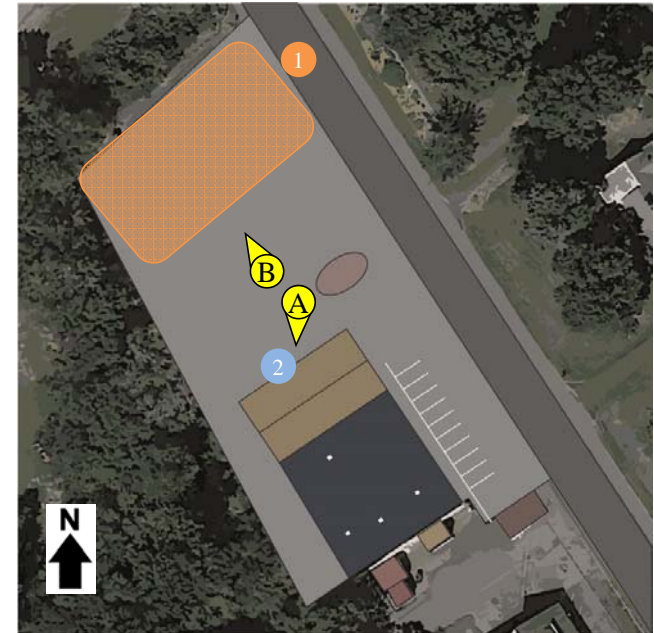
A



B



SITE PLAN:



- 1 POROUS PAVEMENT:** Porous pavement can be implemented in the parking lot located north of the Byram Township Volunteer Fire House. Porous pavement promotes groundwater recharge and filters stormwater.
- 2 RAINWATER HARVESTING:** A cistern could be placed on the north side of the building to help capture the stormwater that drains from the building's rooftop. Connecting the downspouts to the cistern will allow the stormwater to be collected and used for gardening and washing the fire trucks.

1 POROUS PAVEMENT



2 RAINWATER HARVESTING



Byram Township Volunteer Fire House
Green Infrastructure Information Sheet

<p>Location: 225 U.S. 206 Byram Township, NJ 07821</p>	<p>Municipality: Byram Township</p>
<p>Green Infrastructure Description: porous pavement rain barrel</p>	<p>Subwatershed: Cranberry Lake</p> <p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Mitigation Opportunities: recharge potential: yes TSS removal potential: yes stormwater peak reduction potential: yes</p>	<p>Stormwater Captured and Treated Per Year: porous pavement: 644,600 gallons cistern: 44,400 gallons</p>
<p>Existing Conditions and Issues: On the northern side of the building, three downspouts are directing stormwater onto the parking lot. The parking lot directs the runoff into the street with little to no infiltration. The parking lot is damaged and is in need of repair.</p>	
<p>Proposed Solution(s): A cistern can be placed on the northern side of the building to collect the stormwater running off of the rooftop. The gutters system would be altered to allow the water to flow into the cistern. The water stored in the cistern can be used to wash the fire trucks. The damaged parking lot can be repaved with a combination of porous and impervious asphalt.</p>	
<p>Anticipated Benefits: The porous pavement would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.2 inches of rain over 24 hours) for most of the properties asphalt. These systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. The cistern would intercept stormwater runoff coming from the rooftop. The water stored in the cistern can be used to wash the firetrucks or water nearby vegetation.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs grants from foundations home and school associations</p>	
<p>Partners/Stakeholders: Byram Township Local community groups (Boy Scouts, Girl Scouts, etc.) Rutgers Cooperative Extension</p>	

Byram Township Volunteer Fire House
Green Infrastructure Information Sheet

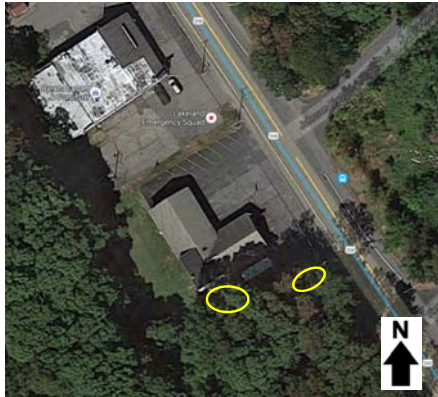
Estimated Cost:

The porous pavement is 9,000 square feet in size. At \$25 per foot, the estimated cost of porous pavement is \$225,000. The cistern capable of retaining 3,000 gallons will be implemented. At \$2 per gallon, the estimated cost of the cistern is \$6,000. The total cost of the project is approximately \$231,000.

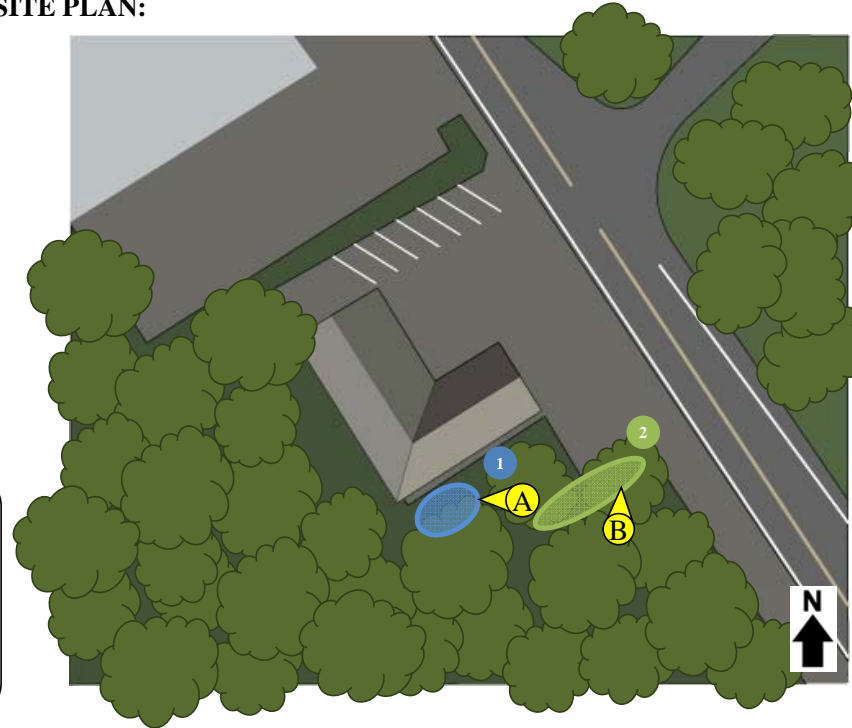
Byram Township Impervious Cover Assessment

Lakeland Emergency Squad, 221 Route 206

PROJECT LOCATION:



SITE PLAN:



1 BIORETENTION SYSTEMS: A bioretention system can be implemented on the southeast face to catch rooftop runoff these are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff. These systems can easily be incorporated into existing landscapes, improving aesthetics and creating wildlife habitat while managing stormwater runoff.

2 BIOSWALE: A bioswale can be implemented to capture runoff from the pavement and roadway. A portion of existing pavement may need to be removed to allow enough room for the system.

1 BIORETENTION SYSTEM



2 BIOSWALE



A



B



Lakeland Emergency Squad
Green Infrastructure Information Sheet

<p>Location: 221 Route 206 Byram, NJ 07821</p>	<p>Municipality: Byram Township</p>
<p>Green Infrastructure Description: bioretention system (rain garden) bioswale</p>	<p>Subwatershed: Musconetcong River</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes</p>	<p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) in surface runoff</p> <p>Stormwater Captured and Treated Per Year: bioretention system: 16,936 gal. bioswale: 59,406 gal.</p>
<p>Existing Conditions and Issues: The site has a building with disconnected downspouts and a substantial paved area. Toward the rear of the building is a grassed area. Runoff from a portion of the paved area and roadway flows toward for forested area to the southeast that has caused some erosion before flowing into a natural depression.</p>	
<p>Proposed Solution(s): A rain garden can be implemented along the southeast face of the building by redirecting downspouts to flow into it. A bioswale can be installed along the southeast pavement edge to capture the runoff from the roadway and pavement then allow it to more slowly flow into the natural depression.</p>	
<p>Anticipated Benefits: Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.2 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. A bioretention system would also provide ancillary benefits, such as enhanced wildlife and aesthetic appeal to the local residents of Byram Township. The bioswale will capture, treat, and infiltrate stormwater reducing TN by 30%, TP by 60%, and TSS by 90%.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs Byram Township local social and community groups</p>	
<p>Partners/Stakeholders: Byram Township Lakeland Emergency Squad local community groups Rutgers Cooperative Extension</p>	

Lakeland Emergency Squad
Green Infrastructure Information Sheet

Estimated Cost:

A rain garden to capture the roof runoff would need to be approximately 165 square feet. At \$5 per square foot, the estimated cost of the rain garden is \$825.

The bioswale would need to be 60 feet long and 9.5 feet wide (570 sq. ft.). At \$5 per square foot, the estimate cost of the bioswale is \$2,850.

The total cost of the project will thus be approximately \$3,675.