RUTGERS

New Jersey Agricultural Experiment Station

Draft

Impervious Cover Assessment for Franklin Township, Hunterdon County, New Jersey

Prepared for Franklin Township by the Rutgers Cooperative Extension Water Resources Program

February 3, 2015

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

Franklin Township Impervious Cover Analysis

Located in Hunterdon County in central New Jersey, Franklin Township covers approximately 23.2 square miles. Figures 3 and 4 illustrate that Franklin Township is dominated by agriculture land uses. A total of 17.5% of the municipality's land use is classified as urban. Of the urban land in Franklin Township, rural 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 steams 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 Franklin 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 Franklin Township. Based upon the 2007 NJDEP land use/land cover data, approximately 2.9% of Franklin Township has impervious cover. This level of impervious cover suggests that the streams in Franklin Township are likely sensitive streams.

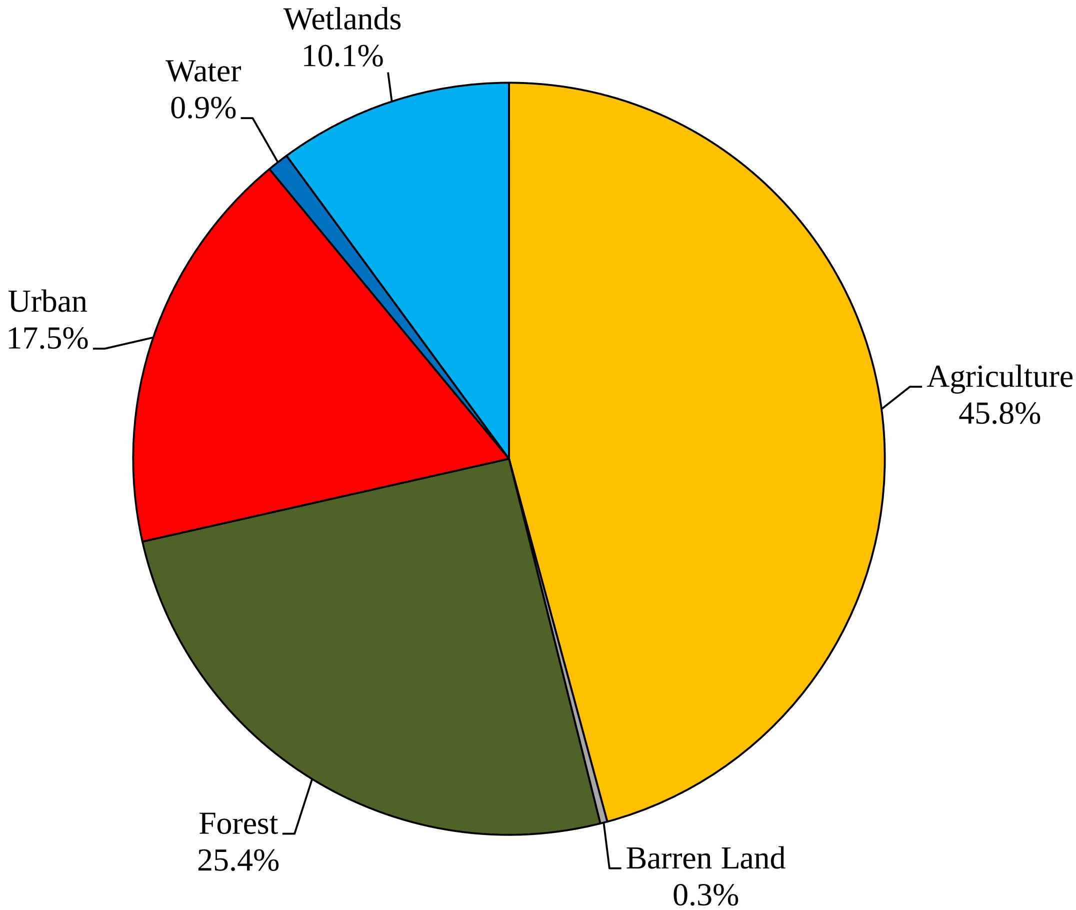


Figure 3: Pie chart illustrating the land use in Franklin Township

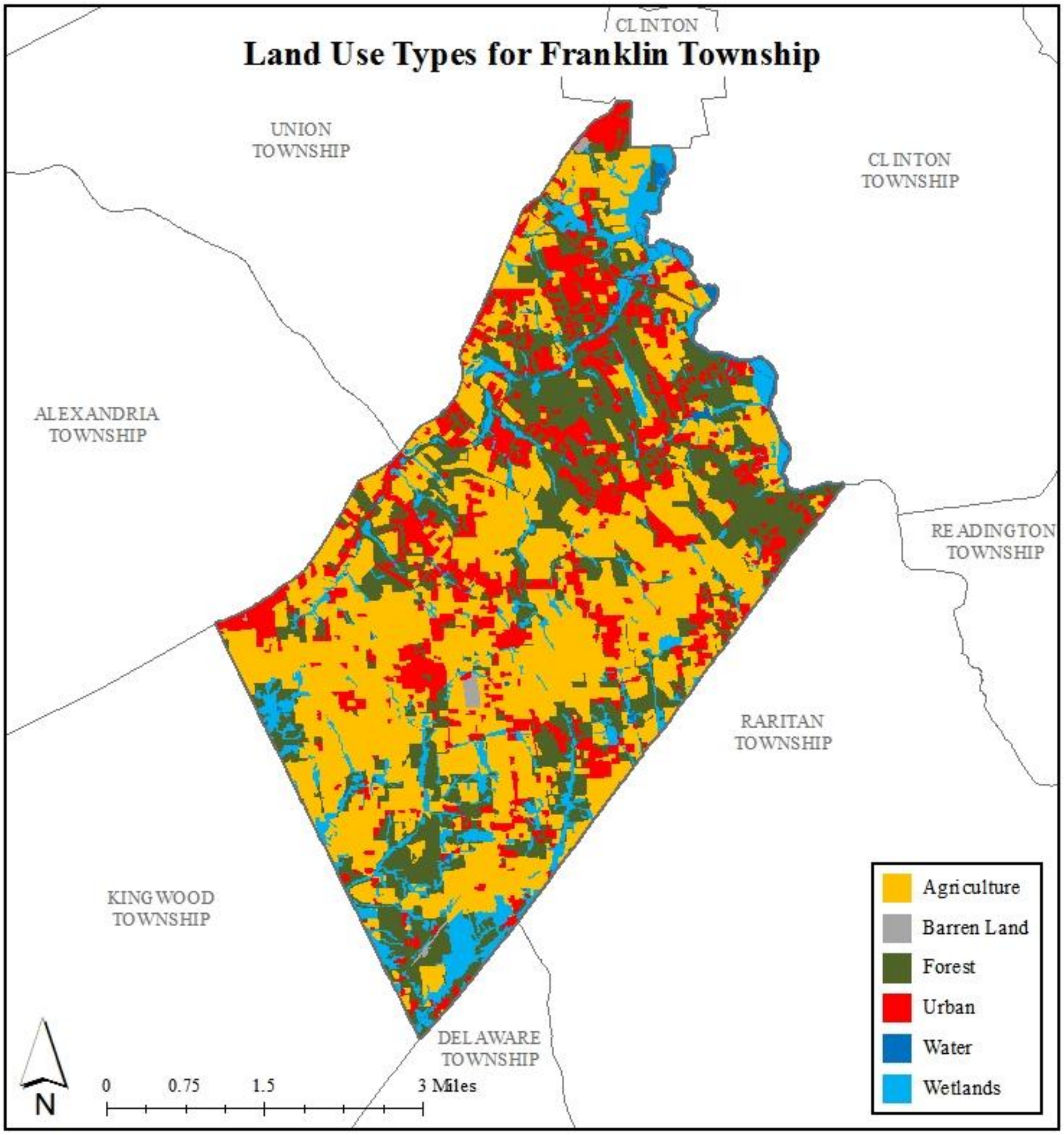


Figure 4: Map illustrating the land use in Franklin Township

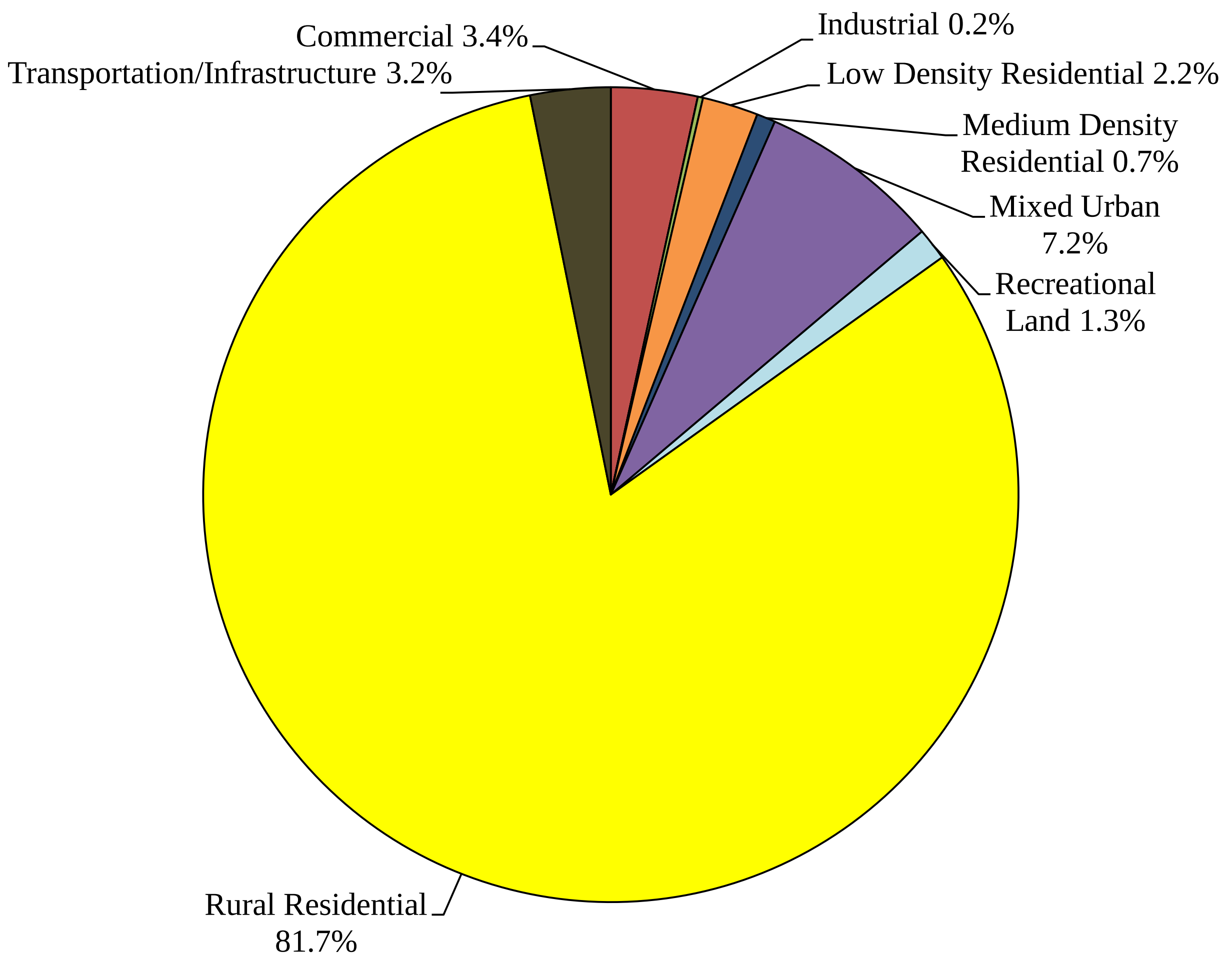


Figure 5: Pie chart illustrating the various types of urban land use in Franklin Township

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each Raritan River subwatershed within Franklin Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 1.7% in the Wickecheoke Creek subwatershed to 47.7% in the Spruce Run Reservoir/Willoughby Brook 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 Franklin Township, Hunterdon 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 (3.4 inches of rain), the 10-year design storm (5.0 inches of rain), and the 100-year design storm (8.0 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Franklin Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Cakepoulin Creek subwatershed was harvested and purified, it could supply water to 58 homes for one year[1].

[1] Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Franklin Township

Subwatershed	**Total Area**		**Land Use Area**		**Water Area**		**Impervious Cover**		
	(ac)	**(mi^2)**	**(ac)**	**(mi^2)**	**(ac)**	**(mi^2)**	**(ac)**	**(mi^2)**	**(%)**
Cakepoulin Creek	6,168.4	9.64	6,127.2	9.57	41.2	0.06	187.5	0.29	3.1%
Lockatong Creek	3,585.5	5.60	3,571.9	5.58	13.6	0.02	87.6	0.14	2.5%
Nishisakawick Creek	54.2	0.08	54.2	0.08	0.00	0.00	2.16	0.00	4.0%
Raritan River South Branch	2,982.3	4.66	2,908.2	4.54	74.1	0.12	95.8	0.15	3.3%
Spruce Run Reservoir/ Willoughby Brook	45.9	0.07	45.9	0.07	0.00	0.00	21.9	0.03	47.7%
Wickecheoke Creek	1,994.3	3.12	1,986.7	3.10	7.6	0.01	32.8	0.05	1.7%
Total	14,830.7	23.2	14,694.2	23.0	136.5	0.21	427.7	0.67	2.9%

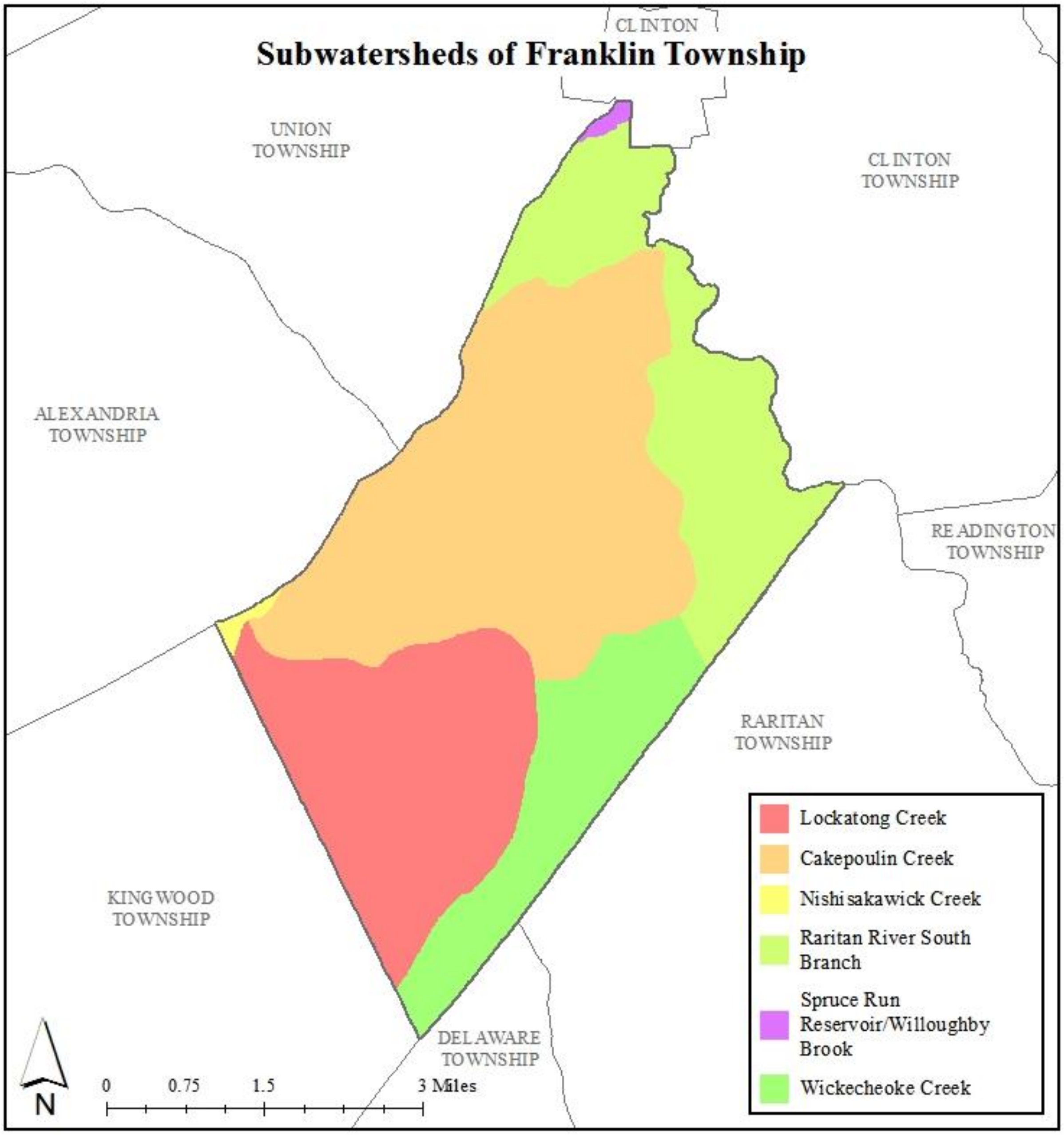


Figure 6: Map of the subwatersheds in Franklin Township

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Franklin 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 (3.4") (MGal)	Total Runoff Volume for the 10-Year Design Storm (5.0") (MGal)	Total Runoff Volume for the 100-Year Design Storm (8.0") (MGal)
Cakepoulin Creek	6.4	224.0	17.3	25.5	40.7
Lockatong Creek	3.0	104.6	8.1	11.9	19.0
Nishisakawick Creek	0.1	2.6	0.2	0.3	0.5
Raritan River South Branch	3.3	114.4	8.8	13.0	20.8
Spruce Run Reservoir/ Willoughby Brook	0.7	26.2	2.0	3.0	4.8
Wickecheoke Creek	1.1	39.2	3.0	4.4	7.1
Total	14.5	511.0	39.5	58.1	92.9

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 Franklin 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 (3.4 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 Franklin Township

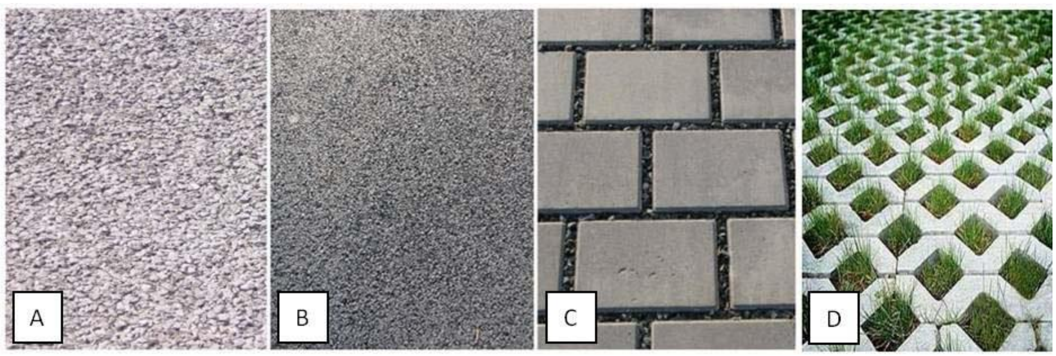
Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction [2] (MGal)
Cakepoulin Creek	18.8	21.3
Lockatong Creek	8.8	9.9
Nishisakawick Creek	0.2	0.2
Raritan River South Branch	9.6	10.9
Spruce Run Reservoir/ Willoughby Brook	2.2	2.5
Wickecheoke Creek	3.3	3.7
Total	42.8	48.5

[2] Annual Runoff Volume Reduction =
Acres of impervious cover x 43,560 ft^2/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft^3) x (1 MGal/1,000,000 gal)
All green infrastructure should be designed to capture the first 3.4 inches of rain from each storm. This would allow the green infrastructure 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 Franklin 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 Franklin 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

Franklin 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.

References

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Appendix A

Examples of Impervious Cover Reduction Action Plan Projects

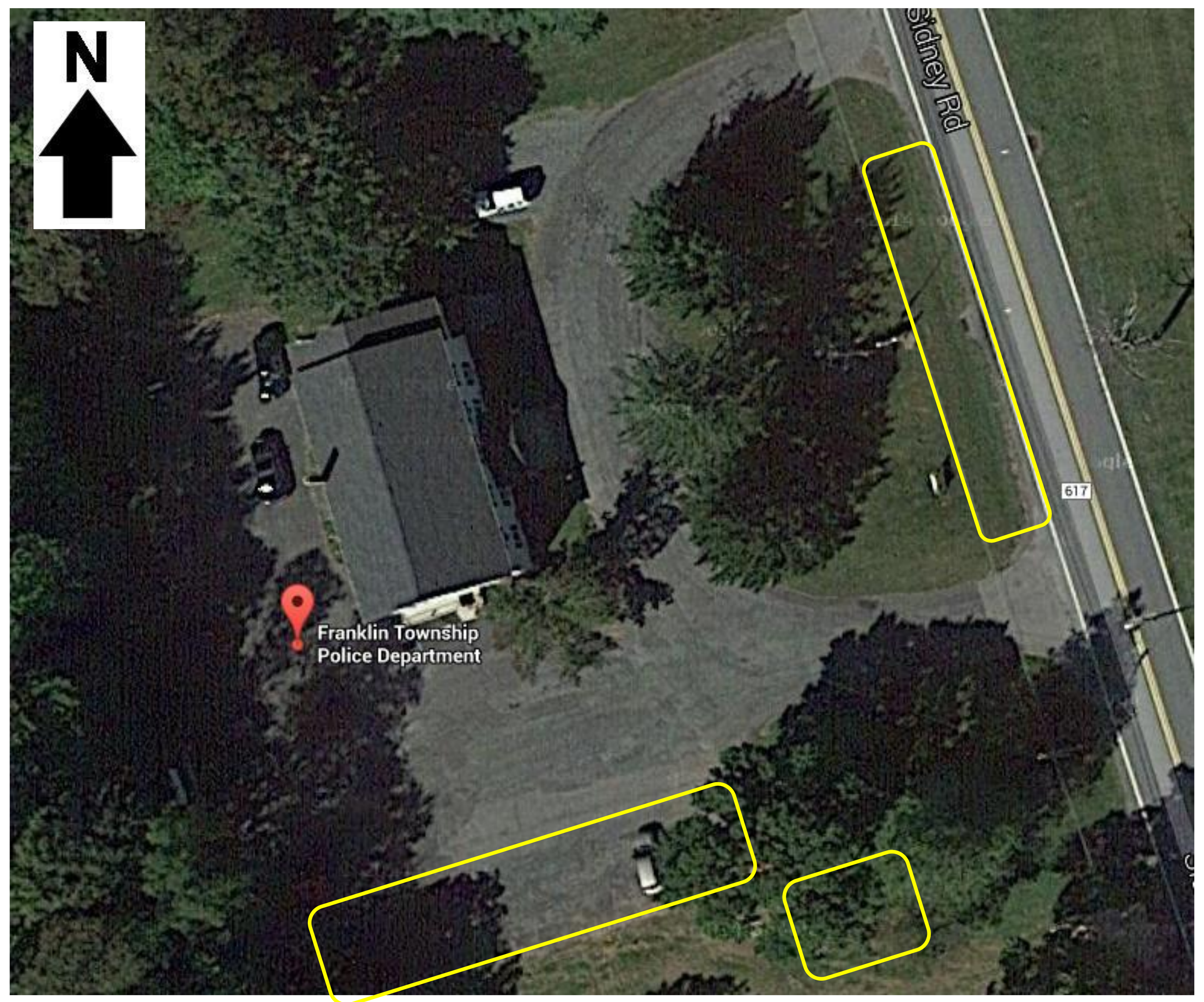
Concept Plans and Detailed Green Infrastructure Information Sheets

Franklin Township
Impervious Cover Assessment
Franklin Township Police Department, 202 Sidney Road

A


B


PROJECT LOCATION:



1. **BIOSWALE:** A bioswale could be installed in the turf grass area adjacent to Sidney Road to treat stormwater runoff. A bioswale is a vegetated system that would convey stormwater along the roadway to intercept, filter, and treat the stormwater prior to it entering the storm sewer system.
2. **BIORETENTION SYSTEM:** A bioretention system could be installed at the southeastern end of the parking lot. This bioretention system will reduce sediment and nutrient loading to the local waterway by treating runoff from the parking lot and facilitating infiltration.
3. **POROUS PAVEMENT:** A section of porous pavement along the southern edge of the parking lot would promote groundwater recharge and filter stormwater runoff from the rest of the lot.

SITE PLAN:

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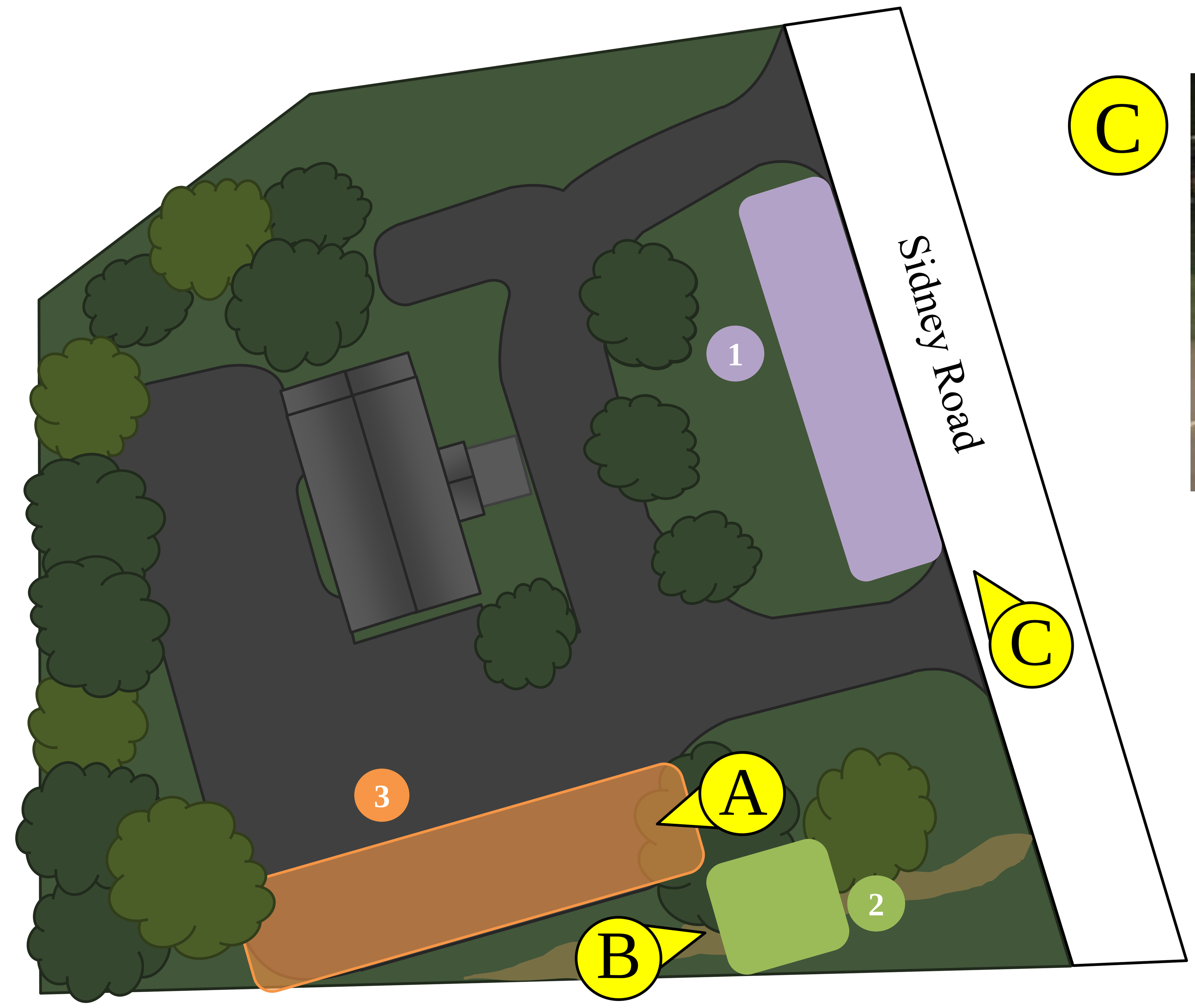

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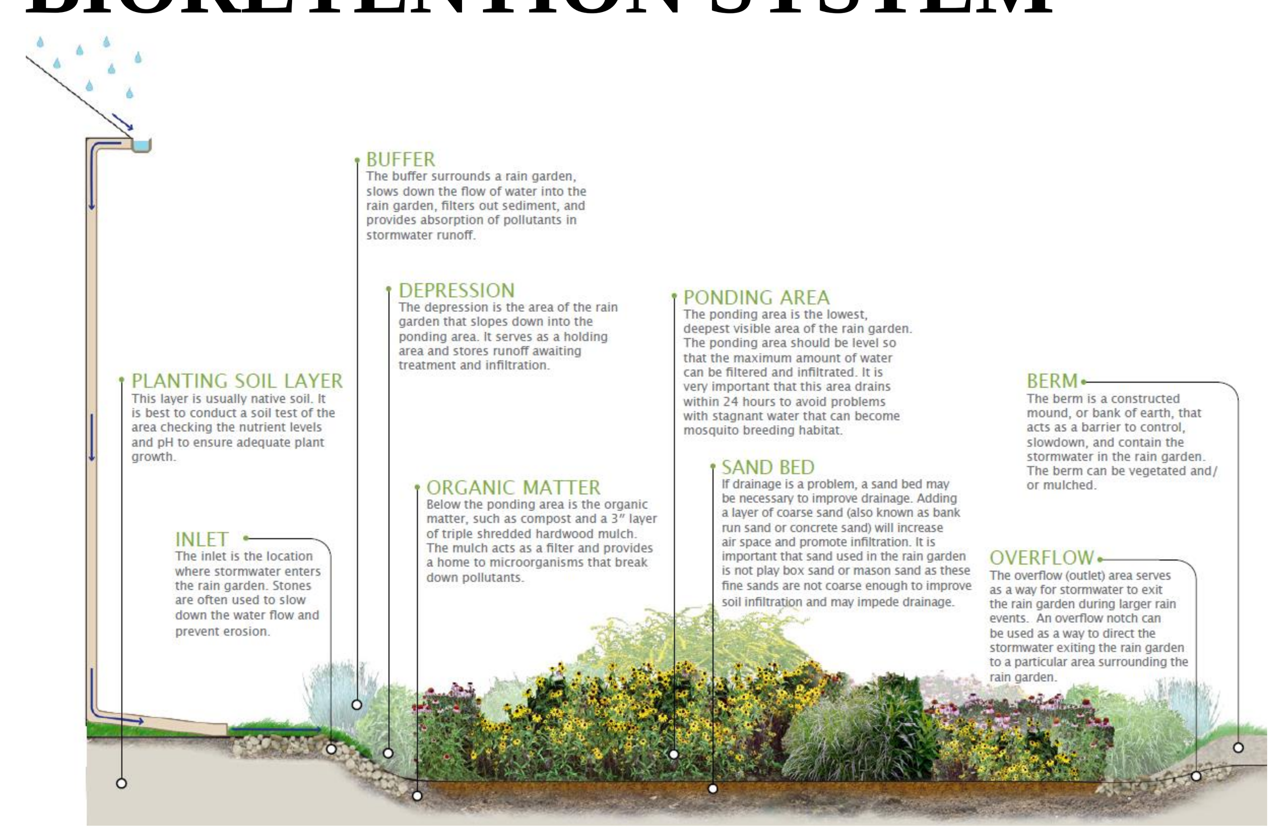
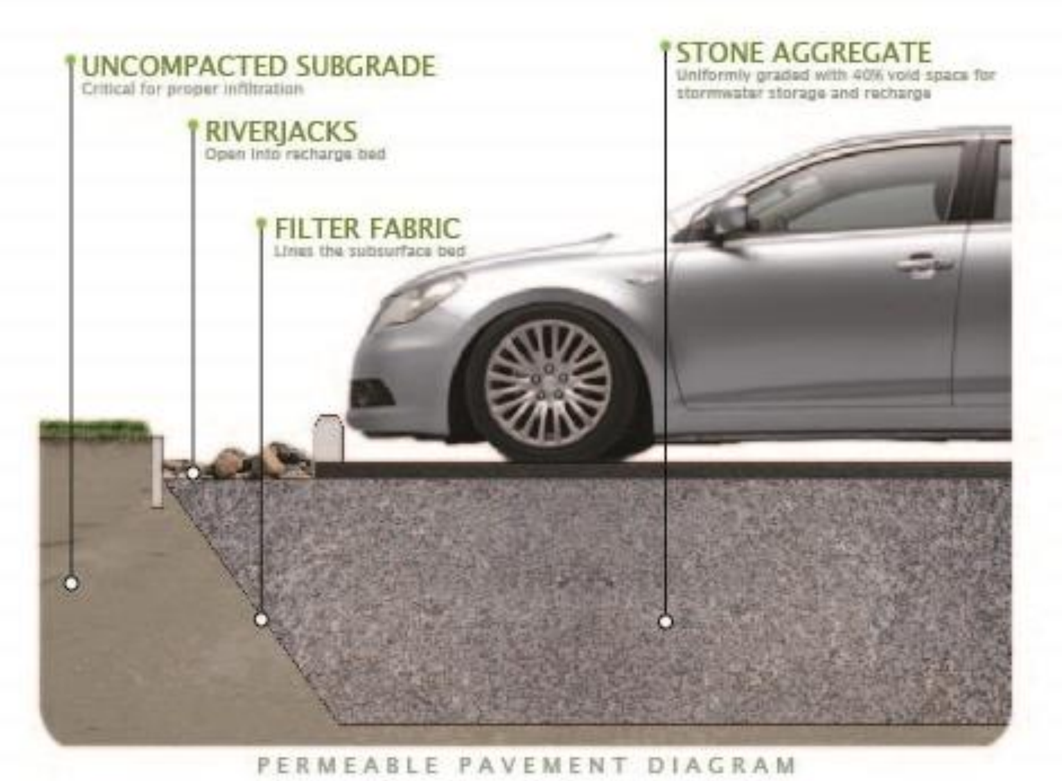
1 BIOSWALE

2 BIORETENTION SYSTEM



3 POROUS PAVEMENT



Location: 202 Sidney Road Pittstown, NJ 08867	**Municipality:** Franklin Township **Subwatershed:** Cakepoulin Creek
Green Infrastructure Description: bioretention system (rain garden) bioswale porous pavement	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes	**Stormwater Captured and Treated Per Year:** bioretention system: 15,633 gal. bioswale: 104,221 gal. porous pavement: 262,638 gal.

Existing Conditions and Issues:

This site has impervious surfaces including driveways, the police department building, and parking areas. These impervious surfaces are directly connected to a storm sewer system. The police department's driveways are graded to the east, so that runoff flows into the roadway and the storm sewer network. There is an existing ditch adjacent to Sidney Road. The parking lot along the southern edge of the property is in poor condition. The parking lot area slopes to the southeast. Along the edge of this parking area there is a turf grass lined ditch that conveys runoff from the parking lot and adjacent property directly into the storm sewer system.

Proposed Solution(s):

The ditch along the front of the property can be retrofitted into a bioswale that would run adjacent to Sidney Road. The bioswale would intercept the stormwater runoff from the driveways and the roadway before it could enter the storm sewer system. The southern parking area could be repaved with porous pavement. The porous pavement system will intercept stormwater runoff from the parking lot and the hill along the western edge of the property. Porous pavement can alleviate flooding of the nearby roadway. A bioretention system (also known as a rain garden) could be installed at the existing ditch alongside the parking area to reduce the amount of runoff reaching the roadway and storm sewer system.

Anticipated Benefits:

Since the bioretention system would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.4 inches of rain over 24 hours), the system is 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 habitat and aesthetic appeal. The bioswale would reduce TN by 30%, TP by 60%, and TSS by 90%, while reducing roadside flooding and enhancing the aesthetics of the police department's entrance and front lawn. Porous pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. This system will achieve the same level of pollutant load reduction for TN, TP and TSS as the bioretention system.

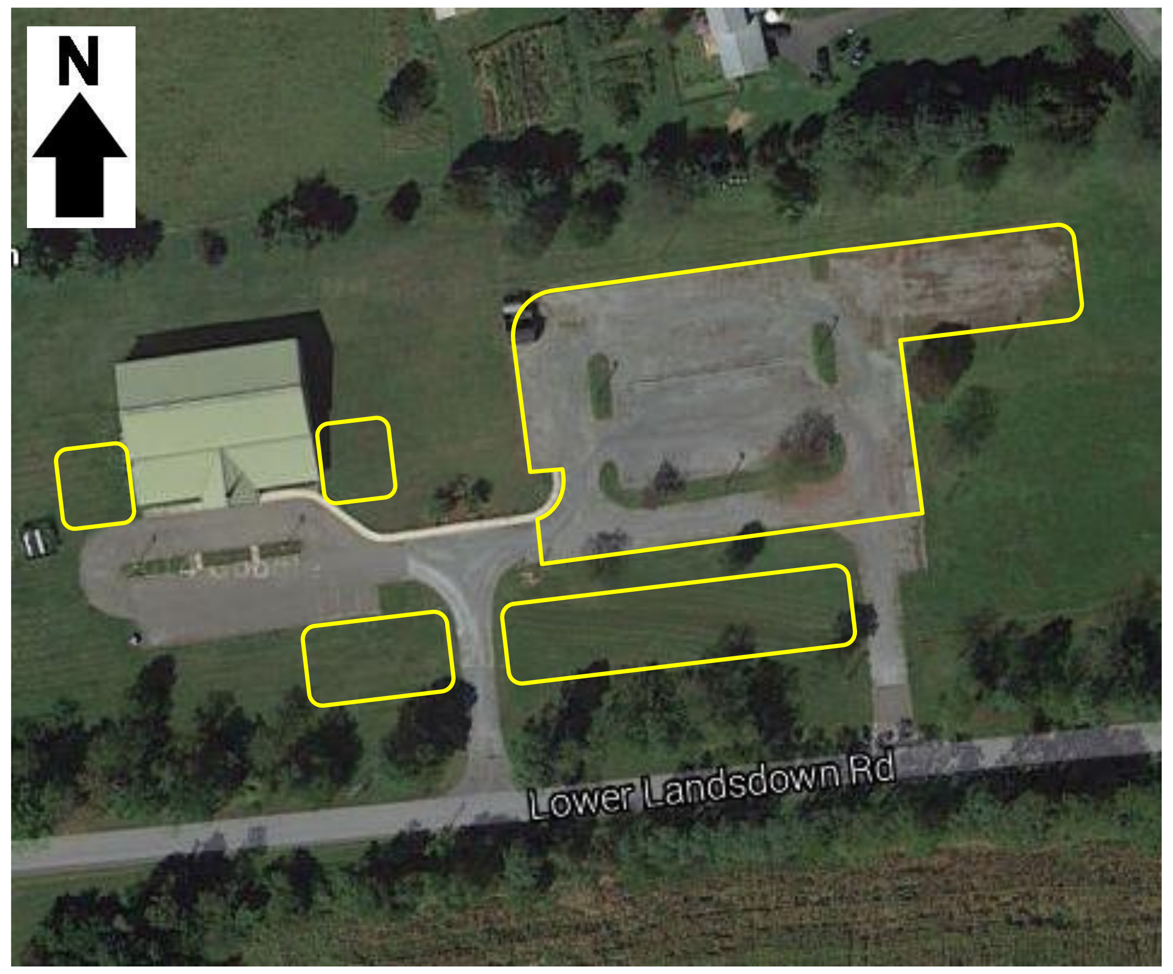
Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
Franklin Township
local social and community groups

Partners/Stakeholders:
Franklin Township
local social and community groups
residents
Rutgers Cooperative Extension

Estimated Cost:
The bioretention system would need to be approximately 150 square feet. At $5 per square foot, the estimated cost of this bioretention system is $750. The bioswale would need to be approximately 1,000 square feet. At $5 per square foot, the estimated cost of the bioswale is $5,000. The porous pavement would cover approximately 2,400 square feet and have a 1.5 foot deep stone reservoir under the surface. At $22.50 per square foot, the cost of the porous asphalt system would be $54,000. The total cost of the project will thus be approximately $59,750.

Franklin Township
Impervious Cover Assessment
Faith Chapel Wesleyan Church, 43 Lower Landsdown Road

PROJECT LOCATION:



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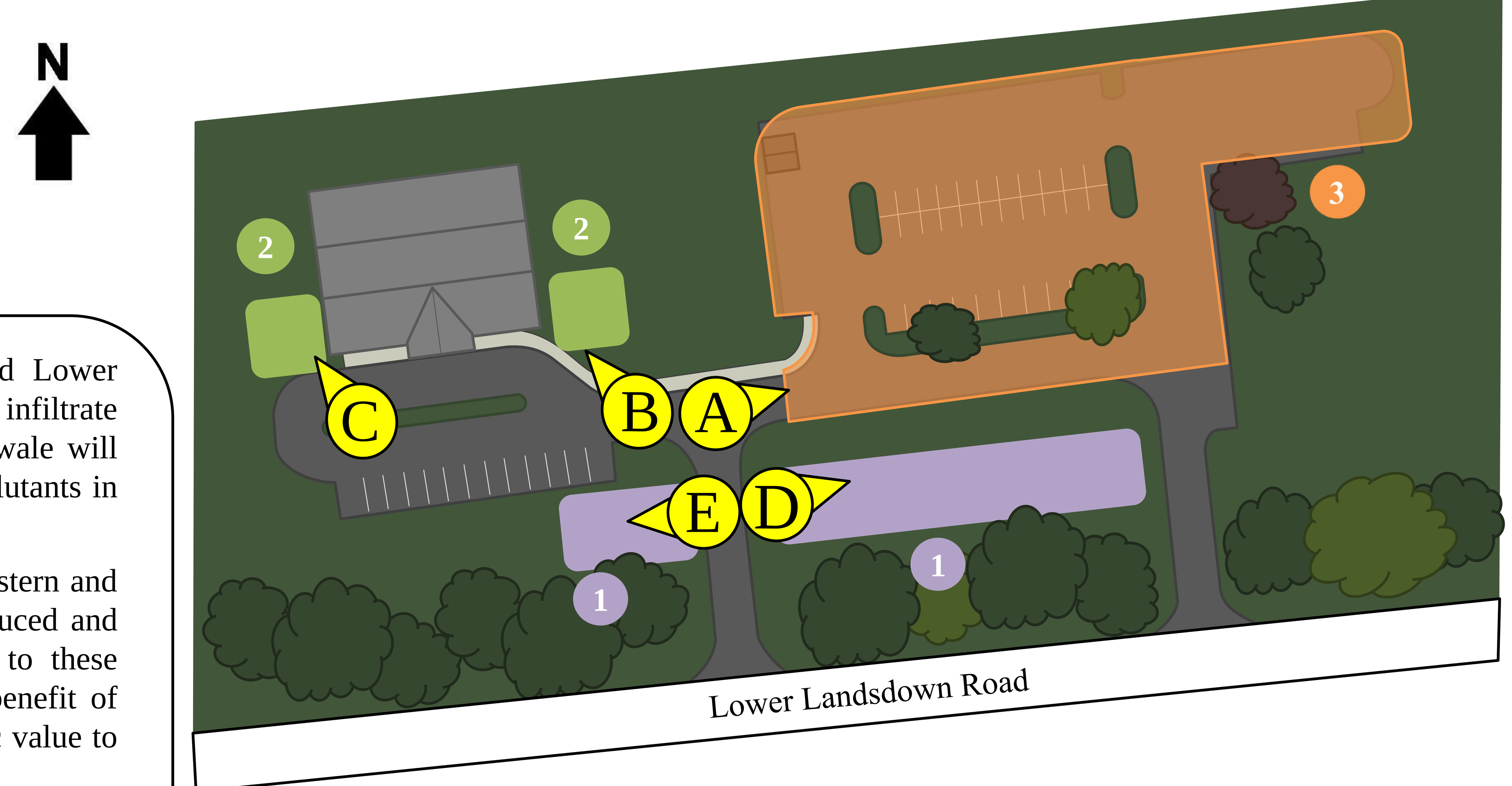
SITE PLAN:



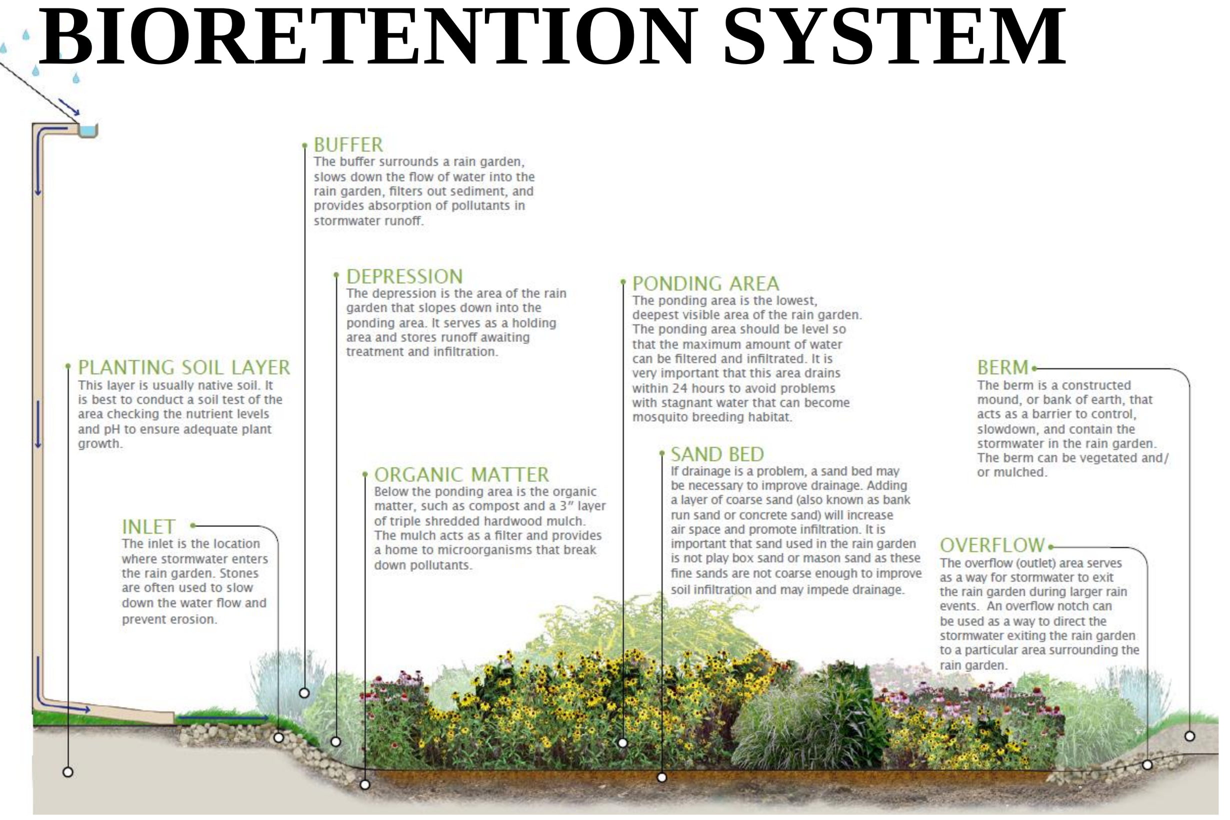
1 **BIOSWALE:** The existing vegetated ditch adjacent to the parking lot and Lower Landsdown Road can be replaced with a bioswale. The bioswale will infiltrate stormwater runoff, while conveying stormwater along the roadway. The bioswale will intercept stormwater prior to the storm sewer system, filtering and treating pollutants in the runoff.

2 **BIORETENTION SYSTEM:** Bioretention systems can be installed on the eastern and western corners of the church building. Sediment and nutrient loading is reduced and infiltration is encouraged by redirecting the church building's downspouts to these bioretention systems. The bioretention systems would provide the ancillary benefit of providing habitat for birds, butterflies and pollinators while increasing aesthetic value to the property.

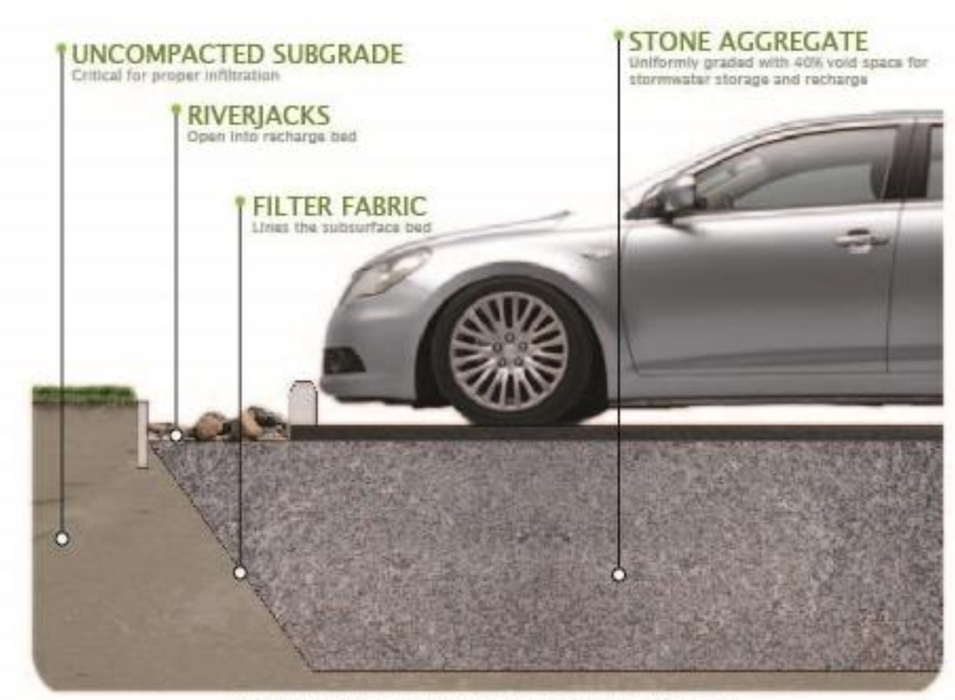
3 **POROUS PAVEMENT:** Porous pavement can be used to replace parking areas upon repaving. Porous pavement promotes groundwater recharge and filters stormwater runoff.

1 BIOSWALE

2 BIORETENTION SYSTEM



3 POROUS PAVEMENT



Location: 43 Lower Landsdown Road Annandale, NJ 08801	**Municipality:** Franklin Township **Subwatershed:** Raritan River South Branch
Green Infrastructure Description: bioretention systems (rain gardens) porous pavement bioswale	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes	**Stormwater Captured and Treated Per Year:** bioretention system # 1: 89,630 gal. bioretention system # 2: 89,630 gal. porous pavement: 672,228 gal. bioswale: 247,526 gal.

Existing Conditions and Issues:
This site has impervious surfaces including paved walkways, driveways, parking areas, and a church building. These impervious surfaces are directly connected to the storm sewer system. The eastern parking lot is in poor condition. This lot slopes slightly toward the north. There are directly connected downspouts near the front of the church on its east and west facing sides. There is a large swale that extends along the front lawn of the property, adjacent to Lower Landsdown Road.

Proposed Solution(s):
The eastern parking lot could be repaved with a combination of grass pavers and porous pavement. The easternmost edge of the parking lot (including all gravel surfaces east of the driveway) could be repaved with grass pavers. Porous pavement can be used to repave the area in the northern section of the parking lot. The downspouts near the front of the building (two on the west face; two on the east face) could be disconnected and redirected into bioretention systems. These bioretention systems would enhance the aesthetics of the church while capturing more than half of the building's stormwater. The existing swale, adjacent to Lower Landsdown Road, can be retrofitted into a bioswale.

Anticipated Benefits:
Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.4 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 habitat and aesthetic appeal. Porous pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. The porous pavement system will achieve the same level of pollutant load reduction for TN, TP and TSS as the bioretention system.

Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
Faith Chapel Wesleyan Church and its parishioners
Franklin Township
local social and community groups

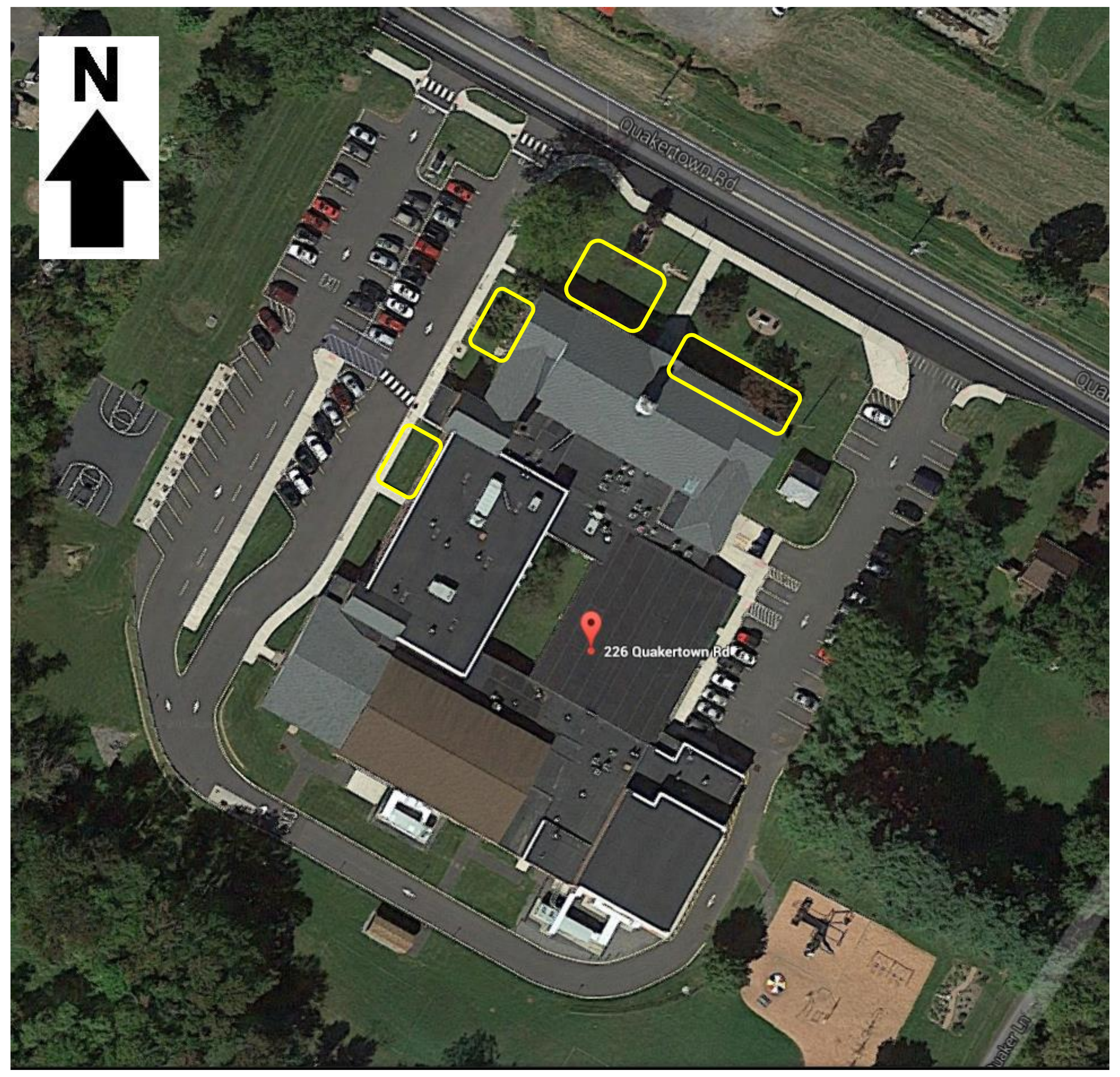
Partners/Stakeholders:
Faith Chapel Wesleyan Church and its parishioners
Franklin Township
local social and community groups
residents and parishioners
Rutgers Cooperative Extension

Estimated Cost:
The bioretention systems would need to be approximately 900 square feet. Both systems would require the disconnection of two downspouts. At $5 per square foot, and $250 additional cost for each downspout disconnection, the estimated cost of these two systems is $10,000. Porous pavement area #1 would cover approximately 2,100 square feet and have a 1 foot stone reservoir under the surface. A $20 per square foot, the cost of the porous asphalt system would be $42,000. Porous pavement area #2 would cover approximately 2,600 square feet and have a 1.5 foot stone reservoir under the surface. A $22.50 per square foot, the cost of the porous asphalt system would be $58,500. The grass pavers will cover approximately 10,600 square feet. At $15 per square foot, this system will cost approximately $159,000. The bioswale would be approximately 2,380 square feet. At $5 per square foot, the cost of this system is approximately $11,900. The total cost of the project will thus be approximately $281,400.

Franklin Township
Impervious Cover Assessment
Franklin Township School, 226 Quakertown Road

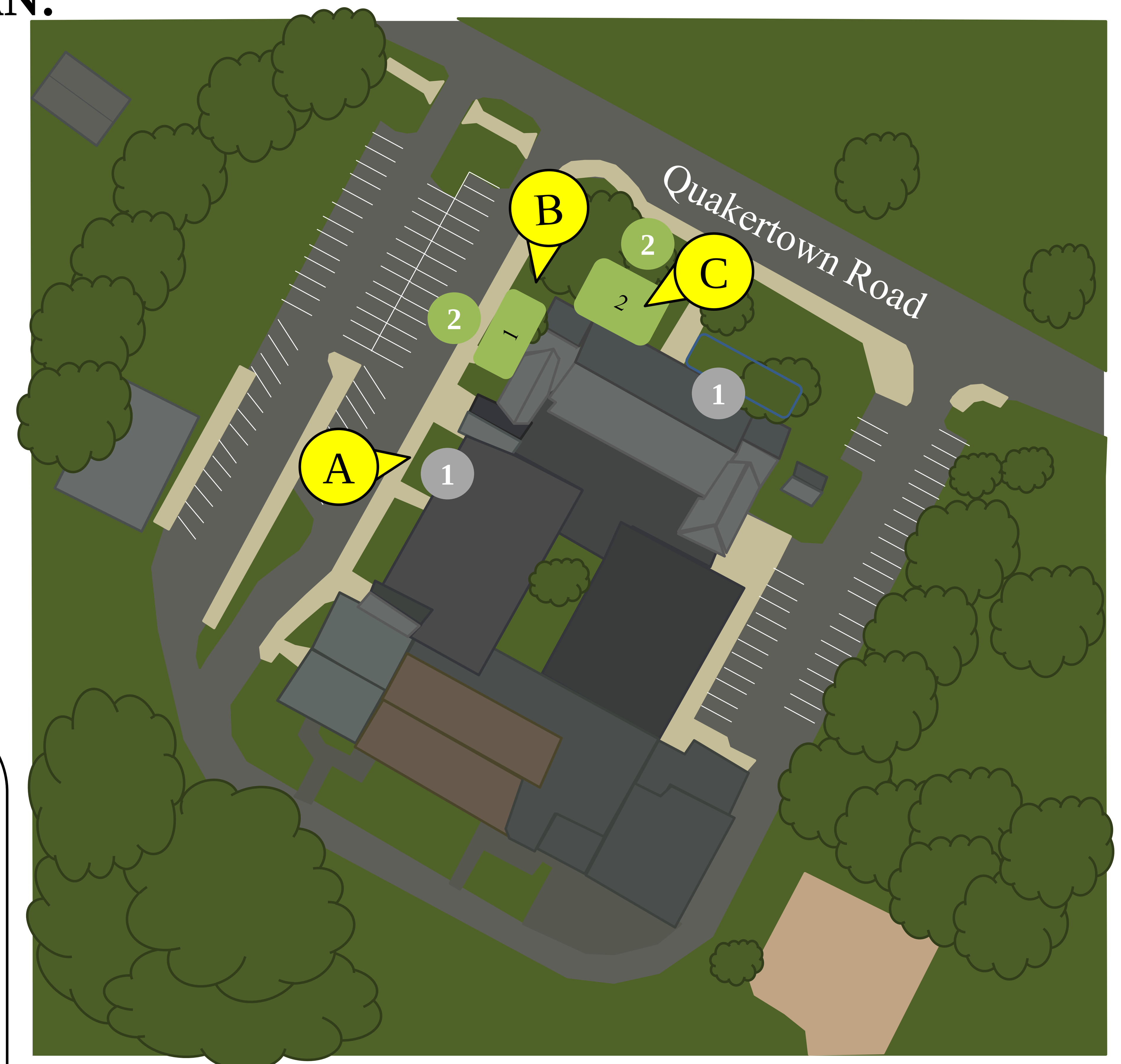
RUTGERS
New Jersey Agricultural Experiment Station

PROJECT LOCATION:



SITE PLAN:

N



A

B

C

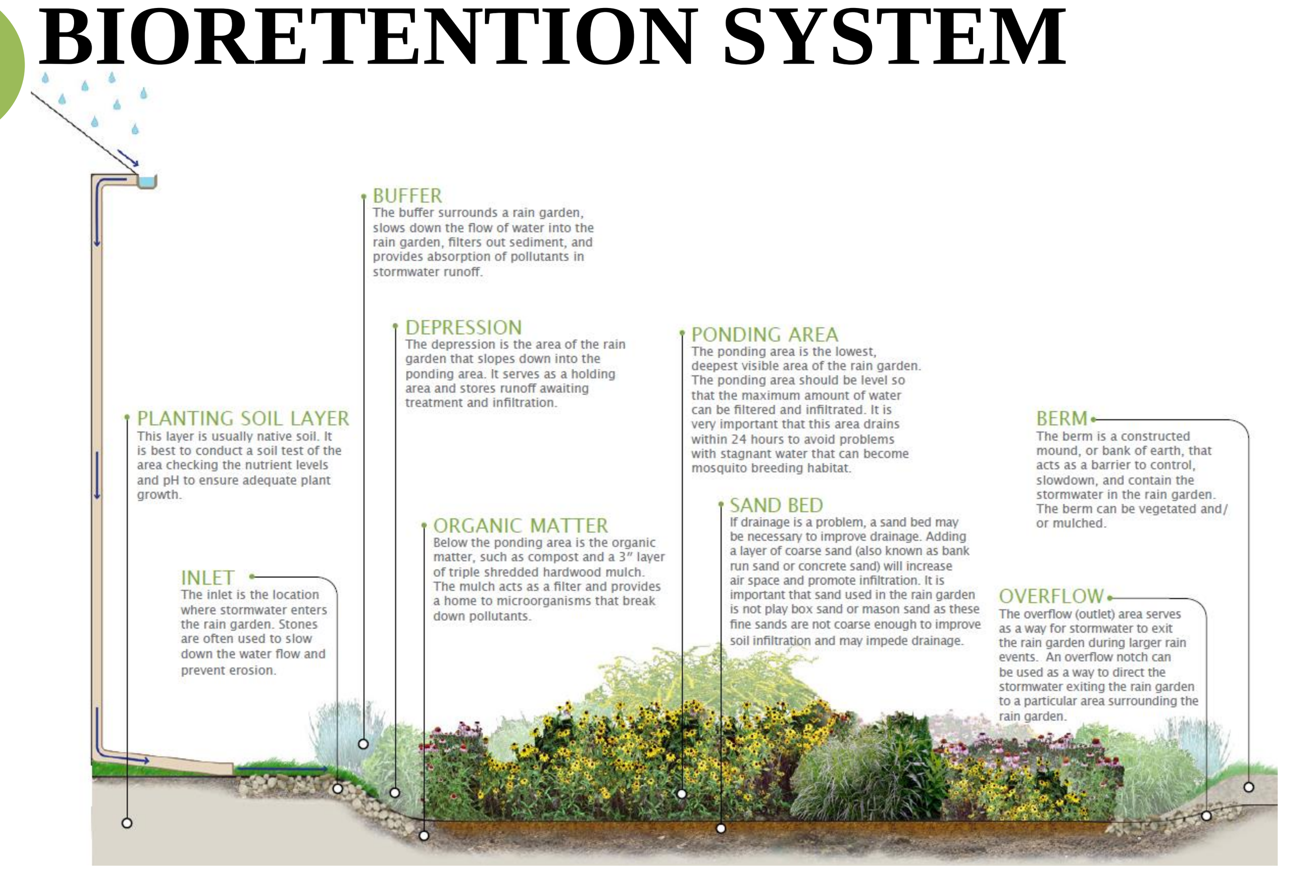
1 **DISCONNECTED DOWNSPOUTS:** Downspouts can be disconnected to allow stormwater runoff to flow onto turf grass areas. Allowing runoff to flow over vegetated areas removes pollutants and allows stormwater to infiltrate.

2 **BIORETENTION SYSTEM:** A bioretention system could be installed in the front of the school nearest to Quakertown Road and another on the west side of the building toward the northwest corner of the school. The bioretention systems will reduce sediment and nutrient loading to local waterways by treating runoff and promoting infiltration.

EDUCATIONAL PROGRAM: The RCE Water Resources Program's *Stormwater Management in Your Schoolyard* program can be delivered at Franklin Township School to educate the students about stormwater management and engage them in designing and building the bioretention systems.

1 DISCONNECTED DOWNSPOUTS

2 BIORETENTION SYSTEM



EDUCATIONAL PROGRAM

Location: 226 Quakertown Road Quakertown, NJ 08868	**Municipality:** Franklin Township **Subwatershed:** Cakepoulin Creek
Green Infrastructure Description: bioretention system (rain garden) simple disconnection	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes	**Stormwater Captured and Treated Per Year:** bioretention system #1: 31,266 gal. bioretention system #2: 72,955 gal. simple disconnection: 47,838 gal.

Existing Conditions and Issues:
The Franklin Township School rooftop is an impervious surface that contributes to stormwater runoff and nonpoint sources pollution. There is an existing detention basin adjacent to the parking lot. The building's downspouts are directly connected to the storm sewer system.

Proposed Solution(s):
Bioretention system #1 can be installed on the northwest corner of the school, adjacent to the parking lot. Bioretention system #2 can be installed in front of the school adjacent to Quakertown Road. Downspouts can be redirected into each of these systems. At the northeast face of the school the two connected downspouts can be disconnected to flow directly into the turf grass area.

Anticipated Benefits:
Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.4 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 habitat and aesthetic appeal. Rutgers Cooperative Extension could additionally present the *Stormwater Management in Your Schoolyard* program to students and include them in bioretention system planting efforts to enhance the program. The disconnected downspouts will allow stormwater to penetrate into the ground naturally, promoting groundwater recharge and reducing loads of TN, TP, and TSS, rather than being sent straight into the stormwater management systems. The simple disconnection also would reduce the pollutant loading by 90% since it will manage the water quality design storm of 1.25 inches of rain.

Possible Funding Sources: mitigation funds from local developers NJDEP grant programs Franklin Township local social and community groups
Partners/Stakeholders: Franklin Township local social and community groups residents, parents, and student Rutgers Cooperative Extension
Estimated Cost: Rain garden #1 would need to be approximately 300 square feet. At $5 per square foot, the estimated cost of the rain garden is $1,500. Rain garden #2 would need to be approximately 700 square feet. At $5 per square foot, the estimated cost of the rain garden is $3,500. Disconnecting the downspouts will cost about $250 each for a total cost of $500. The total cost of the project will be approximately $5,500.