RUTGERS
New Jersey Agricultural
Experiment Station

Draft

Impervious Cover Assessment for Jamesburg Borough, Middlesex County, New Jersey

Prepared for Jamesburg Borough by the
Rutgers Cooperative Extension Water Resources Program

February 1, 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

Jamesburg Borough Impervious Cover Analysis

Located in Middlesex County in central New Jersey, Jamesburg Borough covers approximately 0.89 square miles. Figures 3 and 4 illustrate that Jamesburg Borough is dominated by urban land uses. A total of 41.6% of the municipality's land use is classified as urban. Of the urban land in Jamesburg Borough, 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 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 Jamesburg Borough 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 Jamesburg Borough. Based upon the 2007 NJDEP land use/land cover data, approximately 38.4% of Jamesburg Borough has impervious cover. This level of impervious cover suggests that the streams in Jamesburg Borough are likely non-supporting streams.

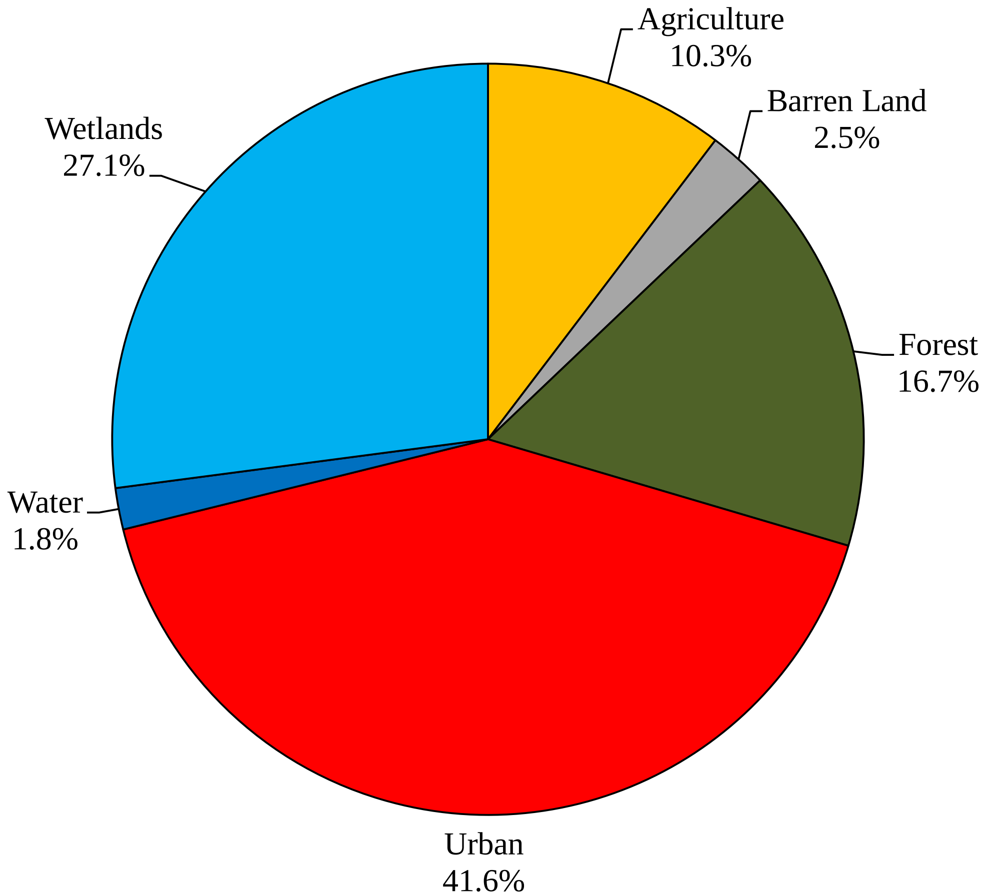


Figure 3: Pie chart illustrating the land use in Jamesburg Borough

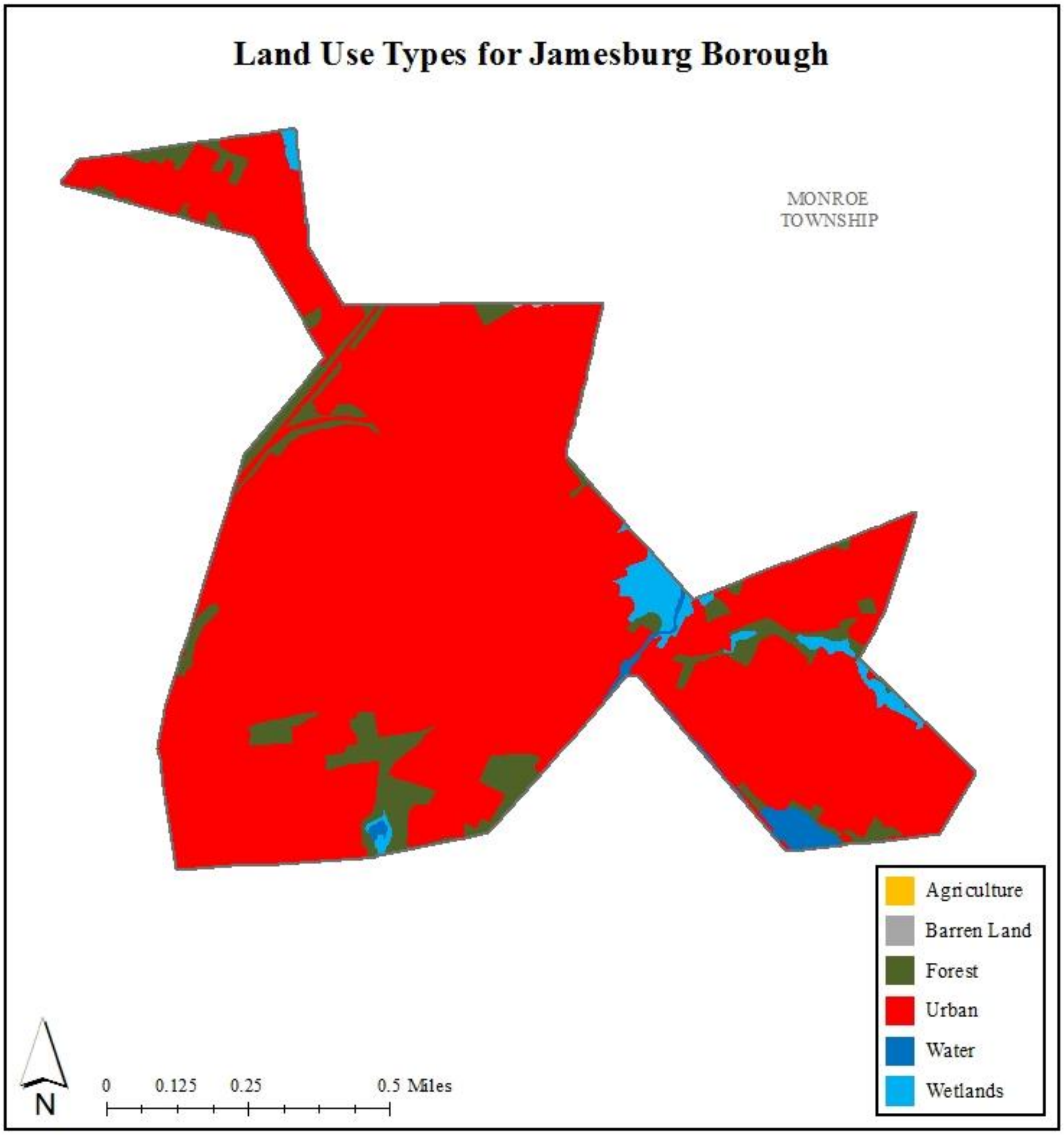


Figure 4: Map illustrating the land use in Jamesburg Borough

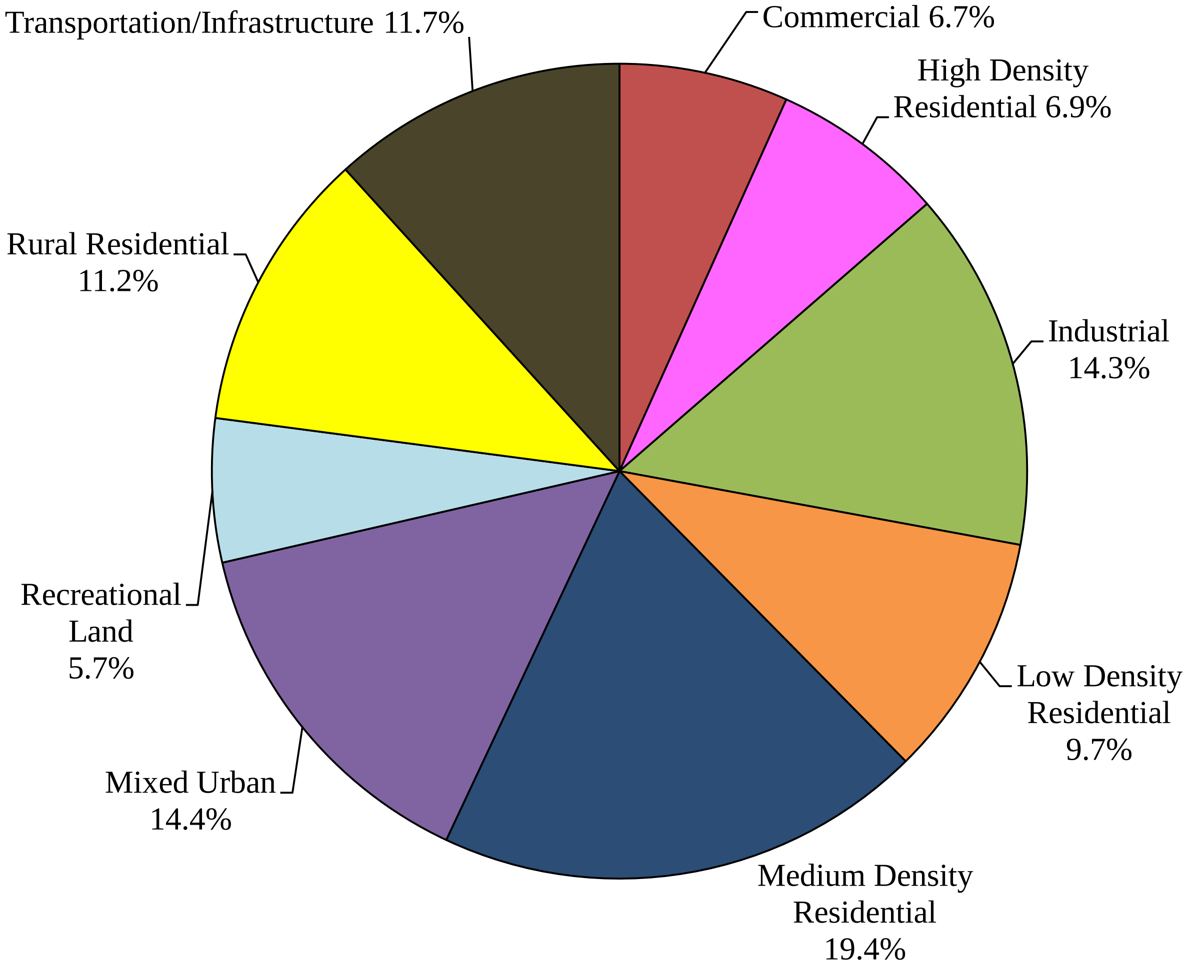


Figure 5: Pie chart illustrating the various types of urban land use in Jamesburg Borough

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for the Raritan River subwatershed within Jamesburg Borough which is the Manalapan Brook subwatershed (Table 1 and Figure 6). Approximately 38.4%, or 216.8 acres, of the Manalapan Brook subwatershed consists of impervious cover. 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 Jamesburg Borough, Middlesex 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 (3.3 inches of rain), the 10-year design storm (5.1 inches of rain), and the 100-year design storm (8.6 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Jamesburg Borough. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Manalapan Brook subwatershed was harvested and purified, it could supply water to 68 homes for one year[1].

[1] Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Jamesburg Borough

Subwatershed	**Total Area**		**Land Use Area**		**Water Area**		**Impervious Cover**		
	(ac)	**(mi^2)**	**(ac)**	**(mi^2)**	**(ac)**	**(mi^2)**	**(ac)**	**(mi^2)**	**(%)**
Manalapan Brook	570.3	0.89	564.5	0.88	5.80	0.01	216.8	0.34	38.4%
Total	570.3	0.89	564.5	0.88	5.80	0.01	216.8	0.34	38.4%

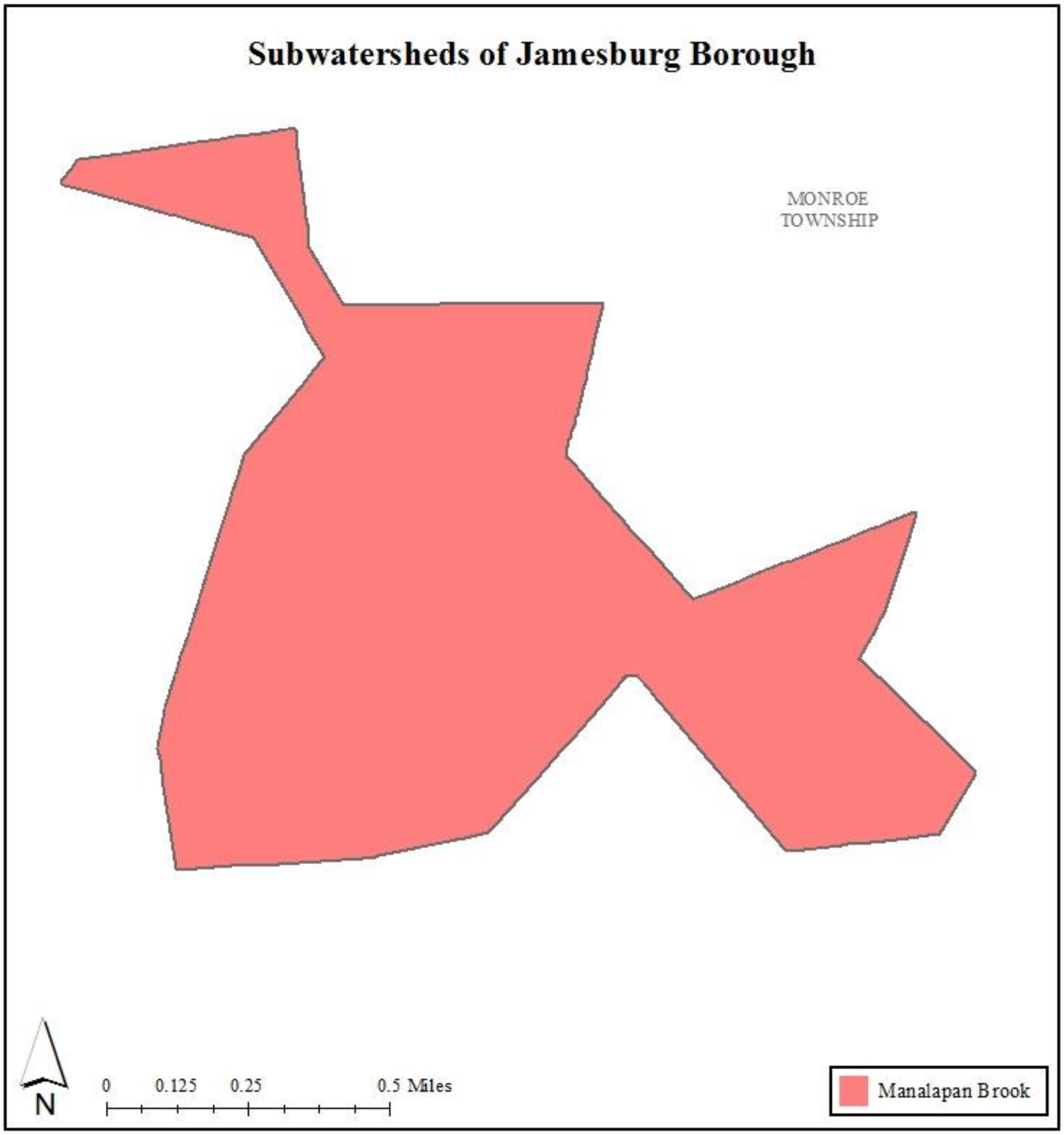


Figure 6: Map of the subwatersheds in Jamesburg Borough

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Jamesburg Borough

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 (3.3") (MGal)	Total Runoff Volume for the 10-Year Design Storm (5.1") (MGal)	Total Runoff Volume for the 100-Year Design Storm (8.6") (MGal)
Manalapan Brook	7.4	259.0	19.4	30.0	50.6
Total	7.4	259.0	19.4	30.0	50.6

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 Jamesburg Borough. 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 (3.3 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 Jamesburg Borough

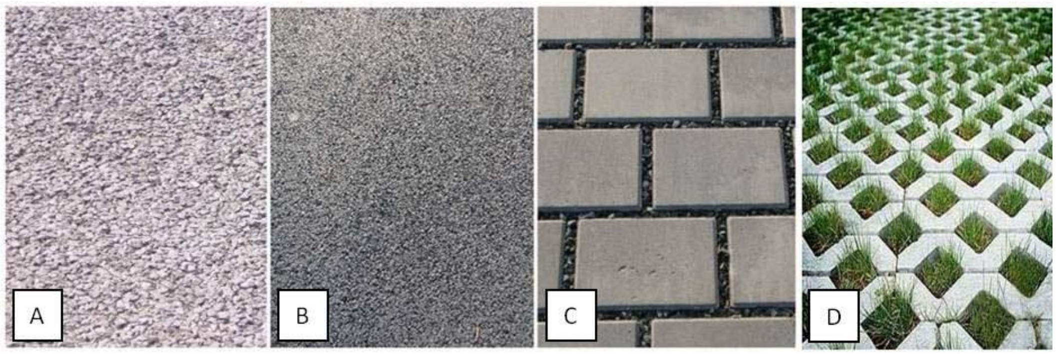
Subwatershed	**Recommended Impervious Area Reduction (10%) (ac)**	**Annual Runoff Volume Reduction [2] (MGal)**
Manalapan Brook	21.7	24.6
Total	21.7	24.6

[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 3.3 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 Jamesburg Borough

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 Jamesburg Borough, 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

Jamesburg Borough 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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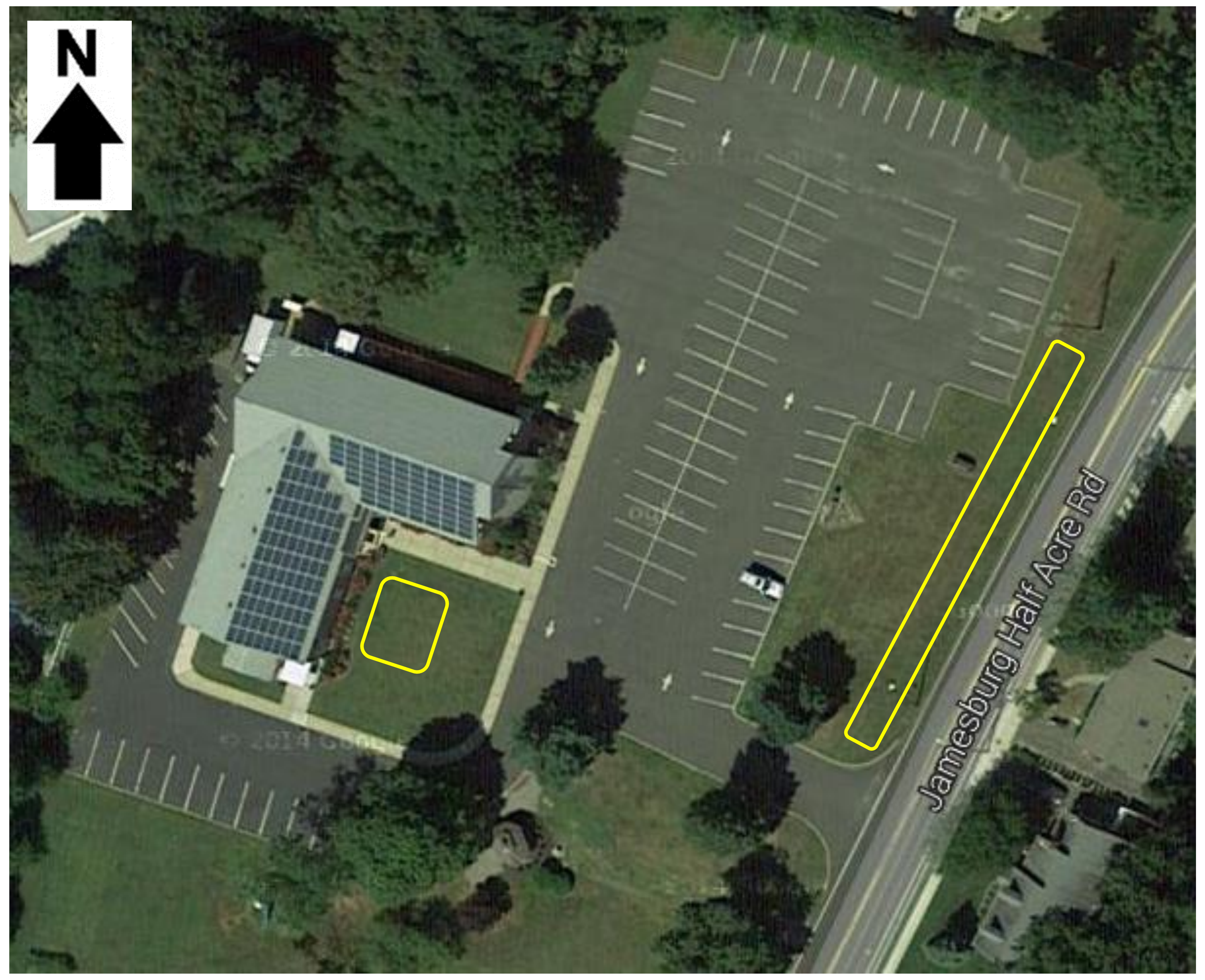
Appendix A

Examples of Impervious Cover Reduction Action Plan Projects

Concept Plans and Detailed Green Infrastructure Information Sheets

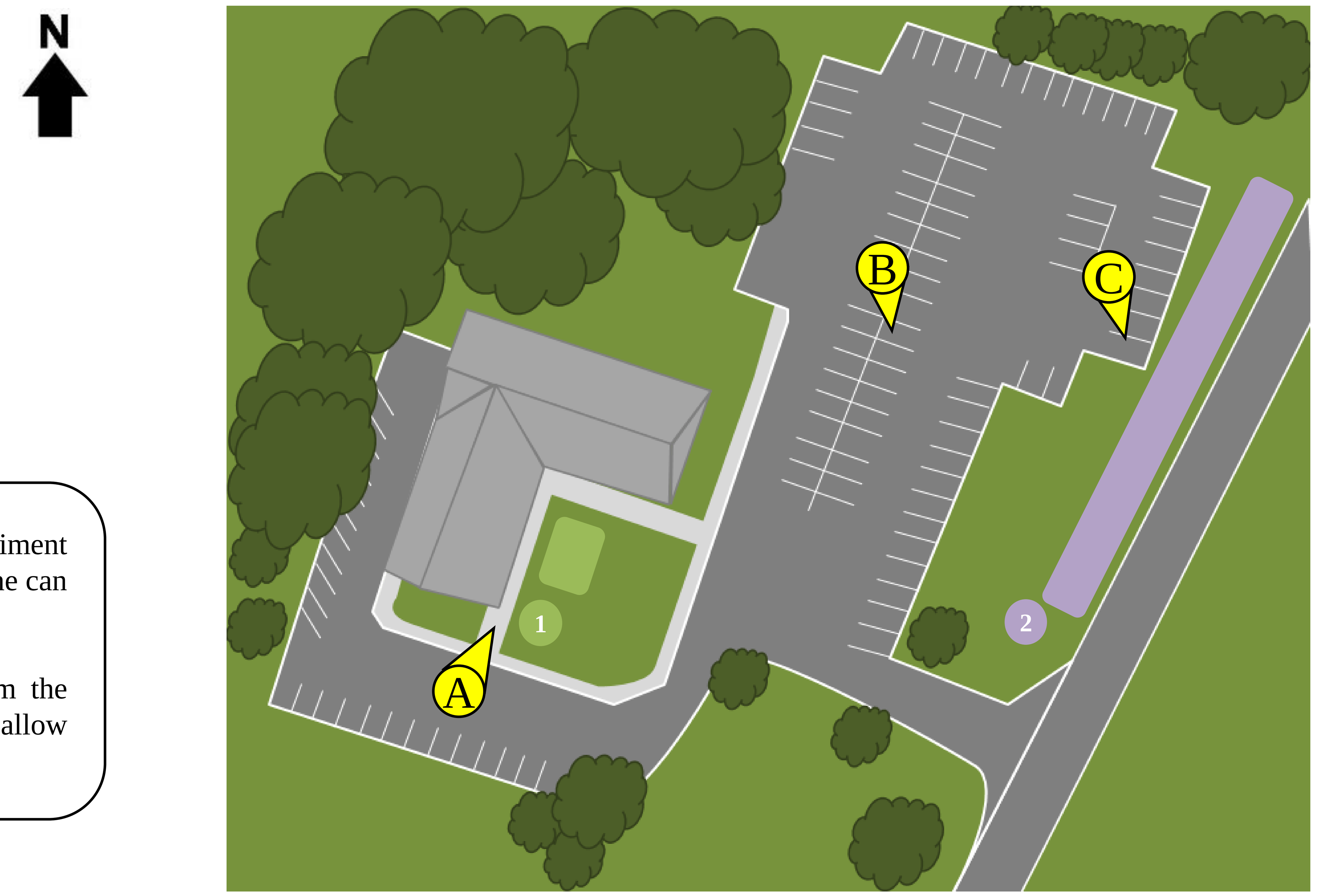
Jamesburg Borough
Impervious Cover Assessment
Calvary Chapel Crossfields, 15 Jamesburg Half Acre Road

PROJECT LOCATION:



A

SITE PLAN:



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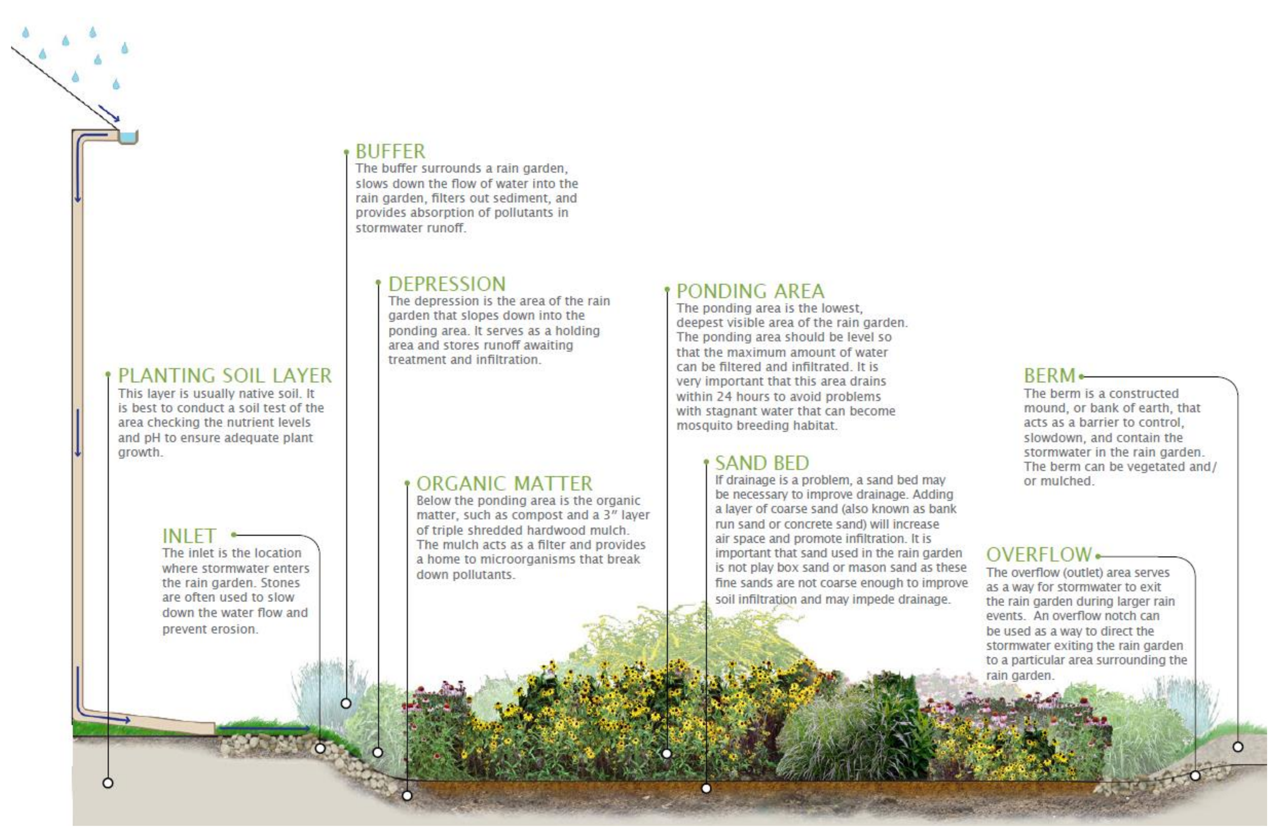
1 **BIORETENTION SYSTEMS:** A bioretention system can be used to reduce sediment and nutrient loading to the local waterways and increase groundwater recharge. One can be implemented in the turf grass area in front of the church to capture roof runoff.

2 **BIOSWALE:** A bioswale is a vegetated system that can take in runoff from the parking lot and remove sediment and nutrients. Curb cuts should be installed to allow runoff to flow into the bioswale.

1 BIORETENTION SYSTEM



2 BIOSWALE

CURB CUTS

Calvary Chapel Crossfields
Green Infrastructure Information Sheet

Location: 15 Jamesburg Half Acre Road Jamesburg, NJ 08831	**Municipality:** Jamesburg Borough **Subwatershed:** Manalapan Brook
Green Infrastructure Description: bioretention systems (rain garden) bioswale curb cuts	**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:** bioswale: 510,685 gal. rain garden: 70,871 gal.

Existing Conditions and Issues:
In the front of the building, there are at least two connected downspouts in a large area of grass where flooding may occur. The parking lot accumulates large volumes of water from storms and directs the water through the use of existing curb cuts onto a grass area.

Proposed Solution(s):
The best option for this site is to install a bioswale to capture, treat, and infiltrate stormwater runoff from the parking lot through to the grass area it drains into. Several more curb cuts would be necessary to direct more volumes of water into the bioswale. They may be put along the parking spots closest to the Jamesburg Half Acre Road entrance. To further address stormwater runoff from the front of the church, installing a bioretention system to treat rooftop runoff also would be a cost effective solution.

Anticipated Benefits:
Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. The bioswale would reduce TN by 30%, TP by 60%, and TSS by 90%. A bioretention system and bioswale would also provide ancillary benefits such as enhanced wildlife habitat and aesthetic appeal.

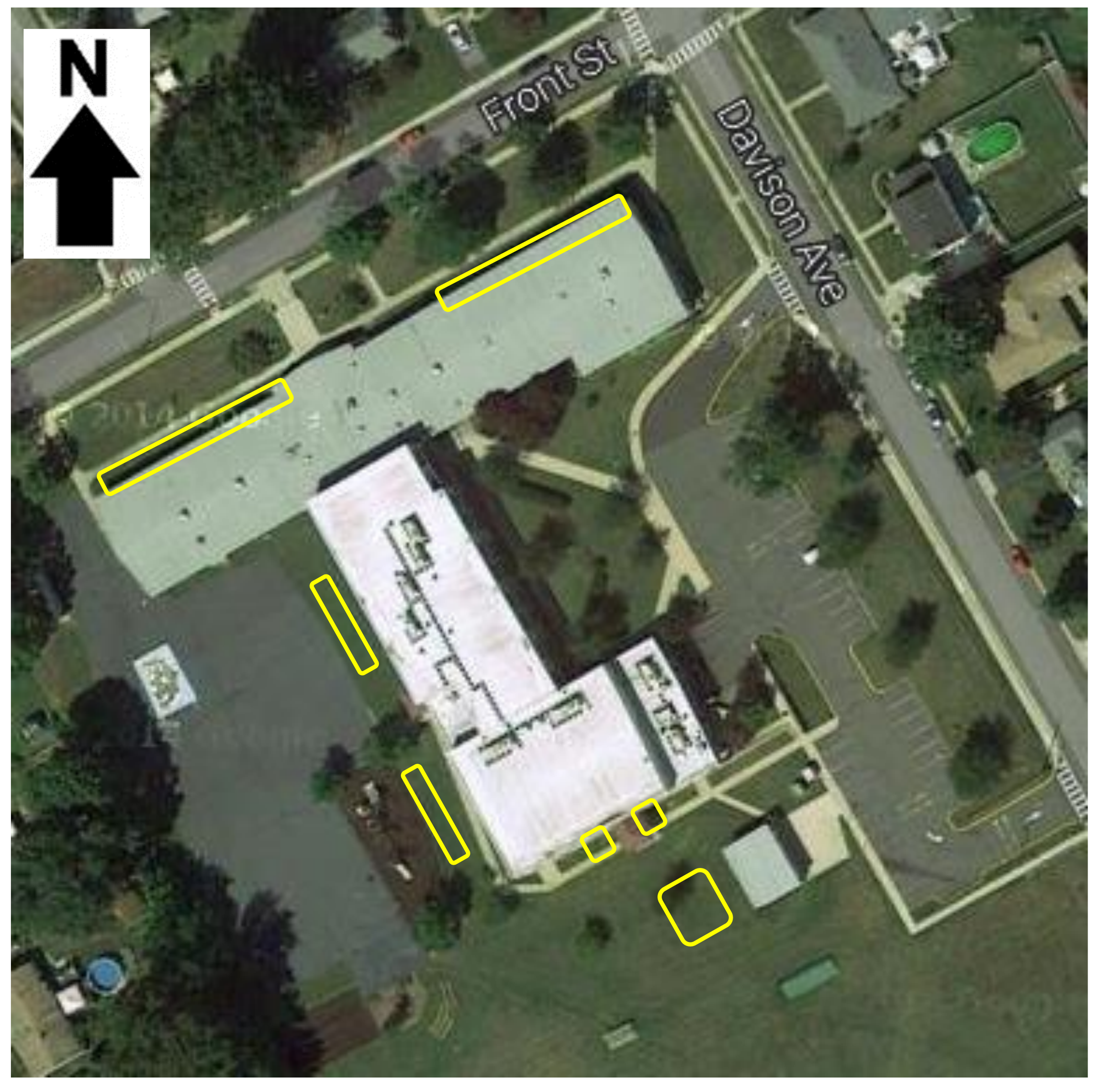
Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs

Partners/Stakeholders:
Jamesburg residents
local community groups (Boy Scouts, Girl Scouts, etc.)
patrons
American Littoral Society
Rutgers Cooperative Extension

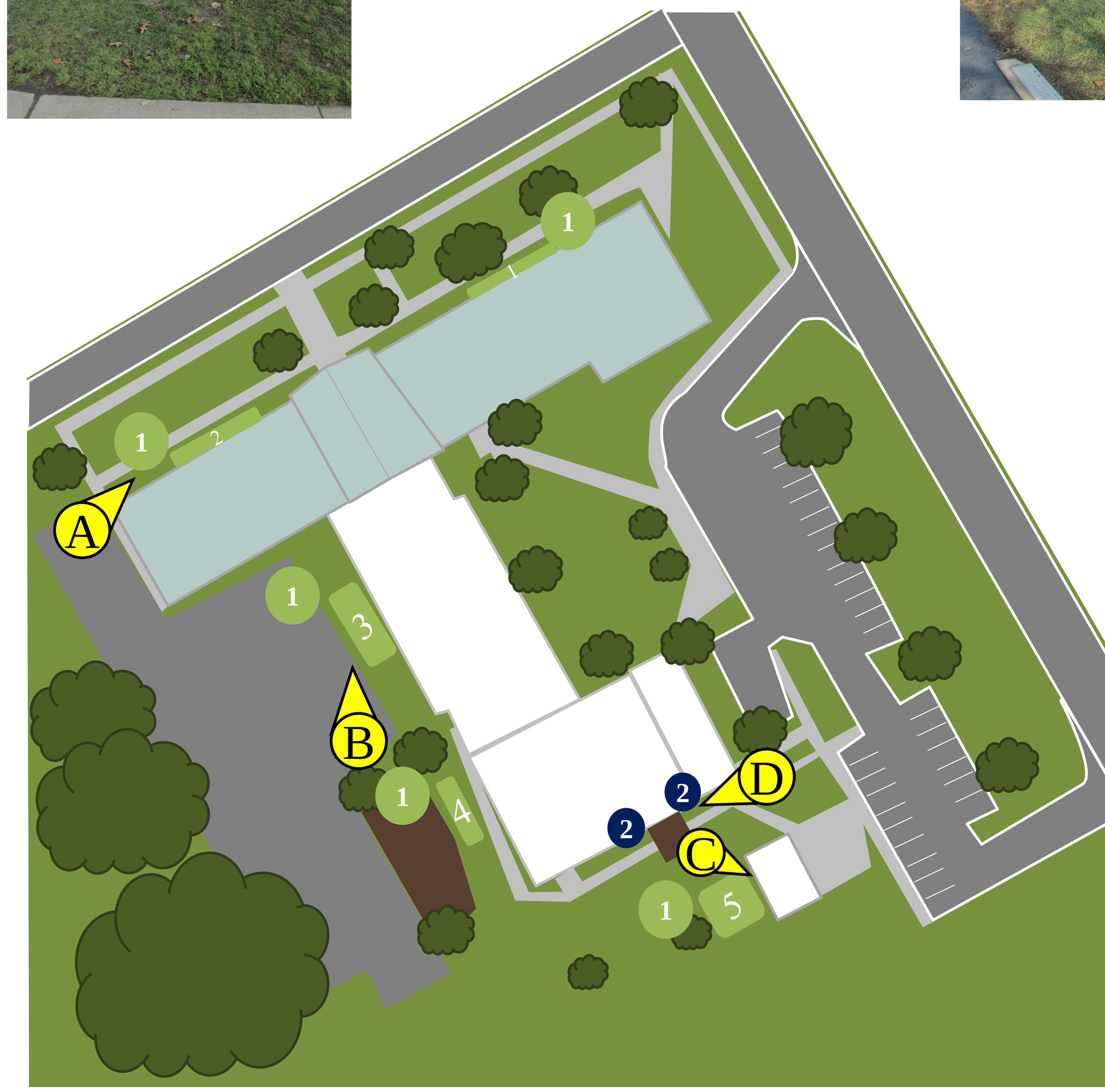
Estimated Cost:
The rain garden would need to be approximately 680 square feet. At $5 a square foot, the approximate cost is $3,400. The bioswale would need to be approximately 4,900 square feet. The cost of the bioswale would be approximately $24,500. The total cost is approximately $27,900.

Jamesburg Borough
Impervious Cover Assessment
John F Kennedy Elementary School, 28 Front Street

PROJECT LOCATION:



SITE PLAN:

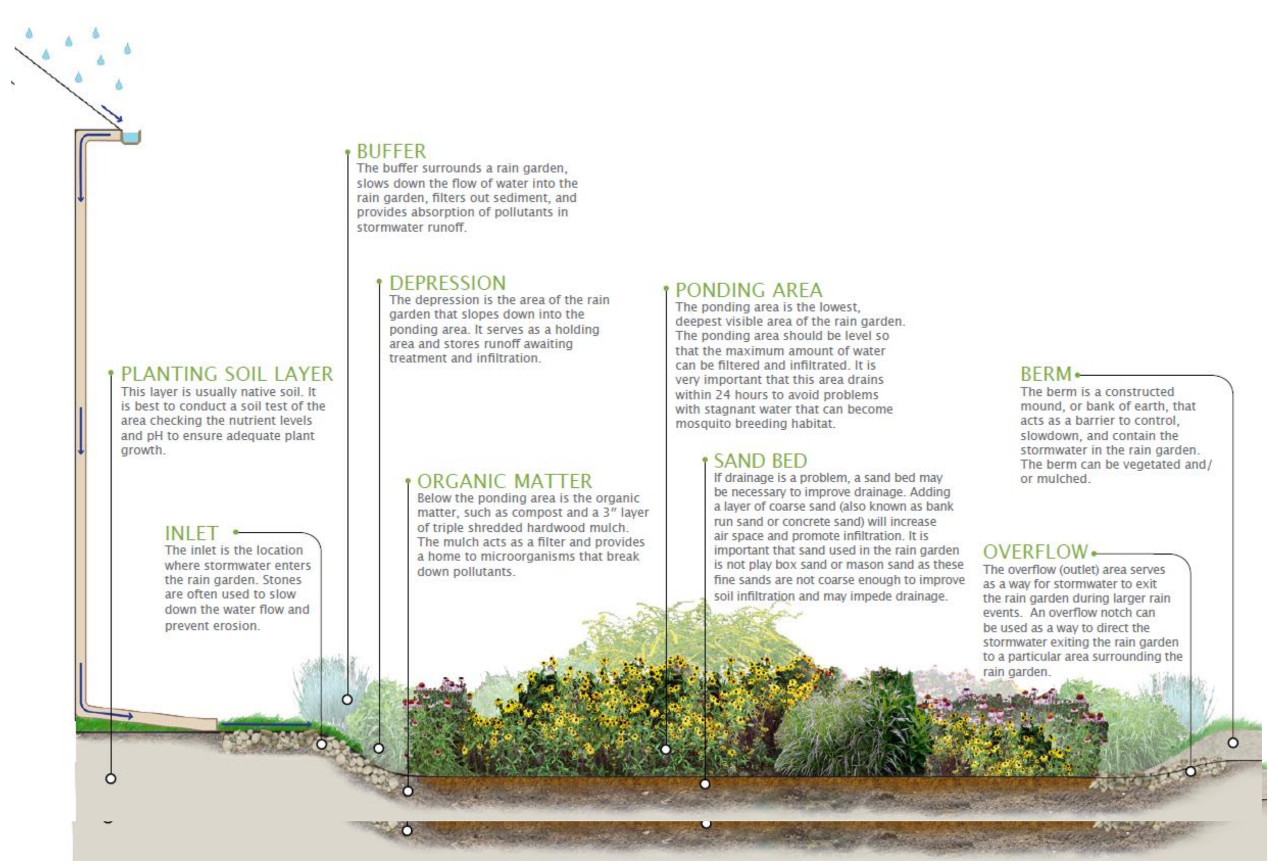


BIORETENTION SYSTEMS: Bioretention systems can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. This site has multiple areas where downspouts can be disconnected and bioretention systems implemented.

DOWNSPOUT PLANTER BOX: Downspout planter boxes can be installed at the southern end of the building to collect water from the nearby downspouts. Planter boxes reduce runoff and allow water to slowly infiltrate while being treated for pollutants.

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

1 BIORETENTION SYSTEM



2 DOWNSPOUT PLANTER BOX

EDUCATIONAL PROGRAM

Location: 28 Front Street Jamesburg, NJ 08831	**Municipality:** Jamesburg Borough **Subwatershed:** Manalapan Brook
Green Infrastructure Description: bioretention systems (rain gardens) youth education program downspout planter boxes	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes TSS removal potential: yes stormwater peak reduction potential: yes	**Stormwater Captured and Treated Per Year:** rain garden #1: 109,432 gal. rain garden #2: 101,616 gal. rain garden #3: 198,021 gal. rain garden #4: 77,645 gal. rain garden #5: 26,055 gal. four downspout planter boxes: 5,600 gal.

Existing Conditions and Issues:
In the front of the school, to the left and right of the entrance, there are three disconnected downspouts flowing onto a grass area causing flooding. On the western side of the school there is a large grass area with five disconnected downspouts going through it. Nearby on the western side, there is a sloped area that collects runoff. In the back of the school there is a considerable amount of pooling as well as two connected downspouts on each side of the overhang near the back entrance. There are also two catch basins located in this area.

Proposed Solution(s):
By the main entrance on both the left and ride side, the three disconnected downspouts can be redirected into bioretention systems #1 and #2. In the area with five connected downspouts, the downspouts can be disconnected and allowed to flow into a bioretention system #3 that will capture the runoff from the roof and the blacktop play area. For the area with a sloped in section, a bioretention system #4 could be beneficial. In the back of the school where the major pooling occurs, bioretention system #5 could be implemented to capture runoff from the small side building's two disconnected downspouts as well as some runoff from the sidewalks. The four connected downspouts in the back of the school can be disconnected and redirected into downspout planter boxes.

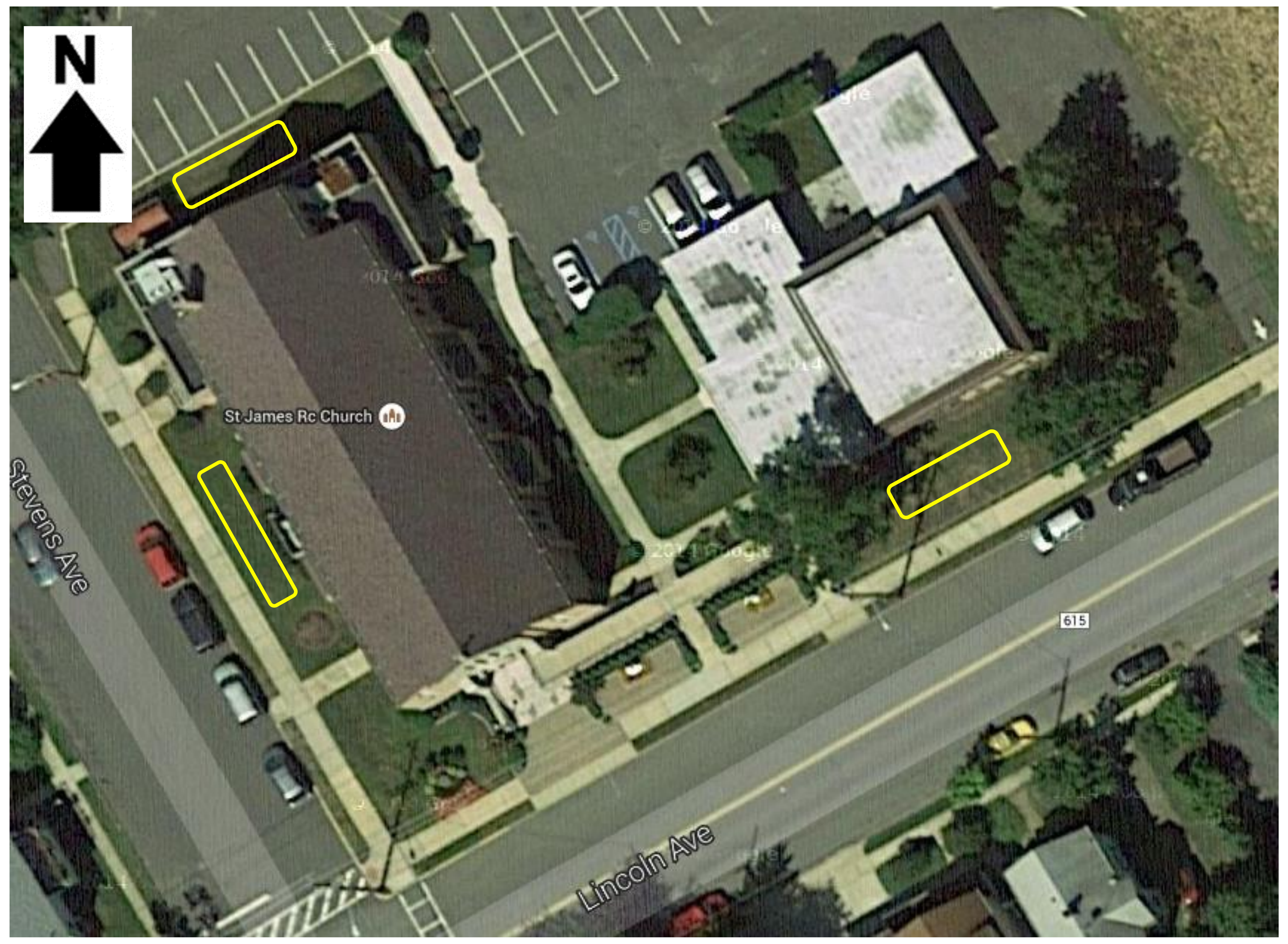
Anticipated Benefits:
Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. This bioretention system would provide additional benefits such as aesthetic appeal and wildlife habitat. 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 downspout

planter boxes could manage the runoff from the roof by storing, infiltrating, and releasing runoff into groundwater supplies.
Possible Funding Sources: mitigation funds from local developers NJDEP grant programs grants from foundations home and school associations
Partners/Stakeholders: Borough of Jamesburg students and parents local community groups (Boy Scouts, Girl Scouts, etc.) NY/NJ Baykeeper Raritan Riverkeeper Rutgers Cooperative Extension
Estimated Cost: For rain gardens 1, 2, 3, 4, and 5, the rain gardens are 1,050, 980, 1,900, 750, and 250 square feet in size. At $5 per foot, the estimated cost of the rain gardens are $5,250, $4,900, $9,500, $3,750, and $1,250, respectively. The downspout planter boxes would be 6'x 6' square feet in size and will cost $300 each for a combined cost of $1,200. For the five connected downspouts to be disconnected and redirected to bioretention system #3 the estimated cost is $1,250. For the one connected downspout near bioretention system #4, the disconnection will cost about $250. The total cost of the project is approximately $27,350.

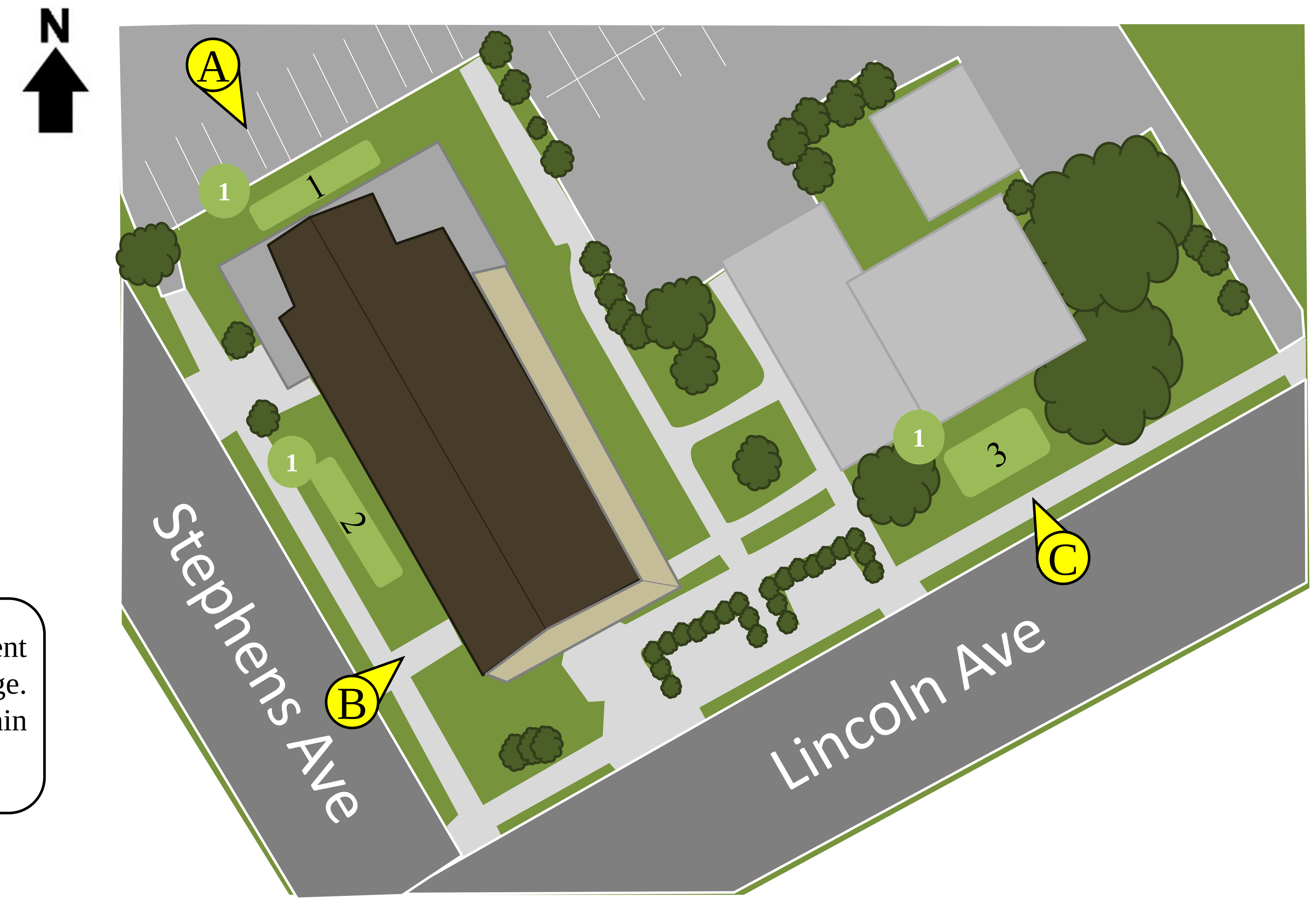
Jamesburg Borough
Impervious Cover Assessment
St. James Roman Catholic Church, 36 Lincoln Avenue

A

PROJECT LOCATION:



SITE PLAN:



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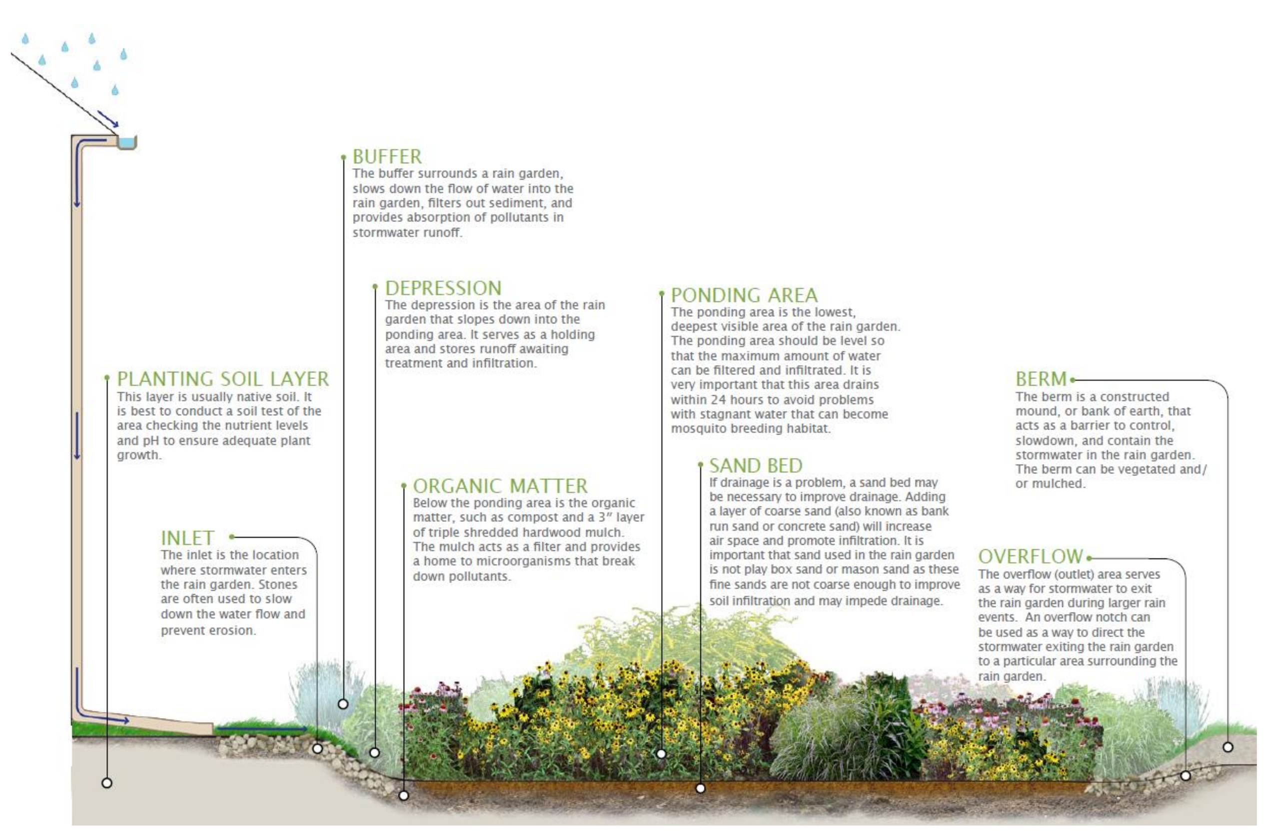
1 **BIORETENTION SYSTEMS:** Rain gardens can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. This site has multiple areas where downspouts can be disconnected and rain gardens implemented.

1 BIORETENTION SYSTEM



St. James Roman Catholic Church
Green Infrastructure Information Sheet

Location: 36 Lincoln Ave Jamesburg, NJ 08831	**Municipality:** Jamesburg Borough **Subwatershed:** Manalapan Brook
Green Infrastructure Description: bioretention systems (rain gardens)	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes TSS removal potential: yes stormwater peak reduction potential: yes	**Stormwater Captured and Treated Per Year:** rain garden #1: 44,295 gal. rain garden #2: 52,100 gal. rain garden #3: 49,500 gal.

Existing Conditions and Issues:
In the back of the church there are two connected downspouts in a large grass area that may be heavily flooded. On the side of the building along Stevens Avenue there are multiple connected downspouts in an area of grass off of the street. There is another building to the east of the main church building that has two connected downspouts and is sloped toward the street that may cause pooling and flooding to occur.

Proposed Solution(s):
In the back of the church a rain garden can be installed to collect the rooftop runoff from the connected downspouts, which can be disconnected and redirected into rain garden #1. Off of Stevens Avenue, the connected downspouts can be disconnected and directed into rain garden #2, which can be installed in the grass area on the west side of the building. On the building next door, rain garden #3 can be installed in the grass area in the front of the building on the east side. The two downspouts would need to be disconnected and redirected into the garden.

Anticipated Benefits:
Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. These bioretention systems would provide additional benefits such as aesthetic appeal and wildlife habitat.

Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
grants from foundations
parishioners

Partners/Stakeholders:
Borough of Jamesburg
parishioners
local community groups (Boy Scouts, Girl Scouts, etc.)

NY/NJ Baykeeper Raritan Riverkeeper Rutgers Cooperative Extension
Estimated Cost: For rain gardens 1, 2, and 3 the rain gardens are approximately 430, 500, and 480 square feet in size. At $5 per foot, the estimated costs of the rain gardens are $2,150, $2,500 and $2,400, respectively. The cost to disconnect the downspouts that will flow into the rain gardens will be about $1,000. The total cost of the project is approximately $8,050.