Impervious Cover Assessment
for
City of Vineland, Cumberland County, New Jersey

Prepared for the City of Vineland by the
Rutgers Cooperative Extension Water Resources Program

February 3, 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 has also increased greatly with this trend, costing billions of dollars over this time span.

- Erosion: Increased stormwater runoff causes an increased 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 as well as cause harm to wildlife.

The primary cause of 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, pervious 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

City of Vineland Impervious Cover Analysis

Located in Cumberland County New Jersey, the City of Vineland covers approximately 69 square miles in southern New Jersey. Figures 3 and 4 illustrate that the City of Vineland is dominated by urban land uses. A total of 36.6% of the municipality's land use is classified as urban. Of the urban land in the City of Vineland, 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 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) 2012 land use/land cover geographical information system (GIS) data layer categorizes the City of Vineland 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 the City of Vineland. Based upon the 2012 NJDEP land use/land cover data, approximately 11.4% of the City of Vineland has impervious cover. This level of impervious cover suggests that the streams in the City of Vineland are likely impacted.

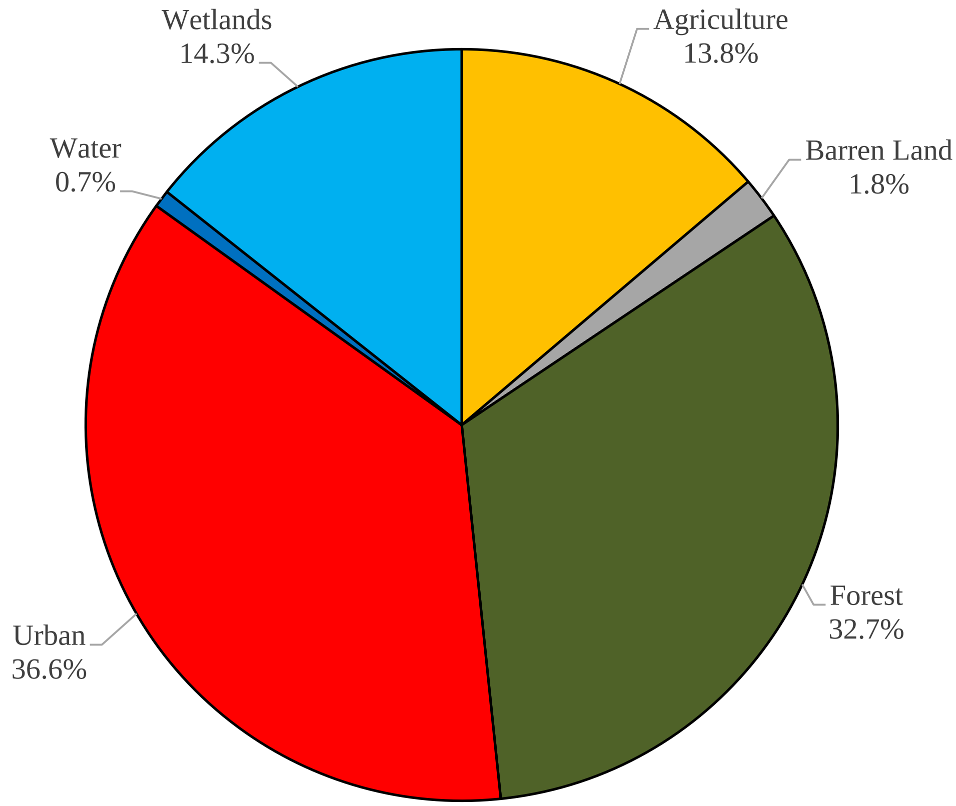


Figure 3: Pie chart illustrating the land use in the City of Vineland

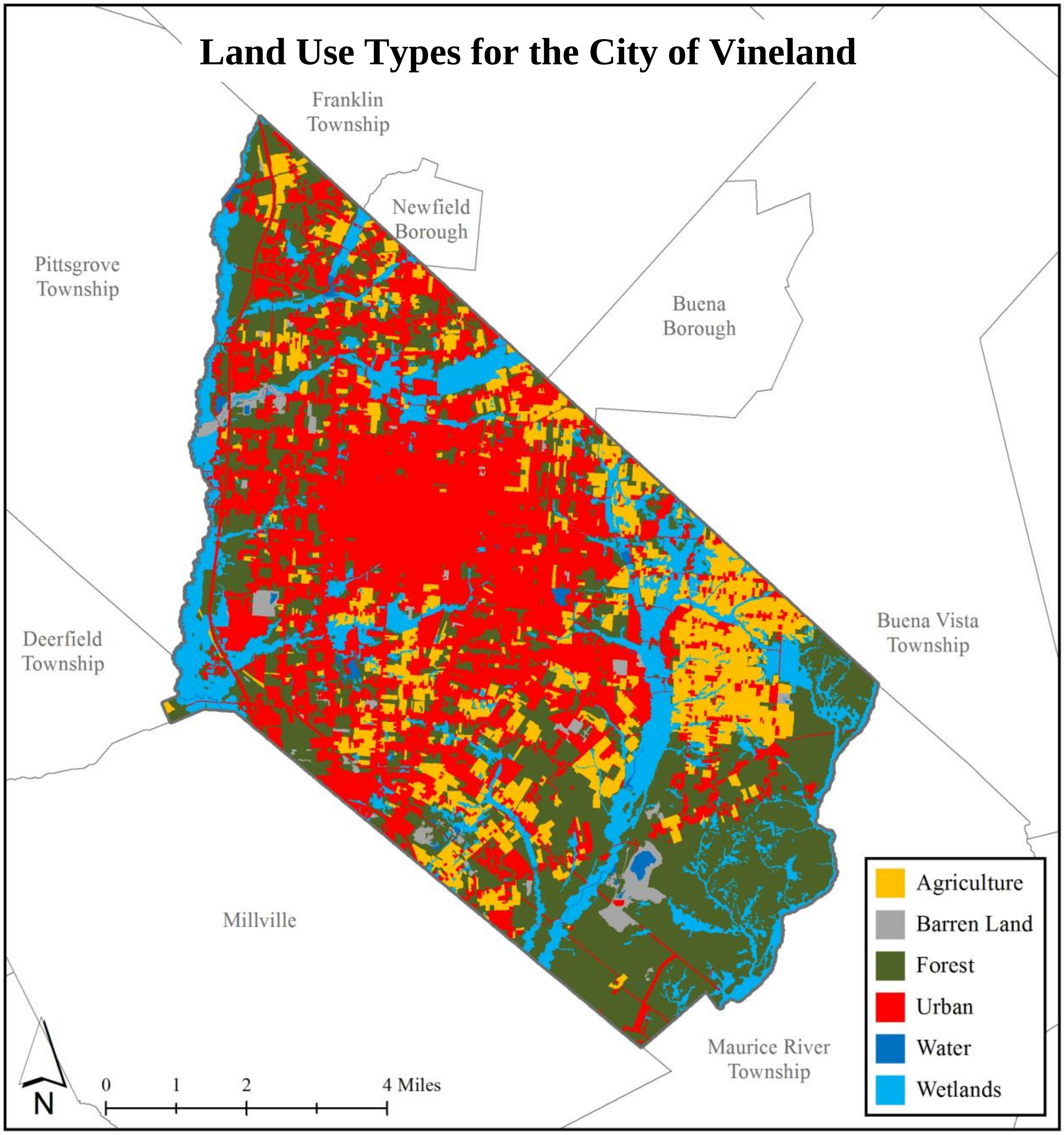


Figure 4: Map illustrating the land use in the City of Vineland

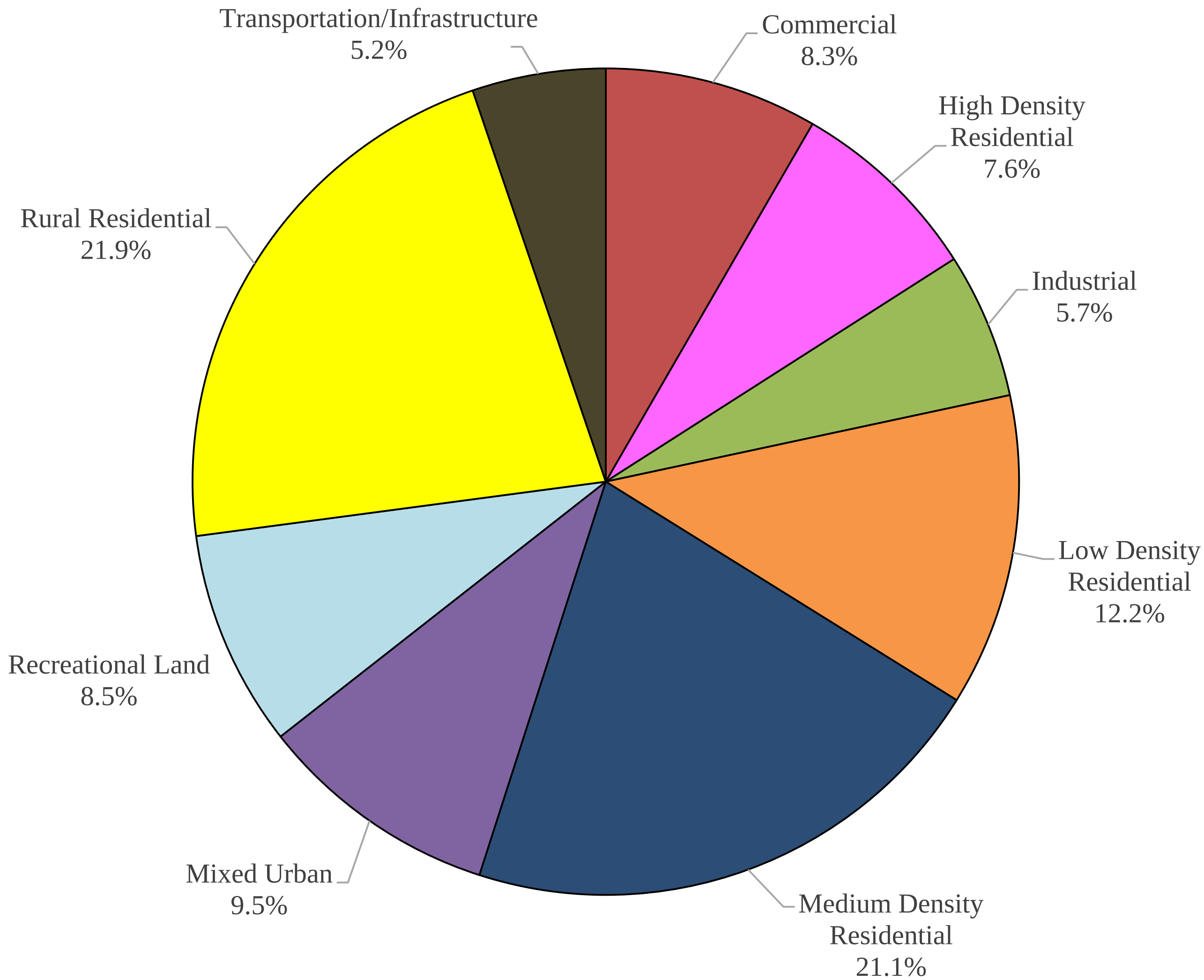


Figure 5: Pie chart illustrating the various types of urban land use in the City of Vineland

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each subwatershed within the City of Vineland (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 0.8% in the Manumuskin River subwatershed to 23.3% in the Parvin Branch/Tarkiln Branch 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 the City of Vineland, Cumberland 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 (8.8 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in the City of Vineland. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Maurice River subwatershed was harvested and purified, it could supply water to 333 homes for one year[1].

[1] Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for the City of Vineland

Subwatershed	**Total Area**		**Land Use Area**		**Water Area**		**Impervious Cover**		
	(ac)	**(mi^2)**	**(ac)**	**(mi^2)**	**(ac)**	**(mi^2)**	**(ac)**	**(mi^2)**	**(%)**
Berryman Branch	3,841.2	6.00	3,833.8	5.99	7.4	0.01	283.7	0.44	7.4%
Blackwater Branch	5,255.8	8.21	5,226.2	8.17	29.6	0.05	732.9	1.15	14.0%
Burnt Mill Branch / Hudson Branch	2,456.2	3.84	2,433.0	3.80	23.2	0.04	280.5	0.44	11.5%
Cedar Branch	2,687.2	4.20	2,669.3	4.17	17.8	0.03	345.6	0.54	13.0%
Hankins Pond Tributaries	1,837.4	2.87	1,825.7	2.85	11.6	0.02	287.5	0.45	15.7%
Manumuskin River	6,456.1	10.09	6,443.9	10.07	12.3	0.02	51.7	0.08	0.8%
Maurice River	6,389.9	9.98	6,321.1	9.88	68.8	0.11	1,074.5	1.68	17.0%
Menantico Creek	7,370.8	11.52	7,256.1	11.34	114.7	0.18	520.4	0.81	7.2%
Panther Branch	1,960.5	3.06	1,957.4	3.06	3.1	0.00	76.2	0.12	3.9%
Parvin Branch / Tarkiln Branch	5,714.5	8.93	5,675.9	8.87	38.6	0.06	1,324.1	2.07	23.3%
Scotland Run	179.9	0.28	178.8	0.28	1.0	0.00	10.5	0.02	6.1%
Total	44,149.3	68.98	43,821.1	68.47	328.2	0.51	4,987.7	7.79	11.4%

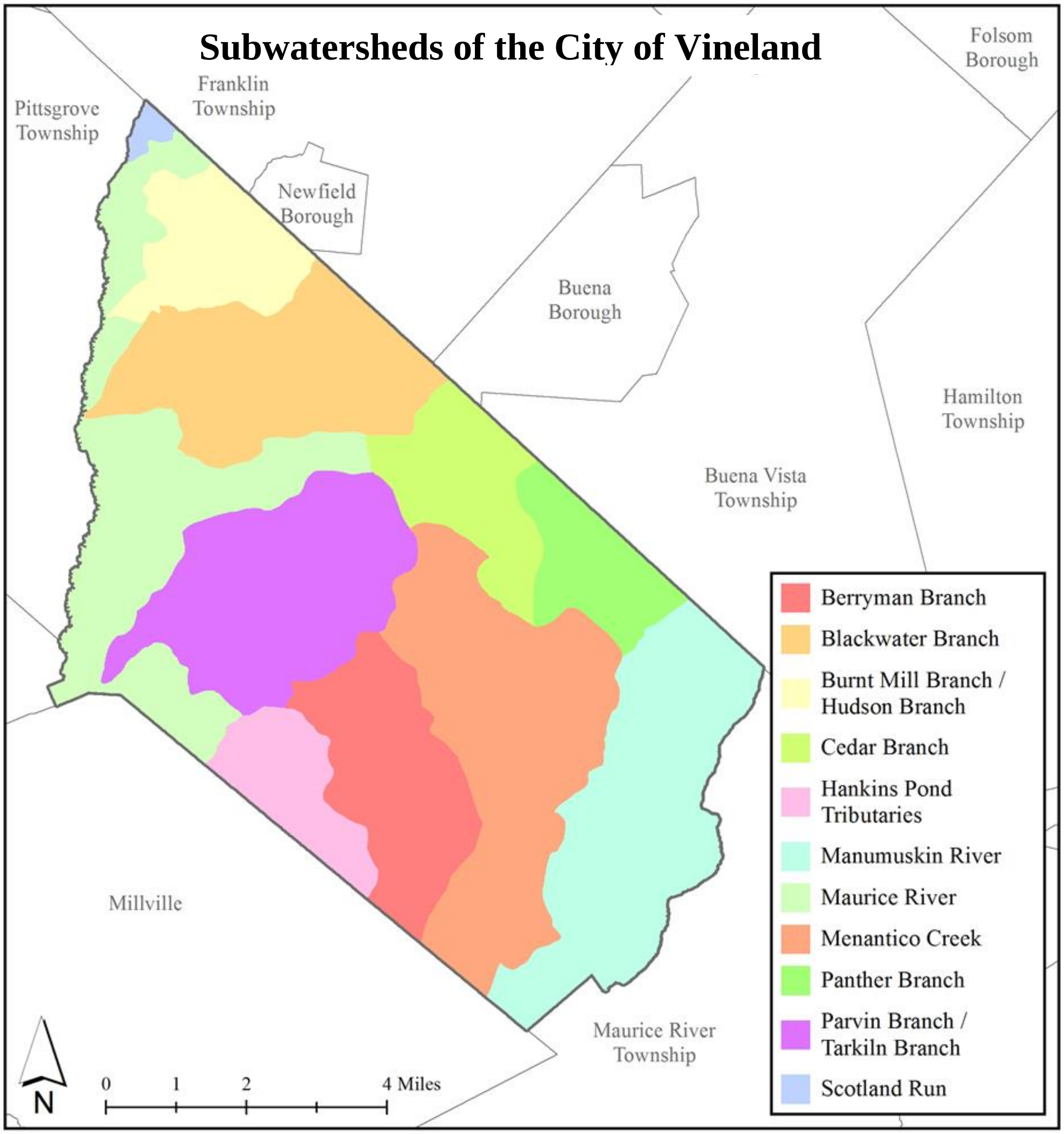


Figure 6: Map of the subwatersheds in the City of Vineland

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in the City of Vineland

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 (8.8") (MGal)
Berryman Branch	9.6	339.3	25.4	39.3	67.9
Blackwater Branch	24.9	875.7	65.7	101.5	175.1
Burnt Mill Branch / Hudson Branch	9.5	335.7	25.2	38.9	67.1
Cedar Branch	11.7	413.4	31.0	47.9	82.7
Hankins Pond Tributaries	9.7	342.9	25.7	39.7	68.6
Manumuskin River	1.8	62.1	4.7	7.2	12.4
Maurice River	36.5	1,284.3	96.3	148.9	256.9
Menantico Creek	17.6	621.2	46.6	72.0	124.2
Panther Branch	2.6	90.8	6.8	10.5	18.2
Parvin Branch / Tarkiln Branch	44.9	1,581.8	118.6	183.3	316.4
Scotland Run	0.4	13.1	1.0	1.5	2.6
Total	169.3	5,959.2	446.9	690.7	1,191.8

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 the City of Vineland. 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 the City of Vineland

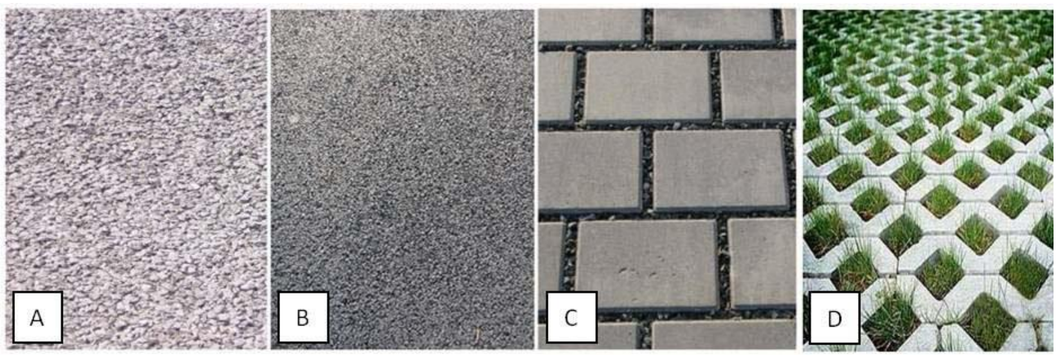
Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction[2] (Mgal)
Berryman Branch	28.4	32.2
Blackwater Branch	73.3	83.2
Burnt Mill Branch / Hudson Branch	28.1	31.9
Cedar Branch	34.6	39.3
Hankins Pond Tributaries	28.7	32.6
Manumuskin River	5.2	5.9
Maurice River	107.5	122.0
Menantico Creek	52.0	59.0
Panther Branch	7.6	8.6
Parvin Branch / Tarkiln Branch	132.4	150.3
Scotland Run	1.1	1.2
Total	498.8	566.1

[2] Annual Runoff Volume Reduction =
Acres of IC 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 BMPs should be designed to capture the first 3.3 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 the City of Vineland

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 the City of Vineland, 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

The City of Vineland 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

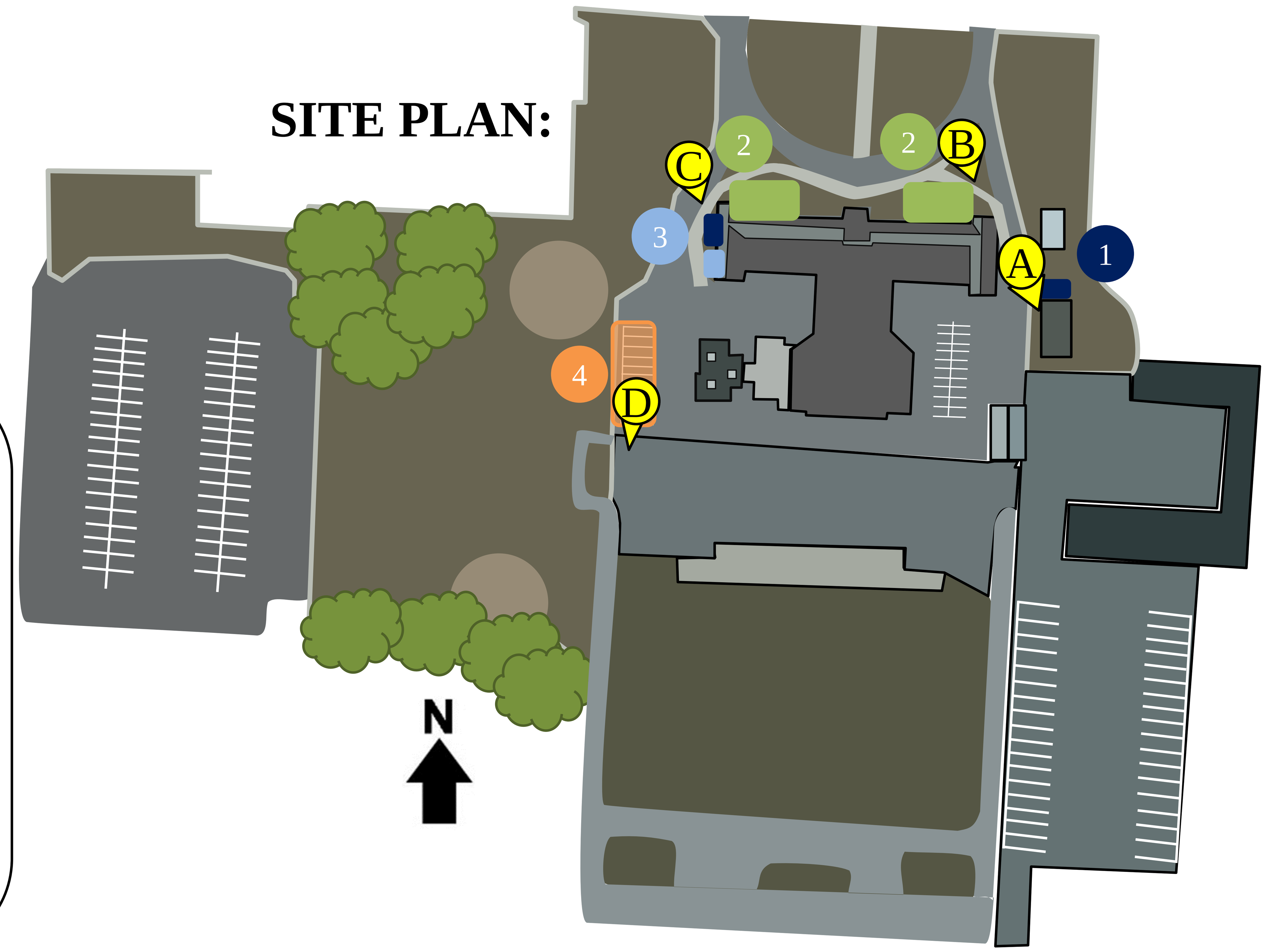
Concept Plans and Detailed Green Infrastructure Information Sheets

City of Vineland
Impervious Cover Assessment
Landis Intermediate School, 61 West Landis Avenue

RUTGERS
New Jersey Agricultural Experiment Station

PROJECT LOCATION:

SITE PLAN:



1 **DOWNSPOUT PLANTER BOX:** Two downspout planter boxes can be installed outside a building east of the school. These are wooden boxes with plants installed at the base of a downspout that provide an opportunity to beneficially reuse rooftop runoff.

2 **BIORETENTION SYSTEM:** Two rain gardens can be installed on the north side of the school. The rain gardens would reduce runoff and erosion and allow stormwater infiltration.

3 **RAINWATER HARVESTING SYSTEM:** Rainwater can be harvested from the roof of the building and stored in a rain barrel. The water can be used to water the school garden.

4 **POROUS PAVEMENT:** Porous pavement can be installed in the western parking lot near the baseball field. Porous pavement promotes groundwater recharge and filters stormwater.

1 DOWNSPOUT PLANTER BOX

2 BIORETENTION SYSTEM

3 RAINWATER HARVESTING SYSTEM

4 POROUS PAVEMENT

Landis Intermediate School
Green Infrastructure Information Sheet

Location: 61 West Landis Avenue Vineland, NJ 08360	**Municipality:** Vineland **Subwatershed:** Maurice River
Green Infrastructure Description: bioretention system (rain garden) disconnecting downspouts porous pavement rainwater harvesting system (rain barrel) downspout planter boxes	**Targeted Pollutants:** total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes	**Stormwater Captured and Treated Per Year:** rain gardens: 46,900 gal. rain barrel: 2,100 gal. porous pavements: 357,000 gal. downspout planter boxes: 2,800 gal.

Existing Conditions and Issues:
Stormwater runoff on the property has caused erosion of parking lots and some areas on the grounds. In heavy rainfall events, stormwater floods into the lower level classrooms through windows. There is a small school garden on the west side of the building, where there are a couple of connected downspouts.

Proposed Solution(s):
Installing two rain gardens in front of the school could lead runoff away from the building, reduce flooding within the school, and encourage infiltration of stormwater. Constructing a downspout planter box by one of the trailers could prevent further erosion and be moved if future development of the property changed. Downspouts by the school garden could be cut and directed into another downspout planter box to reuse roof runoff and a rain barrel to use for watering when needed. Porous pavement could be used to replace existing parking spaces, allowing for infiltration of stormwater runoff.

Anticipated Benefits:
Since the bioretention systems and porous pavement 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. A bioretention system would also provide ancillary benefits, such as enhanced wildlife and aesthetic appeal to the school.

Porous pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. The pervious pavement system will achieve the same level of pollutant load reduction for TN, TP, and TSS as the bioretention system.

Rain barrels can harvest roof runoff which can be used for watering plants or other purposes which cuts back on the use of potable water for nondrinking purposes. Since the rainwater harvesting system would be designed to capture the first 1.25 inches of rain, it would reduce the pollutant loading by 90% during the periods it is operational (i.e., it would not be used in the winter when there is chance of freezing).

Downspout planter boxes will take in runoff from downspouts and achieve similar reductions in TN and TP as the bioretention systems, and 80% TSS.

Rutgers Cooperative Extension could additionally present the *Stormwater Management in Your Schoolyard* program to students and include them in the bioretention system planting efforts to enhance the program.

Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
City of Vineland
local social and community groups

Partners/Stakeholders:
City of Vineland
Landis Intermediate School
local community groups
students and parents
Rutgers Cooperative Extension

Estimated Cost:
The total size of the rain gardens would be approximately 1,960 square feet. At $5 per square foot, the estimated cost of the rain garden is $9,800.

The porous pavement would cover approximately 3,060 square feet and have a 2-foot stone reservoir under the surface. At $25 per square foot, the cost of the porous asphalt system would be $76,500.

The rain barrel would be 100 gallons and cost approximately $200 to purchase and install.

The estimated cost of each planter box is $1,000 for a total cost of $2,000.

The total cost of the project will thus be approximately $88,500.

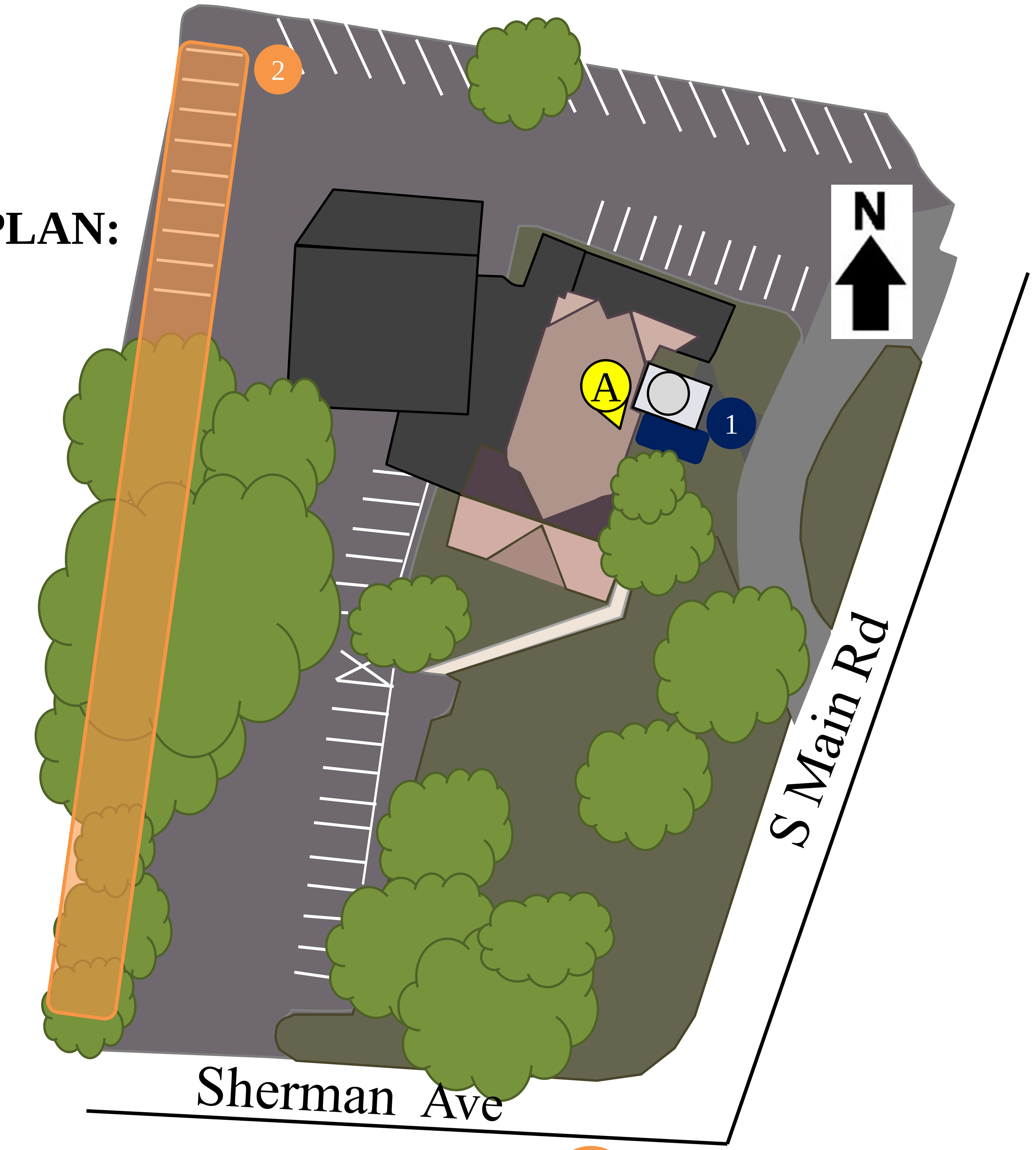
City of Vineland

Impervious Cover Assessment

South Vineland United Methodist Church, 2724 South Main Road

PROJECT LOCATION:

SITE PLAN:



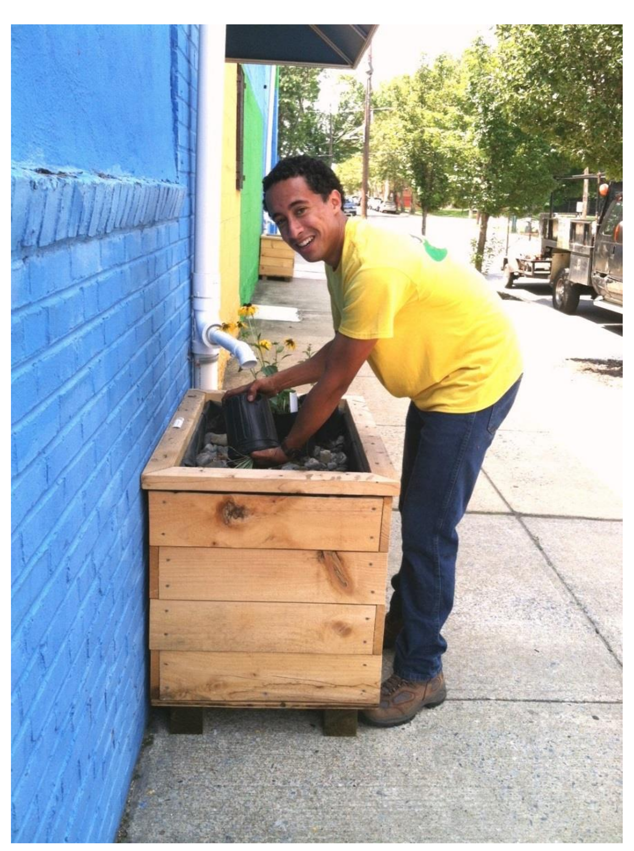
A

B

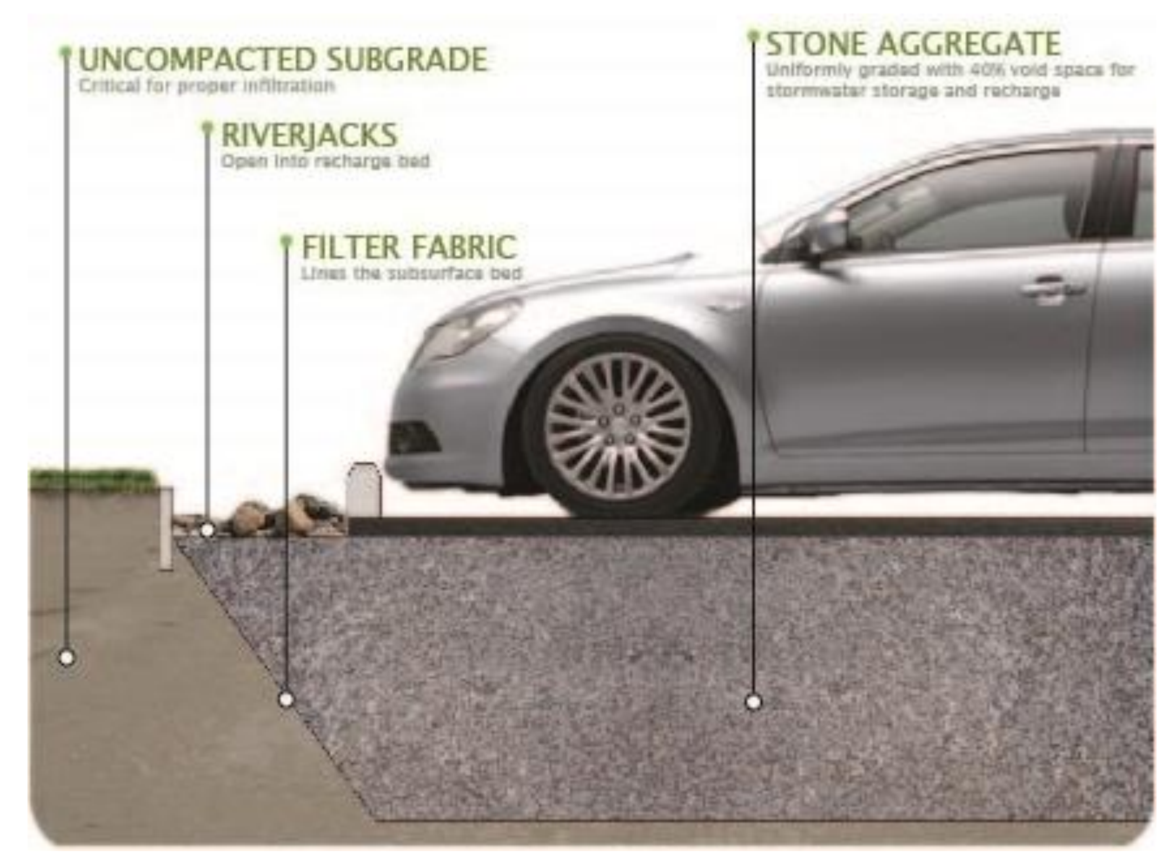
1 **DOWNSPOUT PLANTER BOX:** A downspout planter box can be installed on the eastern side of the church. This is a wooden box with plants installed at the base of a downspout that can provide an opportunity to beneficially reuse rooftop runoff.

2 **POROUS PAVEMENT:** Porous pavement can be installed to replace the parking spots along the west side of the lot. Porous pavement promotes groundwater recharge and filters stormwater.

1 DOWNSPOUT PLANTER BOX



2 POROUS PAVEMENT



South Vineland United Methodist Church
Green Infrastructure Information Sheet

Location: 2724 South Main Road Vineland, NJ 08361	**Municipality:** Vineland **Subwatershed:** Menantico Creek
Green Infrastructure Description: porous pavement downspout planter boxes	**Targeted Pollutants:** total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes	**Stormwater Captured and Treated Per Year:** porous pavement: 610,000 gal. downspout planter boxes: 2,800 gal.

Existing Conditions and Issues:
The parking lot carries runoff to two stormwater catch basins on the southern end of the property. There are numerous downspouts coming off of the building that lead stormwater into the parking lot and to sidewalks in the front of the church. Downspouts on the eastern side of the property have been extended to lead stormwater away from the area. The extensions pose a tripping hazard for congregants.

Proposed Solution(s):
Porous pavement could be installed for the parking spaces in the western lot to infiltrate runoff before reaching the stormwater basin. The extended downspouts could be cut, and planter boxes could be placed underneath to capture and reuse rooftop runoff.

Anticipated Benefits:
Porous pavement allows stormwater to infiltrate through to soil layers, which will promote groundwater recharge as well as intercept and filter stormwater runoff. For an entire 2-year design storm (3.3 inches of rain over 24 hours), the porous pavement system is estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS.

Planter boxes will take in runoff from downspouts and beneficially reuse it.

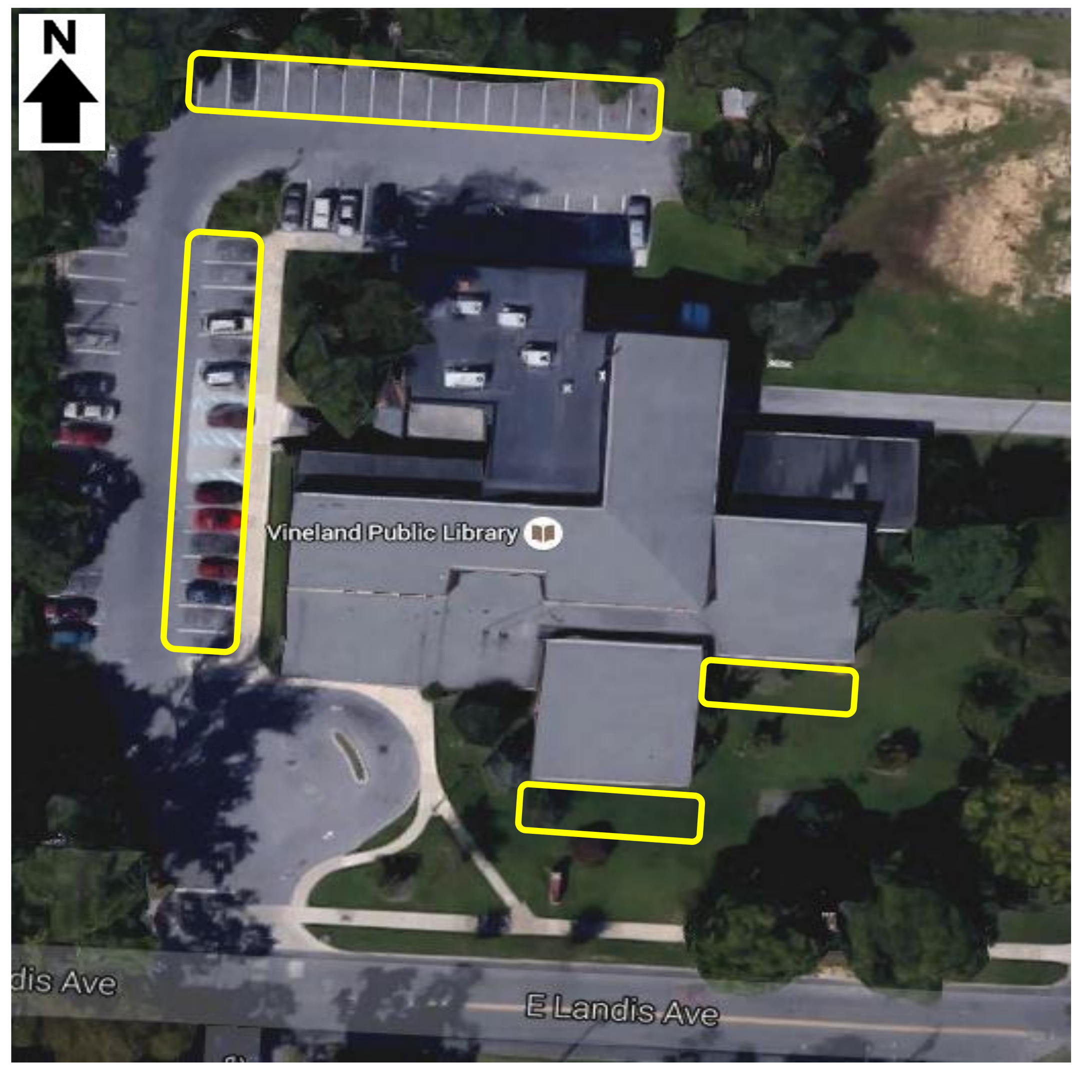
Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
City of Vineland
local social and community groups

Partners/Stakeholders:
City of Vineland
South Vineland United Methodist Church

local community groups residents and parishioners Rutgers Cooperative Extension
Estimated Cost: The pervious pavement would cover 4,400 square feet and have a 2-foot stone reservoir under the surface. At $25 per square foot, the cost of the pervious pavement system would be $110,000. The estimated cost of each planter box is $1,000 for a total cost of $2,000. The total cost of the project will thus be approximately $112,000.

City of Vineland
Impervious Cover Assessment
Vineland Public Library, 1058 East Landis Avenue

PROJECT LOCATION:



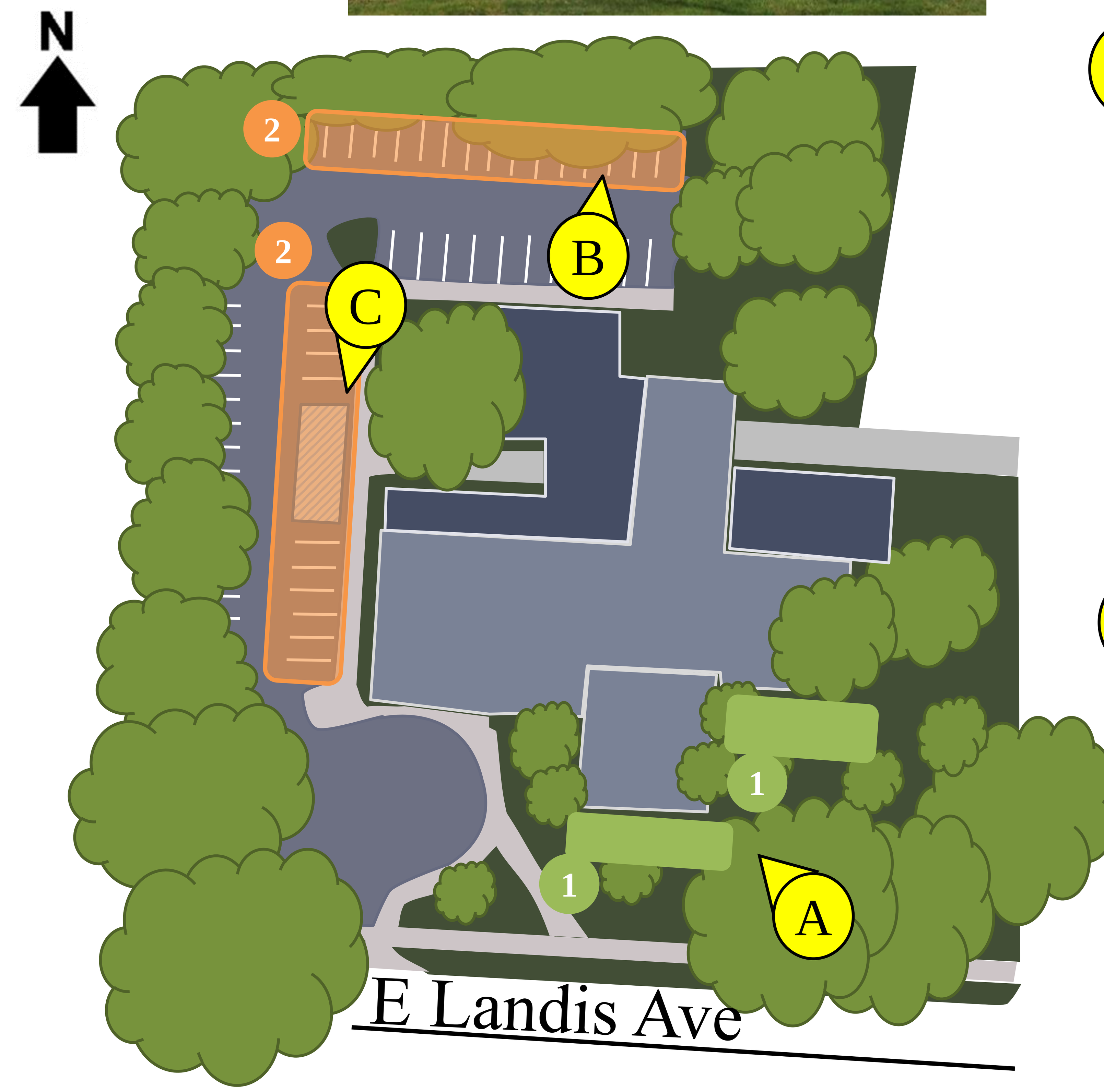
1 **BIORETENTION SYSTEM:** Bioretention systems could be installed adjacent to the library. The bioretention systems would reduce sediment and nutrient loading to the local waterway and increase groundwater recharge.

2 **POROUS PAVEMENT:** Porous pavement could be installed in two locations of the parking lot. Porous pavement promotes groundwater recharge and filters stormwater.

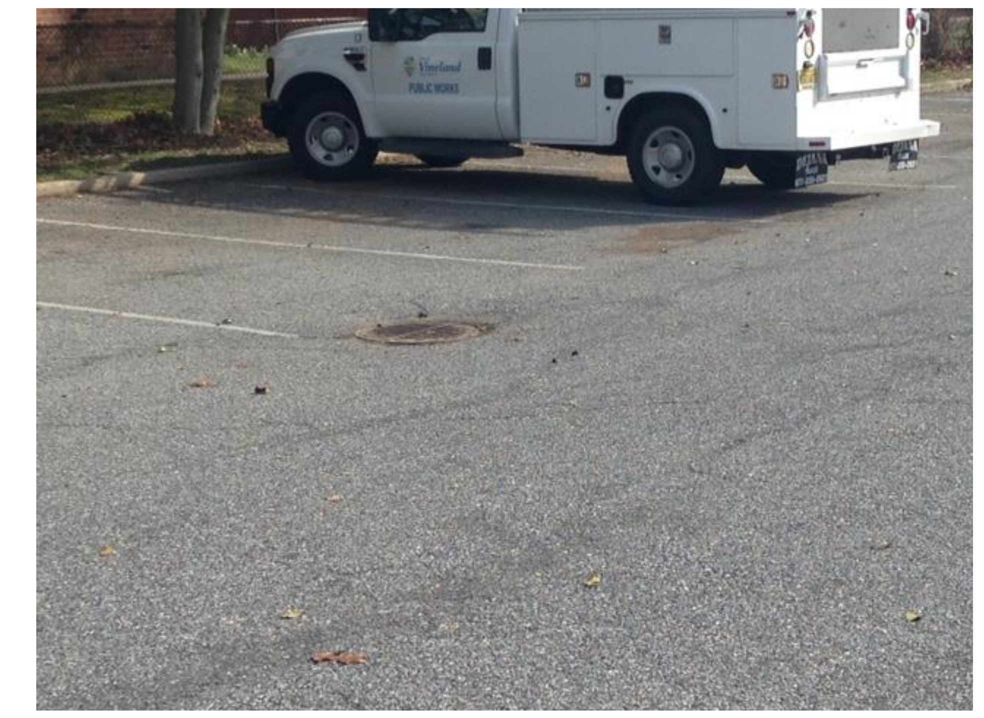
EDUCATIONAL PROGRAM: The RCE Water Resources Program's, *Stormwater Management in Your Backyard* can be delivered to educate the public about stormwater management and engage them in designing and building the bioretention systems.

SITE PLAN:

A

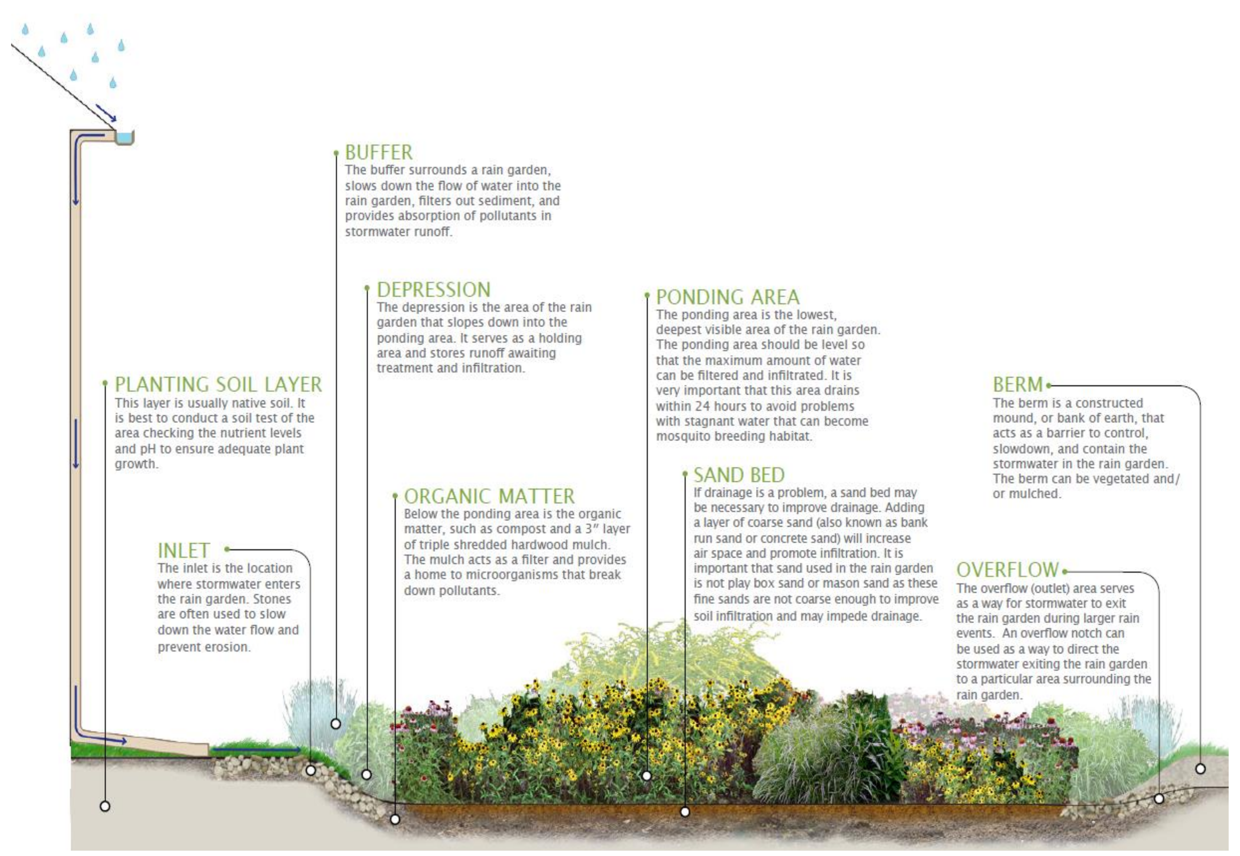


B

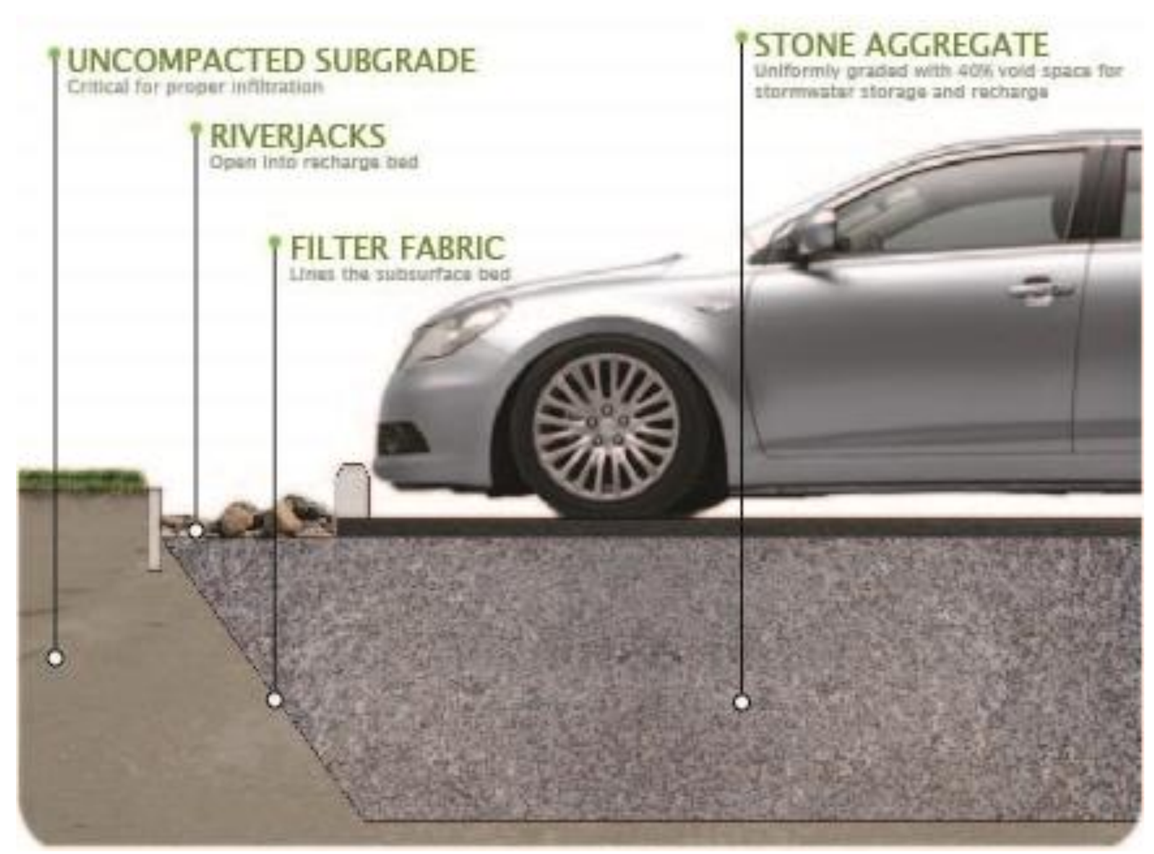


C

1 BIORETENTION SYSTEM



2 POROUS PAVEMENT



EDUCATIONAL PROGRAM

Vineland Public Library
Green Infrastructure Information Sheet

Location:
1058 East Landis Avenue
Vineland, NJ 08360

Municipality:
Vineland

Subwatershed:
Parvin/Tarkiln Branch

Green Infrastructure Description:
disconnecting downspouts
bioretention system
porous pavement

Targeted Pollutants:
total nitrogen (TN), total phosphorus (TP),
total suspended solids (TSS) in surface runoff

Mitigation Opportunities:
recharge potential: yes
stormwater peak reduction potential: yes
total suspended solids removal potential: yes

Stormwater Captured and Treated Per Year:
bioretention system: 122,460 gal.
porous pavement: 536,000 gal.

Existing Conditions and Issues:
The library property has impervious surfaces contributing to stormwater runoff. There are connected downspouts on the building and eight storm drains in the parking lot. There is currently a small native garden within the curbing of a parking lot.

Proposed Solution(s):
Downspouts on the south side of the library can be disconnected and rain gardens can be installed nearby to capture, treat, and infiltrate roof runoff to reduce the amount of stormwater entering the storm sewer system. Parking spaces can be replaced with porous asphalt to allow parking lot runoff an opportunity to infiltrate.

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. A bioretention system would also provide ancillary benefits, such as enhanced wildlife and aesthetic appeal to the local residents of the City of Vineland.

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.

Rutgers Cooperative Extension could additionally present the *Stormwater Management in Your Backyard* program to patrons and include them in bioretention system planting efforts to enhance the program. This may also be used as a demonstration project for Vineland’s Public Works staff to launch educational programming.

Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
City of Vineland
local social and community groups

Partners/Stakeholders:
City of Vineland
Vineland Public Library
local community groups
patrons
Rutgers Cooperative Extension

Estimated Cost:
The bioretention systems would cover a total of approximately 1,390 square feet. At $5 per square foot, the estimated cost of the rain garden is $6,950.

The porous pavement would cover 3,400 square feet and have a 2-foot stone reservoir under the surface. At $25 per square foot, the cost of the porous asphalt system would be $85,000.

The total cost of the project would be approximately $91,950.