GREEN INFRASTRUCTURE STRATEGIC PLAN

HAMILTON TOWNSHIP
ATLANTIC COUNTY

RUTGERS
New Jersey Agricultural Experiment Station

Township of Hamilton, NJ

ACKNOWLEDGEMENTS

This document has been prepared by the Rutgers Cooperative Extension Water Resources Program, primarily funded by the 2020 Atlantic City Electric Sustainable Communities Grants Program, with direction from The Sustainable Township of Hamilton Green Team and the New Jersey Agricultural Experiment Station, to highlight green infrastructure opportunities within Hamilton Township. We would like to thank The Sustainable Township of Hamilton Green Team, the New Jersey Agricultural Experiment Station, and Hamilton Township for their input and support in creating this document.

TABLE OF CONTENTS

GLOSSARY OF GREEN INFRASTRUCTURE TERMINOLOGY

1. **BEST MANAGEMENT PRACTICE (BMP)**

   Activities or structural improvements that help reduce the quantity and improve the quality of stormwater runoff

2. **COMBINED SEWER OVERFLOW (CSO)**

   During wet weather events, stormwater flows can exceed the capacity of the combined sewer system and/or the sewage treatment plant causing an overflow of a slurry of untreated wastewater and stormwater to local waterways.

3. **COMBINED SEWER SYSTEM (CSS)**

   A wastewater collection system designed to carry sanitary sewage (consisting of domestic, commercial, and industrial wastewater) and stormwater (surface drainage from rainfall or snowmelt) in a single pipe to a treatment facility

4. **CONNECTED IMPERVIOUS SURFACE**

   When stormwater runoff flows directly from an impervious surface to a local waterway or a sewer system, the impervious surface is considered "connected" or "directly connected."

5. **DISCONNECTED IMPERVIOUS SURFACE**

   When stormwater runoff flows from an impervious surface onto a pervious surface or into a green infrastructure practice prior to entering a local waterway or a sewer system, the impervious surface is considered "disconnected."

6 **GREEN INFRASTRUCTURE PRACTICE**

A stormwater management practice that captures, filters, absorbs, and/or reuses stormwater to help restore the natural water cycle by reducing stormwater runoff, promoting infiltration, and/or enhancing evapotranspiration

7 **IMPERVIOUS COVER ASSESSMENT (ICA)**

Readily available land use/land cover data from the New Jersey geographic information system (GIS) database are used to determine the percentage of impervious cover in municipalities by subwatershed. The ICA includes calculations of stormwater runoff volumes associated with impervious surfaces.

8 **IMPERVIOUS COVER REDUCTION ACTION PLAN (RAP)**

A plan that identifies opportunities to retrofit specific sites with green infrastructure practices to reduce the impacts of stormwater runoff from impervious surfaces

9 **IMPERVIOUS SURFACE**

Any surface that has been covered with a layer of material so that it is highly resistant to infiltration by water (e.g., paved roadways, paved parking areas, and building roofs)

10 **LONG-TERM CONTROL PLAN (LTCP)**

A systemwide evaluation of the sewage infrastructure and the hydraulic relationship between sewers, precipitation, treatment capacity, and overflows; it identifies measures needed to eliminate or reduce the occurrence of CSOs

11 **LOW IMPACT DEVELOPMENT (LID)**

A land planning and engineering design approach that emphasizes conservation and use of on-site natural features to manage stormwater runoff and protect water quality

12 **MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4)**

A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that transports stormwater runoff to local waterways or stormwater facilities such as a detention basin

13 **NONPOINT SOURCE (NPS) POLLUTION**

"Nonpoint source pollution" is also called "people pollution." It is the pollution that comes from our everyday lives. It is the fertilizers that wash off farms and lawns. It is the pet waste that washes into streams. It is the sediment (or soil) that erodes from the land into local waterways. It is the oil and grease that comes from parking lots. Finally, it is the pollutants such as nitrogen, phosphorus, and heavy metals that settle out of the atmosphere onto roads and rooftops. When it rains, stormwater runoff carries nonpoint source pollution and may ultimately wash it into waterways.

14 **PERVIOUS SURFACE**

Any surface that allows water to pass through it (e.g., lawn area)

15 **STORMWATER RUNOFF**

The water from rain or melting snows that can become "runoff" flowing over the ground surface and returning to lakes and streams

INTRODUCTION

By using cost-effective green infrastructure practices, Hamilton Township can begin to reduce the negative impacts of stormwater runoff and decrease the pressure on local infrastructure and waterways. This feasibility study is intended to be used as a guide for the community of Hamilton Township to begin implementing green infrastructure practices while demonstrating to residents and local leaders the benefits of and opportunities for better managing stormwater runoff.

For Hamilton Township, potential green infrastructure projects have been identified. Each project has been classified as a mitigation opportunity for recharge potential, total suspended solids removal, and stormwater peak reduction. For each proposed green infrastructure practice, detailed green infrastructure information sheets provide an estimate of gallons of stormwater captured and treated per year. Additionally, concept designs for three of the potential green infrastructure projects have been developed. These concept designs provide an aerial photograph of the site and details of the proposed green infrastructure practices. Lastly, Appendix A of this document offers information about community engagement opportunities related to green infrastructure, while Appendix B provides maintenance guidelines for green infrastructure practices.


Rutgers University professor, Tobiah Horton, reviews a rain garden design with a homeowner.

WHAT IS GREEN INFRASTRUCTURE?

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 principle, 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 yield 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, 2015).

A community garden that harvests and recycles rainwater

Rain barrel workshop participants

A rain garden after planting

WHAT IS STORMWATER?

When rainfall hits a surface, it can soak into the surface or flow off of the surface. Pervious surfaces are those which allow stormwater to readily soak into the soil and recharge groundwater. 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 amount of stormwater runoff. New Jersey has many problems due to stormwater runoff from impervious surfaces, including:

- POLLUTION: According to the United States Environmental Protection Agency (USEPA, 2013) over 90% of the assessed waters in New Jersey are impaired, with urban-related stormwagter runoff listed as the most probable source of impairment. As stormwater flows over the ground, it picks up pollutants, including animal waste, excess fertilizers, pesticides, and other toxic substances. These pollutants are then carried with the flow of the runoff to nearby waterways.
- FLOODING: Over the past decade, New Jersey has seen an increase in flooding. Communities around New Jersey have been affected by these floods. The amount of damage caused 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 flow 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 through the destruction of habitat.

Stormwater catch basin

Purple cone flower

Pervious pavers

To protect and repair our waterways, reduce flooding, and stop erosion, stormwater runoff from impervious surfaces has to be better managed. Impervious 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.

WHY ARE IMPERVIOUS SURFACES IMPORTANT?

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. New Jersey has the highest percent of impervious cover in the country at 12.1% of its total area as reported by Nowak and 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).

According to Schuler (1994), Arnold and Gibbons (1996), and May et al. (1997), there is a signifincant link between impervious cover and stream ecosystem impairment. Impervious cover is directly 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.

Urbanizing streams can be classified into three categories (Schueler, 1994 and 2004): *Sensitive* - Sensitive streams typically have a watershed impervious surface cover from 0-10%, *Impacted* - Impacted streams have a watershed impervious cover ranging from 11-25% and typically show clear signs of degradation from urbanization, *Non-supporting* - 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.

Schueler et al. (2009) reformulated the impervious cover model, and this new analysis deterined that stream degradation was first detected between 2% to 15% impervious cover. The updated impervious cover model recognizes the wide variability of stream degradation at imperviouscover below 10%. The updated model also moves away from having a fixed line between stream quality classifications. For example, 5 to 10% impervious cover is included for the transition from sensitive to impacted, 20 to 25% impervious cover for the transition from impacted to non-supporting, and 60 to 70% impervious cover for the transition from non-supporting to urban drainage.

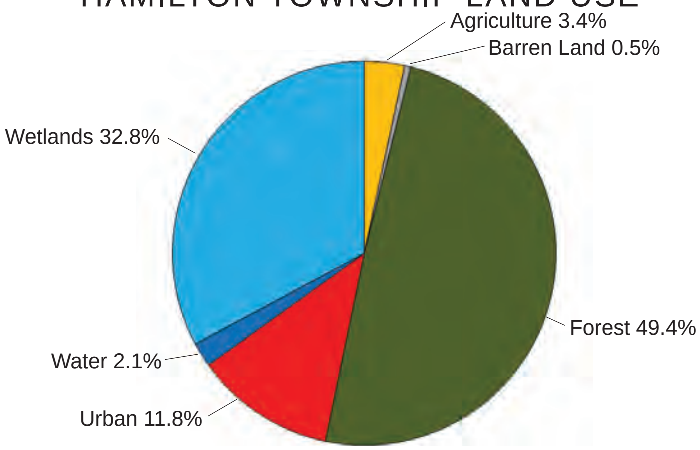
HAMILTON TOWNSHIP

Hamilton Township is located in Atlantic County. The municipality covers an area totaling about 113.1 square miles and has a population of 26,503 according to the 2010 US Census. Hamilton Township shares its northern border with Egg Harbor City and eastern border with Egg Harbor Township. To the south is the community of Estell Manor, and to the west is the community of Rochelle Park. In the event of a heavy storm, much of the municipality's runoff travels into nearby waterbodies untreated. By evaluating the feasibility of green infrastructure, Hamilton Township can identify cost-effective ways to help mitigate water quality and local flooding issues.

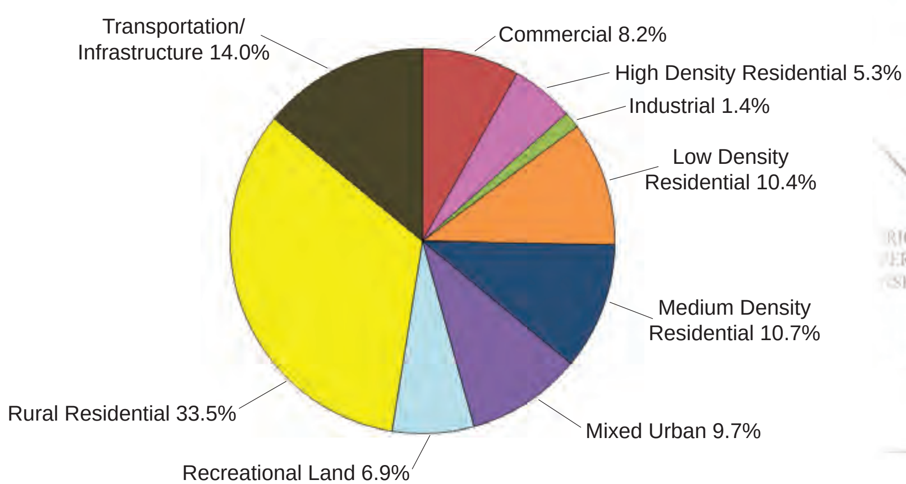
LAND USE IN HAMILTON TOWNSHIP

Hamilton Township is dominated by forest land uses. A total of 11.8% of the municipality's land use is classified as urban. Of the urban land in Hamilton Township, rural residential is the dominant land use. Urban land uses tend to have a high percentage of impervious surfaces.

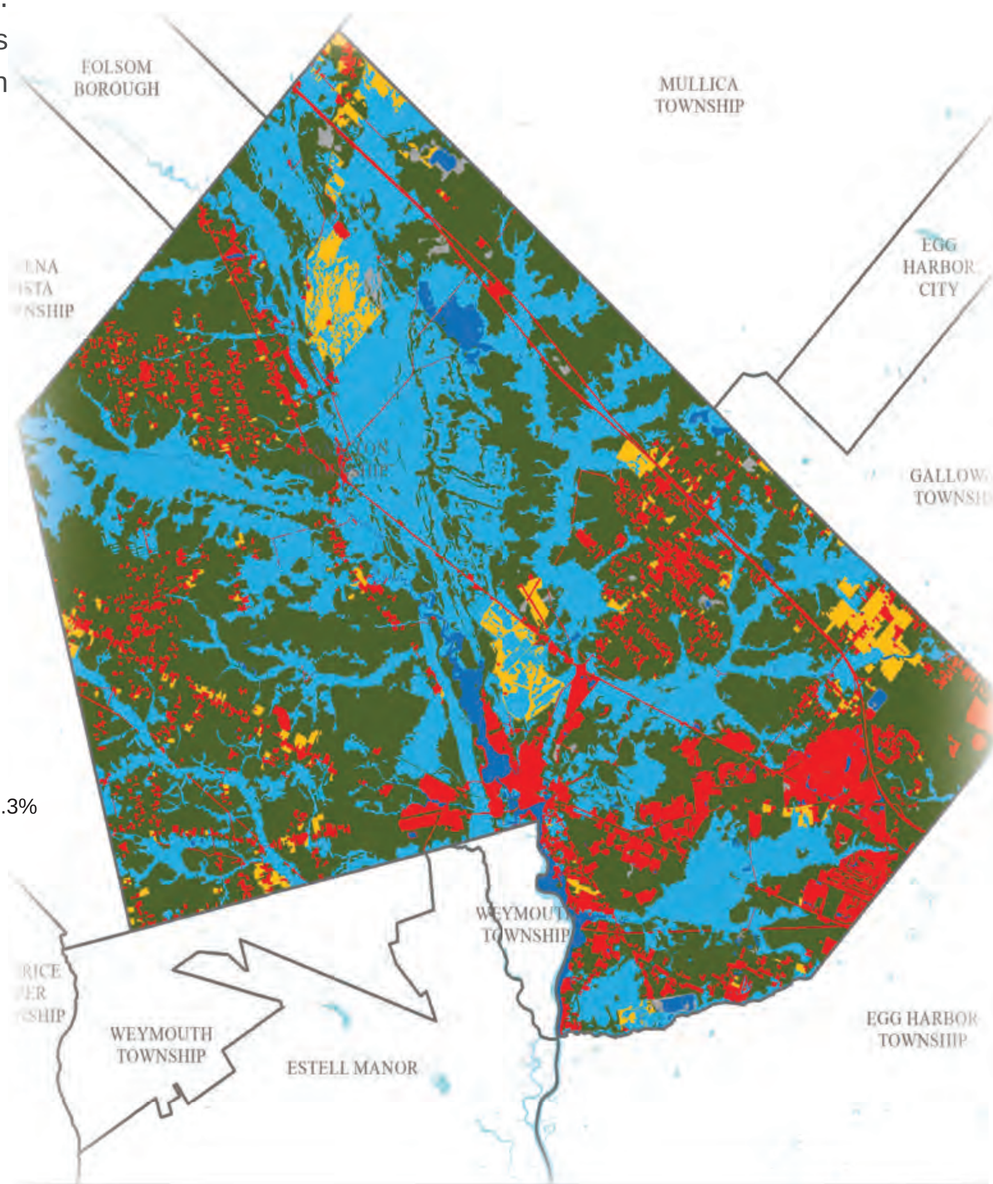
HAMILTON TOWNSHIP LAND USE



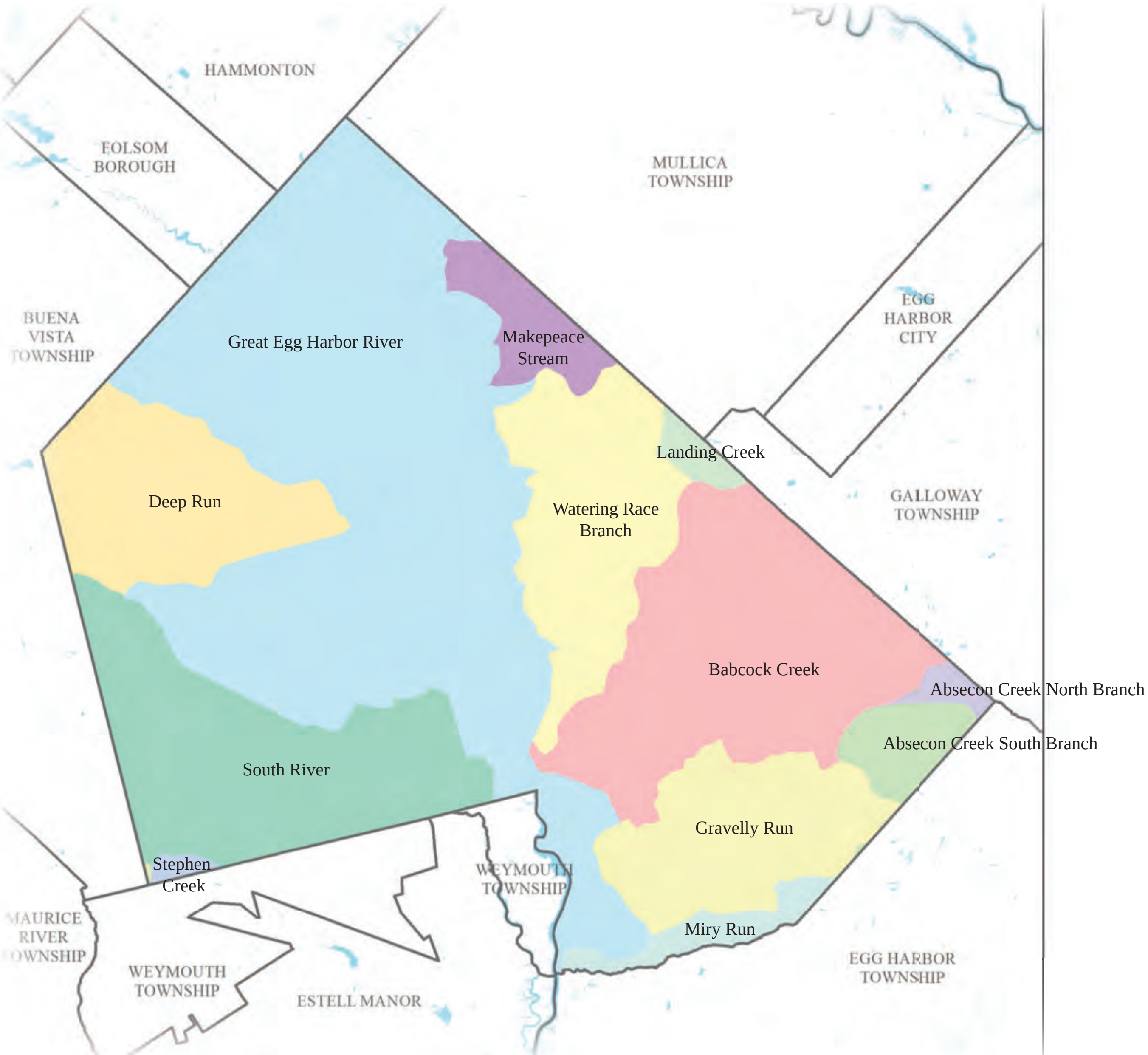
HAMILTON TOWNSHIP URBAN LAND USE



HAMILTON TOWNSHIP LAND USE



HAMILTON TOWNSHIP SUBWATERSHEDS



Hospitality Branch, Mill Branch, and Tuckahoe River not visible on map scale

IMPERVIOUS COVER ANALYSIS

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.

The New Jersey Department of Environmental Protection's (NJDEP) 2015 land use/land cover geographical information system (GIS) data layer categorizes Hamilton Township into many unique land use areas, assigning a percent impervious cover for each delineated area. These impervious cover values are used to estimate the impervious coverage for Hamilton Township. Based upon the 2015 NJDEP land use/land cover data, approximately 5.2% of Hamilton Township has impervious cover.

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis has been performed for each subwatershed within Hamilton Township (Table 1). On a subwatershed basis, impervious cover ranges from 0.3% in the Tuckahoe River subwatershed to 49.0% in the Mill 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.

Connected downspout

Reservoir

TABLE 1. IMPERVIOUS COVER ANALYSIS BY SUBWATERSHED FOR HAMILTON TOWNSHIP

Subwatershed	Total Area	Land Use Area	Water Area	Impervious Cover	
	(ac)	(ac)	(ac)	(ac)	(%)
Absecon Creek North Branch	409.2	409.2	0.0	16.3	4.0%
Absecon Creek South Branch	1,420.9	1,413.2	7.7	119.4	8.4%
Babcock Creek	11,045.7	10,941.5	104.2	847.6	7.7%
Deep Run	6,060.2	6,042.6	17.6	106.1	1.8%
Great Egg Harbor River	28,036.8	26,902.6	1,134.2	1,032.3	3.8%
Gravelly Run	5,523.5	5,459.3	64.3	737.9	13.5%
Hospitality Branch	0.6	0.6	0.0	0.0	1.4%
Landing Creek	541.5	501.5	40.0	10.8	2.1%
Makepeace Stream	1,863.6	1,860.3	3.3	37.6	2.0%
Mill Branch	14.1	14.1	0.0	6.9	49.0%
Miry Run	1,204.6	1,135.8	68.8	59.9	5.3%
South River	9,292.8	9,263.8	29.0	398.2	4.3%
Stephen Creek	207.6	207.6	0.0	6.0	2.9%
Tuckahoe River	17.2	17.2	0.0	0.0	0.3%
Watering Race Branch	6,632.7	6,612.7	20.0	298.8	4.5%
Total	72,271.1	70,782.0	1,489.1	3,677.8	5.2%

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 Hamilton Township, Atlantic County) associated with impervious surfaces have been 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 (3.31 inches of rain), the 10-year design storm (5.16 inches of rain), and the 100-year design storm (8.90 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Hamilton Township. For example, if the stormwater runoff from one New Jersey water quality storm in the Babcock Creek subwatershed was harvested and purified, it could supply water to 320 homes for one year (assuming 300 gallons per day per home).

TABLE 2. STORMWATER RUNOFF VOLUMES FROM IMPERVIOUS SURFACES BY SUBWATERSHED IN HAMILTON 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 (3.31") (Mgal)	Total Runoff Volume for the 10-year Design Storm (5.16") (Mgal)	Total Runoff Volume for the 100 Year Design Storm(8.90") (Mgal)
Absecon Creek North Branch	0.6	19.4	1.5	2.3	3.9
Absecon Creek South Branch	4.1	142.7	10.7	16.9	28.9
Babcock Creek	28.8	1,012.7	76.0	119.7	204.8
Deep Run	3.6	126.8	9.5	15.0	25.6
Great Egg Harbor River	35.0	1,233.3	92.5	145.8	249.5
Gravelly Run	25.0	881.5	66.1	104.2	178.3
Hospitality Branch	0.0	0.0	0.0	0.0	0.0
Landing Creek	0.4	12.8	1.0	1.5	2.6
Makepeace Stream	1.3	44.9	3.4	5.3	9.1
Mill Branch	0.2	8.2	0.6	1.0	1.7
Miry Run	2.0	71.6	5.4	8.5	14.5
South River	13.5	475.7	35.7	56.2	96.2
Stephen Creek	0.2	7.2	0.5	0.8	1.4
Tuckahoe River	0.0	0.1	0.0	0.0	0.0
Watering Race Branch	10.1	357.0	26.8	42.2	72.2
Total	124.8	4,393.9	329.5	519.3	888.8

WHAT CAN WE DO ABOUT IMPERVIOUS SURFACES?

Once impervious surfaces have been identified, there are three steps to better manage these surfaces through green infrastructure practices.

1

Eliminate surfaces that are not necessary. 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 recreation of natural areas that will help reduce flooding, increase wildlife habitat, and positively enhance water quality as well as beautify neighborhoods.

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 cart ways could be converted to one-way cart 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.

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 also exist to harvest rainwater for non-potable uses such as water gardens.

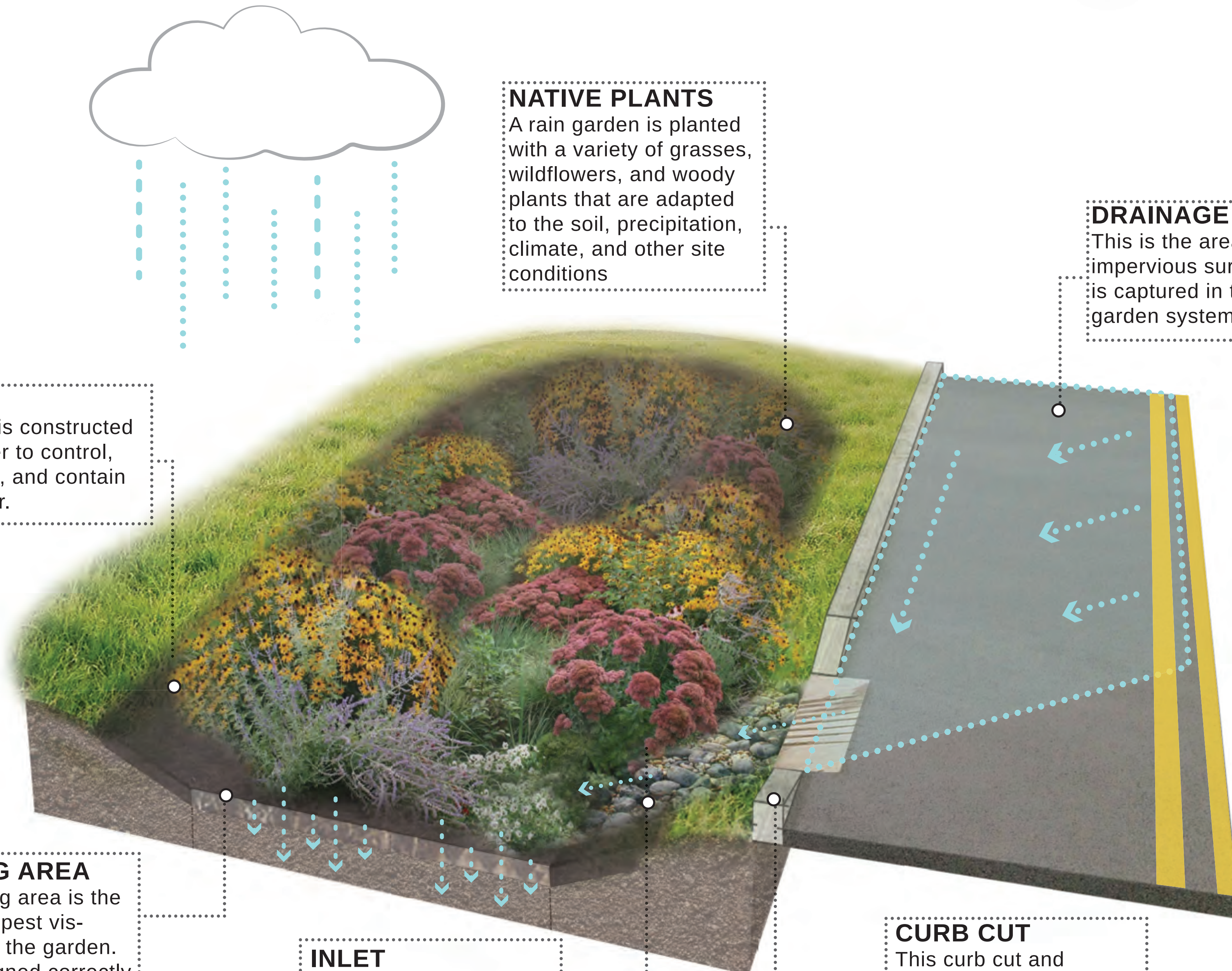

STATE OF
NEW JERSEY
DEPARTMENT OF
ENVIRONMENTAL
PROTECTION

GREEN INFRASTRUCTURE PRACTICES

BIORETENTION SYSTEMS

A rain garden, or bioretention system, is a landscaped, shallow depression that captures, filters, and infiltrates stormwater runoff. The rain garden removes nonpoint source pollutants from stormwater runoff while recharging groundwater. A rain garden serves as a functional system to capture, filter, and infiltrate stormwater runoff at the source while being aesthetically pleasing. Rain gardens are an important tool for communities and neighborhoods to create diverse, attractive landscapes while protecting the health of the natural environment. Rain gardens can also be installed in areas that do not infiltrate by incorporating an underdrain system.

Rain gardens can be implemented throughout communities to begin the process of re-establishing the natural function of the land. Rain gardens offer one of the quickest and easiest methods to reduce runoff and help protect our water resources. Beyond the aesthetic and ecological benefits, rain gardens encourage environmental stewardship and community pride.



NATIVE PLANTS
A rain garden is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions

DRAINAGE AREA
This is the area of impervious surface that is captured in the rain garden system.

BERM
The berm is constructed as a barrier to control, slow down, and contain stormwater.

PONDING AREA
The ponding area is the lowest, deepest visible area of the garden. When designed correctly, this area should drain within 24 hours.

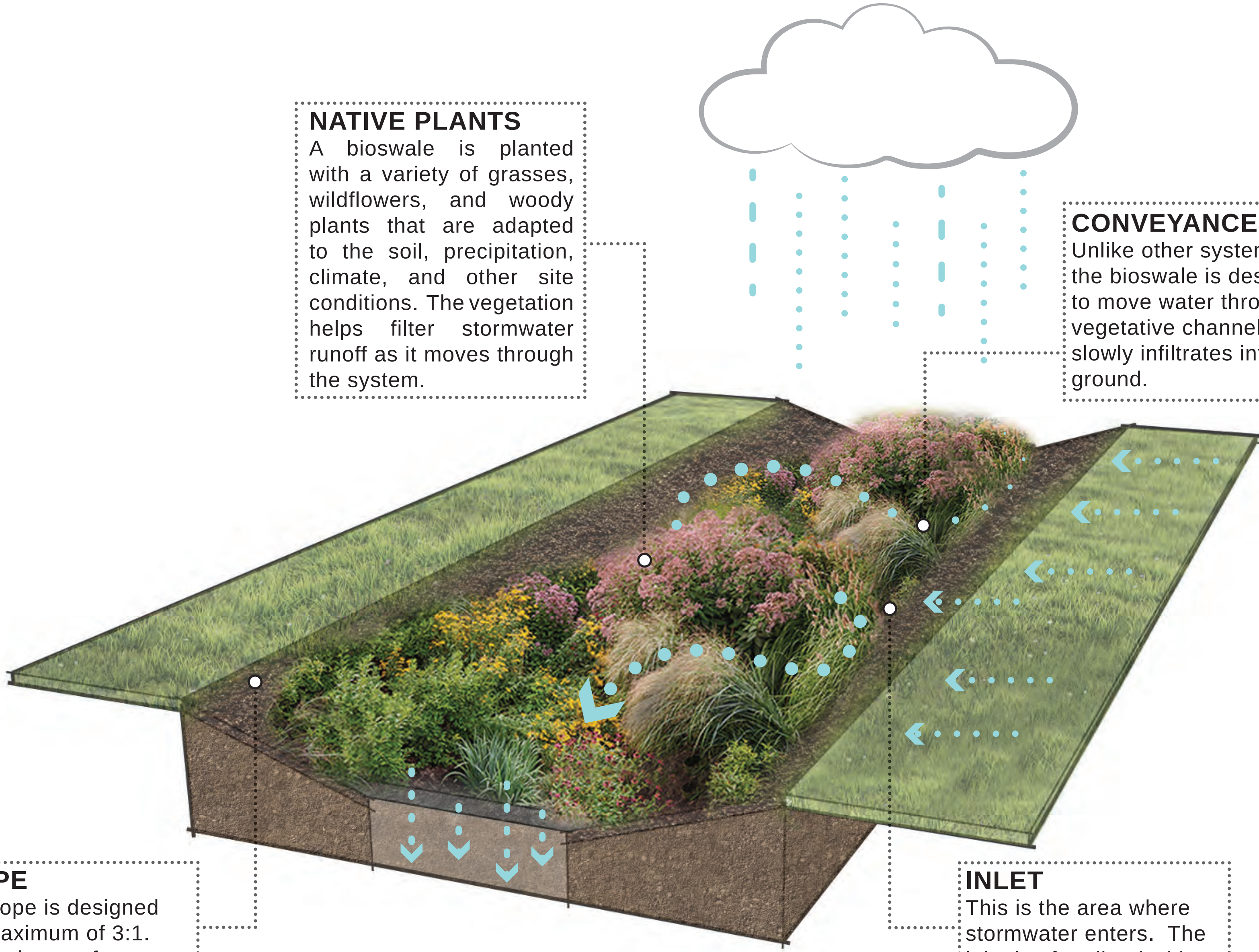
INLET
This is the area where stormwater enters. The inlet is often lined with stone to slow water flow and prevent erosion.

CURB CUT
This curb cut and concrete flow pad are designed to help redirect stormwater runoff to the rain garden system and out of the storm drain.

BIOSWALES

Bioswales are landscape features that convey stormwater from one location to another while removing pollutants and allowing water to infiltrate. Bioswales are often designed for larger scale sites where water needs time to move and slowly infiltrate into the groundwater.

Much like the rain garden systems, bioswales can also be designed with an underdrain pipe that allows excess water to discharge to the nearest catch basin or existing stormwater system.



NATIVE PLANTS

A bioswale is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions. The vegetation helps filter stormwater runoff as it moves through the system.

CONVEYANCE

Unlike other systems, the bioswale is designed to move water through a vegetative channel as it slowly infiltrates into the ground.

SLOPE

The slope is designed at a maximum of 3:1. These slopes often require erosion control blankets for stabilization.

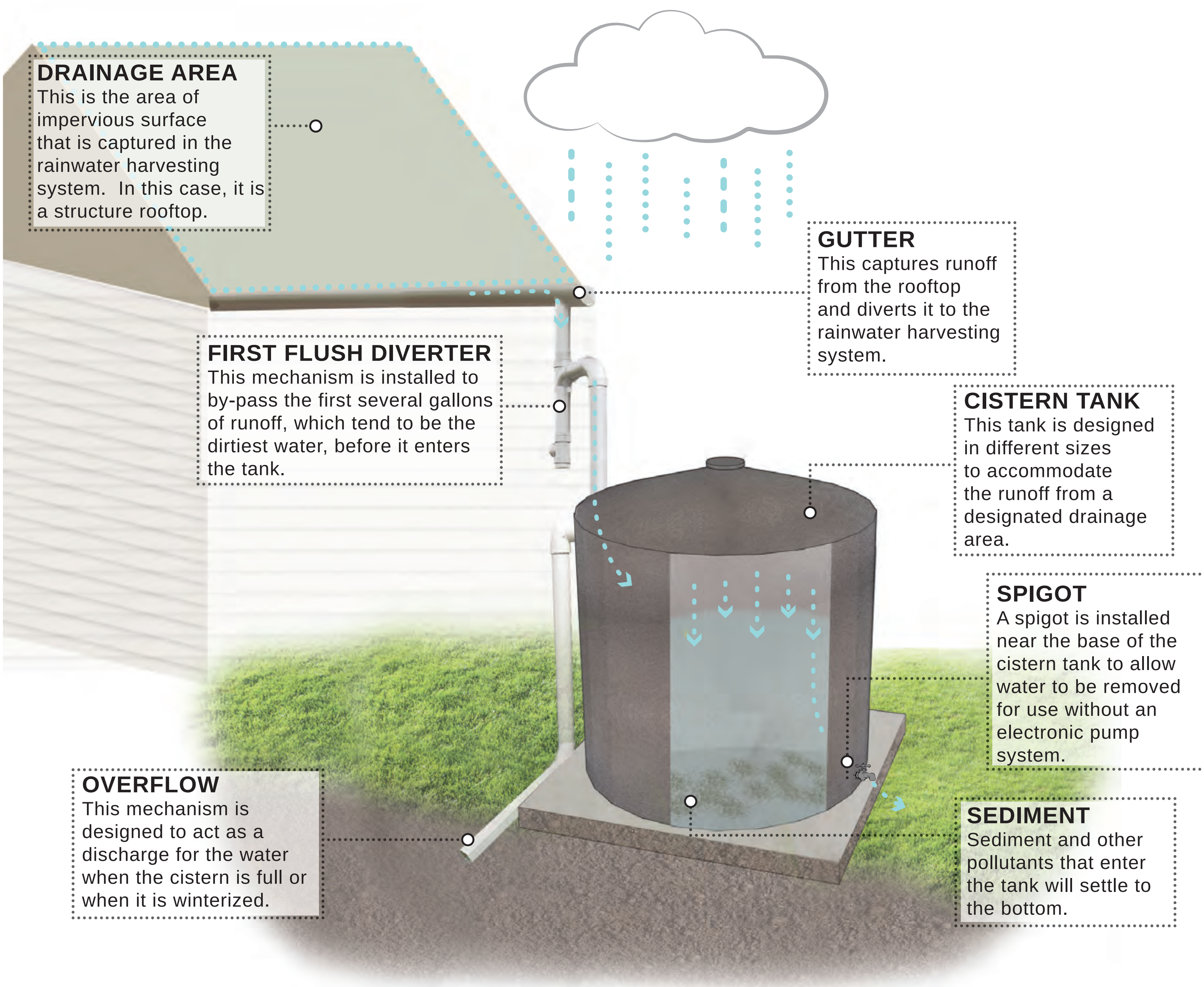
INLET

This is the area where stormwater enters. The inlet is often lined with stone to slow water flow and prevent erosion.

RAINWATER HARVESTING SYSTEMS

These systems capture rainwater, mainly from rooftops, in cisterns or rain barrels. The water can then be used for watering gardens, washing vehicles, or for other non-potable uses.

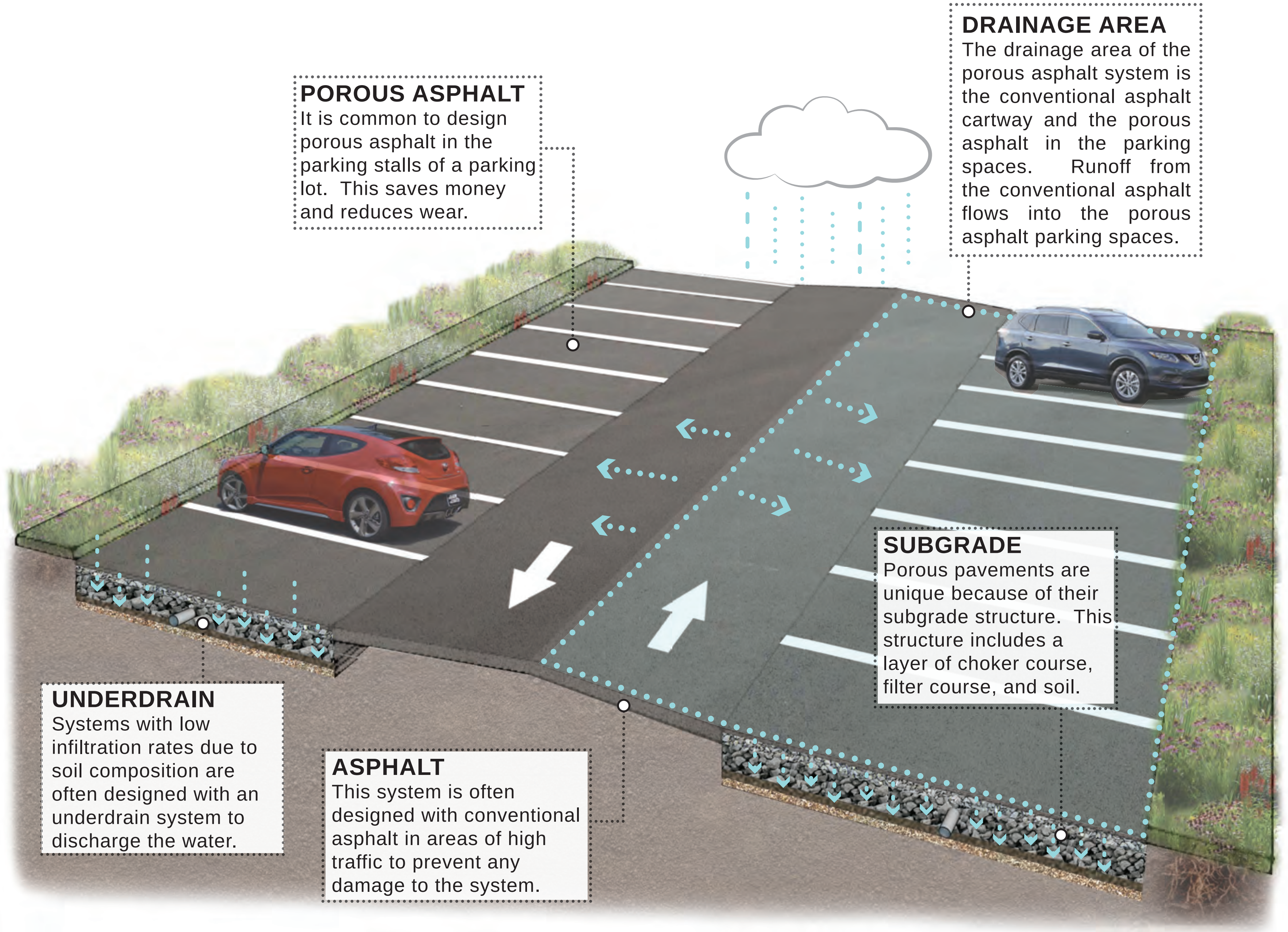
Rainwater harvesting systems come in all shapes and sizes. These systems are good for harvesting rainwater in the spring, summer, and fall but must be winterized during the colder months. Cisterns are winterized, and then their water source is redirected from the cistern back to the original discharge area.


DRAINAGE AREA
This is the area of impervious surface that is captured in the rainwater harvesting system. In this case, it is a structure rooftop.
GUTTER
This captures runoff from the rooftop and diverts it to the rainwater harvesting system.
FIRST FLUSH DIVERTER
This mechanism is installed to by-pass the first several gallons of runoff, which tend to be the dirtiest water, before it enters the tank.
CISTERN TANK
This tank is designed in different sizes to accommodate the runoff from a designated drainage area.
SPIGOT
A spigot is installed near the base of the cistern tank to allow water to be removed for use without an electronic pump system.
OVERFLOW
This mechanism is designed to act as a discharge for the water when the cistern is full or when it is winterized.
SEDIMENT
Sediment and other pollutants that enter the tank will settle to the bottom.

PERMEABLE PAVEMENTS

These surfaces include pervious concrete, porous asphalt, interlocking concrete pavers, and grid pavers. 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. They have an underlying stone layer to store stormwater runoff and allow it to slowly seep into the ground.

By installing an underdrain system, these systems can be used in areas where infiltration is limited. The permeable pavement system will still filter pollutants and provide storage but will not infiltrate the runoff.



POROUS ASPHALT
It is common to design porous asphalt in the parking stalls of a parking lot. This saves money and reduces wear.
DRAINAGE AREA
The drainage area of the porous asphalt system is the conventional asphalt cartway and the porous asphalt in the parking spaces. Runoff from the conventional asphalt flows into the porous asphalt parking spaces.
SUBGRADE
Porous pavements are unique because of their subgrade structure. This structure includes a layer of choker course, filter course, and soil.
UNDERDRAIN
Systems with low infiltration rates due to soil composition are often designed with an underdrain system to discharge the water.
ASPHALT
This system is often designed with conventional asphalt in areas of high traffic to prevent any damage to the system.

DOWNSPOUT PLANTER BOXES

Downspout planter boxes are wooden or concrete boxes with plants installed at the base of the downspout that provide an opportunity to beneficially reuse rooftop runoff. Although small, these systems have some capacity to store rooftop runoff during rainfall events and release it slowly back into the storm sewer system through an overflow.

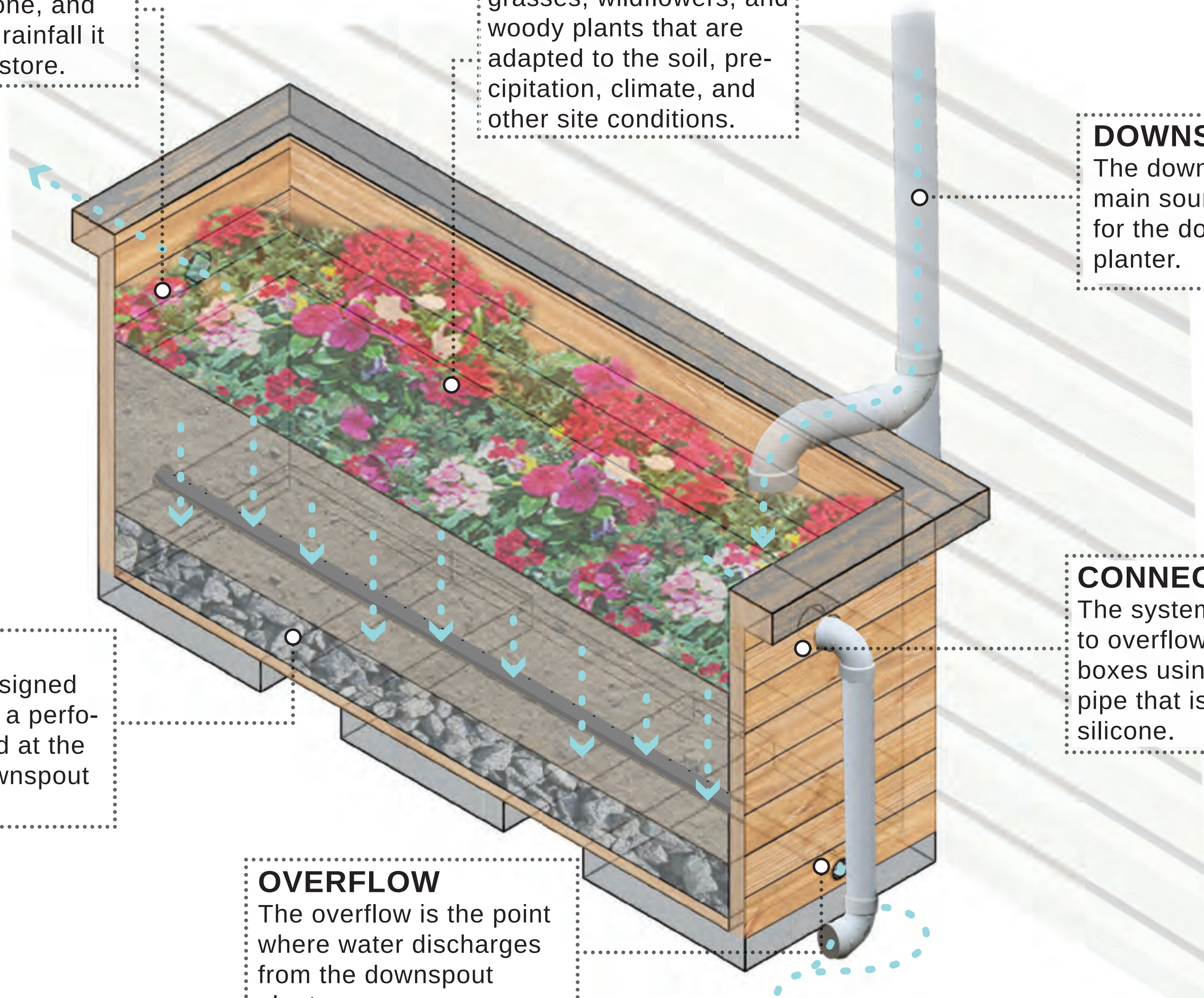
Most often, downspout planter boxes are a reliable green infrastructure practice used to provide some rainfall storage and aesthetic value for property.

PLANTER BOXES

The downspout planter box can be wooden or concrete. However, all boxes must be reinforced to hold soil, stone, and the quantity of rainfall it is designed to store.

NATIVE PLANTS

A downspout planter is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions.



DOWNSPOUT

The downspout is the main source of water for the downspout planter.

CONNECTION

The system is designed to overflow into adjacent boxes using a connecting pipe that is sealed with silicone.

SUBGRADE

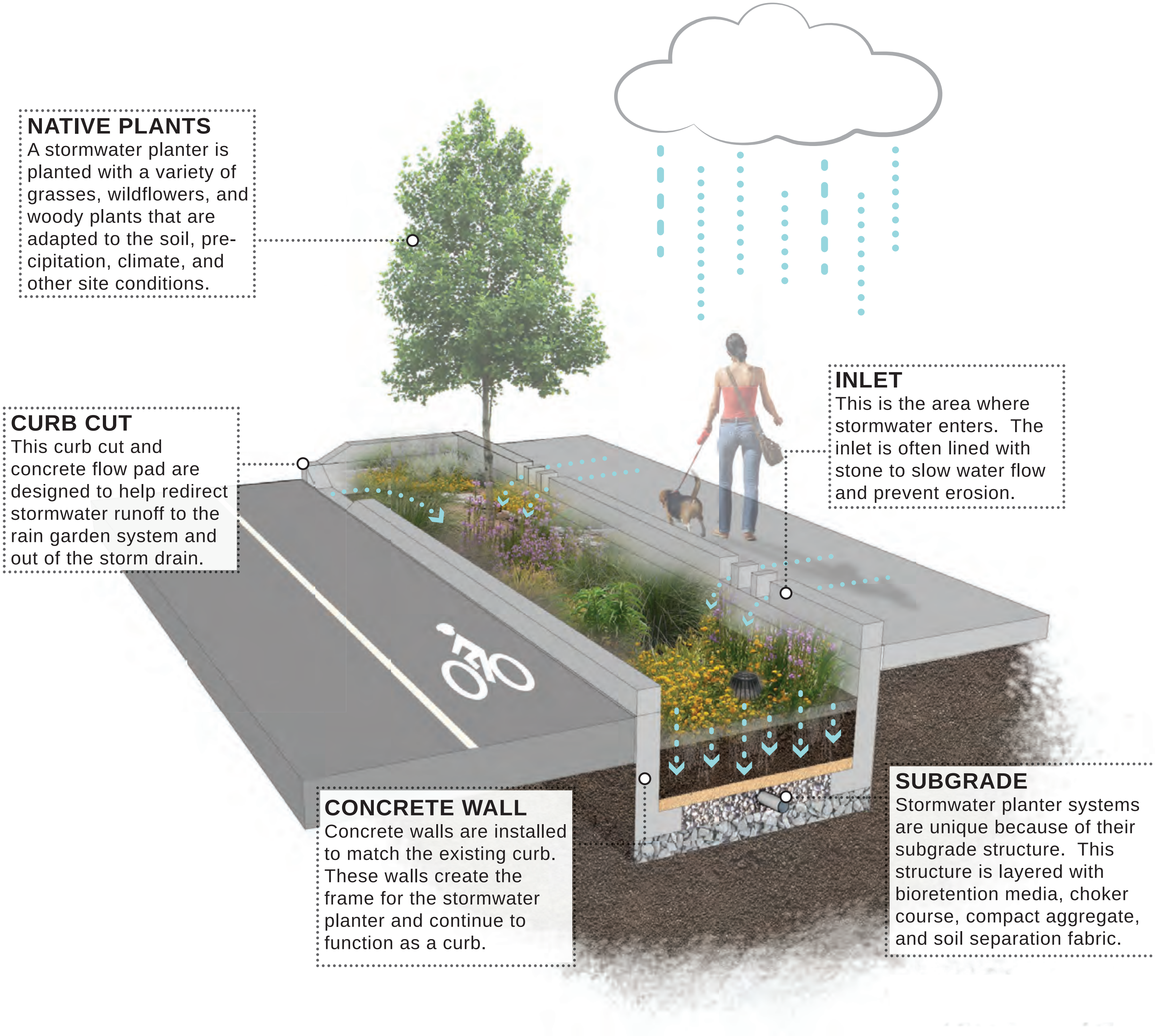
The system is designed to overflow using a perforated pipe located at the bottom of the downspout planter box.

OVERFLOW

The overflow is the point where water discharges from the downspout planter.

STORMWATER PLANTERS

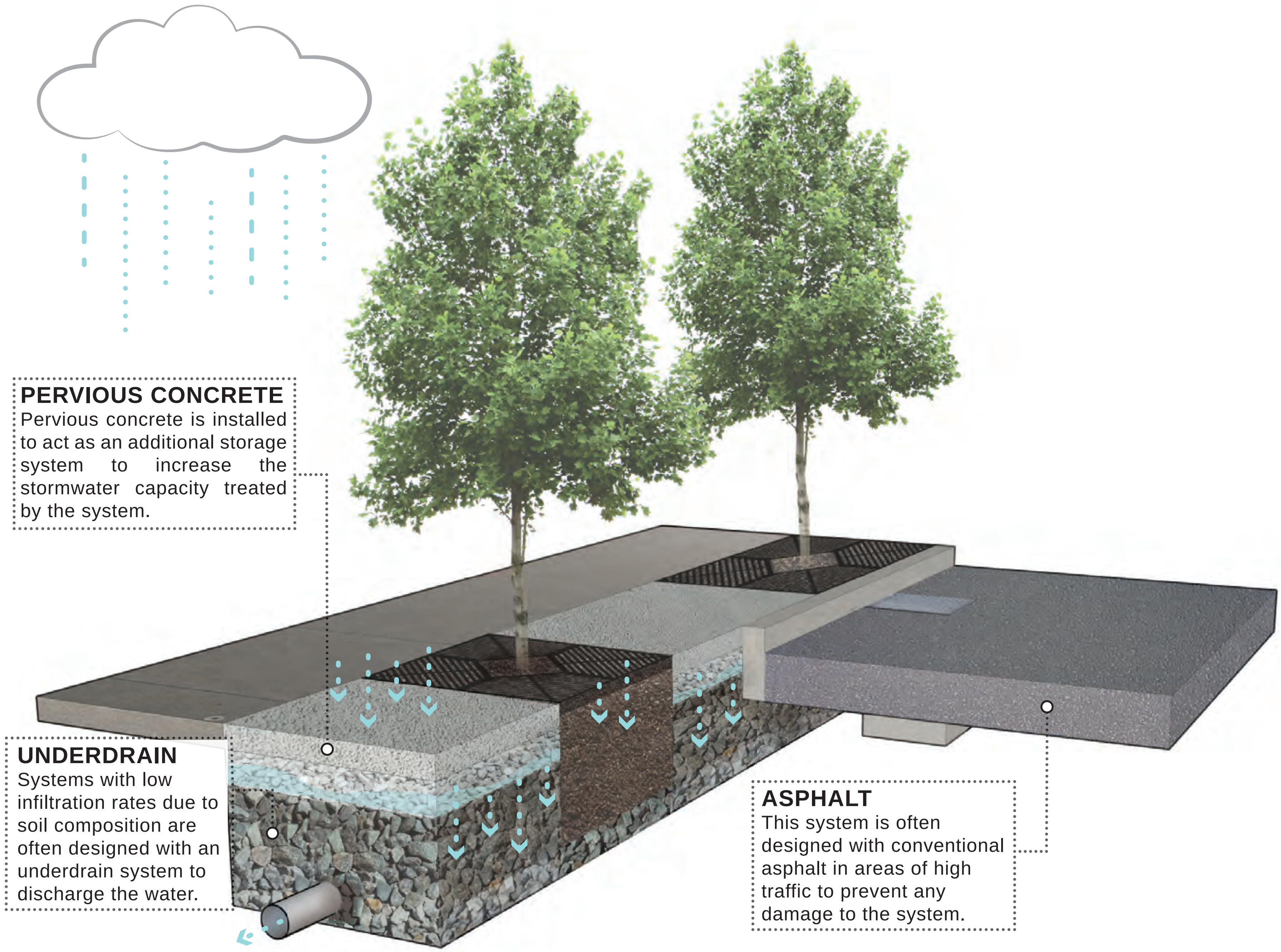
Stormwater planters are vegetated structures that are built into the sidewalk to intercept stormwater runoff from the roadway or sidewalk. Stormwater planters, like rain gardens, are a type of bioretention system. This means many of these planters are designed to allow the water to infiltrate into the ground. However, some are designed simply to filter the water and convey it back into the storm sewer system via an underdrain system.


NATIVE PLANTS
A stormwater planter is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions.
CURB CUT
This curb cut and concrete flow pad are designed to help redirect stormwater runoff to the rain garden system and out of the storm drain.
INLET
This is the area where stormwater enters. The inlet is often lined with stone to slow water flow and prevent erosion.
CONCRETE WALL
Concrete walls are installed to match the existing curb. These walls create the frame for the stormwater planter and continue to function as a curb.
SUBGRADE
Stormwater planter systems are unique because of their subgrade structure. This structure is layered with bioretention media, choker course, compact aggregate, and soil separation fabric.

TREE FILTER BOXES

Tree filter boxes can be pre-manufactured concrete boxes or enhanced tree pits that contain a special soil mix and are planted with a tree or shrub. They filter stormwater runoff but provide little storage capacity. They are typically designed to quickly filter stormwater and then discharge it to the local storm sewer system.

Often tree filter boxes are incorporated into streetscape systems that include an underlying stormwater system which connects several boxes (as shown on the next page). This is also coupled with pervious concrete to increase the storage capacity for rainwater into the system.



PERVIOUS CONCRETE
Pervious concrete is installed to act as an additional storage system to increase the stormwater capacity treated by the system.
UNDERDRAIN
Systems with low infiltration rates due to soil composition are often designed with an underdrain system to discharge the water.
ASPHALT
This system is often designed with conventional asphalt in areas of high traffic to prevent any damage to the system.


STATE OF
NEW JERSEY
DEPARTMENT OF
ENVIRONMENTAL
PROTECTION

GREEN INFRASTRUCTURE IN HAMILTON TOWNSHIP

SITE SELECTION & METHODOLOGY

TABLE 1. AERIAL LOADING COEFFICIENTS

Land Cover	Total Phosphorus (lbs/acre/yr)	Total Nitrogen (lbs/acre/yr)	Total Suspended Solids (lbs/acre/yr)
High, Medium Density Residential	1.4	15	140
Low Density, Rural Residential	0.6	5	100
Commercial	2.1	22	200
Industrial	1.5	16	200
Urban, Mixed Urban, Other Urban	1.0	10	120
Agriculture	1.3	10	300
Forest, Water, Wetlands	0.1	3	40
Barrenland/ Transitional Area	0.5	5	60

A collection of sites has been identified in Hamilton Township based on site visibility, feasibility, cost-effectiveness, and potential partnerships. The RCE Water Resources Program uses a "look here first" method to identify the most accessible and visible sites. These sites include: schools, churches, libraries, municipal buildings, public works, firehouses, post offices, social clubs such as the Elks or Moose lodge, and parks/recreational fields. These sites often have large amounts of impervious cover and typically are relatively easy to engage in implementing green infrastructure practices. Sites are selected based on their feasibility or the ability to get the project in the ground. This criteria is based on property ownership and ability to do maintenance. In addition, potential partnerships related to the site help make a project feasible.

Initially, aerial imagery was used to identify potential project sites that contain extensive impervious cover. Field visits were then conducted at each of these potential project sites to determine if a viable option exists to reduce impervious cover or to disconnect impervious surfaces from draining directly to the local waterway or storm sewer system. During the site visit, appropriate green infrastructure practices for the site were determined.

For each potential project site, specific aerial loading coefficients for commercial land use were used to determine the annual runoff loads for total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS) from impervious surfaces (Table 1). These are the same aerial loading coefficients that NJDEP uses to develop total maximum daily loads (TMDLs) for impaired waterways of the state. The percentage of impervious cover for each site was extracted from the 20125 NJDEP land use/land cover database.

For impervious areas, runoff volumes were determined for the water quality design storm (1.25 inches of rain over two hours) and for the annual rainfall total of 44 inches.

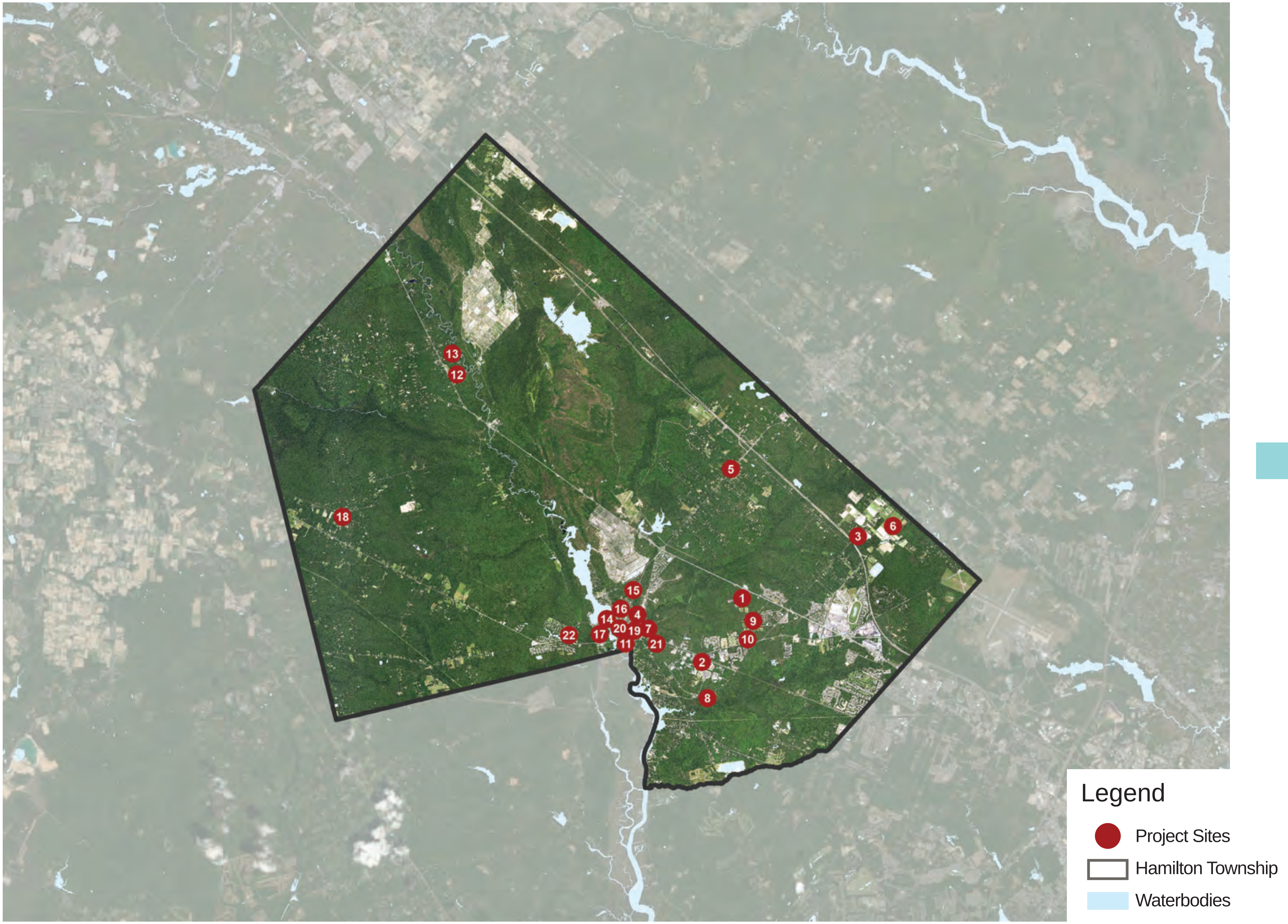
Preliminary soil assessments were conducted for each potential project site identified in Hamilton Township using the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey, which utilizes regional and statewide soil data to predict soil types in an area.

For each potential project site, drainage areas were determined for each of the green infrastructure practices proposed at the site. These green infrastructure practices were designed to manage the 2-year design storm, enabling these practices to capture 95% of the annual rainfall. Runoff volumes were calculated for each proposed green infrastructure practice. The reduction in TSS loading was calculated for each drainage area for each proposed green infrastructure practice using the aerial loading coefficients in Table 1. The maximum volume reduction in stormwater runoff for each green infrastructure practice for a storm was determined by calculating the volume of runoff captured from the 2-year design storm. For each green infrastructure practice, peak discharge reduction potential was determined through hydrologic modeling in HydroCAD. For each green infrastructure practice, a cost estimate is provided. These costs are based upon the square footage of the green infrastructure practice and the real cost of green infrastructure practice implementation in New Jersey.

POTENTIAL PROJECT SITES WITHIN STUDY AREA

Site	Name	Address	Page #
1	Atlantic Cape Community College	5100 East Black Horse Pike, Mays Landing, NJ 08330	40
2	Atlantic County Institute of Technology & Special Services School District	4805 Nawakwa Boulevard, Mays Landing, NJ 08330	42
3	Cologne Volunteer Fire Company: Station 18-5*	2870 South Cologne Avenue, Mays Landing, NJ 08330	44
4	Joseph Shaner Elementary School	5801 3rd Street, Mays Landing, NJ 08330	48
5	Laureldale Volunteer Fire and Rescue Company	2657 NJ-50, Mays Landing, NJ 08330	50
6	Liepzig Avenue Park	3155 South Leipzig Avenue, Mays Landing, NJ 08330	52
7	Underhill Park	129 Old Egg Harbor Avenue, Mays Landing, NJ 08330	54
8	George L. Hess Educational Complex	700 Babcock Road, Mays Landing, NJ 08330	56
9	Oakcrest High School	1824 Dr. Dennis Forman Drive, Mays Landing, NJ 08330	58
10	William Davies Middle School*	1876 Dr. Dennis Forman Drive, Mays Landing, NJ 08330	60
11	Atlantic County Library Mays Landing Branch	40 Farragut Avenue, Mays Landing, NJ 08330	64
12	Cherry Lane Right of Way	2032 Cherry Lane, Mays Landing, NJ08330	66
13	Driftwood Lane Right of Way	7344 Driftwood Lane, Mays Landing, NJ08330	68
14	First Methodist Church of Mays Landing	6011 Main Street, Mays Landing, NJ 08330	70
15	Hamilton Township Municipal Building*	6101 13th Street, Mays Landing, NJ 08330	72
16	Hamilton Township Municipal Utilities Authority	6024 Ken Scull Avenue, Mays Landing, NJ 08330	76
17	Mays Landing Fire Department: Station 18-1	6081 Reliance Avenue, Mays Landing, NJ 08330	78
18	Rose Quaterman Park	6925 Railroad Boulevard, Mays Landing, NJ08330	80
19	St. Vincent de Paul Regional School	5809 Main Street, Mays Landing, NJ 08330	82
20	The Presbyterian Church of Mays Landing	6001 Main Street, Mays Landing, NJ 08330	84
21	Township of Hamilton Public Works	5500 Atlantic Avenue, Mays Landing, NJ, 08330	86
22	Atlantic County Office Building	6260 Old Harding Highway, Mays Landing, NJ 08330	88

* Contains a concept design


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Legend
Project Sites
Hamilton Township
Waterbodies

bioretention system

drainage area

property line

2015 Aerial: NJOIT, OGIS

0' 100' 200'

Two rain gardens can be installed near the entrance of Lot 4 to intercept stormwater from the roadways. An existing saturated area near the solar panels can be converted into a rain garden to capture, treat, and infiltrate stormwater runoff from the parking lot and improve drainage. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
21.2	32,192	1.6	16.3	147.8	0.025	0.88

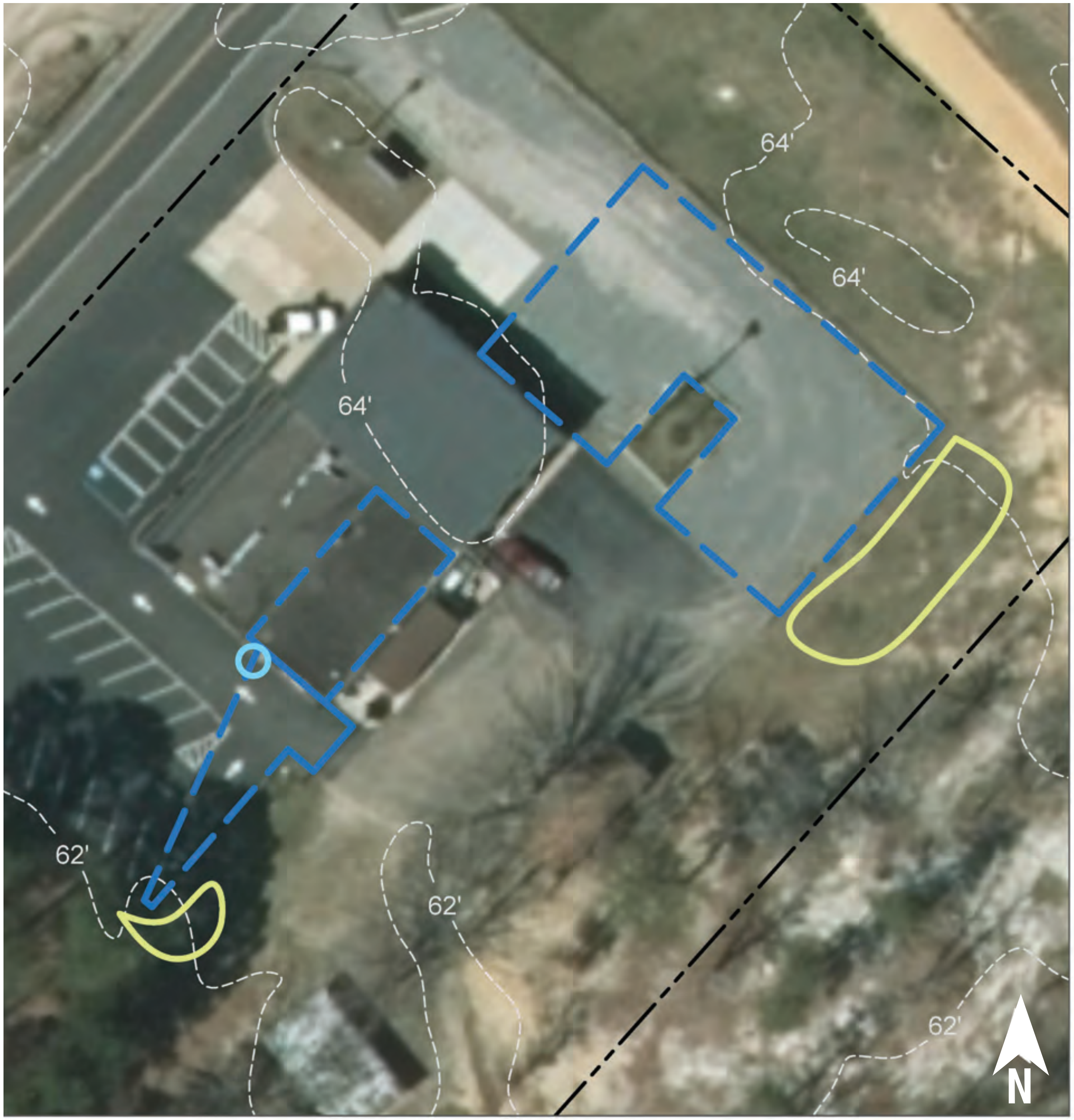
Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.302	51	22,180	0.83	2,900	$14,500


46'
48'
50'50'
52'
52' 54'
56'
58'
50'
52'
54'
48'
46'
44'
46'
42'
56'
N
bioretention system
drainage area
property line
2015 Aerial: NJOIT, OGIS
0'
50'
100'

A bioretention system can be installed in the open green spaces along the sides of the school by the main entrance and flag pole area of the school to capture, treat, and infiltrate stormwater runoff from the school's downspouts. Additionally, bioretention systems can be installed in the open green spaces west of the parking lot to capture, treat, and infiltrate stormwater runoff from the parking lot. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
43	1,603,534	77.3	809.9	7,362.4	1.249	43.98

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.442	74	32,430	1.22	5,355	$26,775



bioretention system
rainwater harvesting
drainage area
property line
2015 Aerial: NJOIT, OGIS

0' 25' 50'

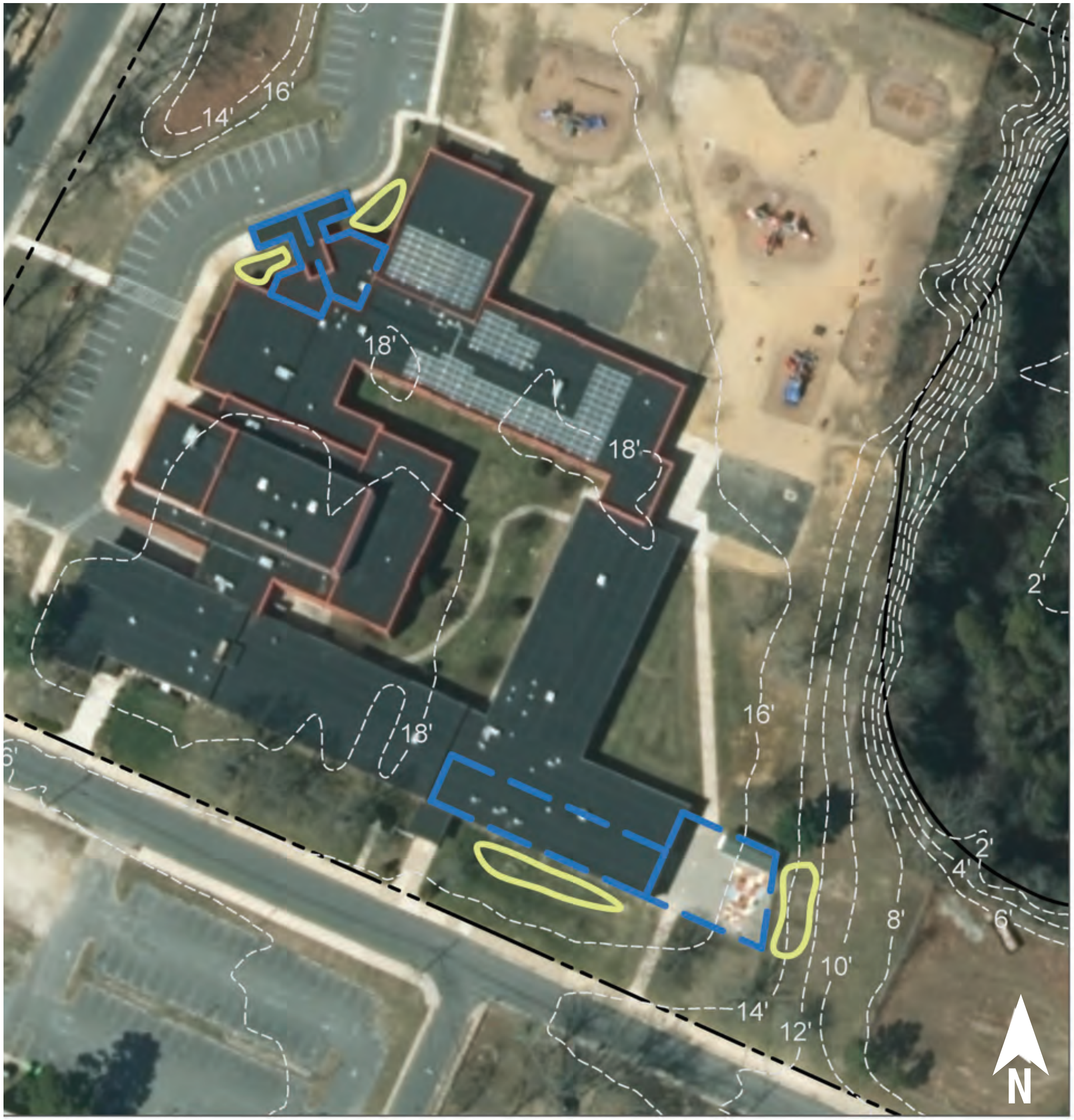
Rain gardens can be installed to intercept stormwater coming from the parking areas at the east and south corners of the site. A cistern can be installed to capture stormwater that can be reused for washing firetrucks or for watering existing landscaping. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
42	48,450	2.3	24.5	222.5	0.038	1.33

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.244	41	17,880	0.67	2,425	$12,125
Rainwater harvesting	0.045	8	1,500	0.06	1,500 (gal)	$3,000

CURRENT CONDITION

CONCEPT DESIGN



bioretention system

drainage area

property line

2015 Aerial: NJOIT, OGIS

Several rain gardens can be installed around the school by redirecting downspouts into them. This will allow treatment and infiltration of stormwater runoff and can also serve as an educational opportunity for students. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
46	187,726	9.1	94.8	861.9	0.146	5.15

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.284	47	20,810	0.78	2,730	$13,650

bioretention system
rainwater harvesting
drainage area
property line
2015 Aerial: NJOIT, OGIS

0' 25' 50'



Several rain gardens can be installed around the school by redirecting downspouts into them. This will allow treatment and infiltration of stormwater runoff and can also serve as an educational opportunity for students. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
18	45,153	2.2	22.8	207.3	0.035	1.24

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.148	25	10,850	0.41	1,420	$7,100
Rainwater harvesting	0.027	5	850	0.03	850 (gal)	$1,700

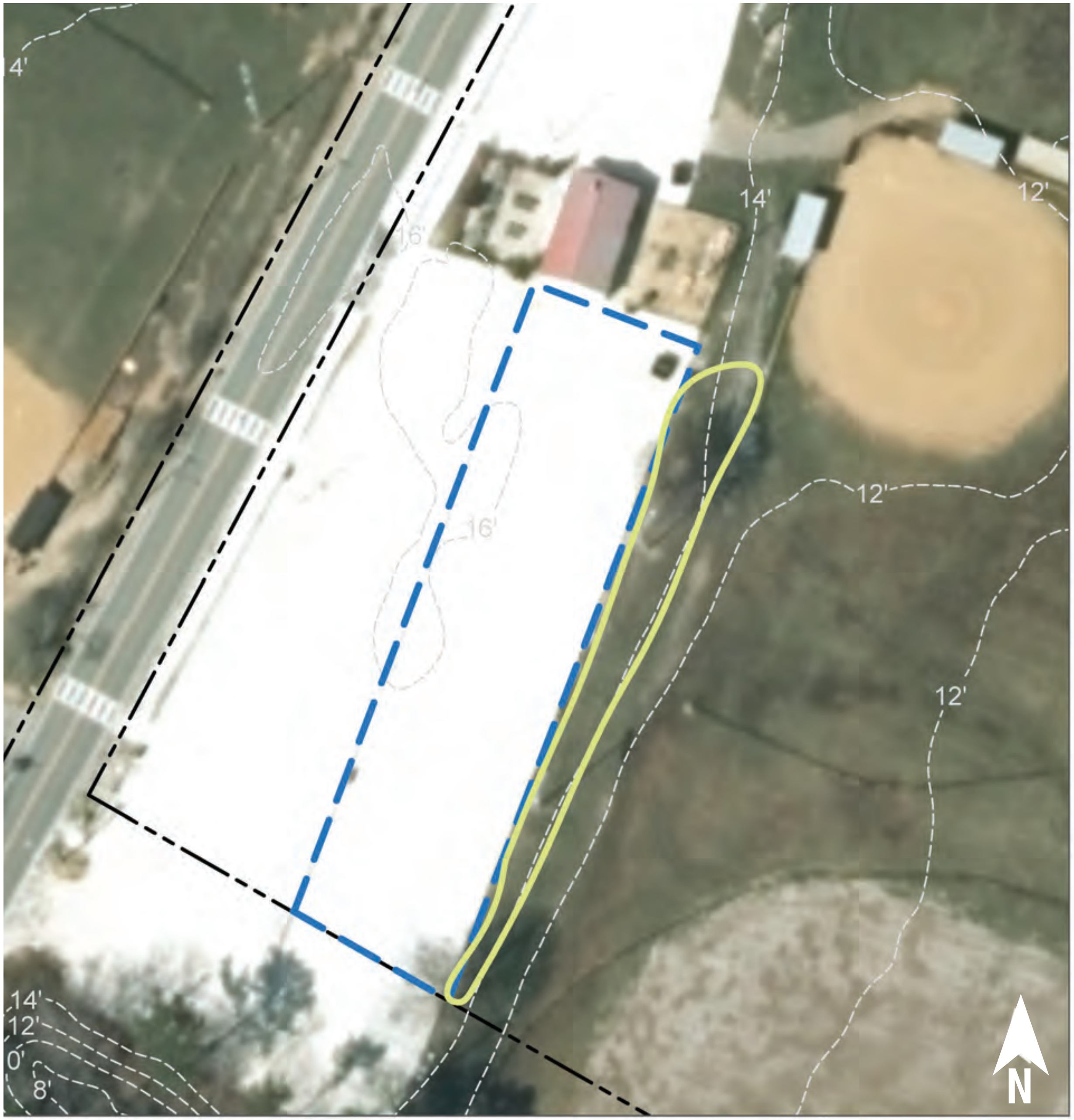
bioretention system
pervious pavement
drainage area
property line
2015 Aerial: NJOIT, OGIS

0' 50' 100'

The pavement along the west edge of the parking lot can be replaced with pervious pavement to capture and infiltrate the stormwater runoff from the parking lot. Bioretention systems can be installed near the entrance on both sides of the road connecting Leipzig Avenue and the parking lot to capture, treat, and infiltrate stormwater runoff from the surrounding area to prevent flooding. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
6	160,261	7.7	80.9	735.8	0.125	4.40

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.177	30	13,000	0.49	1,700	$8,500
Pervious pavement	1.199	201	87,940	3.30	8,000	$200,000



bioretention system

drainage area

property line

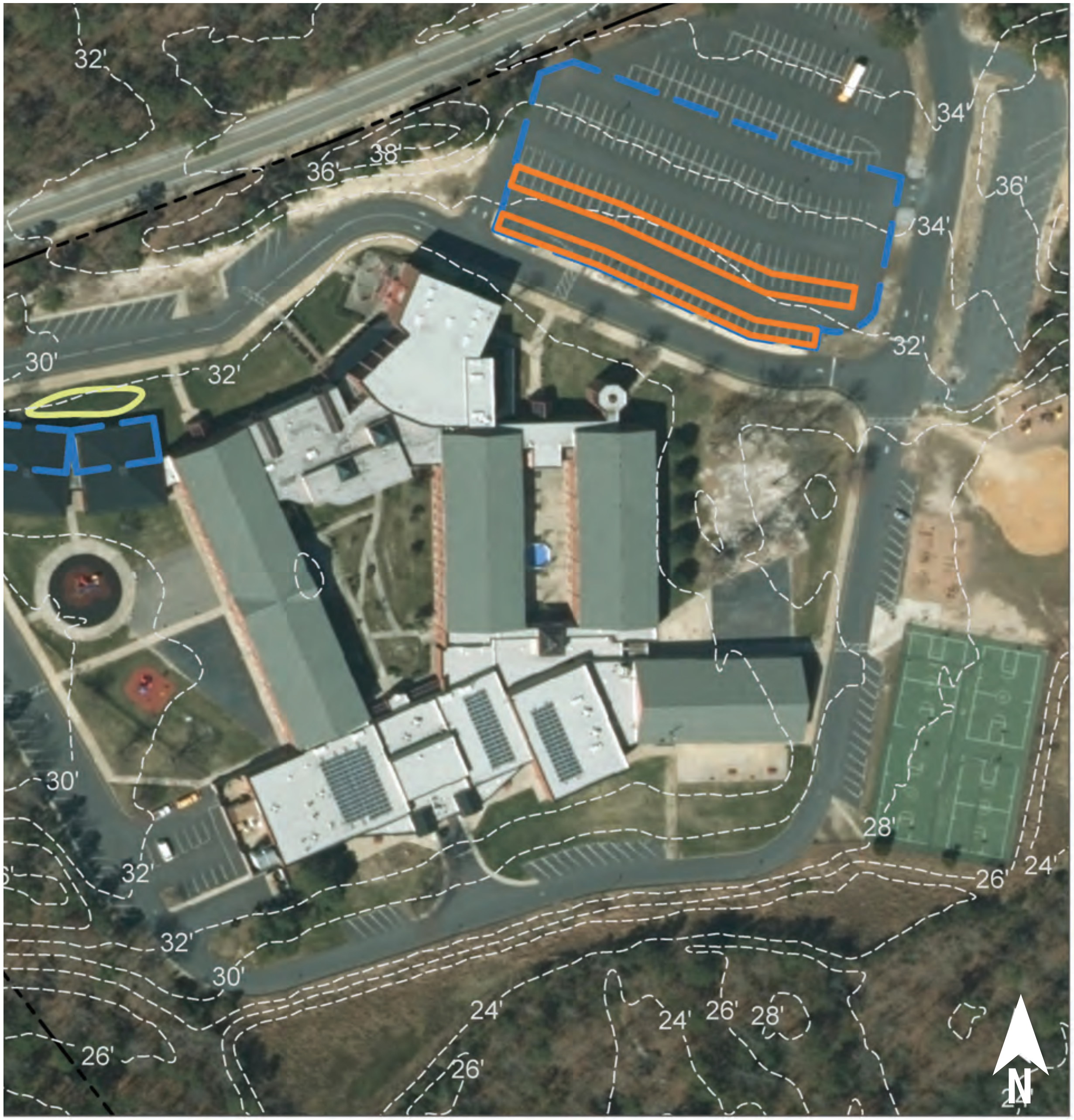
2015 Aerial: NJOIT, OGIS

0' 30' 60'

A bioretention system can be installed to the east of the crushed shell parking lot at the base of the hill but before the baseball field line to capture, treat, and infiltrate stormwater runoff and to help prevent flooding in the baseball field. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
5	148,619	7.2	75.1	682.4	0.116	4.08

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.403	67	29,540	1.11	3,865	$19,325



- bioretention system
- pervious pavement
- drainage area
- property line
- 2015 Aerial: NJOIT, OGIS

0' 75' 150'

A bioretention system can be installed north of the buildings at the northwest corner of the complex to capture, treat, and infiltrate the stormwater runoff from the roof and to prevent that area from flooding. The south end of the parking spaces in the northeast lot can be converted to pervious pavement to capture stormwater from the parking lot area. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
24	548,114	26.4	276.8	2,516.6	0.427	15.03

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.146	24	10,700	0.40	1,400	$7,000
Pervious pavement	1.477	247	108,400	4.07	11,350	$283,750

bioretention system
pervious pavement
drainage area
property line
2015 Aerial: NJOIT, OGIS

A bioretention system can be installed at the northern end of the property in the turfgrass area near an existing outlet pipe to capture, treat, and infiltrate the stormwater runoff from the roof and to help prevent that area from flooding. The south end of the parking spaces in the southeast lot can be converted to pervious pavement to capture stormwater from the parking lot area. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
20	878,994	42.4	443.9	4,035.8	0.685	24.11

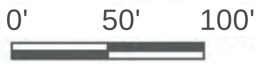
Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.660	111	48,450	1.82	6,335	$31,675
Pervious pavement	2.114	354	155,140	5.83	16,590	$414,750

bioretention system

drainage area

property line

2015 Aerial: NJOIT, OGIS





A bioretention system can be installed in the green space to the west of the property. Another system can be installed next to the garden area and the parking lot at the northwestern edge of the school property. Another system can be installed at the east corner of the school property near the transformer. Another system can be installed along the southeast edge of the school property by the main entrances. All of these systems can be installed to capture, treat, and infiltrate, the stormwater runoff from the nearby road and the downspouts to prevent flooding. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
31	452,709	21.8	228.6	2,078.6	0.353	12.42

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.601	101	44,060	1.66	5,765	$28,825

CURRENT CONDITION

CONCEPT DESIGN

pervious pavement

planter box

drainage area

property line

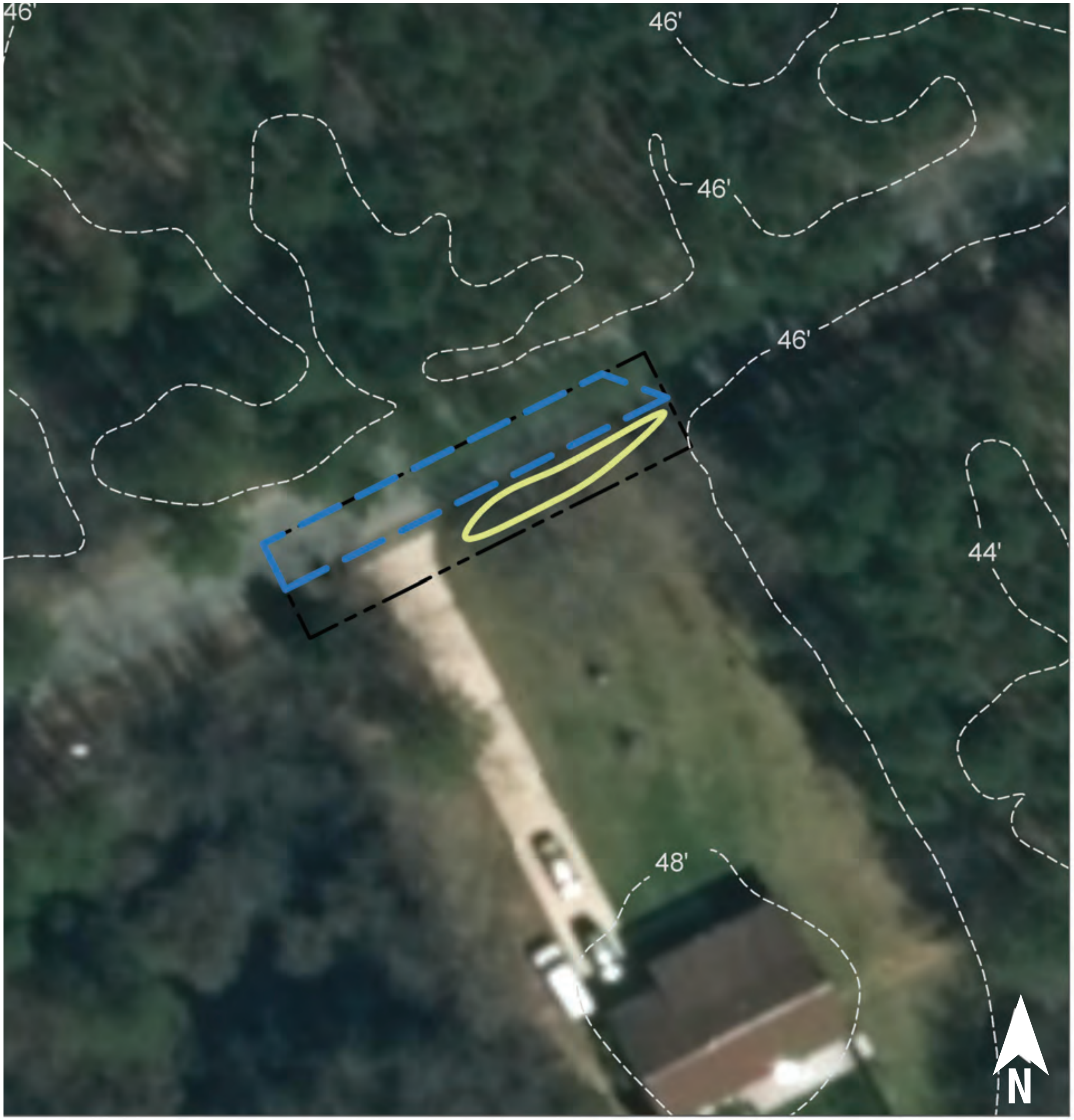
2015 Aerial: NJOIT, OGIS

0' 20' 40'

Parking spaces in the parking lot to the south of the building can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Additional space west of the building can be converted to capture stormwater from the rooftop. This water can first be partially treated with a series of stormwater planters. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
74	38,048	1.8	19.2	174.7	0.030	1.04

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavement	0.644	108	47,280	1.78	5,500	$137,500
Planter boxes	n/a	3	n/a	n/a	4 (boxes)	$4,000



bioretention system

drainage area

property line

2015 Aerial: NJOIT, OGIS

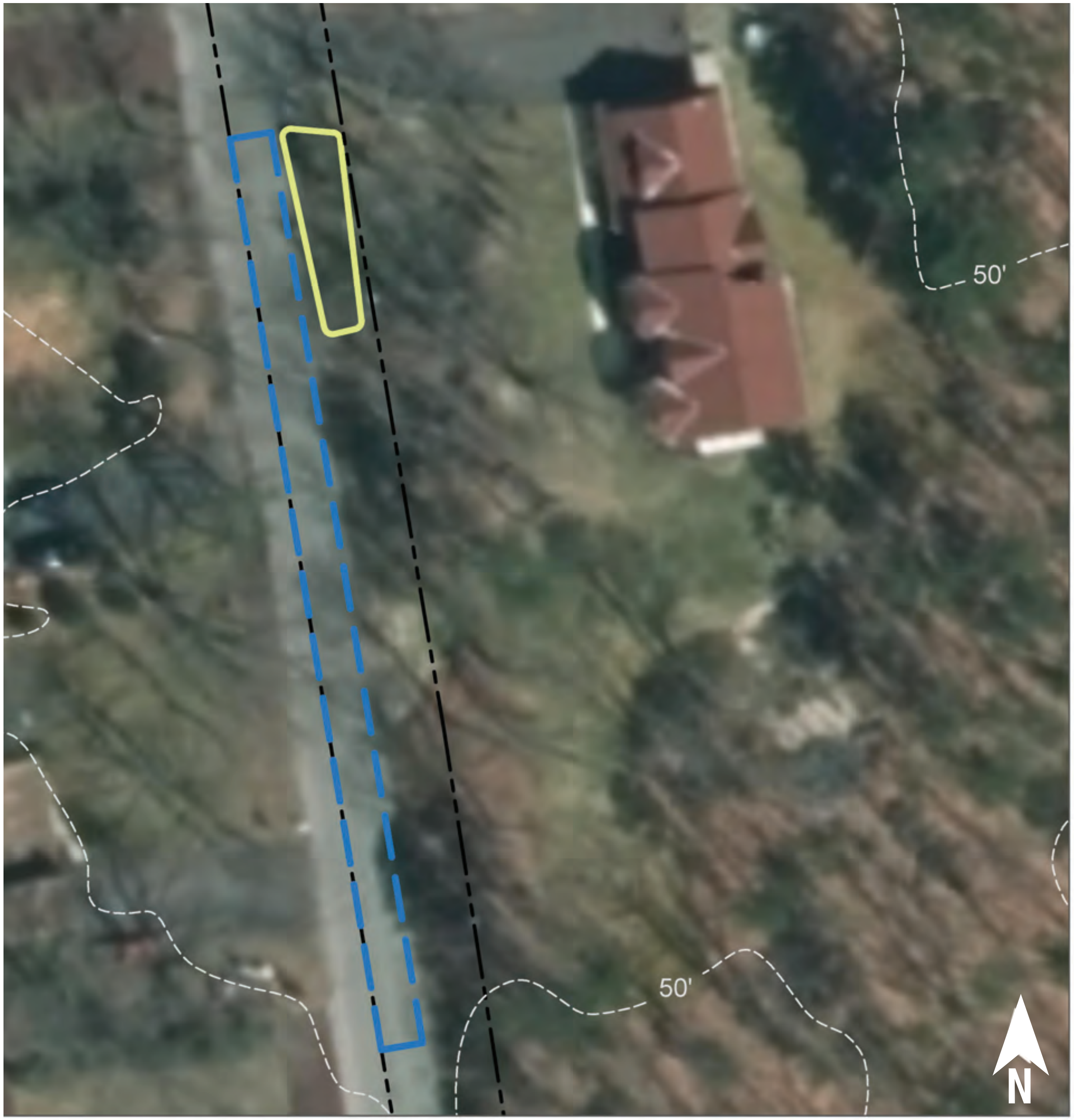
0' 20' 40'



A bioretention system can be installed along Cherry Lane adjacent to the property in the right of way to capture, treat, and infiltrate the stormwater runoff from the roof of the roadway. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
15	371	0.0	0.2	1.7	0.000	0.01

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.030	5	2,200	0.08	290	$1,450



bioretention system

drainage area

property line

2015 Aerial: NJOIT, OGIS

0' 20' 40'

7344 Driftwood Lane
Mays Landing, NJ 08330

A bioretention system can be installed along Driftwood Lane adjacent to the property in the right of way to capture, treat, and infiltrate the stormwater runoff and to prevent the area from flooding. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
13	1,770	0.1	0.9	8.1	0.001	0.05

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.057	10	4,200	0.16	550	$2,750

bioretention system
drainage area
property line
2015 Aerial: NJOIT, OGIS

0' 25' 50'

Several rain gardens can be installed by redirecting downspouts to turfgrass areas to capture, treat, and infiltrate stormwater runoff from the rooftop. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
72	33,528	1.6	16.9	153.9	0.026	0.92

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.085	14	6,220	0.23	815	$4,075

bioretention system

pervious pavement

drainage area

property line

2015 Aerial: NJOIT, OGIS

0' 50' 100'

Parking spaces on the west side of the site can be converted to pervious pavement to capture stormwater from the parking lot. Two rain gardens can be installed along the south end of the building by redirecting downspouts into them to capture stormwater from the rooftop. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
29	155,444	7.5	78.5	713.7	0.121	4.26

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.072	12	5,300	0.20	700	$3,500
Pervious pavement	0.859	144	63,040	2.37	7,290	$182,250

CURRENT CONDITION

CONCEPT DESIGN

bioretention system

drainage area

property line

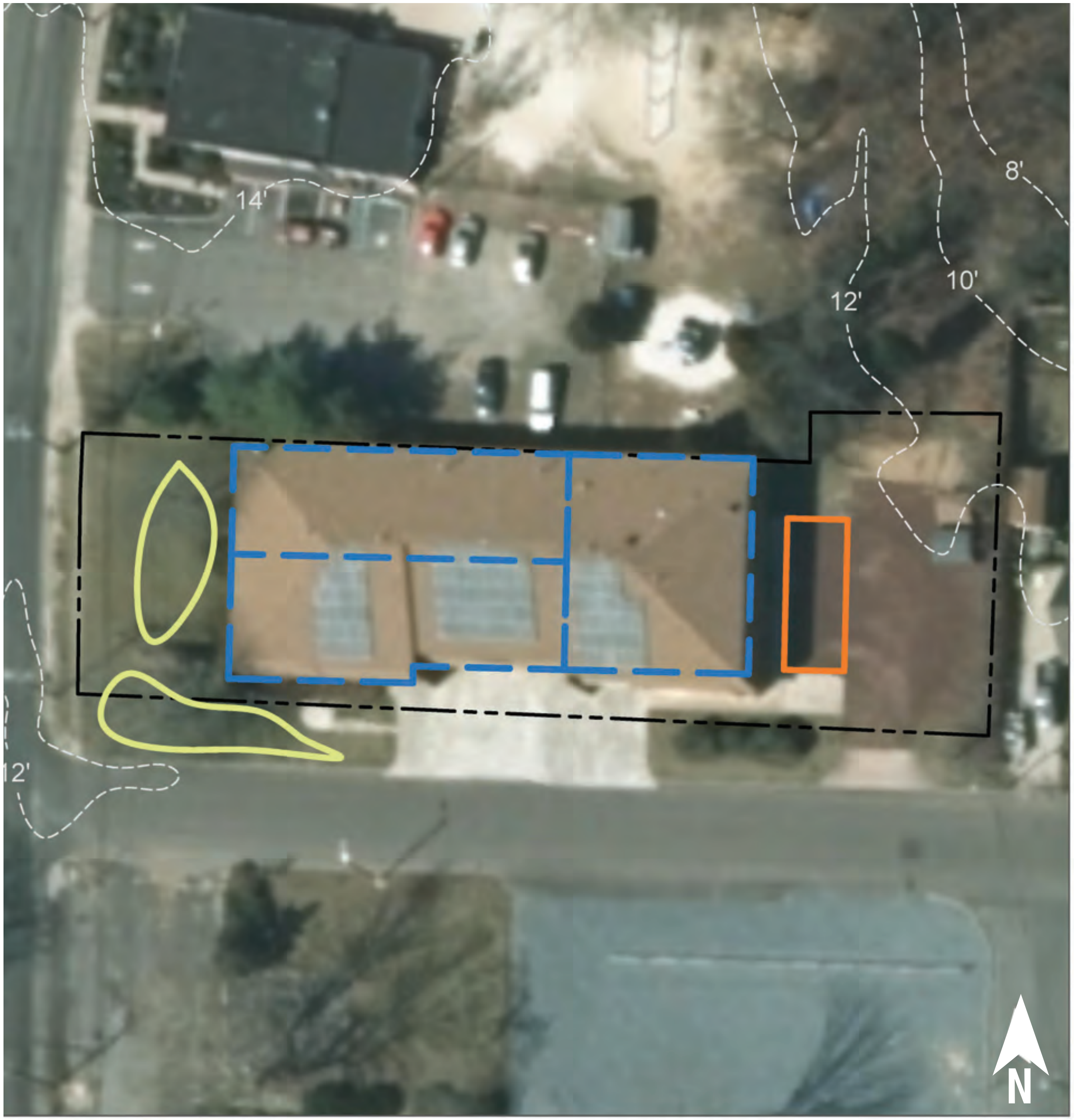
2015 Aerial: NJOIT, OGIS



Two rain gardens can be installed at the southeast end of the building by redirecting downspouts into them to capture, treat, and infiltrate stormwater runoff from the rooftop. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
48	6,958	0.3	3.5	31.9	0.005	0.19

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.051	9	3,730	0.14	500	$2,500



bioretention system

pervious pavement

drainage area

property line

2015 Aerial: NJOIT, OGIS

0' 25' 50'

MAYS LANDING FIRE DEPARTMENT: STATION 18-1

6081 Reliance Avenue
Mays Landing, NJ 08330

Two rain gardens can be installed at the west end of the building by redirecting downspouts into them to capture, treat, and infiltrate stormwater runoff from the rooftop. Parking spaces adjacent to the east face of the building can be retrofitted to pervious pavement to capture stormwater from the rooftop by redirecting downspouts into them. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
70	15,608	0.8	7.9	71.7	0.012	0.43

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.174	29	12,760	0.48	1,670	$8,350
Pervious pavement	0.092	15	6,730	0.25	810	$20,250

bioretention system

drainage area

property line

2015 Aerial: NJOIT, OGIS

0' 25' 50'

A bioretention system can be installed near at the southwest end of the park to capture, treat, and infiltrate stormwater runoff and to help prevent flooding. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
16	9,131	0.4	4.6	41.9	0.007	0.25

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.069	12	5,060	0.19	665	$3,325

bioretention system

planter box

drainage area

property line

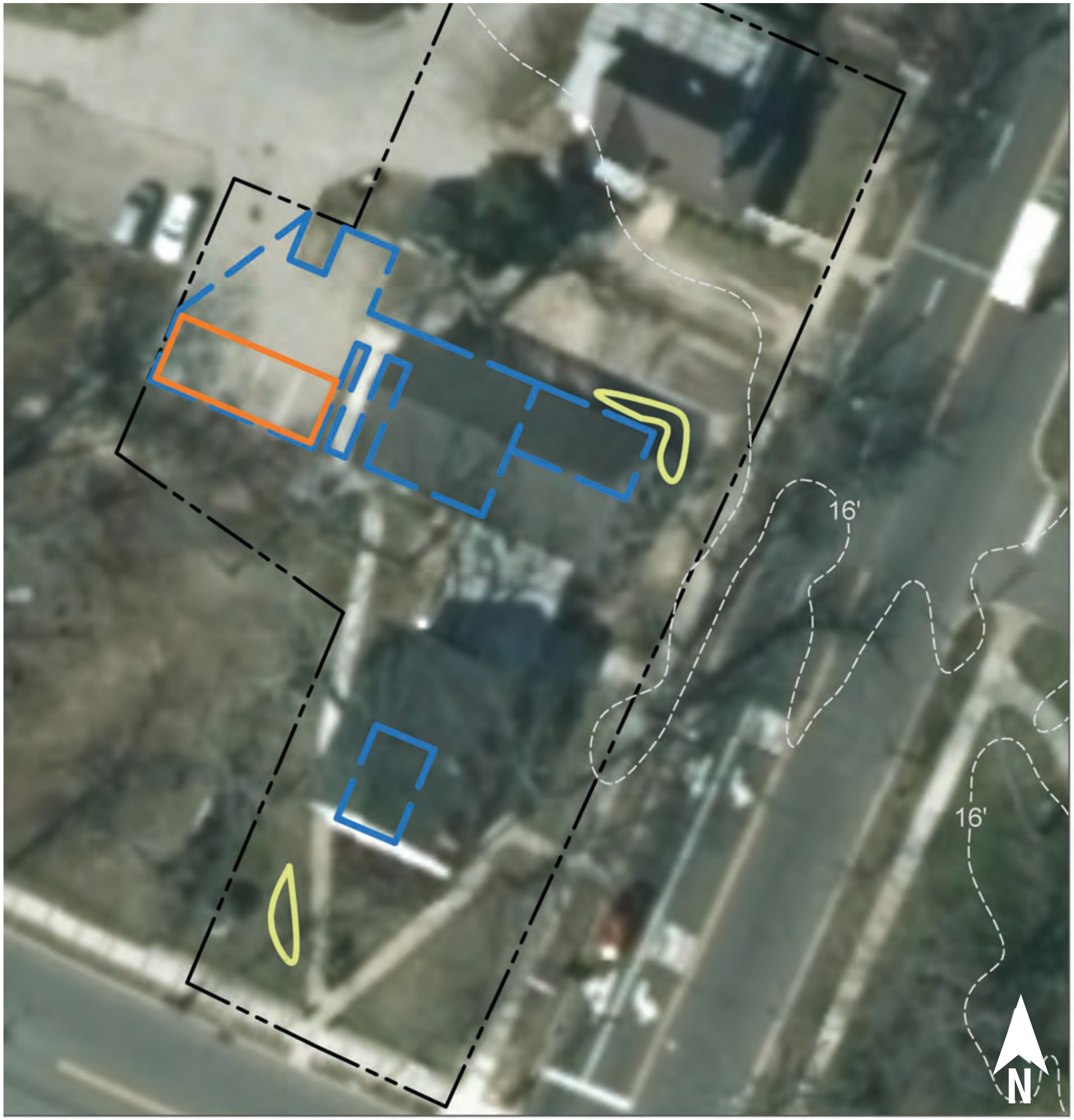
2015 Aerial: NJOIT, OGIS

0' 20' 40'

Two rain gardens can be installed at the south end of the building by redirecting downspouts into them to capture, treat, and infiltrate stormwater runoff from the rooftop. Downspout planter boxes can be installed around the south and west end of the building to filter additional runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
74	69,787	3.4	35.2	320.4	0.054	1.91

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.102	17	7,510	0.28	1,670	$8,350
Planter boxes	n/a	3	n/a	n/a	5 (boxes)	$5,000



bioretention system

pervious pavement

drainage area

property line

2015 Aerial: NJOIT, OGIS

0' 20' 40'



The small parking lot can be converted to pervious pavement that can manage stormwater from both the parking area and the adjacent building by redirecting downspouts towards it. Two rain gardens can be installed at the south and northeast ends of the site by redirecting downspouts into them to capture, treat, and infiltrate stormwater runoff from the rooftop. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
74	19,989	1.0	10.1	91.8	0.016	0.55

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.023	4	1,660	0.06	220	$1,100
Pervious pavement	0.078	13	5,710	0.21	755	$18,875

- bioretention system
- drainage area
- property line
- 2015 Aerial: NJOIT, OGIS

0' 25' 50'

A bioretention system can be installed in the T-shaped green space that separates the two parking lots at the north end of the property to capture, treat, and infiltrate the stormwater runoff from the building by reconfiguring the downspout structure. A second bioretention system can be installed at the north end of the larger building by redirecting the nearby downspouts. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
57	130,970	6.3	66.1	601.3	0.102	3.59

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.108	18	7,940	0.30	790	$3,950

bioretention system
pervious pavement
drainage area
property line
2015 Aerial: NJOIT, OGIS

0' 30' 60'

A bioretention system can be installed at the north end of the site to help manage an area that does not drain properly. A second bioretention system can be installed along the southeast side of the building by redirecting the nearby downspouts. Parking spaces along the east edge of the lot can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
31	52,950	2.6	26.7	243.1	0.041	1.45

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.069	12	5,060	0.19	665	$3,325
Pervious pavement	0.699	117	51,310	1.93	5,185	$129,625

FUNDING STRATEGY, IMPLEMENTATION AGENDA, AND COMMUNITY ENGAGEMENT

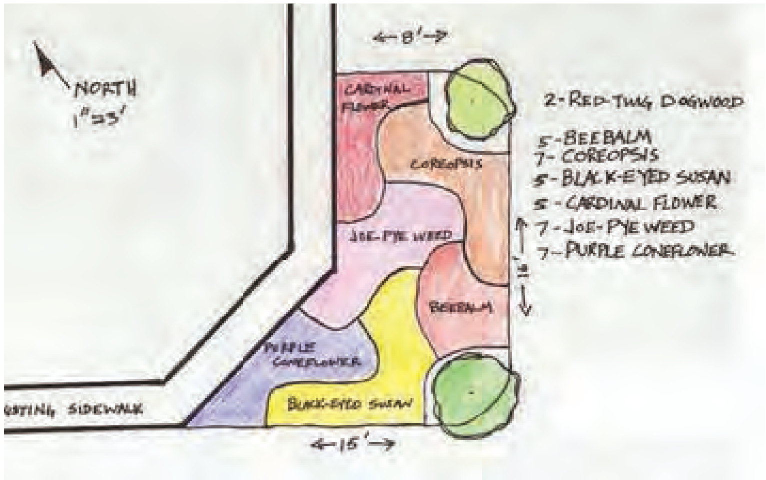
The Sustainable Township of Hamilton Green Team will create a green infrastructure subcommittee that meets monthly to discuss opportunities for projects and coordinate the implementation of projects. The goal is to install five to ten projects per year and possibly increase this number as funding becomes available. Projects can be designed throughout the year with most being installed in the spring, summer, and fall. These are exciting times for Hamilton Township as they hope to be on the forefront of the green infrastructure movement.

FUNDING SOURCES

Hamilton Township is committed to implementing green infrastructure thoroughout the municipality and is currently partnering with the Rutgers Cooperative Extension (RCE) Water Resources Program on a municipal-wide green infrastructure initiative funded through a grant from Sustainable Jersey. A source of funding would be through local, state, and federal grant programs. The NJDEP provides some grant funding for stormwater management projects. Other organizations like the National Fish and Wildlife Foundation, US Environmental Protection Agency, Sustainable Jersey, and ANJEC (Association of New Jersey Environmental Commissions) have also provided grant funding for stormwater management projects in the past. Private foundations could be another source of funding for designing and building green infrastructure projects. The final possible source of funding is the New Jersey Water Bank (formerly known as the Environmental Infrastructure Trust) Financing Program. This program provides low interest loans for water projects.

INCENTIVE PROGRAMS

Hamilton Township may pursue a rain garden rebate program to install rain gardens throughout the municipality. The Sustainable Township of Hamilton Green Team will seek funding for this initiative. As the green infrastructure initiative moves forward, there will be opportuniites to provide additional incentive programs for homeowners and businesses to participate in the effort. As stormwater utilities become a reality in New Jersey, there may also be opportunities to offer incentives to homeowners and businesses to install green infrastructure. A stormwater utility can provide a reduced utility fee to property owners that have installed green infrastructure. A stormwater utility program can also provide direct funding to property owners to install green infrastructure.



POLICY RECOMMENDATIONS

Hamilton Township will update its stormwater management plan and stormwater control ordinance to incorporate green infrastructure requirements for new development. The municipal master plan will also be updated to incorporate green infrastructure recommendations. Hamilton Township's zoning ordinance will be reviewed to determine if barriers to green infrastructure exist. If barriers are uncovered, they will immediately be addressed to encourage the use of green infrastructure when appropriate.

MAINTENANCE AND MONITORING

The municipality's public works department will be trained to maintain all projects installed on public property. As time goes on and more private property owners install green infrastructure systems, these property owners will be held responsible for maintaining their systems. The municipality will provide training sessions for these individuals, and each project will have a maintenance plan.

An annual inspection will be conducted of each green infrastructure project to ensure it is functioning as designed and is maintained on a regular basis. NJDEP provides guidance on maintenance and monitoring of green infrastructure practices. Go to https://www.njstormwater.org/maintenance_guidance.htm or see Appendix B.

RESPONSIBLE PARTIES

Initially, the municipality will be solely responsible for installing and maintaining green infrastructure practices. For each project that is built on non-public property, a memorandum of understanding (MOU) will be established to ensure that each participant understands their role in the implementation. This will include disposal of soil and maintenance of the system.

As the municipal green infrastructure initiative continues to move forward, community engagement will play an important role. Several members of the municipality have attended Rutgers workshops and become Green Infrastructure Champions. These Green Infrastructure Champions can work with the municipality to engage the community to implement green infrastructure practices. Additionally, the Green Infrastructure Champions can reach out to schools within the municipality to discuss rain garden programs for students.

TIME FRAME

The time frame for installation of green infrastructure depends on available resources (i.e., labor and funding). The municipality has committed to installing five to ten projects per year, but this could increase dramatically if an influx of funding becomes available. The policy recommendations will be implemented after NJDEP's passage of the new stormwater management regulations.

SHORT TERM AND LONG TERM GOALS

With the existing municipal impervious cover at 5.2%, Hamilton Township's green infrastructure initiative short-term (i.e., less than five years) impervious cover management goal is to manage stormwater runoff for 10 acres of impervious cover. The long-term goal is to manage 25 acres of impervious surfaces within twenty years. These goals are highly dependent on securing adequate funding for the implementation of green infrastructure projects.


New Jersey TREE
FOUNDATION
TREE
PLANTING

APPENDIX A:
COMMUNITY ENGAGEMENT & EDUCATION

BUILD A RAIN BARREL WORKSHOP

With the *Build a Rain Barrel* workshop, community members participate in a short presentation on stormwater management and water conservation and then learn how to build their own rain barrel. Workshop participants work with trained experts to convert 55 gallon plastic food-grade drums into rain barrels. They are able to take an active role in recycling rainwater by installing a rain barrel at their house! Harvesting rainwater has many benefits including saving water, saving money, and preventing basement flooding. By collecting rainwater, homeowners are helping to reduce flooding and pollution in local waterways. When rainwater flows across hard surfaces like rooftops, driveways, roadways, parking lots, and compacted lawns, it carries pollution to our local waterways. Harvesting the rainwater in a rain barrel is just one of the ways homeowners can reduce the amount of rainwater draining from their property and help reduce neighborhood flooding problems.

STORMWATER MANAGEMENT IN YOUR SCHOOLYARD

The *Stormwater Management in Your Schoolyard* program provides educational lectures, hands-on activities, and community-level outreach for students on the topics of water quality issues and stormwater management practices such as rain gardens and rain barrels. Program objectives include the exploration of various aspects of the natural environment on school grounds, the detailed documentation of findings related to these explorations, and the communication of these findings to the school community. As part of this program, several New Jersey State Core Curriculum Content Standards for science (5.1, 5.3, and 5.4), 21st-century life and careers (9.1, 9.3, and 9.4), and social studies (6.3) are addressed. Every school is unique in its need for stormwater management, so each school's *Stormwater Management in Your Schoolyard* program can be delivered in a variety of ways. This program can be tailored for grades K-8 or 9-12 and can be offered to meet a variety of schedules.

APPENDIX B: MAINTENANCE PROCEDURES

MAINTAINING HAMILTON TOWNSHIP'S GREEN INFRASTRUCTURE SYSTEMS

1. Rain Garden
   Stormwater Planter
   Tree Filter Box

2. Rain Barrel
   Cistern

3. Porous Asphalt
   Underground Detention

RAIN GARDEN / STORMWATER PLANTER / TREE FILTER BOX

Weekly

- Water
- Weed
- Inspect for invasive plants, plant health, excessive sediment, and movement of sediment within the rain garden
- Observe the rain garden during rain events and note any successes (Example of success: stormwater runoff picks up oil and grease from the parking lot, flows through a curb cut, and into a rain garden; the rain garden traps the nonpoint source pollutants before they reach the nearby waterway)

Annually

- Mulch in the spring to retain a 3-inch mulch layer in the garden
- Prune during dormant season to improve plant health
- Remove sediment
- Plant
- Test the soil (every 3 years)
- Harvest plants to use in other parts of the landscape
- Clean debris from gutters connected to rain garden
- Replace materials (such as river rock and landscape fabric) where needed

RAIN BARREL

- Keep screen on top and a garden hose attached to the overflow to prevent mosquitoes; change screen every two years
- Remove debris from screen after storms
- Disconnect the barrel in winter; store inside or outside with a cover
- Clean out with long brush and water/dilute bleach solution (~3%)

CISTERN

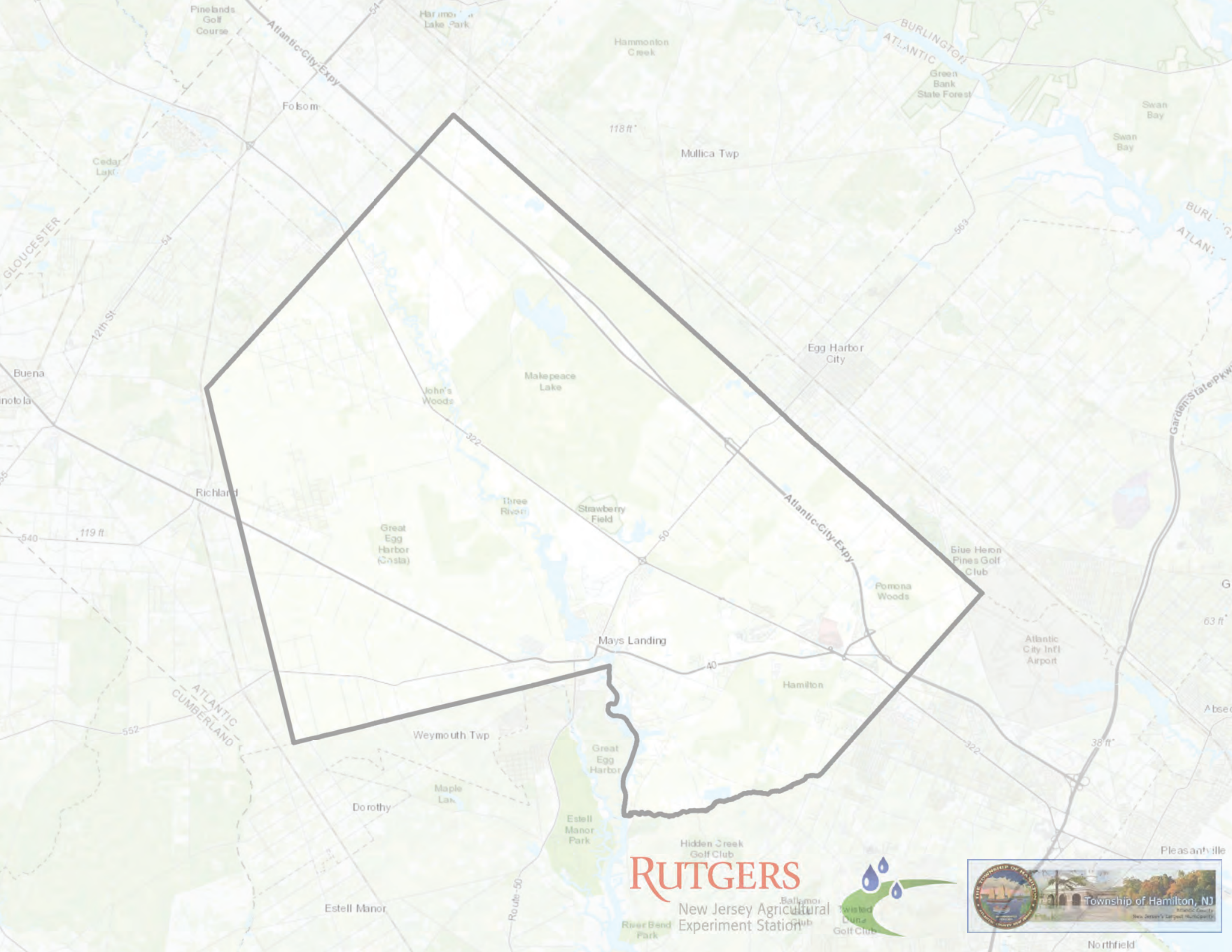
- In the fall prepare your cistern for the winter by diverting flow so no water can enter and freeze within the barrel
- Weekly check: Check for leaks, clogs and other obstructions, holes and vent openings where animals, insects, and rodents may enter; repair leaks with sealant; drain the first flush diverter/ roof washer after every rainfall event
- Monthly check: Check roof and roof catchments to make sure no debris is entering the gutter and downspout directed into the cistern; keep the roof, gutters, and leader inlets clear of leaves; inspect the first flush filter and all of its attachments and make any necessary replacements; inspect cistern cover, screen, overflow pipe, sediment trap and other accessories and make any necessary replacements

POROUS ASPHALT

- Materials cost is ~20-25% more than traditional asphalt
- Long-term maintenance is required by routine quarterly vacuum sweeping
- Sweeping cost may be off-set by reduced deicing costs
- Asphalt repairs can be made with standard asphalt not to exceed 10% of surface area
- Concrete repairs can be made with standard concrete not to exceed 10% of the surface area

UNDERGROUND DETENTION

- Periodic inspections of the inlet and outlet areas to ensure correct operation of system
- Clean materials trapped on grates protecting catch basins and inlet area monthly
- Primary maintenance concerns are removal of floatables that become trapped and removal of accumulating sediments within the system; this should be done at least on an annual basis
- Proprietary traps and filters associated with stormwater storage units should be maintained as recommended by the manufacturer
- Any structural repairs required to inlet and outlet areas should be addressed in a timely manner on an as needed basis
- Local authorities may require annual inspection or require that they carry out inspections and maintenance


Pinelands Golf Course
Atlantic-City-Expy
Hammonton Lake Park
Hammonton Creek
BURLINGTON
ATLANTIC
Green Bank State Forest
Folsom
118 ft
Mullica Twp
Swan Bay
Swan Bay
Cedar Lake
GLOUCESTER
12th St
54
563
Egg Harbor City
Buena
Makepeace Lake
John's Woods
Garden State Pkwy
322
Richland
Three Rivers
Strawberry Field
50
Atlantic-City-Expy
540
119 ft
Great Egg Harbor (Costa)
Blue Heron Pines Golf Club
Pomona Woods
63 ft
Mays Landing
Atlantic City Int'l Airport
40
Hamilton
ATLANTIC
CUMBERLAND
552
Weymouth Twp
Great Egg Harbor
322
38 ft
Maple Lake
Dorothy
Estell Manor Park
Hidden Creek Golf Club
Pleasantville
Route 50
Estell Manor
River Bend Park
Twisted Dune Golf Club
Northfield
RUTGERS
New Jersey Agricultural Experiment Station
Township of Hamilton, NJ