

# GREEN INFRASTRUCTURE STRATEGIC PLAN

FRANKLIN TOWNSHIP  
SOMERSET COUNTY



NFWF



RUTGERS

New Jersey Agricultural  
Experiment Station





## ACKNOWLEDGEMENTS

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# 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, Franklin Township can begin to reduce the negative impacts of stormwater runoff and decrease the pressure on local infrastructure and waterways. This strategic plan is intended to be used as a guide for the community of Franklin 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 Franklin 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?

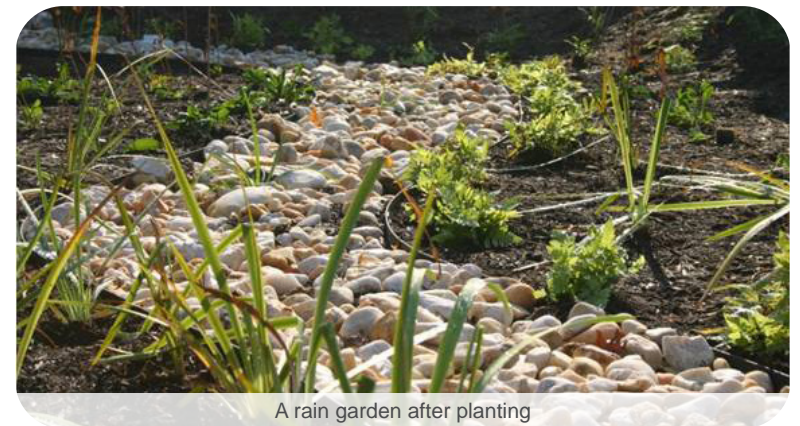
Green infrastructure is an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure projects capture, filter, absorb, and reuse stormwater to maintain or mimic natural systems and to treat runoff as a resource. As a general principle, green 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

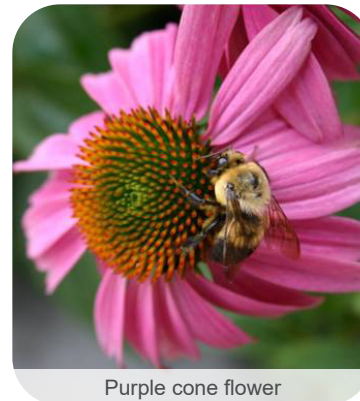
# WHAT IS STORMWATER?

When rainfall hits a surface, it can soak into the surface or flow off the surface. Pervious surfaces are those which allow stormwater to readily soak into the soil and recharge groundwater. An impervious surface is defined as 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. New Jersey faces many problems as a result of stormwater runoff, 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 stormwater 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 flows in our waterways. The increased velocity after storm events erodes stream banks and shorelines, degrading water quality. This erosion can damage local roads and bridges and cause harm to wildlife 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 Schueler (1994), Arnold and Gibbons (1996), and May et al. (1997), there is a significant 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 determined 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 impervious cover 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.





# FRANKLIN TOWNSHIP

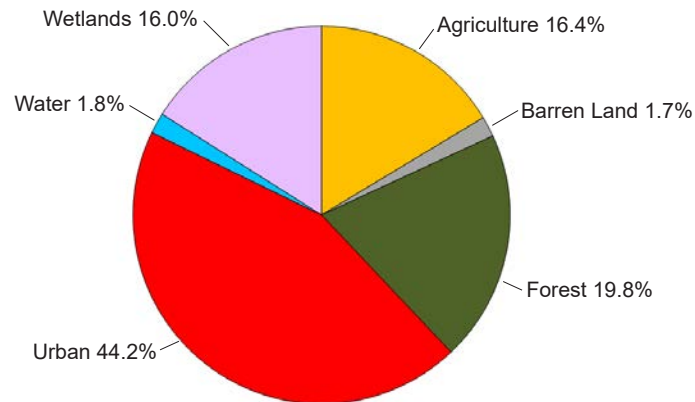
Franklin Township is located in Somerset County. The municipality covers an area totaling about 46.9 square miles and has a population of 22,083 according to the 2010 US Census. Franklin Township shares its northern border with Bound Brook and eastern border with New Brunswick. To the south is the community of Princeton, and to the west is the community of Millstone. 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, Franklin Township can identify cost-effective ways to help mitigate water quality and local flooding issues.



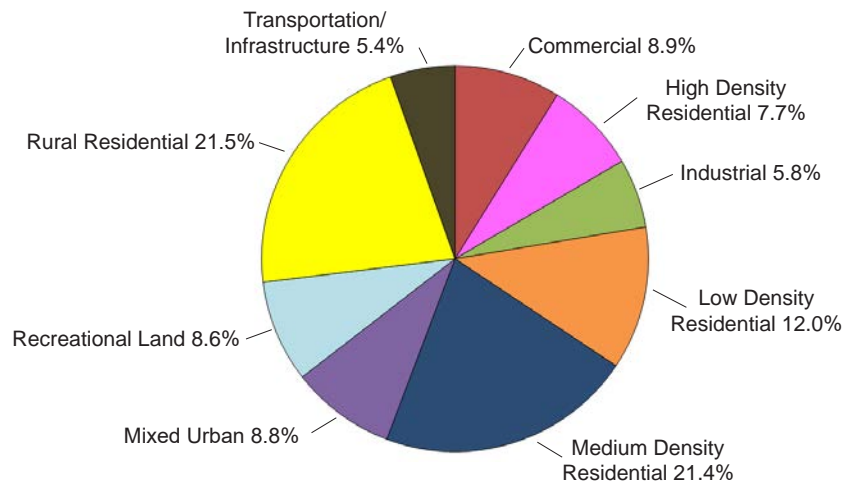
# LAND USE IN FRANKLIN TOWNSHIP

Franklin Township is dominated by urban land uses. A total of 44.2% of the municipality's land use is classified as urban. Of the urban land in Franklin Township, rural residential is the dominant land use. Urban land uses tend to have a high percentage of impervious surfaces.

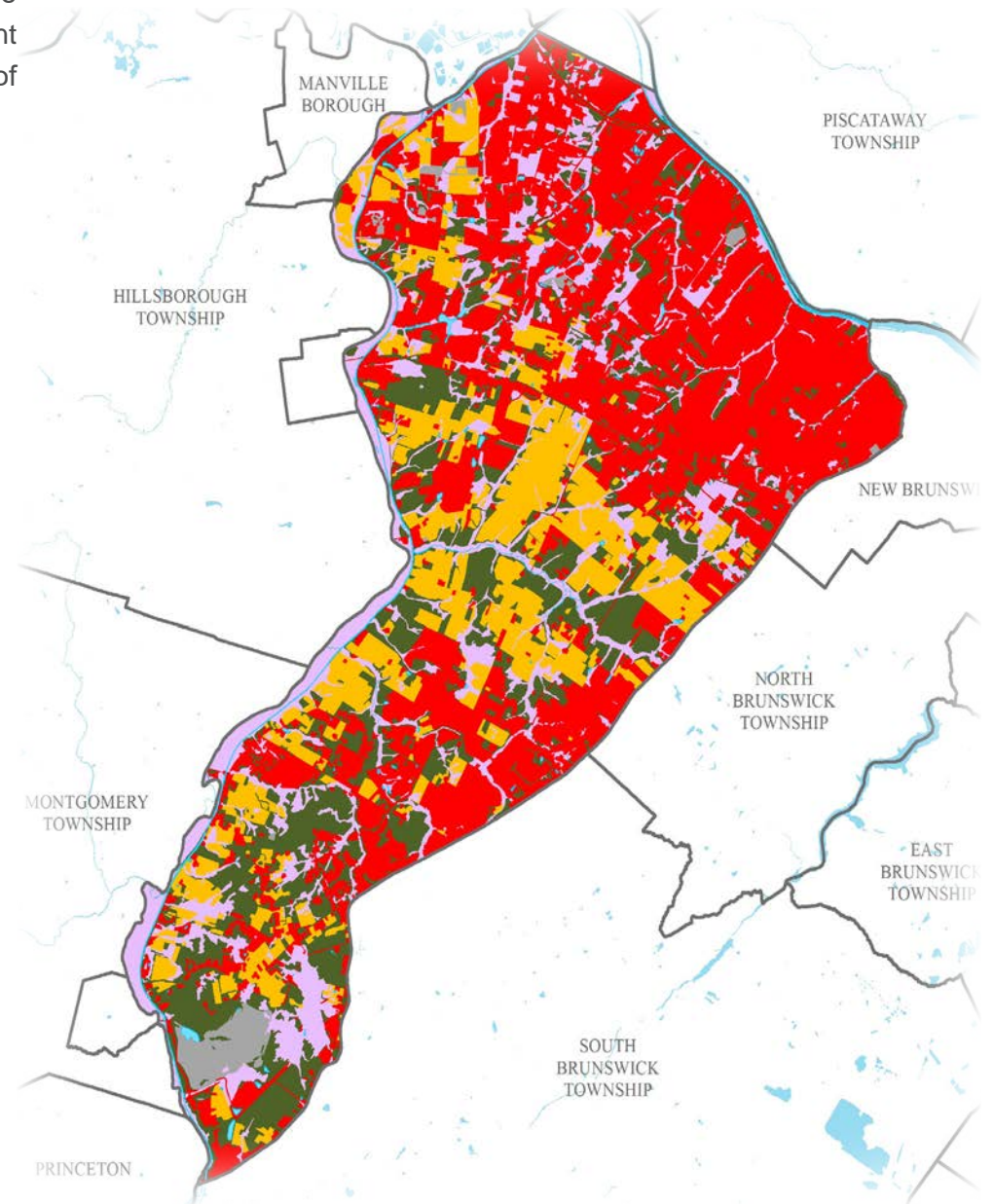
FRANKLIN TOWNSHIP LAND USE



FRANKLIN TOWNSHIP URBAN LAND USE

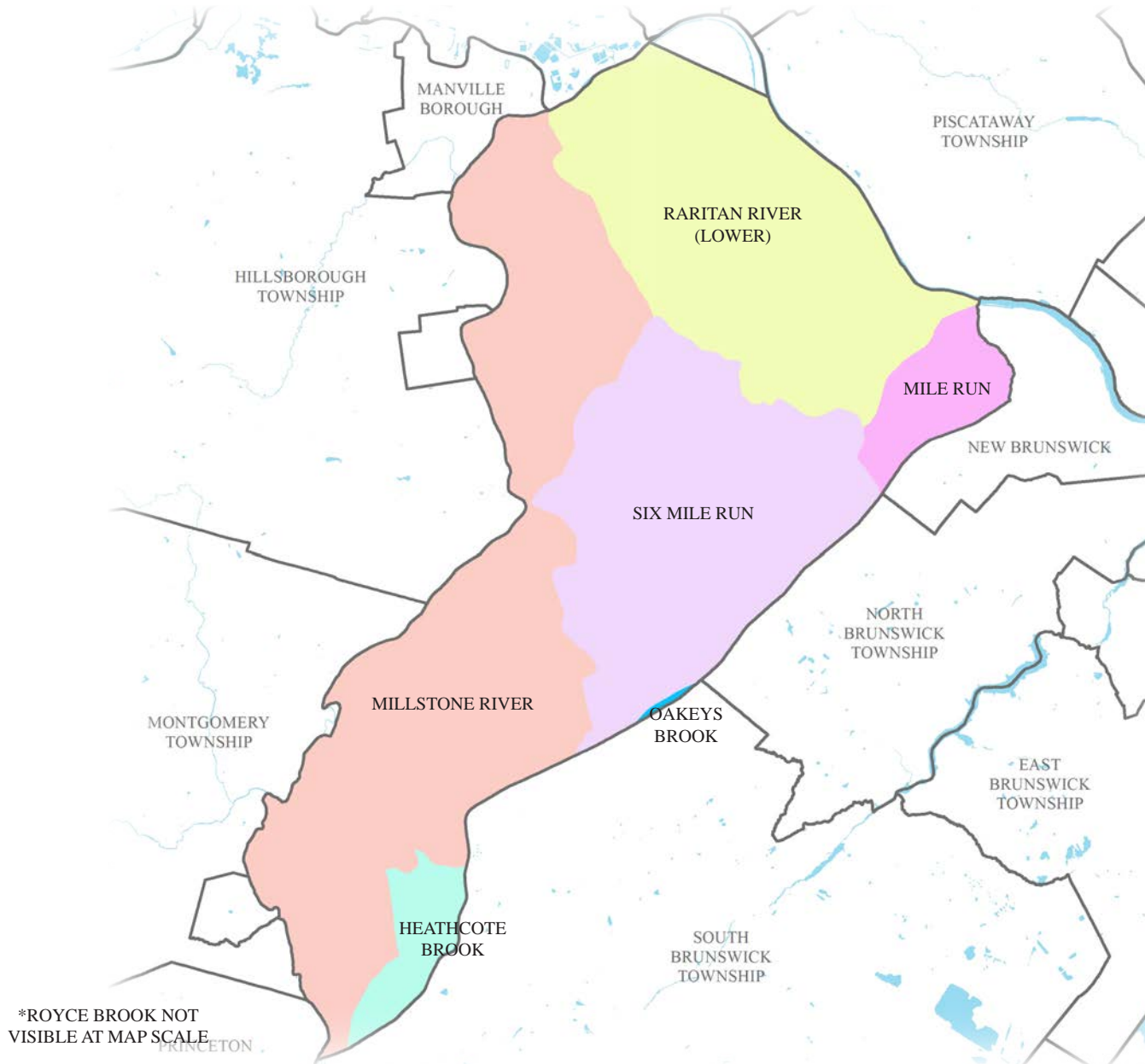


FRANKLIN TOWNSHIP LAND USE





# FRANKLIN TOWNSHIP SUBWATERSHEDS





# 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 Franklin 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 Franklin Township. Based upon the 2015 NJDEP land use/land cover data, approximately 18.8% of Franklin 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 Franklin Township (Table 1). On a subwatershed basis, impervious cover ranges from 0.0% in the Royce Brook subwatershed to 66.5% in the Oakeys Brook subwatershed. Evaluating impervious cover on a subwatershed basis allows the municipality to focus impervious cover reduction or disconnection efforts in the subwatersheds closer to where frequent flooding occurs.



Connected downspout



Reservoir

TABLE 1. IMPERVIOUS COVER ANALYSIS BY SUBWATERSHED FOR FRANKLIN TOWNSHIP

Subwatershed	Total Area	Land Use Area	Water Area	Impervious Cover	
	(ac)	(ac)	(ac)	(ac)	(%)
Heathcote Brook	980.9	979.3	1.66	64.3	6.6%
Mile Run	1,321.8	1,316.3	5.48	590.7	44.9%
Millstone River	12,045.2	11,722.4	322.76	1,125.4	9.6%
Oakeys Brook	36.4	36.1	0.27	24.0	66.5%
Raritan River (Lower)	7,937.4	7,767.1	170.29	2,691.7	34.7%
Royce Brook	0.1	0.0	0.0	0.0	0.0%
Six-Mile Run	7,676.1	7,644.1	32.0	1,053.4	13.8%
<b>Total</b>	<b>29,997.9</b>	<b>29,465.4</b>	<b>532.5</b>	<b>5,549.5</b>	<b>18.8%</b>

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 increased stormwater runoff from these impervious surfaces in addition to thousands of connected downspouts reduces the amount of water that can infiltrate into soils and greatly increases the volume and rate of runoff that flows to waterways.

Stormwater runoff volumes (specific to Franklin Township, Somerset 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 over two hours, an annual rainfall of 44 inches, the 2-year design storm (3.34 inches of rain over 24 hours), the 10-year design storm (5.01 inches of rain over 24 hours), and the 100-year design storm (8.21 inches of rain over 24 hours). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Franklin Township. For example, if the stormwater runoff from one New Jersey water quality storm in the Raritan River (Lower) subwatershed was harvested and purified, it could supply water to 835 homes for one year (assuming 300 gallons per day per home).

TABLE 2. STORMWATER RUNOFF VOLUMES FROM IMPERVIOUS SURFACES BY SUBWATERSHED IN FRANKLIN TOWNSHIP

Subwatershed	Total Runoff Volume for the 1.25" NJ Water Quality Storm (Mgal)	Total Runoff Volume for the NJ Annual Rainfall of 44" (Mgal)	Total Runoff Volume for the 2-year Design Storm (3.34") (Mgal)	Total Runoff Volume for the 10-year Design Storm (5.01") (Mgal)	Total Runoff Volume for the 100 Year Design Storm(8.21") (Mgal)
Heathcote Brook	2.2	76.8	5.6	8.2	13.2
Mile Run	20.0	705.7	51.6	75.4	121.6
Millstone River	38.2	1,344.5	98.4	143.6	231.6
Oakeys Brook	0.8	28.7	2.1	3.1	4.9
Raritan River (Lower)	91.4	3,215.8	235.3	343.5	554.0
Royce Brook	0.0	0.0	0.0	0.0	0.0
Six-Mile Run	35.8	1,258.5	92.1	134.4	216.8
Total	188.4	6,630.0	485.2	708.2	1,142.2



# 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.





# 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

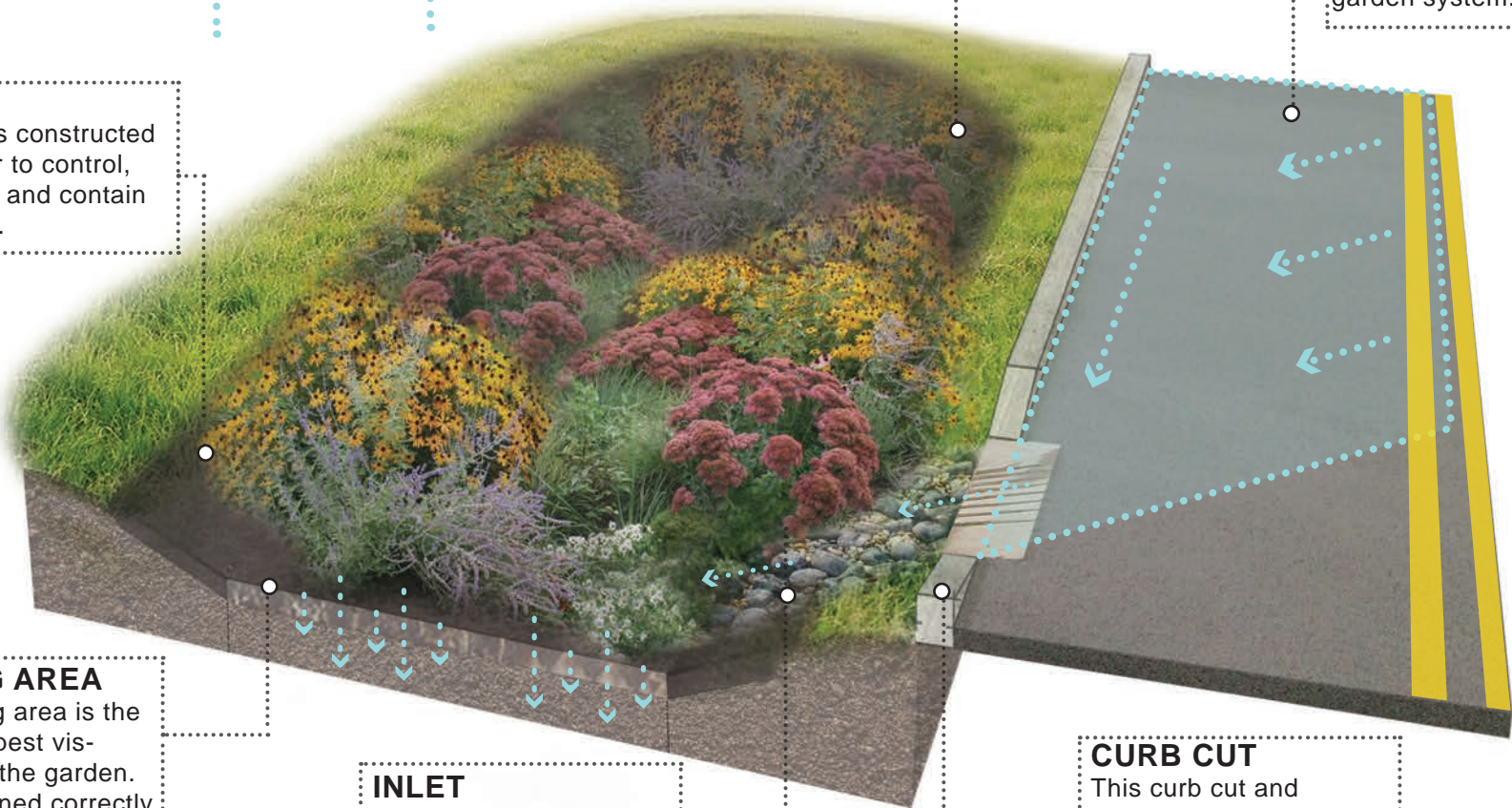
The ponding area is the lowest, deepest visible area of the garden. When designed correctly, this area should drain within 24 hours.

### 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

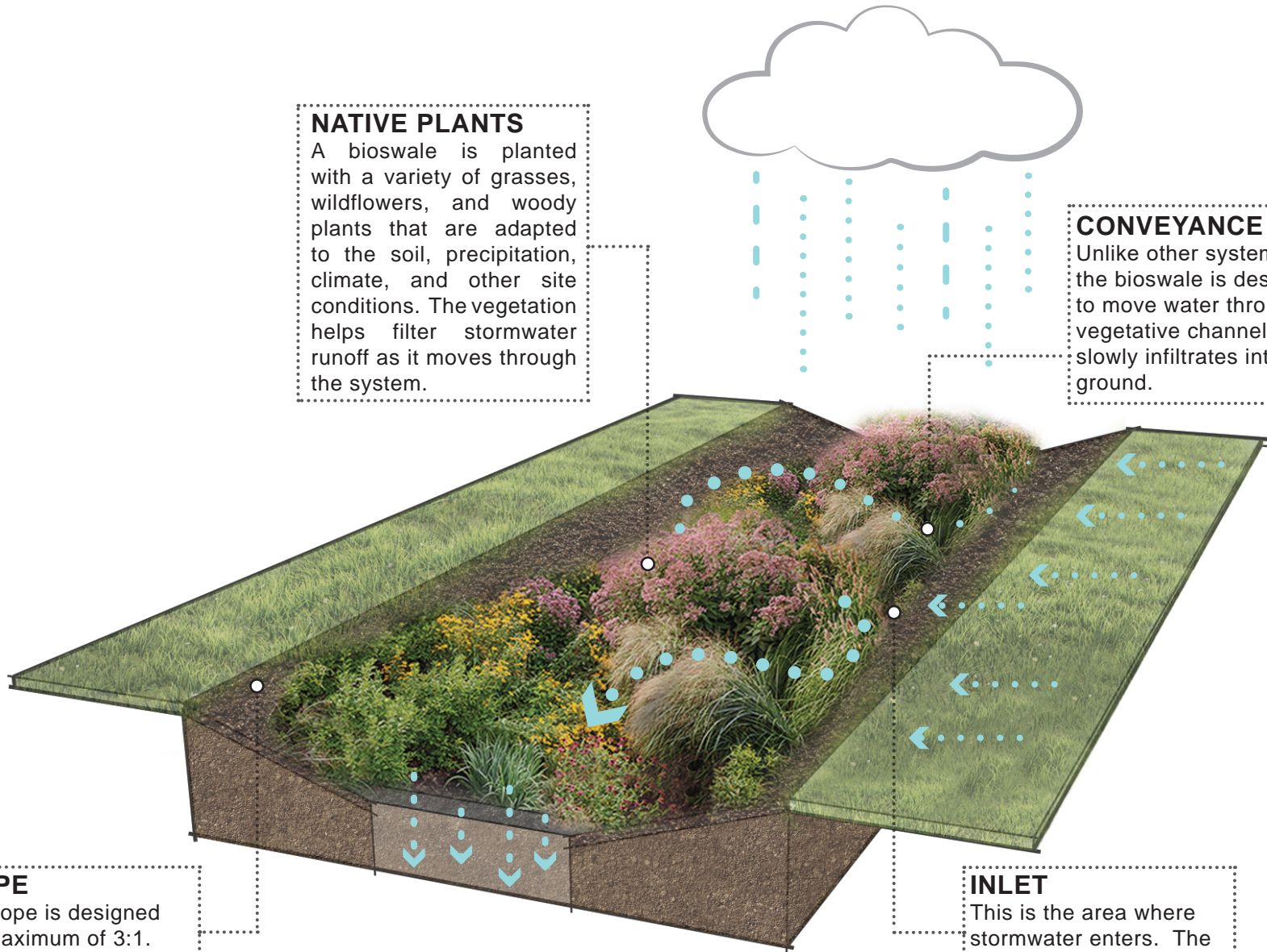
Unlike other systems, the bioswale is designed to move water through a vegetative channel as it slowly infiltrates into the ground.

### 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.



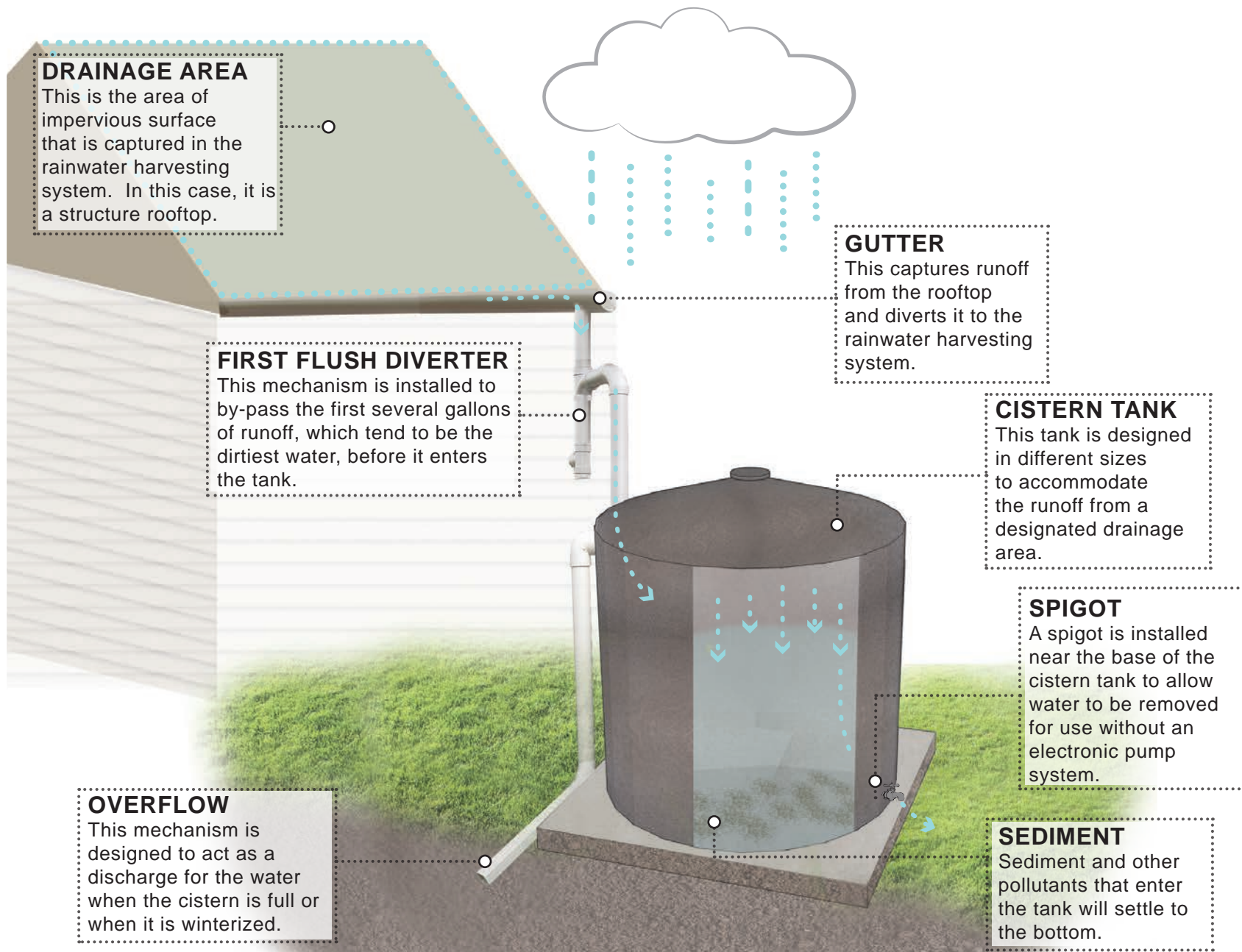
# RAINWATER HARVESTING SYSTEMS

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.







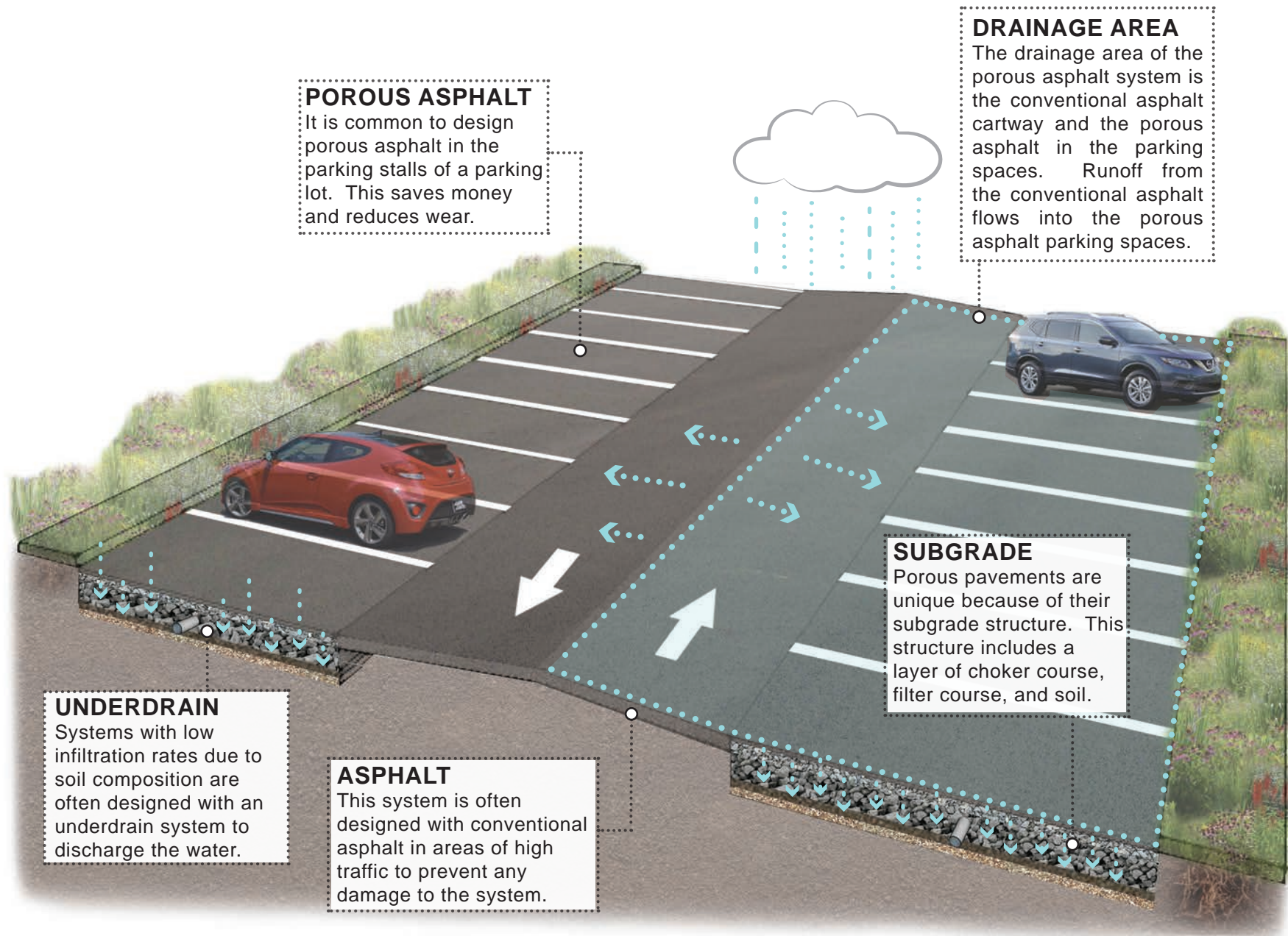


# PERMEABLE PAVEMENTS

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.







## 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.

## SUBGRADE

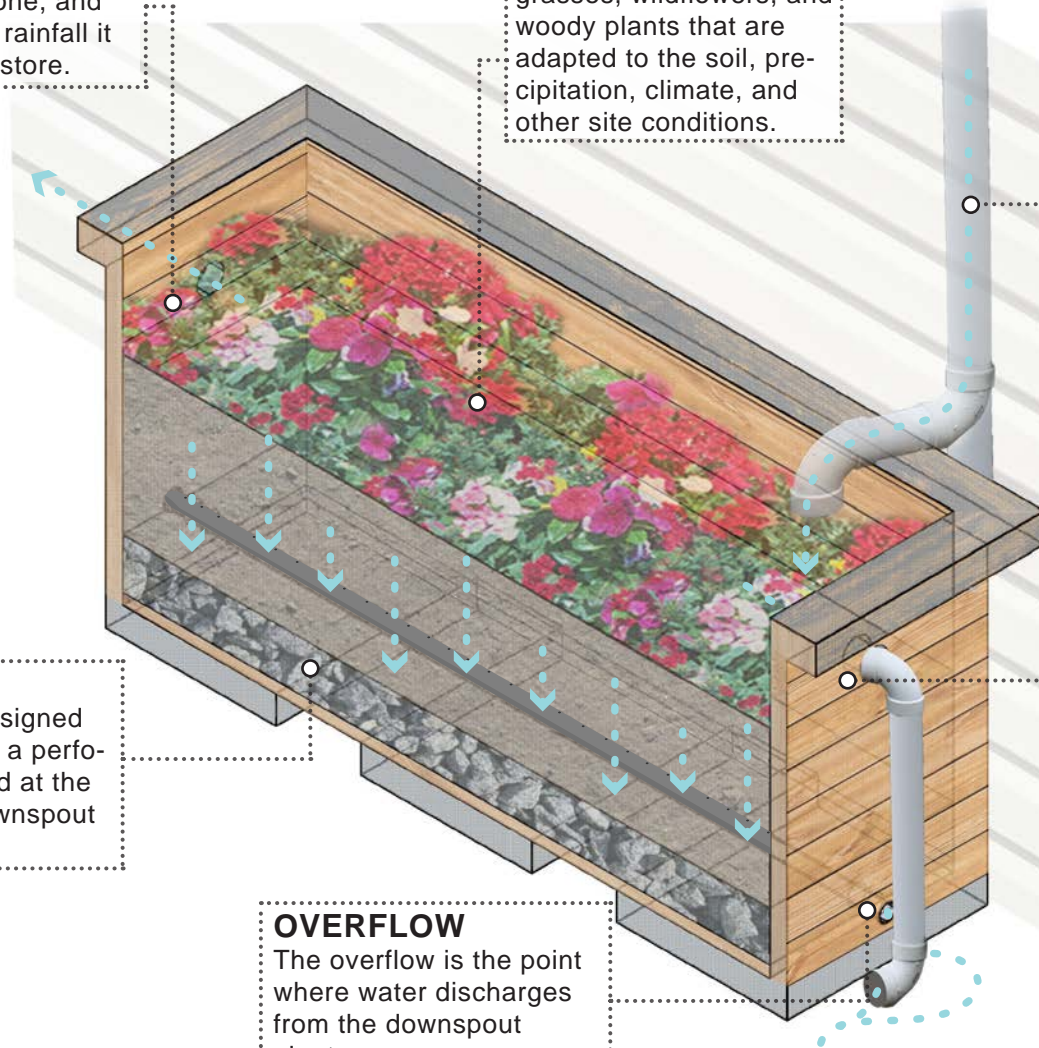
The system is designed to overflow using a perforated pipe located at the bottom of the downspout planter box.

## OVERFLOW

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

## CONNECTION

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



## 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.

### 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.

### INLET

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

### 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.







# GREEN INFRASTRUCTURE IN FRANKLIN TOWNSHIP

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



## SITE SELECTION & METHODOLOGY

A collection of sites has been identified in Franklin 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 2015 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 Franklin 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.

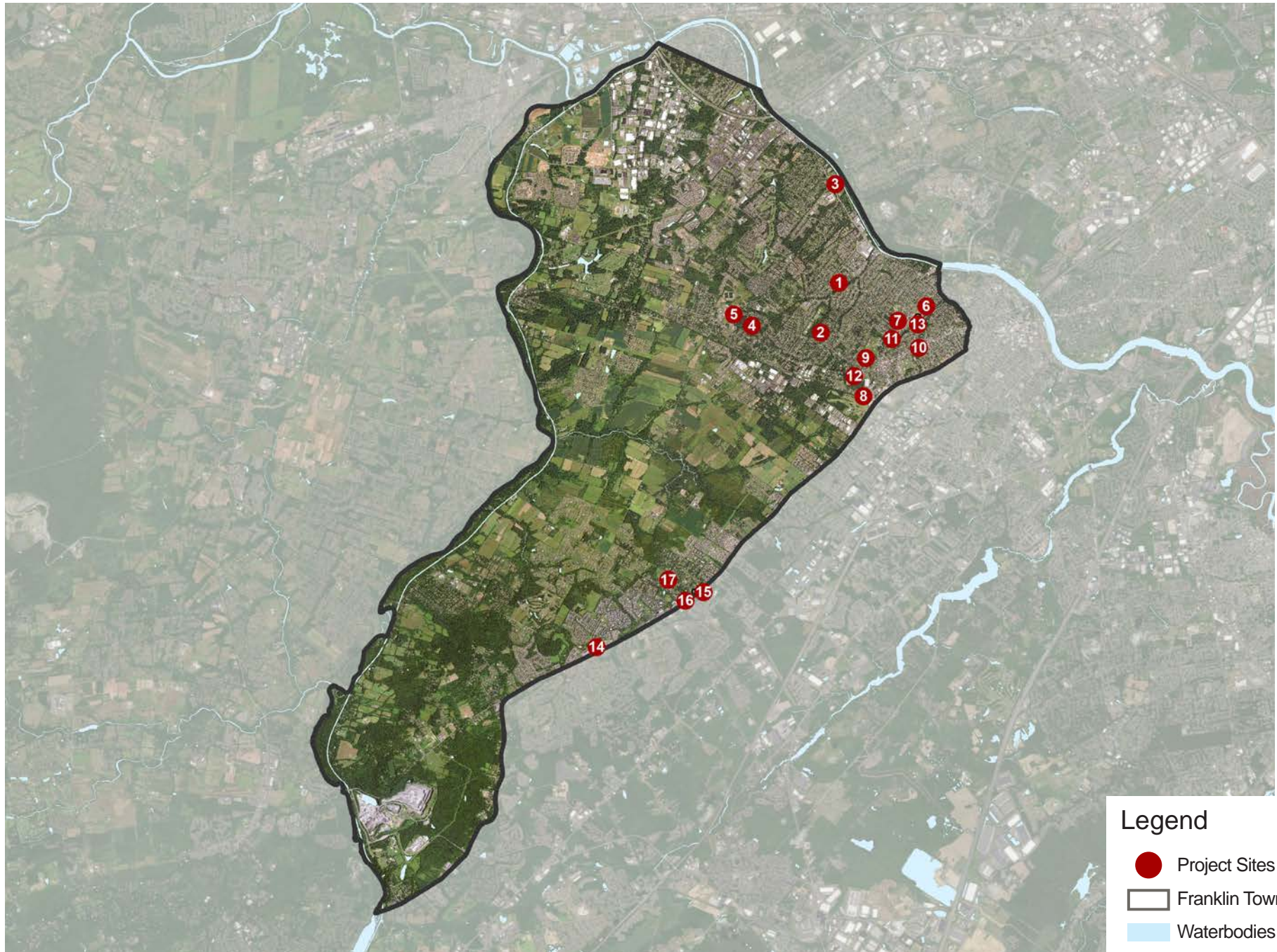




# POTENTIAL PROJECT SITES WITHIN STUDY AREA

Site	Name	Address	Page #
1	Conerly Road School	35 Conerly Road, Somerset, NJ 08873	40
2	MacAfee Road School	53 MacAfee Road, Somerset, NJ 08873	42
3	Rutgers Preparatory School	1345 Easton Avenue, Somerset, NJ 08873	44
4	Sampson G. Smith Intermediate School	1649 Amwell Road, Franklin Township, NJ 08873	46
5	Township Offices and Library	485 Demott Lane, Franklin Township, NJ 08873	48
6	East Franklin Firehouse Company	121 Pinegrove Avenue, Somerset, NJ 08873	50
7	Eternal Life Christian Church	322 Franklin Boulevard, Somerset, NJ 08873	52
8	Franklin Department of Public Works	28-40 Churchill Avenue, Somerset, NJ 08873	54
9	Franklin Middle School & Hillcrest Elementary School*	415 Francis Street, Franklin Township, NJ 08873	56
10	Franklin Street Center	712 Hamilton Street, Somerset, NJ 08873	62
11	Mount Carmel Church	350 Franklin Boulevard, Somerset, NJ 08873	64
12	NJ Army National Guard	1060 Hamilton Street, Somerset, NJ 08873	66
13	Pine Grove Manor School	130 Highland Avenue, Somerset, NJ 08873	68
14	Franklin Care Center	3371 NJ-27, Franklin Township, NJ 08873	70
15	Franklin Park Volunteer Fire Company*	2 Claremont Road, Franklin Township, NJ 08873	72
16	Six Mile Run Reformed Church*	3037 NJ-27, Franklin Township, NJ 08873	76
17	Franklin Park School	30 Eden Street, Franklin Township, NJ 08873	80

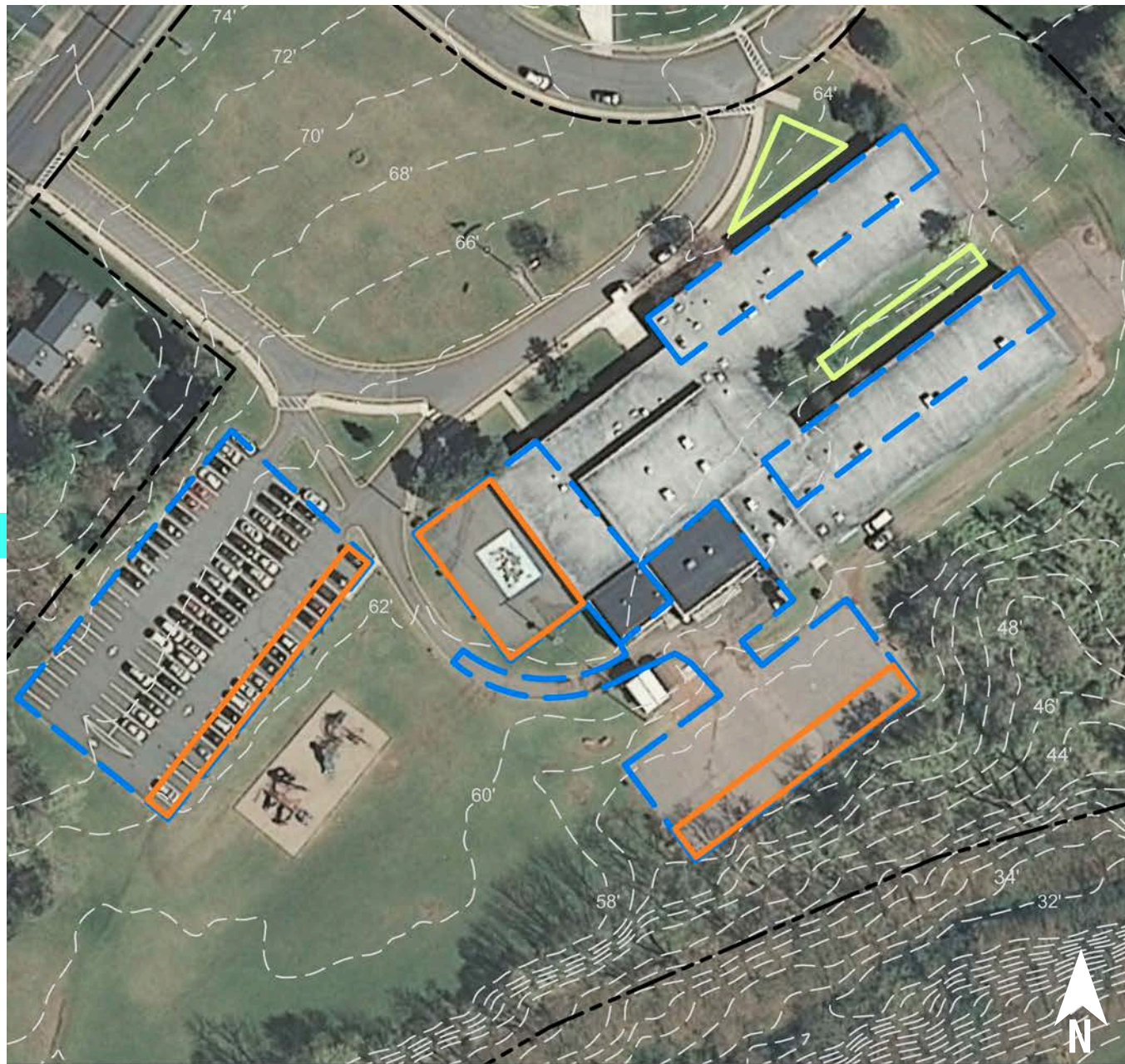
\* Contains a concept design








### Legend

- Project Sites
- ▭ Franklin Township
- Waterbodies





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

0' 50' 100'





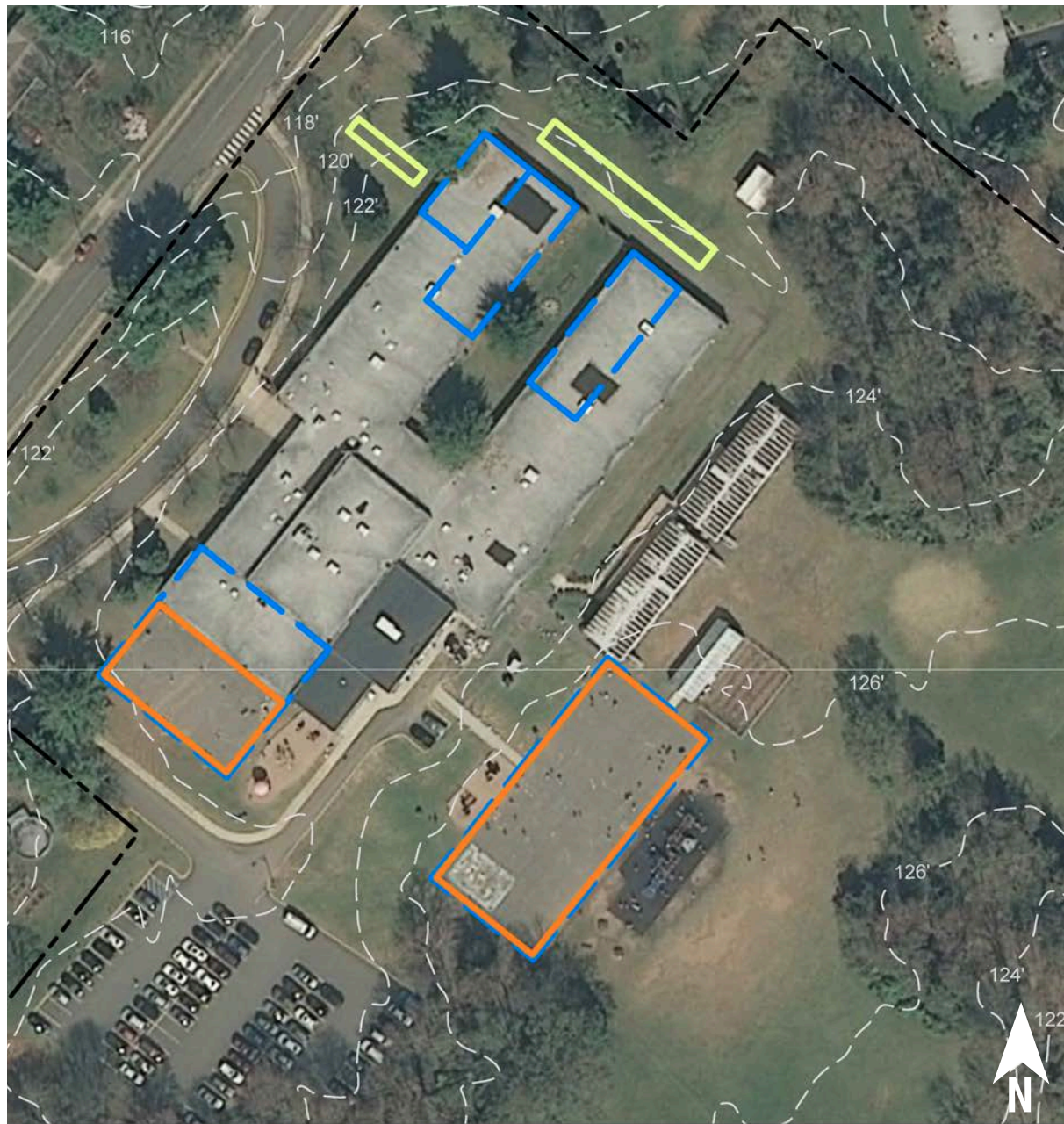







Rain gardens can be installed to capture, treat, and infiltrate roof runoff by disconnecting and redirecting nearby downspouts. These rain gardens can serve as an educational tool for students to learn about stormwater management using green infrastructure. The two play areas at the back of the school can be replaced with porous asphalt. In addition, parking spaces can also be replaced with pervious pavement to capture and infiltrate stormwater. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
32	173,800	8.4	87.8	798.0	0.135	4.77

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	0.365	61	26,760	1.01	3,500	\$17,500
Pervious pavement	1.400	234	102,750	3.86	13,650	\$341,250



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





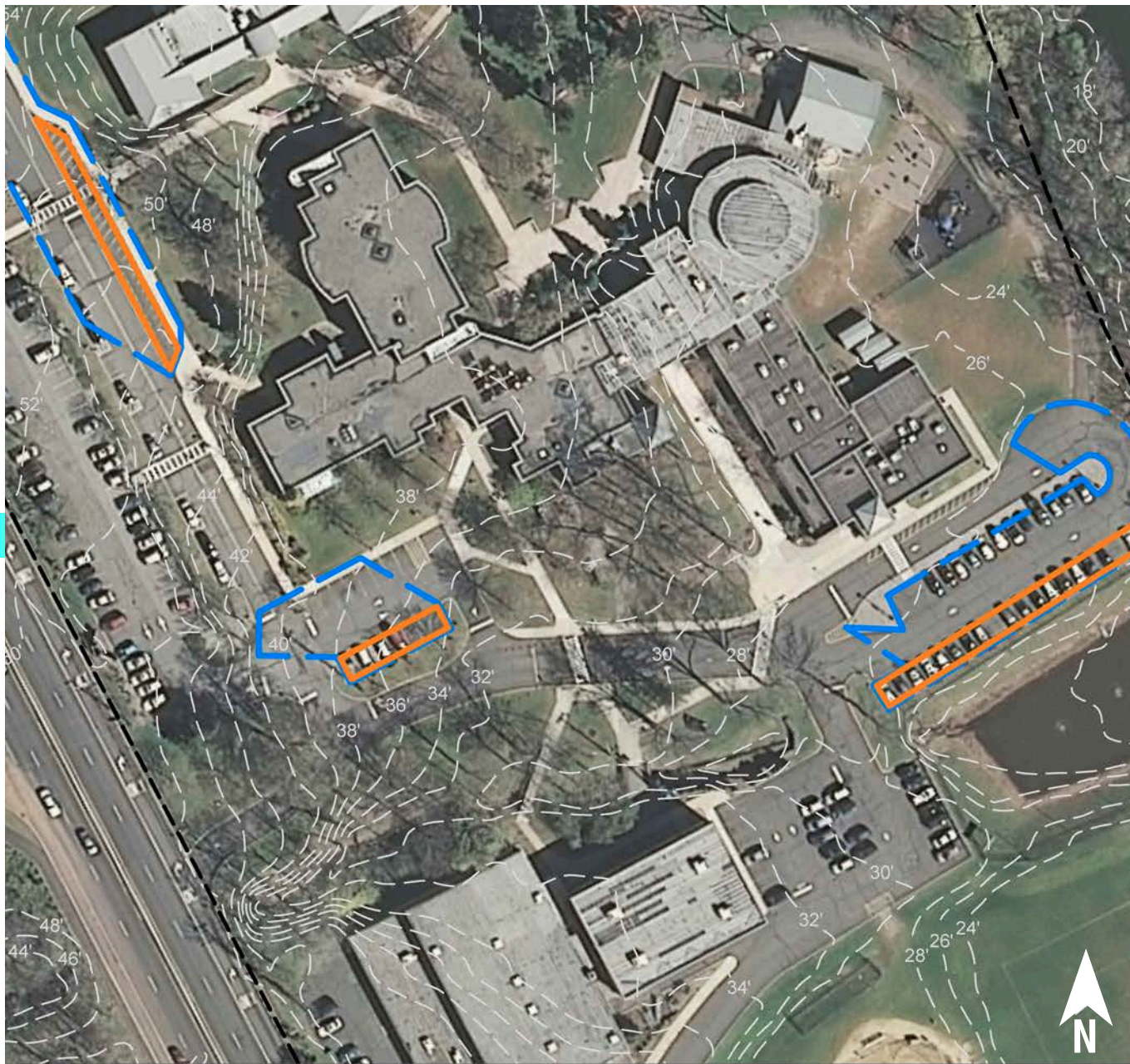
Bioretention systems can be installed to capture, treat, and infiltrate runoff. The rain garden proposed for the northeast side of the building would require connecting the downspouts from the courtyard to a main pipe to discharge into the garden. These systems will provide students with an educational tool to learn about green infrastructure, native plants, and wildlife. The two existing play areas can be replaced with porous asphalt which will allow for runoff storage and groundwater recharge. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
34	171,569	8.3	86.7	787.7	0.134	4.71

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	0.234	39	17,200	0.65	2,250	\$11,250
Pervious pavement	0.580	97	42,560	1.60	18,390	\$459,750





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



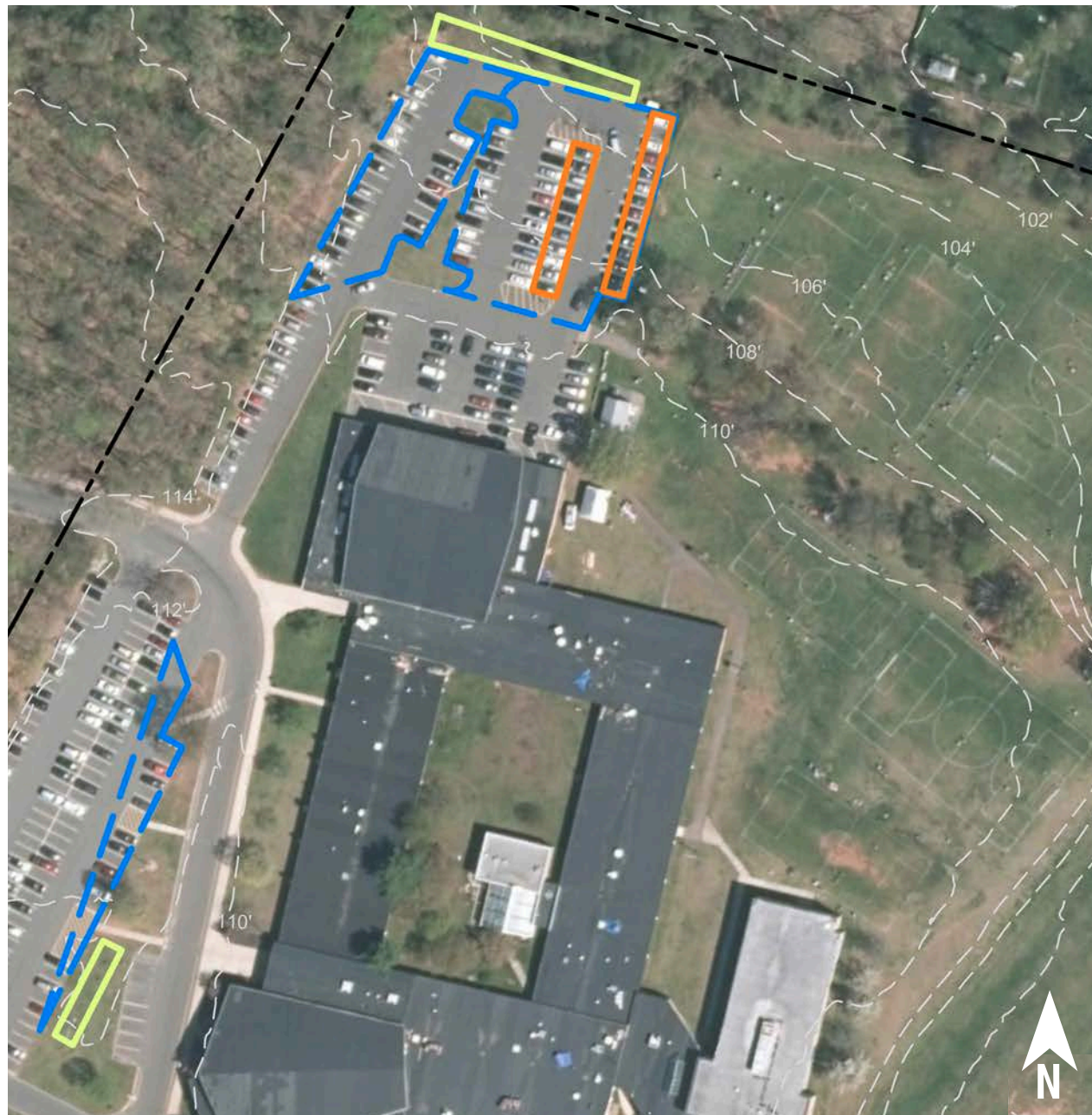







Although the parking spaces are in good condition, pervious pavement is a viable option for mitigating large runoff volumes to the detention basin. Approximately 35 parking spaces in the southern portion of the site could be replaced with pervious pavement. On the northern portion of the site, the most western parking spaces can be replaced with porous pavement. This green infrastructure practice will help reduce flooding and non-point source pollutants from reaching the local waterways. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
39	644,338	31.1	325.4	2,958.4	0.502	17.67

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	0.825	138	60,530	2.27	7,000	\$175,000



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

0' 50' 100'







The parking lot island near the southwestern end of the school can be converted into a rain garden to treat a portion of the parking lot runoff. Stormwater runoff flows north of the building toward a densely vegetated area. In this area, two strips of pavement can be replaced with pervious pavement, and the remainder of runoff can be captured, treated, and infiltrated by installing a rain garden. A preliminary soil assessment suggests that more soil testing would be required before determining the soil’s suitability 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"
26	366,492	17.7	185.1	1,682.7	0.286	10.05

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 systems	0.389	65	28,540	1.07	3,735	\$18,675
Pervious pavement	0.517	86	37,910	1.42	3,360	\$84,000





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

0' 75' 150'



## TOWNSHIP OFFICES AND LIBRARY

485 Demott Lane  
Franklin Township, NJ 08873



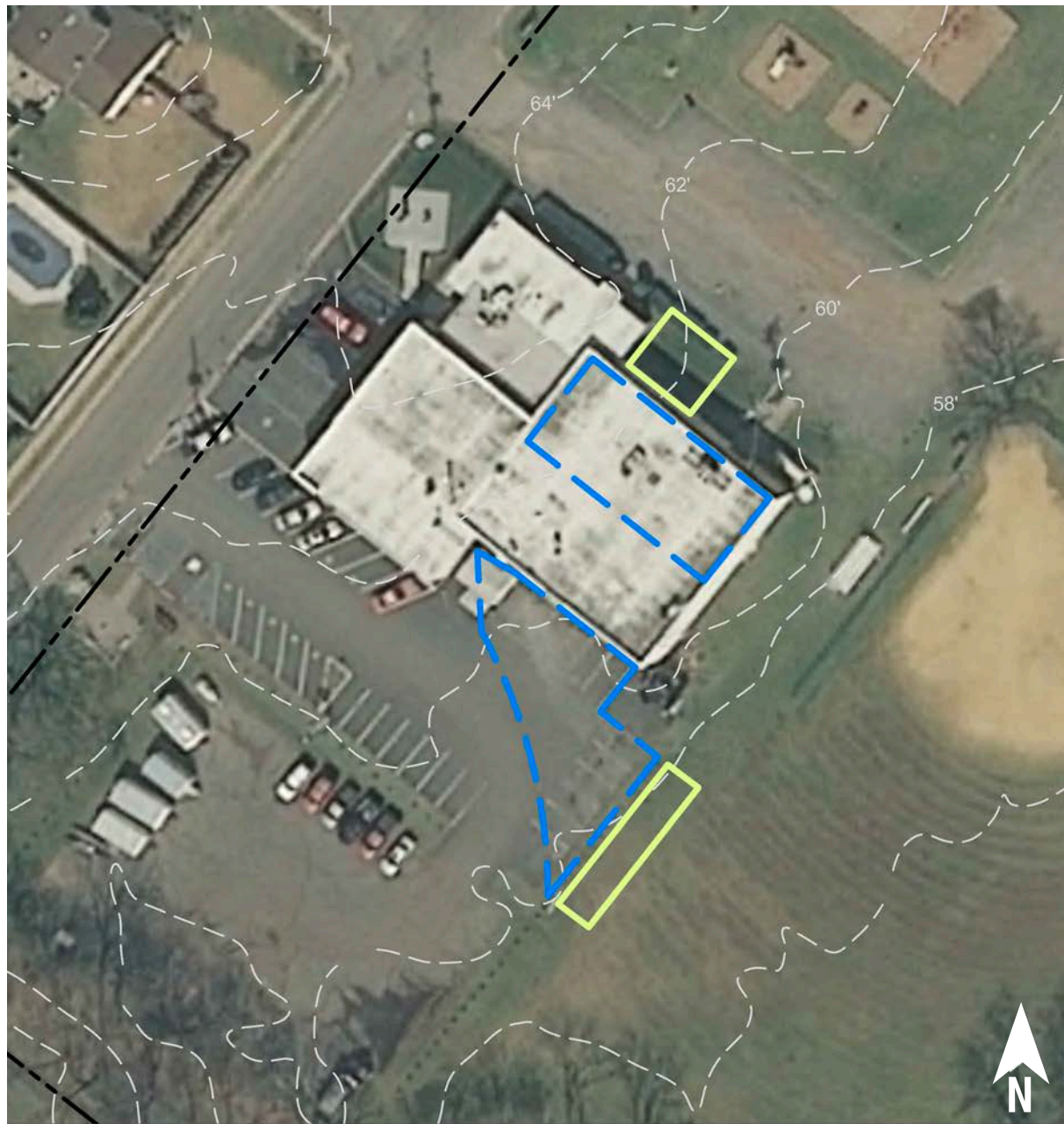






Bioretention systems can be installed to capture, treat, and infiltrate rooftop runoff. Multiple rows of parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. These practices can reduce pollutant loads, discharge volumes, and recharge local groundwater before reaching the adjacent detention basin. 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"
40	609,191	29.4	307.7	2,797.0	0.475	16.71

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	0.194	32	14,240	0.54	1,900	\$9,500
Pervious pavement	2.820	472	206,960	7.78	24,700	\$617,500



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

0' 30' 60'





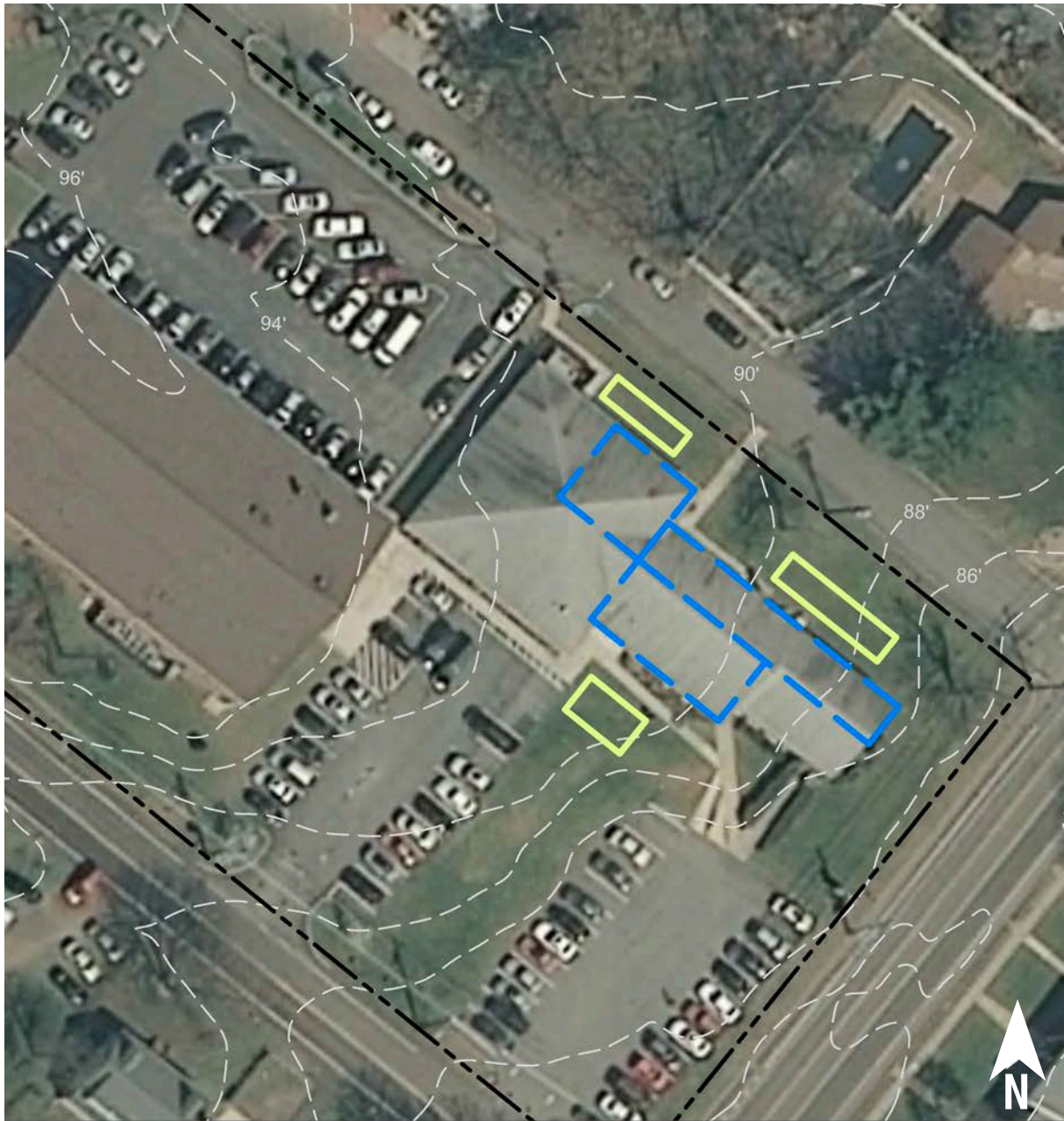






A rain garden can be installed in the turfgrass area to the south of the parking area to capture, treat, and infiltrate stormwater runoff from a portion of the parking lot. Another rain garden can also be installed to capture rooftop runoff from the downspouts on the building. A preliminary soil assessment 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"
35	101,840	4.9	51.4	467.6	0.079	2.79

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	0.167	28	12,240	0.46	1,600	\$8,000



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

0' 30' 60'





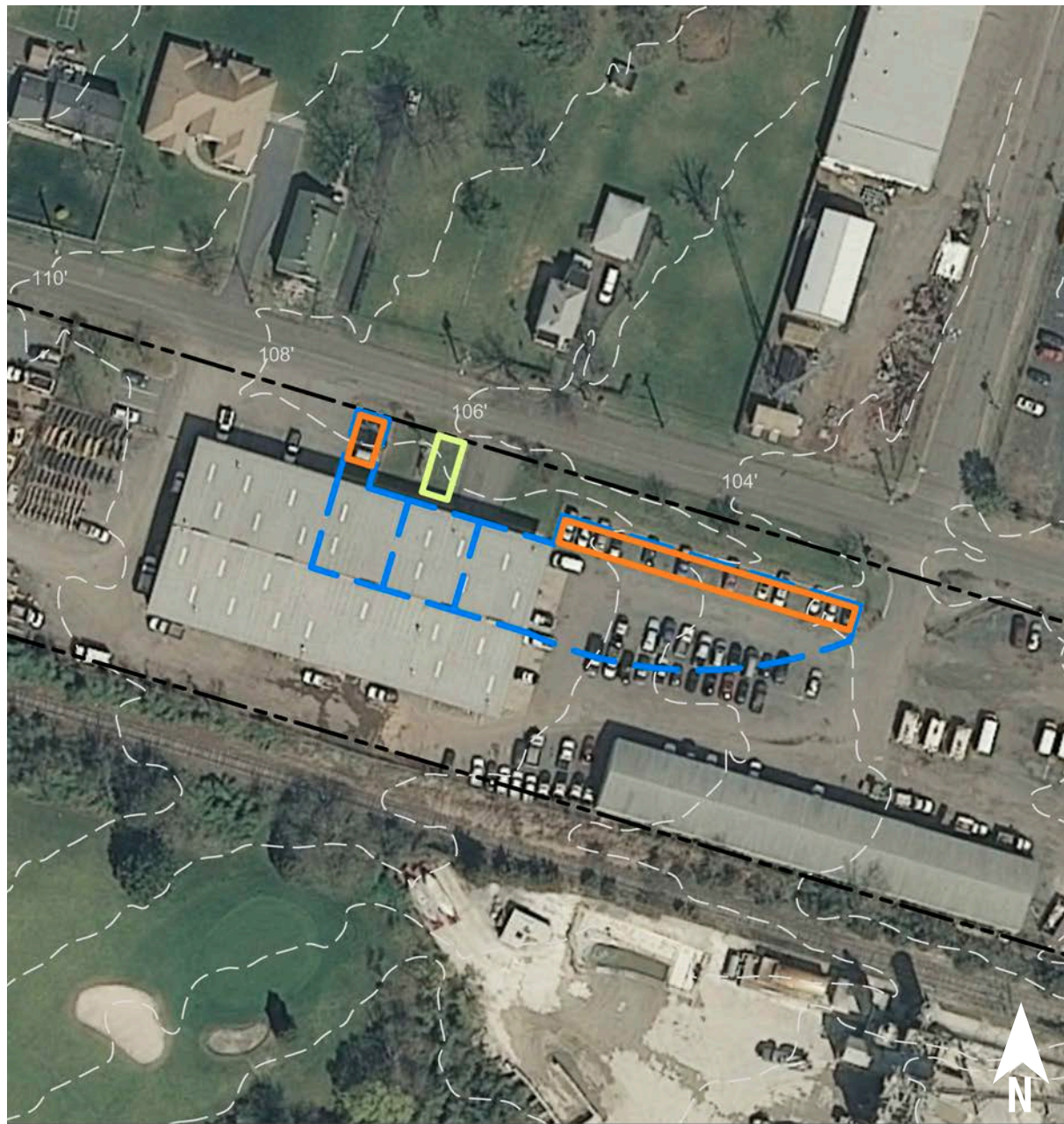







There are three opportunities to install bioretention systems at the church to capture, treat, and infiltrate rooftop runoff. The southern rain garden would require three downspouts to be disconnected and redirected into the rain garden. The two northern gardens would require a total of five disconnections. These rain gardens will prevent large runoff volumes from reaching nearby waterways. 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"
68	98,853	4.8	49.9	453.9	0.077	2.71

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	0.117	20	8,600	0.32	1,130	\$5,650





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

0' 50' 100'





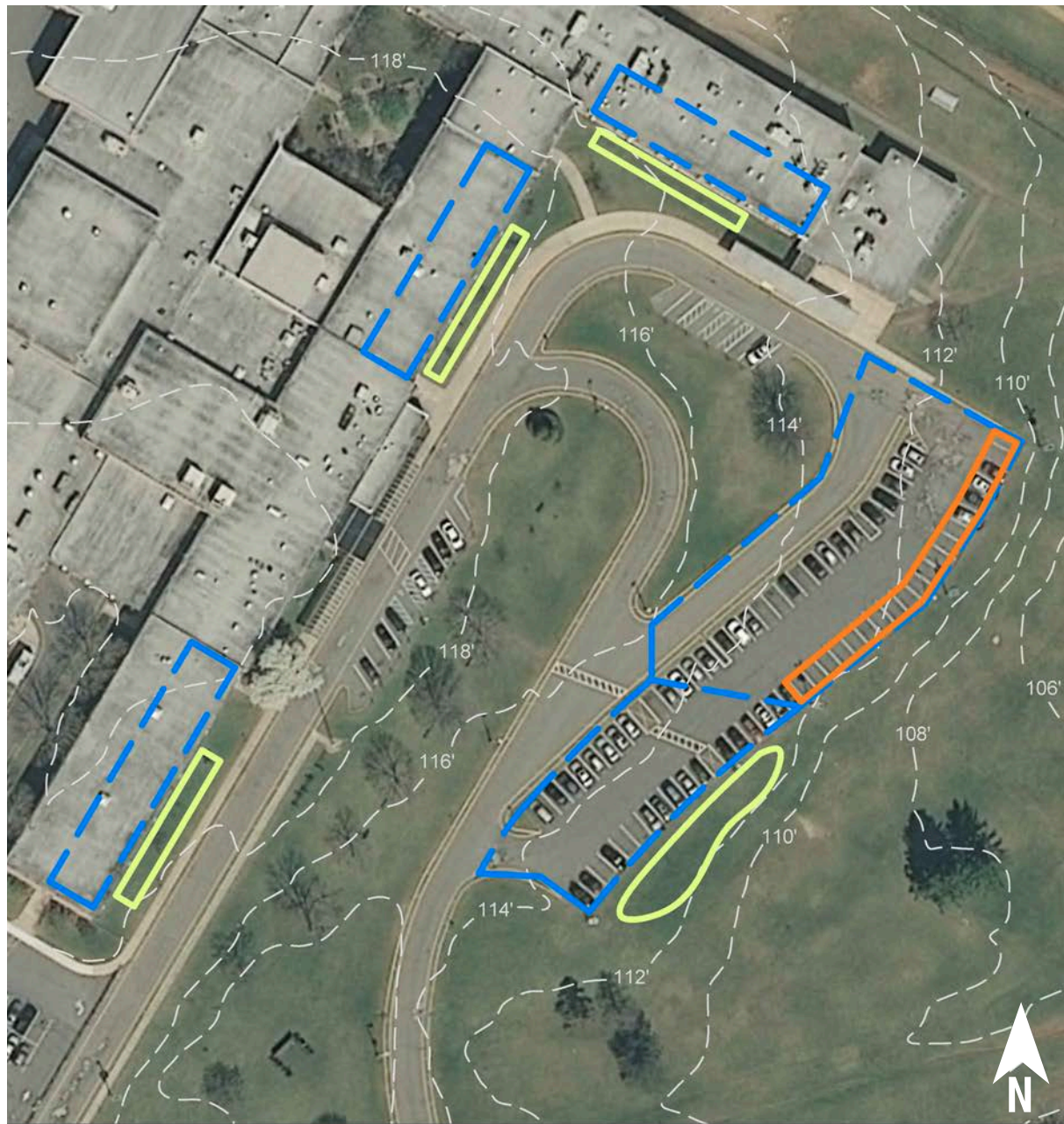







Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. A bioretention system can be installed to capture, treat, and infiltrate rooftop runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
87	160,676	7.7	81.1	737.7	0.125	4.41

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	0.051	9	3,730	0.14	550	\$2,750
Pervious pavement	0.625	105	45,880	1.72	9,150	\$228,750



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





Bioretention systems can be installed to capture, treat, and infiltrate rooftop and parking lot runoff. Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. 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"
28	924,552	44.6	466.9	4,245.0	0.720	25.36

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	0.856	143	62,790	2.36	8,230	\$41,150
Pervious pavement	0.801	134	58,760	2.21	7,270	\$181,750

# CURRENT CONDITION

58



**FRANKLIN MIDDLE SCHOOL**

415 Francis Street  
Franklin Township, NJ 08873



# CONCEPT DESIGN

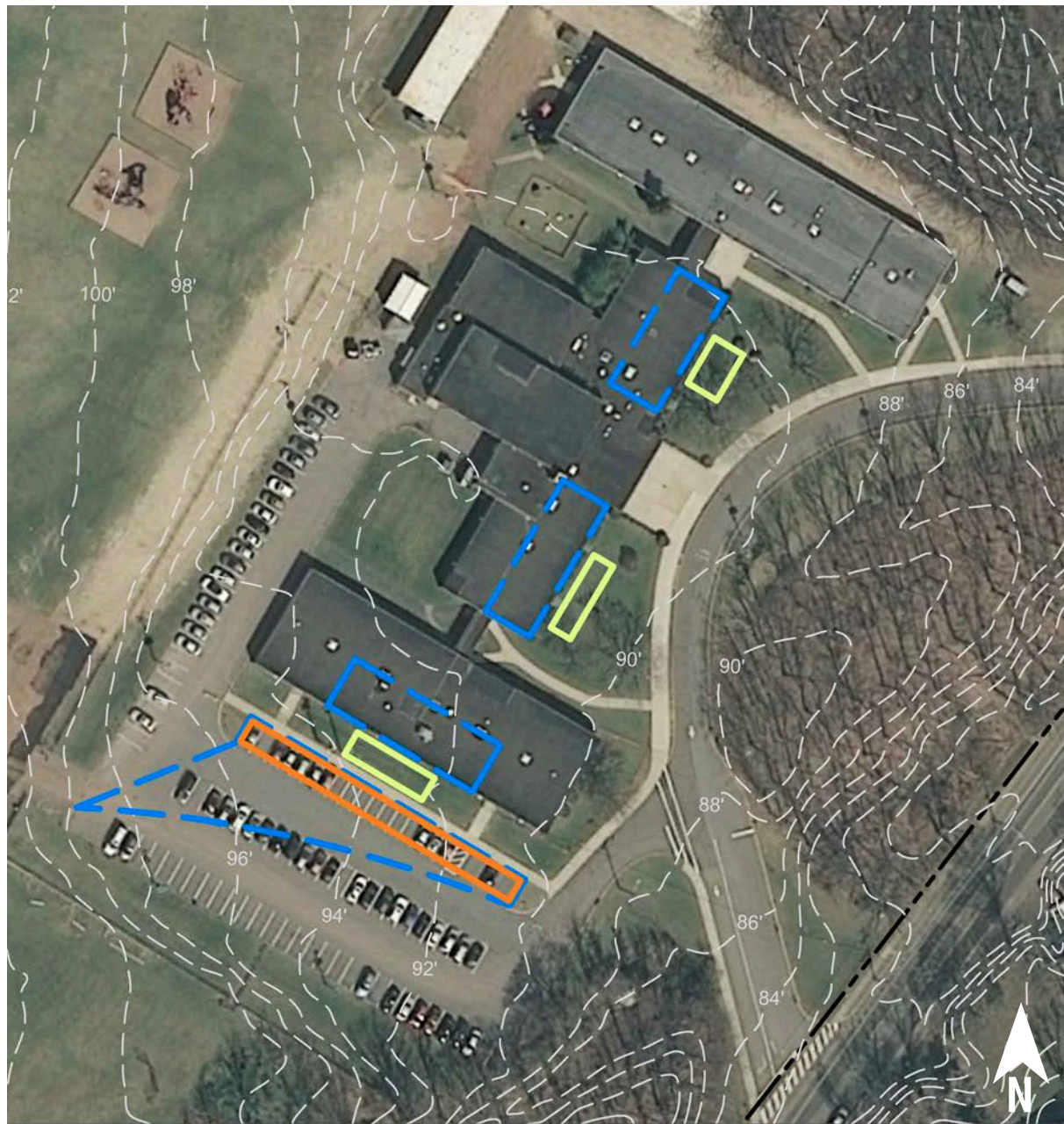







59

**FRANKLIN MIDDLE SCHOOL**

415 Francis Street  
Franklin Township, NJ 08873





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



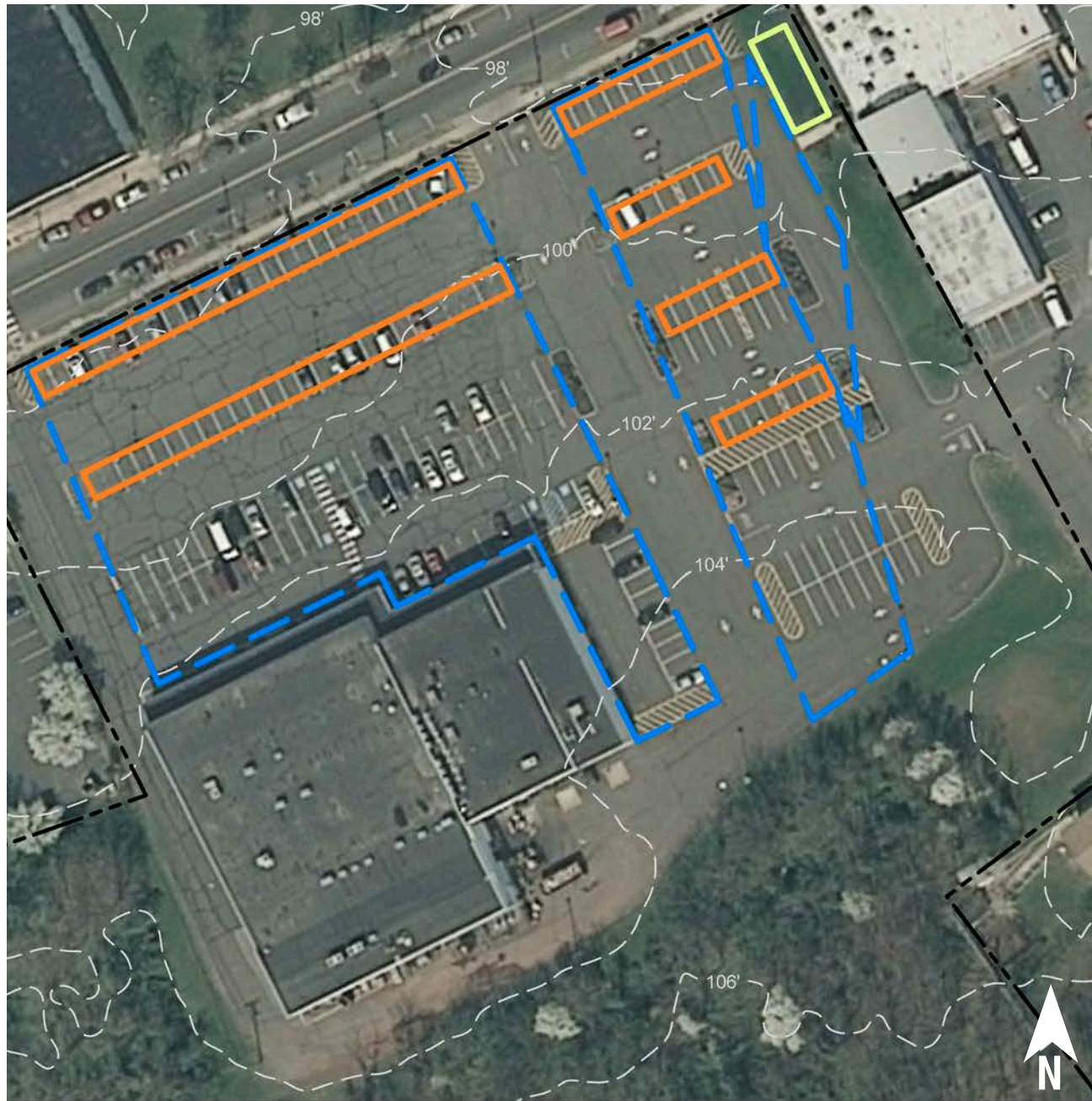







Bioretention systems can be installed to capture, treat, and infiltrate rooftop and parking lot runoff. Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
28	924,552	44.6	466.9	4,245.0	0.720	25.36

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	0.856	143	62,790	2.36	8,230	\$41,150
Pervious pavement	0.801	134	58,760	2.21	7,270	\$181,750



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



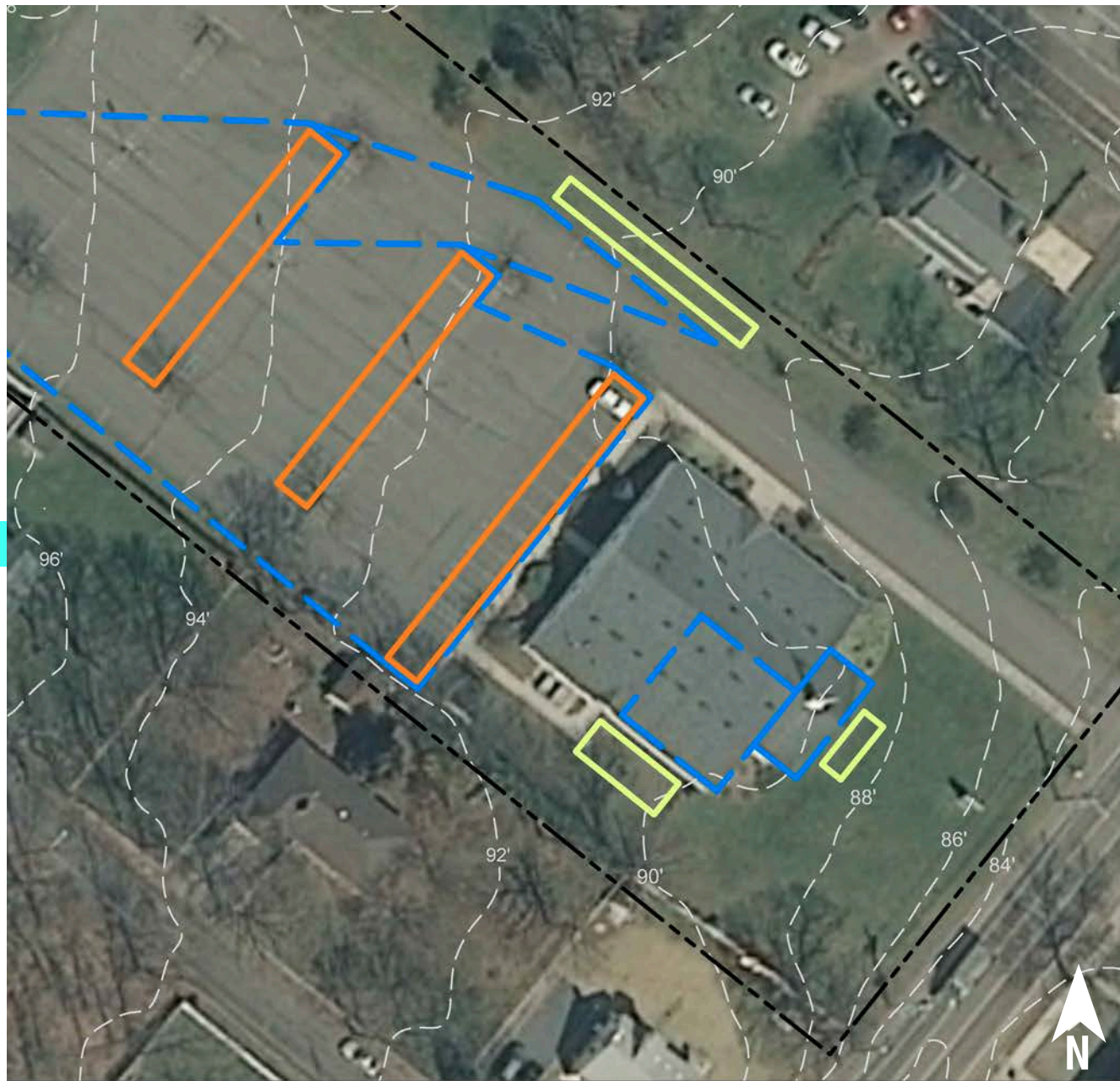







Runoff can be captured and treated by replacing the existing parking spaces with porous pavement. The site drains to an existing turfgrass area to the east where a rain garden can be installed to filter and infiltrate stormwater runoff. A preliminary soil assessment suggests that the soils have suitable 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"
49	174,899	8.4	88.3	803.0	0.136	4.80

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	0.096	16	7,080	0.27	925	\$4,625
Pervious pavement	1.829	306	134,180	5.04	14,525	\$363,125



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



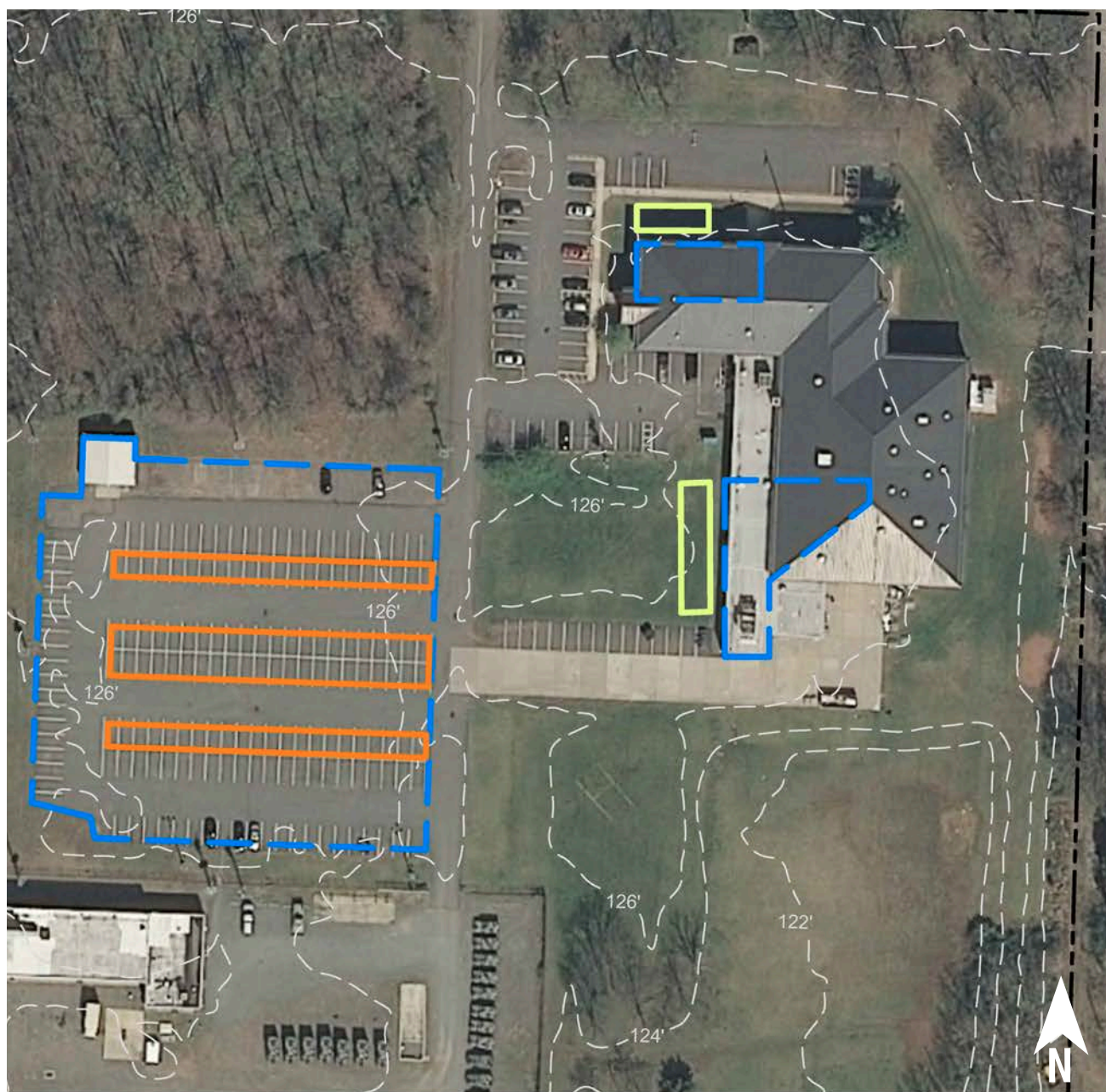


Bioretention systems can be installed to capture, treat, and infiltrate rooftop and parking lot runoff. Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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	66,121	3.2	33.4	303.6	0.052	1.81

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	0.170	29	12,490	0.47	1,635	\$8,175
Pervious pavement	7.847	1,314	575,750	21.64	6,560	\$164,000



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



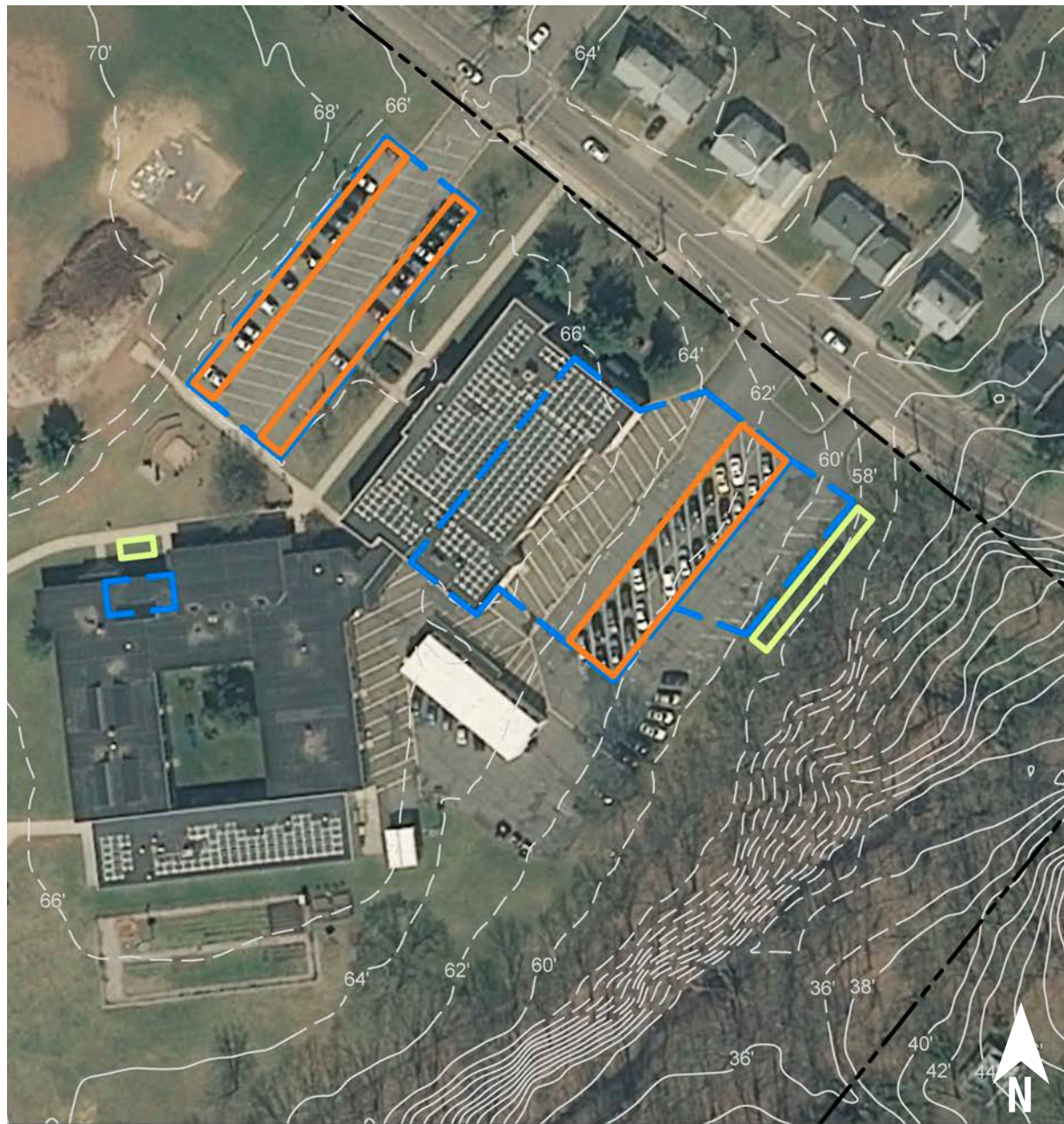







Rows of parking spaces in the southwest parking lot can be replaced with pervious pavement to capture and infiltrate stormwater. Bioretention systems can be installed to capture, treat, and infiltrate rooftop runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil’s suitability 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"
34	298,992	14.4	151.0	1,372.8	0.233	8.20

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	0.205	34	15,030	0.56	1,975	\$9,875
Pervious pavement	1.445	242	106,010	3.98	13,900	\$347,500



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



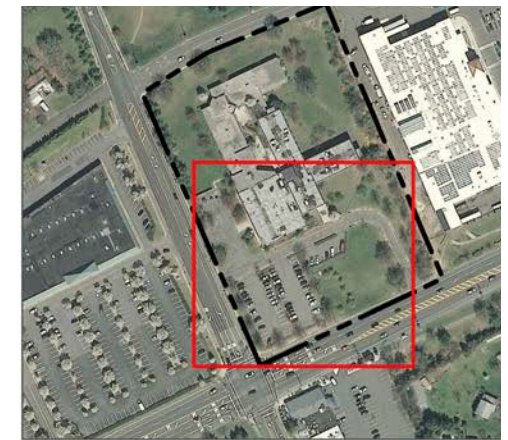







Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. A rain garden can be installed in the turfgrass area adjacent to the parking lot to capture and infiltrate additional runoff from the parking lot. Another rain garden can be installed near the main entrance of the school to manage rooftop runoff from the building. 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"
27	202,284	9.8	102.2	928.8	0.158	5.55


  

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	0.143	24	10,460	0.39	1,375	\$6,875
Pervious pavement	0.919	154	67,450	2.53	13,435	\$335,875



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

0' 30' 60'





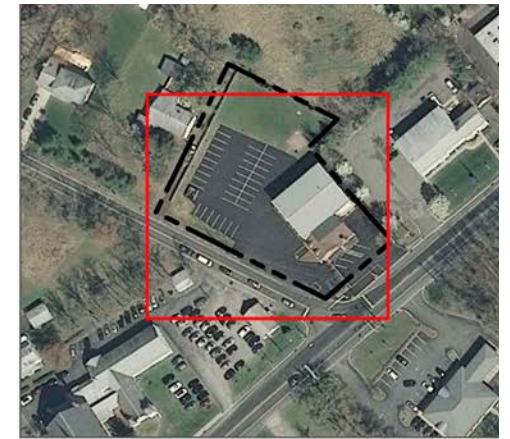
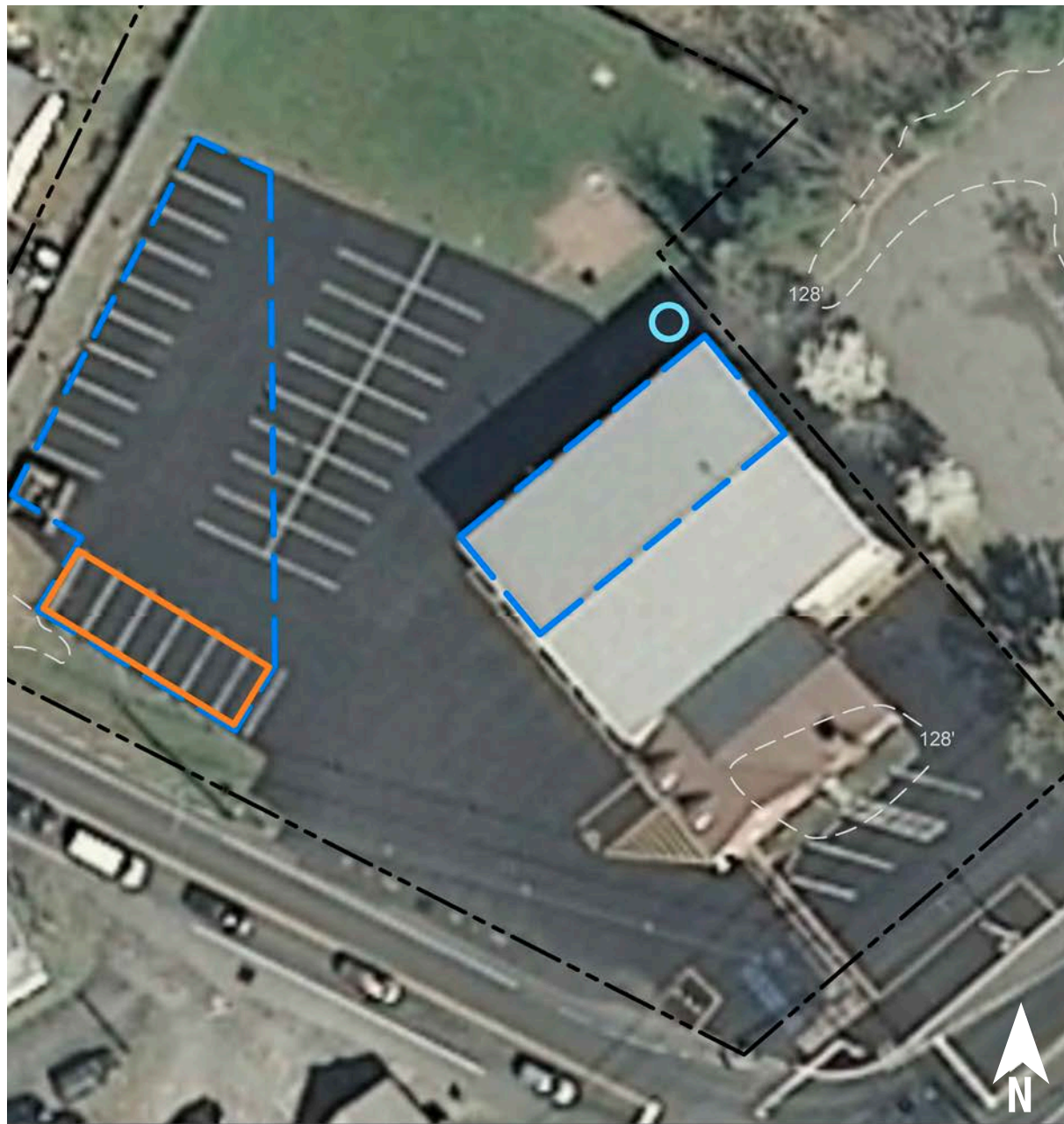







A bioretention system can be installed to capture, treat, and infiltrate parking lot runoff. Pervious pavement can be installed to capture and infiltrate additional parking lot runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
54	144,336	7.0	72.9	662.7	0.112	3.96

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	0.089	15	6,500	0.24	850	\$4,250
Pervious pavement	0.229	38	16,820	0.63	2,175	\$54,375



-  pervious pavement
-  rainwater harvesting
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS





Rainwater from a section of the building's rooftop can be harvested in a cistern. The water can be used for washing emergency vehicles. The southernmost parking spaces in the parking lot could also be replaced with pervious pavement to capture and infiltrate stormwater runoff from the parking lot. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
81	36,567	1.8	18.5	167.9	0.028	1.00

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	0.145	24	10,610	0.40	990	\$24,750
Rainwater harvesting	0.059	10	1,800	0.07	1,800 (gal)	\$3,600

# CURRENT CONDITION

74



**FRANKLIN PARK VOLUNTEER FIRE COMPANY**

2 Claremont Road  
Franklin Township, NJ 08873



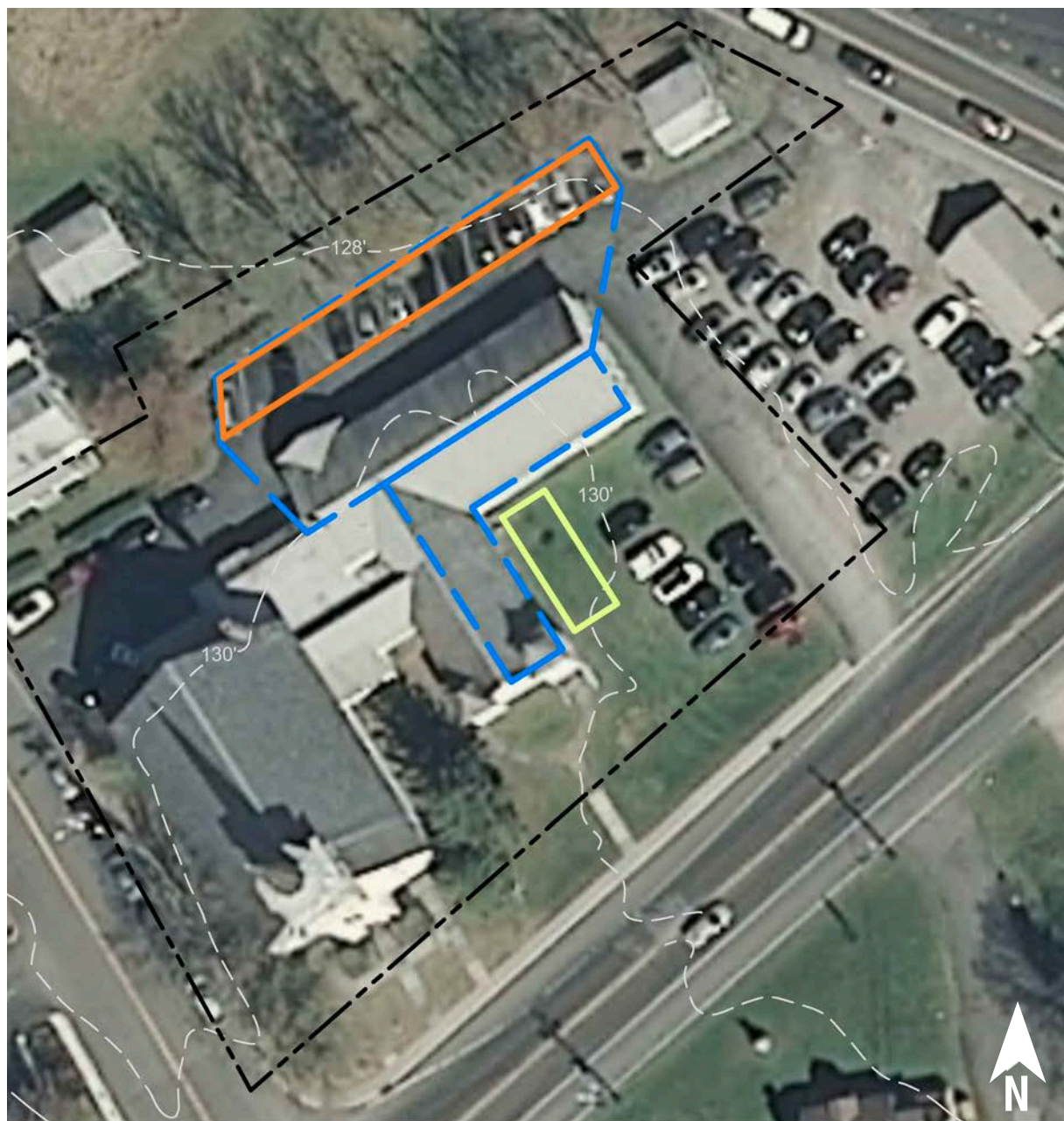
# CONCEPT DESIGN








75

**FRANKLIN PARK VOLUNTEER FIRE COMPANY**

2 Claremont Road  
Franklin Township, NJ 08873



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





Parking spaces north of the church can be replaced with pervious pavement to capture and infiltrate stormwater. A bioretention system can be installed to capture, treat, and infiltrate roof runoff from the church. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
78	42,115	2.0	21.3	193.4	0.033	1.16

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	0.063	11	4,650	0.17	750	\$3,750
Pervious pavement	0.145	24	10,610	0.40	1,690	\$42,250

# CURRENT CONDITION

78



**SIX MILE RUN REFORMED CHURCH**

3037 NJ-27  
Franklin Township, NJ 08873



# CONCEPT DESIGN

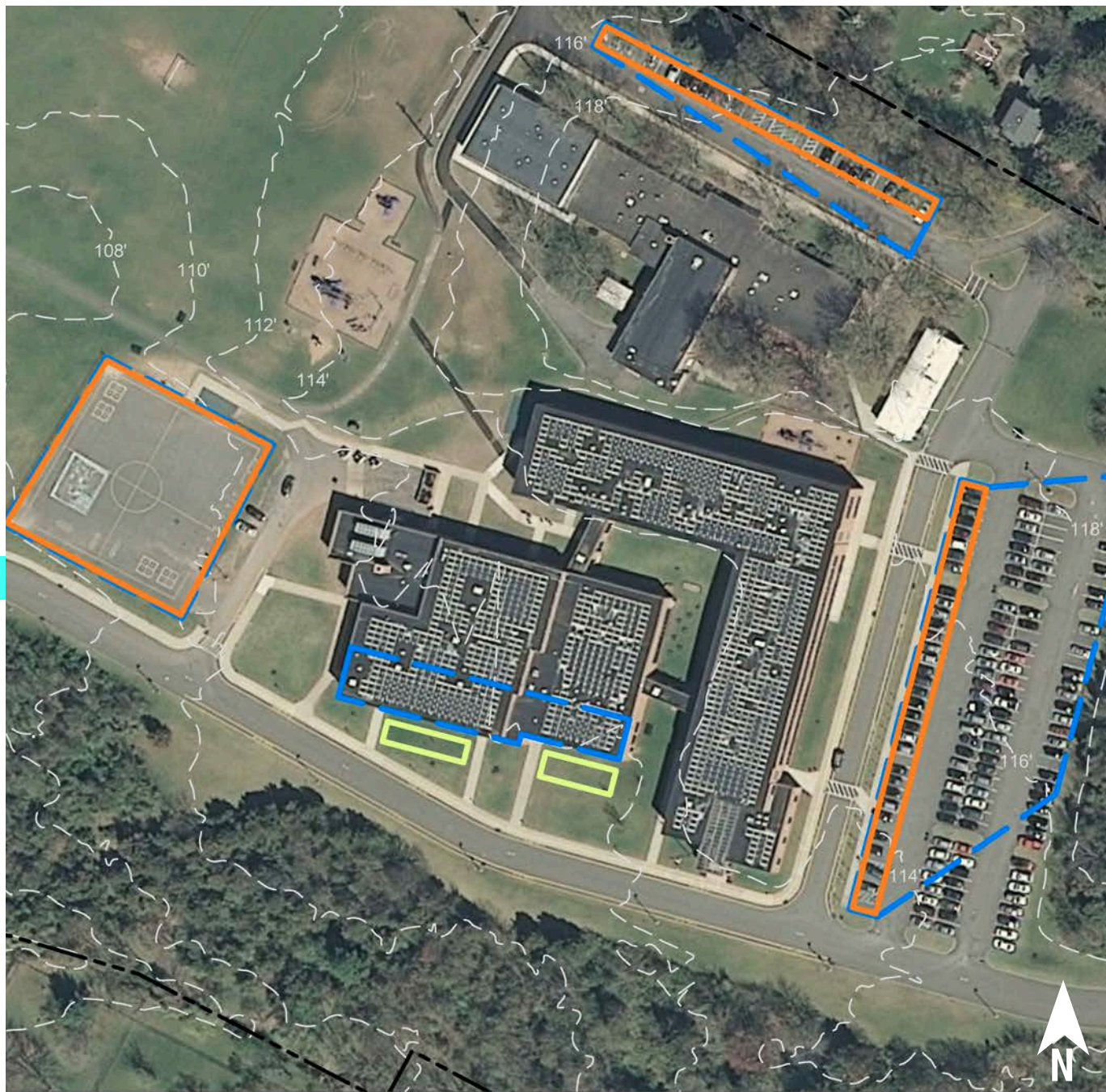







79

**SIX MILE RUN REFORMED CHURCH**

3037 NJ-27  
Franklin Township, NJ 08873





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





Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. The paved play area to the west of the school can also be converted to pervious pavement to capture and infiltrate additional stormwater. Two bioretention systems can be installed to capture, treat, and infiltrate rooftop 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"
22	354,095	17.1	178.8	1,625.8	0.276	9.71

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	0.215	36	15,790	0.59	2,065	\$10,325
Pervious pavement	1.916	321	140,560	5.28	36,350	\$908,750

# FUNDING STRATEGY, IMPLEMENTATION AGENDA, AND COMMUNITY ENGAGEMENT

Franklin Township will have a standing agenda item at the monthly environmental commission meeting to discuss opportunities for projects and coordinate the implementation of projects. The goal is to install two to five 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 Franklin Township as they hope to be on the forefront of the green infrastructure movement.



## FUNDING SOURCES

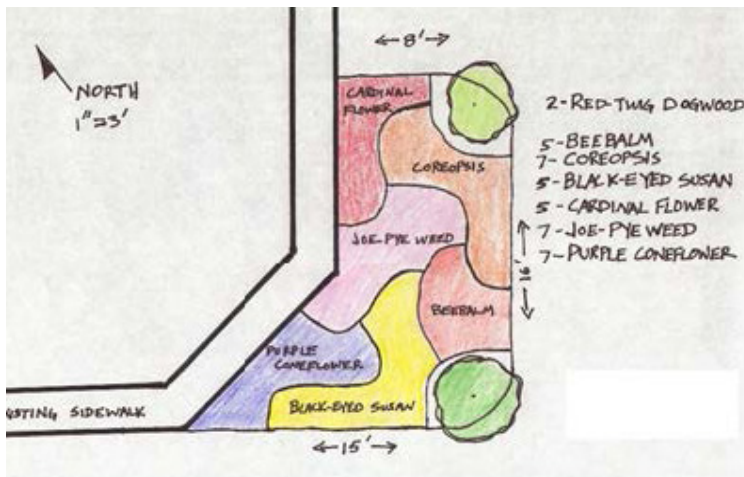
Franklin Township is committed to implementing green infrastructure throughout the municipality and is currently partnering with the Rutgers Cooperative Extension (RCE) Water Resources Program on a municipal-wide green infrastructure initiative funded through a grant from Sustainable Jersey. A source 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

Franklin Township may pursue a rain garden rebate program to install rain gardens throughout the municipality. Many surrounding municipalities have successfully launched a Rain Barrel Rebate Program and could serve as a model and resource for Franklin Township. As the green infrastructure initiative moves forward, there will be opportunities 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

Franklin 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. Franklin 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](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 two to five 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 18.8% (5,549.5 acres), Franklin Township's green infrastructure initiative short-term (i.e., less than five years) impervious cover management goal is to manage stormwater runoff for 15 acres of impervious cover. The long-term goal is to manage 50 acres of impervious surfaces within twenty years. These goals are highly dependent on securing adequate funding for the implementation of green infrastructure projects.





# APPENDIX A: COMMUNITY ENGAGEMENT & EDUCATION

## BUILD A RAIN BARREL WORKSHOP

88



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 FRANKLIN TOWNSHIP'S GREEN INFRASTRUCTURE SYSTEMS

1

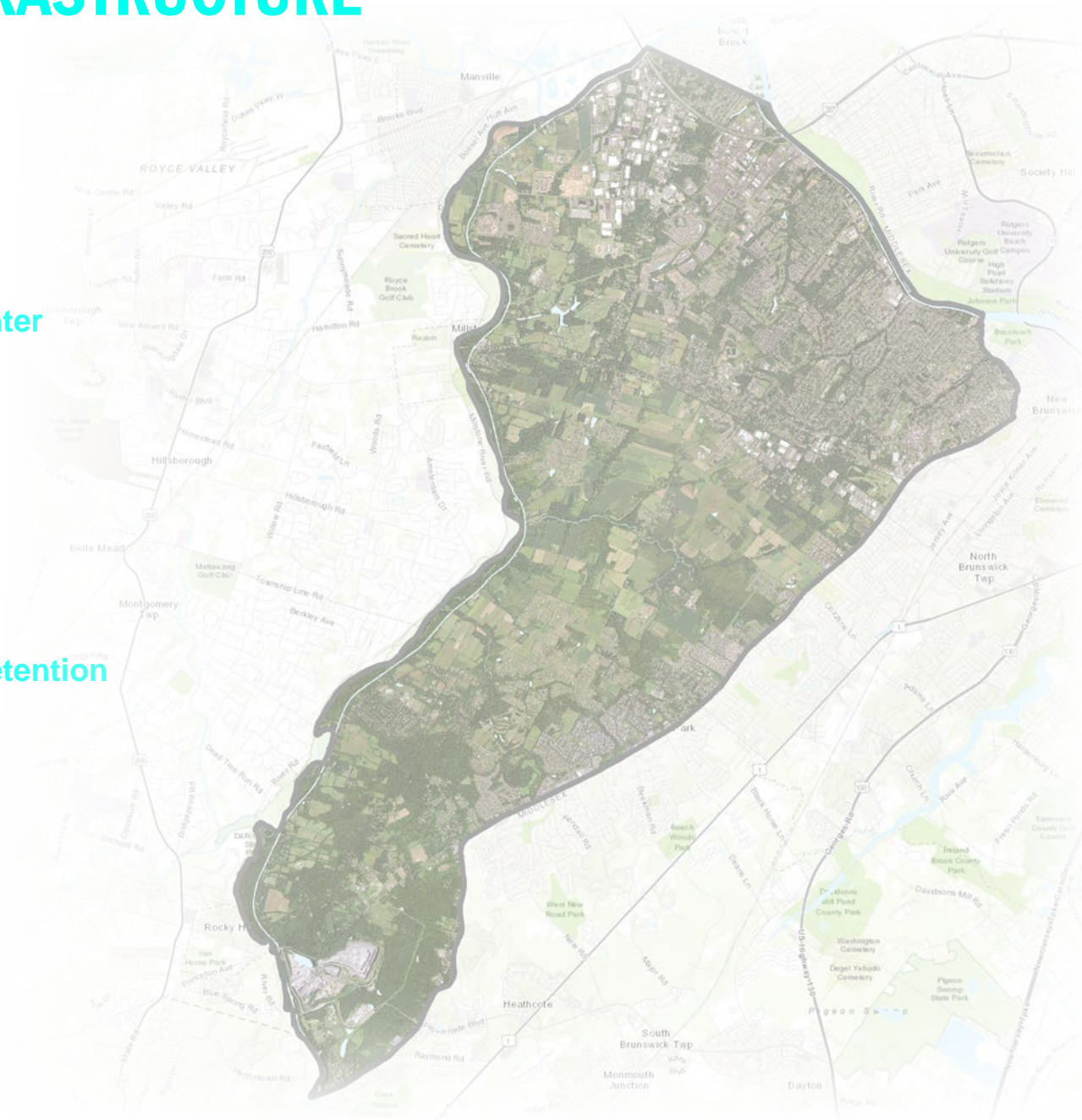
**Rain Garden  
Stormwater Planter  
Tree Filter Box**

2

**Rain Barrel  
Cistern**

3

**Porous Asphalt  
Underground Detention**





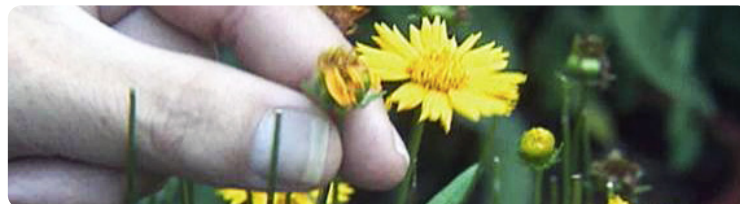
## RAIN GARDEN / STORMWATER PLANTER / TREE FILTER BOX

### 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





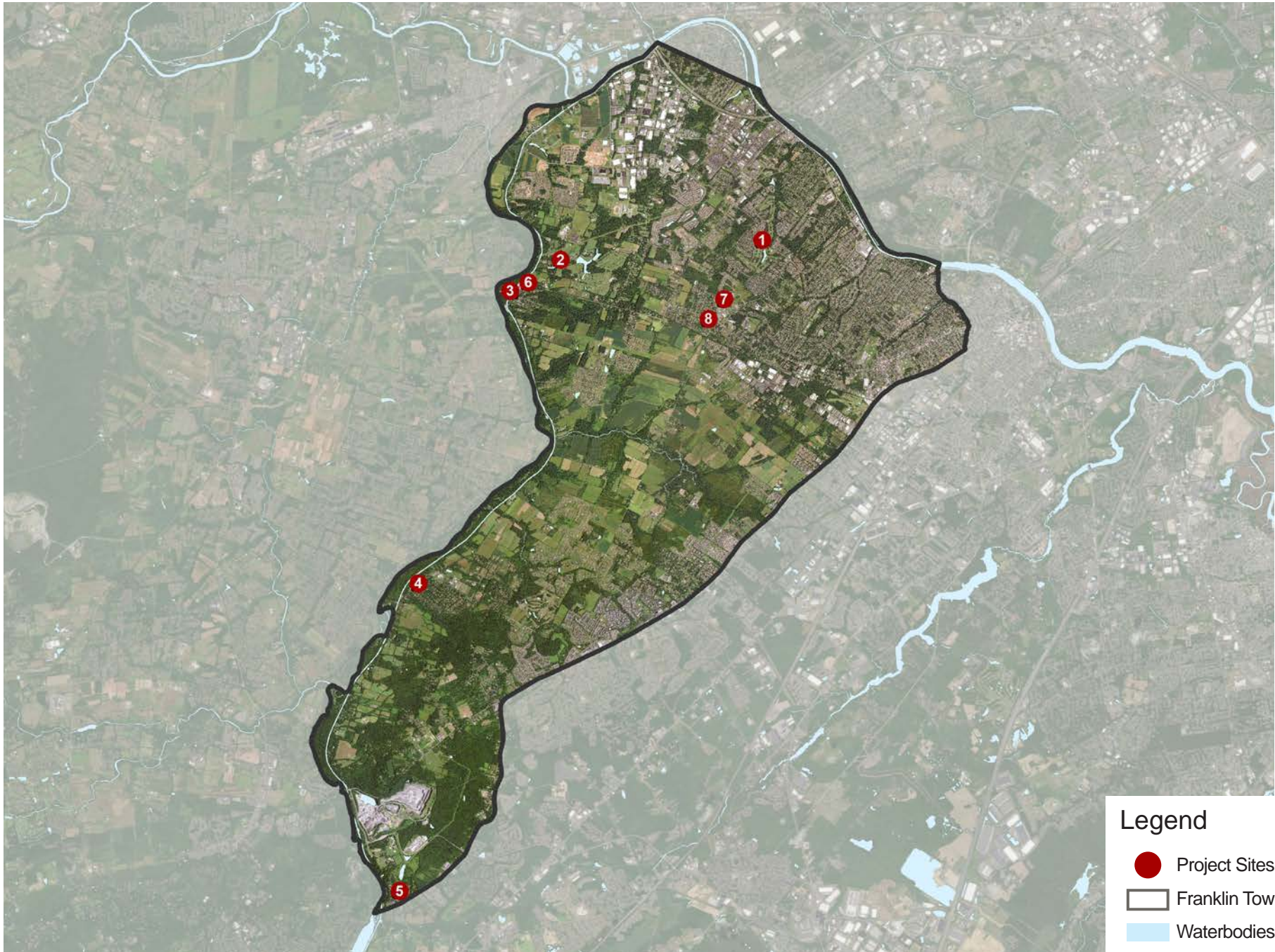


# **APPENDIX C: ADDITIONAL POTENTIAL PROJECT SITES SPRING 2021**

# POTENTIAL PROJECT SITES WITHIN STUDY AREA






Site	Name	Address	Page #
1	Quail Brook Golf Course	625 New Brunswick Road, Somerset, NJ 08873	100
2	Colonial Park & Spooky Brook Golf Course	156 Mettlers Road, Somerset, NJ 08873	102
3	East Millstone First Aid Squad	2378 Amwell Road, Somerset, NJ 08873	104
4	Griggstown Volunteer Fire Company	1037 Canal Road, Princeton, NJ 08540	106
5	Kingston School Park & Ying Hua International School	25 Laurel Avenue, Kingston, NJ 08528	108
6	Millstone Valley Fire Company	2365 Amwell Road, Franklin, NJ 08873	110
7	Franklin Board of Education	1755 Amwell Road, Somerset, NJ 08873	112
8	Middlebush Volunteer Fire Department	21 Olcott Street, Franklin, NJ 08873	114









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



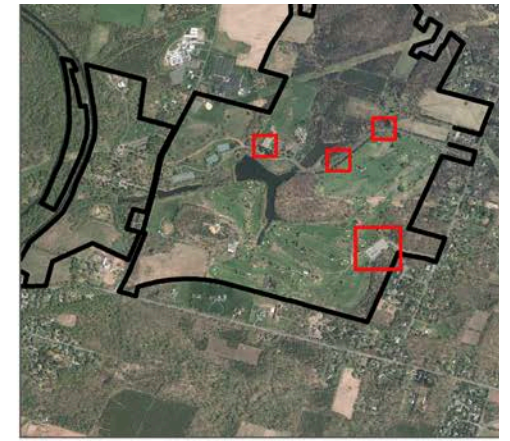


Porous pavement systems can be installed to capture, treat, and infiltrate parking lot runoff. Bioretention systems can be installed to manage rooftop runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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"
8	685,243	33.0	346.1	3,146.2	0.534	18.79

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	6,250	0.23	820	\$4,100
Pervious pavement	1.250	209	91,690	3.45	13,265	\$331,625



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



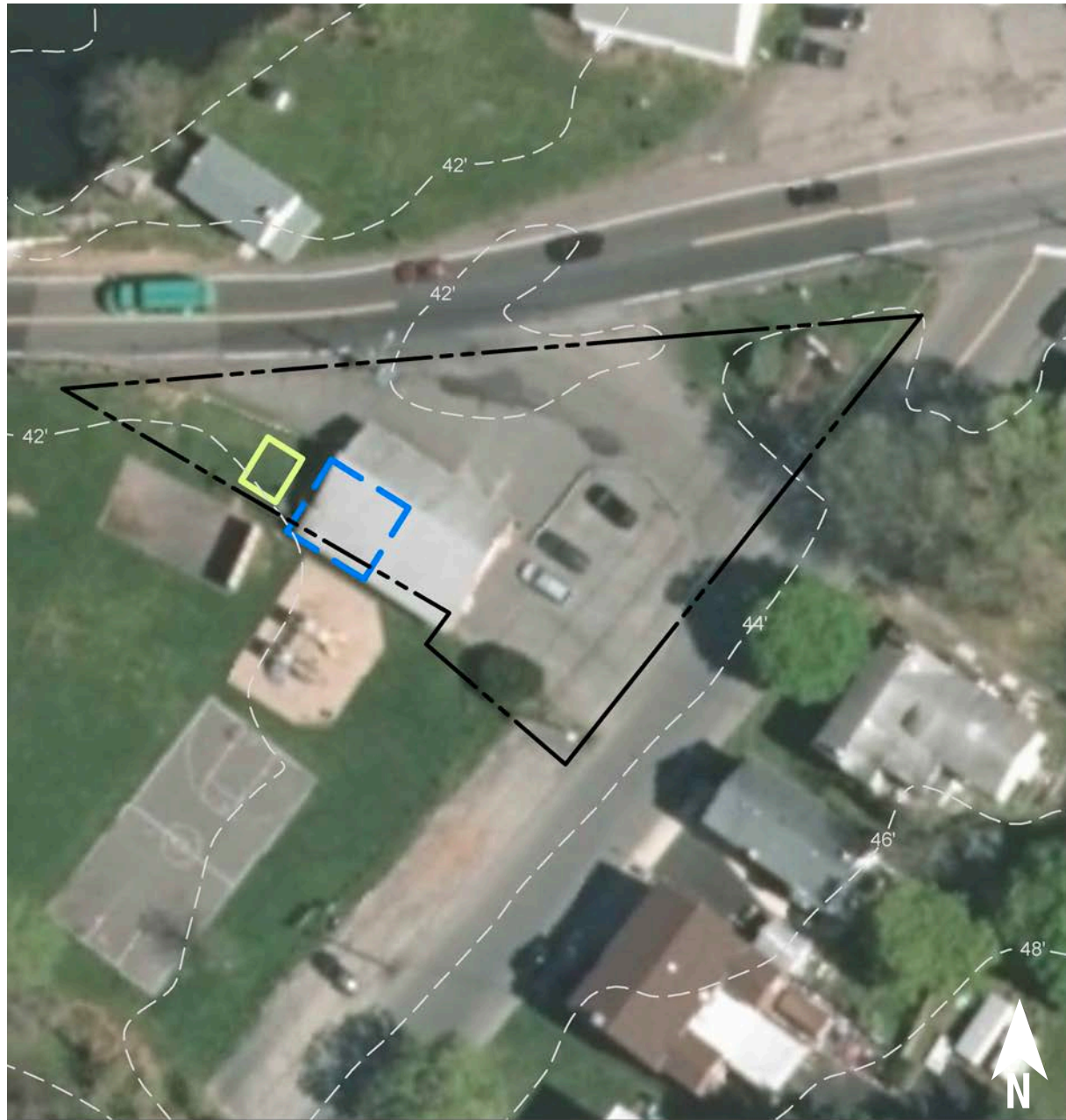






Bioretention systems can be installed to capture, treat, and infiltrate roadway and parking lot runoff by intercepting runoff before it reaches nearby catch basins. A preliminary soil assessment suggests that more soil testing would be required before determining the soil’s suitability for green infrastructure.

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	1,860,862	89.7	939.8	8,543.9	1.450	51.04

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
Bioretention systems	0.653	109	47,920	1.80	6,300	\$31,500



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

0' 25' 50'





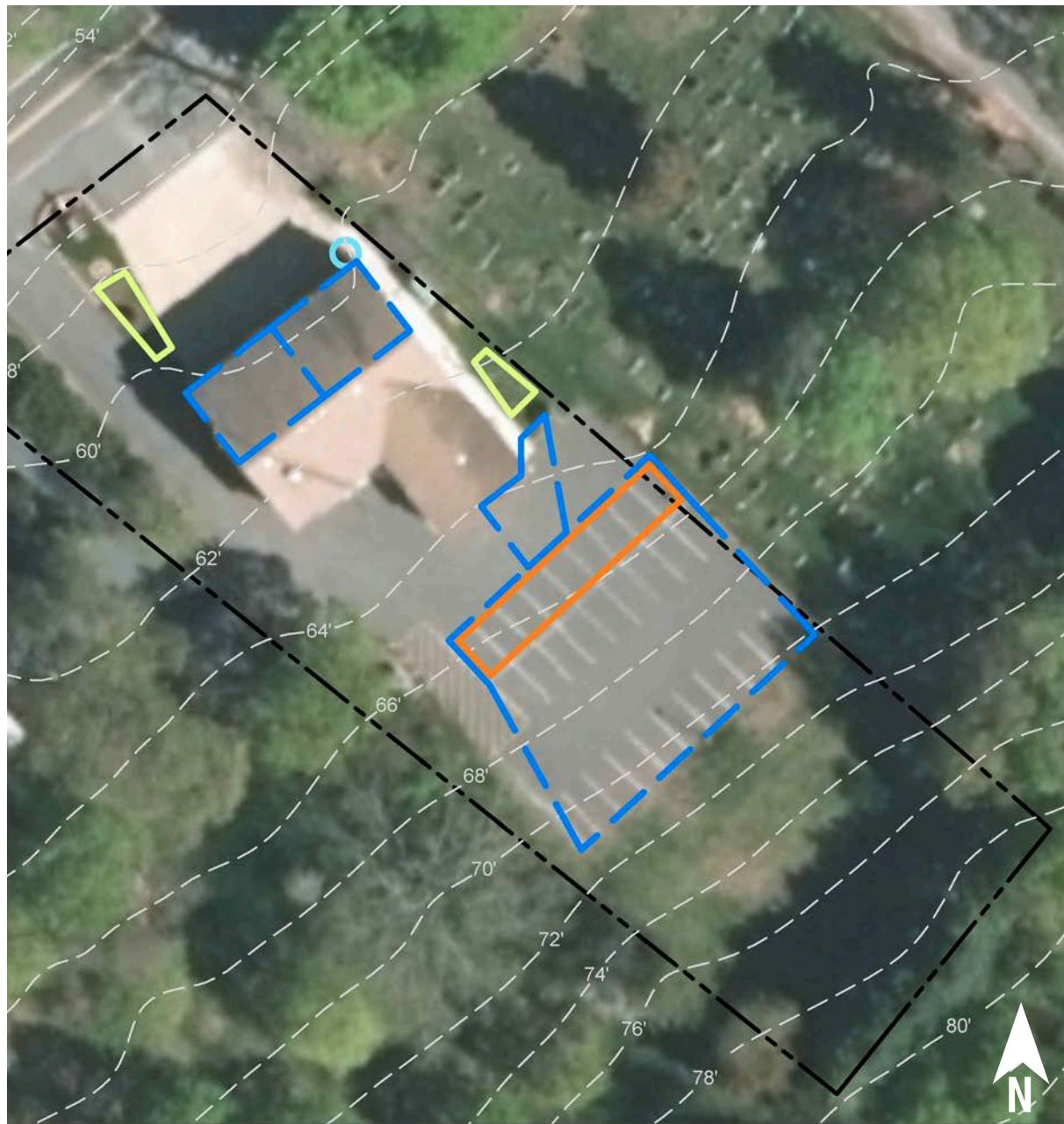






A bioretention system can be installed to capture, treat, and infiltrate rooftop and parking lot runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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	10,848	0.5	5.5	49.8	0.008	0.30

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	0.018	3	1,290	0.05	170	\$850



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

0' 25' 50'







Bioretention systems can be installed to capture, treat, and infiltrate rooftop runoff. Pervious pavement can be installed to manage parking lot runoff. A rainwater harvesting system can be installed to capture and reuse rooftop runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil’s suitability 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"
59	21,900	1.1	11.1	100.6	0.017	0.60

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	0.036	6	2,640	0.10	350	\$1,750
Pervious pavement	0.162	27	11,860	0.45	1,460	\$36,500
Rainwater harvesting	0.022	4	650	0.02	650 (gal)	\$1,300



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











Bioretention systems can be installed to capture, treat, and infiltrate rooftop runoff. The gardens will also provide an educational opportunity for the school. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
23	50,452	2.4	25.5	231.6	0.039	1.38

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	0.034	6	2,480	0.09	330	\$1,650



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

0' 25' 50'



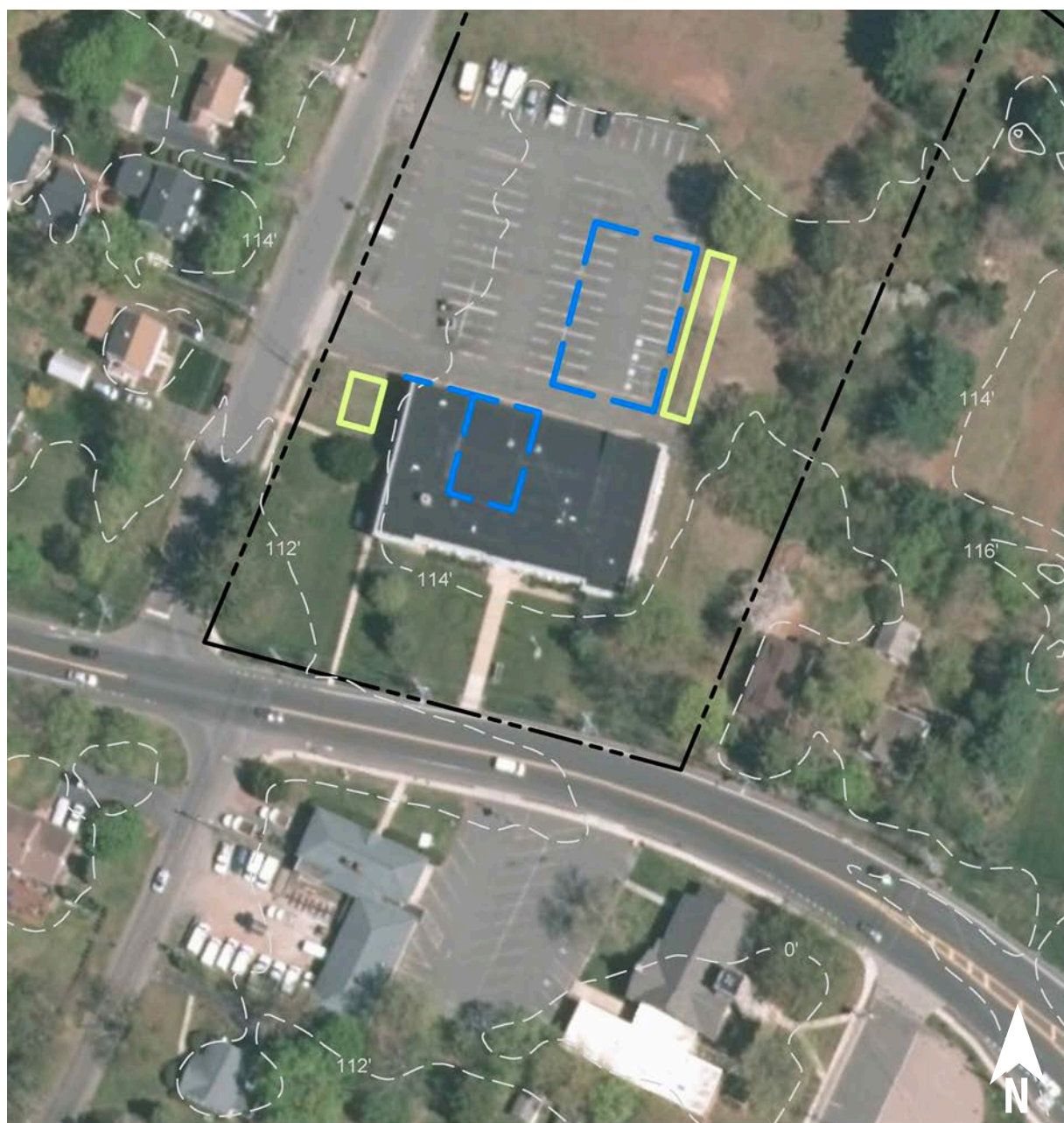






Bioretention systems can be installed to capture, treat, and infiltrate parking lot runoff. Pervious pavement can be installed to manage parking lot runoff. A rainwater harvesting system can be installed to capture and reuse rooftop runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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	62,098	3.0	31.4	285.1	0.048	1.70

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	0.075	12	5,470	0.21	715	\$3,575
Pervious pavement	0.246	41	18,030	0.68	2,520	\$63,000
Rainwater harvesting	0.033	6	1,000	0.04	1,000 (gal)	\$2,000



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

0' 50' 100'












A bioretention system can be installed to capture, treat, and infiltrate parking lot runoff. A second bioretention system can be installed near the driveway entrance by directing a downspout to that area. A preliminary soil assessment suggests that more soil testing would be required before determining the soil’s suitability 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"
32	77,031	3.7	38.9	353.7	0.060	2.11

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 systems	0.224	38	16,440	0.62	2,150	\$10,750



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

0' 25' 50'





A bioretention system can be installed to capture, treat, and infiltrate parking lot runoff. A rainwater harvesting system can be installed to capture and reuse rooftop runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
73	40,434	1.9	20.4	185.6	0.032	1.11

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 systems	0.140	23	10,280	0.39	1,350	\$6,750
Rainwater harvesting	0.050	8	1,500	0.06	1,500	\$3,000



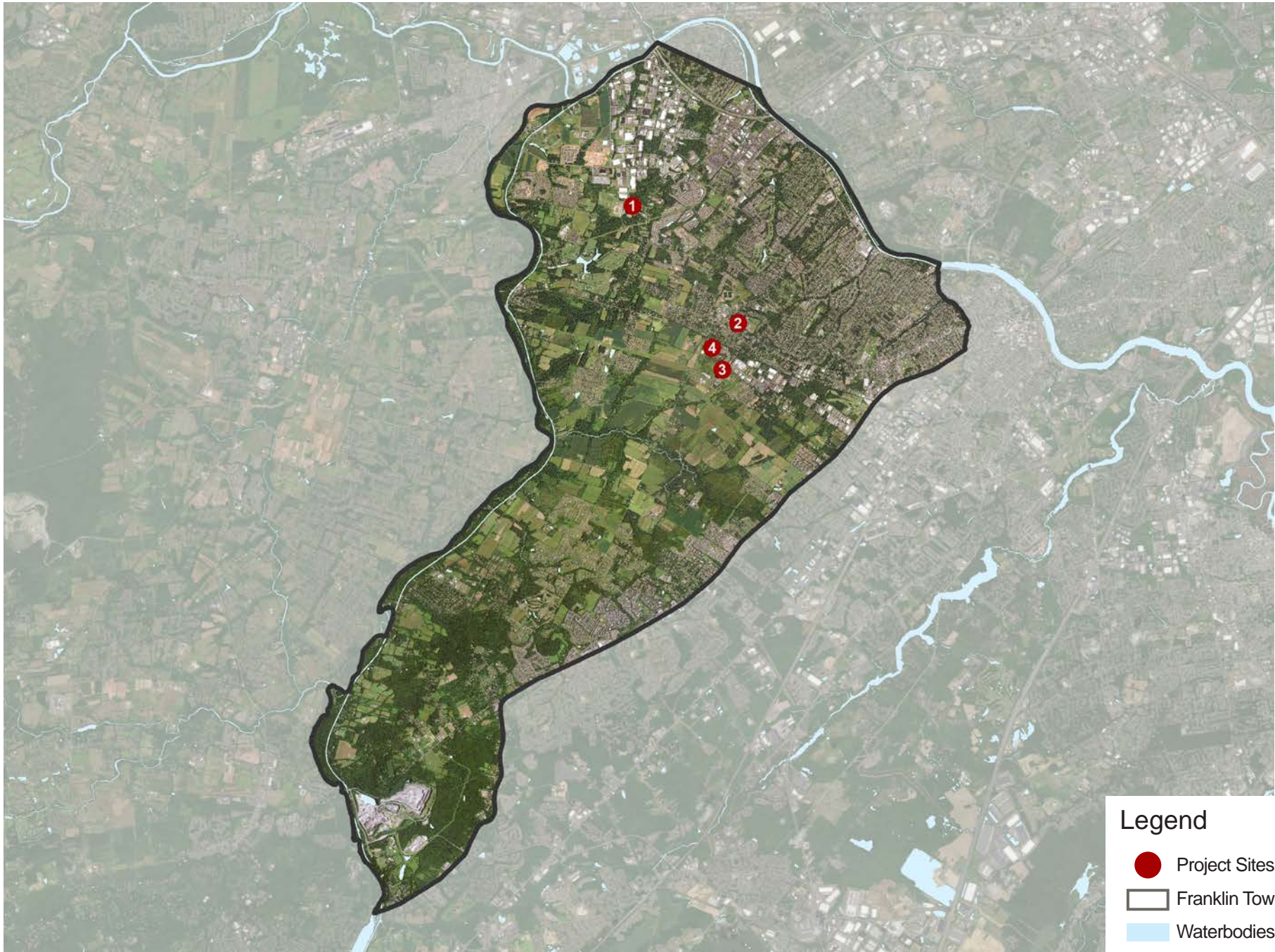


# **APPENDIX D: POTENTIAL BASIN SITES SUITABLE FOR NATURALIZATION/RETROFIT SPRING 2021**

# POTENTIAL PROJECT SITES WITHIN STUDY AREA

Site	Name	Address	Page #
1	Franklin High School Basins	500 Elizabeth Avenue, Somerset, NJ 08873	120
2	Somerset Swaminarayan Temple	1667 Amwell Road, Somerset, NJ, 08873	121
3	Middlebush Brook Residential Basins	85 Dahmer Road, Franklin Township, NJ 08873	122
4	Grace Raod Basin	4 Grace Road, Somerset, NJ 08873	123

















## MIDDLEBUSH BROOK RESIDENTIAL BASINS

85 Dahmer Road  
Franklin, NJ 08873







