RUTGERS
New Jersey Agricultural
Experiment Station

Draft

Impervious Cover Reduction Action Plan
for
Middletown Township, Monmouth County, New Jersey

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

Jauary 15, 2021

Sea Grant
NJ Sea Grant Consortium

ACKNOWLEDGEMENTS:

This document has been prepared by the Rutgers Cooperative Extension Water Resources Program, with funding and direction from the New Jersey Sea Grant Consortium and the New Jersey Agricultural Experiment Station, to highlight green infrastructure opportunities within Middletown Township. We would like to thank the New Jersey Sea Grant Consortium, the New Jersey Agricultural Experiment Station, and Middletown Township for their input and support in creating this document.

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Introduction

Located in Monmouth County, New Jersey, Middletown Township covers approximately 58.74 square miles. Figures 1 and 2 illustrate that Middletown Township is dominated by urban land use. A total of 54.5% of the municipality's land use is classified as urban. Of the urban land in Middletown Township, low density residential is the dominant land use (Figure 3).

The New Jersey Department of Environmental Protection's (NJDEP) 2015 land use/land cover geographical information system (GIS) data layer categorizes Middletown Township into many unique land use areas, assigning a percent impervious cover for each delineated area. These impervious cover values were used to estimate the impervious coverage for Middletown Township. Based upon the 2015 NJDEP land use/land cover data, approximately 22.1% of Middletown Township has impervious cover. This level of impervious cover suggests that the streams in Middletown Township are likely impacted streams. [1]

Methodology

Middletown Township contains portions of nine subwatersheds (Figure 4). For this impervious cover reduction action plan, projects have been identified in four of these watersheds. 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. Sites that already had stormwater management practices in place were not considered.

[1] Schuler, T.R., L. Fraley-McNeal, and K. Cappiella. 2009. Is Impervious Cover Still Important? Review of Recent Research. *Journal of Hydrologic Engineering* 14 (4): 309-315.

Land Use Types for Middletown Township

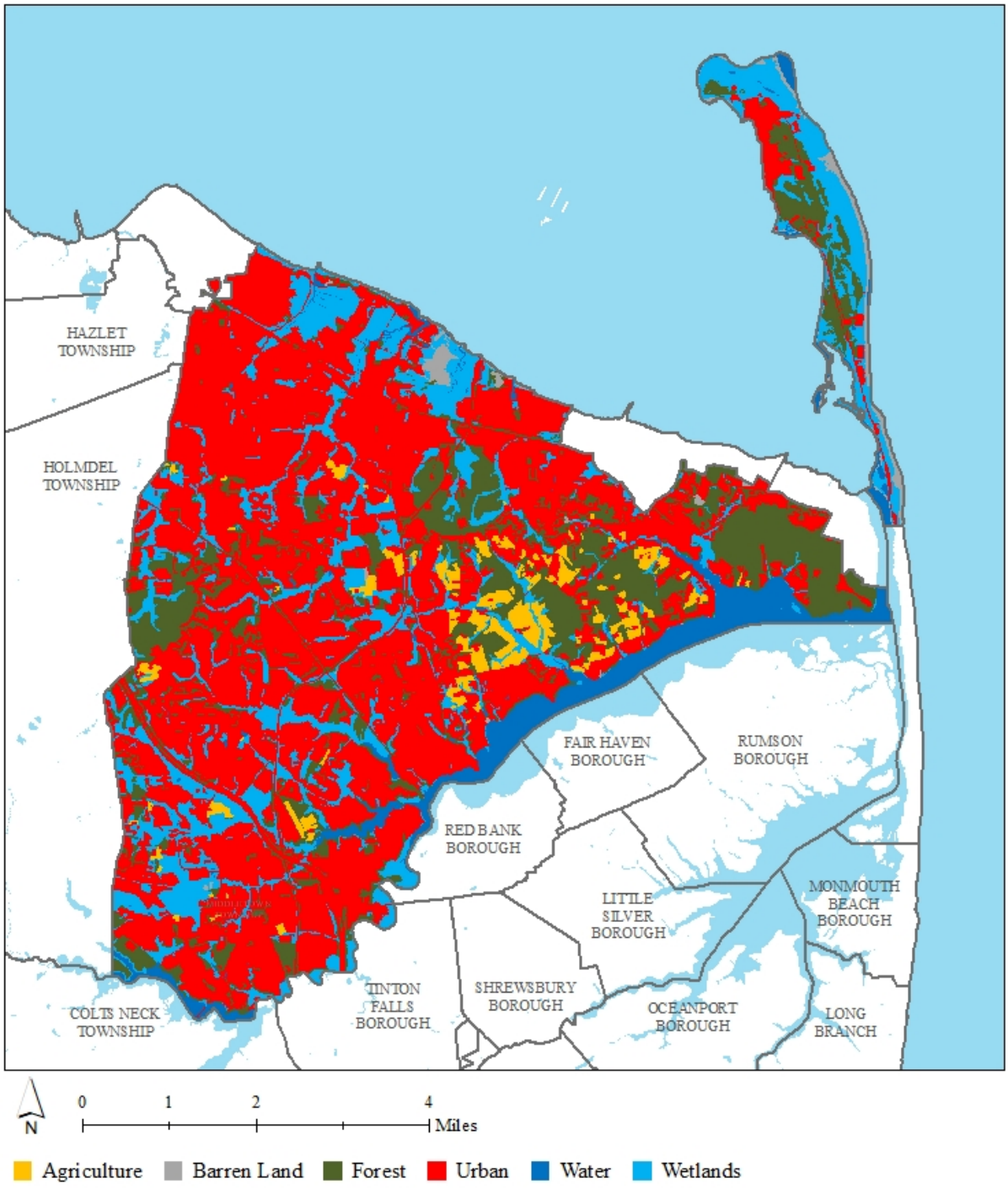


Figure 1: Map illustrating the land use in Middletown Township

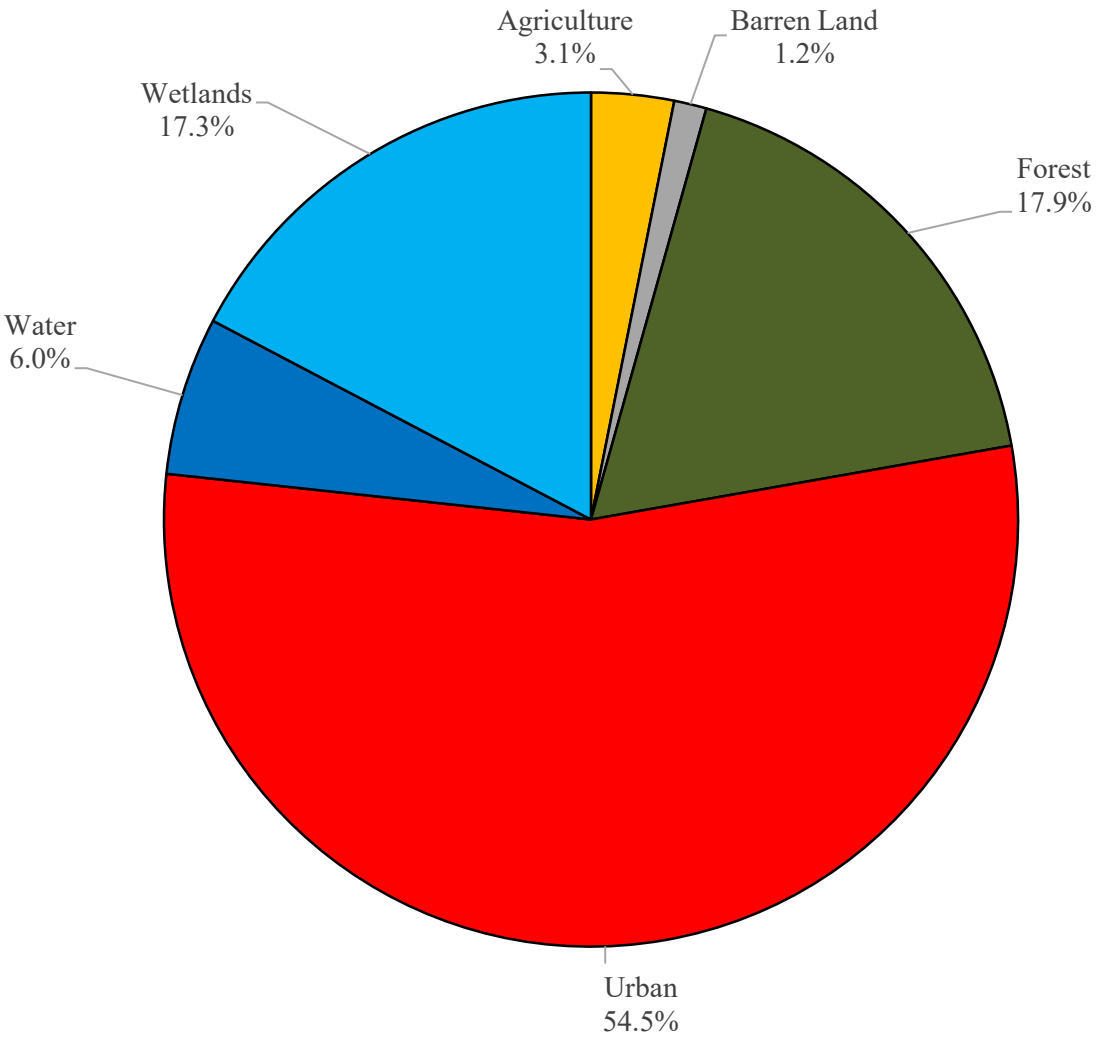


Figure 2: Pie chart illustrating the land use in Middletown Township

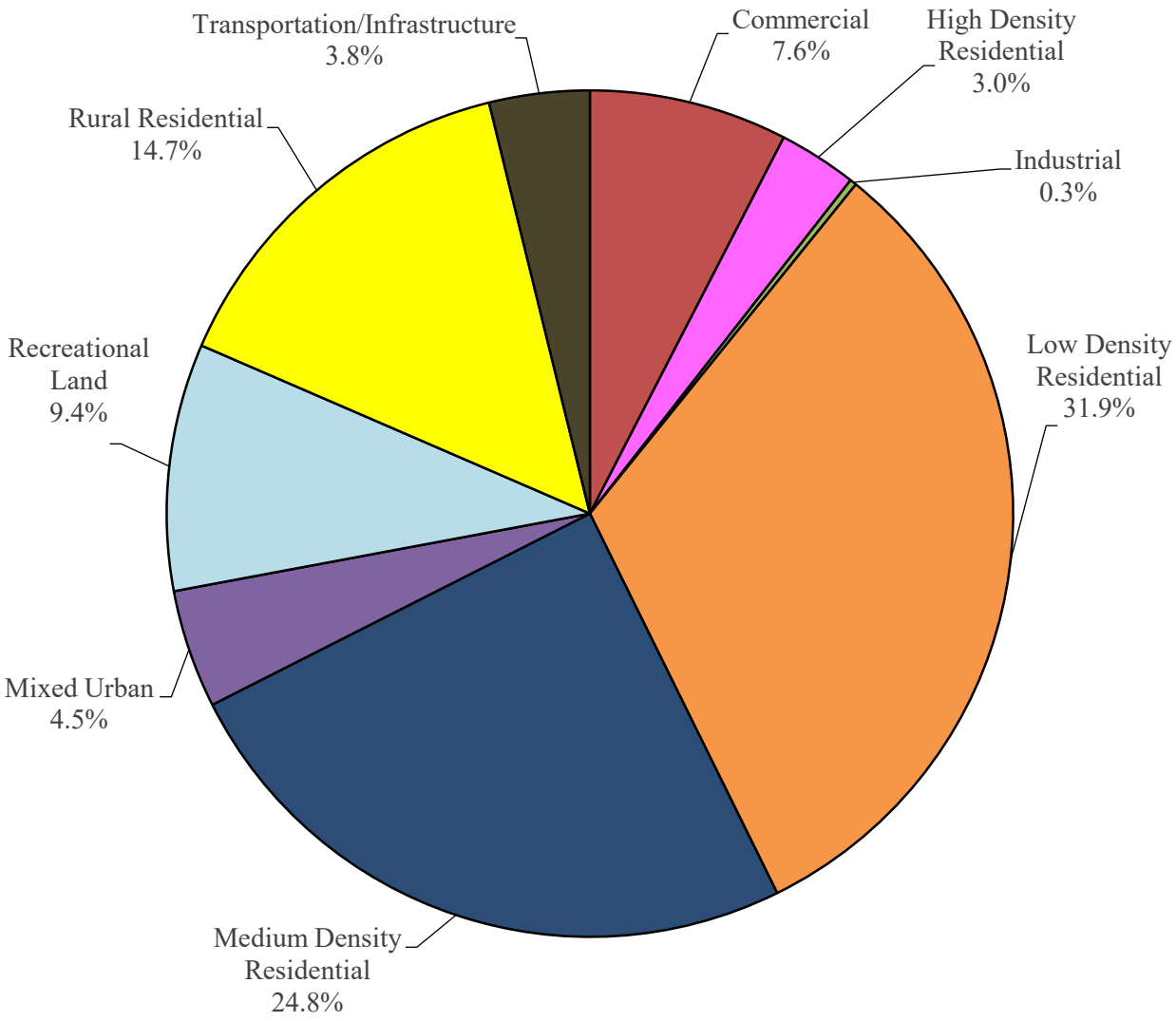


Figure 3: Pie chart illustrating the various types of urban land use in Middletown Township

Subwatersheds of Middletown Township

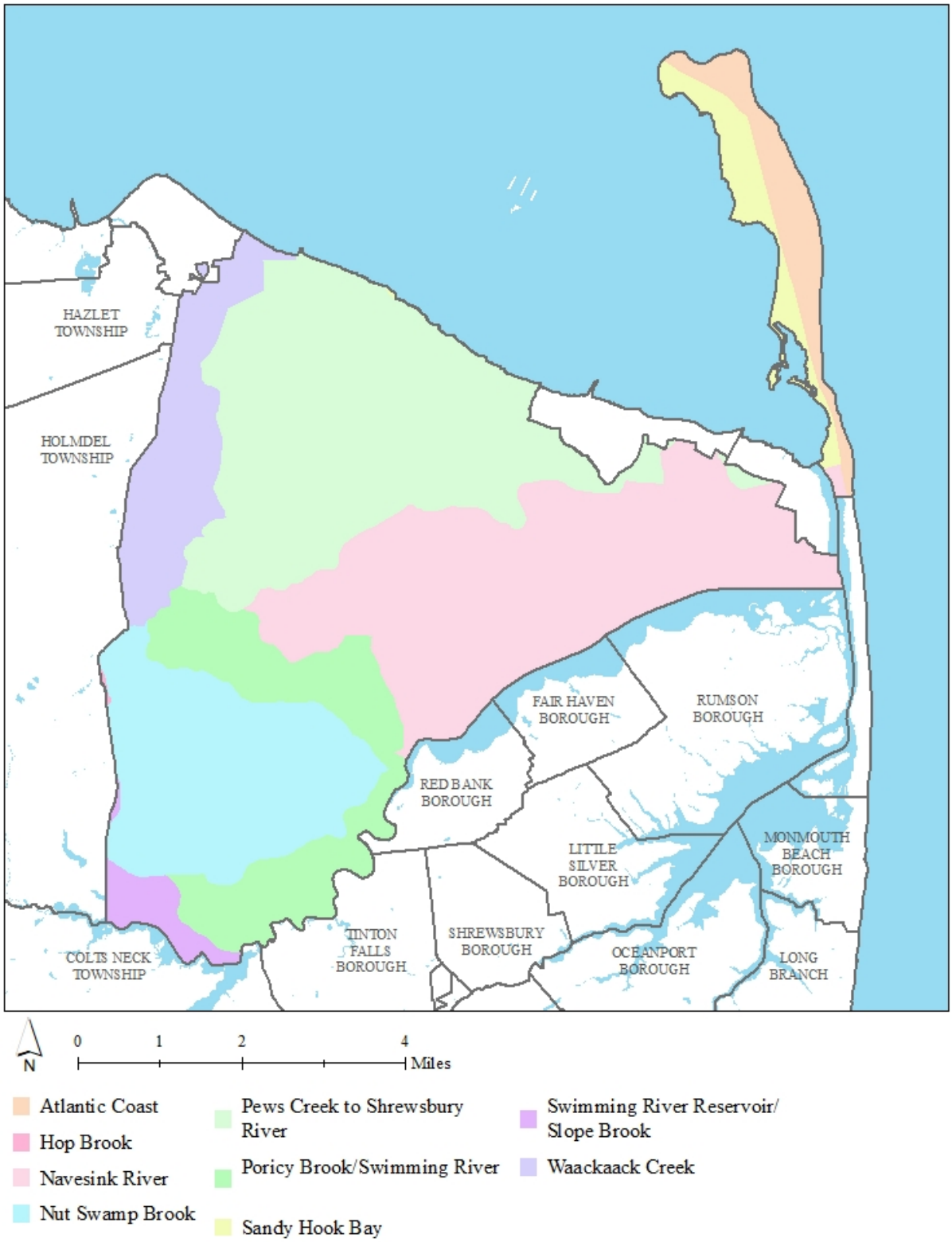


Figure 4: Map of the subwatersheds in Middletown Township

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 in developing 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 Middletown 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. Several key soil parameters were examined (e.g., natural drainage class, saturated hydraulic conductivity of the most limiting soil layer (K_{sat}), depth to water table, and hydrologic soil group) to evaluate the suitability of each site's soil for green infrastructure practices. In cases where multiple soil types were encountered, the key soil parameters were examined for each soil type expected at a site.

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.

Table 1: Aerial Loading Coefficients[2]

Land Cover	TP load (lbs/acre/yr)	TN load (lbs/acre/yr)	TSS load (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

[2] New Jersey Department of Environmental Protection (NJDEP), Stormwater Best Management Practice Manual, 2004.

Green Infrastructure Practices

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 produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these practices 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[3]. A wide range of green infrastructure practices have been evaluated for the potential project sites in Middletown Township. Each practice is discussed below.

Disconnected downspouts

This is often referred to as simple disconnection. A downspout is simply disconnected, prevented from draining directly to the roadway or storm sewer system, and directed to discharge water to a pervious area (i.e., lawn).

Pervious pavements

There are several types of permeable pavement systems including porous asphalt, pervious concrete, permeable pavers, and grass pavers. These surfaces are hard and support vehicle traffic but also allow water to infiltrate through the surface. They have an underlying stone layer to store stormwater runoff and allow it to slowly seep into the ground.

[3] United States Environmental Protection Agency (USEPA), 2013. Watershed Assessment, Tracking, and Environmental Results, New Jersey Water Quality Assessment Report. http://ofmpub.epa.gov/waters10/attains_state.control?p_state=NJ

Bioretention systems/rain gardens

These are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff. These systems can easily be incorporated into existing landscapes, improving aesthetics and creating wildlife habitat while managing stormwater runoff. Bioretention systems also can be used in soils that do not quickly infiltrate by incorporating an underdrain into the system.

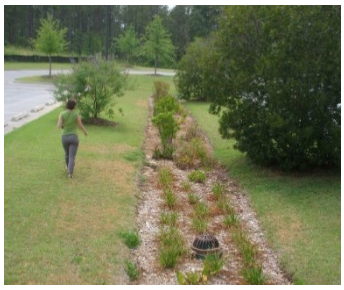
Downspout planter boxes

These are wooden boxes with plants installed at the base of a downspout that provide an opportunity to beneficially reuse rooftop runoff.

Rainwater harvesting systems (cistern or rain barrel)

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.

Bioswale



Bioswales are landscape features that convey stormwater from one location to another while removing pollutants and providing water an opportunity to infiltrate.

Stormwater planters

Stormwater planters are vegetated structures that are built into the sidewalk to intercept stormwater runoff from the roadway or sidewalk. Many of these planters are designed to allow the water to infiltrate into the ground while others are designed simply to filter the water and convey it back into the stormwater sewer system.

Tree filter boxes

These are pre-manufactured concrete boxes 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 sewer system.

Potential Project Sites

Appendix A contains information on potential project sites where green infrastructure practices could be installed as well as information on existing site conditions. The recommended green infrastructure practices and the drainage area that the green infrastructure practices can treat are identified for each potential project site. For each practice, the recharge potential, TSS removal potential, maximum volume reduction potential per storm, the peak reduction potential, and estimated costs are provided. This information is also provided so that proposed development projects that cannot satisfy the New Jersey stormwater management requirements for major development can use one of the identified projects to offset a stormwater management deficit. [4]

[4] New Jersey Administrative Code, N.J.A.C. 7:8, Stormwater Management, Statutory Authority: N.J.S.A. 12:5-3, 13:1D-1 et seq., 13:9A-1 et seq., 13:19-1 et seq., 40:55D-93 to 99, 58:4-1 et seq., 58:10A-1 et seq., 58:11A-1 et seq. and 58:16A-50 et seq., *Date last amended: April 19, 2010*.

Conclusion

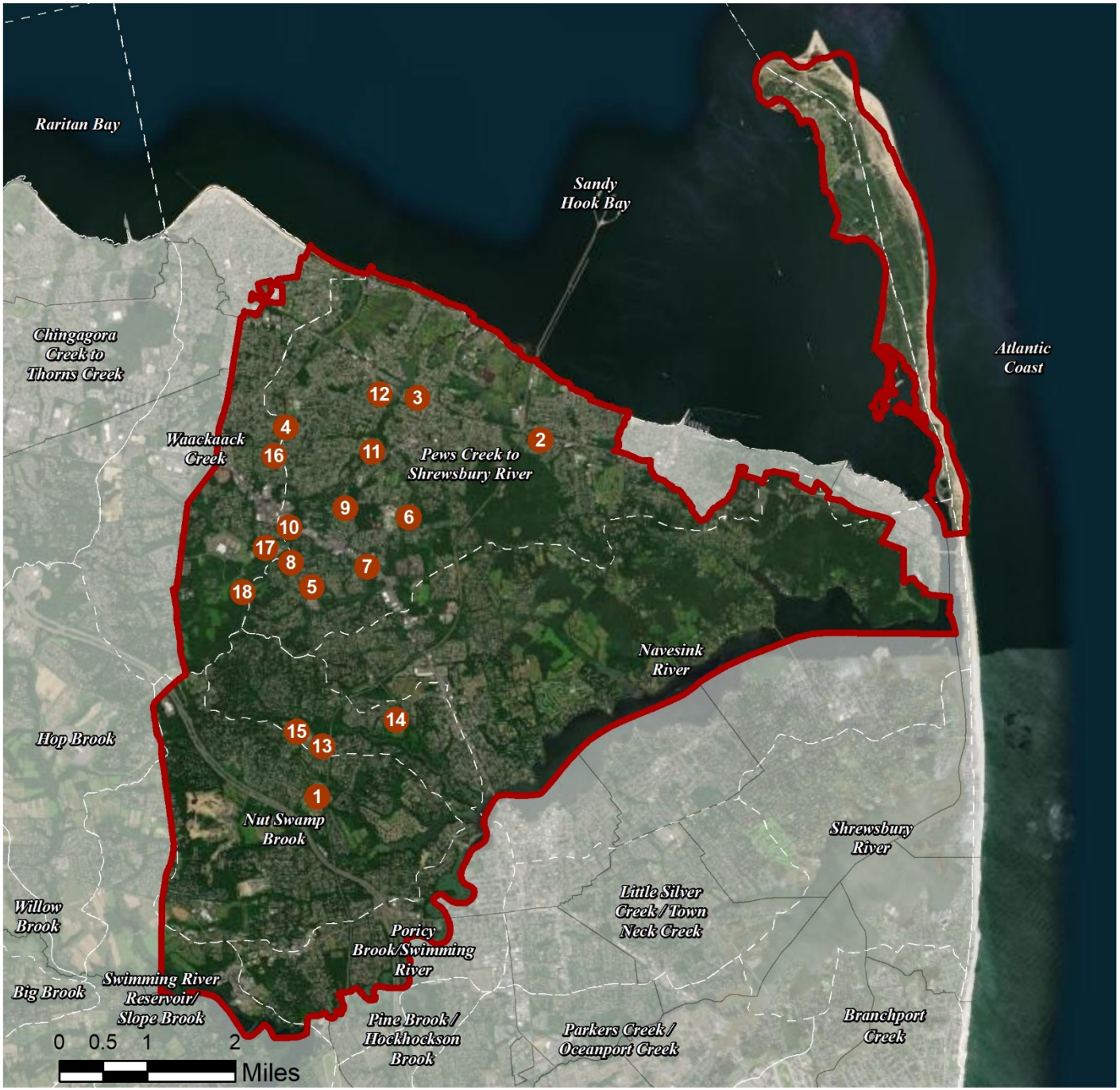
This impervious cover reduction action plan is meant to provide the municipality with a blueprint for implementing green infrastructure practices that will reduce the impact of stormwater runoff from impervious surfaces. These projects can be implemented by a wide variety of people such as boy scouts, girl scouts, school groups, faith-based groups, social groups, watershed groups, and other community groups.

Additionally, development projects that are in need of providing off-site compensation for stormwater impacts can use the projects in this plan as a starting point. The municipality can quickly convert this impervious cover reduction action plan into a stormwater mitigation plan and incorporate it into the municipal stormwater control ordinance.

Appendix A: Climate Resilient Green Infrastructure

a. Green Infrastructure Sites

MIDDLETOWN TOWNSHIP: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE NUT SWAMP BROOK SUBWATERSHED

1. Middletown High School South

SITES WITHIN THE PEWS CREEK TO SHREWSBURY RIVER SUBWATERSHED

2. Community Fire Company, Station #4
3. Elks Lodge 2179
4. Harmony Elementary School
5. Middletown Arts Center
6. Middletown High School North
7. Middletown Municipal Complex
8. Middletown Reformed Church
9. Middletown Library
10 Old Village Fire Company
11. Saint Mary, Mother of God Church/Saint Mary School
12 VFW Post 2179

SITES WITHIN THE PORICY BROOK/SWIMMING RIVER SUBWATERSHED

13. Normandy Park
14. Poricy Park Nature Center
15. Thompson Middle School

SITES WITHIN THE WAACKAACK CREEK SUBWATERSHED

16. King of Kings Lutheran Church
17. Middletown Village Elementary School
18. Tatum Park Red Hill Activity Center

b. Proposed Green Infrastructure Concepts

MIDDLETOWN HIGH SCHOOL SOUTH

Subwatershed: Nut Swamp Brook

Site Area: 3,752,809 sq. ft.

Address: 900 Nut Swamp Road
Middletown, NJ 07748

Block and Lot: Block 998, Lot 10

Parking spaces can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed to capture, treat, and infiltrate stormwater runoff from the rooftops and a section of 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"
21	800,994	38.6	404.5	3,677.7	0.624	21.97

Recommended Green 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	0.633	106	46,420	1.74	6,070	$30,350
Pervious pavement	2.125	356	155,890	5.86	14,560	$364,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Middletown High School South

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

0 100' 200'

COMMUNITY FIRE COMPANY, STATION #4

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 199,761 sq. ft.

Address: 85 Appleton Avenue
Leonardo, NJ 07737

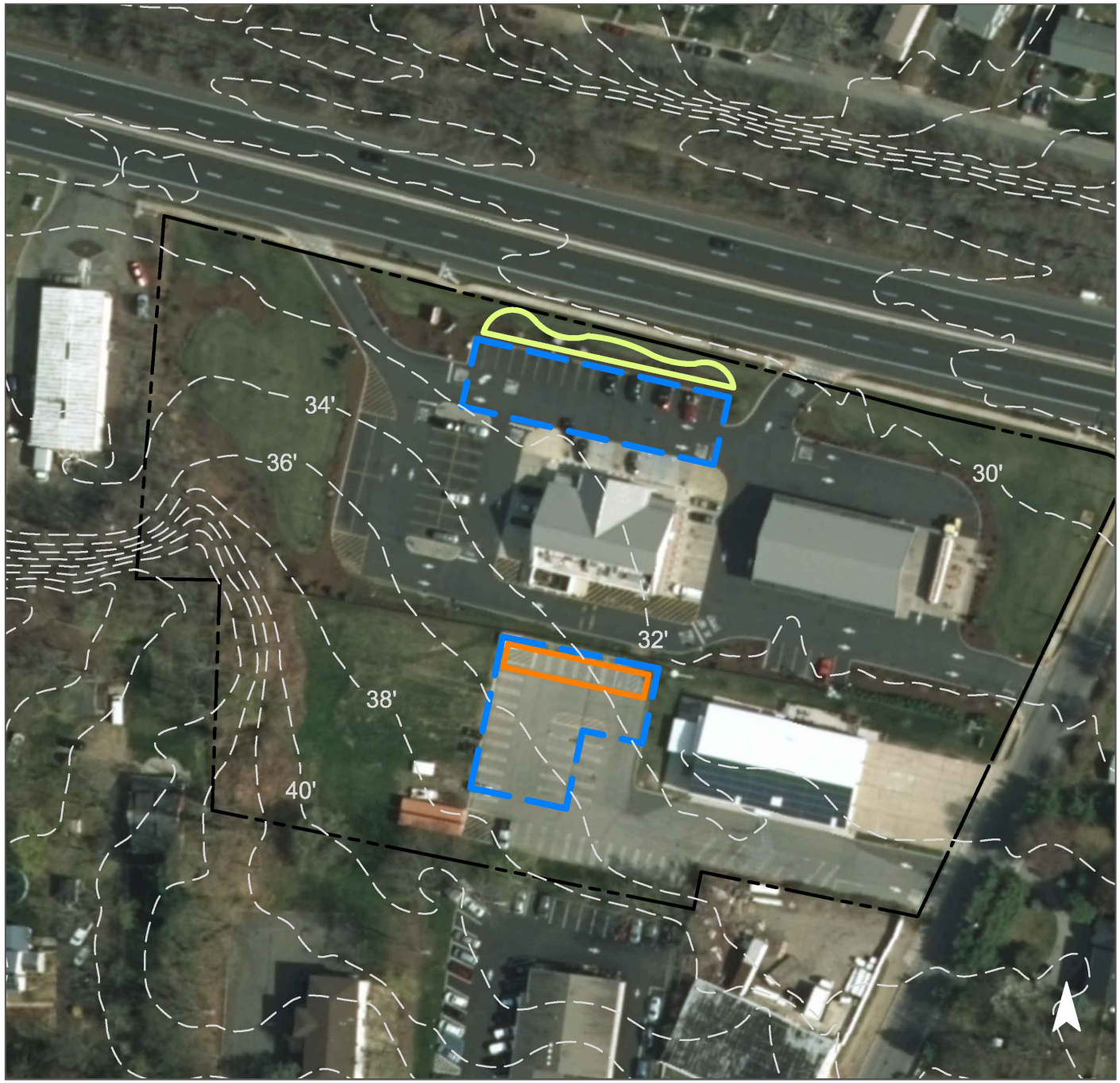
Block and Lot: Block 451, Lots 4, 5

Parking spaces can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. A rain garden can be installed in the turfgrass area near the entrance of the building to capture, treat, and infiltrate stormwater runoff from the roof. 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"
61	121,162	5.8	61.2	556.3	0.094	3.32

Recommended Green 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	0.200	33	14,680	0.55	1,920	$9,600
Pervious pavement	0.213	36	15,630	0.59	1,460	$36,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Community Fire Company, Station # 4

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

0 50' 100'

ELKS LODGE 2179

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 82,064 sq. ft.

Address: 251 Church Street
Belford, NJ 07718

Block and Lot: Block 296, Lot 7

Parking spaces in the parking lot to the east of the building can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed in the turfgrass at the entrance and rear of the building to capture, treat, and infiltrate stormwater runoff from the roof. 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"
86	70,702	3.4	35.7	324.6	0.055	1.94

Recommended Green 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	0.067	11	4,910	0.18	650	$3,250
Pervious pavement	0.134	22	9,840	0.37	920	$23,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Elks Lodge 2179

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

0 50' 100'

HARMONY ELEMENTARY SCHOOL

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 539,906 sq. ft.

Address: 100 Murphy Road
Middletown, NJ 07748

Block and Lot: Block 572, Lots 33, 34

Parking spaces can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed in the turfgrass areas around the school to capture, treat, and infiltrate stormwater runoff from the roof. 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	142,723	6.9	72.1	655.3	0.111	3.91

Recommended Green 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	0.282	47	20,730	0.78	2,710	$13,550
Pervious pavement	0.460	77	33,740	1.27	5,590	$139,750

GREEN INFRASTRUCTURE RECOMMENDATIONS

Harmony Elementary School

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

0 50' 100'

MIDDLETOWN ARTS CENTER

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 638,061 sq. ft.

Address: 36 Church Street
Middletown, NJ 07748

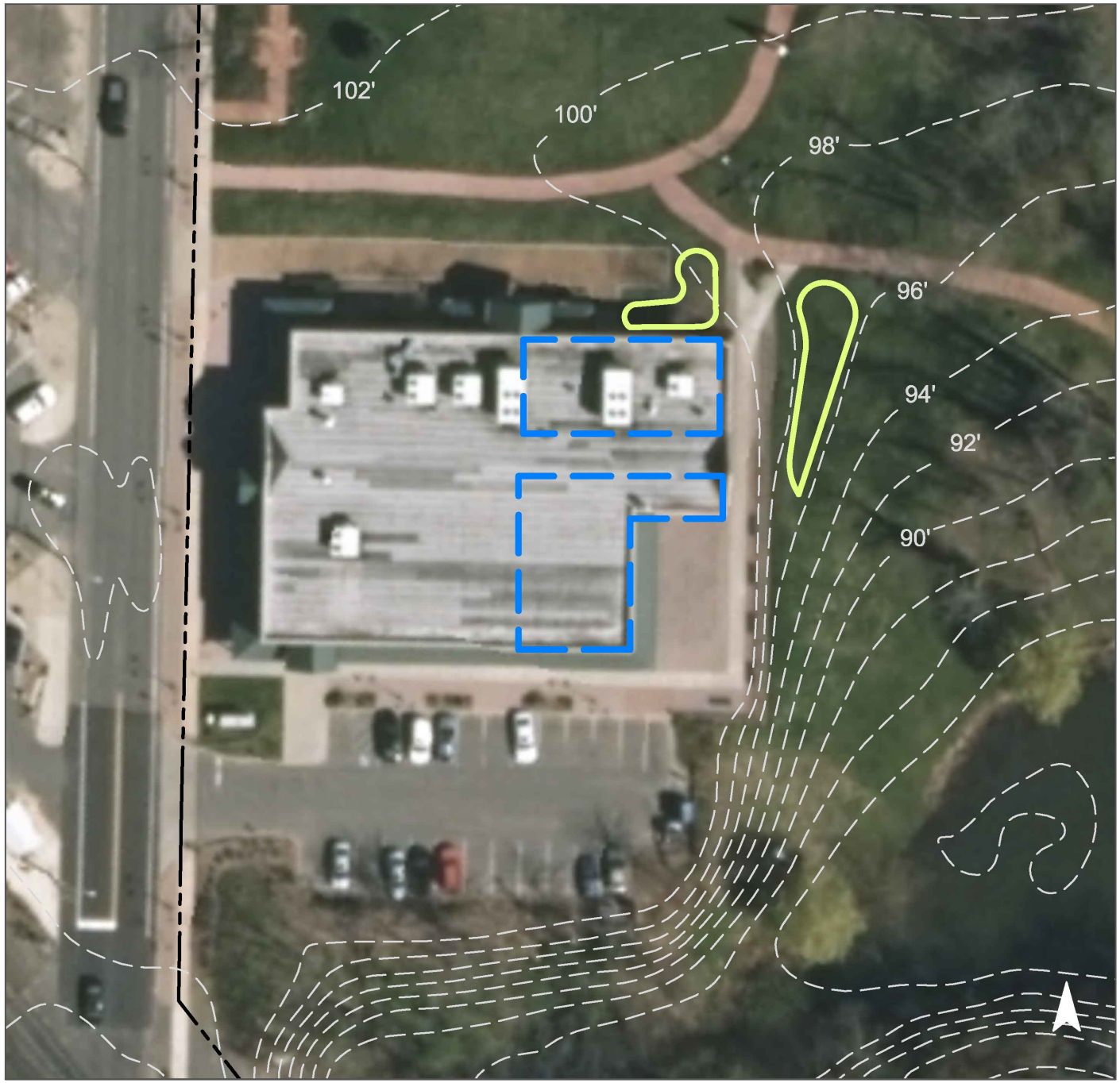
Block and Lot: Block 859, Lot 25.01

Rain gardens can be installed in the turfgrass area near the rear of the building to capture, treat, and infiltrate stormwater runoff from the roof. 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"
14	90,376	4.4	45.6	414.9	0.070	2.48

Recommended Green 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	8,590	0.32	1,125	$5,625

GREEN INFRASTRUCTURE RECOMMENDATIONS



Middletown Arts Center

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

0 25' 50'

MIDDLETOWN HIGH SCHOOL NORTH

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 2,111,770 sq. ft.

Address: 63 Tindall Road
Middletown, NJ 07748

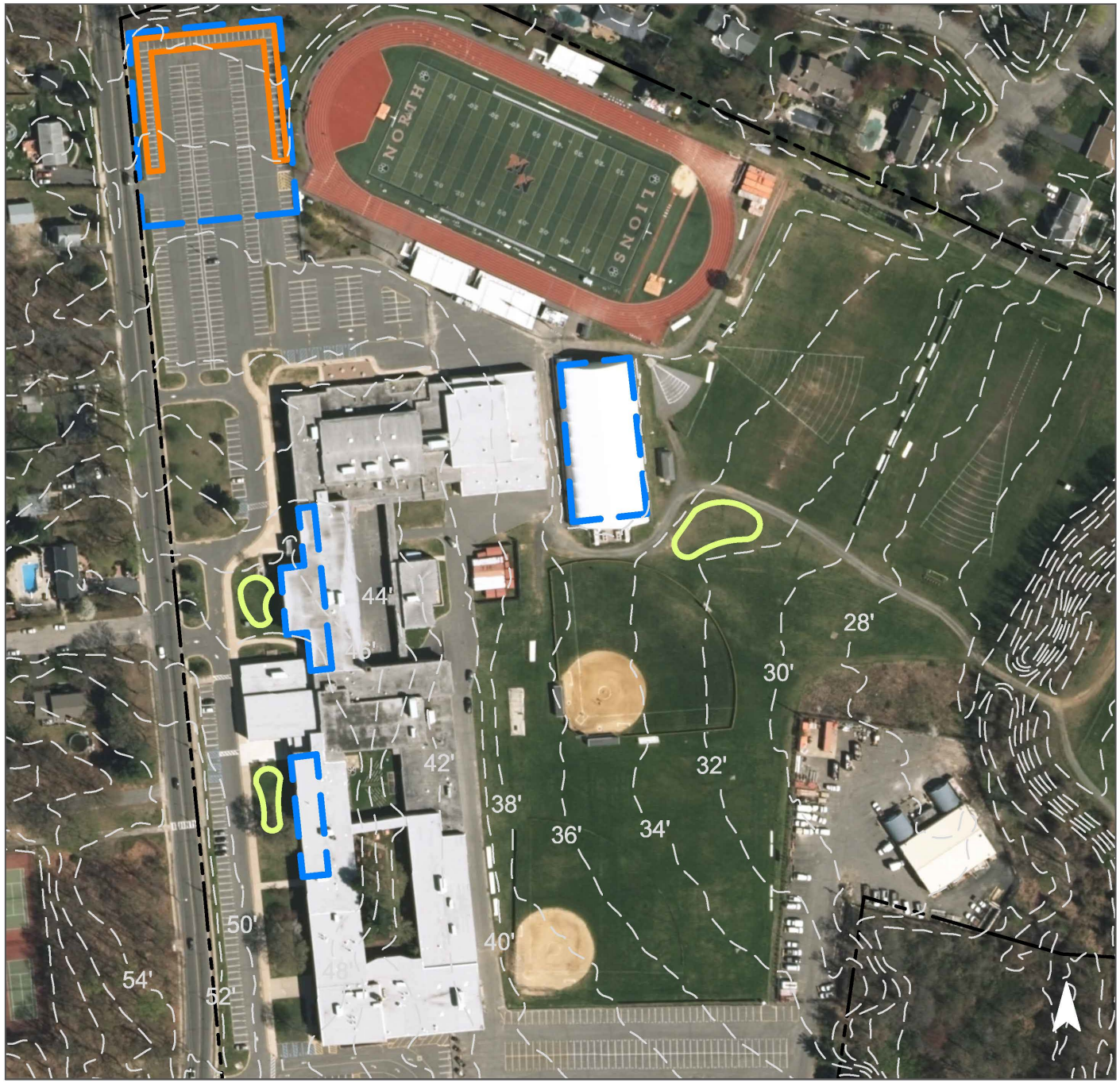
Block and Lot: Block 640, Lots 20,23,35

Parking spaces in the parking lot to the north of the building can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed at several locations to capture, treat, and infiltrate stormwater runoff from the rooftops. 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"
41	874,347	42.2	441.6	4,014.4	0.681	23.98

Recommended Green 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	0.879	147	64,520	2.42	8,440	$42,200
Pervious pavement	1.285	215	94,320	3.54	8,810	$220,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Middletown High School North

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

0 100' 200'

MIDDLETOWN MUNICIPAL COMPLEX

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 445,415 sq. ft.

Address: 1 Kings Highway
Middletown, NJ 07748

Block and Lot: Block 815, Lots 1.01,5,6,7

A section of parking spaces can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed in various locations to capture, treat, and infiltrate stormwater runoff from the rooftops. Three tree filter boxes can be installed to capture and filter 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"
54	240,026	11.6	121.2	1,102.0	0.187	6.58

Recommended Green 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	0.206	34	15,090	0.57	1,975	$9,875
Pervious pavement	0.529	89	38,810	1.46	4,880	$122,000
Tree filter boxes	n/a	92	n/a	n/a	3 (boxes)	$30,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Middletown Municipal Complex

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

0 50' 100'

MIDDLETOWN REFORMED CHURCH

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 167,123 sq. ft.

Address: 121 Kings Highway
Middletown, NJ 07748

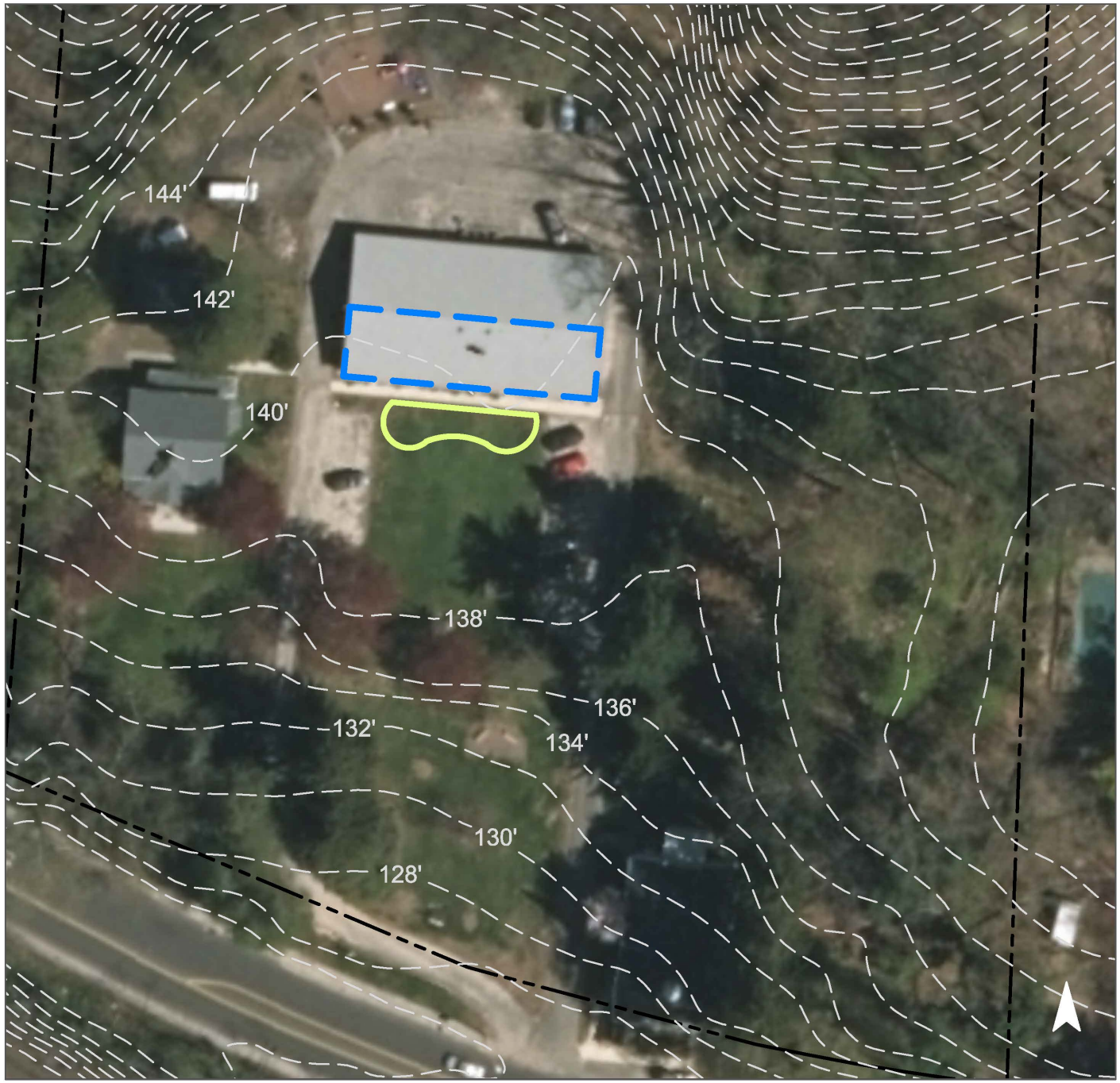
Block and Lot: Block 805, Lots 29,30

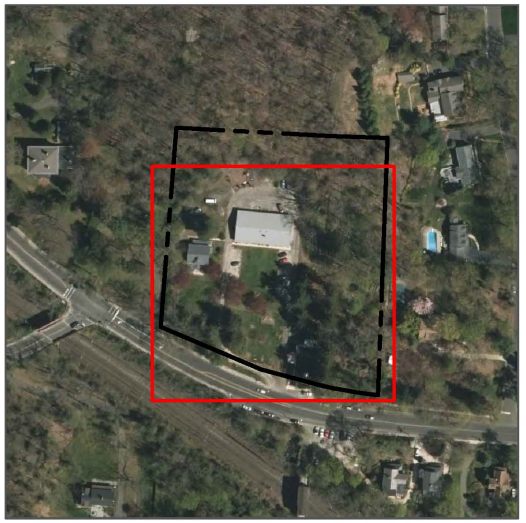
A rain garden can be installed at the entrance of the building to capture, treat, and infiltrate stormwater runoff from the roof. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
23	37,802	1.8	19.1	173.6	0.029	1.04

Recommended Green 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	0.071	12	5,200	0.20	680	$3,400

GREEN INFRASTRUCTURE RECOMMENDATIONS





Middletown Reformed Church

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

0 30' 60'

MIDDLETOWN LIBRARY

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 541,533 sq. ft.

Address: 55 New Monmouth Road
Middletown, NJ 07748

Block and Lot: Block 632, Lots 183,184

A section of parking spaces can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed at various locations of the building to capture, treat, and infiltrate stormwater runoff from the roof. 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"
25	136,404	6.6	68.9	626.3	0.106	3.74

Recommended Green 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	0.202	34	14,820	0.56	1,940	$9,700
Pervious pavement	0.433	72	31,740	1.19	5,140	$128,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Middletown Library

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

0 50' 100'

OLD VILLAGE FIRE COMPANY

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 48,278 sq. ft.

Address: 1340 NJ-35
Middletown, NJ 07748

Block and Lot: Block 805, Lot 22

A rain garden can be installed in the turfgrass area in the rear of the building to capture, treat, and infiltrate stormwater runoff from the roof. 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"
65	31,192	1.5	15.8	143.2	0.024	0.86

Recommended Green 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	0.050	8	3,700	0.14	517	$2,585

GREEN INFRASTRUCTURE RECOMMENDATIONS

Old Village Fire Company

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

0 25' 50'

SAINT MARY, MOTHER OF GOD CHURCH / SAINT MARY SCHOOL

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 2,435,725 sq. ft.

Address: 538 Church Street
Middletown, NJ 07748

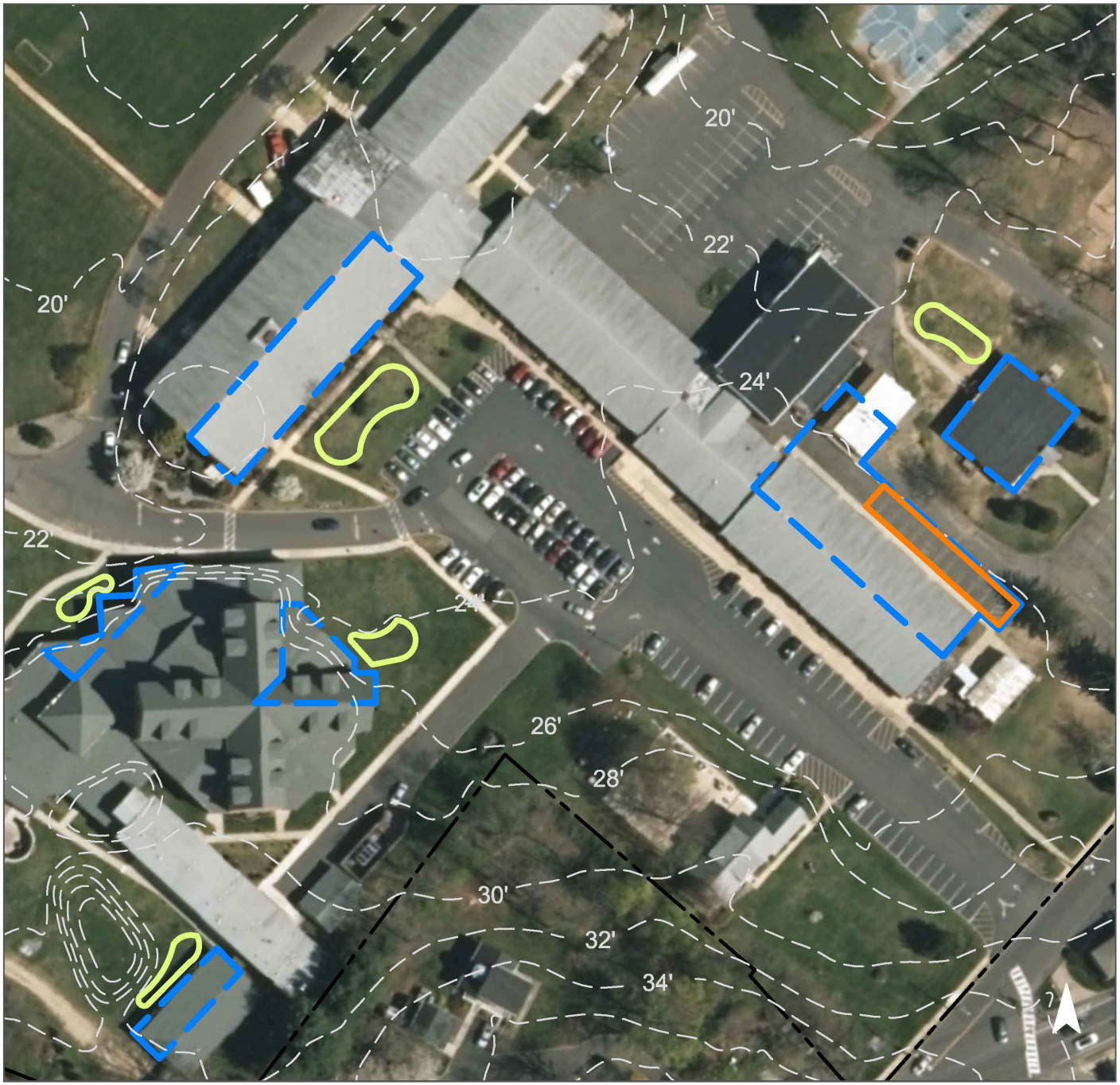
Block and Lot: Block 524, Lots 84,98,101

A row of parking spaces to the north of the main building can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot and roof. Rain gardens can be installed at various locations to capture, treat, and infiltrate stormwater runoff from the roof. 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"
32	786,267	37.9	397.1	3,610.0	0.613	21.56

Recommended Green 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	0.459	77	33,650	1.26	4,405	$22,025
Pervious pavement	0.414	69	30,400	1.14	2,100	$52,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Saint Mary, Mother of God Church/Saint Mary School

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

0 50' 100'

VFW POST 2179

Subwatershed: Pews Creek to Shrewsbury River

Site Area: 163,915 sq. ft.

Address: 1 Veterans Lane
Port Monmouth, NJ 07758

Block and Lot: Block 532, Lot 40

Two sections of parking spaces can be converted to porous 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"
77	125,768	6.1	63.5	577.4	0.098	3.45

Recommended Green 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	0.635	106	46,570	1.75	4,350	$108,750

GREEN INFRASTRUCTURE RECOMMENDATIONS

VFW Post 2179

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

0 50' 100'

NORMANDY PARK

Subwatershed: Poricy Brook/Swimming River

Site Area: 1,743,308 sq. ft.

Address: 933 Nut Swamp Road
Middletown, NJ 07748

Block and Lot: Block 901, Lot 3

A rain garden can be installed in the turfgrass area near the main building to capture, treat, and infiltrate runoff from the roof. 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	143,439	6.9	72.4	658.6	0.112	3.93

Recommended Green 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	0.193	32	14,200	0.53	1,855	$9,275

GREEN INFRASTRUCTURE RECOMMENDATIONS

Normandy Park

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

0 50' 100'

PORICY PARK NATURE CENTER

Subwatershed: Poricy Brook/Swimming River

Site Area: 7,442,305 sq. ft.

Address: 345 Oak Hill Road
Red Bank, NJ 07701

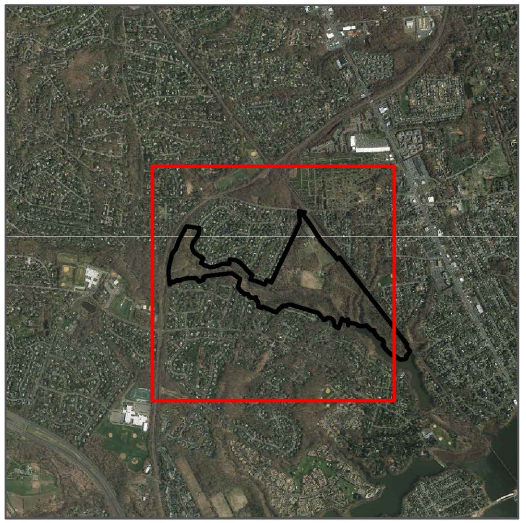
Block and Lot: Blocks 913,3001
Lots 55,136;3,6

Rain gardens can be installed at various locations to capture, treat, and infiltrate stormwater runoff from the parking lot and from the rooftops. 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"
2	183,159	8.8	92.5	840.9	0.143	5.02

Recommended Green 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	0.404	68	29,640	1.11	3,875	$19,375

GREEN INFRASTRUCTURE RECOMMENDATIONS



Poricy Park Nature Center

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

0 50' 100'

THOMPSON MIDDLE SCHOOL

Subwatershed: Poricy Brook/Swimming River

Site Area: 1,310,440 sq. ft.

Address: 1001 Middletown-Lincroft Road
Middletown, NJ 07748

Block and Lot: Block 898, Lot 39

A row of parking spaces in the parking lot to the north of the building can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed throughout the property to capture, treat, and infiltrate stormwater runoff from the rooftops and paved areas. 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	290,771	14.0	146.9	1,335.0	0.227	7.97

Recommended Green 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	0.594	99	43,550	1.64	5,705	$28,525
Pervious pavement	0.844	141	61,930	2.33	5,785	$144,625

GREEN INFRASTRUCTURE RECOMMENDATIONS

Thompson Middle School

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

0 50' 100'

KING OF KINGS LUTHERAN CHURCH

Subwatershed: Waackaack Creek

Site Area: 153,968 sq. ft.

Address: 250 Harmony Road
Middletown, NJ 07748

Block and Lot: Block 611, Lot 10

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. Rain gardens can be installed in the turfgrass areas around the building and near a section of parking spaces to capture, treat, and infiltrate stormwater runoff from the roof and 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"
58	89,627	4.3	45.3	411.5	0.070	2.46

Recommended Green 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	0.291	49	21,390	0.80	2,800	$14,000
Pervious pavement	0.165	28	12,100	0.45	1,130	$28,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

King of Kings Lutheran Church

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

0 50' 100'

MIDDLETOWN VILLAGE ELEMENTARY SCHOOL

Subwatershed: Waackaack Creek

Site Area: 551,014 sq. ft.

Address: 147 Kings Highway
Middletown, NJ 07748

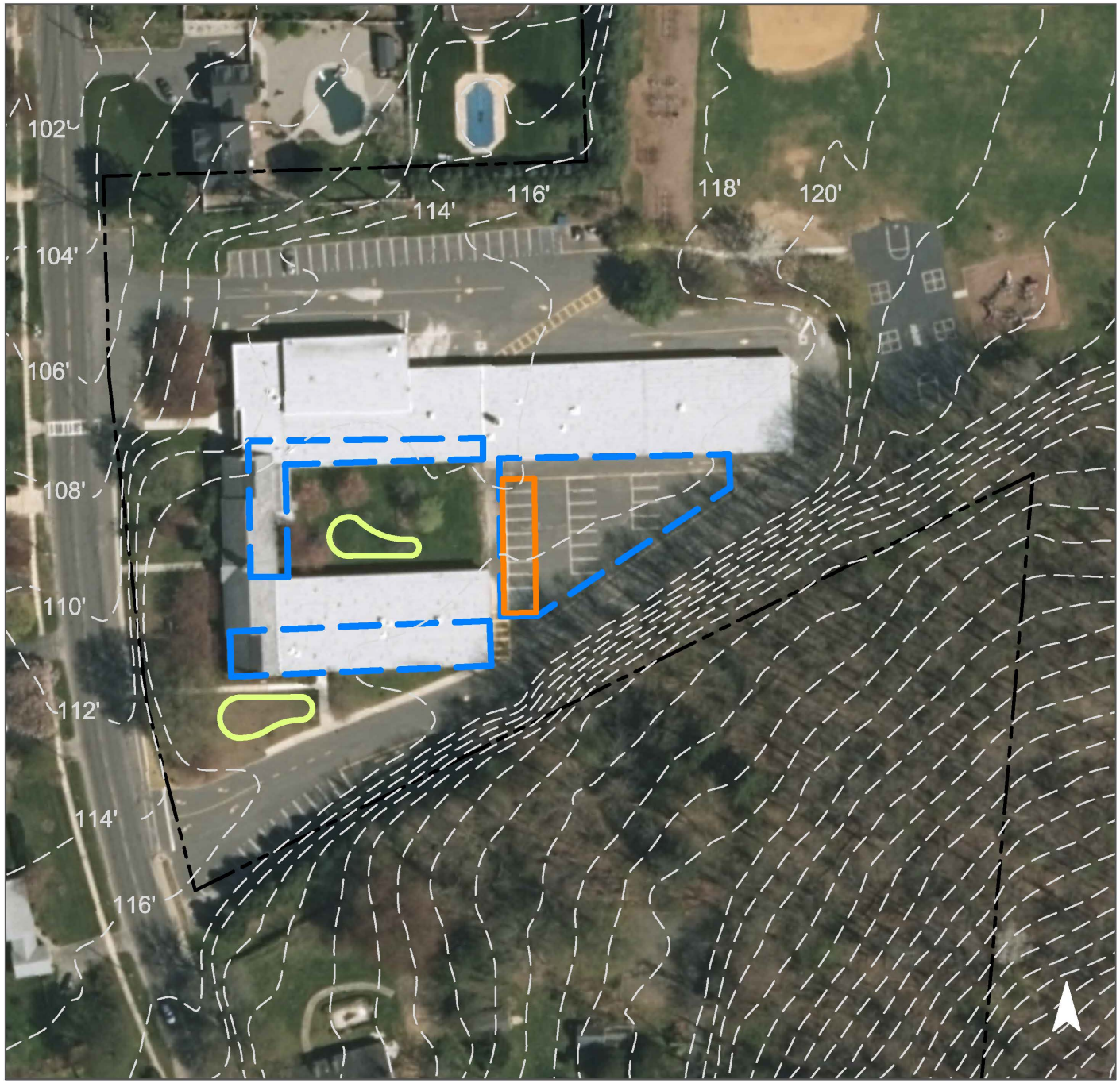
Block and Lot: Block 805, Lot 3

Parking spaces in the parking lot to the east of the building can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed to capture, treat, and infiltrate stormwater runoff from the roof. 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	131,556	6.3	66.4	604.0	0.103	3.61

Recommended Green 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	0.239	40	17,510	0.66	2,290	$11,450
Pervious pavement	0.269	45	19,700	0.74	1,840	$46,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Middletown Village Elementary School

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

0 50' 100'

Tatum Park Red Hill Activity Center

Subwatershed: Waackaack Creek

Site Area: 208,546 sq. ft.

Address: 100-144 Red Hill Road
Middletown, NJ 07748

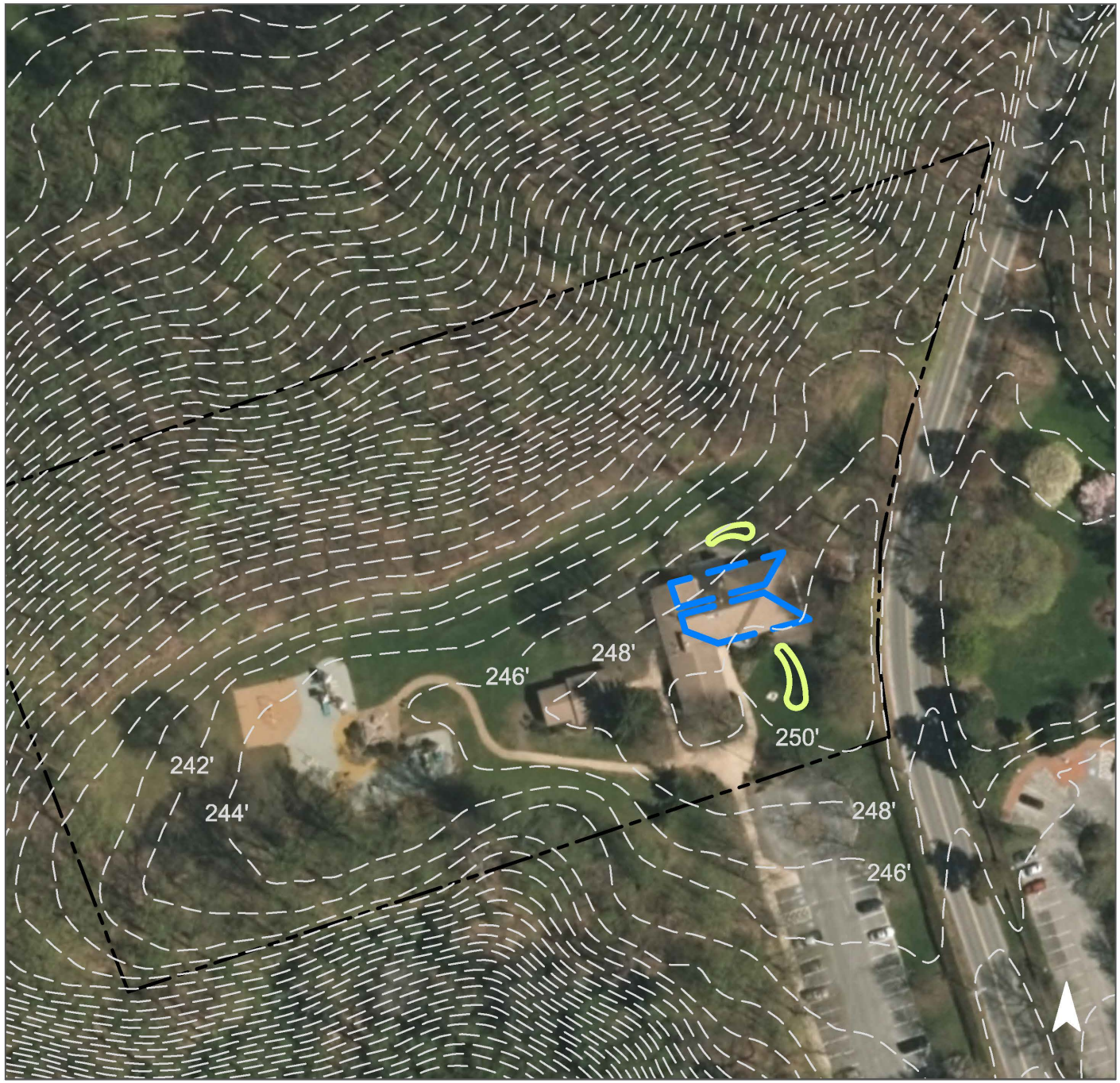
Block and Lot: Block 796, Lot 8

Rain gardens can be installed around the activity center building to capture, treat, and infiltrate stormwater runoff from the roof. 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"
8	16,972	0.8	8.6	77.9	0.013	0.47

Recommended Green 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	0.070	12	5,100	0.19	670	$3,350

GREEN INFRASTRUCTURE RECOMMENDATIONS



Tatum Park Red Hill Activity Center

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

0 50' 100'

c. Summary of Existing Conditions

Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
	NUT SWAMP BROOK SITES	**86.15**	**3,752,809**				**18.39**	**800,994**	**38.6**	**404.5**	**3,677.7**	**83,437**	**2,936,978**	**0.624**	**21.97**
1	**Middletown High School South**														
	Total Site Info	86.15	3,752,809	998	10	21	18.39	800,994	38.6	404.5	3,677.7	83,437	2,936,978	0.624	21.97
	PEWS CREEK TO SHREWBURY RIVER SITES	**169.27**	**7,373,550**				**60.99**	**2,656,769**	**128.1**	**1341.8**	**12,198.2**	**276,747**	**9,741,487**	**2.070**	**72.87**
2	**Community Fire Company (Station 4) & Wawa**														
	Total Site Info	4.59	199,761	451	4,5	61	2.78	121,162	5.8	61.2	556.3	12,621	444,262	0.094	3.32
3	**Elks Lodge 2179**														
	Total Site Info	1.88	82,064	296	7	86	1.62	70,702	3.4	35.7	324.6	7,365	259,240	0.055	1.94
4	**Harmony Elementary School**														
	Total Site Info	12.39	539,906	571	33,34	26	3.28	142,723	6.9	72.1	655.3	14,867	523,316	0.111	3.91
5	**Middletown Art Center**														
	Total Site Info	14.65	638,061	809	25.01	14	2.07	90,376	4.4	45.6	414.9	9,414	331,377	0.070	2.48
6	**Middletown High School North**														
	Total Site Info	48.48	2,111,770	640	20,23,35	41	20.07	874,347	42.2	441.6	4,014.4	91,078	3,205,939	0.681	23.98
7	**Middletown Municipal Complex**														
	Total Site Info	10.23	445,415	815	1.01,5,6,7	54	5.51	240,026	11.6	121.2	1,102.0	25,003	880,095	0.187	6.58
8	**Middletown Reformed Church**														
	Total Site Info	3.84	167,123	805	29,30	23	0.87	37,802	1.8	19.1	173.6	3,938	138,608	0.029	1.04
9	**Middletown Library**														
	Total Site Info	12.43	541,533	632	183,184	25	3.13	136,404	6.6	68.9	626.3	14,209	500,148	0.106	3.74
10	**Old Village Fire Company (Station 11)**														
	Total Site Info	1.11	48,278	805	22	65	0.72	31,192	1.5	15.8	143.2	3,249	114,369	0.024	0.86
11	**Saint Mary Church and School & Mater Dei Prep**														
	Total Site Info	55.92	2,435,725	524	84,98,101	32	18.05	786,267	37.9	397.1	3,610.0	81,903	2,882,981	0.613	21.56
12	**Veterans of Foreign Wars Post 2179**														
	Total Site Info	3.76	163,915	532	40	77	2.89	125,768	6.1	63.5	577.4	13,101	461,151	0.098	3.45
	PORICY BROOK/SWIMMING RIVER SITES	**327.11**	**14,248,862**				**32.56**	**1,418,363**	**68.4**	**716.3**	**6,512.2**	**147,746**	**5,200,663**	**1.105**	**38.90**
13	**Normandy Park**														
	Total Site Info	40.02	1,743,308	901	3	8	3.29	143,439	6.9	72.4	658.6	14,942	525,944	0.112	3.93
14	**Poricy Park Nature Center**														
	Total Site Info	170.85	7,442,305	913;3001	55,136;3,6	2	4.20	183,159	8.8	92.5	840.9	19,079	671,582	0.143	5.02
15	**Thompson Middle School**														
	Total Site Info	30.08	1,310,441	898	39	22	6.68	290,771	14.0	146.9	1,335.0	30,289	1,066,159	0.227	7.97

Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
	WAACKAACK CREEK SITES	**20.97**	**913,528**				**5.47**	**238,155**	**11.5**	**120.3**	**1,093.5**	**24,808**	**873,235**	**0.186**	**6.53**
16	**King of Kings Lutheran Church**														
	Total Site Info	3.53	153,968	611	1,012	58	2.06	89,627	4.3	45.3	411.5	9,336	328,633	0.070	2.46
17	**Middletown Village Elementary School**														
	Total Site Info	12.65	551,014	805	3,6,28	24	3.02	131,556	6.3	66.4	604.0	13,704	482,370	0.103	3.61
18	**Tatum Park: Red Hill Activity Center**														
	Total Site Info	4.79	208,546	796	8	8	0.39	16,972	0.8	8.6	77.9	1,768	62,232	0.013	0.47

d. Summary of Proposed Green Infrastructure Practices

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area Area (SF)	Potential Management Area Area (ac)	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Max Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cfs)	Size of BMP	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
	NUT SWAMP BROOK SITES	**105,820**	**2.43**	**2.757**	**462**	**202,310**	**7.60**				**$394,350**	**13.2%**
1	**Middletown High School South**											
	Bioretention systems	24,280	0.56	0.633	106	46,420	1.74	6,070	$5	SF	$30,350	3.0%
	Pervious pavement	81,540	1.87	2.125	356	155,890	5.86	14,560	$25	SF	$364,000	10.2%
	Total Site Info	**105,820**	**2.43**	**2.757**	**462**	**202,310**	**7.60**				**$394,350**	**13.2%**
	PEWS CREEK TO SHREWBURY RIVER SITES	**278,394**	**6.39**	**6.636**	**1,203**	**486,940**	**18.29**				**$983,060**	**10.5%**
2	**Community Fire Company, Station #4**											
	Bioretention system	7,680	0.18	0.200	33	14,680	0.55	1,920	$5	SF	$9,600	6.3%
	Pervious pavement	8,175	0.19	0.213	36	15,630	0.59	1,460	$25	SF	$36,500	6.7%
	Total Site Info	**15,855**	**0.36**	**0.413**	**69**	**30,310**	**1.14**				**$46,100**	**13.1%**
3	**Elks Lodge 2179**											
	Bioretention systems	2,570	0.06	0.067	11	4,910	0.18	650	$5	SF	$3,250	3.6%
	Pervious pavement	5,150	0.12	0.134	22	9,840	0.37	920	$25	SF	$23,000	7.3%
	Total Site Info	**7,720**	**0.18**	**0.201**	**34**	**14,750**	**0.55**				**$26,250**	**10.9%**
4	**Harmony Elementary School**											
	Bioretention systems	10,840	0.25	0.282	47	20,730	0.78	2,710	$5	SF	$13,550	7.6%
	Pervious pavement	17,650	0.41	0.460	77	33,740	1.27	5,590	$25	SF	$139,750	12.4%
	Total Site Info	**28,490**	**0.65**	**0.742**	**124**	**54,470**	**2.05**				**$153,300**	**20.0%**
5	**Middletown Arts Center**											
	Bioretention systems	4,490	0.10	0.117	20	8,590	0.32	1,125	$5	SF	$5,625	5.0%
	Total Site Info	**4,490**	**0.10**	**0.117**	**20**	**8,590**	**0.32**				**$5,625**	**5.0%**
6	**Middletown High School North**											
	Bioretention systems	33,750	0.77	0.879	147	64,520	2.42	8,440	$5	SF	$42,200	3.9%
	Pervious pavement	49,335	1.13	1.285	215	94,320	3.54	8,810	$25	SF	$220,250	5.6%
	Total Site Info	**83,085**	**1.91**	**2.165**	**362**	**158,840**	**5.96**				**$262,450**	**9.5%**
7	**Middletown Municipal Complex**											
	Bioretention systems	7,890	0.18	0.206	34	15,090	0.57	1,975	$5	SF	$9,875	3.3%
	Pervious pavement	20,300	0.47	0.529	89	38,810	1.46	4,880	$25	SF	$122,000	8.5%
	Tree filter boxes	23,700	0.54	n/a	92	n/a	n/a	3	$10,000	box	$30,000	9.9%
	Total Site Info	**51,890**	**1.19**	**0.734**	**215**	**53,900**	**2.03**				**$161,875**	**21.6%**
8	**Middletown Reformed Church**											

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area Area (SF)	Potential Management Area Area (ac)	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Max Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cfs)	Size of BMP	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
	Bioretention system	2,720	0.06	0.071	12	5,200	0.20	680	$5	SF	$3,400	7.2%
	Total Site Info	**2,720**	**0.06**	**0.071**	**12**	**5,200**	**0.20**				**$3,400**	**7.2%**
9	**Middletown Library**											
	Bioretention systems	7,750	0.18	0.202	34	14,820	0.56	1,940	$5	SF	$9,700	5.7%
	Pervious pavement	16,600	0.38	0.433	72	31,740	1.19	5,140	$25	SF	$128,500	12.2%
	Total Site Info	**24,350**	**0.56**	**0.634**	**106**	**46,560**	**1.75**				**$138,200**	**17.9%**
10	**Old Village Fire Company**											
	Bioretention system	1,934	0.04	0.050	8	3,700	0.14	517	$5	SF	$2,585	6.2%
	Total Site Info	**1,934**	**0.04**	**0.050**	**8**	**3,700**	**0.14**				**$2,585**	**6.2%**
11	**Saint Mary, Mother of God Church/Saint Mary School**											
	Bioretention systems	17,600	0.40	0.459	77	33,650	1.26	4,405	$5	SF	$22,025	2.2%
	Pervious pavement	15,900	0.37	0.414	69	30,400	1.14	2,100	$25	SF	$52,500	2.0%
	Total Site Info	**33,500**	**0.77**	**0.873**	**146**	**64,050**	**2.40**				**$74,525**	**4.3%**
12	**VFW Post 2179**											
	Pervious pavement	24,360	0.56	0.635	106	46,570	1.75	4,350	$25	SF	$108,750	19.4%
	Total Site Info	**24,360**	**0.56**	**0.635**	**106**	**46,570**	**1.75**				**$108,750**	**19.4%**
	PORICY BROOK/SWIMMING RIVER SITES	**183,920**	**4.22**	**4.792**	**802**	**351,630**	**13.21**				**$596,150**	**13.0%**
13	**Normandy Park**											
	Bioretention system	7,425	0.17	0.193	32	14,200	0.53	1,855	$5	SF	$9,275	5.2%
	Total Site Info	**7,425**	**0.17**	**0.193**	**32**	**14,200**	**0.53**				**$9,275**	**5.2%**
14	**Poricy Park Nature Center**											
	Bioretention systems	15,500	0.36	0.404	68	29,640	1.11	3,875	$5	SF	$19,375	8.5%
	Total Site Info	**15,500**	**0.36**	**0.404**	**68**	**29,640**	**1.11**				**$19,375**	**8.5%**
15	**Thompson Middle School**											
	Bioretention systems	22,780	0.52	0.594	99	43,550	1.64	5,705	$5	SF	$28,525	7.8%
	Pervious pavement	32,395	0.74	0.844	141	61,930	2.33	5,785	$25	SF	$144,625	11.1%
	Total Site Info	**55,175**	**1.27**	**1.438**	**241**	**105,480**	**3.97**				**$173,150**	**19.0%**

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area Area (SF)	Potential Management Area Area (ac)	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Max Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cfs)	Size of BMP	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
	WAACKAACK CREEK SITES	**39,650**	**0.91**	**1.033**	**173**	**75,800**	**2.84**				**$103,050**	**16.6%**
16	**King of Kings Lutheran Church**											
	Bioretention systems	11,185	0.26	0.291	49	21,390	0.80	2,800	$5	SF	$14,000	12.5%
	Pervious pavement	6,330	0.15	0.165	28	12,100	0.45	1,130	$25	SF	$28,250	7.1%
	Total Site Info	**17,515**	**0.40**	**0.456**	**76**	**33,490**	**1.25**				**$42,250**	**19.5%**
17	**Middletown Village Elementary School**											
	Bioretention systems	9,160	0.21	0.239	40	17,510	0.66	2,290	$5	SF	$11,450	7.0%
	Pervious pavement	10,305	0.24	0.269	45	19,700	0.74	1,840	$25	SF	$46,000	7.8%
	Total Site Info	**19,465**	**0.45**	**0.507**	**85**	**37,210**	**1.40**				**$57,450**	**14.8%**
18	**Tatum Park Red Hill Activity Center**											
	Bioretention systems	2,670	0.06	0.070	12	5,100	0.19	670	$5	SF	$3,350	15.7%
	Total Site Info	**2,670**	**0.06**	**0.070**	**12**	**5,100**	**0.19**				**$3,350**	**15.7%**