Draft

Impervious Cover Reduction Action Plan for Pennsville Township, Salem County, New Jersey

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

December 17, 2018

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Introduction

Located in Salem County, New Jersey, Pennsville Township covers approximately 24.84 square miles. Figures 1 and 2 illustrate that Pennsville Township is dominated by wetland land uses. A total of 23.3% of the municipality's land use is classified as urban. Of the urban land in Pennsville Township, medium density residential is the dominant land use (Figure 3).

The New Jersey Department of Environmental Protection's (NJDEP) 2012 land use/land cover geographical information system (GIS) data layer categorizes Pennsville 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 Pennsville Township. Based upon the 2012 NJDEP land use/land cover data, approximately 7.8% of Pennsville Township has impervious cover. This level of impervious cover suggests that the streams in Pennsville Township are likely sensitive streams. [1]

Methodology

Pennsville Township contains portions of three subwatersheds (Figure 4). For this impervious cover reduction action plan, projects have been identified in each 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] Caraco, D., R. Claytor, P. Hinkle, H. Kwon, T. Schueler, C. Swann, S. Vysotsky, and J. Zielinski. 1998. Rapid Watershed Planning Handbook. A Comprehensive Guide for Managing Urbanizing Watersheds. Prepared by Center For Watershed Protection, Ellicott City, MD. Prepared for U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds and Region V. October 1998.

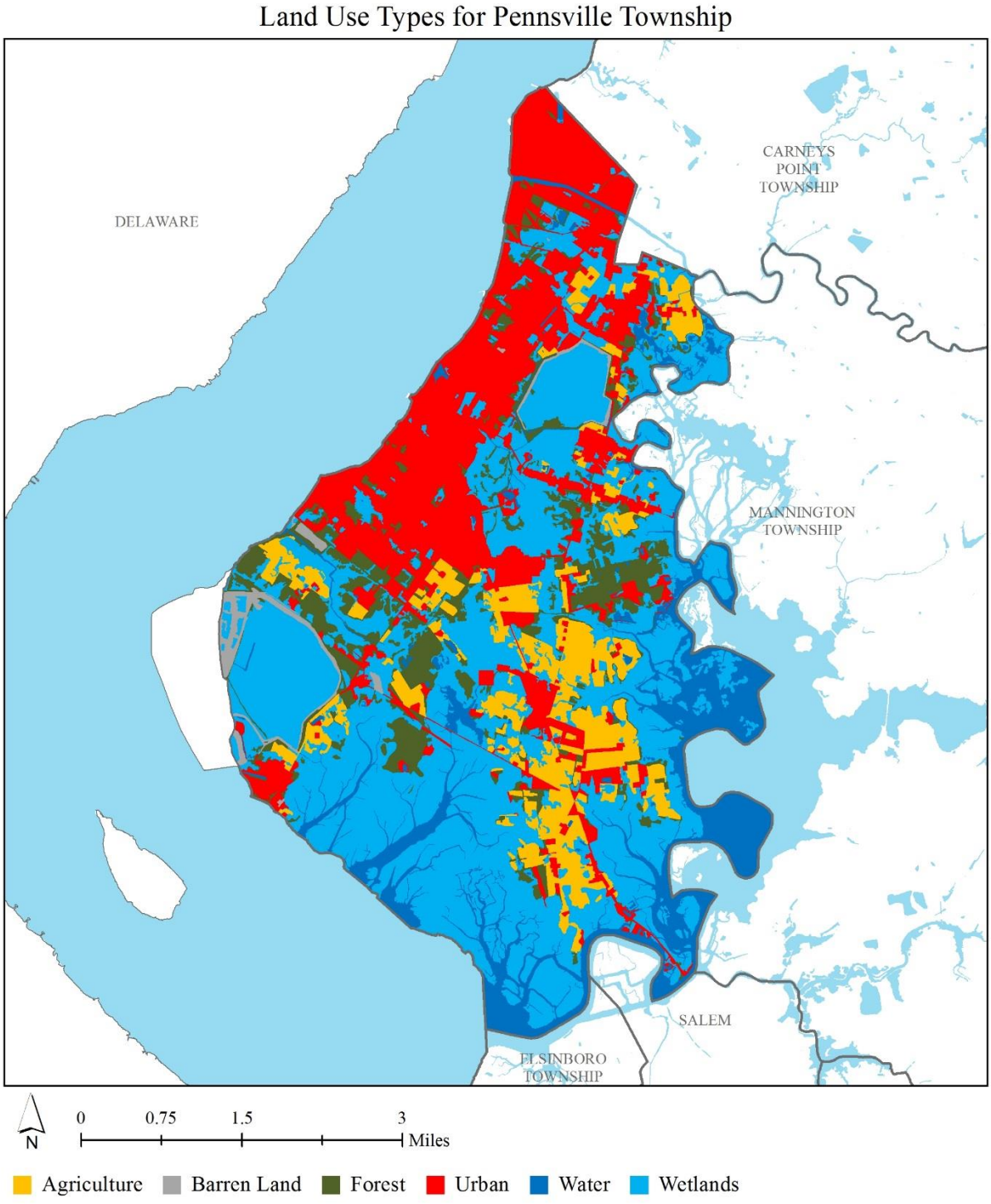


Figure 1: Map illustrating the land use in Pennsville Township

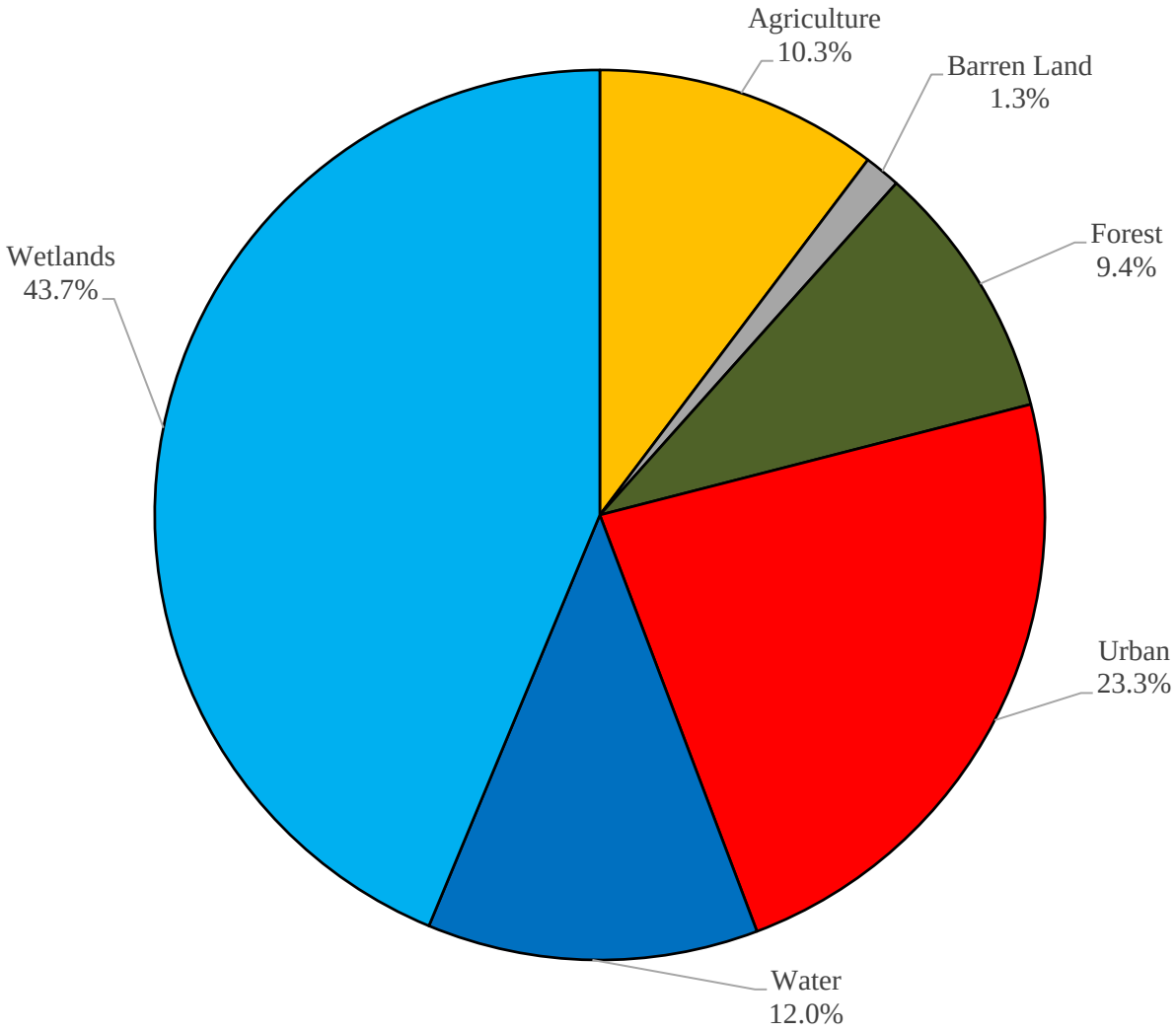


Figure 2: Pie chart illustrating the land use in Pennsville Township

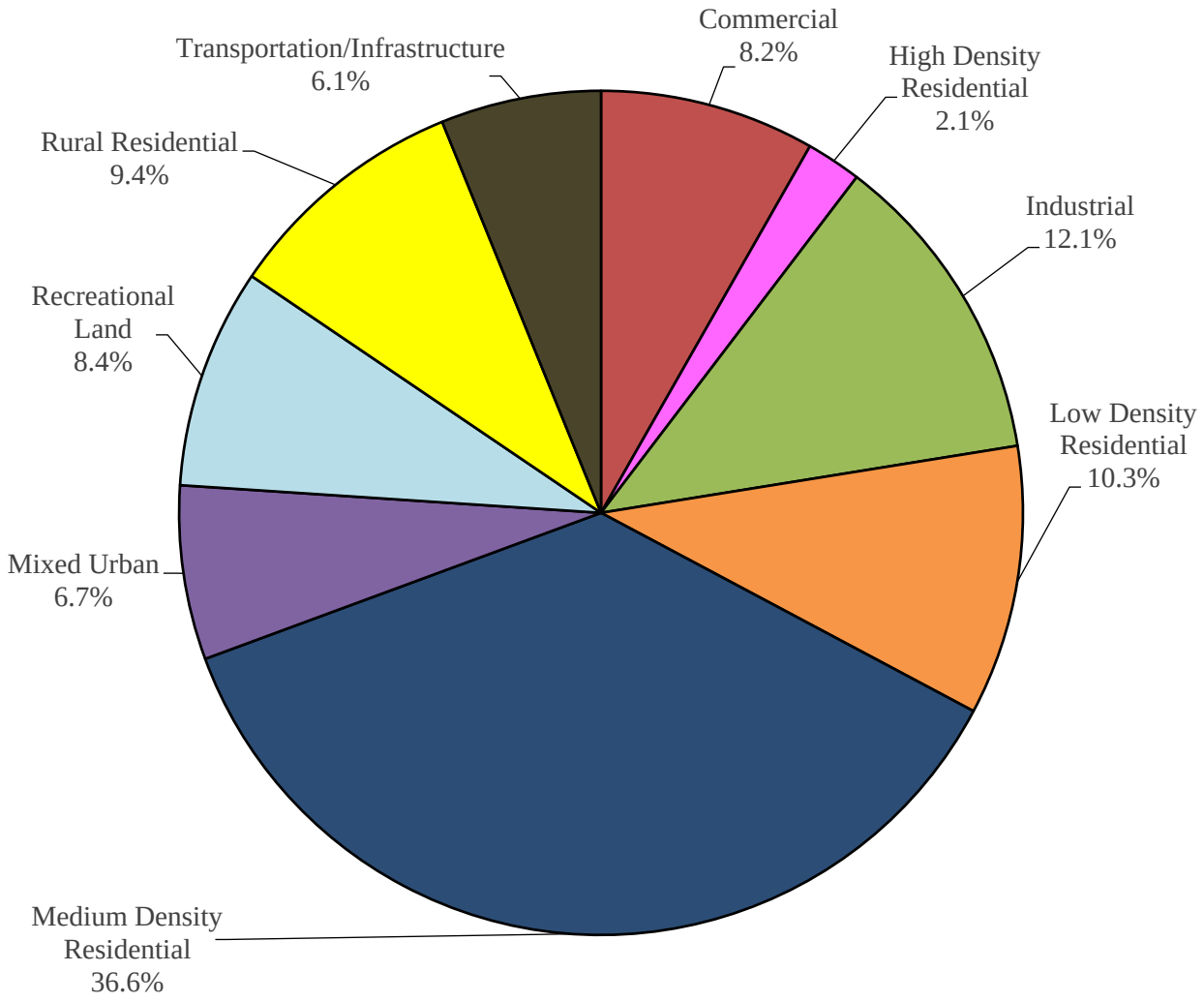


Figure 3: Pie chart illustrating the various types of urban land use in Pennsville Township

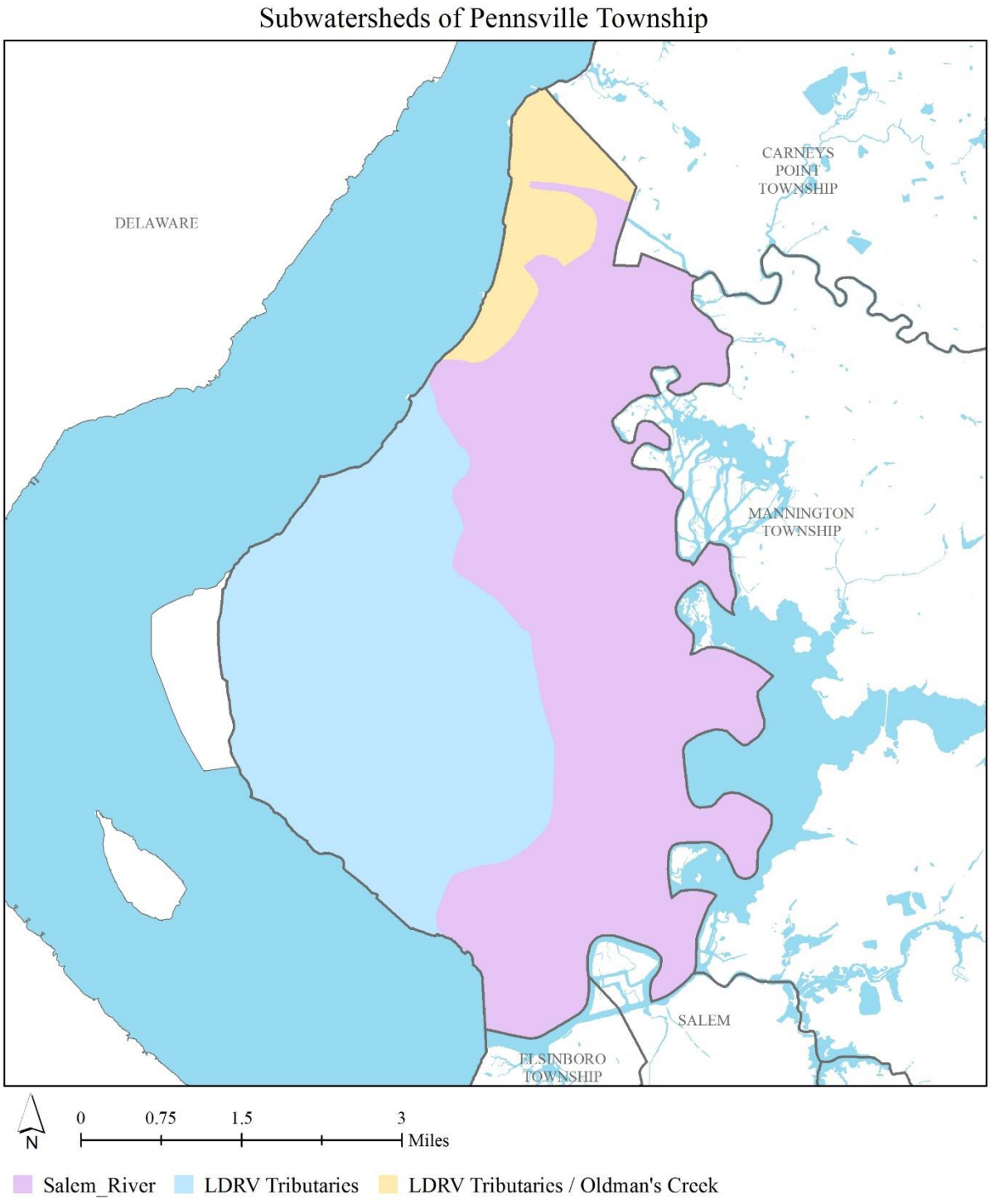


Figure 4: Map of the subwatersheds in Pennsville Township

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 2012 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 Pennsville 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. 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 principal, green infrastructure practices use soil and vegetation to recycle stormwater runoff through infiltration and evapotranspiration. When used as components of a stormwater management system, green infrastructure practices such as bioretention, green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these 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 Pennsville 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*.

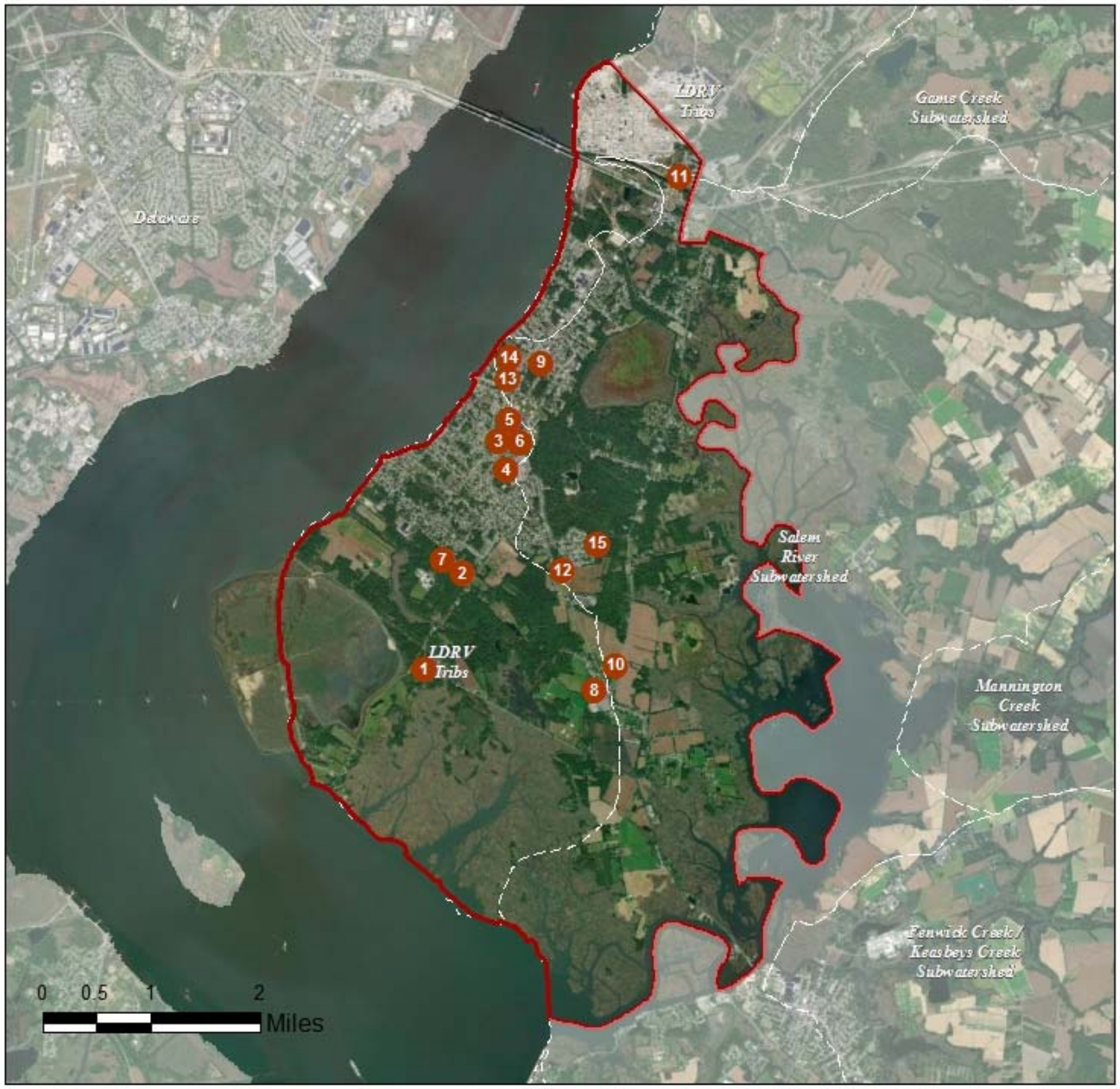
Conclusion

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.

a. Green Infrastructure Sites

PENNSVILLE: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE LOWER DELAWARE RIVER TRIBUTARIES SUBWATERSHED

1. Fort Mott State Park
2. Pennsville Babe Ruth Field
3. Pennsville Fire Department
4. Pennsville Library
5. Pennsville Memorial High School
6. Pennsville Middle School
7. Pennsville Water Treatment
8. Salem County Fraternal Order of Police

SITES WITHIN THE SALEM RIVER SUBWATERSHED

9. Cathedral of Holiness Missionary Baptist Church
10. Christian Life Center
11. Deepwater Fire Company
12. Lutheran Church of Saint Ambrose
13. Pennsville Recreation Department
14. Riverview Beach Park
15. Valley Park Elementary School

b. Proposed Green Infrastructure Concepts

Fort Mott State Park

Subwatershed: Lower Delaware River Valley Tributaries

Site Area: 95,277,715 sq. ft.

Address: 197 Lighthouse Road
Pennsville, NJ 08070

Block and Lot: Block 5501, Lot 17

A rain garden can be installed to capture rooftop runoff from the main building, and another rain garden can be installed in the turfgrass to treat and infiltrate stormwater runoff from the road. 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"
0	63,714	3.1	32.2	292.5	0.050	1.75

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	0.092	15	6,530	0.25	885	$4,425

GREEN INFRASTRUCTURE RECOMMENDATIONS

Fort Mott State Park

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

0 20' 40'

Pennsville Babe Ruth Field

Subwatershed: Lower Delaware River Valley Tributaries

Site Area: 409,518 sq. ft.

Address: 2 Sanderlin Road
Pennsville, NJ 08070

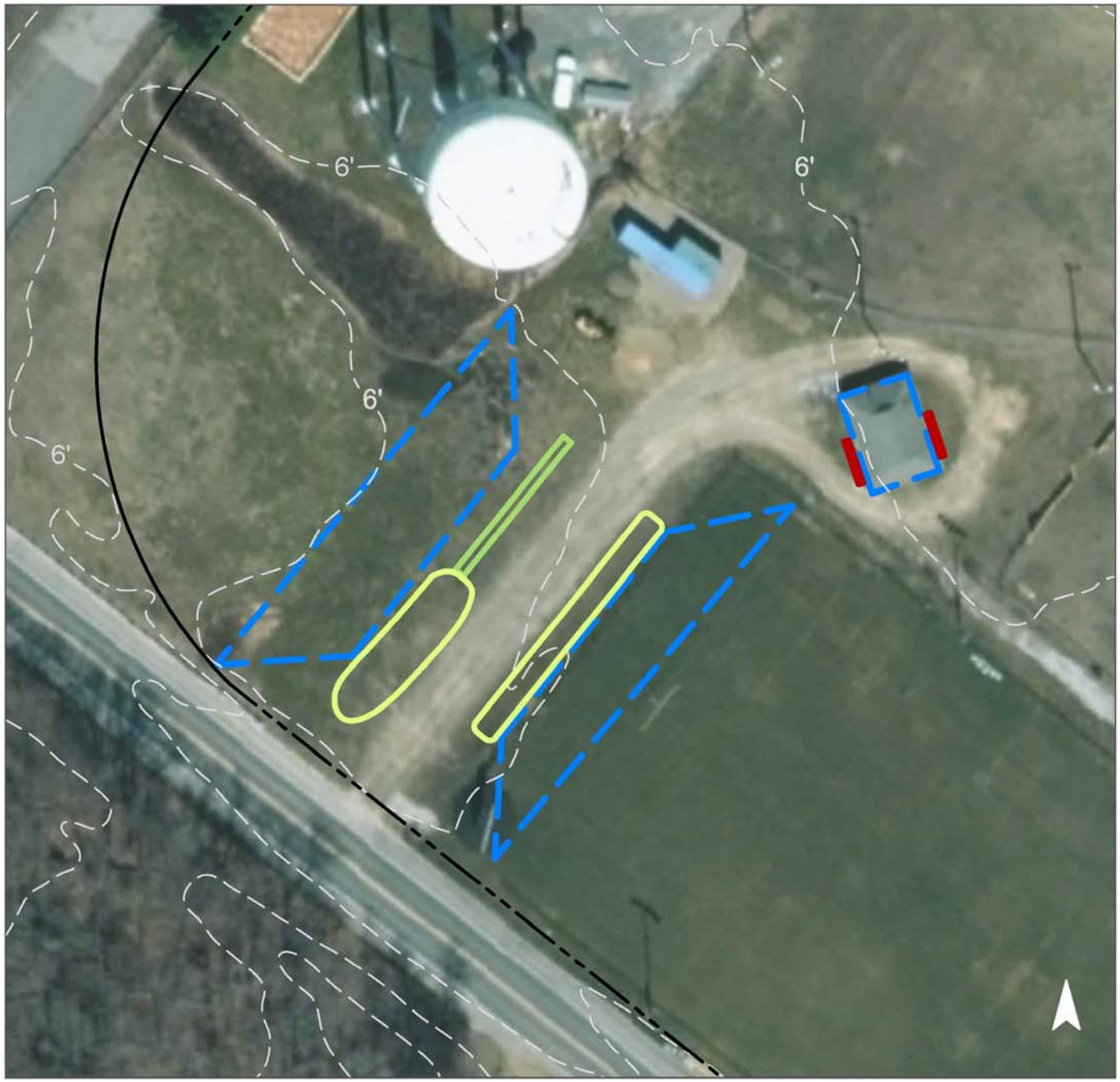
Block and Lot: Block 4803, Lot 1

A bioswale can convey stormwater from the field next to the blue building to a rain garden which will remove pollutants and infiltrate stormwater. Planter boxes placed next to the concessions building can filter rooftop runoff. A bioretention system can be incorporated behind the scoreboard to provide aesthetic value and manage stormwater runoff which otherwise pools in 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"
15	61,086	2.9	30.9	280.5	0.048	1.68

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	0.252	42	17,870	0.67	2,440	$12,200
Bioswale	0.000	0	0	0.00	540	$2,700
Planter boxes	n/a	6	n/a	n/a	6 (boxes)	$6,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Pennsville Babe Ruth Field

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

0 30' 60'

Pennsville Fire Department

Subwatershed: Lower Delaware River Valley Tributaries

Site Area: 228,901 sq. ft.

Address: 91 1st Street
Pennsville, NJ 08070

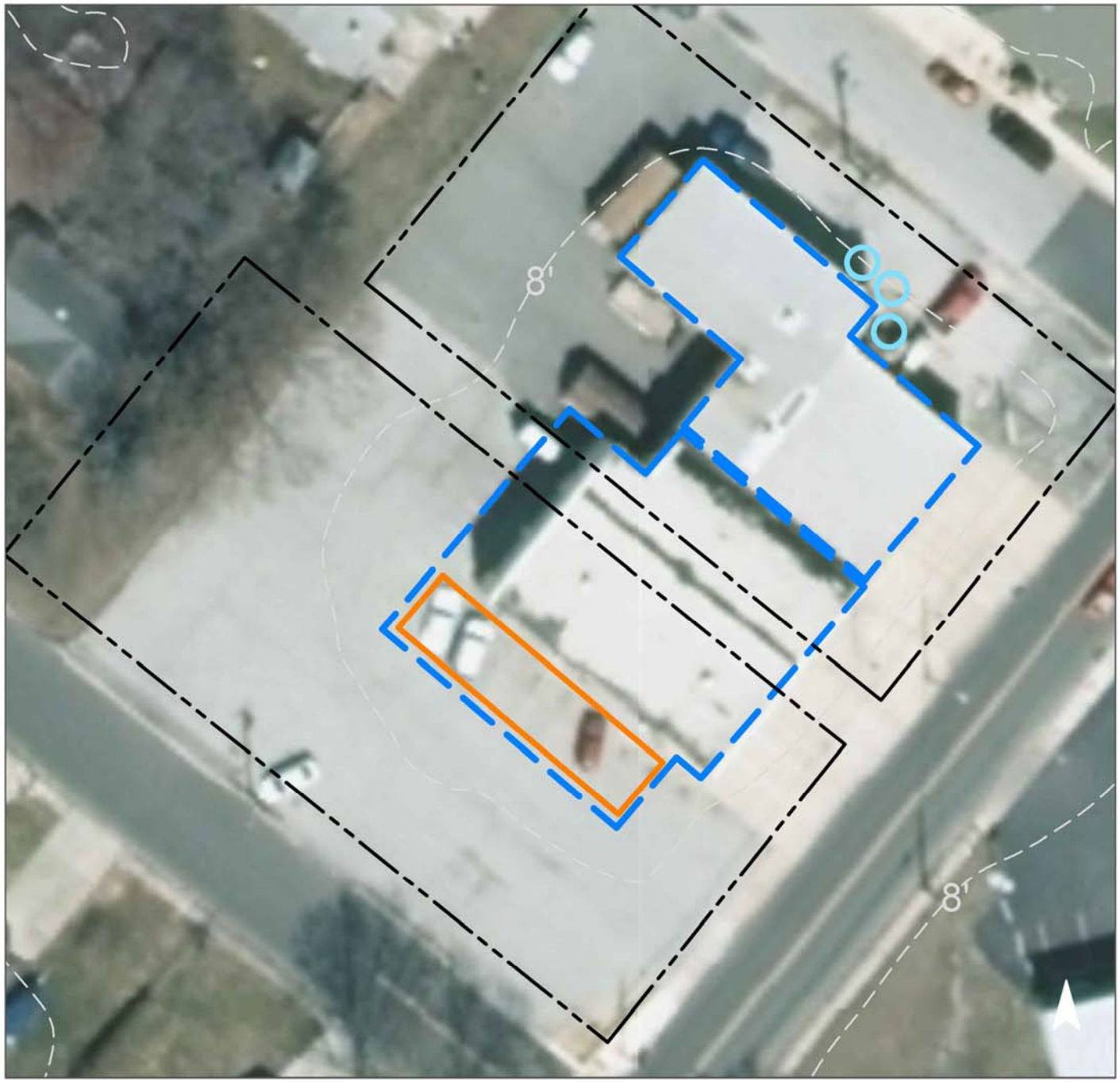
Block and Lot: Block 3002, Lots 6, 7

A section of porous pavement parking spaces can be installed to allow water to infiltrate via the underlying stone layer into the ground. Cisterns installed adjacent to the building can capture stormwater to be used for washing fire trucks and for other non-potable uses. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
15	35,426	1.7	17.9	162.7	0.028	0.97

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
Pervious pavement	0.200	33	14,660	0.53	1,370	$60,000
Rainwater harvesting	0.116	19	3,460	0.13	3,460 (gal)	$6,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Pennsville Fire Department

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

0 20' 40'

Pennsville Library

Subwatershed: Lower Delaware River Valley Tributaries

Site Area: 62,477 sq. ft.

Address: 190 South Broadway
Pennsville, NJ 08070

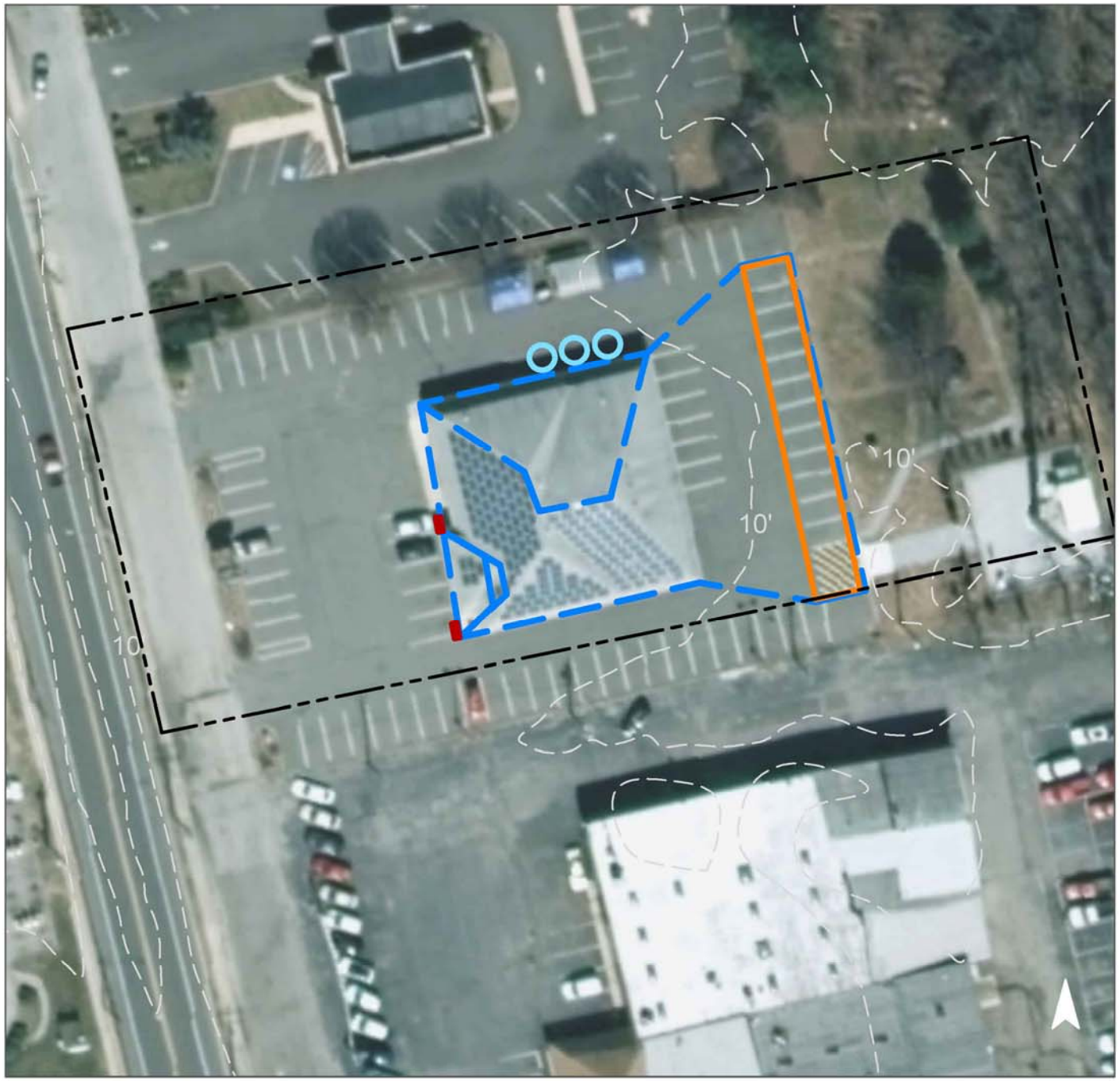
Block and Lot: Block 2601, Lot 66

Porous pavement can be installed in the parking lot behind the building to allow rooftop and parking lot runoff to infiltrate. Cisterns along the side of the building can be used to capture rooftop runoff, and the water can be used for non-potable purposes such as washing vehicles or watering plants. Downspout planter boxes around the entrance can capture and filter 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"
83	51,868	2.5	26.2	238.1	0.040	1.42

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	0.336	56	24,660	0.90	2,400	$60,000
Rainwater harvesting	0.076	13	3,000	0.12	3,000 (gal)	$6,000
Planter boxes	n/a	2	n/a	n/a	2 (boxes)	$2,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Pennsville Library

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

0 30' 60'

Pennsville Memorial High School

Subwatershed: Lower Delaware River Valley Tributaries

Site Area: 1,231,705 sq. ft.

Address: 110 South Broadway
Pennsville, NJ 08070

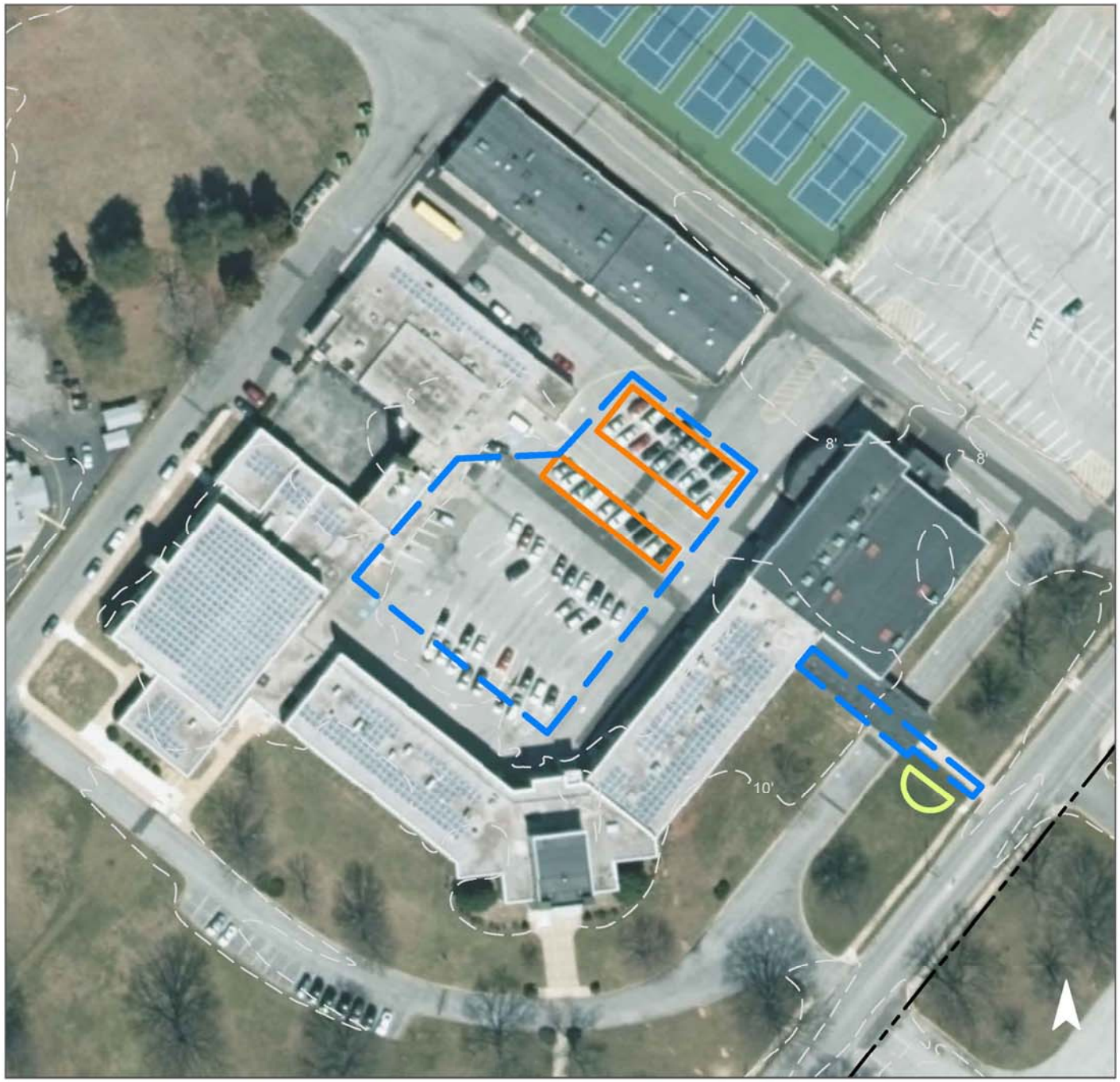
Block and Lot: Block 2702, Lot 2

A bioretention system can be incorporated to capture, treat, and infiltrate stormwater runoff at the southeast entrance to provide aesthetic value and manage stormwater runoff. Porous pavement can replace two rows of parking spaces. These surfaces are hard and support vehicle traffic but also allow water to infiltrate through the surface. 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"
37	455,436	22.0	230.0	2,091.1	0.355	12.49

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	0.048	8	3,540	0.13	465	$2,325
Pervious pavement	0.808	135	59,260	2.15	5,190	$129,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Pennsville Memorial High School

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

0 50' 100'

Pennsville Middle School

Subwatershed: Lower Delaware River Valley Tributaries

Site Area: 1,325,889 sq. ft.

Address: 4 William Penn Avenue
Pennsville, NJ 08070

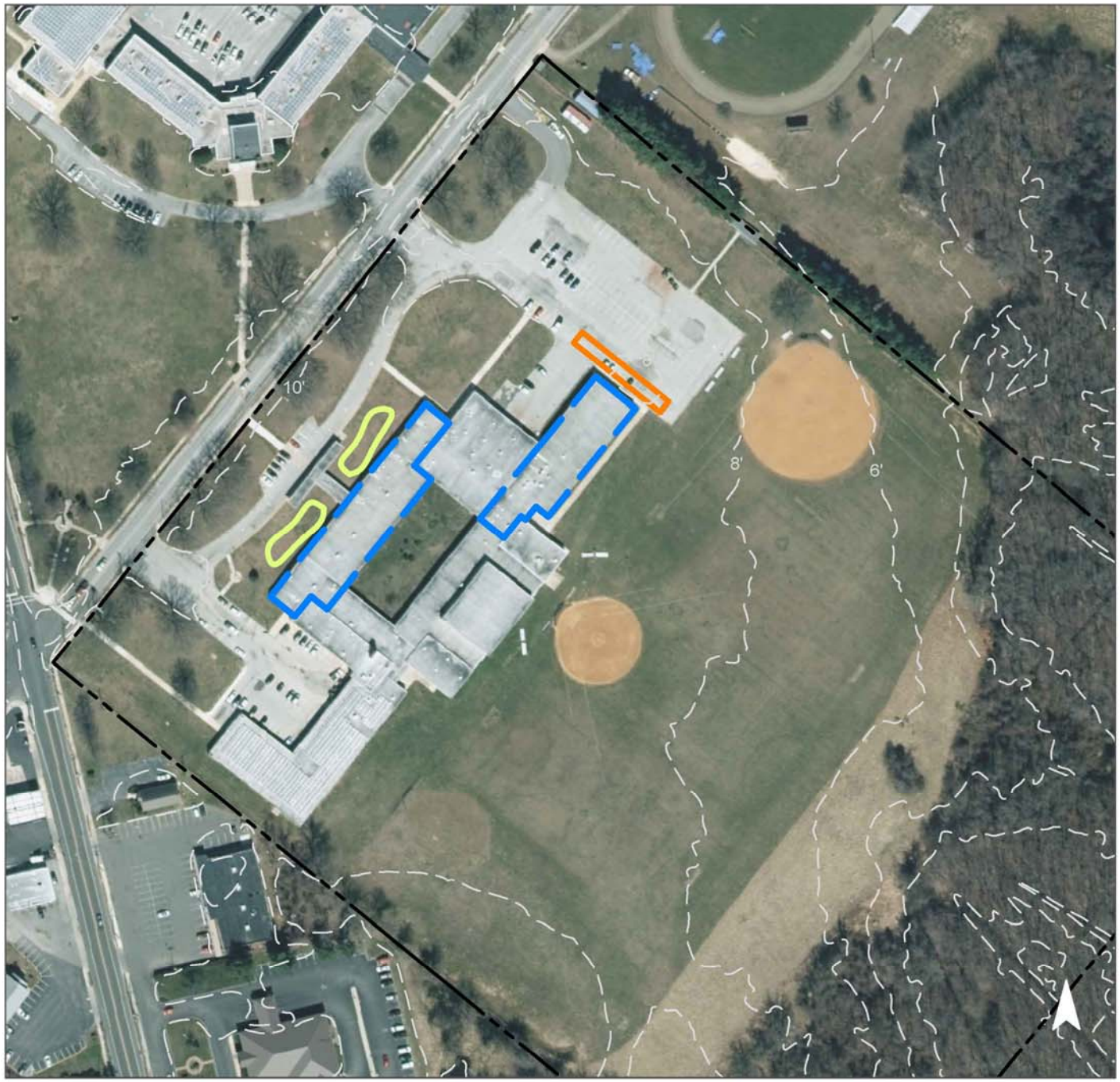
Block and Lot: Block 2601, Lot 1

Two rain gardens can be installed to capture, treat, and infiltrate stormwater runoff at the main entrance. A section of parking spaces can be converted to porous pavement to allow water to infiltrate through the surface. 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"
17	224,122	10.8	113.2	1,029.0	0.175	6.15

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	0.495	83	36,380	1.32	4,750	$23,750
Pervious pavement	0.379	64	27,830	1.01	2,600	$65,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Pennsville Middle School

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

0 100' 200'

Pennsville Water Treatment

Subwatershed: Lower Delaware River Valley Tributaries

Site Area: 409,518 sq. ft.

Address: 2 Sanderlin Road
Pennsville, NJ 08070

Block and Lot: Block 4803, Lot 1

Two rainwater harvesting cisterns can be installed to capture the runoff from the roof be used for practical applications. 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"
15	61,086	2.9	30.9	280.5	0.048	1.68

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
Rainwater harvesting	0.066	11	2,000	0.08	2,000 (gal)	$6,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Pennsville Water Treatment

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

0 20' 40'

Salem County Fraternal Order of Police

Subwatershed: Lower Delaware River Valley Tributaries

Site Area: 95,392 sq. ft.

Address: 693 South Broadway
Pennsville, NJ 08070

Block and Lot: Block 4603, Lots 5, 7

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. Cisterns can also be installed to capture runoff from the rooftop and allow the water to be reused for non-potable purposes such as washing vehicles. 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"
55	52,533	2.5	26.5	241.2	0.041	1.44

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	0.656	110	48,130	1.75	4,500	$112,500
Rainwater harvesting	0.172	29	5,100	0.19	5,100 (gal)	$10,200

GREEN INFRASTRUCTURE RECOMMENDATIONS

Salem County Fraternal Order of Police

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

0 25' 50'

Cathedral of Holiness Missionary Baptist Church

Subwatershed: Salem River

Site Area: 26,905 sq. ft.

Address: 76 Dolbow Avenue
Pennsville, NJ 08070

Block and Lot: Block 2004, Lot 29

Two bioretention systems can be installed to capture, treat, and infiltrate stormwater runoff on each side of the building. They can easily be incorporated to provide aesthetic value and manage stormwater 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"
19	5,172	0.2	2.6	23.7	0.004	0.14

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	8,560	0.31	1,120	$5,600

GREEN INFRASTRUCTURE RECOMMENDATIONS

Cathedral of Holiness

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

0 20' 40'

Christian Life Center

Subwatershed: Salem River

Site Area: 721,237 sq. ft.

Address: 670 South Broadway
Pennsville, NJ 08070

Block and Lot: Block 4201, Lot 10

Parking spaces in the parking lot to the south of the building near the entrance can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Two rain gardens can be installed at the back building's western entrance to capture and treat 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"
18	131,039	6.3	66.2	601.6	0.102	3.59

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	0.212	35	15,540	0.56	2.030	$10,150
Pervious pavement	0.977	164	71,700	2.61	6,750	$168,750

GREEN INFRASTRUCTURE RECOMMENDATIONS

Christian Life Center

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

0 50' 100'

Deepwater Fire Company

Subwatershed: Salem River

Site Area: 22,298 sq. ft.

Address: 545 North Broadway
Pennsville, NJ 08070

Block and Lot: Block 1709, Lot 6,7

A section of porous pavement can be installed in the lot north of the building to allow water to infiltrate through the surface and can support heavy vehicle traffic. 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"
69	15,397	0.7	7.8	70.7	0.012	0.42

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	0.282	47	20,700	0.75	1,930	$48,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

Deepwater Fire Company

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

0 20' 40'

Lutheran Church of Saint Ambrose

Subwatershed: Salem River

Site Area: 176,986 sq. ft.

Address: 443 South Broadway
Pennsville, NJ 08070

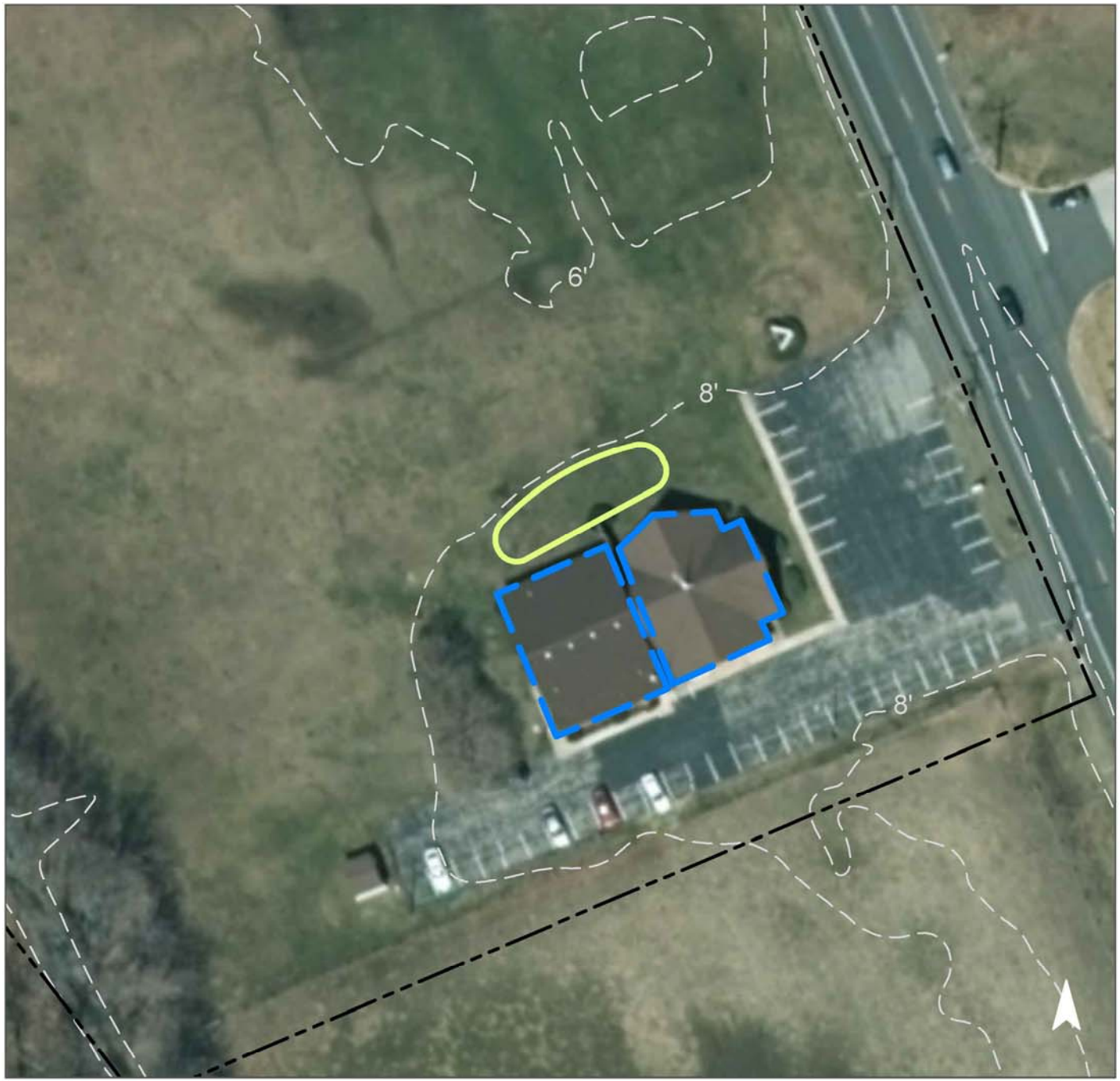
Block and Lot: Block 4701, Lot 4

A rain garden can be placed to the north of the building to capture, treat, and infiltrate stormwater runoff and can also provide aesthetic value and create wildlife habitat. 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"
21	37,974	1.8	19.2	174.4	0.030	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	0.148	25	10,880	0.40	1,425	$7,125

GREEN INFRASTRUCTURE RECOMMENDATIONS



Lutheran Church of Saint Ambrose

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

0 30' 60'

Pennsville Recreation Department

Subwatershed: Salem River

Site Area: 15,283 sq. ft.

Address: 9 North Broadway
Pennsville, NJ 08070

Block and Lot: Block 1901, Lot 2,12

A rain garden can be installed to the northeast of the building to capture, treat, and infiltrate stormwater runoff. Cisterns can be installed next to the building at the northwest side of the property to capture rooftop runoff from that building. The water can then be used for non-potable purposes such as washing cars or watering gardens. 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"
29	4,406	0.2	2.2	20.2	0.003	0.12

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	0.027	5	2,000	0.07	270	$1,350
Rainwater harvesting	0.071	12	2,150	0.08	2,150 (gal)	$4,300

GREEN INFRASTRUCTURE RECOMMENDATIONS

Pennsville Recreation Department

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

0 20' 40'

Riverview Beach Park

Subwatershed: Salem River

Site Area: 2,520,054 sq. ft.

Address: 5 North Broadway
Pennsville, NJ 08070

Block and Lot: Block 1901, Lot 2

The basketball court can be replaced with porous asphalt which will also provide new asphalt for the basketball court. A rain garden can also be installed to the west of the parking lot to capture and treat stormwater runoff from the restroom building before it enters the catch basin. 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"
4	110,577	5.3	558	507.7	0.086	3.03

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	0.030	5	2,200	0.08	300	$1,500
Pervious pavement	0.125	21	9,180	0.33	4,250	$106,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

River Beach Park

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

0 20' 40'

Valley Park Elementary School

Subwatershed: Salem River

Site Area: 434,049 sq. ft.

Address: 63 Mahoney Road
Pennsville, NJ 08070

Block and Lot: Block 4201, Lot 19

The two parking lots on both the east and west sides of the school can be converted to porous pavement to treat the stormwater runoff from the roof of the elementary 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"
42	181,666	8.8	91.8	834.1	0.142	4.98

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
Pervious pavement	1.724	289	126,470	4.60	11,800	$295,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Valley Park Elementary

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

0 50' 100'

c. Summary of Existing Conditions

Summary of Existing Site 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) (Mgal)	Annual (Mgal)
	LOWER DELAWARE RIVER TRIBUTARIES SUBWATERSHED	**2,272.69**	**98,998,562**				**22.07**	**961,194**	**46.3**	**485.5**	**4,413.2**	**0.749**	**26.36**
1	**Fort Mott State Park**												
	Total Site Info	2,187.28	95,277,715	5501	17	0	1.46	63,714	3.1	32.2	292.5	0.050	1.75
2	**Pennsville Babe Ruth Field**												
	Total Site Info	9.40	409,518	4803	1	15	1.40	61,086	2.9	30.9	280.5	0.048	1.68
3	**Pennsville Fire Department**												
	Total Site Info	5.25	228,901	3002	6,7	15	0.81	35,426	1.7	17.9	162.7	0.028	0.97
4	**Pennsville Library**												
	Total Site Info	1.43	62,477	2601	66	83	1.19	51,868	2.5	26.2	238.1	0.040	1.42
5	**Pennsville Memorial High School**												
	Total Site Info	28.28	1,231,705	2702	22	37	10.46	455,436	22.0	230.0	2,091.1	0.355	12.49
6	**Pennsville Middle School**												
	Total Site Info	30.44	1,325,889	2601	1	17	5.15	224,122	10.8	113.2	1,029.0	0.175	6.15
7	**Pennsville Water Treatment**												
	Total Site Info	9.40	409,518	4803	1	15	1.40	61,086	2.9	30.9	280.5	0.048	1.68
8	**Salem County Fraternal Order of Police**												
	Total Site Info	1.21	52,837	4603	5,7	16	0.19	8,456	0.4	4.3	38.8	0.007	0.23
	SALEM RIVER SUBWATERSHED	**89.71**	**3,907,812**				**11.14**	**485,251**	**23.4**	**245.1**	**2,228.0**	**0.378**	**13.31**
9	**Cathedral of Holiness Missionary Baptist Church**												
	Total Site Info	0.62	26,905	2004	29	16	0.10	4,193	0.2	2.1	19.2	0.003	0.11
10	**Christian Life Center**												
	Total Site Info	16.35	712,237	4201	10	18	3.01	131,039	6.3	66.2	601.6	0.102	3.59
11	**Deepwater Fire Company**												
	Total Site Info	0.51	22,298	109	6,7	69	0.35	15,397	0.7	7.8	70.7	0.012	0.42

Summary of Existing Site 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) (Mgal)	Annual (Mgal)
12	**Lutheran Church of St Ambrose**												
	Total Site Info	4.06	176,986	4701	4	21	0.87	37,974	1.8	19.2	174.4	0.030	1.04
13	**Pennsville Recreation Department**												
	Total Site Info	0.35	15,283	1901	12	29	0.10	4,406	0.2	2.2	20.2	0.003	0.12
14	**Riverview Beach Park**												
	Total Site Info	57.85	2,520,054	1901	2	4	2.54	110,577	5.3	55.8	507.7	0.086	3.03
15	**Valley Park Elementary School**												
	Total Site Info	9.96	434,049	4201	19	42	4.17	181,666	8.8	91.8	834.1	0.142	4.98

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 %
	LOWER DELAWARE RIVER TRIBUTARIES SUBWATERSHED	**143,555**	**3.30**	**3.696**	**626**	**252,360**	**9.23**				**$471,820**	**14.3%**
1	**Fort Mott State Park**											
	Bioretention systems	3,530	0.08	0.092	15	6,530	0.25	885	$5	SF	$4,425	5.5%
	Total Site Info	**3,530**	**0.08**	**0.092**	**15**	**6,530**	**0.25**				**$4,425**	**5.5%**
2	**Pennsville Babe Ruth Field**											
	Bioretention systems	9,660	0.22	0.252	42	17,870	0.67	2,440	$5	SF	$12,200	15.8%
	Bioswale	0	0.00	0.000	0	0	0.00	540	$5	SF	$2,700	0.0%
	Planter Boxes	1,290	0.03	n/a	6	n/a	n/a	6	$1,000	box	$6,000	2.1%
	Total Site Info	**10,950**	**0.25**	**0.252**	**48**	**17,870**	**0.67**				**$20,900**	**17.9%**
3	**Pennsville Fire Department**											
	Pervious pavement	7,670	0.18	0.200	33	14,660	0.53	1,370	$25	SF	$34,250	21.7%
	Rainwater harvesting	4,440	0.10	0.116	19	3,460	0.13	3,460	$2	gal	$6,920	12.5%
	Total Site Info	**12,110**	**0.28**	**0.316**	**53**	**18,120**	**0.66**				**$41,170**	**34.2%**
4	**Pennsville Library**											
	Pervious pavement	12,900	0.30	0.336	56	24,660	0.90	2,400	$25	SF	$60,000	24.9%
	Rainwater harvesting	2,900	0.07	0.076	13	3,000	0.12	3,000	$2	gal	$6,000	5.6%
	Planter boxes	430	0.01	n/a	2	n/a	n/a	2	$1,000	box	$2,000	0.1%
	Total Site Info	**16,230**	**0.37**	**0.412**	**70**	**27,660**	**1.02**				**$68,000**	**30.6%**
5	**Pennsville Memorial High School**											
	Bioretention system	1,850	0.04	0.048	8	3,540	0.13	465	$5	SF	$2,325	0.4%
	Pervious pavement	31,000	0.71	0.808	135	59,260	2.15	5,190	$25	SF	$129,750	6.8%
	Total Site Info	**32,850**	**0.75**	**0.856**	**143**	**62,800**	**2.28**				**$132,075**	**7.2%**
6	**Pennsville Middle School**											
	Bioretention systems	19,000	0.44	0.495	83	36,320	1.32	4,750	$5	SF	$23,750	8.5%
	Pervious pavement	14,560	0.33	0.379	64	27,830	1.01	2,600	$25	SF	$65,000	6.5%
	Total Site Info	**33,560**	**0.77**	**0.874**	**146**	**64,150**	**2.33**				**$88,750**	**15.0%**

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 %
7	**Pennsville Water Treatment**											
	Rainwater harvesting system	2,550	0.06	0.066	11	2,000	0.08	2,000	$2	gal	$4,000	4.2%
	Total Site Info	**2,550**	**0.06**	**0.066**	**11**	**2,000**	**0.08**				**$4,000**	**4.2%**
8	**Salem County Fraternal Order of Police**											
	Pervious pavement	25,175	0.58	0.656	110	48,130	1.75	4,500	$25	SF	$112,500	47.9%
	Rainwater harvesting	6,600	0.15	0.172	29	5,100	0.19	5,100	$2	gal	$10,200	12.6%
	Total Site Info	**31,775**	**0.73**	**0.828**	**139**	**53,230**	**1.94**				**$112,500**	**47.9%**
	SALEM RIVER SUBWATERSHED	**142,500**	**3.27**	**3.713**	**622**	**269,380**	**9.79**				**$648,275**	**29.3%**
9	**Cathedral of Holiness Missionary Baptist Church**											
	Bioretention systems	4,480	0.10	0.117	20	8,560	0.31	1,120	$5	SF	$5,600	86.6%
	Total Site Info	**4,480**	**0.10**	**0.117**	**20**	**8,560**	**0.31**				**$5,600**	**86.6%**
10	**Christian Life Center**											
	Bioretention systems	8,125	0.19	0.212	35	15,540	0.56	2,030	$5	SF	$10,150	6.2%
	Pervious pavement	37,500	0.86	0.977	164	71,700	2.61	6,750	$25	SF	$168,750	28.6%
	Total Site Info	**45,625**	**1.05**	**1.189**	**199**	**87,240**	**3.17**				**$178,900**	**34.8%**
11	**Deepwater Fire Company**											
	Pervious pavement	10,830	0.25	0.282	47	20,700	0.75	1,930	$25	SF	$48,250	70.3%
	Total Site Info	**10,830**	**0.25**	**0.282**	**47**	**20,700**	**0.75**				**$48,250**	**70.3%**
12	**Lutheran Church of Saint Ambrose**											
	Bioretention system	5,690	0.13	0.148	25	10,880	0.40	1,425	$5	SF	$7,125	15.0%
	Total Site Info	**5,690**	**0.13**	**0.148**	**25**	**10,880**	**0.40**				**$7,125**	**15.0%**
13	**Pennsville Recreation Department**											
	Bioretention system	1,050	0.02	0.027	5	2,000	0.07	270	$5	SF	$1,350	23.8%
	Rainwater harvesting	2,725	0.06	0.071	12	2,150	0.08	2,150	$2	gal	$4,300	61.8%
	Total Site Info	**3,775**	**0.09**	**0.098**	**16**	**4,150**	**0.15**				**$5,650**	**85.7%**

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 %
14	**Riverview Beach Park**											
	Bioretention system	1,150	0.03	0.030	5	2,200	0.08	300	$5	SF	$1,500	1.0%
	Pervious pavement	4,800	0.11	0.125	21	9,180	0.33	4,250	$25	SF	$106,250	4.3%
	Total Site Info	**5,950**	**0.14**	**0.155**	**26**	**11,380**	**0.41**				**$107,750**	**5.4%**
15	**Valley Park Elementary School**											
	Pervious pavement	66,150	1.52	1.724	289	126,470	4.60	11,800	$25	SF	$295,000	36.4%
	Total Site Info	**66,150**	**1.52**	**1.724**	**289**	**126,470**	**4.60**				**$295,000**	**36.4%**