RUTGERS
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Experiment Station

Draft

Impervious Cover Reduction Action Plan for East Brunswick Township, Middlesex County, New Jersey

Prepared for East Brunswick Township by the Rutgers Cooperative Extension Water Resources Program

September 30, 2015

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Introduction

Located in Middlesex County in central New Jersey, East Brunswick Township covers approximately 22.4 square miles east of Raritan. Figures 1 and 2 illustrate that East Brunswick Township is dominated by urban land uses. A total of 61.4% of the municipality's land use is classified as urban. Of the urban land in East Brunswick Township, medium density residential is the dominant land use (Figure 3).

The New Jersey Department of Environmental Protection's (NJDEP) 2007 land use/land cover geographical information system (GIS) data layer categorizes East Brunswick 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 East Brunswick Township. Based upon the 2007 NJDEP land use/land cover data, approximately 23.0% of East Brunswick Township has impervious cover. This level of impervious cover suggests that the streams in East Brunswick Township are likely impacted. [1]

Methodology

East Brunswick Township contains portions of six 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

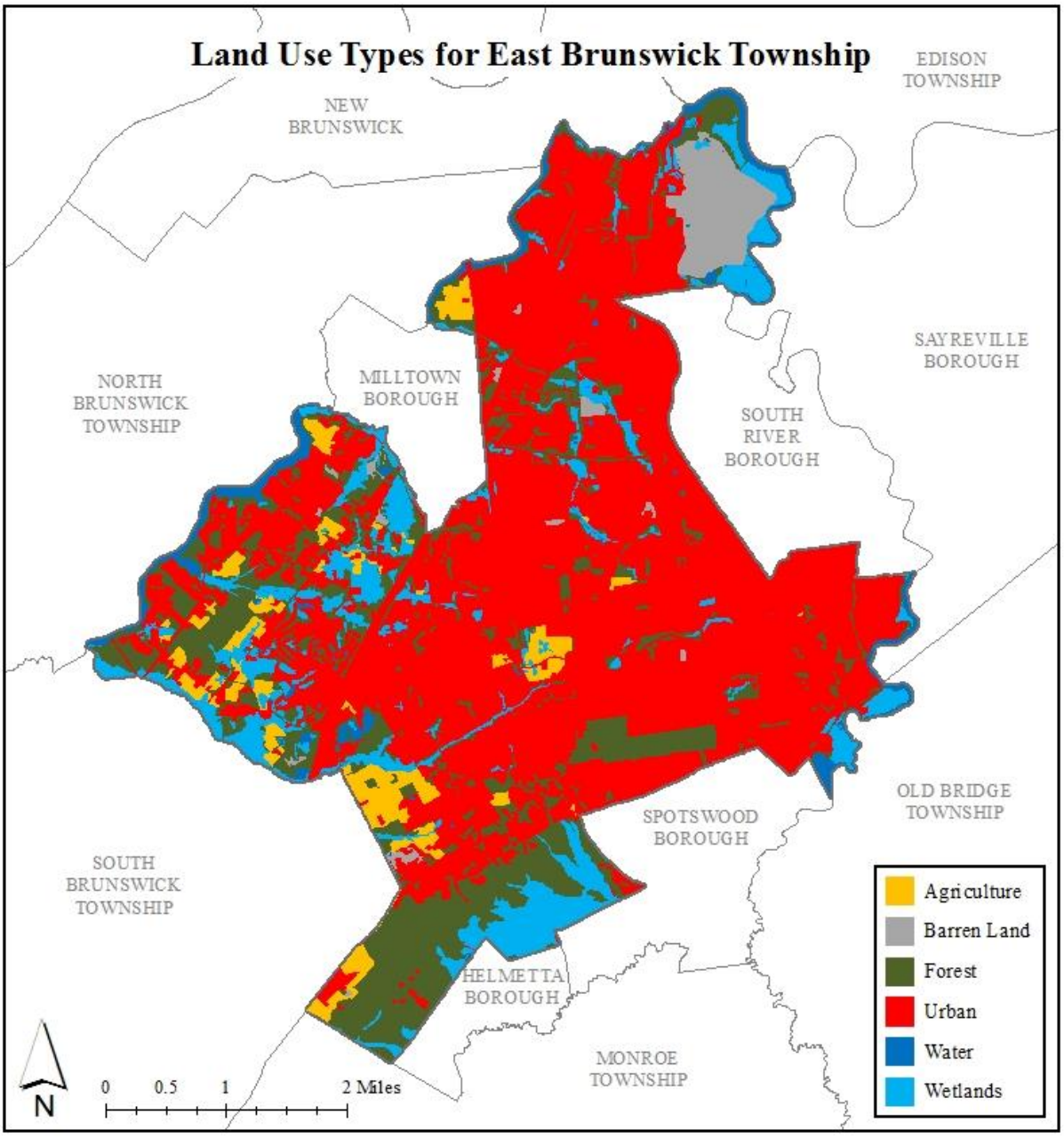


Figure 1: Map illustrating the land use in East Brunswick Township

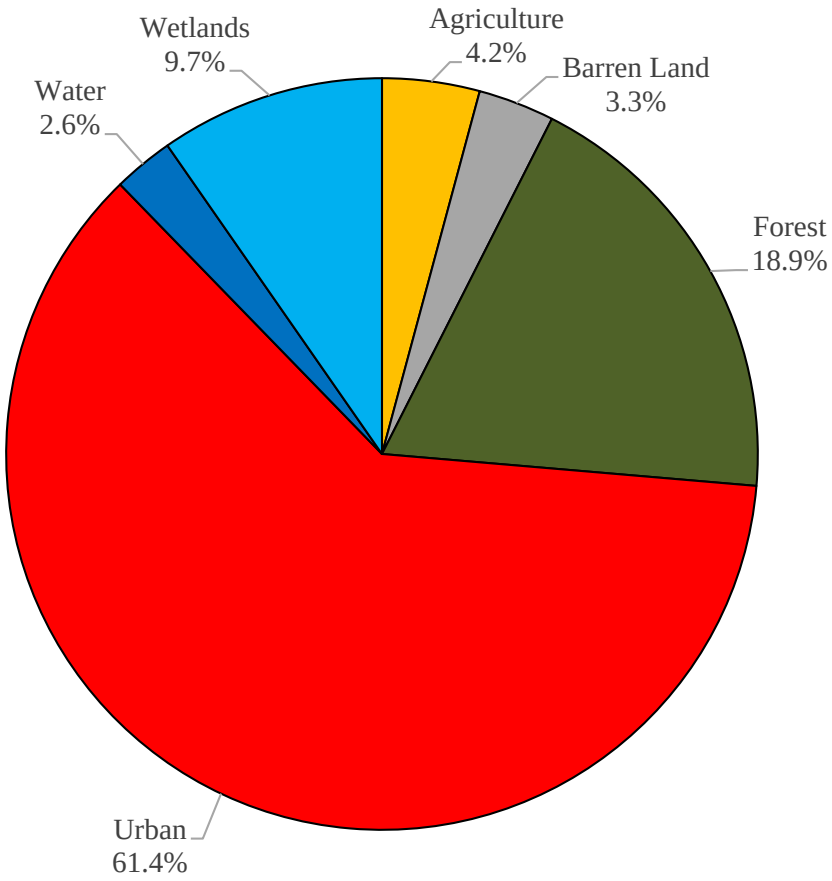


Figure 2: Pie chart illustrating the land use in East Brunswick Township

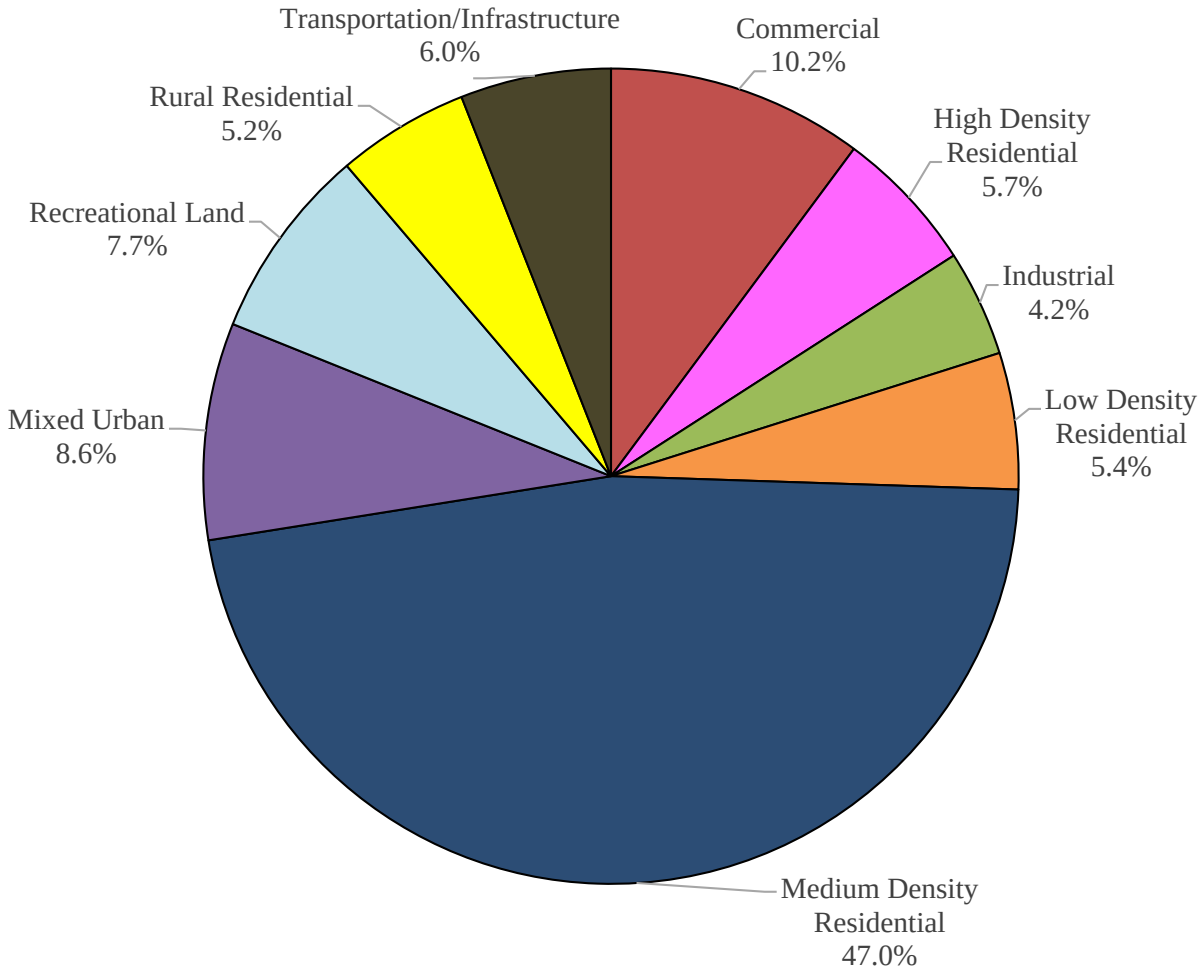


Figure 3: Pie chart illustrating the various types of urban land use in East Brunswick Township

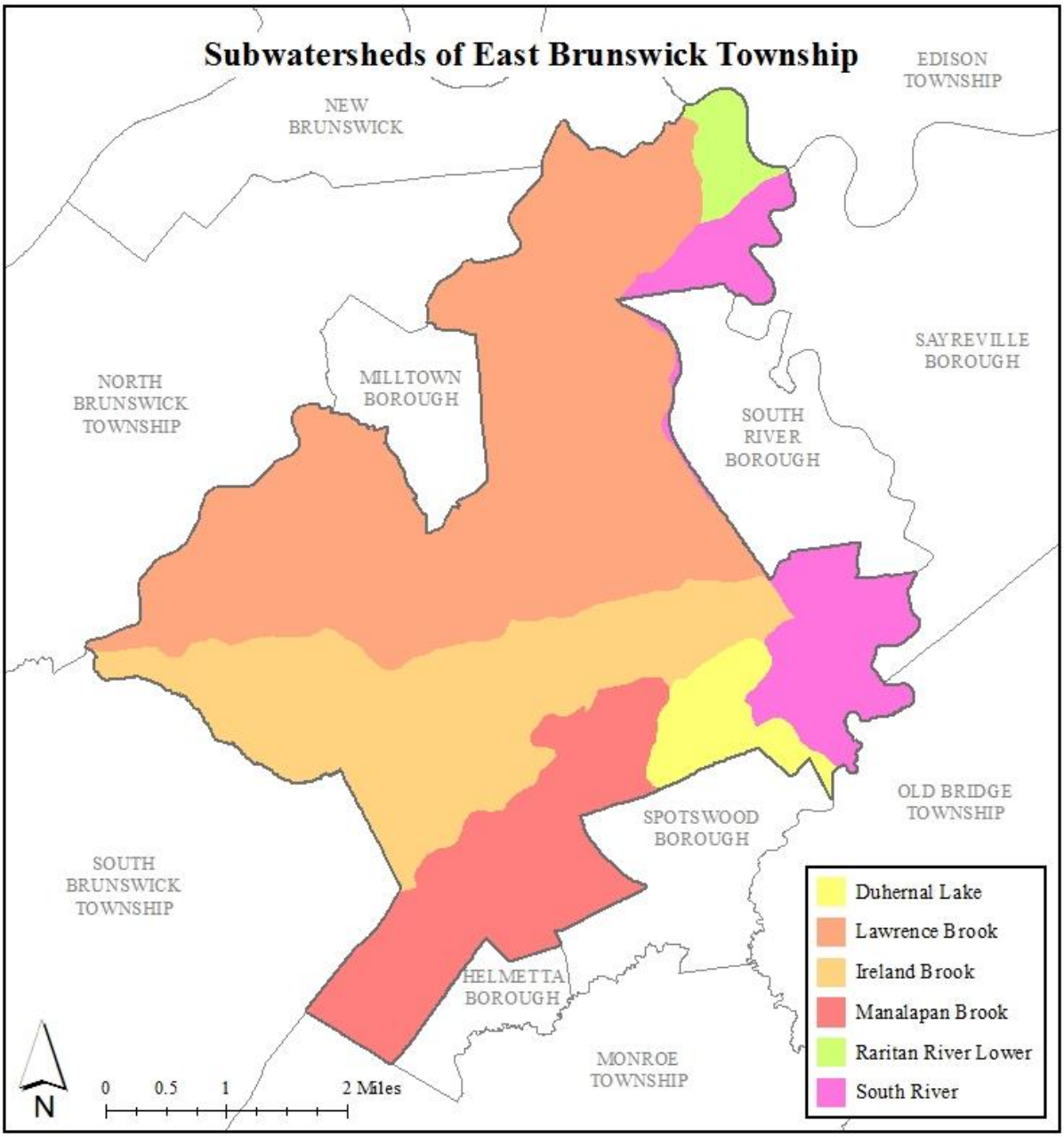


Figure 4: Map of the subwatersheds in East Brunswick Township

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 2007 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 East Brunswick 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 East Brunswick 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

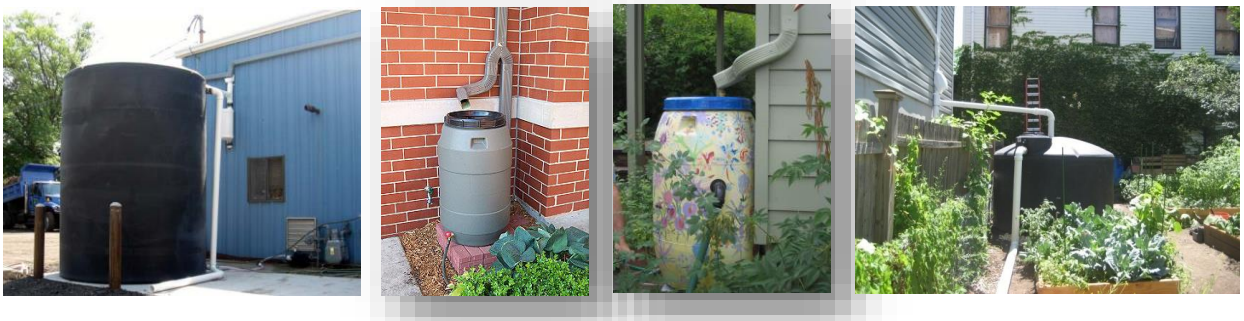
These are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff. These systems can easily be incorporated into existing landscapes, improving aesthetics and creating a wildlife habitat while managing stormwater runoff. Bioretention systems also can be used in soils 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

Attachment 1 contains information on potential project sites where green infrastructure practices could be installed. The recommended green infrastructure practice and the drainage area that the green infrastructure practice can treat are identified for each potential project site. For each practice, the recharge potential, TSS removal potential, maximum volume reduction potential per storm, and the peak reduction potential 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*.

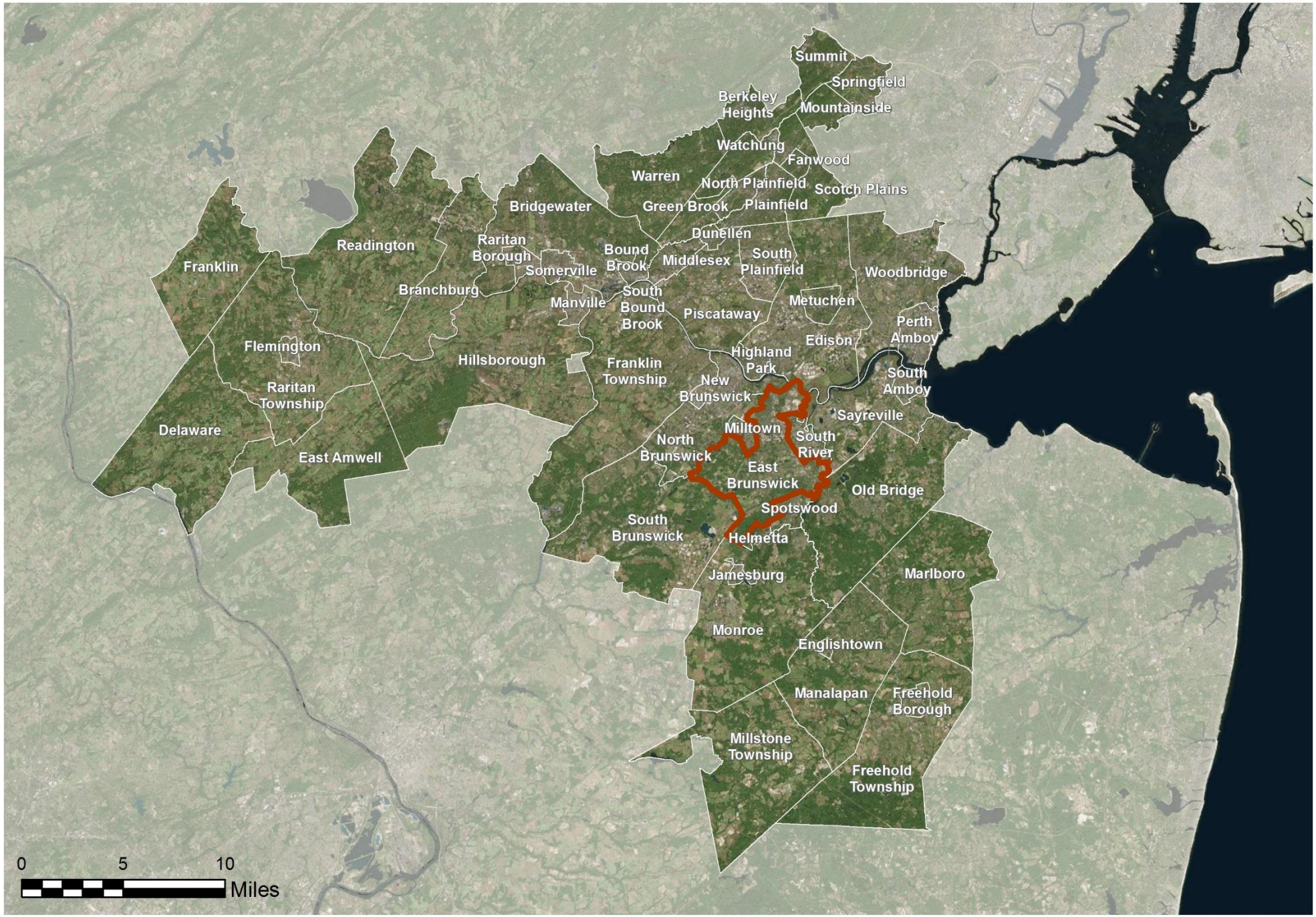
Conclusion

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.

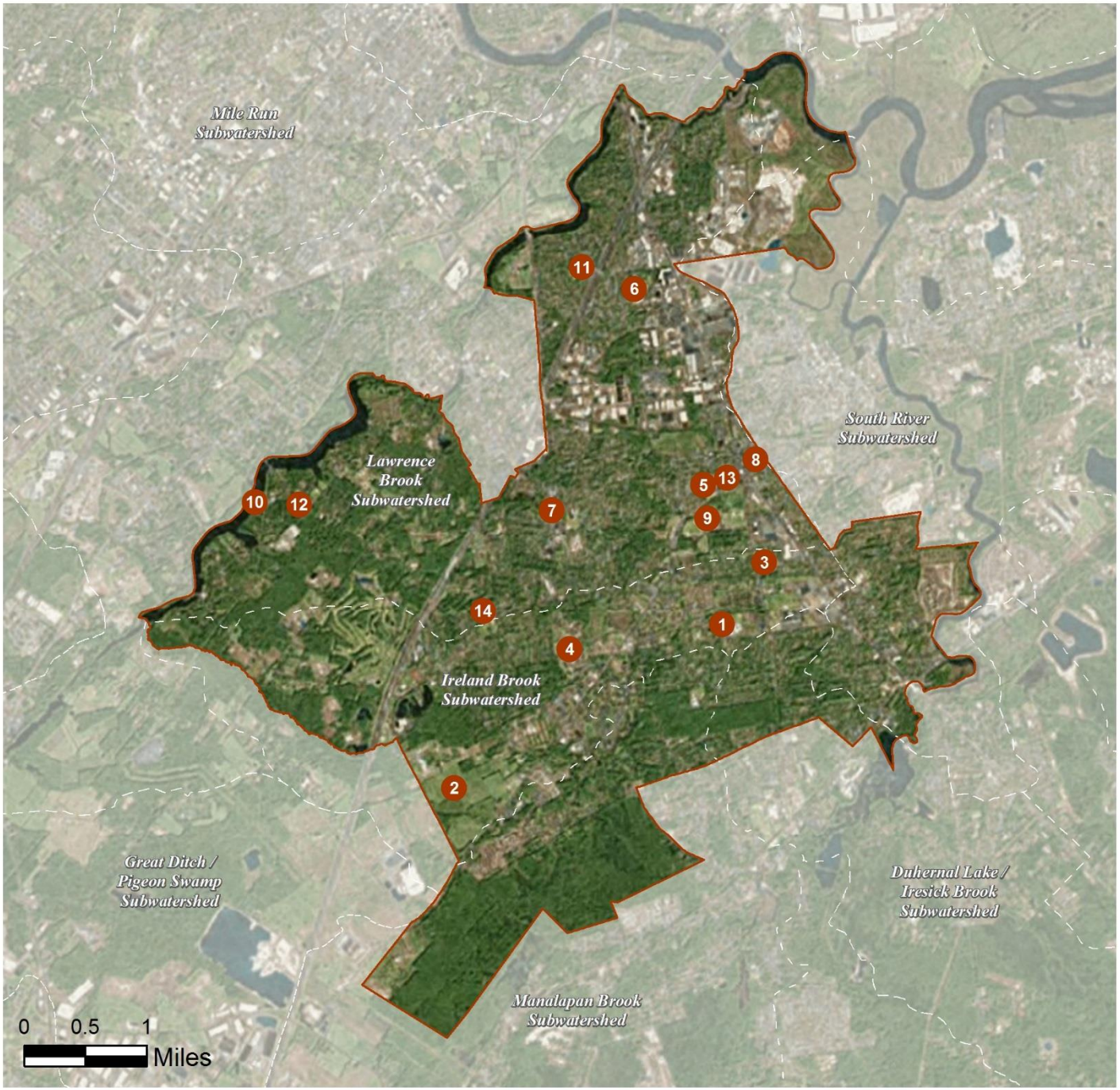
a. Overview Map of the Project

EAST BRUNSWICK: CLIMATE RESILIENT GREEN INFRASTRUCTURE FOR THE RARITAN BASIN



b. Green Infrastructure Sites

EAST BRUNSWICK: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE IRELAND BROOK SUBWATERSHED:

1. East Brunswick Municipal Complex
2. Hammarskjold Middle School
3. Heavenly Farms Park: Dog Park
4. Irwin Elementary School

SITES WITHIN THE LAWRENCE BROOK SUBWATERSHED:

5. Central Elementary School
6. Churchill Junior High School
7. East Brunswick Baptist Church
8. East Brunswick Fire Department
9. East Brunswick High School
10. Elks Lodge
11. Lawrence Brook Elementary School
12. Saint Mary Coptic Orthodox Church of Middlesex County
13. Trinity Presbyterian Church
14. Warnsdorfer Elementary School

c. Proposed Green Infrastructure Concepts

EAST BRUNSWICK MUNICIPAL COMPLEX

Subwatershed: **Ireland Brook**

Site Area: **755,328 sq. ft.**

Address: **Civic Center Drive**
East Brunswick, NJ 08816

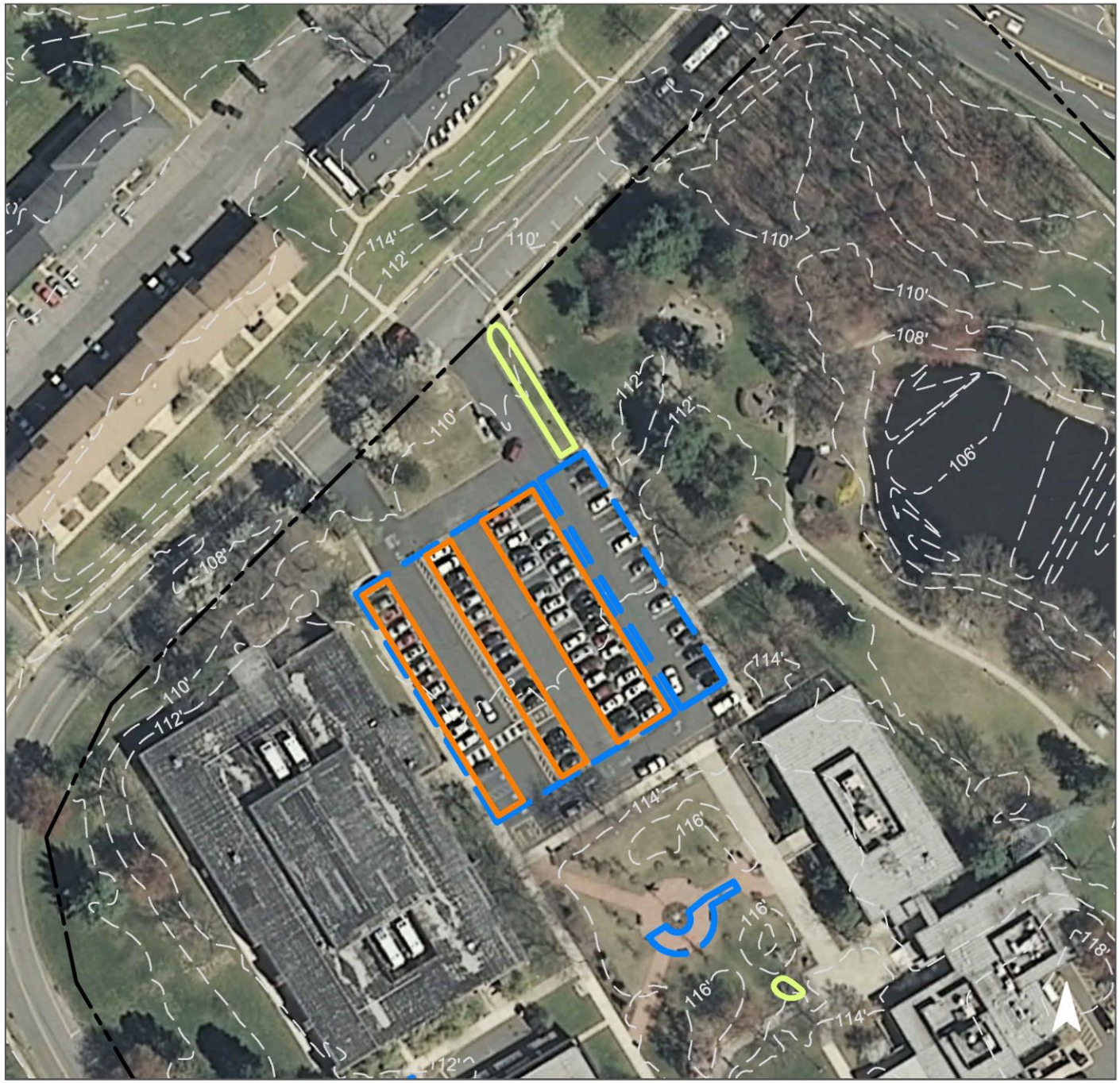
Block and Lot: **Block 319.14, Lot 10.04**

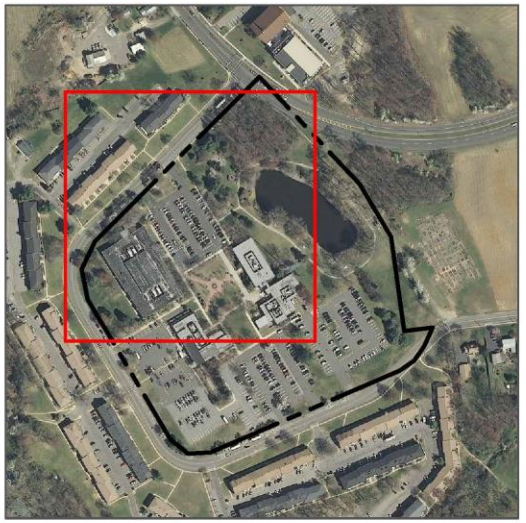
Stormwater is currently directed into a retention basin. Rain gardens can be used to capture, treat, and infiltrate parking lot runoff. Additional runoff can be infiltrated with pervious pavement. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure. The following diagrams have been divided into the library, senior center and court house.

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"
45	339,729	16.4	171.6	1,559.8	0.265	9.32

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 systems	2.123	355	155,778	5.86	18,307	$91,535
Pervious pavements	1.502	251	110,195	4.14	28,361	$709,025

GREEN INFRASTRUCTURE RECOMMENDATIONS



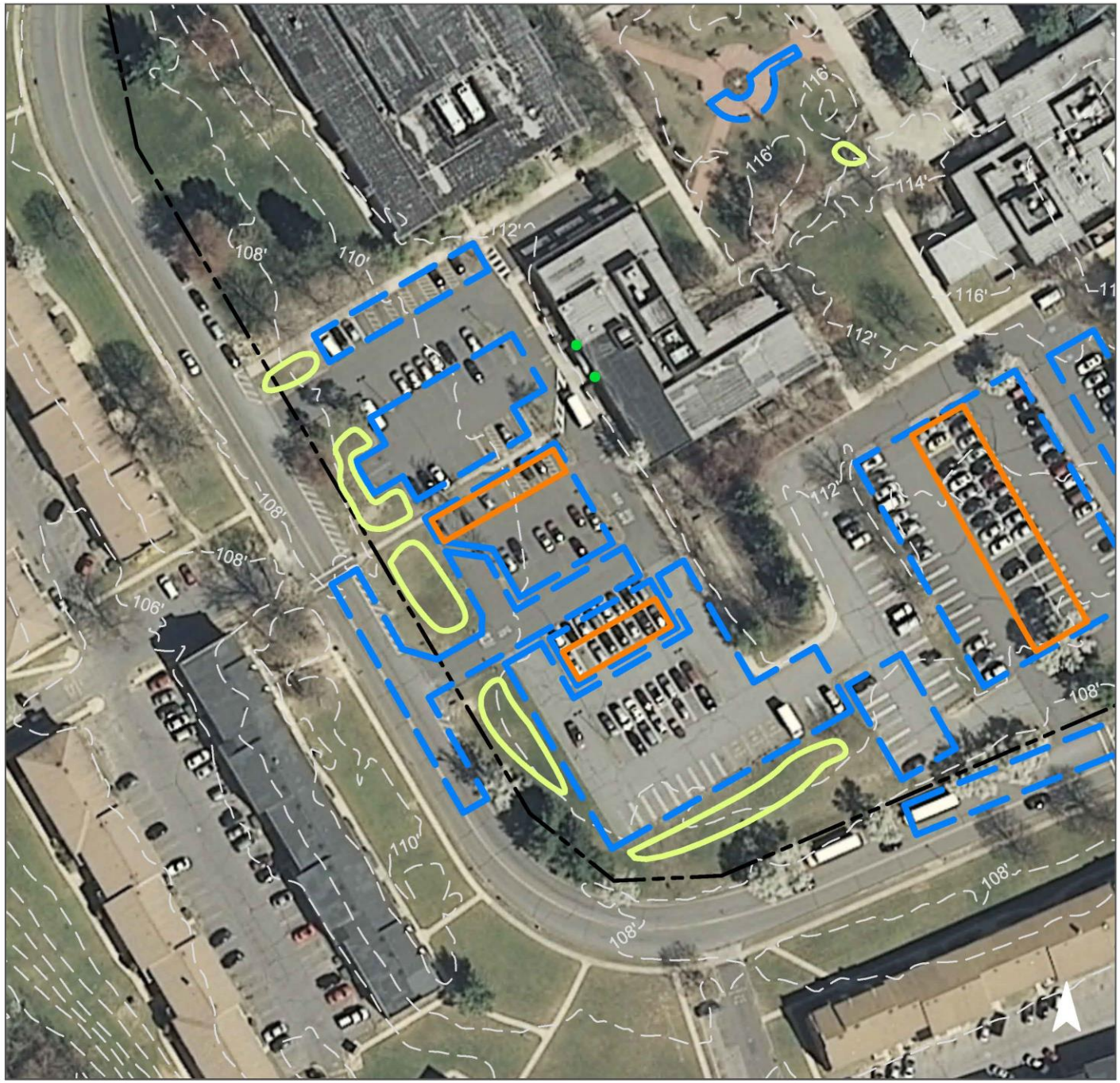


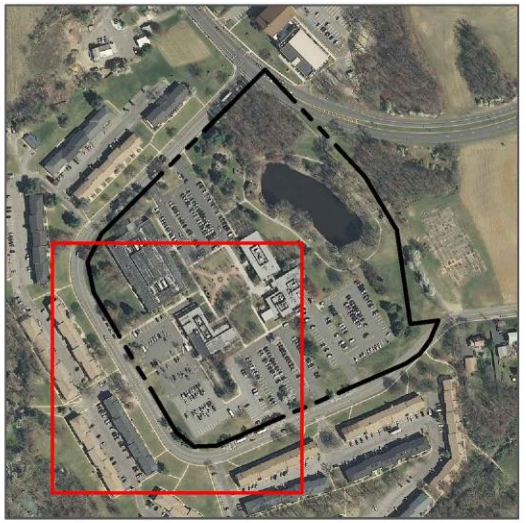
Municipal Complex: Library

- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 30' 60'

GREEN INFRASTRUCTURE RECOMMENDATIONS



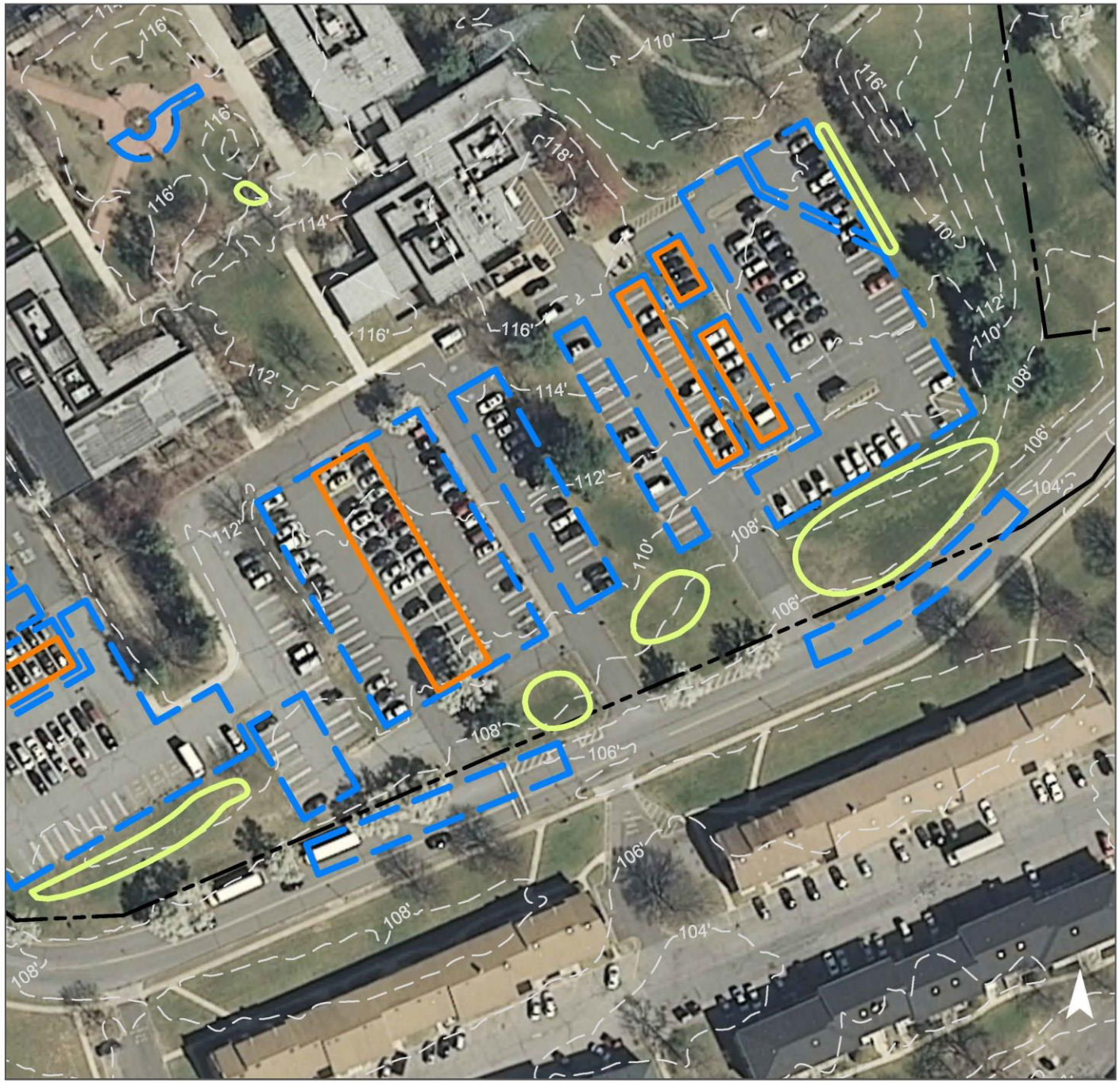


Municipal Complex: Senior Center

- disconnected downspouts
- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

GREEN INFRASTRUCTURE RECOMMENDATIONS



Municipal Complex: Court House

- disconnected downspouts
- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

HAMMARSKJOLD MIDDLE SCHOOL

Subwatershed: **Ireland Brook**

Site Area: **900,087 sq. ft.**

Address: **200 Rues Lane**
East Brunswick, NJ 08816

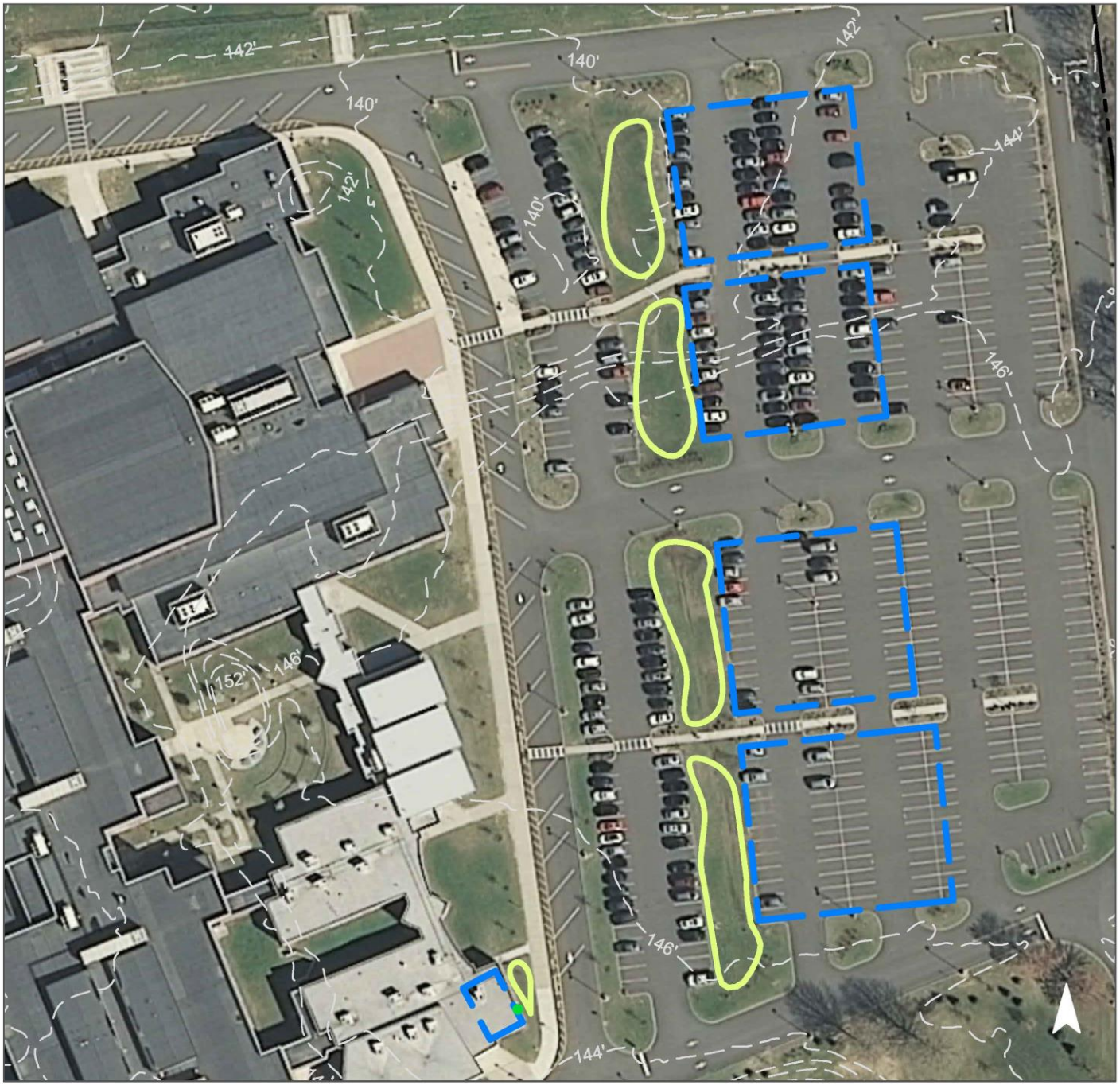
Block and Lot: **Block 88.25, Lot 8.01**

Stormwater is currently directed into an existing detention basin. Rain gardens can be installed within the parking lot median to capture, treat, and infiltrate parking lot 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"
64	578,861	27.9	292.4	2,657.8	0.451	15.88

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	1.375	230	100,860	3.79	13,286	$66,430

GREEN INFRASTRUCTURE RECOMMENDATIONS



Hammarskjold Middle School

- disconnected downspouts
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

HEAVENLY FARMS PARK: DOG PARK

Subwatershed: Ireland Brook

Site Area: 4,534,968 sq. ft.

Address: 440 Dunhams Corner Road
East Brunswick NJ 08816

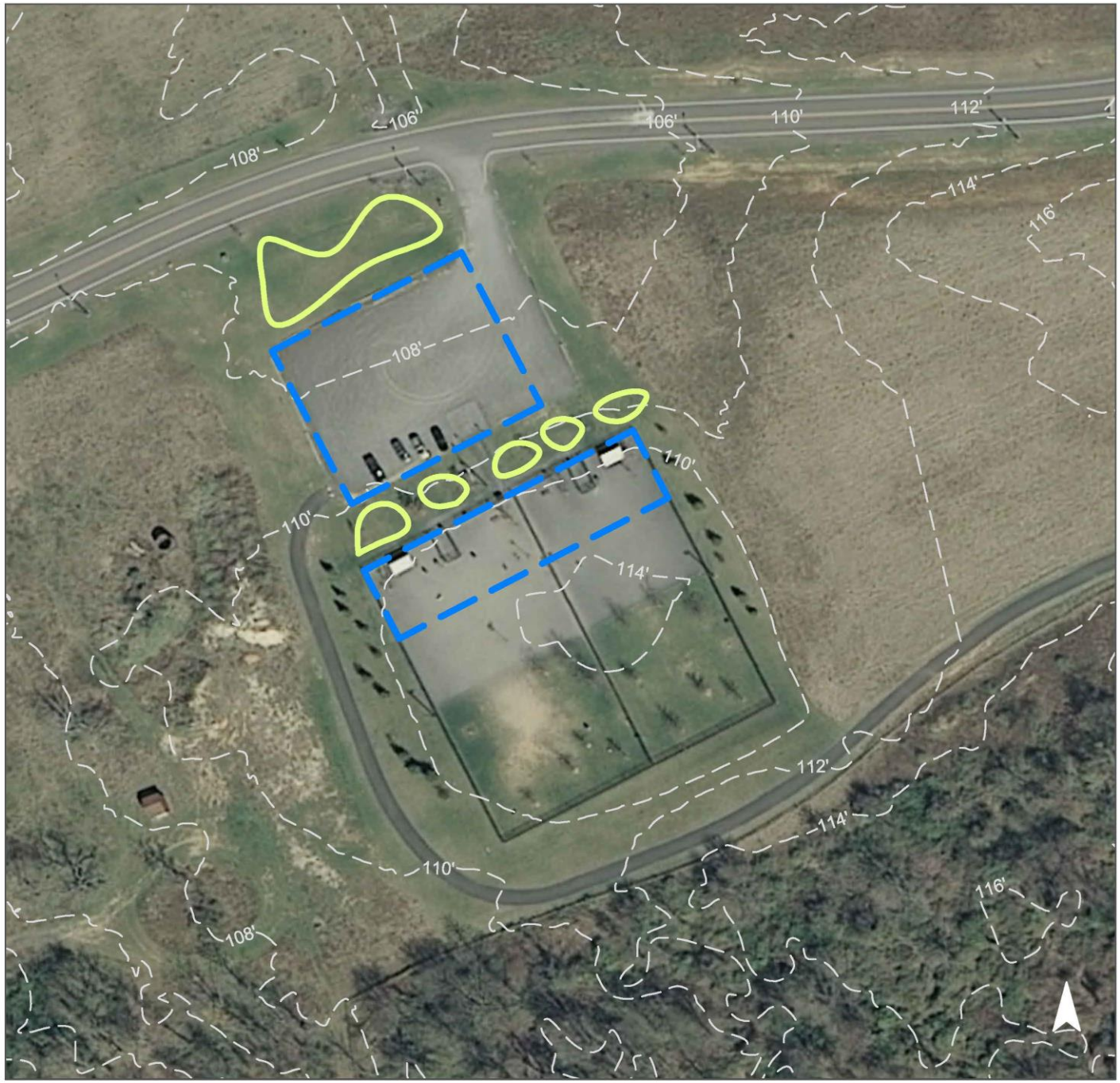
Block and Lot: Block 320, Lot 4

Rain gardens can capture, treat, and infiltrate stormwater. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
8	377,286	18.2	190.5	1,732.3	0.294	10.35

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	0.671	112	49,256	1.85	6,441	$32,205

GREEN INFRASTRUCTURE RECOMMENDATIONS



Heavenly Farms Park: Dog Park

- bioretention / rain gardens
- bioswales
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

IRWIN ELEMENTARY SCHOOL

Subwatershed: **Ireland Brook**

Site Area: **308,905 sq. ft.**

Address: **75 Racetrack Road**
East Brunswick, NJ 08816

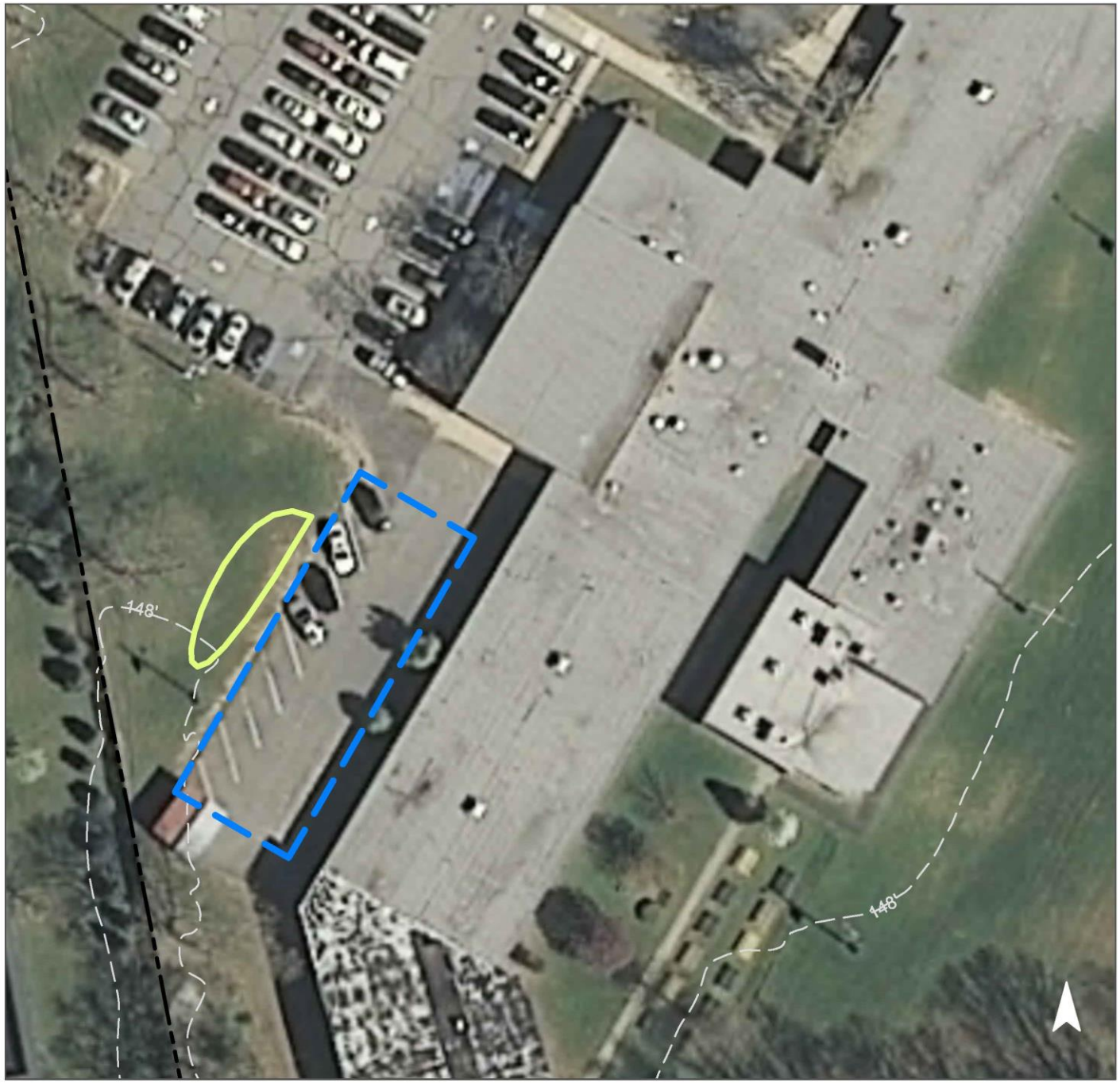
Block and Lot: **Block 131, Lot 1.01**

A rain garden can capture, treat, and infiltrate 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"
36	111,931	5.4	56.5	513.9	0.087	3.07

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	0.136	23	9,948	0.37	1,268	$6,340

GREEN INFRASTRUCTURE RECOMMENDATIONS



Irwin Elementary School

- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 25' 50'

CENTRAL ELEMENTARY SCHOOL

Subwatershed: Lawrence Brook

Site Area: 796,866 sq. ft.

Address: 371 Cranbury Road East
Brunswick, NJ 08816

Block and Lot: Block 86, Lot 40.15

Stormwater currently drains into an existing detention basin. Rain gardens can capture, treat, and infiltrate 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"
26	207,440	10.0	104.8	952.4	0.162	5.69

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	0.130	17	7,532	0.28	985	$4,925
Pervious pavements	0.227	38	16,658	0.63	1,566	$38,900

GREEN INFRASTRUCTURE RECOMMENDATIONS

Central Elementary School

- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

CHURCHILL JUNIOR HIGH SCHOOL

Subwatershed: Lawrence Brook

Site Area: 1,130,014 sq. ft.

Address: 48 Norton Road
East Brunswick, NJ 08816

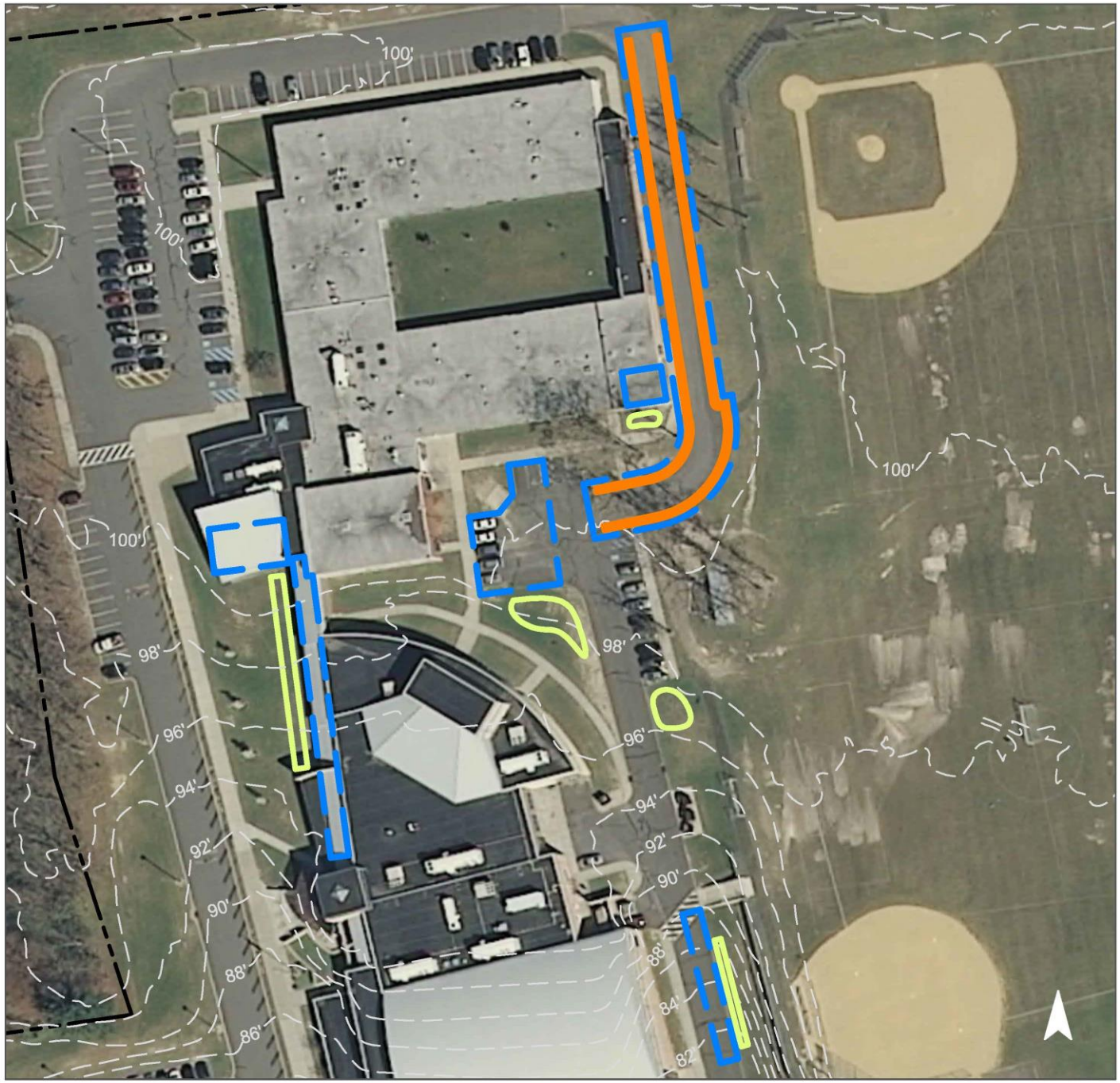
Block and Lot: Block 603, Lot 33

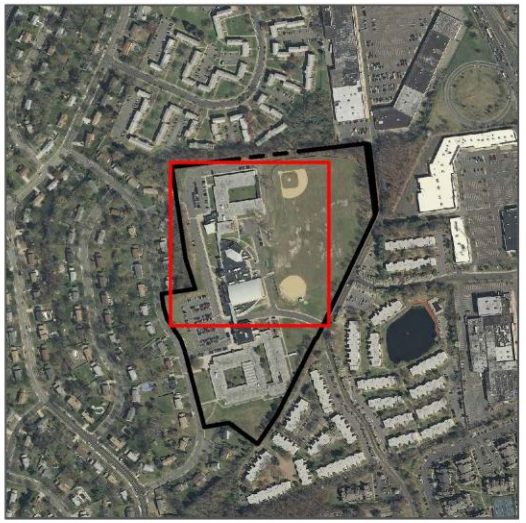
Several rain gardens can be installed to capture, treat and infiltrate runoff. Two rows of pervious pavement can also be installed along the back access road, where compaction is currently causing water to pool. A preliminary soil assessment suggests that more soil testing would be required before determining soil 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	470,481	22.7	237.6	2,160.2	0.367	12.90

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	0.371	62	27,190	1.02	3,555	$17,775
Pervious pavements	0.166	28	12,200	0.46	2,036	$50,900

GREEN INFRASTRUCTURE RECOMMENDATIONS





Churchill Junior High

- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

EAST BRUNSWICK BAPTIST CHURCH

Subwatershed: Lawrence Brook

Site Area: 216,494 sq. ft.

Address: 456 Ryders Lane
East Brunswick, NJ 08816

Block and Lot: Block 86.08, Lot 70.02

Parking spaces can be replaced with porous asphalt to capture runoff from the road and roof. A rain garden can also be planted along the side of the building to capture, treat and infiltrate rooftop runoff. A preliminary soil assessment suggests that 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	44,708	2.2	22.6	205.3	0.035	1.23

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	0.038	6	2,760	0.10	381	$1,905
Pervious pavements	0.438	73	32,149	0.88	4,786	$119,650

GREEN INFRASTRUCTURE RECOMMENDATIONS

East Brunswick Baptist Church

- disconnected downspouts
- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 25' 50'

EAST BRUNSWICK FIRE DEPARTMENT

Subwatershed: Lawrence Brook

Site Area: 67,500 sq. ft.

Address: 216 Joseph Street
East Brunswick, NJ 08816

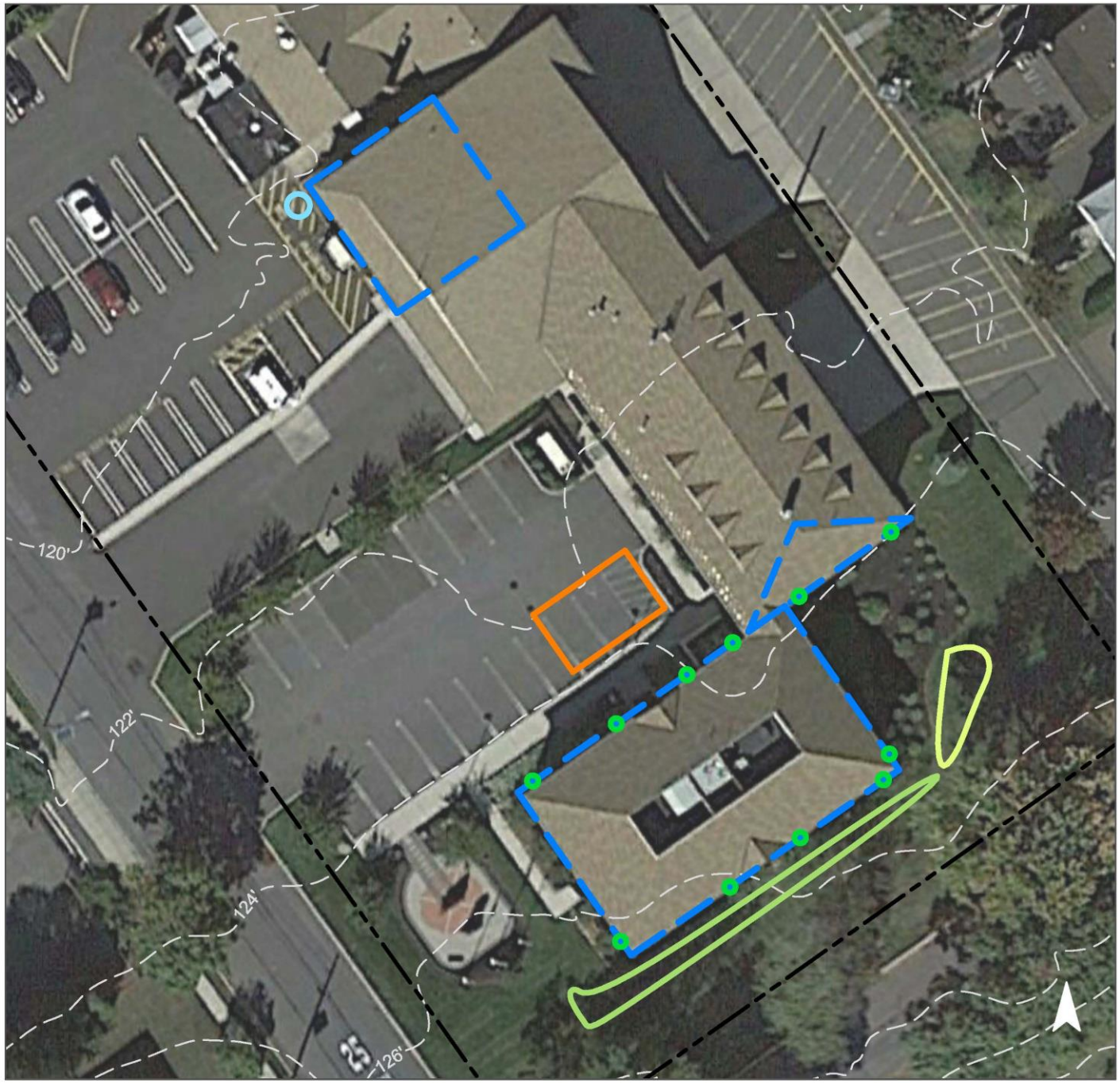
Block and Lot: Block 98, Lot 23

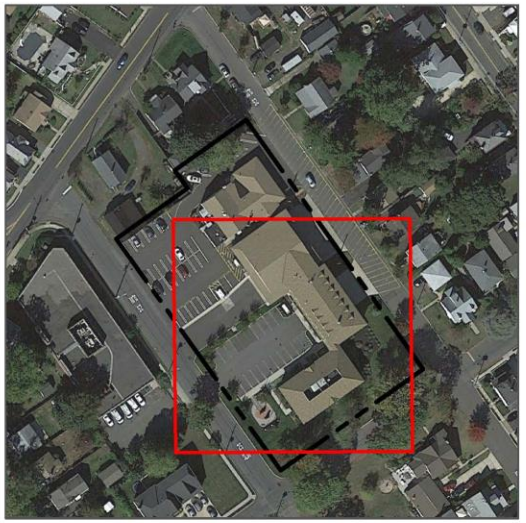
Several downspouts can be disconnected and directed into pervious pavement and a bioswale that leads to a bioretention system. Additionally, rainwater can be harvested in a cistern near the garage to wash service vehicles. A preliminary soil assessment suggests that the soils have suitable drainage characteristics 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"
60	40,441	1.9	20.4	185.7	0.032	1.11

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	0.026	4	1,937	0.07	255	$1,275
Pervious pavements	0.035	6	2,536	0.10	571	$14,275
Rainwater harvesting systems	0.043	7	1,500	0.12	1,500 (gal)	$3,000
Bioswales	0.051	8	3,718	0.14	555	$2,775

GREEN INFRASTRUCTURE RECOMMENDATIONS





Fire Department

- disconnected downspouts
- pervious pavements
- bioretention / rain gardens
- rainwater harvesting
- bioswales
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

EAST BRUNSWICK HIGH SCHOOL

Subwatershed: Lawrence Brook

Site Area: 4,396,828 sq. ft.

Address: 380 Cranbury Road
East Brunswick, NJ 08816

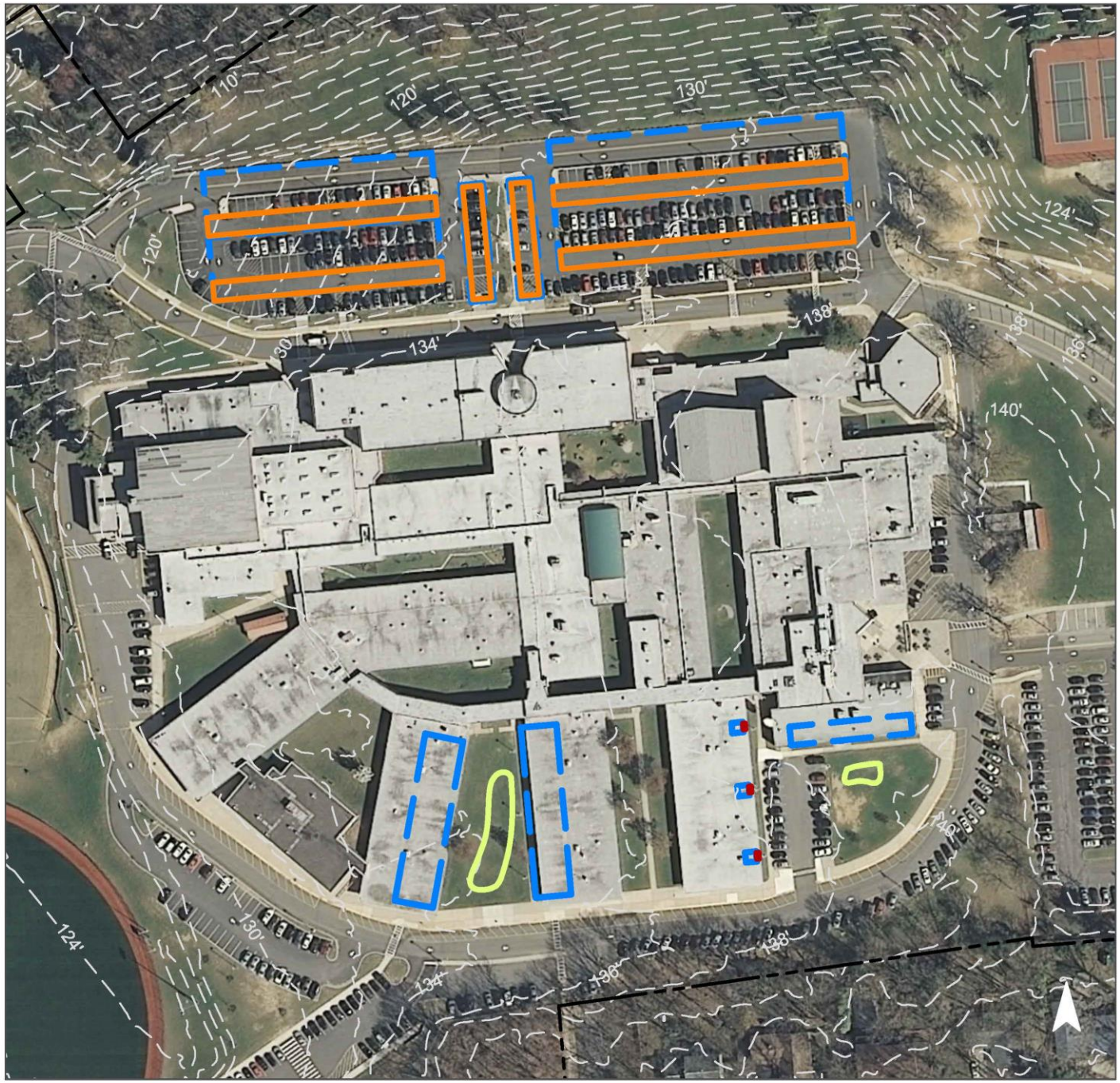
Block and Lot: Block 88, Lot 19.09

Stormwater drains to an existing detention basin near the entrance of the school. Pervious pavement can be used to infiltrate parking lot runoff. Downspouts in the back are already disconnected and can be directed into rain gardens and planter boxes to capture, treat and infiltrate 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"
21	923,226	44.5	466.3	4,238.9	0.719	25.32

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 systems	0.375	63	27,549	1.04	3,367	$16,835
Pervious pavements	1.824	305	133,840	5.03	22,676	$566,900
Downspout planter boxes	0.010	2	n/a	n/a	36	$3,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



East Brunswick High School

- disconnected downspouts
- pervious pavements
- bioretention / rain gardens
- downspout planter boxes
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 75' 150'

ELKS LODGE

Subwatershed: Lawrence Brook

Site Area: 180,506 sq. ft.

Address: 21B Oakmont Avenue
East Brunswick, NJ 08816

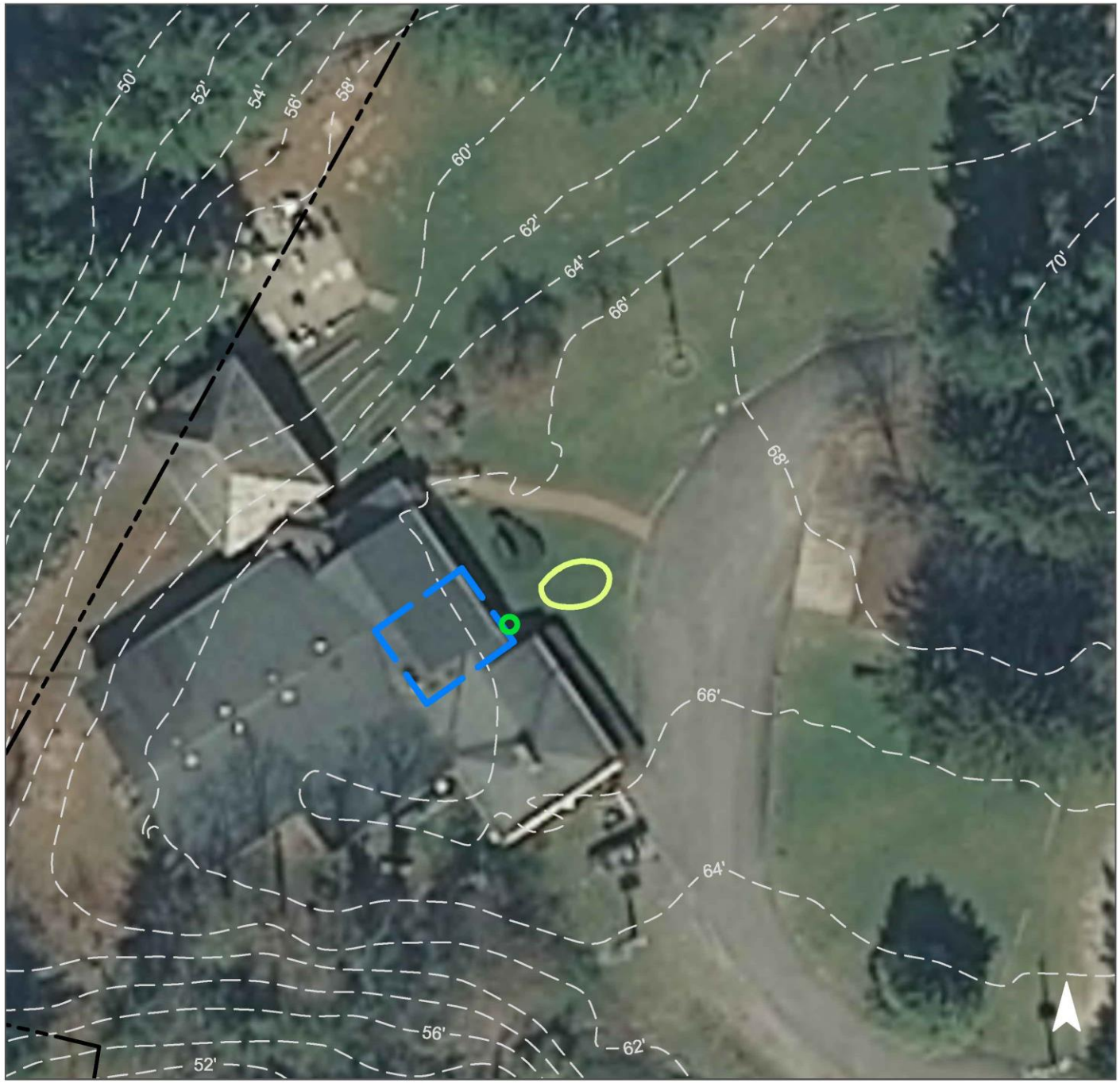
Block and Lot: Block 309.03, Lot 22.06

A downspout can be disconnected into a rain garden to capture, treat, and infiltrate stormwater. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
25	44,691	2.2	22.6	205.2	0.035	1.23

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	0.017	3	1,219	0.05	47	$235

GREEN INFRASTRUCTURE RECOMMENDATIONS



Elks Lodge

- disconnected downspouts
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

LAWRENCE BROOK ELEMENTARY SCHOOL

Subwatershed: Lawrence Brook

Site Area: 531,998 sq. ft.

Address: 48 Sullivan Way
East Brunswick, NJ 08816

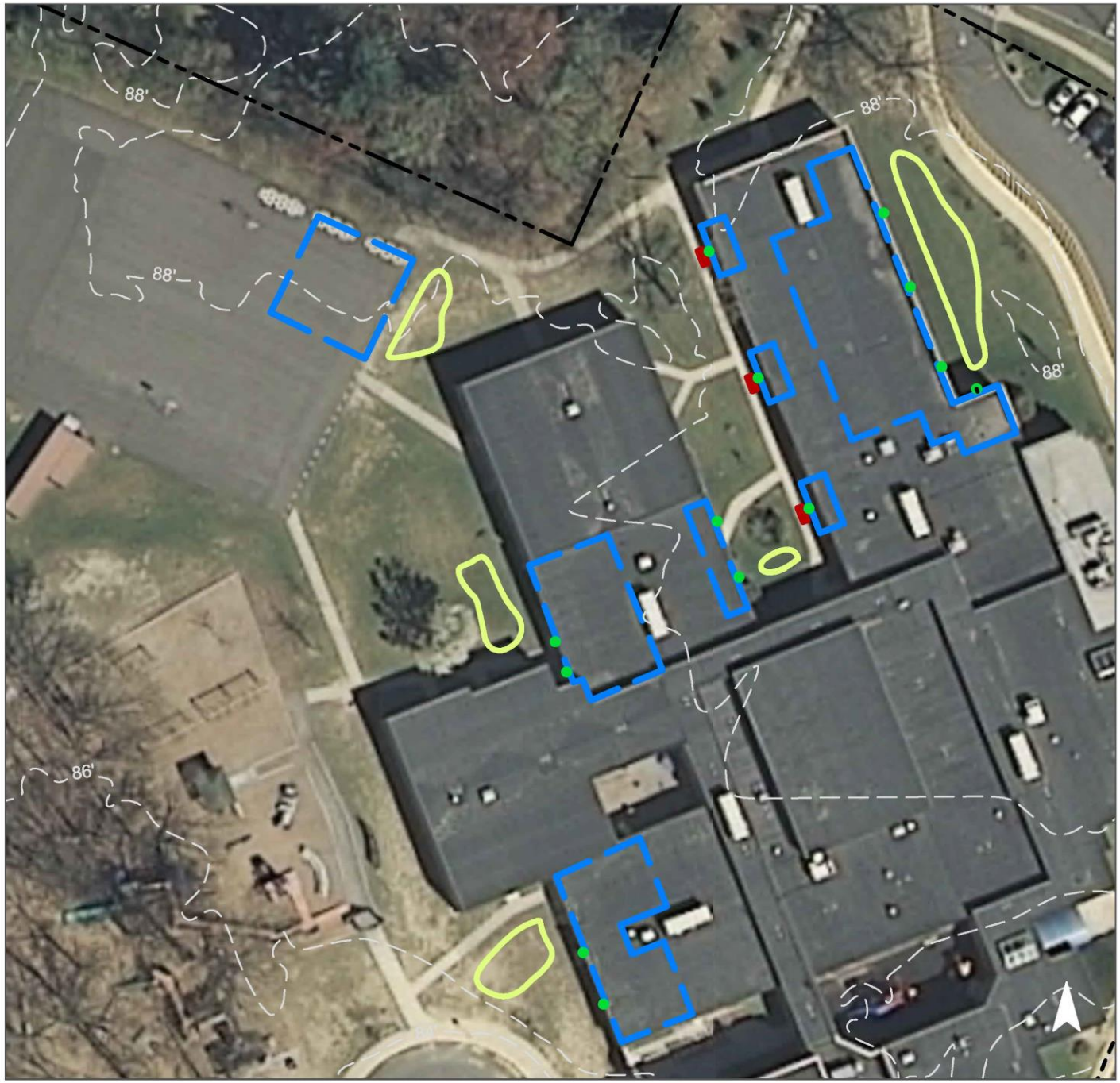
Block and Lot: Block 586, Lot 20

Rain gardens can be installed around the building to capture, treat, and infiltrate roof runoff. Downspout planter boxes can be installed along one of the paths to treat roof runoff as well. 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"
34	182,889	8.8	92.4	839.7	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	0.280	47	20,577	0.77	2,691	$13,455
Downspout planter boxes	0.010	2	n/a	n/a	36	$3,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Lawrence Brook Elementary School

- disconnected downspouts
- bioretention / rain gardens
- downspout planter boxes
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 30' 60'

SAINT MARY COPTIC ORTHODOX CHURCH OF MIDDLESEX COUNTY

Subwatershed: Lawrence Brook

Site Area: 244,492 sq. ft.

Address: 433 Riva Avenue
East Brunswick, NJ 08816

Block and Lot: Block 309.02, Lot 46

Stormwater currently pools in several locations in the parking lot. Downspouts can be disconnected into a rain garden, and pervious pavement can infiltrate 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"
85	207,469	10.0	104.8	952.6	0.162	5.69

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	.077	13	5,625	0.21	744	$3,720
Pervious pavements	.220	37	16,149	0.65	1,508	$37,700

GREEN INFRASTRUCTURE RECOMMENDATIONS

Saint Mary Coptic Orthodox Church in Middlesex County

- disconnected downspouts
- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 25' 50'

TRINITY PRESBYTERIAN CHURCH

Subwatershed: Lawrence Brook

Site Area: 199,373 sq. ft.

Address: 367 Cranbury Road
East Brunswick, NJ 08816

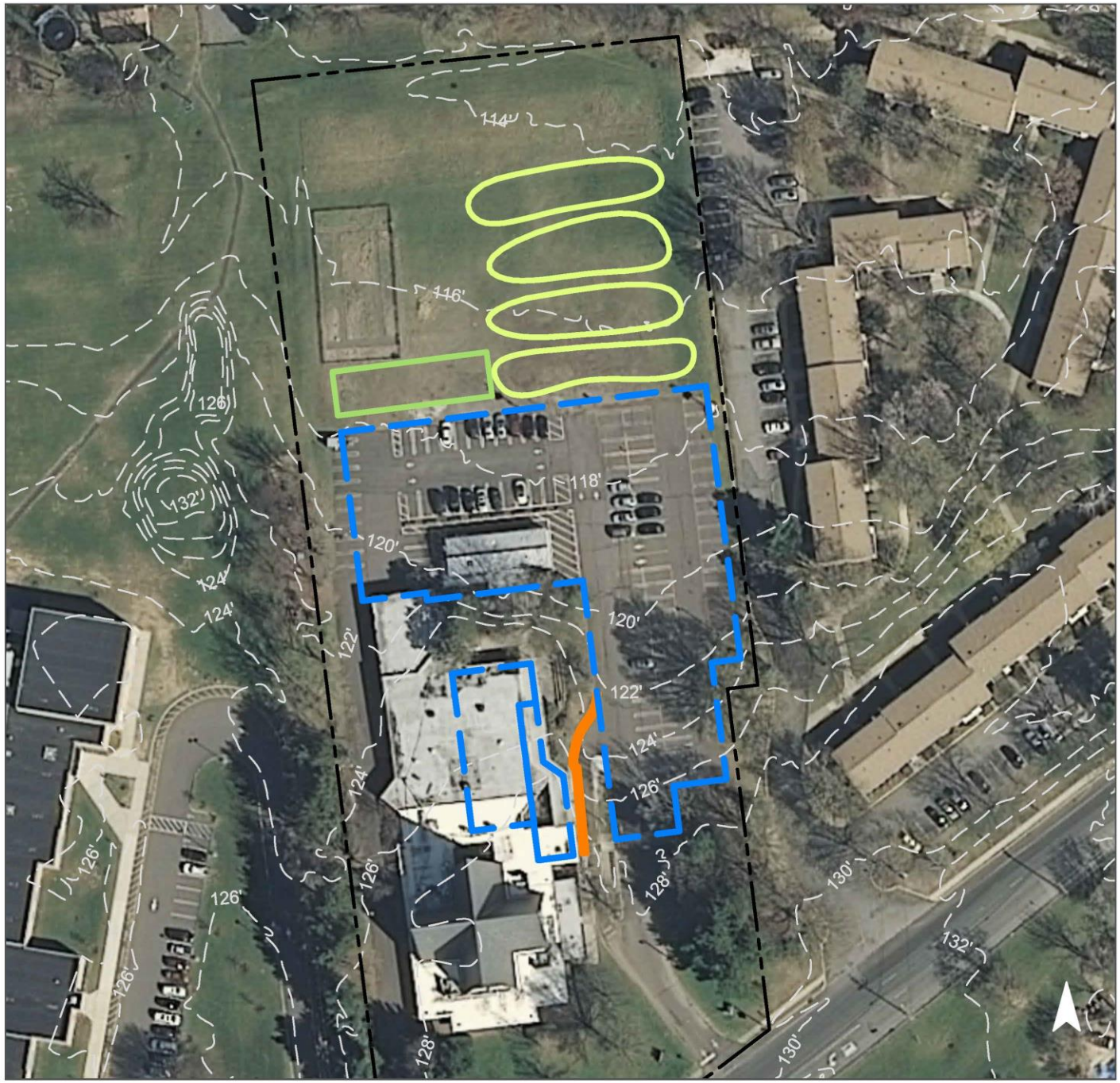
Block and Lot: Block 86, Lot 39.07

Several downspouts currently flow into catch basins located in the back of the building. A bioswale adjacent to an existing community garden can help redirect runoff into a series of terraced rain gardens. 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"
56	111,810	5.4	56.5	513.4	0.087	3.07

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	1.190	199	87,292	3.28	11,863	$59,315
Pervious pavements	0.048	8	3,531	0.13	327	$8,175
Bioswales	0.284	48	20,839	0.78	2,958	$14,790

GREEN INFRASTRUCTURE RECOMMENDATIONS



Trinity Presbyterian Church

- pervious pavements
- bioretention / rain gardens
- bioswales
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

WARNSDORFER ELEMENTARY SCHOOL

Subwatershed: Lawrence Brook

Site Area: 973,253 sq. ft.

Address: 9 Hardenburg Lane
East Brunswick, NJ 08816

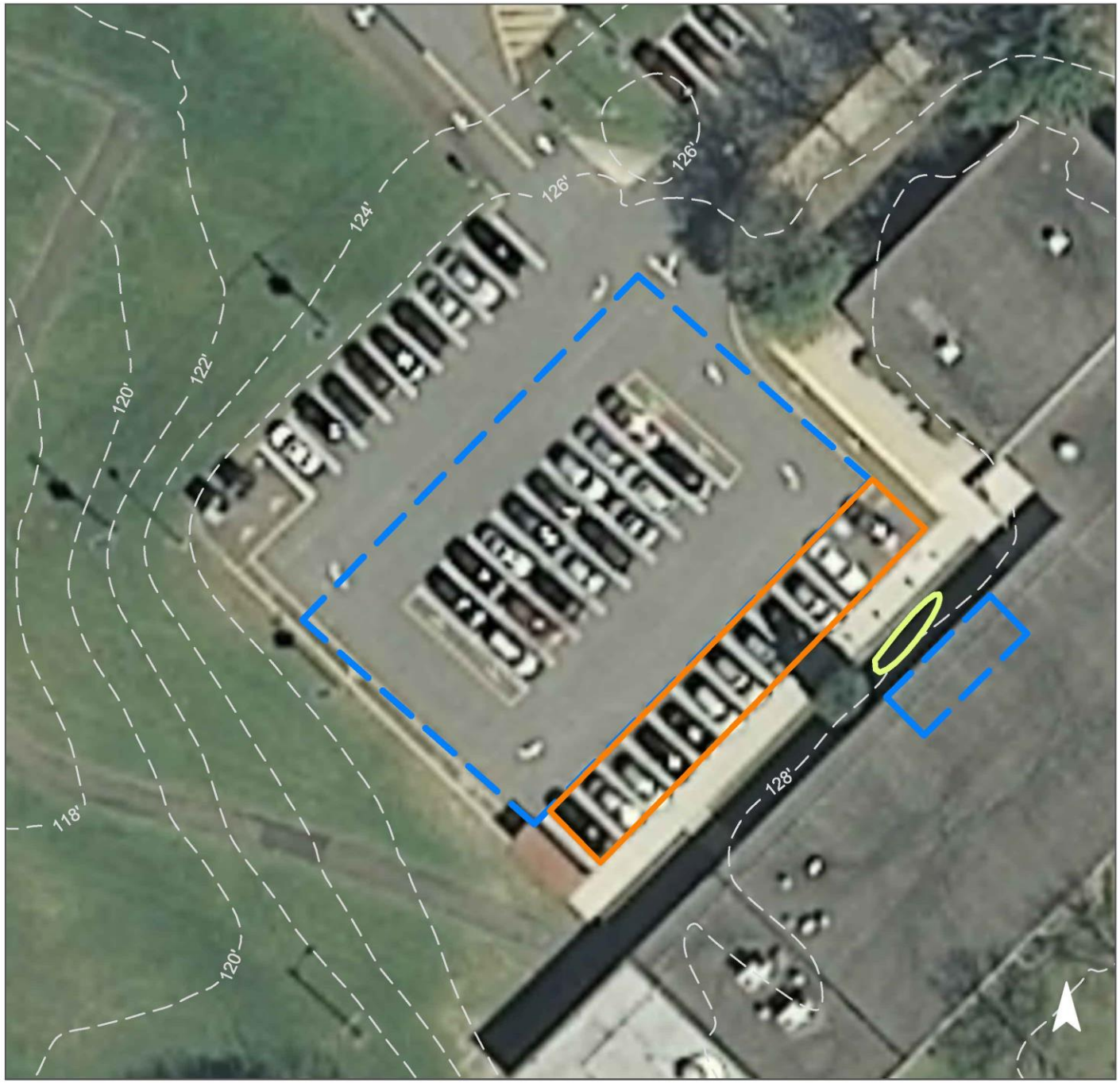
Block and Lot: Block 315.16, Lot 19.04

Parking spaces can be replaced with porous asphalt to infiltrate runoff. A rain garden can be installed adjacent to the building to capture, treat, and infiltrate roof 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"
19	182,741	8.8	92.3	839.0	0.142	5.01

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	0.014	2	1,002	0.04	135	$675
Pervious pavements	0.266	45	19,515	0.73	2,009	$50,225

GREEN INFRASTRUCTURE RECOMMENDATIONS



Warnsdorfer Elementary School

- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

d. Summary of Existing Conditions

Summary of Existing Site Conditions

Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	Existing Annual Loads TP (lb/yr)	Existing Annual Loads TN (lb/yr)	Existing Annual Loads TSS (lb/yr)	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Runoff Volumes from I.C. Annual (Mgal)
IRELAND BROOK SUBWATERSHED	**149.20**	**6,499,289**			**67.9**	**711.0**	**6,463.8**		**32.32**	**1,407,807**	**1.097**	**38.61**
East Brunswick Municipal Complex												
Total Site Info	17.34	755,328	319.14	10.04	16.4	171.6	1,559.8	45.0	7.80	339,729	0.265	9.32
Hammarskjold Middle School												
Total Site Info	20.66	900,087	88.25	8.01	27.9	292.4	2,657.8	64.3	13.29	578,861	0.451	15.88
Heavenly Farms Park: Dog Park												
Total Site Info	104.11	4,534,968	320	4	18.2	190.5	1,732.3	8.3	8.66	377,286	0.294	10.35
Irwin Elementary School												
Total Site Info	7.09	308,905	131	1.01	5.4	56.5	513.9	36.2	2.57	111,931	0.087	3.07
LAWRENCE BROOK SUBWATERSHED	**200.58**	**8,737,323**			**116.5**	**1,220.1**	**11,092.3**		**55.46**	**2,415,897**	**1.882**	**66.26**
Central Elementary School												
Total Site Info	18.29	796,866	86	40.15	10.0	104.8	952.4	26.0	4.76	207,440	0.162	5.69
Churchill Junior High School												
Total Site Info	25.94	1,130,014	603	33	22.7	237.6	2,160.2	41.6	10.80	470,481	0.367	12.90
East Brunswick Baptist Church												
Total Site Info	4.97	216,494	86.08	70.02	2.2	22.6	205.3	20.7	1.03	44,708	0.035	1.23
East Brunswick Fire Department												
Total Site Info	1.55	67,500	98	23	1.9	20.4	185.7	59.9	0.93	40,441	0.032	1.11
East Brunswick High School												
Total Site Info	100.94	4,396,828	88	19.09	44.5	466.3	4,238.9	21.0	21.19	923,226	0.719	25.32
Elks Lodge												
Total Site Info	4.14	180,506	309.03	22.06	2.2	22.6	205.2	24.8	1.03	44,691	0.035	1.23
Lawrence Brook Elementary School												
Total Site Info	12.21	531,998	586	20	8.8	92.4	839.7	34.4	4.20	182,889	0.143	5.02

Summary of Existing Site Conditions

Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	Existing Annual Loads TP (lb/yr)	Existing Annual Loads TN (lb/yr)	Existing Annual Loads TSS (lb/yr)	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Runoff Volumes from I.C. Annual (Mgal)
Saint Mary Coptic Orthodox Church of Middlesex County												
Total Site Info	5.61	244,492	309.02	46	10.0	104.8	952.6	84.9	4.76	207,469	0.162	5.69
Trinity Presbyterian Church												
Total Site Info	4.58	199,373	86	39.07	5.4	56.5	513.4	56.1	2.57	111,810	0.087	3.07
Warnsdorfer Elementary School												
Total Site Info	22.34	973,253	315.16	19.04	8.8	92.3	839.0	18.8	4.20	182,741	0.142	5.01

e. 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 (SF)	Unit Cost ($)	Unit	Total Cost ($)	I.C. Treated %
	IRELAND BROOK SUBWATERSHED	**228,768**	**5.25**	**5.961**	**998**	**435,729**	**16.44**	**70,544**			**$926,860**	**16.2%**
1	**East Brunswick Municipal Complex**											
	Bioretention systems/ rain gardens	81,480	1.87	2.123	355	155,778	5.86	18,307	5	SF	$91,535	24.0%
	Pervious pavements	57,640	1.32	1.502	251	110,195	4.14	28,361	25	SF	$709,025	17.0%
	Total Site Info	**139,120**	**3.19**	**3.625**	**607**	**265,974**	**10.00**	**46,668**			**$800,560**	**41.0%**
2	**Hammarskjold Middle School**											
	Bioretention systems/ rain gardens	52,756	1.21	1.375	230	100,860	3.79	13,286	5	SF	$66,430	9.1%
	Total Site Info	**52,756**	**1.21**	**1.375**	**230**	**100,860**	**3.79**	**13,286**			**$66,430**	**9.1%**
3	**Heavenly Farms Park: Dog Park**											
	Bioretention systems/ rain gardens	25,764	0.59	0.671	112	49,256	1.85	6,441	5	SF	$32,205	6.8%
	Total Site Info	**25,764**	**0.59**	**0.671**	**112**	**49,256**	**1.85**	**6,441**			**$32,205**	**6.8%**
4	**Irwin Elementary School**											
	Bioretention systems/ rain gardens	5,203	0.12	0.136	23	9,948	0.37	1,268	5	SF	$6,340	4.6%
	Total Site Info	**5,203**	**0.12**	**0.136**	**23**	**9,948**	**0.37**	**1,268**			**$6,340**	**4.6%**
	LAWRENCE BROOK SUBWATERSHED	**234,529**	**5.38**	**6.111**	**1,023**	**445,318**	**16.51**	**64,577**			**$1,033,405**	**9.7%**
5	**Central Elementary School**											
	Bioretention systems/ rain gardens	3,940	0.09	0.103	17	7,532	0.28	985	5	SF	$4,925	1.9%
	Pervious pavements	8,714	0.20	0.227	38	16,658	0.63	1,556	25	SF	$38,900	4.2%
	Total Site Info	**12,654**	**0.29**	**0.330**	**55**	**24,190**	**0.91**	**2,541**			**$43,825**	**6.1%**
6	**Churchill Junior High School**											
	Bioretention systems/ rain gardens	14,221	0.33	0.371	62	27,190	1.02	3,555	5	SF	$17,775	3.0%
	Pervious pavements	6,381	0.15	0.166	28	12,200	0.46	2,036	25	SF	$50,900	1.4%
	Total Site Info	**20,602**	**0.47**	**0.537**	**90**	**39,390**	**1.48**	**5,591**			**$68,675**	**4.4%**
7	**East Brunswick Baptist Church**											
	Bioretention systems/ rain gardens	1,445	0.03	0.038	6	2,760	0.10	381	5	SF	$1,905	3.2%
	Pervious pavements	16,815	0.39	0.438	73	32,149	0.88	4,786	25	SF	$119,650	37.6%
	Total Site Info	**18,260**	**0.42**	**0.476**	**80**	**34,909**	**0.98**	**5,167**			**$121,555**	**40.8%**

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 (SF)	Unit Cost ($)	Unit	Total Cost ($)	I.C. Treated %
8	**East Brunswick Fire Department**											
	Bioretention systems/ rain gardens	1,014	0.02	0.026	4	1,937	0.07	255	5	SF	$1,275	2.5%
	Pervious pavements	1,326	0.03	0.035	6	2,536	0.10	571	25	SF	$14,275	3.3%
	Rainwater harvesting systems	1,640	0.04	0.043	7	1,500	0.12	1,500	2	gal	$3,000	4.1%
	Bioswales	1,945	0.04	0.051	8	3,718	0.14	555	5	SF	$2,775	4.8%
	Total Site Info	**5,925**	**0.14**	**0.154**	**26**	**9,691**	**0.43**	**2,881**			**$21,325**	**14.7%**
9	**East Brunswick High School**											
	Bioretention systems/ rain gardens	14,409	0.33	0.375	63	27,549	1.04	3,367	5	SF	$16,835	1.6%
	Pervious pavements	70,004	1.61	1.824	305	133,840	5.03	22,676	25	SF	$566,900	7.6%
	Downspout planter boxes	375	0.01	0.010	2	n/a	n/a	36	1000	SF	$3,000	0.0%
	Total Site Info	**84,788**	**1.95**	**2.209**	**370**	**161,388**	**6.07**	**26,079**			**$586,735**	**9.2%**
10	**Elks Lodge**											
	Bioretention systems/ rain gardens	638	0.01	0.017	3	1,219	0.05	47	5	SF	$235	1.4%
	Total Site Info	**638**	**0.01**	**0.017**	**3**	**1,219**	**0.05**	**47**			**$235**	**1.4%**
11	**Lawrence Brook Elementary School**											
	Bioretention systems/ rain gardens	10,763	0.25	0.280	47	20,577	0.77	2,691	5	SF	$13,455	5.9%
	Downspout planter boxes	375	0.01	0.010	2	n/a	n/a	36	1000	SF	$3,000	0.2%
	Total Site Info	**11,138**	**0.26**	**0.290**	**49**	**20,577**	**0.77**	**2,727**			**$16,455**	**6.1%**
12	**Saint Mary Coptic Orthodox Church of Middlesex County**											
	Bioretention systems/ rain gardens	2,943	0.07	0.077	13	5,625	0.21	744	5	SF	$3,720	1.4%
	Pervious pavements	8,446	0.19	0.220	37	16,149	0.65	1,508	25	SF	$37,700	4.1%
	Total Site Info	**11,389**	**0.26**	**0.297**	**50**	**21,774**	**0.86**	**2,252**			**$41,420**	**5.5%**
13	**Trinity Presbyterian Church**											
	Bioretention systems/ rain gardens	45,657	1.05	1.190	199	87,292	3.28	11,863	5	SF	$59,315	40.8%
	Pervious pavements	1,847	0.04	0.048	8	3,531	0.13	327	25	SF	$8,175	1.7%
	Bioswales	10,900	0.25	0.284	48	20,839	0.78	2,958	5	SF	$14,790	9.7%
	Total Site Info	**58,404**	**1.34**	**1.522**	**255**	**111,661**	**4.19**	**15,148**			**$82,280**	**52.2%**
14	**Warnsdorfer Elementary School**											
	Bioretention systems/ rain gardens	523	0.01	0.014	2	1,002	0.04	135	5	SF	$675	0.3%
	Pervious pavements	10,208	0.23	0.266	45	19,515	0.73	2,009	25	SF	$50,225	5.6%
	Total Site Info	**10,731**	**0.25**	**0.280**	**47**	**20,518**	**0.77**	**2,144**			**$50,900**	**5.9%**