RUTGERS
New Jersey Agricultural
Experiment Station

Draft

Impervious Cover Reduction Action Plan
for
Highland Park Borough, Middlesex County, New Jersey

Prepared for Highland Park Borough by the
Rutgers Cooperative Extension Water Resources Program

September 22, 2015

Introduction

Located in Middlesex County in central New Jersey, Highland Park Borough covers approximately 1.8 square miles. Figures 1 and 2 illustrate that Highland Park Borough is dominated by urban land uses. A total of 77.1% of the municipality's land use is classified as urban. Of the urban land in Highland Park Borough, high 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 Highland Park Borough 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 Highland Park Borough. Based upon the 2007 NJDEP land use/land cover data, approximately 36.9% of Highland Park Borough has impervious cover. This level of impervious cover suggests that the streams in Highland Park Borough are likely non-supporting streams.

Methodology

Highland Park Borough contains portions of one 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.

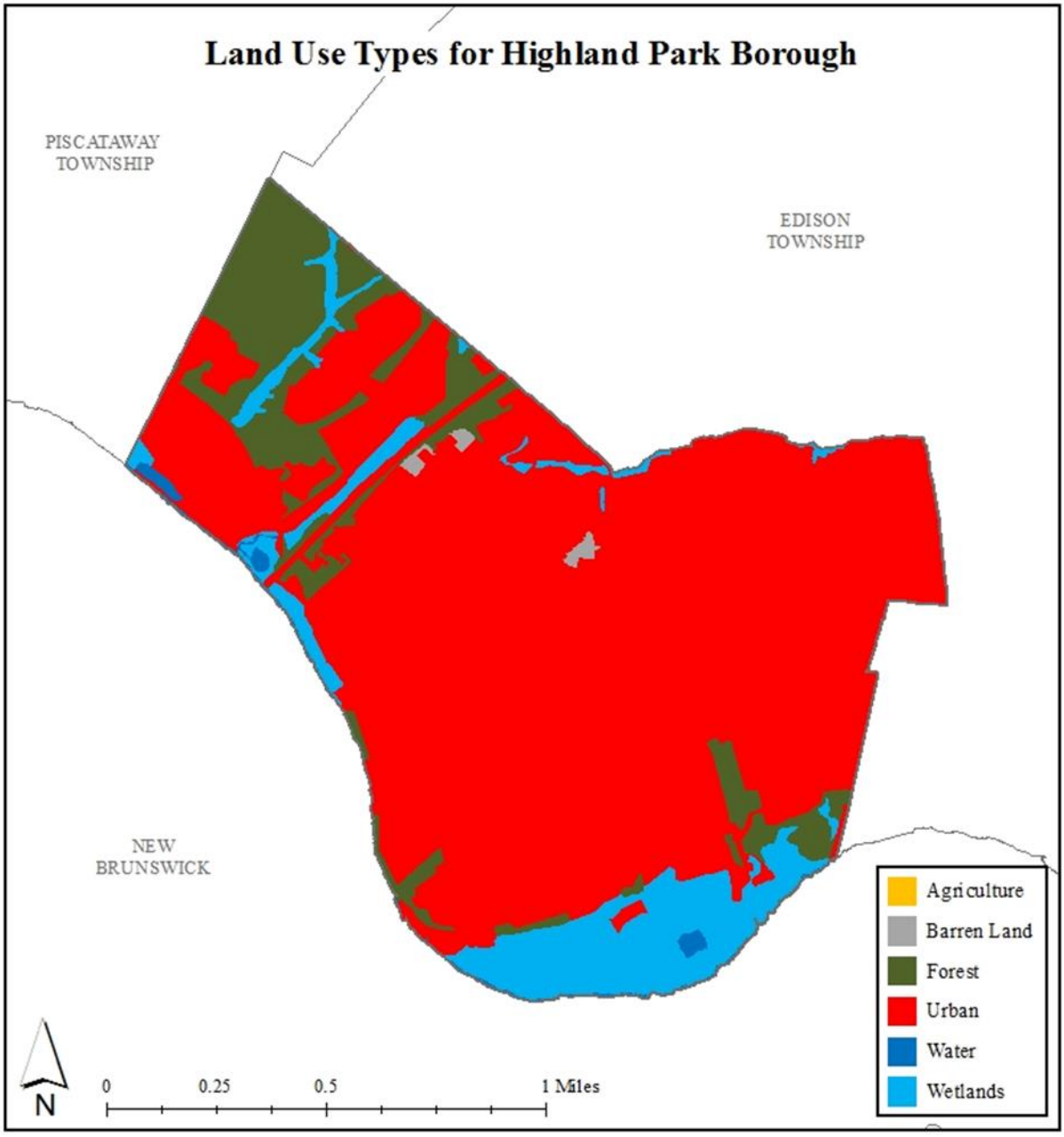


Figure 1: Map illustrating the land use in Highland Park Borough

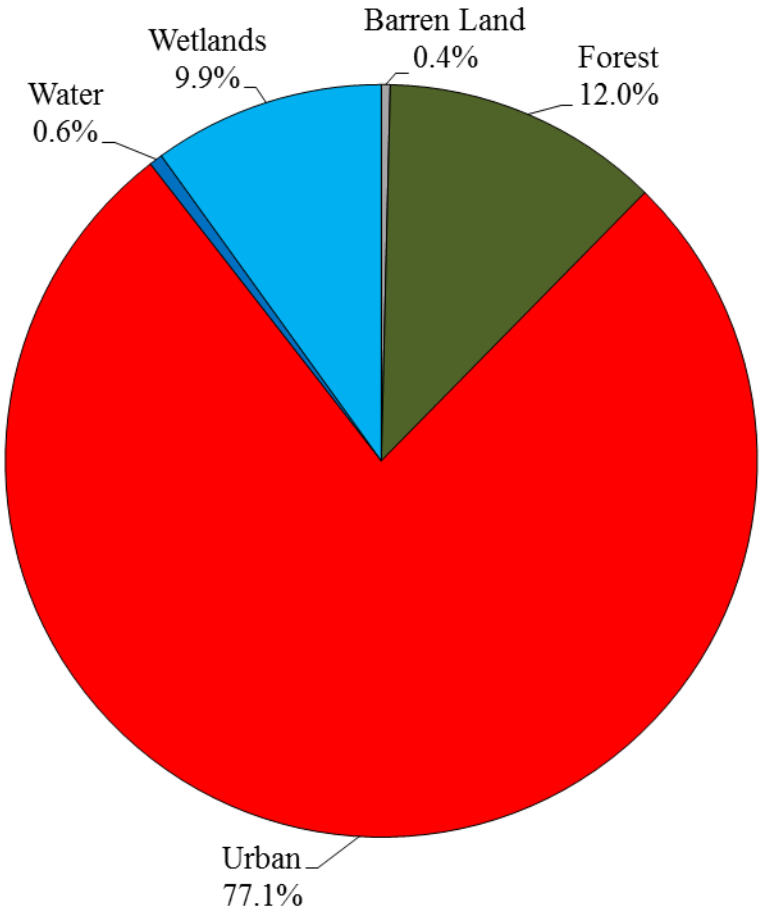


Figure 2: Pie chart illustrating the land use in Highland Park Borough

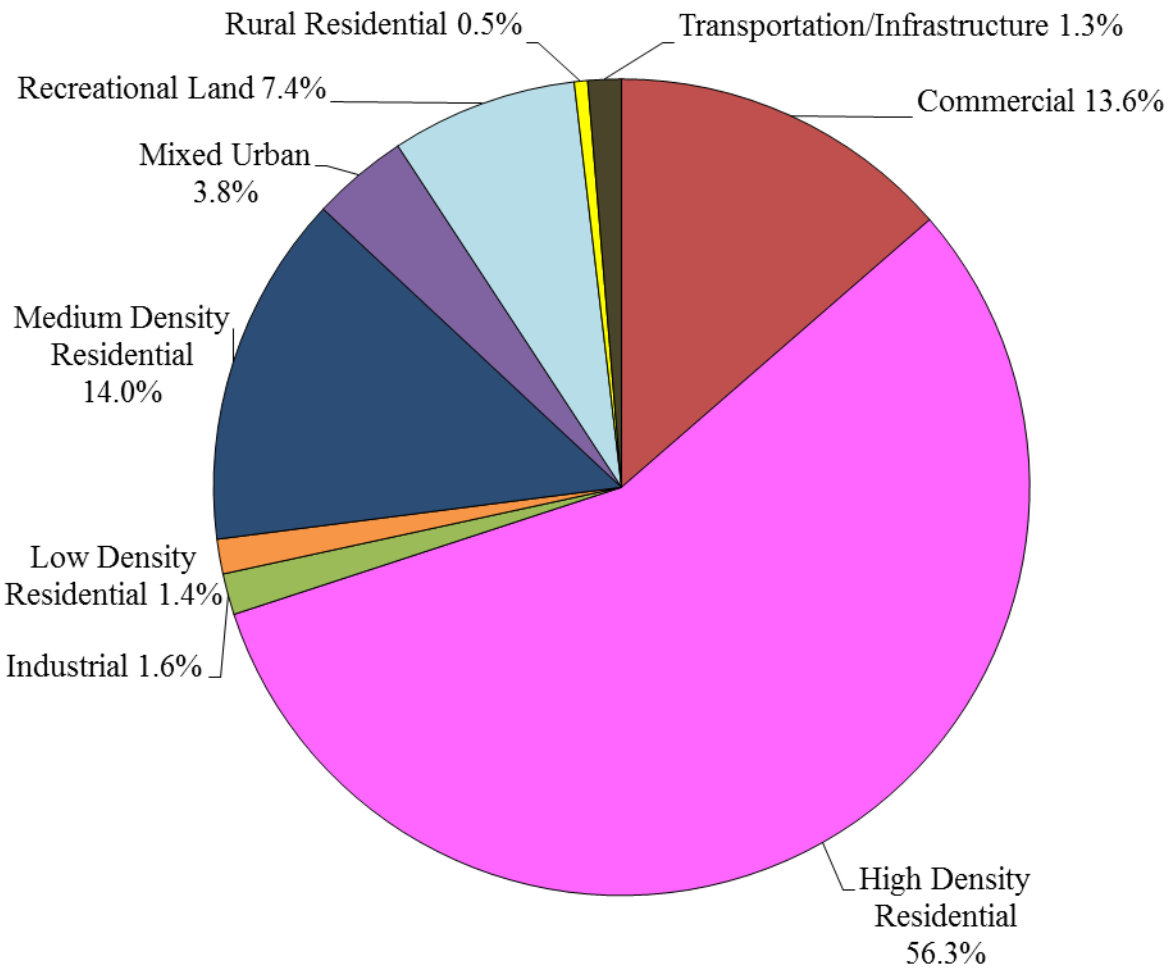


Figure 3: Pie chart illustrating the various types of urban land use in Highland Park Borough

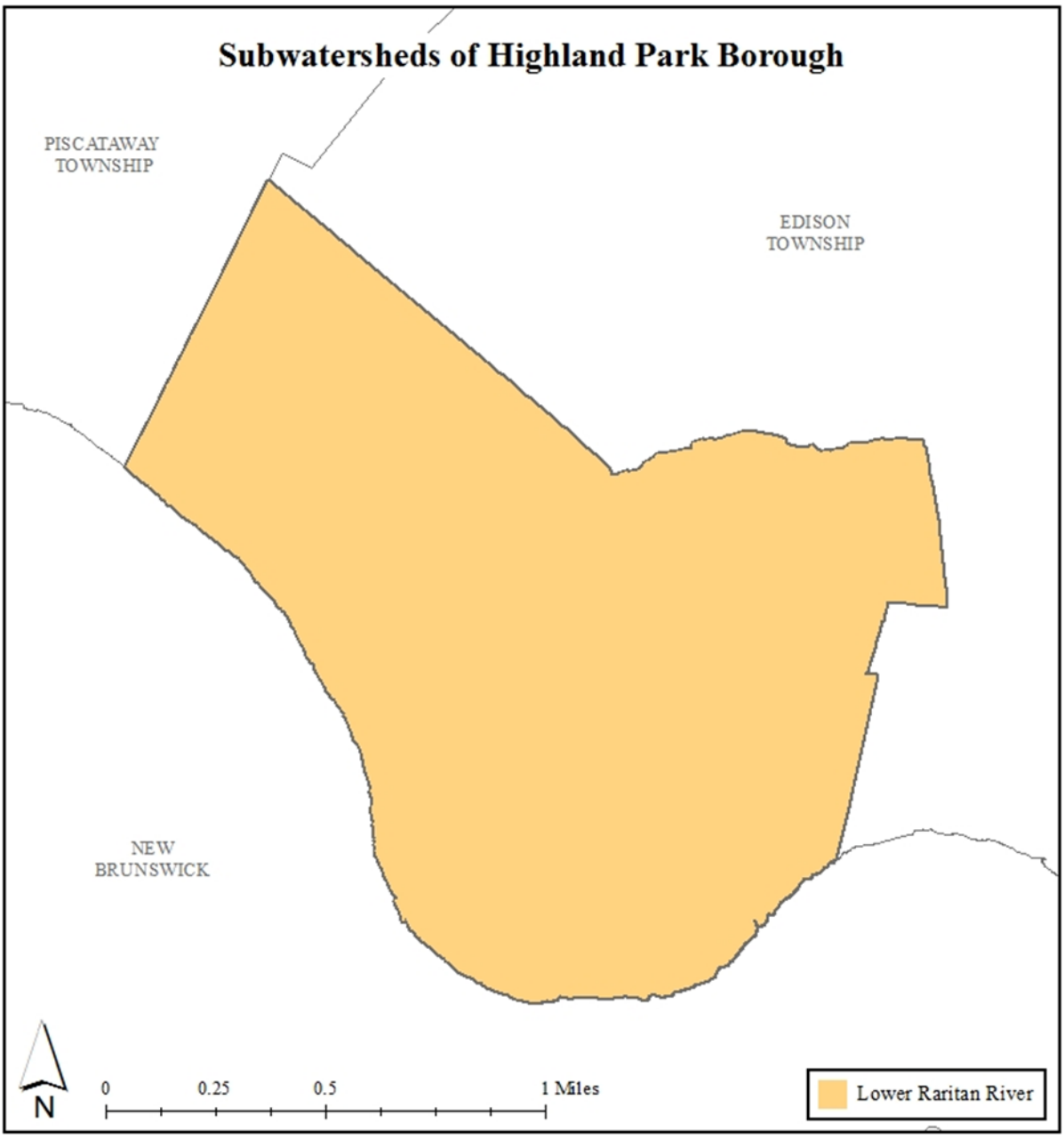


Figure 4: Map of the subwatersheds in Highland Park Borough

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 Highland Park Borough 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[1]

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

[1] 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[2]. A wide range of green infrastructure practices have been evaluated for the potential project sites in Highland Park Borough. 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.




[2] 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

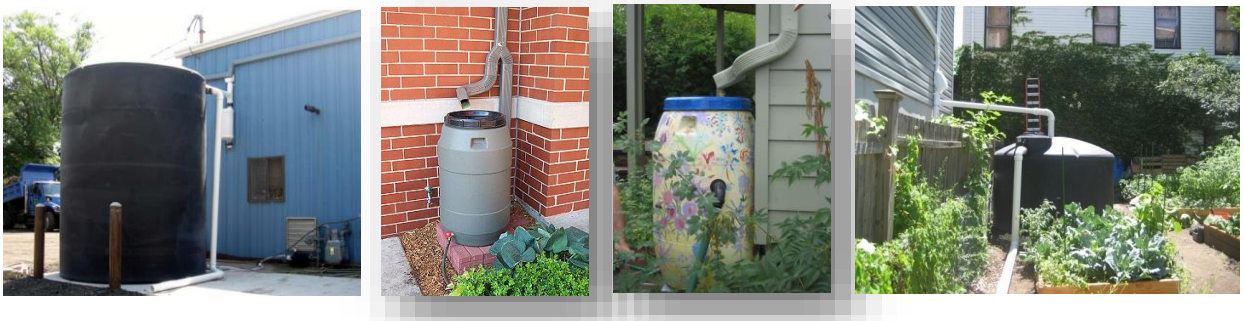
These are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff. These systems can easily be incorporated into existing landscapes, improving aesthetics and creating a wildlife habitat while managing stormwater runoff. Bioretention systems also can be used in soils 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. [3]

[3] 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

HIGHLAND PARK: CLIMATE RESILIENT GREEN INFRASTRUCTURE FOR THE RARITAN BASIN

b. Green Infrastructure Sites

HIGHLAND PARK: GREEN INFRASTRUCTURE SITES

SITES WITHIN THE LOWER RARITAN RIVER SUBWATERSHED:

1. All Saint's Episcopal Church
2. Bartle Elementary School
3. Children's House Montessori School/Trinity United Methodist Church
4. Complex at 31 River Road
5. Farmers Market Parking Lot
6. First Baptist Church of Highland Park
7. Highland Park Conservative Temple
8. Highland Park First Aid Squad
9. Highland Park Housing Authority
10. Highland Park Middle School & High School
11. Highland Park Senior Center and Municipal Building
12. Irving Primary School
13. Noah's Ark Academy
14. Reformed Church of Highland Park
15. Saint Mary of Zyrovicy Church

c. Proposed Green Infrastructure Concepts

ALL SAINT'S EPISCOPAL CHURCH

Subwatershed: Lower Raritan River

Site Area: 12,150 sq. ft.

Address: Third Avenue & Magnolia Street
Highland Park, NJ 08904

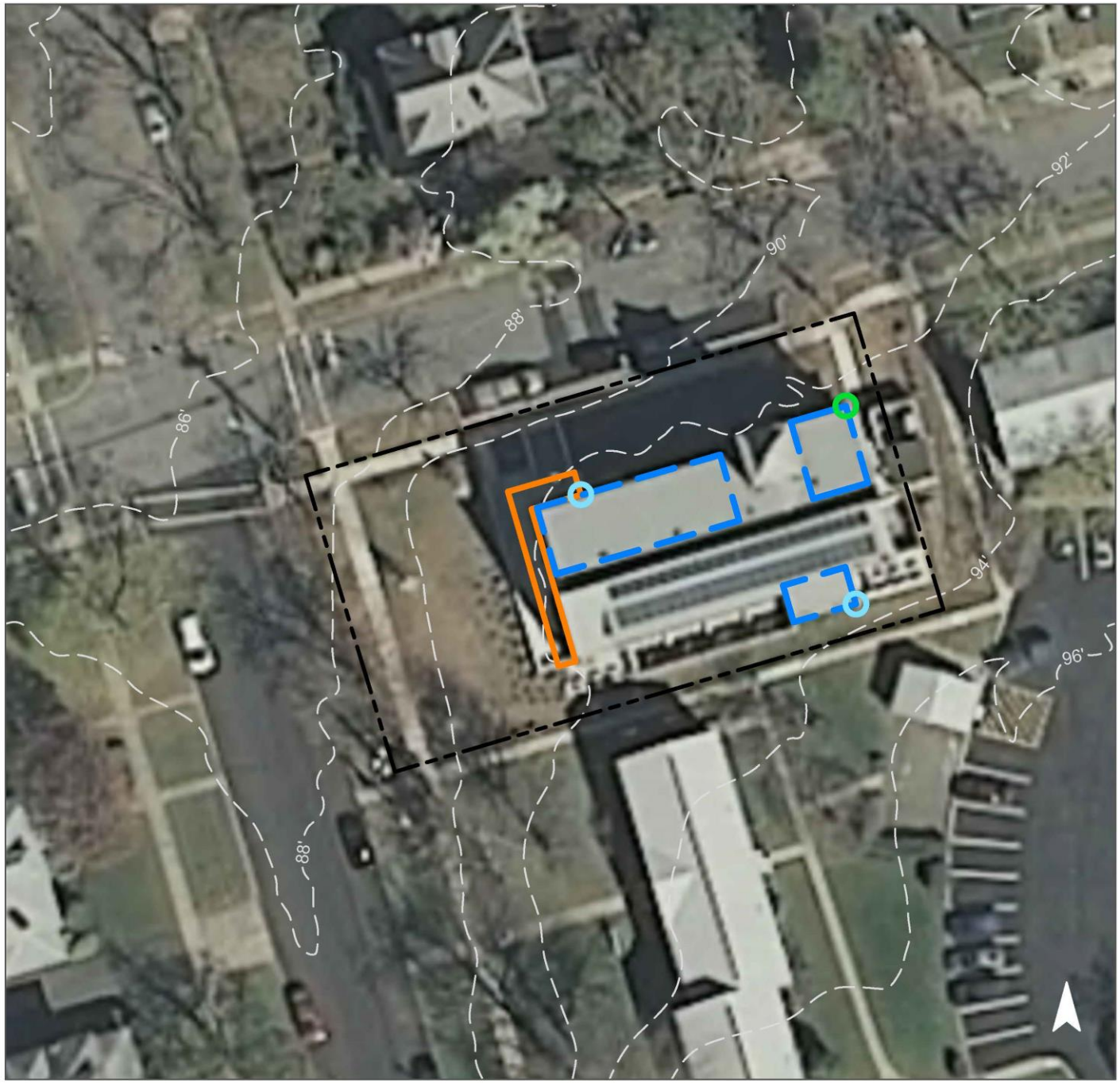
Block and Lot: Block 32, Lot 1

Rainwater harvesting systems can be installed at two downspouts to capture roof runoff to be reused. The entrance ramp can be converted into porous pavement in the future. 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"
55	6,683	0.3	3.4	30.7	0.005	0.18

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 pavements	0.008	1	576	0.02	305	$7,625
Rainwater harvesting systems	0.013	2	1,000	0.08	1,000 (gal)	$2,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



All Saint's Episcopal Church

- disconnected downspouts
- pervious pavements
- rainwater harvesting
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

BARTLE ELEMENTARY SCHOOL

Subwatershed: Lower Raritan River

Site Area: 179,033 sq. ft.

Address: 435 Mansfield Street
Highland Park, NJ 08904

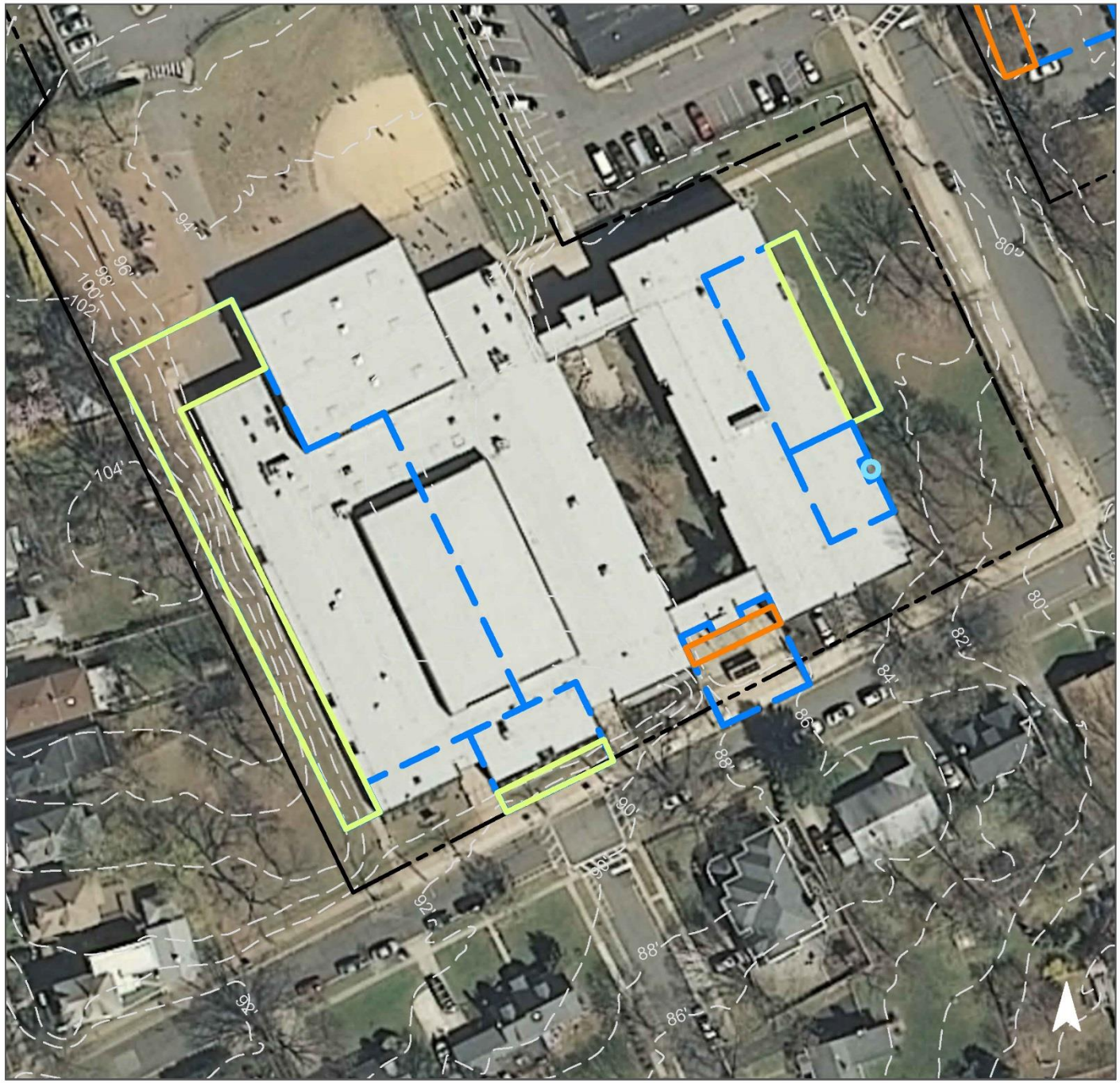
Block and Lot: Block 38, Lot 38

Several bioretention systems can be installed to capture, treat, and infiltrate runoff. The walkway on the southern side can be replaced with porous pavement to 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"
78	140,296	6.8	70.9	644.1	0.109	3.85

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	.893	149	65,525	2.46the	9,600	$48,000
Pervious pavements	.065	11	4,780	0.18	500	$12,500
Rainwater harvesting systems	.048	8	3,500	0.13	3,500 (gal)	$7,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Bartle Elementary School

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

0 40' 80'

CHILDREN'S HOUSE MONTESSORI SCHOOL / TRINITY UNITED METHODIST CHURCH

Subwatershed: Lower Raritan River

Site Area: 27,187 sq. ft.

Address: 417 Montgomery Street
Highland Park, NJ 08904

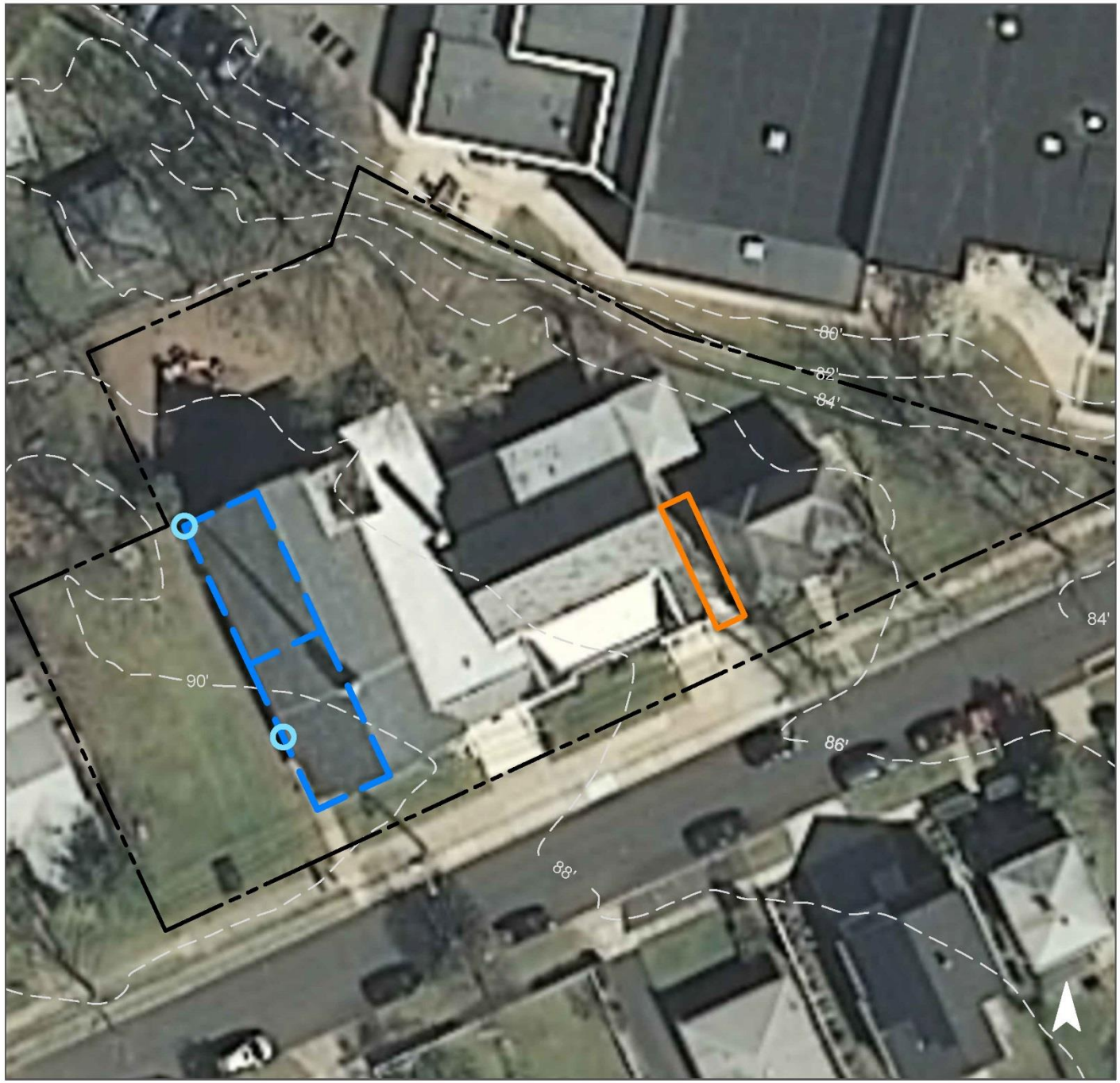
Block and Lot: Block 145, Lot 10

Two downspouts on the western side of the building can be disconnected into rainwater harvesting systems. The driveway on the eastern side of the building can be repaved with porous asphalt in order to infiltrate roof 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"
45	12,234	0.6	6.2	56.2	0.010	0.34

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 pavements	0.007	1	539	0.02	280	$7,000
Rainwater harvesting systems	0.045	8	1,613	0.12	1,613 (gal)	$3,226

GREEN INFRASTRUCTURE RECOMMENDATIONS



Children's House Montessori School / Trinity United Methodist Church

- pervious pavements
- rainwater harvesting
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

COMPLEX AT 31 RIVER ROAD

Subwatershed: Lower Raritan River

Site Area: 44,266 sq. ft.

Address: 31 River Road
Highland Park, NJ 08904

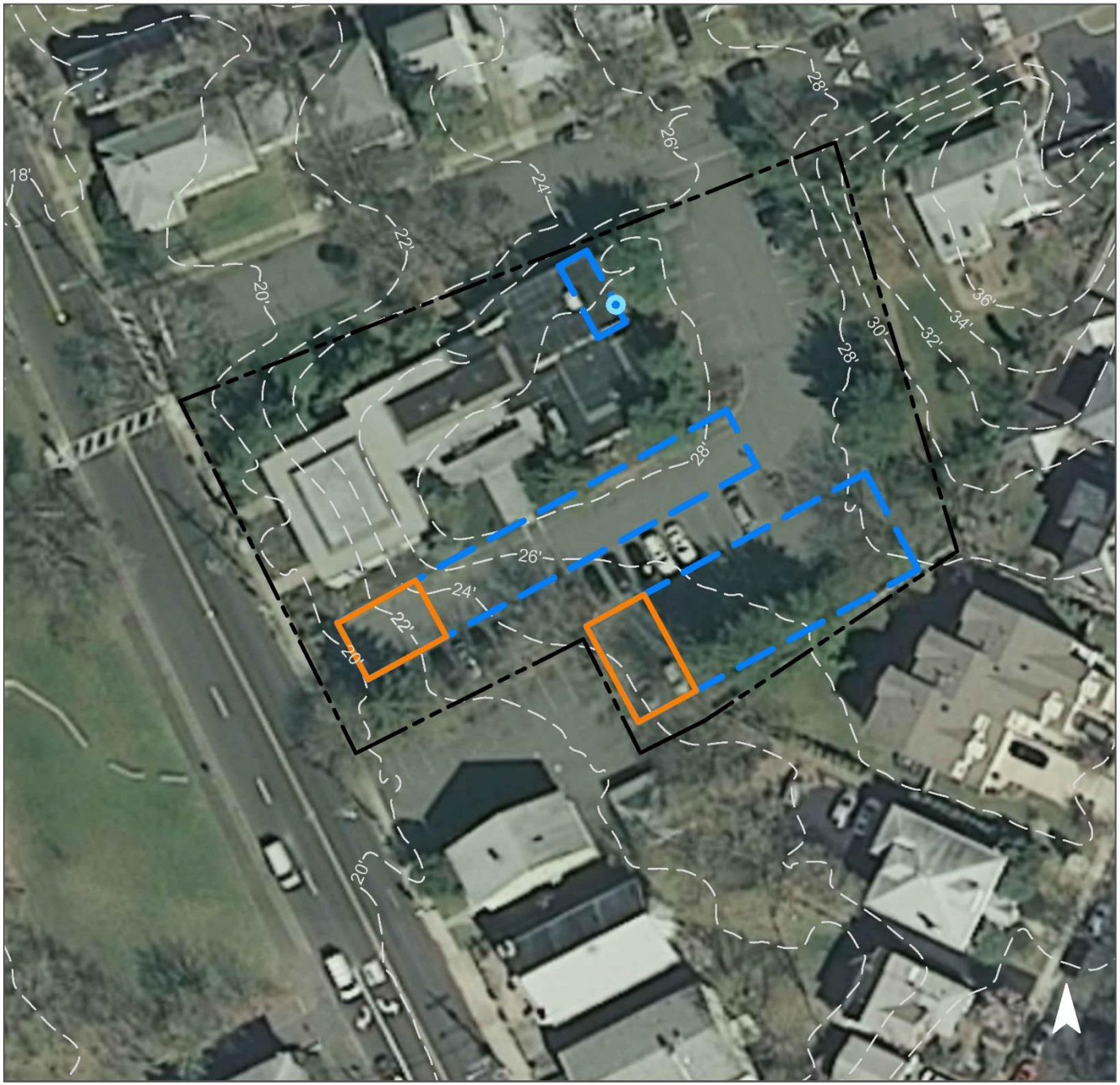
Block and Lot: Block 183, Lot 24

A portion of the drive lane near the River Road entrance can be replaced with porous pavement to capture stormwater from the parking lot. On the eastern side of the building, a downspout can be disconnected into a rainwater harvesting system. 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	36,767	1.8	18.6	168.8	0.029	1.01

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
Pervious pavements	0.122	20	18,880	0.71	1,970	$49,250
Rainwater harvesting systems	0.010	2	374	0.03	374 (gal)	$748

GREEN INFRASTRUCTURE RECOMMENDATIONS



Complex at 31 River Road

- pervious pavements
- rainwater harvesting
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 30' 60'

FARMERS MARKET PARKING LOT

Subwatershed: **Lower Raritan River**

Site Area: **31,932 sq. ft.**

Address: **19-21 South 2nd Avenue**
Highland Park, NJ 08904

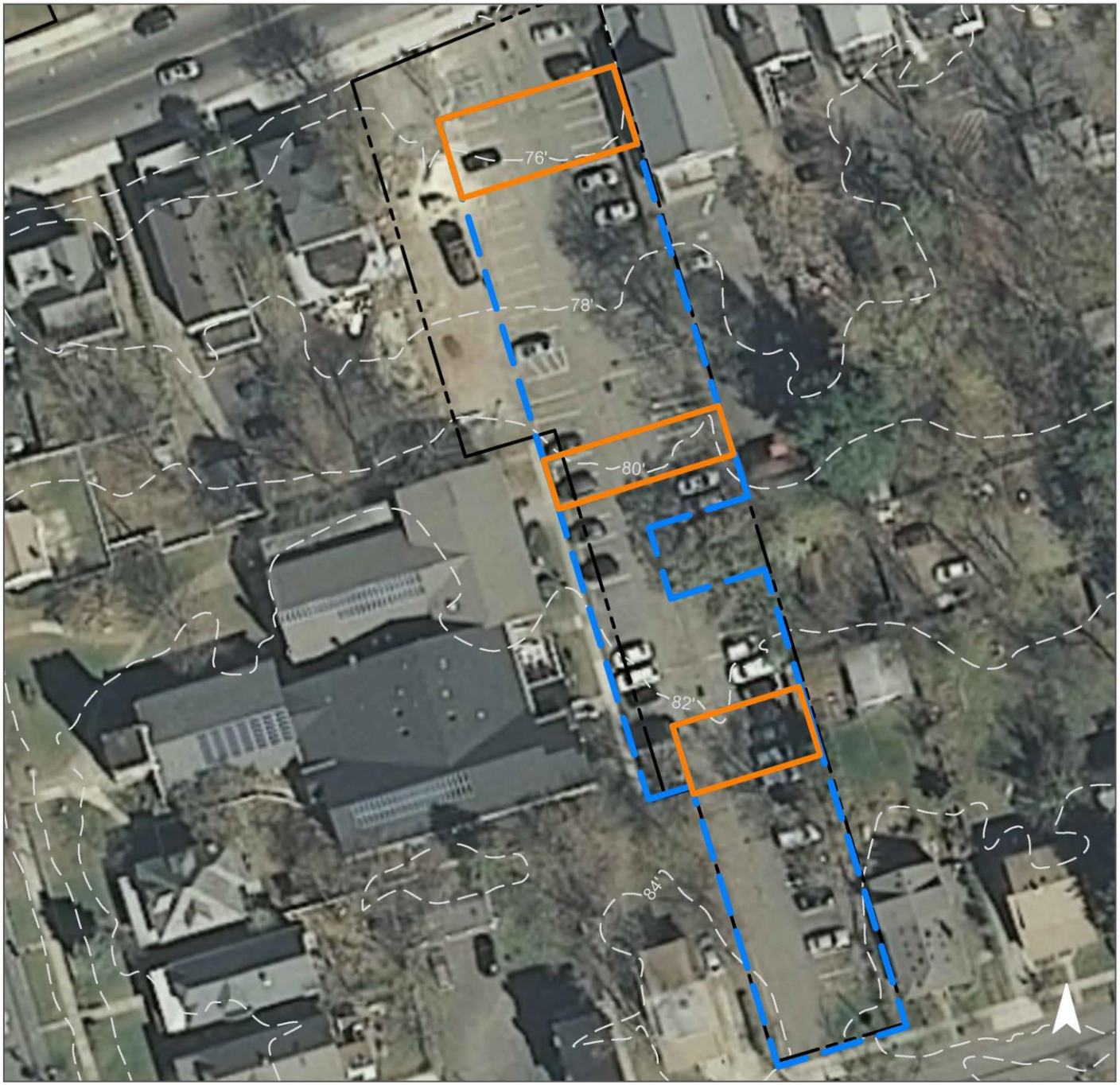
Block and Lot: **Block 22, Lot 32.01**

A portion of the parking lot can be repaved with porous asphalt to manage stormwater. The optimal locations for this porous asphalt would be uphill of three existing catch basins. 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	26,503	1.3	13.4	121.7	0.021	0.73

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 pavements	0.307	51	47,603	1.79	4,900	$122,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Farmers Market Parking Lot

- pervious pavements
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 30' 60'

FIRST BAPTIST CHURCH OF HIGHLAND PARK

Subwatershed: Lower Raritan River

Site Area: 14,098 sq. ft.

Address: 5 North 2nd Ave,
Highland Park, NJ 08904

Block and Lot: Block 162, Lot 25

Stormwater planters can be built alongside the street to infiltrate runoff. Downspouts on the northern side of the building can be disconnected into rainwater harvesting systems. 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	11,983	0.6	6.1	55.0	0.009	0.33

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 systems	0.027	5	982	0.08	982 (gal)	$1,964
Stormwater planters	0.030	5	2,169	0.08	160	$16,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

First Baptist Church of Highland Park

- stormwater planters
- rainwater harvesting
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

HIGHLAND PARK CONSERVATIVE TEMPLE

Subwatershed: Lower Raritan River

Site Area: 43,916 sq. ft.

Address: 201 South 3rd Avenue
Highland Park, NJ 08904

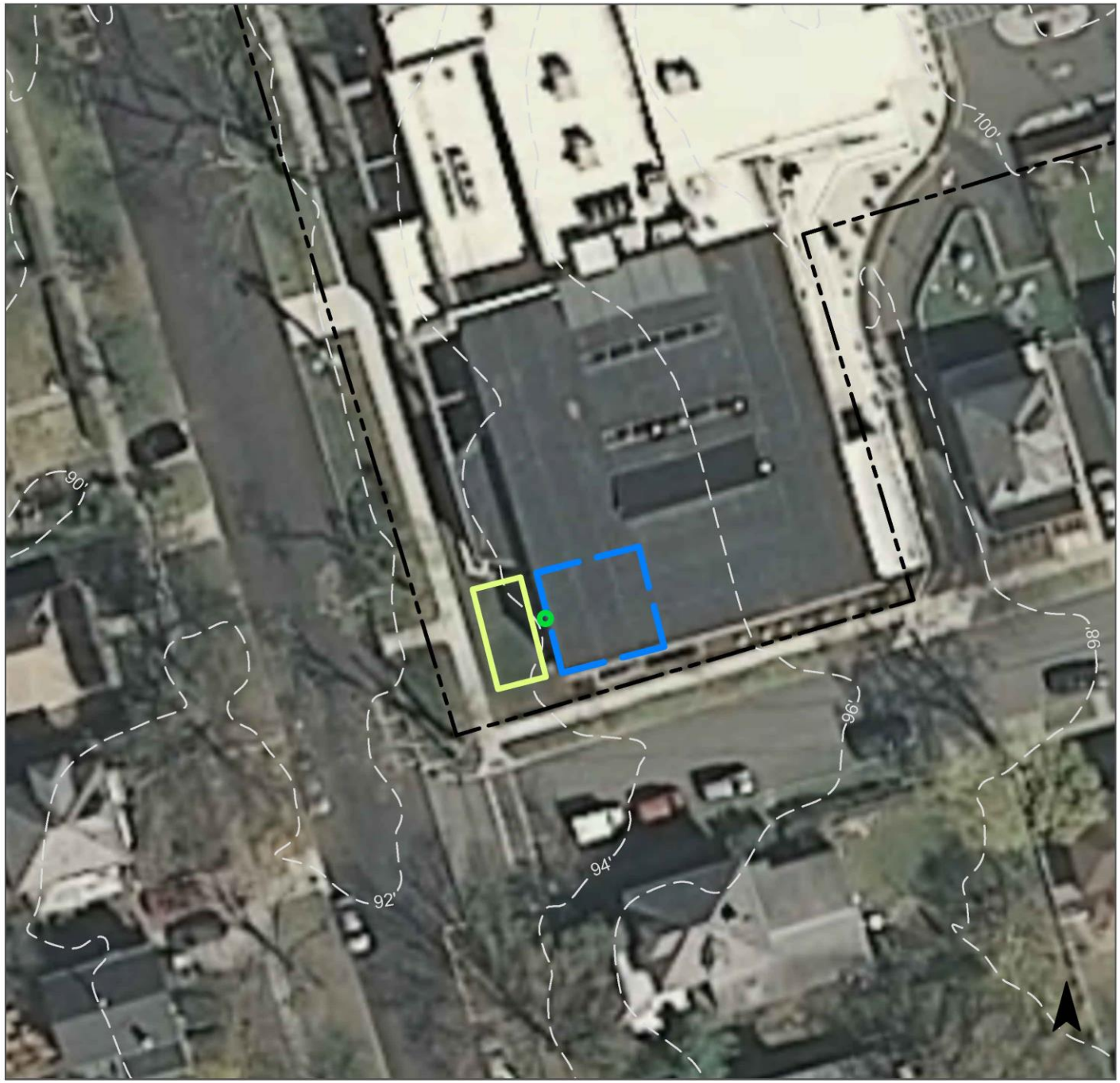
Block and Lot: Block 33, Lot 2

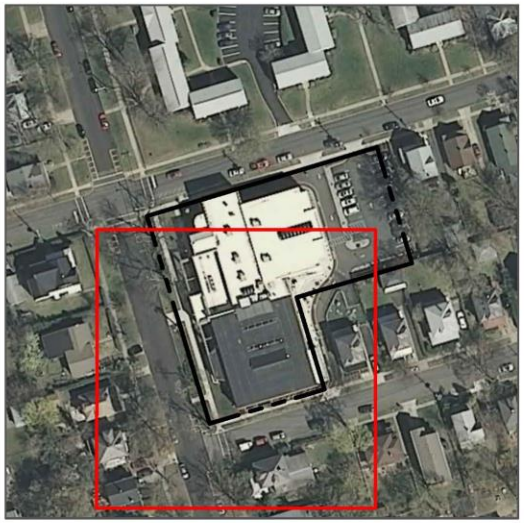
A downspout can be disconnected and directed into a bioretention system near the corner of 3rd Avenue and Summit Place, which will capture, treat and infiltrate roof runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green 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"
75	32,866	1.6	16.6	150.9	0.026	0.90

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	0.031	5	2,296	0.09	300	$1,500

GREEN INFRASTRUCTURE RECOMMENDATIONS





Highland Park Conservative Temple

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

0 20' 40'

HIGHLAND PARK FIRST AID SQUAD

Subwatershed: Lower Raritan River

Site Area: 15,342 sq. ft.

Address: 128 South 11th Avenue
Highland Park, NJ

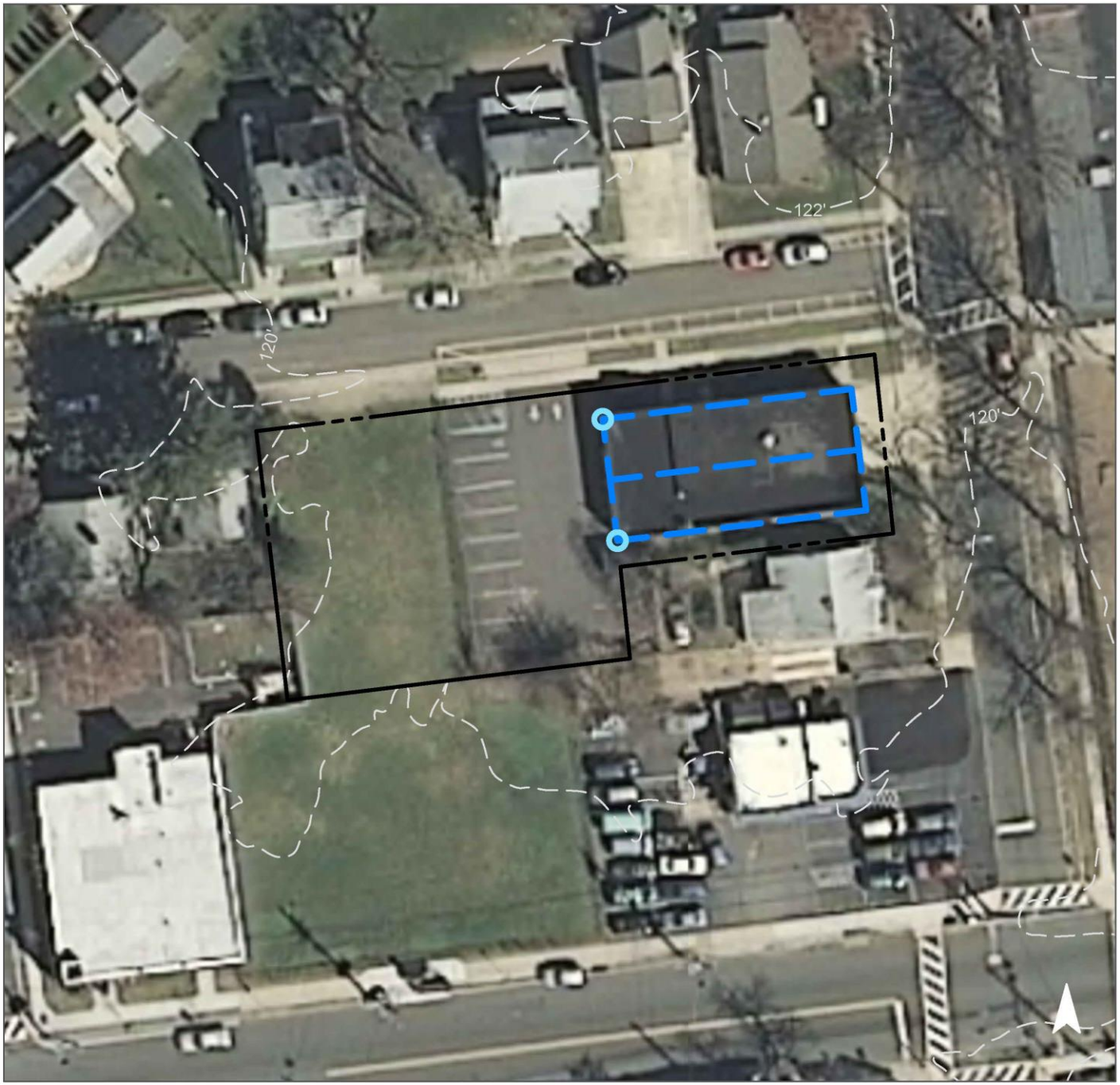
Block and Lot: Block 91, Lot 6

Downspouts on the eastern side of the building can be disconnected into cisterns to harvest rainwater to use for 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"
95	14,575	0.7	7.4	66.9	0.011	0.40

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 systems	0.040	7	3,067	0.24	3,067 (gal)	$6,134

GREEN INFRASTRUCTURE RECOMMENDATIONS



Highland Park First Aid Squad

- rainwater harvesting
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 25' 50'

HIGHLAND PARK HOUSING AUTHORITY

Subwatershed: Lower Raritan River

Site Area: 57,549 sq. ft.

Address: 242 South 6th Avenue
Highland Park, NJ 08904

Block and Lot: Block 42, Lot 38

Parking spaces next to the building can be repaved with porous asphalt to 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"
62	35,486	1.7	17.9	162.9	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 pavements	0.065	11	10,076	0.38	1,250	$31,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

Highland Park Housing Authority

- pervious pavements
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 30' 60'

HIGHLAND PARK MIDDLE SCHOOL AND HIGH SCHOOL

Subwatershed: Lower Raritan River

Site Area: 652,063 sq. ft.

Address: 102 North 5th Avenue
Highland Park, NJ 08904

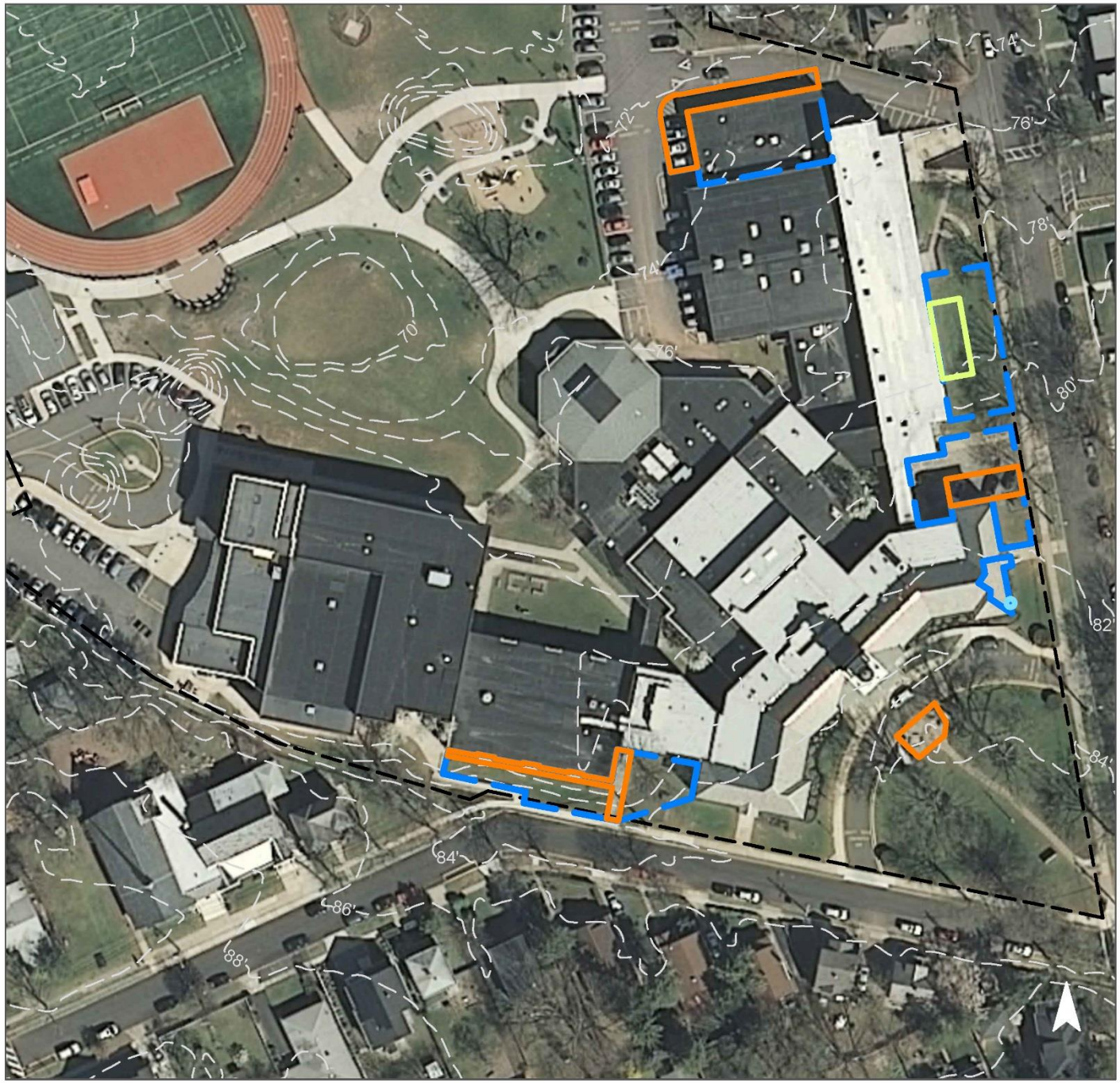
Block and Lot: Block 145, Lot 18

Several areas can be converted to porous pavement to infiltrate runoff. Downspouts on the southern end of the building can be disconnected to allow stormwater to infiltrate into an existing turf grass below. Another downspout can be disconnected a cistern to harvest rainwater, and a rain garden on the eastern side of the building 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"
31	201,606	9.7	101.8	925.6	0.157	5.53

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	0.104	17	7,645	0.29	1,000	$5,000
Pervious pavements	0.386	65	28,342	1.07	4,300	$107,500
Rainwater harvesting systems	0.012	2	421	0.03	421 (gal)	$842

GREEN INFRASTRUCTURE RECOMMENDATIONS



Highland Park Middle and High School

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

0 50' 100'

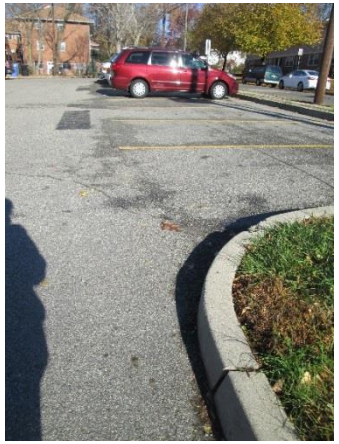
HIGHLAND PARK SENIOR CENTER AND MUNICIPAL BUILDING

Subwatershed: **Lower Raritan River**

Site Area: **64,025 sq. ft.**

Address: **220 South 6th Avenue *and***
221 South 5th Avenue
Highland Park, NJ 08904

Block and Lot: **Block 42, Lot 6 and 32**

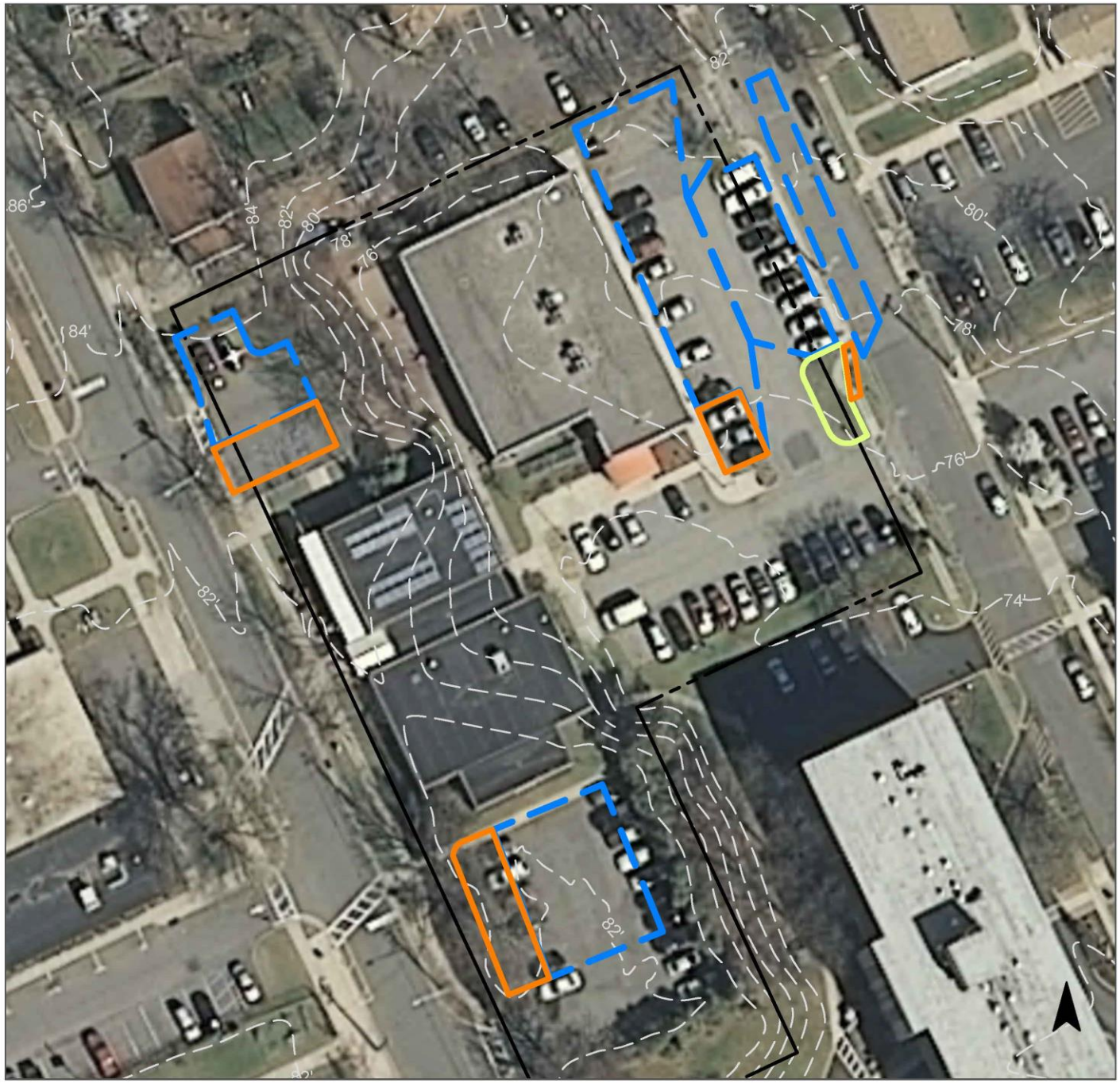


Parking spaces and a portion of the sidewalk can be repaved with porous pavements to infiltrate stormwater. A rain garden can also be installed to capture, treat, and infiltrate runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
78	49,820	2.4	25.2	228.7	0.039	1.37

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 pavements	0.252	42	18,468	0.69	2,526	$63,150
Bioretention systems	0.061	10	4,451	0.17	528	$2,640

GREEN INFRASTRUCTURE RECOMMENDATIONS



Highland Park Senior Center and Municipal Building

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

0 30' 60'

IRVING PRIMARY SCHOOL

Subwatershed: Lower Raritan River

Site Area: 91,387 sq. ft.

Address: 121 S 11th Avenue
Highland Park, NJ 08904

Block and Lot: Block 93, Lot 2

A bioretention system can be installed in the turf grass area near the entrance of the building capture, treat, and infiltrate rooftop runoff. The two downspouts in this area can be disconnected to direct stormwater from the building into the bioretention system. 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"
93	85,430	4.1	43.1	392.2	0.067	2.34

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	0.072	12	5,258	0.20	700	$3,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Irving Primary School

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

0 20' 40'

NOAH'S ARK ACADEMY

Subwatershed: Lower Raritan River

Site Area: 18,565 sq. ft.

Address: 900 Raritan Avenue
Highland Park, NJ 08904

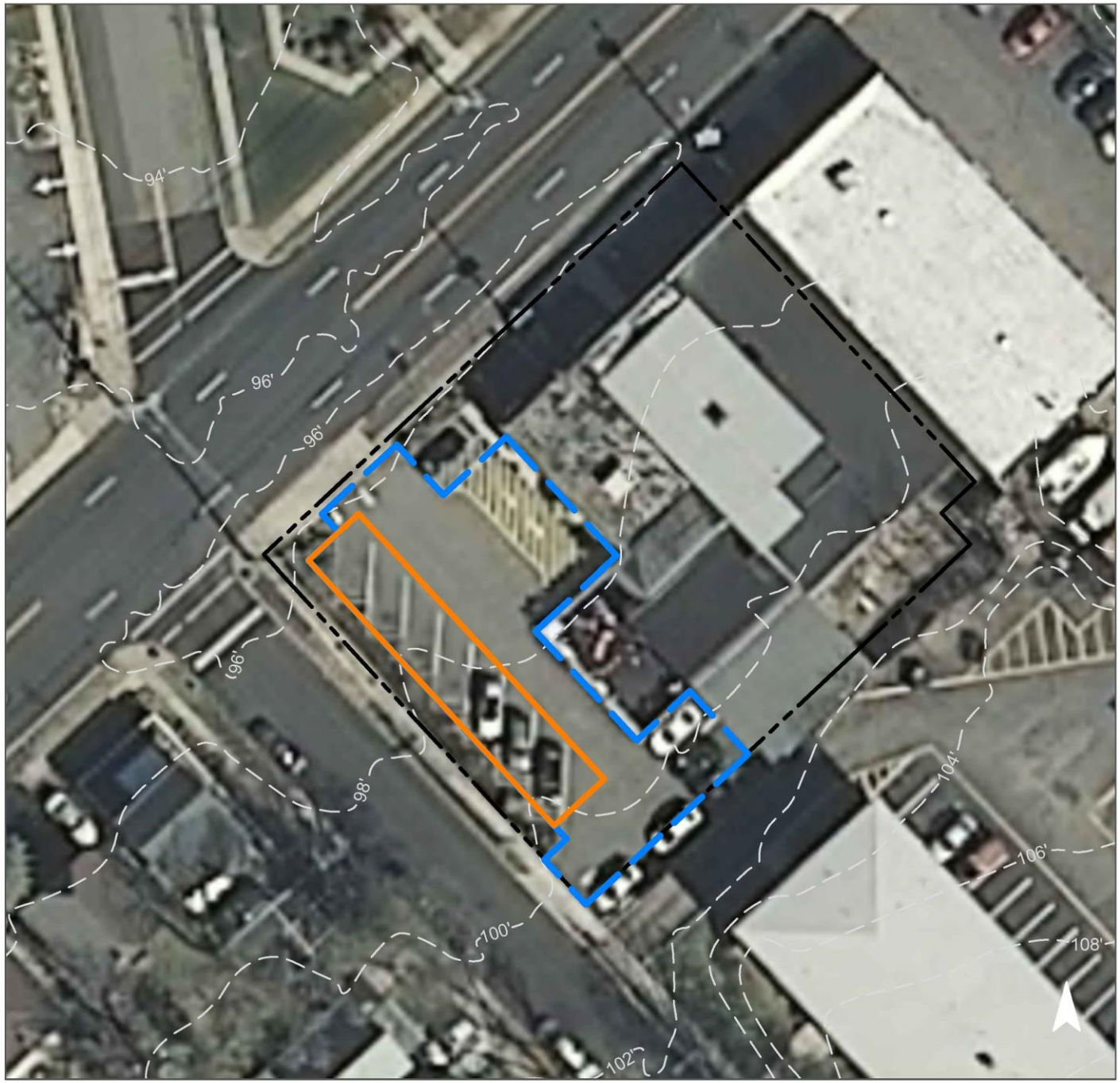
Block and Lot: Block 88, Lot 16

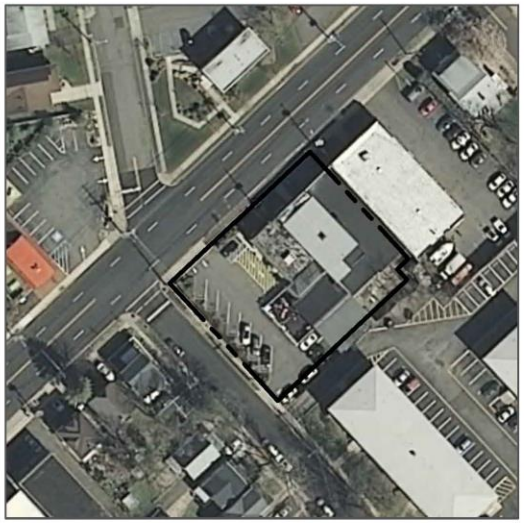
Parking spaces can be converted into pervious pavement to infiltrate runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
95	17,636	0.9	8.9	81.0	0.014	0.48

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
Pervious pavements	0.142	24	10,420	0.39	1,125	$28,125

GREEN INFRASTRUCTURE RECOMMENDATIONS





Noah's Ark Academy

- pervious pavements
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

REFORMED CHURCH OF HIGHLAND PARK

Subwatershed: Lower Raritan River

Site Area: 35,785 sq. ft.

Address: 19-21 South 2nd Avenue
Highland Park, NJ 08904

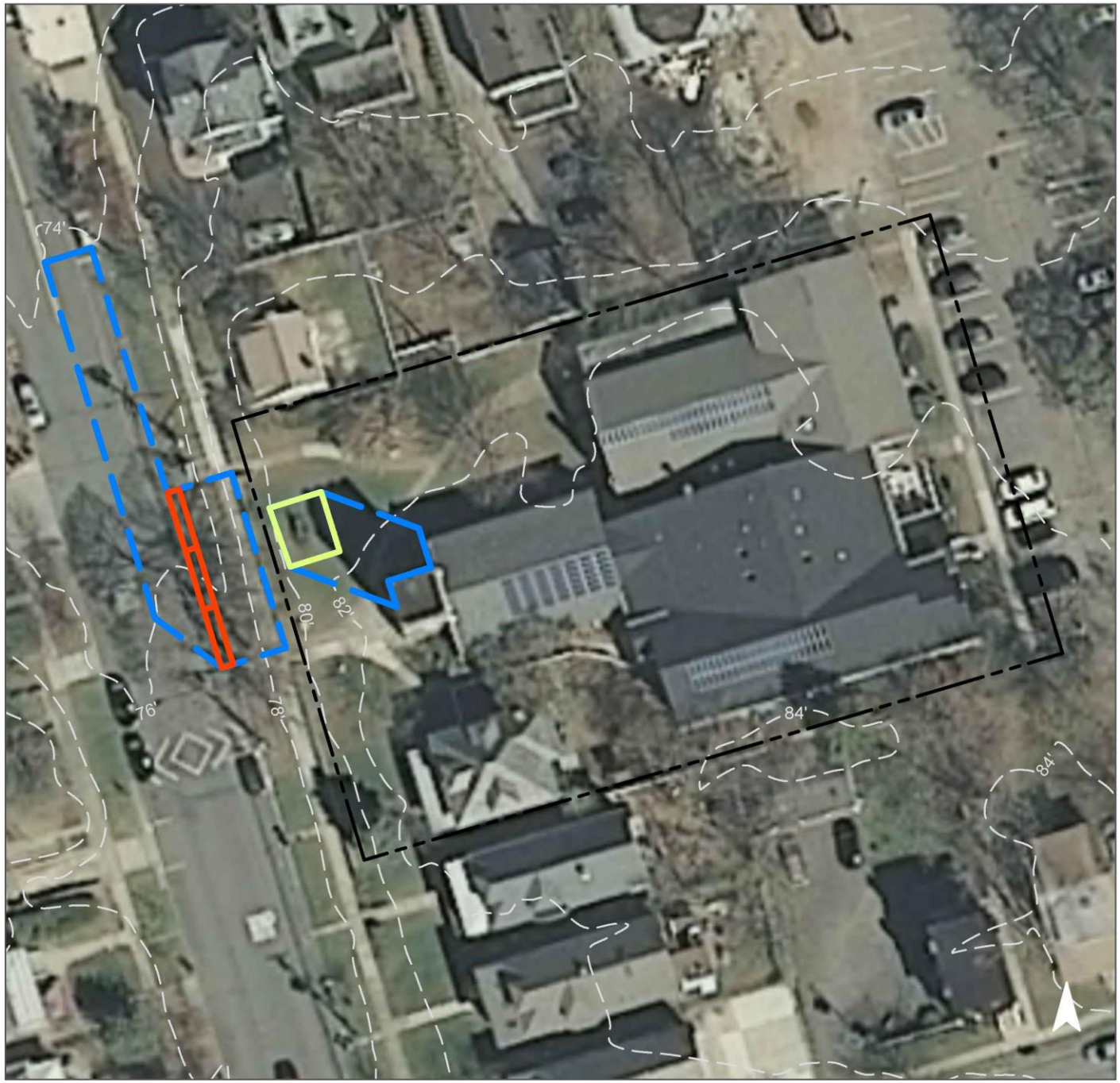
Block and Lot: Block 22, Lot 29.01

Stormwater from the property can be managed with a rain garden near the front sign. The sidewalk closest to the street can be replaced with stormwater planters to manage additional 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"
82	29,497	1.4	14.9	135.4	0.023	0.81

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	0.031	5	2,244	0.08	300	$1,500
Stormwater planters	0.090	15	6,590	0.25	240	$24,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Reformed Church of Highland Park

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

0 25' 50'

SAINT MARY OF ZYROVICY CHURCH

Subwatershed: **Lower Raritan River**

Site Area: **15,556 sq. ft.**

Address: **9 River Road**
Highland Park, NJ 08904

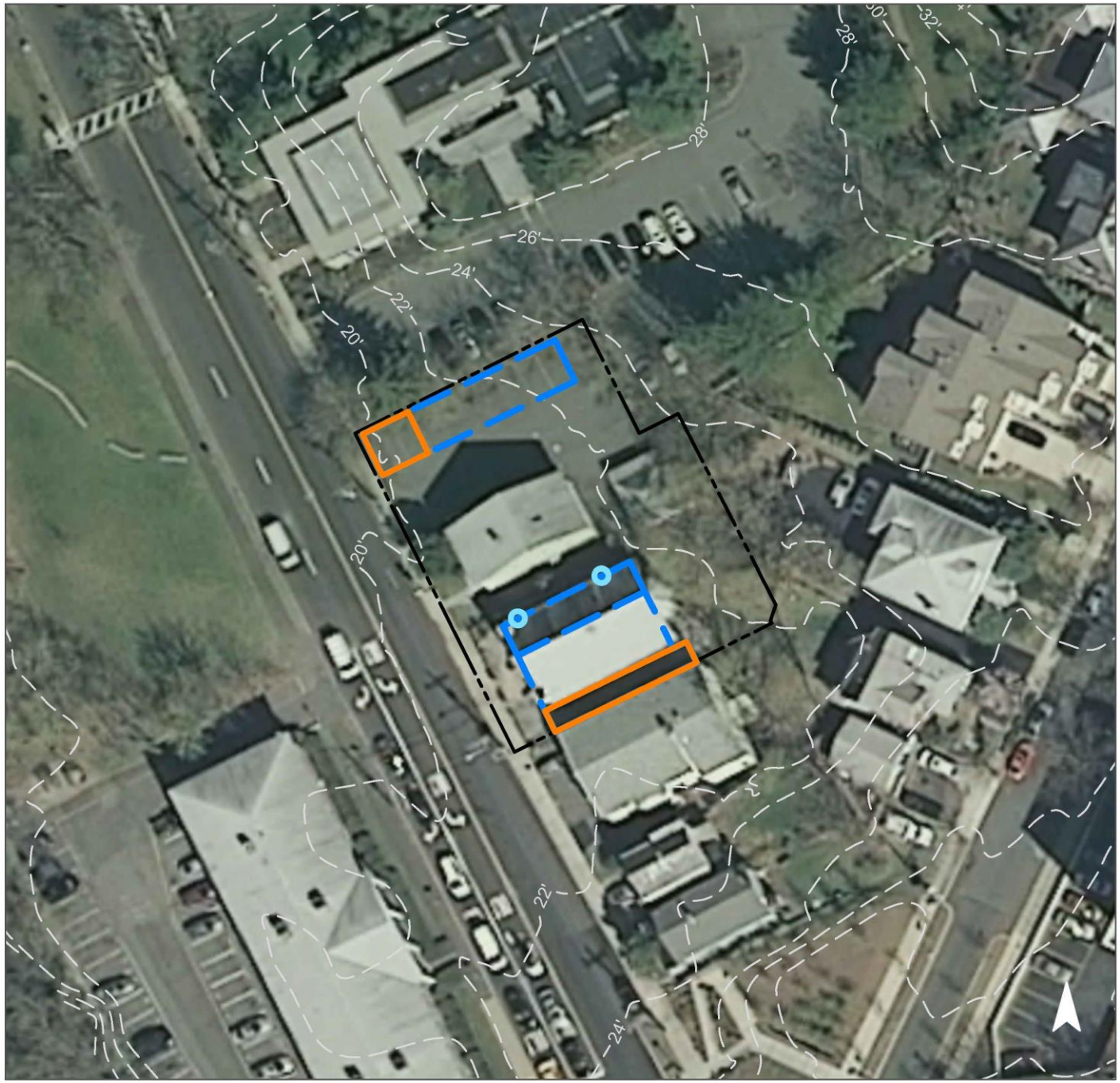
Block and Lot: **Block 183, Lot 19**

Parking spaces can be repaved with porous asphalt to infiltrate parking lot runoff. Downspouts on the northern side of the building can also be disconnected into rainwater harvesting systems. The walkway on the southern side of the building can be repaved with porous asphalt in order to better manage the stormwater from the building. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
47	7,342	0.4	3.7	33.7	0.006	0.20

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 systems	0.019	3	681	0.05	681 (gal)	$1,361
Pervious pavements	0.090	15	6,627	0.25	1,100	$27,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Saint Mary of Zyrovicy Church

- pervious pavements
- rainwater harvesting
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 30' 60'

d. Summary of Existing Conditions

Summary of Existing Site Conditions

Subwatershed/Site Name/GI Practices/Total Site Info	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)
LOWER RARITAN RIVER SUBWATERSHED	**29.91**	**1,302,854**			**34.2**	**357.9**	**3,254.0**		**16.27**	**708,724**	**0.552**	**19.44**
All Saint's Episcopal Church												
Total Site Info	0.28	12,150	32	1	0.3	3.4	30.7	55	0.15	6,683	0.005	0.18
Bartle Elementary School												
Total Site Info	4.11	179,033	38	38	6.8	70.9	644.1	78	3.22	140,296	0.109	3.85
Children's House Montessori School/Trinity United Methodist Church												
Total Site Info	0.62	27,187	145	10	0.6	6.2	56.2	45	0.28	12,234	0.010	0.34
Complex at 31 River Road												
Total Site Info	1.02	44,266	183	24	1.8	18.6	168.8	83	0.84	36,767	0.029	1.01
Farmers Market Parking Lot												
Total Site Info	0.73	31,932	22	32.01	1.3	13.4	121.7	83	0.61	26,503	0.021	0.73
First Baptist Church of Highland Park												
Total Site Info	0.32	14,098	162	25	0.6	6.1	55.0	85	0.28	11,983	0.009	0.33
Highland Park Conservative Temple												
Total Site Info	1.01	43,916	33	2	1.6	16.6	150.9	75	0.75	32,866	0.026	0.90
Highland Park First Aid Squad												
Total Site Info	0.35	15,342	91	6	0.7	7.4	66.9	95	0.33	14,575	0.011	0.40
Highland Park Housing Authority												
Total Site Info	1.32	57,549	42	38	1.7	17.9	162.9	62	0.81	35,486	0.028	0.97
Highland Park Middle & High School												
Total Site Info	14.97	652,063	145	18	9.7	101.8	925.6	31	4.63	201,606	0.157	5.53
Highland Park Senior Center & Municipal Building												
Total Site Info	1.47	64,025	42	32	2.4	25.2	228.7	78	1.14	49,820	0.039	1.37

Summary of Existing Site Conditions

Subwatershed/Site Name/GI Practices/Total Site Info	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)
Irving Primary School												
Total Site Info	2.10	91,387	93	2	4.1	43.1	392.2	93	1.96	85,430	0.067	2.34
Noah's Ark Academy												
Total Site Info	0.43	18,565	88	16	0.9	8.9	81.0	95	0.40	17,636	0.014	0.48
Reformed Church of Highland Park												
Total Site Info	0.82	35,785	22	29.01	1.4	14.9	135.4	82	0.68	29,497	0.023	0.81
Saint Mary Of Zyrovicy Church												
Total Site Info	0.36	15,556	183	19	0.4	3.7	33.7	47	0.17	7,342	0.006	0.20

e. Summary of Proposed Green Infrastructure Practices

Summary of Proposed Green Infrastruture Practices

	Subwatershed/Site Name/GI Practices/Total Site Info	Potential Management Area		Recharge Potential	TSS Removal Potential	Max Volume Reduction Potential	Peak Discharge Reduction Potential	Size of BMP	Unit Cost	Unit	Total Cost	I.C. Treated
		Area (SF)	Area (ac)	(Mgal/yr)	(lbs/yr)	(gal/storm)	(cfs)	(SF)	($)		($)	%
	LOWER RARITAN RIVER SUBWATERSHED	**137,417**	**3.15**	**2.971**	**497**	**254,127**	**9.88**	**31,855**			**$581,814**	**19.4%**
1	**All Saint's Episcopal Church**											
	Pervious pavements	300	0.01	0.008	1	576	0.02	305	25	SF	$7,625	4.5%
	Rainwater harvesting systems	1,070	0.02	0.013	2	1,000	0.08	1,000	2	gal	$2,000	16.0%
	Total Site Info	**1,370**	**0.03**	**0.021**	**4**	**1,576**	**0.10**	**1,305**			**$9,625**	**16.0%**
2	**Bartle Elementary School**											
	Bioretention systems / rain gardens	34,272	0.79	0.893	149	65,525	2.46	9,600	5	SF	$48,000	24.4%
	Pervious pavements	2,500	0.06	0.065	11	4,780	0.18	500	25	SF	$12,500	1.8%
	Rainwater harvesting systems	1,850	0.04	0.048	8	3,500	0.13	3,500	2	gal	$7,000	1.3%
	Total Site Info	**38,622**	**0.89**	**1.006**	**168**	**73,805**	**2.77**	**13,600**			**$67,500**	**27.5%**
3	**Children's Montessori School/Trinity United Church**											
	Pervious pavements	280	0.01	0.007	1	539	0.02	280	25	SF	$7,000	2.3%
	Rainwater harvesting systems	1,725	0.04	0.045	8	1,613	0.12	1,613	2	gal	$3,226	14.1%
	Total Site Info	**2,005**	**0.05**	**0.052**	**9**	**2,152**	**0.14**	**1,893**			**$10,226**	**16.4%**
4	**Complex At 31 River Road**											
	Pervious pavements	9,875	0.23	0.122	20	18,880	0.71	1,970	25	SF	$49,250	26.9%
	Rainwater harvesting systems	400	0.01	0.010	2	374	0.03	374	2	gal	$748	1.1%
	Total Site Info	**10,275**	**0.24**	**0.132**	**22**	**19,254**	**0.74**	**2,344**			**$49,998**	**27.9%**
5	**Farmers Market Parking Lot**											
	Pervious pavements	24,900	0.57	0.307	51	47,603	1.79	4,900	25	SF	$122,500	94.0%
	Total Site Info	**24,900**	**0.57**	**0.307**	**51**	**47,603**	**1.79**	**4,900**			**$122,500**	**94.0%**
6	**First Baptist Church Of Highland Park**											
	Rainwater harvesting systems	1,050	0.02	0.027	5	982	0.08	982	2	gal	$1,964	8.8%
	Stormwater planters	1,136	0.03	0.030	5	2,169	0.08	160	100	SF	$16,000	9.5%
	Total Site Info	**2,186**	**0.05**	**0.057**	**10**	**3,151**	**0.16**	**1,142**			**$17,964**	**18.2%**
7	**Highland Park Conservative Temple**											
	Bioretention systems / rain gardens	1,200	0.03	0.031	5	2,296	0.09	300	5	SF	$1,500	3.7%
	Total Site Info	**1,200**	**0.03**	**0.031**	**5**	**2,296**	**0.09**	**300**			**$1,500**	**3.7%**

Summary of Proposed Green Infrastruture Practices

	Subwatershed/Site Name/GI Practices/Total Site Info	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	**Highland Park First Aid Squad**											
	Rainwater harvesting systems	3,280	0.08	0.040	7	3,067	0.24	3,067	2	gal	$6,134	22.5%
	Total Site Info	**3,280**	**0.08**	**0.040**	**7**	**3,067**	**0.24**	**3,067**			**$6,134**	**22.5%**
9	**Highland Park Housing Authority**											
	Pervious pavements	5,300	0.12	0.065	11	10,076	0.38	1,250	25	SF	$31,250	14.9%
	Total Site Info	**5,300**	**0.12**	**0.065**	**11**	**10,076**	**0.38**	**1,250**			**$31,250**	**14.9%**
10	**Highland Park Middle School & High School**											
	Bioretention systems / rain gardens	4,000	0.09	0.104	17	7,645	0.29	1,000	5	SF	$5,000	2.0%
	Pervious pavements	14,825	0.34	0.386	65	28,342	1.07	4,300	25	SF	$107,500	7.4%
	Rainwater harvesting systems	450	0.01	0.012	2	421	0.03	421	2	gal	$842	0.2%
	Total Site Info	**19,275**	**0.44**	**0.502**	**84**	**36,408**	**1.39**	**5,721**			**$113,342**	**9.6%**
11	**Highland Park Senior Center & Municipal Building**											
	Pervious pavements	9,660	0.22	0.252	42	18,468	0.69	2,526	25	SF	$63,150	19.4%
	Bioretention systems / rain gardens	2,327	0.05	0.061	10	4,451	0.17	528	5	SF	$2,640	4.7%
	Total Site Info	**11,987**	**0.28**	**0.312**	**52**	**22,919**	**0.86**	**3,054**			**$65,790**	**24.1%**
12	**Irving Primary School**											
	Bioretention systems / rain gardens	2,750	0.06	0.072	12	5,258	0.20	700	5	SF	$3,500	3.2%
	Total Site Info	**2,750**	**0.06**	**0.072**	**12**	**5,258**	**0.20**	**700**			**$3,500**	**3.2%**
13	**Noah's Ark Academy**											
	Pervious pavements	5,450	0.13	0.142	24	10,420	0.39	1,125	25	SF	$28,125	30.9%
	Total Site Info	**5,450**	**0.13**	**0.142**	**24**	**10,420**	**0.39**	**1,125**			**$28,125**	**30.9%**
14	**Reformed Church of Highland Park**											
	Bioretention systems / rain gardens	1,175	0.03	0.031	5	2,244	0.08	300	5	SF	$1,500	4.0%
	Stormater planters	3,448	0.08	0.090	15	6,590	0.25	240	100	SF	$24,000	11.7%
	Total Site Info	**4,623**	**0.11**	**0.120**	**20**	**8,834**	**0.33**	**540**			**$25,500**	**15.7%**
15	**Saint Mary of Zyrovicy Church**											
	Pervious pavements	3,466	0.08	0.090	15	6,627	0.25	1,100	25	SF	$27,500	47.2%
	Rainwater harvesting systems	728	0.02	0.019	3	681	0.05	681	2	gal	$1,361	9.9%
	Total Site Info	**4,194**	**0.10**	**0.109**	**18**	**7,308**	**0.30**	**1,781**			**$28,861**	**57.1%**