



**Draft**

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

*Prepared for Holmdel Township by the  
Rutgers Cooperative Extension Water Resources Program*

January 12, 2021



## ACKNOWLEDGEMENTS:

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## Table of Contents

Introduction .....	1
Methodology .....	1
Green Infrastructure Practices .....	8
Potential Project Sites .....	10
Conclusion .....	11

### Appendix A: Climate Resilient Green Infrastructure

- a. Green Infrastructure Sites
- b. Proposed Green Infrastructure Concepts
- c. Summary of Existing Conditions
- d. Summary of Proposed Green Infrastructure Practices



## **Introduction**

Located in Monmouth County, New Jersey, Holmdel Township covers approximately 18.05 square miles. Figures 1 and 2 illustrate that Holmdel Township is dominated by urban land use. A total of 56.6% of the municipality's land use is classified as urban. Of the urban land in Holmdel Township, rural residential is the dominant land use (Figure 3).

The New Jersey Department of Environmental Protection's (NJDEP) 2015 land use/land cover geographical information system (GIS) data layer categorizes Holmdel 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 Holmdel Township. Based upon the 2015 NJDEP land use/land cover data, approximately 19.6% of Holmdel Township has impervious cover. This level of impervious cover suggests that the streams in Holmdel Township are likely impacted streams.<sup>1</sup>

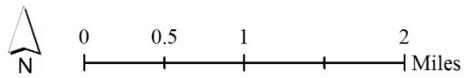
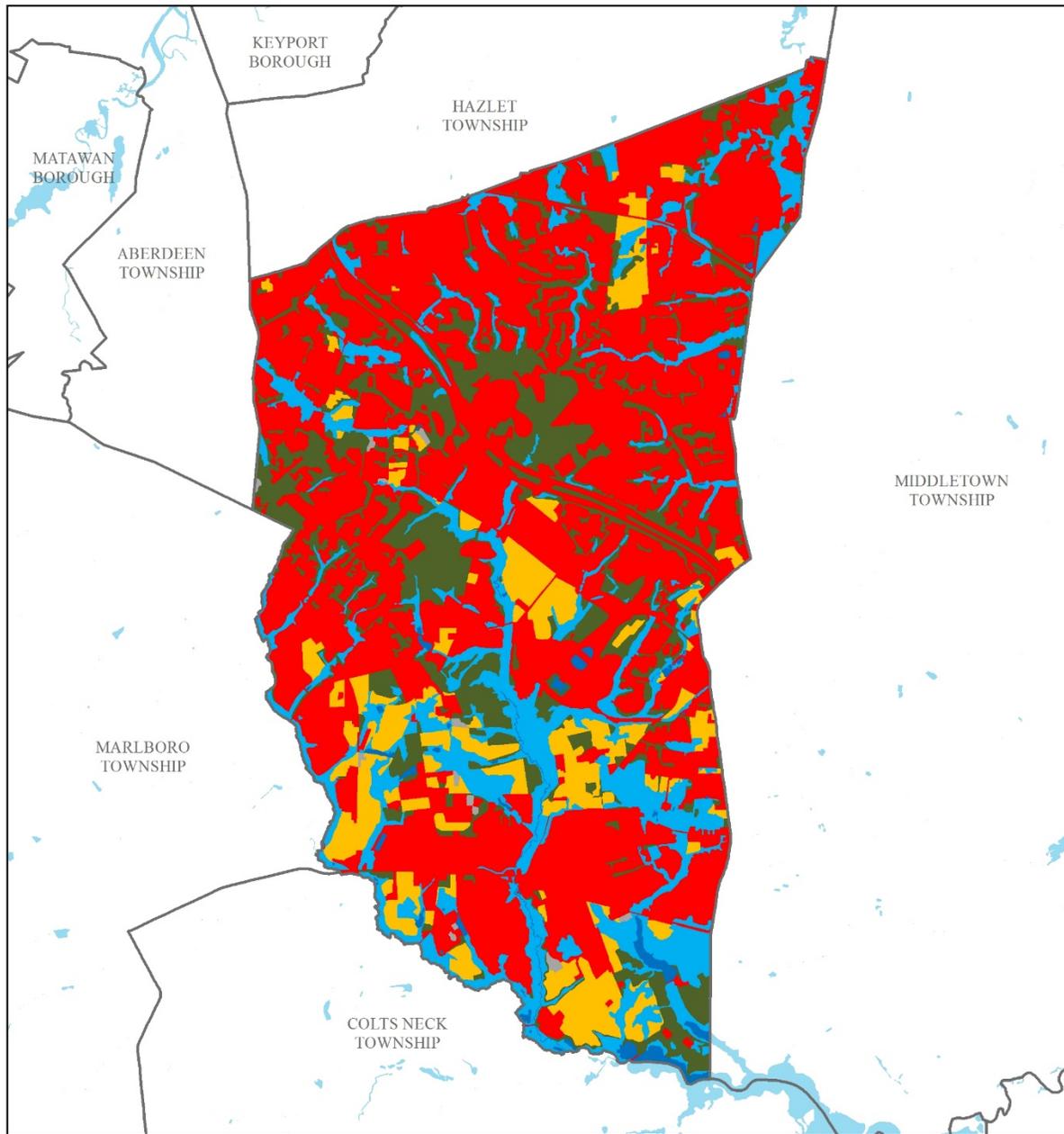
## **Methodology**

Holmdel Township contains portions of seven subwatersheds (Figure 4). For this impervious cover reduction action plan, projects have been identified in three 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.

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

# Land Use Types for Holmdel Township



■ Agriculture ■ Barren Land ■ Forest ■ Urban ■ Water ■ Wetlands

Figure 1: Map illustrating the land use in Holmdel Township

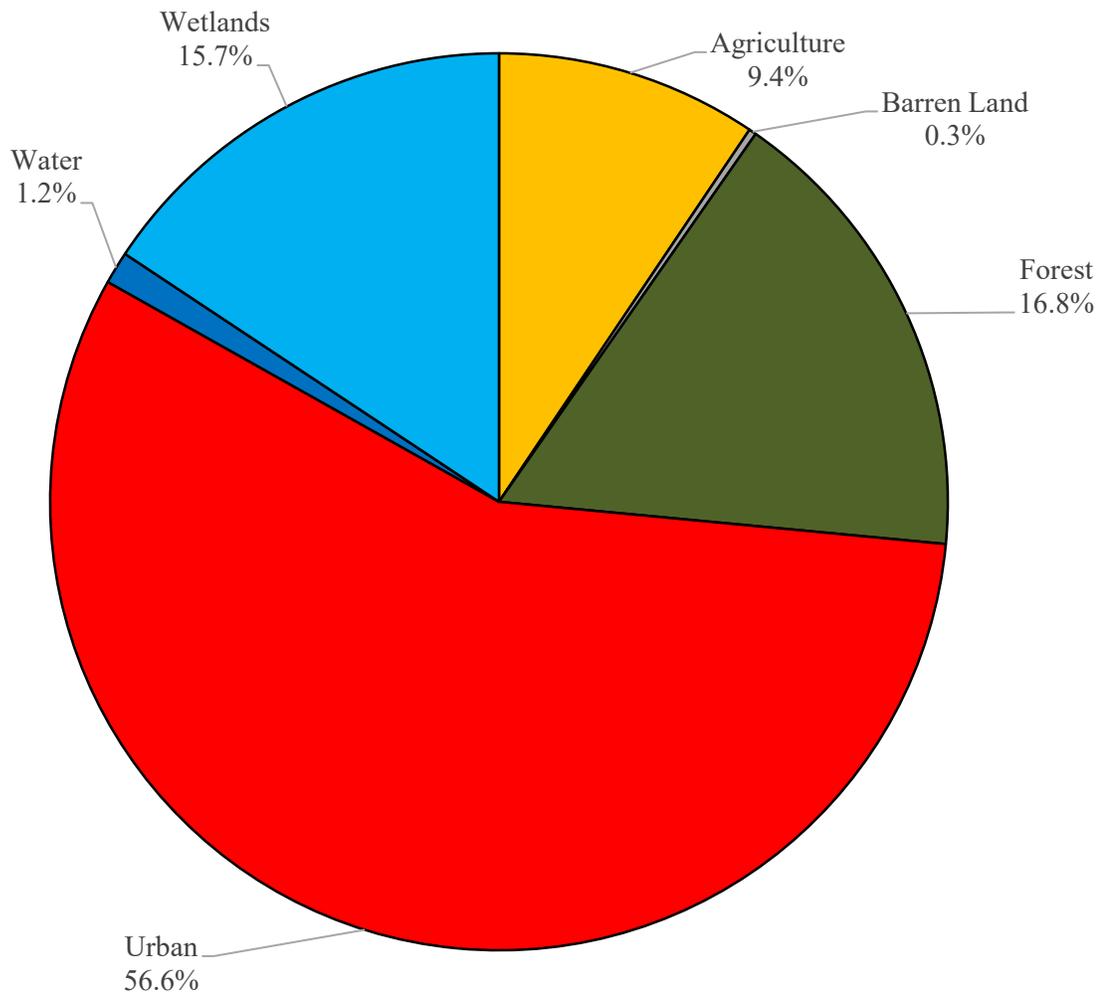


Figure 2: Pie chart illustrating the land use in Holmdel Township

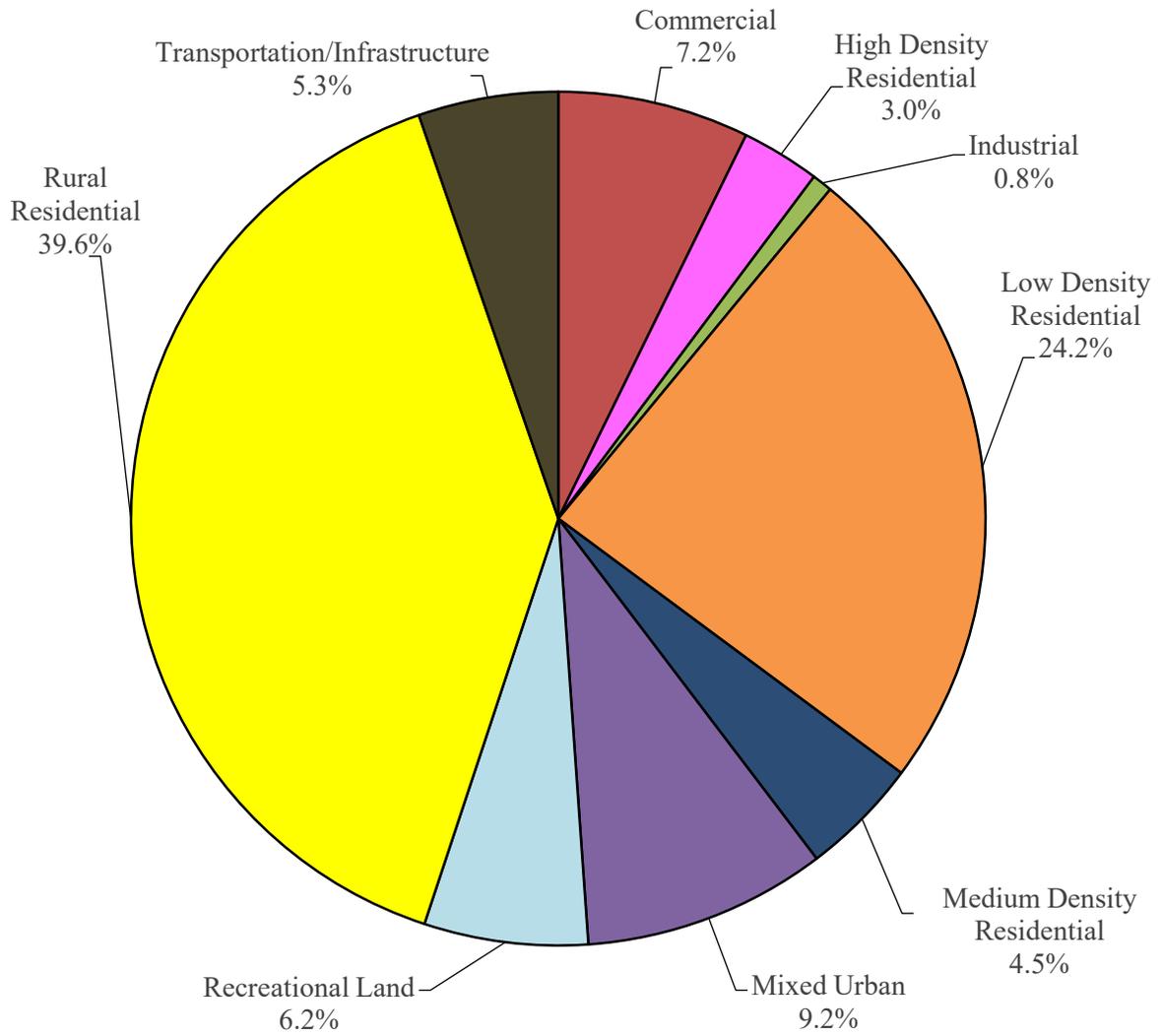


Figure 3: Pie chart illustrating the various types of urban land use in Holmdel Township

# Subwatersheds of Holmdel Township

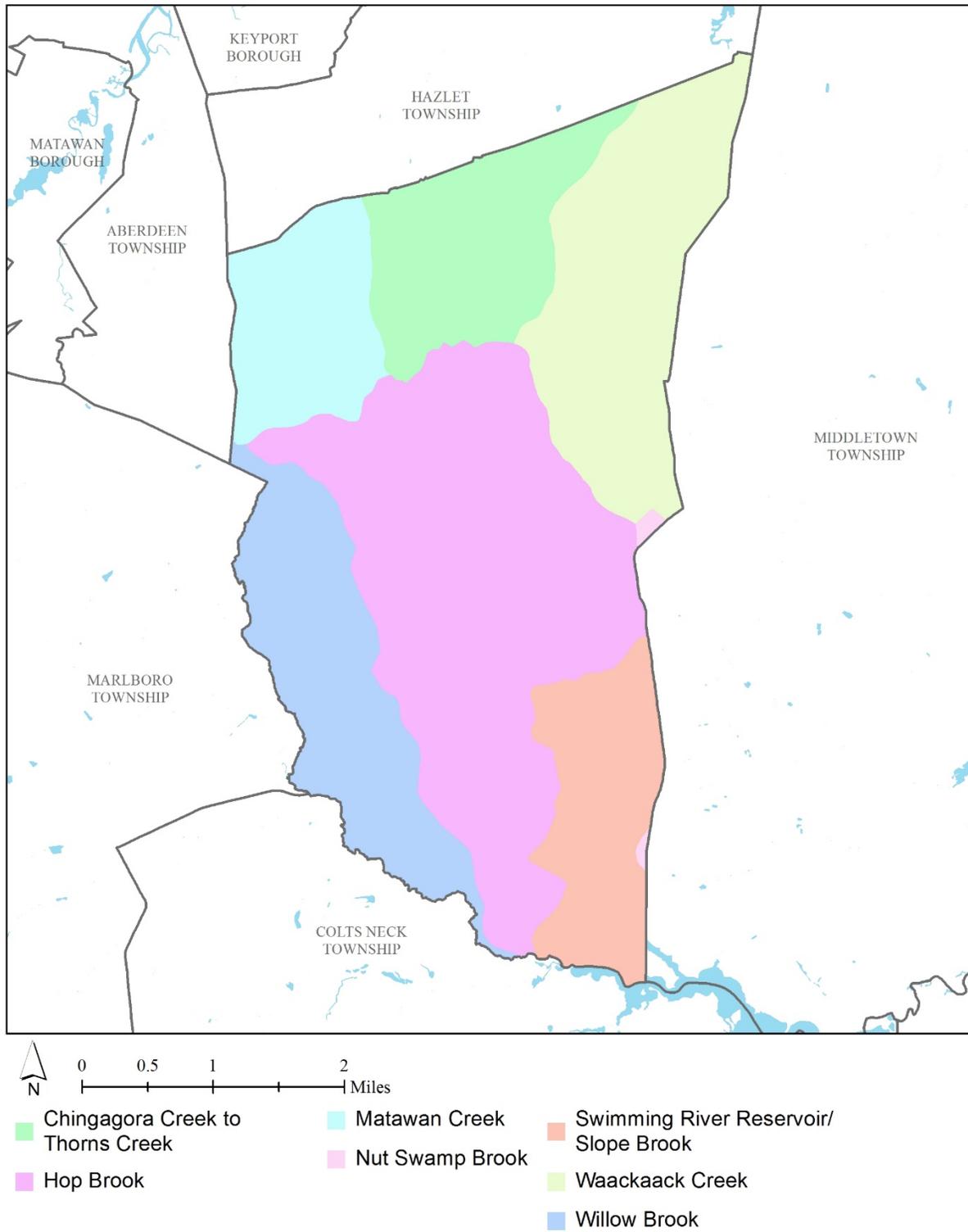


Figure 4: Map of the subwatersheds in Holmdel Township

For each potential project site, specific aerial loading coefficients for commercial land use were used to determine the annual runoff loads for total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS) from impervious surfaces (Table 1). These are the same aerial loading coefficients that NJDEP uses in developing total maximum daily loads (TMDLs) for impaired waterways of the state. The percentage of impervious cover for each site was extracted from the 2015 NJDEP land use/land cover database. For impervious areas, runoff volumes were determined for the water quality design storm (1.25 inches of rain over two-hours) and for the annual rainfall total of 44 inches.

Preliminary soil assessments were conducted for each potential project site identified in Holmdel 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<sup>2</sup>

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

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<sup>2</sup> New Jersey Department of Environmental Protection (NJDEP), Stormwater Best Management Practice Manual, 2004.

## **Green Infrastructure Practices**

Green infrastructure is an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure projects capture, filter, absorb, and reuse stormwater to maintain or mimic natural systems and to treat runoff as a resource. As a general principle, green infrastructure practices use soil and vegetation to recycle stormwater runoff through infiltration and evapotranspiration. When used as components of a stormwater management system, green infrastructure practices such as bioretention, green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these practices can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits<sup>3</sup>. A wide range of green infrastructure practices have been evaluated for the potential project sites in Holmdel 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.



<sup>3</sup> 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](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.<sup>4</sup>

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

## **Conclusion**

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

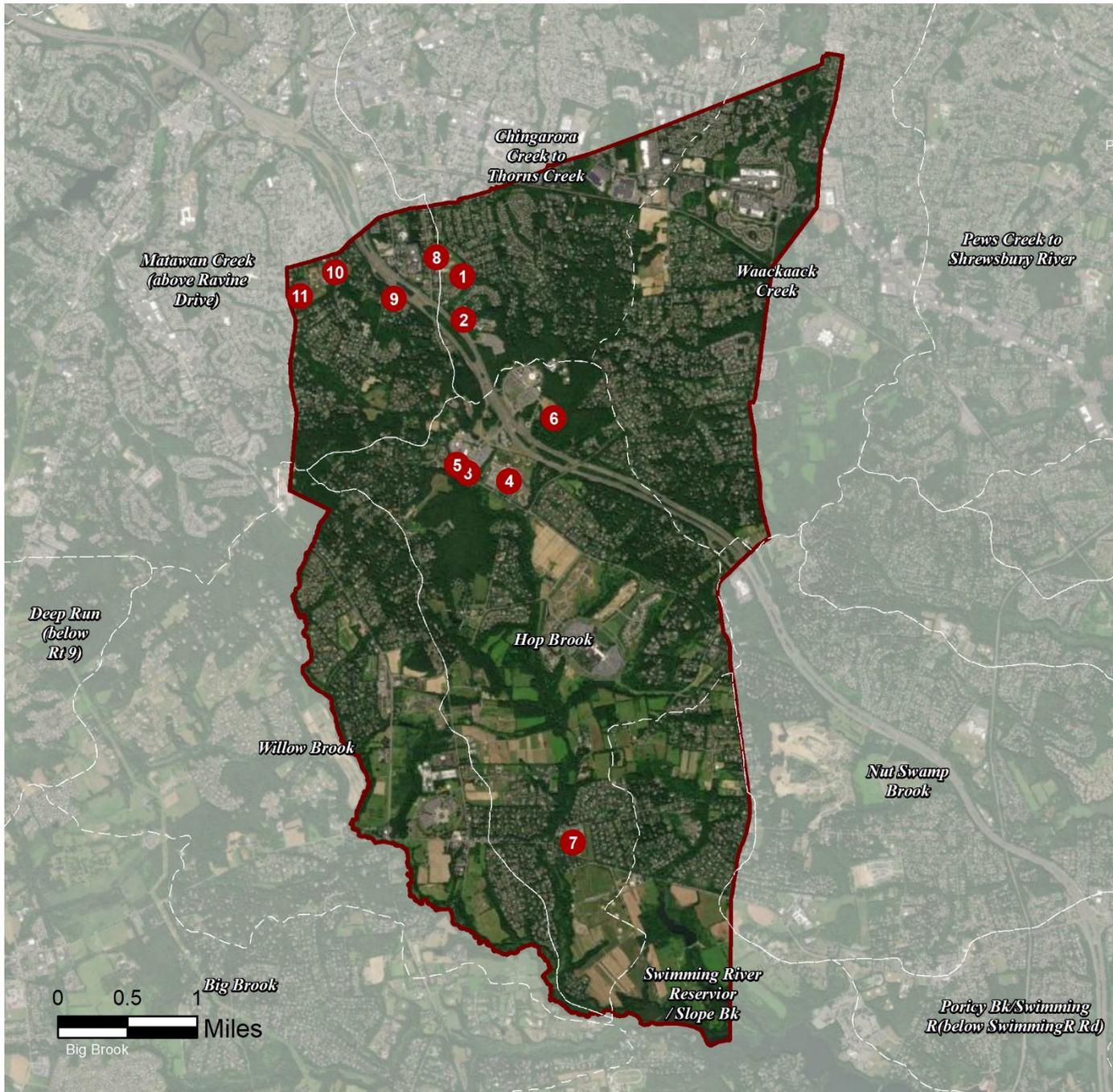
Additionally, development projects that are in need of providing off-site compensation for stormwater impacts can use the projects in this plan as a starting point. The municipality can quickly convert this impervious cover reduction action plan into a stormwater mitigation plan and incorporate it into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



## **Appendix A: Climate Resilient Green Infrastructure**

### **a. Green Infrastructure Sites**

# HOLMDEL: GREEN INFRASTRUCTURE SITES



## SITES WITHIN THE CHINGARORA CREEK SUBWATERSHED

1. Ackerson Park

2. Holmdel Swim Club

## SITES WITHIN THE HOP BROOK SUBWATERSHED

3. Holmdel First Aid Squad

4. Holmdel High School & William R. Satz Middle School

5. Holmdel Municipal Court & Gateway Church of Christ

6. Vietnam Era Museum and Education Center

7. Village Elementary School

## SITES WITHIN THE MATAWAN CREEK SUBWATERSHED

8. Indian Hill School

9. Kimisis Tis Theotokou Church

10. Saint Benedict School and Church

11. Saint John Vianney High School

## **b. Proposed Green Infrastructure Concepts**

# ACKERSON PARK



**Subwatershed:** Chingarora Creek  
**Site Area:** 550,557 sq. ft.  
**Address:** 17 Crape Myrtle Drive  
Holmdel, NJ 07733  
**Block and Lot:** Block 46, Lot 64.09

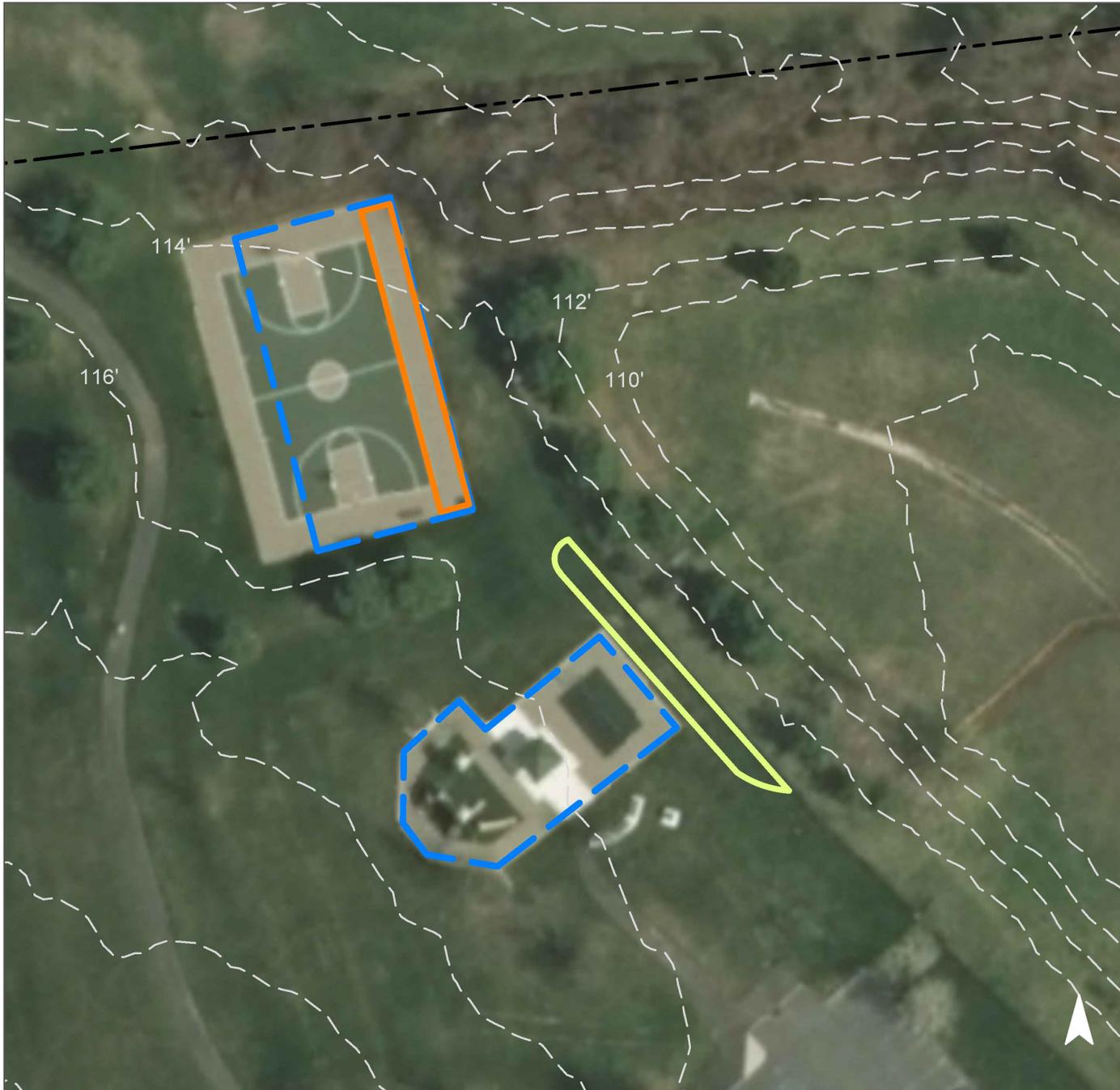


A rain garden can be installed near the playground area to capture, treat, and infiltrate stormwater runoff and also serve as an educational demonstration. Pervious pavement can be installed to treat the drainage area of the basketball court and also improve the structure of the existing cracked pavement. 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"
11	58,326	2.8	29.5	267.8	0.045	1.60

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	0.091	15	6,680	0.25	1,656	\$8,280
Pervious pavement	0.140	23	10,280	0.39	960	\$24,000

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Ackerson Park

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



# HOLMDEL SWIM CLUB



**Subwatershed:** Chingarora Creek

**Site Area:** 1,236,055 sq. ft.

**Address:** 36 Crawfords Corner Road  
Holmdel, NJ 07733

**Block and Lot:** Block 46, Lot 79

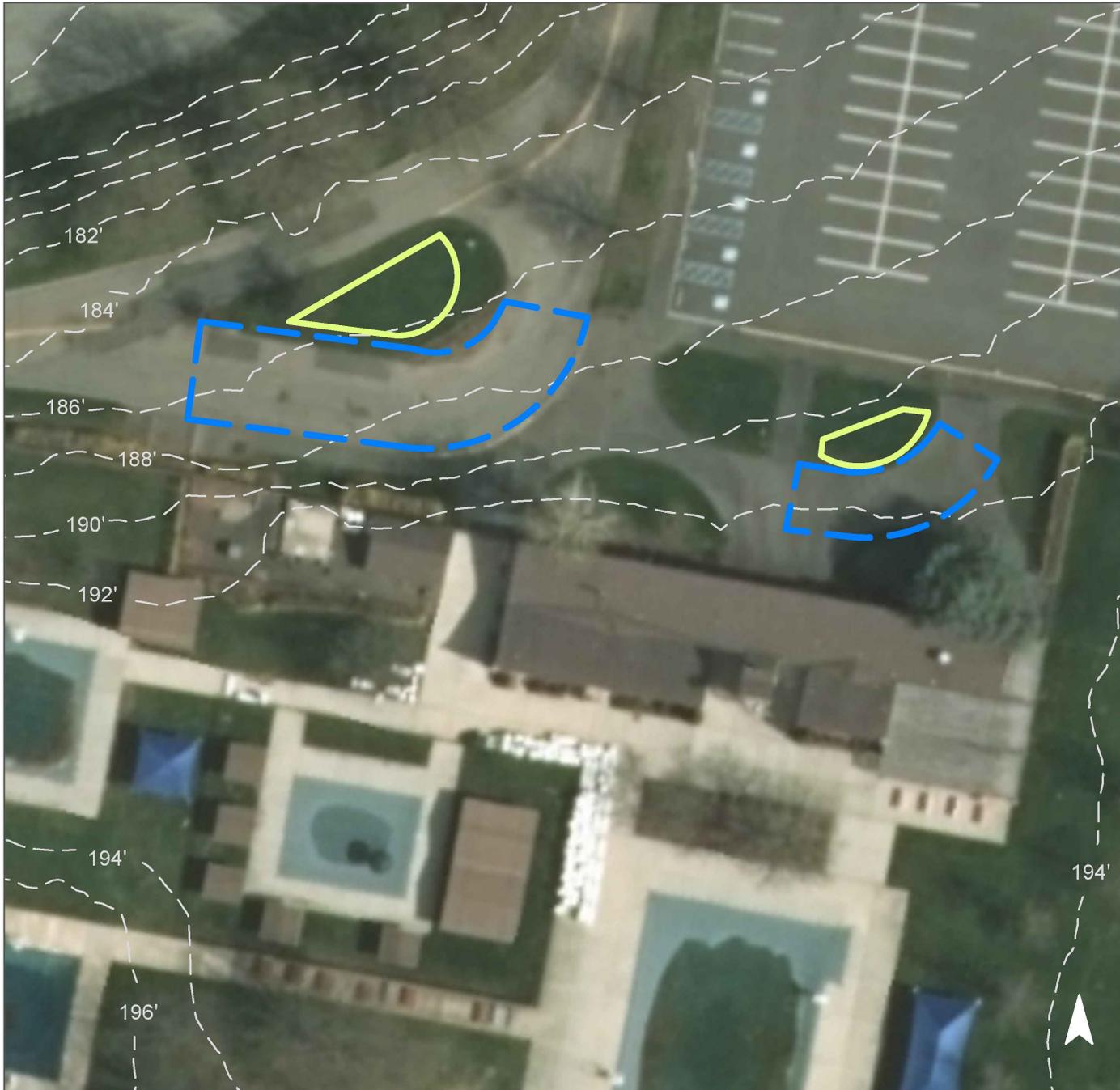


Two bioretention systems can be installed in the front of the building to capture, treat, and infiltrate runoff from the surrounding driveways. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
25	306,098	14.8	154.6	1,405.4	0.239	8.40

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
Bioretention systems	0.139	23	10,230	0.38	1,656	\$8,280

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Holmdel Swim Club

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



# HOLMDEL FIRST AID SQUAD



**Subwatershed:** Hop Brook

**Site Area:** 159,518 sq. ft.

**Address:** 20 Crawfords Corner Road  
Holmdel, NJ 07733

**Block and Lot:** Block 26, Lot 2

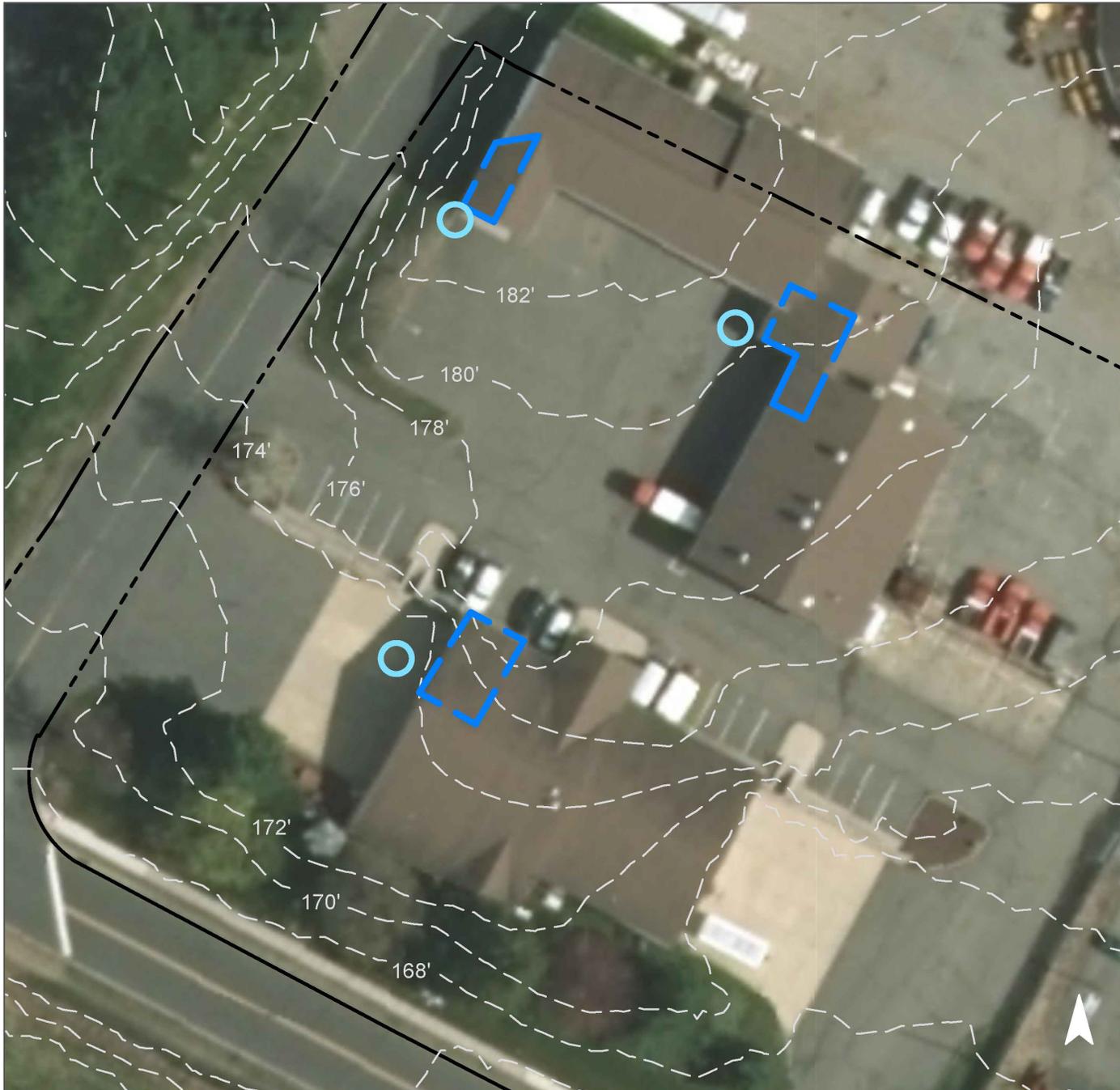


Three cisterns can be installed to capture runoff from the rooftops. The water can then be reused to provide a source of non-potable water for the first aid squad to wash vehicles. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
85	135,943	6.6	68.7	624.2	0.106	3.73

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
Rainwater harvesting	0.042	7	1,250	0.04	1,250 (gal)	\$2,500

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Holmdel First Aid Squad**

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



# HOLMDEL HIGH SCHOOL & WILLIAM R. SATZ MIDDLE SCHOOL



**Subwatershed:** Hop Brook

**Site Area:** 2,856,767 sq. ft.

**Address:** 36 Crawfords Corner Road  
Holmdel, NJ 07733

**Block and Lot:** Block 26, Lot 5.01

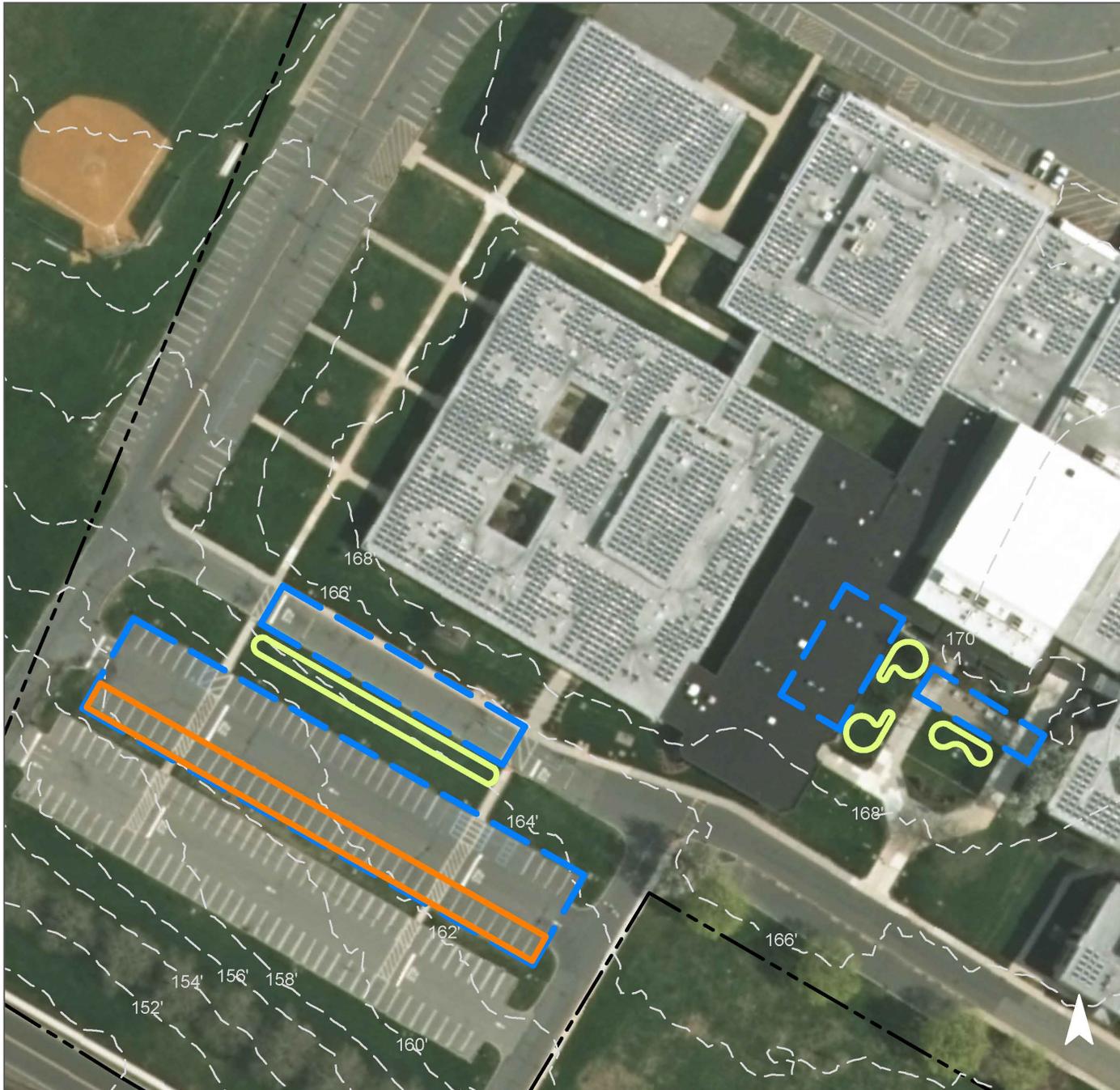


Two bioretention systems can be installed to treat the rooftop drainage area, and an additional one can be installed to capture, treat, and infiltrate runoff from a portion of the driveway. A section of parking spaces can be converted to porous pavement to capture and infiltrate runoff from the parking 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"
33	934,927	45.1	472.2	4,292.6	0.728	25.64

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	0.274	46	20,080	0.75	2,625	\$13,125
Pervious pavement	0.586	98	42,980	1.62	5,970	\$149,250

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Holmdel High School & William R. Satz Middle School**

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



# HOLMDEL MUNICIPAL COURT & GATEWAY CHURCH OF CHRIST



**Subwatershed:** Hop Brook

**Site Area:** 573,985 sq. ft.

**Address:** 4 Crawfords Corner Road  
Holmdel, NJ 07733

**Block and Lot:** Block 27, Lot 10

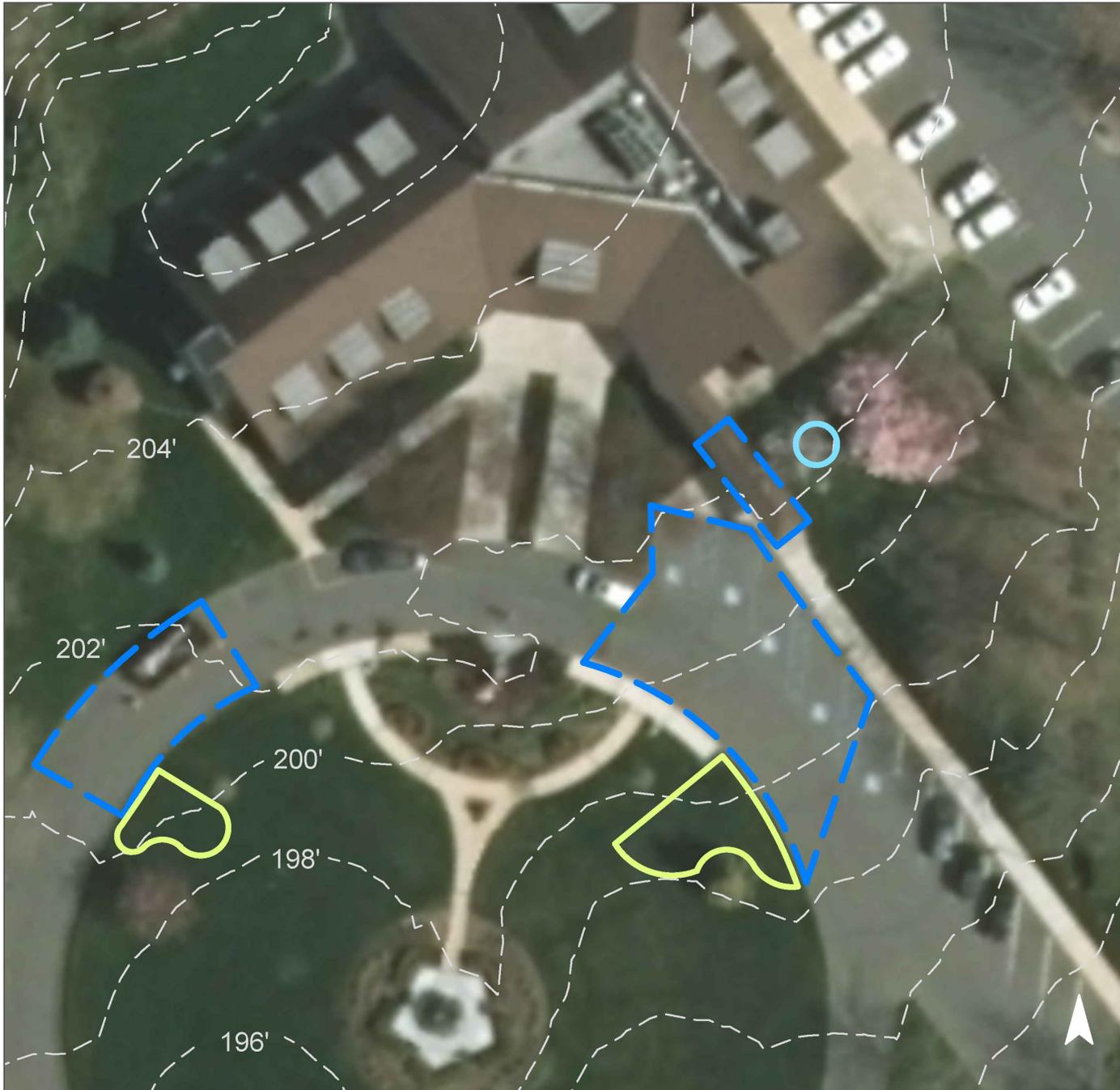


At the municipal court, two identical rain gardens can be installed on either side of the central turfgrass area in the front of the building to treat the parking lot drainage area on both sides. A small rainwater harvesting cistern can be installed near the entrance to capture runoff from the roof. The water can be reused to water the lawn or for other non-potable purposes. At the rear entrance to the church, two rain gardens can be installed to capture, treat, and infiltrate runoff from the rooftop. 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"
44	258,596	12.5	130.6	1,187.3	0.201	7.09

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	0.179	30	13,150	0.49	1,140	\$5,700
Rainwater harvesting	0.009	2	280	0.01	280 (gal)	\$560

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Holmdel Municipal Court**

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



# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Gateway Church of Christ**

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





# VIETNAM ERA MUSEUM AND EDUCATION CENTER



**Subwatershed:** Hop Brook  
**Site Area:** 863,936 sq. ft.  
**Address:** 1 Memorial Lane  
Holmdel, NJ 07733  
**Block and Lot:** Block 47, Lot 2.01

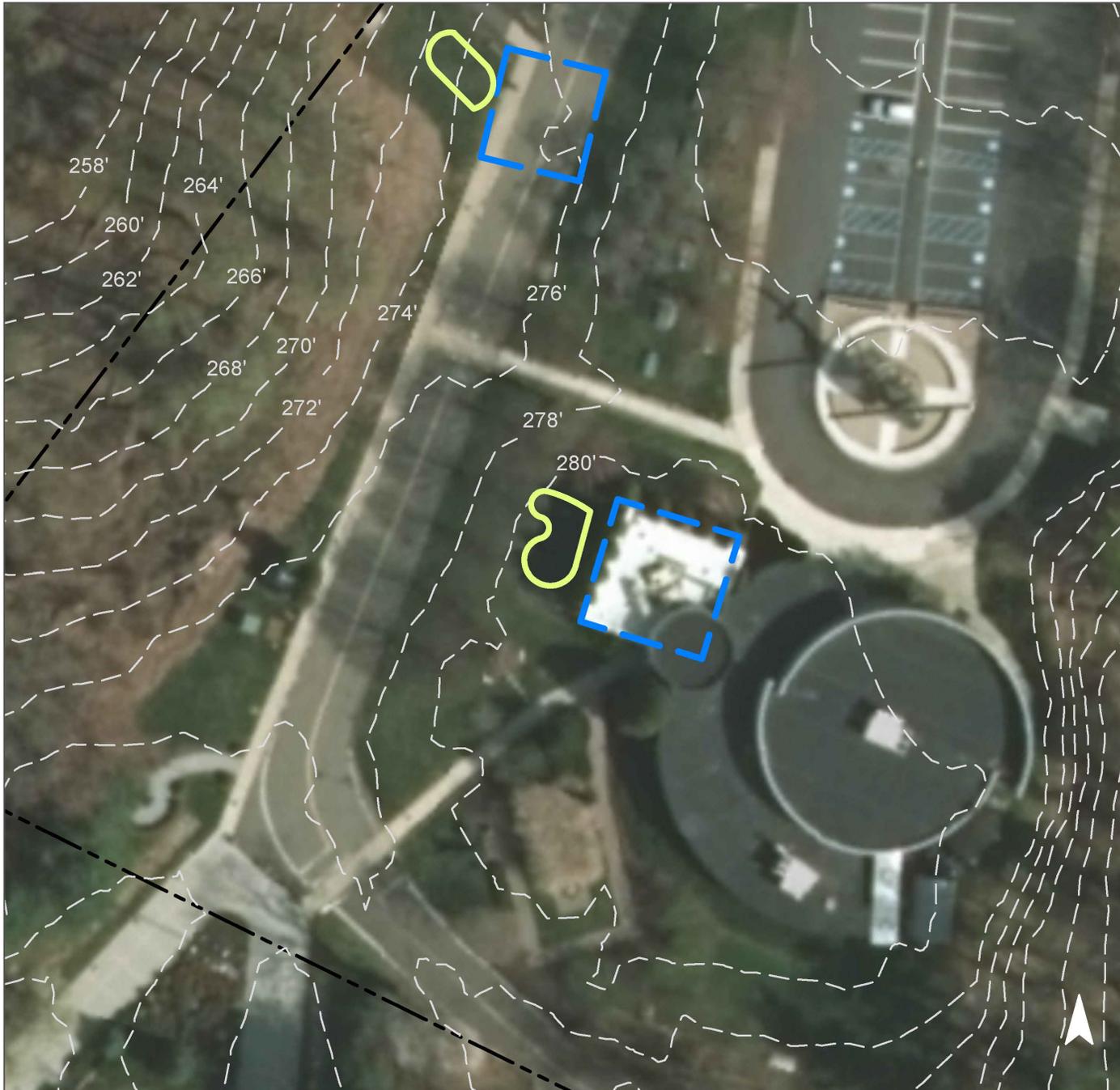


Two bioretention systems can be installed to capture, treat, and infiltrate both the rooftop drainage area and runoff from the road. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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	65,763	3.2	33.2	301.9	0.051	1.80

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	0.075	13	5,510	0.21	725	\$3,625

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Vietnam Era Museum and Education Center**

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



# VILLAGE ELEMENTARY SCHOOL



**Subwatershed:** Hop Brook

**Site Area:** 1,095,449 sq. ft.

**Address:** 67 McCampbell Road  
Holmdel, NJ 07733

**Block and Lot:** Block 8, Lot 3

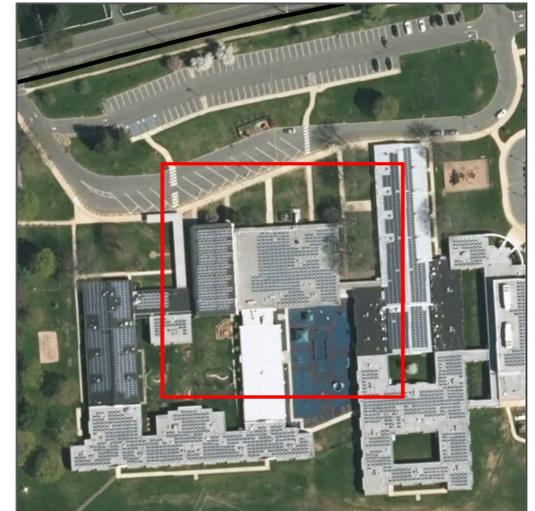
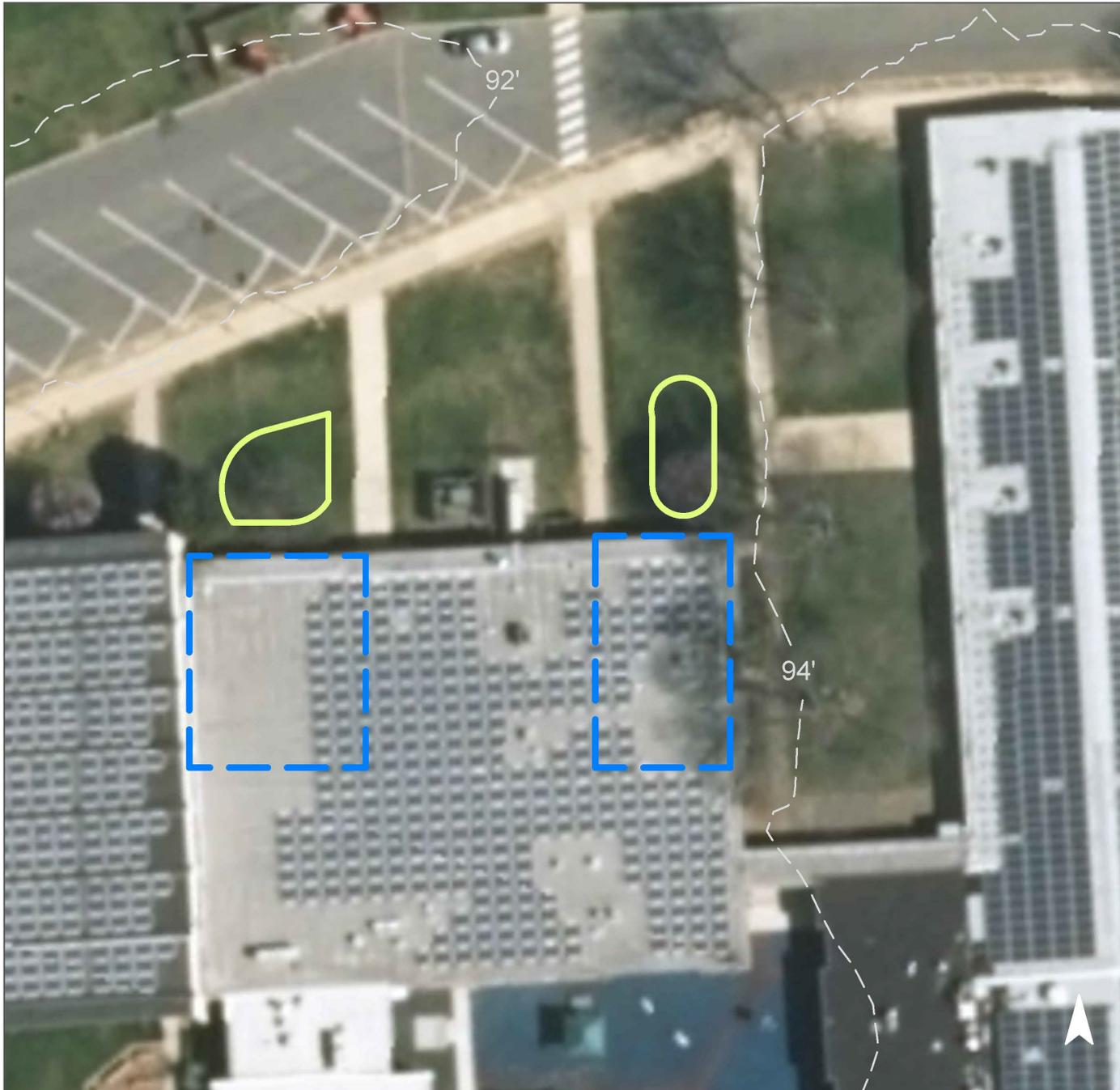


Two bioretention systems can be installed to capture, treat, and infiltrate runoff from the rooftop drainage area and serve as educational demonstration projects. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
32	353,159	17.0	178.4	1,621.5	0.275	9.69

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	0.120	20	8,770	0.33	1,150	\$5,750

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Village Elementary School**

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



# INDIAN HILL SCHOOL



**Subwatershed:** Matawan Creek

**Site Area:** 435,962 sq. ft.

**Address:** 735 Holmdel Road  
Holmdel, NJ 07733

**Block and Lot:** Block 46, Lot 53

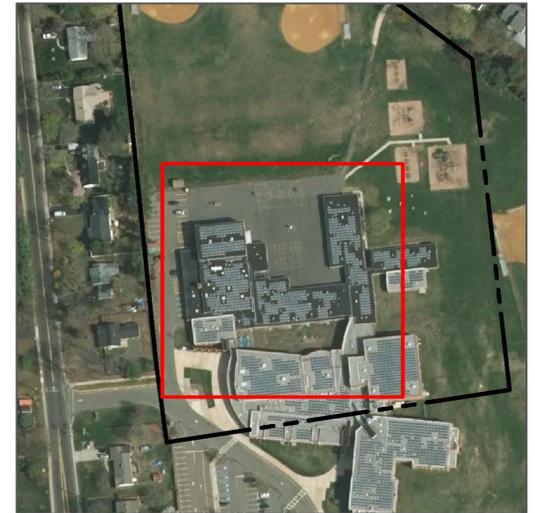
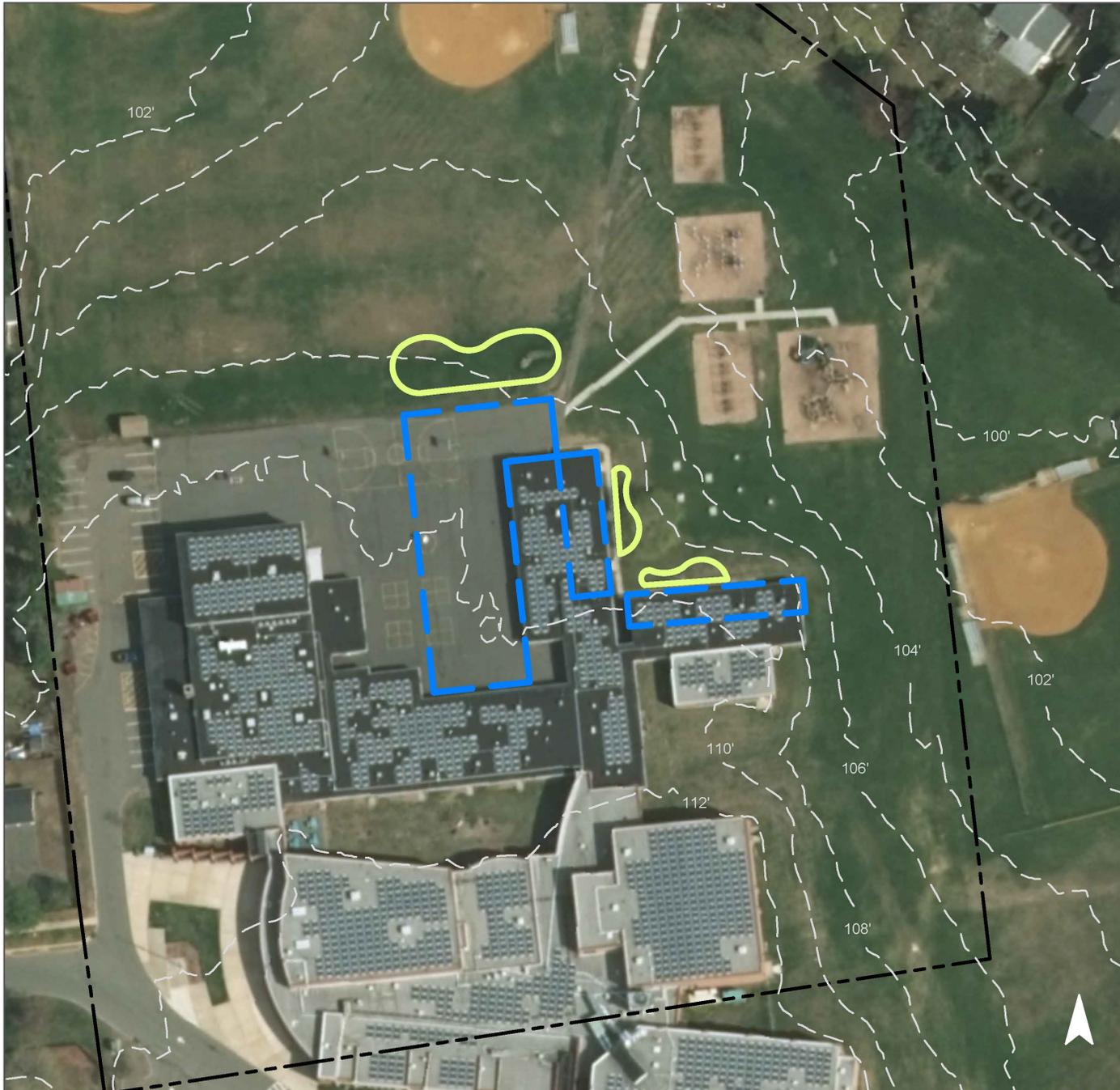


A rain garden can be installed adjacent to the northeast corner of the parking lot to capture, treat, and infiltrate runoff from the parking lot. Additionally, two raingardens can be installed to treat the rooftops of the adjacent buildings. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
35	152,480	7.4	77.0	700.1	0.119	4.18

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
Bioretention systems	0.447	75	32,780	1.23	4,285	\$21,425

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Indian Hill School

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



# KIMISIS TIS THEOTOKOU CHURCH



**Subwatershed:** Matawan Creek  
**Site Area:** 275,133 sq. ft.  
**Address:** 20 Hillcrest Road  
Holmdel, NJ 07733  
**Block and Lot:** Block 32, Lot 1

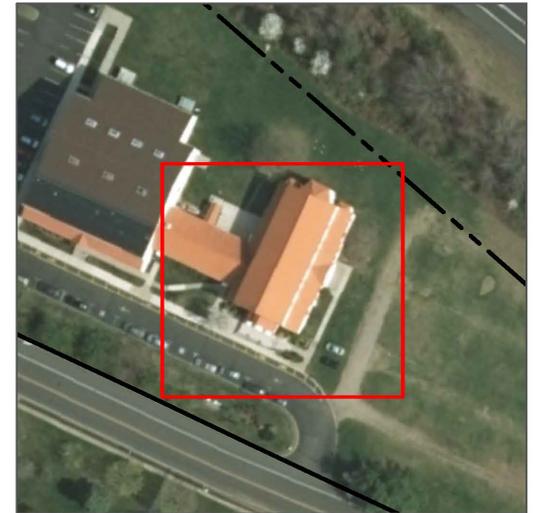
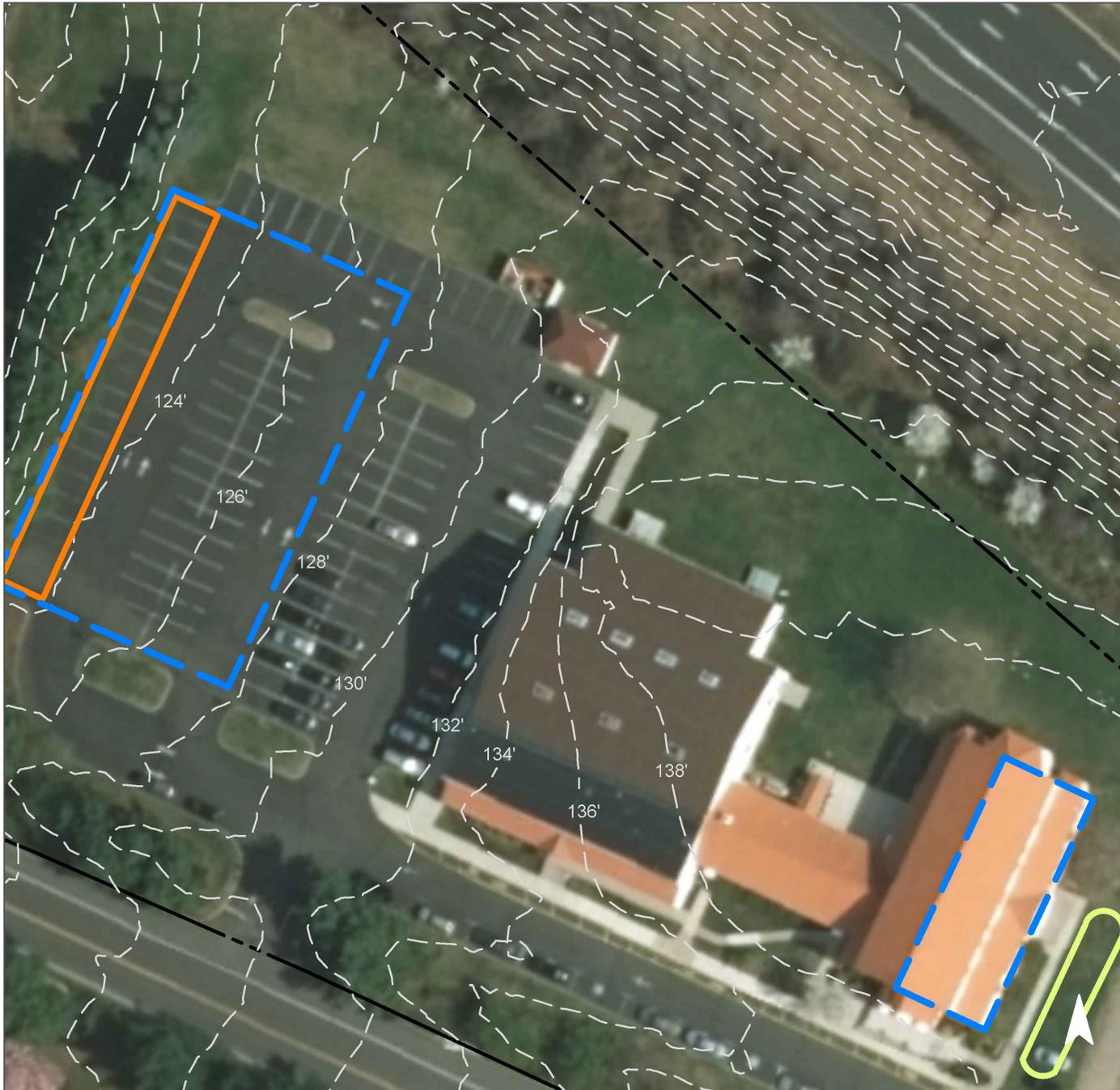


A rain garden can be installed east of the building to capture, treat, and infiltrate runoff from the rooftop. A section of parking spaces can be converted to porous pavement to capture and infiltrate runoff from the parking lot. A preliminary soil assessment suggests that the soils have suitable drainage 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	99,717	4.8	50.4	457.8	0.078	2.73

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
Bioretention system	0.099	17	7,260	0.27	950	\$4,750
Pervious pavement	0.429	72	31,480	1.18	2,940	\$73,500

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Kimisis Tis Theotokou Church**

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



# SAINT BENEDICT SCHOOL AND CHURCH



**Subwatershed:** Matawan Creek  
**Site Area:** 985,133 sq. ft.  
**Address:** 165 Bethany Road  
Holmdel, NJ 07733  
**Block and Lot:** Block 30.09, Lot 6.01

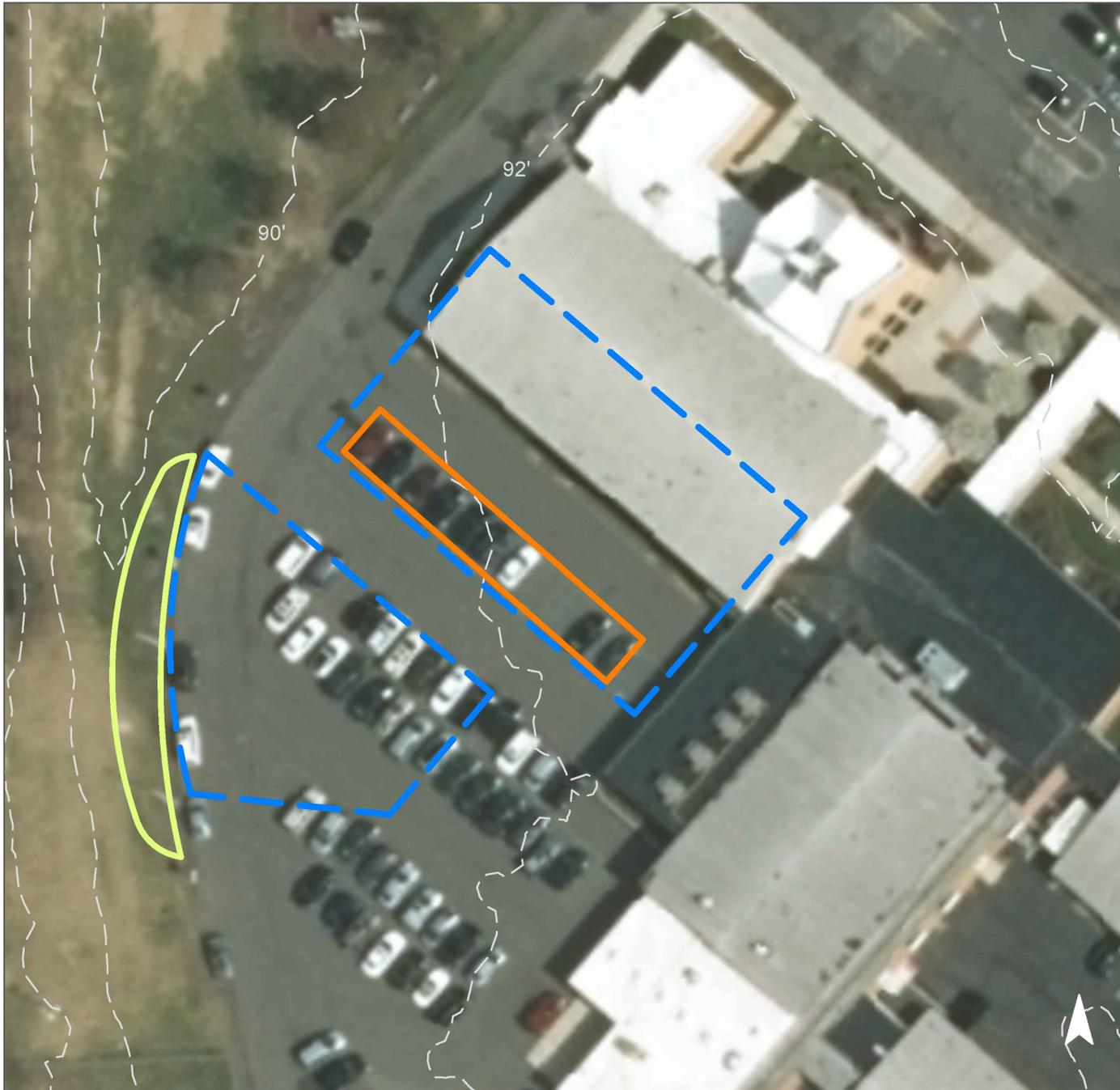


A section of parking spaces can be converted to porous pavement to capture and infiltrate runoff from the rooftop and parking lot. A rain garden can be installed in the turfgrass adjacent to the parking lot to capture, treat, and infiltrate runoff from the parking lot. A preliminary soil assessment suggests 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"
40	395,887	19.1	199.9	1,817.7	0.308	10.86

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.190	32	13,960	0.52	1,825	\$9,125
Pervious pavement	0.296	50	21,740	0.82	2,030	\$50,750

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**St. Benedict School and Church**

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



# SAINT JOHN VIANNEY HIGH SCHOOL



**Subwatershed:** Matawan Creek

**Site Area:** 637,033 sq. ft.

**Address:** 540A Line Road  
Holmdel, NJ 07733

**Block and Lot:** Block 30.09, Lot 33



A rain garden can be installed north of the building to capture, treat, and infiltrate runoff from the rooftop drainage 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"
43	275,694	13.3	139.2	1,265.8	0.215	7.56

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.060	10	4,380	0.16	575	\$2,875

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Saint John Vianney High School**

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





### **c. Summary of Existing Conditions**



**Summary of Existing Conditions**

Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial)			Runoff Volumes from I.C.		Runoff Volumes from I.C.	
								TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
<b>CHINGARORA CREEK SITES</b>	<b>41.01</b>	<b>1,786,612</b>				<b>8.37</b>	<b>364,425</b>	<b>17.6</b>	<b>184.1</b>	<b>1,673.2</b>	<b>37,961</b>	<b>1,336,224</b>	<b>0.284</b>	<b>9.99</b>
1 <b>Ackerson Park</b> <b>Total Site Info</b>	12.64	550,557	46	64.09	11	1.34	58,326	2.8	29.5	267.8	6,076	213,864	0.045	1.60
2 <b>Holmdel Swim Club</b> <b>Total Site Info</b>	28.38	1,236,055	46	79	25	7.03	306,098	14.8	154.6	1,405.4	31,885	1,122,361	0.239	8.40
<b>HOP BROOK SITES</b>	<b>127.40</b>	<b>5,549,656</b>				<b>40.14</b>	<b>1,748,388</b>	<b>84.3</b>	<b>883.0</b>	<b>8,027.5</b>	<b>182,124</b>	<b>6,410,758</b>	<b>1.362</b>	<b>47.95</b>
3 <b>Holmdel First Aid Squad</b> <b>Total Site Info</b>	3.66	159,518	26	2	85	3.12	135,943	6.6	68.7	624.2	14,161	498,459	0.106	3.73
4 <b>Holmdel High School &amp; William R. Satz Middle School</b> <b>Total Site Info</b>	65.58	2,856,767	26	5.01	33	21.46	934,927	45.1	472.2	4,292.6	97,388	3,428,066	0.728	25.64
5 <b>Holmdel Municipal Court &amp; Gateway Church of Christ</b> <b>Total Site Info</b>	13.18	573,985	27	10	44	5.94	258,596	12.5	130.6	1,187.3	26,937	948,185	0.201	7.09
6 <b>Vietnam Era Museum &amp; Education Center</b> <b>Total Site Info</b>	19.83	863,936	47	2.01	8	1.51	65,763	3.2	33.2	301.9	6,850	241,132	0.051	1.80
7 <b>Village Elementary School</b> <b>Total Site Info</b>	25.15	1,095,449	8.14	3	32	8.11	353,159	17.0	178.4	1,621.5	36,787	1,294,916	0.275	9.69
<b>MATAWAN CREEK SITES</b>	<b>53.56</b>	<b>2,333,261</b>				<b>21.21</b>	<b>923,778</b>	<b>44.5</b>	<b>466.6</b>	<b>4,241.4</b>	<b>96,227</b>	<b>3,387,187</b>	<b>0.720</b>	<b>25.34</b>
8 <b>Indian Hill School</b> <b>Total Site Info</b>	10.01	435,962	46	53	35	3.50	152,480	7.4	77.0	700.1	15,883	559,092	0.119	4.18
9 <b>Kimisis Tis Theotokou Church</b> <b>Total Site Info</b>	6.32	275,133	32	1	36	2.29	99,717	4.8	50.4	457.8	10,387	365,629	0.078	2.73
10 <b>Saint Benedict School &amp; Church</b> <b>Total Site Info</b>	22.62	985,133	30.09	6.01	40	9.09	395,887	19.1	199.9	1,817.7	41,238	1,451,587	0.308	10.86
11 <b>Saint John Vianney High School</b> <b>Total Site Info</b>	14.62	637,033	30.09	33	43	6.33	275,694	13.3	139.2	1,265.8	28,718	1,010,879	0.215	7.56



#### **d. Summary of Proposed Green Infrastructure Practices**



**Summary of Proposed Green Infrastructure Practices**

Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area		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 %
	Area (SF)	Area (ac)									
<b>CHINGARORA CREEK SITES</b>	<b>10,727</b>	<b>0.25</b>	<b>0.279</b>	<b>47</b>	<b>20,510</b>	<b>0.77</b>				<b>\$32,280</b>	<b>2.9%</b>
<b>1 Ackerson Park</b>											
Bioretention system	3,495	0.08	0.091	15	6,680	0.25	1,656	\$5	SF	\$8,280	6.0%
Pervious pavement	5,375	0.12	0.140	23	10,280	0.39	960	\$25	SF	\$24,000	9.2%
<b>Total Site Info</b>	<b>5,375</b>	<b>0.12</b>	<b>0.140</b>	<b>23</b>	<b>10,280</b>	<b>0.39</b>				<b>\$24,000</b>	<b>9.2%</b>
<b>2 Holmdel Swim Club</b>											
Bioretention systems	5,352	0.12	0.139	23	10,230	0.38	1,656	\$5	SF	\$8,280	1.7%
<b>Total Site Info</b>	<b>5,352</b>	<b>0.12</b>	<b>0.139</b>	<b>23</b>	<b>10,230</b>	<b>0.38</b>				<b>\$8,280</b>	<b>1.7%</b>
<b>HOP BROOK SITES</b>	<b>49,295</b>	<b>1.13</b>	<b>1.284</b>	<b>215</b>	<b>92,020</b>	<b>3.45</b>	<b>0</b>			<b>\$180,510</b>	<b>2.8%</b>
<b>3 Holmdel First Aid Squad</b>											
Rainwater harvesting	1,600	0.04	0.042	7	1,250	0.04	1,250	\$2	gal	\$2,500	1.2%
<b>Total Site Info</b>	<b>1,600</b>	<b>0.04</b>	<b>0.042</b>	<b>7</b>	<b>1,250</b>	<b>0.04</b>				<b>\$2,500</b>	<b>1.2%</b>
<b>4 Holmdel High School &amp; William R. Satz Middle School</b>											
Bioretention systems	10,500	0.24	0.274	46	20,080	0.75	2,625	\$5	SF	\$13,125	1.1%
Pervious pavement	22,480	0.52	0.586	98	42,980	1.62	5,970	\$25	SF	\$149,250	2.4%
<b>Total Site Info</b>	<b>32,980</b>	<b>0.76</b>	<b>0.859</b>	<b>144</b>	<b>63,060</b>	<b>2.37</b>				<b>\$162,375</b>	<b>3.5%</b>
<b>5 Holmdel Municipal Court &amp; Gateway Church of Christ</b>											
Bioretention systems	6,880	0.16	0.179	30	13,150	0.49	1,140	\$5	SF	\$5,700	2.7%
Rainwater harvesting	360	0.01	0.009	2	280	0.01	280	\$2	gal	\$560	0.1%
<b>Total Site Info</b>	<b>7,240</b>	<b>0.17</b>	<b>0.189</b>	<b>32</b>	<b>13,430</b>	<b>0.50</b>				<b>\$6,260</b>	<b>2.8%</b>
<b>6 Vietnam Era Museum and Education Center</b>											
Bioretention systems	2,885	0.07	0.075	13	5,510	0.21	725	\$5	SF	\$3,625	4.4%
<b>Total Site Info</b>	<b>2,885</b>	<b>0.07</b>	<b>0.075</b>	<b>13</b>	<b>5,510</b>	<b>0.21</b>				<b>\$3,625</b>	<b>4.4%</b>
<b>7 Village Elementary School</b>											
Bioretention systems	4,590	0.11	0.120	20	8,770	0.33	1,150	\$5	SF	\$5,750	1.3%
<b>Total Site Info</b>	<b>4,590</b>	<b>0.11</b>	<b>0.120</b>	<b>20</b>	<b>8,770</b>	<b>0.33</b>				<b>\$5,750</b>	<b>1.3%</b>

**Summary of Proposed Green Infrastructure Practices**

Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area		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 %
	Area (SF)	Area (ac)									
<b>MATAWAN CREEK SITES</b>	<b>58,370</b>	<b>1.34</b>	<b>1.521</b>	<b>255</b>	<b>111,600</b>	<b>4.18</b>				<b>\$162,425</b>	<b>6.3%</b>
8 <b>Indian Hill School</b>											
Bioretention systems	17,150	0.39	0.447	75	32,780	1.23	4,285	\$5	SF	\$21,425	11.2%
<b>Total Site Info</b>	<b>17,150</b>	<b>0.39</b>	<b>0.447</b>	<b>75</b>	<b>32,780</b>	<b>1.23</b>				<b>\$21,425</b>	<b>11.2%</b>
9 <b>Kimisis Tis Theotokou Church</b>											
Bioretention system	3,795	0.09	0.099	17	7,260	0.27	950	\$5	SF	\$4,750	3.8%
Pervious pavement	16,465	0.38	0.429	72	31,480	1.18	2,940	\$25	SF	\$73,500	16.5%
<b>Total Site Info</b>	<b>20,260</b>	<b>0.47</b>	<b>0.528</b>	<b>88</b>	<b>38,740</b>	<b>1.45</b>				<b>\$78,250</b>	<b>20.3%</b>
10 <b>Saint Benedict School and Church</b>											
Bioretention system	7,300	0.17	0.190	32	13,960	0.52	1,825	\$5	SF	\$9,125	1.8%
Pervious pavement	11,370	0.26	0.296	50	21,740	0.82	2,030	\$25	SF	\$50,750	2.9%
<b>Total Site Info</b>	<b>18,670</b>	<b>0.43</b>	<b>0.486</b>	<b>81</b>	<b>35,700</b>	<b>1.34</b>				<b>\$59,875</b>	<b>4.7%</b>
11 <b>Saint John Vianney High School</b>											
Bioretention system	2,290	0.05	0.060	10	4,380	0.16	575	\$5	SF	\$2,875	0.8%
<b>Total Site Info</b>	<b>2,290</b>	<b>0.05</b>	<b>0.060</b>	<b>10</b>	<b>4,380</b>	<b>0.16</b>				<b>\$2,875</b>	<b>0.8%</b>