RUTGERS
New Jersey Agricultural Experiment Station

Draft

Impervious Cover Reduction Action Plan for Summit, Union County, New Jersey

Prepared for Summit by the
Rutgers Cooperative Extension Water Resources Program

October 12, 2015

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Introduction

Located in Union County in central New Jersey, Summit covers approximately 6.0 square miles southwest of Millburn. Figures 1 and 2 illustrate that Summit is dominated by urban land uses. A total of 82.5% of the municipality's land use is classified as urban. Of the urban land in Summit, 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 Summit 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 Summit. Based upon the 2007 NJDEP land use/land cover data, approximately 30.9% of Summit has impervious cover. This level of impervious cover suggests that the streams in Summit are likely non-supporting streams[1].

Methodology

Summit contains portions of four 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

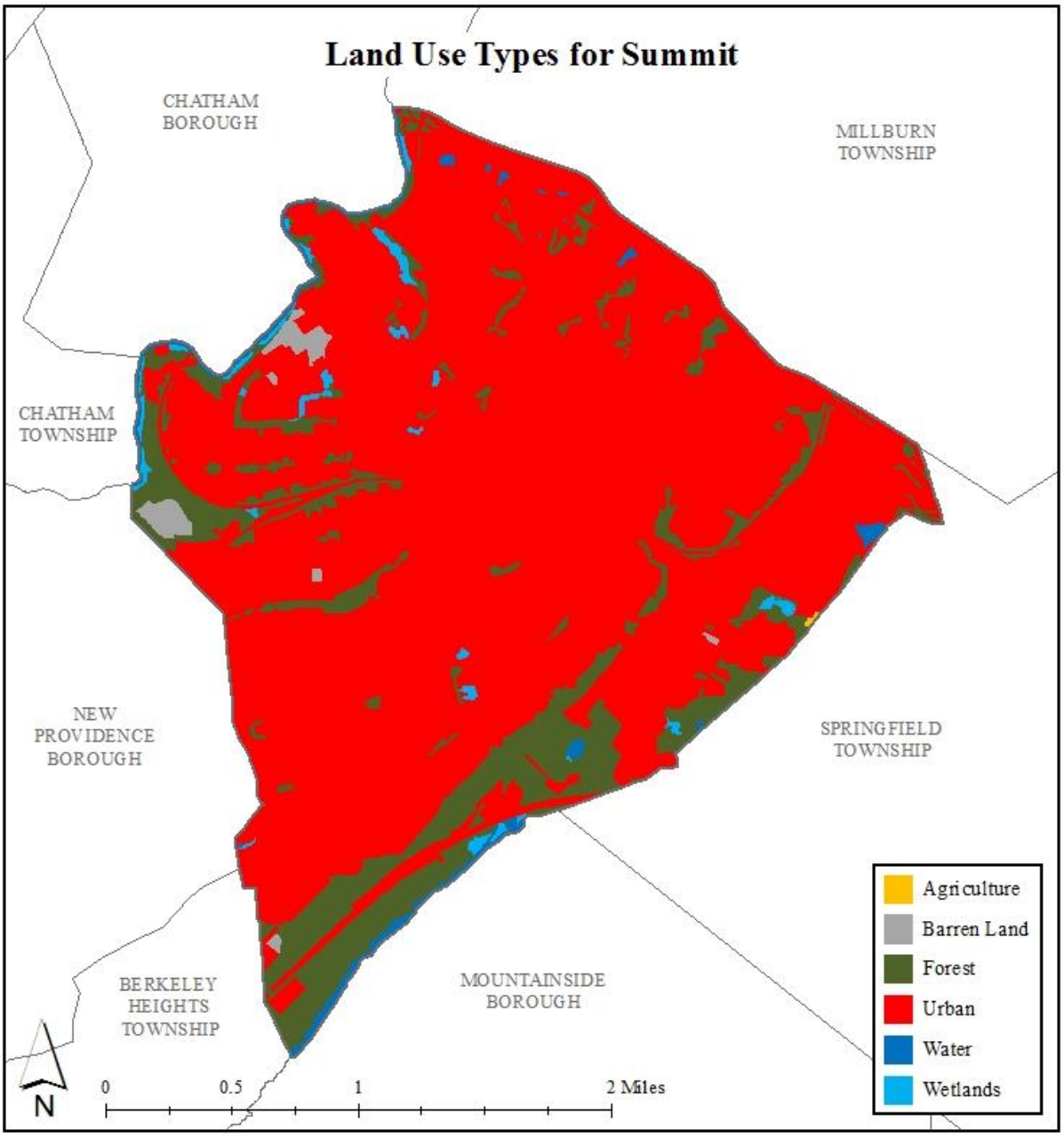


Figure 1: Map illustrating the land use in Summit

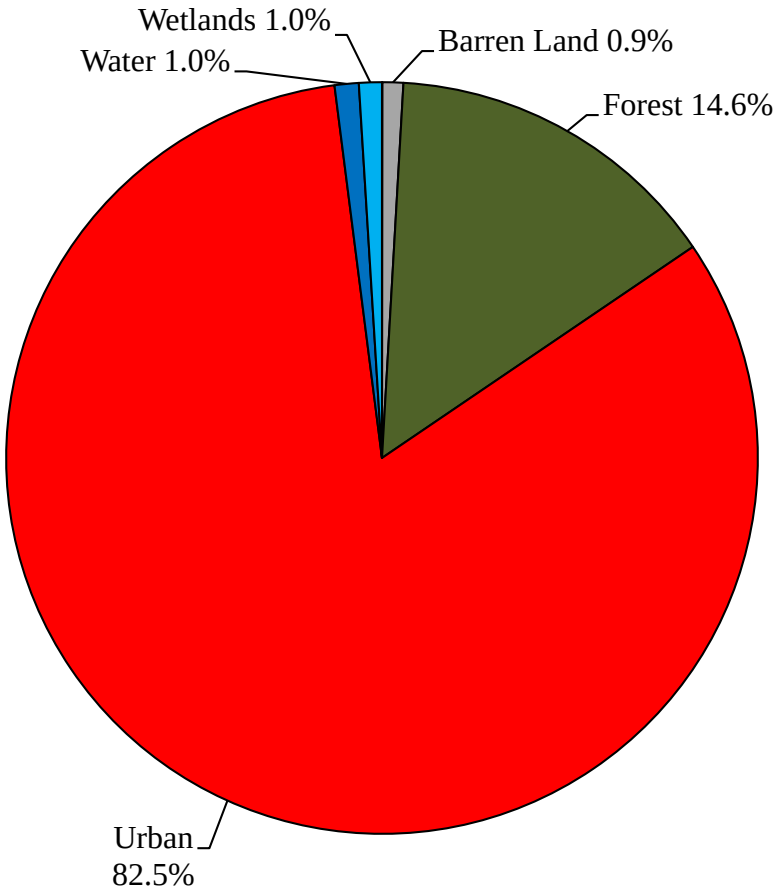


Figure 2: Pie chart illustrating the land use in Summit

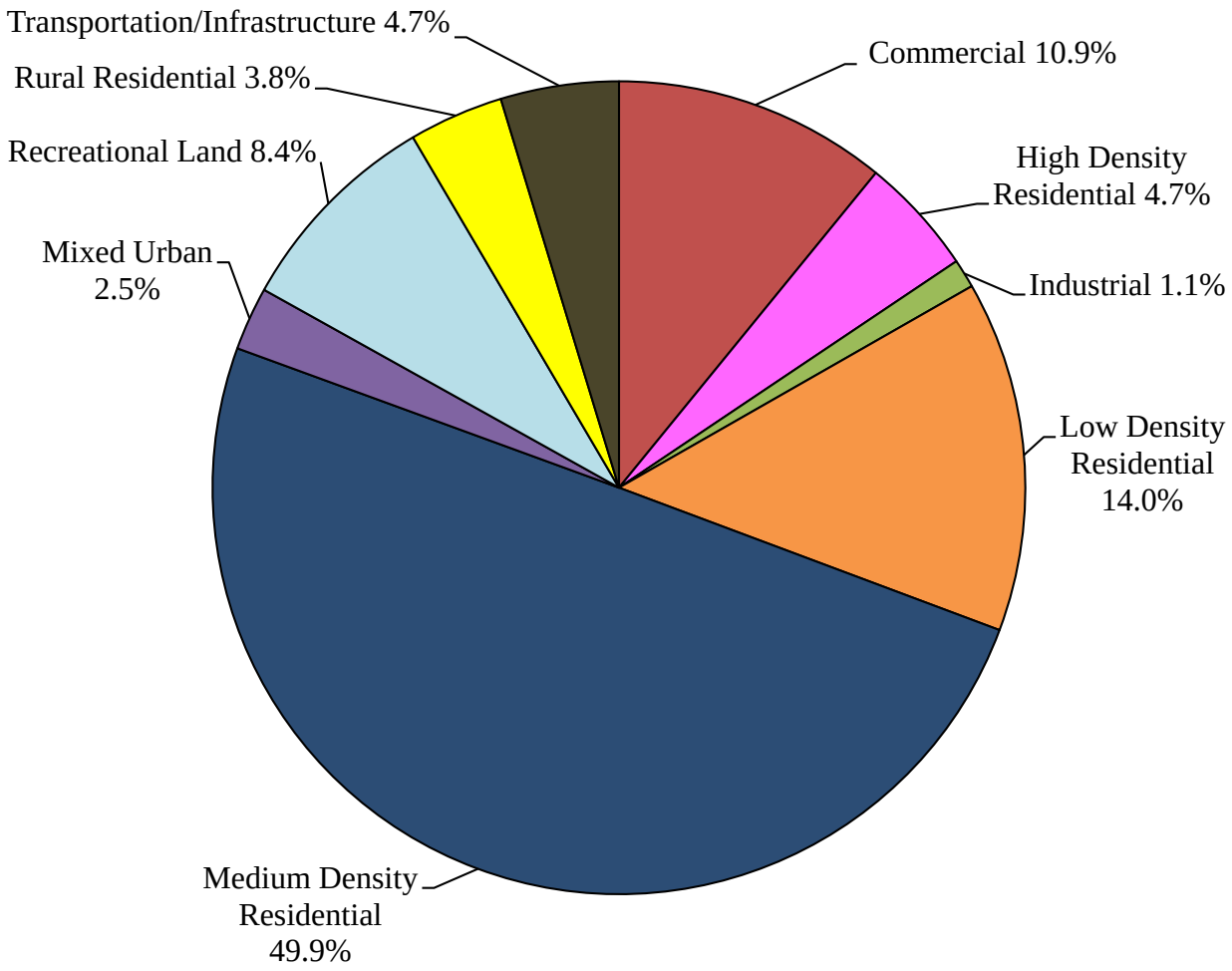


Figure 3: Pie chart illustrating the various types of urban land use in Summit

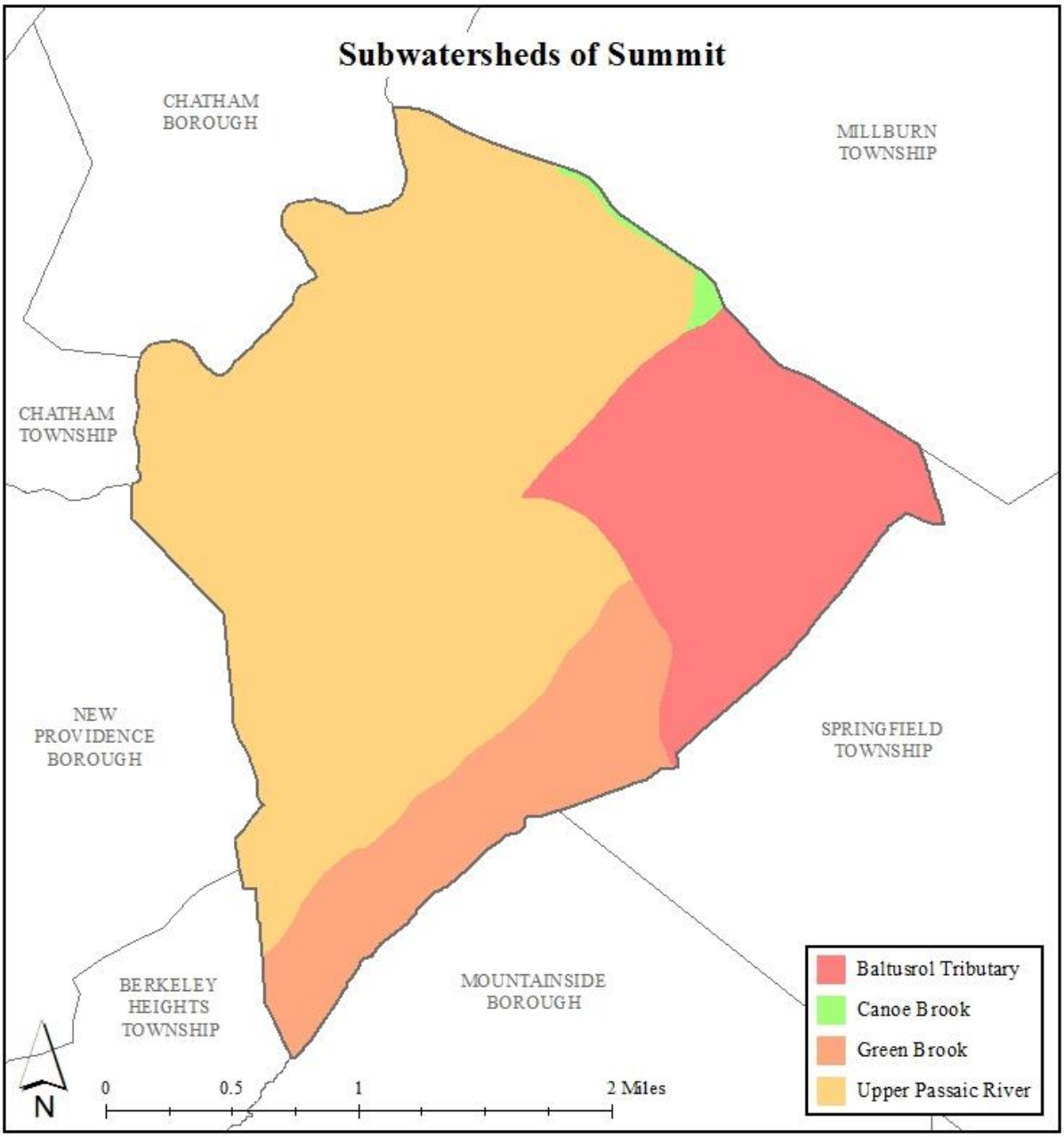


Figure 4: Map of the subwatersheds in Summit

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 Summit 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 Summit. Each practice is discussed below.

Disconnected downspouts

This is often referred to as simple disconnection. A downspout is simply disconnected, and 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*.

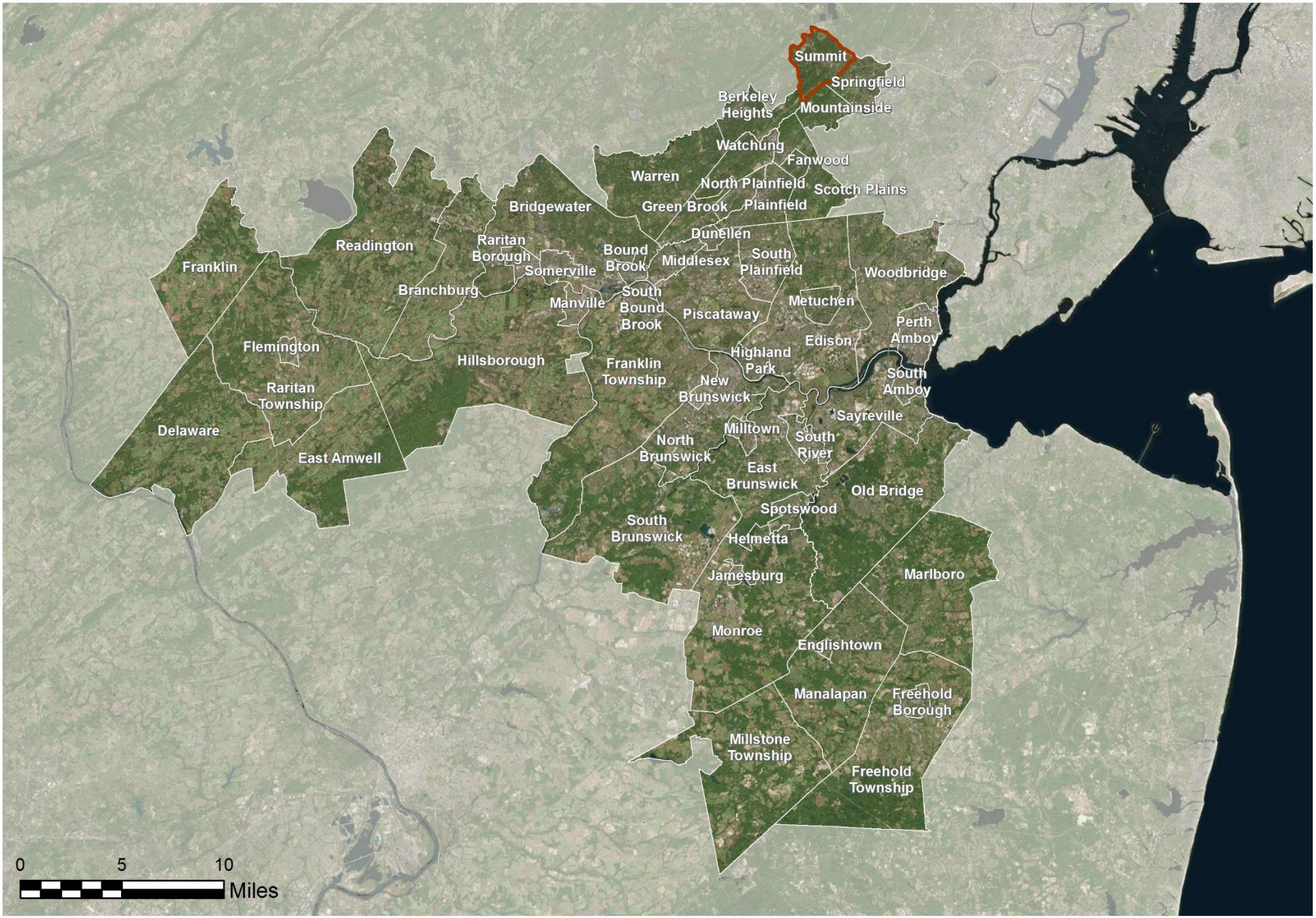
Conclusion

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.

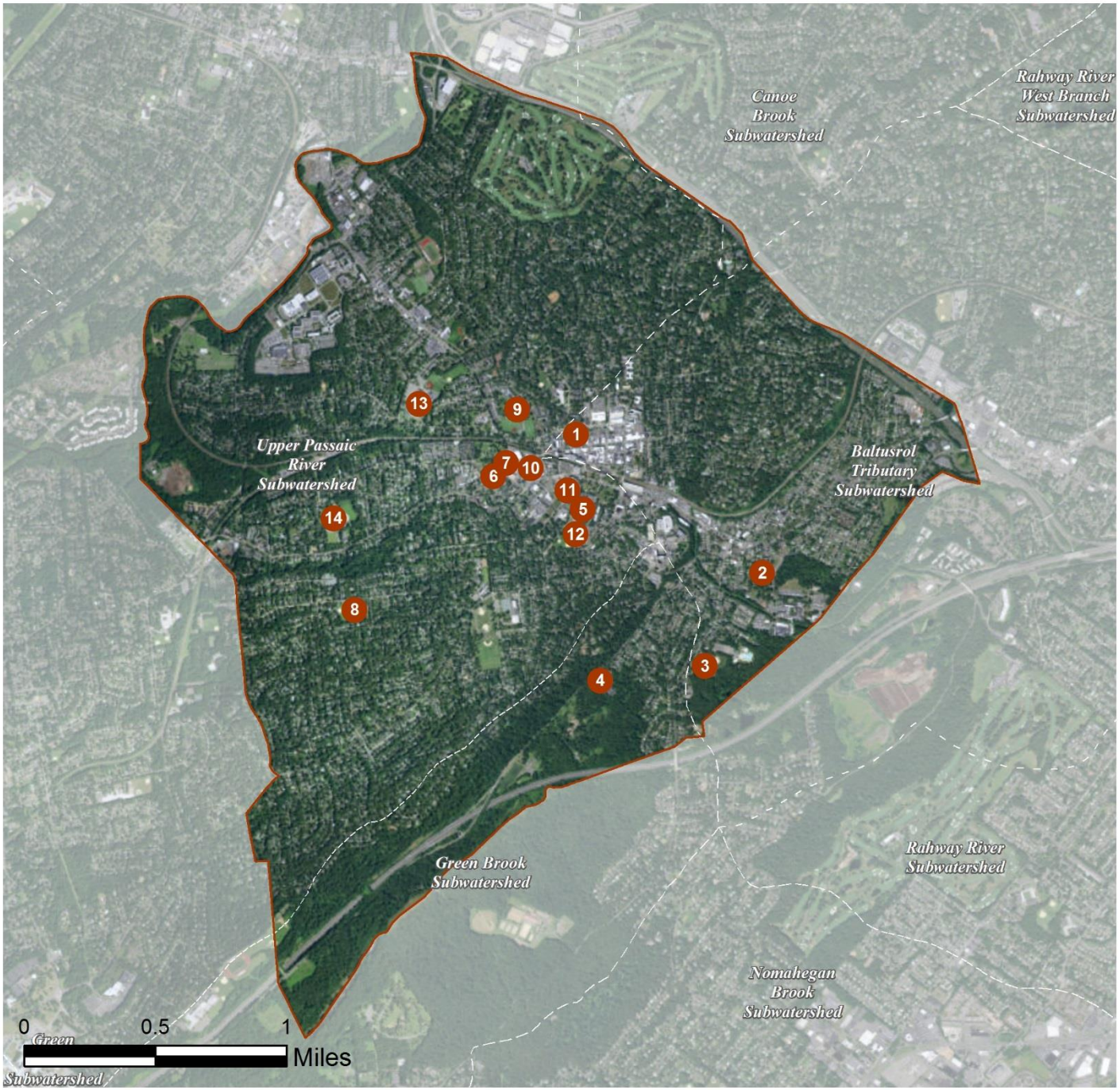
a. Overview Map of the Project

SUMMIT: CLIMATE RESILIENT GREEN INFRASTRUCTURE FOR THE RARITAN BASIN



b. Green Infrastructure Sites

SUMMIT: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE BALTUSROL TRIBUTARY SUBWATERSHED:

1. Daily Parking Lot 1
2. Edison Recreation Center
3. Jefferson Elementary School

SITES WITHIN THE GREEN BROOK SUBWATERSHED:

4. Fountain Baptist Church

SITES WITHIN THE UPPER PASSAIC RIVER SUBWATERSHED:

5. Central Presbyterian Church
6. Christ Church in Summit
7. Dominican Nuns
8. Franklin Elementary School
9. Kent Place School
10. Summit Building Inspector
11. Summit Free Public Library
12. Summit Middle School
13. Summit Senior High School
14. Wilson Primary Center

c. Proposed Green Infrastructure Concepts

DAILY PARKING LOT 1

Subwatershed: Baltusrol Tributary

Site Area: 47,496 sq. ft.

Address: Woodland Avenue & Deforest Avenue Summit, NJ 07901

Block and Lot: Block 1910, Lot 1

Parking spaces can be converted into pervious pavement to infiltrate parking lot 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"
95	45,122	2.2	22.8	207.2	0.035	1.24

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	0.574	96	43,474	1.63	6,724	$168,100

GREEN INFRASTRUCTURE RECOMMENDATIONS

Daily Parking Lot 1

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

0 30' 60'

EDISON RECREATION CENTER

Subwatershed: **Baltusrol Tributary**

Site Area: **292,598 sq. ft.**

Address: **100 Morris Avenue**
Summit, NJ 07901

Block and Lot: **Block 4101, Lot 27**

Parking spaces can be replaced with pervious pavement to 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"
10	28,831	1.4	14.6	132.4	0.022	0.79

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	0.256	43	19,388	0.73	2,606	$65,150

GREEN INFRASTRUCTURE RECOMMENDATIONS

Edison Recreation Center

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

0 25' 50'

JEFFERSON ELEMENTARY SCHOOL

Subwatershed: **Baltusrol Tributary**

Site Area: **369,634 sq. ft.**

Address: **110 Ashwood Avenue**
Summit, NJ 07901

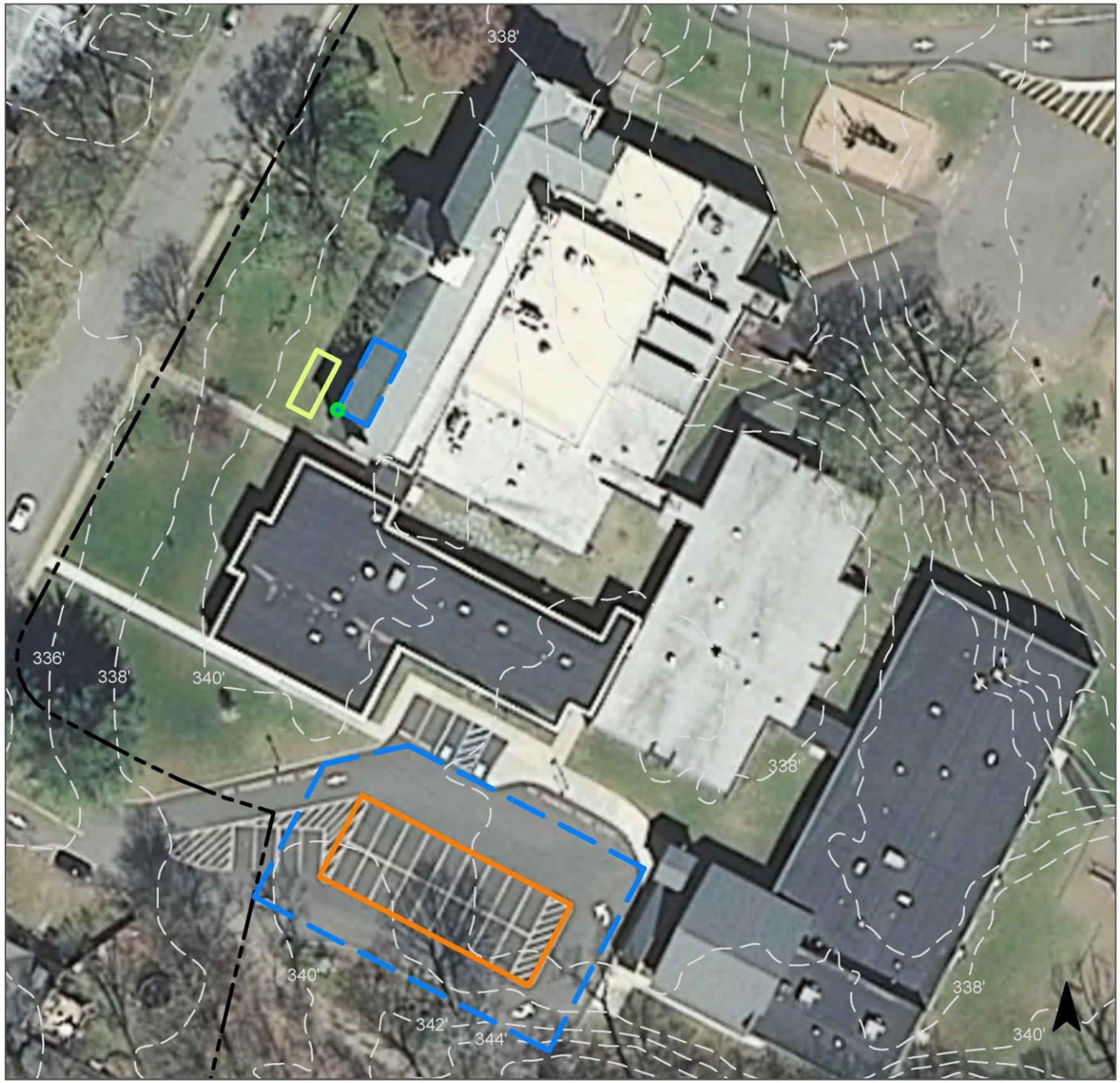
Block and Lot: **Block 4301, Lot 25**

A rain garden can be built to capture, treat, and infiltrate roof runoff. Parking spaces can also be repaved with pervious pavement to infiltrate additional stormwater. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
26	96,507	4.7	48.7	443.1	0.075	2.65

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	0.011	2	823	0.06	239	$1,195
Pervious pavement	0.268	45	20,308	0.76	3,340	$83,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Jefferson Elementary School

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

0 30' 60'

FOUNTAIN BAPTIST CHURCH

Subwatershed: Green Brook

Site Area: 113,831 sq. ft.

Address: 116 Glenside Avenue
Summit, NJ 07901

Block and Lot: Block 3312, Lot 3

A rain garden can be installed to capture, treat, and infiltrate roof runoff. Parking spaces can also be replaced with pervious pavement to infiltrate additional stormwater. 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"
63	71,636	3.5	36.2	328.9	0.056	1.96

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	0.037	6	2,835	0.11	400	$2,000
Pervious pavements	0.194	33	14,721	0.55	2,412	$60,300

GREEN INFRASTRUCTURE RECOMMENDATIONS

Fountain Baptist Church

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

0 30' 60'

CENTRAL PRESBYTERIAN CHURCH

Subwatershed: Upper Passaic River

Site Area: 136,781 sq. ft.

Address: 70 Maple Street
Summit, NJ 07901

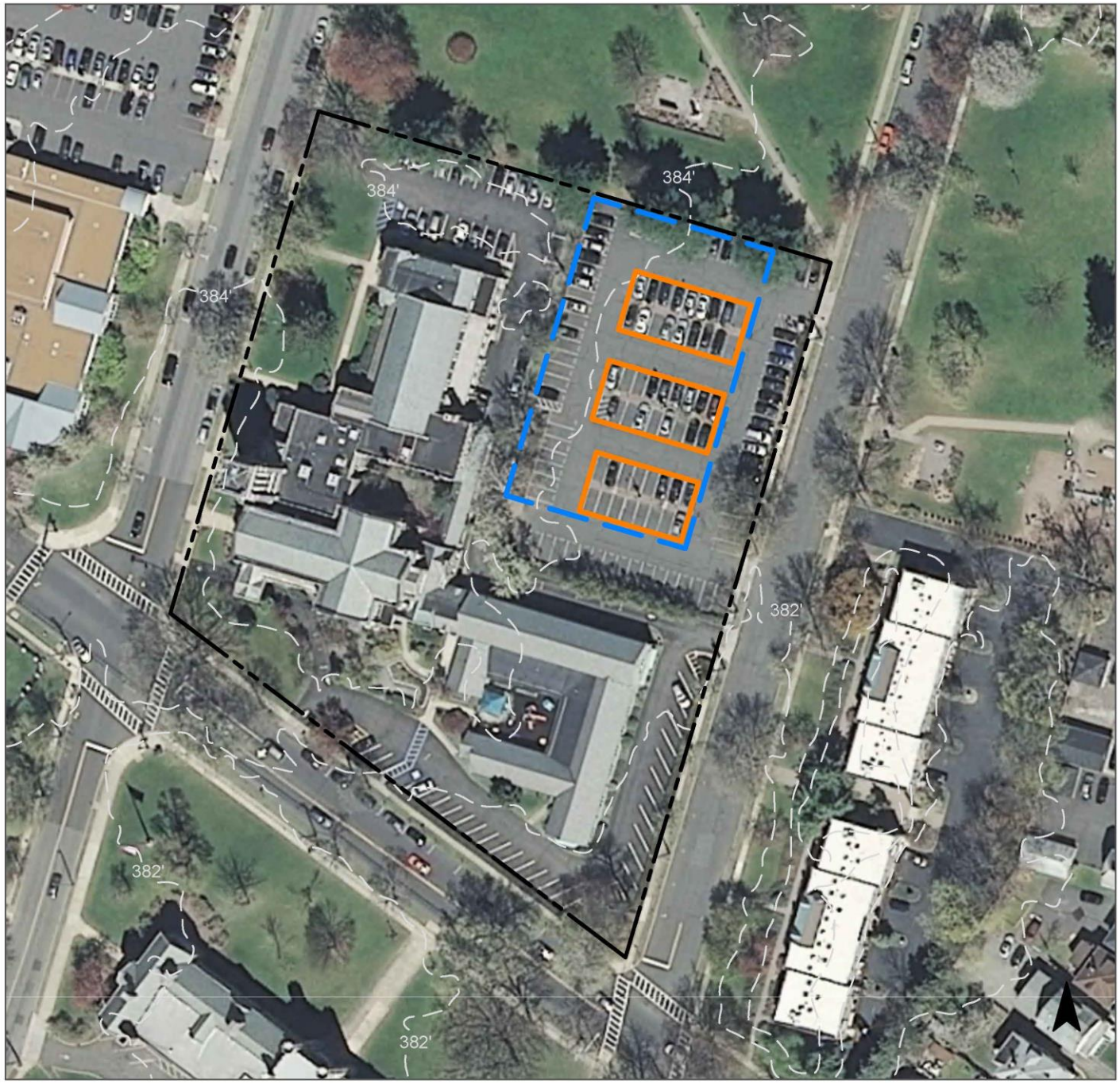
Block and Lot: Block 4401, Lot 1

Parking spaces can be replaced with pervious pavement to infiltrate stormwater. 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"
88	120,612	5.8	60.9	553.8	0.094	3.31

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	0.650	109	49,226	1.85	9,085	$227,125

GREEN INFRASTRUCTURE RECOMMENDATIONS



Central Presbyterian Church

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

0 50' 100'

CHRIST CHURCH IN SUMMIT

Subwatershed: Upper Passaic River

Site Area: 58,265 sq. ft.

Address: 561 Springfield Avenue
Summit, NJ 07901

Block and Lot: Block 1804, Lot 2

Parking spaces can be converted into pervious pavement to provide stormwater an opportunity to infiltrate. A rain garden can also be installed to 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"
55	32,045	1.5	16.2	147.1	0.025	0.88

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	0.004	1	314	0.01	75	$375
Pervious pavements	0.237	40	17,930	0.67	4,880	$122,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Christ Church in Summit

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

0 30' 60'

DOMINICAN NUNS

Subwatershed: **Upper Passaic River**

Site Area: **361,485 sq. ft.**

Address: **543 Springfield Avenue**
Summit, NJ 07901

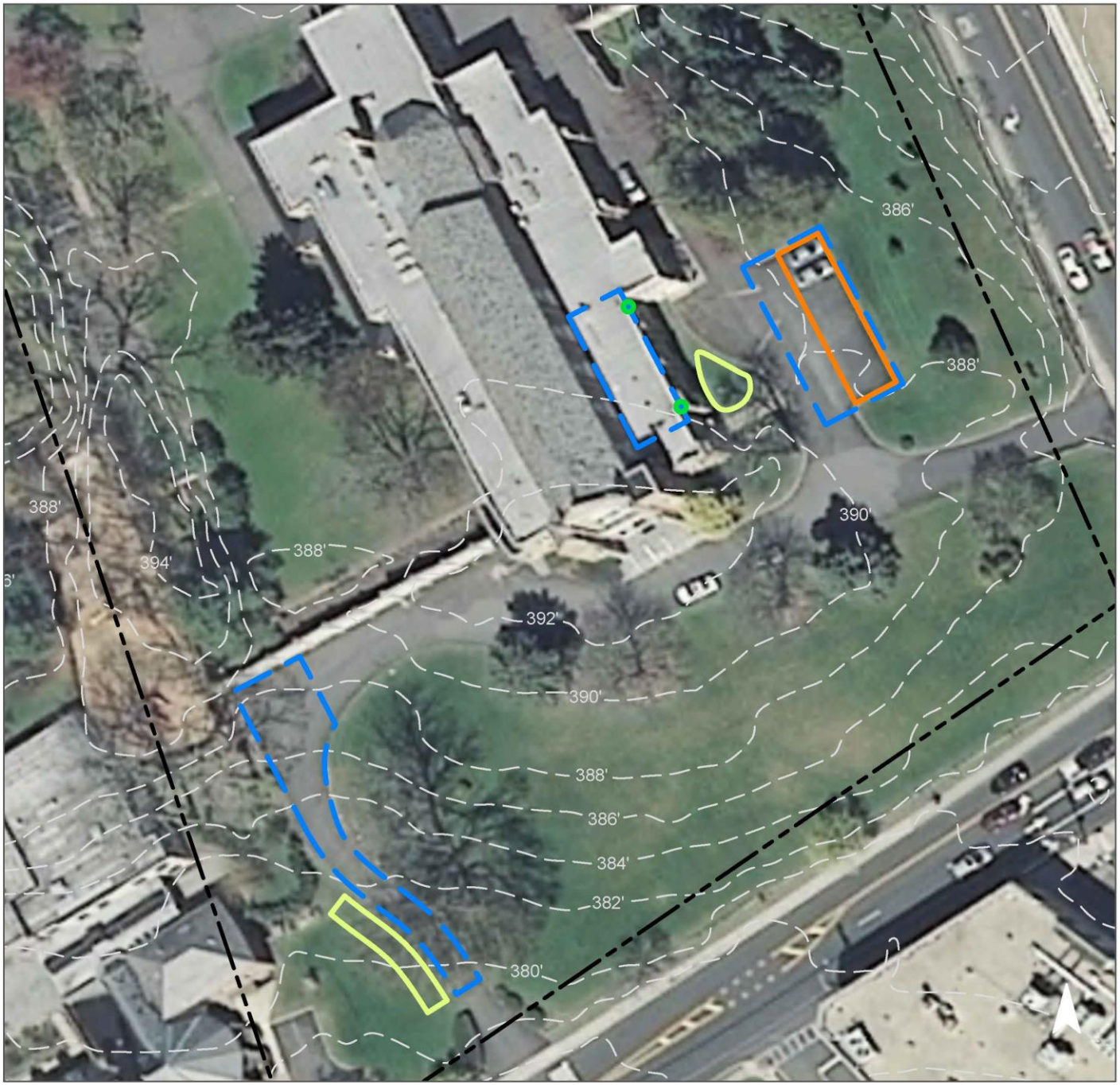
Block and Lot: **Block 1804, Lot 1**

Rain gardens can be installed to capture, treat, and infiltrate runoff. Parking spaces can be replaced with pervious pavement to infiltrate stormwater. 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"
35	125,015	6.0	63.1	574.0	0.097	3.43

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	0.034	6	2,603	0.10	295	$1,475
Pervious pavements	0.063	10	4,750	0.18	1,270	$31,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Dominican Nuns

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

0 30' 60'

FRANKLIN ELEMENTARY SCHOOL

Subwatershed: Upper Passaic River

Site Area: 268,024 sq. ft.

Address: 136 Blackburn Road
Summit, NJ 07901

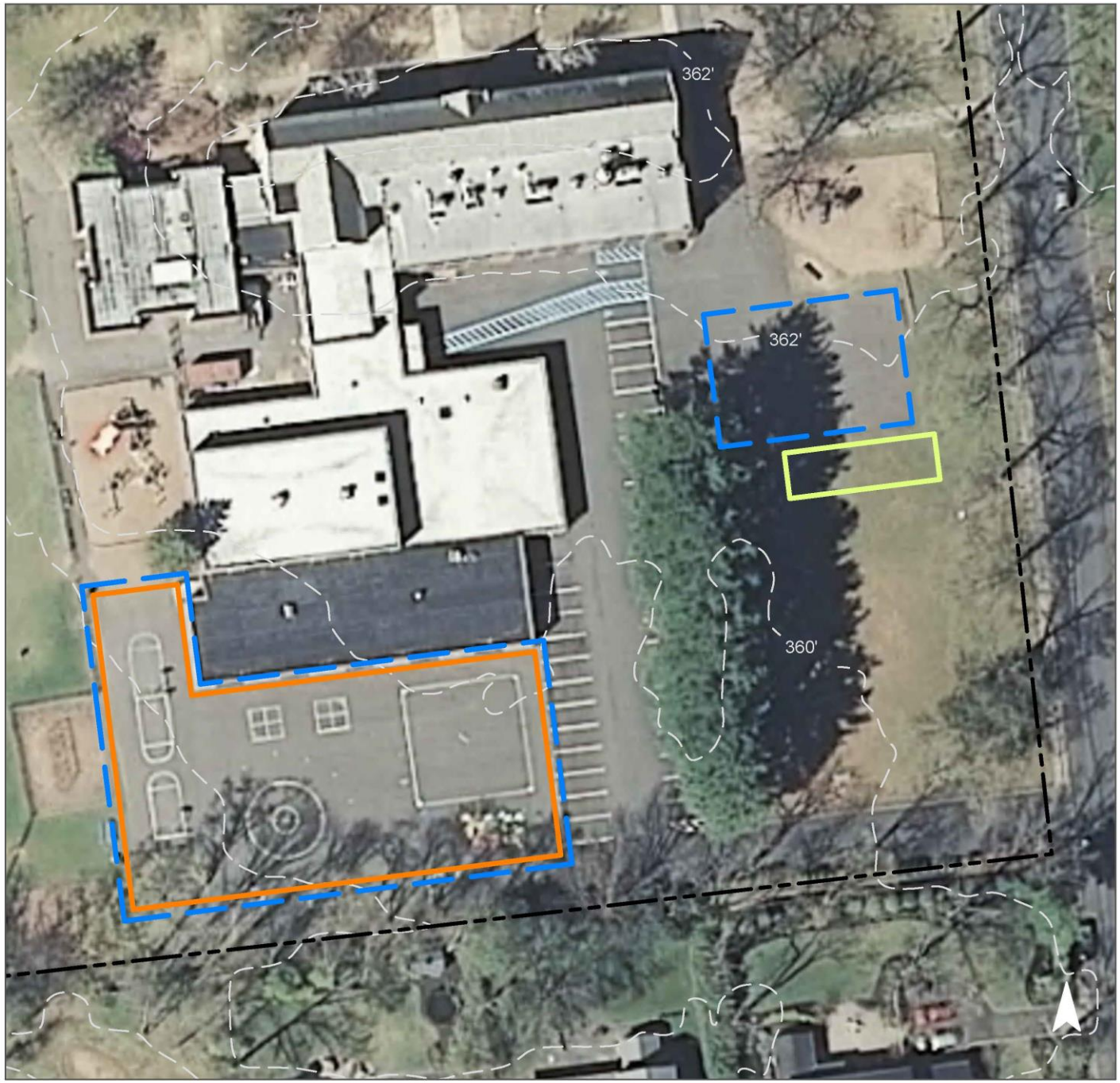
Block and Lot: Block 3004, Lot 49

The asphalt play area can be repaved using pervious pavement to allow stormwater an opportunity to infiltrate. A rain garden can be built to capture, treat, and infiltrate 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"
37	98,098	4.7	49.5	450.4	0.076	2.69

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	0.104	17	7,899	0.30	1,070	$5,350
Pervious pavements	0.394	66	29,883	1.12	15,140	$378,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Franklin Elementary School

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

0 30' 60'

KENT PLACE SCHOOL

Subwatershed: Upper Passaic River

Site Area: 754,443 sq. ft.

Address: 42 Norwood Avenue
Summit, NJ 07901

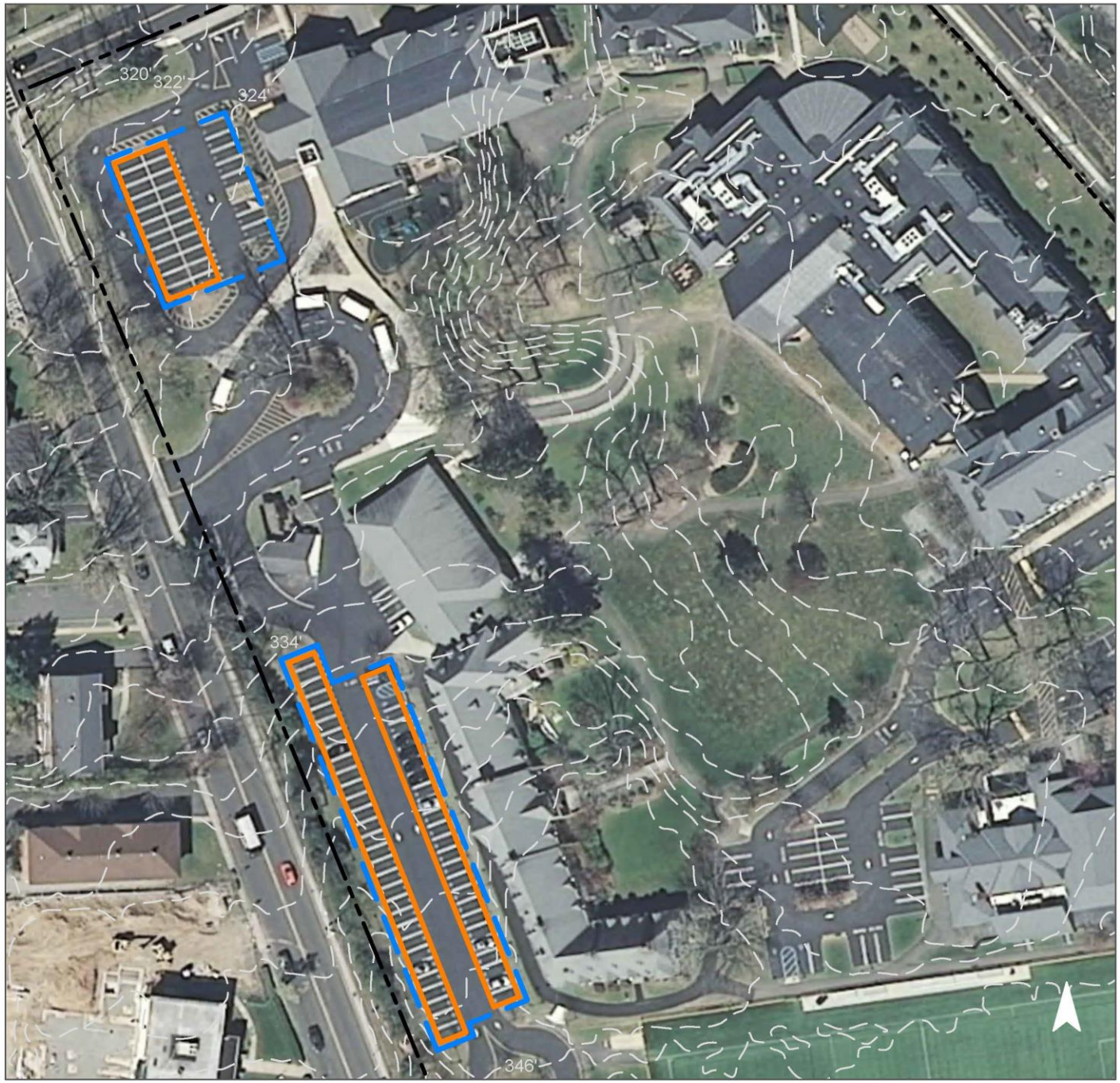
Block and Lot: Block 1901, Lot 1

Parking spaces can be replaced with porous asphalt to 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"
59	445,769	21.5	225.1	2,046.7	0.347	12.23

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
Pervious pavements	0.673	113	50,969	1.91	12,465	$311,625

GREEN INFRASTRUCTURE RECOMMENDATIONS



Kent Place School

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

0 50' 100'

SUMMIT BUILDING INSPECTOR

Subwatershed: Upper Passaic River

Site Area: 98,922 sq. ft.

Address: 512 Springfield Avenue
Summit, NJ 07901

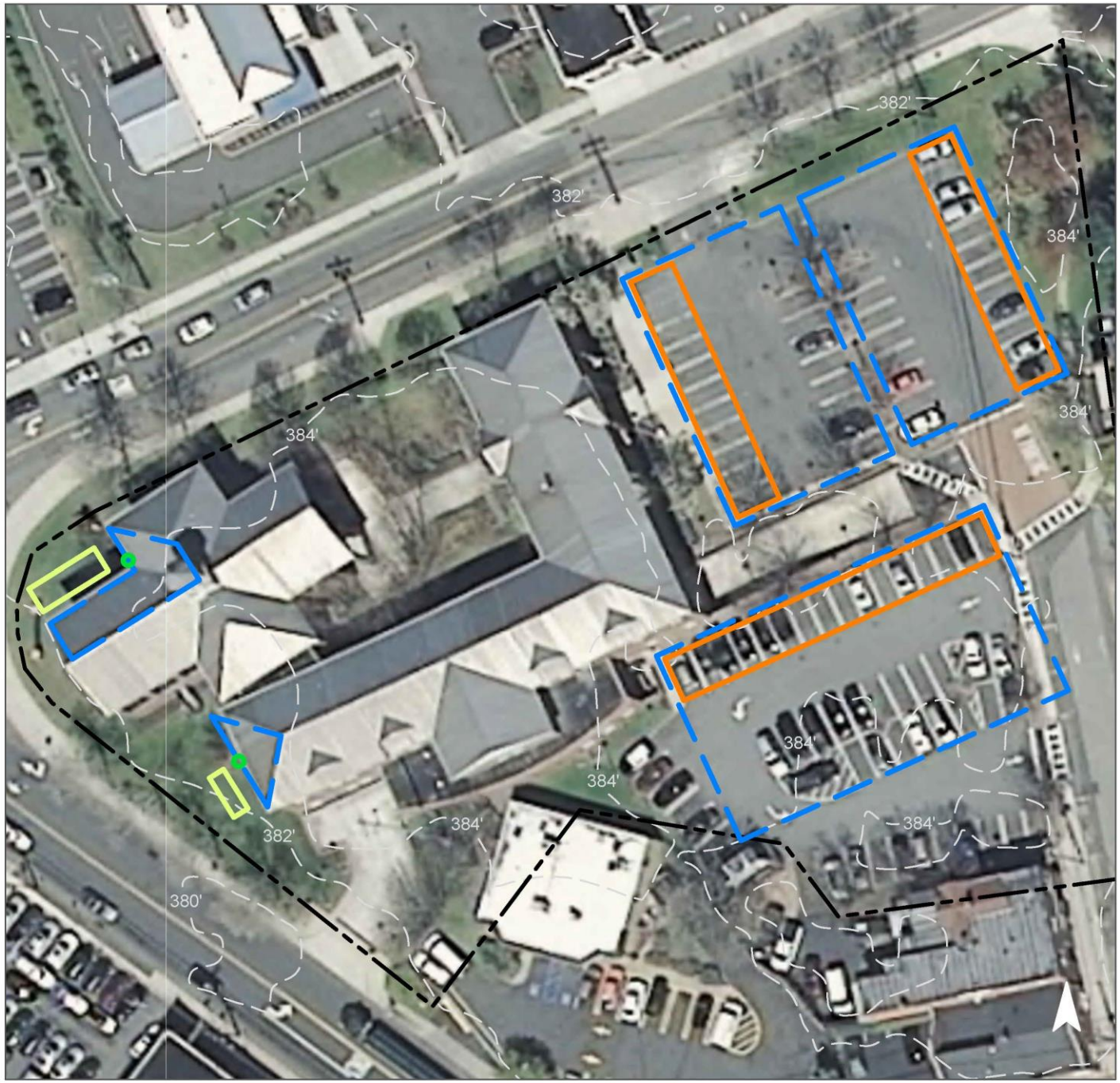
Block and Lot: Block 2701, Lot 1

Bioretention systems can be installed to capture, treat, and infiltrate roof runoff. Parking spaces can also be replaced with pervious pavement to infiltrate stormwater. 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"
94	92,903	4.5	46.9	426.6	0.072	2.55

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	0.041	7	3,082	0.12	437	$2,185
Pervious pavements	0.672	112	50,879	1.91	6,119	$152,975

GREEN INFRASTRUCTURE RECOMMENDATIONS



Summit Building Inspector

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

0 30' 60'

SUMMIT FREE PUBLIC LIBRARY

Subwatershed: Upper Passaic River

Site Area: 78,337 sq. ft.

Address: 75 Maple Street
Summit, NJ 07901

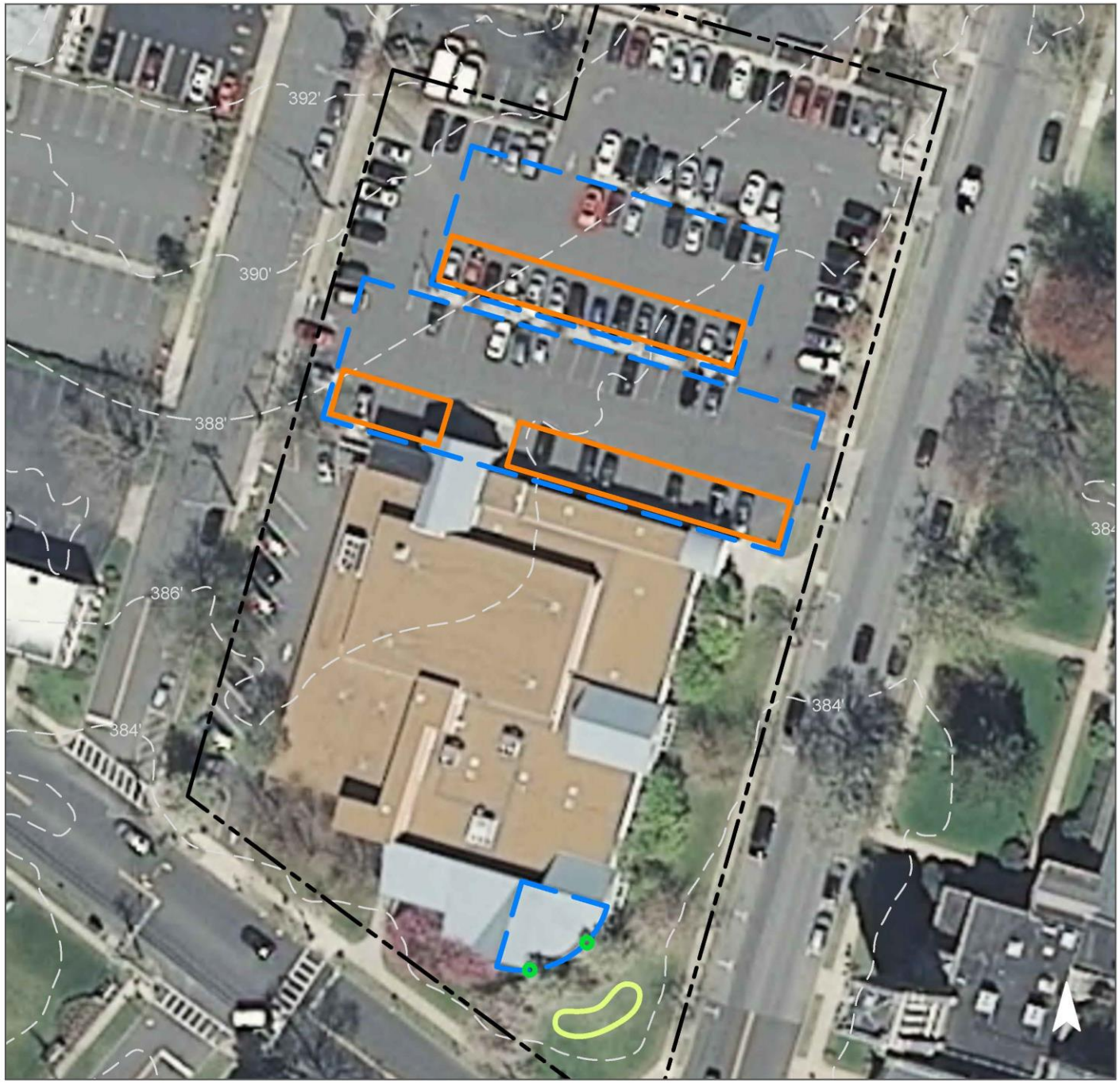
Block and Lot: Block 2705, Lot 2

Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. Installing bioretention systems adjacent to the building can 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"
95	74,420	3.6	37.6	341.7	0.058	2.04

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.025	4	1,900	0.07	344	$1,720
Pervious pavements	0.465	78	35,261	1.32	4,950	$123,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Summit Free Public Library

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

0 30' 60'

SUMMIT MIDDLE SCHOOL

Subwatershed: Upper Passaic River

Site Area: 307,878 sq. ft.

Address: 272 Morris Avenue
Summit, NJ 07901

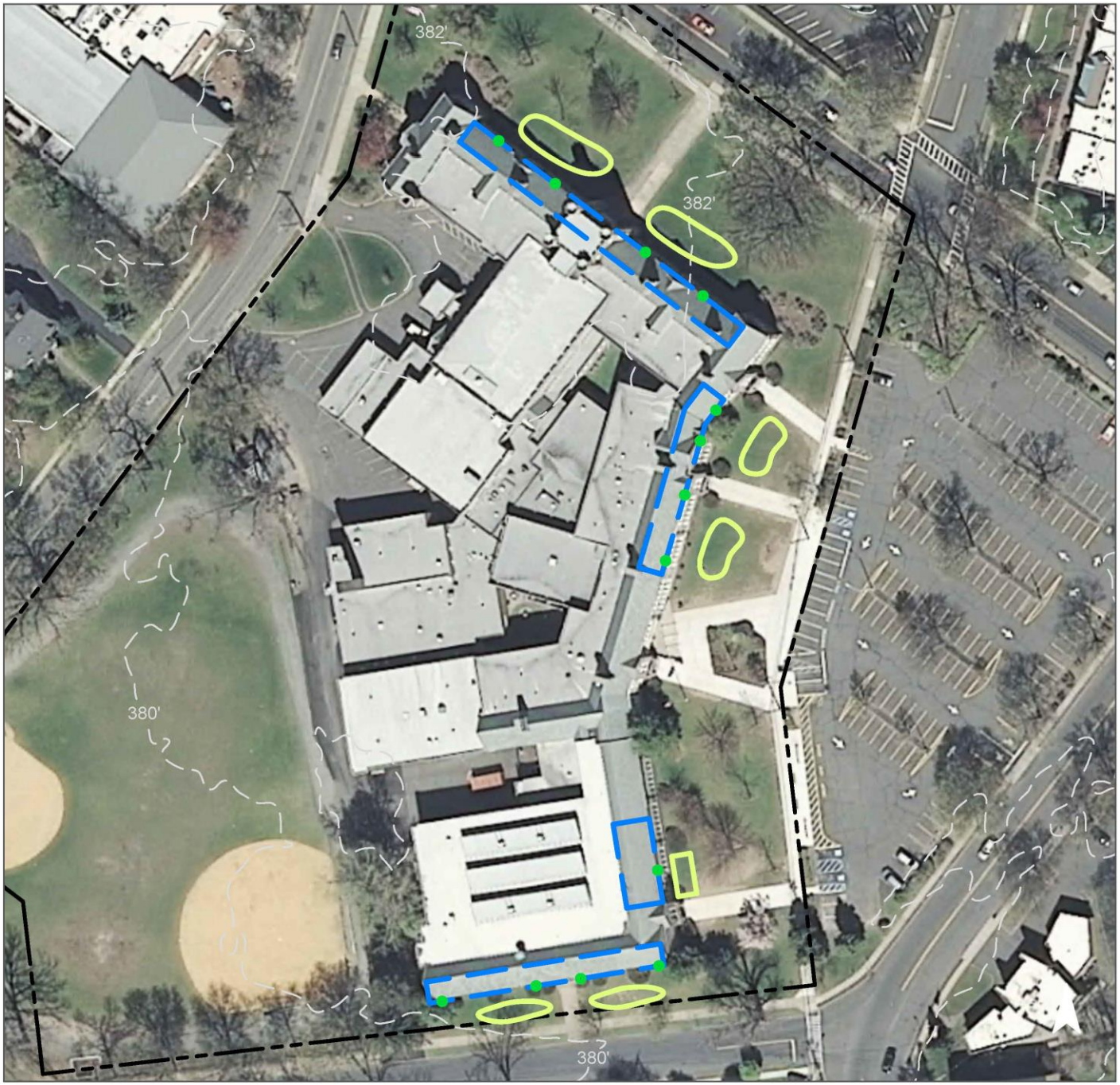
Block and Lot: Block 3203, Lot 2

Bioretention systems can be installed around the perimeter of the school to capture, treat, and infiltrate rooftop 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"
49	150,144	7.2	75.8	689.4	0.117	4.12

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.236	39	17,870	0.67	4,705	$23,525

GREEN INFRASTRUCTURE RECOMMENDATIONS



Summit Middle School

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

0 50' 100'

SUMMIT SENIOR HIGH SCHOOL

Subwatershed: **Upper Passaic River**

Site Area: **777,817 sq. ft.**

Address: **125 Kent Place Boulevard**
Summit, NJ 07901

Block and Lot: **Block 1302, Lot 13**

Parking spots can be replaced with pervious pavement to capture and infiltrate stormwater. Rain gardens can be installed to 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"
45	353,417	17.0	178.5	1,622.7	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	0.201	34	15,229	0.57	1,825	$9,125
Pervious pavements	1.056	177	80,014	3.00	9,317	$232,925

GREEN INFRASTRUCTURE RECOMMENDATIONS

Summit Senior High School

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

0 75' 150'

WILSON PRIMARY CENTER

Subwatershed: **Upper Passaic River**

Site Area: **202,834 sq. ft.**

Address: **14 Beekman Terrace**
Summit, NJ 07901

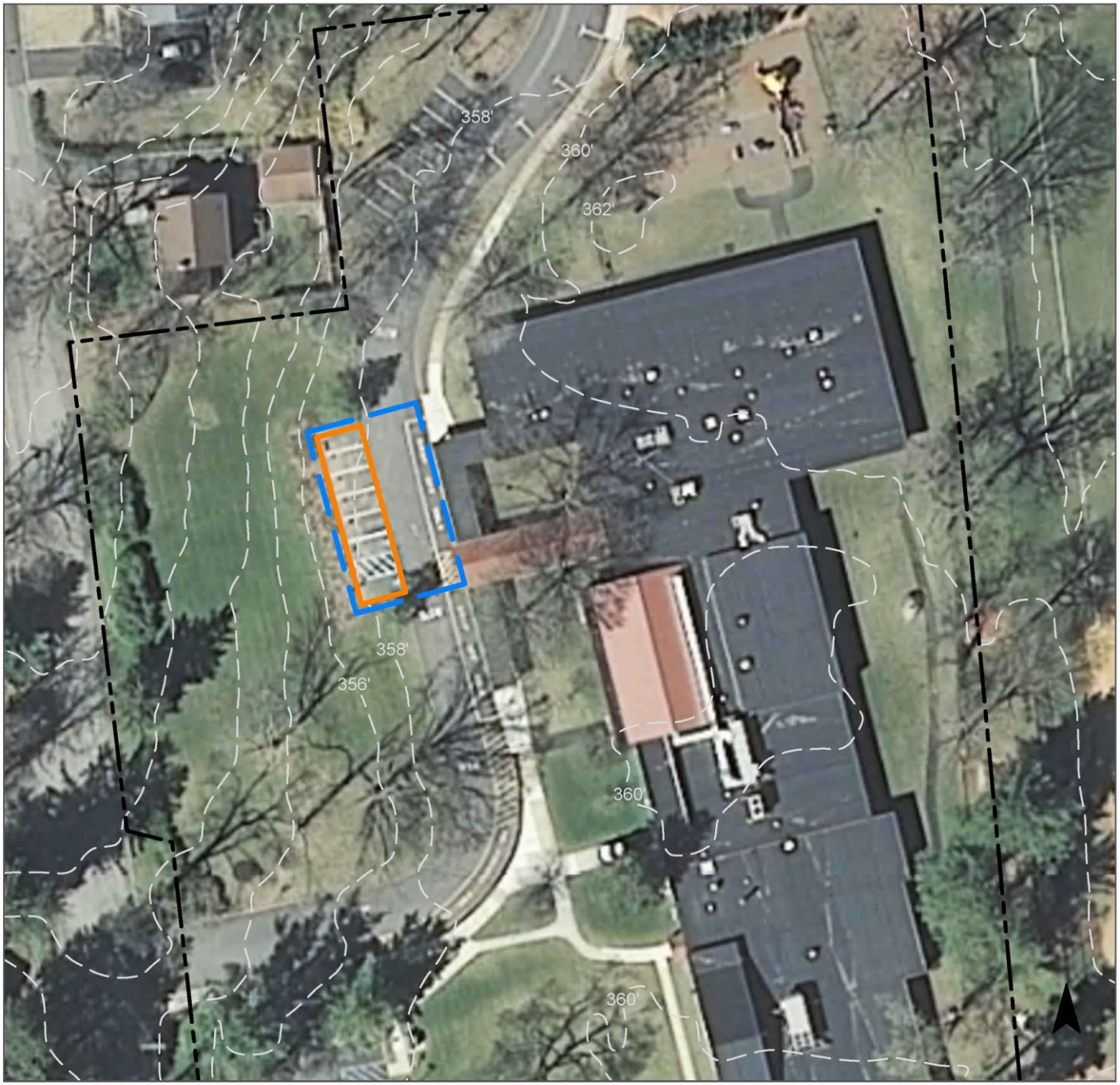
Block and Lot: **Block 1702, Lot 25**

Parking spaces can be replaced with pervious pavement to infiltrate stormwater. 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"
68	138,534	6.7	70.0	636.1	0.108	3.80

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
Pervious pavements	0.085	14	6,418	0.24	1,270	$31,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Wilson Primary Center

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

0 30' 60'

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			I.C. %	I.C. Area (ac)	I.C. Area (SF)	Runoff Volumes from I.C.	
					TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)				Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
BALTUSROL TRIBUTARY SUBWATERSHED	**16.29**	**709,728**			**8.2**	**86.1**	**782.6**		**3.91**	**170,460**	**0.133**	**4.68**
Daily Parking Lot 1												
Total Site Info	1.09	47,496	1910	1	2.2	22.8	207.2	95	1.04	45,122	0.035	1.24
Edison Recreation Center												
Total Site Info	6.72	292,598	4101	27	1.4	14.6	132.4	10	0.66	28,831	0.022	0.79
Jefferson Elementary School												
Total Site Info	8.49	369,634	4301	25	4.7	48.7	443.1	26	2.22	96,507	0.075	2.65
GREEN BROOK SUBWATERSHED	**2.61**	**113,831**			**3.5**	**36.2**	**328.9**		**1.64**	**71,636**	**0.056**	**1.96**
Fountain Baptist Church												
Total Site Info	2.61	113,831	4401	1	3.5	36.2	328.9	63	1.64	71,636	0.056	1.96
UPPER PASSAIC RIVER SUBWATERSHED	**69.90**	**3,044,786**			**78.6**	**823.7**	**7,488.3**		**37.44**	**1,630,956**	**1.271**	**44.73**
Central Presbyterian Church												
Total Site Info	3.14	136,781	3312	3	5.8	60.9	553.8	88	2.77	120,612	0.094	3.31
Christ Church in Summit												
Total Site Info	1.34	58,264	1804	2	1.5	16.2	147.1	55	0.74	32,045	0.025	0.88
Dominican Nuns												
Total Site Info	8.30	361,485	1804	1	6.0	63.1	574.0	35	2.87	125,015	0.097	3.43
Franklin Elementary School												
Total Site Info	6.15	268,024	3004	49	4.7	49.5	450.4	37	2.25	98,098	0.076	2.69
Kent Place School												
Total Site Info	17.32	754,443	1901	1	21.5	225.1	2,046.7	59	10.23	445,769	0.347	12.23
Summit Building Inspector												
Total Site Info	2.27	98,922	2701	1	4.5	46.9	426.6	94	2.13	92,903	0.072	2.55

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)
Summit Free Public Library												
Total Site Info	1.80	78,337	2705	2	3.6	37.6	341.7	95	1.71	74,420	0.058	2.04
Summit Middle School												
Total Site Info	7.07	307,878	3203	2	7.2	75.8	689.4	49	3.45	150,144	0.117	4.12
Summit Senior High School												
Total Site Info	17.86	777,817	1302	13	17.0	178.5	1,622.7	45	8.11	353,417	0.275	9.69
Wilson Primary Center												
Total Site Info	4.66	202,834	1702	25	6.7	70.0	636.1	68	3.18	138,534	0.108	3.80

e. 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 (SF)	Unit Cost ($)	Unit	Total Cost ($)	I.C. Treated %
		Area (SF)	Area (ac)									
	BALTUSROL TRIBUTARY SUBWATERSHED	**42,549**	**0.98**	**1.109**	**186**	**83,993**	**3.18**	**12,909**			**$317,945**	**25.0%**
1	**Daily Parking Lot 1**											
	Pervious pavements	22,022	0.51	0.574	96	43,474	1.63	6,724	25	SF	$168,100	48.8%
	Total Site Info	**22,022**	**0.51**	**0.574**	**96**	**43,474**	**1.63**	**6,724**			**$168,100**	**48.8%**
2	**Edison Recreation Center**											
	Pervious pavements	9,822	0.23	0.256	43	19,388	0.73	2,606	25	SF	$65,150	34.1%
	Total Site Info	**9,822**	**0.23**	**0.256**	**43**	**19,388**	**0.73**	**2,606**			**$65,150**	**34.1%**
3	**Jefferson Elementary School**											
	Bioretention systems/rain gardens	417	0.01	0.011	2	823	0.06	239	5	SF	$1,195	0.4%
	Pervious pavements	10,288	0.24	0.268	45	20,308	0.76	3,340	25	SF	$83,500	10.7%
	Total Site Info	**10,705**	**0.25**	**0.279**	**47**	**21,131**	**0.82**	**3,579**			**$84,695**	**11.1%**
	GREEN BROOK SUBWATERSHED	**8,895**	**0.20**	**0.232**	**39**	**17,556**	**0.66**	**2,812**			**$62,300**	**12.4%**
4	**Fountain Baptist Church**											
	Bioretention systems/rain gardens	1,437	0.03	0.037	6	2,835	0.11	400	5	SF	$2,000	2.0%
	Pervious pavements	7,458	0.17	0.194	33	14,721	0.55	2,412	25	SF	$60,300	10.4%
	Total Site Info	**8,895**	**0.20**	**0.232**	**39**	**17,556**	**0.66**	**2,812**			**$62,300**	**12.4%**
	UPPER PASSAIC RIVER SUBWATERSHED	**189,578**	**4.35**	**4.940**	**827**	**374,227**	**14.04**	**73,247**			**$1,656,155**	**11.6%**
5	**Central Presbyterian Church**											
	Pervious pavements	24,936	0.57	0.650	109	49,226	1.85	9,085	25	SF	$227,125	20.7%
	Total Site Info	**24,936**	**0.57**	**0.650**	**109**	**49,226**	**1.85**	**9,085**			**$227,125**	**20.7%**
6	**Christ Church in Summit**											
	Bioretention systems/rain gardens	161	0.00	0.004	1	314	0.01	75	5	SF	$375	0.5%
	Pervious pavements	9,082	0.21	0.237	40	17,930	0.67	4,880	25	SF	$122,000	28.3%
	Total Site Info	**9,243**	**0.21**	**0.241**	**40**	**18,244**	**0.68**	**4,955**			**$122,375**	**28.8%**

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 %
7	**Dominican Nuns**											
	Bioretention systems/rain gardens	1,320	0.03	0.034	6	2,603	0.10	295	5	SF	$1,475	1.1%
	Pervious pavements	2,407	0.06	0.063	10	4,750	0.18	1,270	25	SF	$31,750	1.9%
	Total Site Info	**3,727**	**0.09**	**0.097**	**16**	**7,353**	**0.28**	**1,565**			**$33,225**	**3.0%**
8	**Franklin Elementary School**											
	Bioretention systems/rain gardens	4,000	0.09	0.104	17	7,899	0.30	1,070	5	SF	$5,350	4.1%
	Pervious pavements	15,140	0.35	0.394	66	29,883	1.12	15,140	25	SF	$378,500	15.4%
	Total Site Info	**19,140**	**0.44**	**0.499**	**83**	**37,782**	**1.42**	**16,210**			**$383,850**	**19.5%**
9	**Kent Place School**											
	Pervious pavements	25,820	0.59	0.673	113	50,969	1.91	12,465	25	SF	$311,625	5.8%
	Total Site Info	**25,820**	**0.59**	**0.673**	**113**	**50,969**	**1.91**	**12,465**			**$311,625**	**5.8%**
10	**Summit Building Inspector**											
	Bioretention systems/rain gardens	1,563	0.04	0.041	7	3,082	0.12	437	5	SF	$2,185	1.7%
	Pervious pavements	25,775	0.59	0.672	112	50,879	1.91	6,119	25	SF	$152,975	27.7%
	Total Site Info	**27,338**	**0.63**	**0.712**	**119**	**53,961**	**2.03**	**6,556**			**$155,160**	**29.4%**
11	**Summit Free Public Library**											
	Bioretention systems/rain gardens	962	0.02	0.025	4	1,900	0.07	344	5	SF	$1,720	1.3%
	Pervious pavements	17,862	0.41	0.465	78	35,261	1.32	4,950	25	SF	$123,750	24.0%
	Total Site Info	**18,824**	**0.43**	**0.490**	**82**	**37,161**	**1.39**	**5,294**			**$125,470**	**25.3%**
12	**Summit Middle School**											
	Bioretention systems/rain gardens	9,052	0.21	0.236	39	17,870	0.67	4,705	5	SF	$23,525	6.0%
	Total Site Info	**9,052**	**0.21**	**0.236**	**39**	**17,870**	**0.67**	**4,705**			**$23,525**	**6.0%**
13	**Summit Senior High School**											
	Bioretention systems/rain gardens	7,715	0.18	0.201	34	15,229	0.57	1,825	5	SF	$9,125	2.2%
	Pervious pavements	40,533	0.93	1.056	177	80,014	3.00	9,317	25	SF	$232,925	11.5%
	Total Site Info	**48,248**	**1.11**	**1.257**	**210**	**95,243**	**3.57**	**11,142**			**$242,050**	**13.7%**
14	**Wilson Primary Center**											
	Pervious pavements	3,250	0.07	0.085	14	6,418	0.24	1,270	25	SF	$31,750	2.3%
	Total Site Info	**3,250**	**0.07**	**0.085**	**14**	**6,418**	**0.24**	**1,270**			**$31,750**	**2.3%**