RUTGERS
New Jersey Agricultural
Experiment Station

Impervious Cover Reduction Action Plan
for
Washington Township, Warren County, New Jersey

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

October 12, 2021

ACKNOWLEDGEMENTS:

This document has been prepared by the Rutgers Cooperative Extension Water Resources Program, with funding and direction from the National Fish and Wildlife Foundation [NFWF GRANT ID: 0403.19.065576] and the New Jersey Agricultural Experiment Station, to highlight green infrastructure opportunities within Washington Township. We would like to thank the National Fish and Wildlife Foundation, the New Jersey Agricultural Experiment Station, and Washington Township for their input and support in creating this document.

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Introduction

Located in Warren County, New Jersey, Washington Township covers approximately 18.05 square miles. Figures 1 and 2 illustrate that Washington Township is dominated by forest land uses. A total of 30.5% of the municipality's land use is classified as urban. Of the urban land in Washington 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 Washington 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 Washington Township. Based upon the 2015 NJDEP land use/land cover data, approximately 8.3% of Washington Township has impervious cover. This level of impervious cover suggests that the streams in Washington Township likely range from being sensitive to impacted streams. [1]

Methodology

Washington Township contains portions of three subwatersheds (Figure 4). For this impervious cover reduction action plan (RAP), projects have been identified in one subwatershed. Aerial imagery initially was studied to identify potential project sites that contain extensive impervious cover. Field inspections were conducted to determine if viable options exist at the sites to reduce impervious cover or to disconnect impervious surfaces from draining directly to the local waterway or storm sewer system. During the field inspections, appropriate green infrastructure practices for the sites were recommended. Sites that already had green infrastructure stormwater management practices in place were not considered.

[1] 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.

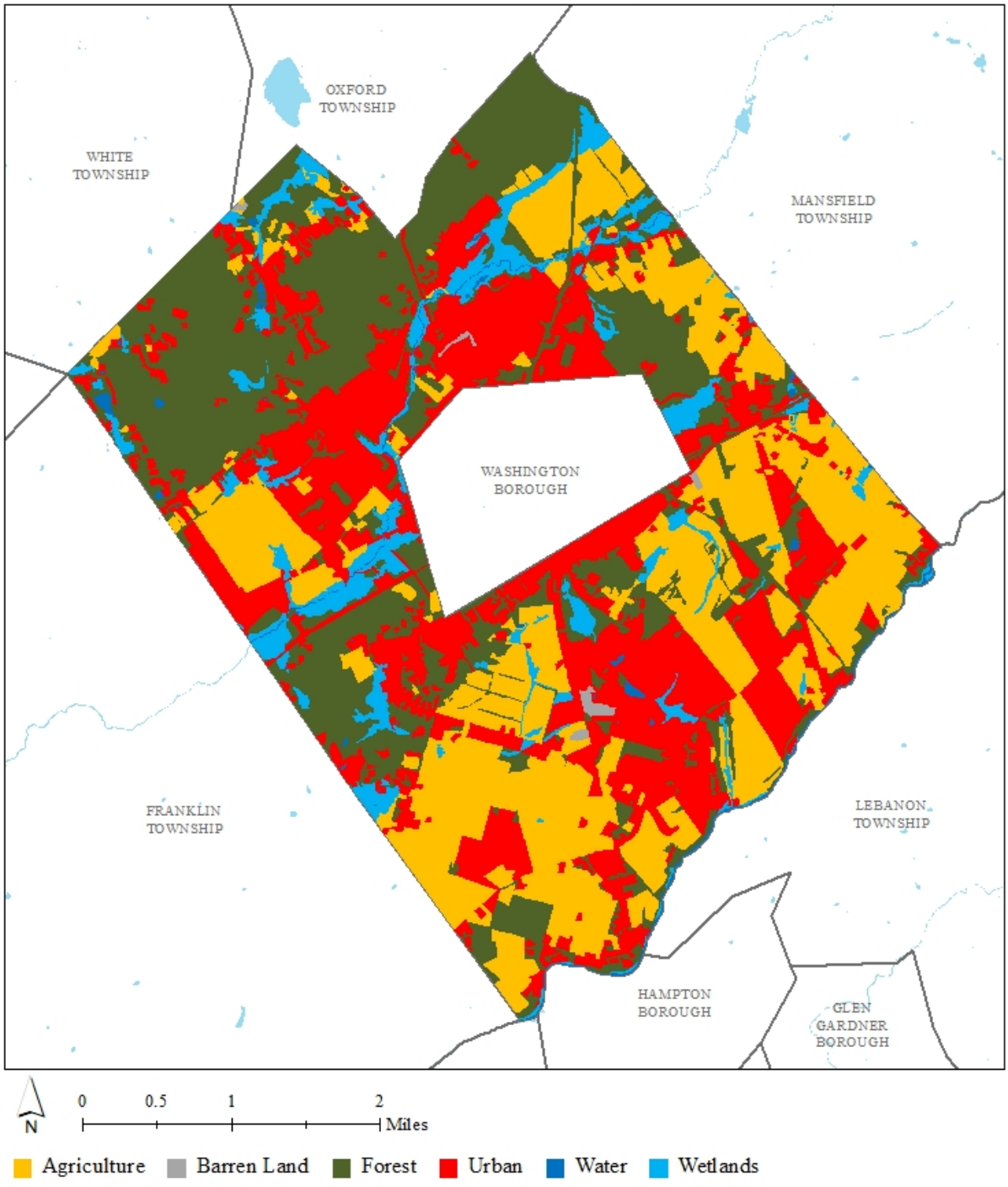


Figure 1: Map of land use in Washington Township

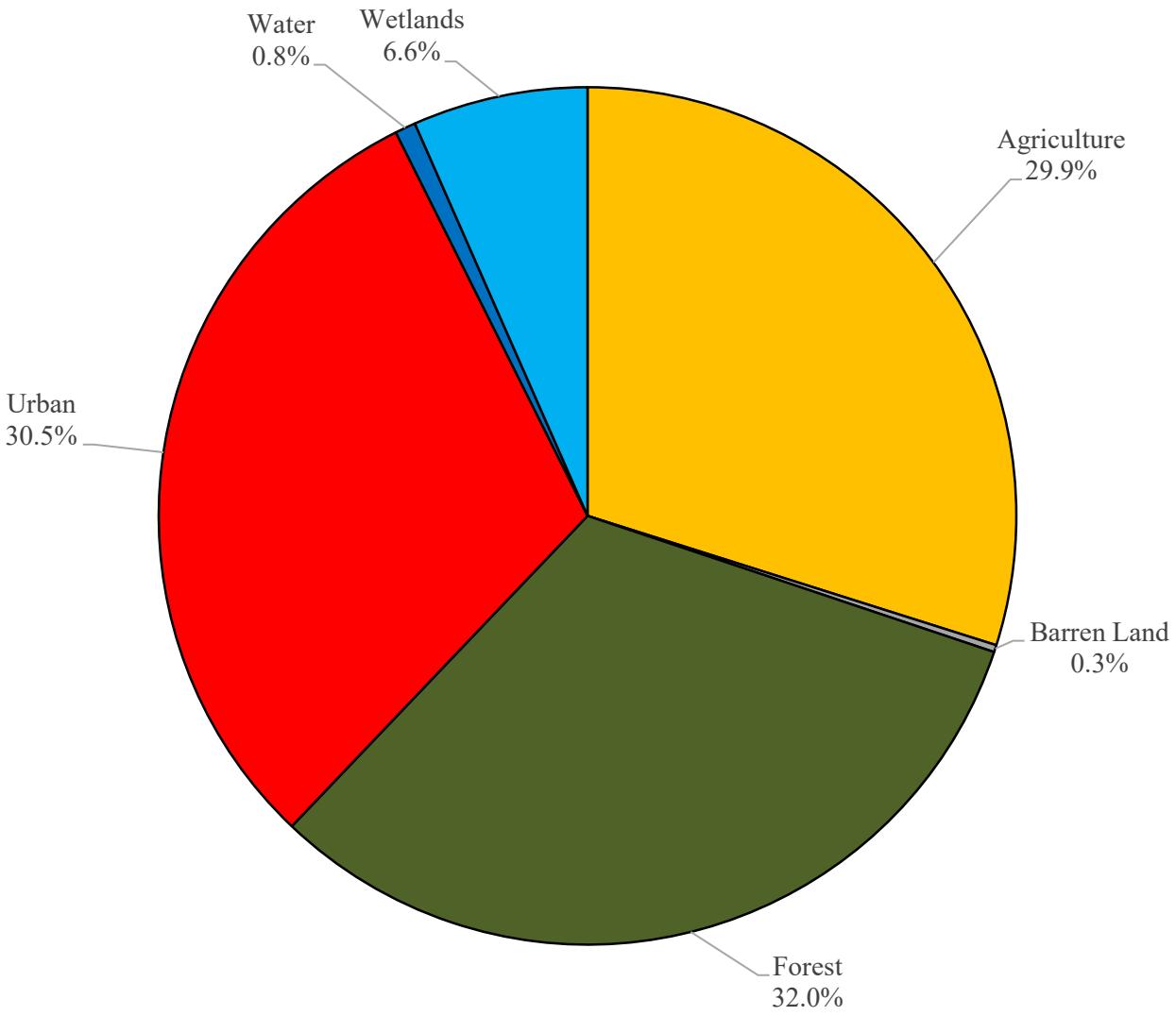


Figure 2: Pie chart illustrating the land use in Washington Township

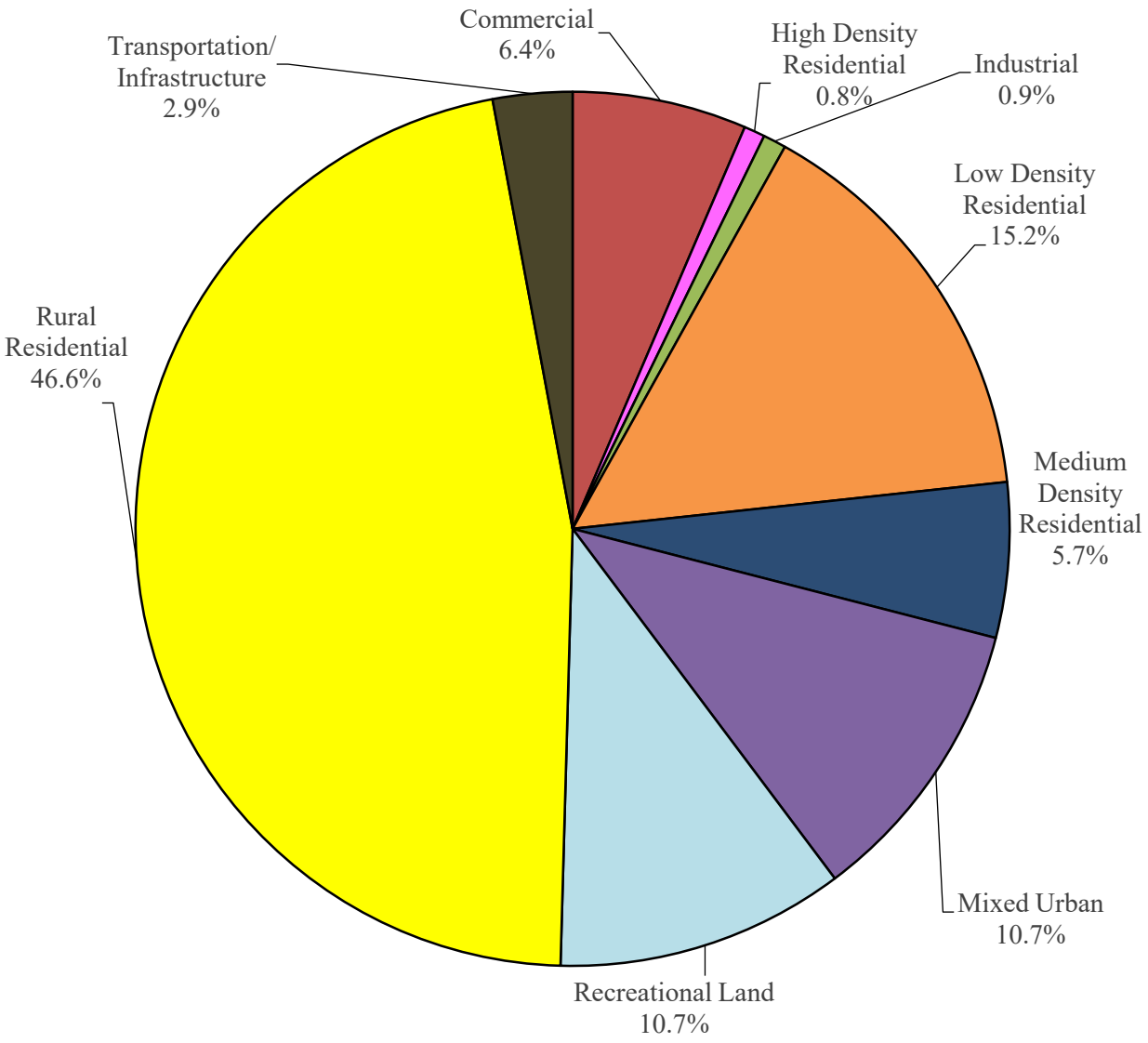


Figure 3: Pie chart illustrating the various types of urban land use in Washington Township

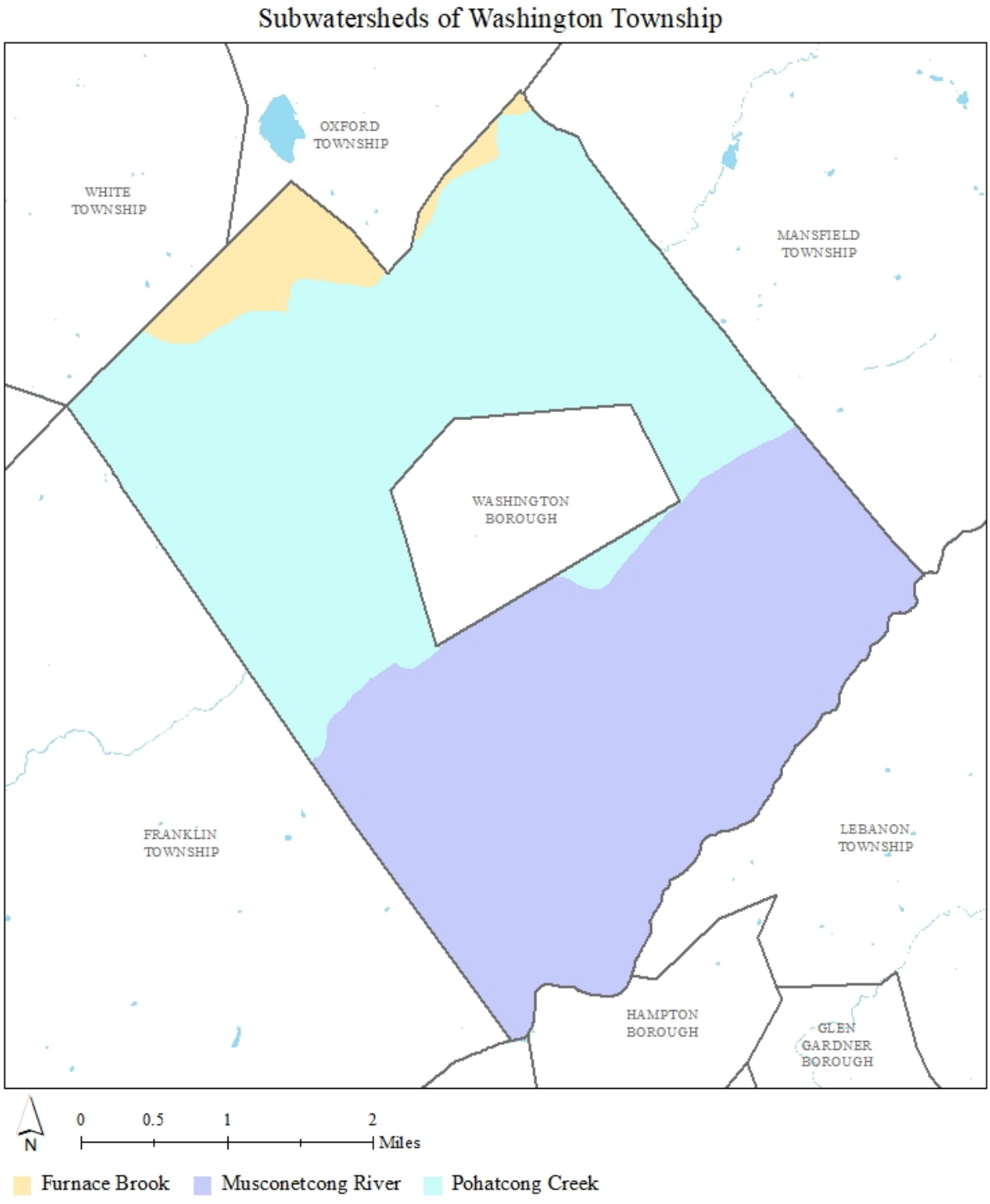


Figure 4: Map of the subwatersheds in Washington Township

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 New Jersey water quality design storm (1.25 inches of rain over two hours) and for the average annual rainfall total of 44 inches.

Preliminary soil assessments were conducted for each potential project site identified in Washington 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, allowing for the capture of 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, February 2004, Page 3-11.

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 yield 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 Washington Township. The practices are discussed below.

Disconnected downspouts

This is often referred to as simple disconnection. A downspout is simply disconnected 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 are designed with an underlying stone layer to retain stormwater runoff and allow it to slowly seep into the ground.




[3] United States Environmental Protection Agency (USEPA). 2015. Benefits of Green Infrastructure. http://www.epa.gov/greeninfrastructure/benefits-green-infrastructure

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.

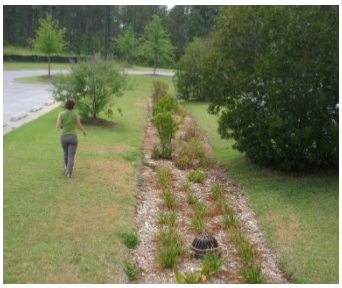
Downspout planter boxes

These are large wooden boxes that house a variety of water-retaining and/or filtering plants. When installed at the base of a downspout, water is captured by the plants which reduces stormwater runoff volume, provides a water source for the vegetation, and provides a small patch of habitat and food sources for birds and insects.

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. Bioswales are often designed for larger scale sites where water needs time to move and slowly infiltrate into the groundwater. Much like rain garden systems, bioswales can also be designed with an underdrain pipe that allows excess water to discharge to the nearest catch basin or existing stormwater system.

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. Tree filter boxes 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.

<u>Potential Project Sites</u>

Appendix A contains information on potential project sites where green infrastructure practices could be installed with a focus 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, recharge potential, TSS removal potential, maximum volume reduction potential per storm, peak reduction potential, and estimated project costs are provided. This information will be especially useful in instances where proposed development projects cannot satisfy the New Jersey stormwater management requirements (N.J.A.C. 7:8).

Conclusion

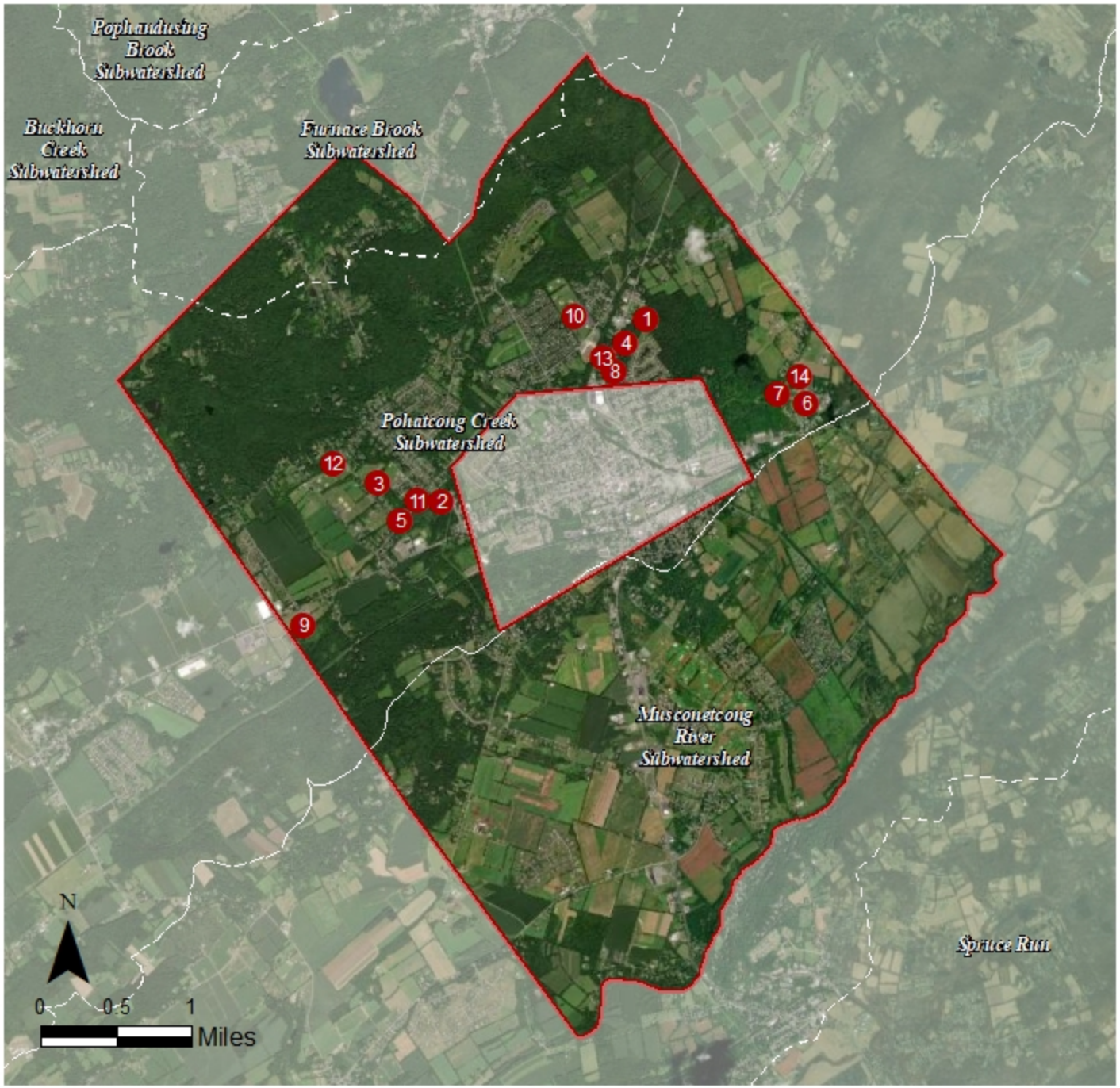
This impervious cover reduction action plan is meant to provide the municipality with a blueprint for implementing green infrastructure practices that will reduce the impact of stormwater runoff from impervious surfaces. These projects can be implemented through a wide variety of volunteer groups, such as Boy Scouts, Girl Scouts, Municipal Green Teams, corporate volunteerism, faith-based groups, school groups, watershed groups, and other active community organizations.

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 green infrastructure 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

WASHINGTON TOWNSHIP: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE POHATCONG CREEK SUBWATERSHED

1. Abilities of Northwest Jersey
2. Faith Discovery Church
3. Meadow Breeze Park
4. Oakwood Lanes
5. Pleasant Valley Veterinary Services
6. Port Colden Elementary School
7. Port Colden United Methodist Church
8. St. Luke's Lutheran Church
9. Warren County Community College
10. Warren Hills Regional High School
11. Washington Township Fire Department
12. Washington Township Parks and Recreation
13. Washington Township Police Department
14. Washington Township School District

b. Proposed Green Infrastructure Concepts

ABILITIES OF NORTHWEST JERSEY

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 371,411 sq. ft.

Address: 264 NJ-31
Washington, NJ 07882

Block and Lot: Block 40, Lot 25

A downspout planter box can be installed at the entrance to capture and retain stormwater runoff from the rooftop and add aesthetic appeal. A rain garden can be installed in the front of the building to capture, treat, and infiltrate rooftop runoff as well. 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	131,654	6.3	66.5	604.5	0.103	3.61

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	4,400	0.17	575	$2,875
Planter box	n/a	1	n/a	n/a	1 (box)	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Abilities of Northwest Jersey

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

0 50' 100'

FAITH DISCOVERY CHURCH

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 224,085 sq. ft.

Address: 33 Brass Castle Road
Washington, NJ 07882

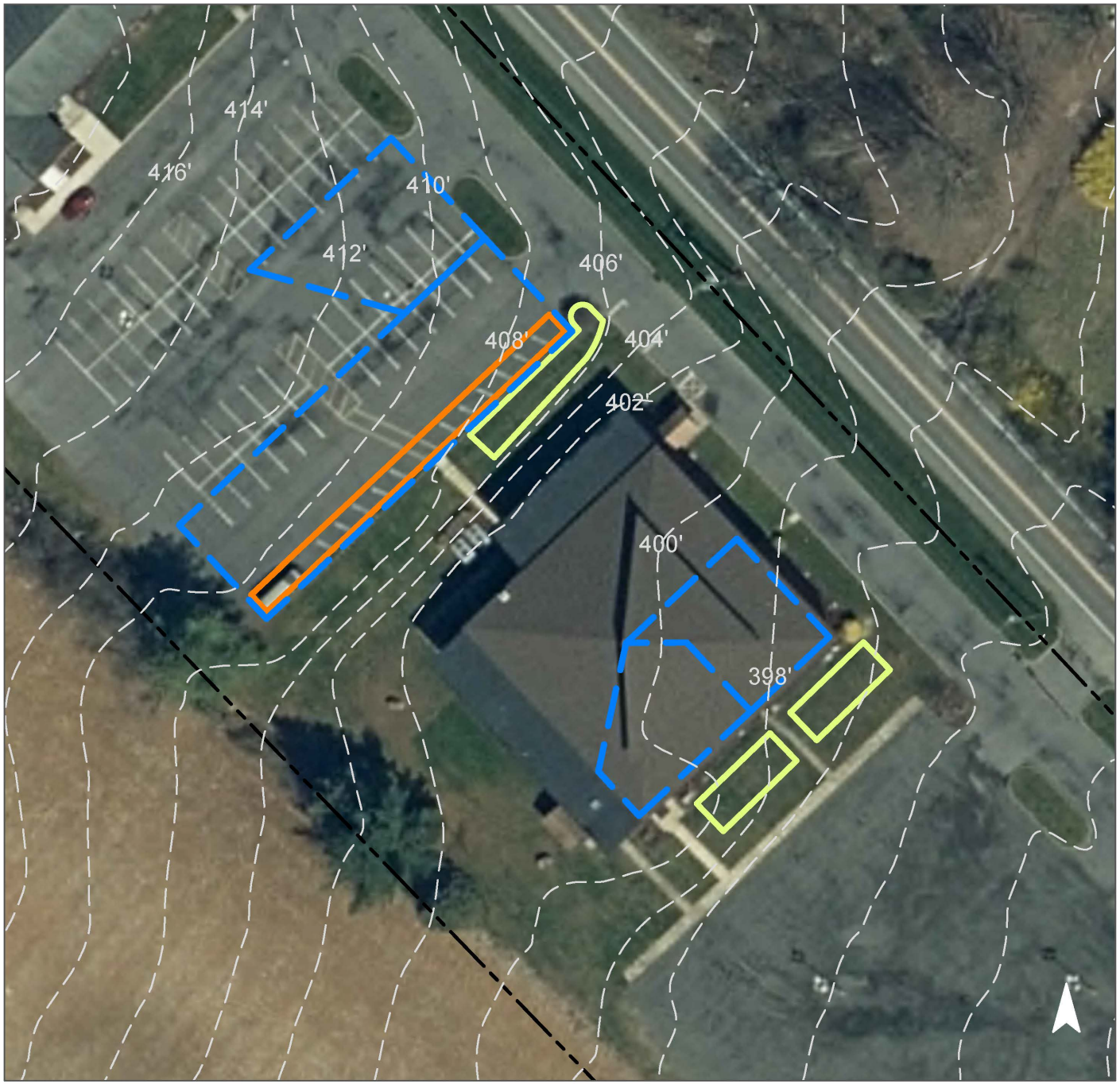
Block and Lot: Block 22, Lot 3.02

A section of parking spaces can be converted to porous asphalt to capture and infiltrate stormwater runoff from the parking lot before it enters the storm drain. A rain garden can be installed in the turfgrass behind the storm drain to capture runoff from the parking lot when the porous asphalt overflows. Two more rain gardens can be installed on the opposite side of the building to capture, treat, and infiltrate rooftop runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
61	137,088	6.6	69.2	629.4	0.107	3.76

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	0.207	35	15,220	0.57	1,990	$9,950
Pervious pavement	0.211	35	15,470	0.58	1,445	$36,125

GREEN INFRASTRUCTURE RECOMMENDATIONS



Faith Discovery Church

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

0 30' 60'

MEADOW BREEZE PARK

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 2,529,187 sq. ft.

Address: 40 Meadow Breeze Lane
Washington, NJ 07882

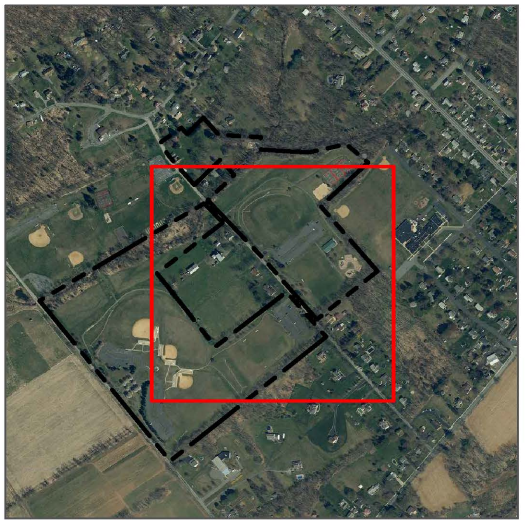
Block and Lot: Block 17;18, Lot 6;9,15

Two rain gardens can be installed on either side of the main pavilion to capture, treat, and infiltrate stormwater runoff and create pollinator habitat. A section of parking spaces can be converted to porous asphalt to capture and 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"
11	283,306	13.7	143.1	1,300.8	0.221	7.77

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	0.050	8	3,660	0.14	480	$2,400
Pervious pavement	0.382	64	28,050	1.05	2,620	$65,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Meadow Breeze Park

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

0 50' 100'

OAKWOOD LANES

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 226,850 sq. ft.

Address: 234 NJ-31
Washington, NJ 07882

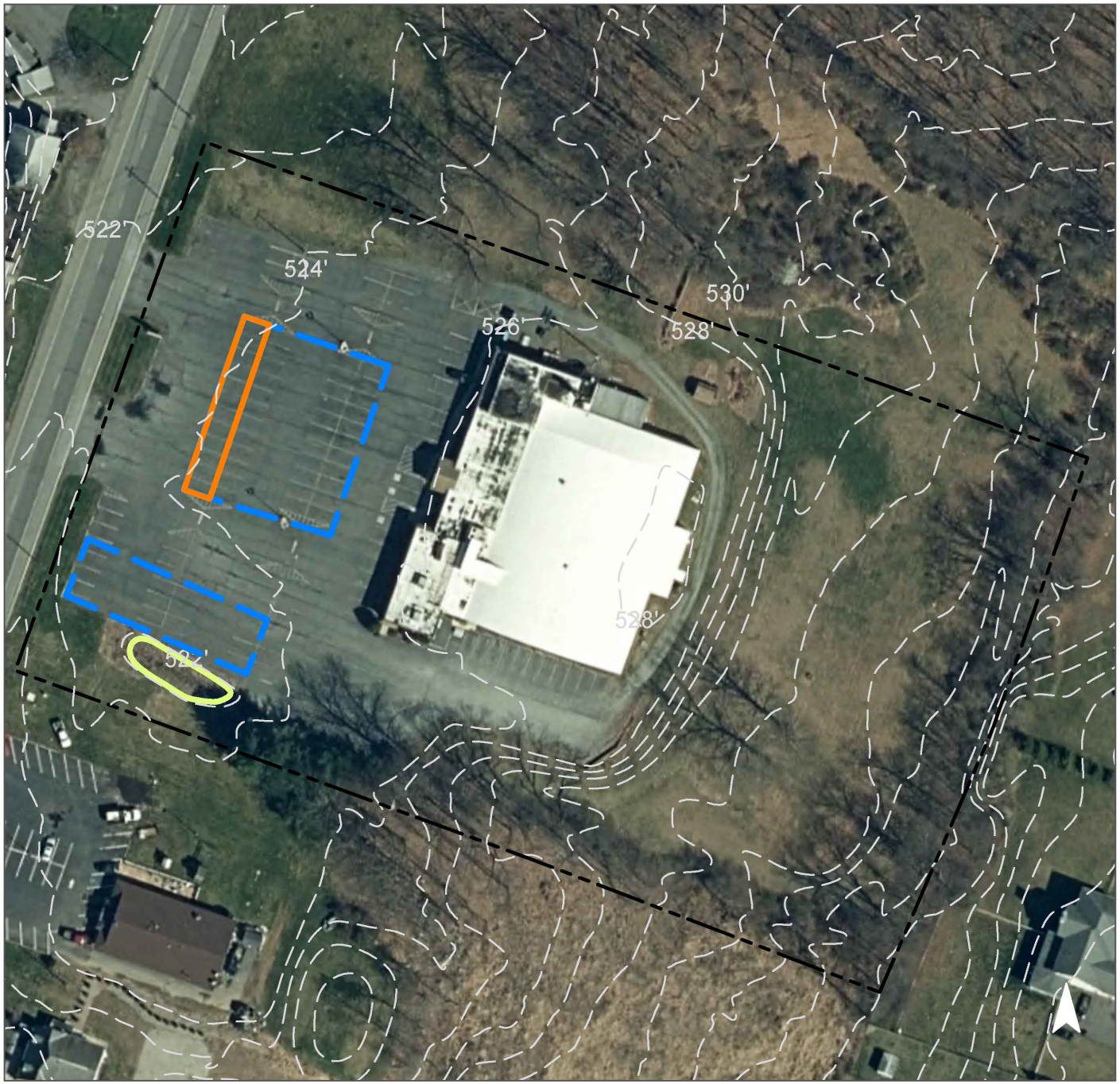
Block and Lot: Block 40, Lot 17

A section of parking spaces can be converted to porous asphalt to capture and infiltrate stormwater runoff from the parking lot. A small detention basin can be retrofitted to a rain garden to create native pollinator habitat and capture, treat, and infiltrate runoff from the parking lot. 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"
34	76,170	3.7	38.5	349.7	0.059	2.09

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 system	0.131	22	9,630	0.36	1,260	$6,300
Pervious pavement	0.311	52	22,810	0.86	2,130	$53,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Oakwood Lanes

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

0 50' 100'

PLEASANT VALLEY VETERINARY SERVICES

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 60,330 sq. ft.

Address: 32 Pleasant Valley Road Washington, NJ 07882

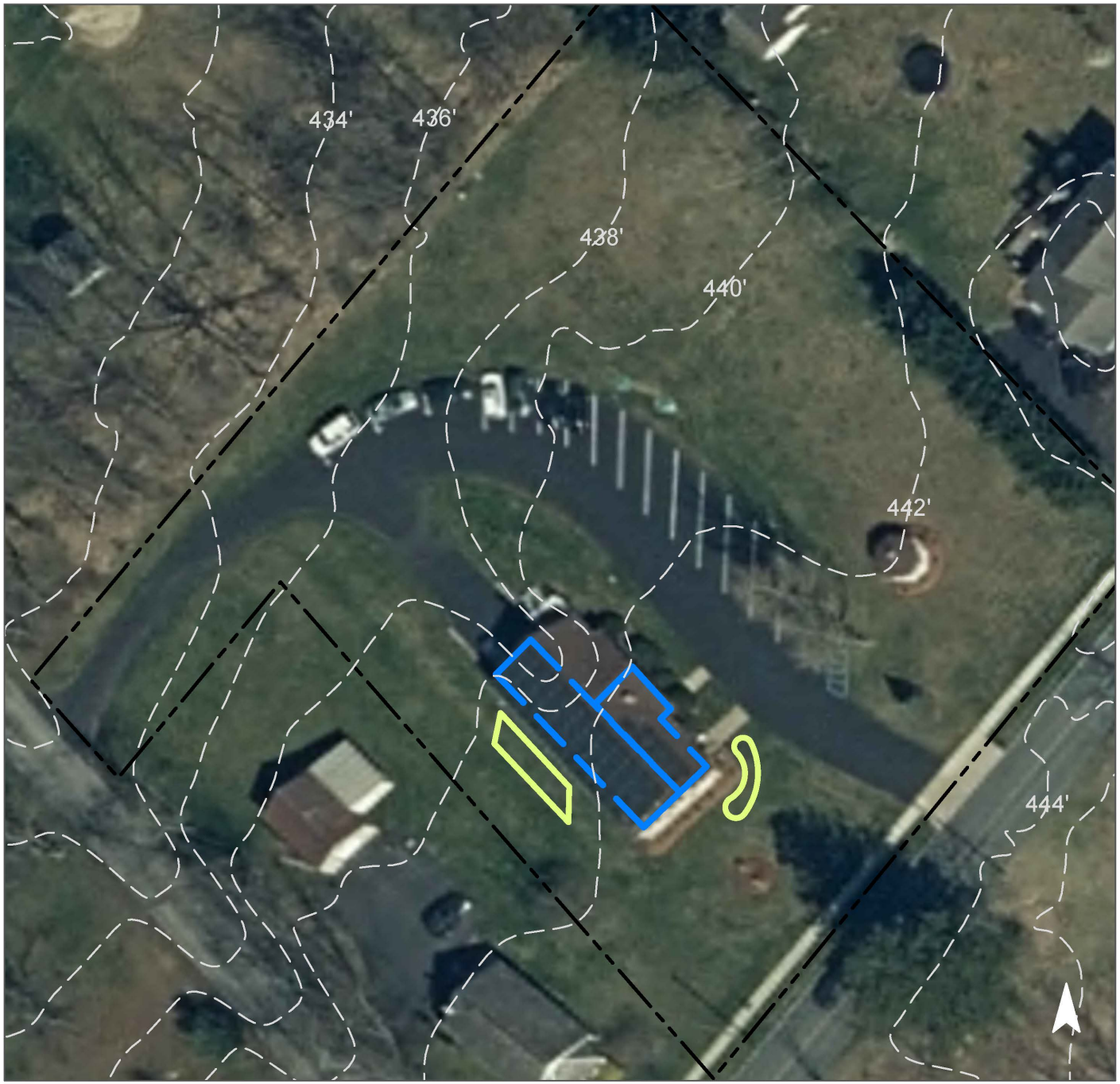
Block and Lot: Block 18, Lot 11.01

Two rain gardens can be installed to capture, treat, and infiltrate rooftop runoff and create pollinator habitat. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
35	20,854	1.0	10.5	95.7	0.016	0.57

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	0.047	8	3,430	0.13	430	$2,150

GREEN INFRASTRUCTURE RECOMMENDATIONS



Pleasant Valley Veterinary Services

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

0 25' 50'

PORT COLDEN ELEMENTARY SCHOOL

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 594,363 sq. ft.

Address: 30 Port Colden Road
Washington, NJ 07882

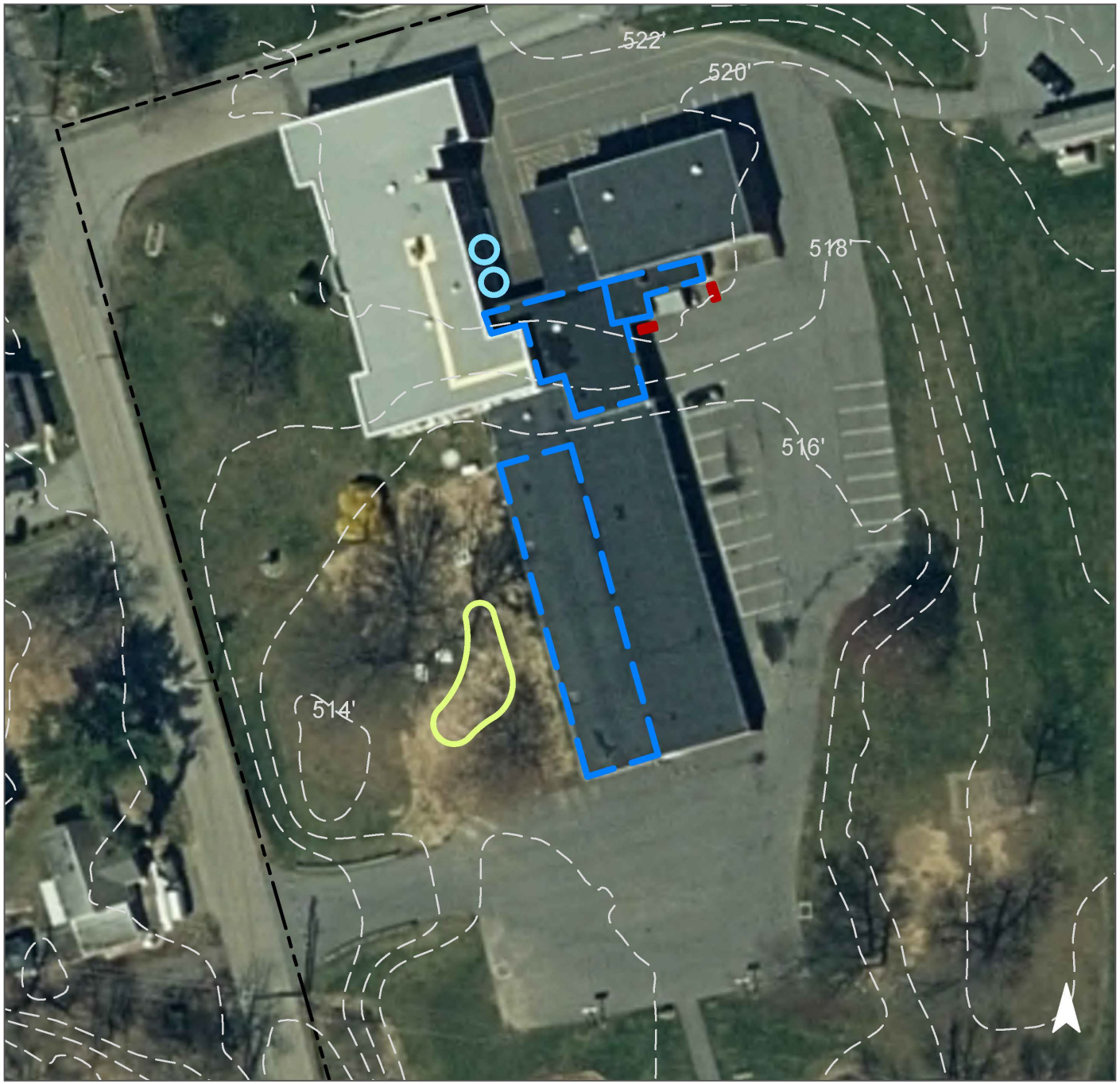
Block and Lot: Block 43, Lot 10

A rain garden can be installed in the front of the school between the trees to capture, treat, and infiltrate rooftop runoff which is currently directed onto the turf grass and causing erosion. Two cisterns can be installed to capture rooftop runoff which can later be used for washing vehicles or other non-potable purposes. Two downspout planter boxes can be installed in the back to capture and store rooftop runoff while also create a pollinator habitat. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
32	193,030	9.3	97.5	886.3	0.150	5.29

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	0.096	16	7,040	0.26	920	$4,600
Planter boxes	n/a	2	n/a	n/a	2 (boxes)	$2,000
Rainwater harvesting	0.045	7	1,335	0.05	1,335 (gal)	$2,670

GREEN INFRASTRUCTURE RECOMMENDATIONS



Port Colden Elementary School

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

0 30' 60'

PORT COLDEN UNITED METHODIST CHURCH

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 20,657 sq. ft.

Address: 64 Port Colden Road
Washington, NJ 07882

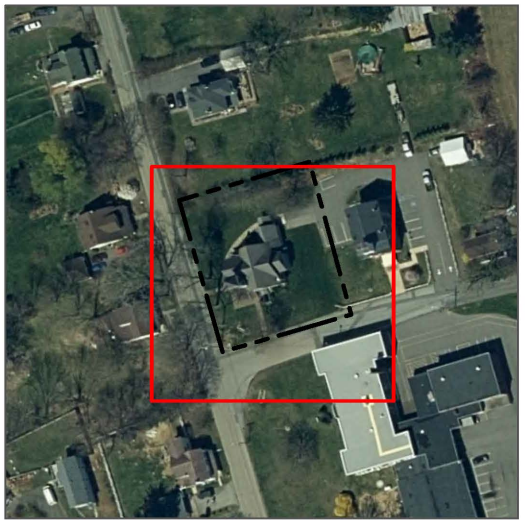
Block and Lot: Block 43, Lot 7

A rain garden can be installed in the rear of the building 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"
71	14,596	0.7	7.4	67.0	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
Bioretention system	0.021	3	1,530	0.06	200	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Port Colden United Methodist Church

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

0 10' 20'

SAINT LUKE'S LUTHERAN CHURCH

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 168,202 sq. ft.

Address: 214 NJ-31
Washington, NJ 07882

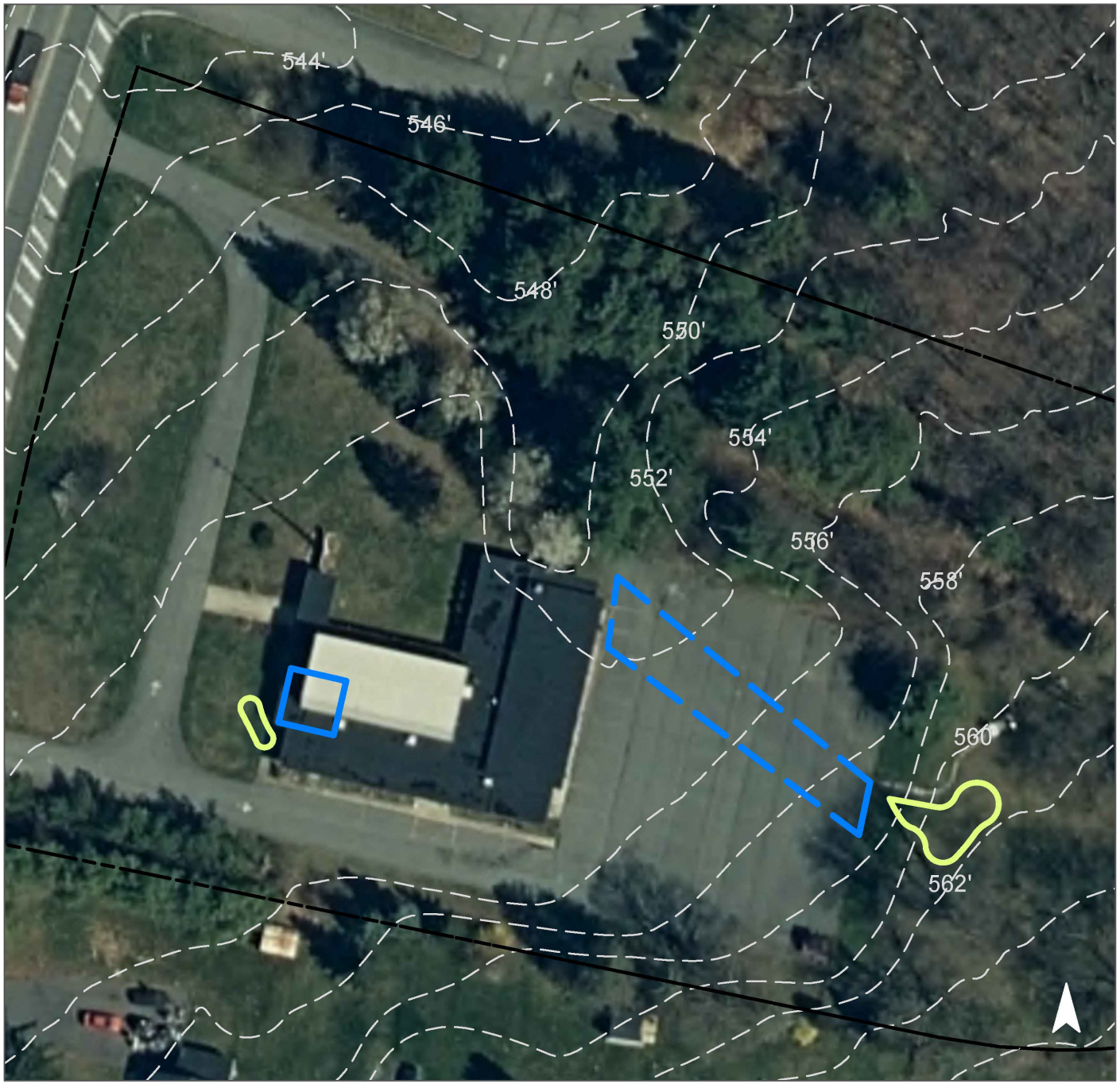
Block and Lot: Block 40, Lot 7,13

A rain garden can be installed in the front of the building to capture, treat, and infiltrate rooftop runoff, adding to the existing pollinator habitat. Another rain garden can be installed at the back of the parking lot to capture, treat, and infiltrate runoff from the parking lot before it reaches a nearby waterway. 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	61,603	3.0	31.1	282.8	0.048	1.69

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	0.084	14	6,130	0.23	995	$4,975

GREEN INFRASTRUCTURE RECOMMENDATIONS



Saint Luke's Lutheran Church

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

0 30' 60'

WARREN COUNTY COMMUNITY COLLEGE

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 3,485,381 sq. ft.

Address: 475 NJ-57
Washington, NJ 07882

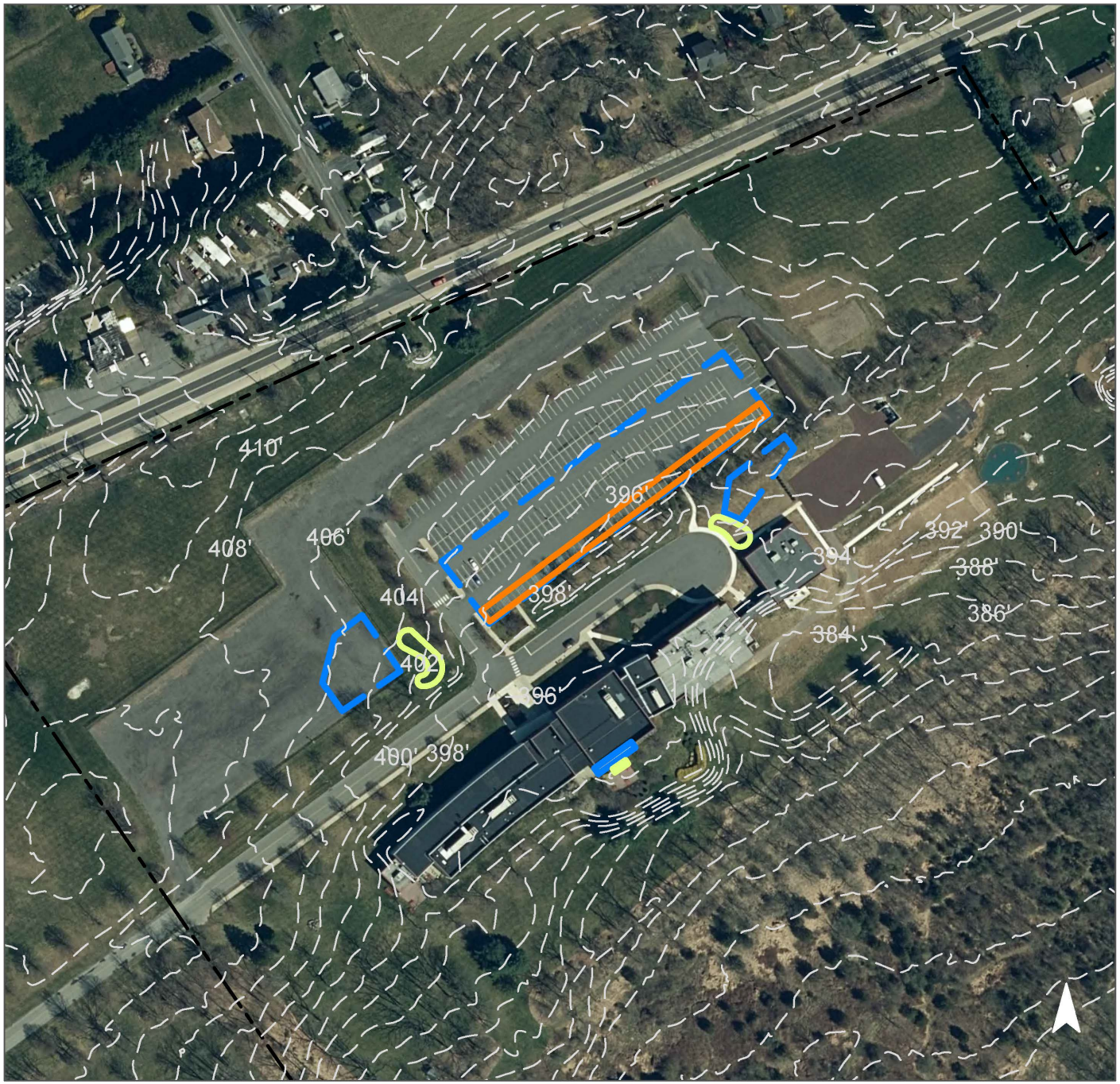
Block and Lot: Block 69, Lot 1

A section of parking spaces can be installed in the parking lot to capture and infiltrate stormwater runoff. Several rain gardens can be installed to capture, treat, and infiltrate runoff from the parking lot, rooftop, and upland areas before it reaches the stormwater sewers. 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"
13	464,858	22.4	234.8	2,134.3	0.362	12.75

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.302	51	22,190	0.83	2,900	$14,500
Pervious pavement	1.194	200	87,580	3.29	8,180	$204,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Warren County Community College

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

0 100' 200'

WARREN HILLS REGIONAL HIGH SCHOOL

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 2,653,531 sq. ft.

Address: 41 Jackson Valley Road
Washington, NJ 07882

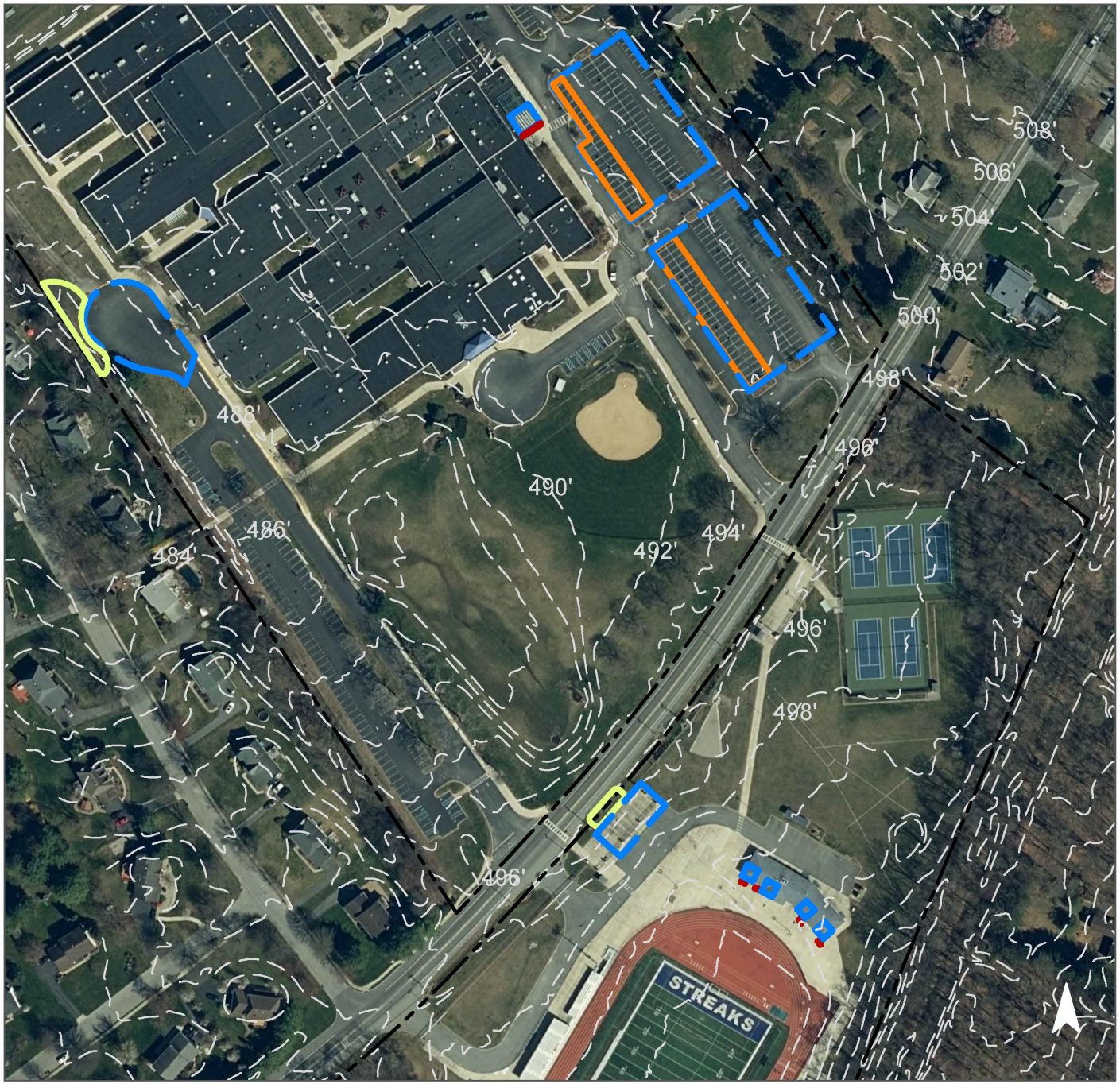
Block and Lot: Block 30;38 , Lot 37;17

Two large sections of parking spaces can be converted to porous pavement to capture and infiltrate parking lot runoff. Rain gardens can be installed to capture, treat, and infiltrate runoff from surrounding paved areas. Downspout planter boxes can be installed around the main entrance to the school and the concession stand to capture and store rooftop runoff and enhance the aesthetics of the 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"
37	977,856	47.1	493.9	4,489.7	0.762	26.82

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	0.401	67	29,430	1.11	3,850	$19,250
Pervious pavement	1.468	246	107,700	4.05	12,620	$315,500
Planter boxes	n/a	6	n/a	n/a	8 (boxes)	$8,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Warren Hills Regional High School

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

0 100' 200'

WASHINGTON TOWNSHIP FIRE DEPARTMENT

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 58,509 sq. ft.

Address: 16 Pleasant Valley Road
Washington, NJ 07882

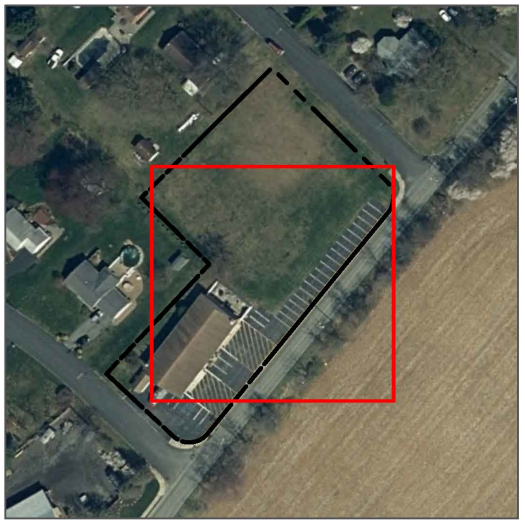
Block and Lot: Block 19, Lot 7,8,9

A cistern can be installed along the side of the building to capture and hold rooftop runoff which can be used for washing vehicles or other non-potable purposes. A rain garden can be installed in the back of the building 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"
45	26,353	1.3	13.3	121.0	0.021	0.72

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	0.033	5	2,410	0.09	315	$1,575
Rainwater harvesting	0.033	5	980	0.04	980 (gal)	$1,960

GREEN INFRASTRUCTURE RECOMMENDATIONS



Washington Township Fire Department

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

0 20' 40'

WASHINGTON TOWNSHIP PARKS AND RECREATION

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 1,137,866 sq. ft.

Address: 33 Little Philadelphia Road
Washington, NJ 07882

Block and Lot: Block 17, Lot 5

Two rain gardens can be installed on either side of the building to capture, treat, and infiltrate rooftop runoff before it reaches the stormwater sewers. 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"
14	154,692	7.5	78.1	710.2	0.121	4.24

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
Bioretention systems	0.034	6	2,520	0.09	330	$1,650

GREEN INFRASTRUCTURE RECOMMENDATIONS

Washington Township Parks and Recreation

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

0 50' 100'

WASHINGTON TOWNSHIP POLICE DEPARTMENT

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 371,411 sq. ft.

Address: 211 NJ-31
Washington, NJ 07882

Block and Lot: Block 30, Lot 15,15.01,15.02

Rain gardens can be installed throughout the property to capture, treat, and infiltrate stormwater runoff from the parking lot and rooftops. Two cisterns can be installed at the rear entrance to capture rooftop runoff which can later be used to wash vehicles or for other non-potable purposes. 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"
27	100,065	4.8	50.5	459.4	0.078	2.74

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	0.243	41	17,820	0.67	2,330	$11,650
Rainwater harvesting	0.026	4	780	0.03	780 (gal)	$1,560

GREEN INFRASTRUCTURE RECOMMENDATIONS

Washington Township Police Department

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

0 30' 60'

WASHINGTON TOWNSHIP SCHOOL DISTRICT

Subwatershed: Pohatcong Creek Subwatershed

Site Area: 20,701 sq. ft.

Address: 1 Front Street
Washington, NJ 07882

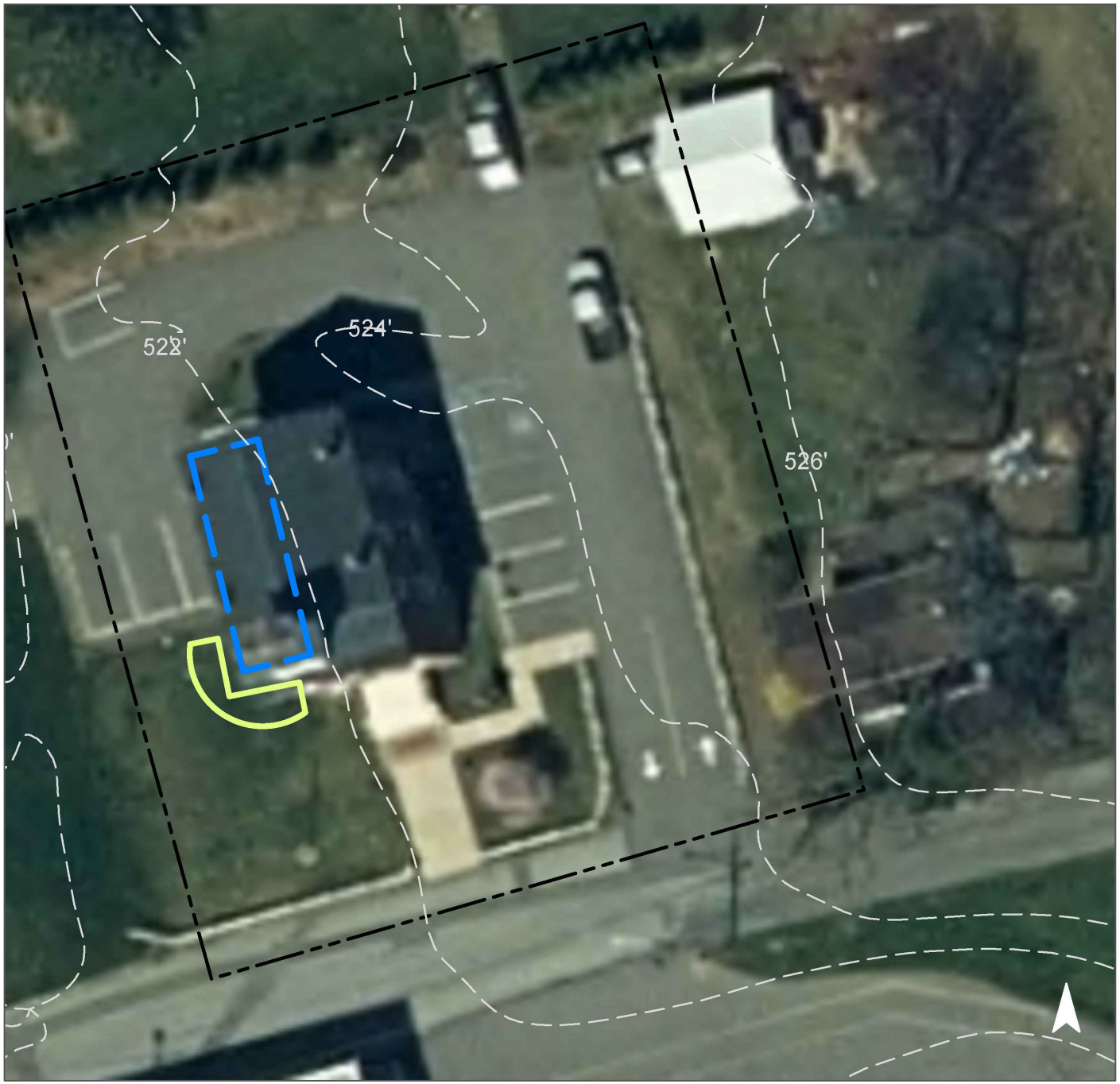
Block and Lot: Block 43, Lot 8

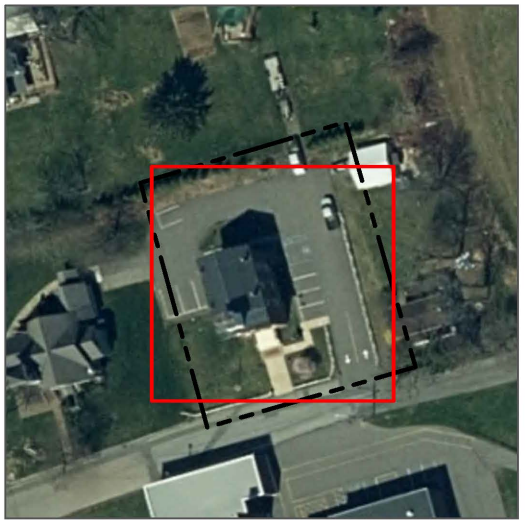
A rain garden can be installed near the building to capture, treat, and infiltrate rooftop runoff and also create pollinator habitat. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
65	13,502	0.7	6.8	62.0	0.011	0.37

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
Bioretention system	0.020	3	1,500	0.06	195	$975

GREEN INFRASTRUCTURE RECOMMENDATIONS





Washington Township School District

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

0 15' 30'

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 from I.C. (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
	Pohatcong Creek Sites	**285.70**	**12,445,281**				**63.67**	**2,773,654**	**133.7**	**1400.8**	**12,734.9**	**288,922**	**10,170,063**	**2.161**	**76.07**
1	**Abilities of Northwest Jersey**														
	Bioretention system														
	Planter box														
	Total Site Info	8.53	371,411	40	25	35	3.02	131,654	6.3	66.5	604.5	13,714	482,730	0.103	3.61
2	**Faith Discovery Church**														
	Bioretention systems														
	Pervious pavement														
	Total Site Info	5.14	224,085	22	3.02	61	3.15	137,088	6.6	69.2	629.4	14,280	502,655	0.107	3.76
3	**Meadow Breeze Park**														
	Bioretention systems														
	Pervious pavement														
	Total Site Info	58.06	2,529,187	17; 18	6; 9, 15	11	6.50	283,306	13.7	143.1	1,300.8	29,511	1,038,787	0.221	7.77
4	**Oakwood Lanes**														
	Bioretention system														
	Pervious pavement														
	Total Site Info	5.21	226,850	40	17	34	1.75	76,170	3.7	38.5	349.7	7,934	279,288	0.059	2.09
5	**Pleasant Valley Veterinary Services**														
	Bioretention systems														
	Total Site Info	1.38	60,330	18	11.01	35	0.48	20,854	1.0	10.5	95.7	2,172	76,466	0.016	0.57
6	**Port Colden Elementary School**														
	Bioretention system														
	Planter boxes														
	Rainwater harvesting														
	Total Site Info	13.64	594,363	43	10	32	4.43	193,030	9.3	97.5	886.3	20,107	707,775	0.150	5.29
7	**Port Colden United Methodist Church**														
	Bioretention systems														
	Total Site Info	0.47	20,657	43	7	71	0.34	14,596	0.7	7.4	67.0	1,520	53,518	0.011	0.40
8	**St. Luke's Lutheran Church**														
	Bioretention system														
	Total Site Info	3.86	168,202	40	7, 13	37	1.41	61,603	3.0	31.1	282.8	6,417	225,878	0.048	1.69
9	**Warren County College**														
	Bioretention systems														
	Pervious pavement														
	Total Site Info	80.01	3,485,381	69	1	13	10.67	464,858	22.4	234.8	2,134.3	48,423	1,704,480	0.362	12.75
10	**Warren Hills Regional High School**														
	Bioretention systems														
	Pervious pavement														
	Planter boxes														
	Total Site Info	60.92	2,653,531	30; 38	37; 17	37	22.45	977,856	47.1	493.9	4,489.7	101,860	3,585,470	0.762	26.82

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 from I.C. (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
11	**Washington Township Fire Department**														
	Bioretention system														
	Rainwater harvesting														
	Total Site Info	1.34	58,509	19	7, 8, 9	45	0.60	26,353	1.3	13.3	121.0	2,745	96,626	0.021	0.72
12	**Washington Township Parks and Recreation**														
	Bioretention systems														
	Total Site Info	26.12	1,137,866	17	5	14	3.55	154,692	7.5	78.1	710.2	16,114	567,202	0.121	4.24
13	**Washington Township Police Department**														
	Bioretention systems														
	Rainwater harvesting														
	Total Site Info	8.53	371,411	30	15, 15.01, 15.02	27	2.30	100,065	4.8	50.5	459.4	10,423	366,903	0.078	2.74
14	**Washington Township School District**														
	Bioretention system														
	Total Site Info	0.48	20,701	43	8	65	0.31	13,502	0.7	6.8	62.0	1,406	49,506	0.011	0.37

d. Summary of Proposed Green Infrastructure Practices

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area Area (SF)	Potential Management Area Area (ac)	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Max Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cfs)	Size of BMP	Total Cost ($)	I.C. Treated %
	Pohatcong Creek Sites	**207,285**	**4.76**	**5.339**	**903**	**389,855**	**14.65**		**$772,395**	**7.5%**
1	**Abilities of Northwest Jersey**									
	Bioretention system	2,300	0.05	0.060	10	4,400	0.17	575	$2,875	1.7%
	Planter box	215	0.00	n/a	1	n/a	n/a	1	$1,000	0.2%
	Total Site Info	**2,515**	**0.06**	**0.060**	**11**	**4,400**	**0.17**		**$3,875**	**1.9%**
2	**Faith Discovery Church**									
	Bioretention systems	7,960	0.18	0.207	35	15,220	0.57	1,990	$9,950	5.8%
	Pervious pavement	8,090	0.19	0.211	35	15,470	0.58	1,445	$36,125	5.9%
	Total Site Info	**16,050**	**0.37**	**0.418**	**70**	**30,690**	**1.15**		**$46,075**	**11.7%**
3	**Meadow Breeze Park**									
	Bioretention systems	1,915	0.04	0.050	8	3,660	0.14	480	$2,400	0.7%
	Pervious pavement	14,670	0.34	0.382	64	28,050	1.05	2,620	$65,500	5.2%
	Total Site Info	**16,585**	**0.38**	**0.432**	**72**	**31,710**	**1.19**		**$67,900**	**5.9%**
4	**Oakwood Lanes**									
	Bioretention system	5,040	0.12	0.131	22	9,630	0.36	1,260	$6,300	6.6%
	Pervious pavement	11,930	0.27	0.311	52	22,810	0.86	2,130	$53,250	15.7%
	Total Site Info	**16,970**	**0.39**	**0.442**	**74**	**32,440**	**1.22**		**$59,550**	**22.3%**
5	**Pleasant Valley Veterinary Services**									
	Bioretention systems	1,790	0.04	0.047	8	3,430	0.13	430	$2,150	8.6%
	Total Site Info	**1,790**	**0.04**	**0.047**	**8**	**3,430**	**0.13**		**$2,150**	**8.6%**
6	**Port Colden Elementary School**									
	Bioretention system	3,680	0.08	0.096	16	7,040	0.26	920	$4,600	1.9%
	Planter boxes	430	0.01	n/a	2	n/a	n/a	2	$2,000	0.2%
	Rainwater harvesting	1,715	0.04	0.045	7	1,335	0.05	1,335	$2,670	0.9%
	Total Site Info	**5,825**	**0.13**	**0.141**	**25**	**8,375**	**0.31**		**$9,270**	**3.0%**
7	**Port Colden United Methodist Church**									
	Bioretention systems	800	0.02	0.021	3	1,530	0.06	200	$1,000	5.5%
	Total Site Info	**800**	**0.02**	**0.021**	**3**	**1,530**	**0.06**		**$1,000**	**5.5%**

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	Total Cost ($)	I.C. Treated %
8	**St. Luke's Lutheran Church**									
	Bioretention system	3,205	0.07	0.084	14	6,130	0.23	995	$4,975	5.2%
	Total Site Info	**3,205**	**0.07**	**0.084**	**14**	**6,130**	**0.23**		**$4,975**	**5.2%**
9	**Warren County Community College**									
	Bioretention systems	11,605	0.27	0.302	51	22,190	0.83	2,900	$14,500	2.5%
	Pervious pavement	45,810	1.05	1.194	200	87,580	3.29	8,180	$204,500	9.9%
	Total Site Info	**57,415**	**1.32**	**1.496**	**250**	**109,770**	**4.12**		**$219,000**	**12.4%**
10	**Warren Hills Regional High School**									
	Bioretention systems	15,390	0.35	0.401	67	29,430	1.11	3,850	$19,250	1.6%
	Pervious pavement	56,335	1.29	1.468	246	107,700	4.05	12,620	$315,500	5.8%
	Planter boxes	1,720	0.04	n/a	6	n/a	n/a	8	$8,000	0.2%
	Total Site Info	**73,445**	**1.69**	**1.869**	**319**	**137,130**	**5.16**		**$342,750**	**7.5%**
11	**Washington Township Fire Department**									
	Bioretention system	1,260	0.03	0.033	5	2,410	0.09	315	$1,575	4.8%
	Rainwater harvesting	1,260	0.03	0.033	5	980	0.04	980	$1,960	4.8%
	Total Site Info	**1,260**	**0.03**	**0.033**	**5**	**2,410**	**0.09**		**$1,575**	**4.8%**
12	**Washington Township Parks and Recreation**									
	Bioretention systems	1,320	0.03	0.034	6	2,520	0.09	330	$1,650	0.9%
	Total Site Info	**1,320**	**0.03**	**0.034**	**6**	**2,520**	**0.09**		**$1,650**	**0.9%**
13	**Washington Township Police Department**									
	Bioretention systems	9,320	0.21	0.243	41	17,820	0.67	2,330	$11,650	9.3%
	Rainwater harvesting	1,000	0.02	0.026	4	780	0.03	780	$1,560	1.0%
	Total Site Info	**9,320**	**0.21**	**0.243**	**41**	**17,820**	**0.67**		**$11,650**	**9.3%**
14	**Washington Township School District**									
	Bioretention system	785	0.02	0.020	3	1,500	0.06	195	$975	5.8%
	Total Site Info	**785**	**0.02**	**0.020**	**3**	**1,500**	**0.06**		**$975**	**5.8%**