RUTGERS
New Jersey Agricultural
Experiment Station

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

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

November 3, 2016

WILLIAM PENN
FOUNDATION

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Introduction

Located in Warren County in eastern New Jersey, Lopatcong Township covers approximately 7.16 square miles. Figures 1 and 2 illustrate that Lopatcong Township is dominated by urban land uses. Approximately 48.4% of the municipality's land use is classified as urban. Of the urban land in Lopatcong Township, medium density residential is the dominant land use (Figure 3).

The New Jersey Department of Environmental Protection's (NJDEP) 2007 land use/land cover geographical information system (GIS) data layer categorizes Lopatcong 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 Lopatcong Township. Based upon the 2007 NJDEP land use/land cover data, approximately 12.5% of Lopatcong Township has impervious cover. This level of impervious cover suggests that the streams in Lopatcong Township are likely impacted streams. [1]

Methodology

Lopatcong Township contains portions of three 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

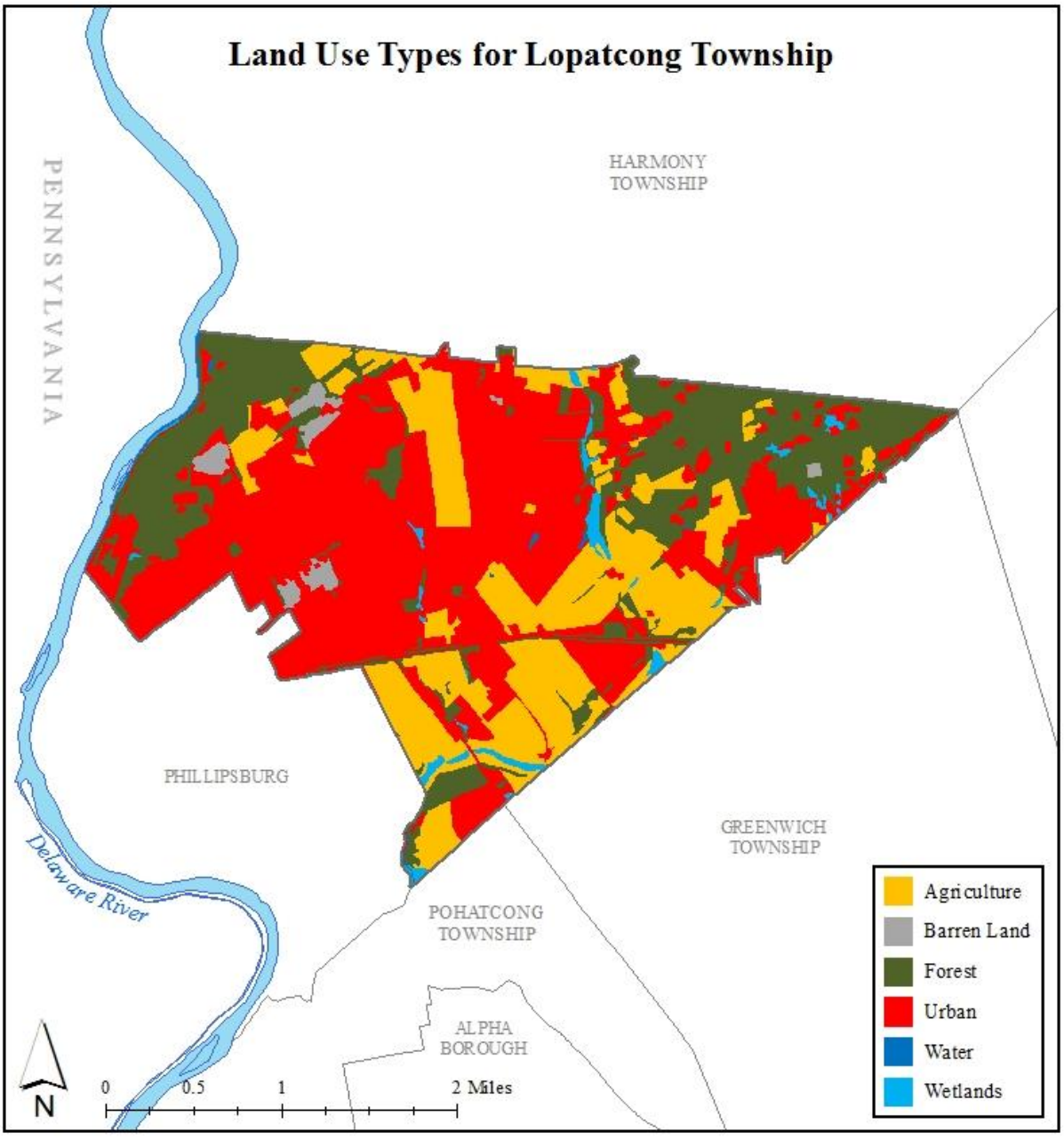


Figure 1: Map of the land use in Lopatcong Township

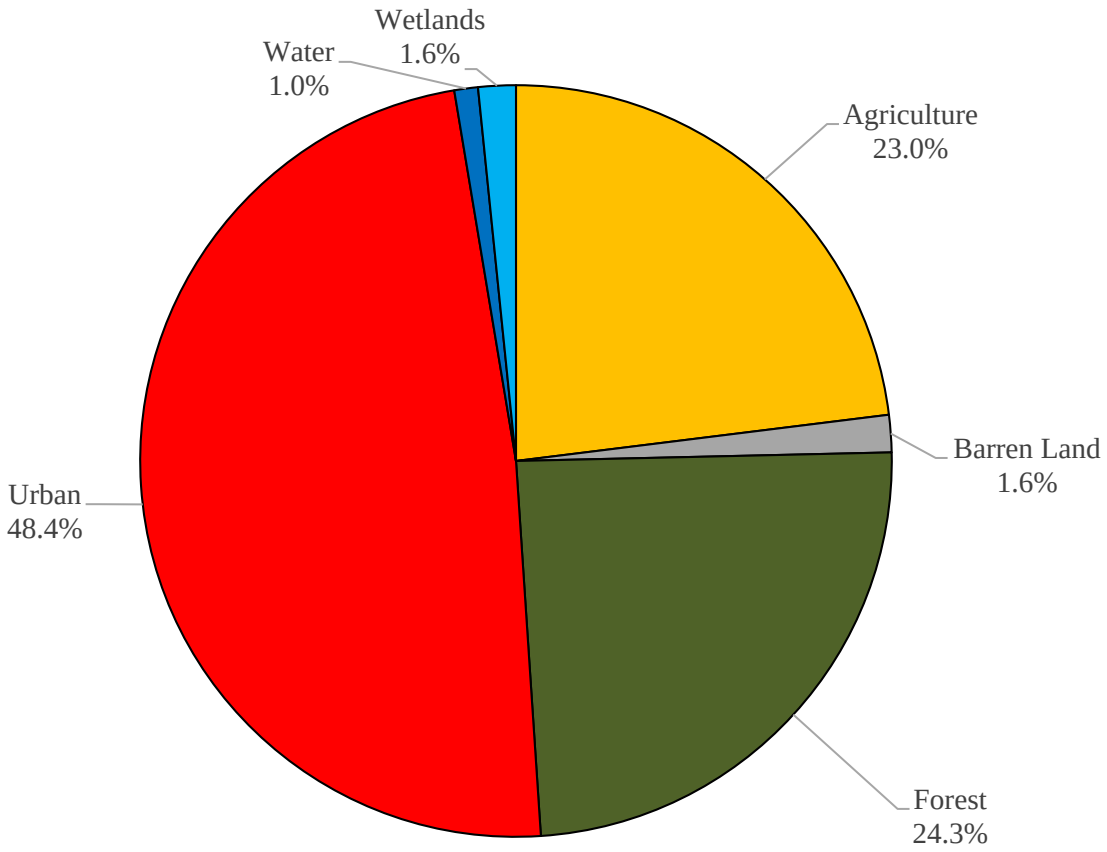


Figure 2: Pie chart illustrating the land use in Lopatcong Township

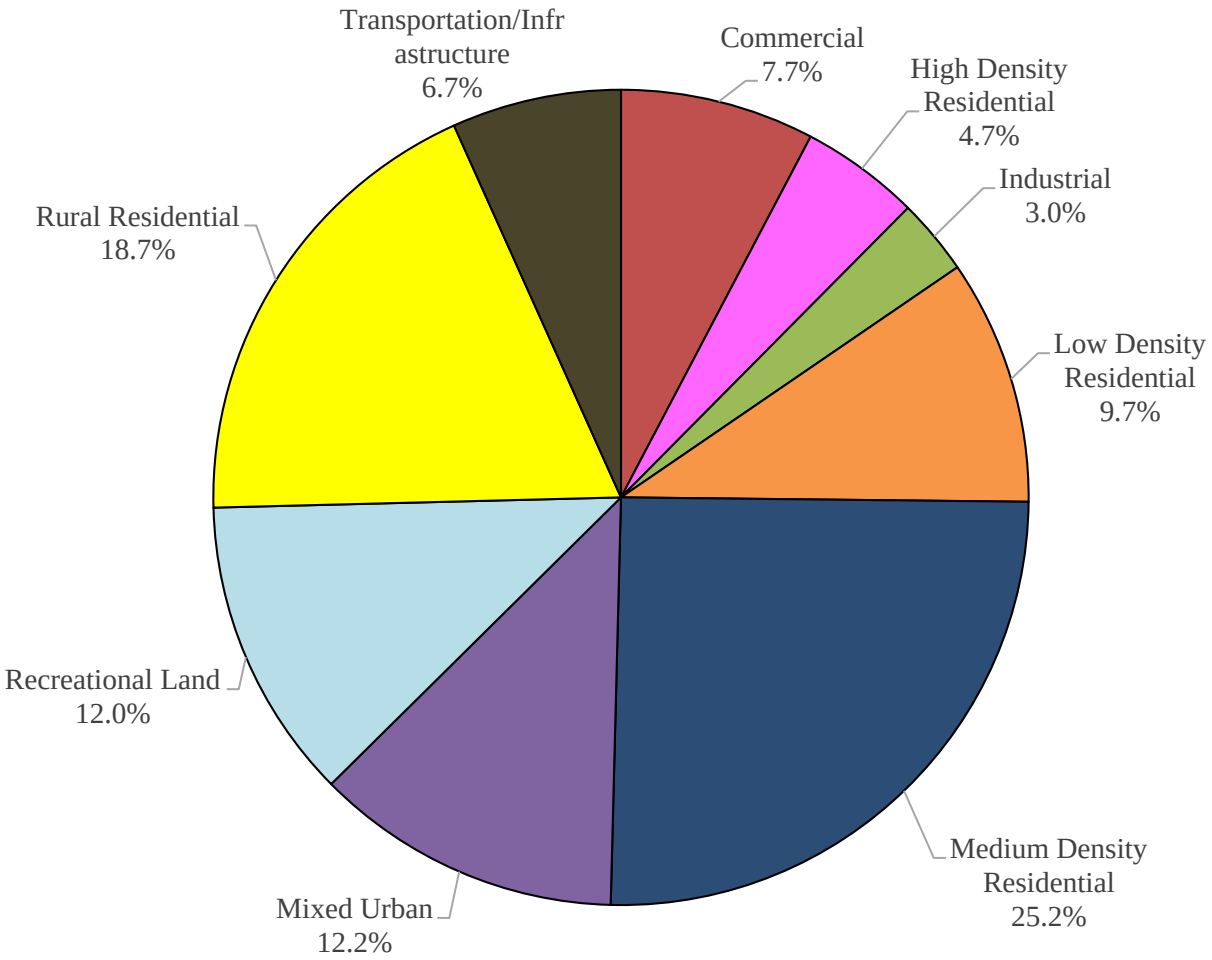


Figure 3: Pie chart illustrating the various types of urban land use in Lopatcong Township

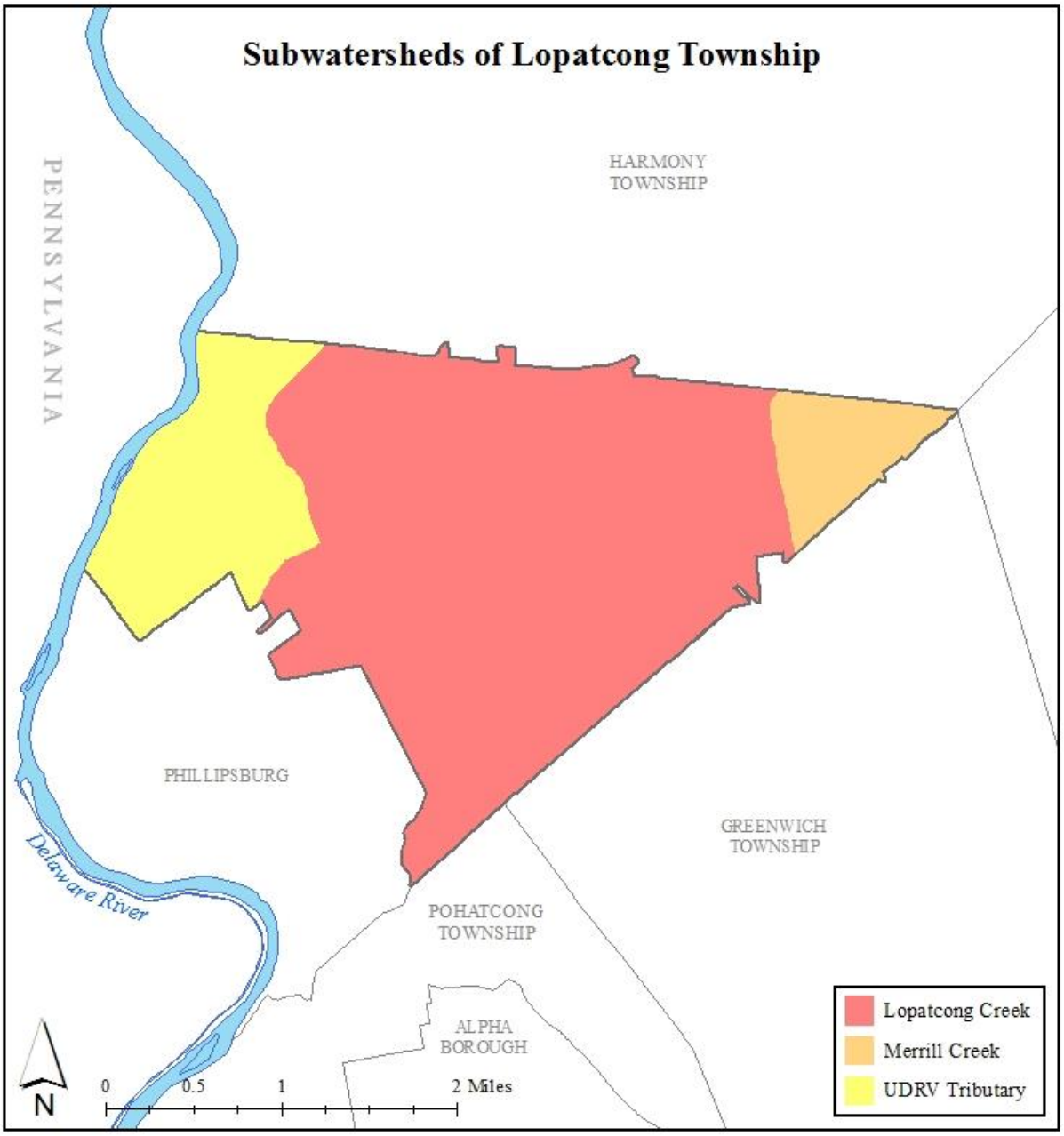


Figure 4: Map of the subwatersheds in Lopatcong Township

For each potential project site, specific aerial loading coefficients for commercial land use were used to determine the annual runoff loads for total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS) from impervious surfaces (Table 1). These are the same aerial loading coefficients that NJDEP uses in developing total maximum daily loads (TMDLs) for impaired waterways of the state. The percentage of impervious cover for each site was extracted from the 2007 NJDEP land use/land cover database. For impervious areas, runoff volumes were determined for the water quality design storm (1.25 inches of rain over two-hours) and for the annual rainfall total of 44 inches.

Preliminary soil assessments were conducted for each potential project site identified in Lopatcong Township using the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey, which utilizes regional and statewide soil data to predict soil types in an area. Several key soil parameters were examined (e.g., natural drainage class, saturated hydraulic conductivity of the most limiting soil layer (K_{sat}), depth to water table, and hydrologic soil group) to evaluate the suitability of each site's soil for green infrastructure practices. In cases where multiple soil types were encountered, the key soil parameters were examined for each soil type expected at a site.

For each potential project site, drainage areas were determined for each of the green infrastructure practices proposed at the site. These green infrastructure practices were designed to manage the 2-year design storm, enabling these practices to capture 95% of the annual rainfall. Runoff volumes were calculated for each proposed green infrastructure practice. The reduction in TSS loading was calculated for each drainage area for each proposed green infrastructure practice using the aerial loading coefficients in Table 1. The maximum volume reduction in stormwater runoff for each green infrastructure practice for a storm was determined by calculating the volume of runoff captured from the 2-year design storm. For each green infrastructure practice, peak discharge reduction potential was determined through hydrologic modeling in HydroCAD. For each green infrastructure practice, a cost estimate is provided. These costs are based upon the square footage of the green infrastructure practice and the real cost of green infrastructure practice implementation in New Jersey.

Table 1: Aerial Loading Coefficients[2]

Land Cover	TP load (lbs/acre/yr)	TN load (lbs/acre/yr)	TSS load (lbs/acre/yr)
High, Medium Density Residential	1.4	15	140
Low Density, Rural Residential	0.6	5	100
Commercial	2.1	22	200
Industrial	1.5	16	200
Urban, Mixed Urban, Other Urban	1.0	10	120
Agriculture	1.3	10	300
Forest, Water, Wetlands	0.1	3	40
Barrenland/Transitional Area	0.5	5	60

[2] New Jersey Department of Environmental Protection (NJDEP), Stormwater Best Management Practice Manual, 2004.

Green Infrastructure Practices

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

Disconnected downspouts

This is often referred to as simple disconnection. A downspout is simply disconnected, prevented from draining directly to the roadway or storm sewer system, and directed to discharge water to a pervious area (i.e., lawn).

Pervious pavements

There are several types of permeable pavement systems including porous asphalt, pervious concrete, permeable pavers, and grass pavers. These surfaces are hard and support vehicle traffic but also allow water to infiltrate through the surface. They have an underlying stone layer to store stormwater runoff and allow it to slowly seep into the ground.




[3] United States Environmental Protection Agency (USEPA), 2013. Watershed Assessment, Tracking, and Environmental Results, New Jersey Water Quality Assessment Report. http://ofmpub.epa.gov/waters10/attains_state.control?p_state=NJ

Bioretention systems/rain gardens

These are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff. These systems can easily be incorporated into existing landscapes, improving aesthetics and creating 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 practices 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*.

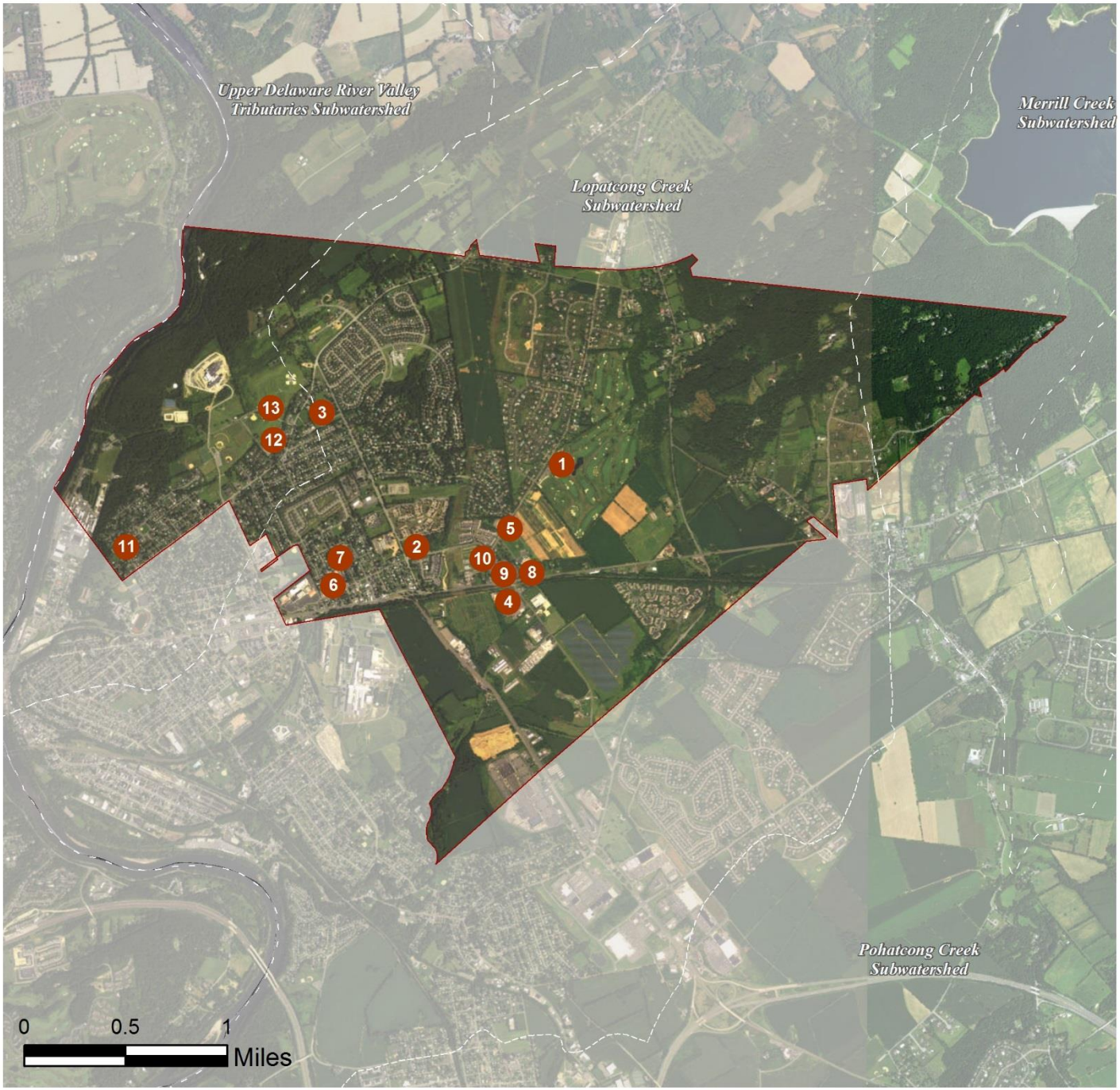
Conclusion

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. Green Infrastructure Sites

LOPATCONG TOWNSHIP: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE LOPATCONG CREEK SUBWATERSHED:

1. Architects Golf Club
2. Clymer Village
3. First Baptist Church
4. JHM Communications
5. Lopatcong Fire Department
6. Lopatcong Township Municipal Court
7. Phillipsburg Christian Academy & Fellowship Church
8. Schoolhouse Village
9. Shopping Plaza
10. St. Luke's Village Health Center

SITES WITHIN THE UPPER DELAWARE RIVER VALLEY TRIBUTARIES SUBWATERSHED:

11. Delaware Park Fire Department
12. Lopatcong Swimming Pool
13. Recreation Fields

b. Proposed Green Infrastructure Concepts

ARCHITECTS GOLF CLUB

Subwatershed: **Lopatcong Creek**

Site Area: **7,617,692 sq. ft.**

Address: **700 Stryker Road**
Phillipsburg, NJ 08865

Block and Lot: **Block 95, Lot 29**

Parking islands can be replaced with tree filter boxes to capture, treat, and infiltrate stormwater runoff and improve the aesthetic of 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"
3	201,476	9.7	101.8	925.1	0.157	5.53

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Tree filter boxes	0.607	102	44,506	1.67	3,530	$353,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Architects Golf Club

- tree filter box
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

CLYMER VILLAGE

Subwatershed: Lopatcong Creek

Site Area: 299,097 sq. ft.

Address: 211 Red School Lane
Phillipsburg, NJ 08865

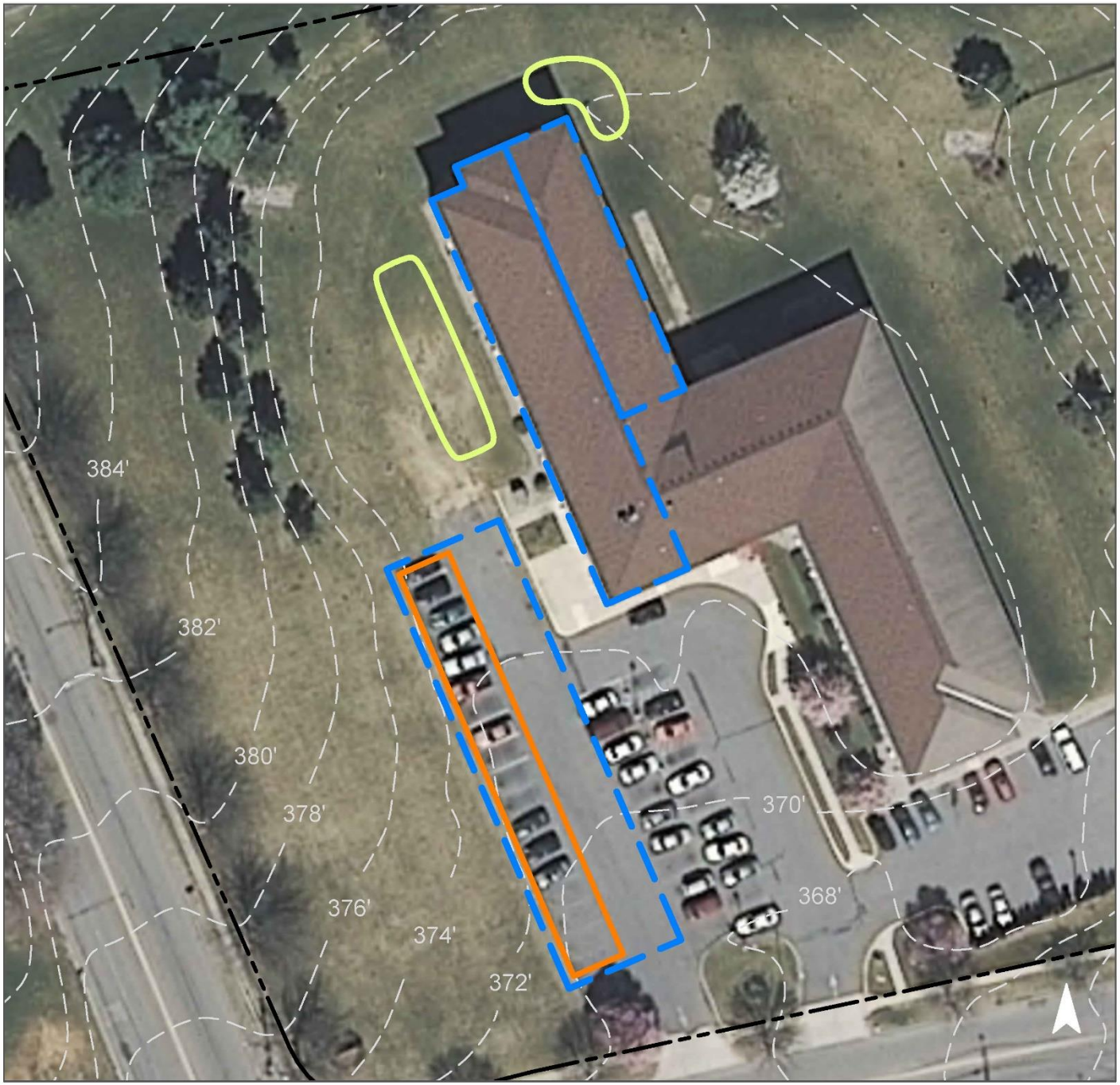
Block and Lot: Block 115, Lot 1

Parking spots to the west of the building can be replaced with porous asphalt to capture and infiltrate stormwater. Rain gardens adjacent to the building can capture, treat, and infiltrate roof runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
22	67,070	3.2	33.9	307.9	0.052	1.84

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	0.242	40	16,577	0.67	2,410	$12,050
Pervious pavement	0.224	38	15,358	0.62	3,780	$94,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Clymer Village

- bioretention system
- pervious pavement
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 30' 60'

FIRST BAPTIST CHURCH

Subwatershed: **Lopatcong Creek**

Site Area: **423,689 sq. ft.**

Address: **810 Red School Lane**
Phillipsburg, NJ 08865

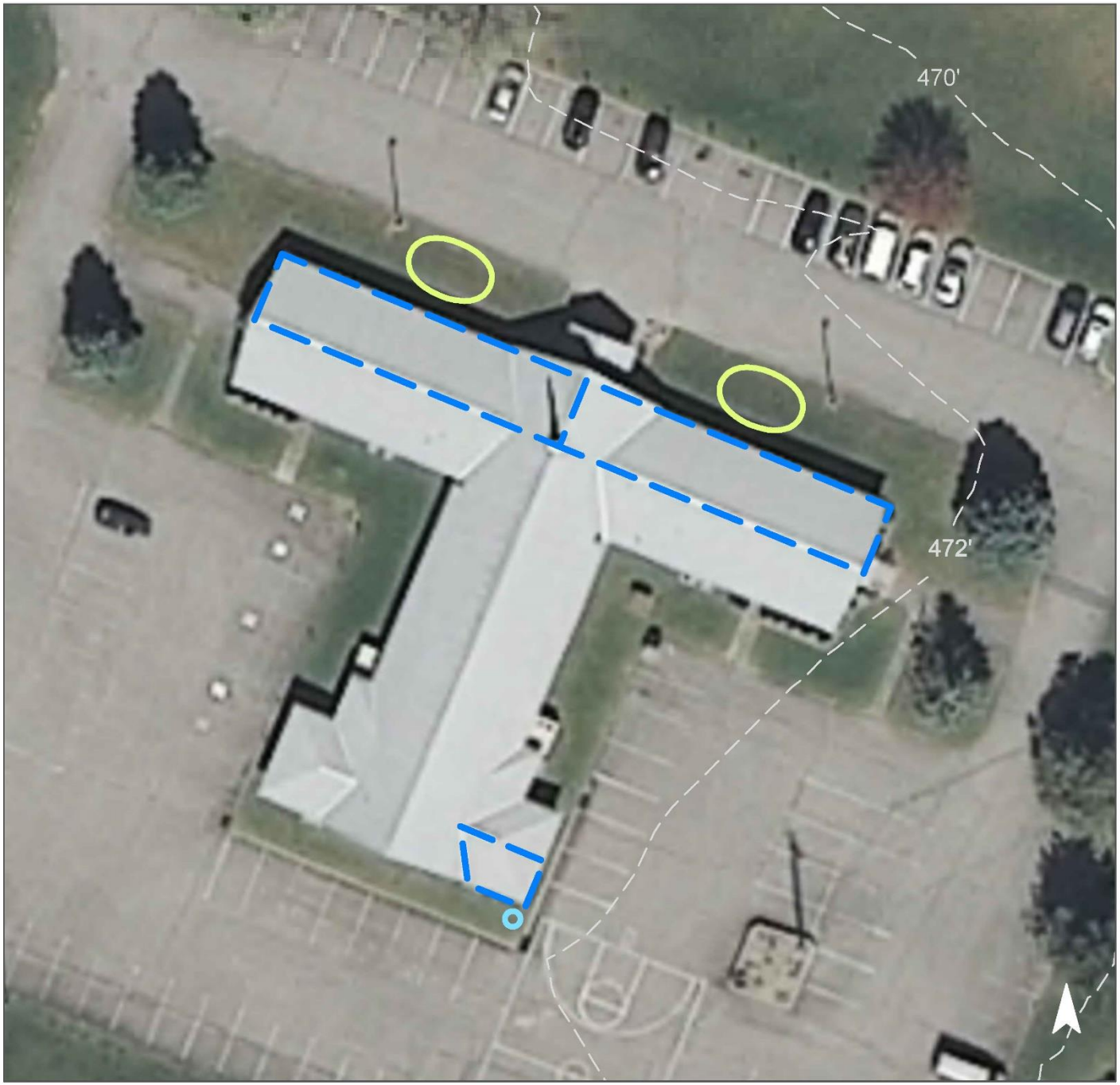
Block and Lot: **Block 32, Lot 9.03**

Rain gardens can be installed in front of the building to capture, treat, and infiltrate roof runoff. Runoff from the southeast corner of the building can be disconnected and rerouted into a rainwater harvesting system to be reused for watering plants. 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"
23	99,479	4.8	50.2	456.7	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 systems	0.084	14	6,164	0.23	800	$4,000
Rainwater harvesting	0.007	1	500	0.02	500 (gal)	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



First Baptist Church

- bioretention system
- rainwater harvesting
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

JHM COMMUNICATIONS

Subwatershed: **Lopatcong Creek**

Site Area: **676,501 sq. ft.**

Address: **199 Strykers Road**
Phillipsburg, NJ 08865

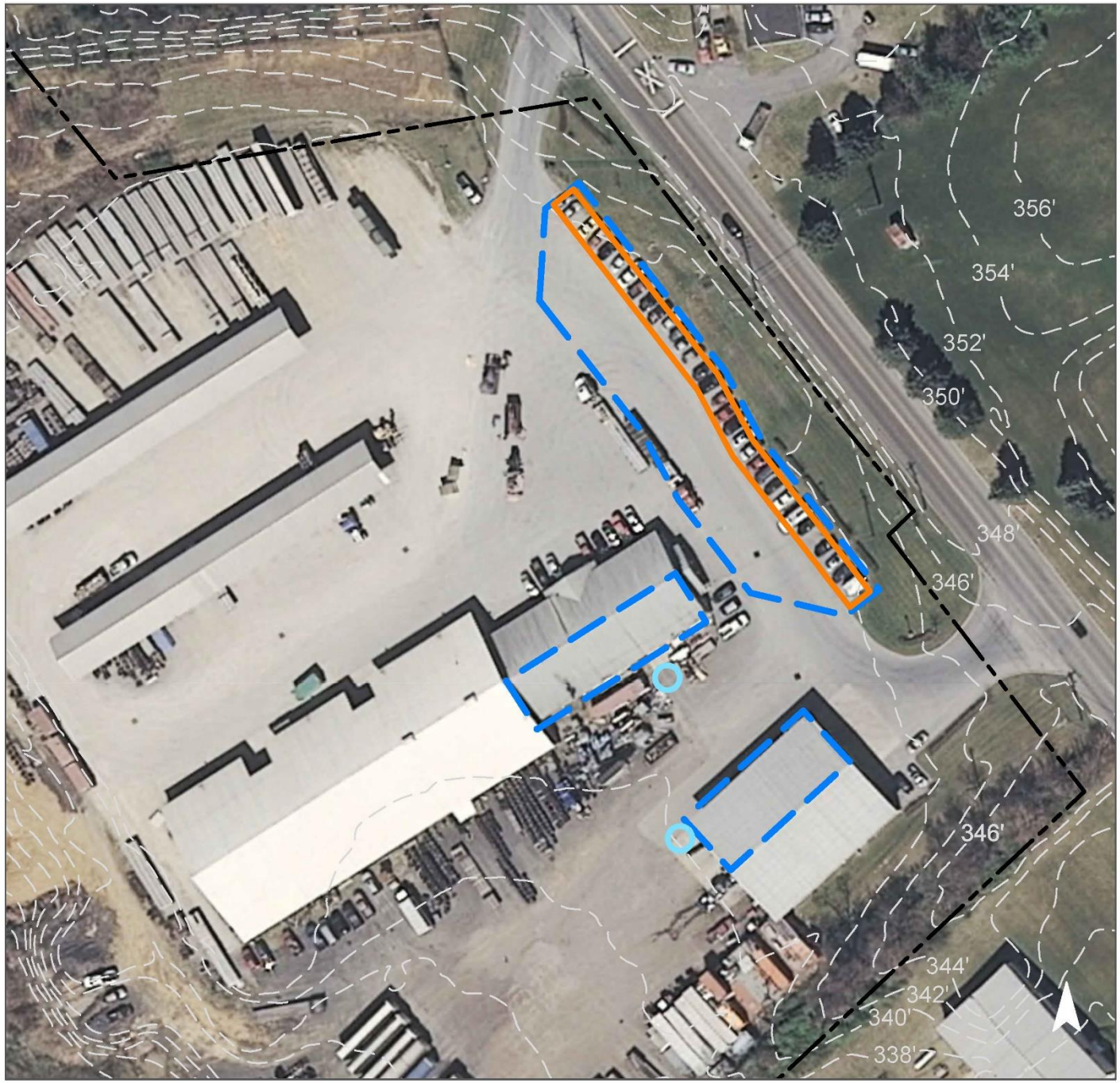
Block and Lot: **Block 100, Lot 2,2.04**

Parking spots can be replaced with porous asphalt to capture and infiltrate stormwater. Installing a cistern will capture roof runoff and provide water for washing vehicles or other non-potable uses. 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"
24	165,047	8.0	83.4	757.8	0.129	4.53

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavement	0.535	90	39,285	1.48	5,490	$137,250
Rainwater harvesting	0.254	42	18,618	0.70	10,000 (gal)	$20,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



JHM Communications

- pervious pavement
- rainwater harvesting
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

LOPATCONG FIRE DEPARTMENT

Subwatershed: Lopatcong Creek

Site Area: 53,778 sq. ft.

Address: 224 Strykers Road
Phillipsburg, NJ 08865

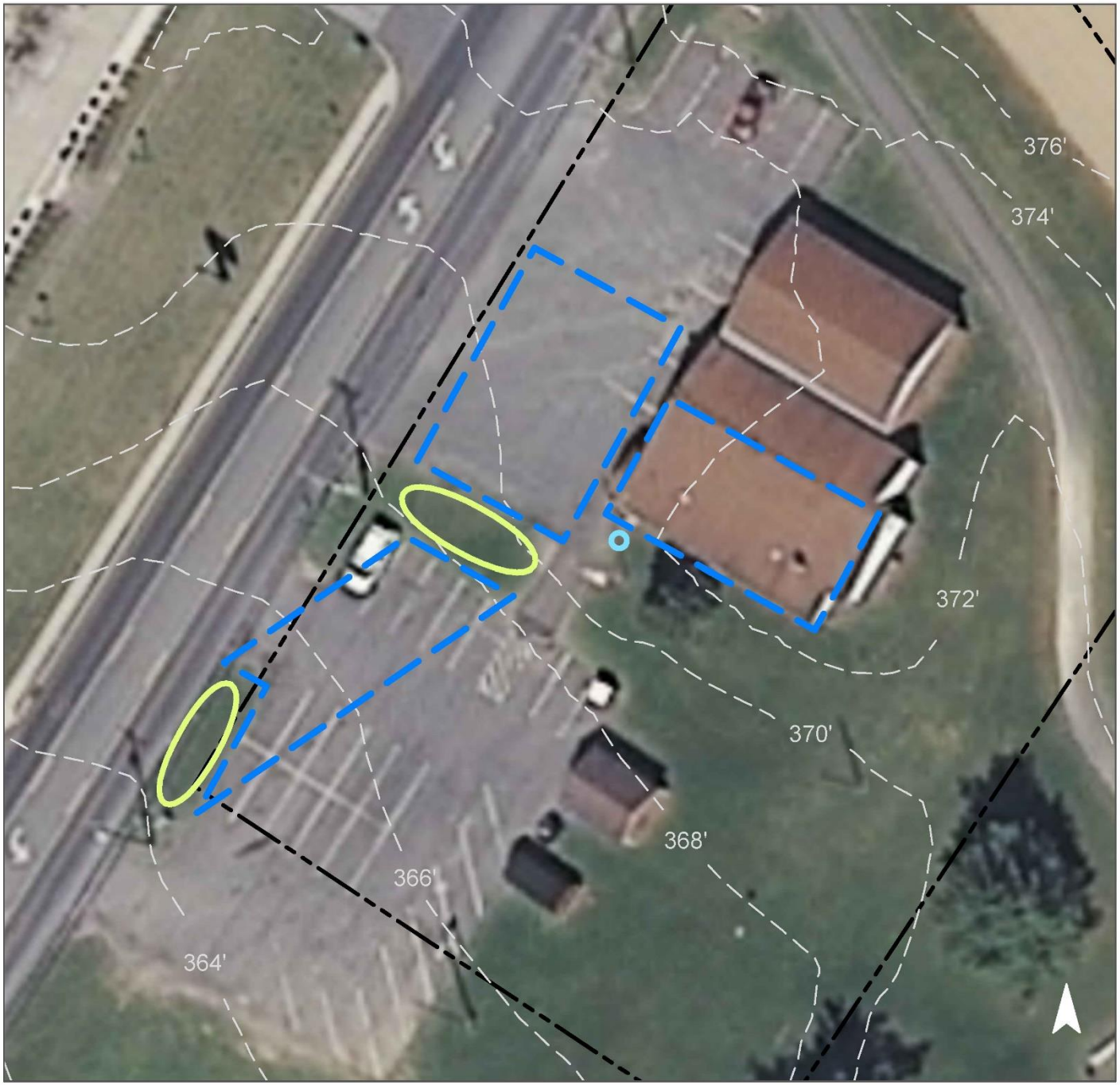
Block and Lot: Block 95, Lot 44.01

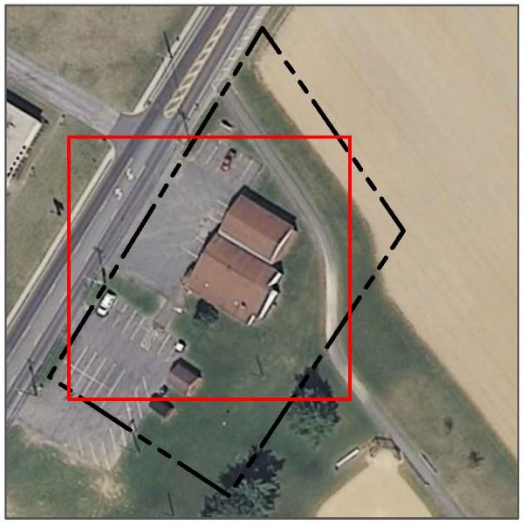
Runoff from the rooftop can be disconnected and drain into a rainwater harvesting system. Installing two rain gardens adjacent to the parking lot can capture, treat, and infiltrate runoff from the parking lots. A preliminary soil assessment suggests that the soils have suitable drainage characteristics 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"
48	25,997	1.3	13.1	119.4	0.020	0.71

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	0.125	21	9,149	0.34	1,150	$5,750
Rainwater harvesting	0.050	10	1,700	0.16	1,700 (gal)	$3,400

GREEN INFRASTRUCTURE RECOMMENDATIONS





Lopatcong Fire Department

- bioretention system
- rainwater harvesting
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

LOPATCONG TOWNSHIP MUNICIPAL COURT

Subwatershed: Lopatcong Creek

Site Area: 43,580 sq. ft.

Address: 232 South 3rd Street
Phillipsburg, NJ 08865

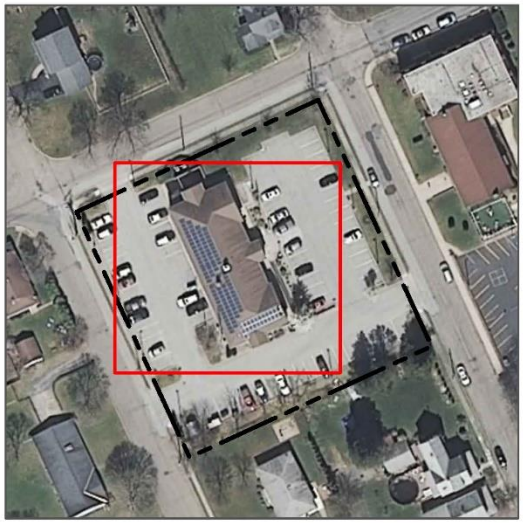
Block and Lot: Block 67, Lot 1, 2, 3, 10

Parking spots in the west and south lots can be replaced with porous asphalt to capture and infiltrate stormwater. Installing a rain garden adjacent to the building can capture, treat, and infiltrate roof runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
74	32,173	1.6	16.2	147.7	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 system	0.015	3	1,100	0.04	150	$750
Pervious pavement	0.718	120	52,618	1.98	7,000	$175,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Lopatcong Township Municipal Court

- bioretention system
- pervious pavement
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

PHILLIPSBURG CHRISTIAN ACADEMY & FELLOWSHIP CHURCH

Subwatershed: Lopatcong Creek

Site Area: 31,307 sq. ft.

Address: 300 Cromwell Street
Phillipsburg, NJ 08865

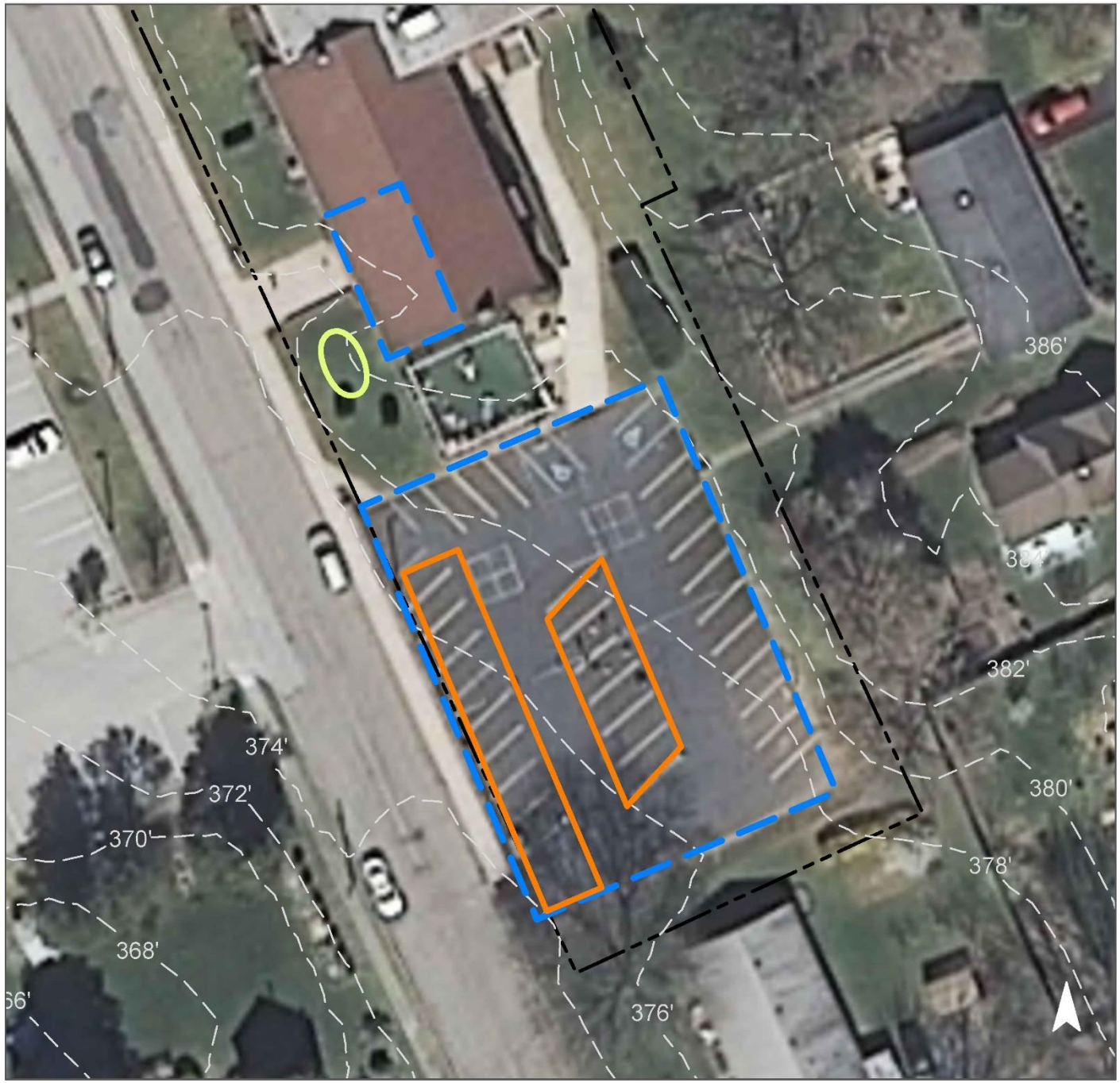
Block and Lot: Block 70, Lot 9, 10

Parking spots to the south of the building can be replaced with porous asphalt to capture and infiltrate stormwater. Installing a rain garden adjacent to the building can capture, treat, and infiltrate roof runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
74	23,080	1.1	11.7	106.0	0.018	0.63

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	0.022	4	1,638	0.06	220	$1,100
Pervious pavement	0.261	44	19,105	0.72	2,740	$68,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Phillipsburg Christian Academy & Fellowship Church

- bioretention system
- pervious pavement
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

SCHOOLHOUSE VILLAGE

Subwatershed: Lopatcong Creek

Site Area: 176,233 sq. ft.

Address: 259 New Jersey 57
Phillipsburg, NJ 08865

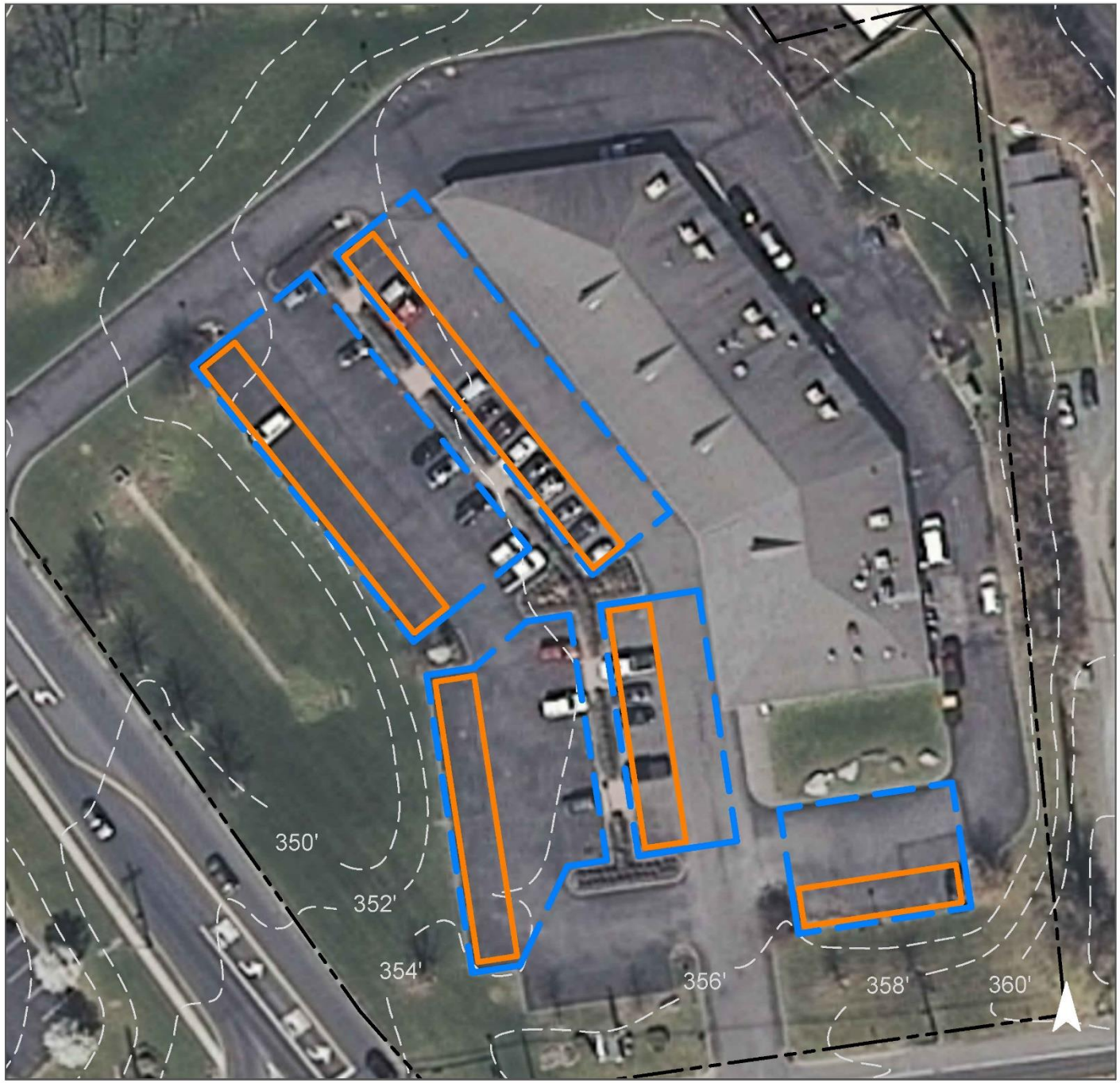
Block and Lot: Block 95, Lot 36.01,37

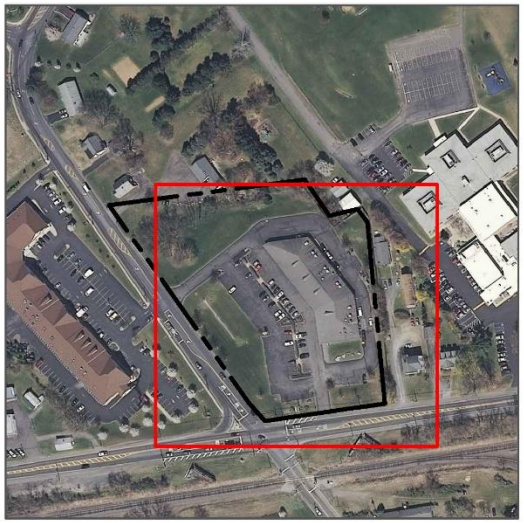
Parking spots can be replaced with porous asphalt to capture and infiltrate stormwater. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
53	92,981	4.5	47.0	426.9	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
Pervious pavement	0.734	123	50,299	2.02	9,390	$234,750

GREEN INFRASTRUCTURE RECOMMENDATIONS





Schoolhouse Village

- pervious pavement
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 30' 60'

SHOPPING PLAZA

Subwatershed: Lopatcong Creek

Site Area: 167,149 sq. ft.

Address: 206 Stryker Road
Phillipsburg, NJ 08865

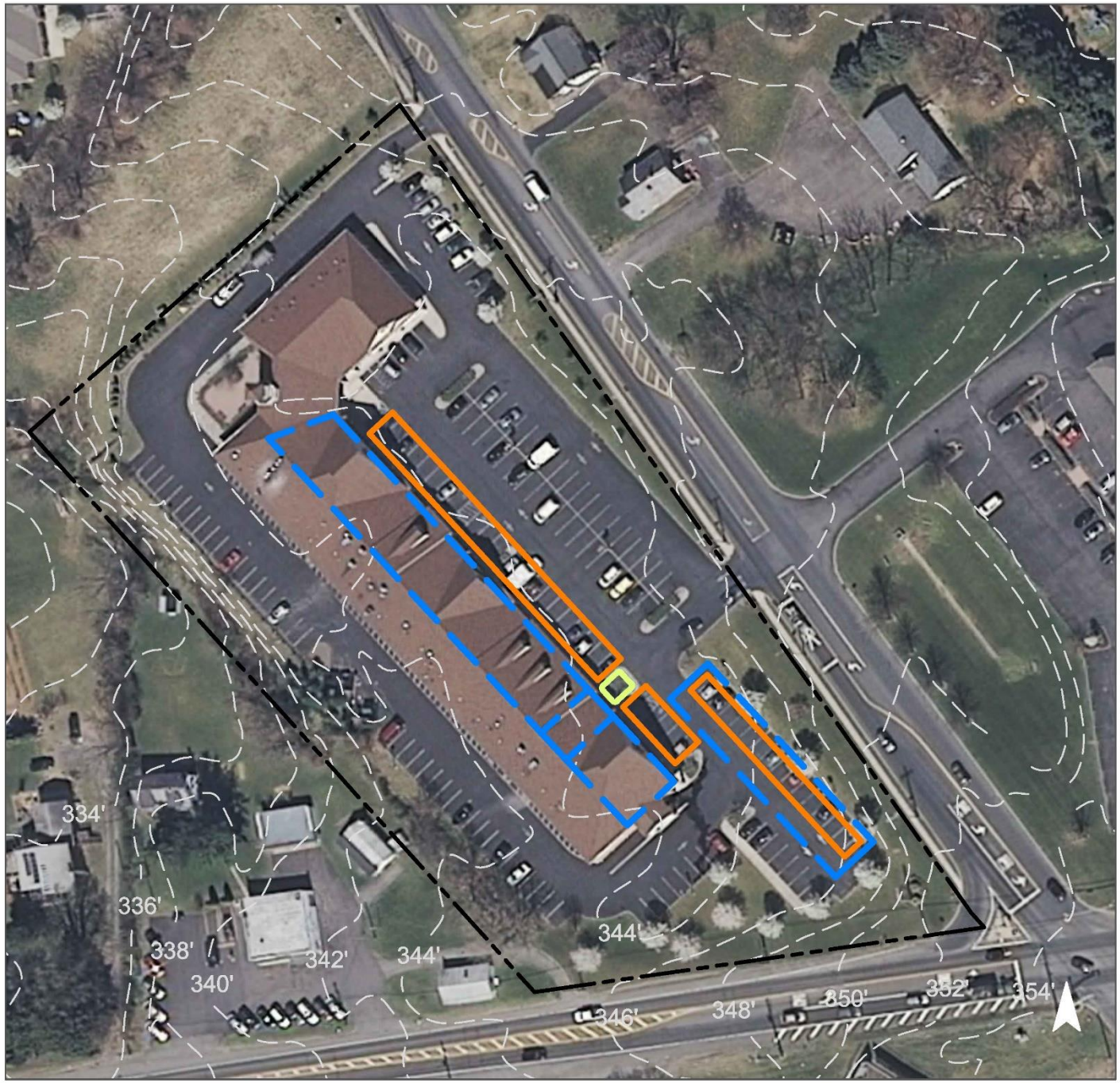
Block and Lot: Block 116, Lot 24

Parking spots in front of the building can be replaced with porous asphalt to capture and infiltrate stormwater runoff. Downspouts from the roof can be disconnected and directed into a rain garden. 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"
76	126,806	6.1	64.0	582.2	0.099	3.48

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.026	4	1,803	0.07	220	$1,100
Pervious pavement	0.483	81	33,116	1.33	7,940	$198,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Shopping Plaza

- bioretention system
- pervious pavement
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

ST. LUKE'S VILLAGE HEALTH CENTER

Subwatershed: Upper Delaware River Valley Tributaries

Site Area: 99,945 sq. ft.

Address: 205 Stryker Road
Phillipsburg, NJ 08865

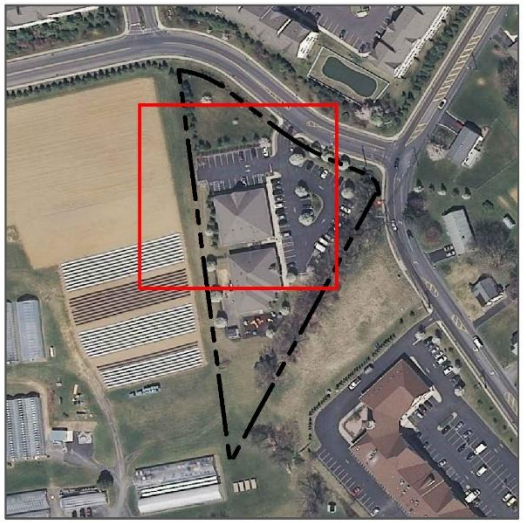
Block and Lot: Block 116, Lot 23

A rain garden installed along the western side of the parking lot can capture, treat, and infiltrate parking lot runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
58	58,268	2.8	29.4	267.5	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	0.167	28	3,175	0.12	1,650	$8,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



St. Luke's Village Health Center

- bioretention system
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 20' 40'

DELAWARE PARK FIRE DEPARTMENT

Subwatershed: Upper Delaware River Valley Tributaries

Site Area: 21,173 sq. ft.

Address: 112 Park Avenue
Phillipsburg, NJ 08865

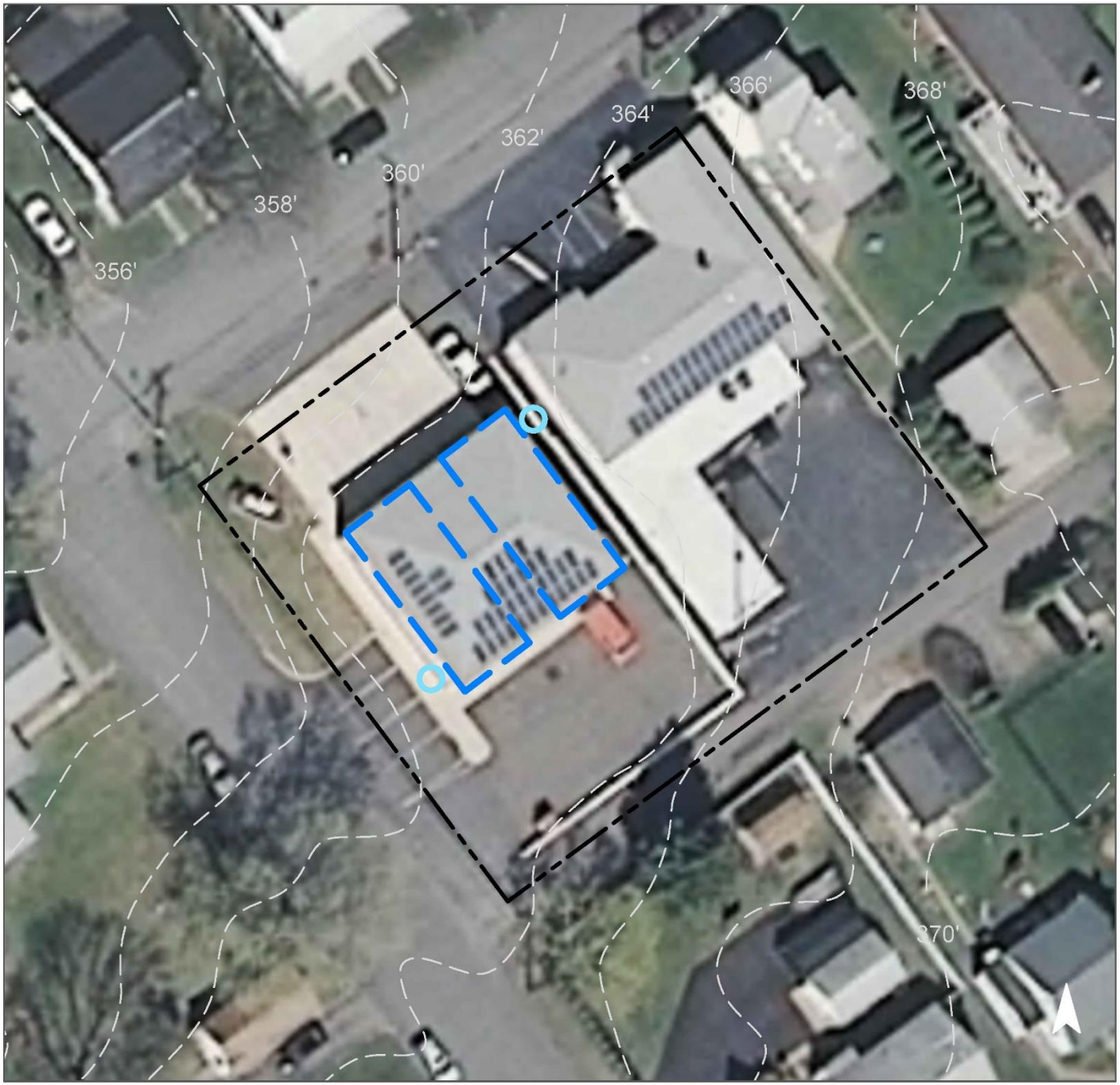
Block and Lot: Block 22, Lot 2

Rainwater can be harvested by installing two cisterns at the corners of the building. The water can then be used for washing vehicles or for other non-potable uses. 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"
30	6,352	0.3	3.2	29.2	0.005	0.17

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	0.057	10	3,000	0.16	3,000 (gal)	$6,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Delaware Park Fire Department

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

0 20' 40'

LOPATCONG SWIMMING POOL

Subwatershed: Upper Delaware River Valley Tributaries

Site Area: 384,143 sq. ft.

Address: 9 Wildew Avenue
Phillipsburg, NJ 08865

Block and Lot: Block 2, Lot 30.07,30.08

Parking spots along the western side of the lot can be replaced with porous asphalt to capture and infiltrate stormwater. Rain gardens adjacent to the building can capture, treat, and infiltrate roof runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
29	113,230	5.5	57.2	519.9	0.088	3.11

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.046	8	3,164	0.13	480	$2,400
Pervious pavement	0.368	62	25,254	1.02	3,380	$84,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Lopatcong Swimming Pool

- bioretention system
- pervious pavement
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

RECREATION FIELDS

Subwatershed: Upper Delaware River Valley Tributaries

Site Area: 2,464,699 sq. ft.

Address: Amy Street
Phillipsburg, NJ 08865

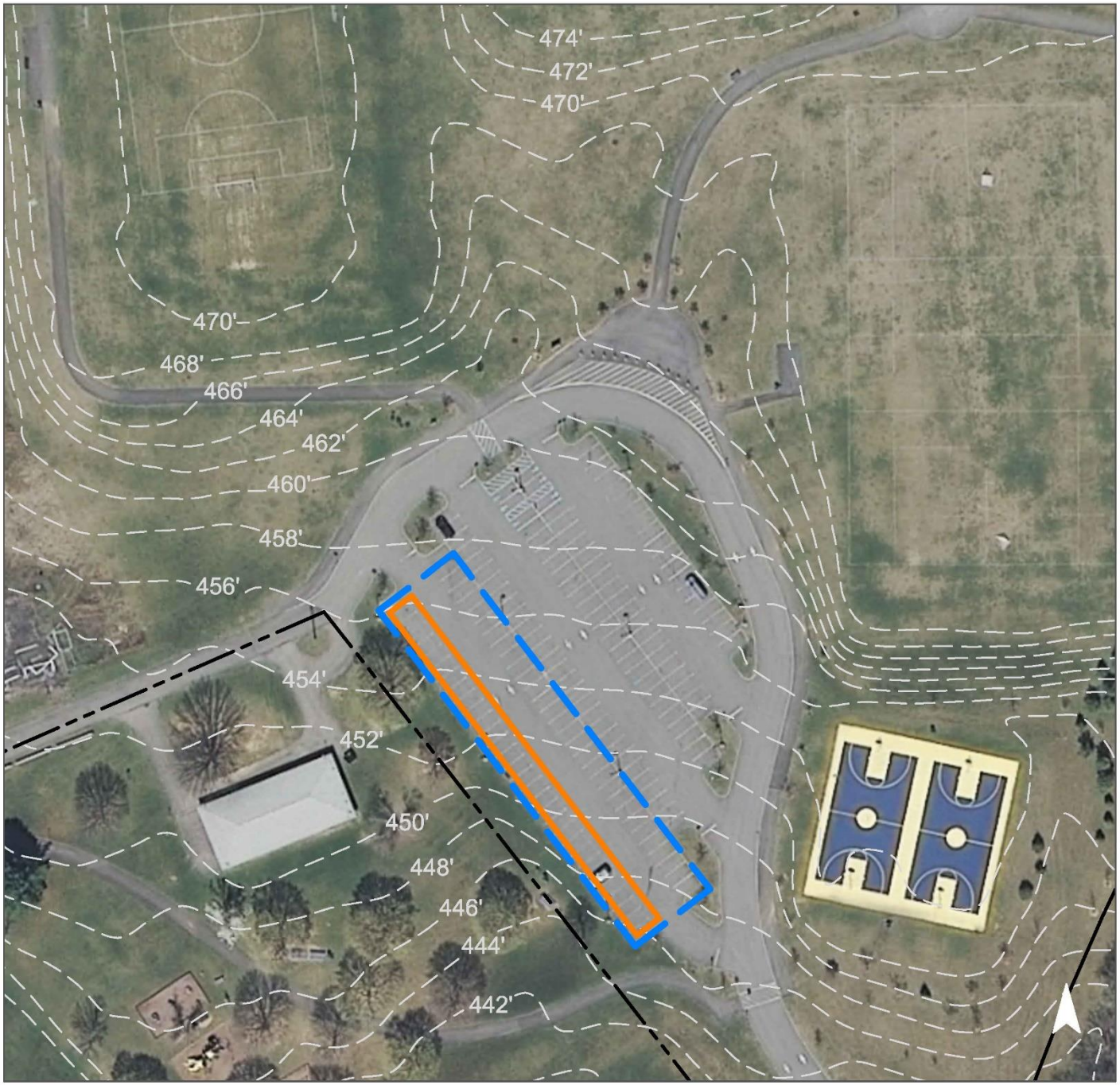
Block and Lot: Block 2, Lot 30.01

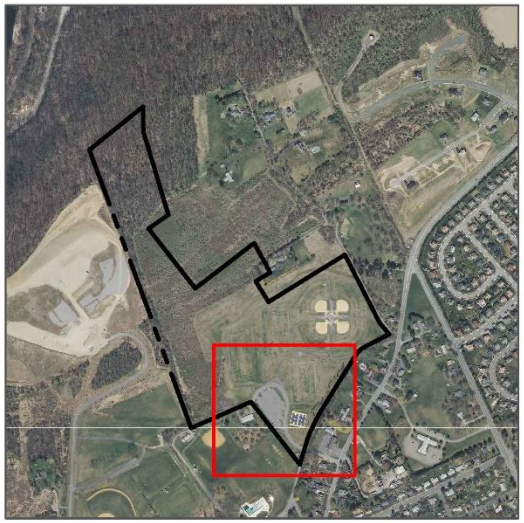
Parking spots of the site can be replaced with porous asphalt to capture and infiltrate stormwater. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
4	100,416	4.3	45.2	411.0	0.070	2.46

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 pavement	0.443	74	30,363	1.22	5,060	$126,500

GREEN INFRASTRUCTURE RECOMMENDATIONS





Recreation Fields

- pervious pavement
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

c. Summary of Existing Conditions

Summary of Existing 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)
LOPATCONG CREEK SUBWATERSHED	**220.13**	**9,588,970**			**43.0**	**450.7**	**4,097.2**		**20.49**	**892,377**	**0.695**	**24.47**
Architects Golf Club												
Total Site Info	174.88	7,617,692	95	29	9.7	101.8	925.1	3	4.63	201,476	0.157	5.53
Clymer Village												
Total Site Info	6.87	299,097	115	1	3.2	33.9	307.9	22	1.54	67,070	0.052	1.84
First Baptist Church												
Total Site Info	9.73	423,689	32	9.03	4.8	50.2	456.7	23	2.28	99,479	0.078	2.73
JHM Communications												
Total Site Info	15.53	676,501	100	2,2.04	8.0	83.4	757.8	24	3.79	165,047	0.129	4.53
Lopatcong Fire Department												
Total Site Info	1.23	53,778	95	44.01	1.3	13.1	119.4	48	0.60	25,997	0.020	0.71
Lopatcong Township Municipal Court												
Total Site Info	1.00	43,580	67	1,2,3,10	1.6	16.2	147.7	74	0.74	32,173	0.025	0.88
Phillipsburg Christian Academy & Fellowship Church												
Total Site Info	0.72	31,307	70	9,10	1.1	11.7	106.0	74	0.53	23,080	0.018	0.63
Schoolhouse Village												
Total Site Info	4.05	176,233	95	36.01,37	4.5	47.0	426.9	53	2.13	92,981	0.072	2.55
Shopping Plaza												
Total Site Info	3.84	167,149	116	24	6.1	64.0	582.2	76	2.91	126,806	0.099	3.48
St. Luke’s Village Health Center												
Total Site Info	2.29	99,945	116	23	2.8	29.4	267.5	58	1.34	58,268	0.045	1.60

Summary of Existing 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)
UPPER DELAWARE RIVER TRIBUTARIES SUBWATERSHED	**65.89**	**2,870,014**			**10.1**	**105.6**	**960.1**		**4.80**	**209,101**	**0.163**	**5.73**
Delaware Park Fire Department												
Total Site Info	0.49	21,173	22	2	0.3	3.2	29.2	30	0.15	6,352	0.005	0.17
Lopatcong Swimming Pool												
Total Site Info	8.82	384,143	2	30.07,30.08	5.5	57.2	519.9	29	2.60	113,230	0.088	3.11
Recreation Fields												
Total Site Info	56.58	2,464,699	2	30.01	4.3	45.2	411.0	4	2.06	89,519	0.070	2.46

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 (SF)	Unit Cost ($)	Unit	Total Cost ($)	I.C. Treated %
	LOPATCONG CREEK SUBWATERSHED	**115,006**	**2.64**	**2.997**	**502**	**211,572**	**8.26**	**40,300**			**$805,000**	**9.6%**
1	**Architects Golf Club**											
	Tree filter boxes	23,280	0.53	0.607	102	44,506	1.67	3,530	100	SF	$353,000	11.6%
	Total Site Info	**23,280**	**0.53**	**0.607**	**102**	**44,506**	**1.67**	**3,530**			**$353,000**	**11.6%**
2	**Clymer Village**											
	Bioretention systems	9,280	0.21	0.242	40	16,577	0.67	2,410	5	SF	$12,050	13.8%
	Pervious pavement	8,600	0.20	0.224	38	15,358	0.62	3,780	25	SF	$94,500	12.8%
	Total Site Info	**17,880**	**0.41**	**0.466**	**78**	**31,935**	**1.29**	**6,190**			**$106,550**	**26.7%**
3	**First Baptist Church**											
	Bioretention systems	3,224	0.07	0.084	14	6,164	0.23	800	5	SF	$4,000	3.2%
	Rainwater harvesting	263	0.01	0.007	1	501	0.02	500	2	gal	$1,000	0.3%
	Total Site Info	**3,487**	**0.08**	**0.091**	**15**	**6,665**	**0.25**	**1,300**			**$5,000**	**3.5%**
4	**JHM Communications**											
	Pervious pavement	20,550	0.47	0.535	90	39,285	1.48	5,490	25	SF	$137,250	12.5%
	Rainwater harvesting	9,740	0.22	0.254	42	18,618	0.70	10,000	2	gal	$20,000	5.9%
	Total Site Info	**30,290**	**0.70**	**0.789**	**132**	**57,903**	**2.18**	**15,490**			**$157,250**	**18.4%**
5	**Lopatcong Fire Department**											
	Bioretention systems	4,788	0.11	0.125	21	9,149	0.34	1,150	5	SF	$5,750	18.4%
	Rainwater harvesting	2,168	0.05	0.056	9	4,144	0.16	4,000	2	gal	$8,000	8.3%
	Total Site Info	**6,956**	**0.16**	**0.181**	**30**	**13,293**	**0.50**	**5,150**			**$13,750**	**26.8%**
6	**Lopatcong Township Municipal Court**											
	Bioretention system	575	0.01	0.015	3	1,100	0.04	150	5	SF	$750	1.8%
	Pervious pavement	27,539	0.63	0.718	120	52,618	1.98	7,000	25	SF	$175,000	85.6%
	Total Site Info	**28,114**	**0.65**	**0.733**	**123**	**53,718**	**2.02**	**7,150**			**$175,750**	**87.4%**
7	**Phillipsburg Christian Academy & Fellowship Church**											
	Bioretention system	859	0.02	0.022	4	1,638	0.06	220	5	SF	$1,100	3.7%
	Pervious pavement	10,000	0.23	0.261	44	19,105	0.72	2,740	25	SF	$68,500	43.3%
	Total Site Info	**10,859**	**0.25**	**0.283**	**47**	**20,743**	**0.78**	**2,960**			**$69,600**	**47.0%**

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area Area (SF)	Potential Management Area Area (ac)	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Max Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cfs)	Size of BMP (SF)	Unit Cost ($)	Unit	Total Cost ($)	I.C. Treated %
8	**Schoolhouse Village**											
	Pervious pavement	28,160	0.65	0.734	123	50,299	2.02	9,390	25	SF	$234,750	30.3%
	Total Site Info	**28,160**	**0.65**	**0.734**	**123**	**50,299**	**2.02**	**9,390**			**$234,750**	**30.3%**
9	**Shopping Plaza**											
	Bioretention system	1,010	0.02	0.026	4	1,803	0.07	220	5	SF	$1,100	0.8%
	Pervious pavement	18,540	0.43	0.483	81	33,116	1.33	7,940	25	SF	$198,500	14.6%
	Total Site Info	**19,550**	**0.45**	**0.509**	**85**	**34,919**	**1.40**	**8,160**			**$199,600**	**15.4%**
10	**St. Luke's Village Health Center**											
	Bioretention system	6,420	0.15	0.167	28	3,157	0.12	1,650	5	SF	$8,250	11.0%
	Total Site Info	**6,420**	**0.15**	**0.167**	**28**	**3,157**	**0.12**	**1,650**			**$8,250**	**11.0%**
	UPPER DELAWARE RIVER TRIBUTARIES SUBWATERSHED	**44,840**	**1.03**	**1.168**	**196**	**81,311**	**3.23**	**21,920**			**$239,400**	**1.6%**
11	**Delaware Park Fire Department**											
	Rainwater harvesting	2,190	0.05	0.057	10	3,912	0.16	3,000	2	gal	$6,000	34.5%
	Total Site Info	**2,190**	**0.05**	**0.057**	**10**	**3,912**	**0.16**	**3,000**			**$6,000**	**34.5%**
12	**Lopatcong Swimming Pool**											
	Bioretention systems	1,770	0.04	0.046	8	3,164	0.13	480	5	SF	$2,400	1.6%
	Pervious pavement	14,140	0.32	0.368	62	25,254	1.02	3,380	25	SF	$84,500	12.5%
	Total Site Info	**15,910**	**0.37**	**0.415**	**69**	**28,418**	**1.15**	**3,860**			**$86,900**	**14.1%**
13	**Recreation Fields**											
	Pervious pavement	17,000	0.39	0.443	74	30,363	1.22	5,060	25	SF	$126,500	19.0%
	Total Site Info	**17,000**	**0.39**	**0.443**	**74**	**30,363**	**1.22**	**5,060**			**$126,500**	**19.0%**