RUTGERS
New Jersey Agricultural
Experiment Station

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

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

November 3, 2016

WILLIAM PENN
FOUNDATION

ANJEC
Local Environment Matters

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Introduction

Located in Warren County, New Jersey, Greenwich Township covers over 10.6 square miles. Figures 1 and 2 illustrate that Greenwich Township is dominated by agricultural land uses. A total of 32.1% of the municipality's land use is classified as urban. Of the urban land in Greenwich Township, rural 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 Greenwich 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 Greenwich Township. Based upon the 2007 NJDEP land use/land cover data, approximately 7.7% of Greenwich Township has impervious cover. This level of impervious cover suggests that the streams in Greenwich Township are sensitive streams. [1]

Methodology

Greenwich Township 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

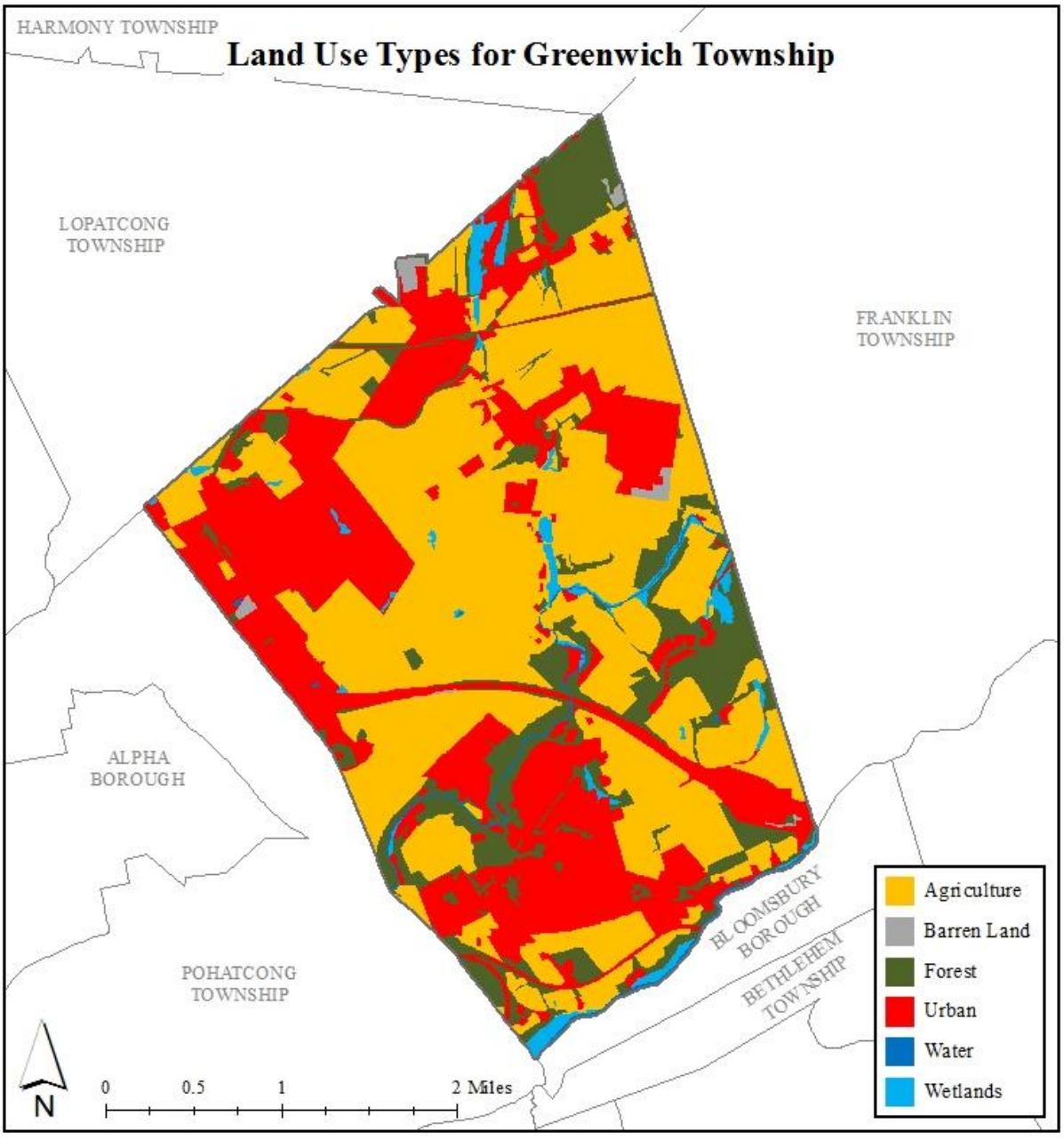


Figure 1: Map illustrating the land use in Greenwich Township

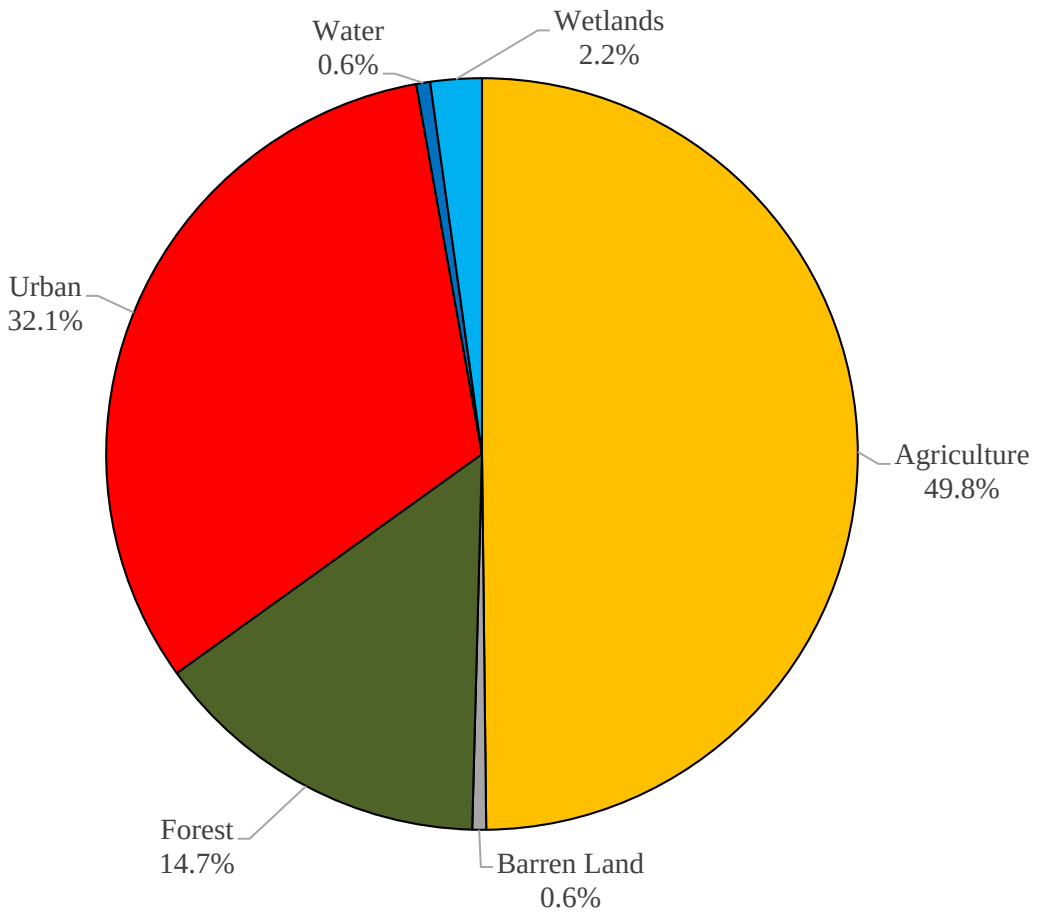


Figure 2: Pie chart illustrating the land use in Greenwich Township

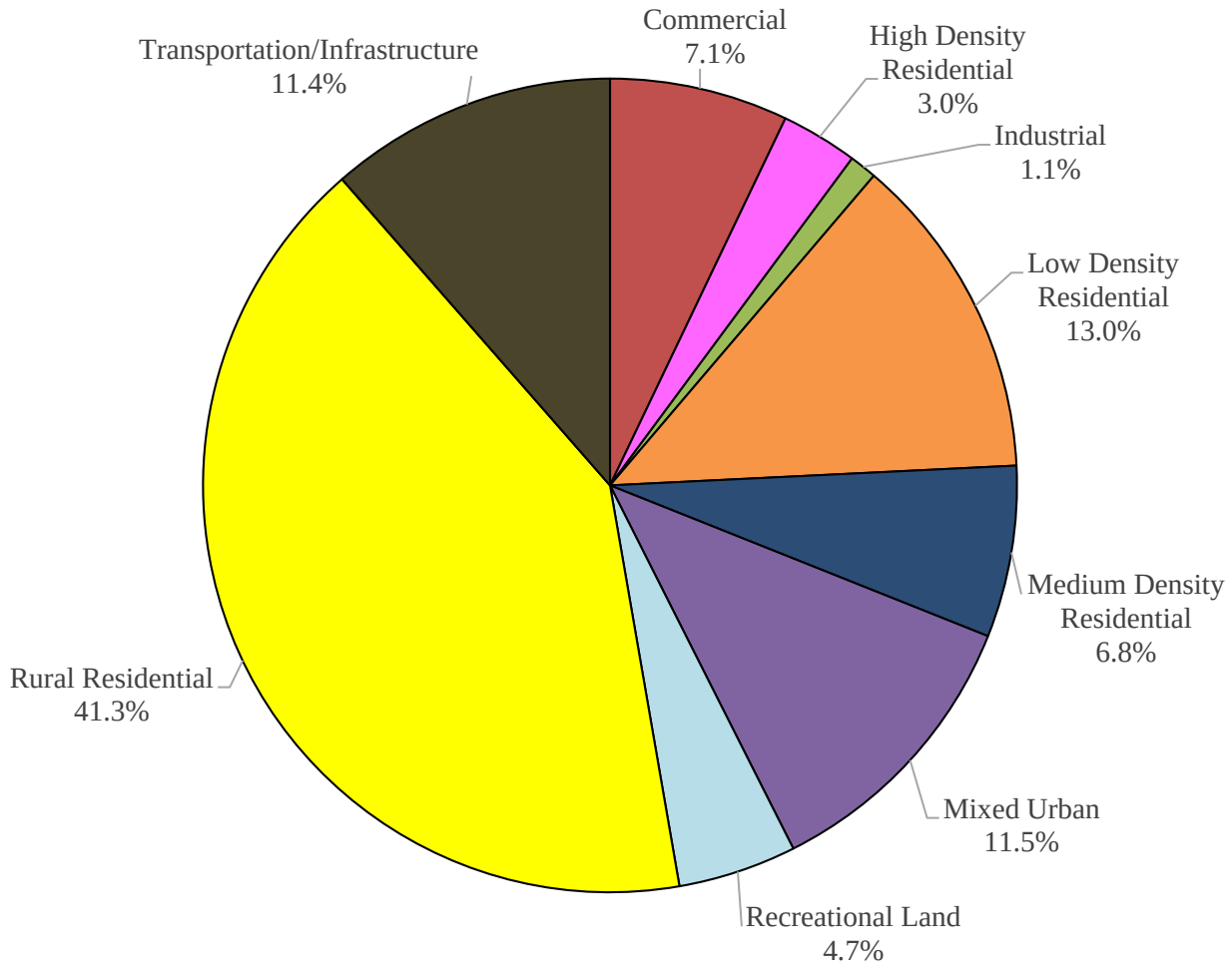


Figure 3: Pie chart illustrating the various types of urban land use in Greenwich Township

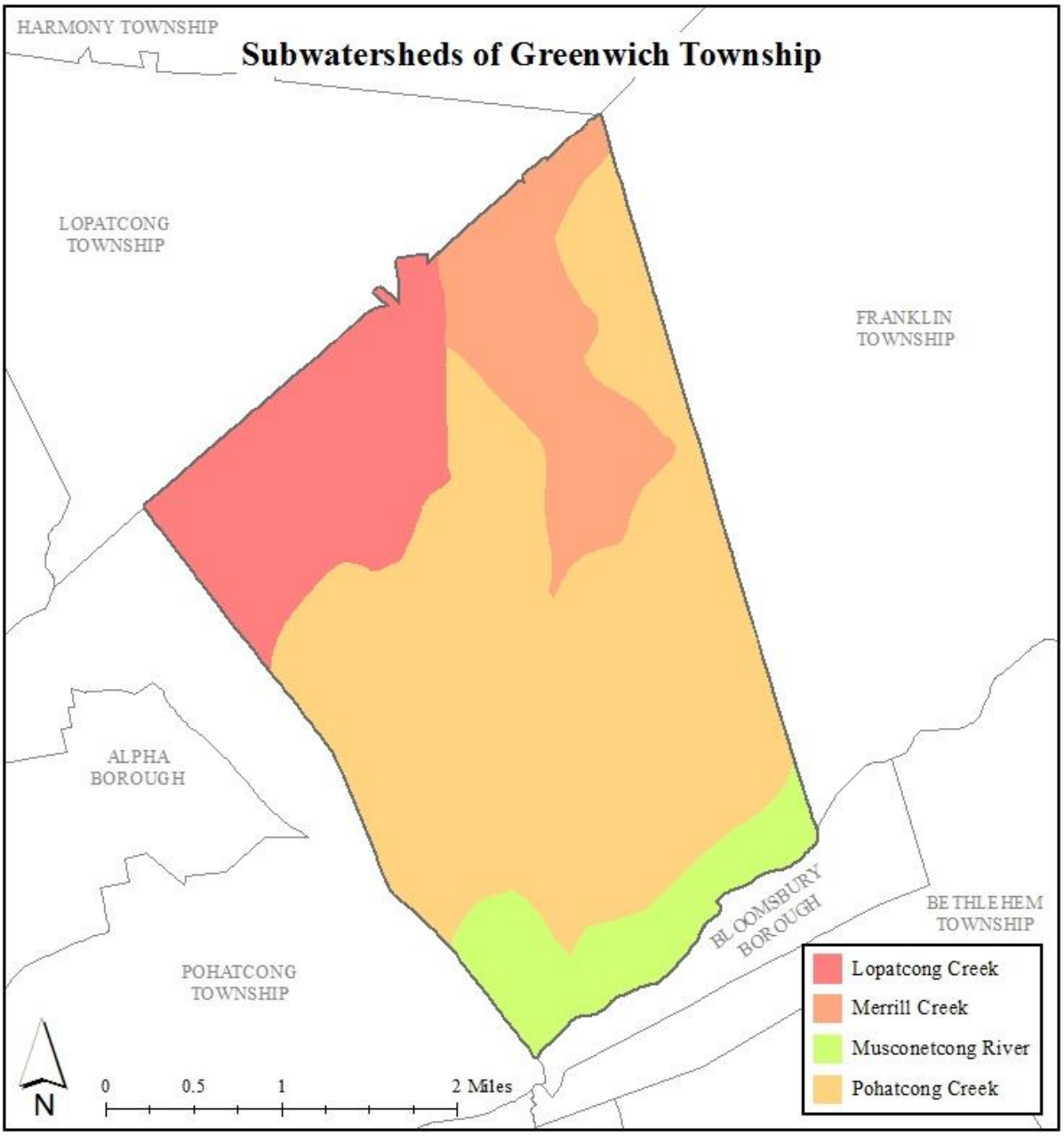


Figure 4: Map of the subwatersheds in Greenwich Township

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 Greenwich 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 in Greenwich 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*.

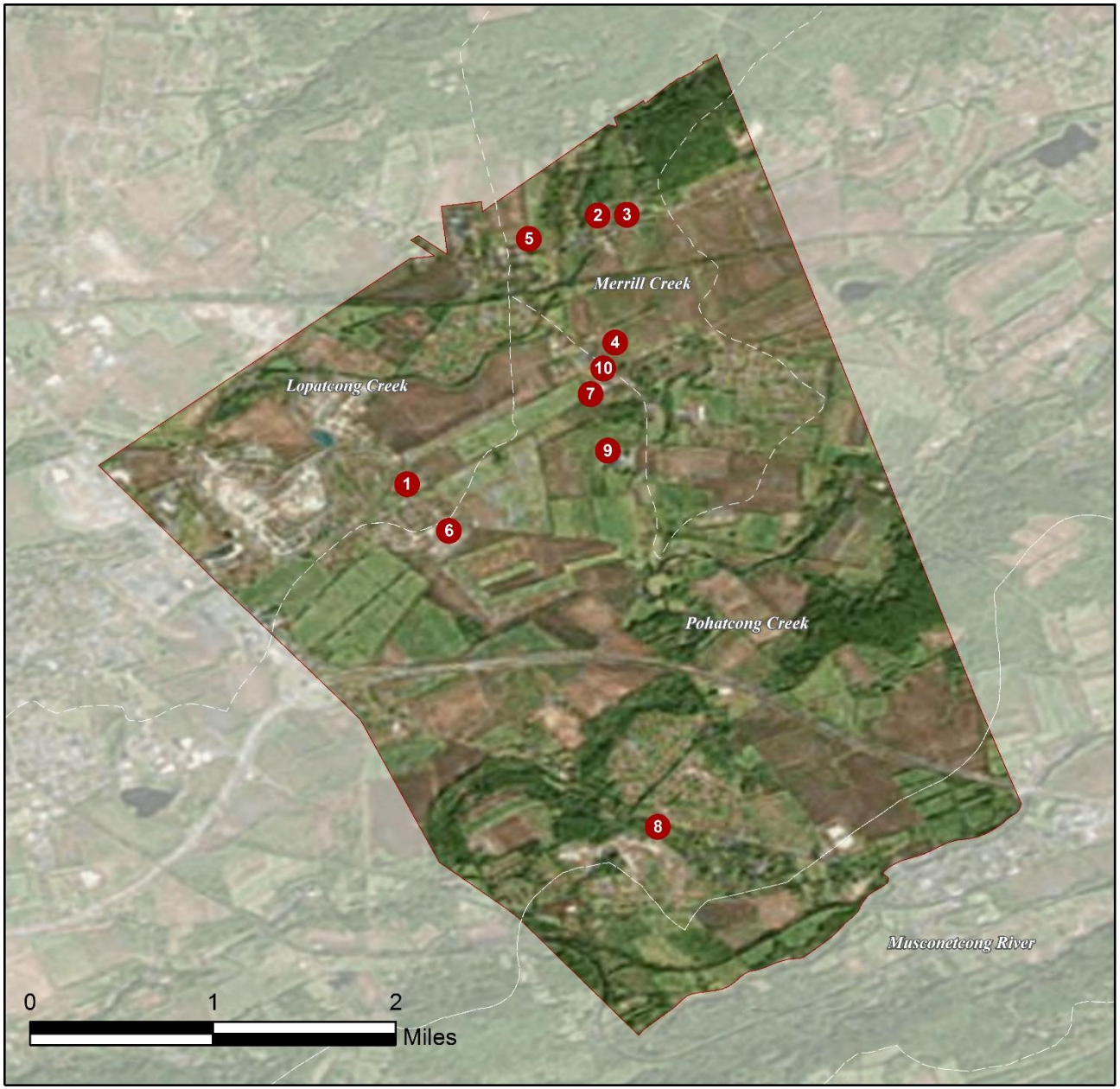
Conclusion

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

GREENWICH TOWNSHIP: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE LOPATCONG CREEK SUBWATERSHED:

1. Rod Pianelli - State Farm Insurance Agent

SITES WITHIN THE MERRILL CREEK SUBWATERSHED:

2. Christian Assembly Ministry
3. Pizza Express
4. Smart Start Pre - School
5. Stewartsville Post Office

SITES WITHIN THE POHATCONG CREEK SUBWATERSHED:

6. Greenwich Elementary
7. Greenwich Township Municipal Building
8. Janry Pet Resort
9. Stewartsville Middle School
10. Stewartsville Presbyterian Church

b. Proposed Green Infrastructure Concepts

ROD PIANELLI-STATE FARM INSURANCE AGENT

Subwatershed: Lopatcong Creek

Site Area: 47,529 sq. ft.

Address: 107 Greenwich Street
Stewartsville, NJ 08886

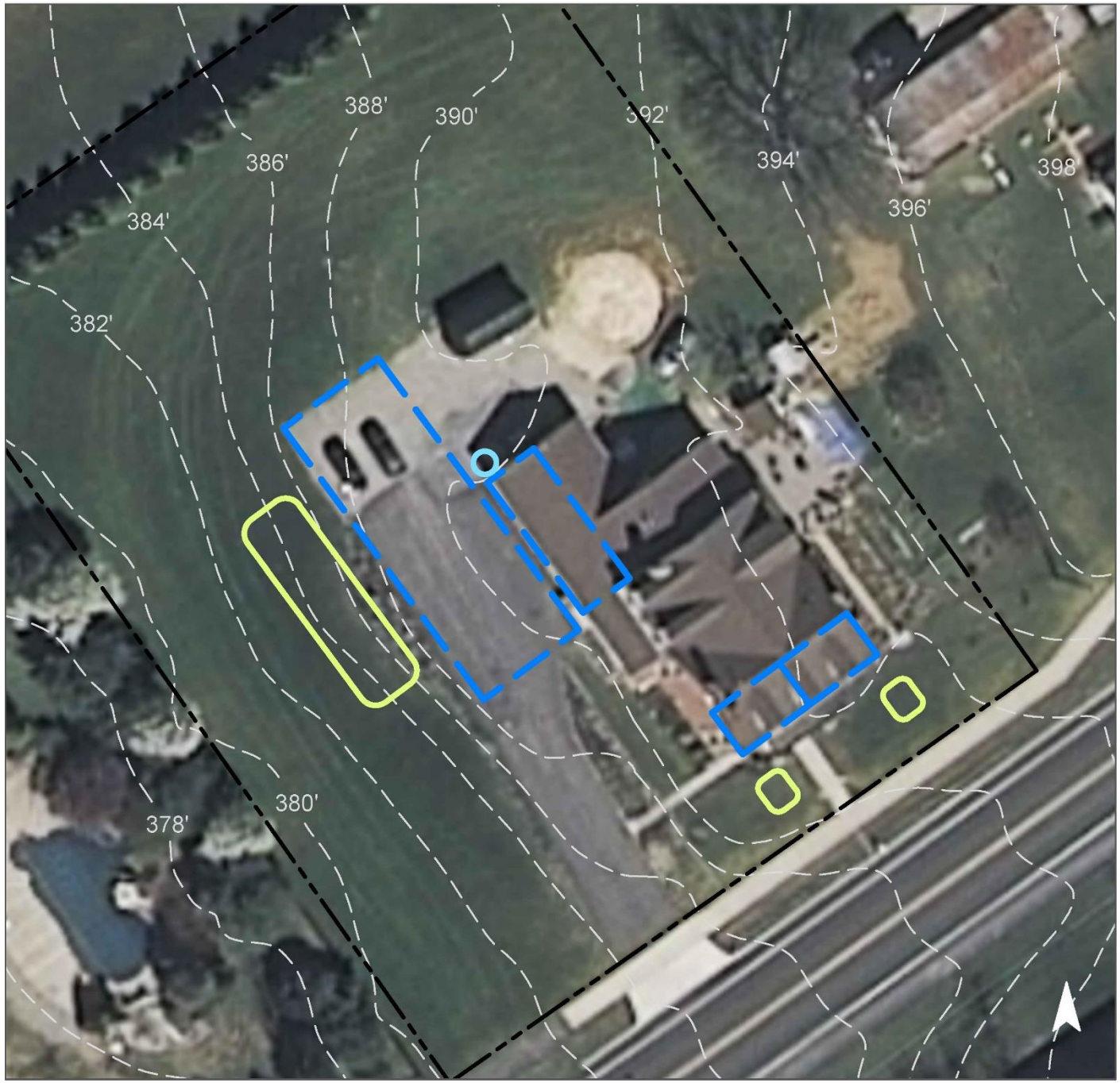
Block and Lot: Block 23.3, Lot 1

Installing rain gardens to the south and west of the building can capture, treat, and infiltrate runoff. A cistern can be installed 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 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"
20	9,506	0.5	4.8	43.6	0.007	0.26

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	0.087	15	6,358	0.24	1,135	$5,670
Rainwater harvesting	0.010	2	748	0.03	350 (gal)	$700

GREEN INFRASTRUCTURE RECOMMENDATIONS



Rod Pianelli - State Farm Insurance Agent

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

0 20' 40'

CHRISTIAN ASSEMBLY MINISTRY

Subwatershed: Merrill Creek

Site Area: 356,287 sq. ft.

Address: 809 New Jersey 57
Stewartsville, NJ 08886

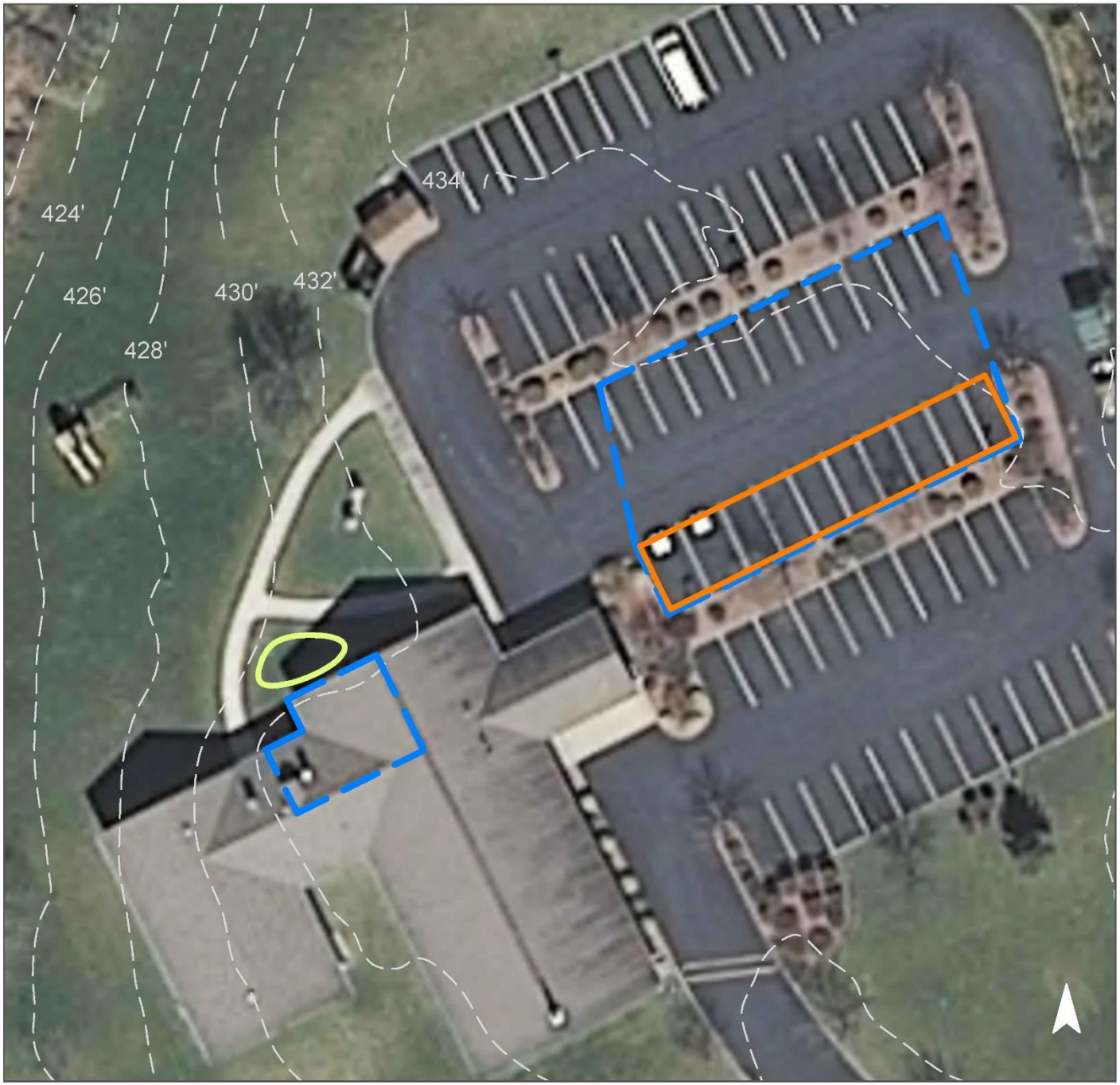
Block and Lot: Block 2, Lot 16

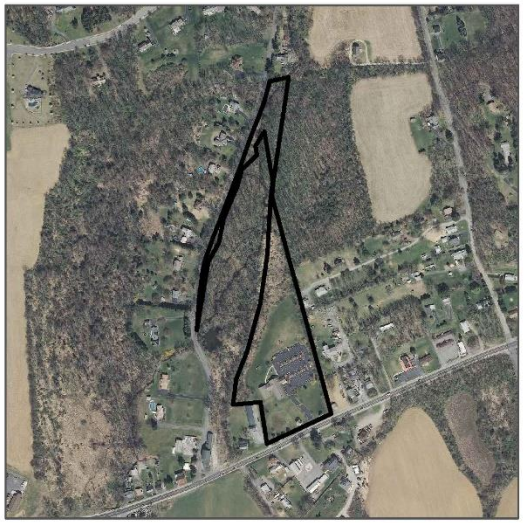
Parking spots in front of the building can be replaced with porous asphalt to capture and infiltrate stormwater. Installing a rain garden adjacent to the building can capture, treat, and infiltrate roof runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics 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"
17	60,563	2.9	30.6	278.1	0.047	1.66

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	0.024	4	1,780	0.07	210	$1,050
Pervious pavement	0.165	28	12,118	0.46	1,840	$46,000

GREEN INFRASTRUCTURE RECOMMENDATIONS





Christian Assembly Ministry

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

0 20' 40'

PIZZA EXPRESS

Subwatershed: Pohatcong Creek

Site Area: 48,505 sq. ft.

Address: 817 New Jersey 57
Stewartsville, NJ 08886

Block and Lot: Block 2, Lot 12.01

Installing a rain garden adjacent to the building can capture, treat, and infiltrate roof and 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"
35	16,823	0.8	8.5	77.2	0.013	0.46

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
Bioretention system	0.079	13	5,790	0.22	775	$3,875

GREEN INFRASTRUCTURE RECOMMENDATIONS

Pizza Express

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

0 10' 20'

SMART START PRE-SCHOOL

Subwatershed: **Merrill Creek**

Site Area: **29,985 sq. ft.**

Address: **563 North Main Street**
Stewartsville, NJ 08886

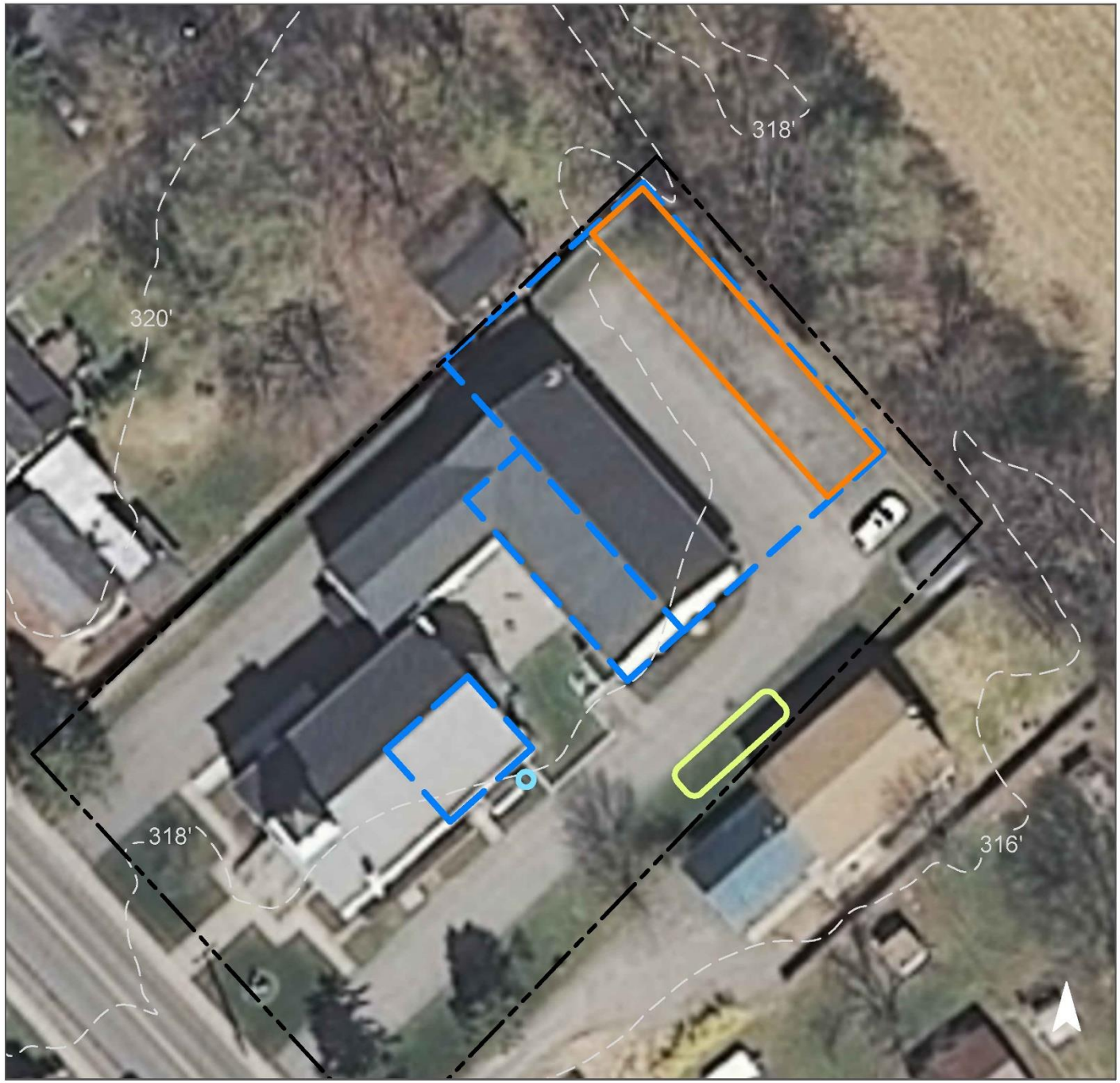
Block and Lot: **Block 16, Lot 19**

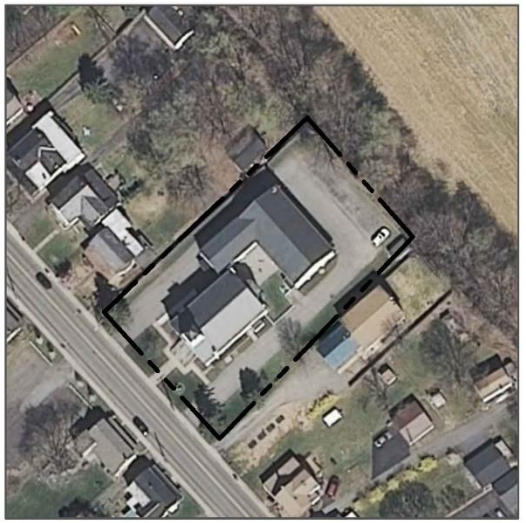
Concrete in the back of the building can be replaced with porous asphalt to capture and infiltrate stormwater. Installing a rain garden to the south of the building can capture, treat, and infiltrate roof runoff. A cistern can be installed at the corners of the building. The water can then be used for washing vehicles or for other non-potable uses. A preliminary soil assessment suggests that 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	22,082	1.1	11.2	101.4	0.017	0.61

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	0.033	5	2,386	0.09	305	$1,525
Pervious pavement	0.174	29	12,731	0.48	1,650	$41,250
Rainwater harvesting	0.019	3	1,399	0.05	750 (gal)	$1,500

GREEN INFRASTRUCTURE RECOMMENDATIONS





Smart Start Pre-school

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

0 20' 40'

STEWARTSVILLE POST OFFICE

Subwatershed: Merrill Creek

Site Area: 1,715,764 sq. ft.

Address: 731 New Jersey 57
Stewartsville, NJ 08886

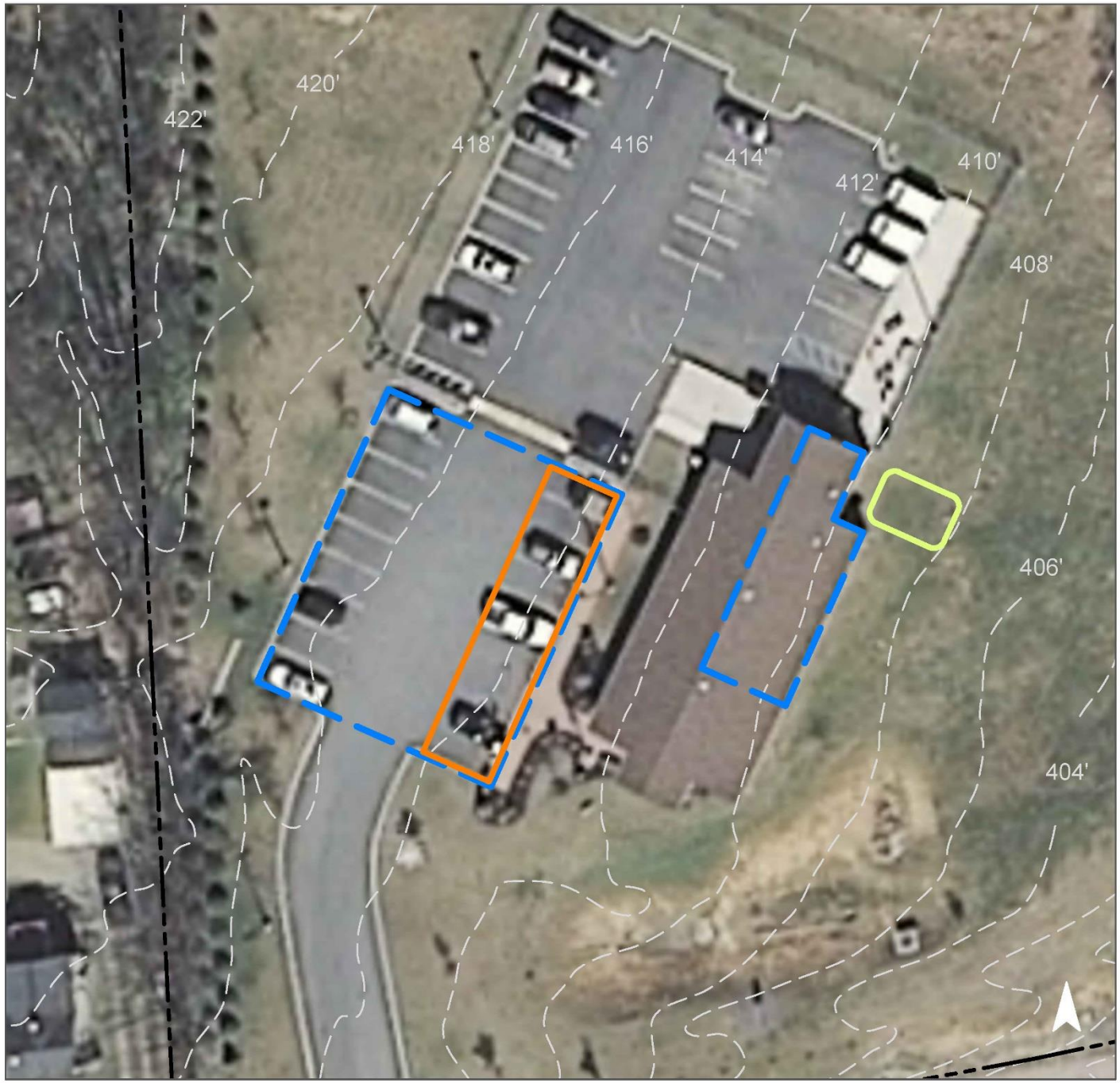
Block and Lot: Block 3, Lot 2

Parking spots in front 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"
2	36,147	1.7	18.3	166.0	0.028	0.99

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	0.039	7	2,865	0.11	300	$1,500
Pervious pavement	0.147	25	10,764	0.40	1,555	$38,875

GREEN INFRASTRUCTURE RECOMMENDATIONS



Stewartsville Post Office

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

0 20' 40'

GREENWICH ELEMENTARY

Subwatershed: Pohatcong Creek

Site Area: 1,174,436 sq. ft.

Address: 101 Wyndham Farm Boulevard
Stewartsville, NJ 08886

Block and Lot: Block 26.05, Lot 17

Parking spots to the south of the building can be replaced with porous asphalt to capture and infiltrate stormwater. Installing 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"
15	180,853	8.7	91.3	830.4	0.141	4.96

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	0.490	82	35,926	1.35	4,690	$23,450
Pervious pavement	0.392	66	28,678	1.08	4,625	$115,625

GREEN INFRASTRUCTURE RECOMMENDATIONS

Greenwich Elementary

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

0 50' 100'

GREENWICH TOWNSHIP MUNICIPAL BUILDING

Subwatershed: Pohatcong Creek

Site Area: 35,171 sq. ft.

Address: 321 Greenwich Street
Stewartsville, NJ 08886

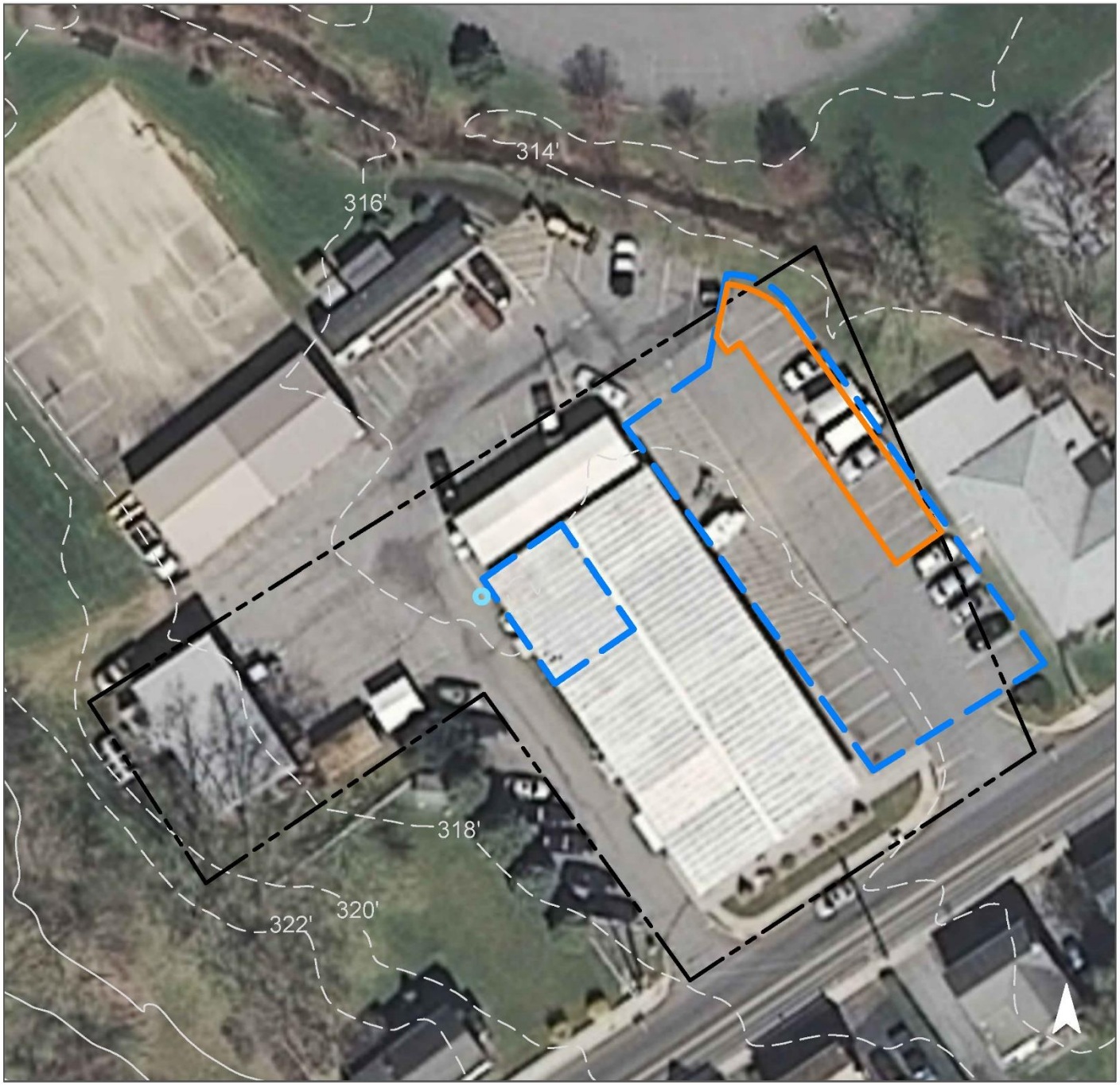
Block and Lot: Block 23, Lot 31.01

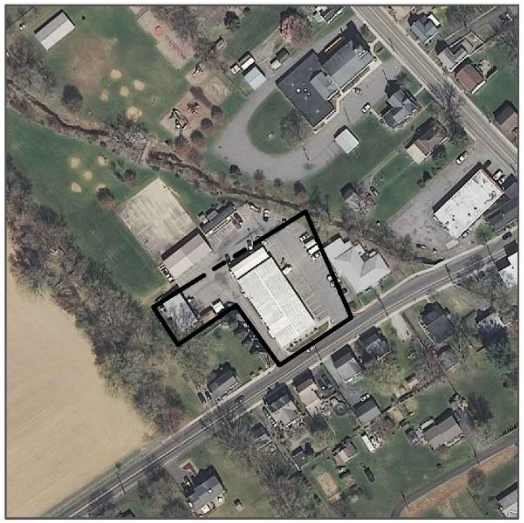
Parking spots to the north of the building can be replaced with porous asphalt to capture and infiltrate stormwater. Runoff from the roof top can be disconnected and drain into the rainwater harvesting system. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
85	29,854	1.4	15.1	137.1	0.023	0.82

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
Pervious pavement	0.244	41	17,892	0.67	1,860	$46,500
Rainwater harvesting	0.034	6	2,483	0.09	1,500 (gal)	$3,000

GREEN INFRASTRUCTURE RECOMMENDATIONS





Greenwich Township Municipal Building

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

0 25' 50'

JANRY PET RESORT

Subwatershed: Pohatcong Creek

Site Area: 240,735 sq. ft.

Address: 470 New Jersey 173
Stewartsville, NJ 08886

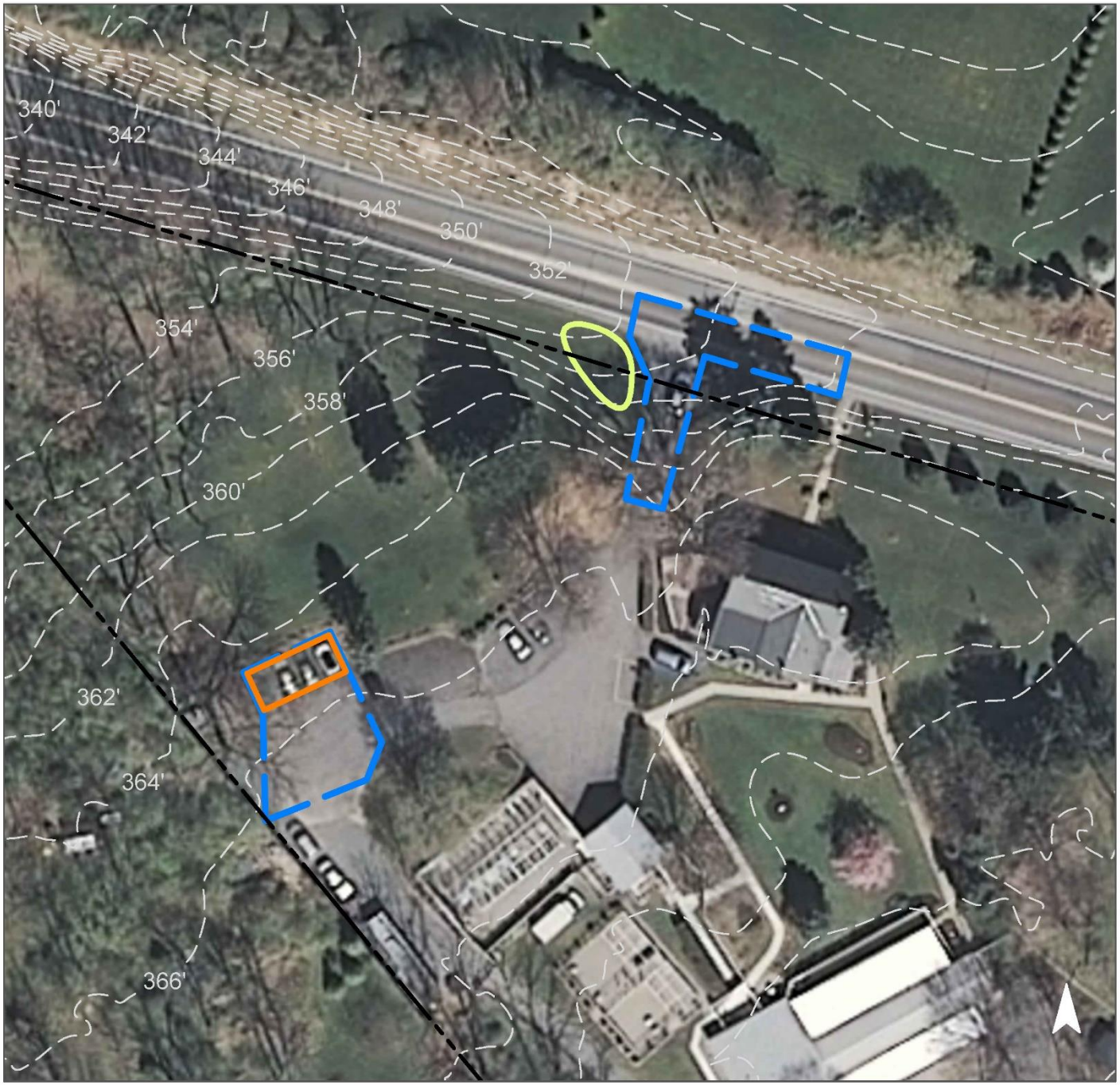
Block and Lot: Block 42, Lot 14

Parking spots to the west of the building can be replaced with porous asphalt to capture and infiltrate stormwater. Installing a rain garden by the entrance can capture, treat, and infiltrate road 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"
14	32,601	1.6	16.5	149.7	0.025	0.89

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	0.067	11	4,892	0.18	570	$2,850
Pervious pavement	0.064	11	4,690	0.18	565	$14,125

GREEN INFRASTRUCTURE RECOMMENDATIONS



Janry Pet Resort

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

0 30' 60'

STEWARTSVILLE MIDDLE SCHOOL

Subwatershed: Pohatcong Creek

Site Area: 615,929 sq. ft.

Address: 642 South Main Street
Greenwich, NJ 08886

Block and Lot: Block 26, Lot 26.01

Parking spots to the south and east of the building can be replaced with porous asphalt to capture and 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"
26	161,126	7.8	81.4	739.9	0.126	4.42

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	0.893	150	65,540	2.46	9,370	$234,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

Stewartsville Middle School

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

0 50' 100'

STEWARTSVILLE PRESBYTERIAN CHURCH

Subwatershed: Pohatcong Creek

Site Area: 26,277 sq. ft.

Address: 550 North Main Street
Stewartsville, NJ 08886

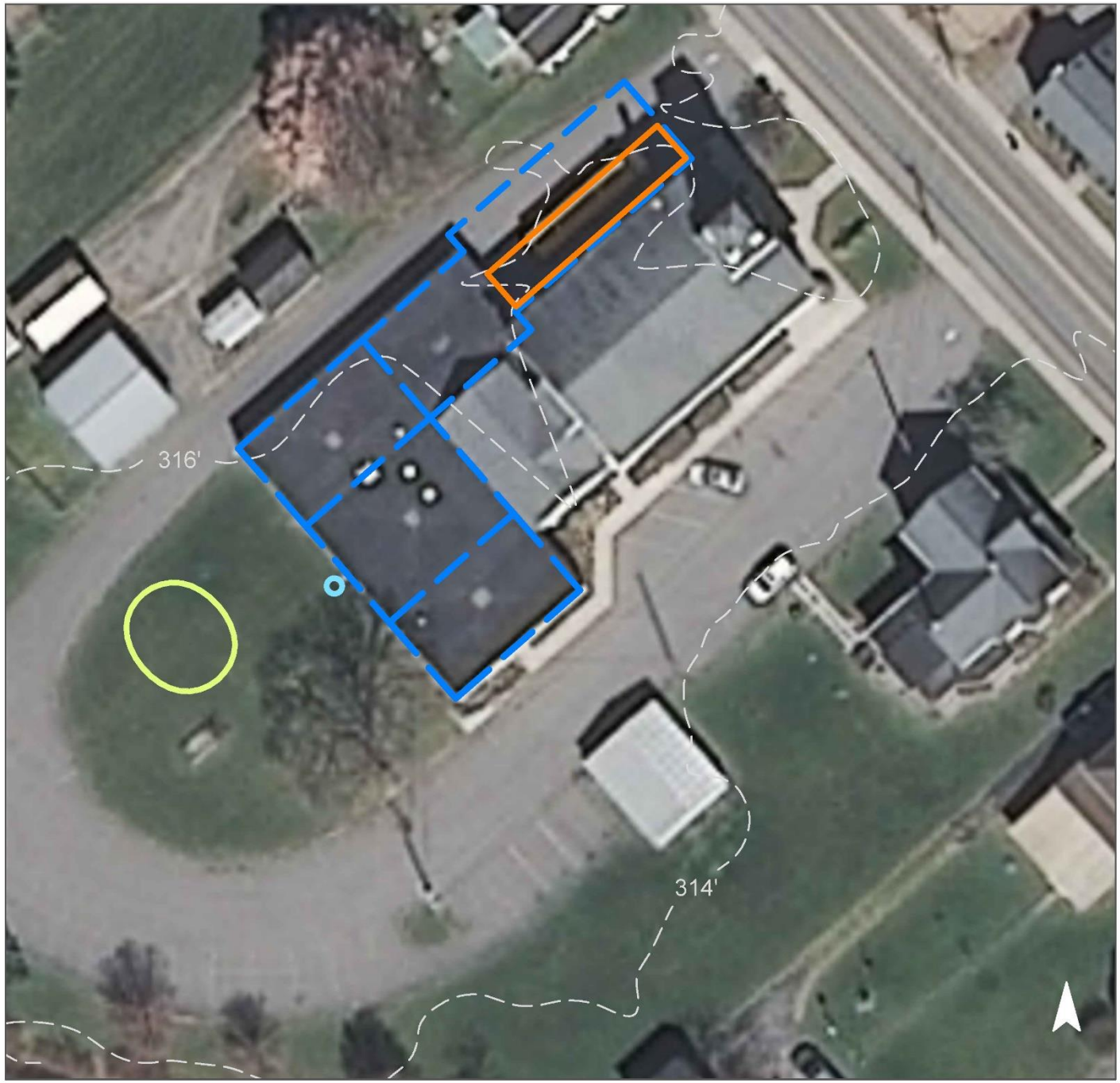
Block and Lot: Block 23, Lot 25

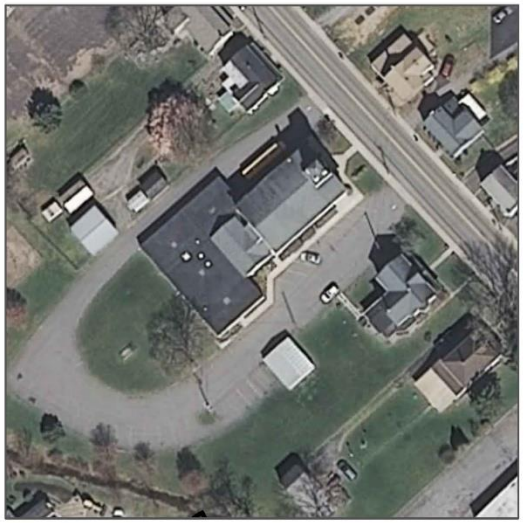
Parking spots north of the building can be replaced with porous asphalt to capture and infiltrate stormwater. Installing a rain garden adjacent to the building can capture, treat, and infiltrate roof runoff. Part of the runoff from the rooftop can be disconnected to drain into a rainwater harvesting system. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
74	19,430	0.9	9.8	89.2	0.015	0.53

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.060	10	4,428	0.17	600	$3,000
Pervious pavement	0.067	11	4,952	0.19	670	$16,750
Rainwater harvesting	0.038	6	2,753	0.10	3,000 (gal)	$6,000

GREEN INFRASTRUCTURE RECOMMENDATIONS





Stewartsville Presbyterian Church

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

0 20' 40'

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 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)
LOPATCONG CREEK SUBWATERSHED	**1.09**	**47,529**			**0.5**	**4.8**	**43.6**		**0.22**	**9,506**	**0.007**	**0.26**
Rod Pianelli-State Farm Insurance Agent												
Total Site Info	1.09	47,529	23.3	1	0.5	4.8	43.6	20	0.22	9,506	0.007	0.26
MERRILL CREEK SUBWATERSHED	**49.37**	**2,150,542**			**6.5**	**68.5**	**622.7**		**3.11**	**135,615**	**0.106**	**3.72**
Christian Assembly Ministry												
Total Site Info	8.18	356,287	2	16	2.9	30.6	278.1	17	1.39	60,563	0.047	1.66
Pizza Express												
Total Site Info	1.11	48,505	2	12.01	0.8	8.5	77.2	35	0.39	16,823	0.013	0.46
Smart Start Pre-school												
Total Site Info	0.69	29,985	16	19	1.1	11.2	101.4	74	0.51	22,082	0.017	0.61
Stewartsville Post Office												
Total Site Info	39.39	1,715,764	3	2	1.7	18.3	166.0	2	0.83	36,147	0.028	0.99
POHATCONG CREEK SUBWATERSHED	**48.04**	**2,092,547**			**20.4**	**214.1**	**1,946.3**		**9.73**	**423,895**	**0.330**	**11.63**
Greenwich Elementary												
Total Site Info	26.96	1,174,436	26.05	17	8.7	91.3	830.4	15	4.15	180,853	0.141	4.96
Greenwich Township Municipal Building												
Total Site Info	0.81	35,171	23	31.01	1.4	15.1	137.1	85	0.69	29,854	0.023	0.82
Janry Pet Resort												
Total Site Info	5.53	240,735	42	14	1.6	16.5	149.7	14	0.75	32,601	0.025	0.89
Stewartsville Middle School												
Total Site Info	14.14	615,929	26	26.01	7.8	81.4	739.9	26	3.70	161,156	0.126	4.42
Stewartsville Presbyterian Church												
Total Site Info	0.60	26,277	23	25	0.9	9.8	89.2	74	0.45	19,430	0.015	0.53

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	**3,715**	**0.09**	**0.097**	**16**	**7,106**	**0.27**	**1,485**			**$6,375**	**7.8%**
1	**Rod Pianelli-State Farm Insurance Agent**											
	Bioretention systems	3,325	0.08	0.087	15	6,358	0.24	1,135	5	SF	$5,675	35.0%
	Rainwater harvesting	390	0.01	0.010	2	748	0.03	350	2	gal	$700	4.1%
	Total Site Info	**3,715**	**0.09**	**0.097**	**16**	**7,106**	**0.27**	**1,485**			**$6,375**	**39.1%**
	MERRILL CREEK SUBWATERSHED	**26,070**	**0.60**	**0.679**	**114**	**49,832**	**1.88**	**7,385**			**$135,575**	**1.2%**
2	**Christian Assembly Ministry**											
	Bioretention system	930	0.02	0.024	4	1,780	0.07	210	5	SF	$1,050	1.5%
	Pervious pavement	6,340	0.15	0.165	28	12,118	0.46	1,840	25	SF	$46,000	10.5%
	Total Site Info	**7,270**	**0.17**	**0.189**	**32**	**13,898**	**0.53**	**2,050**			**$47,050**	**12.0%**
3	**Pizza Express**											
	Bioretention system	3,030	0.07	0.079	13	5,790	0.22	775	5	SF	$3,875	18.0%
	Total Site Info	**3,030**	**0.07**	**0.079**	**13**	**5,790**	**0.22**	**775**			**$3,875**	**18.0%**
4	**Smart Start Pre-school**											
	Bioretention system	1,250	0.03	0.033	5	2,386	0.09	305	5	SF	$1,525	5.7%
	Pervious pavement	6,660	0.15	0.174	29	12,731	0.48	1,650	25	SF	$41,250	30.2%
	Rainwater harvesting	730	0.02	0.019	3	1,399	0.05	750	2	gal	$1,500	3.3%
	Total Site Info	**8,640**	**0.20**	**0.225**	**38**	**16,516**	**0.62**	**2,705**			**$44,275**	**39.1%**
5	**Stewartsville Post Office**											
	Bioretention system	1,500	0.03	0.039	7	2,865	0.11	300	5	SF	$1,500	4.1%
	Pervious pavement	5,630	0.13	0.147	25	10,764	0.40	1,555	25	SF	$38,875	15.6%
	Total Site Info	**7,130**	**0.16**	**0.186**	**31**	**13,629**	**0.51**	**1,855**			**$40,375**	**19.7%**
	POHATCONG CREEK SUBWATERSHED	**90,130**	**2.07**	**2.348**	**393**	**172,234**	**6.47**	**27,450**			**$465,550**	**4.3%**
6	**Greenwich Elementary**											
	Bioretention systems	18,790	0.43	0.490	82	35,926	1.35	4,690	5	SF	$23,450	10.4%
	Pervious pavement	15,040	0.35	0.392	66	28,678	1.08	4,625	25	SF	$115,625	8.3%
	Total Site Info	**33,830**	**0.78**	**0.881**	**148**	**64,605**	**2.43**	**9,315**			**$139,075**	**18.7%**

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area		Recharge Potential	TSS Removal Potential	Max Volume Reduction Potential	Peak Discharge Reduction Potential	Size of BMP	Unit Cost	Unit	Total Cost	I.C. Treated
		Area (SF)	Area (ac)	(Mgal/yr)	(lbs/yr)	(gal/storm)	(cfs)	(SF)	($)		($)	%
7	**Greenwich Township Municipal Building**											
	Pervious pavement	9,360	0.21	0.244	41	17,892	0.67	1,860	25	SF	$46,500	31.4%
	Rainwater harvesting	1,300	0.03	0.034	6	2,483	0.09	1,500	2	gal	$3,000	4.4%
	Total Site Info	**10,660**	**0.24**	**0.278**	**46**	**20,376**	**0.76**	**3,360**			**$49,500**	**35.7%**
8	**Janry Pet Resort**											
	Bioretention system	2,560	0.06	0.067	11	4,892	0.18	570	5	SF	$2,850	7.9%
	Pervious pavement	2,455	0.06	0.064	11	4,690	0.18	565	25	SF	$14,125	7.5%
	Total Site Info	**5,015**	**0.12**	**0.131**	**22**	**9,582**	**0.36**	**1,135**			**$16,975**	**15.4%**
9	**Stewartsville Middle School**											
	Pervious pavement	34,280	0.79	0.893	150	65,540	2.46	9,370	25	SF	$234,250	21.3%
	Total Site Info	**34,280**	**0.79**	**0.893**	**150**	**65,540**	**2.46**	**9,370**			**$234,250**	**21.3%**
10	**Stewartsville Presbyterian Church**											
	Bioretention system	2,315	0.05	0.060	10	4,428	0.17	600	5	SF	$3,000	11.9%
	Pervious pavement	2,590	0.06	0.067	11	4,952	0.19	670	25	SF	$16,750	13.3%
	Rainwater harvesting	1,440	0.03	0.038	6	2,753	0.10	3,000	2	gal	$6,000	7.4%
	Total Site Info	**6,345**	**0.15**	**0.165**	**28**	**12,133**	**0.46**	**4,270**			**$25,750**	**32.7%**