RUTGERS
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Impervious Cover Reduction Action Plan
for
Tewksbury Township, Hunterdon County, New Jersey

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

May 19, 2020

Highlands Council
New Jersey

ACKNOWLEDGEMENTS:

This document has been prepared by the Rutgers Cooperative Extension Water Resources Program, with funding and direction from the New Jersey Highlands Water Protection and Planning Council and the New Jersey Agricultural Experiment Station, to highlight green infrastructure opportunities within Tewksbury Township. We would like to thank the New Jersey Highlands Water Protection and Planning Council, the New Jersey Agricultural Experiment Station, and Tewksbury Township for their input and support in creating this document.

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Introduction

Located in Hunterdon County, New Jersey, Tewksbury Township covers approximately 31.70 square miles. Figures 1 and 2 illustrate that Tewksbury Township is dominated by forest land use. A total of 22.9% of the municipality's land use is classified as urban. Of the urban land in Tewksbury 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 Tewksbury 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 Tewksbury Township. Based upon the 2015 NJDEP land use/land cover data, approximately 3.2% of Tewksbury Township has impervious cover. This level of impervious cover suggests that the streams in Tewksbury Township are likely sensitive streams. [1]

Methodology

Tewksbury Township contains portions of six subwatersheds (Figure 4). For this impervious cover reduction action plan, projects have been identified in three of these watersheds. Initially, aerial imagery was used to identify potential project sites that contain extensive impervious cover. Field visits were then conducted at each of these potential project sites to determine if a viable option exists to reduce impervious cover or to disconnect impervious surfaces from draining directly to the local waterway or storm sewer system. During the site visit, appropriate green infrastructure practices for the site were determined. Sites that already had stormwater management practices in place were not considered.

[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.

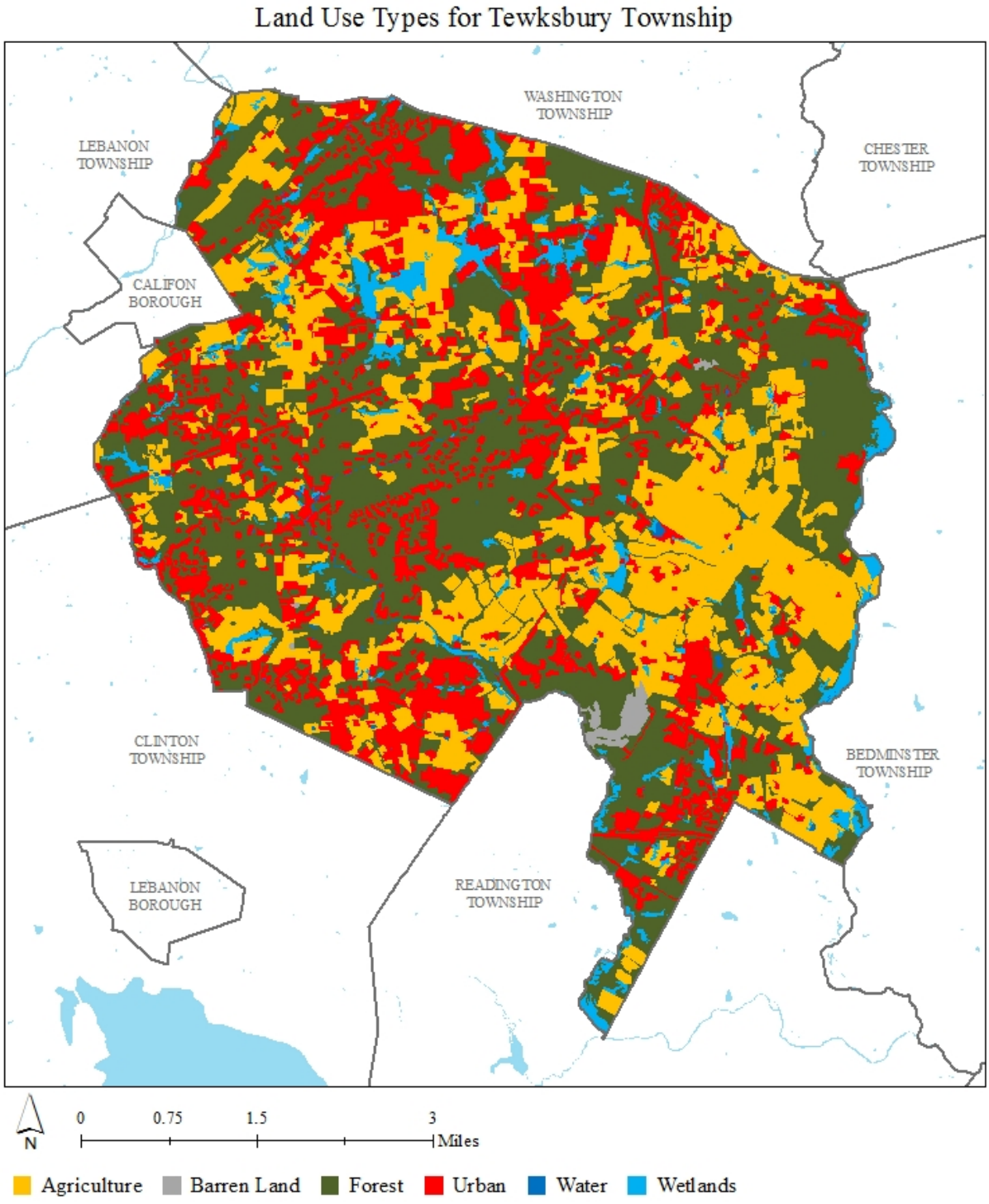


Figure 1: Map illustrating the land use in Tewksbury Township

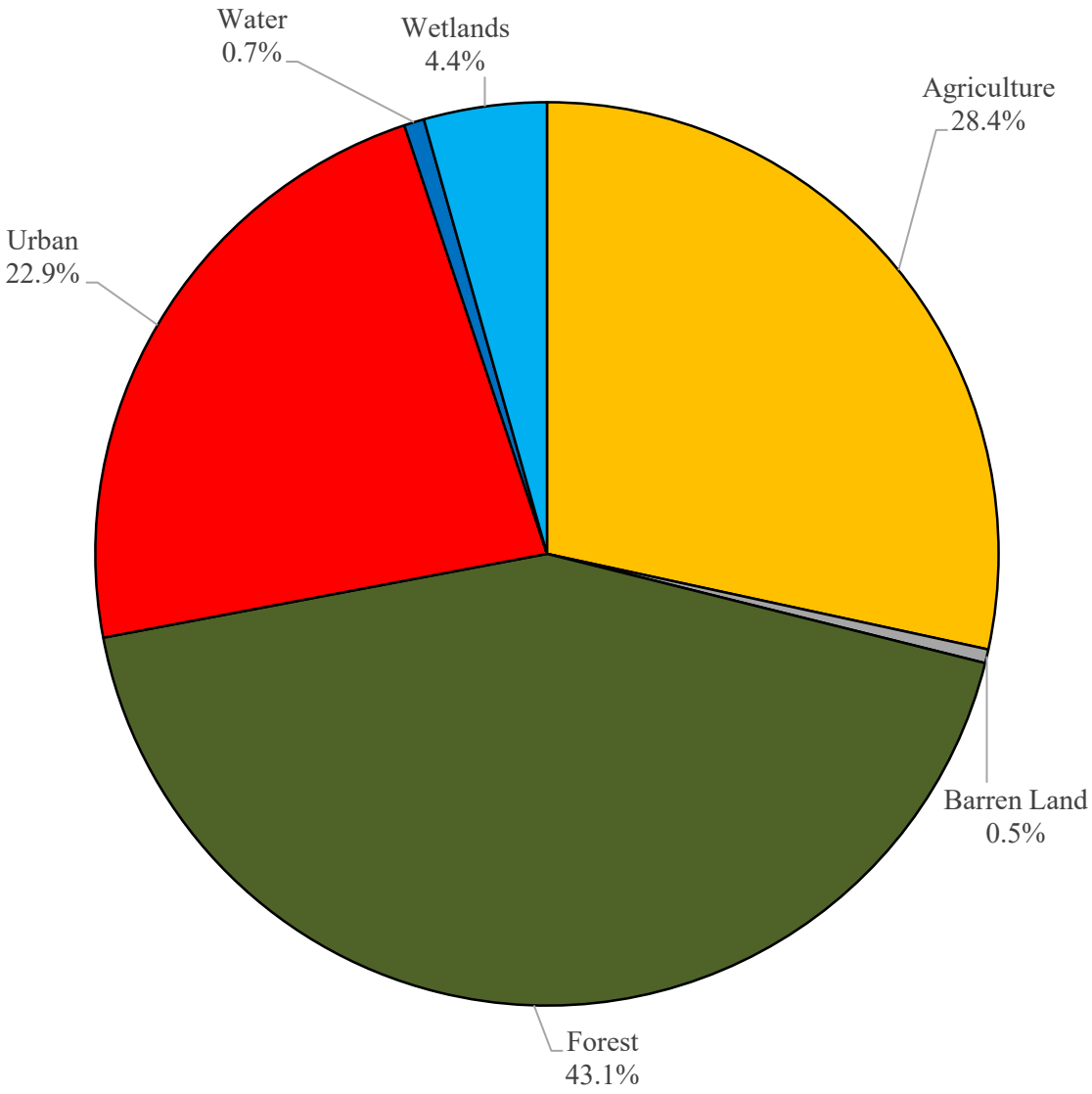


Figure 2: Pie chart illustrating the land use in Tewksbury Township

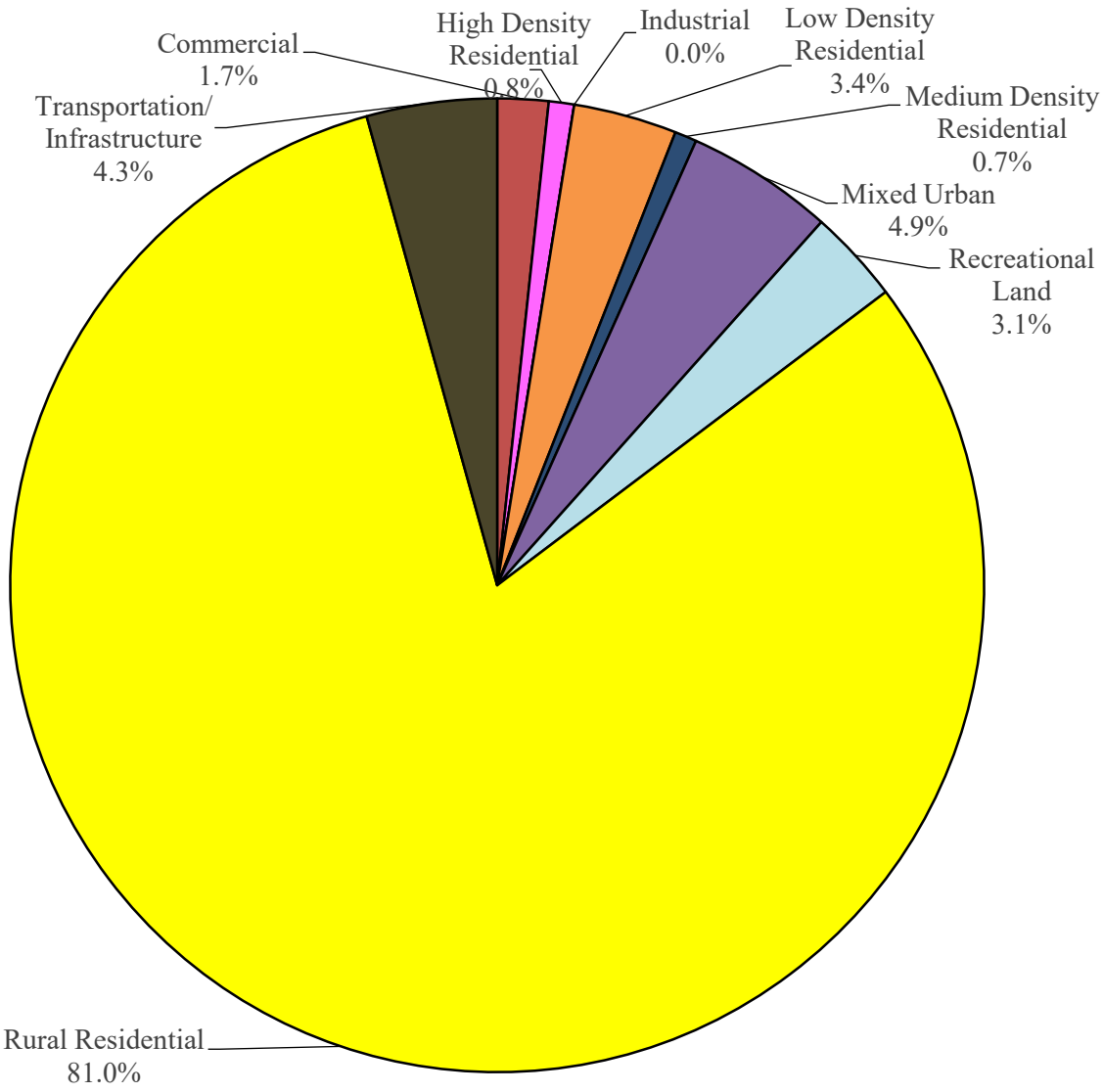


Figure 3: Pie chart illustrating the various types of urban land use in Tewksbury Township

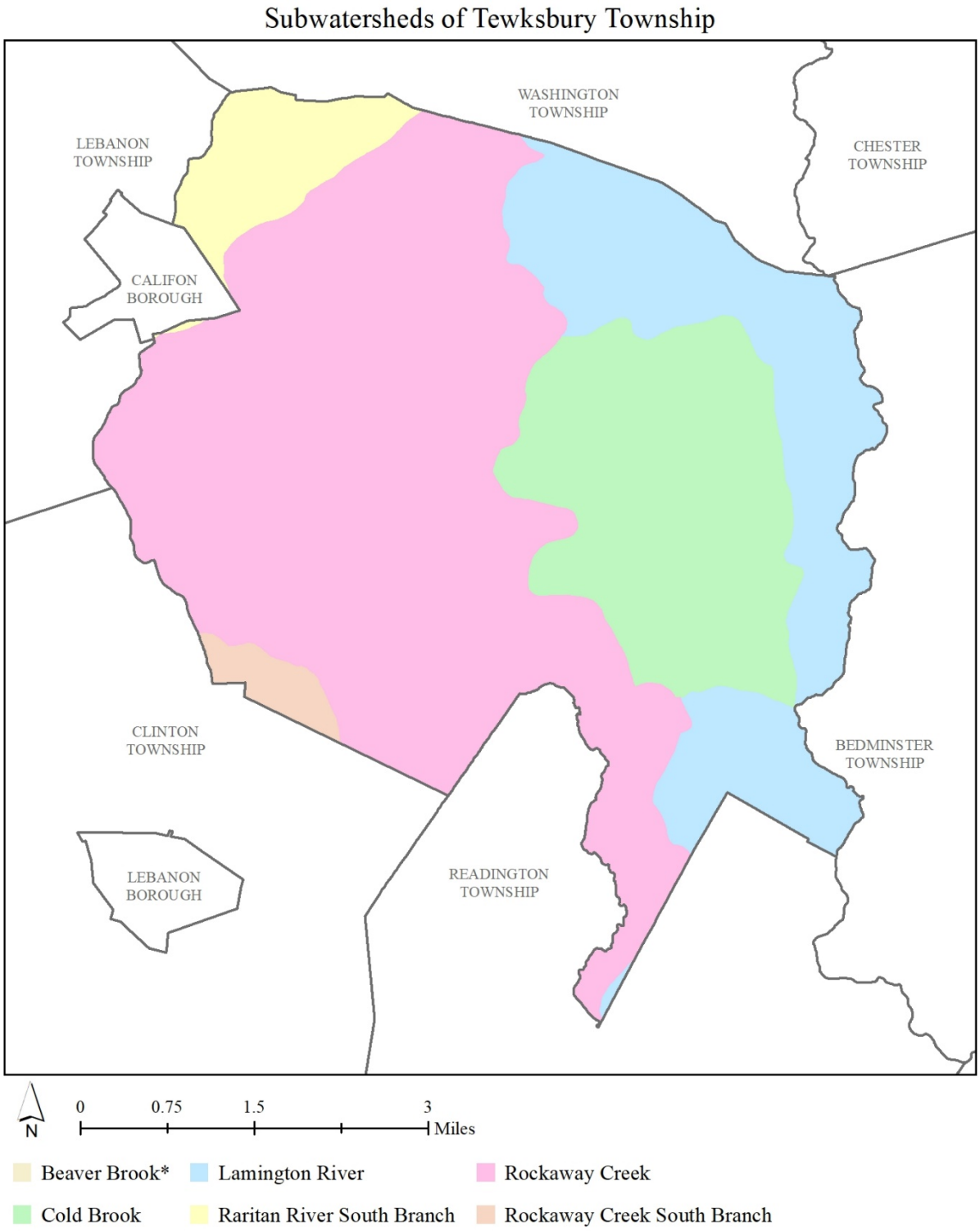


Figure 4: Map of the subwatersheds in Tewksbury Township

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

Preliminary soil assessments were conducted for each potential project site identified in Tewksbury 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 principle, green infrastructure practices use soil and vegetation to recycle stormwater runoff through infiltration and evapotranspiration. When used as components of a stormwater management system, green infrastructure practices such as bioretention, green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these practices can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits[3]. A wide range of green infrastructure practices have been evaluated for the potential project sites in Tewksbury 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.

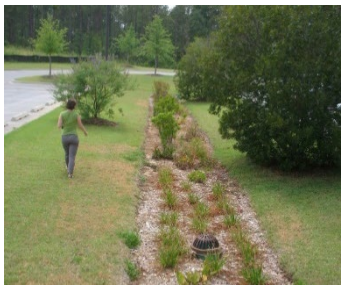
Downspout planter boxes

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

Appendix A contains information on potential project sites where green infrastructure practices could be installed as well as information on existing site conditions. The recommended green infrastructure practices and the drainage area that the green infrastructure practices can treat are identified for each potential project site. For each practice, the recharge potential, TSS removal potential, maximum volume reduction potential per storm, the peak reduction potential, and estimated costs are provided. This information is also provided so that proposed development projects that cannot satisfy the New Jersey stormwater management requirements for major development can use one of the identified projects to offset a stormwater management deficit. [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

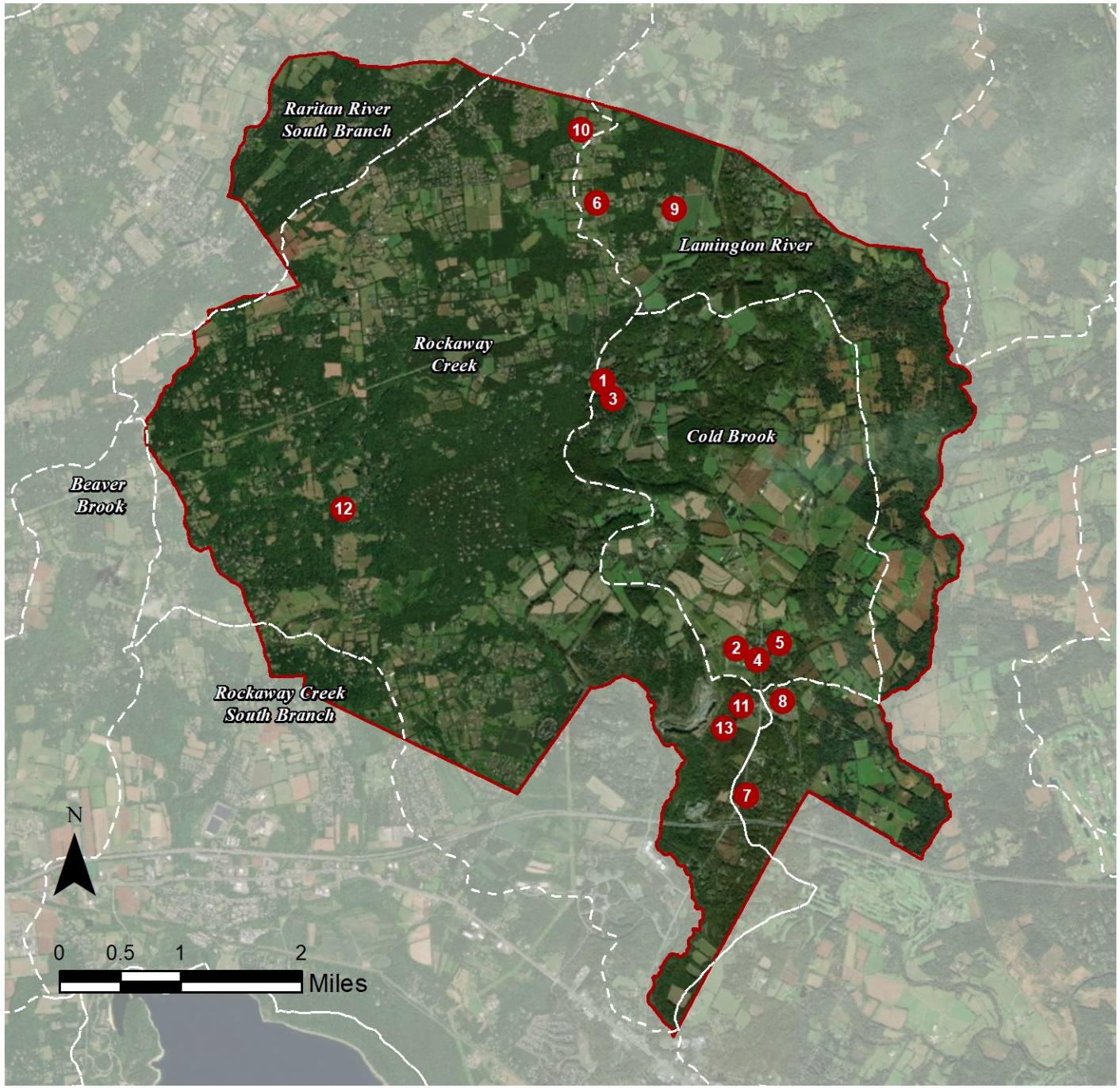
This impervious cover reduction action plan is meant to provide the municipality with a blueprint for implementing green infrastructure practices that will reduce the impact of stormwater runoff from impervious surfaces. These projects can be implemented by a wide variety of people such as boy scouts,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

Appendix A: Climate Resilient Green Infrastructure

a. Green Infrastructure Sites

TEWKSBURY TOWNSHIP: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE COLD BROOK SUBWATERSHED

1. Old Turnpike Middle School
2. Oldwick Park
3. Tewksbury First Aid & Rescue, Administration/ Police, and Municipal Complex
4. Tewksbury Township Library
5. Zion Lutheran Church

SITES WITHIN THE LAMINGTON RIVER SUBWATERSHED

6. Fairmount United Methodist Church
7. Oldwick Animal Hospital
8. Oldwick Post Office
9. Tewksbury Elementary School

SITES WITHIN THE ROCKAWAY CREEK SUBWATERSHED

10. Haytown Nursery School
11. Oldwick Fire Company Social Hall
12. Tewksbury Historical Society
13. The Meadows At Oldwick

b. Proposed Green Infrastructure Concepts

OLD TURNPIKE MIDDLE SCHOOL

Subwatershed: Cold Brook

Site Area: 997,124 sq. ft.

Address: 171 Old Turnpike Road
Tewksbury, NJ 07830

Block and Lot: Block 27, Lot 68.01

Two rain gardens can be installed adjacent to the entrance of the building and in the turfgrass south of the building to capture, treat, and infiltrate rooftop runoff. A section of parking spaces can be converted to pervious pavement 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"
21	212,600	10.2	107.4	976.1	0.166	5.83

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	0.449	75	18,304	0.81	3,080	$15,400
Pervious pavement	0.143	24	9,073	0.40	1,370	$34,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

Old Turnpike Middle School

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

0 50' 100'

OLDWICK PARK

Subwatershed: Cold Brook

Site Area: 528,992 sq. ft.

Address: 31 Old Turnpike Road
Whitehouse Station, NJ 07830

Block and Lot: Block 44, Lot 12

A cistern can be installed on the southern side of the building near a downspout to capture stormwater from the roof. The water can then be used for watering gardens, washing vehicles, or for other non-potable uses. Four downspout planter boxes can be constructed along the building to allow roof runoff to be reused. 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	59,764	2.9	30.2	274.4	0.047	1.64

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Planter boxes	n/a	3	n/a	n/a	4 (boxes)	$4,000
Rainwater harvesting	0.017	3	500	0.12	500 (gal)	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Oldwick Park

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

0 20' 40'

TEWKSBURY FIRST AID & RESCUE, ADMINISTRATION/POLICE, AND MUNICIPAL COMPLEX

Subwatershed: Cold Brook

Site Area: 417,784 sq. ft.

Address: 169 Old Turnpike Road
Caldwell, NJ 07830

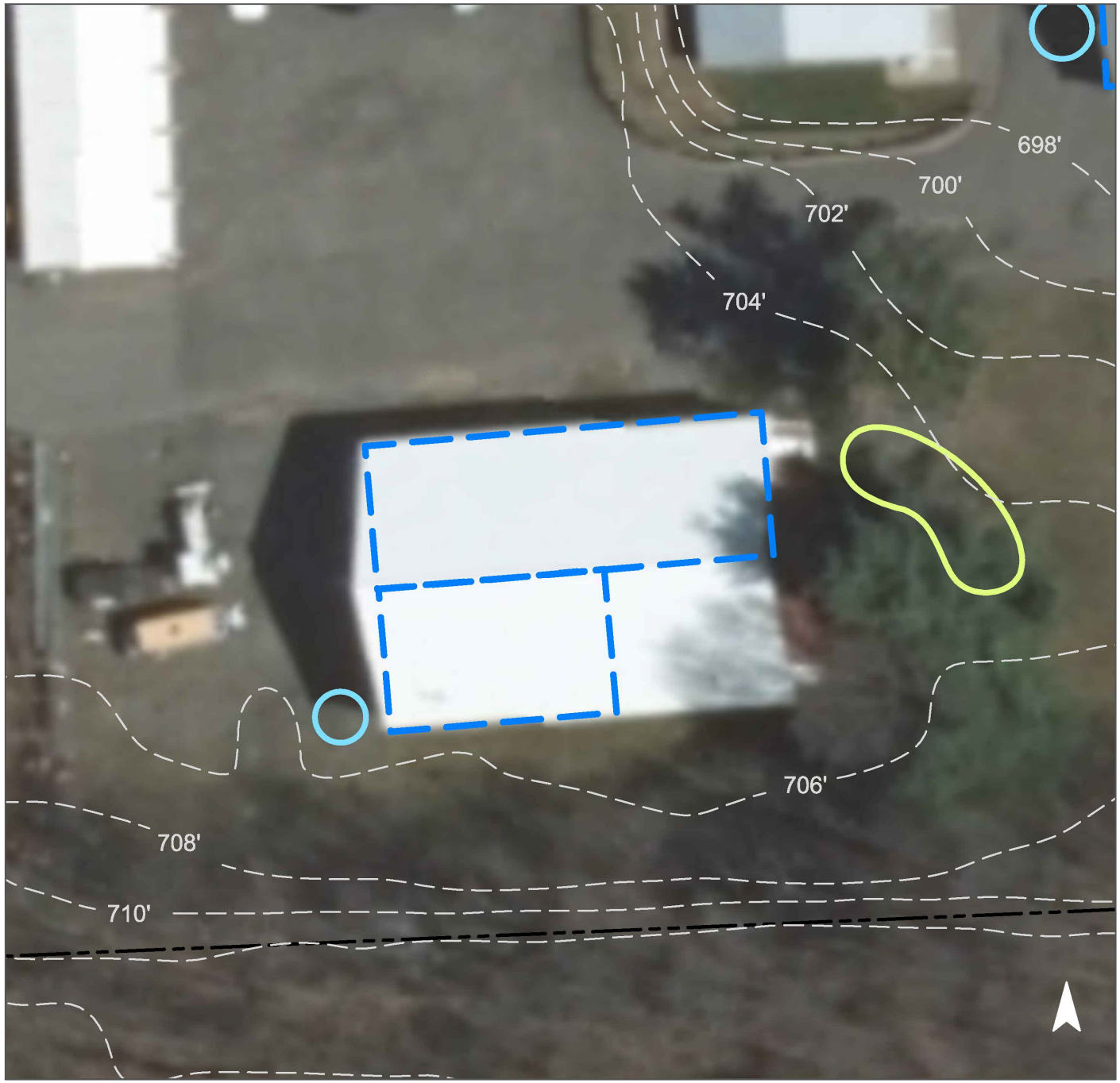
Block and Lot: Block 27, Lot 68.02

Rain gardens can be installed near the First Aid & Rescue building and the new Municipal Complex building to capture, treat, and infiltrate runoff from the roofs. Cisterns can be installed on each building, and the water can then be used for watering gardens, 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"
49	206,339	9.9	104.2	947.4	0.161	5.66

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 systems	0.083	14	2,379	0.10	795	$3,975
Rainwater harvesting	0.134	22	4,000	0.21	4,000 (gal)	$8,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

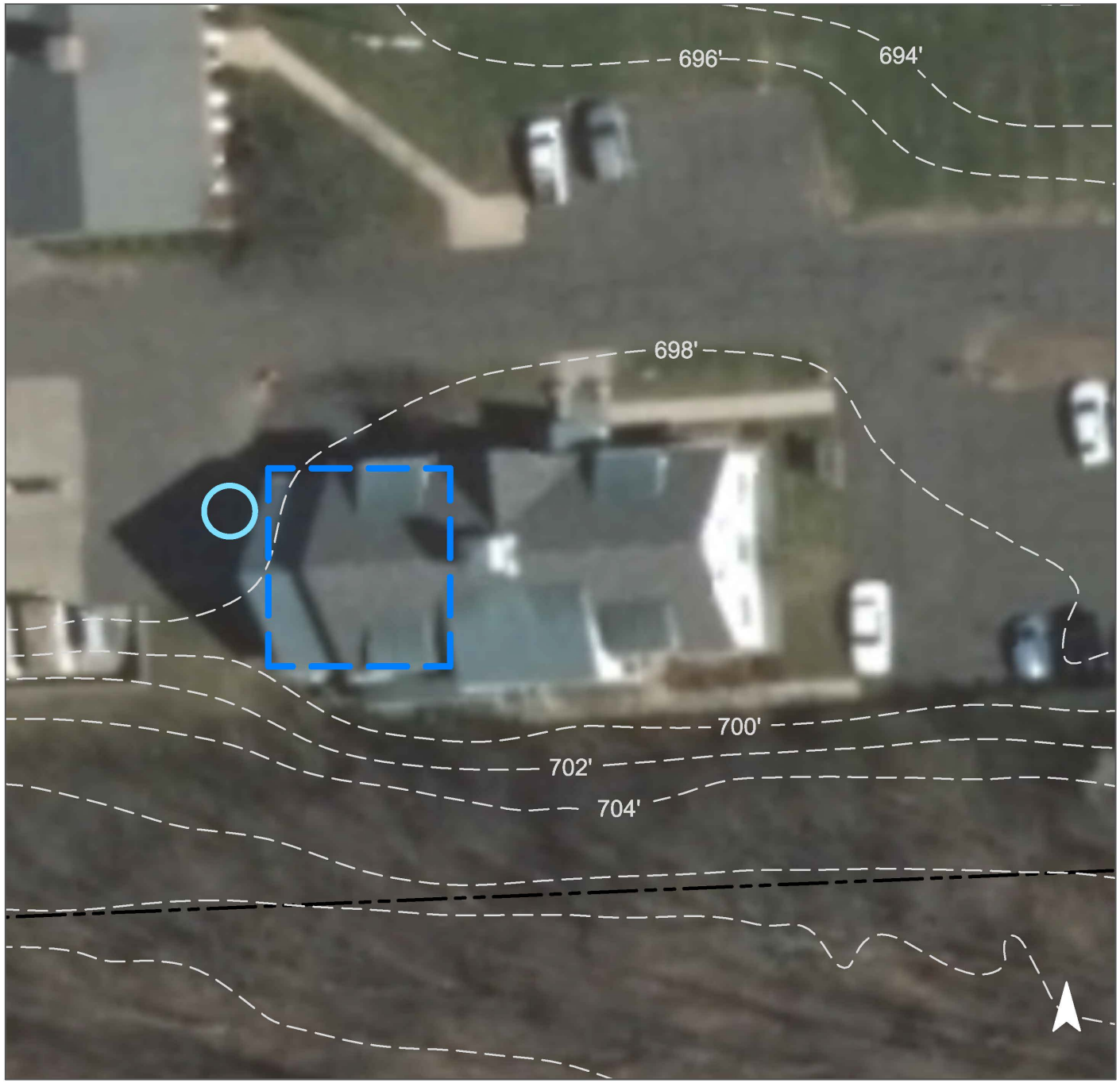


Tewksbury First Aid & Rescue

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

0 15' 30'

GREEN INFRASTRUCTURE RECOMMENDATIONS

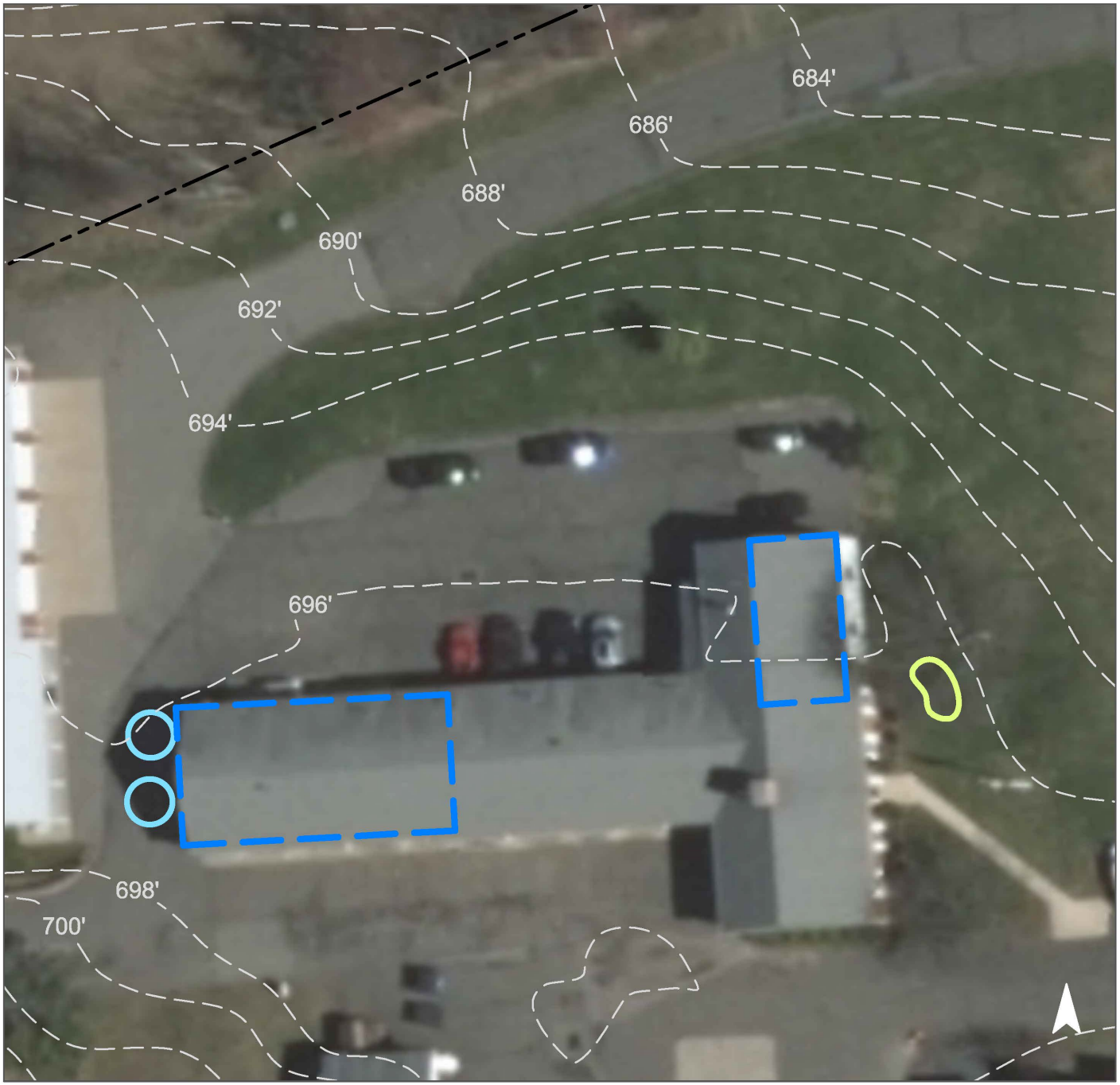


Tewksbury Administration/ Police

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

0 15' 30'

GREEN INFRASTRUCTURE RECOMMENDATIONS



Tewksbury Municipal Complex

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

0 20' 40'

TEWKSBURY TOWNSHIP LIBRARY

Subwatershed: Cold Brook

Site Area: 27,235 sq. ft.

Address: 31 Old Turnpike Road
Whitehouse Station, NJ
08889

Block and Lot: Block 44, Lot 11

Two rain gardens can be used to capture, treat, and infiltrate rooftop runoff. A downspout planter box can be constructed along the building to allow roof runoff to be captured and reused. 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"
49	13,271	0.6	6.7	60.9	0.010	0.36

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	0.020	3	1,459	0.06	195	$975
Planter box	n/a	1	n/a	n/a	1 (box)	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Tewksbury Township Library

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

0 10' 20'

ZION LUTHERAN CHURCH

Subwatershed: Cold Brook

Site Area: 104,636 sq. ft.

Address: 18 Miller Avenue
Oldwick, NJ 08858

Block and Lot: Block 42, Lot 1

Two rain gardens can be installed in the turfgrass areas adjacent to the building to capture, treat, and infiltrate stormwater runoff from the roof. Another rain garden can be installed in a parking lot island to capture, treat, and infiltrate stormwater 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"
44	46,252	2.2	23.4	212.4	0.036	1.27

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	0.103	17	4,421	0.19	995	$4,975

GREEN INFRASTRUCTURE RECOMMENDATIONS

Zion Lutheran Church

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

0 20' 40'

FAIRMOUNT UNITED METHODIST CHURCH

Subwatershed: Lamington River

Site Area: 56,952 sq. ft.

Address: 253 Old Turnpike Road
Califon, NJ 07830

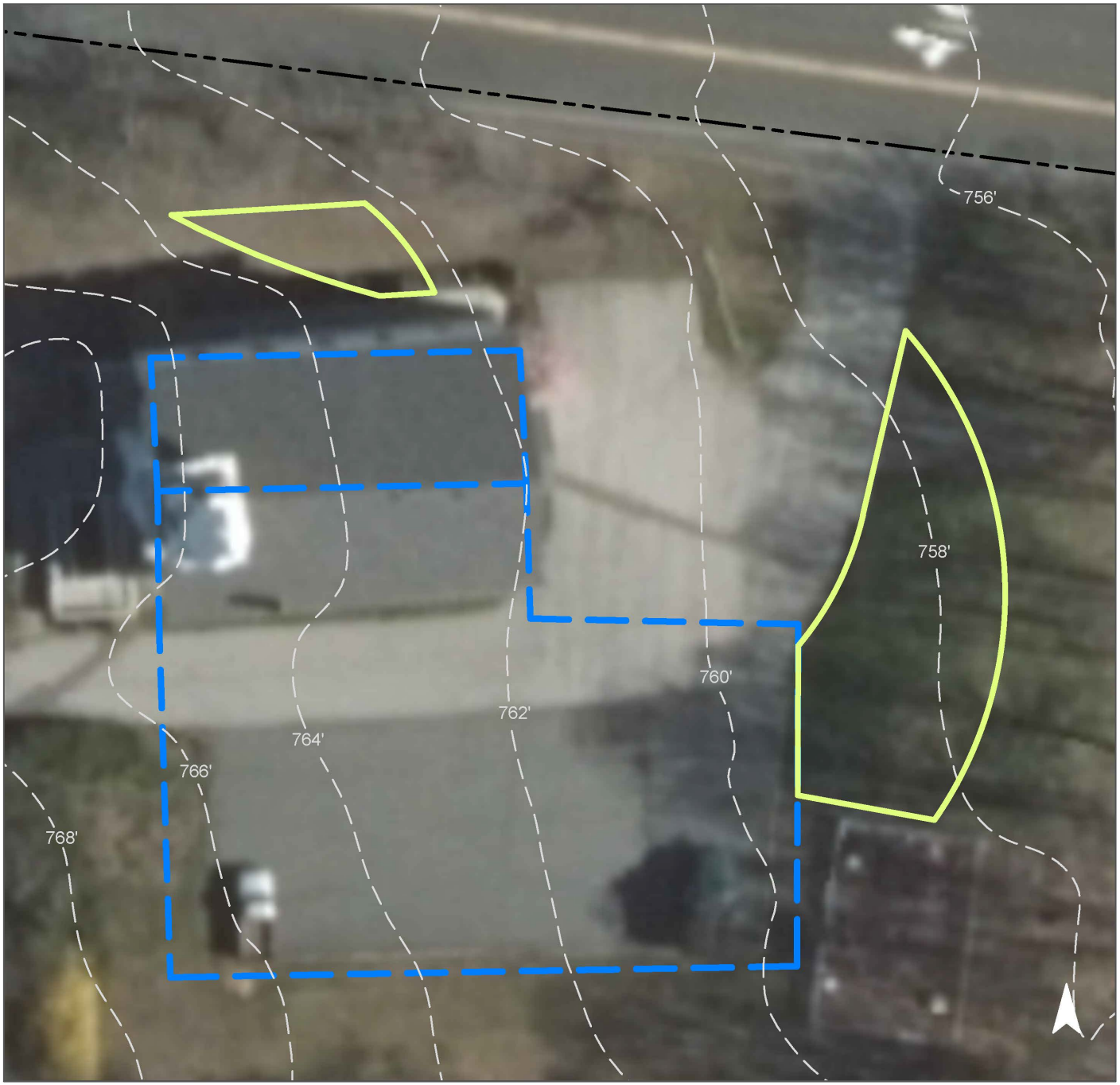
Block and Lot: Block 16, Lot 1,2.012

Rain gardens can be installed on the north side of the building and on the turfgrass area east of the parking lot to capture, treat, and infiltrate stormwater runoff from the roof. 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"
54	30,764	1.5	15.5	141.2	0.024	0.84

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	0.28	0.322	54	24,385	1.07	3,090

GREEN INFRASTRUCTURE RECOMMENDATIONS



Fairmount United Methodist Church

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

0 15' 30'

OLDWICK ANIMAL HOSPITAL

Subwatershed: Lamington River

Site Area: 44,718 sq. ft.

Address: 130 Oldwick Road
Whitehouse Station, NJ
08889

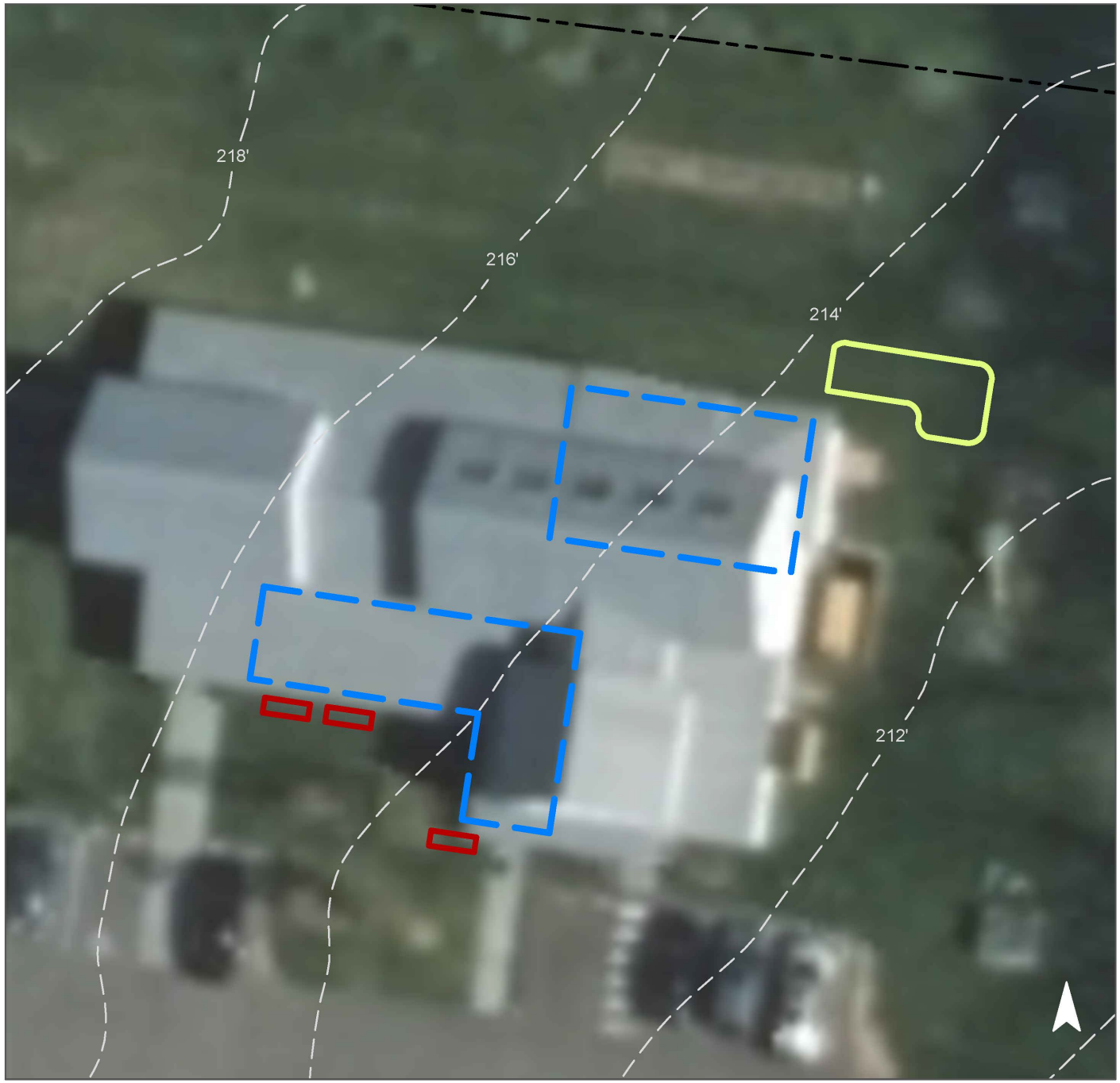
Block and Lot: Block 45, Lot 28

A rain garden can be installed in the turfgrass area to capture, treat, and infiltrate stormwater runoff from the roof. Downspout planter boxes can be constructed along the building to allow roof runoff to be captured and reused. 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"
61	27,479	1.3	13.9	126.2	0.021	0.75

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 system	0.017	3	741	0.03	165	$825
Planter boxes	n/a	2	n/a	n/a	3 (boxes)	$3,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Oldwick Animal Hospital

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

0 10' 20'

OLDWICK POST OFFICE

Subwatershed: Lamington River

Site Area: 21,980 sq. ft.

Address: 174 Lamington Road
Oldwick, NJ 08858

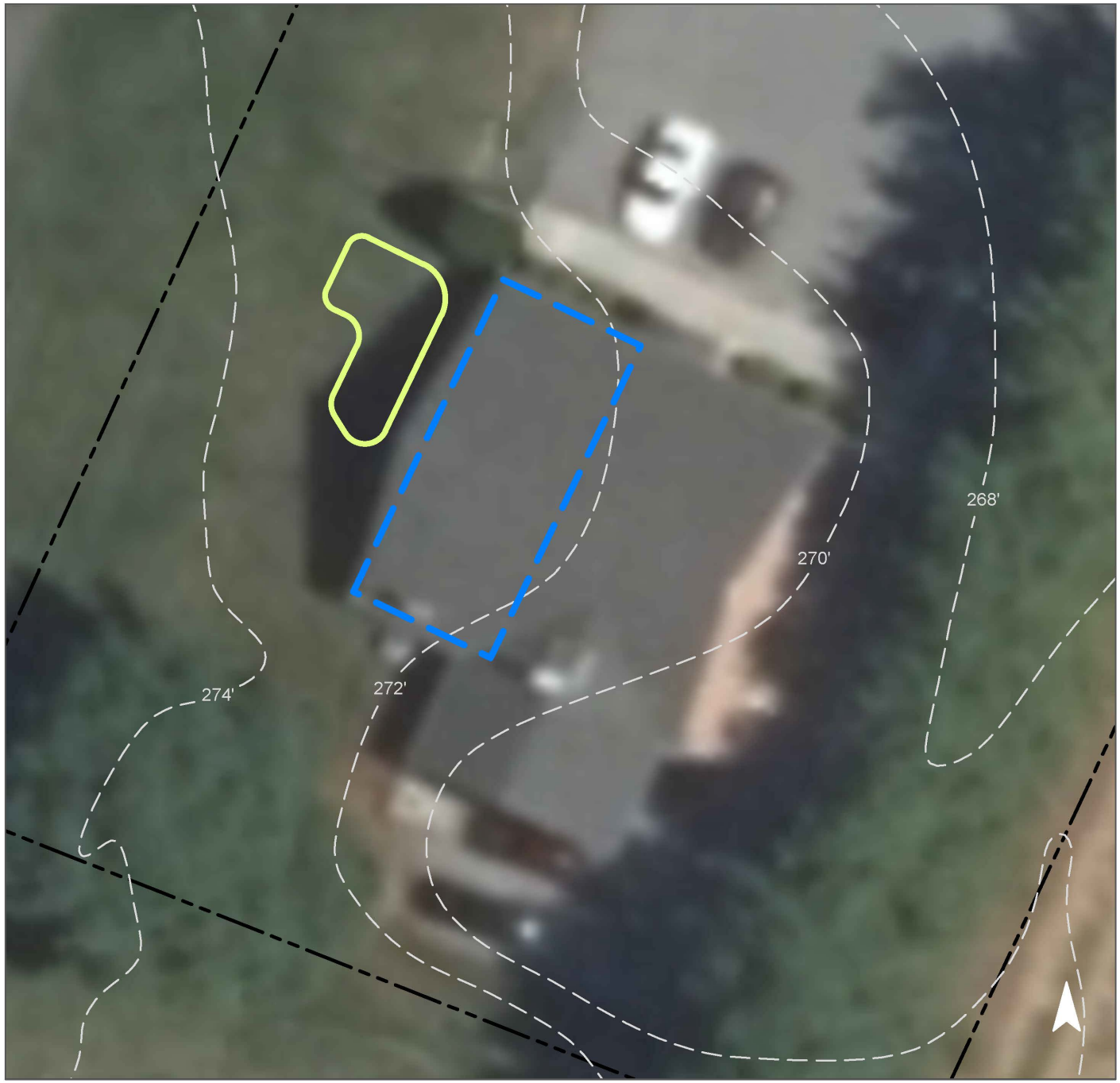
Block and Lot: Block 45, Lot 1.01

A rain garden can be installed on the west side of the building to capture, treat, and infiltrate stormwater runoff from the roof. 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	9,842	0.5	5.0	45.2	0.008	0.27

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	1,825	0.07	225	$1,125

GREEN INFRASTRUCTURE RECOMMENDATIONS



Oldwick Post Office

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

0 10' 20'

TEWKSBURY ELEMENTARY SCHOOL

Subwatershed: Lamington River

Site Area: 5,952,026 sq. ft.

Address: 109 Fairmount Road East
Whitehouse Station, NJ
08889

Block and Lot: Block 16, Lot 6

A rain garden can be installed in the turfgrass area on the west side of the building and on the turfgrass area in the parking lot to capture, treat, and infiltrate stormwater runoff from the roof. Parking spaces north of the building can be replaced with pervious pavement to capture and infiltrate stormwater 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"
6	333,441	16.1	168.4	1,531.0	0.260	9.15

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	0.133	22	16,164	0.71	1,275	$6,375
Pervious pavement	0.371	62	24,662	1.08	2,540	$63,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Tewksbury Elementary School

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

0 75' 150'

HAYTOWN NURSERY SCHOOL

Subwatershed: Rockaway Creek

Site Area: 131,401 sq. ft.

Address: 247 Old Turnpike Road
Califon, NJ 07830

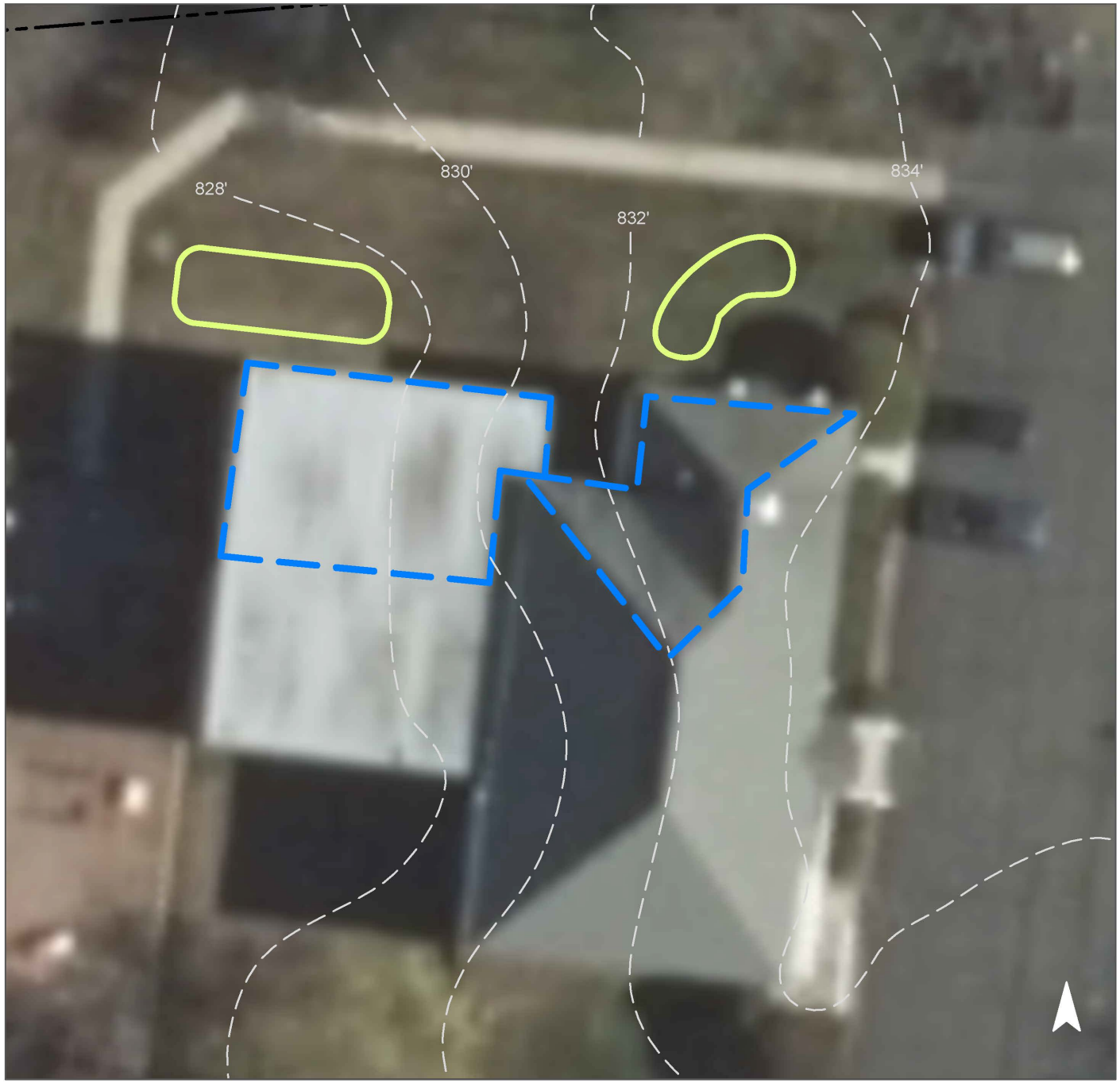
Block and Lot: Block 6.04, Lot 6.01

Two rain gardens can be installed on the north side of the building to capture, treat, and infiltrate stormwater runoff from the roof. 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"
27	35,744	1.7	18.1	164.1	0.028	0.98

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.041	7	4,107	0.18	630	$3,150

GREEN INFRASTRUCTURE RECOMMENDATIONS



Haytown Nursery School

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

0 10' 20'

OLDWICK FIRE COMPANY SOCIAL HALL

Subwatershed: Rockaway Creek

Site Area: 200,735 sq. ft.

Address: 163 Oldwick Road
Oldwick, NJ 08858

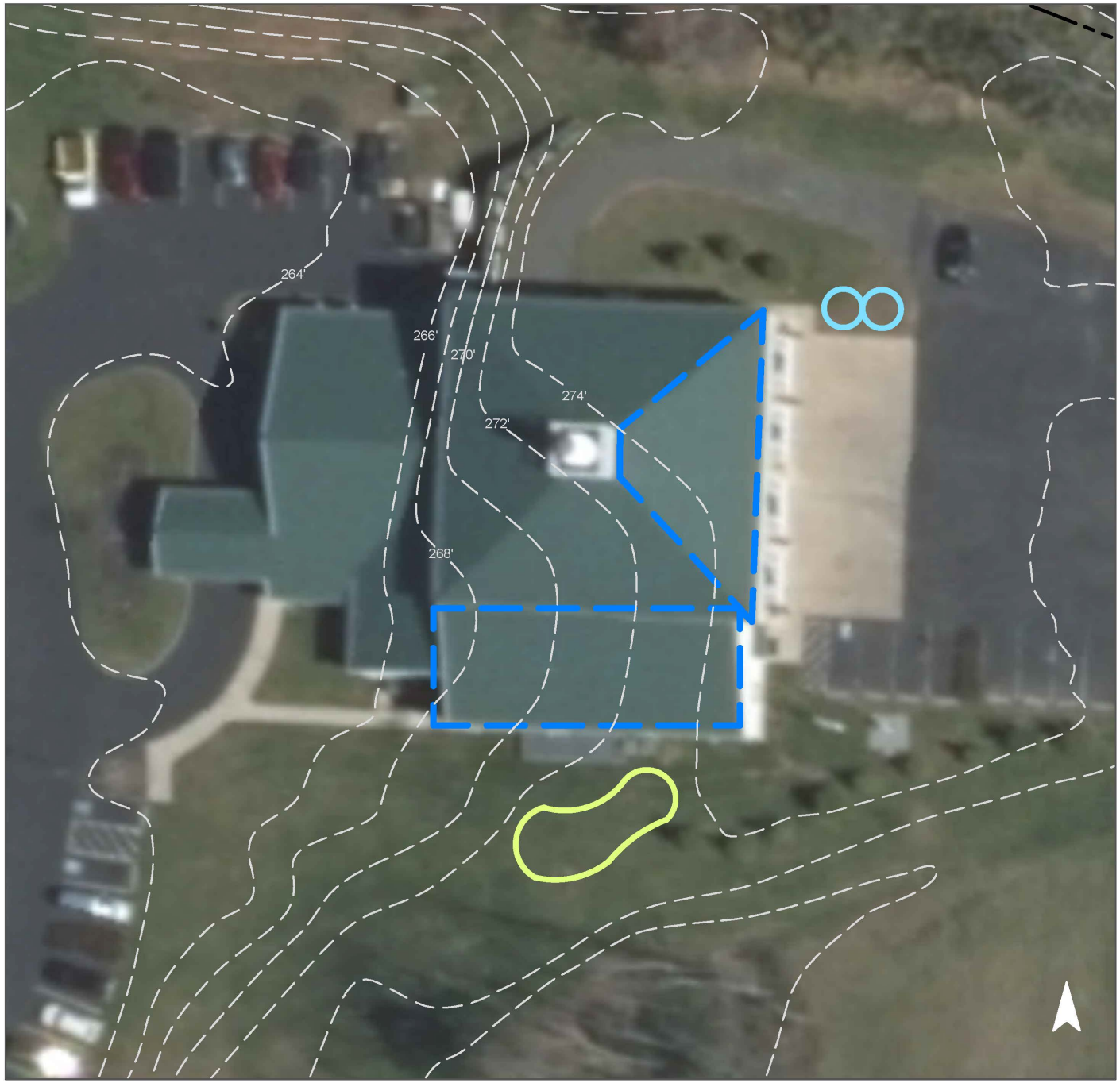
Block and Lot: Block 44, Lot 22.01

A rain garden can installed on the south side of the building to capture, treat, and infiltrate stormwater runoff from the roof. Two cisterns can be installed on the north side of the building to capture stormwater from the roof. The water can then be used for watering gardens, 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"
31	61,279	3.0	30.9	281.4	0.048	1.68

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	0.065	11	4,869	0.18	625	$3,125
Rainwater harvesting	0.044	7	1,325	0.15	1,325 (gal)	$2,650

GREEN INFRASTRUCTURE RECOMMENDATIONS



Oldwick Fire Company Social Hall

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

0 15' 30'

TEWKSBURY HISTORICAL SOCIETY

Subwatershed: Rockaway Creek

Site Area: 35,923 sq. ft.

Address: 60 Water Street
Lebanon, NJ 08833

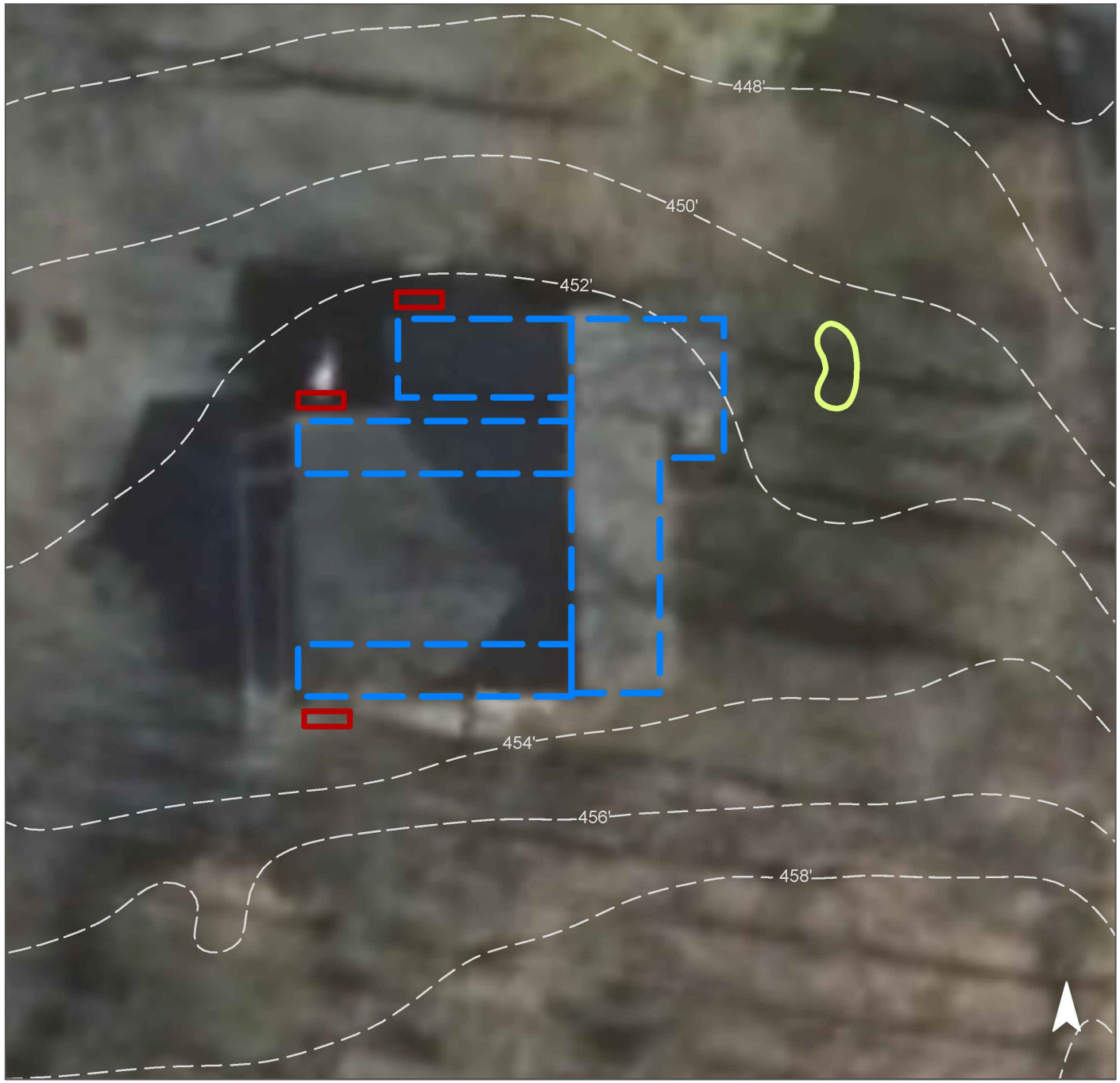
Block and Lot: Block 32, Lot 19

A rain garden can be installed in the turfgrass area on the east side of the building to capture, treat, and infiltrate stormwater runoff from the roof. Downspout planter boxes can be installed to allow roof runoff to be captured and reused. 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	5,372	0.3	2.7	24.7	0.004	0.15

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	0.019	3	367	0.02	185	$925
Planter boxes	n/a	2	n/a	n/a	3 (boxes)	$3,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Tewksbury Historical Society

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

0 10' 20'

THE MEADOWS AT OLDWICK

Subwatershed: Rockaway Creek

Site Area: 2,218,965 sq. ft.

Address: 800 Fisher Road
Whitehouse Station, NJ 08889

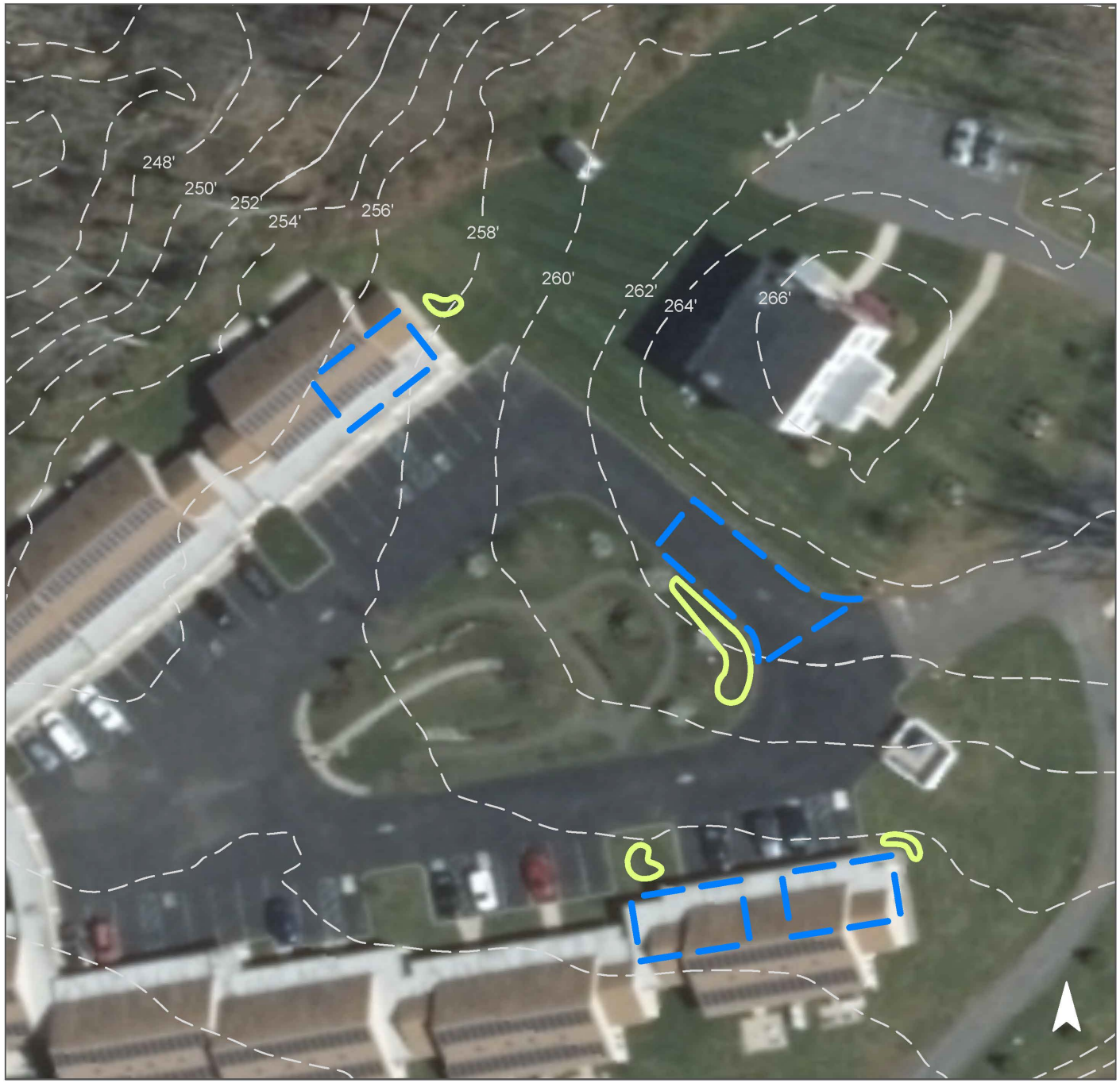
Block and Lot: Block 44, Lot 22

Multiple rain gardens can be installed in the turfgrass area adjacent to the buildings and in the center parking lot island to capture, treat, and infiltrate stormwater runoff from the roof. 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"
10	219,372	10.6	110.8	1,007.2	0.171	6.02

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	0.089	15	5,991	0.26	865	$4,325

GREEN INFRASTRUCTURE RECOMMENDATIONS



The Meadows At Oldwick

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

0 25' 50'

c. Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Runoff Volumes from I.C. Annual (cu.ft.)	Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
	COLD BROOK SITES	**47.65**	**2,075,770**				**12.36**	**538,227**	**25.9**	**271.8**	**2,471.2**	**56,065**	**1,973,498**	**0.419**	**14.76**
1	**Old Turnpike Middle School**														
	Total Site Info	22.89	997,124	27	68.01	21	4.88	212,600	10.2	107.4	976.1	22,146	779,534	0.166	5.83
2	**Oldwick Park**														
	Total Site Info	12.14	528,992	44	12	11	1.37	59,764	2.9	30.2	274.4	6,225	219,136	0.047	1.64
3	**Tewksbury First Aid & Rescue, Administration/Police, and Municipal Complex**														
	Total Site Info	9.59	417,784	27	68.02	49	4.74	206,339	9.9	104.2	947.4	21,494	756,576	0.161	5.66
4	**Tewksbury Township Library**														
	Total Site Info	0.63	27,235	44	11	49	0.30	13,271	0.6	6.7	60.9	1,382	48,661	0.010	0.36
5	**Zion Lutheran Church**														
	Total Site Info	2.40	104,636	42	1	44	1.06	46,252	2.2	23.4	212.4	4,818	169,591	0.036	1.27
	LAMINGTON RIVER SITES	**139.48**	**6,075,677**				**9.22**	**401,526**	**19.4**	**202.8**	**1,843.6**	**41,826**	**1,472,262**	**0.313**	**11.01**
6	**Fairmount United Methodist Church**														
	Total Site Info	1.31	56,952	16	1-2.02	54	0.71	30,764	1.5	15.5	141.2	3,205	112,801	0.024	0.84
7	**Oldwick Animal Hospital**														
	Total Site Info	1.03	44,718	45	28	61	0.63	27,479	1.3	13.9	126.2	2,862	100,756	0.021	0.75
8	**Oldwick Post Office**														
	Total Site Info	0.50	21,980	45	1.01	45	0.23	9,842	0.5	5.0	45.2	1,025	36,088	0.008	0.27
9	**Tewksbury Elementary School**														
	Total Site Info	136.64	5,952,026	16	6	6	7.65	333,441	16.1	168.4	1,531.0	34,733	1,222,618	0.260	9.15
	ROCKAWAY CREEK SITES	**59.39**	**2,587,025**				**7.39**	**321,768**	**15.5**	**162.5**	**1,477.4**	**33,517**	**1,179,815**	**0.251**	**8.83**
10	**Haytown Nursery School**														
	Total Site Info	3.02	131,401	6.04	6.01	27	0.82	35,744	1.7	18.1	164.1	3,723	131,061	0.028	0.98
11	**Oldwick Fire Co Social Hall**														

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Runoff Volumes from I.C. Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Runoff Volumes from I.C. Annual (Mgal)
	Total Site Info	4.61	200,735	44	22.01	31	1.41	61,279	3.0	30.9	281.4	6,383	224,691	0.048	1.68
12	**Tewksbury Historical Society**														
	Total Site Info	0.82	35,923	32	19	15	0.12	5,372	0.3	2.7	24.7	560	19,699	0.004	0.15
13	**The Meadows At Oldwick**														
	Total Site Info	50.94	2,218,965	44	22	10	5.04	219,372	10.6	110.8	1,007.2	22,851	804,363	0.171	6.02

d. 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	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
	COLD BROOK SITES	**25,767**	**0.59**	**0.625**	**111**	**39,921**	**2.18**				**$53,784**	**5.4%**
1	**Old Turnpike Middle School**											
	Bioretention systems	9,271	0.21	0.242	40	18,304	0.81	1,202	$5	SF	$6,010	5.0%
	Pervious pavement	4,596	0.11	0.120	20	9,073	0.40	1,286	$25	SF	$32,150	2.5%
	Total Site Info	**13,867**	**0.32**	**0.361**	**60**	**27,377**	**1.21**				**$38,160**	**7.4%**
2	**Oldwick Park**											
	Planter boxes	1,372	0.03	n/a	5	n/a	n/a	2	$1,000	box	$2,000	40.6%
	Rainwater harvesting	1,372	0.03	0.036	6	988	0.12	988	$2	gal	$1,976	40.6%
	Total Site Info	**2,744**	**0.06**	**0.036**	**11**	**988**	**0.12**				**$3,976**	**81.1%**
3	**Tewksbury First Aid & Rescue**											
	Bioretention system	1,204	0.03	0.031	5	2,379	0.10	578	$5	SF	$2,890	2.0%
	Rainwater harvesting	1,204	0.03	0.031	5	942	0.21	942	$2	gal	$1,884	2.0%
	Total Site Info	**2,408**	**0.06**	**0.063**	**11**	**3,321**	**0.31**				**$4,774**	**3.9%**
	Tewksbury Administration/ Police											
	Rainwater harvesting	215	0.00	0.006	1	142	0.02	142	$2	gal	$284	0.3%
	Total Site Info	**215**	**0.00**	**0.006**	**1**	**142**	**0.02**				**$284**	**0.3%**
	Tewksbury Municipal Complex											
	Bioretention system	701	0.02	0.018	3	1,384	0.06	126	$5	SF	$630	0.9%
	Rainwater harvesting	2,453	0.06	0.064	11	830	0.21	830	$2	gal	$1,660	3.1%
	Total Site Info	**3,154**	**0.07**	**0.082**	**14**	**2,214**	**0.27**				**$2,290**	**4.0%**
4	**Tewksbury Township Library**											
	Bioretention systems	739	0.02	0.019	3	1,459	0.06	153	$5	SF	$765	3.5%
	Planter boxes	399	0.01	n/a	1	n/a	n/a	1	$1,000	box	$1,000	1.9%
	Total Site Info	**1,138**	**0.03**	**0.019**	**5**	**1,459**	**0.06**				**$1,765**	**5.4%**
5	**Zion Lutheran Church**											
	Bioretention systems	2,241	0.05	0.058	10	4,421	0.19	507	$5	SF	$2,535	5.0%
	Total Site Info	**2,241**	**0.05**	**0.058**	**10**	**4,421**	**0.19**				**$2,535**	**5.0%**
	LAMINGTON RIVER SITES	**35,409**	**0.81**	**0.895**	**154**	**67,776**	**2.96**				**$79,745**	**11.4%**
6	**Fairmount United Methodist Church**											
	Bioretention systems	12,355	0.28	0.322	54	24,385	1.07	1,328	$5	SF	$6,640	36.7%
	Total Site Info	**12,355**	**0.28**	**0.322**	**54**	**24,385**	**1.07**				**$6,640**	**36.7%**
7	**Oldwick Animal Hospital**											
	Bioretention system	377	0.01	0.010	2	741	0.03	90	$5	SF	$450	2.8%
	Planter boxes	1,070	0.02	n/a	4	n/a	n/a	3	$1,000	box	$3,000	8.0%

	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	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
	Total Site Info	**1,447**	**0.03**	**0.010**	**6**	**741**	**0.03**				**$3,450**	**10.8%**
8	**Oldwick Postal Service**											
	Bioretention system	923	0.02	0.024	4	1,825	0.07	224	$5	SF	$1,120	12.0%
	Total Site Info	**923**	**0.02**	**0.024**	**4**	**1,825**	**0.07**				**$1,120**	**12.0%**
9	**Tewksbury Elementary School**											
	Bioretention systems	8,190	0.19	0.213	36	16,164	0.71	997	$5	SF	$4,985	3.2%
	Pervious pavement	12,494	0.29	0.326	54	24,662	1.08	2,542	$25	SF	$63,550	4.9%
	Total Site Info	**20,684**	**0.47**	**0.539**	**90**	**40,826**	**1.79**				**$68,535**	**8.1%**
	ROCKAWAY CREEK SITES	**11,109**	**0.26**	**0.247**	**47**	**16,527**	**0.79**				**$12,796**	**5.8%**
10	**Haytown Nursery School**											
	Bioretention systems	2,080	0.05	0.054	9	4,107	0.18	428	$5	SF	$2,140	9.4%
	Total Site Info	**2,080**	**0.05**	**0.054**	**9**	**4,107**	**0.18**				**$2,140**	**9.4%**
11	**Oldwick Fire Co Social Hall**											
	Bioretention system	2,466	0.06	0.064	11	4,869	0.18	555	$5	SF	$2,775	3.4%
	Rainwater harvesting	1,707	0.04	0.044	7	1,193	0.15	1,193	$2	gal	$2,386	2.4%
	Total Site Info	**4,173**	**0.10**	**0.109**	**18**	**6,062**	**0.33**				**$5,161**	**5.8%**
12	**Tewksbury Historical Society**											
	Bioretention system	186	0.00	0.005	1	367	0.02	45	$5	SF	$225	6.8%
	Planter boxes	1,635	0.04	n/a	6	n/a	n/a	3	$1,000	box	$3,000	59.9%
	Total Site Info	**1,821**	**0.04**	**0.005**	**7**	**367**	**0.02**				**$3,225**	**66.7%**
13	**The Meadows At Oldwick**											
	Bioretention systems	3,035	0.07	0.079	13	5,991	0.26	454	$5	SF	$2,270	3.3%
	Total Site Info	**3,035**	**0.07**	**0.079**	**13**	**5,991**	**0.26**				**$2,270**	**3.3%**