RUTGERS
New Jersey Agricultural Experiment Station

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

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

November 3, 2016

WILLIAM PENN FOUNDATION

ANJEC
Local Environment Matters

Table of Contents

Introduction

Located in Warren County in western New Jersey, Harmony Township covers approximately 24.1 square miles. Figures 1 and 2 illustrate that Harmony Township is dominated by agricultural land uses. A total of 12.3% of the municipality's land use is classified as urban. Of the urban land in Harmony 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 Harmony 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 Harmony Township. Based upon the 2007 NJDEP land use/land cover data, approximately 1.93% of Harmony Township has impervious cover. This level of impervious cover suggests that the streams in Harmony Township are likely sensitive streams. [1]

Methodology

Harmony Township contains portions of five 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

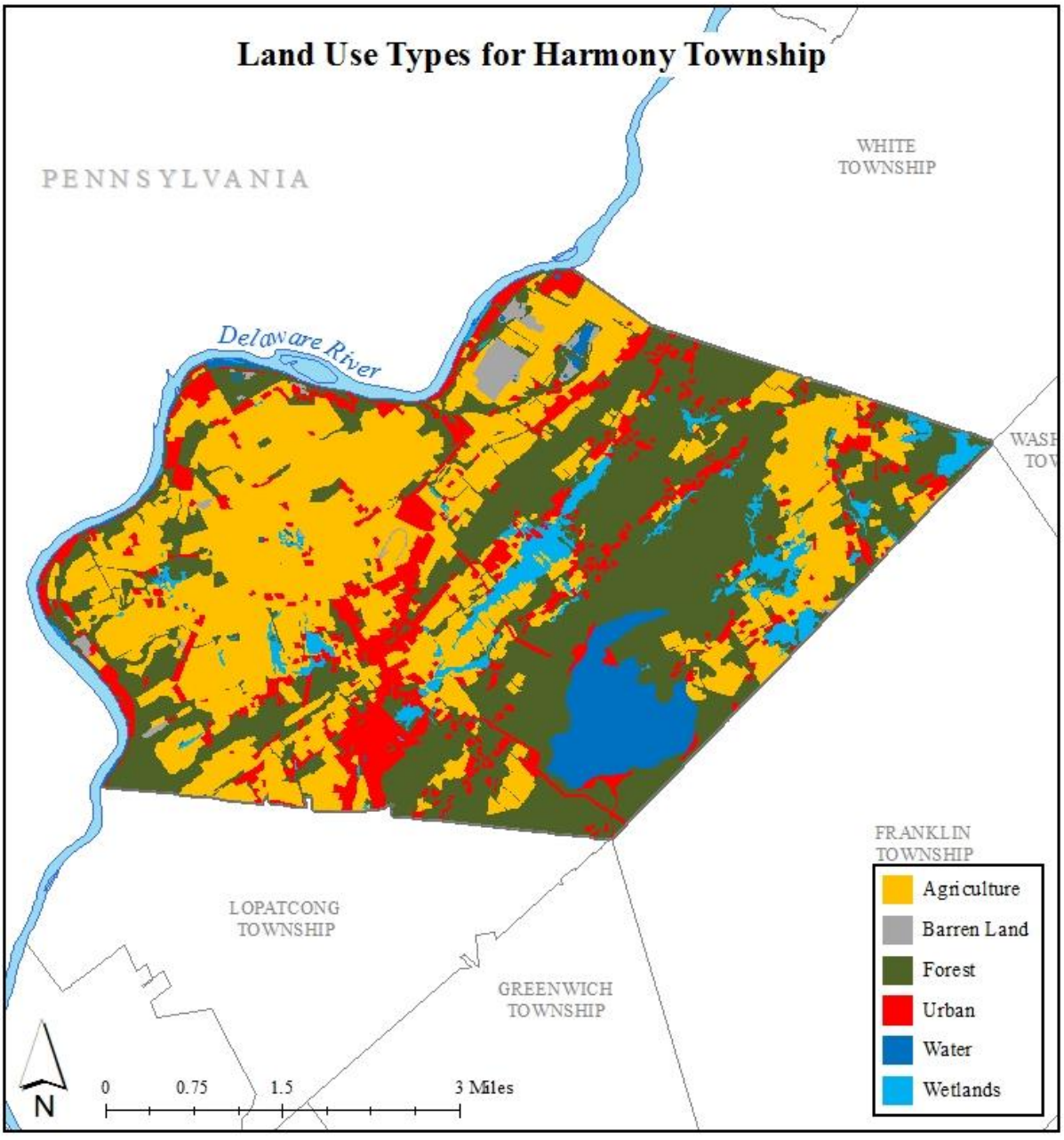


Figure 1: Map illustrating the land use in Harmony Township

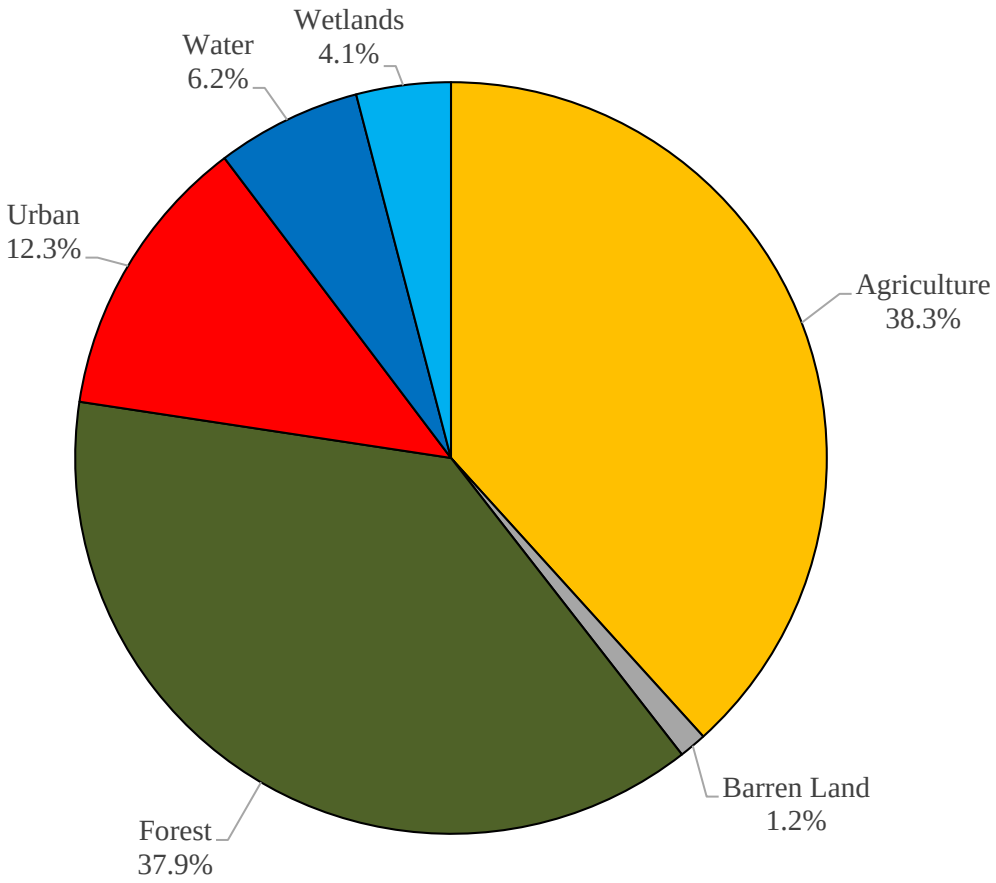


Figure 2: Pie chart illustrating the land use in Harmony Township

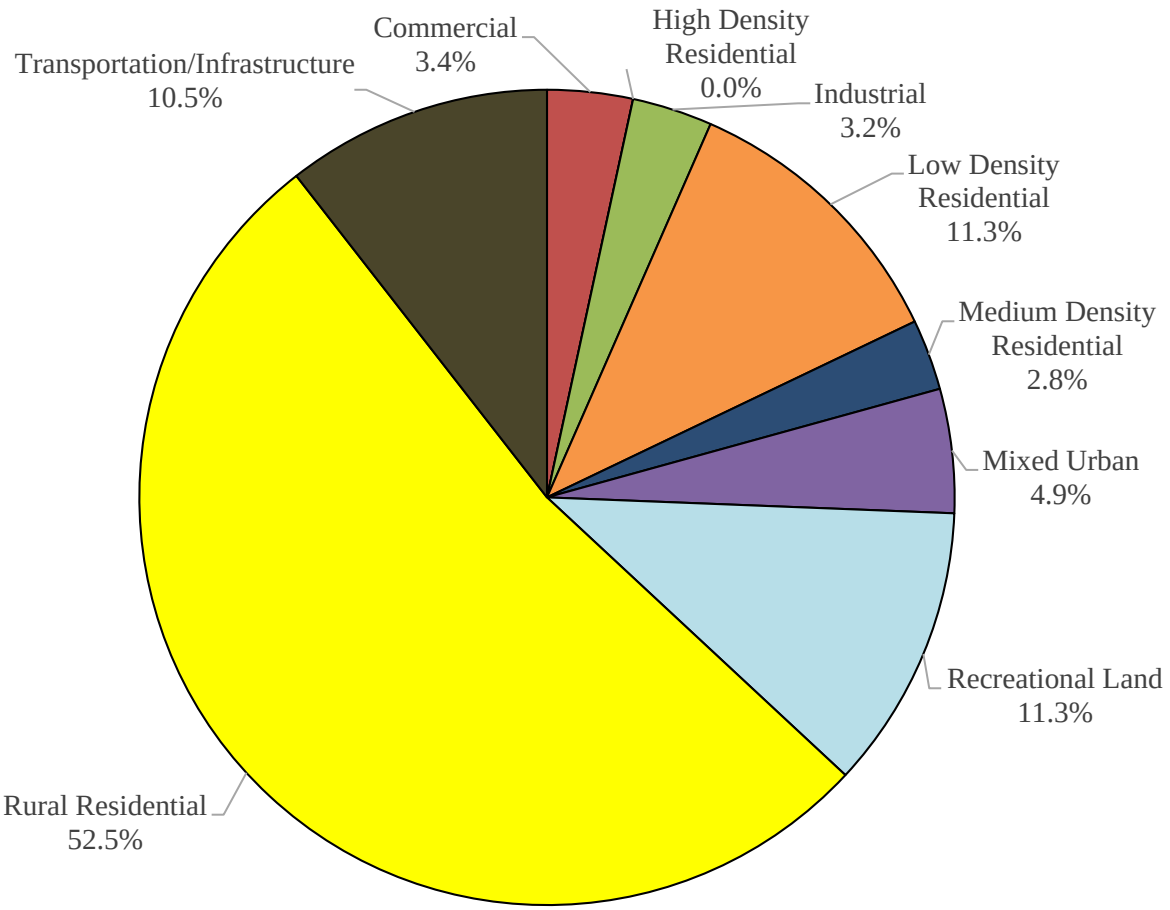


Figure 3: Pie chart illustrating the various types of urban land use in Harmony Township

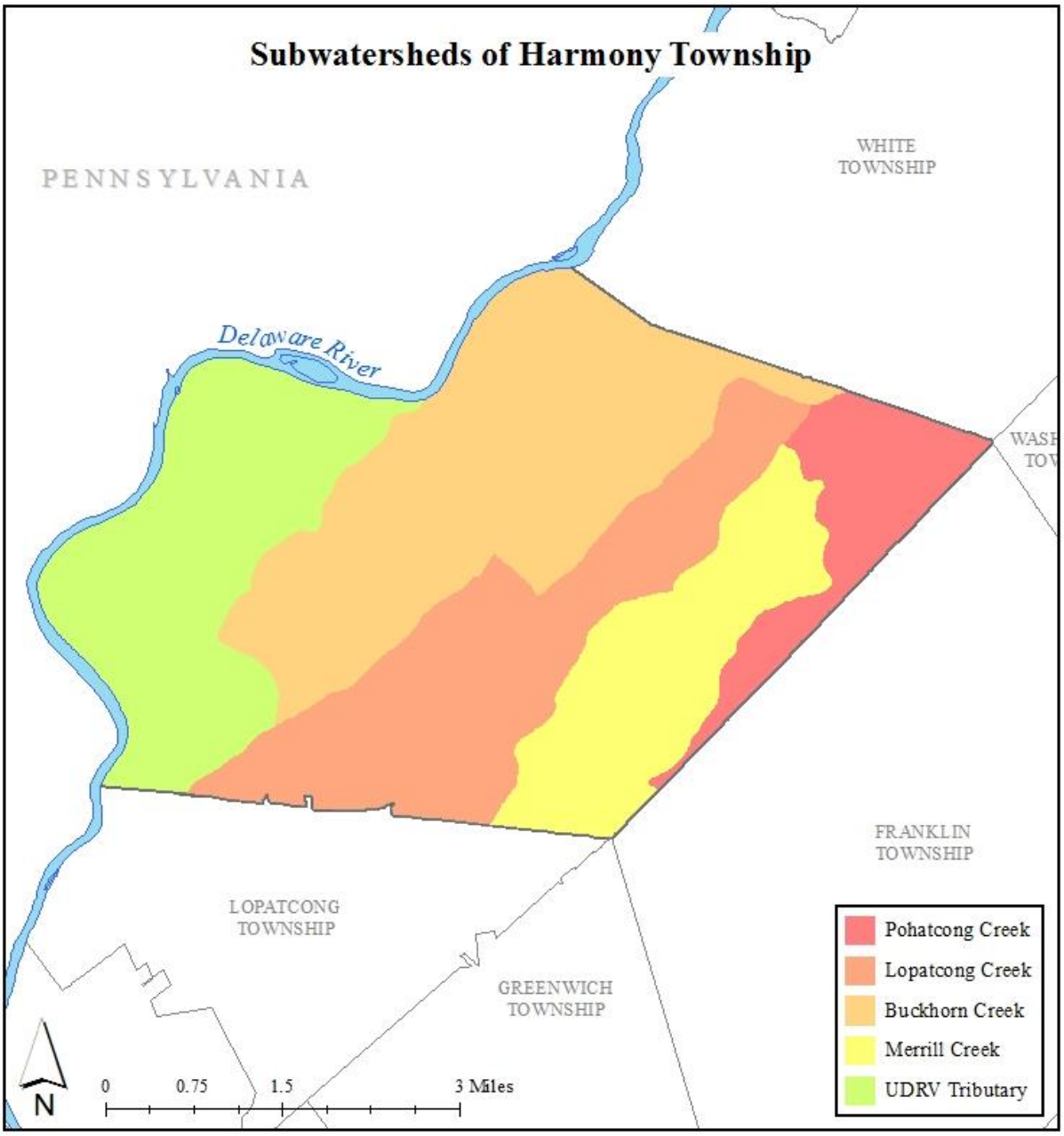


Figure 4: Map of the subwatersheds in Harmony Township

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 Harmony 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 Harmony 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*.

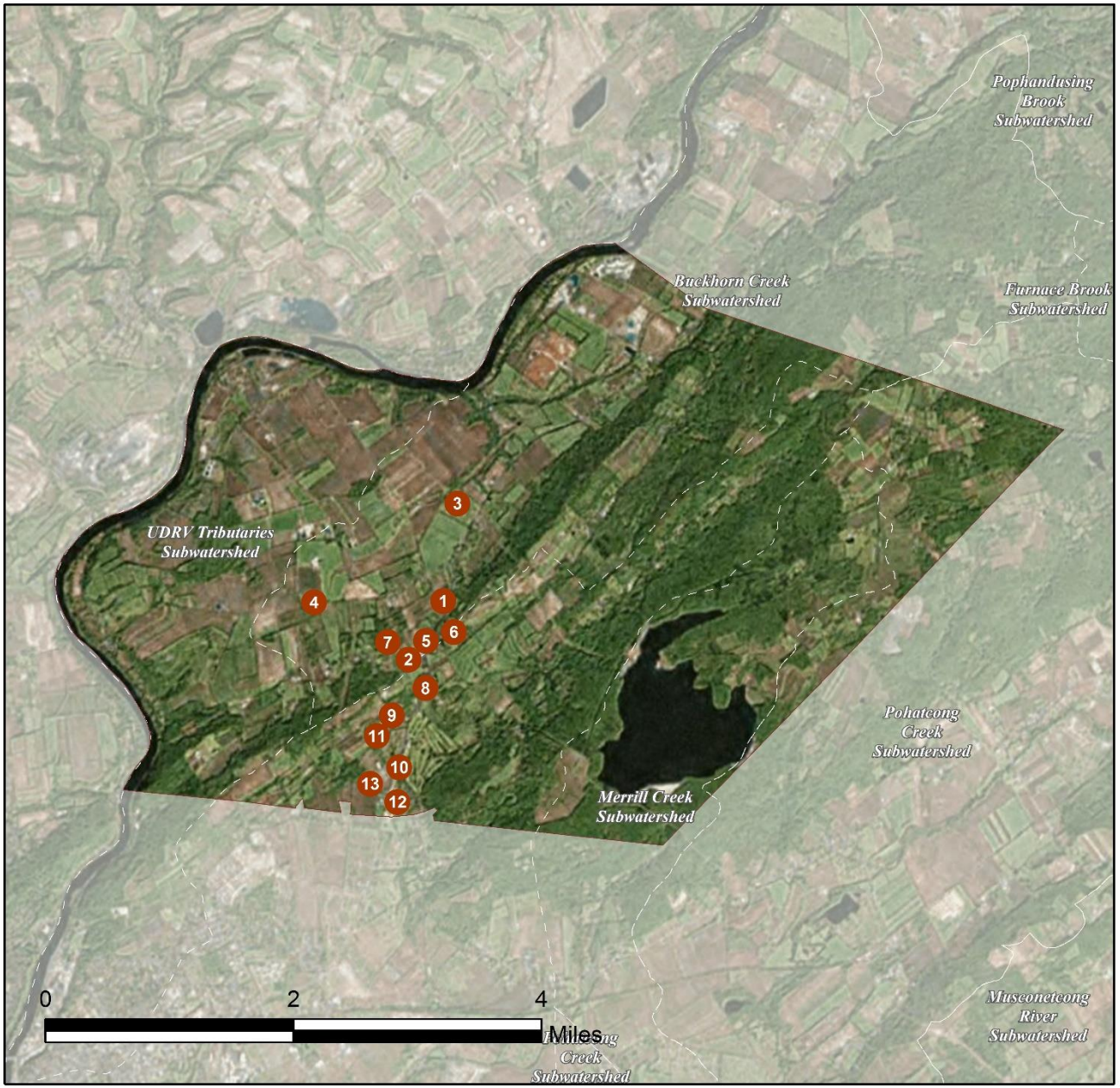
Conclusion

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

HARMONY TOWNSHIP: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE BUCKHORN CREEK SUBWATERSHED:

1 Harmony Presbyterian Church

2 Harmony Township Fire Department

3 Harmony Township Municipal Building

4 Harmony Township Road Department

5 Harmony Township School

6 Kingdom Hall Jehovahs Witness

7 Presbyterian & Reformed Publishing

SITES WITHIN THE LOPATCONG CREEK SUBWATERSHED:

8 Calvary Community Orthodox Church

9 Family Dentistry

10 Harkers Hollow Golf & Country Club

11 Harmony Animal Hospital

12 Phillips & Tosco Landscaping

13 Warren County Farmers Fair

b. Proposed Green Infrastructure Concepts

HARMONY PRESBYTERIAN CHURCH

Subwatershed: Buckhorn Creek

Site Area: 116,435 sq. ft.

Address: 2727 Belvidere Road
Phillipsburg, NJ 08865

Block and Lot: Block 36, Lot 5

Parking spots to the south of the building 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"
33	38,308	1.8	19.3	175.9	0.030	1.05

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	0.557	93	40,851	1.54	7,250	$181,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

Harmony Presbyterian Church

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

0 20' 40'

HARMONY TOWNSHIP FIRE DEPARTMENT

Subwatershed: **Buckhorn Creek**

Site Area: **279,591 sq. ft.**

Address: **440 Brainards Road**
Phillipsburg, NJ 08865

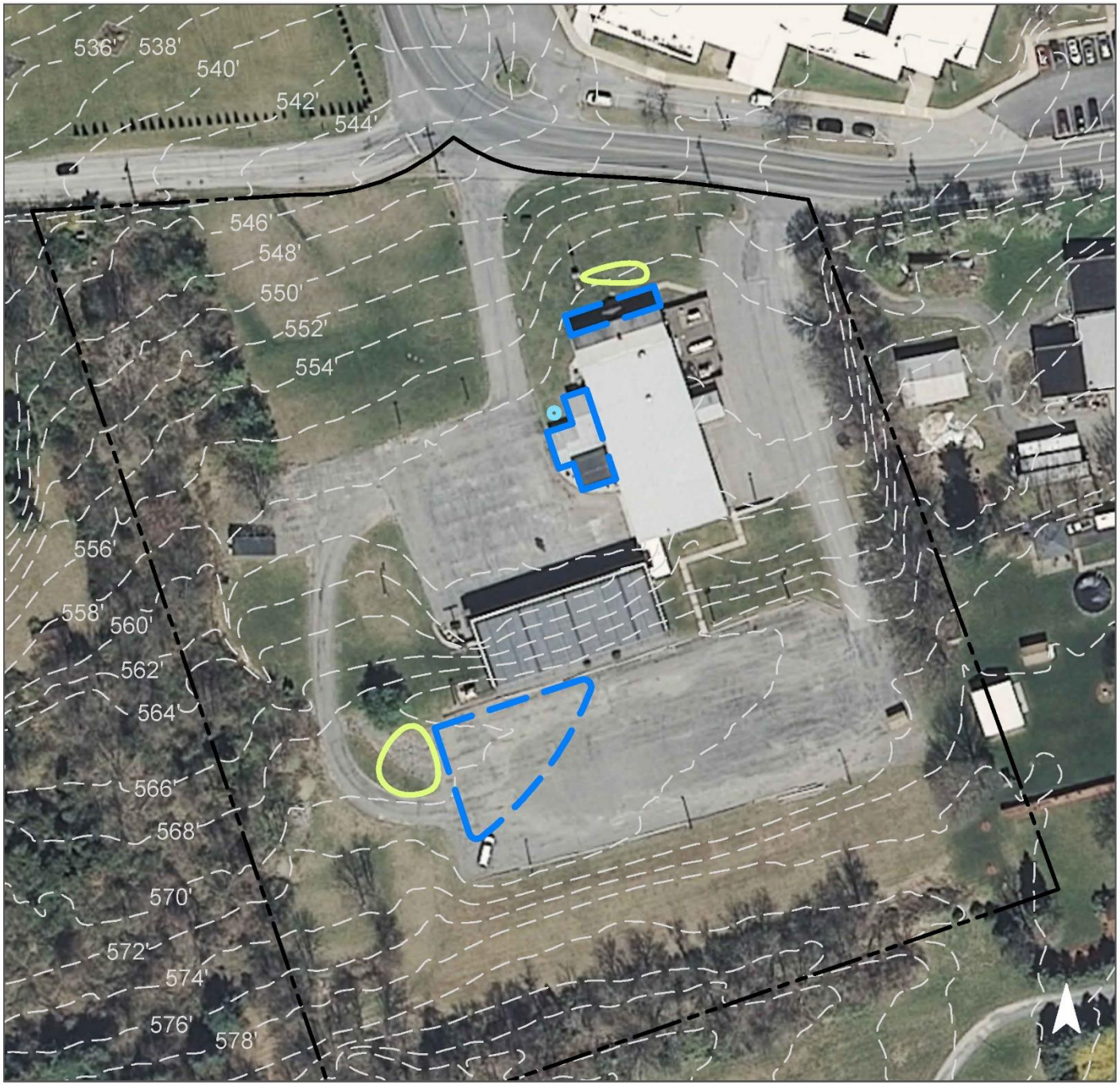
Block and Lot: **Block 33, Lot 25.02**

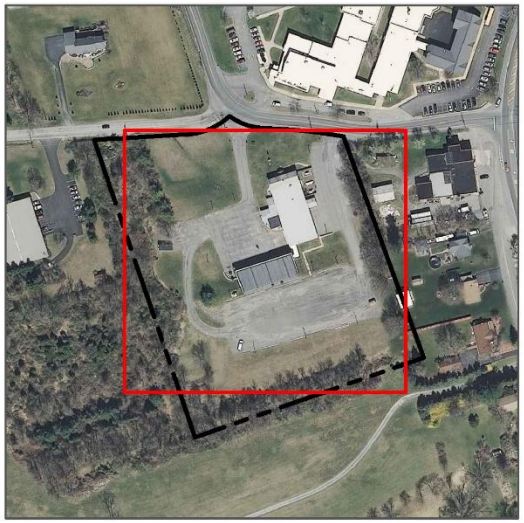
A rain garden installed in the front of the building can capture, treat, and infiltrate roof runoff. A cistern can also be installed to collect more rainwater from the roof, which can then be used for washing vehicles and other non-potable uses. A second rain garden in the back of the building can capture, treat, and infiltrate runoff from the parking lot. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
37	103,526	5.0	52.3	475.3	0.081	2.84

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	0.162	27	11,856	0.45	1,560	$7,800
Rainwater harvesting	0.040	7	2,947	0.11	3,000 (gal)	$6,000

GREEN INFRASTRUCTURE RECOMMENDATIONS





Harmony Township Fire Department

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

0 50' 100'

HARMONY TOWNSHIP MUNICIPAL BUILDING

Subwatershed: Buckhorn Creek

Site Area: 1,792,148 sq. ft.

Address: 3003 Belvidere Road
Phillipsburg, NJ 08865

Block and Lot: Block 38, Lot 10

Installing rain gardens adjacent to the building can capture, treat, and infiltrate roof runoff. Downspouts on the northwest section of the roof can be disconnected and rerouted into a rain garden. 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"
4	71,584	3.5	36.2	328.7	0.056	1.96

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.070	12	5,139	0.19	700	$3,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Harmony Township Municipal Building

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

0 20' 40'

HARMONY TOWNSHIP ROAD DEPARTMENT

Subwatershed: **Buckhorn Creek**

Site Area: **153,761 sq. ft.**

Address: **800 Harmony Station Road**
Phillipsburg, NJ 08865

Block and Lot: **Block 34, Lot 4.01**

A rain garden installed adjacent to the east side of the building can capture, treat, and infiltrate roof runoff. A rainwater harvesting cistern can also be installed to store rainwater from the roof, which can be reused to wash vehicles. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
13	20,425	1.0	10.3	93.8	0.016	0.56

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	0.034	6	4,495	0.17	610	$3,050
Rainwater harvesting	0.027	5	1,997	0.08	1,000 (gal)	$2,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Harmony Township Road Department

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

0 20' 40'

HARMONY TOWNSHIP SCHOOL

Subwatershed: Buckhorn Creek

Site Area: 1,163,931 sq. ft.

Address: 2551 Belvidere Road
Phillipsburg, NJ 08865

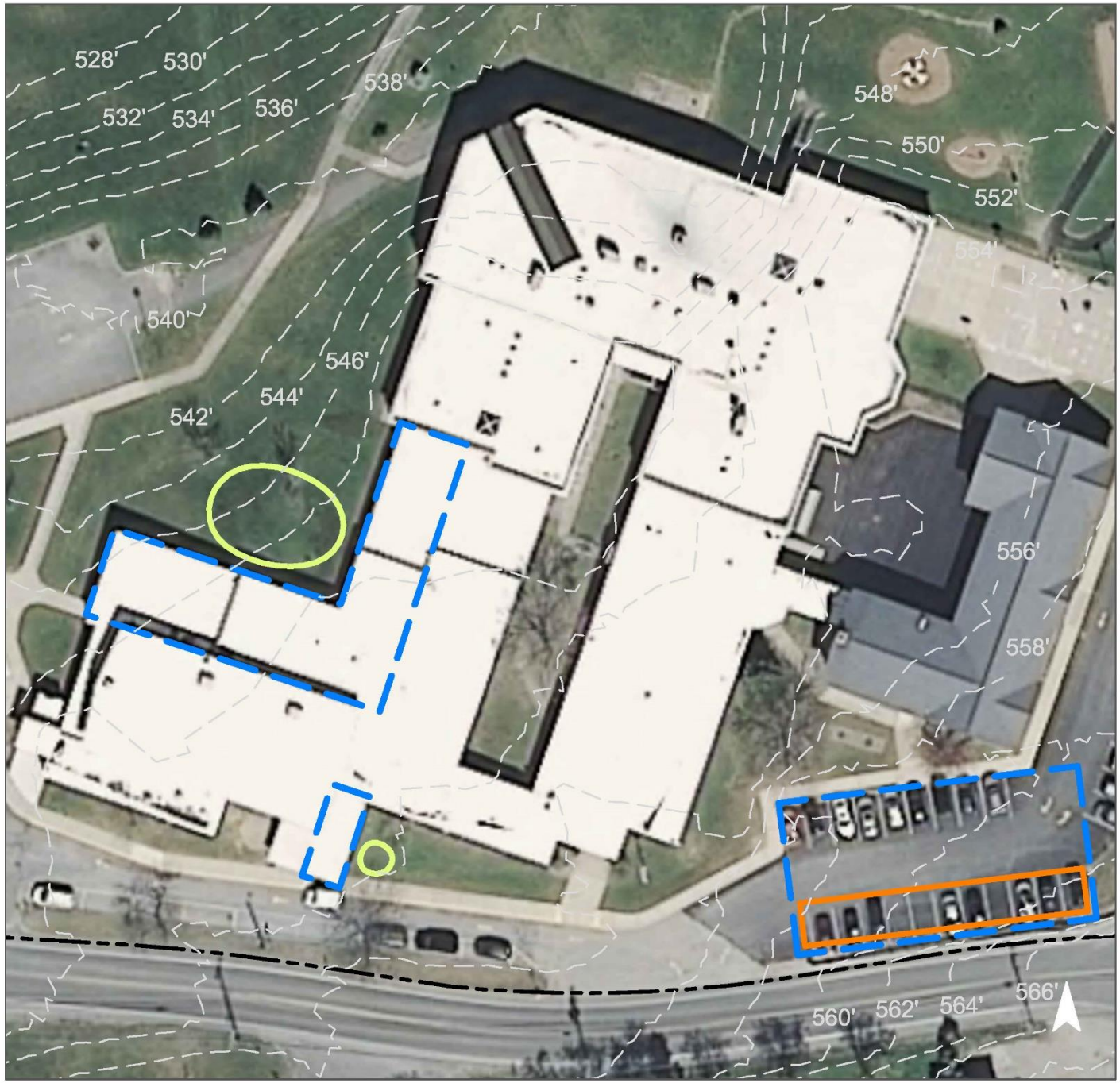
Block and Lot: Block 35, Lot 18

Parking spots to the south of the building can be replaced with porous asphalt to capture and infiltrate stormwater. Rain gardens installed adjacent to the building can capture, treat, and infiltrate roof runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
11	129,310	6.2	65.3	593.7	0.101	3.55

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.181	30	13,292	0.50	1,750	$8,750
Pervious pavement	0.186	31	13,651	0.51	1,905	$47,625

GREEN INFRASTRUCTURE RECOMMENDATIONS



Harmony Township School

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

0 30' 60'

KINGDOM HALL JEHOVAHS WITNESS

Subwatershed: Buckhorn Creek

Site Area: 224,713 sq. ft.

Address: 2603 Belvidere Road
Phillipsburg, NJ 08865

Block and Lot: Block 35, Lot 13.01

Parking spaces along the north and south parking lots can be replaced with porous asphalt to infiltrate stormwater runoff. Downspouts from the northern roof can also be disconnected and redirected to the porous pavement. 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"
19	43,552	2.1	22.0	200.0	0.034	1.19

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	0.214	36	15,679	0.59	2,500	$62,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Kingdom Hall Jehovahs Witness

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

0 20' 40'

PRESBYTERIAN & REFORMED PUBLISHING

Subwatershed: Buckhorn Creek

Site Area: 238,897 sq. ft.

Address: 1102 Marble Hill Road
Phillipsburg, NJ 08865

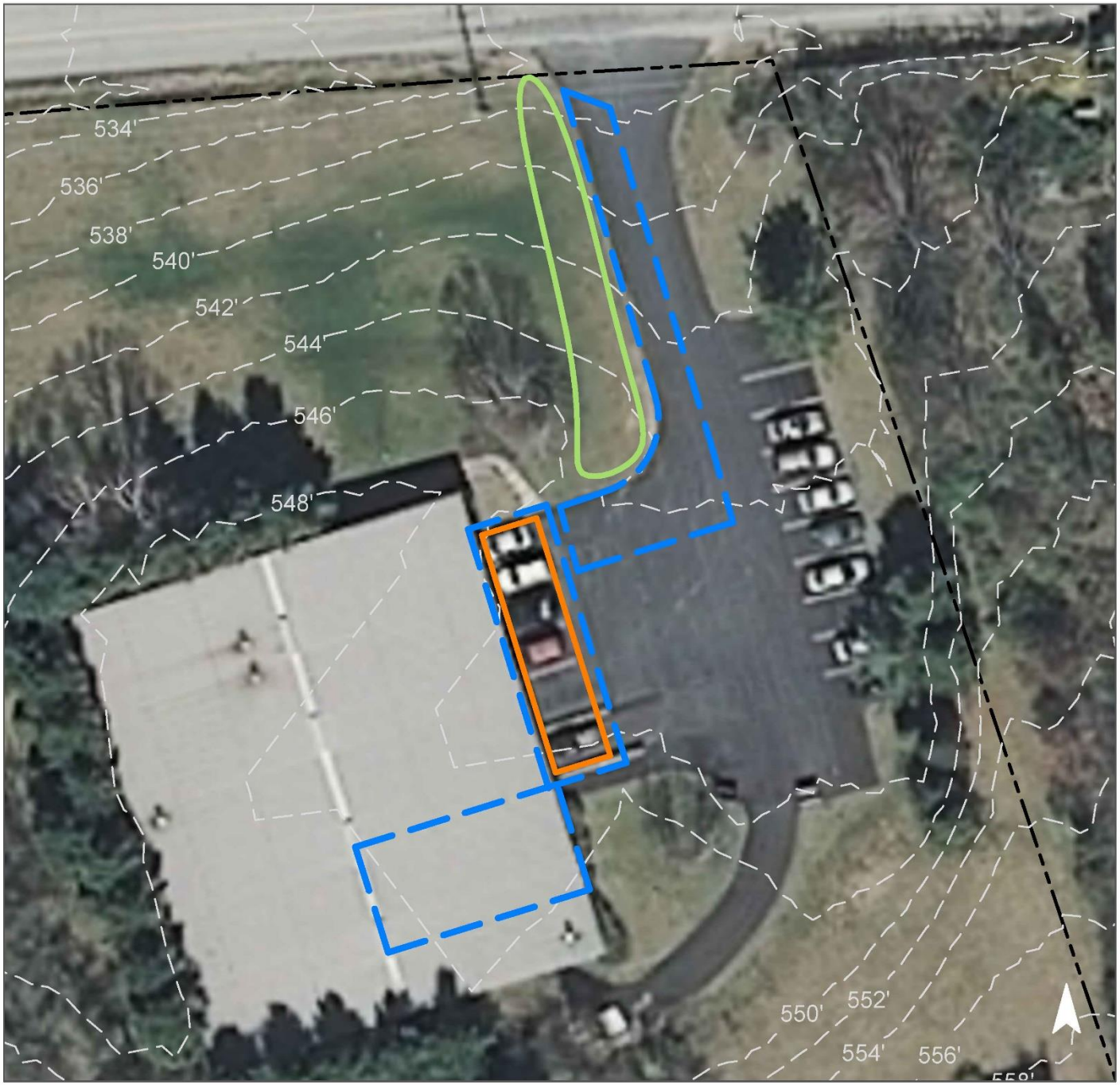
Block and Lot: Block 33, Lot 25.04

A bioswale installed in the grass along the driveway will help to capture and infiltrate runoff from the impervious asphalt. Parking spaces along the building can also be replaced with porous pavement. A downspout from the roof of the building can be disconnected and rerouted to the porous asphalt to intercept more rainwater. 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	48,380	2.3	24.4	222.1	0.038	1.33

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
Bioswale	0.049	8	3,576	0.13	1,480	$7,400
Pervious pavement	0.081	14	5,955	0.22	975	$24,375

GREEN INFRASTRUCTURE RECOMMENDATIONS



Presbyterian & Reformed Publishing

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

0 20' 40'

CALVARY COMMUNITY ORTHODOX CHURCH

Subwatershed: Lopatcong Creek

Site Area: 848,713 sq. ft.

Address: 4 Old Church Road
Phillipsburg, NJ 08865

Block and Lot: Block 26 , Lot 33

A bioswale can be installed at the water erosion area to capture, treat, and infiltrate runoff from the roadway. A rain garden can be installed at the grass area north of the bioswale to intercept 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"
9	79,399	3.8	40.1	364.5	0.062	2.18

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	0.126	21	9,223	0.35	1,945	$9,725
Bioswale	0.286	48	20,974	0.79	3,360	$16,800

GREEN INFRASTRUCTURE RECOMMENDATIONS

Calvary Community Orthodox Church

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

0 50' 100'

FAMILY DENTISTRY

Subwatershed: Lopatcong Creek

Site Area: 39,212 sq. ft.

Address: 2220 Belvidere Road
Phillipsburg, NJ 08865

Block and Lot: Block 31, Lot 3.02

A rain garden installed in the grass medium can help intercept, capture, and infiltrate runoff from the road. Parking spots at the north corner of the building can be replaced with porous asphalt to capture rainwater from the roof, which is already being piped there via a downspout. 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	13,568	0.7	6.9	62.3	0.011	0.37

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.042	7	3,097	0.12	530	$1,850
Pervious pavement	0.053	9	3,920	0.15	370	$9,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

Family Dentistry

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

0 20' 40'

HARKERS HOLLOW GOLF & COUNTRY CLUB

Subwatershed: Lopatcong Creek

Site Area: 4,774,118 sq. ft.

Address: 950 Uniontown Road
Phillipsburg, NJ 08865

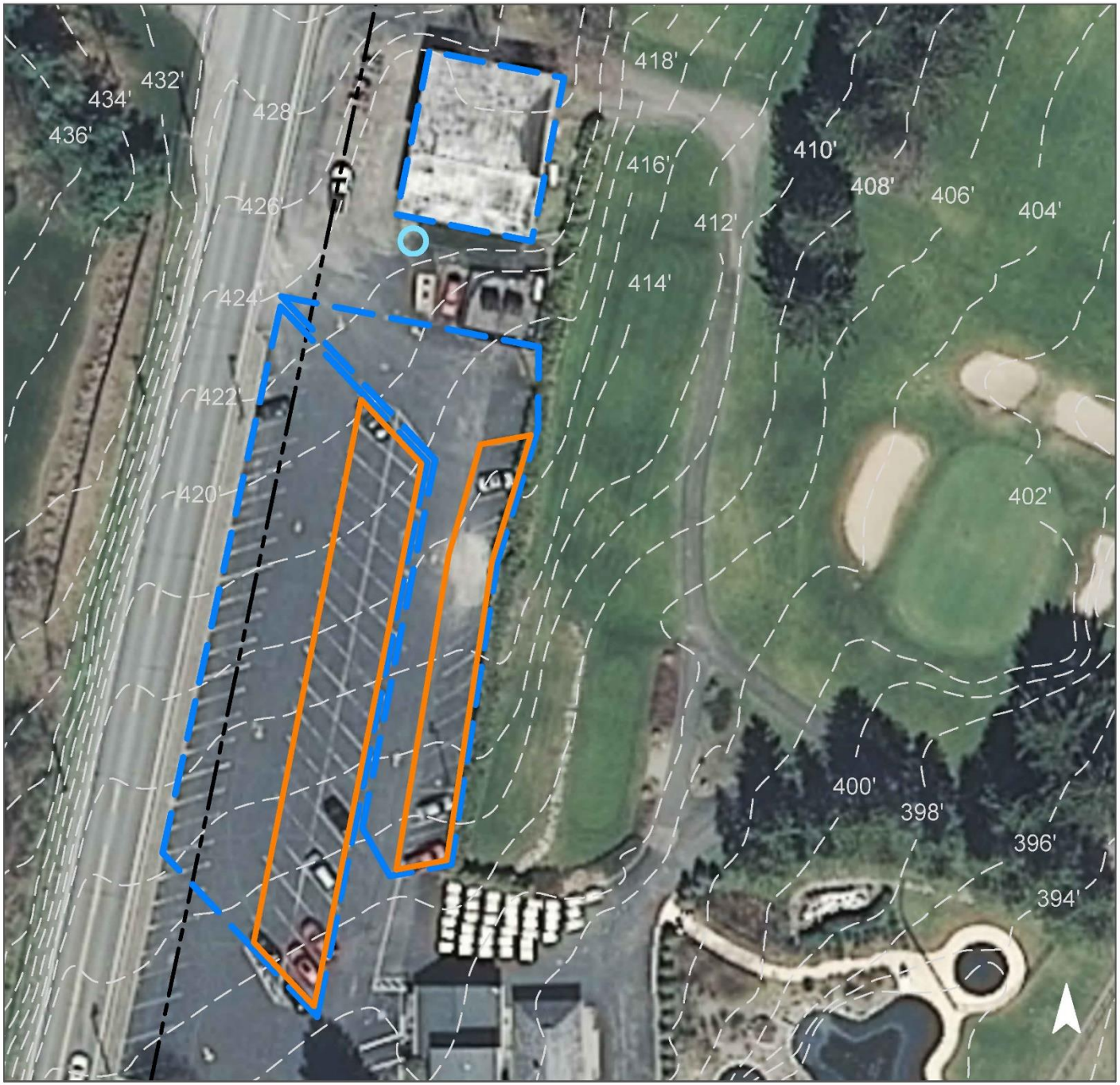
Block and Lot: Block 31 , Lot 8.01

Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. Rainwater can be harvested by installing a cistern at the garage in the north. 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"
3	142,616	6.9	72.0	654.8	0.111	3.91

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	0.641	107	47,072	1.77	9,155	$228,875
Rainwater harvesting	0.092	15	6,747	0.25	5,000 (gal)	$10,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Harkers Hollow Golf & Country Club

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

0 30' 60'

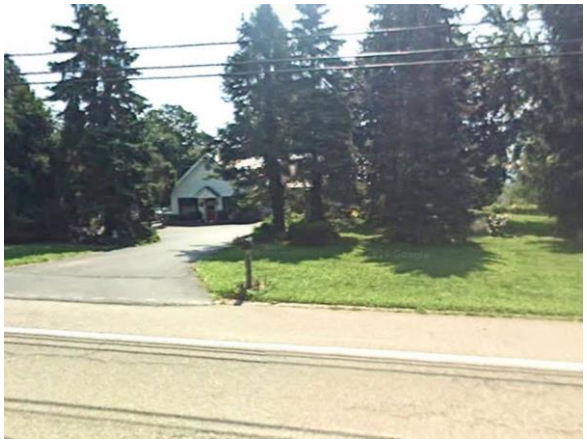
HARMONY ANIMAL HOSPITAL

Subwatershed: Lopatcong Creek

Site Area: 38,145 sq. ft.

Address: 2200 Belvidere Road
Phillipsburg, NJ 08865

Block and Lot: Block 31, Lot 3.03

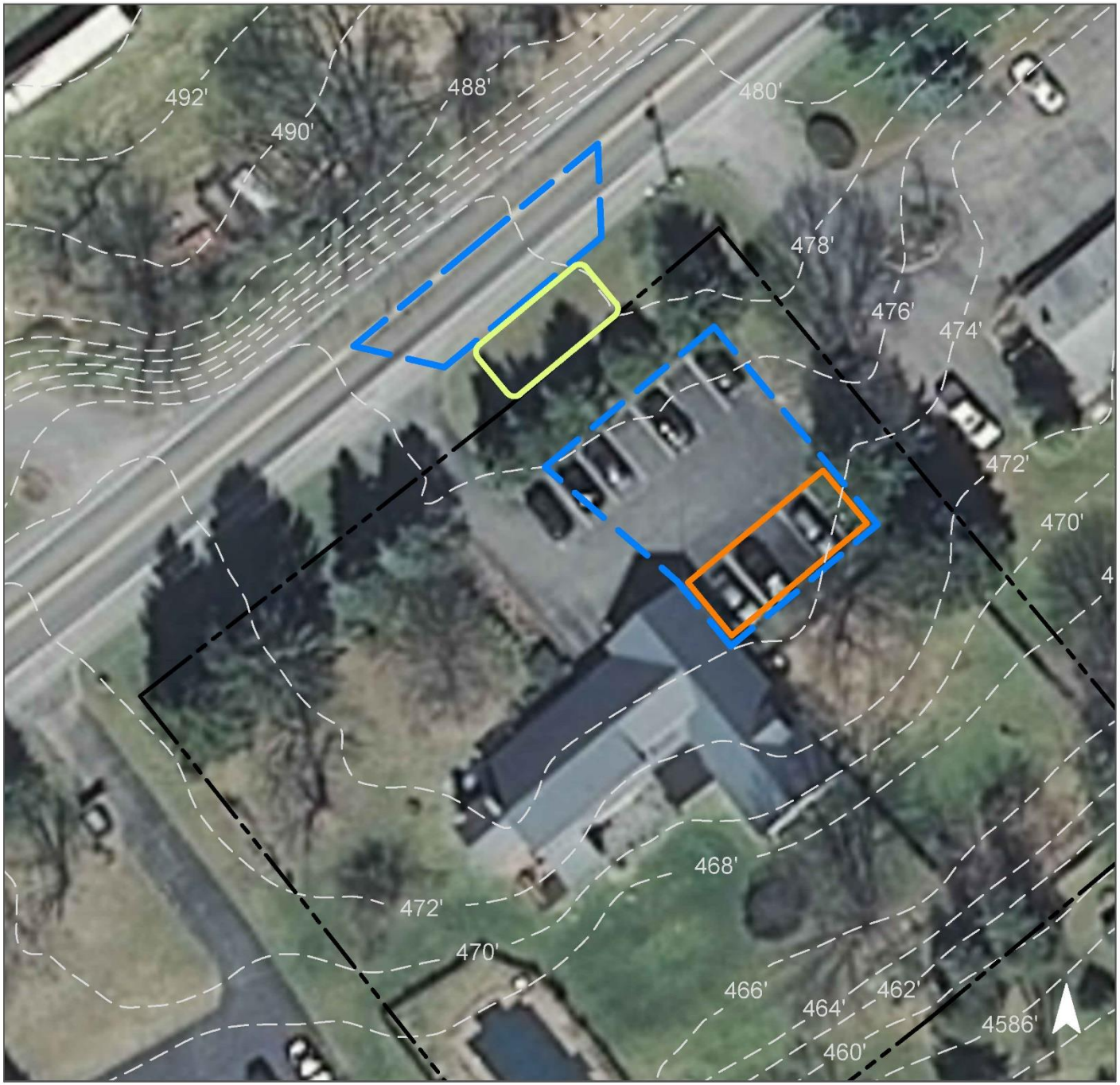


Parking spots can be replaced with porous asphalt to capture and infiltrate stormwater. Installing a rain garden in front of the building can capture, treat, and infiltrate road runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
34	13,125	0.6	6.6	60.3	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 system	0.035	6	2,543	0.10	610	$4,150
Pervious pavement	0.092	15	6,732	0.25	830	$20,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Harmony Animal Hospital

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

0 20' 40'

PHILLIPS & TOSCO LANDSCAPING

Subwatershed: **Lopatcong Creek**

Site Area: **196,467 sq. ft.**

Address: **1355 Stryker Road**
Phillipsburg, NJ 08865

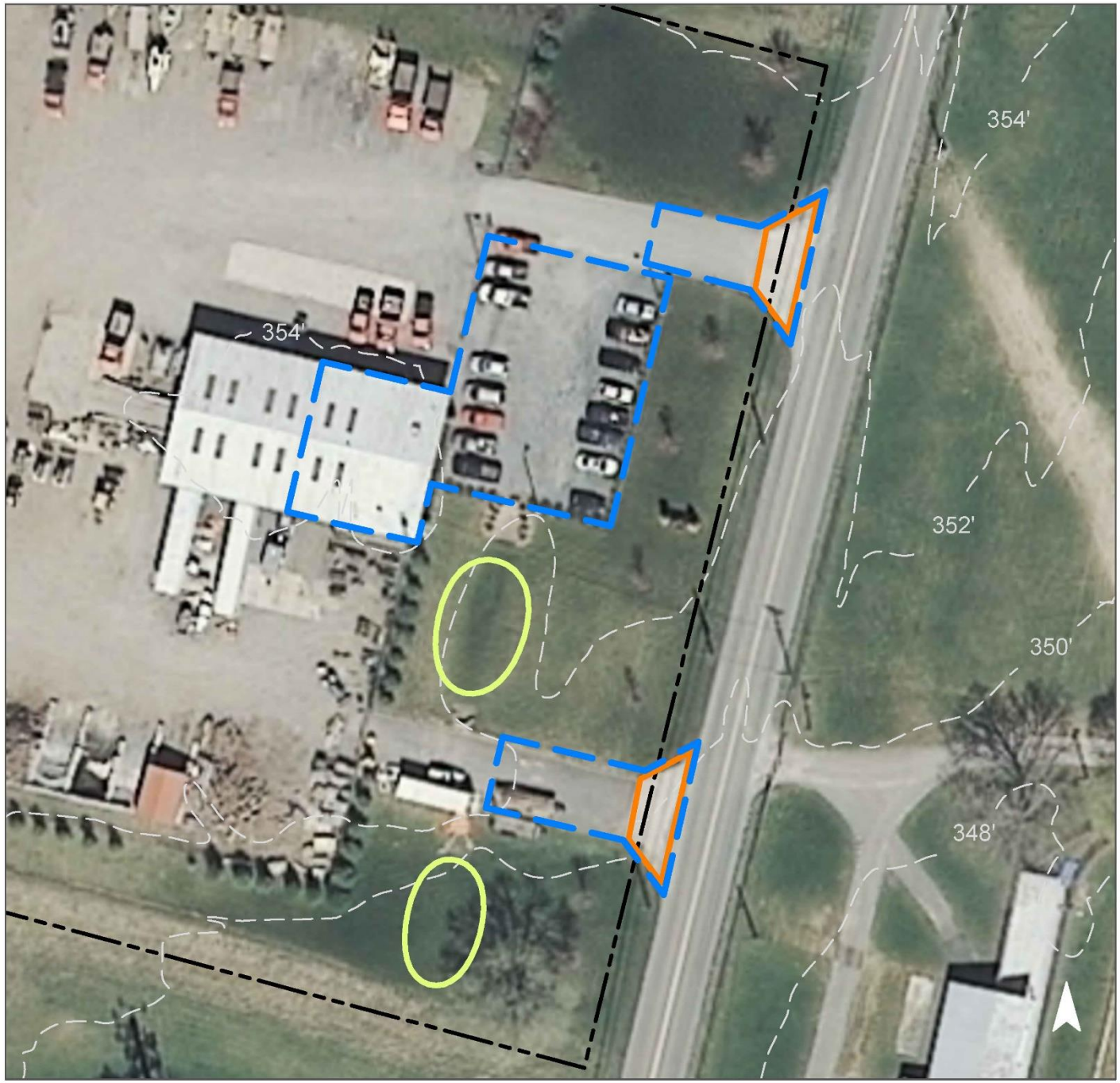
Block and Lot: **Block 28 , Lot 1**

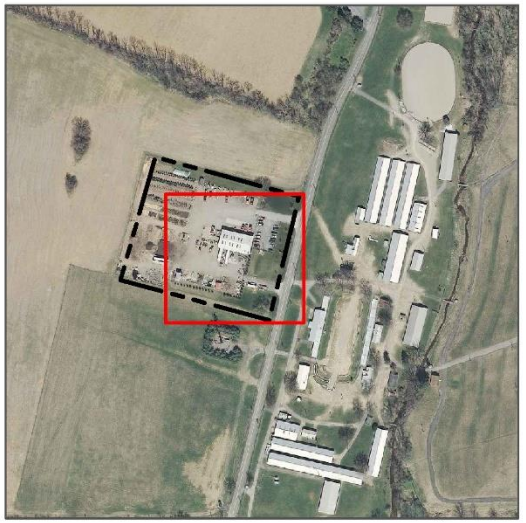
Rain gardens can be installed to capture, treat, and infiltrate rooftop runoff. Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
10	19,008	0.9	9.6	87.3	0.015	0.52

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	0.274	46	20,106	0.76	2,675	$13,375
Pervious pavement	0.115	19	8,430	0.32	1,285	$32,125

GREEN INFRASTRUCTURE RECOMMENDATIONS





Phillips & Tosco Landscaping

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

0 30' 60'

WARREN COUNTY FARMERS FAIR

Subwatershed: **Lopatcong Creek**

Site Area: **1,857,973 sq. ft.**

Address: **1350 Stryker Road**
Phillipsburg, NJ 08865

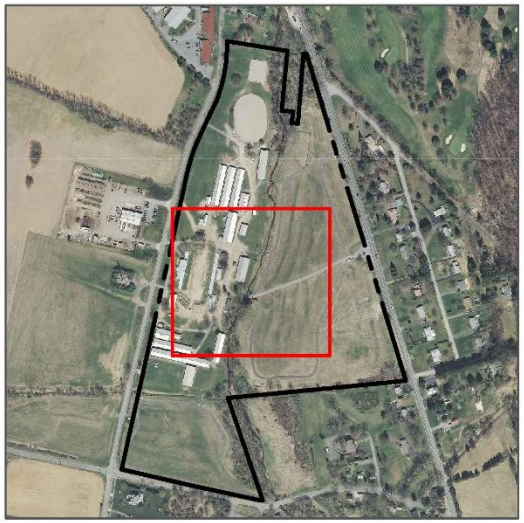
Block and Lot: **Block 30, Lot 2,2.01,3**

Downspouts from the roof of the sheltered market area can be disconnected and redirected into rain gardens that will capture, treat, and infiltrate runoff. A rain garden on the eastern side of the structure will intercept runoff before it reaches the stream. A cistern can be used to harvest rainwater from the roof for 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"
8	149,252	7.2	75.4	685.3	0.116	4.09

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.150	25	10,996	0.41	1,620	$8,100
Rainwater harvesting	0.021	4	1,571	0.06	2,000 (gal)	$4,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Warren County Farmers Fair

- bioretention system
- rainwater harvesting
- 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 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)
BUCKHORN CREEK SUBWATERSHED	**91.13**	**3,969,476**			**21.9**	**229.8**	**2,089.5**		**10.45**	**455,085**	**0.355**	**12.48**
Harmony Presbyterian Church												
Total Site Info	2.67	116,435	36	5	1.8	19.3	175.9	33	0.88	38,308	0.030	1.05
Harmony Township Fire Department												
Total Site Info	6.42	279,591	33	25.02	5.0	52.3	475.3	37	2.38	103,526	0.081	2.84
Harmony Township Municipal Building												
Total Site Info	41.14	1,792,148	38	10	3.5	36.2	328.7	4	1.64	71,584	0.056	1.96
Harmony Township Road Department												
Total Site Info	3.53	153,761	34	4.01	1.0	10.3	93.8	13	0.47	20,425	0.016	0.56
Harmony Township School												
Total Site Info	26.72	1,163,931	35	18	6.2	65.3	593.7	11	2.97	129,310	0.101	3.55
Kingdom Hall Jehovahs Witness												
Total Site Info	5.16	224,713	35	13.01	2.1	22.0	200.0	19	1.00	43,552	0.034	1.19
Presbyterian & Reformed Publishing												
Total Site Info	5.48	238,897	33	25.04	2.3	24.4	222.1	20	1.11	48,380	0.038	1.33
LOPATCONG CREEK SUBWATERSHED	**178.02**	**7,754,629**			**20.1**	**210.6**	**1,914.5**		**9.57**	**416,968**	**0.325**	**11.44**
Calvary Community Orthodox Church												
Total Site Info	19.48	848,713	26	33	3.8	40.1	364.5	9	1.82	79,399	0.062	2.18
Family Dentistry												
Total Site Info	0.90	39,212	31	3.02	0.7	6.9	62.3	35	0.31	13,568	0.011	0.37
Harkers Hollow Golf & Country Club												
Total Site Info	109.60	4,774,118	31	8.01	6.9	72.0	654.8	3	3.27	142,616	0.111	3.91
Harmony Animal Hospital												
Total Site Info	0.88	38,145	31	3.03	0.6	6.6	60.3	34	0.30	13,125	0.010	0.36

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)
Phillips & Tosco Landscaping												
Total Site Info	4.51	196,467	28	1	0.9	9.6	87.3	10	0.44	19,008	0.015	0.52
Warren County Farmers Fair												
Total Site Info	42.65	1,857,973	30	2,2.01,3	7.2	75.4	685.3	8	3.43	149,252	0.116	4.09

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 %
	BUCKHORN CREEK SUBWATERSHED	**61,416**	**1.41**	**1.600**	**268**	**119,439**	**4.49**	**22,730**			**$354,250**	**1.5%**
1	**Harmony Presbyterian Church**											
	Pervious pavement	21,366	0.49	0.557	93	40,851	1.54	7,250	25	SF	$181,250	55.8%
	Total Site Info	**21,366**	**0.49**	**0.557**	**93**	**40,851**	**1.54**	**7,250**			**$181,250**	**55.8%**
2	**Harmony Township Fire Department**											
	Bioretention systems	6,200	0.14	0.162	27	11,856	0.45	1,560	5	SF	$7,800	6.0%
	Rainwater harvesting	1,540	0.04	0.040	7	2,947	0.11	3,000	2	gal	$6,000	1.5%
	Total Site Info	**7,740**	**0.18**	**0.202**	**34**	**14,803**	**0.56**	**4,560**			**$13,800**	**7.5%**
3	**Harmony Township Municipal Building**											
	Bioretention systems	2,688	0.06	0.070	12	5,139	0.19	700	5	SF	$3,500	3.8%
	Total Site Info	**2,688**	**0.06**	**0.070**	**12**	**5,139**	**0.19**	**700**			**$3,500**	**3.8%**
4	**Harmony Township Road Department**											
	Bioretention system	1,300	0.03	0.034	6	4,495	0.17	610	5	SF	$3,050	6.4%
	Rainwater harvesting	1,045	0.02	0.027	5	1,997	0.08	1,000	2	gal	$2,000	5.1%
	Total Site Info	**2,345**	**0.05**	**0.061**	**10**	**6,493**	**0.25**	**1,610**			**$5,050**	**11.5%**
5	**Harmony Township School**											
	Bioretention systems	6,953	0.16	0.181	30	13,292	0.50	1,750	5	SF	$8,750	5.4%
	Pervious pavement	7,139	0.16	0.186	31	13,651	0.51	1,905	25	SF	$47,625	5.5%
	Total Site Info	**14,092**	**0.32**	**0.367**	**61**	**26,943**	**1.01**	**3,655**			**$56,375**	**10.9%**
6	**Kingdom Hall Jehovahs Witness**											
	Pervious pavement	8,200	0.19	0.214	36	15,679	0.59	2,500	25	SF	$62,500	18.8%
	Total Site Info	**8,200**	**0.19**	**0.214**	**36**	**15,679**	**0.59**	**2,500**			**$62,500**	**18.8%**
7	**Presbyterian & Reformed Publishing**											
	Bioswale	1,870	0.04	0.049	8	3,576	0.13	1,480	5	SF	$7,400	3.9%
	Pervious pavement	3,115	0.07	0.081	14	5,955	0.22	975	25	SF	$24,375	6.4%
	Total Site Info	**4,985**	**0.11**	**0.130**	**22**	**9,531**	**0.35**	**2,455**			**$31,775**	**10.3%**

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	**73,960**	**1.70**	**1.927**	**323**	**141,410**	**5.33**	**29,380**			**$359,000**	**1.0%**
8	**Calvary Community Orthodox Church**											
	Bioretention system	4,825	0.11	0.126	21	9,223	0.35	1,945	5	SF	$9,725	6.1%
	Bioswale	10,970	0.25	0.286	48	20,974	0.79	3,360	5	SF	$16,800	13.8%
	Total Site Info	**15,795**	**0.36**	**0.412**	**69**	**30,197**	**1.14**	**5,305**			**$26,525**	**19.9%**
9	**Family Dentistry**											
	Bioretention system	1,620	0.04	0.042	7	3,097	0.12	530	5	SF	$1,850	11.9%
	Pervious pavement	2,050	0.05	0.053	9	3,920	0.15	370	25	SF	$9,250	15.1%
	Total Site Info	**3,670**	**0.08**	**0.096**	**16**	**7,017**	**0.27**	**900**			**$11,100**	**27.0%**
10	**Harkers Hollow Golf & Country Club**											
	Pervious pavement	24,620	0.57	0.641	107	47,072	1.77	9,155	25	SF	$228,875	17.3%
	Rainwater harvesting	3,530	0.08	0.092	15	6,747	0.25	5,000	2	gal	$10,000	2.5%
	Total Site Info	**28,150**	**0.65**	**0.733**	**123**	**53,819**	**2.02**	**14,155**			**$238,875**	**19.7%**
11	**Harmony Animal Hospital**											
	Bioretention system	1,330	0.03	0.035	6	2,543	0.10	610	5	SF	$4,150	10.1%
	Pervious pavement	3,520	0.08	0.092	15	6,732	0.25	830	25	SF	$20,750	26.8%
	Total Site Info	**4,850**	**0.11**	**0.126**	**21**	**9,275**	**0.35**	**1,440**			**$24,900**	**37.0%**
12	**Phillips & Tosco Landscaping**											
	Bioretention systems	10,515	0.24	0.274	46	20,106	0.76	2,675	5	SF	$13,375	55.3%
	Pervious pavement	4,410	0.10	0.115	19	8,430	0.32	1,285	25	SF	$32,125	23.2%
	Total Site Info	**14,925**	**0.34**	**0.389**	**65**	**28,536**	**1.08**	**3,960**			**$45,500**	**78.5%**
13	**Warren County Farmers Fair**											
	Bioretention systems	5,750	0.13	0.150	25	10,996	0.41	1,620	5	SF	$8,100	3.9%
	Rainwater harvesting	820	0.02	0.021	4	1,571	0.06	2,000	2	SF	$4,000	0.5%
	Total Site Info	**6,570**	**0.15**	**0.171**	**29**	**12,566**	**0.47**	**3,620**			**$12,100**	**4.4%**