

**Impervious Cover Reduction Action Plan
for
Caldwell Borough, Essex County, New Jersey**

*Prepared for Caldwell Borough by the
Rutgers Cooperative Extension Water Resources Program*

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Introduction

Located in northwestern Essex County, New Jersey, Caldwell covers approximately 1.17 square miles. Figures 1 and 2 illustrate that Caldwell is dominated by urban land use. A total of 92.3% of the municipality's land use is classified as urban. Of the urban land in Caldwell, medium density residential is the dominant land use (Figure 3).

The New Jersey Department of Environmental Protection's (NJDEP) 2012 land use/land cover geographical information system (GIS) data layer categorizes Caldwell 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 Caldwell. Based upon the 2012 NJDEP land use/land cover data, approximately 37.9% of Caldwell has impervious cover. This level of impervious cover suggests that the streams in Caldwell are likely non-supporting streams.¹

Methodology

Caldwell contains portions of two subwatersheds (Figure 4). For this impervious cover reduction action plan, projects have been identified in both 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. Capiella. 2009. Is Impervious Cover Still Important? Review of Recent Research. *Journal of Hydrologic Engineering* 14 (4): 309-315.

Land Use Types for Caldwell Borough



Figure 1: Map illustrating the land use in Caldwell

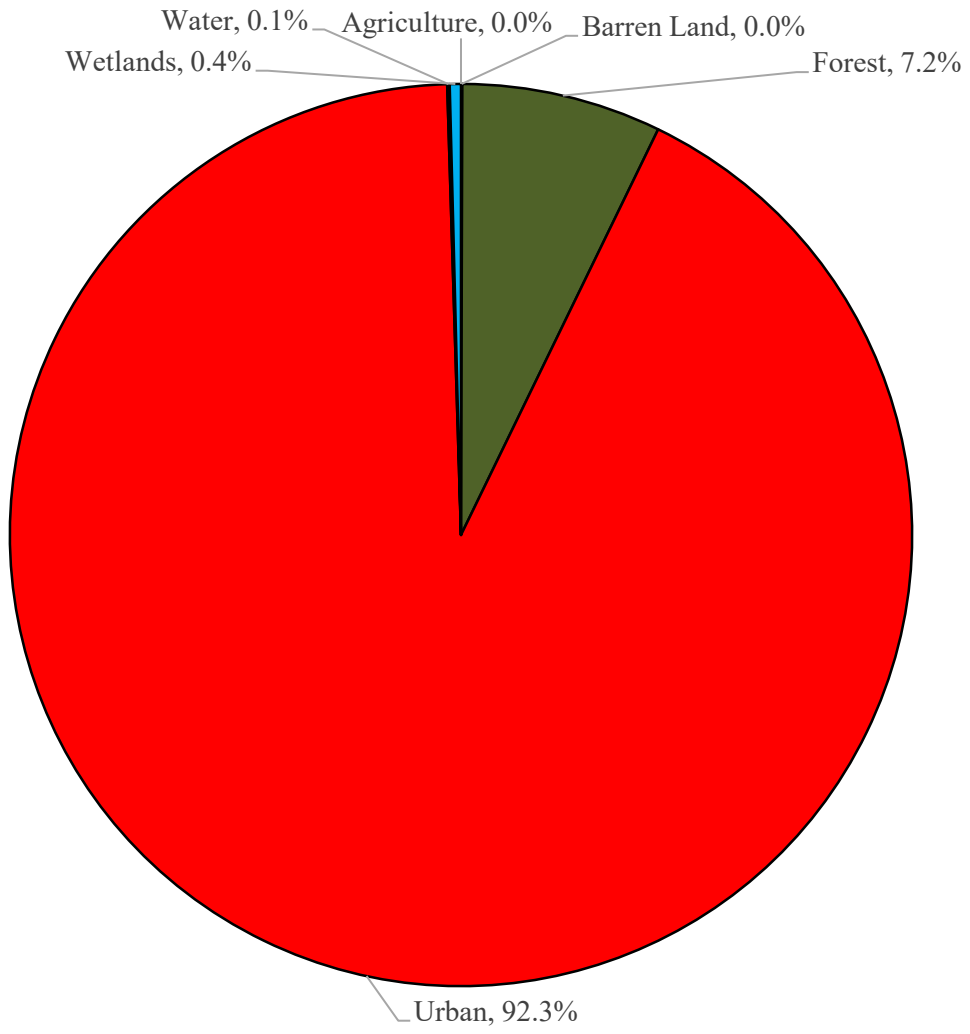


Figure 2: Pie chart illustrating the land use in Caldwell

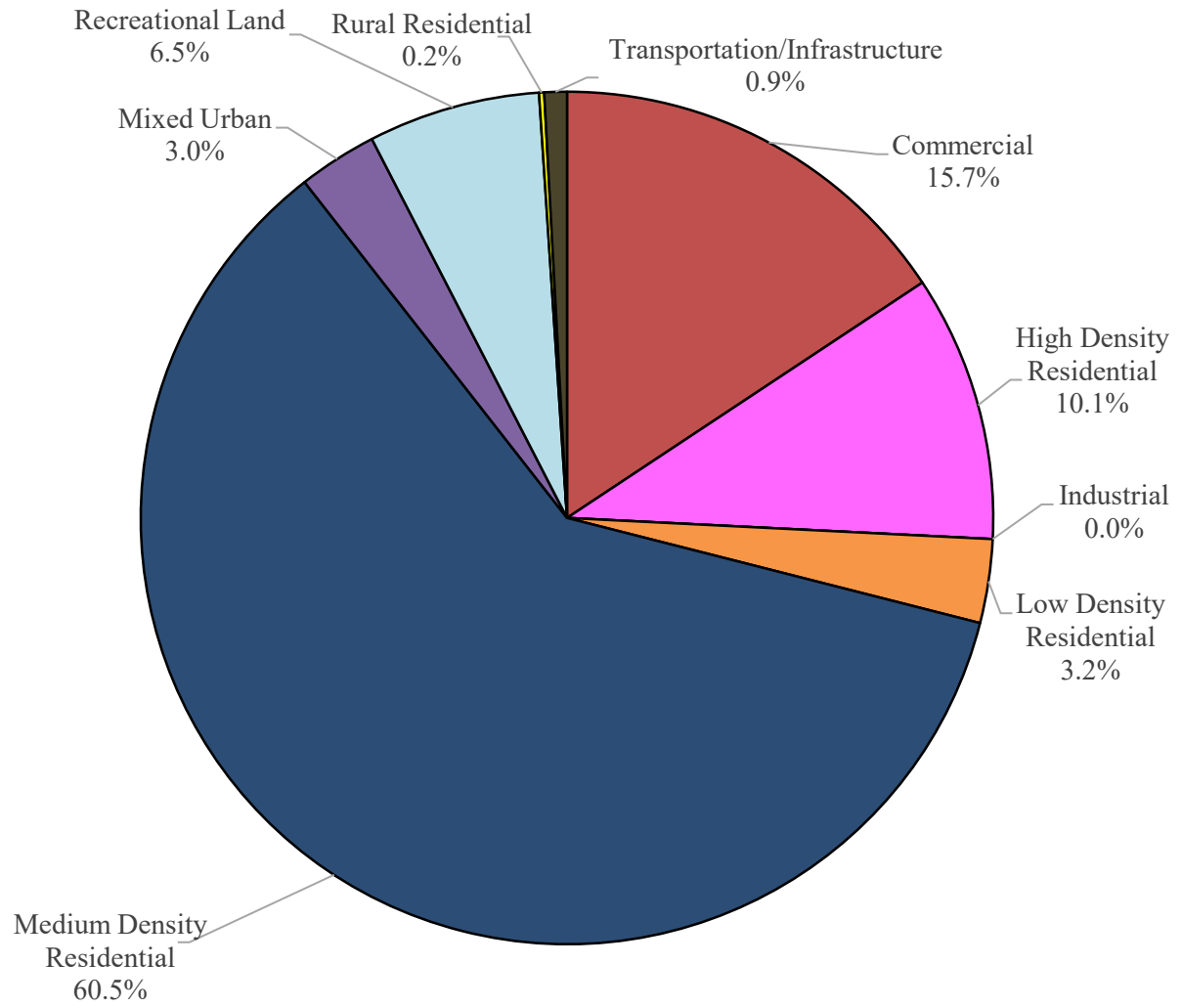


Figure 3: Pie chart illustrating the various types of urban land use in Caldwell

Subwatersheds of Caldwell Borough

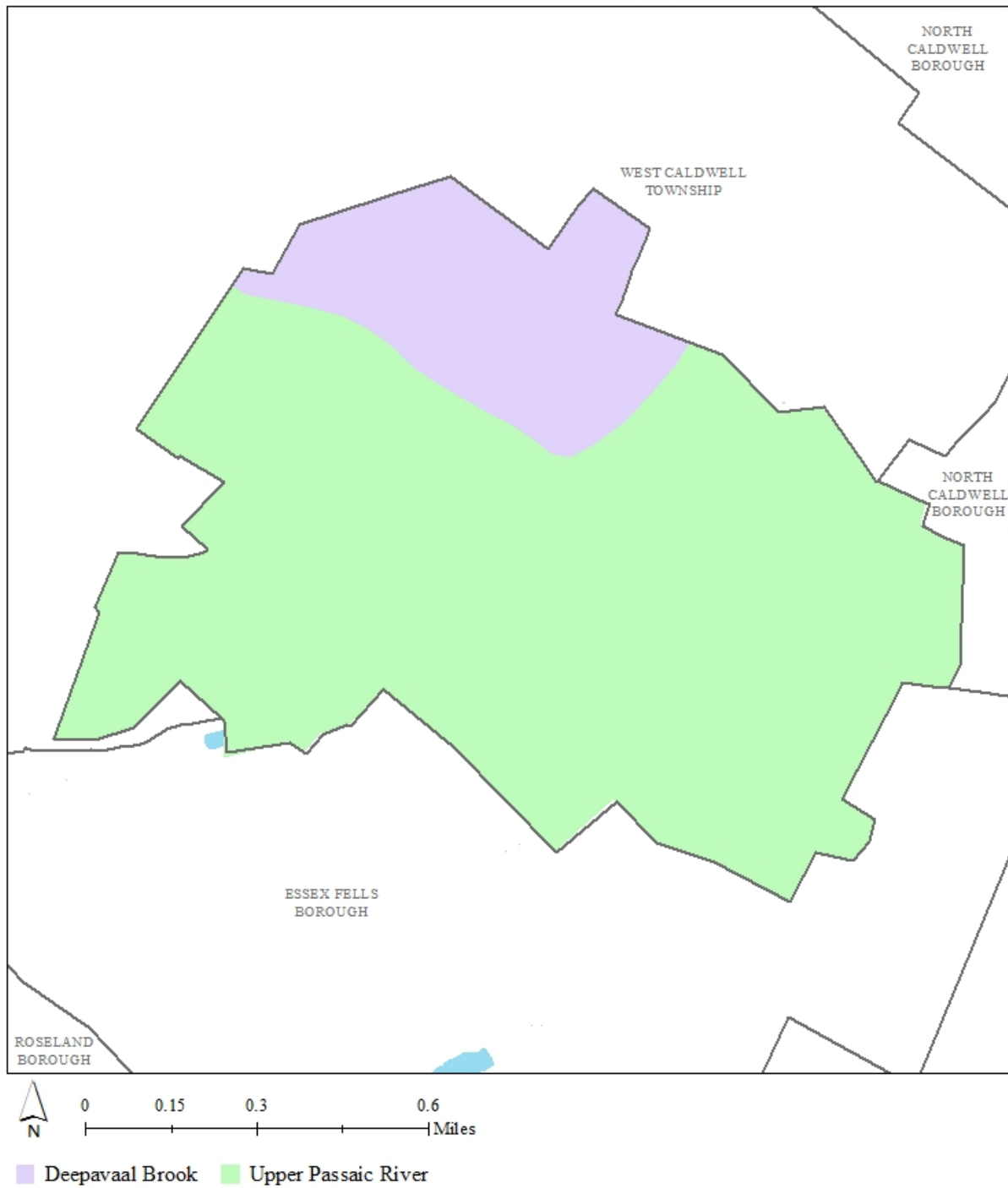


Figure 4: Map of the subwatersheds in Caldwell

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 2012 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 Caldwell 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 Coefficients²

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 benefits³. A wide range of green infrastructure practices have been evaluated for the potential project sites in Caldwell. 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.



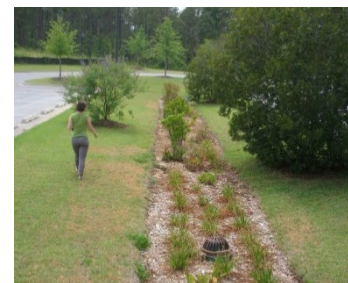
Rainwater harvesting systems (cistern or rain barrel)

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.*

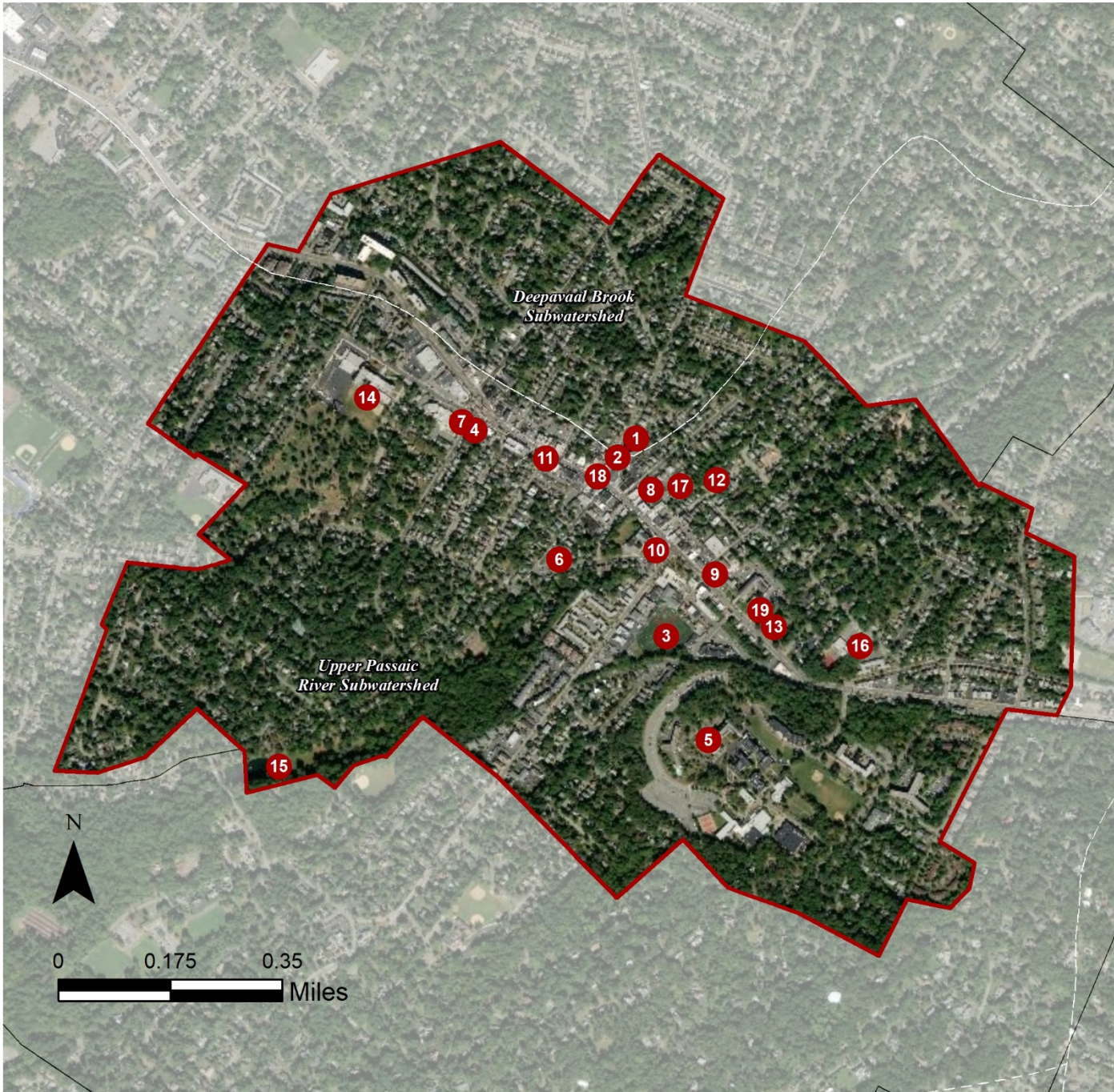
Conclusion

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

CALDWELL BOROUGH: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE DEEPAVAAL BROOK SUBWATERSHED

1. Grover Cleveland Center for Senior Citizens
2. United States Postal Service

SITES WITHIN THE UPPER PASSAIC RIVER SUBWATERSHED

3. Caldwell Municipal Complex
4. Caldwell United Methodist Church
5. Caldwell University
6. Center For Spiritual Living North Jersey
7. Congregation Agudath Israel
8. Essex Lodge No. 7
9. First Baptist Church
10. First Presbyterian Church
11. Gould Place & Bloomfield Avenue Right of Way
12. Green Acres: 27 Personette Street
13. Grover Cleveland Birthplace
14. Grover Cleveland Middle School
15. Grover Cleveland Park
16. Lincoln Elementary School
17. Municipal Parking Lot
18. Park Avenue & Bloomfield Avenue Right of Way
19. Saint Aloysius Roman Catholic Church

.....**b. Proposed Green Infrastructure Concepts**

GROVER CLEVELAND CENTER FOR SENIOR CITIZENS



Subwatershed: Deepavaal Brook

Site Area: 5,707 sq. ft.

Address: 14 Park Avenue
Caldwell, NJ 07006

Block and Lot: Block 23, Lot 9.03

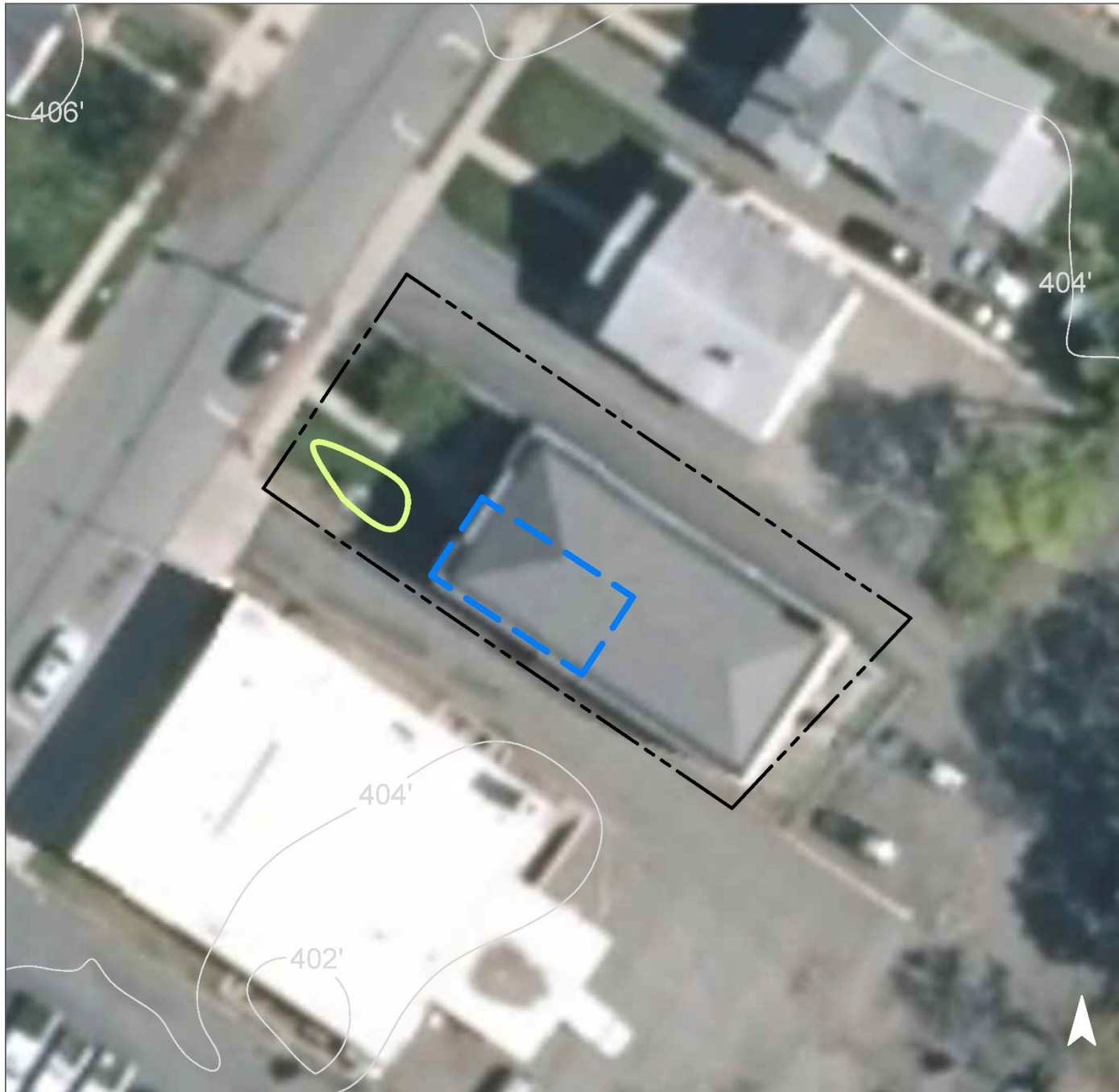


A rain garden can be installed at the front of the building around the flag pole by disconnecting the downspout from the corner of the building into the garden. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.





Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
95	5,422	0.3	2.7	24.9	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	0.016	3	1,240	0.05	160	\$800

GREEN INFRASTRUCTURE RECOMMENDATIONS



Grover Cleveland Center for Senior Citizens

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



UNITED STATES POSTAL SERVICE



Subwatershed: Deepavaal Brook

Site Area: 28,614 sq. ft.

Address: 10 Park Avenue
Caldwell, NJ 07006

Block and Lot: Block 23, Lot 9.03, 9.04

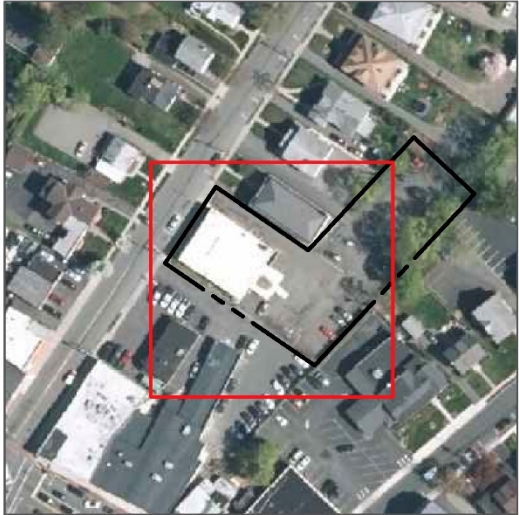
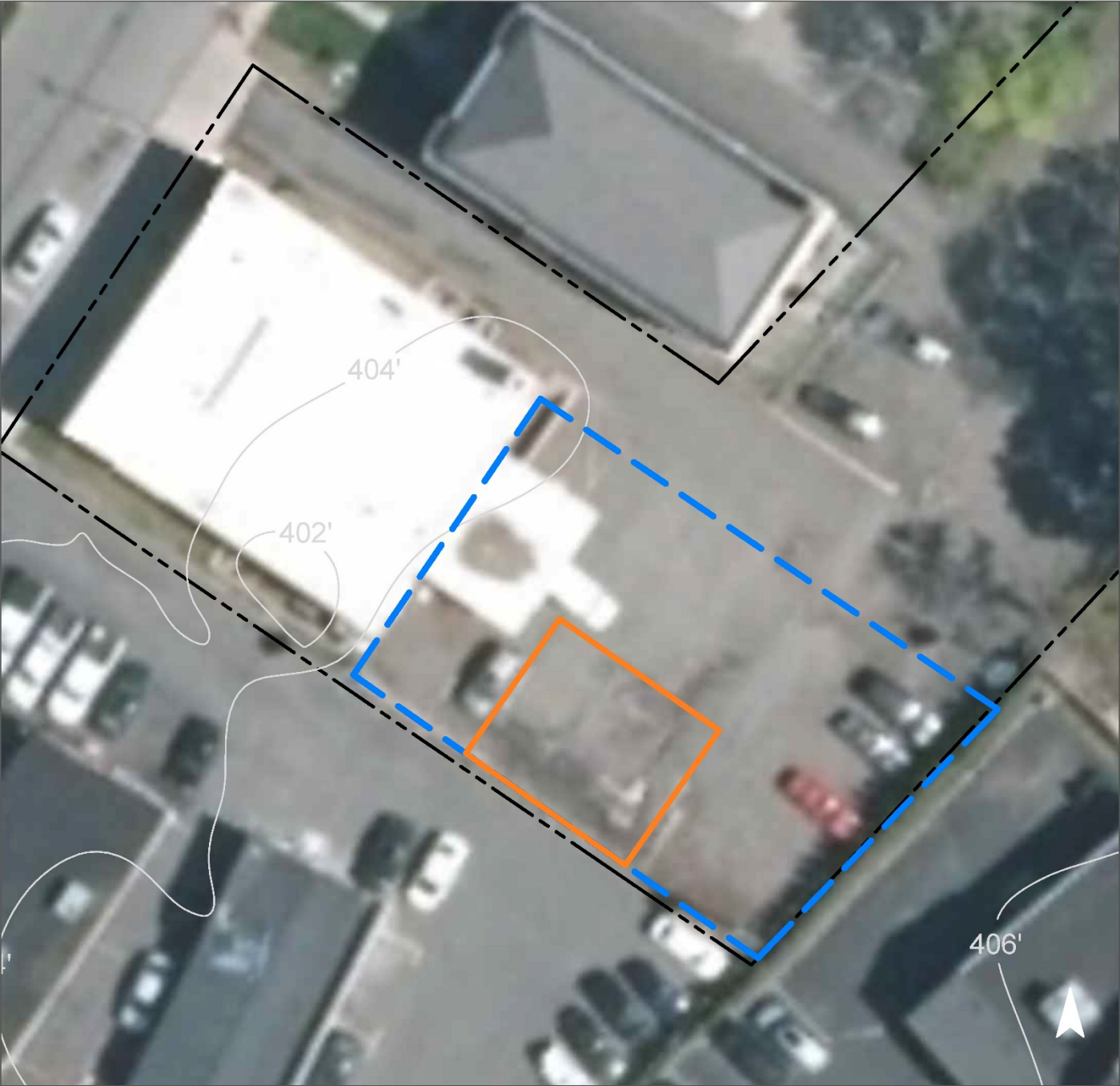


Parking spaces in the parking lot at the back of the building can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Porous pavement can also help drain the large pooling area of the parking lot. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.





Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
94	27,015	1.3	13.6	124.0	0.021	0.74

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavement	0.175	29	13,260	0.50	1,200	\$30,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



**United States
Postal Service**

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



CALDWELL MUNICIPAL COMPLEX



Subwatershed: Upper Passaic River

Site Area: 343,616 sq. ft.

Address: 1 Provost Square
Caldwell, NJ 07006

Block and Lot: Block 56, Lot 1, 2, 3, 10.01,
10.02, 0.03, 10.06, 17



Several rain gardens can be installed in the turfgrass area around the municipal complex to capture, treat, and infiltrate stormwater runoff from the field and help reported flooding in the area. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.





Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
90	307,669	14.8	155.4	1,412.6	0.240	8.44

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	0.179	30	13,540	0.51	1,715	\$8,575

GREEN INFRASTRUCTURE RECOMMENDATIONS



Caldwell Municipal Complex

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



CALDWELL UNITED METHODIST CHURCH



Subwatershed: Upper Passaic River

Site Area: 47,735 sq. ft.

Address: 8 Academy Road
Caldwell, NJ 07006

Block and Lot: Block 50, Lot 29, 30, 31.01

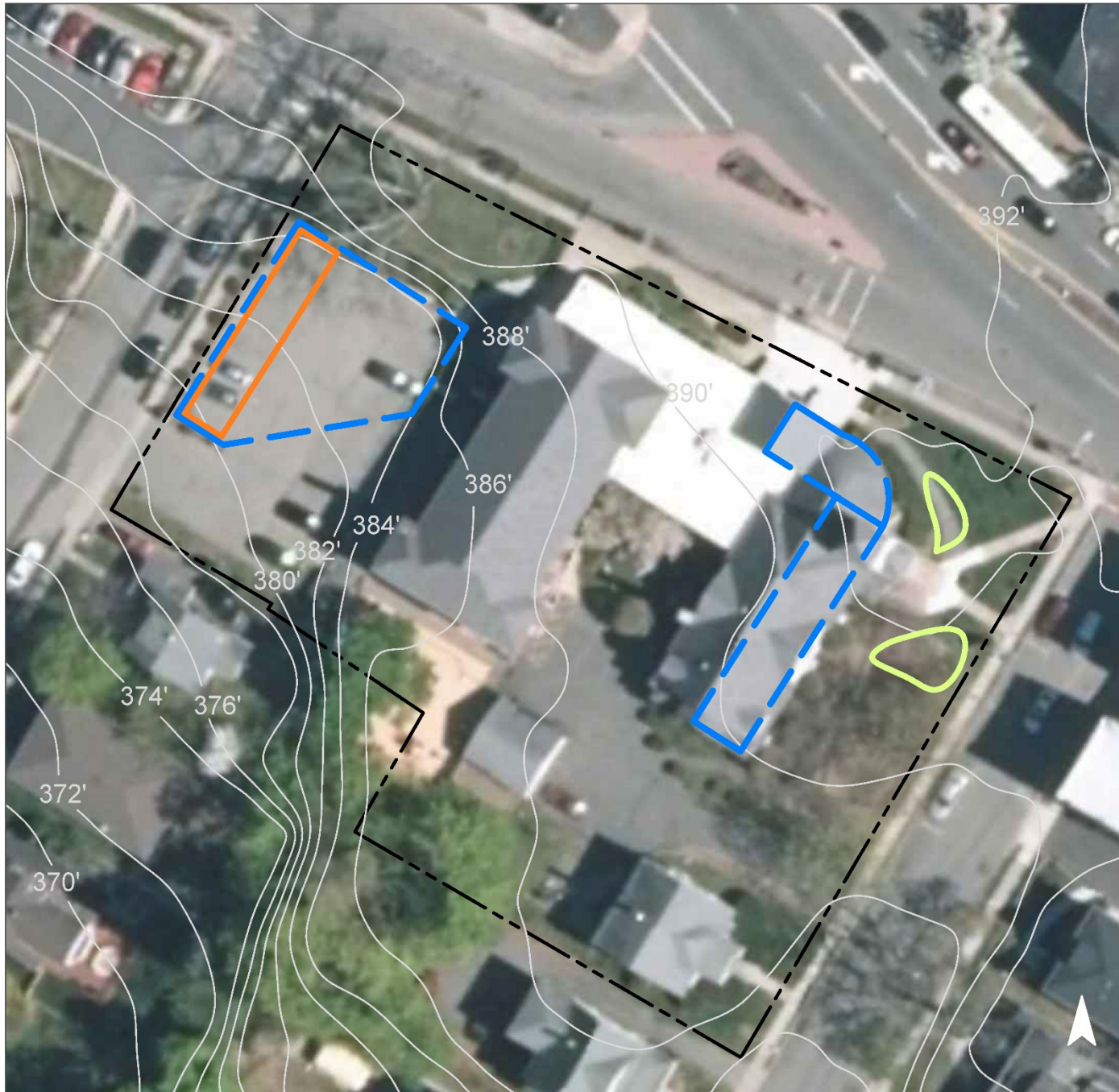


Parking spaces can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed in the turfgrass areas at the eastern side of the building to capture, treat, and infiltrate stormwater runoff from the roof if the downspouts are disconnected. 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"
70	33,277	1.6	16.8	152.8	0.026	0.91

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
Bioretention systems	0.059	10	4,500	0.17	575	\$2,875
Pervious pavement	0.099	17	7,480	0.28	1,330	\$33,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Caldwell United Methodist Church

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



CALDWELL UNIVERSITY



Subwatershed: Upper Passaic River

Site Area: 2,782,378 sq. ft.

Address: 3 Ryerson Avenue
Caldwell, NJ 07006

Block and Lot: Block 57; 60 Lot 5; 3, 3.01,
3.02, 3.03



A rain garden can be installed in the turfgrass areas adjacent to various buildings to capture, treat, and infiltrate stormwater runoff from the roof. Another rain garden can also be installed toward the northeast, adjacent to the driveway, to capture runoff by installing curb cuts. Parking spaces can be converted to porous pavement to capture large portions of runoff from the parking lots. 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"
36	996,020	48.0	503.0	4,573.1	0.776	27.32

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	0.366	61	27,710	1.04	4,300	\$21,500
Pervious pavement	2.008	336	152,090	5.72	15,900	\$397,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Caldwell University

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



CENTER FOR SPIRITUAL LIVING NORTH JERSEY



Subwatershed: Upper Passaic River

Site Area: 14,915 sq. ft.

Address: 31 Westville Avenue
Caldwell, NJ 07006

Block and Lot: Block 53, Lot 7

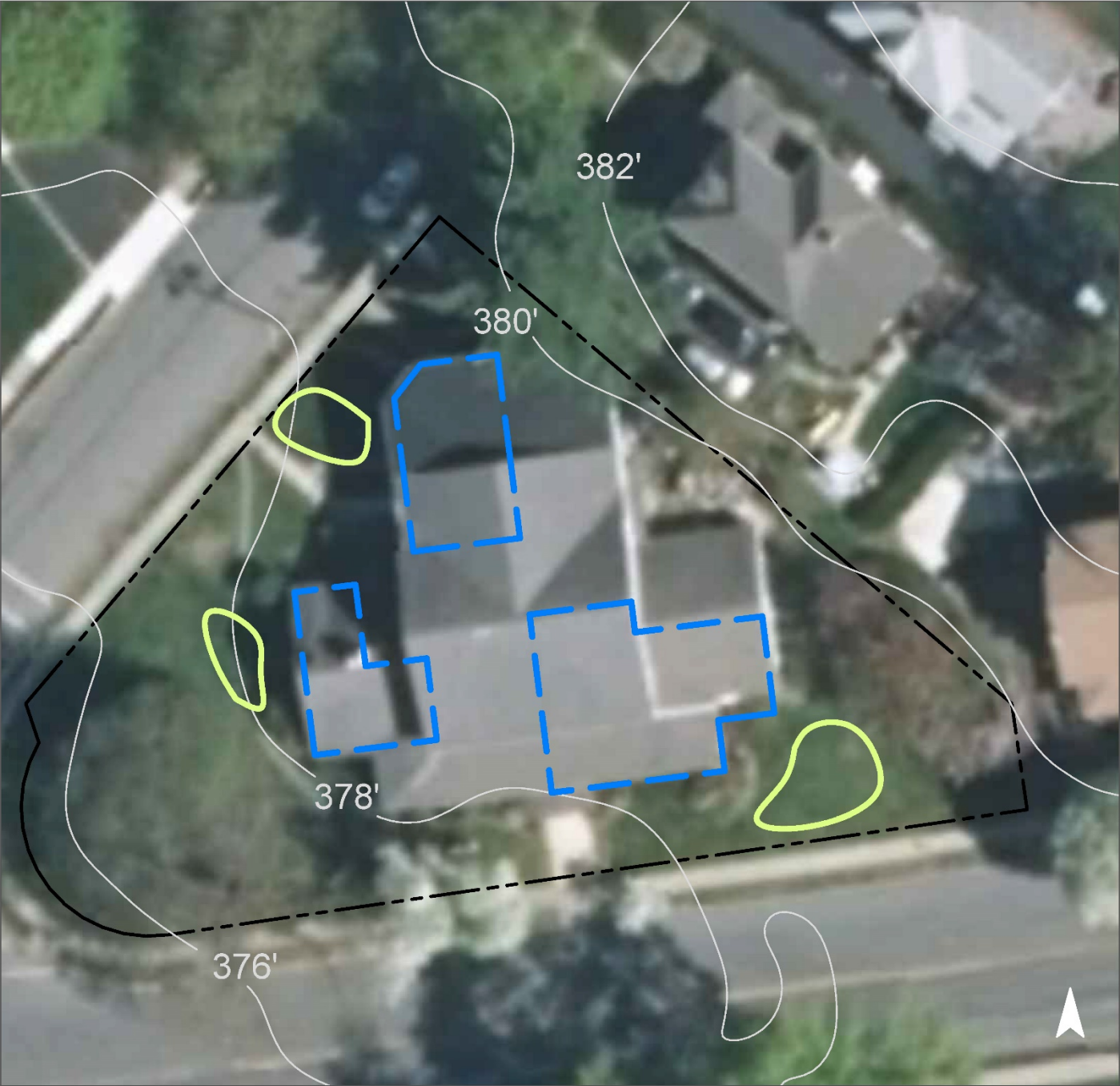


A rain garden can be installed in the turfgrass area near the downspouts of the southeast corner near the entrance of the building to capture, treat, and infiltrate stormwater runoff from the roof. Two other rain gardens can be installed along the west end of the building by redirecting downspouts into the gardens. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.





Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
30	4,475	0.2	2.3	20.5	0.003	0.12

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	0.062	10	4,670	0.18	600	\$3,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



**Center for Spiritual Living
North Jersey**

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



CONGREGATION AGUDATH ISRAEL



Subwatershed: Upper Passaic River

Site Area: 103,306 sq. ft.

Address: 20 Academy Road
Caldwell, NJ 07006

Block and Lot: Block 43.01, Lot 9.11, 9.12,
12, 13, 13.01, 13.02, 14, 15,
16, 17

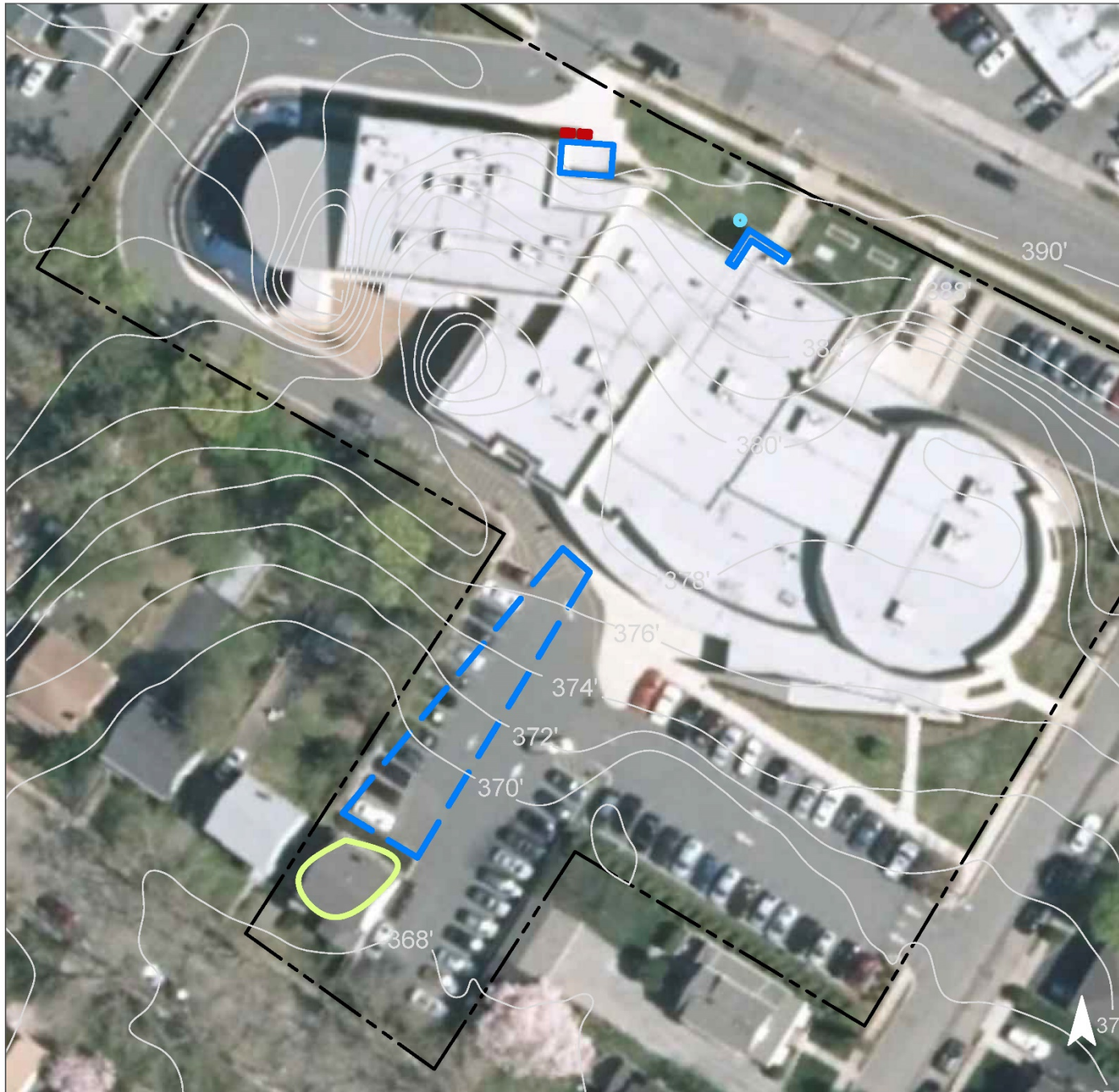


A rain garden can be installed in the parking lot island to capture, treat, and infiltrate stormwater runoff from the parking lot by installing curb cuts. Downspout planter boxes can be used to capture stormwater from downspouts around the building. A rain barrel can be installed to harvest rainwater for use in the garden. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.







Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
86	89,314	4.3	45.1	410.1	0.070	2.45

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	0.081	14	6,120	0.23	775	\$3,875
Planter boxes	n/a	1	n/a	n/a	2 (boxes)	\$2,000
Rainwater harvesting	0.002	0	70	0.00	70 (gal)	\$140

GREEN INFRASTRUCTURE RECOMMENDATIONS



Congregation Agudath Israel

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



ESSEX LODGE NO. 7



Subwatershed: Upper Passaic River

Site Area: 9,945 sq. ft.

Address: 8 Smull Avenue
Caldwell, NJ 07006

Block and Lot: Block 22, Lot 15

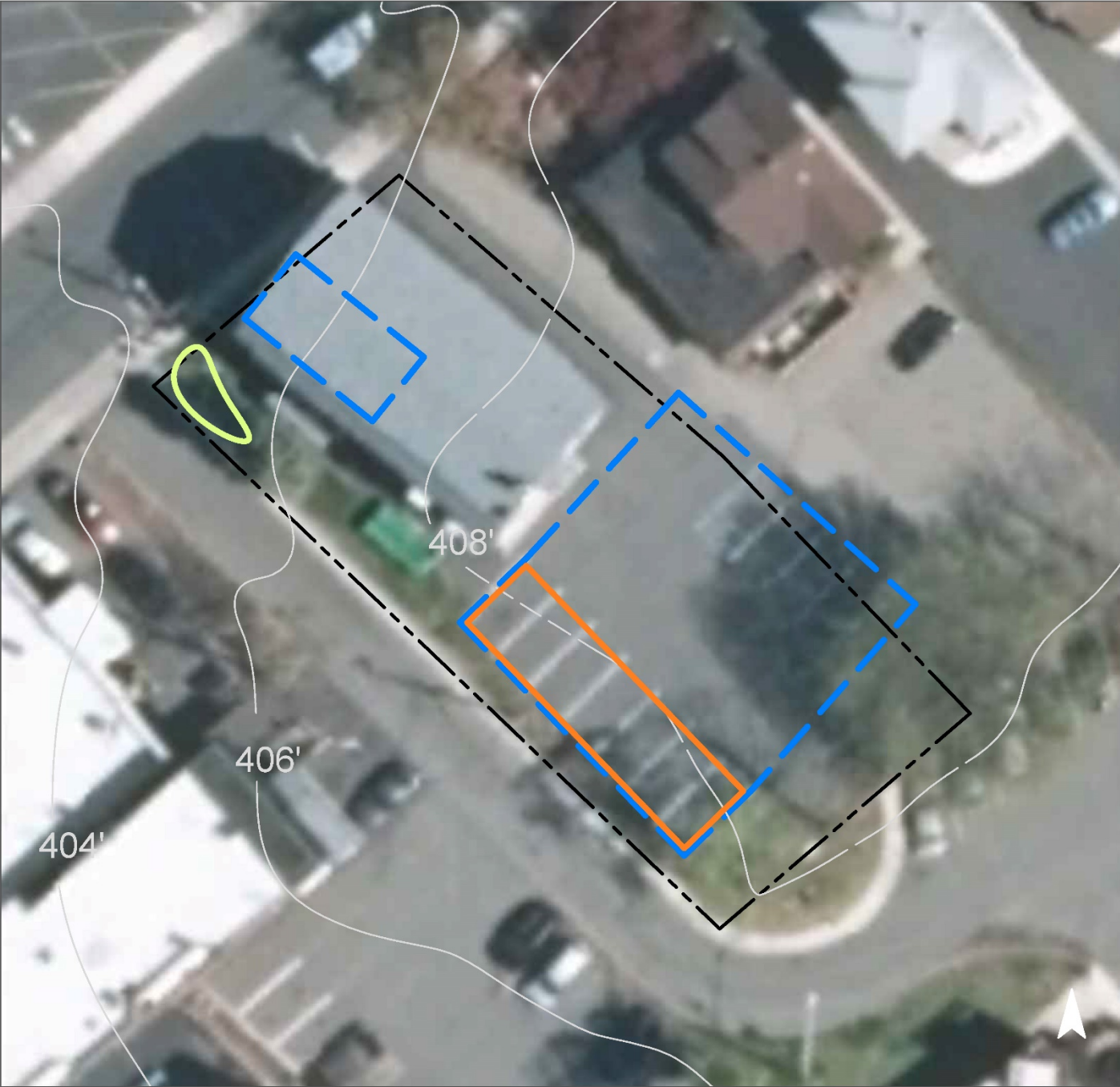


A rain garden can be installed in the turfgrass area along the west side of the building to capture, treat, and infiltrate stormwater runoff from the roof via the nearby downspout. Parking spaces in the parking lot at the back of the building can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot before it flows onto the street. 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"
95	9,448	0.5	4.8	43.4	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 system	0.013	2	1,010	0.04	130	\$650
Pervious pavement	0.104	17	7,900	0.30	1,135	\$28,375

GREEN INFRASTRUCTURE RECOMMENDATIONS



Essex Lodge No. 7

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



FIRST BAPTIST CHURCH



Subwatershed: Upper Passaic River

Site Area: 32,452 sq. ft.

Address: 259 Bloomfield Avenue
Caldwell, NJ 07006

Block and Lot: Block 10, Lot 6, 6.01, 7

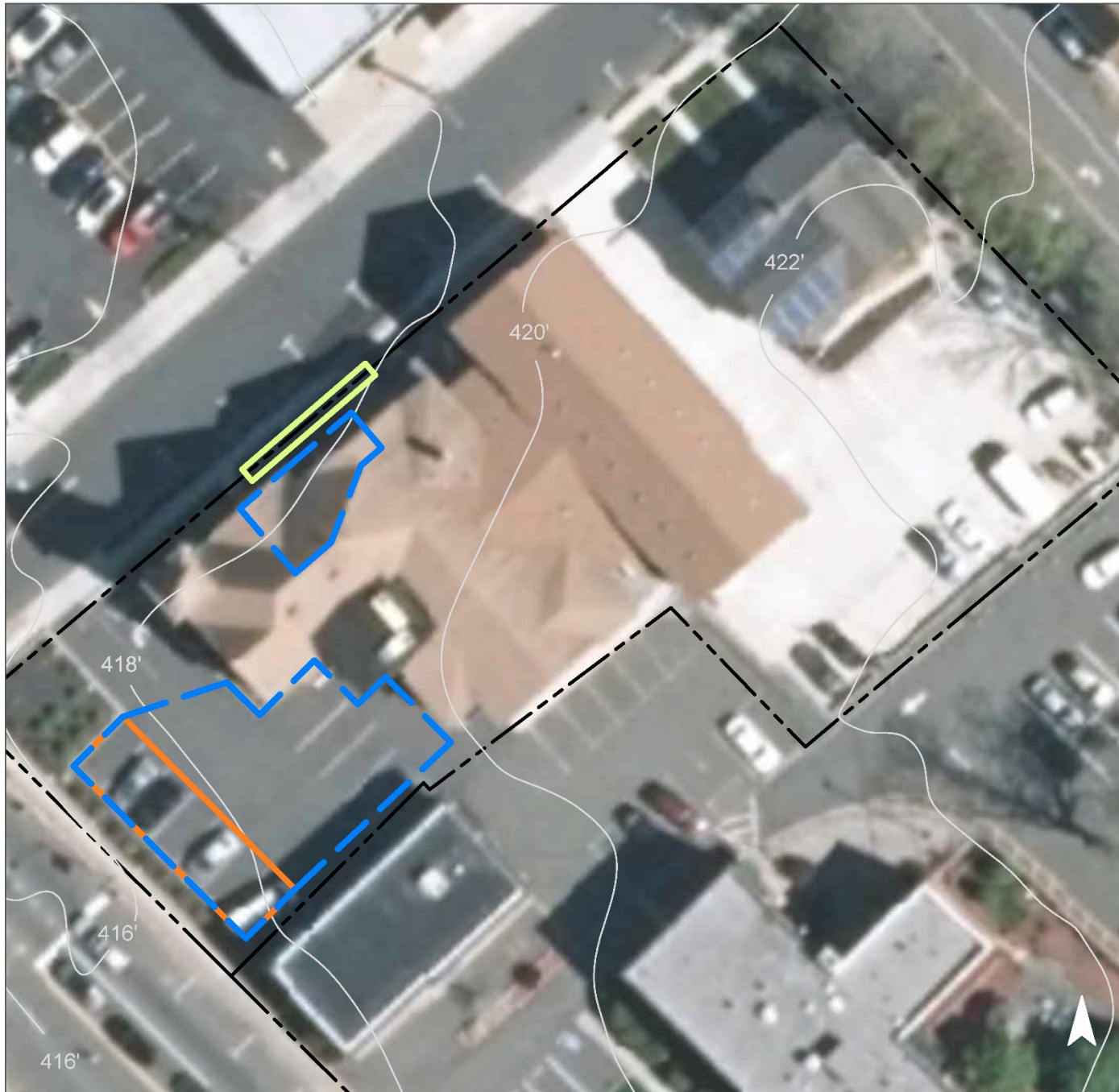


A rain garden can be installed in the turfgrass and shrub area along the side of the building to capture, treat, and infiltrate stormwater runoff from the roof. Parking spaces in the parking lot can be converted to porous pavement to capture and infiltrate stormwater runoff from the front parking lot. 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"
85	27,584	1.3	13.9	126.6	0.021	0.76

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.033	5	2,470	0.09	161	\$805
Pervious pavement	0.104	17	7,900	0.30	1,135	\$28,375

GREEN INFRASTRUCTURE RECOMMENDATIONS



First Baptist Church

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



FIRST PRESBYTERIAN CHURCH



Subwatershed: Upper Passaic River

Site Area: 101,635 sq. ft.

Address: 326 Bloomfield Avenue
Caldwell, NJ 07006

Block and Lot: Block 53, Lot 9

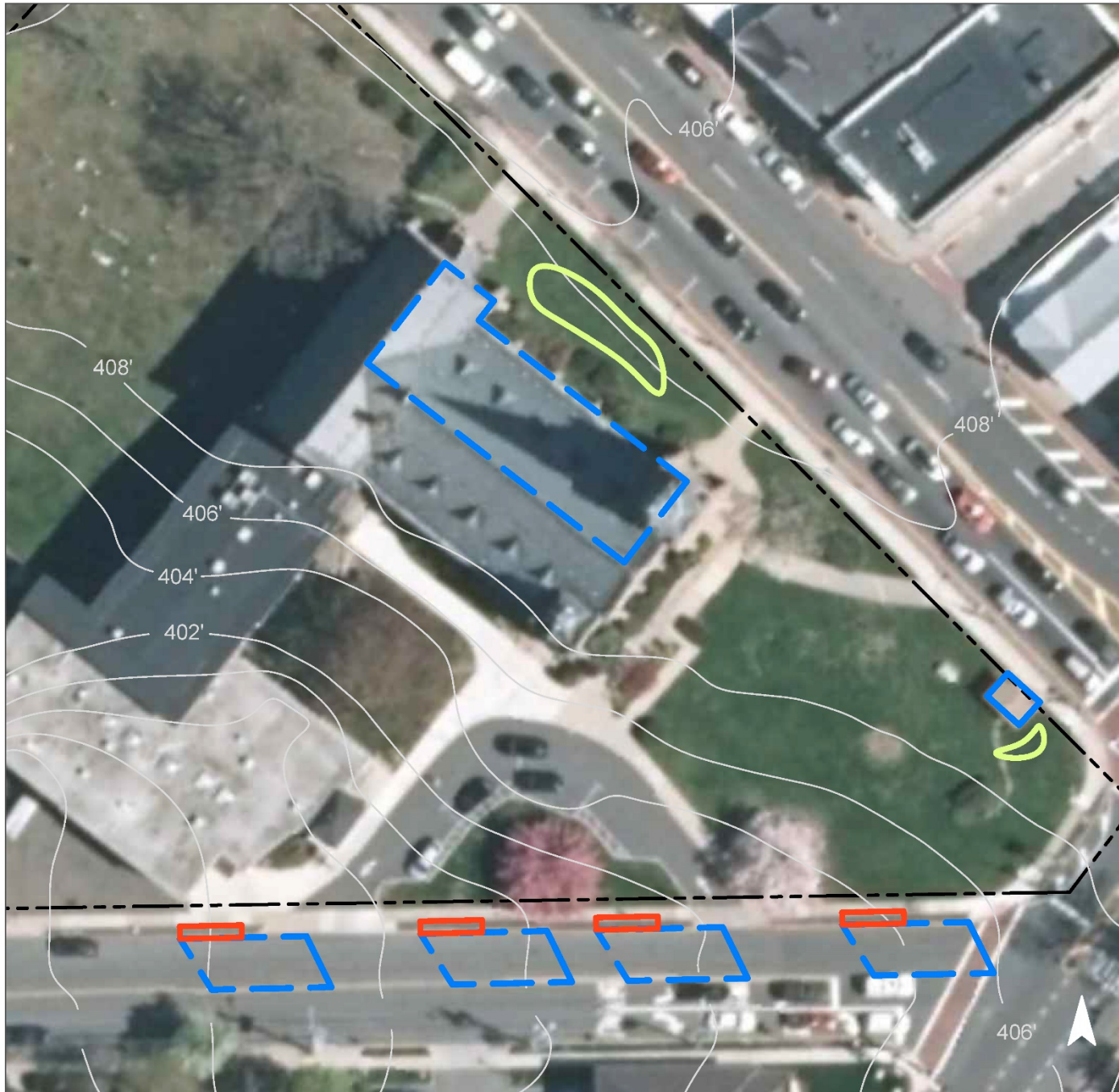


A rain garden can be installed in the turfgrass along the side of the church to capture, treat, and infiltrate stormwater runoff from the roof. An existing asphalt strip adjacent to the sidewalk can be replaced with a series of stormwater planters that could capture stormwater from the roadway. A preliminary 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"
33	33,845	1.6	17.1	155.4	0.026	0.93

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	0.017	3	1,320	0.05	170	\$850
Stormwater planters	0.070	12	5,290	0.20	680	\$255,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



First Presbyterian Church

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



GOULD PLACE & BLOOMFIELD AVENUE RIGHT OF WAY



Subwatershed: Upper Passaic River

Site Area: 5,548 sq. ft.

Address: Gould Place & Bloomfield Avenue
Caldwell, NJ 07006

Block and Lot: Right of Way

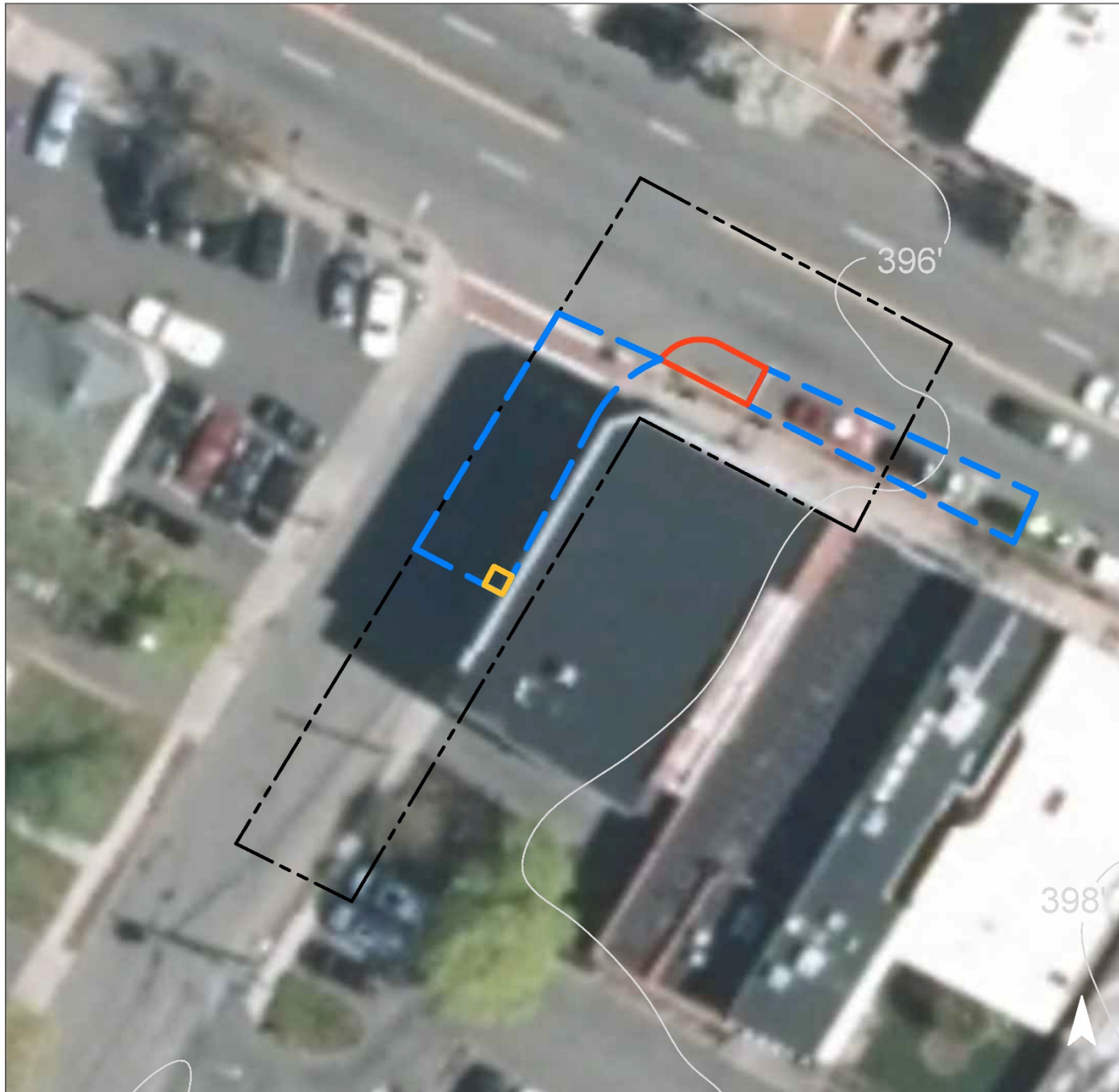


A stormwater planter can be installed near the catch basin to intercept stormwater coming from the roadway. A tree filter box can be installed in the sidewalk area to capture additional runoff from the roadway. A preliminary soil assessment suggests that more soil testing would be required before determining 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"
94	5,217	0.3	2.6	24.0	0.004	0.14

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
Stormwater planter	0.014	2	1,020	0.04	130	\$48,750
Tree filter box	n/a	4	n/a	n/a	1 (box)	\$10,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Gould Place & Bloomfield Avenue Right of Way

-  stormwater planter
-  tree filter box
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



GREEN ACRES: 27 PERSONETTE STREET



Subwatershed: Upper Passaic River

Site Area: 7,849 sq. ft.

Address: 27 Personette Street
Caldwell, NJ 07006

Block and Lot: Block 22, Lot 25.02

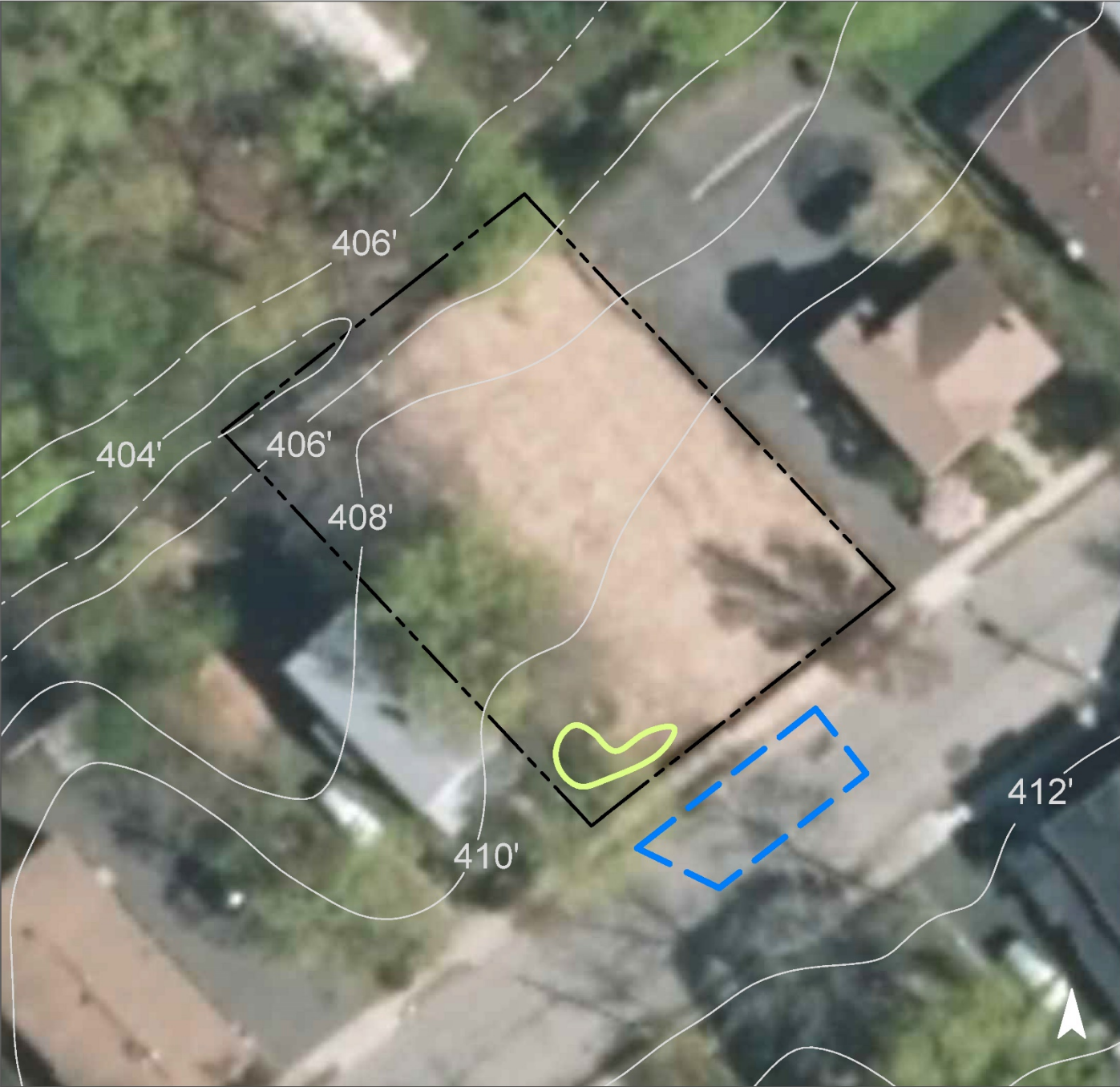


A rain garden can be installed in the turfgrass area along the fence to capture, treat, and infiltrate stormwater runoff from the roadway. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.





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"
40	3,140	0.2	1.6	14.4	0.002	0.09

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.017	3	1,260	0.05	160	\$800

GREEN INFRASTRUCTURE RECOMMENDATIONS



**Green Acres:
27 Personette Street**

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



GROVER CLEVELAND BIRTHPLACE



Subwatershed: Upper Passaic River

Site Area: 94,147 sq. ft.

Address: 217 Bloomfield Avenue
Caldwell, NJ 07006

Block and Lot: Block 10, Lot 12, 13, 14



Rain gardens can be installed in the turfgrass areas around the building to capture, treat, and infiltrate stormwater runoff from the roof by redirecting the downspouts into the gardens. 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"
16	14,667	0.7	7.4	67.3	0.011	0.40

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.029	5	2,170	0.08	280	\$1,400

GREEN INFRASTRUCTURE RECOMMENDATIONS



Grover Cleveland Birthplace

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



GROVER CLEVELAND MIDDLE SCHOOL



Subwatershed: Upper Passaic River

Site Area: 341,439 sq. ft.

Address: 36 Academy Road
Caldwell, NJ 07006

Block and Lot: Block 42, Lot 6, 7



Parking spaces in the parking lot to the north of the building, near the entrance, can be converted to porous pavement to capture and infiltrate stormwater runoff from the rooftop by disconnected the downspouts into the pavement. Rain gardens can be installed in the turfgrass areas in front of the building by installing curb cuts and trench drains to redirect runoff from the roadway. Ponding at the back of the school could be remediated with 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"
52	178,896	8.6	90.4	821.4	0.139	4.91

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
Bioretention systems	0.415	69	31,420	1.18	3,980	\$19,900
Pervious pavement	0.225	38	17,050	0.64	1,630	\$40,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Grover Cleveland Middle School

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



GROVER CLEVELAND PARK



Subwatershed: Upper Passaic River

Site Area: 1,053,001 sq. ft.

Address: 69 Brookside Avenue
Caldwell, NJ 07006

Block and Lot: Block 54; 67, Lot 2, 3, 4, 5;
1







A rain garden can be installed along the back of the building to capture, treat, and infiltrate stormwater runoff from the roof by installing gutters to direct the water into the 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"
2	22,748	1.1	11.5	104.4	0.018	0.62

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.022	4	1,660	0.06	210	\$1,050

GREEN INFRASTRUCTURE RECOMMENDATIONS



- Grover Cleveland Park**
-  bioretention system
 -  drainage area
 -  property line
 -  2015 Aerial: NJOIT, OGIS



LINCOLN ELEMENTARY SCHOOL



Subwatershed: Upper Passaic River

Site Area: 152,731 sq. ft.

Address: 18 Crane Street
Caldwell, NJ 07006

Block and Lot: Block 1, Lot 3, 5

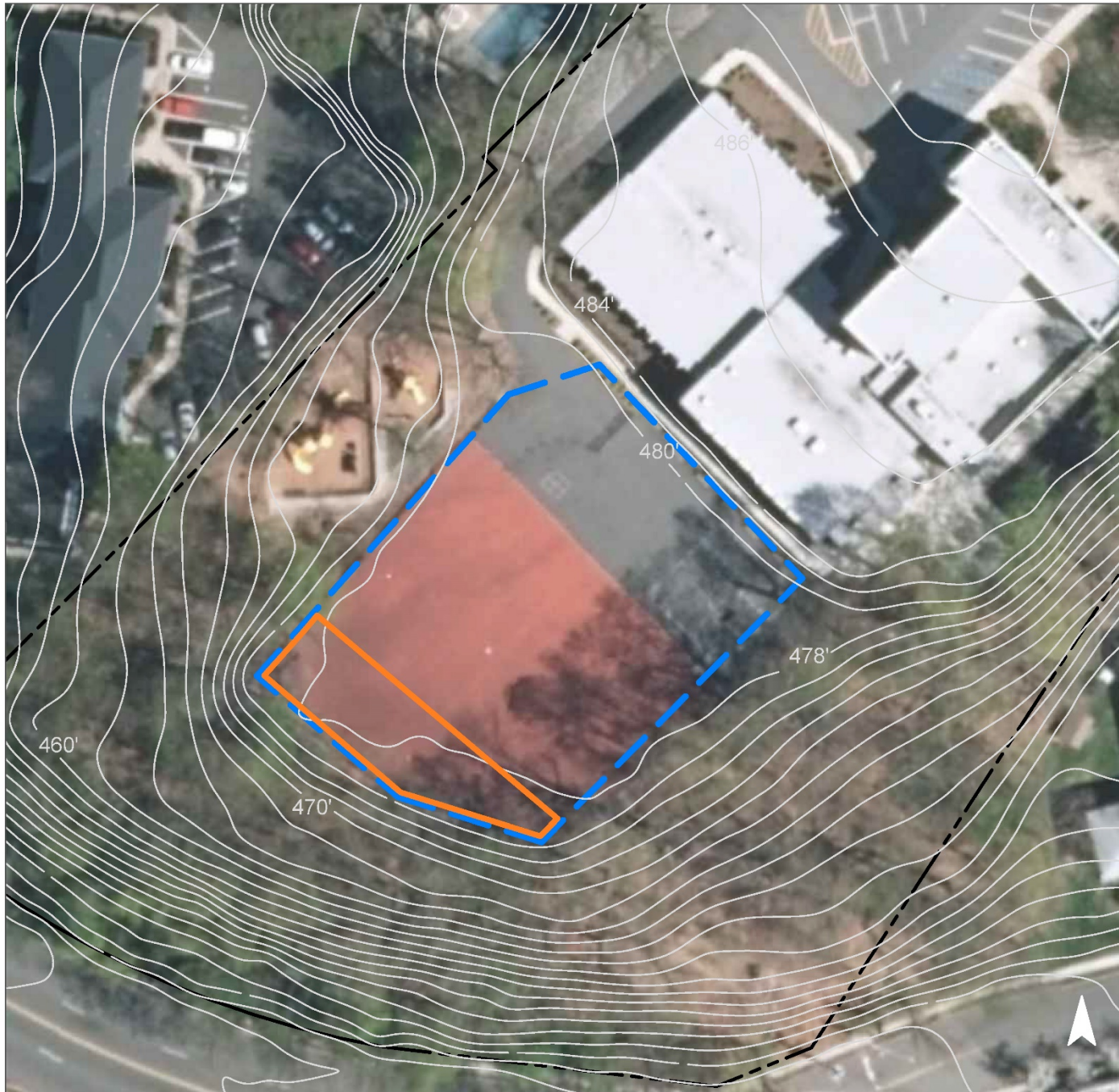


Porous pavement can be installed at the back of the building in the playground to capture runoff from the large area of pavement. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.





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"
55	83,889	4.0	42.4	385.2	0.065	2.30

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	0.556	93	42,100	1.58	3,825	\$95,625

GREEN INFRASTRUCTURE RECOMMENDATIONS



Lincoln Elementary School

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



MUNICIPAL PARKING LOT



Subwatershed: Upper Passaic River

Site Area: 44,149 sq. ft.

Address: 6 Smull Avenue
Caldwell, NJ 07006

Block and Lot: Block 22, Lot 14.02

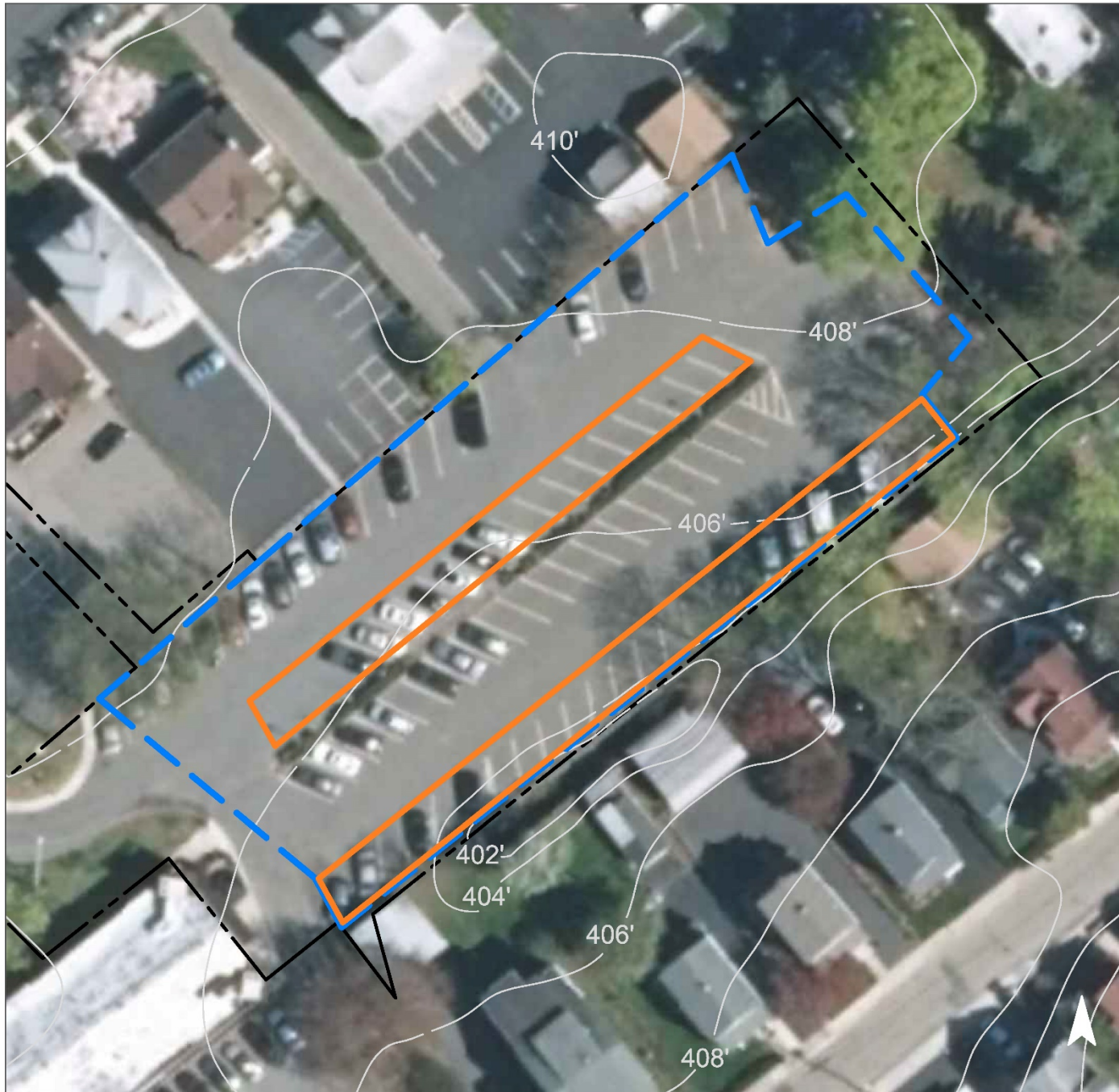


Parking spaces throughout the lot can be converted to porous pavement to capture and infiltrate stormwater runoff from the rest of the parking lot. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.





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"
94	41,587	2.0	21.0	190.9	0.032	1.14

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	0.788	132	59,710	2.24	8,115	\$202,875

GREEN INFRASTRUCTURE RECOMMENDATIONS



Municipal Parking Lot

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



PARK AVENUE & BLOOMFIELD AVENUE RIGHT OF WAY



Subwatershed: Upper Passaic River

Site Area: 6,106 sq. ft.

Address: Park Avenue & Bloomfield Avenue
Caldwell, NJ 07006

Block and Lot: Right of Way

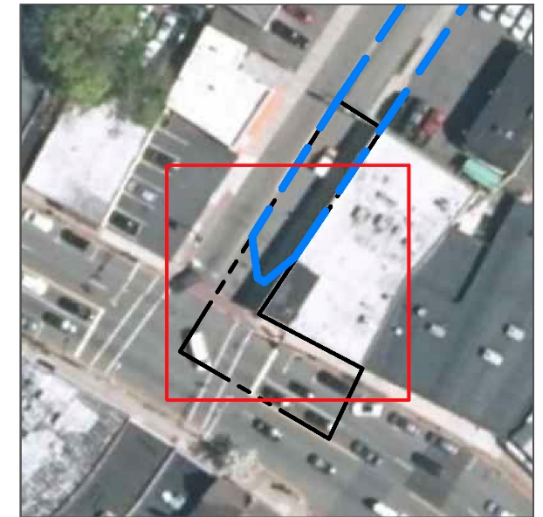
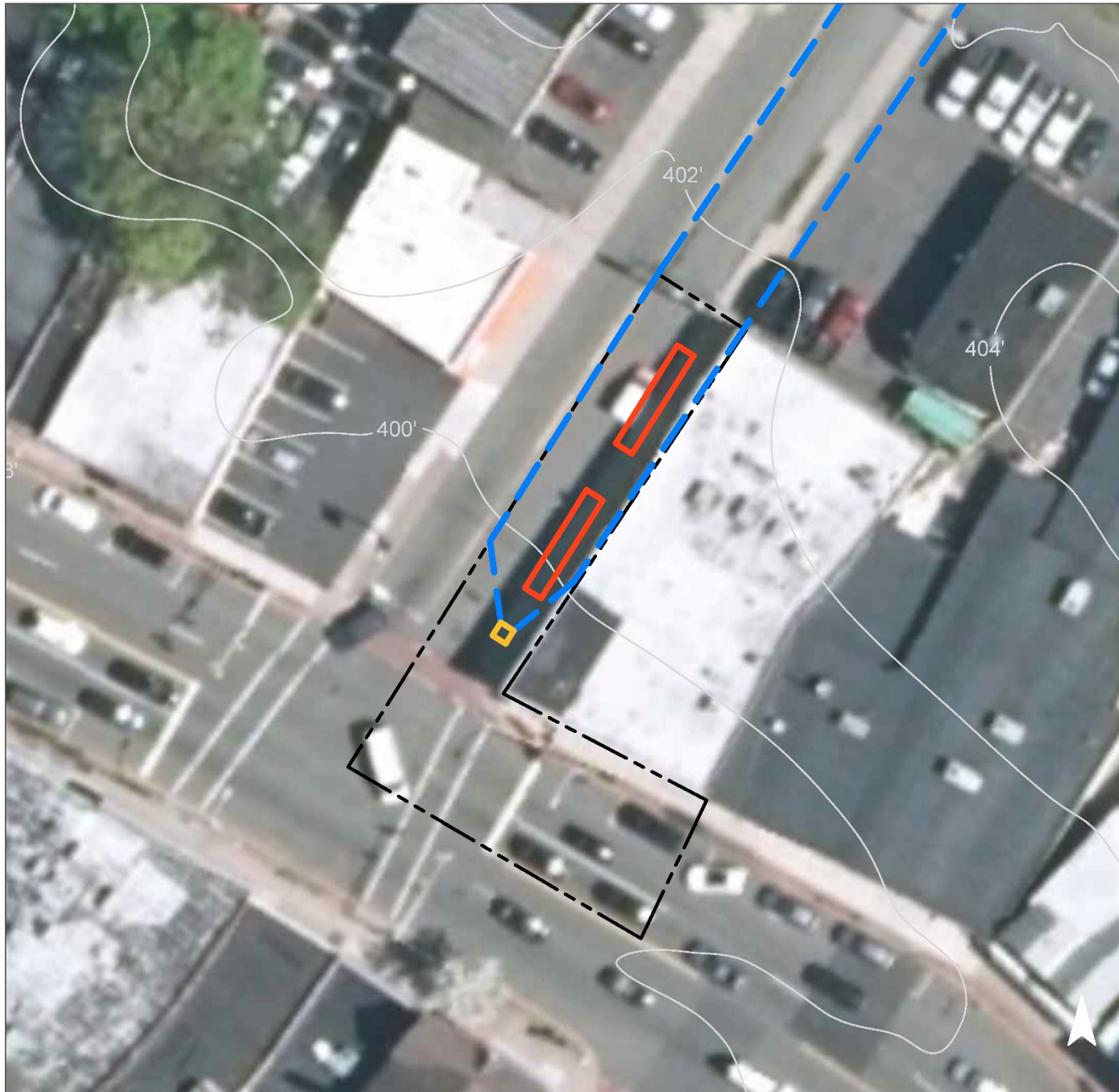


Stormwater planters can be installed in the sidewalk area before the catch basin to intercept stormwater coming from the roadway. A tree filter box can also be installed in the sidewalk area to filter additional runoff from the roadway. A preliminary soil assessment suggests that more soil testing would 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"
95	5,801	0.3	2.9	26.6	0.005	0.16

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
Stormwater planters	0.031	5	2,370	0.09	300	\$112,500
Tree filter box	n/a	26	n/a	n/a	1	\$10,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Park Avenue & Bloomfield Avenue Right of Way

-  stormwater planter
-  tree filter box
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



SAINT ALOYSIUS ROMAN CATHOLIC CHURCH



Subwatershed: Upper Passaic River

Site Area: 194,198 sq. ft.

Address: 219 Bloomfield Avenue
Caldwell, NJ 07006

Block and Lot: Block 10, Lot 8, 9, 10, 11

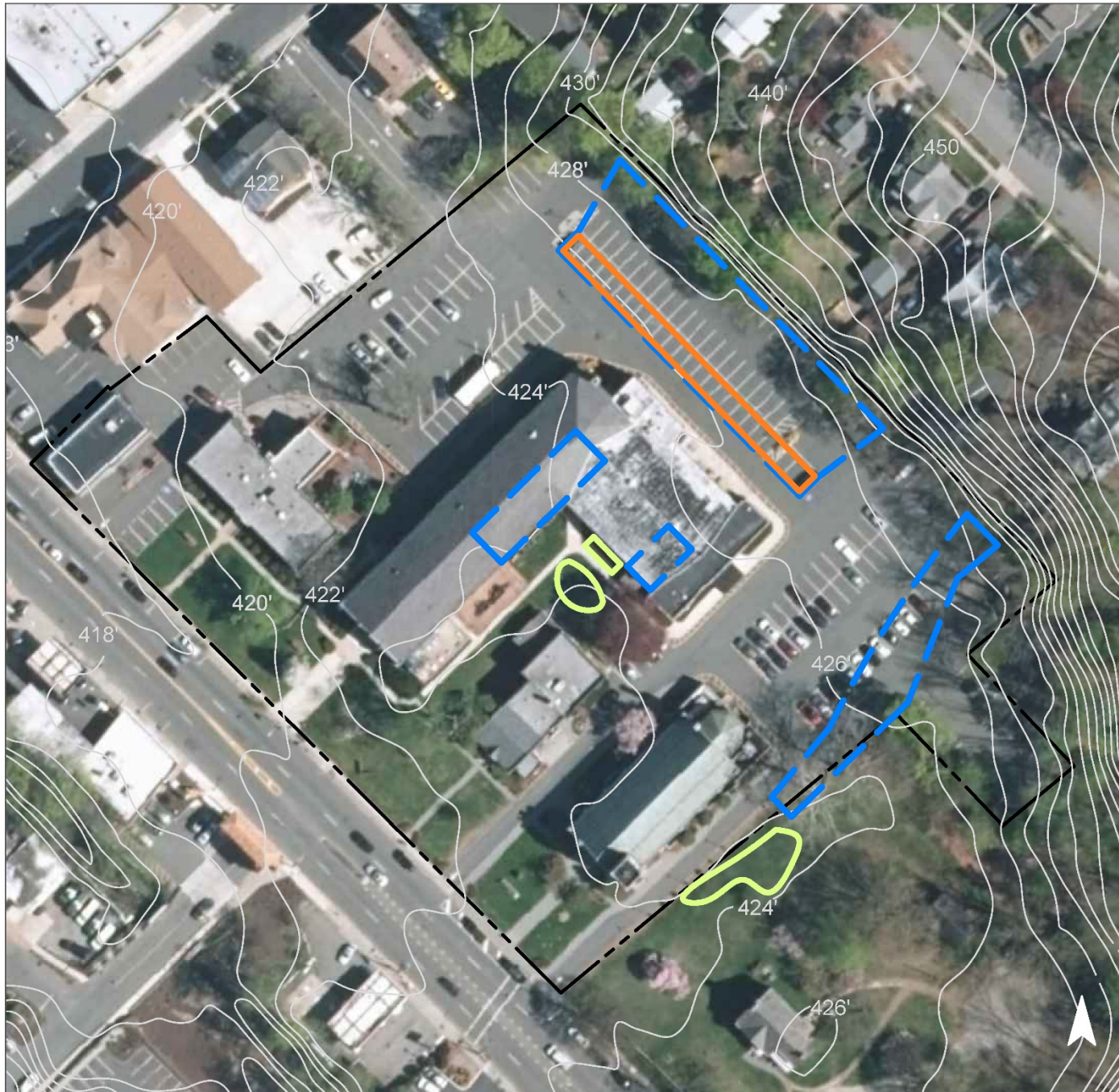


Parking spaces in the parking lot behind the building can be converted to porous pavement to capture and infiltrate stormwater runoff from the parking lot. Rain gardens can be installed in the turfgrass area along the side of the building to capture, treat, and infiltrate stormwater runoff from the roof if nearby downspouts are disconnected. A rain garden can also be installed at the south end of the site by installing curb cuts to direct stormwater into the garden. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.






Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
85	164,760	7.9	83.2	756.5	0.128	4.52

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	0.242	40	18,320	0.69	2,335	\$11,675
Pervious pavement	0.414	69	31,390	1.18	4,000	\$100,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Saint Aloysius Roman Catholic Church

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



c. Summary of Existing Conditions

d. Summary of Proposed Green Infrastructure Practices