GREEN INFRASTRUCTURE FEASIBILITY STUDY

NORTH BERGEN

RUTGERS
New Jersey Agricultural Experiment Station

PASSAIC VALLEY SEWERAGE COMMISSION
EST. 1902

"Protecting Public Health and the Environment"

ACKNOWLEDGEMENTS

Designed to highlight green infrastructure opportunities within the Township of North Bergen, this document has been prepared by the Rutgers Cooperative Extension Water Resources Program with funding and direction by the Passaic Valley Sewerage Commission and the New Jersey Agricultural Experiment Station.

We would like to thank the Passaic Valley Sewerage Commission, the New Jersey Agricultural Experiment Station, and the Township of North Bergen for their input and support in creating this document.

RUTGERS
New Jersey Agricultural Experiment Station

PASSAIC VALLEY SEWERAGE COMMISSION
"Protecting Public Health and the Environment"

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INTRODUCTION

In 2013, the Passaic Valley Sewerage Commission (PVSC) began a new initiative to assist the 48 municipalities within its jurisdiction to manage flooding and eliminate combined sewer overflows. With municipalities spread across five counties, PVSC is dedicated to leading efforts throughout the PVSC Sewerage District by using green infrastructure to intercept stormwater runoff, reduce combined sewer overflows (CSOs), manage existing water infrastructure, and minimize frequent flooding events. To help with this effort, PVSC has entered into a partnership with the Rutgers Cooperative Extension (RCE) Water Resources Program.

North Bergen is a community with a combined sewer system which carries both wastewater and stormwater in the same pipes. During heavy rain or snow melt, combined sewer systems often cannot manage all of the water and overflow, causing a combined sewer overflow (CSO) event. When overflows or CSO events occur, stormwater that has been mixed with untreated wastewater is discharged into local waterways, carrying with it many contaminants. By using cost-effective green infrastructure practices, North Bergen can begin to reduce the negative impacts of stormwater runoff and pressure on the local infrastructure, while also increasing resiliency to CSO events and protecting the health of our waterways.

This feasibility study is intended to be used as a guide for the community of North Bergen to begin implementing green infrastructure practices while demonstrating to residents and local leaders the benefits of and opportunities for better managing stormwater runoff.

Rutgers University professor, Tobiah Horton, reviews a rain garden design with a homeowner.

NORTH BERGEN

Located in Hudson County, the Township of North Bergen is situated on the Hudson Palisades between the Hudson River and the Hackensack Meadowlands. The township covers an area totaling about 5.5 square miles and has a population of 60,773 according to the 2010 U.S. Census.

As a landlocked town in a densely populated area, North Bergen shares its border with many other communities. North Bergen shares its northern border with the Bergen County communities of Ridgefield, Fairview, Cliffside Park, and Edgewater. To the east is Guttenberg, West New York, and Union City. Secaucus is located to the west, and Jersey City is to the south.

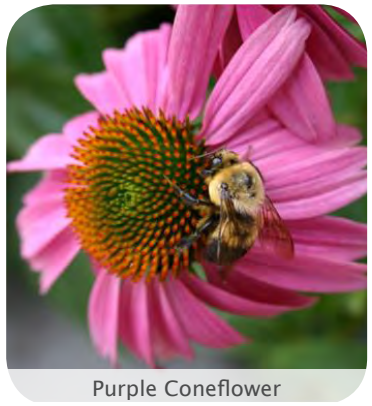
The town has a combined sewer system with a total of seven combined sewer overflow (CSO) points. This means that in the event of a heavy storm, much of the town's runoff and wastewater travels into nearby water bodies untreated. By evaluating the feasibility of green infrastructure, North Bergen can identify cost-effective ways to help mitigate water quality and local flooding issues.

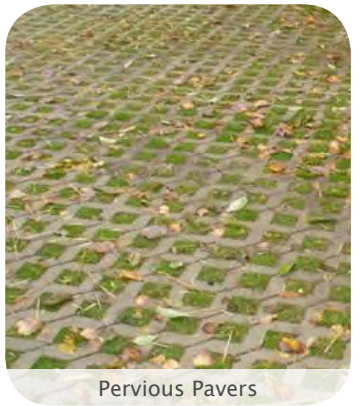
WHAT IS STORMWATER?

When rainfall hits the ground, it can soak into the ground or flow across the surface. When rainfall flows across a surface, it is called "stormwater" runoff. Pervious surfaces allow stormwater to readily soak into the soil and recharge groundwater. An impervious surface can be any material that has been placed over soil that prevents water from soaking into the ground. Impervious surfaces include paved roadways, parking lots, sidewalks, and rooftops. As impervious areas increase, so does the amount of stormwater runoff. New Jersey has many problems due to stormwater runoff from impervious surfaces, including:

- POLLUTION: According to the 2010 New Jersey Water Quality Assessment Report, 90% of the assessed waters in New Jersey are impaired. Urban-related stormwater runoff is listed as the most probable source of impairment (USEPA, 2013). As stormwater flows over the ground, it picks up pollutants, including animal waste, excess fertilizers, pesticides and other toxic substances. These pollutants are carried to waterways.
- FLOODING: Over the past decade, the state has seen an increase in flooding. Communities around the state have been affected by these floods. The amount of damage caused also has increased greatly with this trend, costing billions of dollars over this time span.
- EROSION: Increased stormwater runoff causes an increase in stream velocity. The increased velocity after storm events erodes stream banks and shorelines, degrading water quality. This erosion can damage local roads and bridges and cause harm to wildlife.

A local reservoir

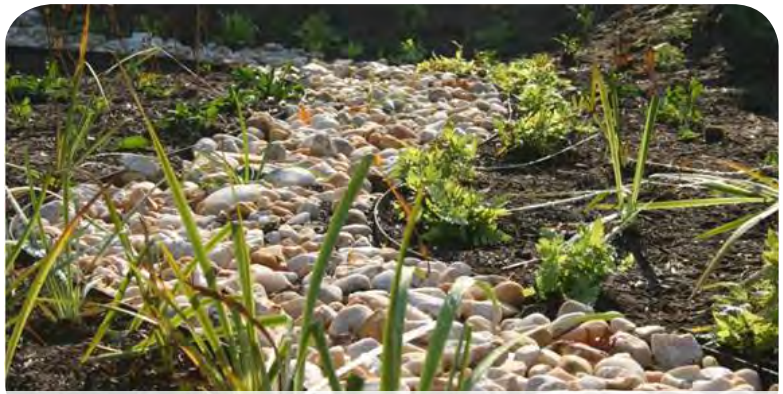

Purple Coneflower


Pervious Pavers

To protect and repair our waterways, reduce flooding, and stop erosion, stormwater runoff has to be better managed. Impervious surfaces need to be disconnected with green infrastructure to prevent stormwater runoff from flowing directly into New Jersey's waterways. Disconnection redirects runoff from paving and rooftops to pervious areas in the landscape.

A community garden that harvests and recycles rainwater

Rain barrel workshop participants



A rain garden after planting

WHAT IS GREEN INFRASTRUCTURE?

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 technologies 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 (USEPA, 2013).

GLOSSARY OF GREEN INFRASTRUCTURE TERMINOLOGY

A ***DISCONNECTED:***

Disconnected refers to channeling water from gutters and pipes that collect runoff to somewhere other than a sewer drain where it can be filtered.

B ***DEPAVING:***

Depaving is the process of removing hardscape such as asphalt or concrete.

C ***INFILTRATION:***

Infiltration occurs when water on the ground's surface is absorbed into the soil below. Plants promote infiltration.

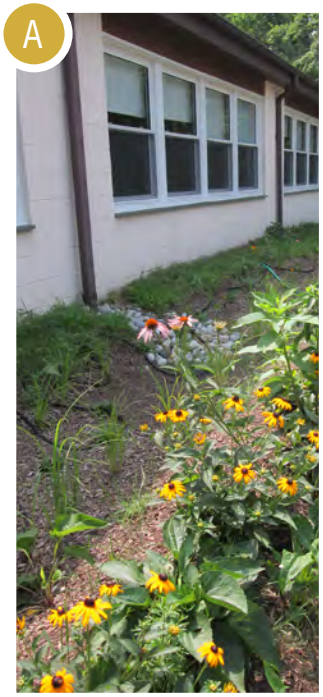
D ***IMPERVIOUS SURFACE:***

An impervious surface is one that water cannot penetrate.

E ***RUNOFF:***

Runoff is water from precipitation that flows across land and paved surfaces before entering local waterways or sewer systems.

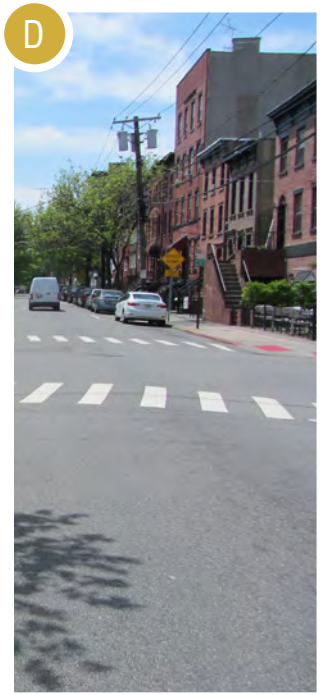
A



B

C

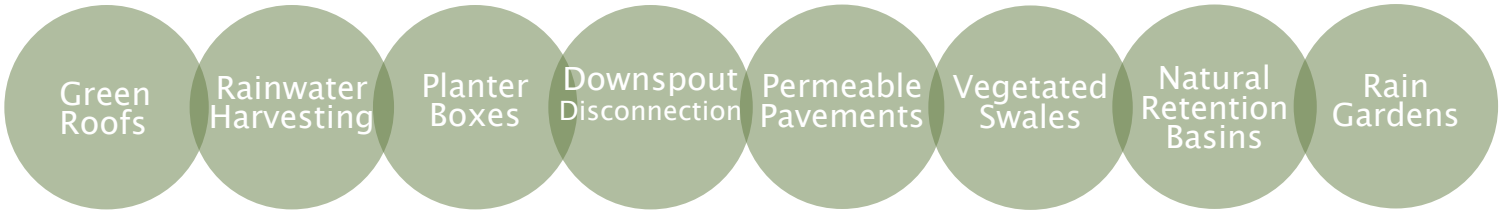
D



E

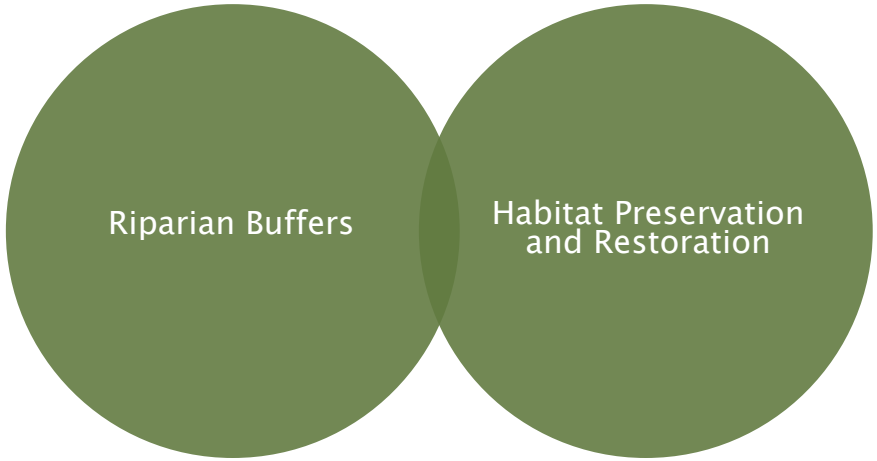
GREEN INFRASTRUCTURE STRATEGIES WITHIN STUDY AREA

SITE



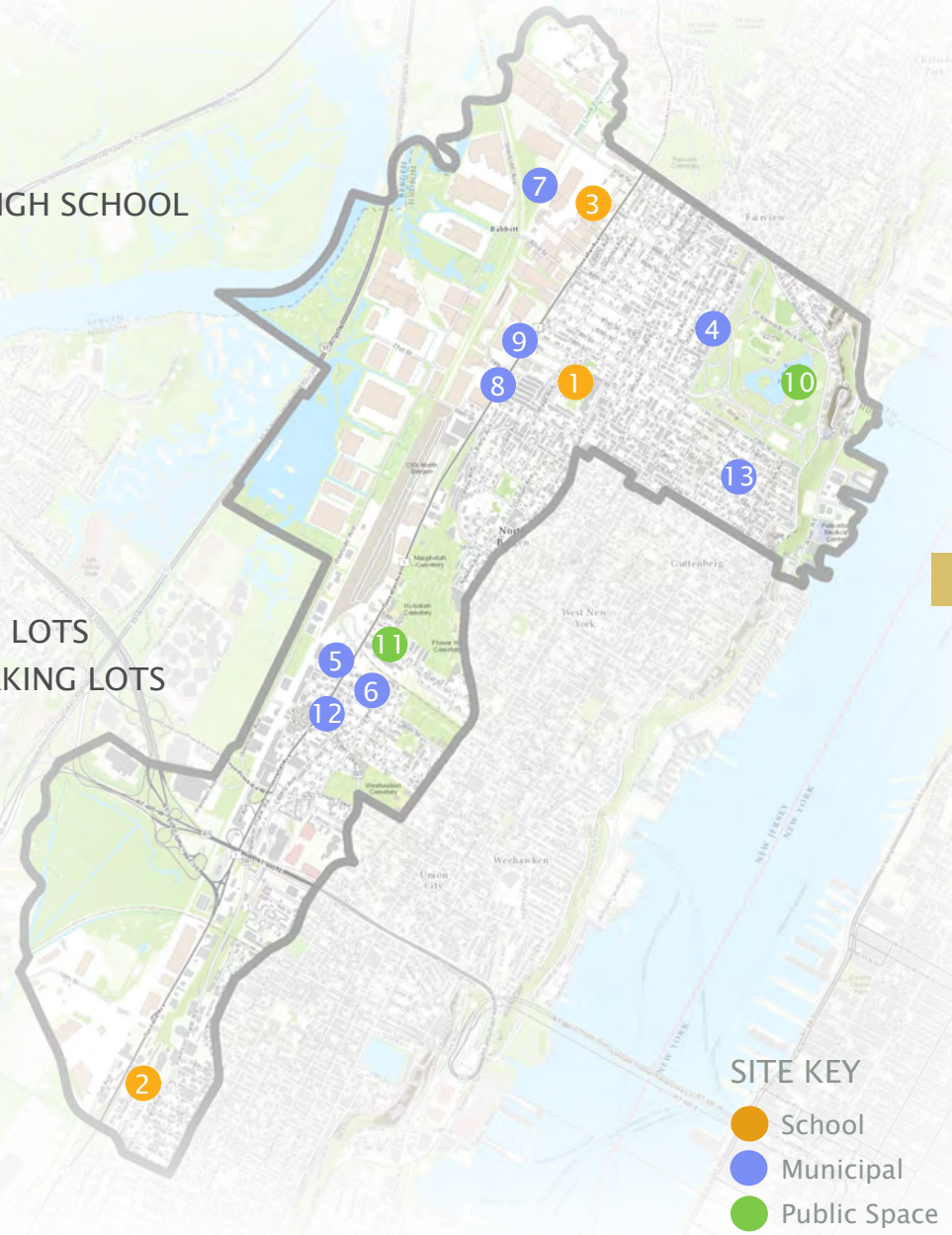
NEIGHBORHOOD

WATERSHED



POTENTIAL PROJECT SITES

1. NORTH BERGEN HIGH SCHOOL
2. JOHN F. KENNEDY ELEMENTARY SCHOOL
3. HUDSON COUNTY SCHOOL OF TECHNOLOGY ADULT HIGH SCHOOL
4. NORTH BERGEN PUBLIC LIBRARY
5. NORTH BERGEN PARKING AUTHORITY BUILDING
6. NORTH BERGEN MUNICIPAL BUILDING
7. NORTH BERGEN COMMUNITY POOL
8. NORTH BERGEN DEPARTMENT OF PUBLIC WORKS
9. NORTH BERGEN MUNICIPAL UTILITIES AUTHORITY
10. JAMES J. BRADDOCK PARK
11. MUNICIPAL PARK
12. NORTH BERGEN PARKING AUTHORITY STREET PARKING LOTS
13. NORTH BERGEN PARKING AUTHORITY OFF-STREET PARKING LOTS

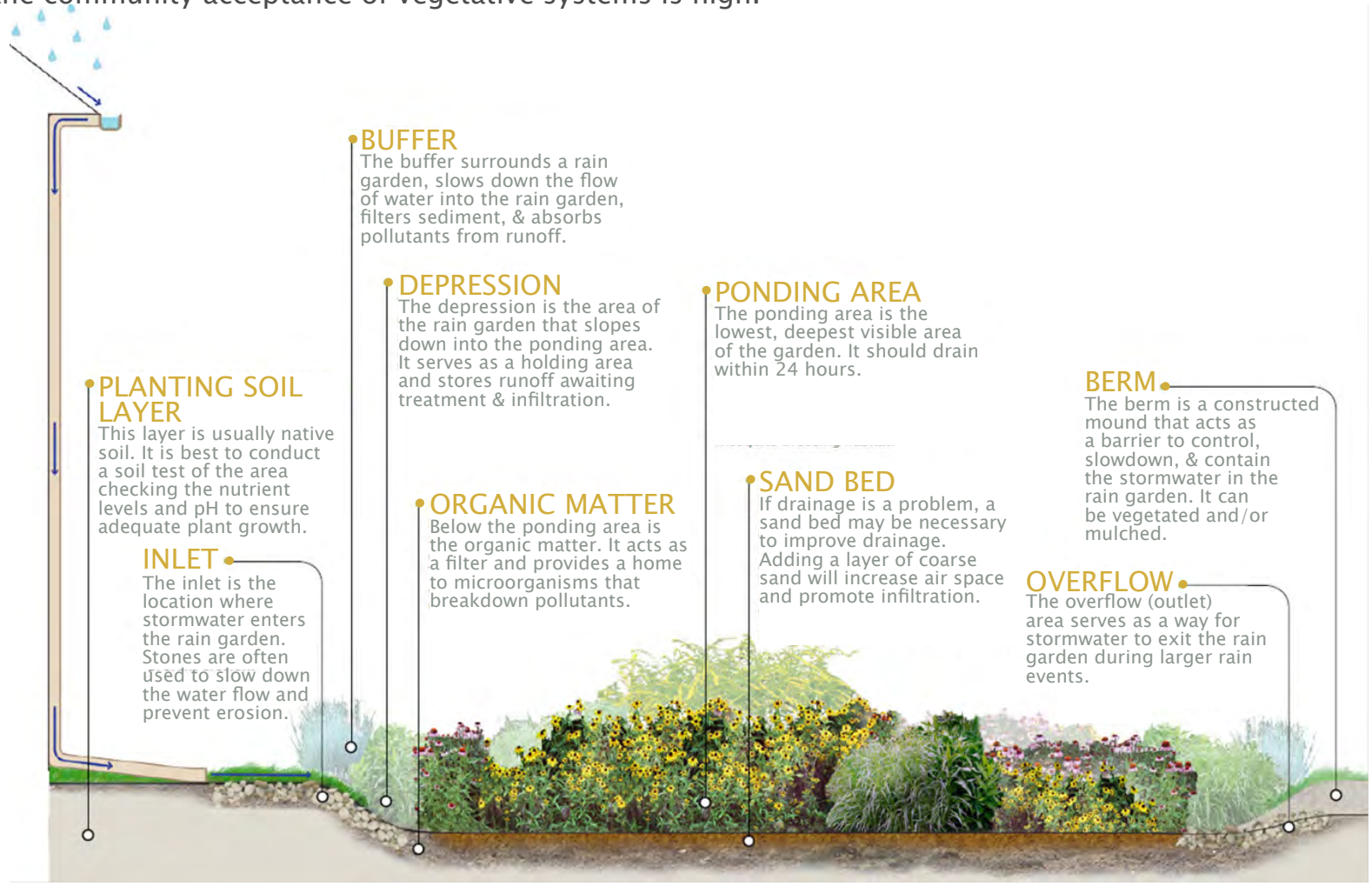



STATE OF
NEW JERSEY
DEPARTMENT OF
ENVIRONMENTAL
PROTECTION

GREEN INFRASTRUCTURE SYSTEMS

VEGETATED SYSTEMS

Vegetative systems primarily focus on reducing water quality impacts and less on reducing flooding. These systems are typically located close to the sources of runoff and can manage the smaller storms of several inches. The main treatment mechanisms are infiltration, filtration, and evapotranspiration. These systems do an excellent job at removing total suspended solids, nutrients, and pathogens. Construction costs for vegetated systems are typically low to moderate when compared to other green infrastructure practices. Since these systems often can be incorporated into existing landscapes and enhance aesthetics, the community acceptance of vegetative systems is high.



RAIN GARDEN DIAGRAM

VEGETATED SYSTEM SUITABILITY

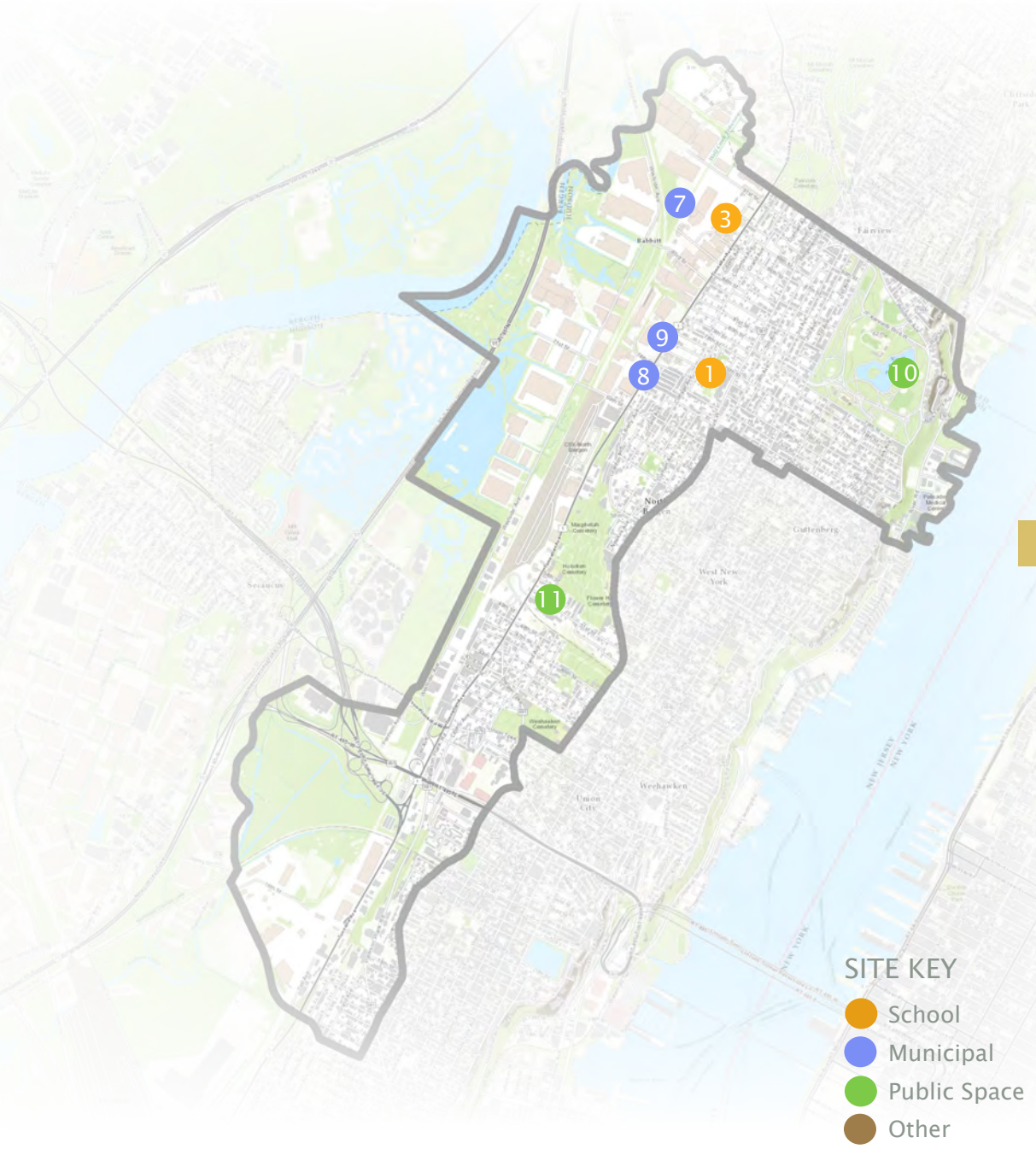
Rain gardens are shallow landscaped depressions designed to capture, treat, and infiltrate stormwater runoff. Rain gardens can be readily installed throughout a community to begin re-establishing the natural processes of the landscape.

Rain gardens:

- Capture stormwater runoff, reducing soil erosion and sedimentation and the amount of water that flows to our streams and waterways during rain storms
- Protect water quality by filtering out and breaking down pollutants
- Infiltrate runoff and recharge groundwater supplies by providing base flow to nearby streams and waterways
- Enhance and increase green space and vegetated cover

Rain gardens are a simple way communities can begin to reduce stormwater runoff, manage flows to sewer systems, and protect water resources. Rain gardens can be placed in strategic locations to capture runoff from rooftops and paved areas, including:

- Homes
- Schools
- Churches
- Parking areas
- Community gardens



VEGETATED SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

The Municipal Utilities Authority building has several easily accessible downspouts that discharge onto the adjacent lawn.

6200 Tonnelle Avenue
North Bergen, NJ 07047

VEGETATED SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

Rain gardens are suitable for downspout disconnection at several lawn locations on this site.

6200 Tonnelle Avenue
North Bergen, NJ 07047

RAINWATER HARVESTING SYSTEMS

Rainwater harvesting systems focus on the conservation, capture, storage, and reuse of rainwater. These systems are located close to residential and commercial buildings. Construction costs are low to moderate, depending on the size of the system, compared to other green infrastructure practices. Since these systems can be easily incorporated into the built landscape, the community acceptance of rainwater harvesting systems is moderate to high. Rainwater harvesting systems include rain barrels and cisterns.

RAIN BARREL DIAGRAM

INLET
Rainwater collected in gutters is released into the barrel here

OVERFLOW OUTLET
Releases water when the rain barrel reaches capacity

SPIGOT
Valve that opens and closes barrel's water flow

RAINWATER HARVESTING SYSTEMS SUITABILITY

Typical rainwater harvesting systems can store up to 5,000 gallons of water. Harvesting during the rainy months of spring and summer provides a source of water during hot and dry periods between rain storms. Instead of using potable water, residents can save money using the rainwater stored in a rain barrel or cistern. This also reduces the demand on drinking water supplies and related infrastructure.

Rain barrels and cisterns are an effective rainwater harvesting tool and can be an important element in a community-wide green infrastructure program. For every inch of rain that falls on an eight hundred square foot roof (20' x 40'), nearly 500 gallons of water can be collected. Over an entire year, water draining from this rooftop will total over 20,000 gallons. This sustainable practice reduces the impact a building has on the environment by harvesting stormwater runoff from rooftops and decreasing flow to sewer systems. Rain barrels and cisterns provide an alternative source of water for gardens, lawns, and landscaping by reducing the use of potable water supplies.

RAINWATER HARVESTING SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

Roof runoff is internally piped into the ground where it connects to the sewer system.

RAINWATER HARVESTING SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

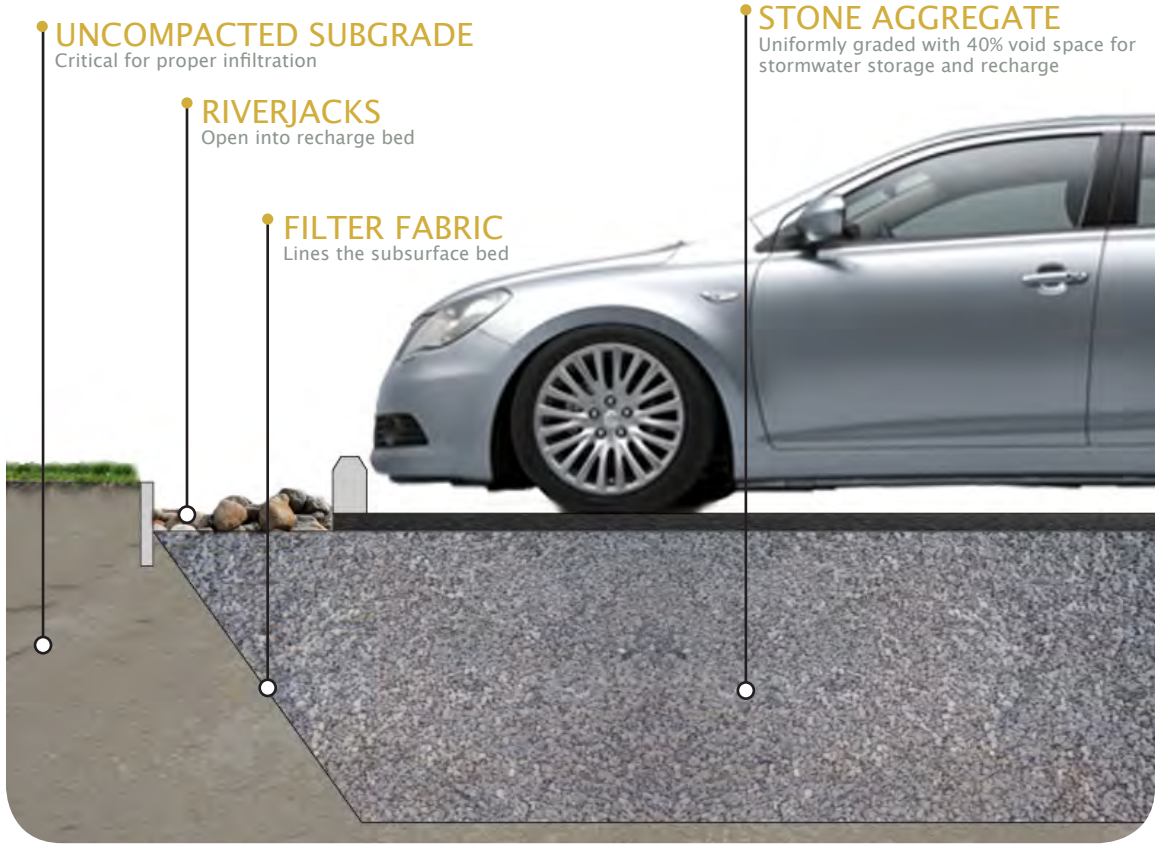
Pending confirmation of the location of the drainage system, rainwater could be harvested in a cistern and used to wash Hudson County vehicles on site.

STORAGE, QUANTITY, & INFILTRATION SYSTEMS

Storage, quantity, and infiltration systems primarily focus on storage. These systems are typically located close to runoff sources within residential, commercial, and industrial landscapes. The main treatment mechanism is reducing peak flows of stormwater by storing it before it becomes runoff. Construction costs for storage, quantity, and infiltration are moderate to high when compared to other green infrastructure practices because they require more space and infrastructure and are more laborious to install. Since these systems can be seamlessly incorporated into the built environment and can manage a large quantity of water, the community acceptance of storage, quantity, and infiltration systems is high.

PERMEABLE PAVEMENT

- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without “fine” materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Ideal application for porous pavement is to treat a low traffic or overflow parking area



PERMEABLE PAVEMENT DIAGRAM

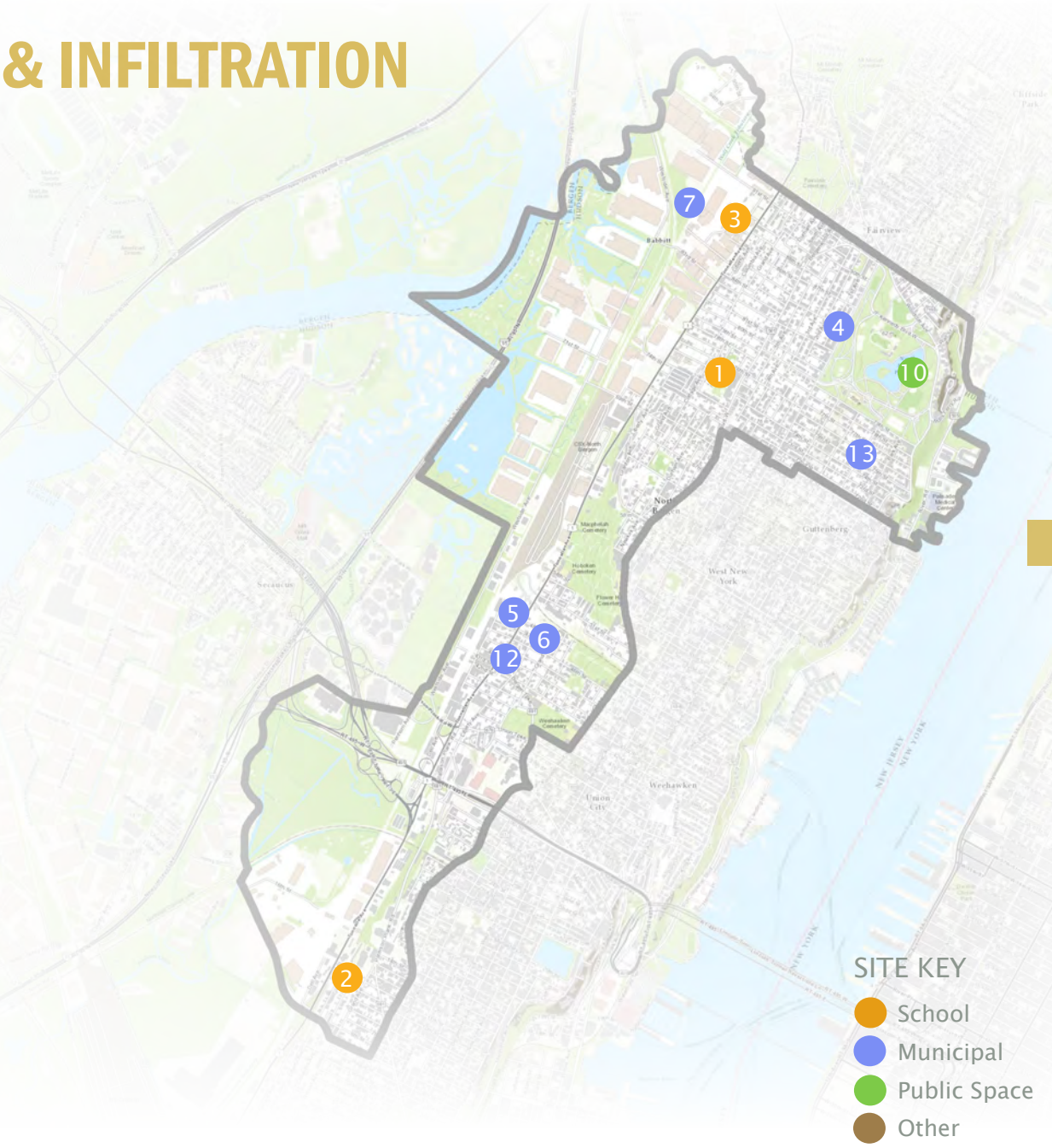
STORAGE, QUANTITY, & INFILTRATION SYSTEM SUITABILITY

Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. These systems include:

- Permeable pavers
- Porous asphalt
- Pervious concrete

The paving material is placed over a bed of uniformly graded stone. The paving materials allow water to pass through and then infiltrate into the pore spaces of the underlying stone bed. The stored runoff then infiltrates over time into the uncompacted subgrade soils.

Stormwater planters are small, contained vegetated systems that collect and treat stormwater using a prepared soil media and mulch. These systems serve as small bioretention facilities filtering stormwater through layers of mulch, soil, and plant root systems. Treated stormwater can then be infiltrated into existing surrounding soils as groundwater (infiltration planter), or if infiltration is not appropriate, drainage pipes can discharge filtered stormwater into traditional storm sewer infrastructure (flow-through planter).



STORAGE, QUANTITY, & INFILTRATION SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

Stormwater flows quickly over impervious surfaces where it can contribute to flooding downhill.

STORAGE, QUANTITY, & INFILTRATION SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

Creating curbside stormwater planters in no-parking zones will intercept stormwater runoff and provide traffic calming for pedestrians.


TREE
PLANTING

COMMUNITY ENGAGEMENT & EDUCATION

BUILD A RAIN BARREL WORKSHOP

With the Build a Rain Barrel Workshop, community members participate in a short presentation on stormwater management and water conservation and then learn how to build their own rain barrel. Workshop participants work with trained experts to convert 55 gallon plastic food-grade drums into rain barrels. They are quickly able to take an active role in recycling rainwater by installing a rain barrel at their house! Harvesting rainwater has many benefits including saving water, saving money, and preventing basement flooding. By collecting rainwater, homeowners are helping to reduce flooding and pollution in local waterways. When rainwater flows across hard surfaces like rooftops, driveways, roadways, parking lots, and compacted lawns, it carries pollution to our local waterways. Harvesting the rainwater in a rain barrel is just one of the ways homeowners can reduce the amount of rainwater draining from their property and help reduce neighborhood flooding problems.

STORMWATER MANAGEMENT IN YOUR SCHOOLYARD

The *Stormwater Management in Your Schoolyard* program provides educational lectures, hands-on activities, and community-level outreach for students on the topics of water quality issues and stormwater management practices such as rain gardens and rain barrels. Program objectives include the exploration of various aspects of the natural environment on school grounds, the detailed documentation of findings related to these explorations, and the communication of these findings to the school community. As part of this program, several New Jersey State Core Curriculum Content Standards for science (5.1, 5.3, and 5.4), twenty-first century life and careers (9.1, 9.3, and 9.4), and social studies (6.3) are addressed. Every school is unique in its need for stormwater management, so each school's *Stormwater Management in Your Schoolyard* program can be delivered in a variety of ways. This program can be tailored for grades K-8 or 9-12 and can be offered to meet a variety of schedules.




MAINTENANCE PROCEDURES

MAINTAINING NORTH BERGEN'S GREEN INFRASTRUCTURE SYSTEMS

1. VEGETATED SYSTEMS
   - Rain Garden
   - Stormwater Planter
   - Bioswale

2. RAINWATER HARVESTING
   - Rain Barrel
   - Cistern

3. STORAGE, QUANTITY, AND INFILTRATION
   - Porous Asphalt & Concrete
   - Underground Detention

VEGETATED SYSTEM MAINTENANCE

RAIN GARDEN:

Weekly

- Water
- Weed
- Inspect for invasive plants, plant health, excessive sediment, and movement of sediment within the rain garden
- Observe the rain garden during rain events and note any successes (Example of success: stormwater runoff picks up oil and grease from the parking lot, flows through a curb cut, and into a rain garden; the rain garden traps the nonpoint source pollutants before they reach the nearby waterway)

Annually

- Mulch in the spring to retain a 3-inch mulch layer in the garden
- Prune during dormant season to improve plant health
- Remove sediment
- Plant
- Test the soil (every 3 years)
- Harvest plants to use in other parts of the landscape
- Clean debris from gutters connected to rain garden
- Replace materials (such as river rock and landscape fabric) where needed

STORMWATER PLANTER

- Very similar maintenance regime to rain gardens

BIOSWALE

- Very similar maintenance regime to rain gardens

RAINWATER HARVESTING SYSTEM MAINTENANCE

RAIN BARREL:

- Keep screen on top and a garden hose attached to the overflow to prevent mosquitoes; change screen every two years
- Remove debris from screen after storms
- Disconnect the barrel in winter; store inside or outside with a cover
- Clean out with long brush and water/dilute bleach solution (~3%)

CISTERN:

- In the fall, prepare your cistern for the winter by diverting flow so that no water can enter and freeze within the tank
- Weekly check: Check for leaks, clogs, obstructions, holes, and vent openings where animals, insects, and rodents may enter; repair leaks with sealant; drain the first flush diverter/ roof washer after every rainfall event
- Monthly check: Check roof and roof catchments to make sure no debris is entering the gutter and downspout directed into the cistern; keep the roof, gutters, and leader inlets clear of leaves; inspect the first flush filter and all of its attachments, making any necessary replacements; inspect cistern cover, screen, overflow pipe, sediment trap, and other accessories while making any necessary replacements

STORAGE, QUANTITY, & INFILTRATION SYSTEM MAINTENANCE

POROUS ASPHALT & CONCRETE:

- Materials cost is ~20-25% more than traditional asphalt or concrete
- Long-term maintenance is required by routine quarterly vacuum sweeping
- Sweeping cost may be off-set by reduced deicing costs
- Asphalt repairs can be made with standard asphalt not to exceed 10% of surface area
- Concrete repairs can be made with standard concrete not to exceed 10% of the surface area

UNDERGROUND DETENTION:

- Periodic inspections of the inlet and outlet areas to ensure correct operation of system
- Clean materials trapped on grates protecting catch basins and inlet area monthly
- Primary maintenance concerns are removal of floatables that become trapped and removal of accumulating sediments within the system; this should be done at least on an annual basis
- Proprietary traps and filters associated with stormwater storage units should be maintained as recommended by the manufacturer
- Any structural repairs required to inlet and outlet areas should be addressed in a timely manner on an as needed basis
- Local authorities may require annual inspection or require that they carry out inspections and maintenance

POTENTIAL PROJECT SITES

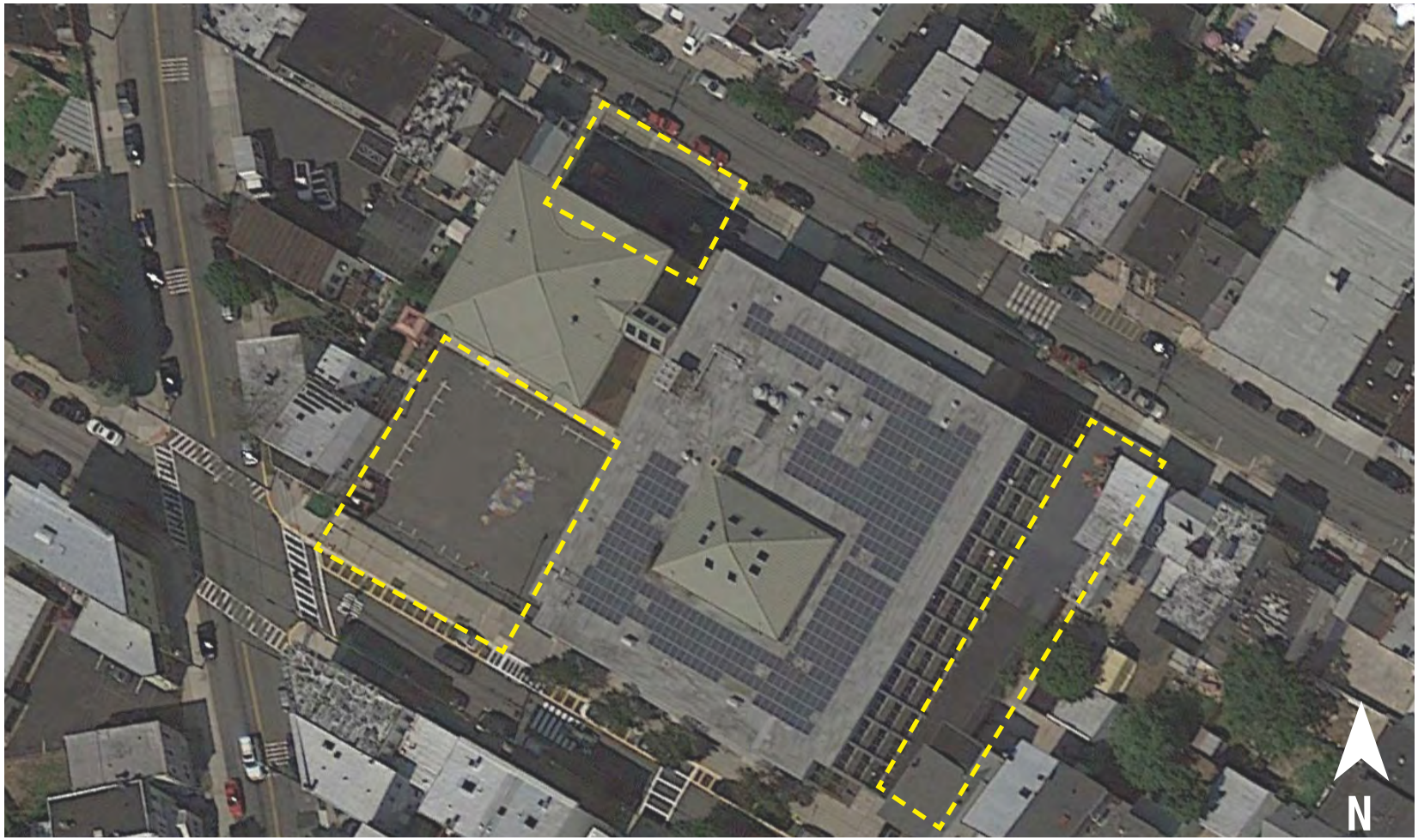
7417 John F. Kennedy Boulevard
North Bergen, NJ 07047



The North Bergen High School building has internally fed rooftop drainage. Demonstration rain gardens could manage roadway runoff in the front and side lawns of the school. A cistern could be used to harvest rooftop runoff from the downspouts on a greenhouse structure located on the rear grounds of the school. Water collected in the cistern could be used to irrigate the plants in the greenhouse. Although parking is limited and in good condition, paved areas of lower traffic could be paved with porous asphalt when the lots are repaved.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] tree pits
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [x] cisterns
- [x] pervious pavement
- [ ] bioswales
- [ ] depaving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This site is a public elementary school with grounds containing a basketball court and a playground. The court is graded to drain over the sidewalk and into catch basins on adjacent streets. Stormwater runoff can be intercepted in pervious strips along the pavement edges, parallel to the court fence. Although the condition of the pavement is good at this time, pervious pavement should be considered when repaving. A portion of the building has downspouts that are directly connected to the sewer. These can be diverted into rainwater harvesting systems like rain barrels and cisterns or into raised stormwater planters. Water harvested from the tanks can be used as a water source for an outdoor classroom or community garden. This strategy can be replicated at many North Bergen public schools.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

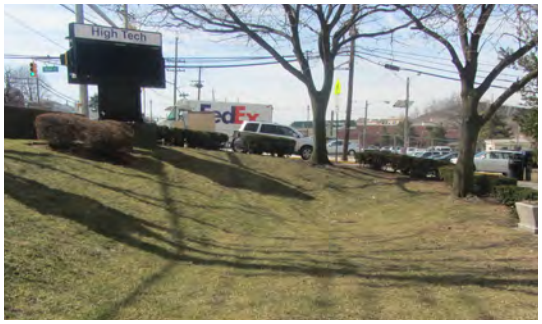
- ☐ rain gardens
- ☐ tree pits
- ☑ stormwater planters
- ☑ rain barrels
- ☐ buffers
- ☑ cisterns
- ☑ pervious pavement
- ☐ bioswales
- ☐ depaving

JOHN F. KENNEDY SCHOOL

1210 11th Street
North Bergen, NJ 07047

HUDSON COUNTY SCHOOL OF TECHNOLOGY
EVENING AND ADULT HIGH SCHOOL

2000 85th Street
North Bergen, NJ 07047




Hudson County School of Technology Evening and Adult High School is a large campus of buildings and parking lots, many of which have downspouts directly connected into the sewer system or discharge directly onto impervious surfaces. Rain gardens are only feasible in the front and side of the main building, where open lawn space exists. Depaving could provide additional sites of green infrastructure and reduce overall impermeability.

Stormwater planters and tree pits in sidewalks could intercept roadway runoff and rainwater to prevent flooding downhill. Downspouts near asphalt parking surfaces could be redirected onto pervious pavements like porous asphalt or permeable pavers to manage their stormwater flow. Redirecting downspouts into a cistern or rain barrel is another method of disconnection. Water harvested from the cistern could be used to wash county vehicles or irrigate landscape features.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] tree pits
- [x] stormwater planters
- [x] rain barrels
- [ ] buffers
- [x] cisterns
- [x] pervious pavement
- [ ] bioswales
- [x] depaving

HUDSON COUNTY SCHOOL OF TECHNOLOGY EVENING AND ADULT HIGH SCHOOL

2000 85th Street
North Bergen, NJ 07047


N



This site is a branch of the North Bergen Free Public Library. The asphalt parking lot is in fair condition and could be repaved with porous asphalt to retain stormwater on site. A strip of porous pavement/ sidewalk or stormwater planter may also be used to intercept parking lot runoff before it reaches the street and catch basins. Empty tree pits across the street could be planted with trees and retrofitted with stormwater storage capacity underground. This strategy could be replicated at other municipal buildings and streetscapes.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☑ tree pits
- ☑ stormwater planters
- ☐ rain barrels
- ☐ buffers
- ☐ cisterns
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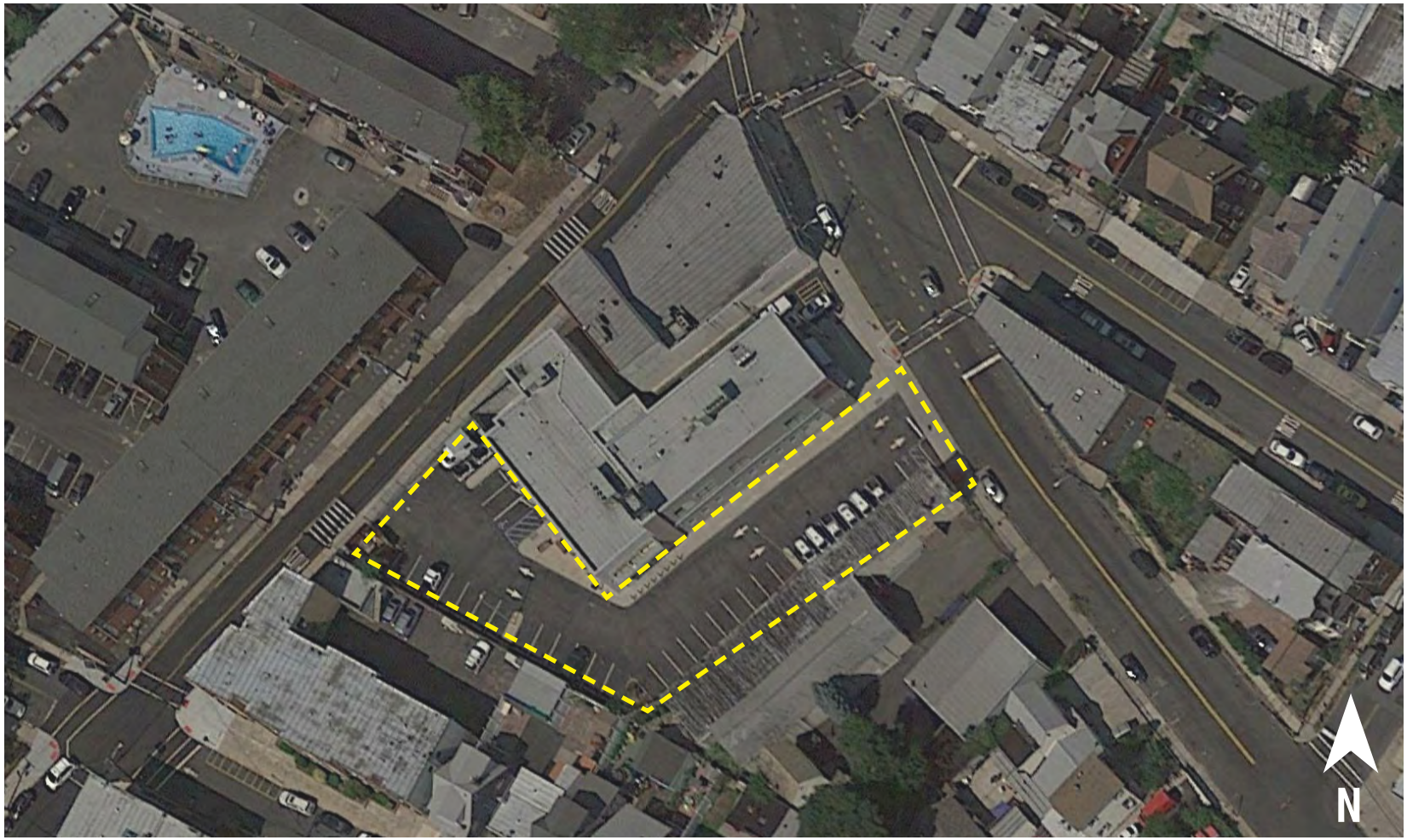
- ☐ bioswales
- ☐ depaving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North Bergen Parking Authority building has internally fed rooftop drainage and no visible downspouts. Many of the parking stalls in the surrounding asphalt lot are for municipal vehicles only, and the lot has minimal traffic. Parking stalls can be repaved using porous asphalt or permeable pavers to intercept and store stormwater runoff before it reaches a catch basin. This strategy could be replicated at other municipal buildings.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [ ] rain gardens
- [ ] rain barrels
- [x] pervious pavement
- [ ] tree pits
- [ ] buffers
- [ ] bioswales
- [ ] stormwater planters
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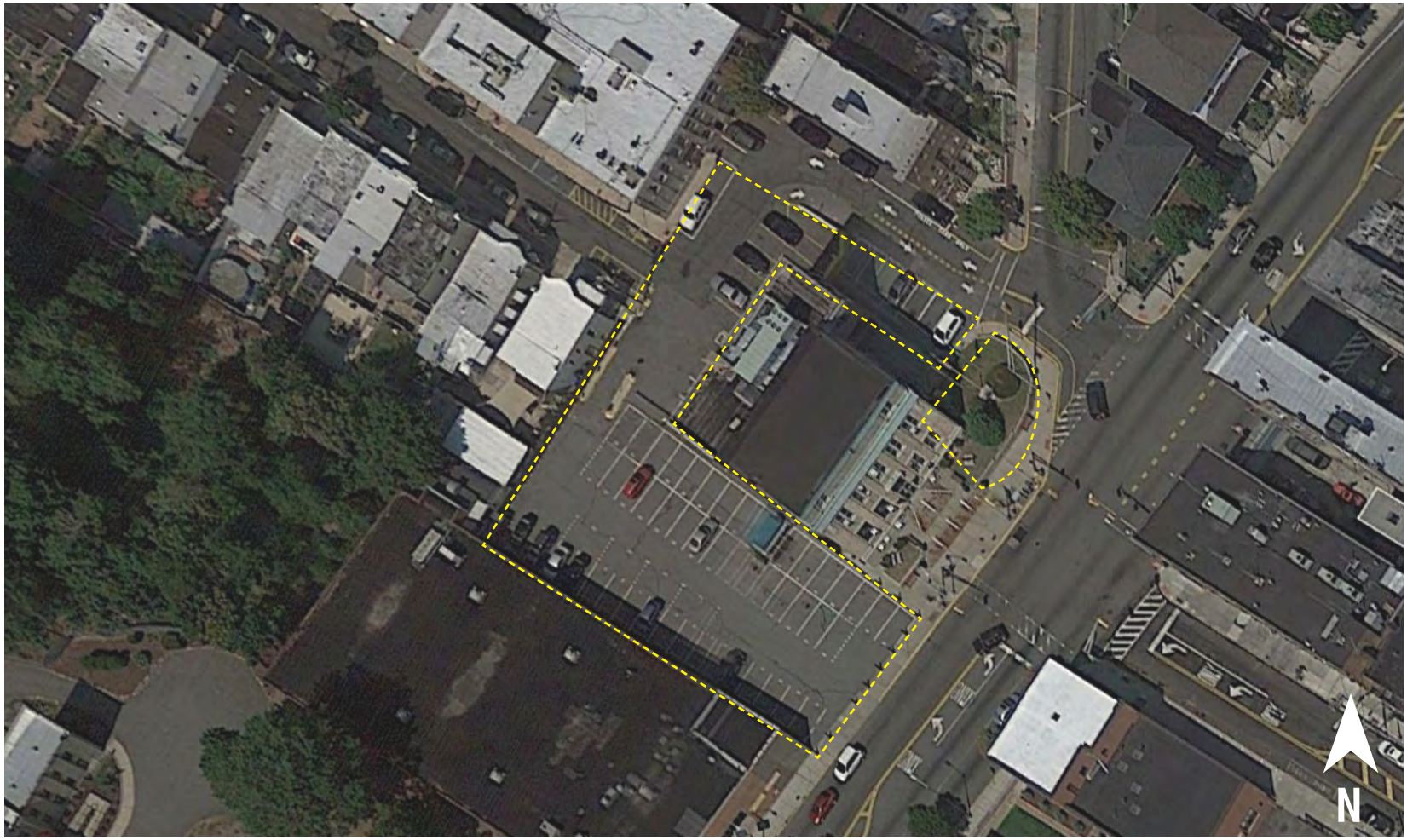
- [ ] depaving



NORTH BERGEN MUNICIPAL BUILDING

4233 John F. Kennedy Boulevard West
North Bergen, NJ 07047


The North Bergen municipal building has external downspouts directly connected to the sewer system. Rooftop runoff could be diverted into a cistern. Water collected in the cistern could be used to wash municipal vehicles on site or at the adjacent North Bergen police building. Porous asphalt could be considered when repaving the visitor and staff parking areas.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ tree pits
- ☐ buffers
- ☐ bioswales
- ☐ stormwater planters
- ☑ cisterns
- ☐ depaving

NORTH BERGEN COMMUNITY POOL

2111 91st Street
North Bergen, NJ 07047

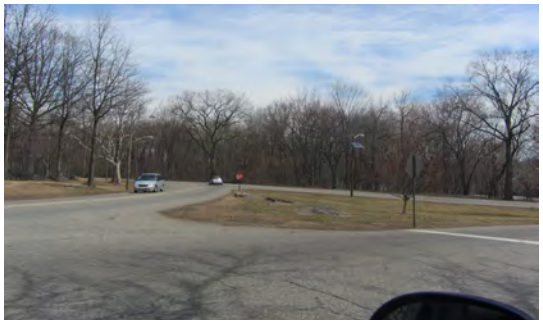
The North Bergen Community Pool is a municipal outdoor swimming pool complex. The site has several small bathhouse structures, tree plantings, and a large asphalt parking area. Grassed islands in the parking lot are potential sites for curbside rain gardens or stormwater planters that would intercept stormwater runoff. Strategic areas in the parking lot could be repaved with porous asphalt to increase stormwater storage and infiltration on site. Rooftop runoff could be redirected into a rain garden or a landscaped strip.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] tree pits
- [x] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [x] pervious pavement
- [ ] bioswales
- [ ] depaving

8701 John F. Kennedy Boulevard East
North Bergen, NJ 07047



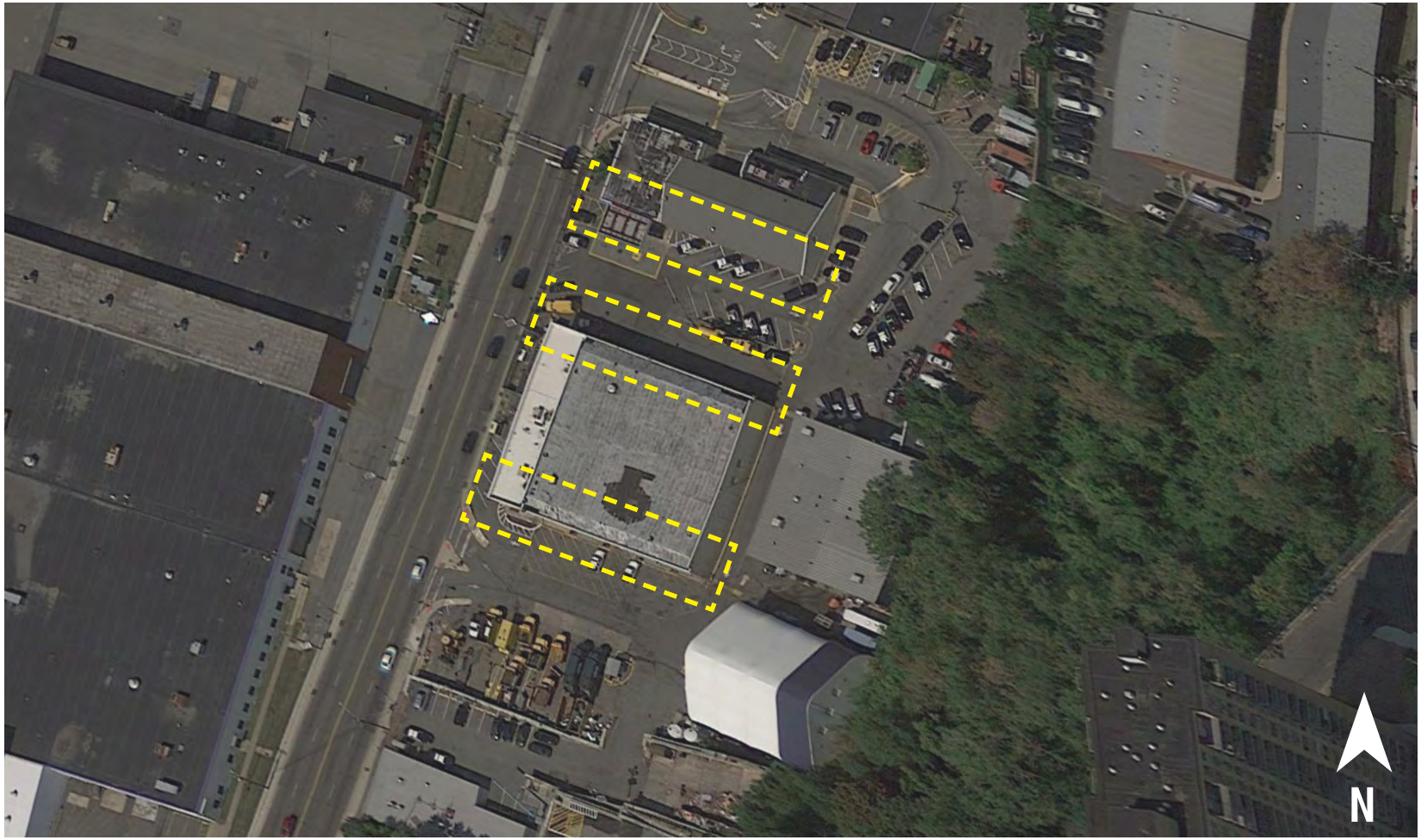


James J. Braddock Park is a large Hudson County park. There are many opportunities for green infrastructure in Washington Park, including rain gardens, bioswales, buffers, tree pits, and pervious pavement. Rain gardens, bioswales, and landscaped buffers placed adjacent to sidewalks and roadways could intercept stormwater runoff, slow erosion and ponding, and beautify open lawn areas. Most of the pavement in the park is in fair condition, and as older sections are replaced, they could be repaved with pervious pavers or porous asphalt.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] tree pits
- [ ] stormwater planters
- [ ] rain barrels
- [x] buffers
- [ ] cisterns
- [x] pervious pavement
- [x] bioswales
- [ ] depaving

8701 John F. Kennedy Boulevard East
North Bergen, NJ 07047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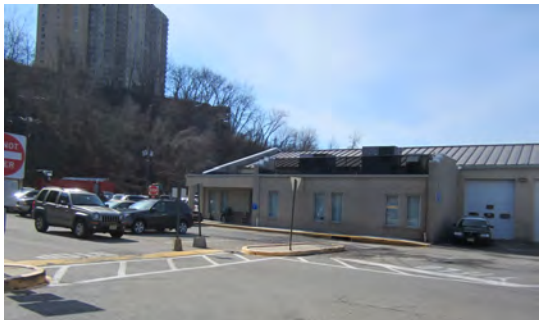


The North Bergen Department of Public Works facilities have several garage structures with downspouts located on Tonnelle Avenue and 61st Street. Roof runoff is captured and externally piped onto the asphalt parking lot. Downspouts can be diverted into a cistern. Rainwater harvested from the cistern tank can be used to wash the township vehicles on site.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [ ] rain gardens
- [ ] rain barrels
- [ ] pervious pavement
- [ ] tree pits
- [ ] buffers
- [ ] bioswales
- [ ] stormwater planters
- [x] cisterns
- [ ] depaving


N

The North Bergen Municipal Utilities Authority consists of two buildings and an asphalt parking lot. The administration building has downspouts directly connected into the sewer system. These downspouts could be redirected into rain gardens in the front and rear lawns to manage stormwater from the rooftop. Lawn and parking islands adjacent to the asphalt parking lot are also potential sites for rain gardens. A downspout could also be directed into a rainwater harvesting system like a cistern. Stormwater collected in the cistern can be used to wash municipal vehicles or irrigate landscaping on site.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] tree pits
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [x] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [ ] depaving

MUNICIPAL PARK

1228 46th Street
North Bergen, NJ 07047



Park and recreation open space is suitable for green infrastructure like rain gardens, landscape buffers, and bioswales. Stormwater often flows from paved playgrounds and adjacent streets and sidewalks over open lawn causing flooding and erosion downhill. Rain gardens, native landscape plantings, or bioswales strategically placed in the path of stormwater runoff can help hold water and allow it to infiltrate into the ground. A maintenance shed at this park in particular could collect rainwater in a cistern. Water from the cistern could be used to irrigate landscaping or a community garden. The Township of North Bergen can apply this model to other municipal parks and playgrounds across the town including:

1228 46th Street Park/Baseball field
76th Street Little League field
1811 Paterson Plank Road (upcoming park development)

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] tree pits
- [ ] stormwater planters
- [ ] rain barrels
- [x] buffers
- [x] cisterns
- [ ] pervious pavement
- [x] bioswales
- [ ] depaving

PARKING AUTHORITY
STREET PARKING LOTS

28th Street and Grand Avenue
North Bergen, NJ 07047



The following sites are municipal street parking lots. They serve as great opportunites for porous asphalt or curbside stormwater planters to capture both roadway stormwater runoff and rainwater.

Bove Terrace
Grand Avenue
28th Street

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ tree pits
- ☐ buffers
- ☐ bioswales
- ☑ stormwater planters
- ☐ cisterns
- ☐ depaving

PARKING AUTHORITY STREET PARKING LOTS

28th Street and Grand Avenue
North Bergen, NJ 07047

PARKING AUTHORITY
OFF-STREET PARKING LOTS

Park Avenue and 75th Street
North Bergen, NJ 07047



The following sites are designated municipal parking lots. They serve as great opportunites for porous asphalt to capture both stormwater runoff and rainwater.

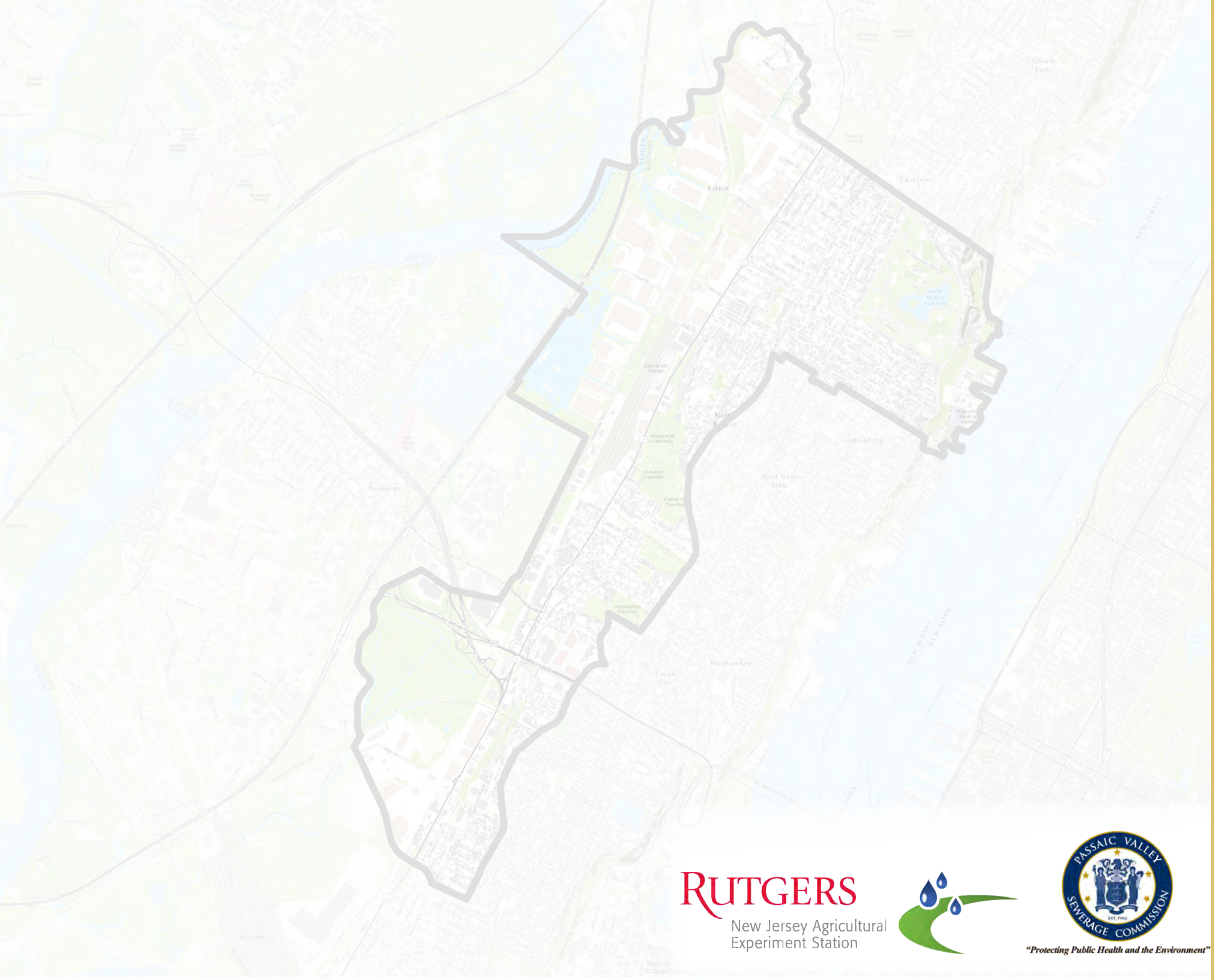
14th Street
Dietz Place
Meadowview Avenue
51st Street
Bergenline Avenue
Broadway and 73rd Street
Broadway and 74th Street
Park Avenue and 75th Street
Kennedy Boulevard and 21st Street

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ tree pits
- ☐ buffers
- ☐ bioswales
- ☐ stormwater planters
- ☐ cisterns
- ☐ depaving

PARKING AUTHORITY OFF-STREET PARKING LOTS

Park Avenue and 75th Street
North Bergen, NJ 07047



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PASSAIC VALLEY SEWERAGE COMMISSION
EST. 1902

"Protecting Public Health and the Environment"