



COMMUNITY-BASED GREEN INFRASTRUCTURE FOR THE CITY OF CAMDEN

Feasibility Study

November 2011



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Beginning in July 2010, numerous individuals and organizations have contributed to this feasibility study for the City of Camden. The following represents our best efforts to recognize those who have actively supported the work needed to complete this study.

- City of Camden
- Camden County Municipal Utilities Authority
- New Jersey Department of Environmental Protection Brownfields Program
- New Jersey Tree Foundation
- Cooper's Ferry Partnership
- Camden County Soil Conservation District
- Cramer Hill Community Development Corporation
- Center for Environmental Transformation
- Camden Children's Garden/Camden City Garden Club
- Parkside Business and Community in Partnership



Cooperating Agencies: Rutgers, The State University of New Jersey, U.S. Department of Agriculture, and County Boards of Chosen Freeholders. Rutgers Cooperative Extension, a unit of the Rutgers New Jersey Agricultural Experiment Station, is an equal opportunity program provider and employer.

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EXECUTIVE SUMMARY

In July 2010 the Rutgers Cooperative Extension (RCE) Water Resources Program entered into a partnership with the Camden County Municipal Utilities Authority (CCMUA) to pilot a community-based initiative implementing green infrastructure projects throughout the City of Camden.

As a result of this partnership, the Camden SMART (Stormwater Management and Resources Training) Initiative formed. This initiative is a collaboration between the City of Camden, CCMUA, the RCE Water Resources Program, New Jersey Tree Foundation (NJTF), Cooper's Ferry Partnership (CFP), the Center for Environmental Transformation (CfET), New Jersey Department of Environmental Protection (NJDEP), public-private partners, community organizations, and most importantly, Camden residents to restore and revitalize their neighborhoods. The objective of the Camden SMART Initiative is to develop a comprehensive network of green infrastructure programs and projects for the City of Camden. The initiative includes neighborhood green and grey infrastructure projects, stormwater management policy development, and green infrastructure training programs. More information on the Camden SMART Initiative can be found in on page six.

This pilot program focuses on reducing negative impacts to waterways as well as negative impacts of combined sewer overflows (CSOs), flooding, and sewer backups on private properties. This program is about improving the quality of life of the residents of Camden. Camden SMART is taking the first steps needed to develop this community-based initiative. The pilot program included:

- Educating community leaders, businesses, and residents on the benefits and opportunities for green infrastructure projects
- Providing training to local residents and contractors on green infrastructure installation techniques
- Establishing a network of community-based organizations to provide capacity for continual growth and expansion of the program

The RCE Water Resources Program, working with Camden SMART partners, completed the following tasks:

- Hosted a series of local workshops and meetings with community leaders and activists from each Camden City neighborhood
- Identified a total of 40 priority demonstration rain garden, water harvesting, and green infrastructure projects throughout the City of Camden



- Prepared concept designs for these 40 priority demonstration green infrastructure projects
- Established a community-based network to support on-going development, installation, operation, and maintenance of green infrastructure projects
- Prepared a city-wide feasibility study for green infrastructure projects (rain gardens, rain barrels, water harvesting, pervious paving, etc.)

The initial target is to identify and secure funding to implement pilot rain gardens, rainwater harvesting, and other green infrastructure projects to reduce stormwater runoff flows to the combined sewer system in the City of Camden.

Within the first year, this pilot program resulted in the construction of eight demonstration projects throughout the City of Camden, including 11 rain gardens designed to capture, treat, and infiltrate over 800,000 gallons of stormwater each year.

INTRODUCTION

Camden is home to nearly 80,000 residents living in an area totaling 10.6 square miles. The median household income is \$23,421, less than half of the New Jersey median household income, and over 35% of the population lives below the poverty level.¹ Many neighborhoods contain multiple vacant properties that have been abandoned by commerce and industry over the past century. These industries have left behind aging infrastructure and a questionable environmental legacy, and still today City residents experience impacts to their quality of life from deteriorating sewer infrastructure, polluting industrial facilities, high diesel emissions, and multiple contaminated sites.

The Problem

Camden is one of 24 communities in New Jersey that have combined sewer systems. Combined sewer systems (CSOs) are designed to carry sanitary sewage at all times and during rainfall events; they also carry stormwater runoff collected from roadways and other impervious surfaces. This dual role of carrying both sanitary sewage and stormwater runoff defines the “combined” purpose of the system. The City has a total of 28 CSO points discharging to three waterways.²

Constructed in the late 19th century, the City’s sewer system is not equipped to handle today’s sanitary and stormwater flows. Today’s flow levels have placed tremendous pressures on the aging sewer infrastructure.



In many cases, the combined sewer system no longer has the capacity to carry all of the stormwater runoff generated during storm events along with the sanitary sewage. When the capacity of the system is exceeded, this causes an overflow into the nearest waterbody. Often this untreated sewage does not even make it to the river, but is surcharged through manhole covers into the streets of Camden or backs up into private properties, creating a human health hazard. This overflow carries with it untreated wastewater containing pathogens (disease causing organisms), floatable

Photo Credit: Andrea Ferich, The CFET

debris, toxic metals, settleable solids, toxic organic chemicals, nutrients, and organic contaminants, degrading water quality and adversely impacting aquatic animals, plants, and human health in certain situations.

Communities with CSO systems are continuing to struggle to better manage the systems, reducing overflows and upgrading failing piping, pump stations, and treatment facilities. The investment funding needed for this “grey infrastructure” upgrade is tremendous. New and larger infrastructure systems and facilities are extremely costly and require a long-term commitment and investment of capital and effort.

Need and Opportunity

In addition to “grey infrastructure” improvements, new methods of stormwater management in urban areas using a “green infrastructure” approach are proving cost-effective in many communities throughout the United States. These programs integrate water resources management with improvement of human quality of life as well as community and environmental enhancement to reduce stormwater runoff volumes to combined sewer systems.

Today, Camden residents throughout each of the City’s 20 unique neighborhoods are working at the grassroots level to capitalize on political, economic, and social changes which promise to highlight the positive attributes of Camden’s excellent location, diverse population, tremendous infrastructure, and rich culture. With reinvestment and revitalization plans continuously being proposed throughout the City, now is an ideal time for Camden residents to participate in green infrastructure planning and sustainable water resources management. Numerous industrial and brownfield sites, along with vacant and abandoned commercial and residential properties, can provide space for a new stormwater management approach in the City. Residents and businesses will need to invest in Camden over the next several decades, making it imperative for the City to endorse a stormwater management strategy which allows for an improved quality of life for its current and future residents. Green infrastructure needs to be implemented simultaneously with redevelopment and economic growth to maximize the benefits to Camden residents. Given the current availability of land and space throughout much of the City, planning and designing for easily accessible neighborhood services, sustainable communities, and green infrastructure is a reality.

What is Green Infrastructure?

Green infrastructure is an adaptable term used to describe an array of products, technologies, and practices that use natural systems – or engineered systems that mimic natural processes – to enhance overall environmental quality and provide infrastructure services. As a general principal, green infrastructure techniques use soils and vegetation to infiltrate, evapotranspire, and/or recycle stormwater runoff. When used as components of a stormwater management system, green infrastructure practices such as rain gardens, water conservation and rainwater harvesting, porous pavements, green roofs, downspout disconnections, planter boxes and tree box filters, and greenways, open space, and landscape plantings can produce a variety of environmental benefits. These green infrastructure practices are briefly discussed in Appendix A starting on page 19. In addition to effectively retaining and infiltrating rainfall, these technologies can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat island effect, and sequester carbon while also providing communities with aesthetic and natural resource benefits.³



CAMDEN SMART INITIATIVE

The Camden SMART Initiative was formed to improve the quality of life and environmental and economic health of the City of Camden. The future of Camden is inextricably tied to the environmental and economic health of the region. A green stormwater infrastructure approach is the most environmentally beneficial and economically favorable way to remediate the effects of urbanization on the region's waterways. Sustainability needs to be a fundamental component of the revitalization strategy for the City of Camden. A holistic, sustainable approach can generate economic development, improve the lives and health of Camden residents, and improve the quality of the water and air. The Camden SMART Initiative will benefit the City of Camden by:

- Preventing neighborhood flooding
- Reducing combined sewer overflows
- Creating sustainable green jobs
- Improving air, water and climate quality
- Developing environmental policy
- Increasing property values
- Providing economic development opportunities
- Adding recreational amenities and open space
- Beautifying neighborhoods

Photo, immediate right: Mayor Dana Redd and Father Michael Doyle cut down branches and cleaned up an abandoned lot at the Camden SMART Earth Day event in Waterfront South, April 2010.

Photo Credit: Jessica Franzini, NJTF (all three photos)



PROJECT TYPE	PROJECT LOCATION	STORMWATER CAPTURED GALLONS PER YEAR	PROJECT PAGE
Rain Garden	1645 Ferry Ave	75,000	86-87
Rain Garden	S Broadway & Chelton Ave	470,000	84-85
Rain Garden	Park Blvd & Magnolia Ave	60,000	78-79
Rain Garden	Park Blvd & Vesper Ave	40,000	80-81
Rain Barrels	304 State St	4,600	75
Rain Garden	N 20th St & River Ave	63,000	40-41
Rain Garden	Jackson St & N 8th St	110,000	65-66
TOTAL STORMWATER RUNOFF CAPTURED: 822,600 gallons per year			

Partnering with local community-based organizations is critical to establishing lasting relationships in the City. Each of the City's 20 neighborhoods is unique. A successful city-wide program for green infrastructure that is embraced by the community will be dependent upon strong local relationships with multiple community-based organizations and activist groups. Through local partners, the effort will be able to effectively engage residents providing the necessary education and programming outlining the need for green infrastructure; the many benefits it can provide to the community at the lot, block, and neighborhood scales; and the opportunities for improvements and changes in future planning, redevelopment and reinvestment projects.

Refer to Camden SMART's website for more information about Camden SMART projects, upcoming events, and green infrastructure: www.camdensmart.com.

The Camden SMART is a federation of six entities: The City of Camden, CCMUA, NJDEP, RCE Water Resources Program, CFP, and NJTF.

City of Camden

Under the leadership of Mayor Dana L. Redd, the City of Camden is deeply committed to the implementation of the Camden SMART Initiative. Strengthening communities and revitalizing neighborhoods in the City of Camden includes not only economic sustainability, but also environmental sustainability. Effectively managing stormwater in the City of Camden not only will help prevent neighborhood flooding and combined sewer overflows, but can also tackle other issues such as air pollution, recreational needs and neighborhood beautification. The City of Camden is dedicated to educating residents and community leaders about the benefits of stormwater management and green infrastructure through neighborhood projects, training programs, and the incorporation of stormwater management into city policies.

Camden County Municipal Utilities Authority

The CCMUA is responsible for the treatment of sewage discharged from properties in Camden County. Inefficient management of stormwater, especially where there are combined sewers, impacts the capacity of the CCMUA to treat wastewater and increases the incidence of combined sewer overflows to the river. The CCMUA is supportive of the Camden SMART Initiative as it may reduce the quantity of stormwater that 1) is conveyed to CCMUA plant, 2) discharges to the Delaware River, 3) floods Camden's streets and/or residents' homes. As a Camden SMART partner, the CCMUA has pledged to assist with project coordination and implementation, as well as the identification of potential funding for the initiative.

New Jersey Department of Environmental Protection

NJDEP is continually striving to protect the air, waters, land, and natural resources of the State of New Jersey to ensure continued public benefit. NJDEP has targeted experience in Camden and is working towards to the effective implementation and enforcement of environmental laws to protect the health and safety of Camden residents. NJDEP has pledged to offer institutional support for the SMART Initiative and its efforts to eliminate the disproportionate environmental hazards in the City of Camden. NJDEP will also aid in locating additional funding for the maintenance of the program.

Rutgers Cooperative Extension Water Resources Program

The RCE Water Resources Program is a major contributor to the SMART team through its preparation of a comprehensive feasibility study for the implementation of green infrastructure projects in Camden. Working at the neighborhood level, RCE is dedicated to educating community leaders and residents through a series of local workshops and community meetings. To ensure the longevity of the initiative, RCE will provide technical assistance and job training to local organizations and contractors for green infrastructure project implementation and maintenance. RCE will also work alongside the other SMART partners to secure funding for the initiative.

Cooper's Ferry Partnership

CFP is a non-profit corporation based in Camden, New Jersey. Since its inception in 1984, CFP has made its mission to facilitate the revival of the City of Camden as a place where people choose to live, work, visit, and invest. To reach this goal, CFP develops visionary long-range plans for the redevelopment of Camden's extensive waterfronts working with private sector, government, and community partners to implement these plans from vision to reality. Through the implementation of these high-quality development projects, seeks to enhance the economic and environmental health of the City by:

- Stimulating economic development and creating jobs for City residents
- Strengthening Camden's connections to its physical assets including its waterways, regional rail and road network, and proximity to Center City Philadelphia
- Leveraging public investment into parks and infrastructure to improve quality of life, create recreational opportunities, and attract private reinvestment
- Cultivating vibrancy and a strong sense of place through physical upgrades and programming
- Working with all residents and stakeholders to improve the City of Camden

Starting in 2011, Cooper's Ferry has taken a leadership role in facilitating the Camden SMART Initiative.

New Jersey Tree Foundation

NJTF is working to reforest New Jersey's most urban cities, where the need is greatest. Through tree planting, volunteerism and partnerships, NJTF assists numerous communities in improving their environment and quality of life. Community-based tree plantings involve city residents and volunteers. NJTF provides training so that local residents can take charge and complete tree planting projects themselves.

In the City of Camden, NJTF has developed the Urban Airshed Reforestation Program (UARP). This effort was started in 2002 to improve Camden's air and water quality while empowering residents to create positive changes in their own neighborhoods. Through the UARP, Camden residents apply for trees along their streets and then work with NJTF to organize tree plantings in their communities.

As of November 2011, NJTF has planted 4,402 trees with over 145 community groups and nearly 9,000 volunteers. In doing so, they have removed over 70,000 square feet of impervious surfaces. These trees have a 95% survival rate thanks to high levels of resident-based stewardship and participation in the UARP Camden TreeKeepers Workshops.

NJTF has become an active participant and leader for the Camden SMART Initiative within the City. They organize community-based tree plantings in Camden every spring and fall, removing impervious cover and allowing stormwater infiltration. Additionally, NJTF distributes information and serves as a community liaison with numerous neighborhood groups and resident volunteers.

ENGAGING THE PUBLIC

During winter and spring 2011, a series of public meetings were held in the City of Camden. Five individual evening meetings were scheduled in various locations throughout the City. Each meeting targeted residents within four or five of the City's 20 unique neighborhoods. Jessica Franzini of NJTF facilitated and organized the meetings with technical assistance from the RCE Water Resources Program. RCE Water Resources Program, NJTF, and CFP presented information in order to educate residents about the issues of combined sewer systems and the benefits and opportunities of green infrastructure. In addition, residents were asked to provide information on localized flooding and sewer backups in their neighborhoods. Information was gathered during these meetings on local neighborhood groups, organizations, community gardens, and civic buildings and activities. This information provided insight into potential community partners and sites for demonstration green infrastructure projects.

Community Meetings

On February 10th the first community meeting was held in Waterfront South at the CCMUA administrative building on Ferry Avenue. The meeting targeted residents in the Waterfront South, Bergen Square, Centerville, Morgan Village, and Fairview neighborhoods. A total of 35 attendees participated in the meeting. Subsequent meetings included:

- February 15th, meeting held in Cramer Hill at Christus Lutheran Church targeting residents in the Cramer Hill, Rosedale, Dudley, Stockton and Marlton neighborhoods (18 attendees)
- February 22nd, meeting held in Parkside at the MLK Community Center targeting residents from the Parkside, Whitman Park, Liberty Park, and Gateway neighborhoods (17 attendees)
- March 22nd, a public information meeting was held at Camden City Hall with residents from the Liberty Park Neighborhood (11 attendees)
- April 7th, meeting held in North Camden at the Respond Senior Center targeting residents from the North Camden, Lanning Square, Cooper Grant, and Central Business District neighborhoods (36 attendees)

These meetings provided valuable interaction with local residents. The project team members used neighborhood maps and short surveys to engage participants in discussions regarding flooding and sewer issues at the neighborhood and block scale. The comments, input, and results of these discussions are included in the attachments of this study. Each neighborhood has a detailed summary and map outlining its unique issues and opportunities. The input provided by residents, in combination with

digital mapping, were used to direct surveys and site selection of priority demonstration projects throughout the City. In total, over 40 projects and programs were identified that will serve as the first efforts to implement green infrastructure practices on a city-wide scale.

This is a unique approach to incorporating green infrastructure into an urban community. Most of the green infrastructure initiatives are top down initiatives that are organized and managed by large governmental bodies. In Camden, the thought was to first gain community support through informative meetings, educational workshops, and demonstration projects. Once the community embraced the green infrastructure concepts and gained trust in the partnership working to incorporate green infrastructure into the City, the green infrastructure movement made rapid advances.

The concept of green infrastructure for the City of Camden was embraced quickly by local groups and the City of Camden.

Community-based Non-profit Organizations

Individual meetings with several Camden area organizations were held. These organizations serve a leadership role in individual neighborhoods throughout the City working to provide services and resources to local residents and to directly assist with a variety of redevelopment and reinvestment projects and programs. These groups, along with many others, provide an important and trusted connection with local City residents, as well as a wealth of knowledge specific to the City and its neighborhoods. Camden SMART is always looking for new opportunities to establish partnerships with other organizations.

Cramer Hill Community Development Corporation

Cramer Hill Community Development Corporation (CDC) is dedicated to building a thriving, safe, family-oriented community that is economically and culturally diverse. Cramer Hill CDC believes that development is most successful when there is continuous input from residents, by fostering resident leadership and civic engagement, by creating affordable housing, by strengthening economic opportunity and by improving the quality of life in Cramer Hill.



Cramer Hill CDC is leading a variety of projects, programs, and efforts in this neighborhood including streetscape improvements and community gardens. A partnership with Cramer Hill CDC was established to evaluate the need and opportunity for green infrastructure. Through the leadership of this community organization, demonstration project sites have been identified, and multiple green infrastructure design efforts have been initiated for the Cramer Hill neighborhood.

Parkside Business and Community in Partnership

Parkside Business and Community in Partnership (PBCIP) is a 501(c)3 non-profit organization which for much of its existence was run solely by volunteers from the neighborhood of Parkside. It is a membership-based organization that takes very seriously its founding principal of neighborhood-driven change. PBCIP has a membership of approximately 120 residents and stakeholders. The organization takes a holistic approach to neighborhood revitalization by integrating commercial investment, housing improvements and quality-of-life initiatives to restore, rather than to replace, the neighborhood. PBCIP and its members are working to build a vibrant neighborhood in Parkside. Through advocacy, collaboration and commitment, PBCIP supports quality education, mixed income housing and commercial development, and sustainable practices to achieve a green community.

The RCE Water Resources Program has partnered with PBCIP to install two demonstration rain gardens along Park Boulevard in the heart of Parkside. Through outreach efforts, PBCIP, with support from the RCE Water Resources Program, is educating local residents and volunteers on innovative ways to conserve and protect water resources while addressing flooding and combined sewer issues in the neighborhood.

The Heart of Camden

The Heart of Camden is a community-based organization dedicated to revitalizing the Waterfront South neighborhood through affordable housing, family and youth services, economic expansion and human development. This organization provides active programs and volunteer resources for the community. In addition to providing key input for the redevelopment of a formerly contaminated gas station site in Waterfront South, The Heart of Camden participated in the first rain garden training workshop held in the City.

The Center for Environmental Transformation

The Center for Environmental Transformation (The CfET) is dedicated to environmental transformation and environmental justice in the Waterfront South neighborhood of Camden. The CfET collaborated on both the redevelopment of the gas station site in Waterfront South and the first rain garden training workshop held in the City.

Additionally, The CfET initiated a native nursery program to grow plant material for use in rain garden projects throughout the City of Camden. The RCE Water Resources Program provided the initial plugs that The CfET will grow into larger plants, which will be purchased from the nursery and planted in the rain gardens throughout Camden.

Respond, Inc.

For more than 41 years, Respond, Inc. has carried out a central mission to help North Camden and the other communities it serves to bring about improved levels of economic independence and sound community development. Respond, Inc. is a voluntary, non-profit 501(c)3 agency created by community residents to enhance and promote the economic independence and general welfare of individuals and families residing in Camden City and Camden County. This mission is carried forth in the provision of comprehensive services in child care, a senior adult center, programs for homeless adults, rental housing and home ownership, youth services, employment, economic development, job training and associated programs that help people help themselves.

Respond, Inc. owns and operates multiple properties in the North Camden neighborhood. In partnership with the RCE Water Resources Program, a series of rainwater harvesting systems, rain gardens, and other green infrastructure demonstration projects are being proposed at several properties owned and managed by Respond, Inc. These projects will serve as direct examples for the City and local residents of how stormwater management can be achieved at a lot and block scale to reduce impacts of runoff on the City's aging sewer infrastructure.

Camden City Garden Club

Over 100 community gardens are now active throughout the City of Camden due in large part to the efforts of the Camden City Garden Club. This organization has been active in the City since the mid-1980's and continues to serve as a resource for residents and neighborhoods interested in creating a community garden site within the city limits. Many gardens have been constructed on vacant lots with permission from the City. Together with the Garden Club, local neighborhood organizations provide the opportunity for many residents to grow and provide fresh produce for local families.

Community garden sites provide a unique opportunity for green infrastructure demonstration projects. One of the key challenges for community gardens is securing a consistent source of water. Integrating rainwater harvesting systems and rain gardens into community garden sites provide gardeners with a reliable source of low-cost fresh water and can provide opportunities for disconnecting rooftops, driveways, and roadways from direct discharge to the City's combined sewer system.



Photo Credit: Andrea Ferich, The CfET

EDUCATION AND TRAINING PROGRAMS

Youth and Schools

Through a partnership with the Camden County Soil Conservation District (CCSCD) and Camden County 4-H program, the RCE Water Resources Program piloted an educational program at Sumner Elementary School located in the Liberty Park neighborhood in Camden. The Stormwater Management in Your Schoolyard educational program is designed to provide fourth and/or fifth grade students with an opportunity to apply their science, math, and communication skills to real-world environmental problems through the building of a rain garden on the school's campus.



The main focus of the Stormwater Management in Your Schoolyard curriculum is rain gardens. However, topics such as water, soil, and plant ecology are presented, and connections between these topics and rain gardens are introduced and discussed with the students. The specific learning goals include:

- Students will understand what a watershed is and how we all live in a watershed.
- Students will understand the types of land use and how the land is connected to the sea.
- Students will understand nonpoint source pollution.
- Students will understand how stormwater runoff transports nonpoint source pollution to local waterways and affects the health of watersheds.
- Students will understand how to manage stormwater runoff in multiple ways, including the use of rain gardens.
- Students will increase their environmental awareness.
- Students will be motivated to teach others in their communities about the importance of rain gardens and how rain gardens can serve as one of the solutions to water resources issues in New Jersey.

Through the efforts of the Camden County 4-H staff and the Camden County Environmental and Natural Resource Management Agent, two student classes participated in the program and constructed two demonstration rain gardens at Sumner Elementary School.

This pilot program is being evaluated and will be available to other interested schools and youth programs in the coming year.



Workshops and Training Seminars

In February and March 2011, the CCMUA, along with the CCSCD, the RCE Water Resources Program, and the RCE of Camden County, conducted a two-day training workshop on rain garden planning, design, construction, and maintenance for landscape professionals and Camden City residents. At this educational program, participants were provided with instructional seminars and a manual outlining the practice of installing and maintaining a rain garden. The two-day training included both a classroom program and hands-on field training.

The classroom program was held on February 17th at CCMUA's administrative offices located on Ferry Avenue in Camden. Over 40 participants attended the training program and received instruction on rain gardens. The second day of this program was held on Thursday, March 24th at the vacant lot across from the CCMUA administration building where again over 40 participants joined the RCE Water Resources Program staff in completing the installation of a demonstration rain garden to manage stormwater runoff from Ferry Avenue.

The high levels of interest, enthusiasm, and participation from both local residents and contractors indicate that additional training workshops and seminars are needed. Future programs on rain gardens and other green infrastructure strategies can be effectively developed and offered throughout the City.



DEMONSTRATION PROJECTS

Additional information regarding each of these demonstration projects can be found on page 24 in Appendix B.

CCMUA Demonstration Rain Garden

In March 2011, the RCE Water Resources Program directed the installation of a demonstration rain garden on Ferry Avenue adjacent to the CCMUA. The rain garden was designed on a vacant lot owned by the CCMUA and is approximately 800-900 square feet. The garden is four to six inches deep and can intercept runoff from 2,000-3,000 square feet of surrounding roadways. The project is located near a low-lying intersection which frequently floods during storm events. The rain garden provides additional storage for stormwater runoff helping to alleviate the nuisance flooding routinely plaguing the surrounding community.

Photo Credit: Doug Burns, CCMUA
(photo below)



Photo Credit: Doug Burns, CCMUA
(photo below)



The rain garden was installed with assistance from a local contractor and planted by community volunteers. The contractor, with direction from the RCE Water Resources Program staff, excavated the garden and provided required soil amendments and mulch. Once the garden was shaped and leveled, volunteers who had participated in the February 17th rain garden training workshop assisted with the installation of the inlets, outlets, spreading mulch, and planting. The completed rain garden can capture, treat, and infiltrate over 75,000 gallons of stormwater each year.



Cramer Hill Demonstration Rain Garden – 20th Street Community Garden

The RCE Water Resources Program, in partnership with the Cramer Hill CDC, installed a demonstration rain garden project at an existing community garden in the neighborhood of North Camden. The Cramer Hill CDC received authorization from the City of Camden to create a community garden on this vacant lot and with the assistance of the RCE Water Resources Program, integrated a demonstration rain garden project to educate residents, better manage stormwater runoff and improve the quality of life in the neighborhood. This community garden retrofit project focuses on redirecting stormwater runoff from North 20th Street into two rain gardens via curb cuts. Each rain garden is approximately 250 square feet and planted with appropriate native plant species. Plantings for the rain garden include native grasses and perennials adapted to the climate, soils, and periodic flooding, so they require minimal maintenance once established. The project not only manages water quality and quantity, but also provides valuable wildlife habitat, improves air quality, and reduces the urban heat island effect for the neighborhood of Cramer Hill. Rain gardens will help to mitigate nuisance flooding in the area and reduce nonpoint source pollution and stormwater flows that would otherwise discharge into the City's combined sewer system.



Park Boulevard Demonstration Rain Gardens

Two rain gardens, both situated within medians along Park Boulevard, manage the stormwater runoff on one of the busiest streets in Parkside. The first rain garden, located at the intersection of Park Boulevard and Magnolia Avenue, includes a series of curb cuts (two acting as inlets and two acting as outlets) that direct the stormwater through this 800 square foot rain garden. The rain garden captures, treats, and infiltrates over 100,000 gallons of stormwater runoff each year. This system mitigates flooding in the neighborhood and reduces nonpoint source pollution from discharging into the City of Camden's combined sewer system. Native plants such as Blue False Indigo, Blazing Star, Butterfly Weed, Great Blue Lobelia, Sweet Pepperbush, and Switchgrass provide valuable habitat for native birds, bees, and butterflies. In addition, the garden improves the aesthetic qualities of the highly residential area of Parkside. The RCE Water Resources Program, CCSCD, NJTF, PBCIP, and the City of Camden worked in partnership on this project. With the assistance from both a contractor and over 30 volunteers from Campbell's Soup Company, the rain garden installation occurred on April 29, 2011.

The second rain garden, located in a median at Park Boulevard and Vesper Boulevard, functions similarly to the rain garden at Park Boulevard and Magnolia Avenue. The rain garden is approximately 410 square feet and planted with native species such as Blue Vervain, Broomsedge, Butterfly Milkweed, Fireworks Goldenrod, Foxglove Beardtongue, Iron Butterfly Ironweed, Purple Coneflower, and Short-toothed Mountain Mint. The RCE Water Resources Program, CCSCD, NJTF, PBCIP, and the City of Camden worked in partnership on this project. With the assistance from both a contractor and 12 volunteers, the rain garden installation occurred in October, 2011.

The rain gardens capture stormwater runoff from the surrounding urban area totaling approximately ½ acre. During a one-inch rain event, stormwater is diverted and captured within the two 6-inch deep rain gardens that are approximately 250 square feet in size. Stormwater will temporarily pond in the gardens, infiltrating into the rain garden soils within 24 hours. Rain events greater than 1.25 inches fill the rain gardens and overflow into the existing curb and gutter along North 20th Street, continuing to flow as it did previously to the nearest storm sewer inlet. These two rain gardens will capture, treat, and infiltrate approximately 63,000 gallons of stormwater each year.





Sumner School Demonstration Rain Gardens

The RCE Water Resources Program, in partnership with RCE of Camden County, conducted a rain garden educational program at the Sumner Elementary School in Camden during spring 2010 and spring 2011.

In spring 2010, a sixth grade class participated in the RCE of Camden County 4-H Climate Change educational program. In this program, the students learned about climate change and how climate change affects the Camden community. As part of this program, the students wanted to conduct a community service project. Therefore, RCE faculty and staff, along with the CCSCD, worked with the students to install a rain garden on the school grounds.

Due to the success of the previous year, the school wanted to expand the climate change program to include stormwater management. Therefore, in spring 2011, a fourth grade class had the opportunity to participate in the Stormwater Management in Your Schoolyard educational program. In this program the students learned about watersheds, nonpoint source pollution, and how rain gardens can be used to manage stormwater runoff. Additionally, the students in this program worked together in groups to design another rain garden for their school. The students' rain garden designs were incorporated into the final design, and the rain garden was installed on the school grounds. RCE faculty and staff, along with the CCSCD, worked with the students to install another rain garden on the school grounds.

These educational programs not only increased the students' knowledge about their environment, but also gave them a sense of community pride. In particular, the students have taken pride in knowing that they are taking an active role in solving local environmental problems such as stormwater runoff and flooding. The two rain gardens at Sumner School will capture, treat, and infiltrate approximately 110,000 gallons of stormwater each year.



Waterfront South Rain Garden Park

Photo Credit: Franklin McLaughlin, NJDEP (top two photos)

The RCE Water Resources Program partnered with CCMUA, The Heart of Camden, The CfET, and NJDEP to develop a community-based open space plan for a former fueling station located at the corner of Broadway and Chelton Avenue in the Waterfront South neighborhood. The CCMUA, with support from NJDEP, led an effort to remediate this corner property and, with assistance from the RCE Water Resources Program, developed a plan to create a green amenity for the community. The extensive site remediation consisted of the removal of twelve underground storage tanks as well as the removal of 1,850 tons of contaminated soil from the site. The final plan integrated four rain gardens on the site to reduce stormwater flow to the combined sewer system and flooding in nearby intersections and properties. Site remediation work was completed in spring 2011, and the park amenities were completed in July 2011. The project serves as a model for the City of Camden as well as other urban areas on how cost-effective green infrastructure solutions can be integrated into parks, open spaces, and redevelopment projects. The rain gardens will capture, treat, and infiltrate approximately 470,000 gallons of stormwater each year.

RESOURCES

Costs

An evaluation of the cost of the rain gardens that were constructed as demonstration projects was performed. The average cost of a rain garden was \$4.59 per square foot of rain garden. The cost ranged from \$1.39 to \$7.49 per square foot of garden. The higher costs were a result of hiring contractors to install the gardens. The lower costs were a result of the Camden County Parks Department conducting the excavation as an in-kind service. Translating these costs into dollars of each square foot of drainage area treated is \$0.99 per square foot of drainage area. Translating these costs into each gallon of stormwater treated is \$0.05 per gallon. The four rain gardens installed in the Waterfront South Rain Garden Park were not included in this calculation since the cost of the rain garden construction could not be separated from the entire Brownfield Cleanup project at the site.

Funding

The RCE Water Resources Program, along with other Camden SMART partners, are working to secure funding for implementation of the first phases of green infrastructure work in the City. Through existing relationships and new grant writing efforts, individual partner organizations can assist one another in securing financial support from local, State, and Federal entities for green infrastructure projects and programs. Funding programs for green infrastructure include:



USEPA Clean Water State Revolving Fund

One of the largest, most readily available sources of funding for green infrastructure implementation is the U.S. Environmental Protection Agency (EPA) Clean Water State Revolving Fund (CWSRF). The CWSRF is a powerful financing program that provides funding through low interest loans for wastewater treatment, stormwater management, nonpoint source abatement and estuary protection projects.

Today, all 50 states and Puerto Rico operate successful CWSRF programs that have provided over \$63 billion in financial assistance since 1988, with funding generally provided in the form of low interest loans. In 2007 alone, \$5.3 billion was provided to fund a wide variety of projects that protect or improve national water quality.

Each year, funds to establish or capitalize the CWSRF program are provided to states through EPA grants. In addition, states add matching funds which are then loaned to a wide variety of water quality improvement projects. Repayment of the loan begins within one year of project completion. To complete the cycle, loan payments, interest and new capitalization grants are reincorporated into the fund and used for new projects. This is the basis of the revolving funding program.

For more information:

- USEPA, Managing Wet Weather with Green Infrastructure, Municipal Handbook, Funding Options, September 2008 (http://www.epa.gov/npdes/pubs/gi_munichandbook_funding.pdf)
- NJDEP Division of Water Supply and Geoscience, State Revolving Fund, November 2011 (<http://www.nj.gov/dep/watersupply/loanprog.htm>)

NJDEP 319(h) Nonpoint Source Program

The New Jersey Statewide Nonpoint Source Program is responsible for administering the federal Section 319(h) Grant Program. Each year, New Jersey publishes a Request for Proposals (RFP) to solicit applications for Section 319(h) funds for eligible projects. The RFP serves as a guidance document that establishes criteria for projects based on federal requirements and state priorities; identifies specific administrative, procedural, and programmatic requirements for applicants; and provides timetables and deadlines for the grant application and related decision-making processes. A public notice is published in the New Jersey Register (NJR) announcing the availability of 319(h) pass-through grants.

Under the federal guidelines, each state may pass through a portion of 319(h) funds to other entities to reduce water quality impairment through implementation of nonpoint source pollution control projects. For the past few years, New Jersey's Nonpoint Source Program has targeted Section 319(h) grant funds on the development of watershed restoration and protection plans. Watershed restoration and protection is a priority not only for New Jersey but nationally as well. Recently, the USEPA issued a handbook providing information on developing and implementing watershed plans designed to restore and protect water quality.

For more information:

- USEPA, Handbook for Developing Watershed Plans to Restore and Protect Our Waters, March 2008 (http://www.epa.gov/owow/nps/watershed_handbook/)
- NJDEP Division of Watershed Management, Funding, September 2010 (<http://www.nj.gov/dep/watershedmgt/319grant.htm>)

Many other local, private, and public grant-making agencies also can provide financial assistance for related efforts supporting green infrastructure. Through effective communication, funding obtained by individual organizations can be leveraged to assist in the successful implementation of a variety of green infrastructure efforts.



Technical Resources

Assistance will be necessary for local organizations and residents to successfully plan, install, and maintain green infrastructure projects. In addition, educational resources and expertise will be required to continue providing interested residents and community groups with the information they need to understand the opportunities and benefits green infrastructure can bring to their city. Currently, the following organizations have technical staff and resources available to City residents and organizations interested in implementing green infrastructure projects and programs:

- Rutgers Cooperative Extension Water Resources Program (<http://www.water.rutgers.edu>)
- New Jersey Tree Foundation (<http://www.njtreefoundation.org>)
- Camden County Soil Conservation District (<http://www.camdenscd.org>)
- Camden County Environmental and Natural Resources Management Agent (<http://njaes.rutgers.edu/personnel/unit.asp?id=75&s=u>)
- Camden County 4-H Program (<http://camdencounty4h.com>)
- Center for Environmental Transformation (<http://camdencenterfortransformation.org>)
- Camden SMART (<http://camdensmart.com>)



OPPORTUNITIES AND RECOMMENDATIONS

The opportunities for successful green infrastructure projects and programs in the City of Camden are significant. Large expanses of vacant land, along with the numerous vacant lots scattered throughout the many neighborhoods, can serve as the foundation for a network for disconnection and management of stormwater runoff at a lot and block scale. A variety of tools and approaches can be developed and applied to best fit the needs and desires of each neighborhood while achieving the goal of reducing stormwater runoff flows to the City’s combined sewer system. For a city-wide green infrastructure program to be successful, efforts must continue to build relationships and trust with local community groups; educate residents, both youth and adults, through formal and informal workshops and training programs; identify available technical resources; secure funding for proposed projects; and clearly demonstrate through in-the-ground installations how green infrastructure technologies can benefit individual neighborhoods and the City of Camden as a whole. A successful program would result in a better quality of life for the residents of Camden.

In addition to improving the quality of life for Camden’s residents, a green infrastructure program can also help create jobs. A job training program can easily accompany this initiative. There is enormous job potential in designing, building and maintaining green infrastructure. The vacant lots in the City of Camden also can be used to grow the plant material needed for the green infrastructure projects, thereby creating more jobs for the residents of Camden.

The green infrastructure initiative has the potential to partner with many other programs such as the Brownfield restoration efforts that are on-going in Camden, the Camden GreenWay effort, and all the ecological restoration efforts that are a result of offsetting the natural resources damages, which have been created by past polluters. There also are opportunities to partner with tree planting and urban gardening programs that already exist in Camden. The NJ Green Acres Program and the NJ Blue Acres Program also could provide opportunities for partnership with the green infrastructure initiative.

In conclusion, the successful green infrastructure initiative in the City of Camden will provide a great number of economic, environmental, and social benefits. Through the Camden SMART leadership, this effort can begin to transform Camden into a healthy, economically thriving community.



APPENDIX



A. GREEN INFRASTRUCTURE STRATEGIES

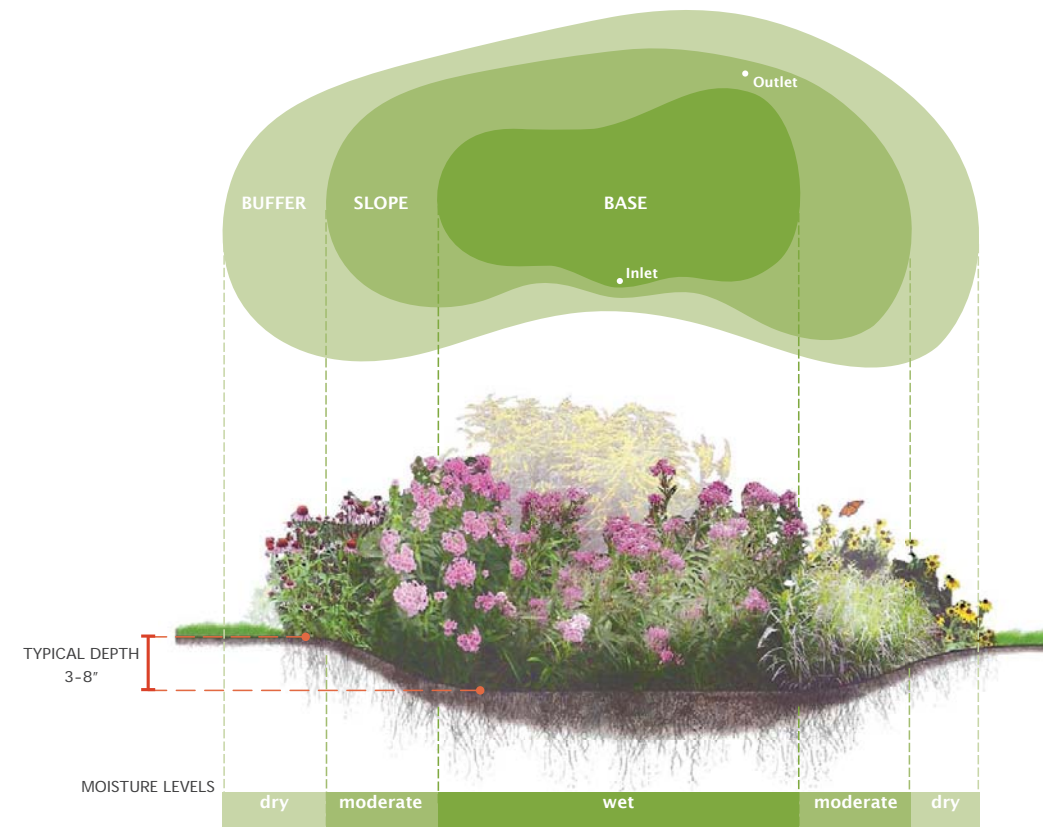
Green infrastructure strategies address the primary task of managing water quantity and quality while providing a wealth of ancillary benefits such as opportunities for water conservation and reuse, wildlife habitat, plant diversity, open green space, improved air quality and urban heat island effect reductions. These strategies are often also referred to as stormwater best management practices (BMPs).

Rain Gardens

A rain garden is a landscaped, shallow depression that captures, treats, and infiltrates stormwater runoff. The rain garden removes pollutants from stormwater runoff while recharging groundwater and keeping it out of the combined sewer system. Rain gardens are an important tool for communities and neighborhoods to create diverse, attractive landscapes where people live while protecting the health of the natural environment.

Rain gardens can be readily implemented throughout a community to begin the process of re-establishing the natural processes of the land. Rain gardens:

- Capture stormwater runoff, reducing 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 thereby recharge groundwater supplies and provide base flow to nearby streams and waterways
- Provide the opportunity to establish native plant communities to promote biodiversity and habitat for beneficial wildlife



The Environmental Protection Agency (EPA) defines stormwater runoff as the number one threat to water quality in our lakes and streams, and rain gardens are one of the quickest and easiest methods communities can use to reduce runoff, manage flows to combined sewer systems, and protect water resources. Beyond the aesthetic and ecological benefits, rain gardens encourage environmental stewardship and community pride. In addition, using native plant materials in rain gardens is an important way to promote biodiversity and preserve native species in developed communities. When used throughout a community, rain gardens can also provide significant economic benefits by lowering costs for local government and businesses to maintain and upgrade traditional stormwater infrastructure pipes and management basins.⁴ Rain gardens can be placed in strategic locations to capture runoff from rooftops and paved areas, including:

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

Water Conservation and Rainwater Harvesting

With an average rainfall of 45 inches per year, New Jersey is often considered a “water rich” state. However, when considering that New Jersey is also the most densely populated state in the country, our current and future demands are likely to exceed the sustainable supply of freshwater resources. Even in areas where water seems abundant, water conservation is important. In addition to saving money on utility bills, water conservation helps prevent water pollution in nearby lakes, rivers, and local watersheds. Water conservation extends the life and reliability of septic systems, public and private infrastructure, and prevents or postpones the need to fund and build expanded public works systems.

New Jersey’s water demands are quickly approaching the resource’s limits. Water will likely influence the future of New Jersey in regard to the natural environment, the overall landscape, statewide development, local zoning, and the State’s economy. With an increase in population, New Jersey is seeing a big jump in potable water consumption particularly due to outdoor water use for lawns and landscaping. It is important to remember that groundwater and freshwater supplies are limited. Residents need to start adopting water saving practices at home to help prevent water shortages. There are many simple and cost-effective ways that individuals can help conserve water.⁵

Outdoor water conservation practices include:

- Plant native plants; they are adapted to New Jersey’s soils and climate and need less fertilizer and water to grow and thrive.
- Mulch around garden plants; this will trap and hold water reducing evaporation and moisture loss.
- Water lawns, plants, and gardens early in the morning when evaporation rates are lowest.
- Harvest rainwater by capturing runoff from rooftops and reusing it for watering landscape plantings.

Typical rainwater harvesting systems can store up to 1,000 gallons of water. Harvesting during rainy periods in spring and summer provides a source of water for the drier periods between rain events. 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 our drinking water supply and infrastructure. In some communities, nearly forty percent of household water consumption is used on domestic irrigation during the growing season.



Rainwater harvesting has proven to be successful. In New York City, 35 rainwater harvesting systems working in NYC’s community gardens collect 422,900 gallons of water every year. While individual small-scale construction of rainwater harvesting systems is not enough to significantly impact the environment, a city-wide program promoting and constructing rain barrels and harvesting systems along with rain gardens throughout the city landscape can begin to make a difference.⁶

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 one 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 running off of 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, decreasing flow to combined sewer systems and minimizing water pollution flowing into local waterways. They provide an alternative source of water for gardens, lawns, and landscapes thereby reducing the need for potable water.

It is important to note that harvested water in a rain barrel should not be used as a drinking water source. Rainwater should not be collected in a rain barrel if a moss killer was recently used on the roof (up to three months prior). If water quality is a concern, a first flush diverter can be installed to route the first flow of water off the roof away from the rain barrel (see images to the left of a first flush diverter installation). First flush diverters are available for purchase online from rainwater harvesting supply companies. Additionally, before using the harvested rainwater to water a vegetable garden, a sample should be taken and sent to a certified water testing laboratory. Water samples should be taken periodically throughout the growing season to confirm results. Check the NJDEP Data Miner website to search for certified laboratories in your area, www.nj.gov/dep/oqa/certlabs.htm. Recommended tests include metals (zinc, lead, chromium, arsenic), polycyclic aromatic hydrocarbons (PAHs), and pathogens (fecal coliform, and E. coli). Studies have shown that most of metals detected in rooftop runoff are also detected in rainwater that has yet to contact the rooftop. Therefore, these contaminants are unlikely to result in intolerable residues in edible plants, fruits, and vegetables, especially when they bind with soil particles and organic matter on the ground.⁷ Regardless, if the water is confirmed to be safe, it is still best to use drip line irrigation to water the roots of the plants. Be sure to thoroughly clean any edible plants harvested with potable water before consumption.

Porous Pavements

Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. This reduction is achieved primarily through the infiltration of a greater portion of the rain falling on the area than would occur with conventional paving. This increased infiltration occurs either through the paving material itself or through void spaces between individual paving blocks known as permeable pavers.

Porous paving systems consist of a porous asphalt or concrete surface course placed over a bed of uniformly graded broken stone. The broken stone bed is placed on an uncompacted earthen subgrade and is used to temporarily store the runoff that moves vertically through the porous asphalt or concrete into the bed. The high rate of infiltration through the porous paving is achieved through the elimination of the finer aggregates that are typically used in conventional paving. The remaining aggregates are bound together with an asphalt or Portland cement binder. The lack of the finer aggregate sizes creates

voids in the normally dense paving that allow runoff occurring on the paving to move vertically through the paving and into the void spaces of the broken stone storage bed below. From there, the stored runoff then infiltrates over time into the uncompacted subgrade soils similar to an infiltration basin.

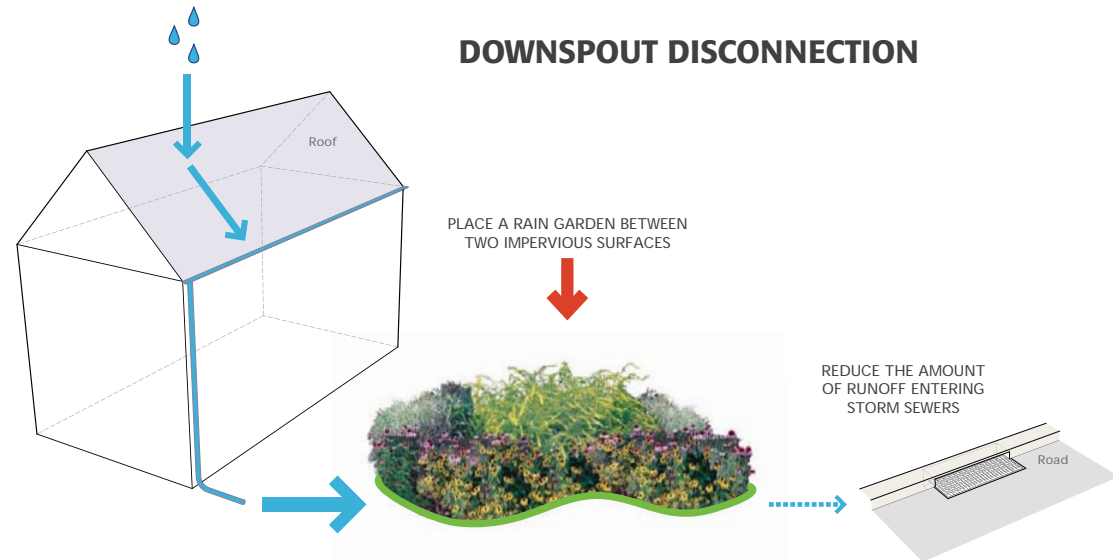
A permeable paver installed over an aggregate base also has a subsurface storage bed and functions in a similar manner to a porous paving system. However, instead of a continuous porous asphalt or concrete surface course, the system's surface consists of impervious concrete paver blocks that either have void spaces cast into their surfaces or interlock in such a way as to create void spaces. These void spaces allow runoff from the impervious paver surface to collect and move vertically past the individual pavers into the broken stone storage bed below. Similar to a porous paving system, the runoff stored in the broken stone storage bed, which also provides structural support to the pavers, then infiltrates over time into the uncompacted subgrade soils.⁸

Green Roofs

Green roofs can be effectively used to reduce stormwater runoff from commercial, industrial, and residential buildings. In contrast to traditional asphalt or metal roofing, green roofs absorb, store, and later evapotranspire initial precipitation, thereby acting as a stormwater management system and reducing overall peak flow discharge to a storm sewer system.

In urban areas with combined sewer systems, stormwater and untreated human and industrial waste are collected in the same pipe. During periods of heavy rainfall and snow melt, these systems can become overwhelmed by the volume of water and overflow into nearby waterbodies resulting in combined sewer overflows (CSOs). Since green roofs can reduce the volume of stormwater discharged, CSOs can also be reduced, thus preventing the discharge of millions of gallons of sewage into local waterways.⁹

Green roofs offer additional benefits including reduction of urban heat island effect, increased thermal insulation and energy efficiency, increased acoustic insulation, and increased durability and lifespan compared to conventional roofs.



Downspout Disconnection

In urban areas, downspouts are commonly connected to drain tiles that feed the sewer system, and the cumulative effect of thousands of connected downspouts can greatly increase the annual number, magnitude, and duration of CSO events. Downspout disconnection is the process of separating roof downspouts from the sewer system and redirecting roof runoff onto pervious surfaces, most commonly a lawn. This reduces the amount of directly connected impervious area in a drainage area.¹⁰

Ideally, a downspout disconnection plan will work with the existing downspouts on a building. In some cases, however, downspouts can be relocated if the new position would drain to a more appropriate receiving area (e.g., a hedge). Re-pitching the gutters to direct the flow to another corner of the roof is another option. For buildings with internal drainage, disconnecting internal downspouts may be difficult or impractical. Other BMPs such as cisterns or vegetated roofs may be more appropriate in this scenario.

For disconnection to be safe and effective, each downspout must discharge into a suitable receiving area. Runoff must not flow toward building foundations or onto adjacent property. Typical receiving areas for disconnected roof runoff include lawns, gardens, and other existing landscaping such as shrubs. Soil amendments can be used to increase soil permeability if necessary. However, site constraints, such as small or non-existent lawns, may dictate that runoff be directed into a rain garden or, most commonly, an infiltration practice.

Volume reductions occur through infiltration and evapotranspiration in the receiving area. The potential exists for disconnected roof runoff to be completely taken "out of the system" by spreading out and infiltrating over pervious surfaces and BMPs. Stormwater that eventually flows onto an impervious surface and then into the sewer will at least be initially detained by flowing over rough, pervious surfaces such as grass.

Downspout disconnection decreases the peak discharge by reducing the volume of roof runoff that enters the sewer and by increasing the discharge time over which it enters. Also, roofs are inherently distributed over a drainage area. Connected downspouts concentrate and centralize roof runoff, causing peak discharges from individual roofs to accumulate in a relatively small number of man-made conveyances. By contrast, downspout disconnection helps to keep separate the peak discharge from each individual roof.

Roof runoff contains deposited atmospheric pollutants, particles of roofing material, nutrients and bird droppings. The concentrations of these pollutants will be reduced as the stormwater infiltrates and is taken up into plant roots. Also, receiving water quality will improve because CSOs will occur less frequently and with less magnitude as a result of the water quantity benefits of downspout disconnection.

Planter Boxes and Tree Box Filters

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).

A flow-through planter is designed to collect stormwater from roof areas and allows it to flow through soil and be used by plants. Flow-through planter systems contain layers of gravel, soil, and vegetation and are directly connected to a roof's gutter and downspout. These systems detain stormwater runoff allowing it to be filtered to remove sediment and pollutants as water infiltrates down through the planter. Planters are typically waterproofed and do not infiltrate runoff into surrounding soils; the system relies on evapotranspiration and short-term storage to manage stormwater flow. Excess water discharges back into the existing downspout connection or storm sewer system. Flow-through planters range in size and shape and can be constructed using a variety of materials, including concrete, brick, plastic lumber, or wood.¹¹

Stormwater planters are frequently used in urban communities where space is limited. These systems do not require large amounts of space and can be designed to enhance neighborhoods and communities providing aesthetic appeal and plant materials to the city streetscape and parking lots on both commercial and residential properties. When installed adjacent to buildings, the design and materials can reflect existing architecture. Planters may also be built of concrete or block providing durable, low maintenance units along sidewalks and roadways. An appropriate soil media is necessary to ensure plant growth and successful infiltration. Native plant species and vegetation suited to urban environments are preferable to minimize routine maintenance. Underdrain piping with observation/clean out wells should be installed to connect planter boxes to existing storm sewer systems.¹²

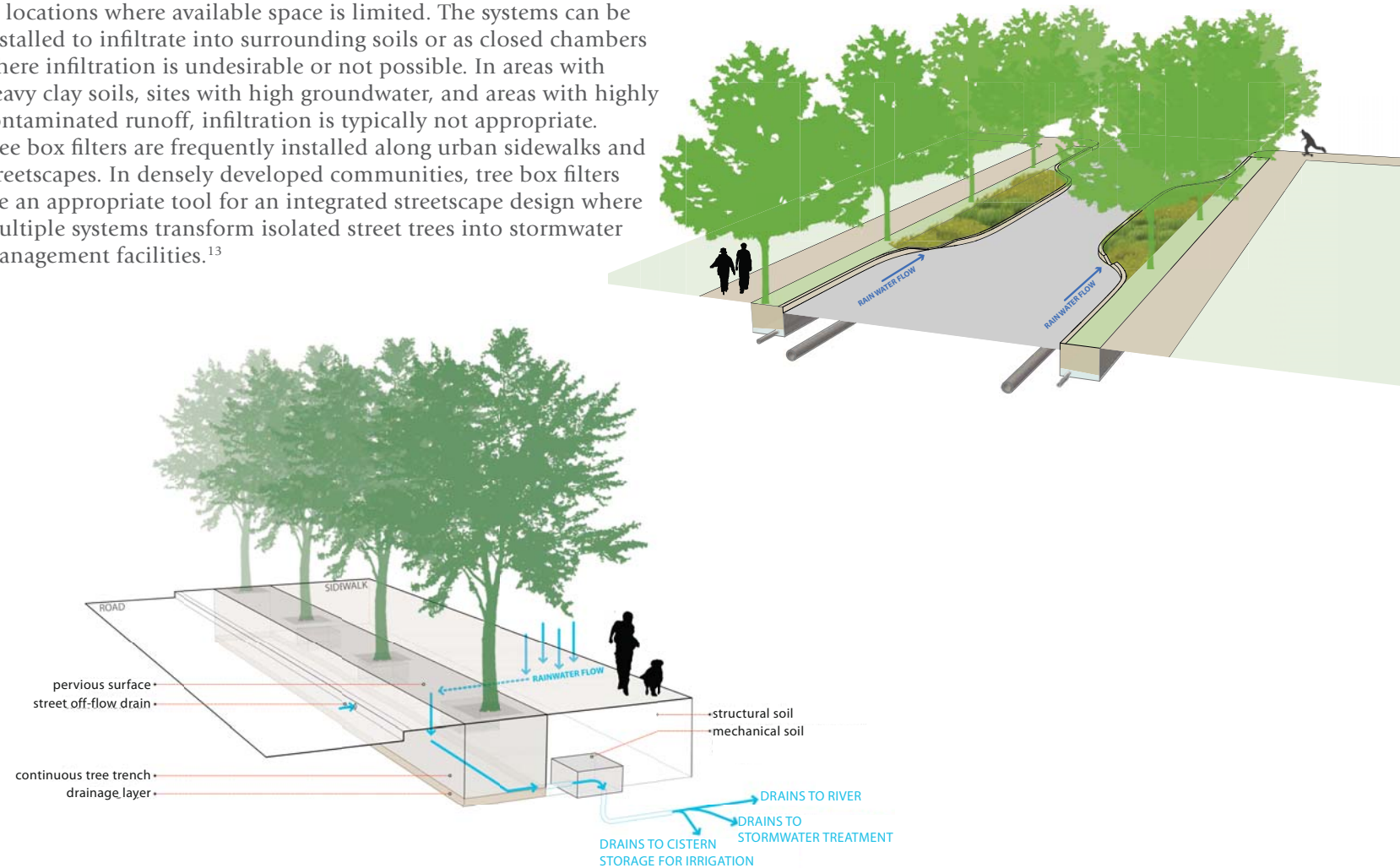
Stormwater tree pits manage stormwater using an underground structure and above ground plantings. The system collects and filters stormwater through layers of mulch, soil and plant root systems where pollutants such as bacteria, nitrogen, phosphorus, heavy metals, oil and grease are retained, degraded and absorbed. These small bioretention systems can then discharge treated stormwater by infiltrating it into the ground or, if infiltration is not appropriate,

discharging into the existing storm sewer system. A variety of manufactured tree pit structures are commercially available. These systems typically include a precast concrete box filled with a proprietary soil and media mix and may also include limited plantings consisting of a single tree or a few small shrubs. While the underground components differ, above ground the systems closely resemble traditional street tree plantings and are an effective solution for urban conditions where space is limited and healthy trees are few. Where possible, tree pits should be installed in conjunction with other stormwater BMPs.

Tree box filters are appropriate in many urban and suburban communities throughout the United States and are most effective in locations where available space is limited. The systems can be installed to infiltrate into surrounding soils or as closed chambers where infiltration is undesirable or not possible. In areas with heavy clay soils, sites with high groundwater, and areas with highly contaminated runoff, infiltration is typically not appropriate. Tree box filters are frequently installed along urban sidewalks and streetscapes. In densely developed communities, tree box filters are an appropriate tool for an integrated streetscape design where multiple systems transform isolated street trees into stormwater management facilities.¹³

Stormwater Curb Extensions

Conventional curb extensions, or bump outs, are typically paved areas that extend from the sidewalk and are designed to calm traffic and improve pedestrian safety. The design of a stormwater curb extension is an alteration to that of the traditional curb extension. A stormwater curb extension incorporates curb openings, vegetation, and appropriate soil amendments that allow the curb extension to function as a stormwater facility. Stormwater runoff is filtered through the vegetation and soil media and can be stored to sustain nearby trees or be conveyed to an underdrain system.



Greenways, Open Space, and Landscape Plantings

Landscape plantings, including trees, shrubs, perennials and grasses, can help to manage stormwater by diverting runoff from the storm sewer system via infiltration, evapotranspiration, and filtration. Plant materials, including leaves, branches, and stems intercept rainfall before the water hits the ground and can become runoff. Much of the rainfall collected by healthy landscape plantings can easily evaporate into the air and never reach the storm sewer system. In addition, healthy plants minimize stormwater runoff by promoting infiltration into the soil and through evapotranspiration, the process by which water is taken up by a plant's roots and transpired through its leaves. A healthy landscape with diverse plantings and quality soils can effectively filter stormwater runoff.¹⁴

In urban and suburban communities, the temperature of stormwater runoff increases as it flows over heated impermeable surfaces like concrete, asphalt, and roofs. When this water enters nearby surface waterways, it can increase the temperature of a stream, lake or river, adversely affecting aquatic health. This thermal pollution can have a dramatic effect on natural systems, biota, and diversity. To address this issue, landscapes in densely developed communities are being designed to capture stormwater so more can infiltrate into soils and less stormwater runs off directly to waterways. In these landscapes, a key factor is planting trees to provide canopy interception, when rainfall is caught by leaves and stored or evaporated back into the atmosphere so less water reaches the ground and becomes stormwater runoff. This brief retention of rainwater, or rainfall interception, is affected by intensity and duration of rain events, tree species and local climate. Studies of rainfall interception indicate that interception rates are primarily dependent on the type and amount of leaves. Studies have shown that a mature deciduous tree (deciduous trees, such as sweet gums, lose leaves during the winter) can intercept 500–700 gallons of water per year. Mature evergreen trees (evergreens, such as magnolias or pines, retain their leaves year round) can intercept more than 4,000 gallons per year.¹⁵

Trees also increase infiltration of rainwater into soil. Tree roots absorb rainwater, returning it to the atmosphere via transpiration after the tree has filtered potential pollutants. When trees use soil moisture, more rainwater is able to infiltrate into and percolate through the soil. Roots of trees help to reduce soil erosion minimizing sediment pollution. Tree roots also take up nutrients, a common stormwater pollutant, reducing nutrient loads in stormwater runoff.

The combination of trees, shrubs, perennials, and grasses in a “Greenway” along waterways sustains hydrological function while improving stormwater management effectiveness in a community. Healthy greenways protect public infrastructure facilities such as roads, bridges and culverts, sewer and water lines, parks, trails, and public facilities and buildings. Dysfunctional floodplains and waterways, which are not mapped or protected, can threaten the integrity and stability of public infrastructure during major storm events. Functional stream and river systems seasonally flood, some years over more of their floodplain than others. Drainage swales from uplands, in combination with lower floodplain areas, infiltrate rainwater into groundwater aquifers. These wet “hydrological greenways” perform best when the landscape consists of deep-rooted native vegetation. Their function is compromised when they are built upon or converted to lawn. When this occurs they pass on their lost capacity for flood storage to downstream communities expanding the floodplain of the next property owner. When stormwater is not infiltrated to groundwater aquifers, it is lost to the local community and becomes an increasingly expensive, lost resource flowing into waterways. A protected greenway network, with good infiltration and stormwater storage capacity, is a simple and cost-effective strategy for protecting public infrastructure.¹⁶

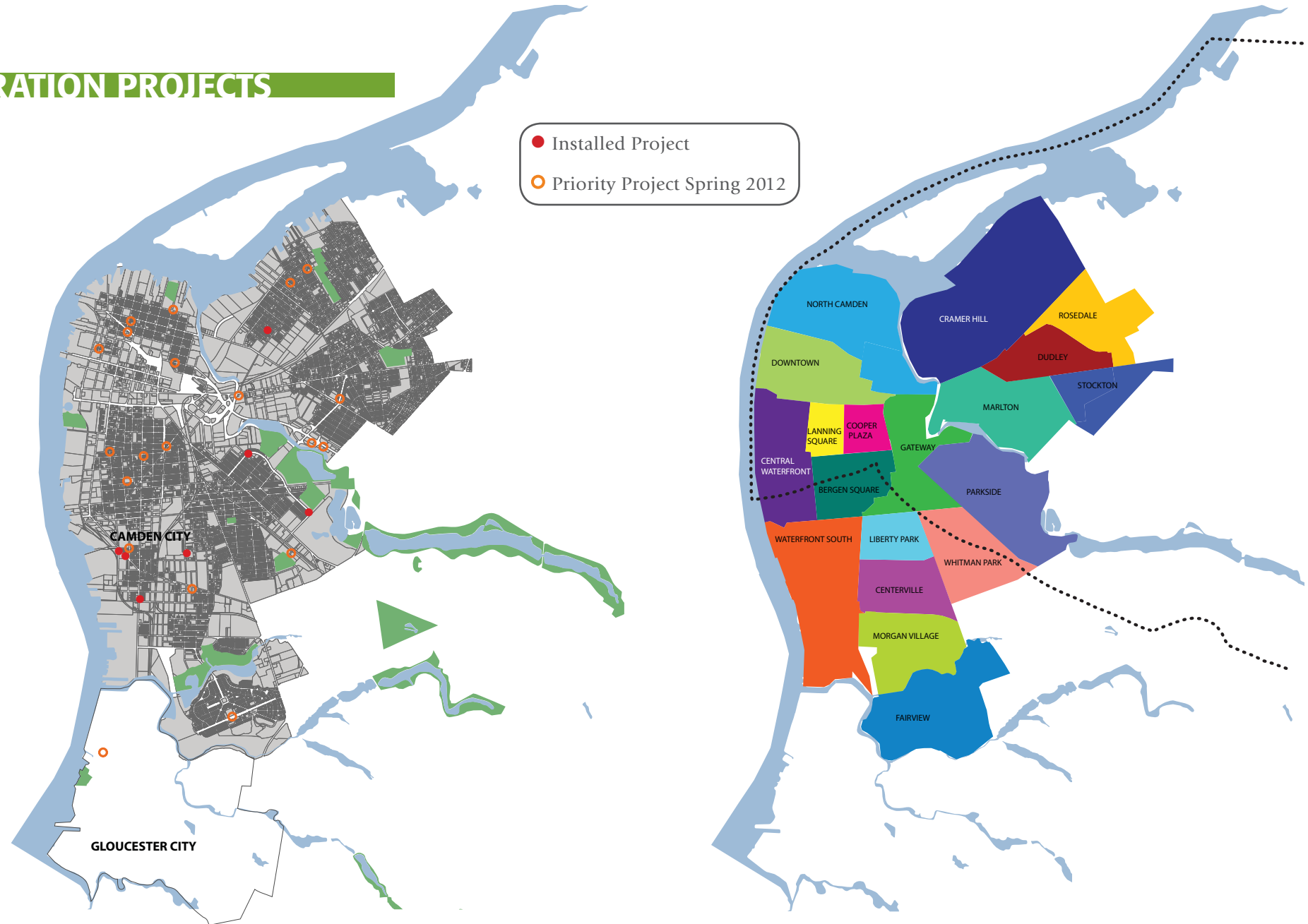
Photo Credit: Jessica Franzini, NJTF
(bottom photo)



B. NEIGHBORHOOD DEMONSTRATION PROJECTS

Over the past year, multiple demonstration projects have been identified that will provide the foundation for a city-wide green infrastructure program. The RCE Water Resources Program staff, with assistance from NJTF and numerous local organizations and residents, visited each of the City's 20 unique neighborhoods to evaluate the need and opportunities for green infrastructure. In total, over 40 projects were selected, incorporating every one of the City's neighborhoods. Implementation of these efforts will be a priority to accomplish the first steps of a city-wide program. More details for each of these demonstration projects are presented in Appendix B and include site locations, photos, potential community partners, green infrastructure strategies and preliminary designs.

Eight of the demonstration projects have already been constructed this past year, which include 11 rain gardens that are designed to capture, treat, and infiltrate over 800,000 gallons of stormwater each year. The RCE Water Resources Program is eager to continue to lead the people of Camden with in-the-ground green infrastructure projects that beautify the City as well as mitigate environmental concerns.



List of Demonstration Projects

BERGEN SQUARE (p. 26)

South Broadway & Pine Street ○

South Broadway & Walnut Street ○

CENTERVILLE (p. 29)

South 9th Street & Ferry Avenue ○

Master Street & Chelton Avenue

CENTRAL WATERFRONT (p. 32)

278 Kaighns Avenue

Riverside Drive & Mickle Boulevard

COOPER PLAZA (p. 35)

St. John Street & Clinton Street

South 7th Street & Pine Street ○

CRAMER HILL (p. 38)

North 20th Street & River Avenue ●

27th Street at Pierce Street & Dupont Street ○

29th Street between Pierce Street & Tyler Street ○

DOWNTOWN/COOPER GRANT (p. 44)

North Front Street

Penn Street & North Front Street ○

EAST CAMDEN - DUDLEY (p. 47)

Saunders Street & North 30th Street

Thompson Street at North 30th Street

EAST CAMDEN - MARLTON (p. 50)

Baird Boulevard ○

CSO Area C22 - Federal Street & River Road* ○

CSO Area C27 - Baird Boulevard & Route 30* ○

CSO Area CMT - Thorndyke & Route 30 East* ○

EAST CAMDEN - ROSEDALE (p. 52)

North 39th Street

EAST CAMDEN - STOCKTON (p. 54)

Freemont Avenue & Burwood Avenue

FAIRVIEW (p. 56)

Sumter Road & North Common Road

Alabama Road & Independence Road

Collings Road* ○

GATEWAY (p. 59)

Kaighns Avenue & Louis Street - Challenge Square Academy

Kaighns Avenue & Louis Street - Sword of the Spirit Christian Center

LANNING SQUARE (p. 62)

South 3rd Street & Line Street ○

LIBERTY PARK (p. 64)

Jackson Street & North 8th Street ●

MORGAN VILLAGE (p. 67)

South 10th Street & Florence Street

South 9th Street & Woodland Avenue

NORTH CAMDEN (p. 70)

North 2nd Street & York Street

North 3rd Street & Main Street ○

North 7th Street & Erie Street ○

North 9th Street & Linden Street ○

304 State Street ●

PARKSIDE (p. 76)

Kaighns Avenue - Dr. Charles Brimm Boulevard

Park Boulevard & Magnolia Avenue ●

Park Boulevard & Vesper Boulevard ●

WATERFRONT SOUTH (p. 82)

Ferry Avenue & Jackson Street ●

South Broadway & Chelton Avenue ●

1645 Ferry Avenue ●

CSO Area C03 - Jackson Street* ○

WHITMAN PARK (p. 88)

Davis Street & Sayrs Avenue

1626 Copewood Street* ○

GLOUCESTER CITY (p. 90)

South 6th Street & Division Street

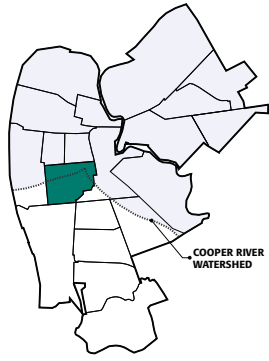
North King Street & Monmouth Street ○

● Installed Project

○ Priority Project Spring 2012

* denotes a site that is not included in this Study. The site survey will be completed Spring 2011.

BERGEN SQUARE



POTENTIAL PARTNERSHIP OPPORTUNITIES

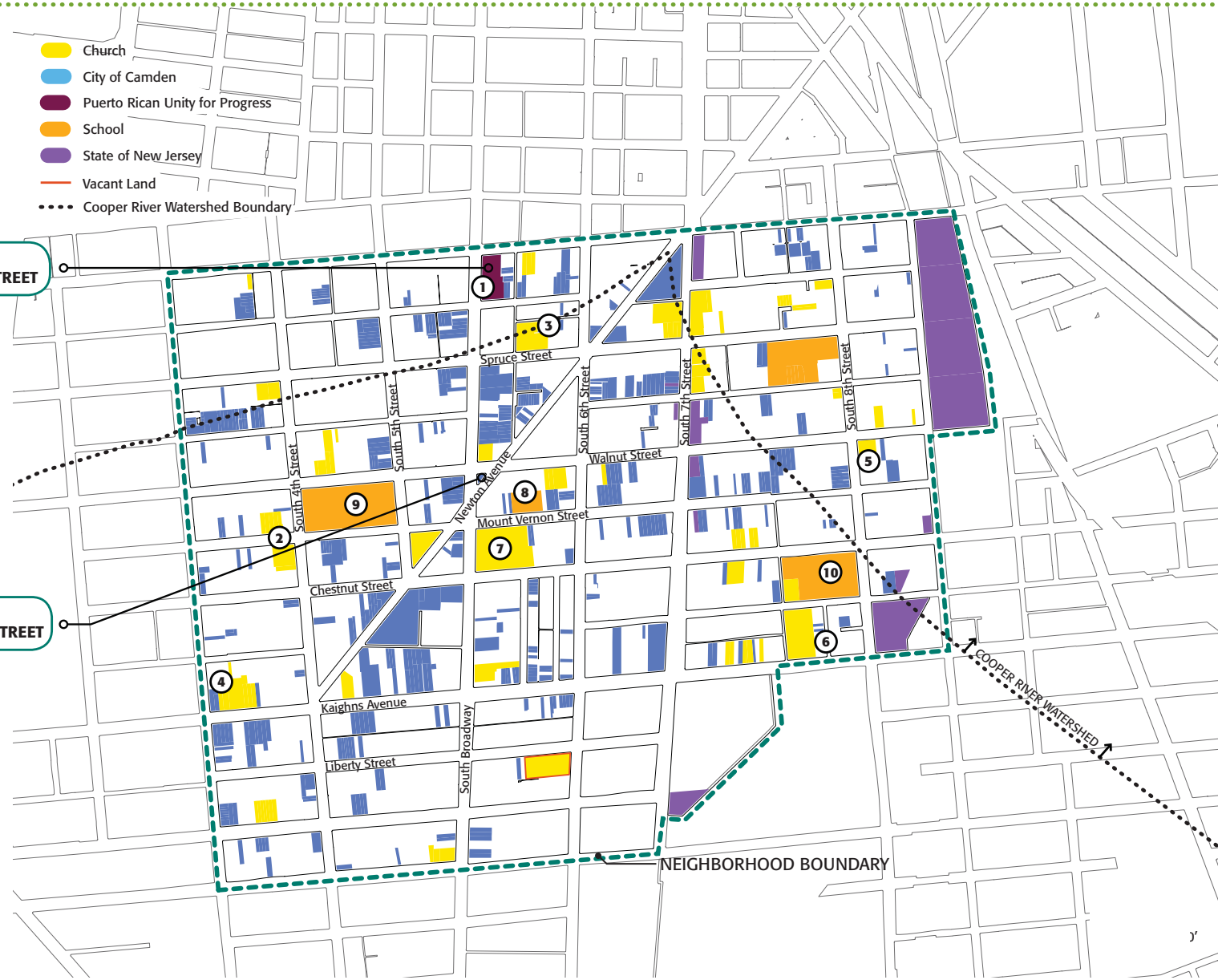
1. PUERTO RICAN UNITY FOR PROGRESS

CHURCH

- 2. Baptist Temple Church
- 3. Faith Tabernacle Church
- 4. Federation of Pentecostal Church
- 5. Friendship Baptist Church
- 6. Saint Bartholomew Roman Catholic Church
- 7. Shalom Baptist Church

SCHOOL

- 8. South Camden Alternative School
- 9. US Wiggins Elementary School
- 10. Whittier Elementary School



BERGEN SQUARE

SOUTH BROADWAY & PINE STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

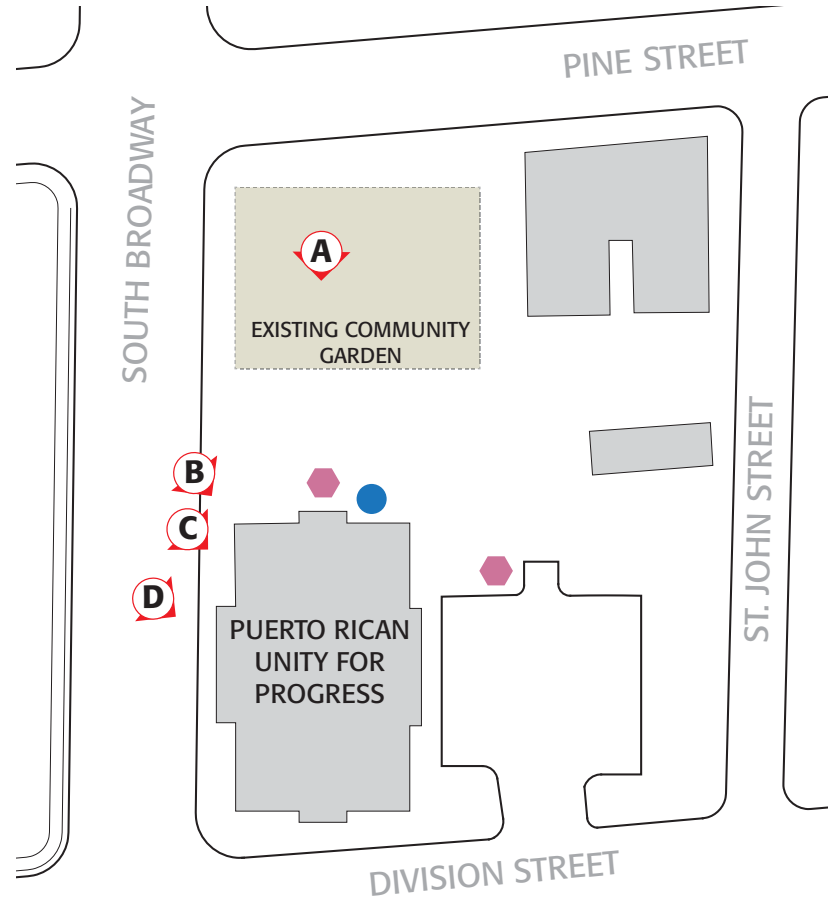
This project proposes to install two rain gardens and a rainwater harvesting system at the Puerto Rican Unity for Progress Center. The above ground cistern, designed to capture and store between 500-1,500 gallons of rainwater from the building's rooftop, will help irrigate the community gardens located on the site. In addition, rain gardens will manage both the overflow from the rainwater harvesting system as well as the stormwater runoff from the building's parking lot. This project would complement the existing NJTF tree and shrub plantings on the site.

POTENTIAL COMMUNITY PARTNERS

Puerto Rican Unity for Progress

PROPOSED GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- rainwater harvesting
- downspout disconnection



CONCEPTUAL SITE PLAN
 SCALE = 1:60

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- RAINWATER HARVESTING/RAIN BARRELS

SITE PHOTOS



BERGEN SQUARE

SOUTH BROADWAY & WALNUT STREET

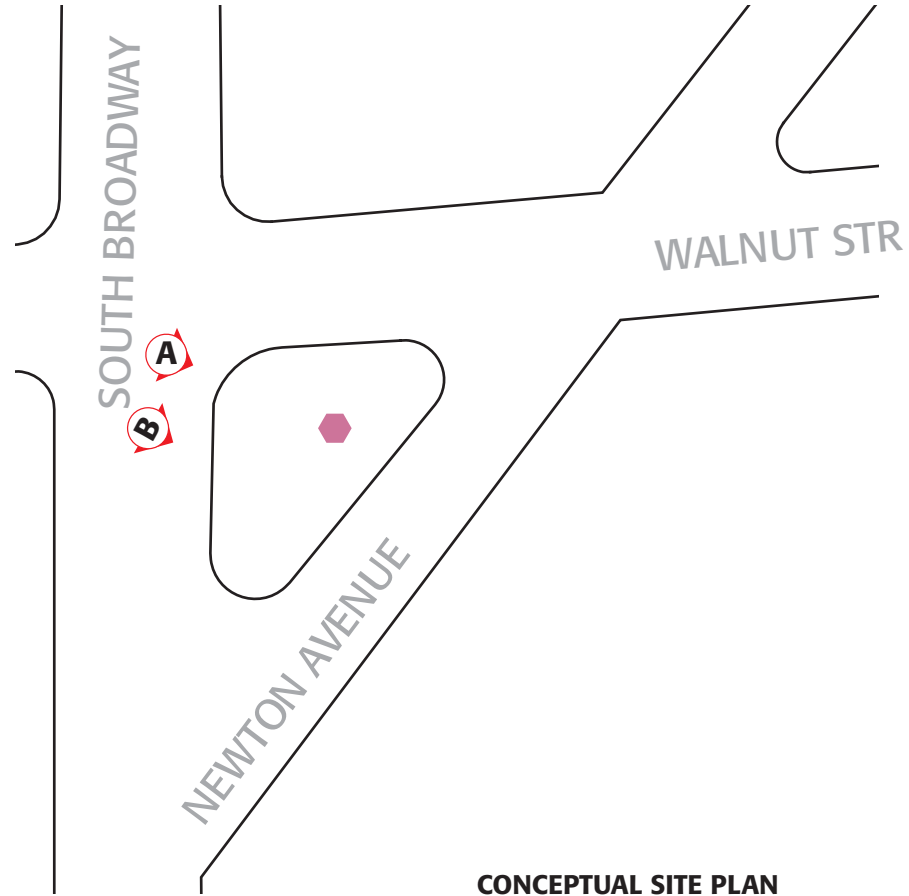
PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

This project includes a rain garden, strategically located within a busy intersection of Bergen Square, to capture the stormwater runoff from three converging streets. In addition to functioning as a stormwater management BMP, this rain garden will improve the aesthetic qualities of this neighborhood. Native plants planted in this sunny location could include species such as Black-eyed Susan, Purple Coneflower, False Sunflower, and Wild Bergamont.

GREEN INFRASTRUCTURE STRATEGIES

- rain garden



SITE LOCATION



GREEN INFRASTRUCTURE KEY:

◆ RAIN GARDEN

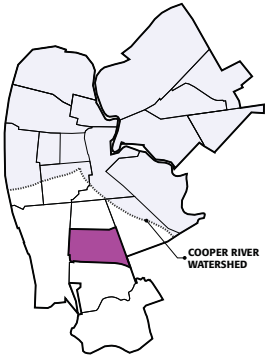
CONCEPTUAL SITE PLAN

SCALE = 1:50

SITE PHOTOS



CENTERVILLE

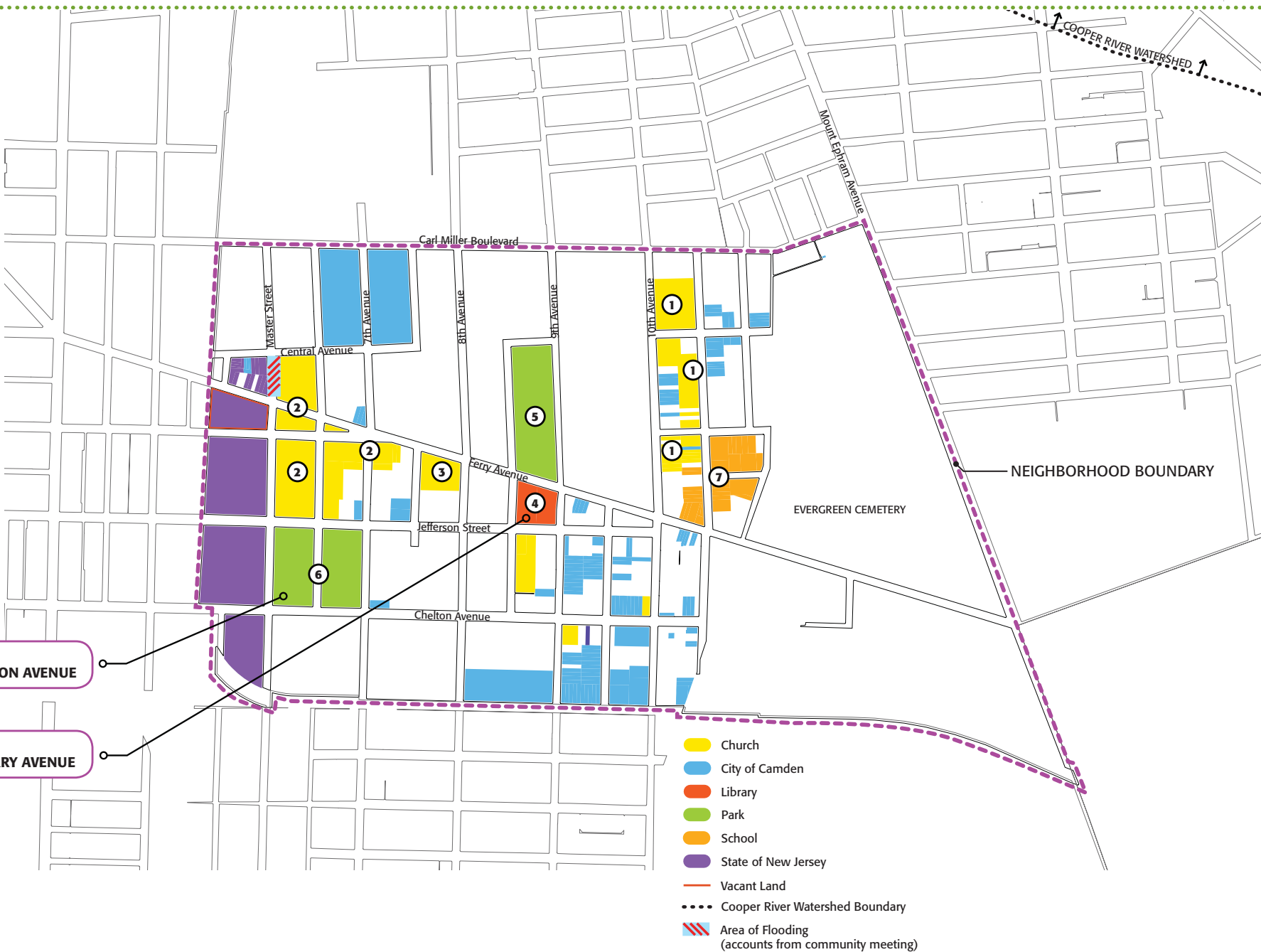


POTENTIAL PARTNERSHIP OPPORTUNITIES

- CHURCH**
1. 10th Street Baptist Church
 2. Antioch Baptist Church
 3. Ferry Avenue United Methodist Church
- LIBRARY**
4. Ferry Avenue Branch Library
- PARK**
5. Elijah Perry Park
 6. Staley Park
- SCHOOL**
7. RT Cream School

PROPOSED PROJECT:
MASTER STREET & CHELTON AVENUE

PROPOSED PROJECT:
SOUTH 9th STREET & FERRY AVENUE



- Church
- City of Camden
- Library
- Park
- School
- State of New Jersey
- Vacant Land
- Cooper River Watershed Boundary
- Area of Flooding (accounts from community meeting)

CENTERVILLE

SOUTH 9TH STREET & FERRY AVENUE

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

This project, located at the Camden County Ferry Avenue Branch Library, will disconnect the rooftop runoff and prevent it from flowing directly into the CSO system. Two rain gardens will be designed to capture, filter, and infiltrate the first one-inch of rainfall. Native herbaceous species planted within these rain gardens should be adapted to dry, sunny sites. This project could be an appropriate location for a rain garden training workshop.

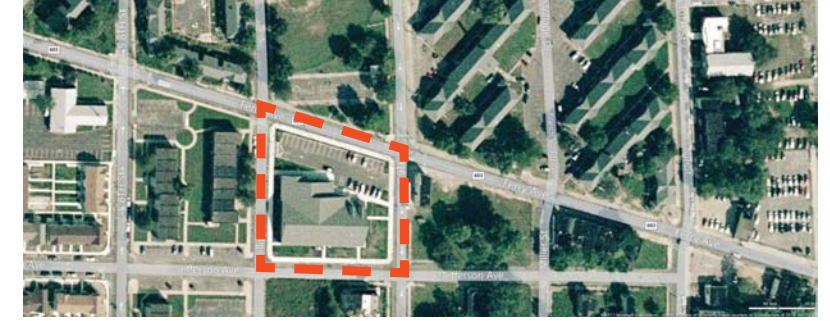
POTENTIAL COMMUNITY PARTNERS

Ferry Avenue Branch Library

GREEN INFRASTRUCTURE STRATEGIES

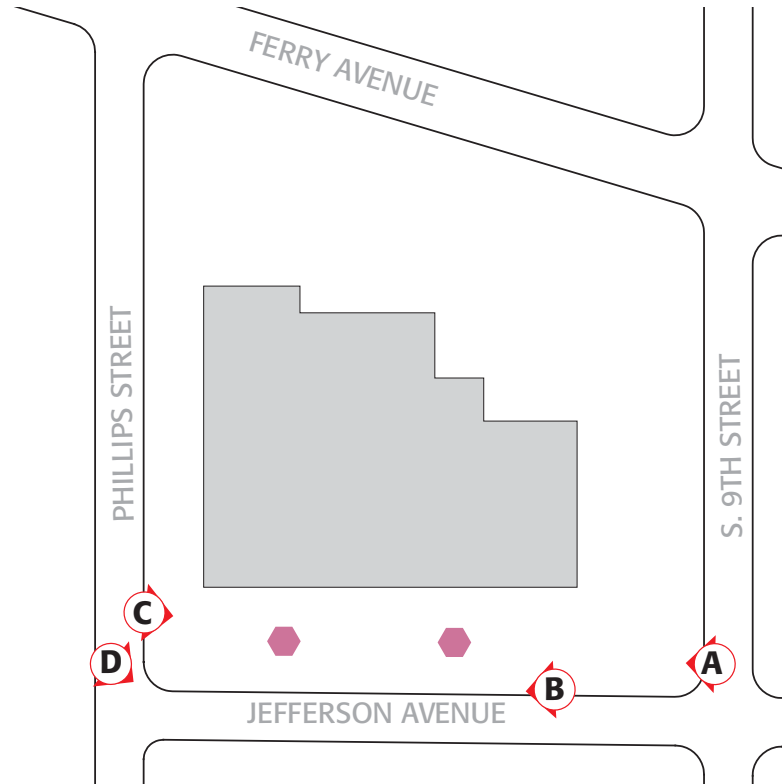
- rain garden
- downspout disconnection

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN



CONCEPTUAL SITE PLAN

SCALE = 1:80

SITE PHOTOS



CENTERVILLE

MASTER STREET & CHELTON AVENUE

PROJECT DESCRIPTION

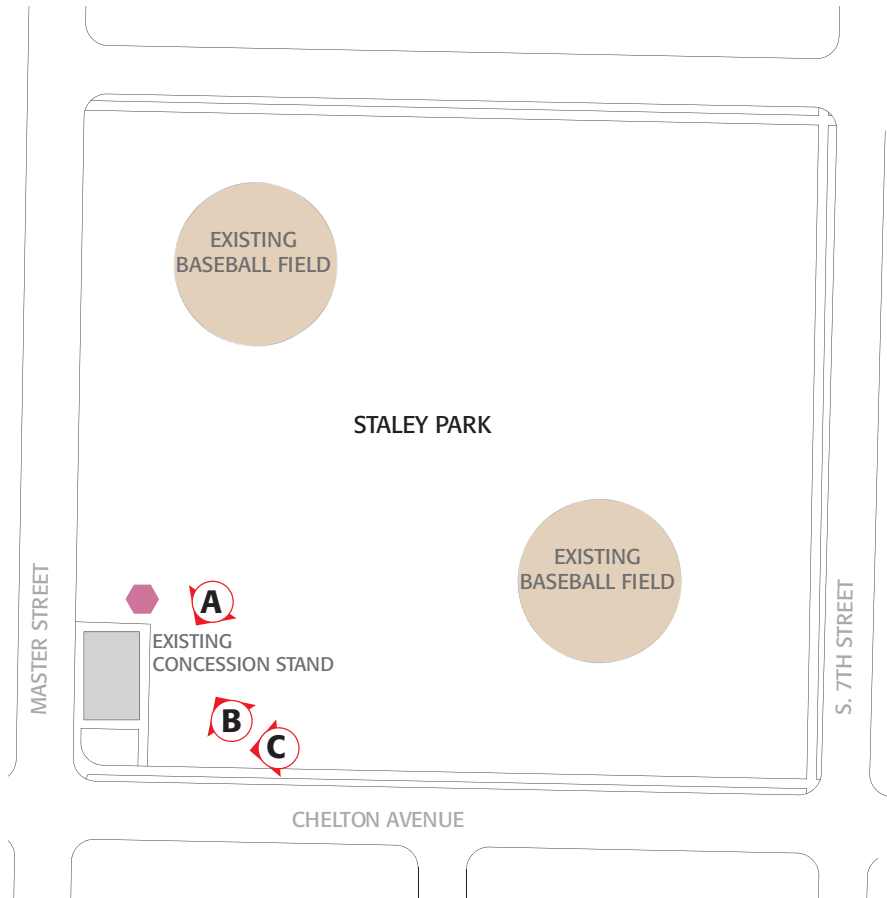
A demonstration rain garden is proposed at Camden City's Staley Park to capture, filter, and infiltrate stormwater runoff from a small concession building. The rain garden will disconnect stormwater runoff from the CSO system while enhancing the public park.

POTENTIAL COMMUNITY PARTNERS

Staley Park

GREEN INFRASTRUCTURE STRATEGIES:

- rain garden
- downspout disconnection



CONCEPTUAL SITE PLAN
 SCALE = 1:120

SITE LOCATION



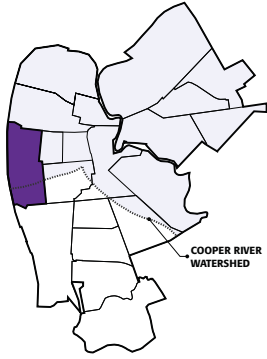
GREEN INFRASTRUCTURE KEY:

 RAIN GARDEN

SITE PHOTOS



CENTRAL WATERFRONT



POTENTIAL PARTNERSHIP OPPORTUNITIES

CHURCH

1. Holy Trinity Baptist Church
2. Macedonia African Methodist Episcopal Church
3. Mount Zion Highway of Holiness

PARK

4. 3rd & Knights Park
5. Wiggins Waterfront Park

RECREATION/COMMUNITY CENTER

6. Neighborhood Center United

SCHOOL

7. Fetters Alternative High School

- Church
- City of Camden
- Park
- Recreation/Community Center
- School
- City of Camden Boundary
- ... Cooper River Watershed Boundary
- Vacant Land

PROPOSED PROJECT:
RIVERSIDE DRIVE & MICKLE BOULEVARD

PROPOSED PROJECT:
278 KAIGHNS AVENUE



CENTRAL WATERFRONT

278 KAIGHNS AVENUE

PROJECT DESCRIPTION

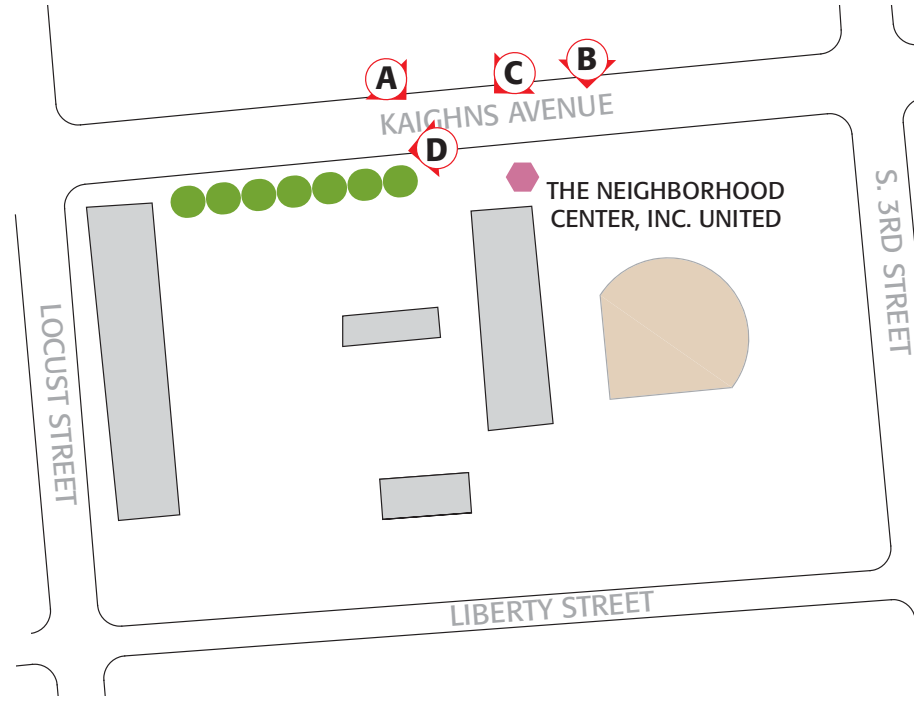
A rain garden and tree plantings are proposed on the site of the Neighborhood Center. The rain garden will capture rainwater from the building's rooftop and add visual interest to the building's entranceway. The additional trees planted within the playground area will increase canopy cover and provide shade for the children playing in the space.

POTENTIAL COMMUNITY PARTNERS

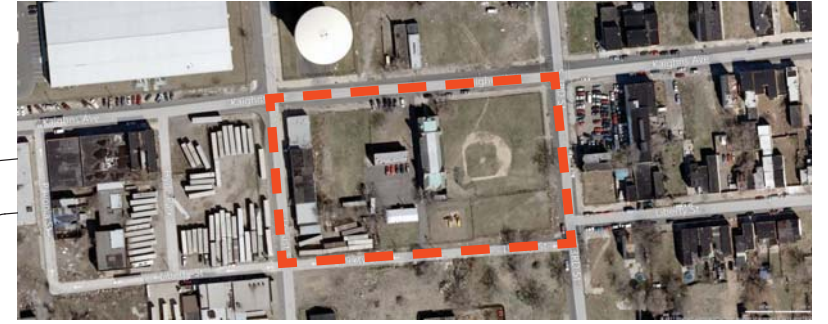
The Neighborhood Center, Inc. United

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings
- downspout disconnection



SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- TREE PLANTINGS

CONCEPTUAL SITE PLAN
 SCALE = 1:120

SITE PHOTOS



CENTRAL WATERFRONT

RIVERSIDE DRIVE & MICKLE BOULEVARD

PROJECT DESCRIPTION

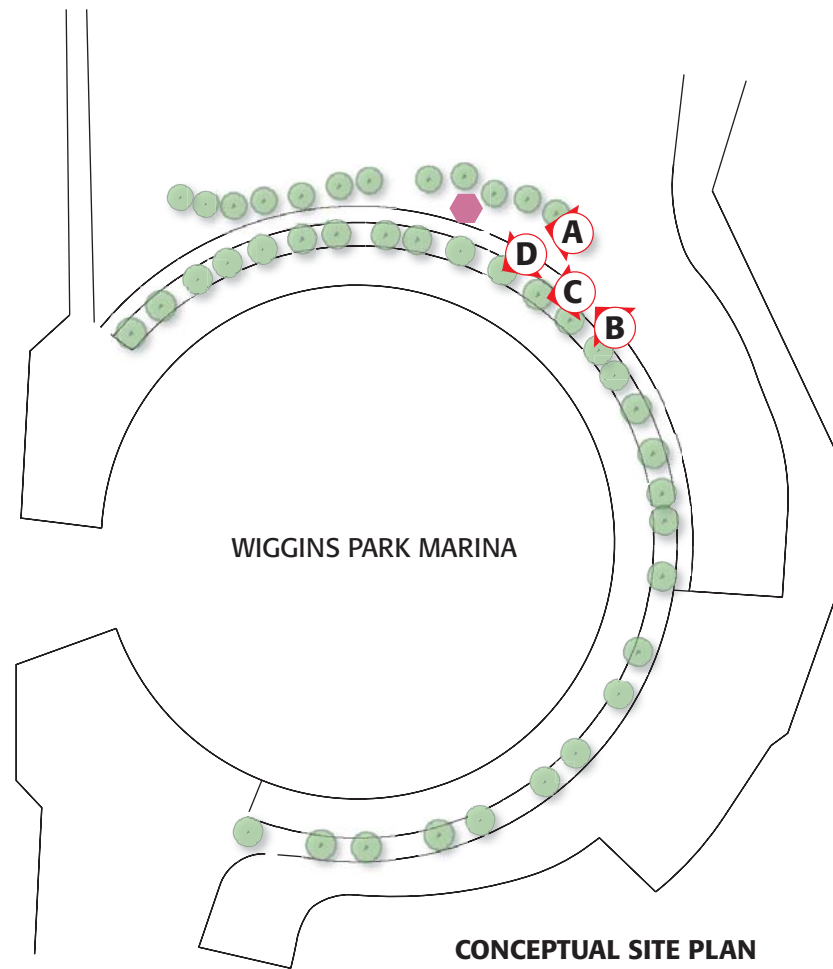
A bioretention swale is proposed along the existing gravel walking path adjacent to the Wiggins Park Marina. The site will be enhanced using soil amendments to promote infiltration of overland runoff and will be landscaped with native grasses and flowering species to create an attractive and functional landscape feature.

POTENTIAL COMMUNITY PARTNERS

Wiggins Park Marina

GREEN INFRASTRUCTURE STRATEGIES

- rain garden



CONCEPTUAL SITE PLAN
SCALE = 1:150

SITE LOCATION



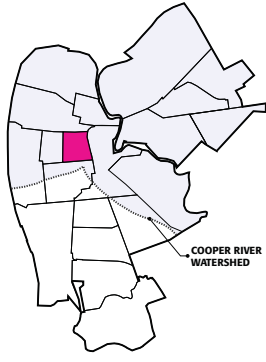
GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN

SITE PHOTOS



COOPER PLAZA



POTENTIAL PARTNERSHIP OPPORTUNITIES

CHURCH

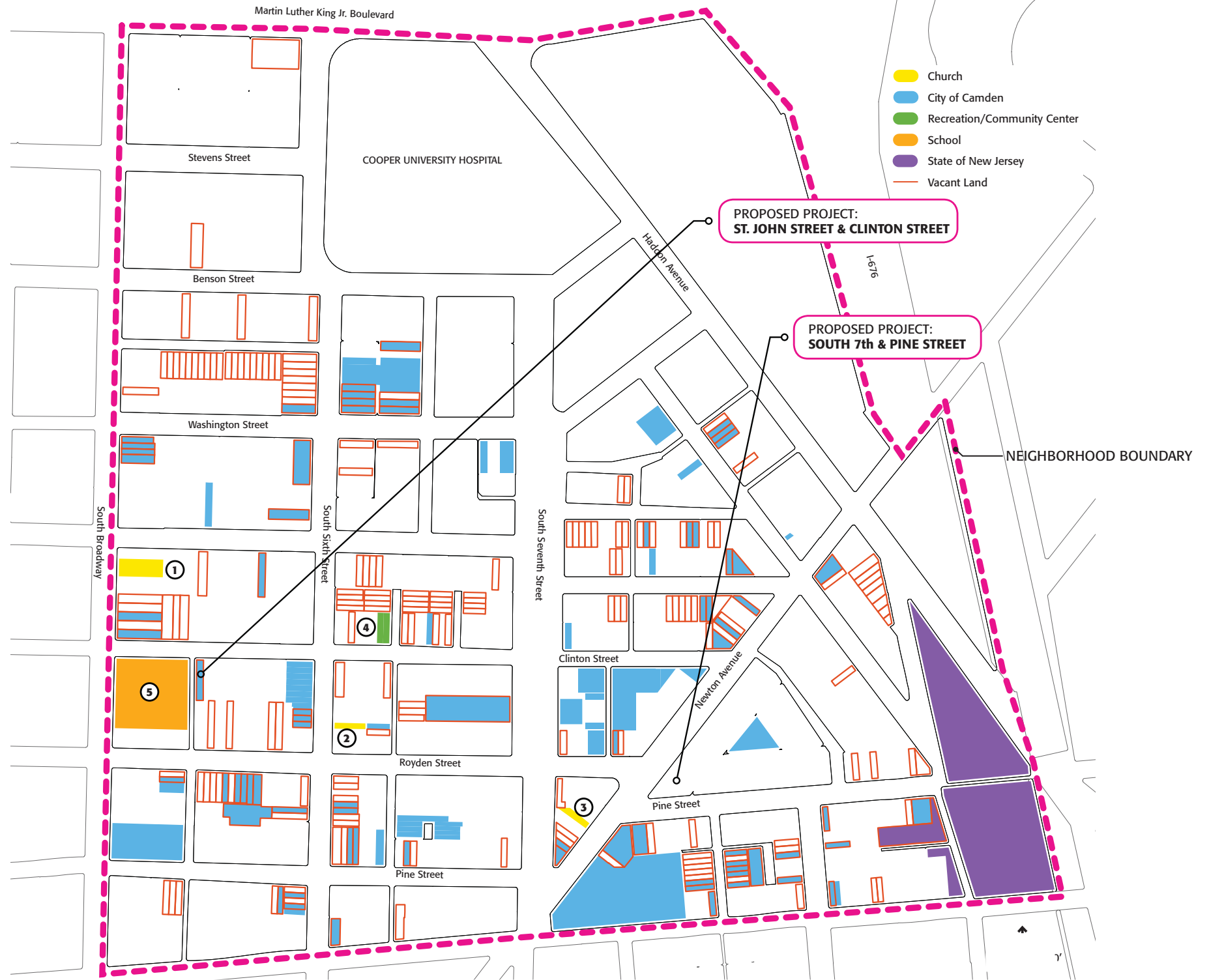
1. Faith Baptist Church
2. Gethsemane Baptist Church
3. New Mickle Baptist Church

RECREATION CENTER

4. Sikora Center

SCHOOL

5. Broadway Elementary School



COOPER PLAZA

ST. JOHN STREET & CLINTON STREET

PROJECT DESCRIPTION

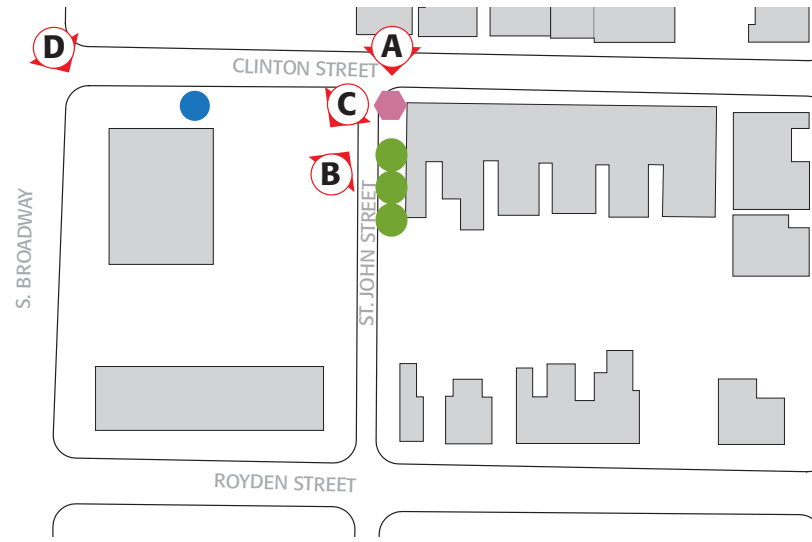
A rain garden and tree plantings are proposed on the vacant lot adjacent to The Broadway School. In addition to improving on-site infiltration and increasing tree canopy, this project has the opportunity to become an outdoor learning space for the school and an open green space for the community. To provide irrigation for the site, rain barrels will be used to collect rainwater from the rooftop of the school.

POTENTIAL COMMUNITY PARTNERS

The Broadway School

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings
- rainwater harvesting



SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- RAINWATER HARVESTING/RAIN BARRELS
- TREE PLANTINGS

SITE PHOTOS



COOPER PLAZA

SOUTH 7TH STREET & PINE STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

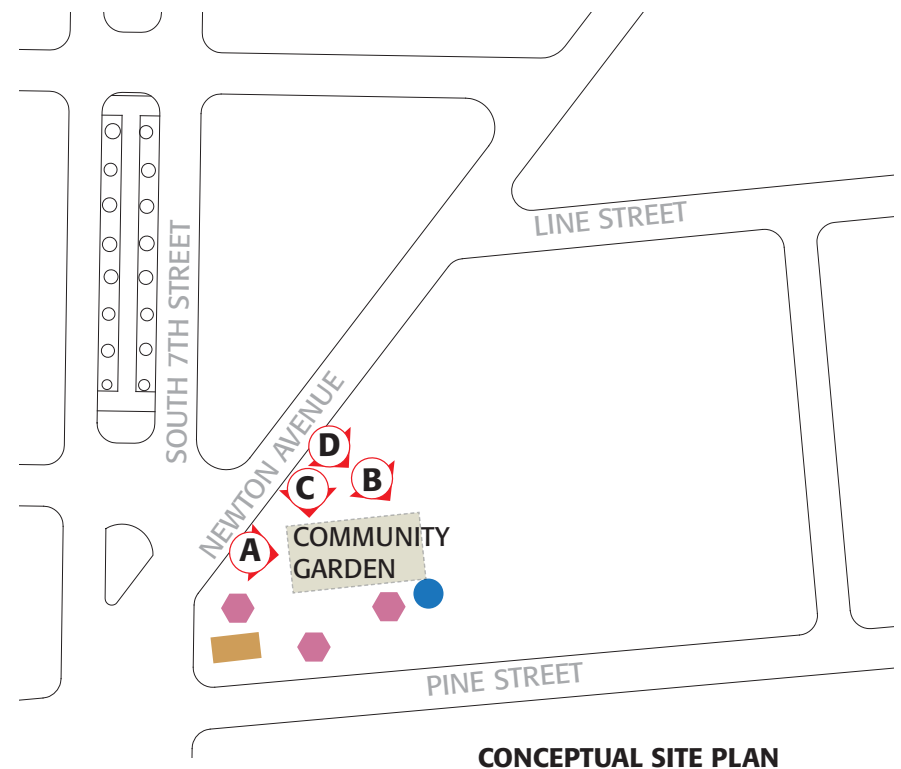
This project, known as Cooper Sprouts, aims to revitalize a large vacant lot adjacent to an existing community garden. The site will have several rain gardens collecting roadway runoff from Pine Street, South 7th Street, and Newton Avenue. New pervious paved walkways and sidewalks will improve pedestrian circulation around the site. NJTF planted trees on the site in fall 2011.

POTENTIAL COMMUNITY PARTNERS

- Cooper Lanning Civic Association
- Cooper University Hospital

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- rainwater harvesting
- pervious pavers



CONCEPTUAL SITE PLAN
 SCALE = 1:120

SITE LOCATION



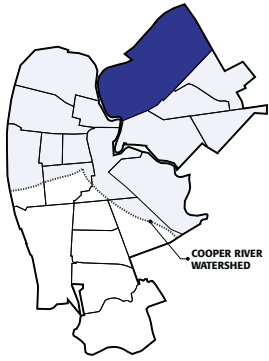
GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- RAINWATER HARVESTING/RAIN BARRELS
- PERVIOUS PAVERS

SITE PHOTOS



CRAMER HILL



POTENTIAL PARTNERSHIP OPPORTUNITIES

1. CCMUA

CHURCH

2. Saint Anthony of Padua
3. Church of Saint Andrew
4. Alpha Community Baptist Church
5. Congregation of Yahweh

COMMUNITY CENTER

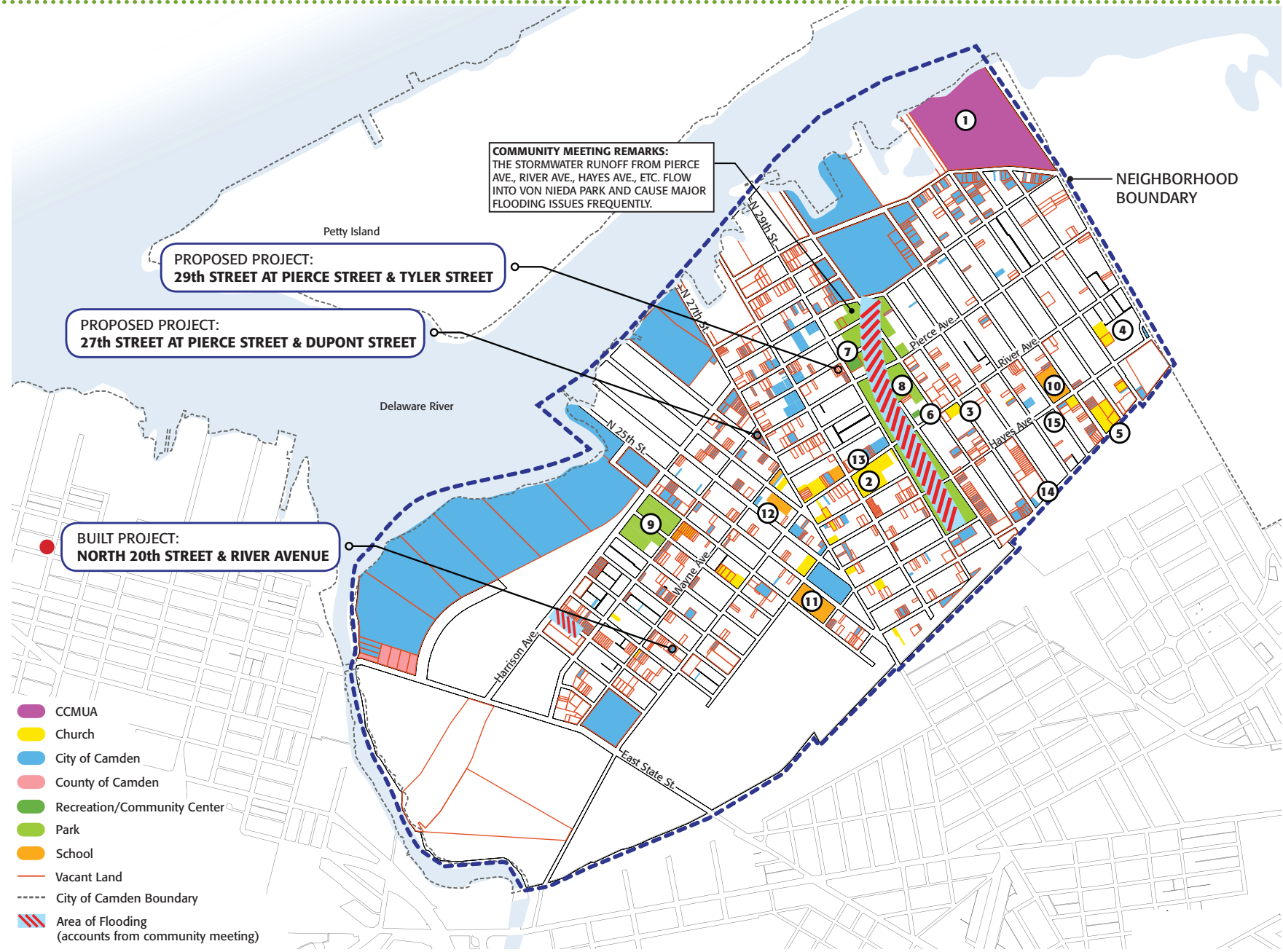
6. Cramer Hill Community Center
7. Cramer Hill Boys Club

PARK

8. Von Nieda Park
9. 22nd and Harrison Park

SCHOOL

10. Sharp Elementary School
11. Veteran's Memorial Middle School
12. Washington Elementary School
13. Saint Anthony of Padua School
14. Camden's Promise Charter School
15. Camden Academy Charter High School



CRAMER HILL

29TH STREET BETWEEN PIERCE STREET & TYLER STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

This project proposes to direct stormwater into a large rain garden (bioretention swale) located on the vacant 1/2 acre lot between Pierce Avenue and Tyler Street. The bioretention SWALE should be offset from 29th Street by at least ten feet. Currently, stormwater runoff runs directly down these streets and into Von Nieda Park, which is frequently severely flooded. This project would alleviate some of that flooding. A row of street trees planted along 29th Street will work in coordination with the bioswale to improve ground infiltration.

POTENTIAL COMMUNITY PARTNERS

Cramer Hill CDC

GREEN INFRASTRUCTURE STRATEGIES

- bioswale



SITE LOCATION



SITE PHOTOS



CRAMER HILL

NORTH 20TH STREET & RIVER AVENUE

INSTALLED SPRING 2011

PROJECT DESCRIPTION

This community garden retrofit design focuses on redirecting the stormwater from North 20th Street into two rain gardens via curb cuts. Once in the rain gardens, the stormwater runoff flows through piping into an underground water cistern. The proposed cistern (not yet built) will hold water, and if not utilized, the water will slowly percolate into the ground. This BMP design will manage water quality and quantity, provide irrigation for the community garden, improve the air quality, and reduce the urban heat island effect.

COMMUNITY PARTNERS

Cramer Hill CDC

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings
- rainwater harvesting

SITE LOCATION



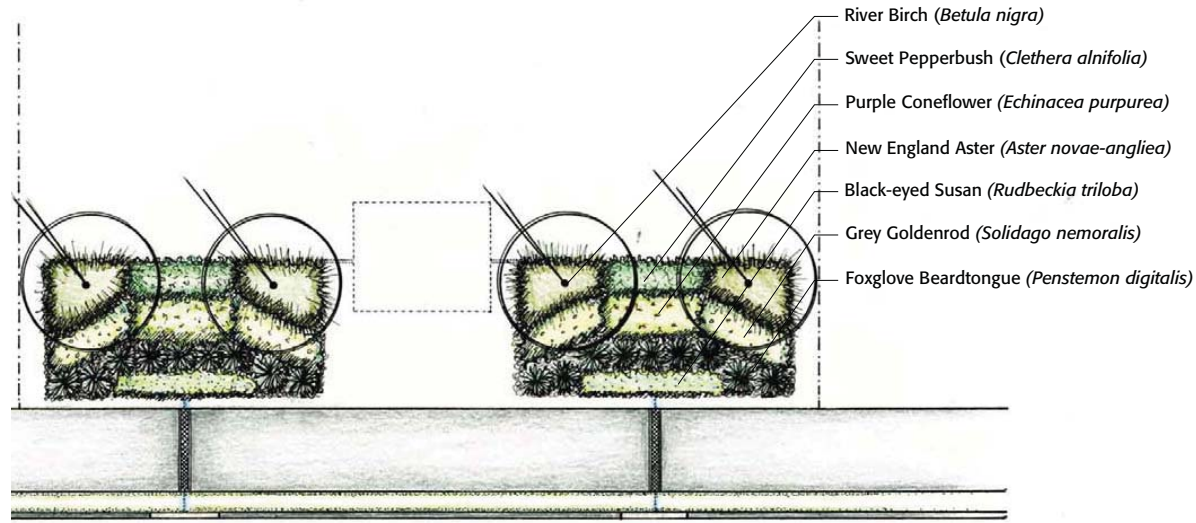
SITE PHOTOS



CRAMER HILL

NORTH 20TH STREET & RIVER AVENUE

INSTALLED SPRING 2011



PLANTING PLAN

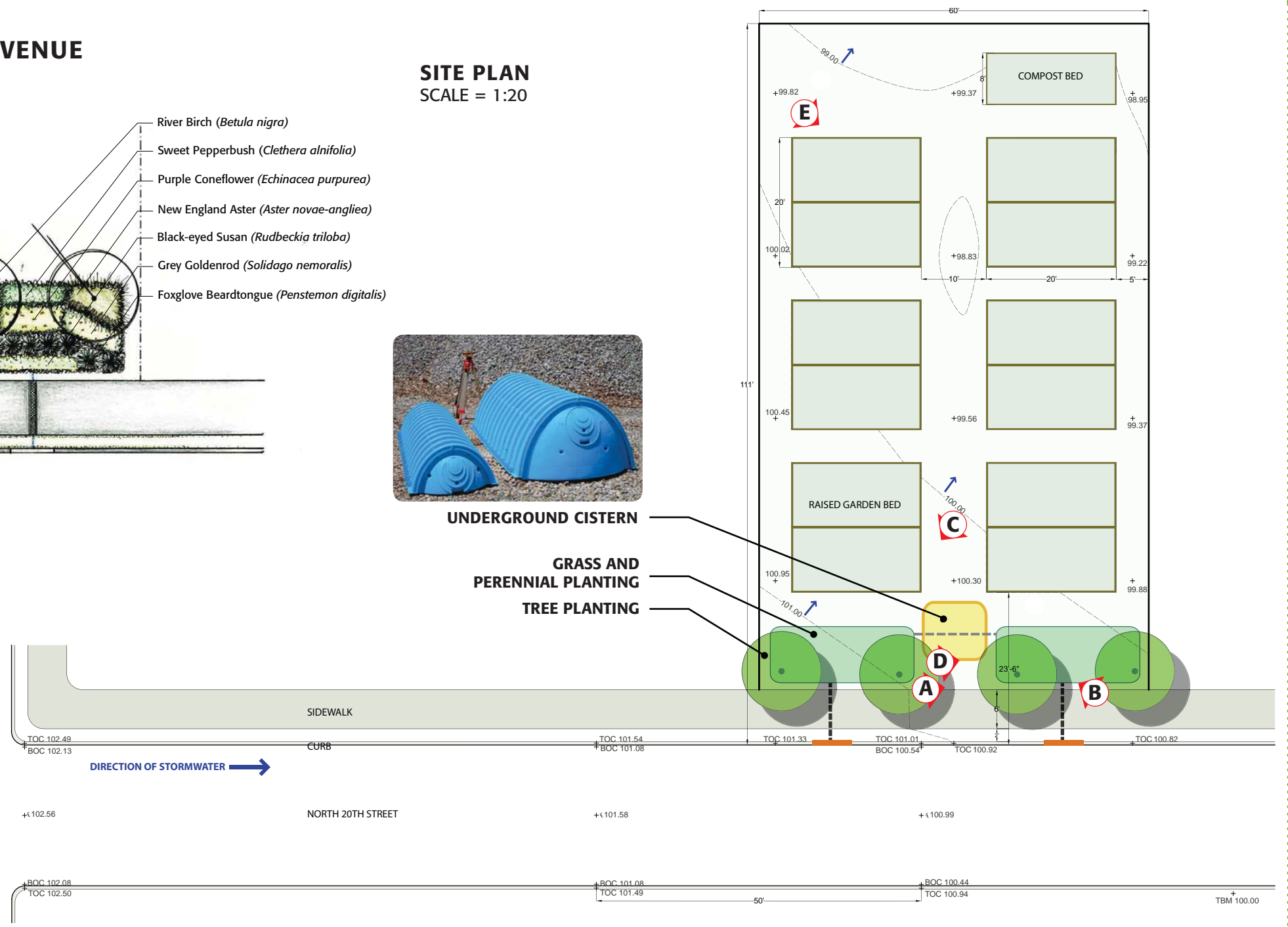
SITE PLAN

SCALE = 1:20



UNDERGROUND CISTERN

GRASS AND PERENNIAL PLANTING
TREE PLANTING



CRAMER HILL

27TH STREET AT PIERCE STREET & DUPONT STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

This project consists of a rain garden and an underground infiltration system for an existing community garden site. The system would capture stormwater near the corner of Pierce Avenue and 27th Street, direct it into the rain garden, and then infiltrate into an underground stormwater detention chamber. A pump within this chamber could potentially provide irrigation water for the community garden. This project would complement the existing NJTF tree and shrub planting located on the site.

COMMUNITY PARTNERS

Cramer Hill CDC

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- rainwater harvesting

SITE LOCATION



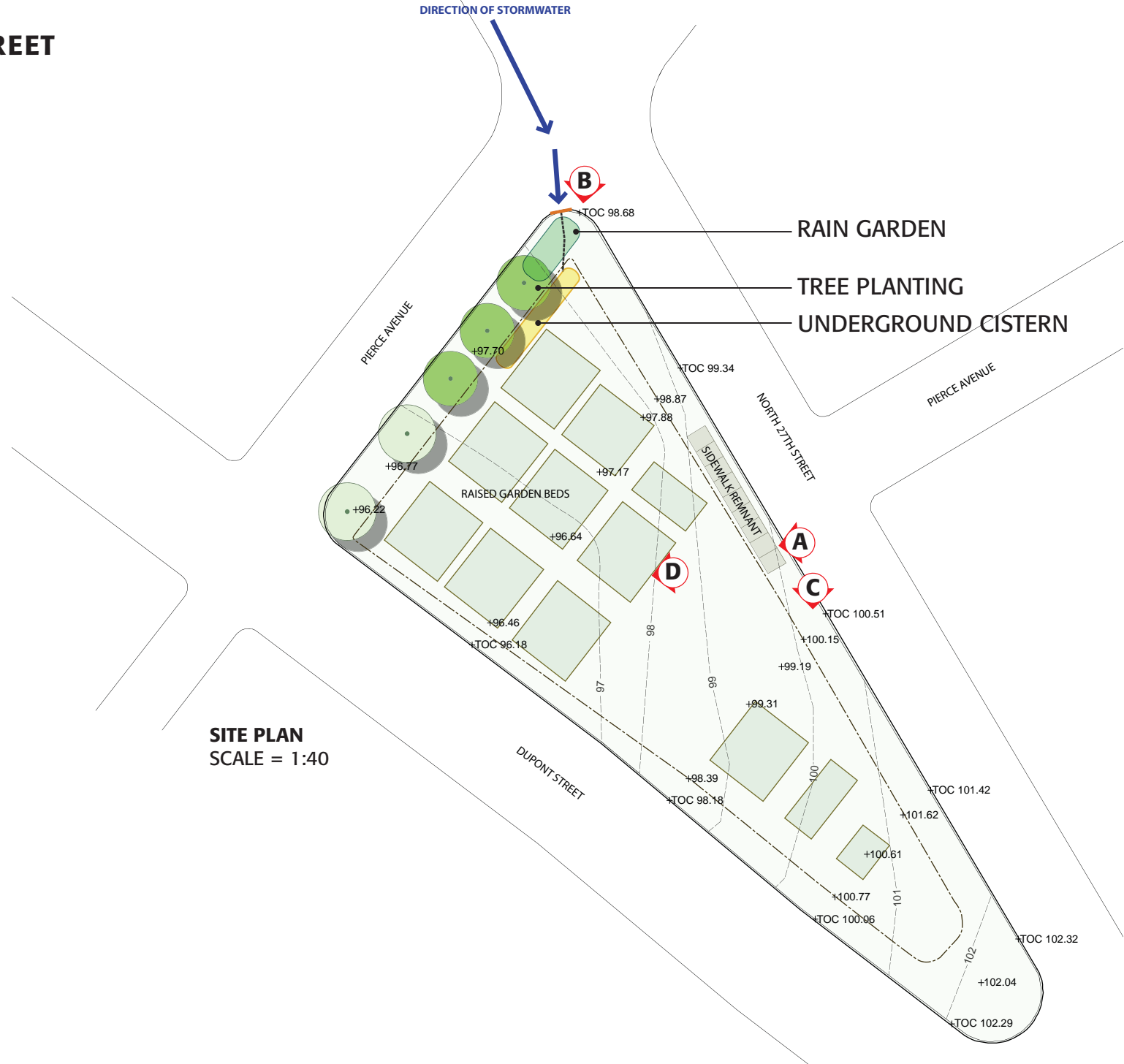
SITE PHOTOS



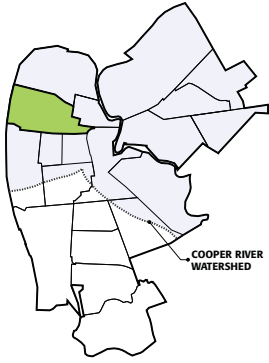
CRAMER HILL

27TH STREET AT PIERCE STREET & DUPONT STREET

PRIORITY PROJECT SPRING 2012



DOWNTOWN/COOPER GRANT



**PROPOSED PROJECT:
NORTH FRONT STREET**

COMMUNITY MEETING REMARKS:
RUNOFF FROM POINT & LINDEN
WAREHOUSE CAUSES FLOODING IN AREA.

COMMUNITY MEETING REMARKS:
24' x 60' COMMUNITY GARDEN WITH
POTENTIAL FOR RAINWATER HARVESTING.
CONTACT: dariachacon@yahoo.com

COMMUNITY MEETING REMARKS:
THIS AREA HAS A LOT OF PARKING WITH
STORMWATER RUNOFF.

**PROPOSED PROJECT:
PENN STREET & NORTH FRONT STREET**

COMMUNITY MEETING REMARKS:
CITY OF CAMDEN OWNED LAND,
MANAGED BY RUTGERS. POTENTIAL
LOCATION FOR A RAIN GARDEN.

COMMUNITY MEETING REMARKS:
NEW DEVELOPMENT OF APPROXIMATELY
12 HOMES WITH PLAN FOR A PARK IN
THE MIDDLE - POTENTIAL LOCATION FOR
A RAIN GARDEN. CONTACT: JONATHAN
LATKO latkoj@hotmail.com

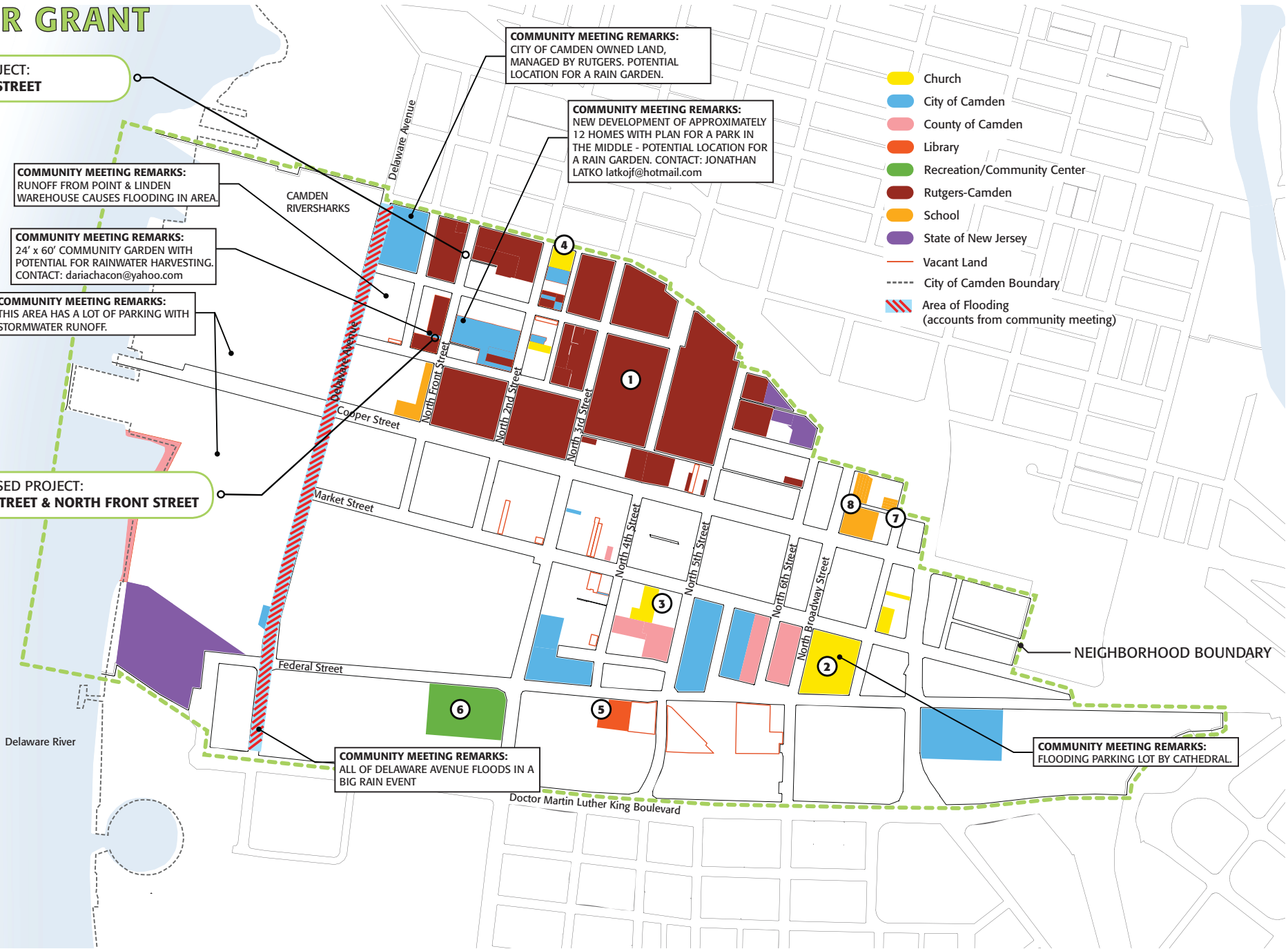
COMMUNITY MEETING REMARKS:
ALL OF DELAWARE AVENUE FLOODS IN A
BIG RAIN EVENT

COMMUNITY MEETING REMARKS:
FLOODING PARKING LOT BY CATHEDRAL.

- Church
- City of Camden
- County of Camden
- Library
- Recreation/Community Center
- Rutgers-Camden
- School
- State of New Jersey
- Vacant Land
- City of Camden Boundary
- ▨ Area of Flooding (accounts from community meeting)

POTENTIAL PARTNERSHIP OPPORTUNITIES

1. RUTGERS-CAMDEN
- CHURCH**
2. Cathedral of Immaculate Conception
 3. Saint Paul's Episcopal Church
 4. Victory Temple Community Church
- LIBRARY**
5. Camden Free Library
- RECREATION/COMMUNITY CENTER**
6. YMCA
- SCHOOL**
7. Leap Academy Charter School
 8. Rowan University



DOWNTOWN/COOPER GRANT

NORTH FRONT STREET

PROJECT DESCRIPTION

This project consists of two curb extensions, located on either side of North Front Street. Stormwater runoff will flow into these slightly depressed, vegetated swales and will infiltrate into the ground before it has a chance to enter the existing storm sewer inlet. Not only does a curb extension function as a stormwater management BMP, but it also improves pedestrian safety.

POTENTIAL COMMUNITY PARTNERS

Cooper Grant Neighborhood Association
 Rutgers-Camden

GREEN INFRASTRUCTURE STRATEGIES

- curb extensions



CONCEPTUAL SITE PLAN
 SCALE = 1:100

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

 STORMWATER CURB EXTENSION

SITE PHOTOS



DOWNTOWN/COOPER GRANT

PENN STREET & NORTH FRONT STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

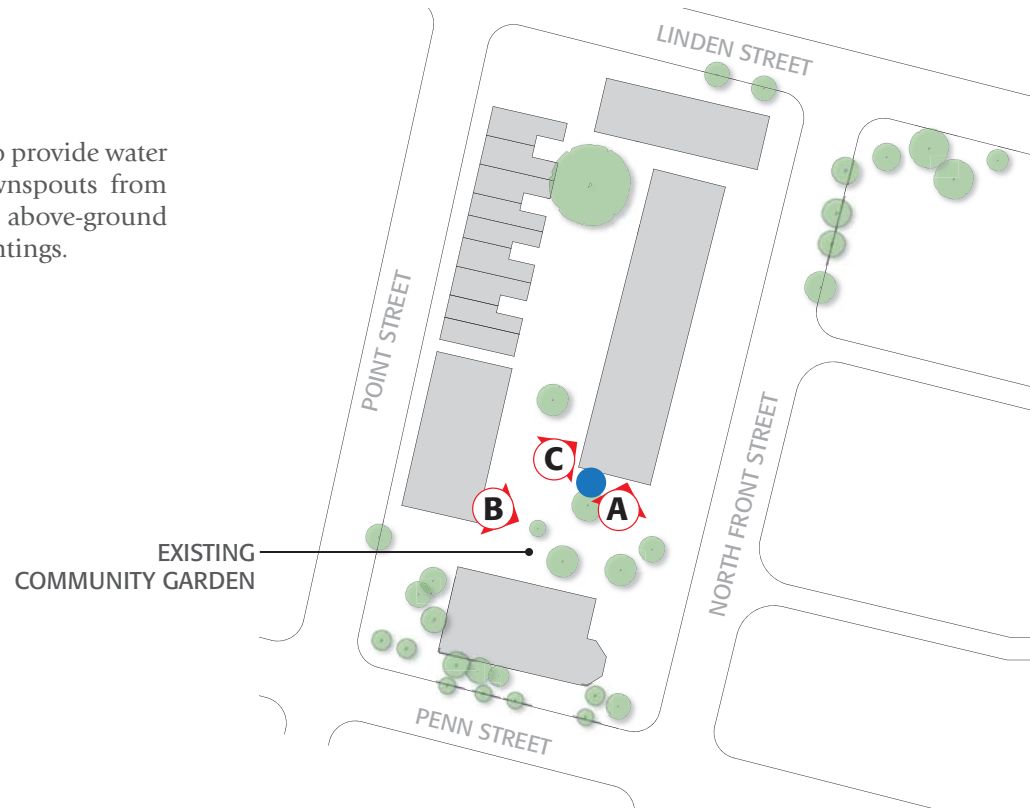
A 500 gallon rainwater harvesting system is proposed to provide water for the community garden located at this site. Downspouts from adjacent residential buildings will be diverted into an above-ground cistern, providing a free source of water for garden plantings.

POTENTIAL COMMUNITY PARTNERS

Cooper Grant Neighborhood Association
Rutgers-Camden

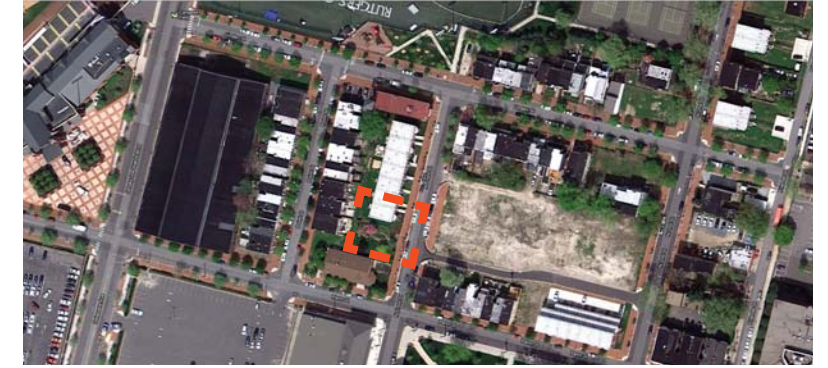
GREEN INFRASTRUCTURE STRATEGIES

- rainwater harvesting
- downspout disconnection



CONCEPTUAL SITE PLAN
SCALE = 1:100

SITE LOCATION



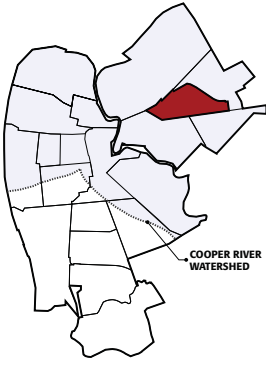
GREEN INFRASTRUCTURE KEY:

- RAINWATER HARVESTING/RAIN BARRELS

SITE PHOTOS



EAST CAMDEN - DUDLEY



POTENTIAL PARTNERSHIP OPPORTUNITIES

CHURCH

1. Calvary Bible Protestant Church
2. Saint Joseph's Catholic Church
3. Saint John's Baptist Church
4. Spanish Pentecostal Church
5. Victory Baptist Church
6. Hosanna AME Church

PARK

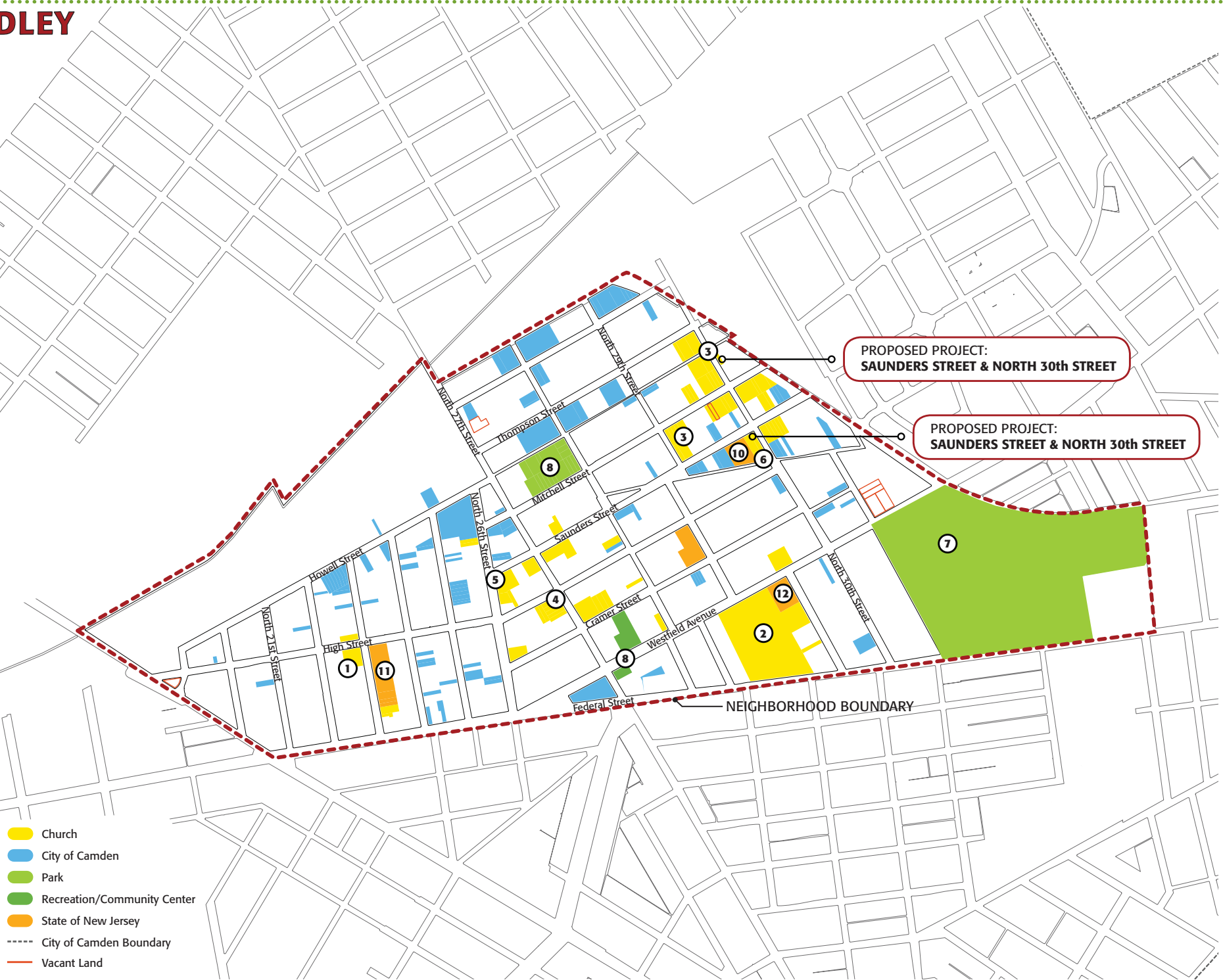
7. Dudley Grange Park
8. Roger Williams Memorial Park

RECREATION/COMMUNITY CENTER

9. Hispanic Family Centers of Southern Jersey

SCHOOL

10. Catto School
11. Dudley School
12. Saint Joseph's Catholic School



- Church
- City of Camden
- Park
- Recreation/Community Center
- State of New Jersey
- City of Camden Boundary
- Vacant Land

EAST CAMDEN - DUDLEY

SAUNDERS STREET & NORTH 30TH STREET

PROJECT DESCRIPTION

A rain garden and tree planting are proposed at the Catto Elementary School and adjacent Hosanna AME Church. The two properties provide multiple opportunities to disconnect rooftop runoff from flowing directly into the CSO system. Tree plantings along North 30th Street will also improve soil infiltration, provide shade, and improve the neighborhood's aesthetic character.

POTENTIAL COMMUNITY PARTNERS

Catto School
Hosanna AME Church

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings
- downspout disconnection

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- TREE PLANTINGS



CONCEPTUAL SITE PLAN
SCALE = 1:120

SITE PHOTOS



EAST CAMDEN - DUDLEY

THOMPSON STREET AT NORTH 30TH STREET

PROJECT DESCRIPTION

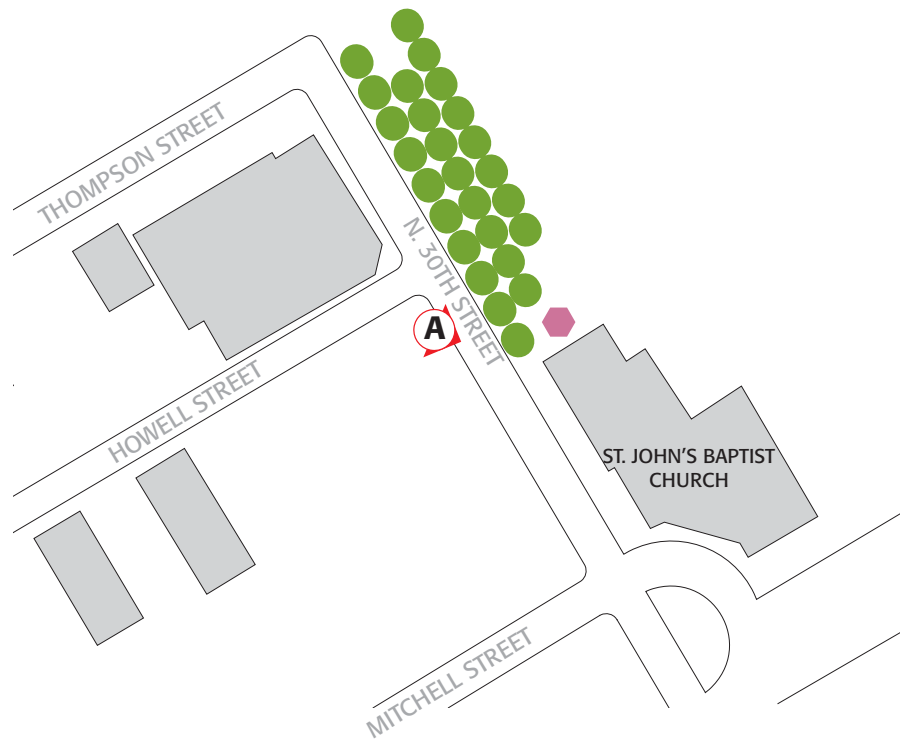
A rain garden and tree plantings are proposed at the site of St. John's Baptist Church. Along with the environmental benefits of increased infiltration, reduced soil erosion, and reducing nutrient loads in stormwater runoff, planting a dense group of trees in this location will block the community's view of the adjacent industrial area.

POTENTIAL COMMUNITY PARTNERS

St. John's Baptist Church

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings
- downspout disconnection



CONCEPTUAL SITE PLAN
 SCALE = 1:120

SITE LOCATION



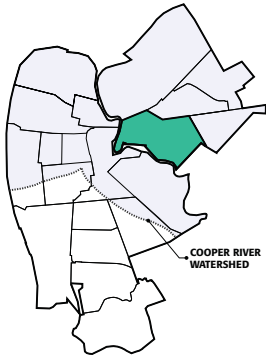
GREEN INFRASTRUCTURE KEY:

- RAIN GARDEN
- TREE PLANTINGS

SITE PHOTOS



EAST CAMDEN - MARLTON



POTENTIAL PARTNERSHIP OPPORTUNITIES

CHURCH

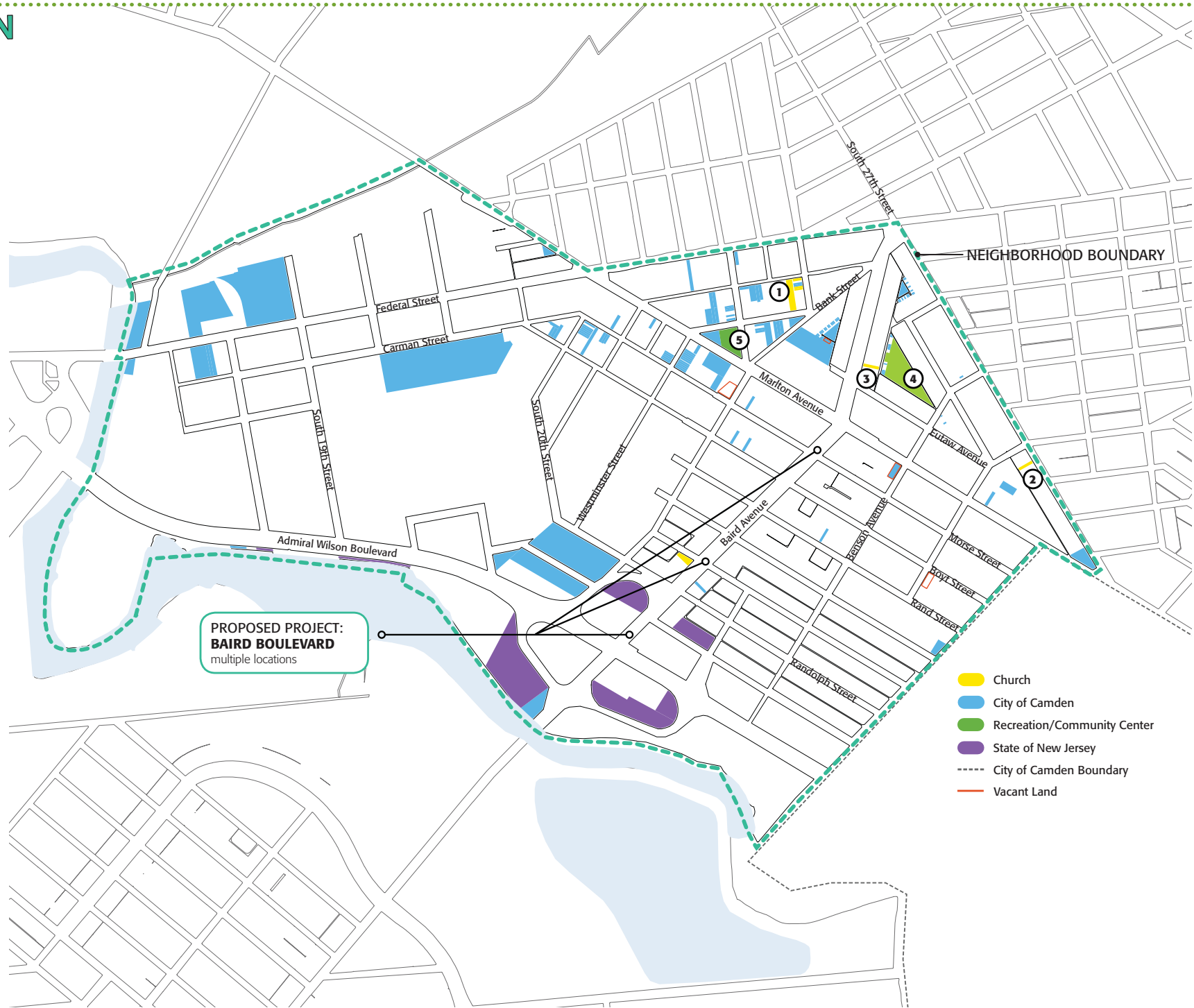
1. Federation of Pentecostal Churches
2. Holy Temple Church
3. Scott Methodist Church

PARK

4. Mickel/Eutaw Park

RECREATION/COMMUNITY CENTER

5. Iglesia Pentecostal Recreation Center



- Church
- City of Camden
- Recreation/Community Center
- State of New Jersey
- City of Camden Boundary
- Vacant Land

EAST CAMDEN - MARLTON

BAIRD BOULEVARD

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

There appears to be multiple opportunities for rain gardens, bioretention swales, and tree plantings in various locations along the vacant median of Baird Boulevard. Necessary efforts include excavating the existing soils, amending soils to promote infiltration, installing curb cuts, and planting low maintenance, native plants. Not only will these functioning systems reduce localized flooding, but they will also improve the aesthetic quality of this busy boulevard and minimize required landscape maintenance of the road right-of-way.

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings



CONCEPTUAL SITE PLAN
 SCALE = 1:120

SITE LOCATION



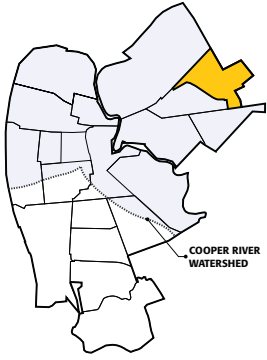
GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- TREE PLANTINGS

SITE PHOTOS



EAST CAMDEN - ROSEDALE



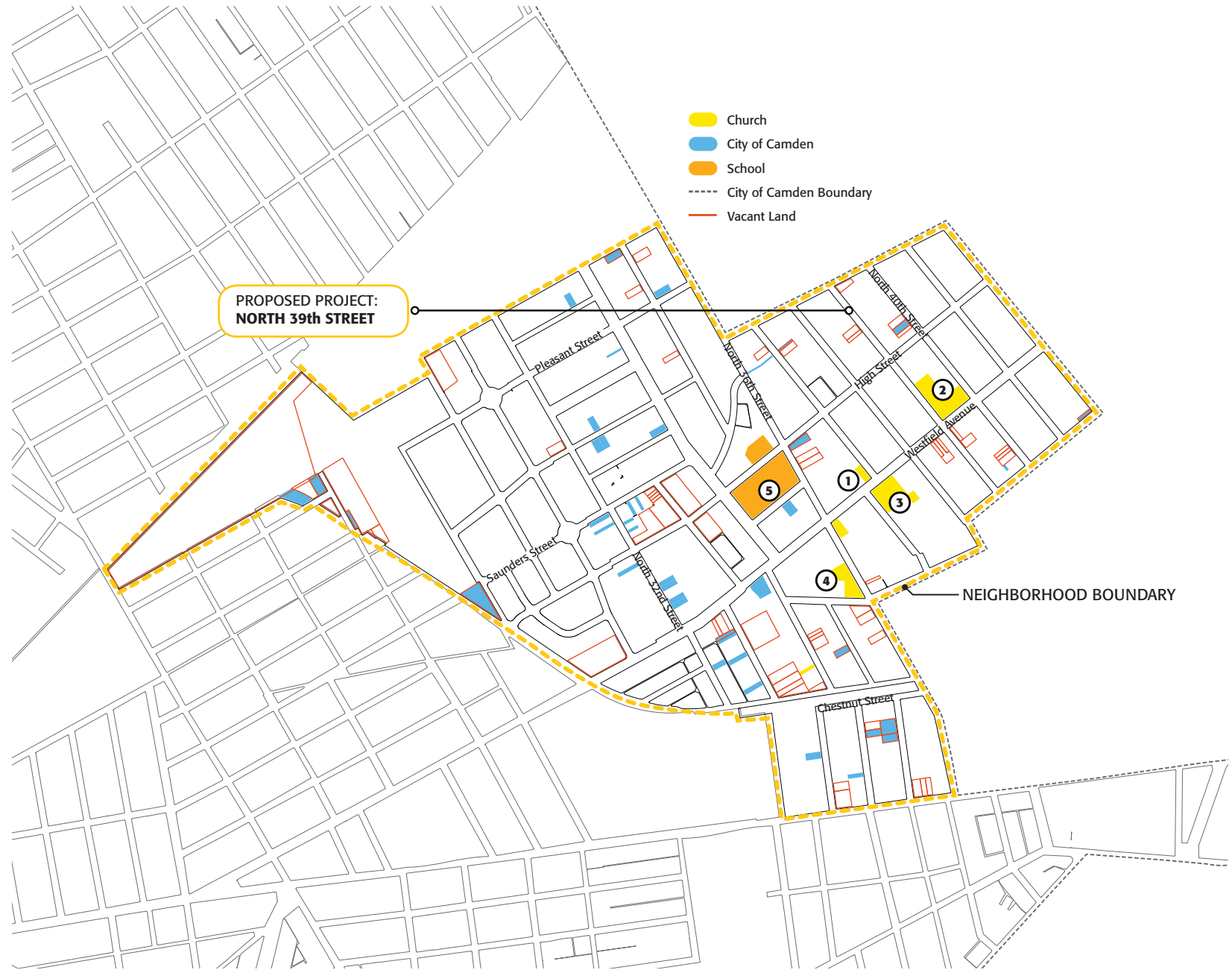
POTENTIAL PARTNERSHIP OPPORTUNITIES

CHURCH

1. Congregation of Yahweh
2. Bethel United Methodist Church
3. Rosedale Baptist Church
4. Temple of Love Christian Center

SCHOOL

5. Davis Elementary School



EAST CAMDEN - ROSEDALE

NORTH 39TH STREET

(various locations throughout the neighborhood)

PROJECT DESCRIPTION

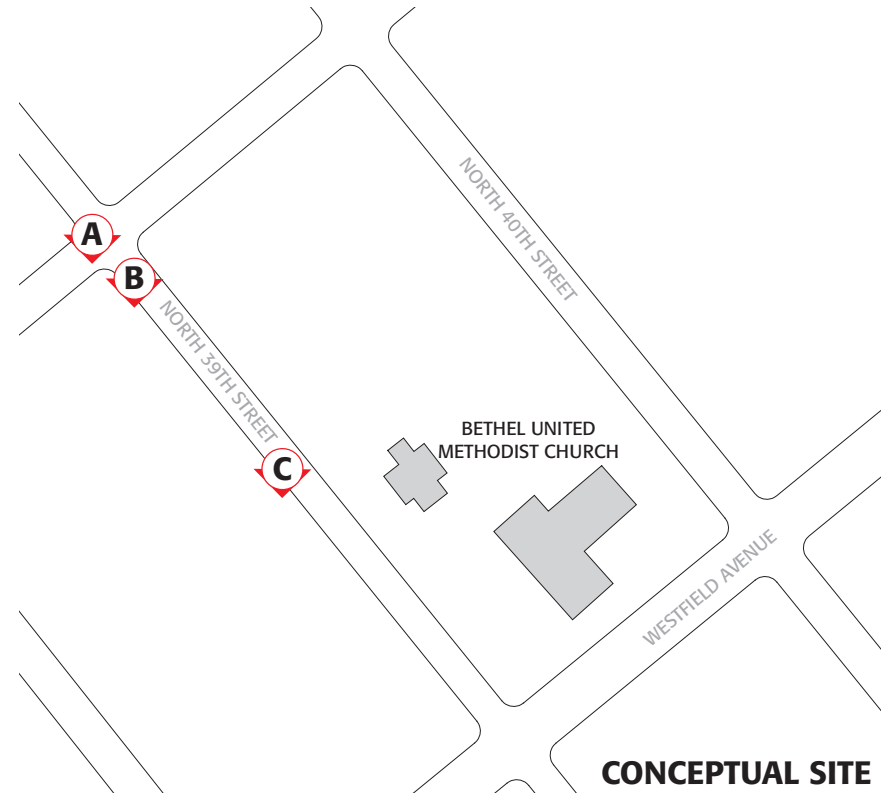
Site visits to this neighborhood revealed that many small garden plots existed, particularly in the residential area around North 39th Street. This project addresses the need to water these gardens. A neighborhood-wide rain barrel and water conservation program will engage local gardeners and community organizations. Through a neighborhood flier campaign, residents will be invited to participate in a water conservation education program and *Build-a-Rain Barrel* workshop, which could be run in partnership with The CfET.

POTENTIAL COMMUNITY PARTNERS

Bethel United Methodist Church
 The CfET

GREEN INFRASTRUCTURE STRATEGIES

- rainwater harvesting
- downspout disconnection
- water conservation education program



CONCEPTUAL SITE PLAN
 SCALE = 1:150



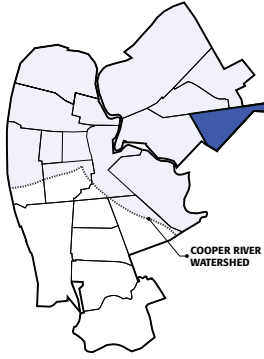
- Downspout (connects to gutter)
- Flexible Downspout (plastic)
- Inlet
- Overflow
- Rain Barrel (55 gallons)
- Faucet
- Platform (elevated + level)

Example of a residential rainwater harvesting system

SITE PHOTOS



EAST CAMDEN - STOCKTON



POTENTIAL PARTNERSHIP OPPORTUNITIES

- CHURCH**
 1. Bible Baptist Fellowship Church
 2. Holy Temple of Our Lord Jesus
- PARK**
 3. Green Alberta Woods
- RECREATION/COMMUNITY CENTER**
 4. Respond, Inc.
- SCHOOL**
 5. Cramer School
 6. Woodrow Wilson High School



PROPOSED PROJECT:
FREEMONT AVENUE & BURWOOD AVENUE

- Church
- City of Camden
- Recreation/Community Center
- School
- - - - City of Camden Boundary

NOTE: Vacant Land GIS Data may be incomplete

EAST CAMDEN - STOCKTON

FREMONT AVENUE & BURWOOD AVENUE

PROJECT DESCRIPTION

This project consists of installing a rain garden at the East Camden Middle School. Working with students and staff, a demonstration rain garden will be designed and installed to capture, filter, and infiltrate parking lot runoff. An existing curb cut can be used as the inlet for the rain garden, which will capture and store parking lot runoff. Native herbaceous species planted within this rain garden should be adapted to shade conditions. This project could include a water conservation education program with the school.

POTENTIAL COMMUNITY PARTNERS

Woodrow Wilson High School (3100 Federal Street)
 East Camden Middle School (3064 Stevens Street)

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- water conservation education program

SITE PHOTOS

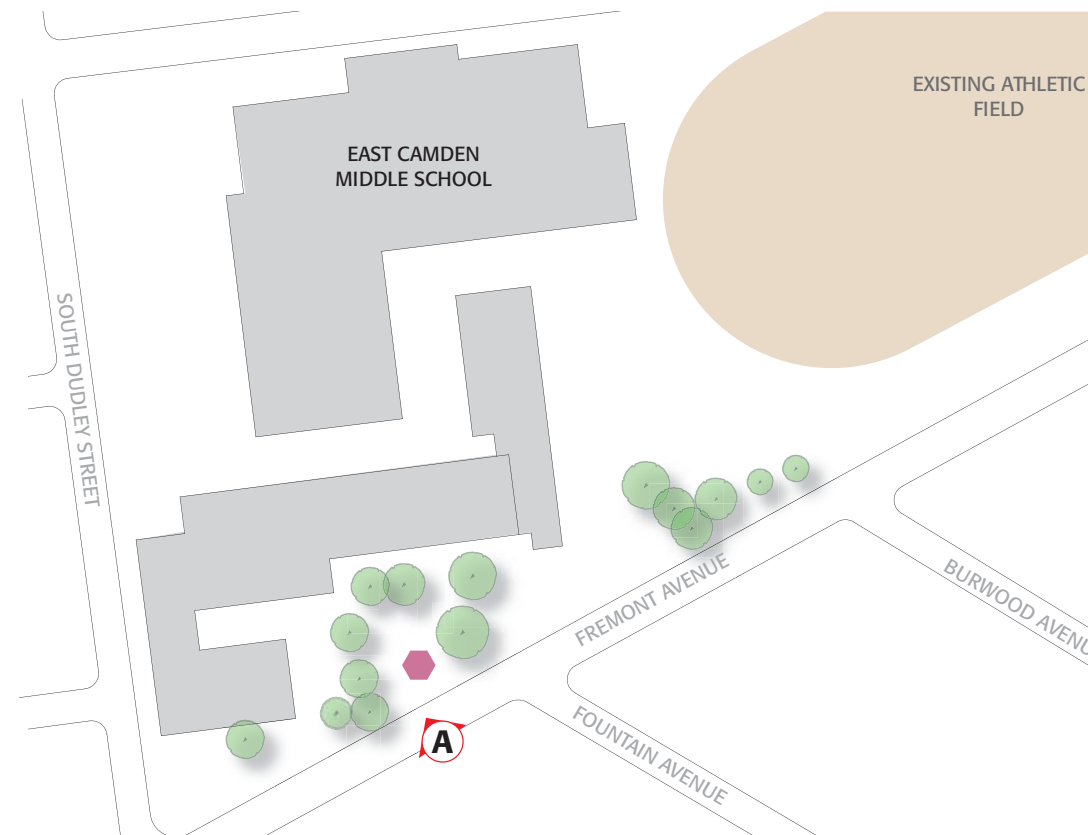


SITE LOCATION



GREEN INFRASTRUCTURE KEY:

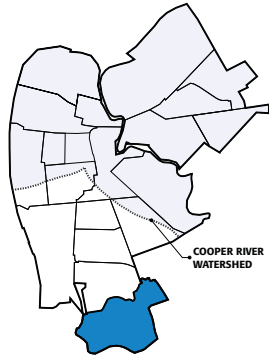
- ◆ RAIN GARDEN



CONCEPTUAL SITE PLAN

SCALE = 1:150

FAIRVIEW



POTENTIAL PARTNERSHIP OPPORTUNITIES

CHURCH

1. Fairview Community Baptist Church
2. Saint Joan of Arc Church
3. Fairview Village Methodist Church

LIBRARY

4. Fairview Branch Library

PARK

5. Camden County Park
6. Yorkship Square

RECREATION/COMMUNITY CENTER

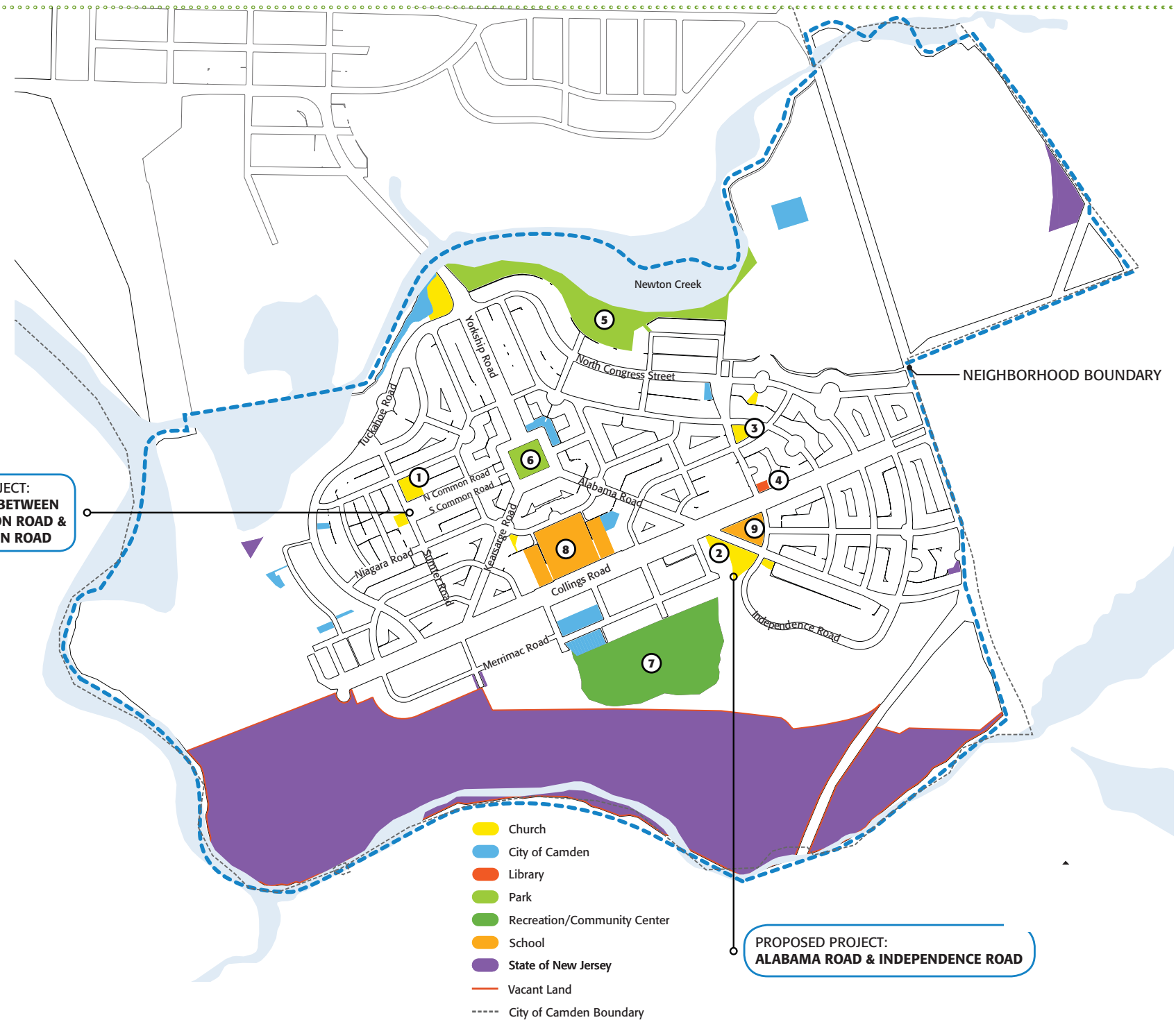
7. Union Field

SCHOOL

8. Yorkship Elementary School
9. Freedom Academy Charter School

PROPOSED PROJECT:
SUMTER ROAD BETWEEN
NORTH COMMON ROAD &
SOUTH COMMON ROAD

PROPOSED PROJECT:
ALABAMA ROAD & INDEPENDENCE ROAD



- Church
- City of Camden
- Library
- Park
- Recreation/Community Center
- School
- State of New Jersey
- Vacant Land
- - - - City of Camden Boundary

NOTE: Vacant Land GIS Data may be incomplete

FAIRVIEW

SUMTER ROAD & NORTH COMMON ROAD

PROJECT DESCRIPTION

This project includes rain gardens and tree plantings. At the Fairview Community Baptist Church, downspouts will be disconnected and directed to discharge rooftop runoff into a rain garden. In the common green, rain gardens will be designed and constructed to divert roadway runoff before it flows into the storm sewer drain. These rain gardens and accompanying tree plantings will improve stormwater management effectiveness and provide aesthetic interest for this historic neighborhood.

POTENTIAL COMMUNITY PARTNERS

Fairview Community Baptist Church

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings



CONCEPTUAL SITE PLAN
 SCALE = 1:80

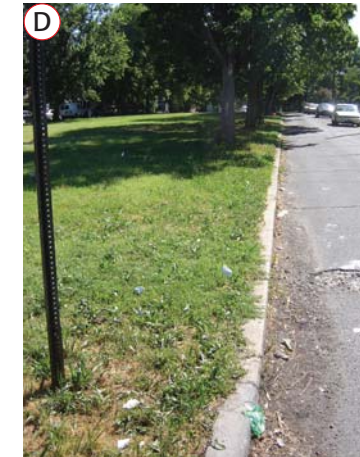
SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- RAIN GARDEN
- TREE PLANTINGS

SITE PHOTOS



FAIRVIEW

ALABAMA ROAD & INDEPENDENCE ROAD

PROJECT DESCRIPTION

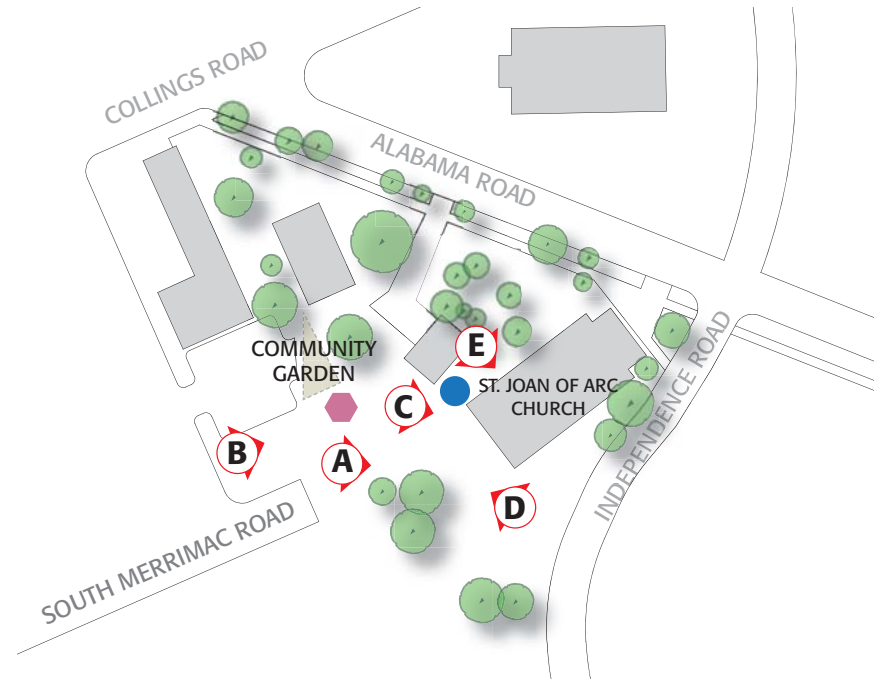
A rainwater harvesting system and rain garden are proposed for this community garden site. Rooftop runoff from the adjacent St. Joan of Arc Church will be directed into a 1,000-1,500 gallon above-ground cistern to provide water for the community garden. A rain garden, positioned next to the community garden, will capture the stormwater runoff flowing to the site from South Merrimac Road.

POTENTIAL COMMUNITY PARTNERS

St. Joan of Arc Church

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings
- downspout disconnection



CONCEPTUAL SITE PLAN

SCALE = 1:120

SITE LOCATION



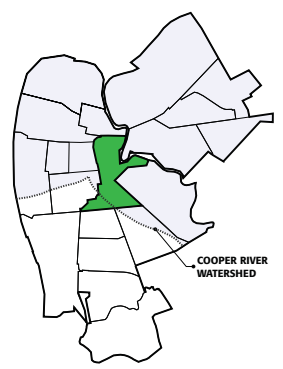
GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- RAINWATER HARVESTING/RAIN BARRELS

SITE PHOTOS



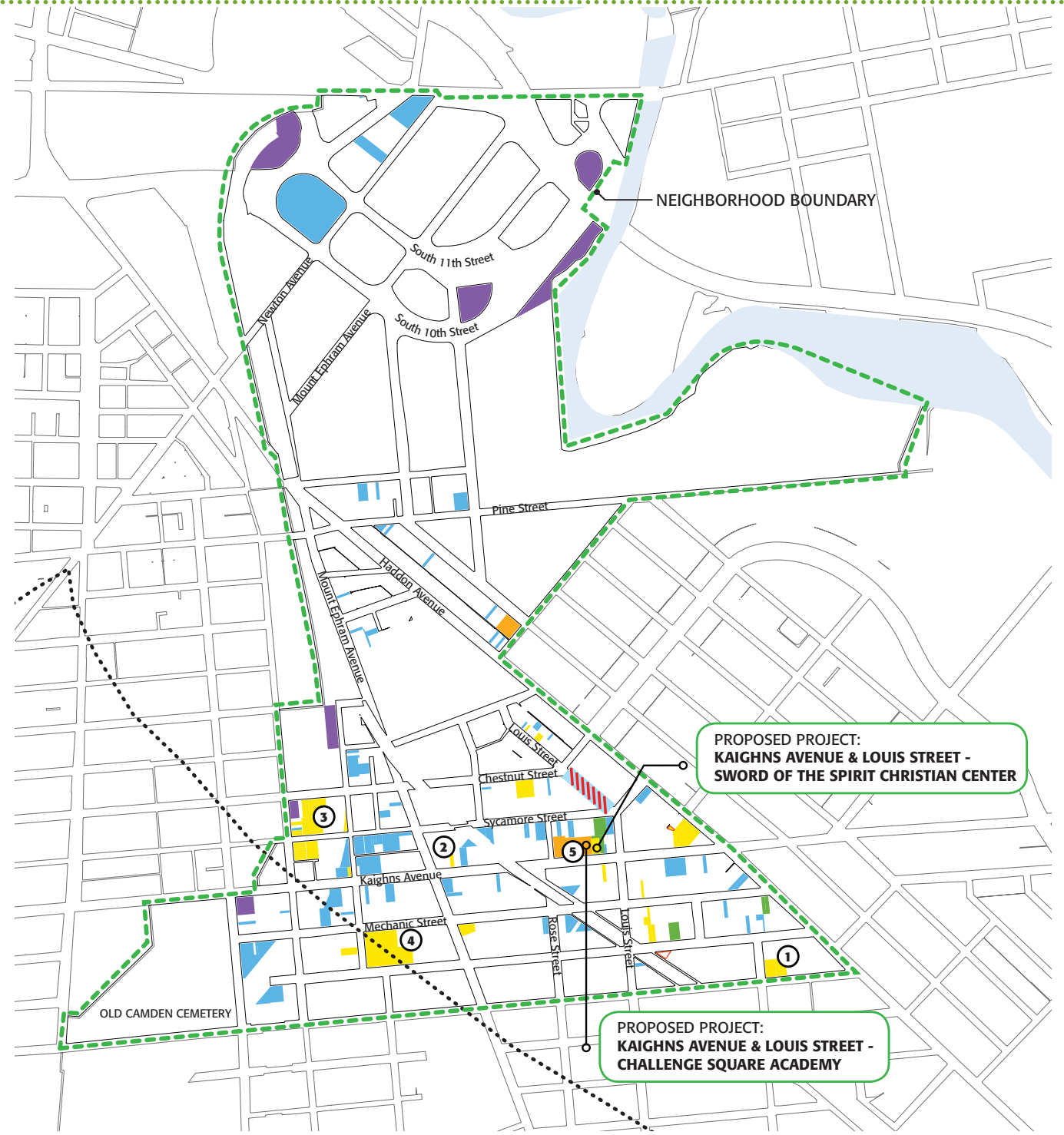
GATEWAY



POTENTIAL PARTNERSHIP OPPORTUNITIES

- CHURCH**
1. Christian Pentecostal Church
 2. Refuge Church of Christ
 3. Rock of Ages Holy Church
 4. Saint Joseph's Church
- SCHOOL**
5. Challenge Square Academy

- Church
- City of Camden
- Recreation/Community Center
- School
- State of New Jersey
- Cooper River Watershed Boundary
- Vacant Land
- Area of Flooding (accounts from community meeting)



GATEWAY

KAIGHNS AVENUE & LOUIS STREET - CHALLENGE SQUARE ACADEMY

PROJECT DESCRIPTION

This project proposes to reduce the impervious surfaces and stormwater runoff volume from the large paved playground and site area surrounding the Challenge Square Academy. Currently, over 12,000 square feet of the site is paved with concrete. Green infrastructure opportunities include replacing impervious concrete areas with pervious paving materials and infiltration systems. In addition, tree plantings with tree filter boxes will increase canopy cover, reduce urban heat island effect, manage stormwater runoff, improve the appearance of Challenge Square Academy, and provide shade for the school's basketball court.

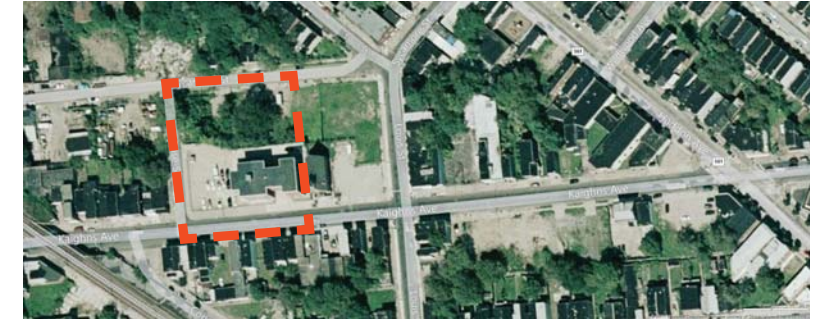
POTENTIAL COMMUNITY PARTNERS

Challenge Square Academy Playground

GREEN INFRASTRUCTURE STRATEGIES

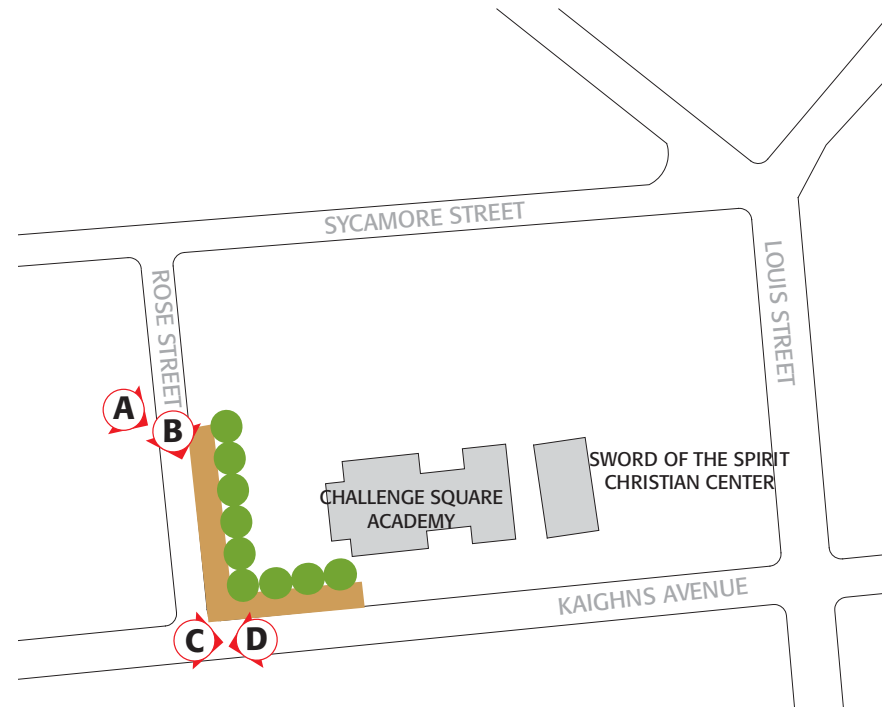
- tree plantings
- pervious pavers

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- TREE PLANTINGS
- PERVIOUS PAVERS



CONCEPTUAL SITE PLAN

SCALE = 1:120

SITE PHOTOS



GATEWAY

KAIGHNS AVENUE & LOUIS STREET - SWORD OF THE SPIRIT CHRISTIAN CENTER

PROJECT DESCRIPTION

This project consists of the installation of a rain garden, located at the rear of the building and adjacent to the site's parking lot, to disconnect the rooftop runoff from the CSO system. A rain garden consisting entirely of native shrub species would be most appropriate for this location.

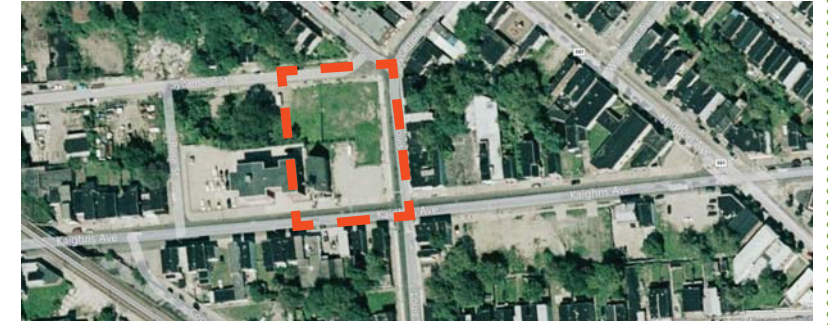
POTENTIAL COMMUNITY PARTNERS

Sword of the Spirit Christian Center

GREEN INFRASTRUCTURE STRATEGIES

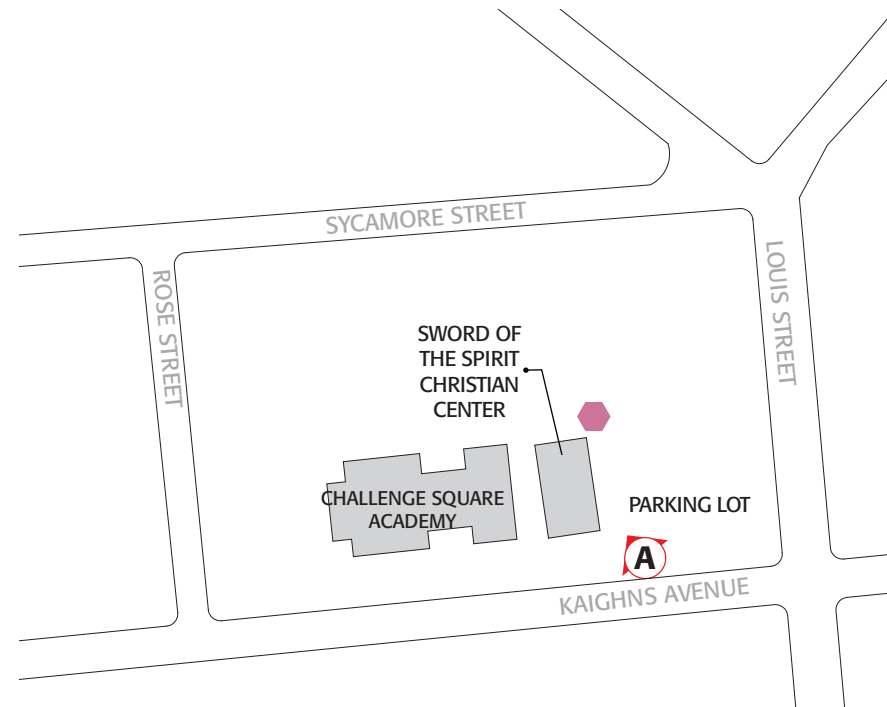
- rain garden
- downspout disconnection

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN



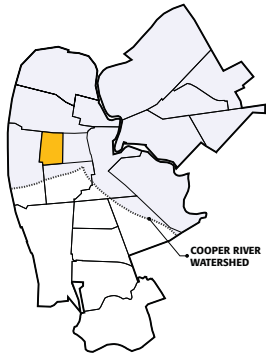
CONCEPTUAL SITE PLAN

SCALE = 1:120

SITE PHOTOS



LANNING SQUARE



COMMUNITY MEETING REMARKS:
 BESIDES A FEW CLOGGED STORM SEWER DRAINS, LANNING SQUARE DOES NOT HAVE SERIOUS FLOODING PROBLEMS. INSTEAD, THERE IS A NEED RAINWATER HARVESTING SYSTEMS FOR COMMUNITY GARDENS. CONTACT: MARY RODRIGUEZ, RESIDENT

POTENTIAL PARTNERSHIP OPPORTUNITIES

CHURCH

1. Broadway United Methodist Church
2. Church of the Living God
3. Emanuel United Pentecostal Church
4. New Mickle Baptist Church
5. Saint John's Episcopal Church

PARK

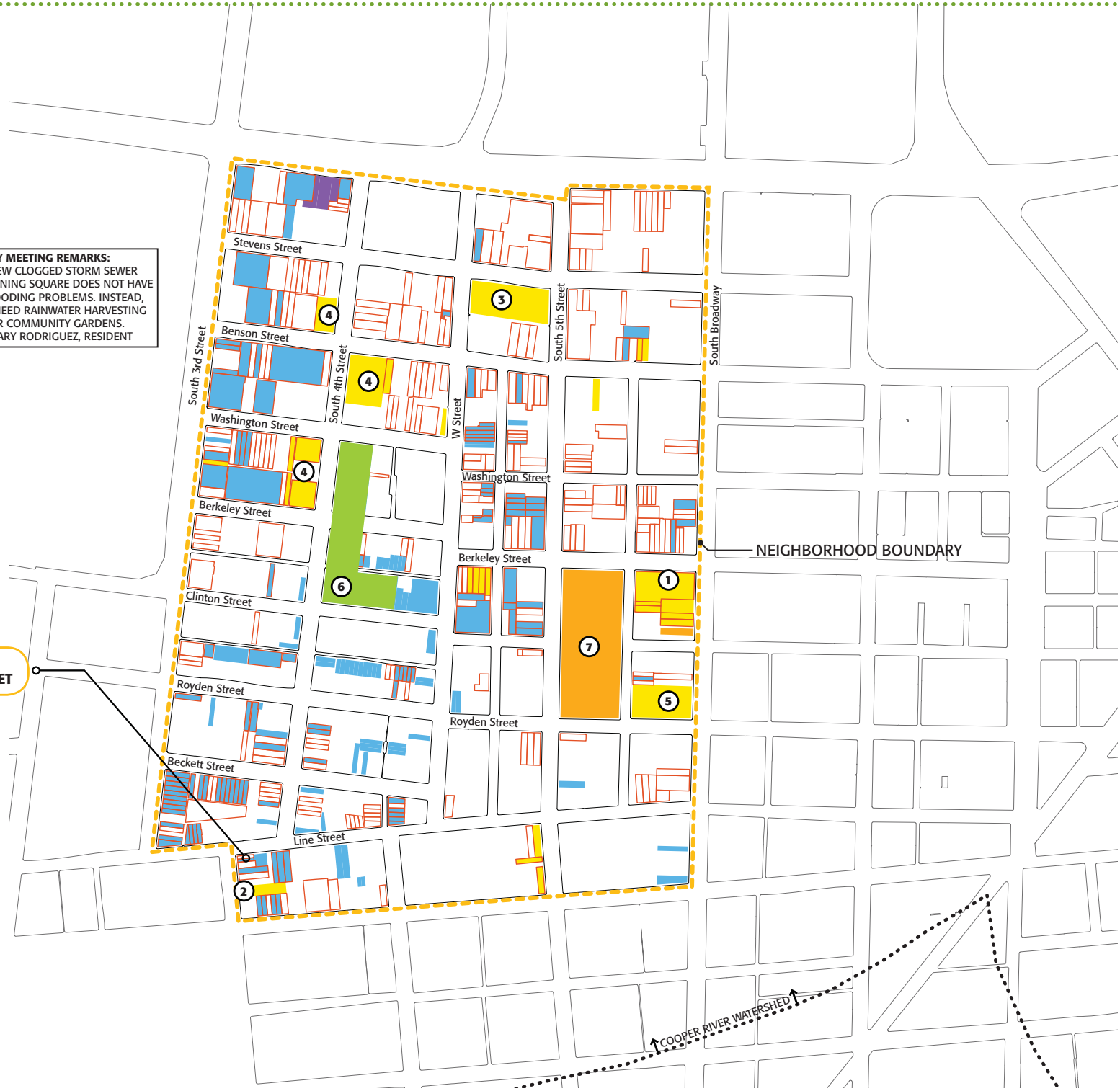
6. 4th & Washington Park

SCHOOL

8. Lanning Square Elementary School

PROPOSED PROJECT:
SOUTH 3rd STREET & LINE STREET

- Church
- City of Camden
- Park
- School
- State of New Jersey
- Vacant Land
- - - Cooper River Watershed Boundary



NEIGHBORHOOD BOUNDARY

COOPER RIVER WATERSHED

LANNING SQUARE

SOUTH 3RD STREET & LINE STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

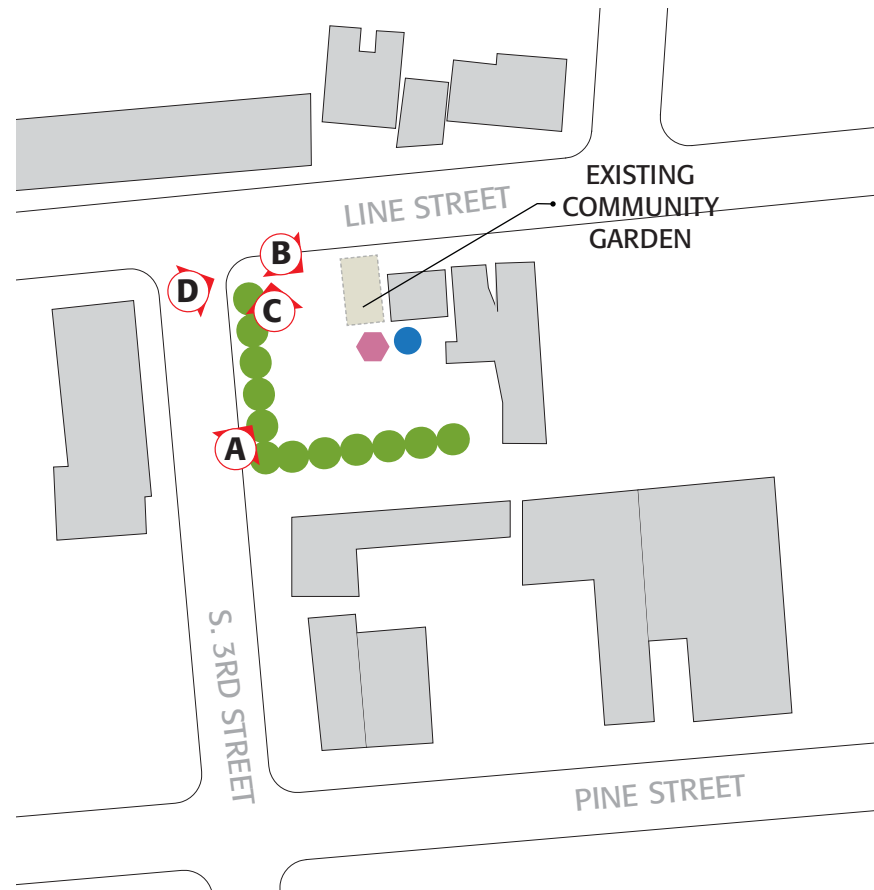
Responses from this community have indicated that rainwater harvesting for their community gardens would be the most beneficial stormwater BMP. To create a substantial source of water for the community garden, rooftop runoff from an adjacent residential building will be directed into a 1,000 gallon above-ground cistern. Tree and shrub plantings along South 3rd Street and Line Street will capture, filter, and infiltrate stormwater runoff from the vacant lot and will also beautify the neighborhood.

POTENTIAL COMMUNITY PARTNERS

Mary Rodriguez (resident)

GREEN INFRASTRUCTURE STRATEGIES

- rainwater harvesting
- tree plantings
- downspout disconnection



CONCEPTUAL SITE PLAN
SCALE = 1:80

SITE LOCATION



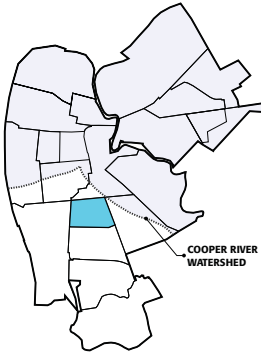
GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- RAINWATER HARVESTING/RAIN BARRELS
- TREE PLANTINGS

SITE PHOTOS



LIBERTY PARK



POTENTIAL PARTNERSHIP OPPORTUNITIES

CHURCH

1. First Nazarene Baptist Church
2. Community Baptist Church
3. Saint Joseph's Catholic Church

PARK

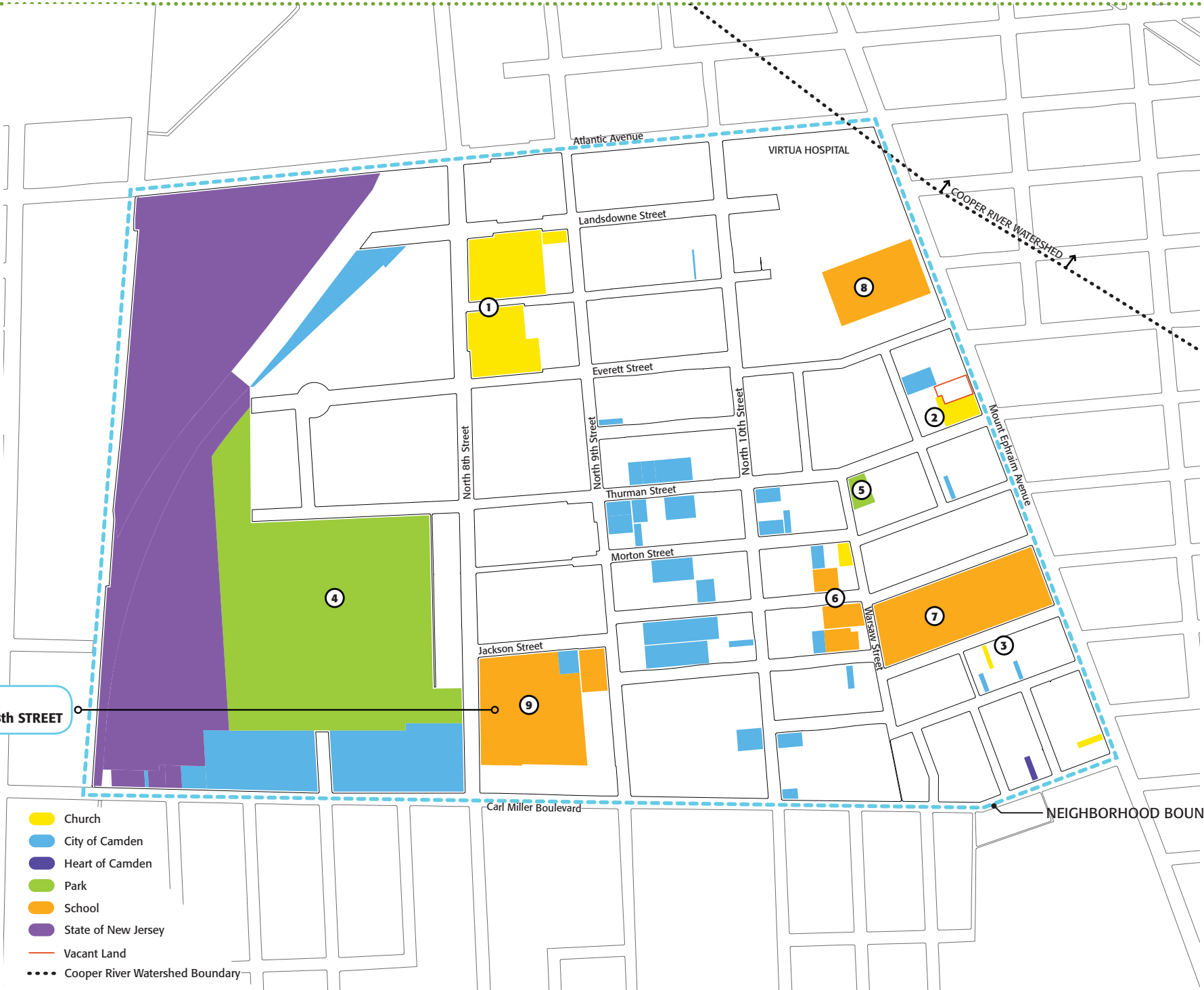
4. Judge Robert Johnson Park (The Pink Elephant Park)
5. Warsaw & Thurman Park

SCHOOL

6. Bonsall Annex School
7. Bonsall Elementary School
8. Due Season Charter School
9. Sumner Elementary School

**BUILT PROJECTS (2):
JACKSON STREET & NORTH 8th STREET**

- Church
- City of Camden
- Heart of Camden
- Park
- School
- State of New Jersey
- Vacant Land
- - - Cooper River Watershed Boundary



NEIGHBORHOOD BOUNDARY

LIBERTY PARK

**JACKSON STREET & NORTH 8TH STREET
 INSTALLED SPRING 2010**

PROJECT DESCRIPTION

This demonstration rain garden, the first to be built in Camden, was installed at the Sumner Elementary School in spring 2010. The project disconnects rooftop runoff from directly discharging into the CSO system and serves as an outdoor learning environment for students and teachers.

COMMUNITY PARTNERS

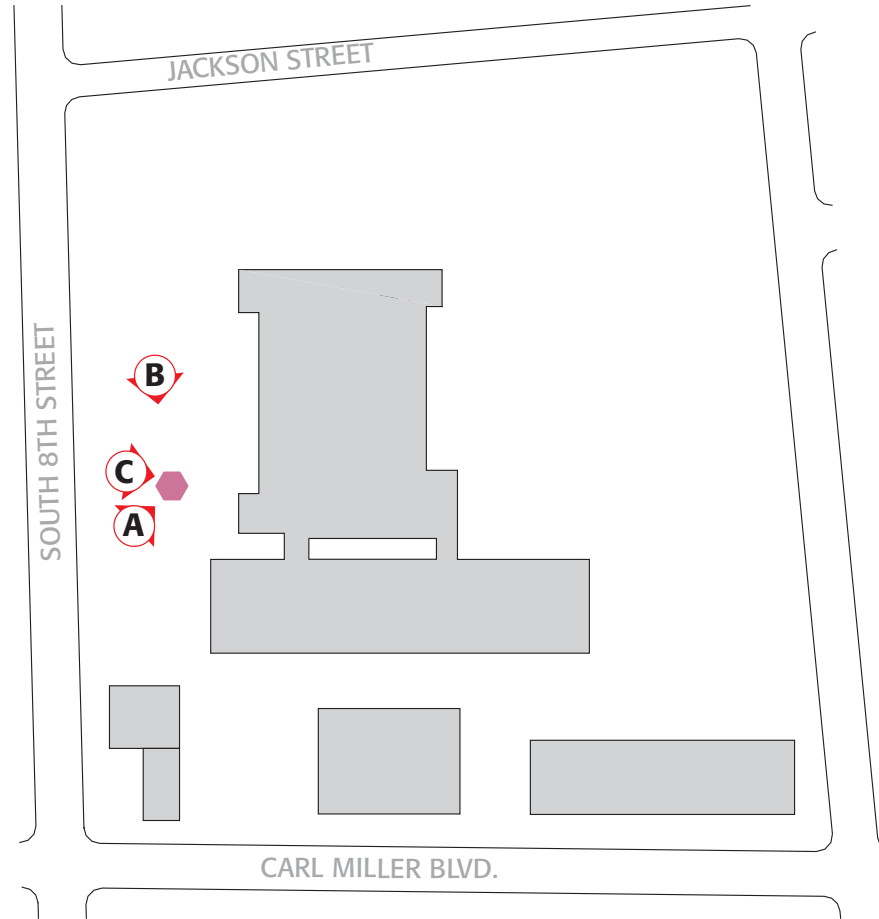
Sumner Elementary School

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- downspout disconnection
- water conservation education program

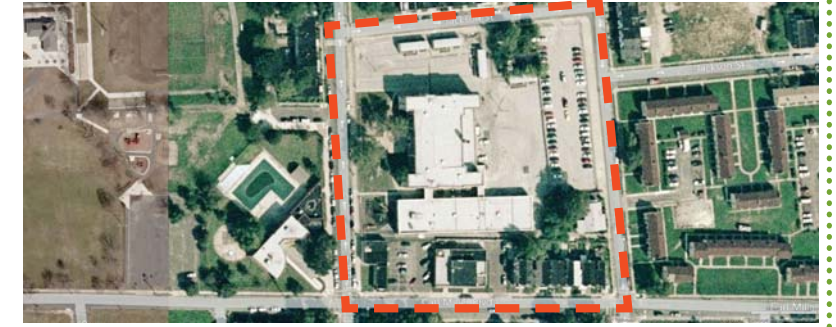
GREEN INFRASTRUCTURE KEY:

◆ RAIN GARDEN



CONCEPTUAL SITE PLAN
 SCALE = 1:120

SITE LOCATION



PLANTING PLAN
 (for both Sumner Elementary School rain gardens)

SITE PHOTOS



LIBERTY PARK

JACKSON STREET & NORTH 8TH STREET

INSTALLED SPRING 2011

PROJECT DESCRIPTION

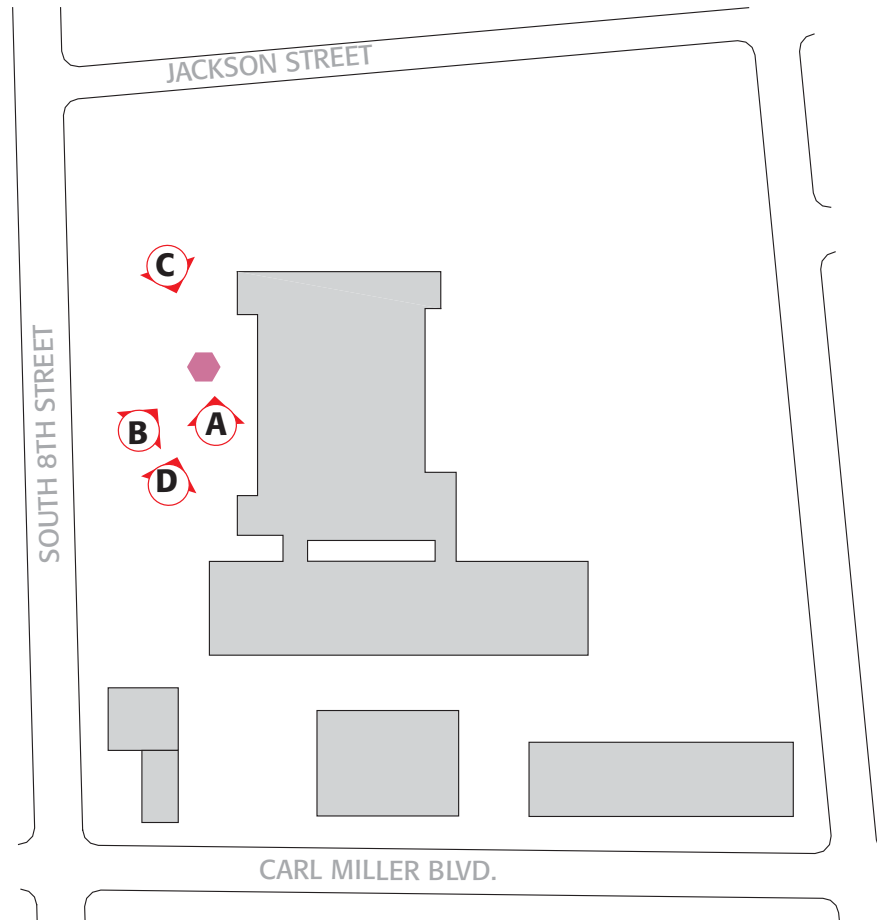
This project was the second rain garden installed at the Sumner Elementary School. In conjunction with the Stormwater Management in Your Schoolyard educational program, fourth grade students helped to install this rain garden. This rain garden contains the same plant species as the first rain garden.

COMMUNITY PARTNERS

Sumner Elementary School

GREEN INFRASTRUCTURE STRATEGIES

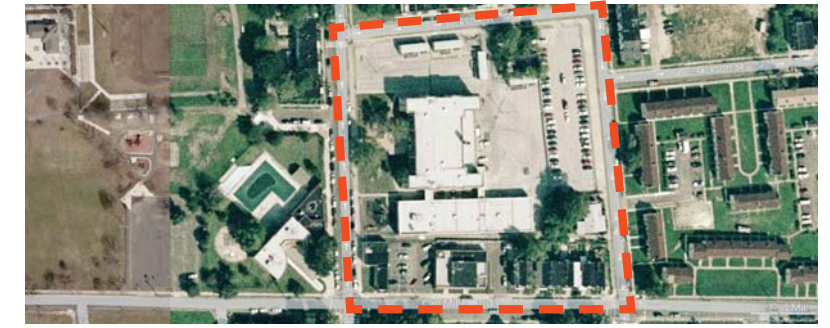
- rain garden
- downspout disconnection
- water conservation education program



CONCEPTUAL SITE PLAN

SCALE = 1:120

SITE LOCATION



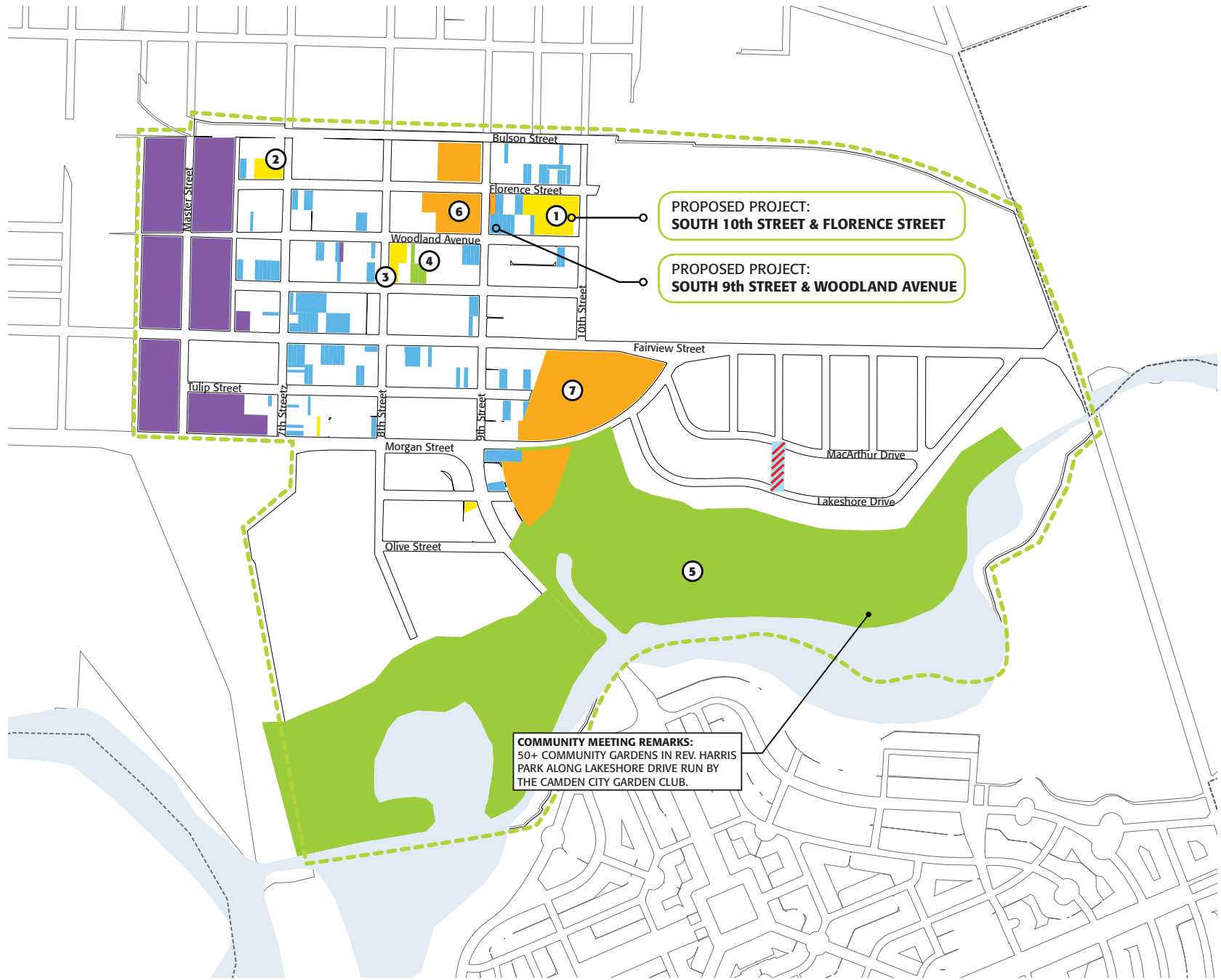
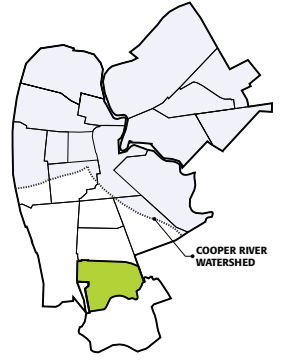
GREEN INFRASTRUCTURE KEY:

RAIN GARDEN

SITE PHOTOS



MORGAN VILLAGE



POTENTIAL PARTNERSHIP OPPORTUNITIES

- CHURCH**
1. Harris Temple Zion Church
 2. Saint Matthews Church
 3. Woodland Avenue Presbyterian Church
- PARK**
4. 8th & Woodland Park
 5. Reverend Harris Park
- SCHOOL**
6. HB Wilson School
 7. Project SEED

- Church
 - City of Camden
 - Park
 - School
 - State of New Jersey
 - City of Camden Boundary
 - Area of Flooding (accounts from community meeting)
- NOTE: Vacant Land GIS Data may be incomplete

MORGAN VILLAGE

SOUTH 10TH STREET & FLORENCE STREET

PROJECT DESCRIPTION

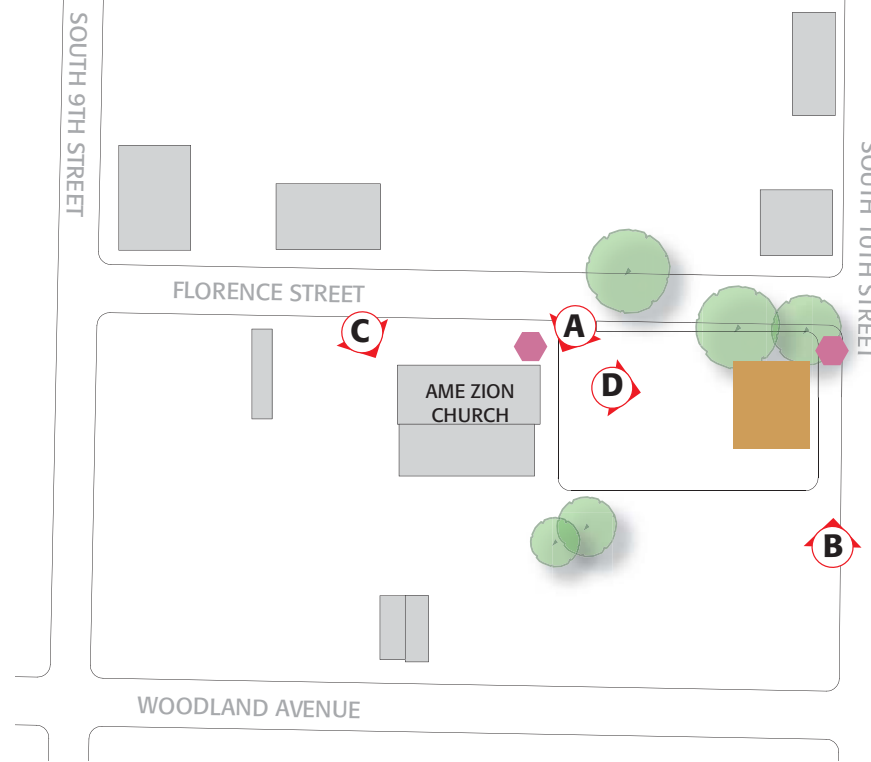
This project consists of several green infrastructure strategies for the Harris Temple AME Zion Church property. Rooftop runoff will be directed into a rain garden located at the front entrance way of the church. In addition, the deteriorating parking area will be replaced with pervious paving. A large rain garden, or bioretention swale, will be built next to the pervious paving, along South 10th Street. This will capture additional stormwater runoff before it leaves the site and enters the storm sewer system.

POTENTIAL COMMUNITY PARTNERS

Harris Temple AME Zion Church

GREEN INFRASTRUCTURE STRATEGIES

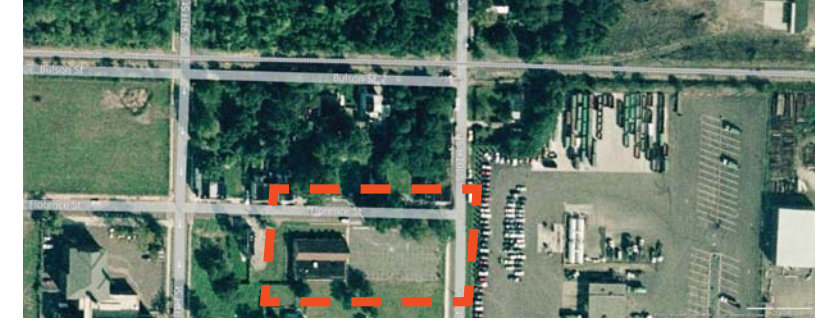
- rain garden
- pervious pavers
- downspout disconnection



CONCEPTUAL SITE PLAN

SCALE = 1:120

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- PERVIOUS PAVERS

SITE PHOTOS



MORGAN VILLAGE

SOUTH 9TH STREET & WOODLAND AVENUE

PROJECT DESCRIPTION

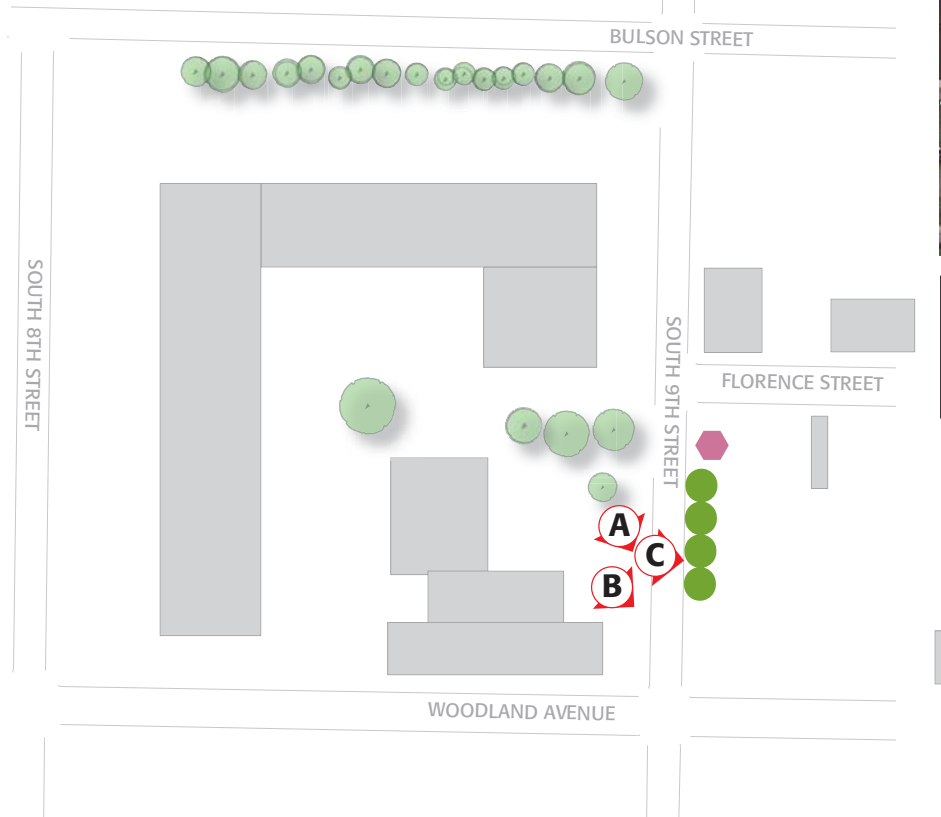
A rain garden and tree plantings are proposed on vacant land owned by the City of Camden. The rain garden, with curb cuts to direct the stormwater runoff into the rain garden, will capture runoff from South 9th Street. Depending upon the interest of the local community, the site could include an area for community garden plots. In addition, this project could collaborate with the nearby H. B. Wilson Elementary school for an environmental education program.

POTENTIAL COMMUNITY PARTNERS

Henry Braid Wilson Elementary School

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings



CONCEPTUAL SITE PLAN
 SCALE = 1:150

SITE LOCATION



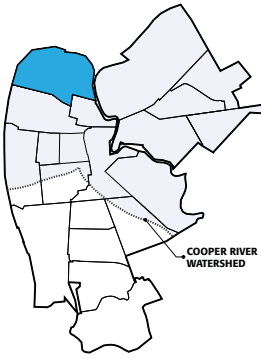
GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- TREE PLANTINGS

SITE PHOTOS



NORTH CAMDEN



- Church
- City of Camden
- North Camden Land Trust
- County of Camden
- Park
- Recreation/Community Center
- School
- State of New Jersey
- Vacant Land
- City of Camden Boundary
- Area of Flooding (accounts from community meeting)

POTENTIAL PARTNERSHIP OPPORTUNITIES

RESPOND, INC. (See locations below)

1. SAVE OUR WATERFRONT
2. NORTH CAMDEN GREENING COMMITTEE
3. C.O.L.T.
4. CONCERNED CITIZENS OF NORTH CAMDEN

CHURCH

5. Apostolic Christian Church of God
6. Holy Church of Mount Carmel
7. Holy Name Roman Catholic Church
8. Iglesia Pentecostal Ungida de Dios
9. Mount Zion Baptist Church
10. St. Paul's Episcopal Church
11. Grace Lutheran Church
12. Mount Calvary Baptist Church

PARK

13. Northeast School Park
14. Northgate II Park
15. Pine Poynt Park
16. Second & Erie - Compensation
17. Camden Towne Civic Association Park
18. Cornelius Martin Park

RECREATION/COMMUNITY CENTER

19. Respond, Inc. - Main Office
20. Respond, Inc. - New Worker Development Center
21. Respond, Inc. - Senior Center
22. HopeWorks N Camden
23. City of Camden Community Center
24. Camden Lutheran Housing

SCHOOL

25. Cooper's Poynt School
26. Pine Poynt School
27. Rafael Cordero Molina School
28. Powell Elementary School
29. Environment Community Charter School

PROPOSED PROJECT:
NORTH 2nd STREET & YORK STREET

PROPOSED PROJECT:
304 STATE STREET

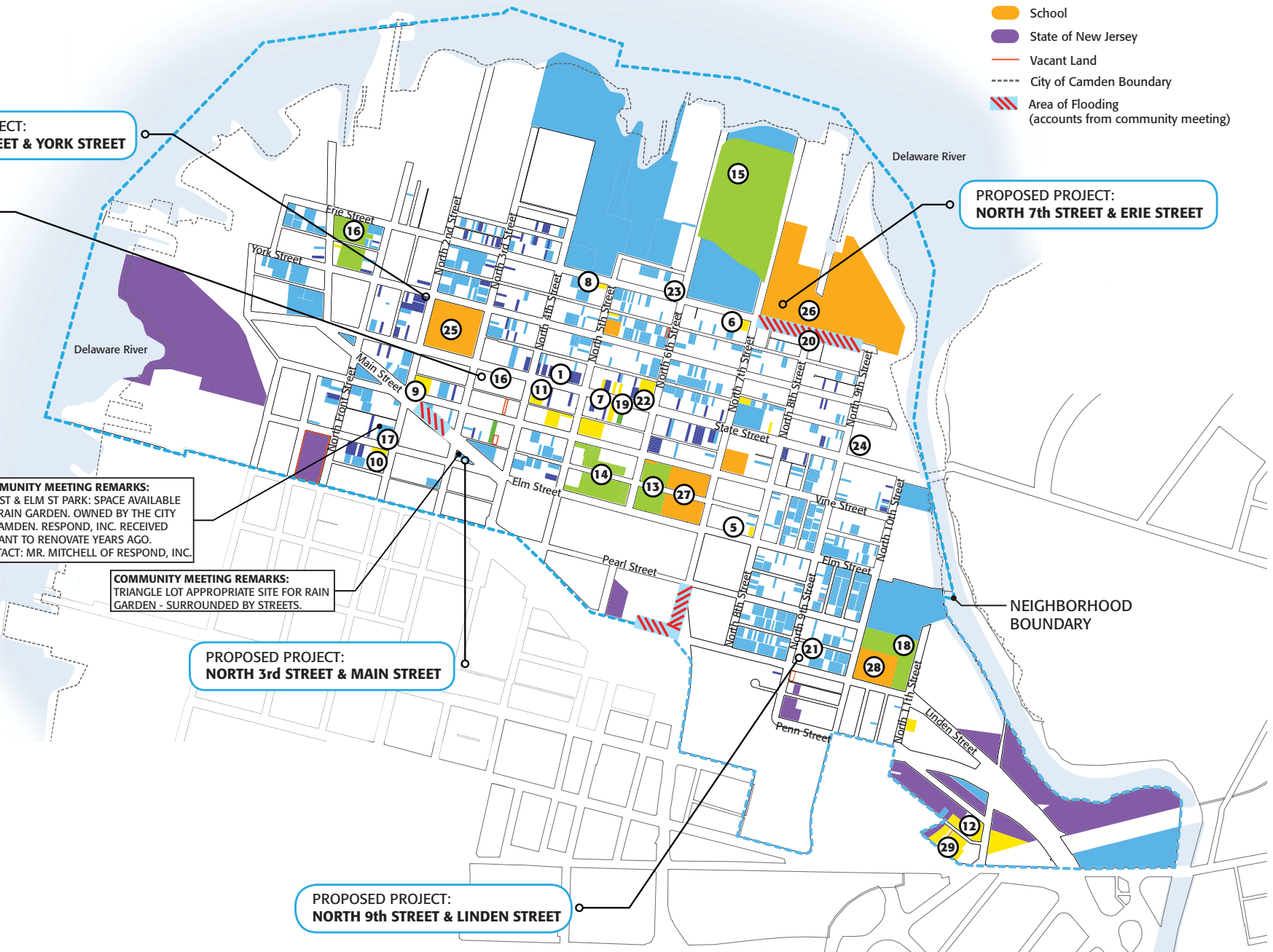
PROPOSED PROJECT:
NORTH 7th STREET & ERIE STREET

COMMUNITY MEETING REMARKS:
2ND ST & ELM ST PARK: SPACE AVAILABLE FOR RAIN GARDEN. OWNED BY THE CITY OF CAMDEN. RESPOND, INC. RECEIVED A GRANT TO RENOVATE YEARS AGO. CONTACT: MR. MITCHELL OF RESPOND, INC.

COMMUNITY MEETING REMARKS:
TRIANGLE LOT APPROPRIATE SITE FOR RAIN GARDEN - SURROUNDED BY STREETS.

PROPOSED PROJECT:
NORTH 3rd STREET & MAIN STREET

PROPOSED PROJECT:
NORTH 9th STREET & LINDEN STREET



NEIGHBORHOOD BOUNDARY

NORTH CAMDEN

NORTH 2ND STREET & YORK STREET

PROJECT DESCRIPTION

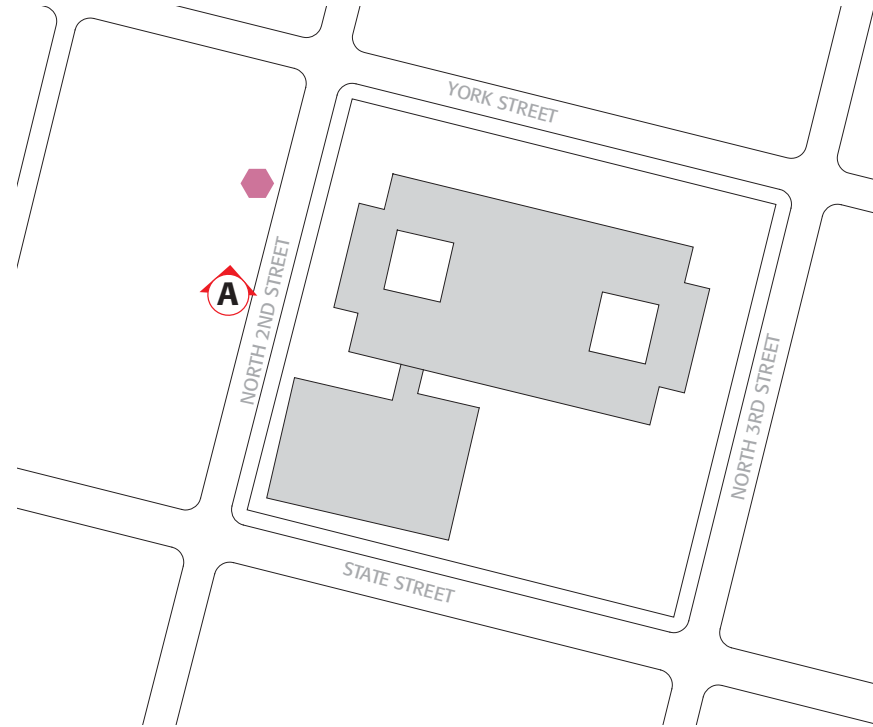
A demonstration rain garden is proposed for a vacant lot adjacent to Cooper's Poynt School. Two curb cuts along North 2nd Street will direct stormwater into the rain garden. The herbaceous species planted within the rain garden will complement the relatively young tree plantings existing on site. Partnering with staff and students at the school, the rain garden will be constructed to serve as a learning opportunity and outdoor classroom.

POTENTIAL COMMUNITY PARTNERS

Cooper's Poynt School
 Respond, Inc.

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- water conservation education program



CONCEPTUAL SITE PLAN
 SCALE = 1:150

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

 RAIN GARDEN

SITE PHOTOS



NORTH CAMDEN

NORTH 3RD STREET & MAIN STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

This project will irrigate the existing plants, planted by NJTF, located on this triangular vacant lot. Runoff from surrounding roadways will be directed into the rain garden through several gravel filled infiltration trenches. Along with infiltrating stormwater runoff at the source, this rain garden will also enhance the visual appeal of this neighborhood.

POTENTIAL COMMUNITY PARTNERS

Respond, Inc.

GREEN INFRASTRUCTURE STRATEGIES

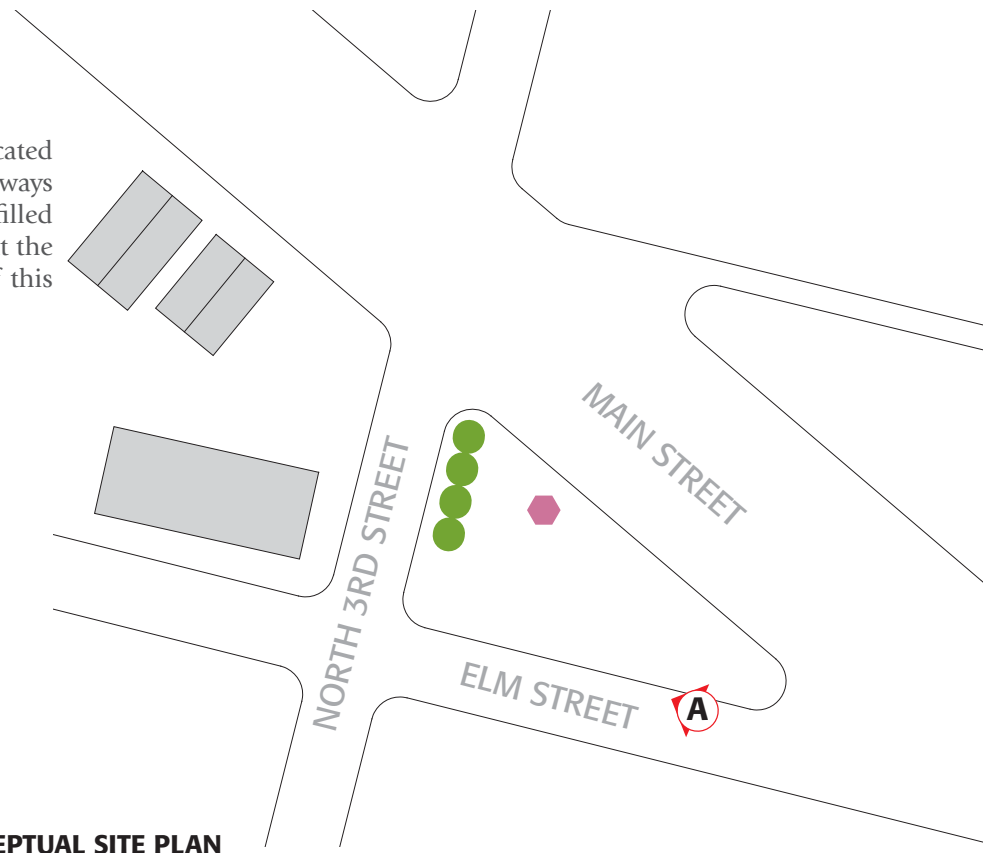
- rain garden
- tree plantings

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- TREE PLANTINGS



CONCEPTUAL SITE PLAN
SCALE = 1:80

SITE PHOTOS



NORTH CAMDEN

NORTH 7TH STREET & ERIE STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

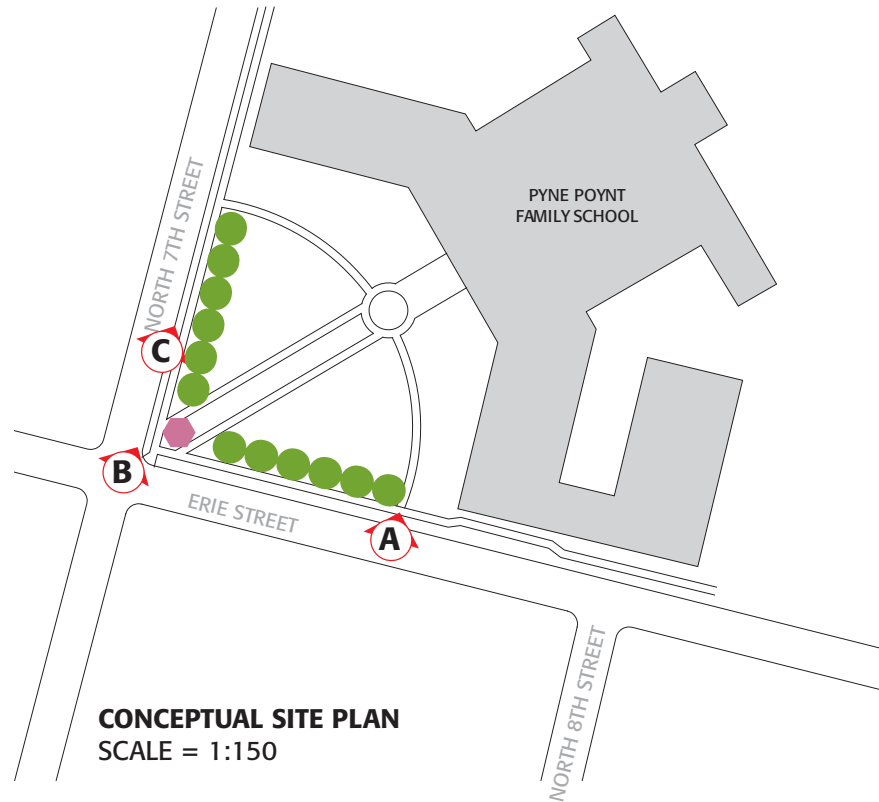
Street tree plantings and tree filter boxes are proposed to intercept stormwater runoff from roadways and to increase canopy cover in the North Camden neighborhood. In addition, a demonstration rain garden is proposed in partnership with the Pyne Poynt Family School to serve as a learning opportunity for staff and students. These efforts will reduce pressure on the CSO system, mitigate urban heat island effect during summer months, and enhance the appearance of the school.

POTENTIAL COMMUNITY PARTNERS

Pyne Poynt Family School
 Respond, Inc.

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings
- water conservation education program



SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- TREE PLANTINGS

SITE PHOTOS



NORTH CAMDEN

NORTH 9TH STREET & LINDEN STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

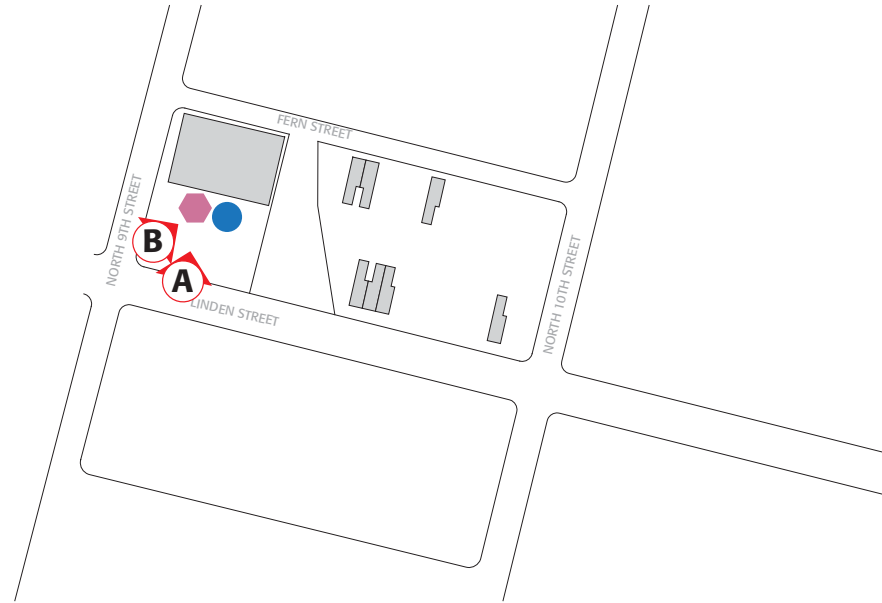
A demonstration rain garden and rainwater harvesting system is proposed at the Community Center maintained by Respond, Inc. Rain barrels will be used to capture rooftop runoff for watering raised planter beds. A rain garden will be installed to capture, filter, and infiltrate stormwater runoff from rooftop and paved playground areas.

POTENTIAL COMMUNITY PARTNERS

Respond, Inc.

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings
- downspout disconnection



CONCEPTUAL SITE PLAN

SCALE = 1:20

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- RAINWATER HARVESTING/RAIN BARRELS

SITE PHOTOS



NORTH CAMDEN

304 STATE STREET

INSTALLED SPRING 2011

PROJECT DESCRIPTION

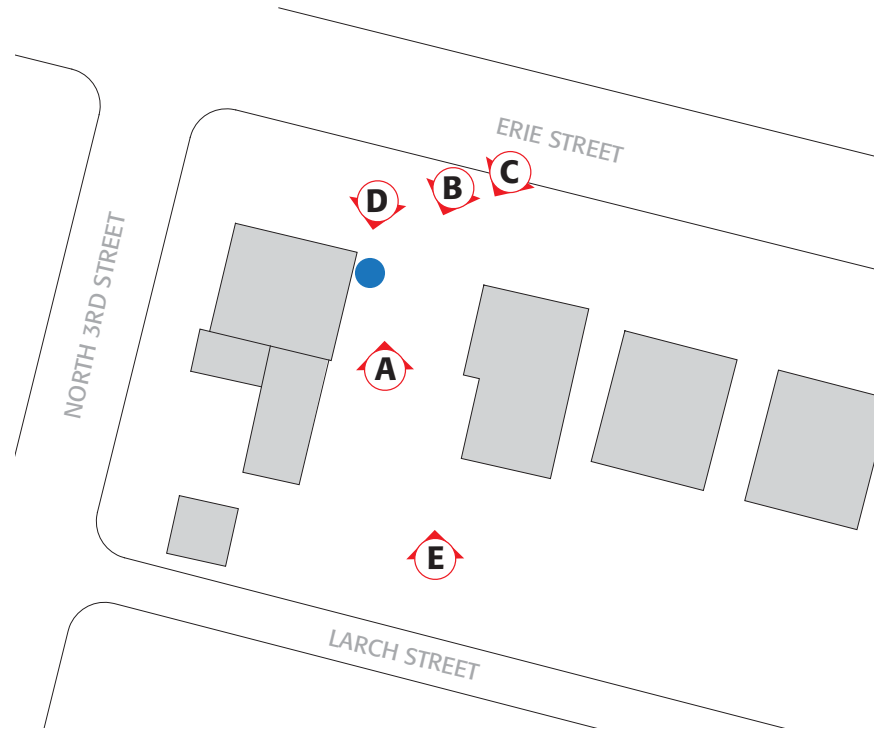
The RCE Water Resources Program worked with Respond, Inc to outfit a community garden with rainwater harvesting capabilities. A central manifold and spigot connect the three 55-gallon drums so that the three barrels act as one bigger barrel, filling and emptying equally and at the same time. The rain barrel system collects runoff from a building located adjacent to the community garden.

POTENTIAL COMMUNITY PARTNERS

Respond, Inc.

GREEN INFRASTRUCTURE STRATEGIES

- rainwater harvesting
- downspout disconnection



CONCEPTUAL SITE PLAN
 SCALE = 1:60

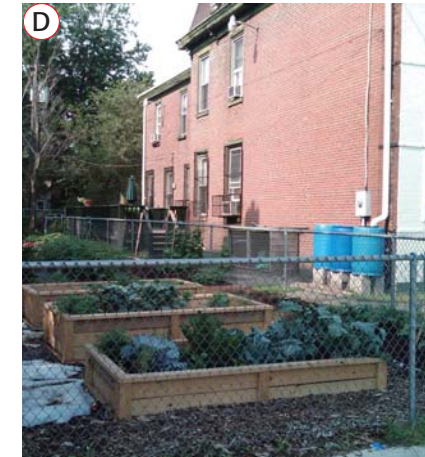
SITE LOCATION



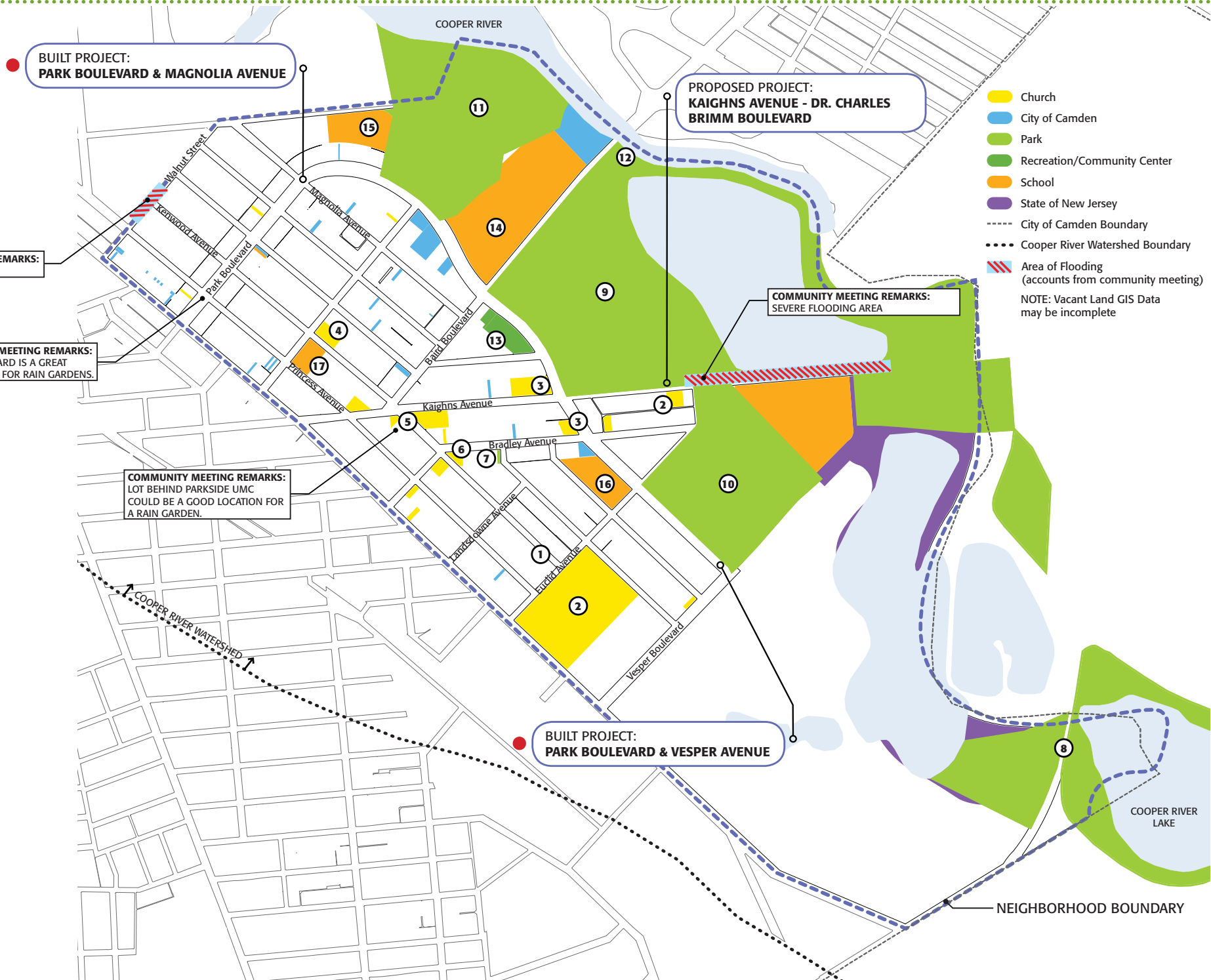
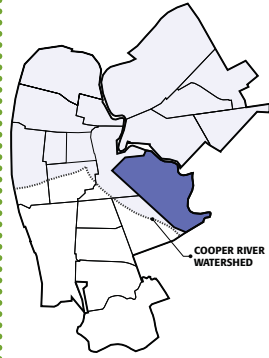
GREEN INFRASTRUCTURE KEY:

- RAINWATER HARVESTING/RAIN BARRELS

SITE PHOTOS



PARKSIDE



- Church
 - City of Camden
 - Park
 - Recreation/Community Center
 - School
 - State of New Jersey
 - - - City of Camden Boundary
 - · · Cooper River Watershed Boundary
 - Area of Flooding (accounts from community meeting)
- NOTE: Vacant Land GIS Data may be incomplete

POTENTIAL PARTNERSHIP OPPORTUNITIES

1. PARKSIDE BUSINESS & COMMUNITY IN PARTNERSHIP

CHURCH

2. Dominican Sisters Perpetual Rosary
3. First Refuge Missionary Baptist Church
4. Little Rock Baptist
5. Parkside United Methodist Church
6. Saint Paul's Baptist Church

PARK

7. Bradley & Ormand Park
8. Cooper River Park
9. Farnham Park
10. High School Athletic Fields
11. New Camden Park
12. Camden GreenWay Trail

RECREATION/COMMUNITY CENTER

13. Jackson Boys & Girls Club

SCHOOL

14. Camden High School
15. Forest Hill Elementary School
16. Hatch Middle School
17. Parkside School

**BUILT PROJECT:
PARK BOULEVARD & MAGNOLIA AVENUE**

**PROPOSED PROJECT:
KAIGHNS AVENUE - DR. CHARLES
BRIMM BOULEVARD**

**BUILT PROJECT:
PARK BOULEVARD & VESPER AVENUE**

**COMMUNITY MEETING REMARKS:
FLOODING IS TIRE HIGH.**

**COMMUNITY MEETING REMARKS:
PARK BOULEVARD IS A GREAT
OPPORTUNITY FOR RAIN GARDENS.**

**COMMUNITY MEETING REMARKS:
LOT BEHIND PARKSIDE UMC
COULD BE A GOOD LOCATION FOR
A RAIN GARDEN.**

**COMMUNITY MEETING REMARKS:
SEVERE FLOODING AREA**

↑ COOPER RIVER WATERSHED ↑

NEIGHBORHOOD BOUNDARY

COOPER RIVER LAKE

COOPER RIVER

COOPER RIVER WATERSHED

PARKSIDE

KAIGHNS AVENUE (Dr. CHARLES BRIMM BOULEVARD)

PROJECT DESCRIPTION

This project addresses the frequent flooding issues in this area through the installation of a rain garden along Kaighns Avenue. At this location, in Farnham Park, the rain garden will capture the runoff before it has a chance to travel and collect downhill.

POTENTIAL COMMUNITY PARTNERS

PBCIP

GREEN INFRASTRUCTURE STRATEGIES

- rain garden

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

◆ RAIN GARDEN



CONCEPTUAL SITE PLAN
 SCALE = 1:200

SITE PHOTOS



PARKSIDE

PARK BOULEVARD & MAGNOLIA AVENUE

INSTALLED SPRING 2011

PROJECT DESCRIPTION

This rain garden, located within the median of Park Boulevard, collects stormwater runoff from both Park Boulevard and Magnolia Avenue. Curb cuts act as both inlets and outlets for the stormwater runoff. The rain garden captures, treats, and infiltrates over 100,000 gallons of stormwater runoff each year. In addition to improving the aesthetic quality of the neighborhood, the native species, such as Butterfly Weed and Sweet Pepperbush, provide valuable habitat for native birds, bees, and butterflies. In addition, NJTF planted two trees and several shrubs around the rain garden.

COMMUNITY PARTNERS

PBCIP

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings

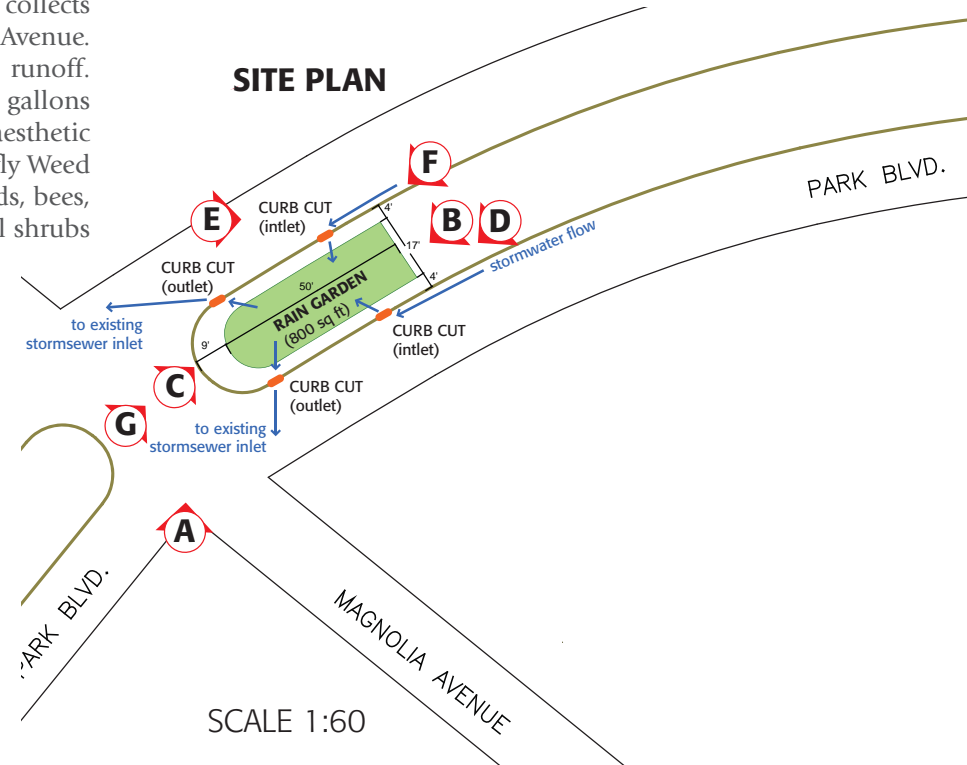
SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- ◆ RAIN GARDEN
- TREE PLANTINGS

SITE PLAN

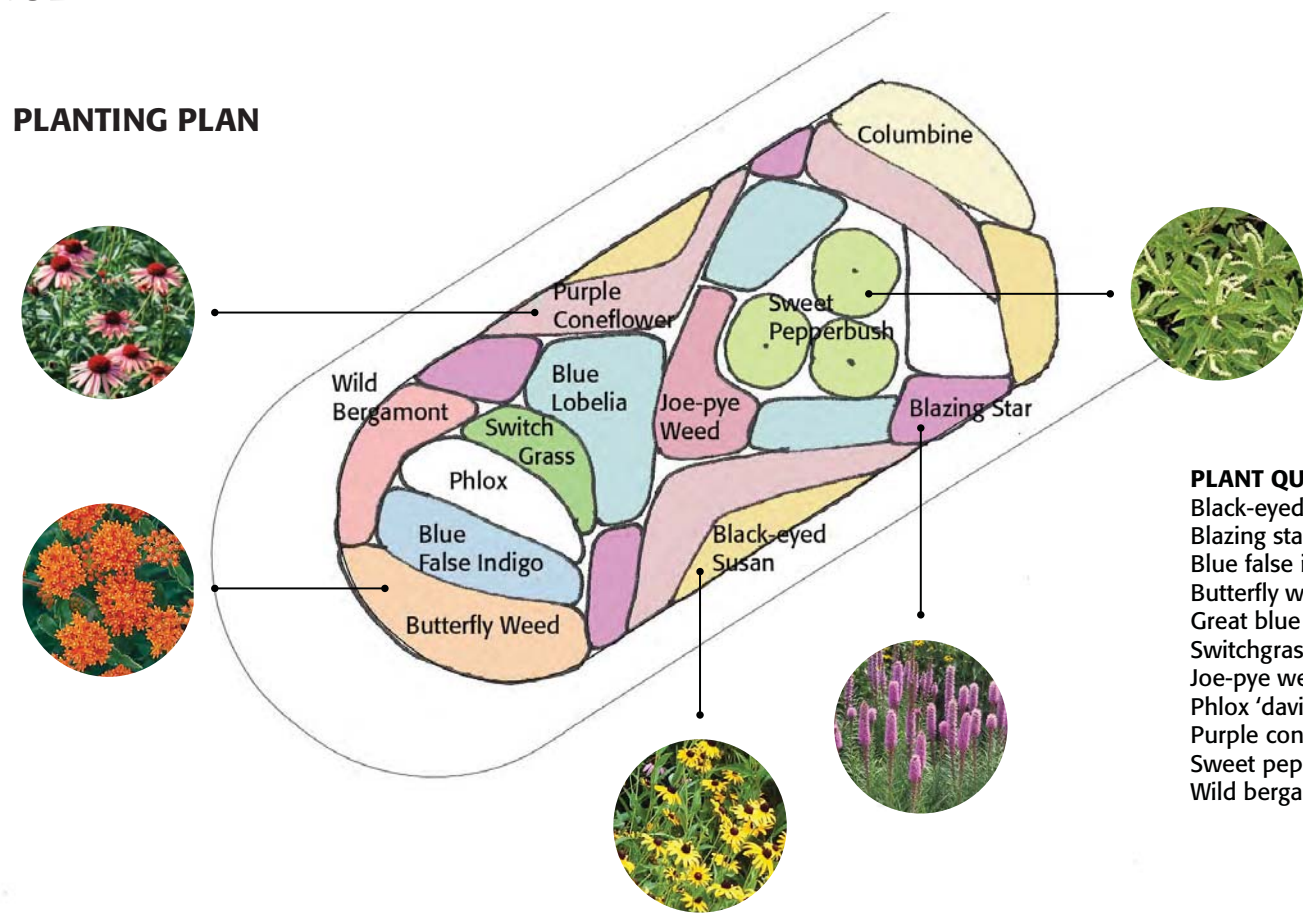


SITE PHOTOS



PARKSIDE
PARK BOULEVARD & MAGNOLIA AVENUE
INSTALLED SPRING 2011

PLANTING PLAN



- PLANT QUANTITIES**
- Black-eyed susan – 15
 - Blazing star – 15
 - Blue false indigo – 9
 - Butterfly weed – 15
 - Great blue lobelia – 25
 - Switchgrass – 5
 - Joe-pye weed 'little joe' – 7
 - Phlox 'david' – 17
 - Purple coneflower – 21
 - Sweet pepperbush – 3
 - Wild bergamont – 7

SITE PHOTOS



PARKSIDE

PARK BOULEVARD & VESPER BOULEVARD

INSTALLED FALL 2011

PROJECT DESCRIPTION

The residents of this section of Park Boulevard initiated this project after they saw the rain garden built at Park Boulevard and Magnolia Avenue. This rain garden, located in a median, captures stormwater runoff running along Park Boulevard through several curb cuts. Volunteers assisted in planting over 500 herbaceous plugs, which included native plants such as Short-toothed Mountain Mint, Foxglove Beardtongue, and Purple Coneflower. The NJTF planted a Sweetbay Magnolia tree next to the rain garden.

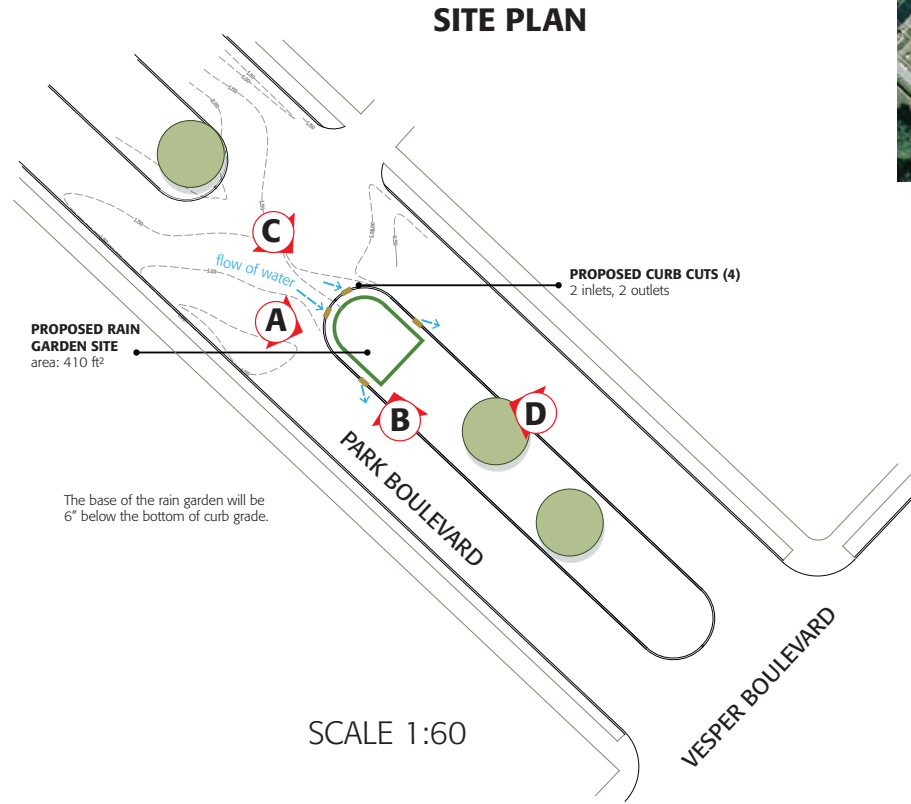
COMMUNITY PARTNERS

PBCIP

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings

SITE LOCATION



SITE PHOTOS



PARKSIDE

PARK BOULEVARD & VESPER BOULEVARD

INSTALLED FALL 2011

PLANTING PLAN



CURB CUT



GROUND COVERS:

- AnVi** *Andropogon virginicus*
Broomsedge
- PyMu** *Pycnanthemum muticum*
Short-toothed Mountain Mint
- SoFW** *Solidago rugosa* 'Fireworks'
Fireworks Goldenrod

INTERPLANTED SPECIES:

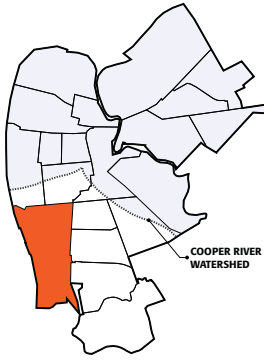
- PeDi** *Penstemon digitalis*
Foxglove Beardtongue
- AsIn** *Asclepias incarnata*
Butterfly Milkweed
- EcPu** *Echinacea purpurea*
Purple Coneflower
- VeHa** *Verbena hastata*
Blue Vervain
- VeLe** *Veronica* 'Iron Butterfly'

planting plan in collaboration with:



SCALE 1:5

WATERFRONT SOUTH



POTENTIAL PARTNERSHIP OPPORTUNITIES

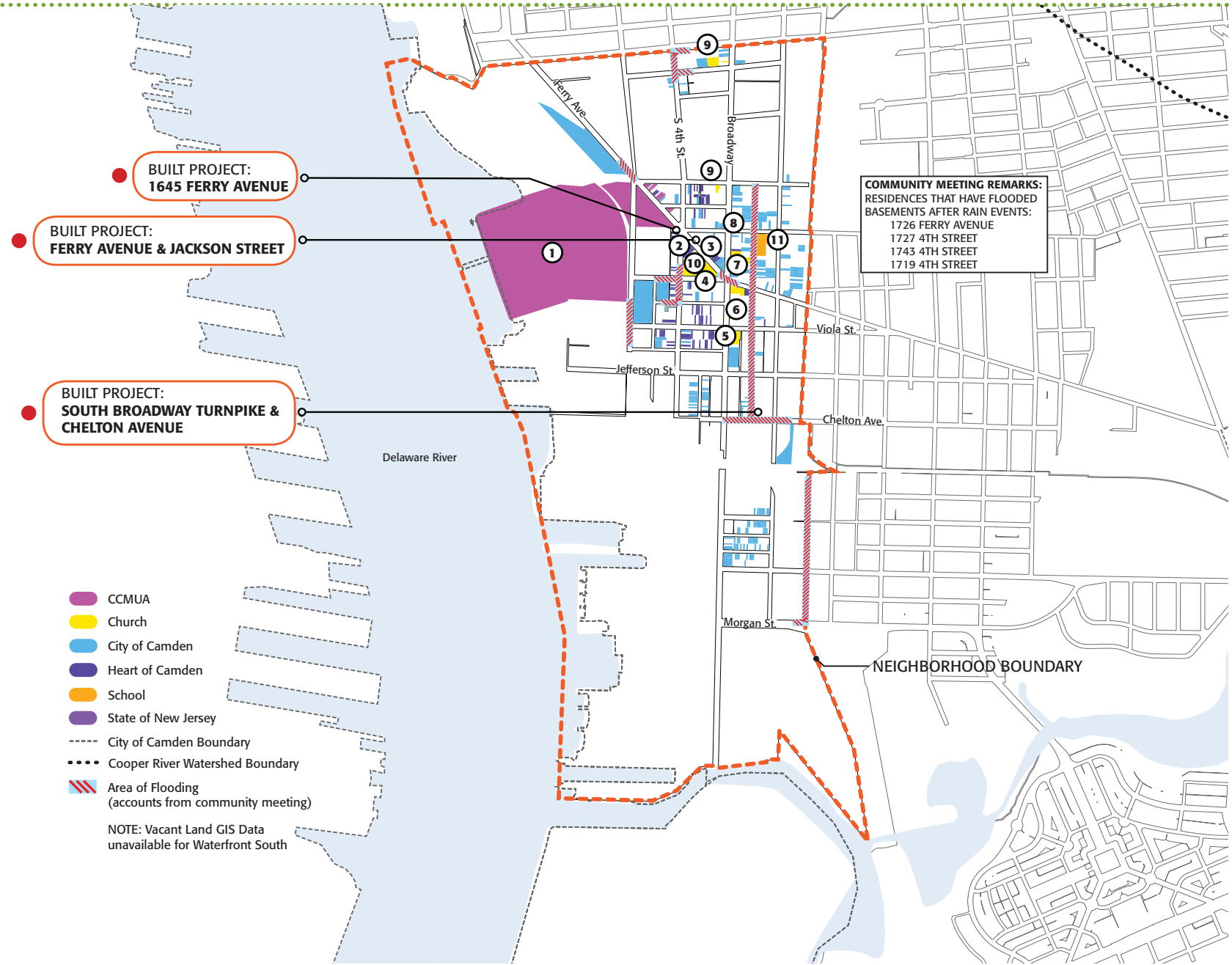
1. CCMUA
2. HEART OF CAMDEN
3. THE CENTER FOR ENVIRONMENTAL TRANSFORMATION

CHURCH

3. Sacred Heart Church
4. Church of Our Saviour
5. Holy Bethel Church
6. South Camden Christian Fellowship
7. Holy Trinity Pentecostal Church
8. New Hope Temple Assemblies of Christ
9. The First Church of Deliveries

SCHOOL

10. Sacred Heart School
11. Creative Arts High School



WATERFRONT SOUTH

FERRY AVENUE & JACKSON STREET

INSTALLED SUMMER 2011

PROJECT DESCRIPTION

In collaboration with CCMUA, The CfET started a native plant nursery to grow plants for the use in green infrastructure projects in the City of Camden. The RCE Water Resources Program provided The CfET 1,000 native plant plugs. Once the plants reach an appropriate size, the plants will be purchased from the nursery and planted in new rain garden projects throughout Camden. Not only does this project provide the rain gardens with healthier, more substantial plant material, but it also offers a potential opportunity to create green jobs in Camden.

POTENTIAL COMMUNITY PARTNERS

The CfET

GREEN INFRASTRUCTURE STRATEGIES

- native plant propagation

SITE PHOTOS Photo Credits: Andrea Ferich, The CfET



GOLDENROD



WILD BERGAMONT



PURPLE CONEFLOWER



FOXGLOVE BEARDTONGUE

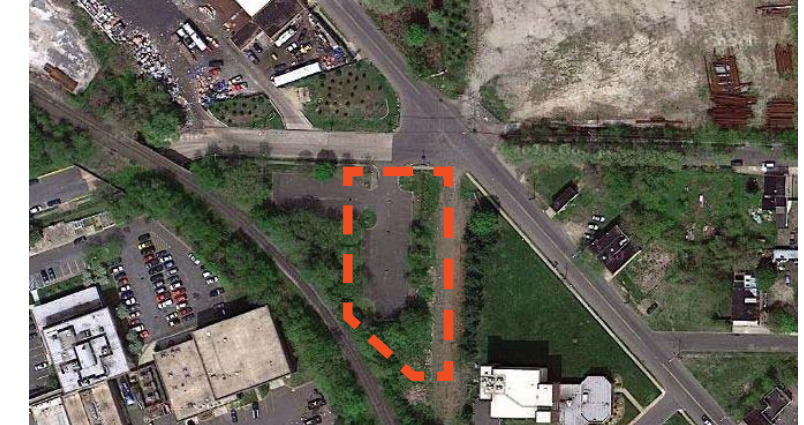


BROWN-EYED SUSAN



NEW ENGLAND ASTER

SITE LOCATION



PLANT LIST

- Blue Lobelia - *Lobelia siphilitica*
- Blueflag Iris - *Iris versicolor*
- Brown-eyed Susan - *Rudbeckia hirta*
- Canadian Goldenrod - *Solidago canadensis*
- Cardinal Flower - *Lobelia cardinalis*
- False Sunflower - *Heliopsis helianthoides*
- Foxglove Beardtongue - *Penstemon digitalis*
- New England Aster - *Aster novae-angliae*
- Purple Coneflower - *Echinacea purpurea*
- Swamp Milkweed - *Asclepias syriaca*
- Wild Bergamont - *Monarda fistulosa*

WATERFRONT SOUTH

SOUTH BROADWAY & CHELTON AVENUE

INSTALLED SPRING 2011

PROJECT DESCRIPTION

This project, located at a main entranceway to the Waterfront South neighborhood, creates a new open space amenity for the community. A series of four rain gardens capture stormwater runoff from the surrounding roadways to alleviate the nuisance flooding that routinely plagues the neighborhood. Native trees planted throughout the site also aid in rainwater infiltration. This project serves as a key example of how a stormwater management project can also transform the aesthetic quality of a neighborhood.

COMMUNITY PARTNERS

CCMUA

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings

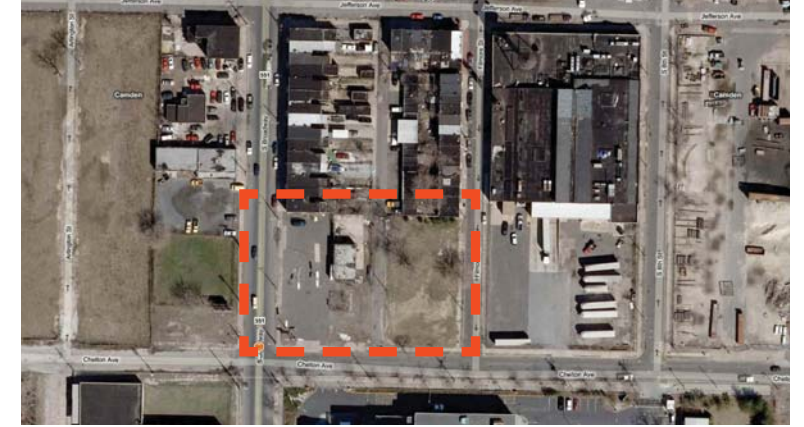
SITE PHOTOS



Photo Credit: Franklin McLaughlin, NJDEP (center and right photos)

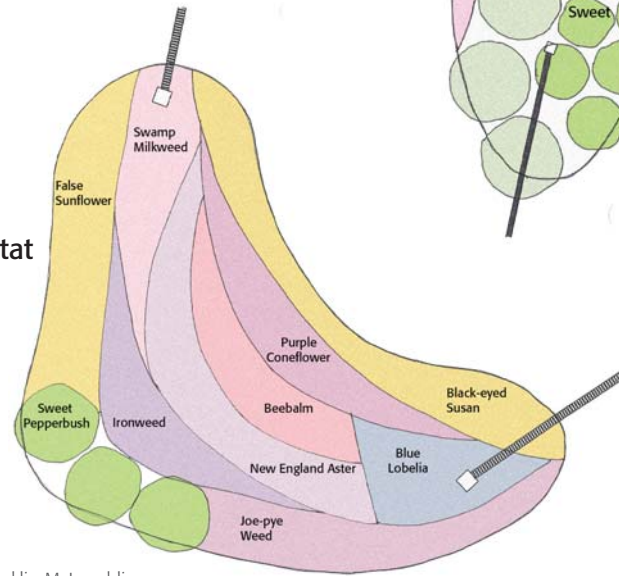


SITE LOCATION

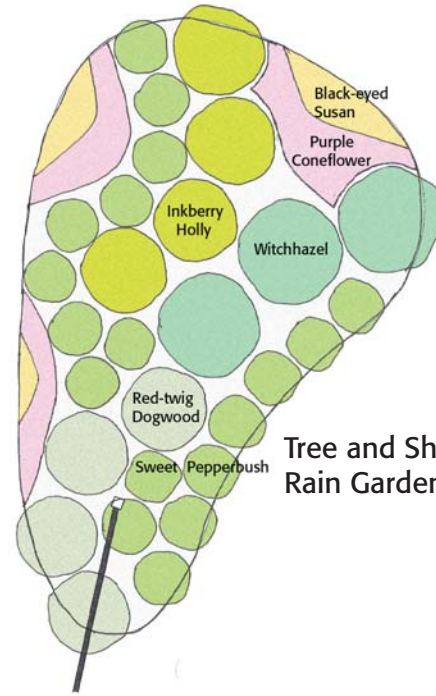


PLANTING PLANS

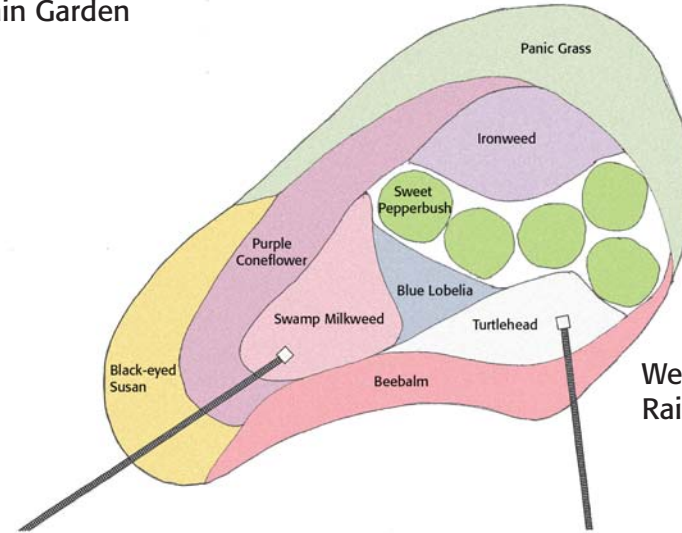
Butterfly Habitat Rain Garden



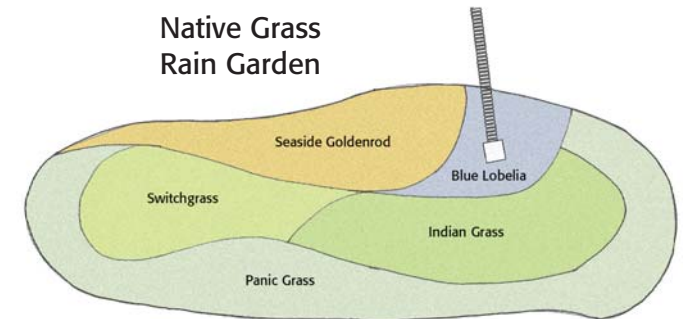
Tree and Shrub Rain Garden



Wet Meadow Rain Garden



Native Grass Rain Garden



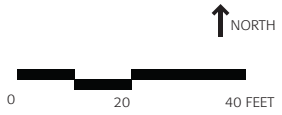
WATERFRONT SOUTH

SOUTH BROADWAY & CHELTON AVENUE

INSTALLED SPRING 2011



SITE PLAN



WATERFRONT SOUTH

1645 FERRY AVENUE

INSTALLED SPRING 2011

PROJECT DESCRIPTION

This project, located on a vacant lot owned by the CCMUA adjacent to its Administration Building, is approximately 800-900 square feet. Two curb cut inlet channels capture, filter, and infiltrate stormwater from the surrounding roadways. The project is located near a low-lying intersection which frequently floods during storm events. The installation of this project was part of a two-day training workshop on rain gardens for landscape professionals. This project included a tree and shrub planting organized by NJTF.

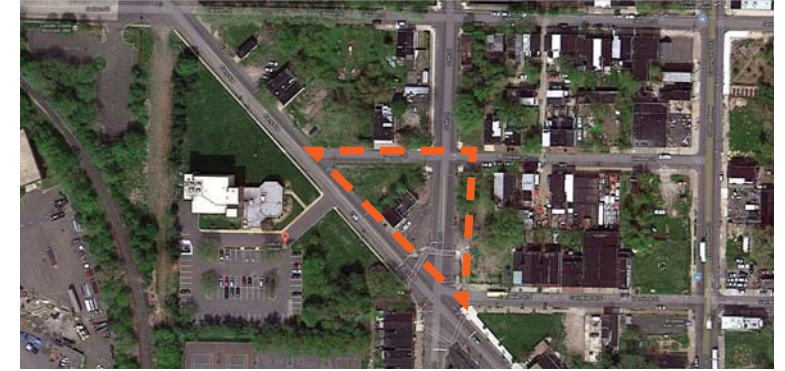
COMMUNITY PARTNERS

CCMUA

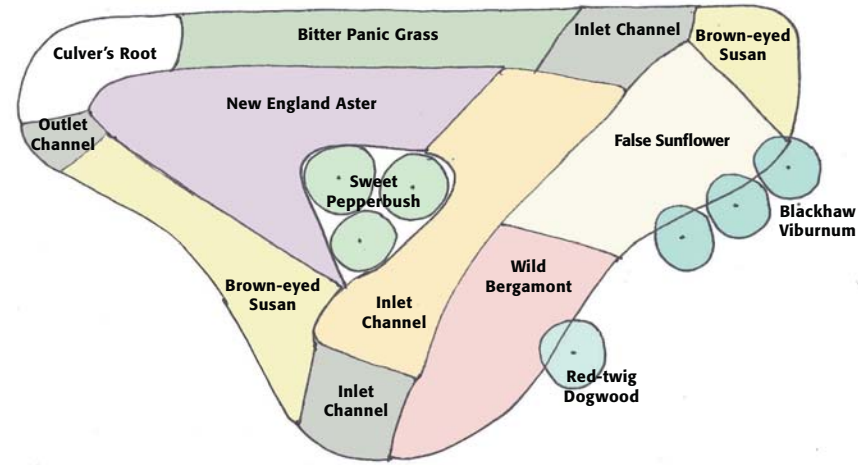
GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- tree plantings
- water conservation education program

SITE LOCATION



PLANTING PLAN



SITE PHOTOS

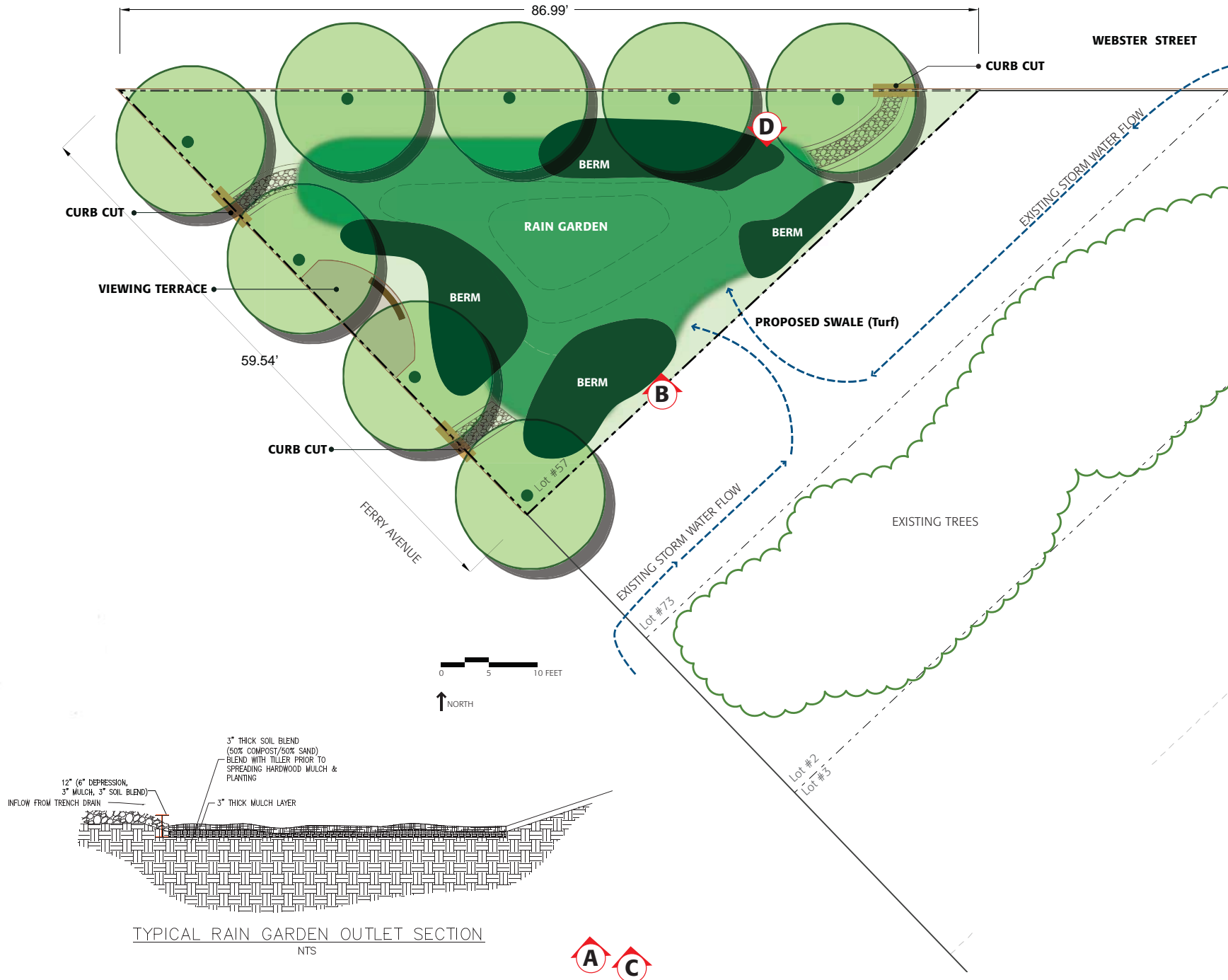


WATERFRONT SOUTH

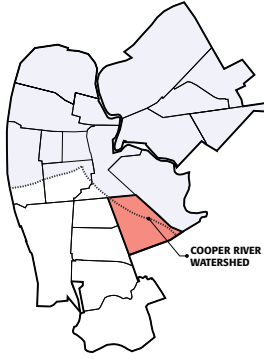
1645 FERRY AVENUE

INSTALLED SPRING 2011

SITE PLAN



WHITMAN PARK



POTENTIAL PARTNERSHIP OPPORTUNITIES

CHURCH

1. 4th Presbyterian Church
2. Antioch Baptist
3. Friendship Baptist Church
4. New Life Lutheran Church

PARK

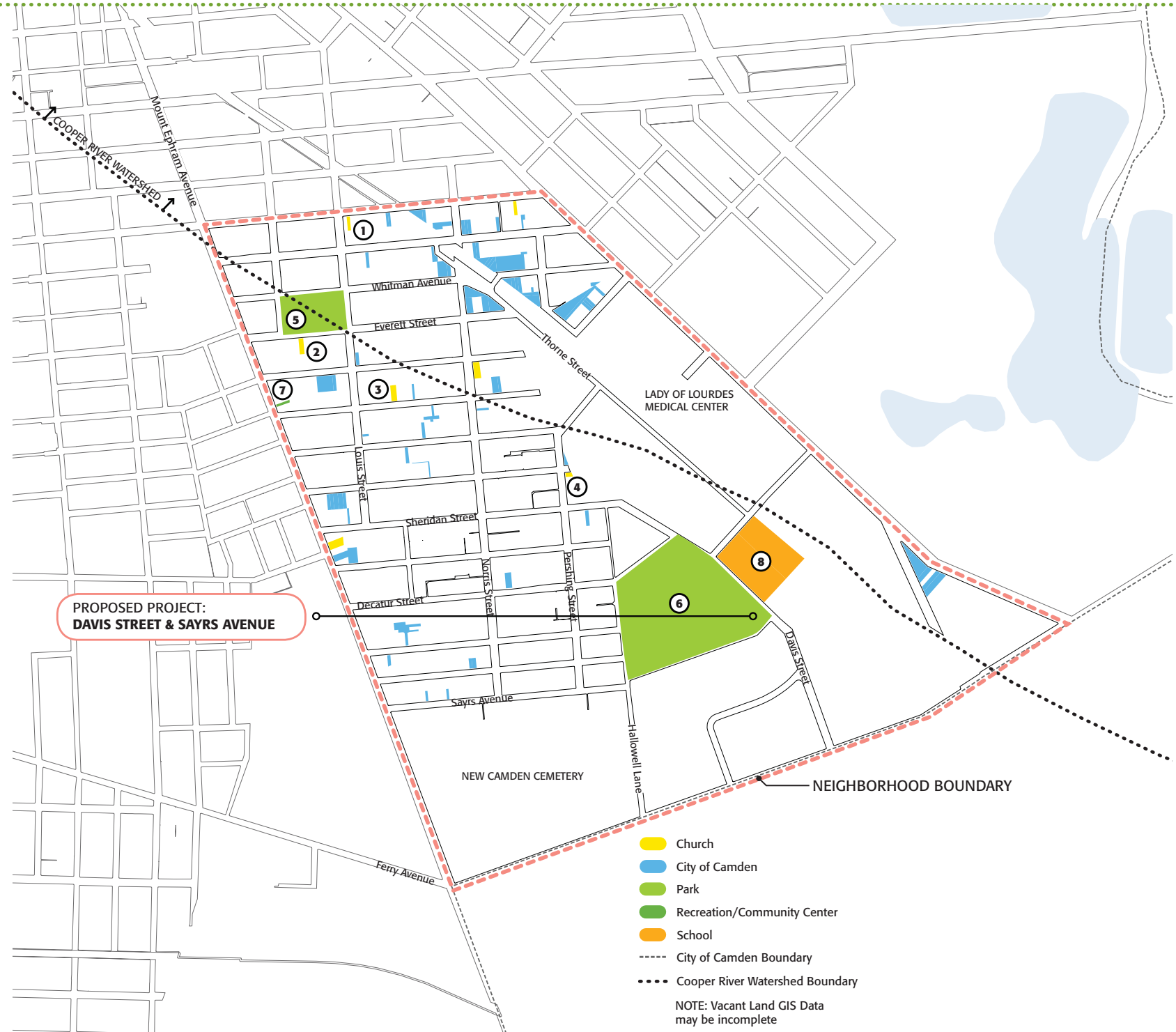
5. Everett & Louis Park
6. Whitman Park

RECREATION/COMMUNITY CENTER

7. Unity Community Center

SCHOOL

8. Charles E. Brimm Medical Arts High School



WHITMAN PARK

DAVIS STREET & SAYRS AVENUE

PROJECT DESCRIPTION

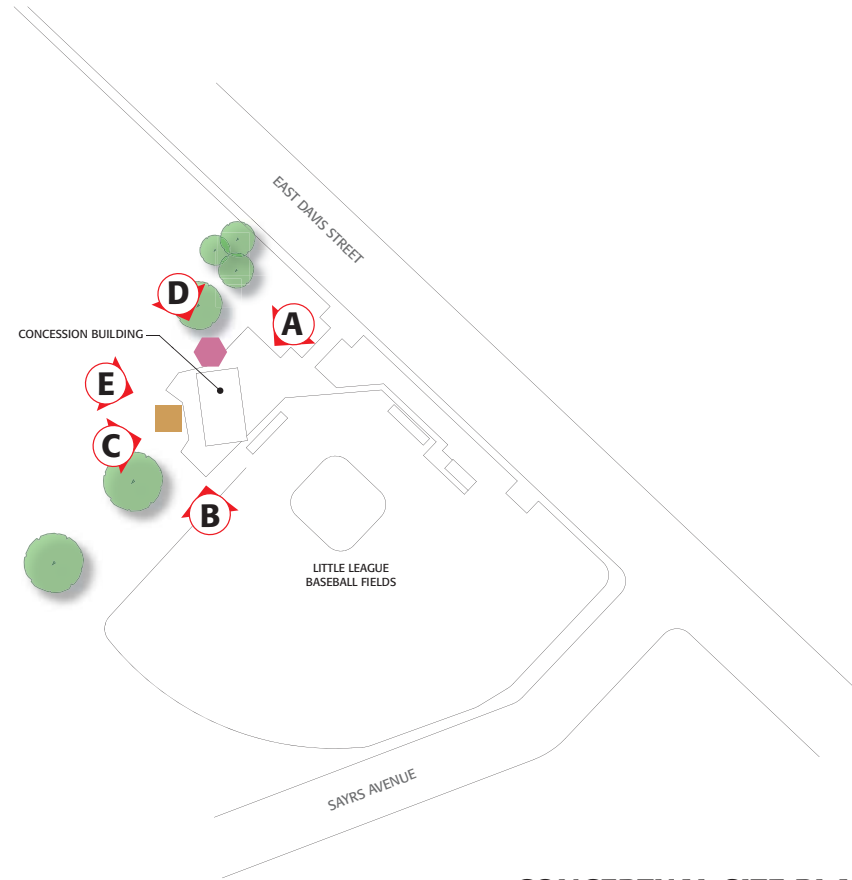
This project responds to the visible ponding and flooding issue near the concession/equipment building of the Little League Baseball fields within Whitman Park. Pervious pavers will replace portions of existing asphalt drives and parking areas near the building. Additionally, rain gardens, or bioretention swales, will capture, filter, and infiltrate stormwater runoff from the building and surrounding concrete areas.

POTENTIAL COMMUNITY PARTNERS

Whitman Park - Little League Baseball

GREEN INFRASTRUCTURE STRATEGIES:

- rain garden
- pervious pavers
- downspout disconnection



CONCEPTUAL SITE PLAN
 SCALE = 1:120

SITE LOCATION



GREEN INFRASTRUCTURE KEY:

- RAIN GARDEN
- PERVIOUS PAVERS

SITE PHOTOS



GLOUCESTER CITY

POTENTIAL OPPORTUNITIES OF PARTNERSHIP

- CHURCH**
1. Church of God
 2. Church of the Ascension
 3. Church of the Risen King
 4. Lighthouse Baptist Church
 5. St. Mary's Church
 6. Trinity United Methodist Church

- COMMUNITY CENTER**
7. Nicholson Road Community Place

- LIBRARY**
8. Gloucester City Public Library

- PARK**
9. Division Street Playground
 10. Johnson Boulevard Recreation Area
 11. Johnson Park
 12. Martin Lake
 13. Middlesex Neighborhood Park
 14. Paul Street Playground
 15. Proprietors Park
 16. Sherman Neighborhood Play L
 17. Thompson Street & Lane Avenue Park
 18. Washington Street Playlot

- SCHOOL**
19. Cold Springs Elementary School
 20. Gloucester City Catholic High School
 21. Gloucester City High School
 22. Highland Park School
 23. Mary E. Costello Elementary School
 24. St. Mary's Grade School



GLOUCESTER CITY

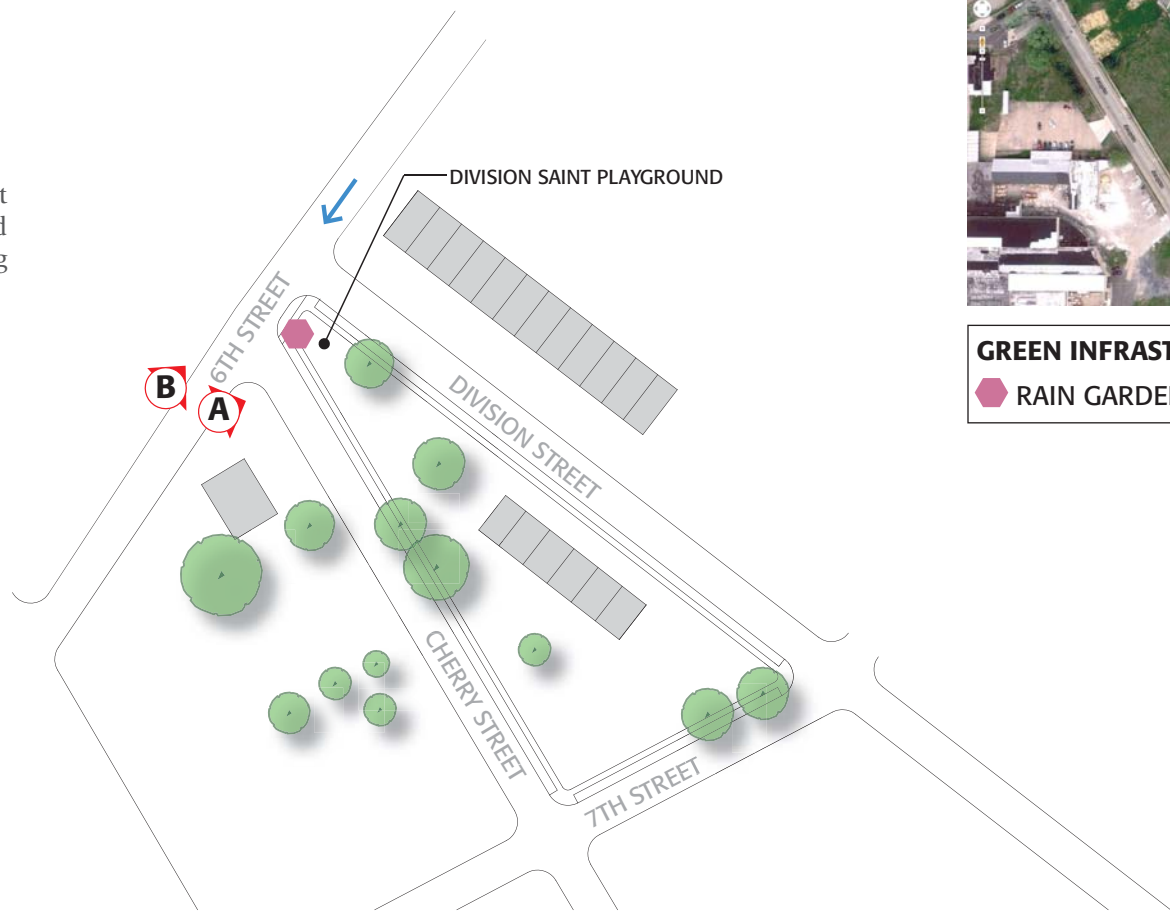
SOUTH 6TH STREET & DIVISION STREET

PROJECT DESCRIPTION

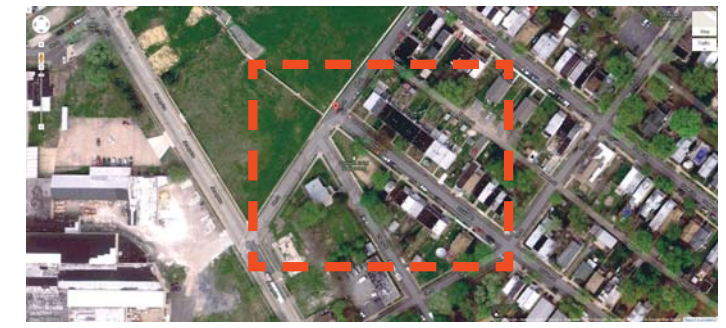
This project consists of a rain garden installation in the Division Street Playground. Stormwater from adjacent roadways will be directed into the site through curb cuts and will reduce the nearby flooding problem.

GREEN INFRASTRUCTURE STRATEGIES

- rain garden



SITE LOCATION



GREEN INFRASTRUCTURE KEY:
 RAIN GARDEN

CONCEPTUAL SITE PLAN
 SCALE = 1:120

SITE PHOTOS



GLOUCESTER CITY

NORTH KING STREET & MONMOUTH STREET

PRIORITY PROJECT SPRING 2012

PROJECT DESCRIPTION

Located at the Gloucester City Fire Department Headquarters, this project aims to disconnect the building's downspouts and divert the stormwater into rain gardens located on either side of the building. This project would reduce the volume of runoff running along North King Street, which is an area frequently flooded.

GREEN INFRASTRUCTURE STRATEGIES

- rain garden
- downspout disconnection



SITE LOCATION



GREEN INFRASTRUCTURE KEY:

◆ RAIN GARDEN

CONCEPTUAL SITE PLAN

SCALE = 1:120

SITE PHOTOS



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Waterfront South Rain Garden Park



BEFORE

Summer 2010

AFTER

Summer 2011

