



Small Scale Green Infrastructure Retrofits on Private Properties in New York City

Green Infrastructure Program
of the New York City
Soil & Water
Conservation District
2014

New York City Soil & Water Conservation District assists New Yorkers and local decision makers in making wise use of the City's soil, water and other natural resources. Our mission is to conserve, preserve and protect natural resources, improve water quality, prevent soil erosion and sedimentation, and promote the health, safety and general welfare of the City.

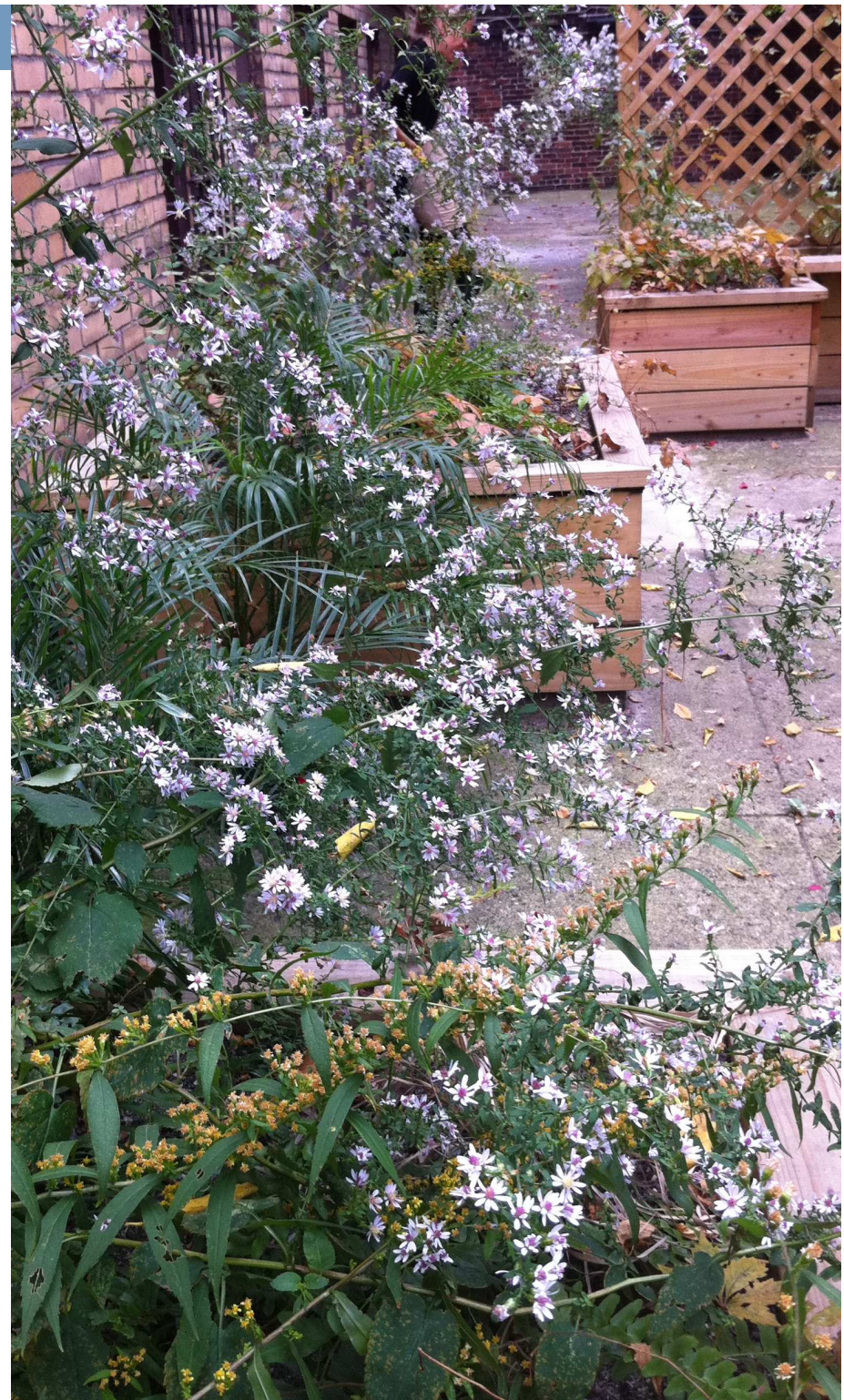
Introduction

The New York City Soil & Water Conservation District was created to assist New Yorkers in making wise use of the City's soil, water and related natural resources. The District's green infrastructure program has grown to a portfolio of seven projects in three boroughs. While the City has made great strides in implementing its Green Infrastructure Plan, small private properties are not the priority for installing green infrastructure. For this reason, the District continues to focus its programming on private properties, particularly low income housing owned by not-for-profit organizations.

This report features brief summaries of the District's Green Infrastructure Program, which includes implementation, outreach & education and policy.



Above: Orange Cone Flower in a stormwater capture planter on Home Street in the South Bronx.



Right: Blue Stemmed Goldenrod and Blue Wood Aster in full bloom in stormwater capture planters on West 74th Street in Manhattan.

Green Infrastructure Implementation Projects

Planter rain gardens are planter systems connected to the downspout draining the roof of a building. These systems are designed as hybrid detention/retention systems, in which stormwater is detained in the planter above the soil surface and retained in the soil for use by plants. The volume captured is limited by the size, configuration and use of the yard.

Green Roof on West 131st Street, Manhattan

The building is a 100+ unit low-income senior housing in Central Harlem with a penthouse community room on the southern half of the top floor. The community room overlooks a roof (approximately 1,200 square feet). The project is a retrofit and thus the scope is limited by existing building structure, which did not allow an intensive green roof or the use of the roof for public assembly purposes (e.g., community event). The extensive green roof was installed using a sedum planted interlocking tray system.

The project was coordinated with a major roof repair work already underway. While the coordination made sense, it led to delays in green roof installation. The project was completed four days before the grant deadline.

Location	450 West 131st Street, New York, NY 10027
Type of Property	Non-profit owned low-income senior housing with approximately 100 units
Size of the Roof	1,230 square feet
Drainage Area	1,271 square feet (roof of the community room)
Volume of 1" Rain	793 gallons
System Capacity	750 gallons
Stormwater Management Capacity for 1" rain	94%
Project Partners	Highview Creations (design and construction), Community Assisted Tenant Controlled Housing (property owner)
Grant Amount	\$65,000
Funding Source	Deutsche Bank & Hudson River Estuary Program
Project Completion	Fall 2014

Left: A sedum green roof on the southern half of the roof outside the community room.



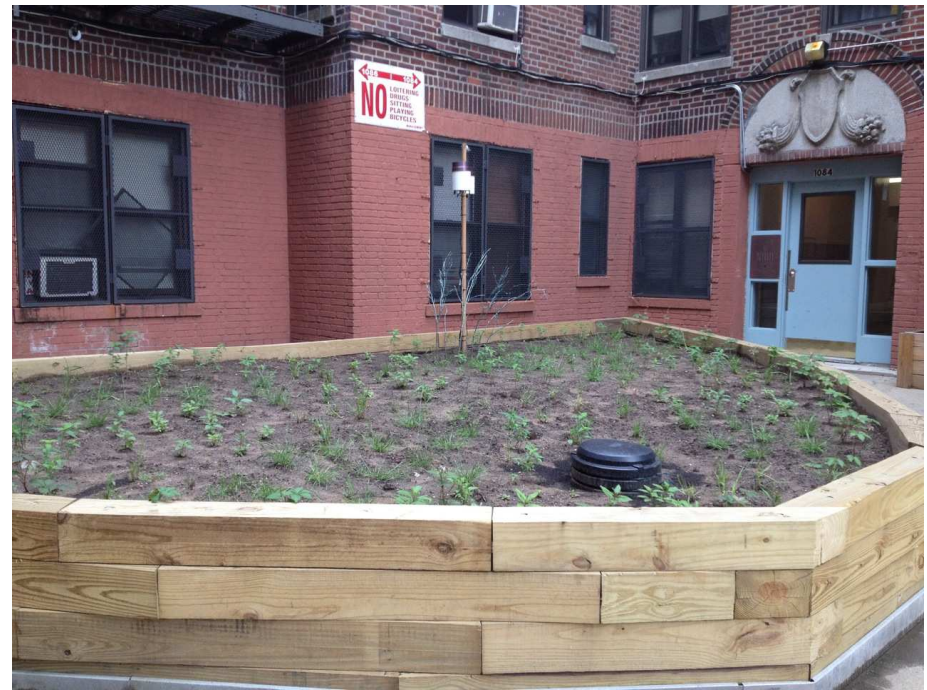
Stormwater Capture Planters with Rainwater Harvesting on Home Street, the Bronx

Stormwater capture planters are installed in yards where there are no external downspouts draining the roof. These planters are deeper than conventional horticultural planters (the height of the planters range from 18” to 42”) to enhance soil pore space.

The front courtyard of this building has two levels: 1,600 square feet upper courtyard and XXX square feet lower entry corridor to the sidewalk. This configuration allowed us to capture stormwater running off the upper courtyard. The project consists of multiple planters, a cistern, a foot pump and rain barrels. The largest planter covers a significant area of the courtyard and will retain the water falling on it. The existing underground drain in the upper courtyard was connected to a 300-gallon cistern buried under the entry corridor, which is at lower grade. The tank is connected to a series of three 55-gallon barrels via a foot pump.

In addition to the large planter, there are 8 smaller planters of various sizes. Some of these planters will be available for the residents for gardening. Others will be planted with native species. These planters can be irrigated using the water in the barrels.

For the system to function as a detention/retention system, water in the cistern must be pumped to the barrels and used for irrigation (or for other uses, such as sidewalk cleaning). As such, residents’ involvement is more critical for this project. As in the past, we began the process with a meeting with residents to solicit their feedback on the design. Concerns and ideas shared by the residents were incorporated into the final design. Because the project is in the courtyard serving the entrances to the building, residents are aware of the project, enabling more effective engagement. The project is being monitored for rainfall and water levels in the cistern and one of the barrels. Data are uploaded to a website automatically, allowing remote access. Through Drexel University’s Citizen Scientist program one of the residents has been recruited to serve as a citizen scientist, who will verify instruments’ accuracy.



Above: A large planter was constructed in the middle of the courtyard. The floor drain is connected to a subsurface cistern in the lower courtyard. Below: The water in the subsurface cistern can be pumped to rain barrels via a treadle pump. Above the pump is monitoring data logger, which sends data via internet for remote access.

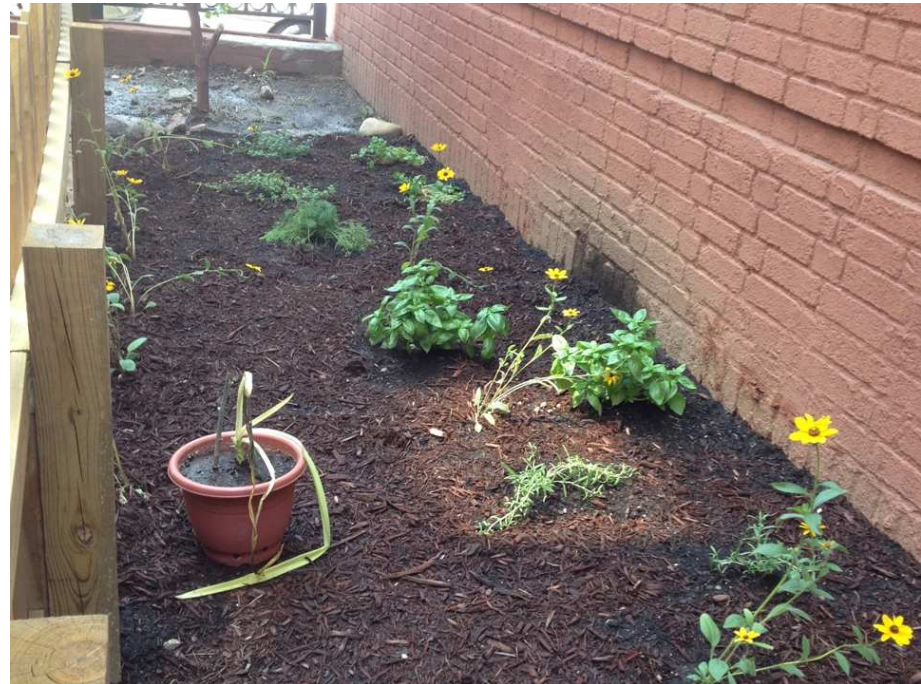




Above: Purple Joe-Pye, Wild Bergamot, and Orange Cone Flower were the showy plants planted among various native grasses.

Location	1084 Home Street, the Bronx, NY 10459
Type of Property	Non-profit owned low-income senior housing with approximately 50 units
Size of the Courtyard	1,600 square feet
Drainage Area	900 square feet (upper courtyard draining to cistern)
Volume of 1" Rain	1,135 gallons
System Capacity	795 gallons
Stormwater Management Capacity for 1" rain	70 %
Project Partners	eDesign Dynamics (design and construction), Banaka Kelly Community Improvement Association (property owner)
Grant Amount	\$84,000
Funding Source	National Fish & Wildlife Foundation, Bronx River Watershed Initiative
Project Completion	Summer 2014

Below Left: Around the large center planter, smaller planters of various sizes were constructed. Many of the smaller planters were also planted with native flowering species. Below Right: Along the walkway in the lower courtyard we created a vegetable and herb garden for residents.



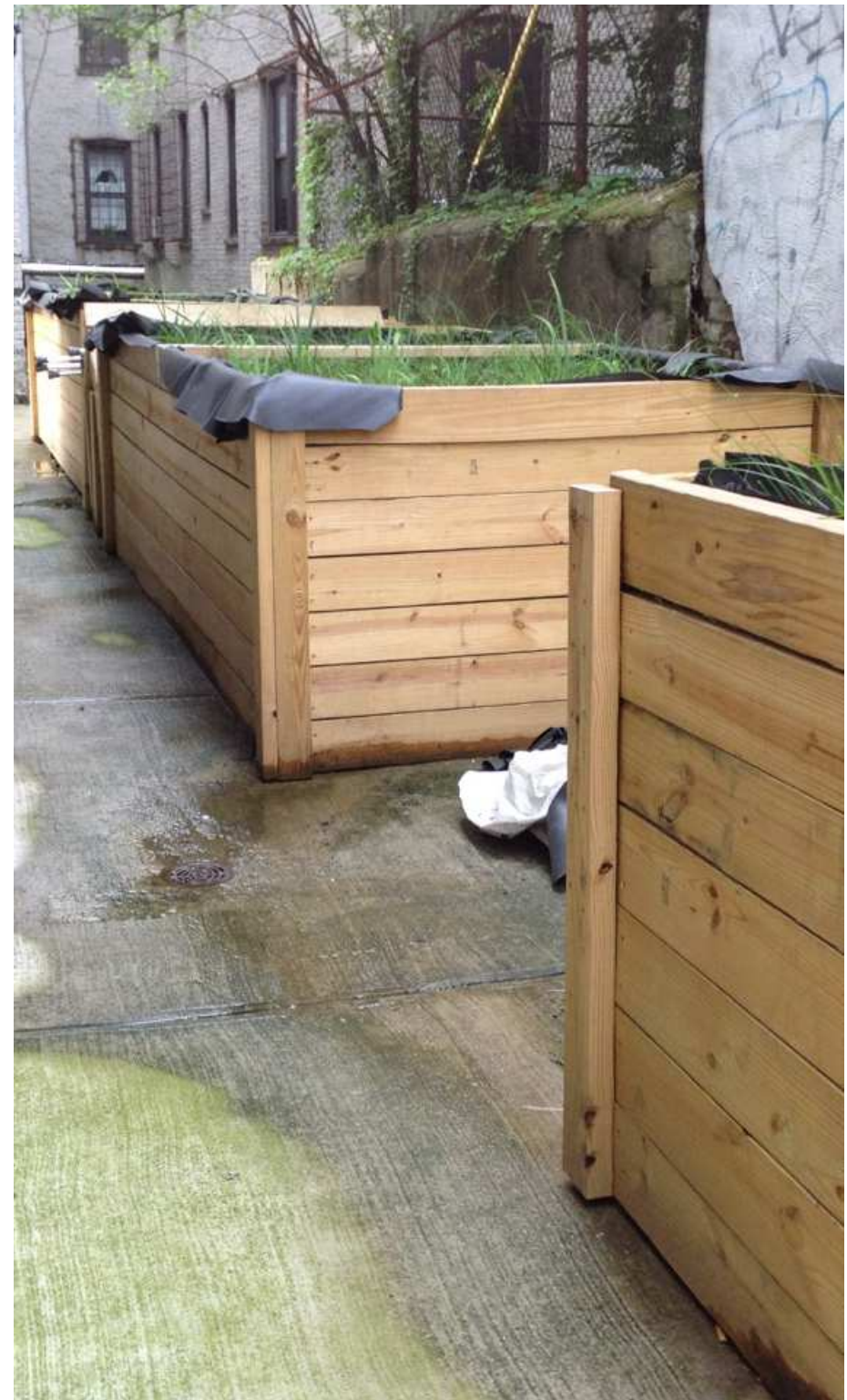
Wetland Planters on Rochester Avenue, Brooklyn

This apartment building in Crown Heights, Brooklyn, has a modest size backyard with a side yard open to the street. Three planters, 5' wide x 3.5' deep x 10 to 14' long, are connected in series to the downspout from the roof. As in the Prospect Avenue project, a rain barrel connected to the diverter controls the water level in the planters. Water in excess of the maximum volume in the planters will be routed to the existing sewer line. The sizes of the planters were limited by the lot size and the fire egress requirement, such that 100% capture of a 1" storm was not possible.

The project began with a meeting with residents. We requested their permission to work on their site at the initial meeting with a subsequent meeting to share the conceptual design and solicit feedback. Because the yard is accessible from the street, safety issues were the residents' main concerns. We modified the design to minimize "blind spots" where people off the street may hide and spaces that may promote loitering.

Location	270 Rochester Avenue, Brooklyn NY 11213
Type of Property	Non-profit owned low-income housing with approximately 15 units
Size of the Yard	440 square feet
Drainage Area	3,133 square feet
Volume of 1" Rain	1,855 gallons
System Capacity	1,720 gallons
Stormwater Management Capacity for 1" rain	92%
Project Partners	eDesign Dynamics (design and construction), Community Assisted Tenant Controlled Housing (property owner)
Grant Amount	\$30,000
Funding Source	Deutsche Bank
Project Completion	Summer 2014

Right: Three planters are connected via PVC pipes to a downspout from the roof of the building. The level of the water in the planters is controlled by a barrel located at the diverter from the downspout.





Wetland Planters on Prospect Avenue, the Bronx

This building, located in the Longwood neighborhood in the South Bronx, has a large paved backyard. The property owner, Banana Kelly Community Improvement Association, was interested in creating a community space with a residents committee which will oversee the use. We partnered with Banana Kelly to create an above-ground “rain garden” with planters.

We met with residents to introduce the project concept and to begin recruiting residents for a gardening committee. At a subsequent meeting, we presented two designs for the backyard: one with two large wooden planters, and the other with a series of open top, planted rain barrels. We also created a poster for the entrance hall way with both designs and solicited residents to vote. Residents also requested a vegetable planter.

The planters – 8’ wide by 19’ long by 3’ deep, constructed with pressure treated lumber – were lined with pond liners. We installed a diverter to the building’s external downspout draining half of the roof. Stormwater off the roof is diverted into a rain barrel with an outflow calibrated to the maximum water level in the planters. The rain barrel is connected to the two planters via a PVC pipe, which enters the planters at the soil surface level. Inside the planters, the perforated PVC pipes serve both to fill and drain the planters.

Left: Woolgrass flowers.

Location	970 Prospect Avenue, Bronx, NY 10458
Type of Property	Non-profit owned low-income housing with approximately 50 units
Size of the Yard	2,600 square feet
Drainage Area	3,600 square feet
Volume of 1” Rain	2,244 gallons
System Capacity	3,638 gallons
Stormwater Management Capacity for 1” rain	> 100%
Project Partners	eDesign Dynamics (design and construction), Community Assisted Tenant Controlled Housing (property owner)
Grant Amount	\$34,000
Funding Source	NYS Conservation Project Fund; Community Trust
Project completion	Summer 2011

Constructed Wetland on a Vacant Lot on West 150th Street, Manhattan

We constructed a wetland in a vacant lot adjacent to a low income apartment building. Stormwater from the roof is diverted from the external downspout into a series of ten rain barrels. Water from the barrels then enters the constructed wetland via another barrel outfitted with a float inside to regulate the water level (using the same principle as a toilet tank). When the water in the constructed wetland reaches the maximum level, the stormwater from the roof is no longer diverted to the system and flows directly into the existing sewer system. The water that enters the wetland is completely retained through infiltration.

The site presented significant challenges during the construction. Because of the configuration of the site, there is no direct access from the street, necessitating manually carrying all construction materials, including soil, through the building's egress corridor. The wetland ditch approximately 3' wide 2' deep and 54' long (approximate volume = 2,400 gallons) was hand dug. The existing top layer of the soil on the lot comprised of construction debris: bricks, pieces of concrete and asphalt dominated the layer. Below this layer, we uncovered loamy fine sand on the western half of the lot. On the eastern half buried under the top layer of debris was a slab of concrete running almost the entire length of the lot. We used a jack hammer to drill holes to place soil and plant plugs in this area. Despite these conditions, the native plants are now thriving after several summers of routine weeding.



Above: The barrel in the middle is a sump that controls the flow of rainwater from the rain barrels outside the fence. Below: Despite the poor condition of the soil at the site, many of the native species, like the Spotted Beebalm in this photograph, are thriving. Weeding has been important in ensuring the natives species' establishment.



Location	281 West 150th Street, New York, NY 10039
Type of Property	Non-profit owned low-income housing with approximately 15 units
Size of the Yard	1,000 square feet (vacant lot size, not the building lot size)
Drainage Area	2,648 square feet
Volume of 1" Rain	1,651 gallons
System Capacity	4,040 gallons
Stormwater Management Capacity for 1" rain	>> 100 %
Project Partners	eDesign Dynamics (design and construction), Central Harlem Bradhurst LP (property owner)
Grant Amount	\$28,000
Funding Source	NYS Conservation Project Fund
Project Completion	Summer 2010



Rain Barrels with Green Wall on West 83rd Street, Manhattan

The external downspout draining the roof of the building is connected to a series of rain barrels outfitted with low flow orifices. The system is a detention system which releases water in the barrels over 24 hours. An educational component was integrated into the system, with one barrel designated as a rain water harvesting barrel for the adjacent preschool.

The project site is a narrow backyard with very little space. In addition, the backyard adjacent to the site has several mature trees that shade the site, making it challenging for vegetation growth.

Location	122-130 West 83rd Street, New York, NY 10024
Type of Property	Multiple mixed use buildings with low-income housing, commercial tenants, a not-for-profit preschool with a common backyard
Size of the Yard	500 square feet
Drainage Area	4,000 square feet
Volume of 1" Rain	2,493 gallons
System Capacity	900 gallons
Stormwater Management Capacity for 1" rain	36 %
Project Partners	eDesign Dynamics (design and construction), Church of St. Matthew St. Timothy (property owner), Sustainable Yards (outreach and communication)
Grant Amount	\$31,500
Funding Source	NY NJ Harbor & Estuary Program
Project Completion	Summer 2010

Left: Rain barrels connected in series detain rain water off the roof. Water in the barrel is drained through low flow orifices calibrated to empty the barrel over 24 hours.

Maintenance

Our maintenance model has been based on resident engagement. If we can engage and empower the residents to take ownership of the project, they will maintain and steward the project. This was very successful with our first project on West 74th Street in Manhattan. For other sites, even though we began our work at each site with a meeting with the residents, engaging them in the long term has proven to be difficult. We have learned that the project visibility enhances resident participation. At Home Street where the project is in the courtyard that serves as the main entrance to the building, we have a group of residents who have shown an interest in the project. At Prospect Avenue where the project is in the backyard with limited access to the residents, only a few residents became involved even though the idea was for the residents to begin using the backyard as a community space once the project was completed. At Bryant Avenue, residents interested in gardening were afraid to be in the backyard until some problematic tenants were evicted from the building. Maintaining a cordial relationship with the superintendent of the properties has been critical in ensuring problems are addressed collaboratively in a timely manner.

The District continues to monitor all but the first project every year to ensure proper functioning. We have discovered that plumbing fixtures, such as ball valves, may require replacement or repair after some years. Some PVC connections have also required replacements. Unlike indoor plumbing, our systems are entirely outdoor, open to the elements as well as foot traffic, careless handling and even vandalism. We are learning that plumbers used to indoor work may not fully understand the environmental conditions associated with this type of projects. Vegetation, on the other hand, has thrived in even the most challenging site (West 150th Street). We have experienced first-hand the importance of planting in spring to enhance plant survival. Unfortunately we are not always able to control the timing of the planting.



Right: Wild Bergamot is one of the native plants thriving in the challenging conditions on West 150th Street.

Education and Policy

Green Infrastructure Bus Tour

With modest grant funding, the District has hosted several bus tours of green infrastructure. These free tours are open to anyone with an interest. The participants have come from a wide array of professions: natural resources managers from government agencies, landscape architects, green roof professionals, environmental policy analysts, academics, students, environmental advocates, and educators.

We have showcased green infrastructure in New York City as well as elsewhere – Philadelphia and Villanova. Green infrastructure practices visited have included green roofs, brownfield reclamation, urban farms, bioswales, constructed wetlands, stormwater capture planters, porous pavement, green streets, rain gardens and more. We partner with project managers for each site so that tour participants have the opportunity to learn about the site first hand and ask questions.

In 2014 we visited three green roof projects and a DEP-funded large scale GI project encompassing a green roof, rain water harvesting and an urban farm in the South Bronx.

Policy

The District has been involved with the Stormwater Infrastructure Matters Coalition (S.W.I.M. Coalition) as a member of the Steering Committee. Through this coalition, the District has been engaged in stormwater management policies development and review. Our work in green infrastructure implementation on private properties has given us useful perspective in evaluating various policy initiatives. The District is particularly interested in researching policies that promote green infrastructure implementation on small private properties.



Above: The chef at the Lenox Neighborhood Housing talked about using herbs from the roof garden, part of the green roof project. Below: Banana Kelly Community Improvement Association turned one of its properties into a green infrastructure demonstration site that includes an urban farm for the residents.



The District's Green Infrastructure Projects Constructed to Date

Location	Project	Year Completed
West 74th Street, Manhattan	Stormwater Capture Planters	2009
West 83rd Street, Manhattan	Rain Barrel Detention System	2010
West 150th Street, Manhattan	Rain Garden/Constructed Wetland	2010
Prospect Avenue, Bronx	Stormwater Capture Planters with Downspout Connection	2011
Bryant Avenue, Bronx	Stormwater Capture Planters	2012
Home Street, Bronx	Stormwater Capture Planters with Cistern	2014
Rochester Avenue, Brooklyn	Stormwater Capture Planters with Downspout Connection	2014
West 131st Street, Manhattan	Extensive Green Roof	2014



New York City Soil & Water Conservation District

121 Sixth Avenue, Suite 501, New York, NY 10013

212.431.9676

www.nycswcd.net