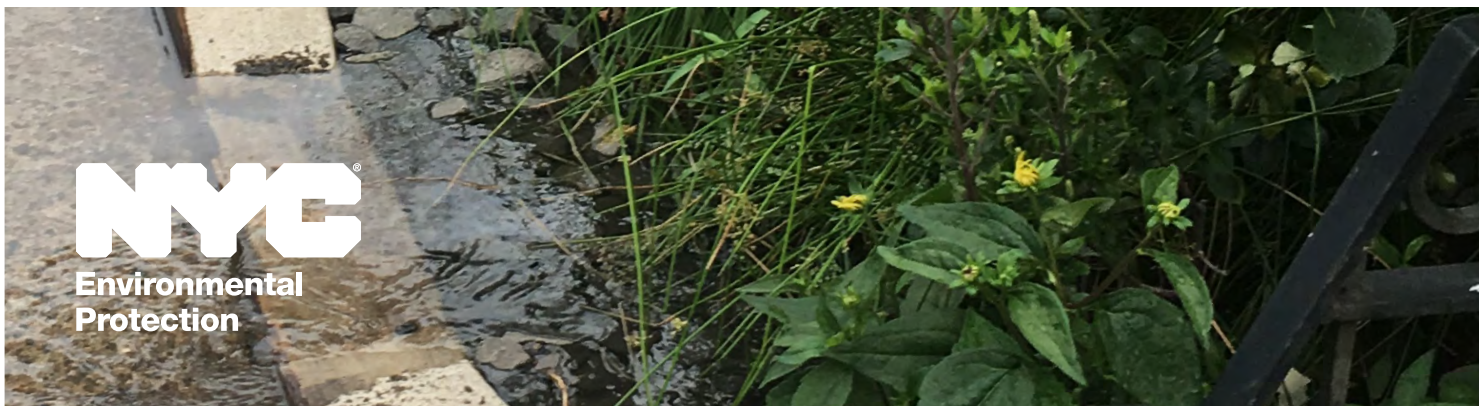


NYC GREEN INFRASTRUCTURE

2018 Annual Report



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Environmental
Protection

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Hi!

DEP is excited to present the 2018 Green Infrastructure Annual Report. The Annual Report provides an update on the NYC Green Infrastructure Program (or the “Program”) including all of the achievements and advancements through 2018 and outlines what is in store for 2019. Previous Annual Reports and the Green Infrastructure Plan can be found on DEP’s green infrastructure reports [website](#).

Installing green infrastructure is a win-win-win for New York. While the primary goal of the Program is to reduce combined sewer overflows (CSO) into New York Harbor in a cost-effective way, the distributed projects also provide community and environmental benefits to New York neighborhoods and residents. These “co-benefits” include increased urban greening, urban heat island reduction, and more habitat for birds and pollinators around the City.

By retrofitting NYC’s streets, sidewalks and other public property, and incentivizing retrofits on private property, DEP is on its way toward the 2030 CSO reduction goal of 1.67 billion gallons a year. As reported in past years, DEP has successfully installed and continuing to install thousands of right-of-way (ROW) rain gardens and other green infrastructure practices in the City’s combined sewer areas, and thousands more green infrastructure practices are in planning and design phases.

The Program staff do more than just design and build projects, they also perform all of the maintenance of constructed green infrastructure in the ROW, conduct research and development on green infrastructure, engage elected officials and civic stakeholders, track all green infrastructure projects, and lead planning, mapping and data management efforts.

Speaking of data, the GreenHUB tracking application DEP launched in 2017 is working great! It allows DEP staff to conduct various analyses, queries, mapping, reporting, and other critical functions as the number of assets exponentially grows. DEP tracks green infrastructure assets at both the project (or property) level and at the individual asset level, and related asset attributes such as the status of the asset, geographic location, cubic feet of stormwater managed, classification and permeability characteristics of the underlying soils, year constructed, and other relevant data. An example of how DEP can use GreenHUB data is on page 7. Also the Green Infrastructure Webmap (Page 8) displays the GreenHUB data through a publicly accessible map for all constructed, in construction, and planned assets.

As of early 2019, the Program has committed over \$600 million in capital funds since fiscal year 2012, and has approximately \$1 billion currently budgeted through fiscal year 2029 (see Exhibit A). These future funds are earmarked for ongoing design, construction, and construction management work. The implementation of the program is undertaken by DEP, the Economic Development Corporation (EDC) and the Department of Design and Construction (DDC) for the ROW program. In addition, our partnership with the Departments of Parks and Recreation (DPR), Department of Education (DOE), New York City Housing Authority (NYCHA), New York Police Department (NYPD), New York Fire Department (FDNY), Housing, Preservation and Development (HPD) agency, and public libraries facilitate retrofits on public property.

Throughout 2018, DEP staff continued to engage the public through various neighborhood association meetings, classroom activities, private grant program workshops, groundbreaking ceremonies, and public tours (see Exhibit B). This outreach is critical to the success of the Program and also includes hundreds of correspondences

PROGRAM HIGHLIGHTS

591

Greened Acres from 2010-2018

4,585

Assets constructed or in construction

~5,500

Assets going into construction in 2019

and phone conversations with residents and local organizations.

DEP has various initiatives planned for 2019, such as launching rain garden stewardship, installing signage on select rain gardens in the right-of-way, publishing a public property retrofit design manual, working with private property owners to install even more green infrastructure, porous pavement planning and design, developing a framework for a new grant program geared toward community groups, and creating new construction management and inspection teams.



IMPLEMENTATION UPDATE



RIGHT-OF-WAY GREEN INFRASTRUCTURE

The public right-of-way (ROW) includes sidewalks, parking lanes, medians, and the roadway. It makes up approximately 30% of the impervious cover in the City and generates stormwater runoff during rain events. In 2012, DEP launched area-wide green infrastructure projects, in partnership with DOT and DPR, and has achieved the vast majority of stormwater management through the installation of rain gardens (formerly called bioswales).

All of the initial Priority CSO area-wide projects are either constructed, in construction, or in advanced design phases. In addition, DEP selected several East River/Open Waters CSO tributary areas to build ROW green infrastructure based on public access and to improve water quality in confined waterways. By and large, this effort has been a tremendous success and has greened many neighborhoods across the City.

In 2018, the ROW program initiated construction in the western Queens tributary to Newtown Creek, the northern Queens tributary to Flushing Creek, and the southern Queens tributary to Jamaica Bay/Bergen Basin. In 2019, there are contracts starting construction

in the East River (Brooklyn), Bronx River, Westchester Creek and Jamaica Bay watersheds.

Detailed descriptions of the area-wide implementation strategy and the design and construction processes are described in previous Annual Reports. Photos of ROW green infrastructure construction can be found on DEP's Flickr [webpage](#).

**DEP has
constructed
over 4,000 rain
gardens across
the City.**

PUBLIC PROPERTY RETROFITS

DEP, with DPR, NYCHA, and DOE, continued green infrastructure project design development on almost 200 publicly owned properties in 2018. Newly constructed projects include green infrastructure schoolyards with the Trust for Public Land (TPL) and playgrounds with DPR’s Community Parks Initiative (CPI).

DEP also continues to work with DDC’s Public Buildings Unit in order to facilitate retrofits with their client city agencies. Upcoming projects with NYPD, FDNY, and other city agencies are in progress. The rain garden and green roof at the Taxi and Limousine Commission property in Queens is planned to start construction in 2019.

DEP acknowledges these agencies for sharing our mission and for their willingness to take on more work by facilitating the design and construction of public property retrofits. In the next several years, these partnership projects will deliver real improvements to New York City’s schools, parks, housing, and other city-owned property as well as improve water quality in the City.

Individual sites in the pipeline for each watershed are listed in the Watershed Section of this report. Photos of constructed projects can be seen on DEP’s Flickr [webpage](#).

TABLE 1: PUBLIC PROPERTY RETROFITS BY PROJECT STATUS

Project Status	Parks/ Playgrounds	Public Schools	NYCHA Housing	Other Public	Total
In Construction/ Constructed	39	25	5	2	71
In Design	53	35	27	1	116
Potential	128	150	27	3	308
Total	220	210	59	6	495



TPL GREEN INFRASTRUCTURE PLAYGROUND AT J.H.S. 189, QUEENS



PRIVATE PROPERTY INITIATIVES

Green Infrastructure Grant Program

Since its introduction in 2011, the Grant Program has sought to strengthen public-private partnerships and public engagement in regards to the design, construction and maintenance of green infrastructure on private property throughout New York City. In 2018, DEP released a streamlined funding schedule (see Table 2) and a fast track review process for green roof projects funded through the Grant Program. Green roofs are an important part of achieving reductions in stormwater runoff from building rooftops, which account for a sizable portion of impervious area in New York City.

TABLE 2: REIMBURSEMENT RATE (\$/SF) FOR GREEN ROOFS

Soil Depth (in)	3,500- 20,000 (SF)*
1.5 - 1.99	\$10
2.0 - 2.99	\$15
3.0 - 3.99	\$25
4.0 +	\$30

* The reimbursement rate for SF of planted area over 20,000 SF is calculated using 50% of the rate shown above

In the fall of 2018, the Salmar Properties and Brooklyn Grange project located in Sunset Park, Brooklyn completed construction. Totalling more than 70,000 SF, this project is now New York City’s largest green roof farm.

To date, the Grant Program has committed more than \$13.5 million to 32 private property owners to build green infrastructure projects. Photos of planned and constructed green infrastructure projects can be found on DEP’s Green Infrastructure Grant Program [webpage](#).

Private Incentive Retrofit Program

In November 2018, DEP issued a Request for Proposals (RFP) to select a Program Administrator and initiate a new Private Property Retrofit Incentive program, marking a significant expansion of DEP’s private incentives for green infrastructure. Proposals are currently under review and DEP expects to select a winning proposal and enter into an agreement with the Program Administrator in 2019. The Administrator will be responsible for connecting with private property owners across the city and installing green infrastructure to manage 200 Greened Acres. The program will focus on properties over 50,000 square feet in total lot area in order to maximize the cost effectiveness. Projects are expected to begin in 2020. (See Exhibit D for a description of “Greened Acres.”)

2012 Stormwater Performance Standard

New development and redevelopment projects often require a sewer certification from DEP to certify new sewer connections to confirm the adequacy of the existing sewer to receive flow from the development. Sewer certifications require either a Site Connection Proposal (SCP) or a House Connection Proposal (HCP). DEP tracks the number of new SCPs and HCPs submitted to the Agency that are affected by the 2012 Stormwater Performance Standard (or Stormwater Rule). Since the rule took effect in July 2012, approximately 1,149 sites have been required to meet reduced stormwater release rates of 0.25 cubic feet per second or 10% of the allowable flow, whichever is greater.¹

In 2018, there were approximately 200 stormwater management structures associated with sewer connections constructed. Table 3 presents the total number of approved SCPs/HCPs impacted by the Stormwater Rule in 2018. Table 4 presents the total breakdown of storm-

water management structure types utilized by applicants affected by the rule in 2018. These systems are primarily detention-based. In Table 4, the Total Planned and Total Constructed totals are independent from one another. Certified HCPS and SCPs are valid for two years. Therefore, the planned connections may not have been constructed in the same year. Additionally, sites may have proposed more than one structure type. Constructed connections are those where DEP has permitted and inspected the certified sewer connection between the property and the sewer pipe.

In 2018, DEP reviewed 2016 and 2017 HCP and SCPs that utilized green infrastructure to comply with the Stormwater Rule. Many of those projects and assets have been entered in GreenHUB and are included in Table 5. DEP will work internally to collect 2012-2015 data, as feasible, to credit the stormwater managed from these private projects toward green infrastructure goals.

TABLES 3: CERTIFIED SCPS/HCPS AFFECTED BY STORMWATER RULE BY BOROUGH, 2018

Borough	# of HCPs/SCPs
Manhattan	98
Bronx	71
Brooklyn	160
Queens	92
Staten Island	4
Total	425
Contributing Drainage Area (acres)	193.08

TABLES 4: SCP/HCP SEWER CONNECTIONS PLANNED AND CONSTRUCTED BY STRUCTURE TYPE

Structure Type*	Connections Planned			Connections Constructed**		
	Primary Structure	Other Structures	Total Planned	Primary Structure	Other Structures	Total Constructed
Rain Garden	0	0	0	0	0	0
Blue Roof	136	54	190	63	17	80
Green Roof	1	1	2	0	0	0
Drywell	14	23	37	5	14	19
Perforated Pipe	4	1	5	1	0	1
Tank	206	16	222	92	7	99
Storm Chamber	3	0	3	1	0	1
Total	364	95	459	162	38	200

* Sites may have proposed more than one structure type.

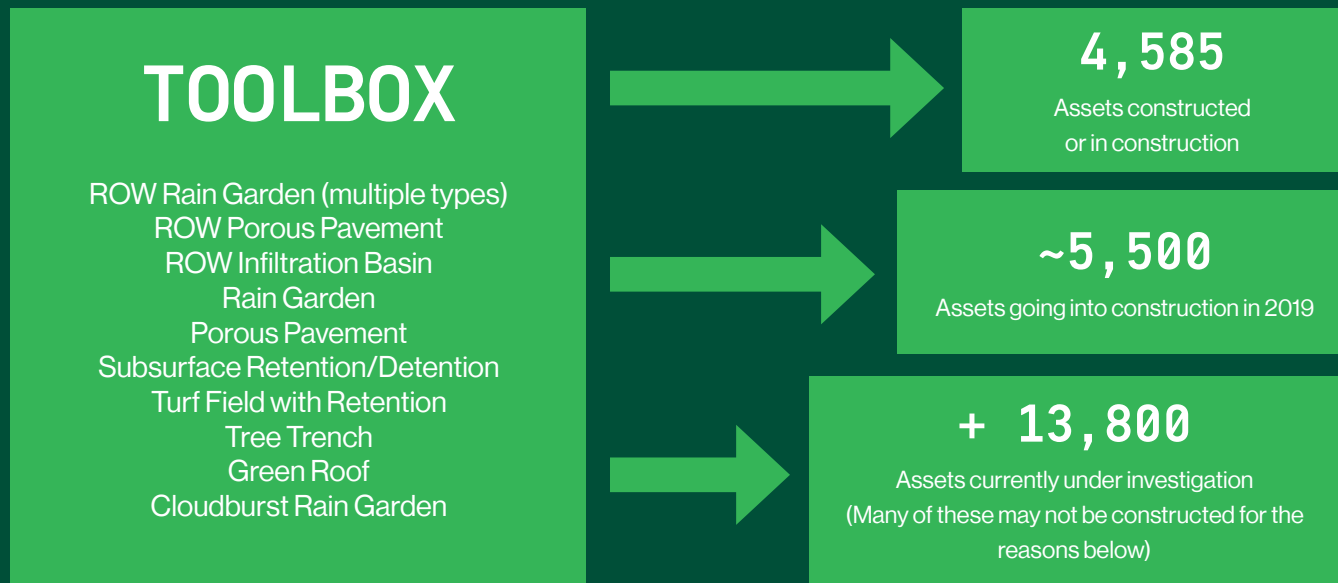
** Constructed connections are those where DEP has permitted and inspected the installation of the certified sewer connection, and whatever structure was required pursuant to the approved SCP/HCP is assumed to have been installed/constructed.

¹ DEP's Stormwater Rule tracking does not include SCP/HCPs certified by the Department of Buildings (DOB); hence, the Stormwater Rule may affect additional sites. More information on the Rule is located [here](#).

GreenHUB Snapshot

All “potential” asset locations are added to the GreenHUB database as soon as they are identified. DEP engineers use a toolbox of standard practices to determine which type of green infrastructure practice is feasible and best suited for each specific location, whether in the right-of-way or on public or private property. In many cases, DEP finds that the location does not meet minimum siting criteria, has poor soils or underground conflicts, or other limiting physical factors that are not suitable for implementation. For asset locations where it is feasible to site a green infrastructure practice, the asset continues through the design phase and GreenHUB is updated monthly to reflect this process for all locations and assets.

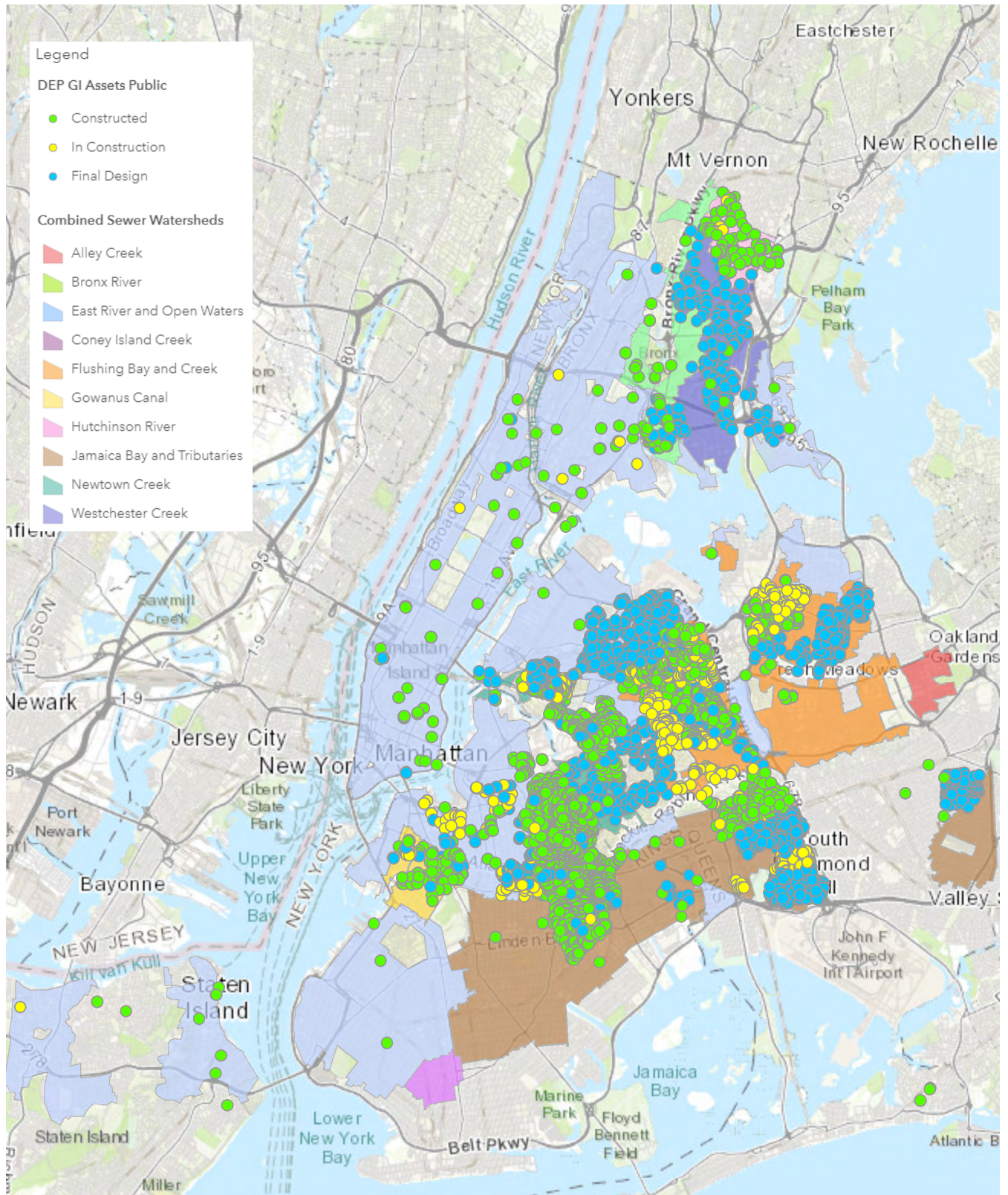
At any given time, GreenHUB contains assets in various phases of design through post-construction and also tracks locations that were removed from consideration or were rejected. The diagram below is a GreenHUB snapshot from April 9, 2019, showing the statuses of active green infrastructure assets in the database at that time: 4,585 assets in construction or constructed, approximately 5,500 going into construction in 2019, and over 13,800 assets undergoing investigation. The assets that are no longer active were rejected due to the common reasons listed below. Over the years, DEP has expanded the green infrastructure toolbox to overcome many of these challenges.



Most Common Reasons Assets are Removed from Consideration or Rejected

Siting Criteria/Site Visits	Site Investigation/Design Phase	Construction Phase
Mature Trees	High Fines Percentage	Nearby Roadwork
Narrow Sidewalks	High Bedrock or Groundwater	Scaffolding and Building Construction Conflicts
Building Entrances and Driveways	Low Permeability	Underground Utility Conflicts
Bus Stops	Hazardous Sites	
Subway / Transit Setbacks	Underground Vaults	
Small Drainage Area		

GREEN INFRASTRUCTURE PROGRAM MAP



View the complete map at nyc.gov/dep/gimap

Watersheds by the Numbers

PROGRESS TOWARD 1.67 BILLION GALLONS PER YEAR OF CSO REDUCTION

DEP's Performance Metrics Report (PMR) submitted to the Department of Environmental Conservation (DEC) on June 30, 2016 and approved on July 5, 2017, showed that DEP can achieve 507 million gallons a year (MGY) of CSO reductions with the 2015 target, primarily from retention green infrastructure assets. DEP is ultimately working toward a reduction of 1.67 billion gallons a year (BGY) by 2030 through green infrastructure implementation. While some of the projects included in the 507 MGY reduction are still underway and are part of the 2015 Contingency Plan (see Exhibit C), DEP expects to complete those projects by December 2020. Half of the projects are in the ground and already providing CSO reduction benefits, while the remaining will start managing stormwater in 2019 and 2020. DEP and its partners have made significant progress and currently have 27 construction bids prepared to build ROW and public property retrofits to achieve the 507 MGY reduction.

For the 2020 milestone, DEP continues to make significant progress to design and build green infrastructure; a contingency plan is expected to be submitted by June 30, 2021 as per the CSO Consent Order.¹

TABLE 5: STORMWATER MANAGED AND EQUIVALENT GREENED ACRES, 2010-2018

Watershed	Total Assets	Total Equivalent Greened Acres
Alley Creek	0	0
Bronx River	52	17
Coney Island Creek	2	1
Flushing Bay	771	79
Flushing Creek	339	38
Gowanus Canal	116	13
Hutchinson River	213	42
Jamaica Bay	1,322	135
Newtown Creek	1,327	122
Westchester Creek	8	2
Total Watershed	4,150	447
East River/Open Waters	435	144
Total Citywide*	4,585	591

* Sum may not add up to total due to rounding.

Note: The Annual Report and its contents, including this table, provide yearly updates for public consumption and transparency for our stakeholder community. It should not be interpreted as a milestone compliance document. The Program's compliance with the Consent Order is based on milestone certifications submitted to DEC at five year intervals. For the milestone submittal schedule, see the Order [here](#). In addition, assets and Greened Acres may increase or decrease in any given year due to rejections during construction, termination of construction contracts or other unforeseen circumstances.

¹ (DEC # CO2-2000107-8, as modified).



THE GREEN INFRASTRUCTURE PLAYGROUND AT P.S. 15, MANHATTAN

Green Infrastructure Watershed Maps

DEP is again presenting the green infrastructure implementation and planning updates at a watershed level in order to show stakeholders the magnitude and scale of the work completed and planned in each of the City's watersheds to reduce CSOs and provide the co-benefits resulting from green infrastructure projects.

HOW DOES DEP IDENTIFY POTENTIAL PROJECTS WITHIN A WATERSHED?

The watershed maps illustrate DEP's area-wide approach to evaluating green infrastructure opportunities block-by-block and site-by-site in each watershed, starting with the Priority CSO watersheds. Once this area-wide survey is completed, DEP implements green infrastructure at each feasible location through ROW and public property retrofits, private property initiatives or other strategic partnerships. These maps also include green infrastructure and ecosystem restoration projects that DEP is undertaking in non-combined sewer areas as part of other City initiatives.

The 2018 accomplishments provide a quick visual representation of all the work in each watershed that "rolls up" to the Program-wide information presented in Table 5. Each page also includes a list of all upcoming projects that DEP is working hard to bring to reality. The result is a comprehensive, watershed-by-watershed snapshot of DEP's current and projected Program.

As previously described, all of the green infrastructure assets that are constructed and in construction are tracked and counted. Each asset contributes to the overarching goals of the Program to reduce CSO volume and provide co-benefits for New Yorkers. DEP expects to achieve 1.67 billion gallons of CSO volume reduction per year by 2030.

THE MAPS SHOW PROJECTS IN SEPARATELY SEWERED AREAS OF THE CITY. ARE THESE PROJECTS COUNTED IN TABLE 5 AND IN THE WATERSHED ACHIEVEMENTS?

The green infrastructure projects that DEP is installing in the separately sewered areas of the City are shown in the maps in order to provide a full picture of green infrastructure implementation in each of the watersheds. They are not counted toward CSO volume reduction and not included in Table 5 or the watershed achievement numbers.

NOW THAT DEP IS TRACKING THE SITE CONNECTION PERMITS IN GREENHUB, ARE THOSE PROJECTS SHOWN IN THE MAP?

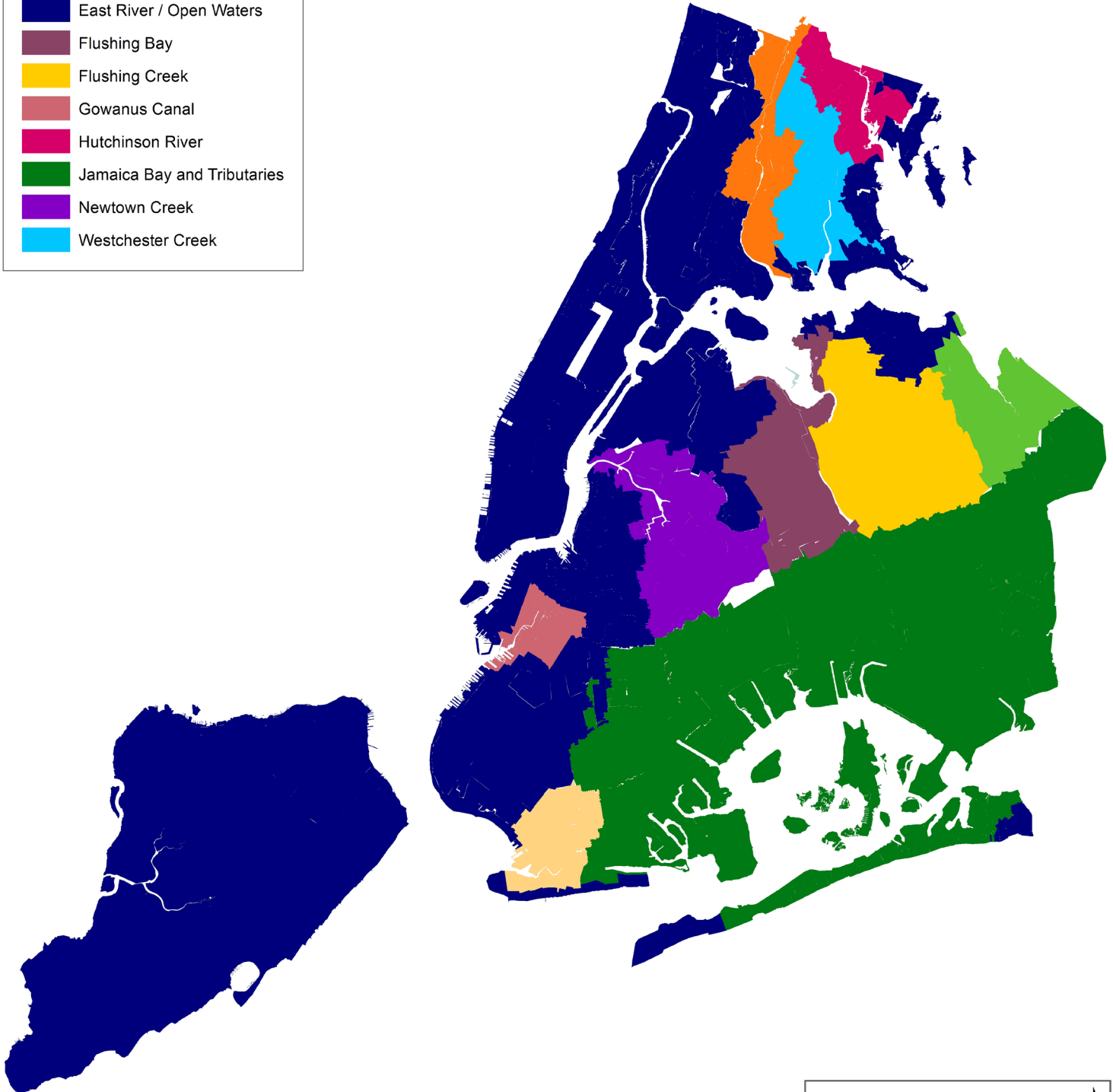
Green infrastructure on private property that was not installed through the Green Infrastructure Grant Program, including SCPs, are not mapped to protect privacy. However, the assets are counted in Table 5 and in the watershed achievements, as they are a part of DEP's efforts to achieve 1.67 billion gallons of CSO volume reduction per year by 2030.



WATERSHED MAP KEY

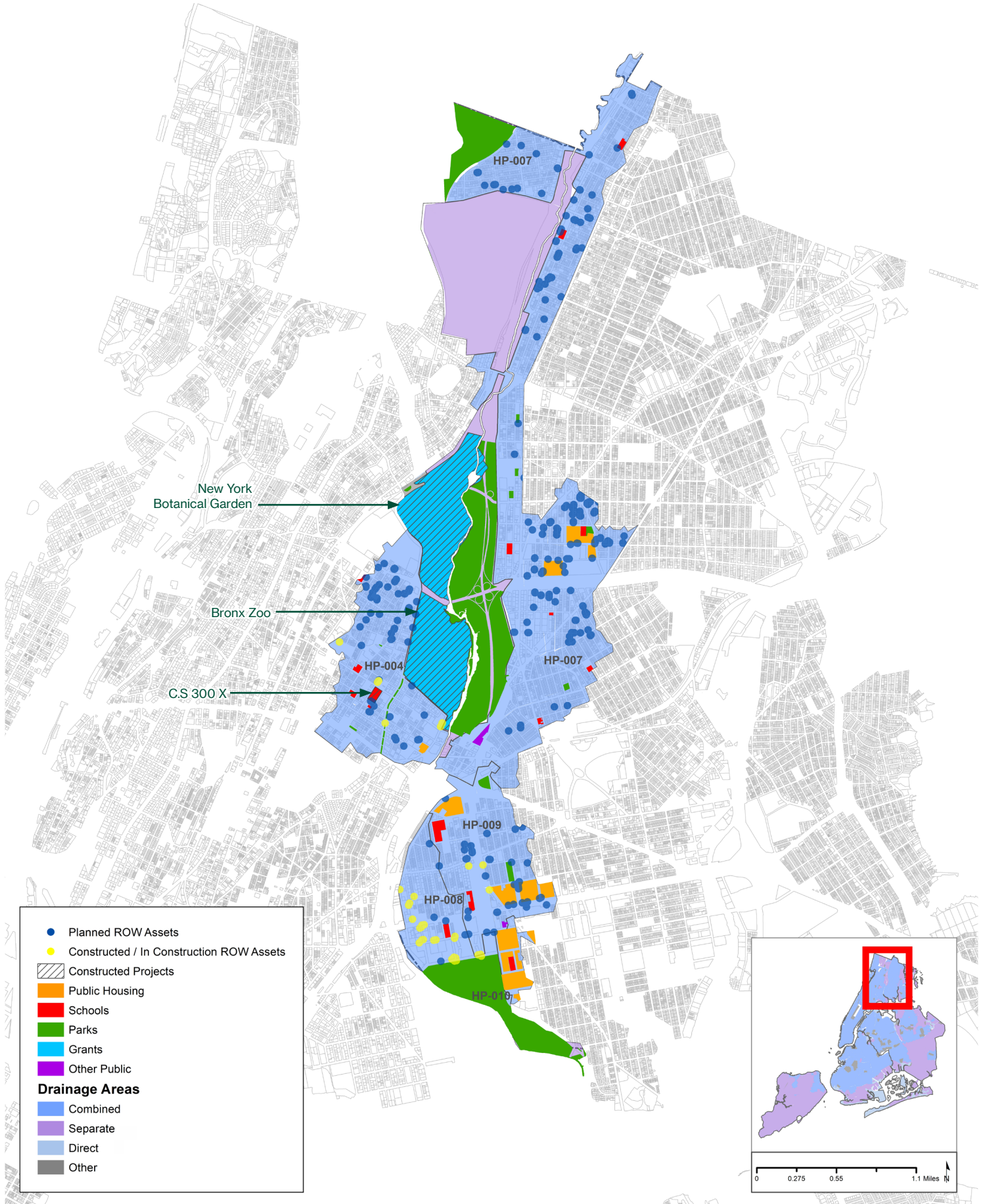
Watersheds

- Alley Creek
- Bronx River
- Coney Island Creek
- East River / Open Waters
- Flushing Bay
- Flushing Creek
- Gowanus Canal
- Hutchinson River
- Jamaica Bay and Tributaries
- Newtown Creek
- Westchester Creek



BRONX RIVER WATERSHED

CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



BRONX RIVER WATERSHED

2010-2018 ACCOMPLISHMENTS

52 Assets Constructed and In Construction

21.1M Annual Gallons of Stormwater Managed*

17 Equivalent Greened Acres

* Annual gallons of stormwater managed = asset capacity (cf/1 in rainfall)*46.25 (in/yr) (typical annual rainfall)*7.48 (gal/cf)

UPCOMING PUBLIC & GRANT PROJECTS**

- 1010 E. 178th St.
- 43rd Precinct
- Bronx Command Office
- Bronx Park
- Bronx River Addition
- Clason Point Gardens
- Crotona Parkway Malls at E. 175th
- Fairmount Playground
- I.S. 123 X
- I.S. 45 Annex
- James Monroe Educational Campus
- Magenta Playground
- Mary Mitchell
- Matthews Muliner Playground
- Mazzei Playground
- Noble Playground
- P.S. 103 X
- P.S. 107 X
- P.S. 50 X
- P.S. 57 X
- P.S. 64 X
- P.S. 83 X
- P.S. 89 X
- P.S. 92 X
- P.S. 93 X
- P.S. 96 X
- Parkside Playground
- Pelham Parkway Houses
- Sack Wern Houses
- Sotomayor Houses
- Soundview Houses
- Soundview Park
- The Dominic Castore Educational Campus
- Watson-Gleason Playground
- Whalen Grove Houses
- Zimmerman Playground

** Not counted toward stormwater managed or greened acres above. Subject to change based on feasibility and/or other project constraints.

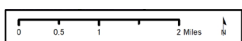
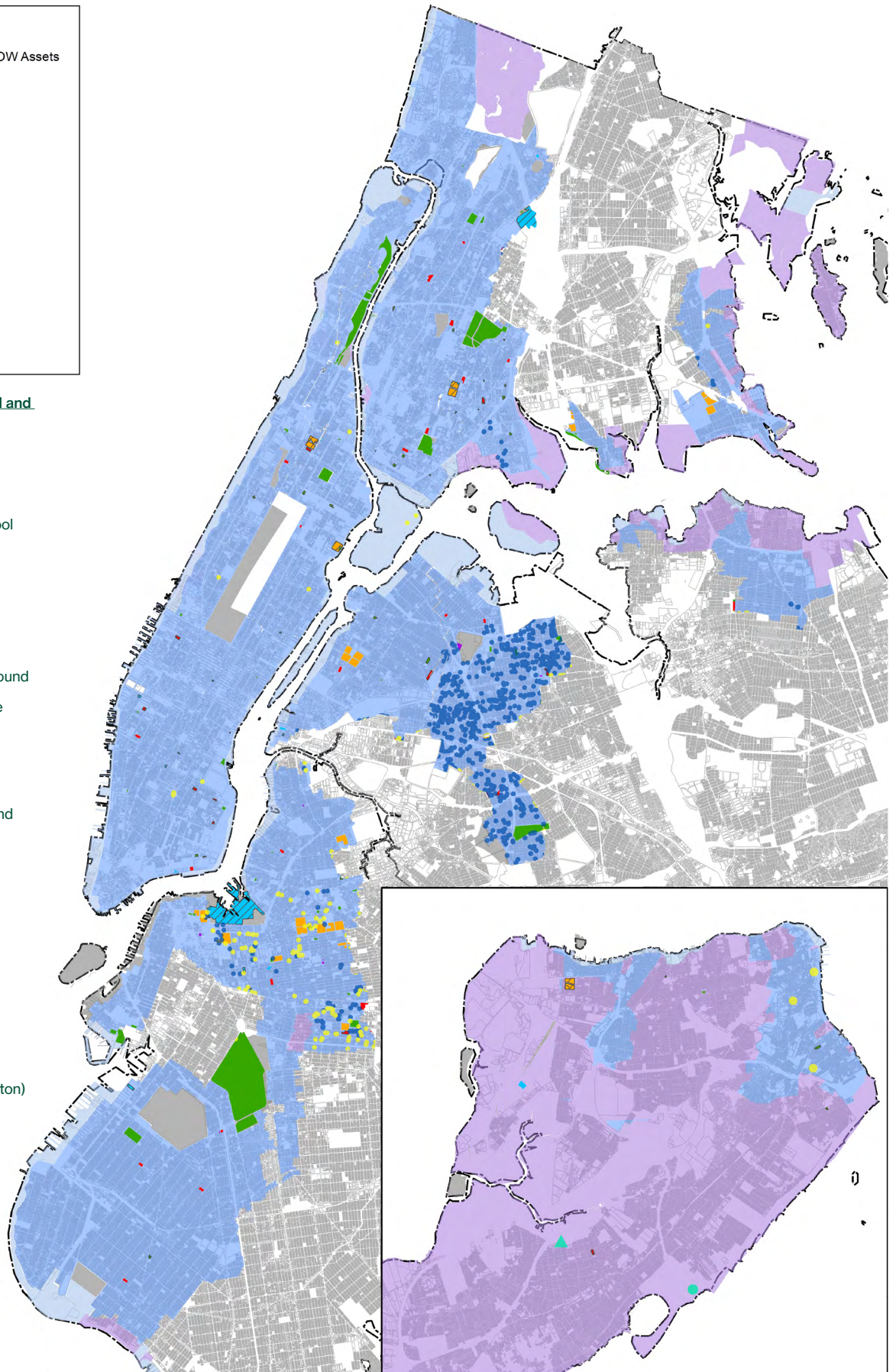
EAST RIVER / OPEN WATERS

CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



Public & Grant Projects Constructed and In Construction:

- Arrochar Playground
- Astoria Heights Playground
- ATCO
- Ballet Tech
- Banana Kelly
- Bishop Loughlin Memorial School
- Bloomingdale Playground
- Brooklyn Navy Yard
- Carmansville Playground
- DeMatti Playground
- Forest House
- Grandview Playground
- Henry M. Jackson Playground
- Hunts Point Playground
- I.S. 227 Q
- James Weldon Johnson Playground
- Javits Center Green Roof
- Lenox Hill Neighborhood House
- Levy Playground
- Little Claremont Park
- Longfellow Garden
- Lt. Joseph Petrosino Park
- Lyons Square Playground
- M.S. 354 K
- Martin Luther King Jr. Playground
- McDonald Playground
- NYRP - Paradise on Earth
- NYU Langone Medical Center - Alumni Hall
- Osborne Association
- P.S. 111 M
- P.S. 15 M
- P.S. 154 M
- P.S. 19 M Asher Levy School
- P.S. 32 R
- P.S. 33 M
- P.S. 361 M
- Playground 103 CIII
- Playground 52
- Plimpton Playground
- Pratt Institute
- Ranaqua Park
- Related Companies (The Abington)
- Salmar
- Saw Mill Playground
- Seabury Park
- SoBRO: Jasmine Court
- SoBRO: Venture Center
- Sol Lain Playground
- St. Luke and St. Matthew
- St. Nicholas Playground North
- Stockton Playground / P.S. 297
- The New School
- UA Local 1 - Plumbers
- Van Alst Playground
- William C. Bryant H.S.



EAST RIVER / OPEN WATERS

2010-2018 ACCOMPLISHMENTS

435 Assets Constructed and In Construction

180.6M Annual Gallons of Stormwater Managed*

144 Equivalent Greened Acres

* Annual gallons of stormwater managed = asset capacity (cf/1 in rainfall)*46.25 (in/yr) (typical annual rainfall)*7.48 (gal/cf)

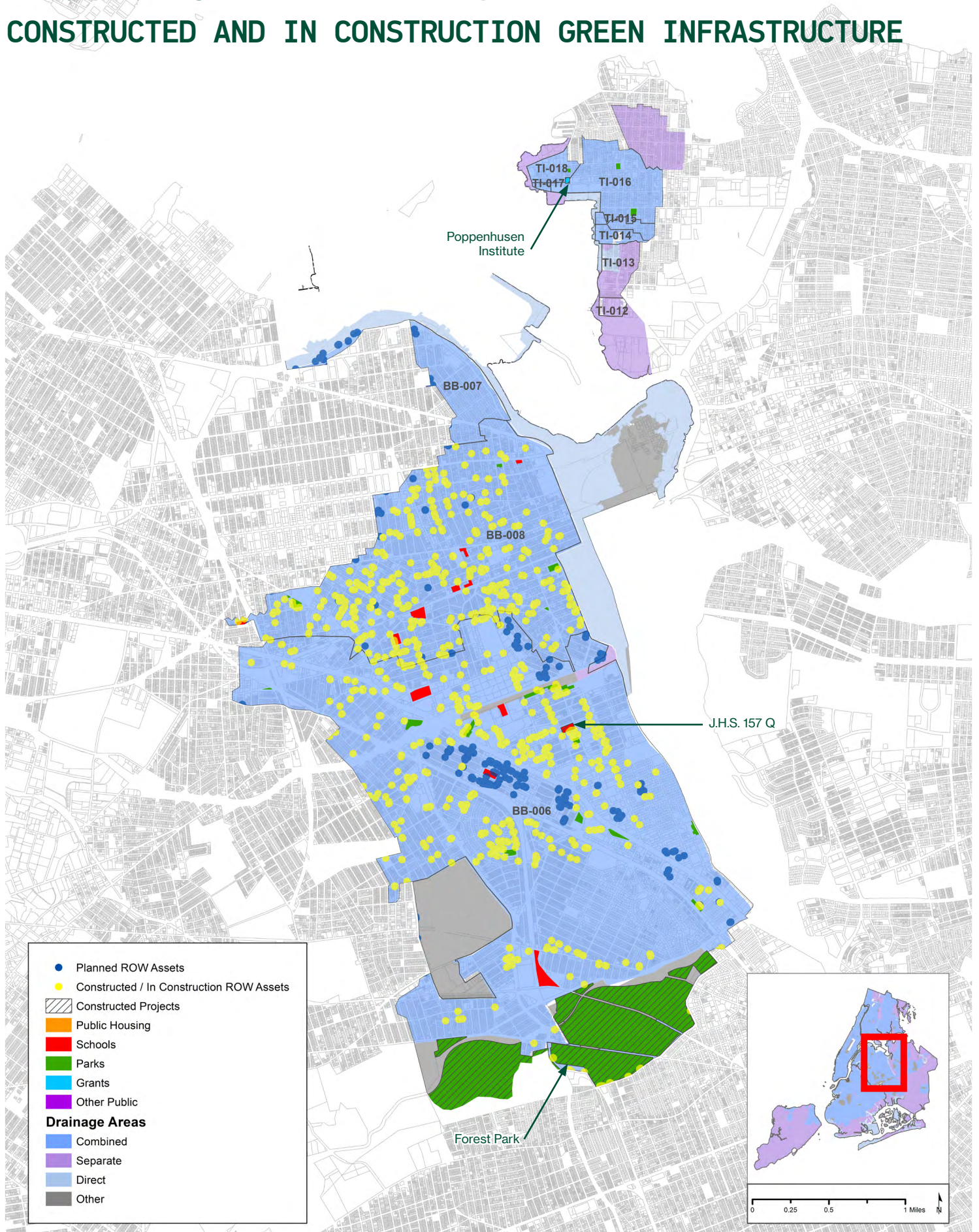
UPCOMING PUBLIC & GRANT PROJECTS**

- 115th Precinct Off Street Parking
- Admiral's Row
- Albany Houses
- Arrow Community Center
- Asser Levy Recreation Center and Pool
- Aurum Condominium
- Barretto Park
- Bartlett Playground
- Bedford Stuyvesant Restoration
- Boys and Girls High School
- Bridge Park 3 - East and West
- Bulova Park
- Bushwick Pool Building
- Chelsea Recreation Center
- Citylights
- Classon Playground (PS 270K)
- Cooper Park Houses
- Corporate Commons Three
- Crotona Park Boathouse
- Dry Dock Pool Building
- East Elmhurst Playground (PS 127Q)
- Engine 207
- Epiphany Playground
- Farragut Houses
- Gertrude Ederle Recreation Center
- Gilbert Ramirez Park
- Gorman Playground
- Greenpoint Playground
- Greenpoint Public Library
- Hansborough Recreation Center
- Highbridge Recreation Center
- I.S. 220 K
- I.S. 339 / 313 X (147)
- I.S. 73 Q
- Juniper Valley Park
- Juniper Valley Park Field House
- Kingsbridge Heights Community Center
- Lafayette Houses
- M.S. 223 K
- M.S. 224 X (X139)
- M.S. 267 X (X158)
- M.S. 306 X
- M.S. 399 X (X115)
- M.S. 584 X (X162)
- Marcy Houses
- Metropolitan Pool and Fitness Center
- Montefiore (Moses) Hospital
- NYC Lab School
- P.S. / I.S. 35 K and Decatur Playground
- P.S. 111 Q
- P.S. 130 K
- P.S. 17 K
- P.S. 171 M
- P.S. 180 M
- P.S. 184 / 137 M
- P.S. 2 Q
- P.S. 204 K
- P.S. 56 K
- P.S. 58 Q
- P.S. 84 Q
- Parade Grounds Recreation Center
- Pelham Fritz Recreation Center
- Playground 115
- Poe Park Visitors Center
- Ravenswood Houses
- Recreation Center 54
- Sheltering Arms Poolhouse
- St. James Recreation Center
- St. John's Recreation Center
- St. Mary's Recreation Center
- Sugar Hill Co-op
- Sumner Houses
- Sunset Park Recreation Center
- TLC Woodside Facility Renovation
- Tompkins Houses
- Tony Dapolito Recreation Center
- Two Bridges Neighborhood Council
- Whitman Houses
- Willoughby Playground (PS 23K)
- Windsor Terrance Public Library

** Not counted toward stormwater managed or greened acres above. Subject to change based on feasibility and/or other project constraints.

FLUSHING BAY WATERSHED

CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



FLUSHING BAY WATERSHED

2010-2018 ACCOMPLISHMENTS

771 Assets Constructed and In Construction

98.6M Annual Gallons of Stormwater Managed*

79 Equivalent Greened Acres

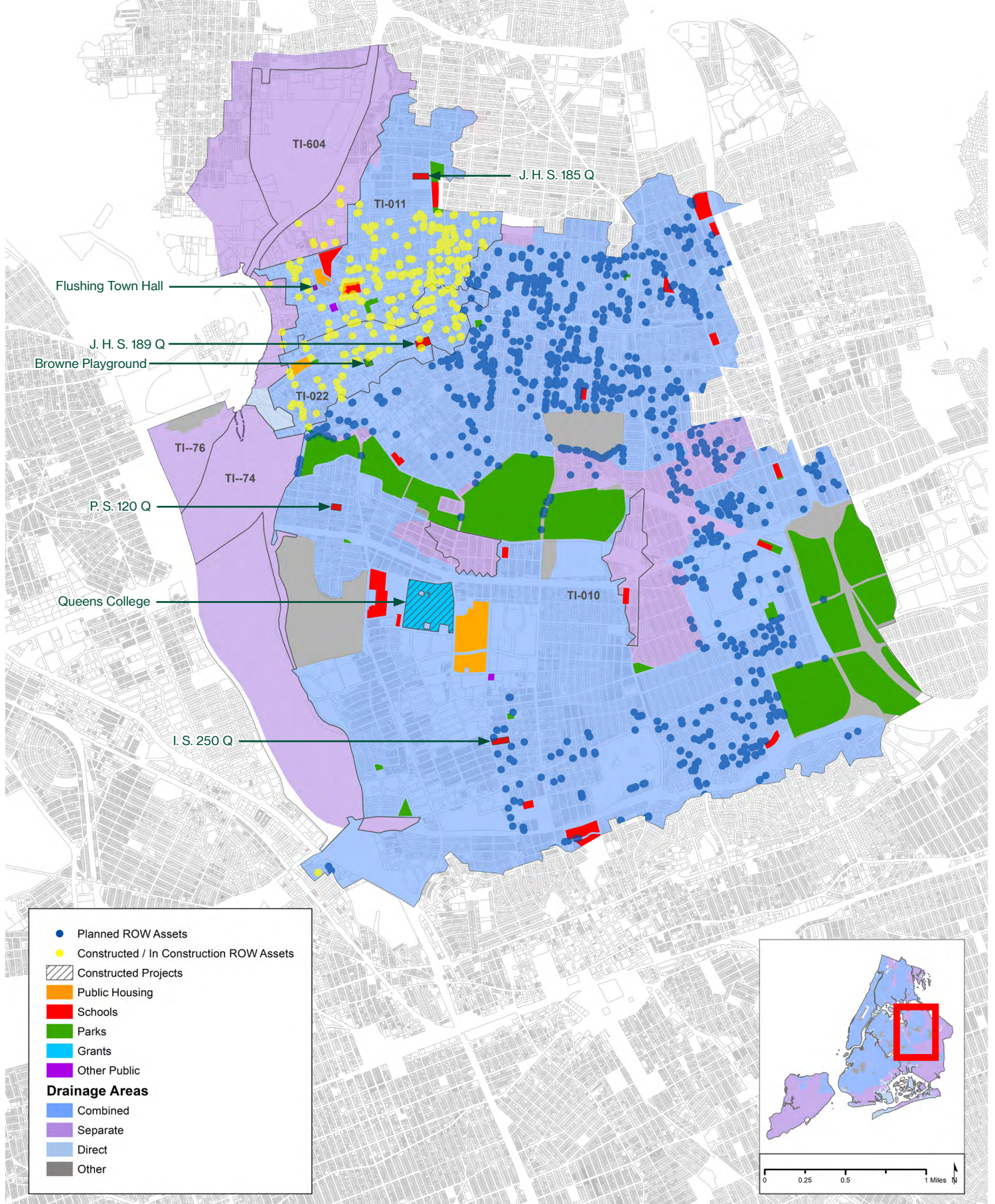
* Annual gallons of stormwater managed = asset capacity (cf/1 in rainfall)*46.25 (in/yr) (typical annual rainfall)*7.48 (gal/cf)

UPCOMING PUBLIC & GRANT PROJECTS**

- Annadale Playground/PS 175
- Barrier Playground
- Corona Golf Playground
- Ehrenreich-Austin Playground
- Frank D. O'Connor Playground
- Hoffman Park
- Long Island Mews
- Lost Battalion Hall Recreation Center
- Louis Armstrong Community Center
- M.S. 293 Q
- MacDonald Park
- Metropolitan Avenue Campus
- Newtown High School
- Newtown High School Athletic Field
- P.S. 12 Q
- P.S. 139 Q
- P.S. 206 Q
- P.S. 307 Q
- P.S. 315 Q
- P.S. 330 Q
- P.S./I.S. 311 Q
- Playground Sixty Two LXII
- Poppenhusen Playground
- Real Good Park
- Russell Sage Playground/JHS 190Q
- The Painter's Playground/PS 174
- William F Moore Park
- Willow Lake Playground

FLUSHING CREEK WATERSHED

CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



FLUSHING CREEK WATERSHED

2010-2018 ACCOMPLISHMENTS

339

Assets Constructed and In Construction

47.3M

Annual Gallons of Stormwater Managed*

38

Equivalent Greened Acres

* Annual gallons of stormwater managed = asset capacity (cf/1 in rainfall)*46.25 (in/yr) (typical annual rainfall)*7.48 (gal/cf)

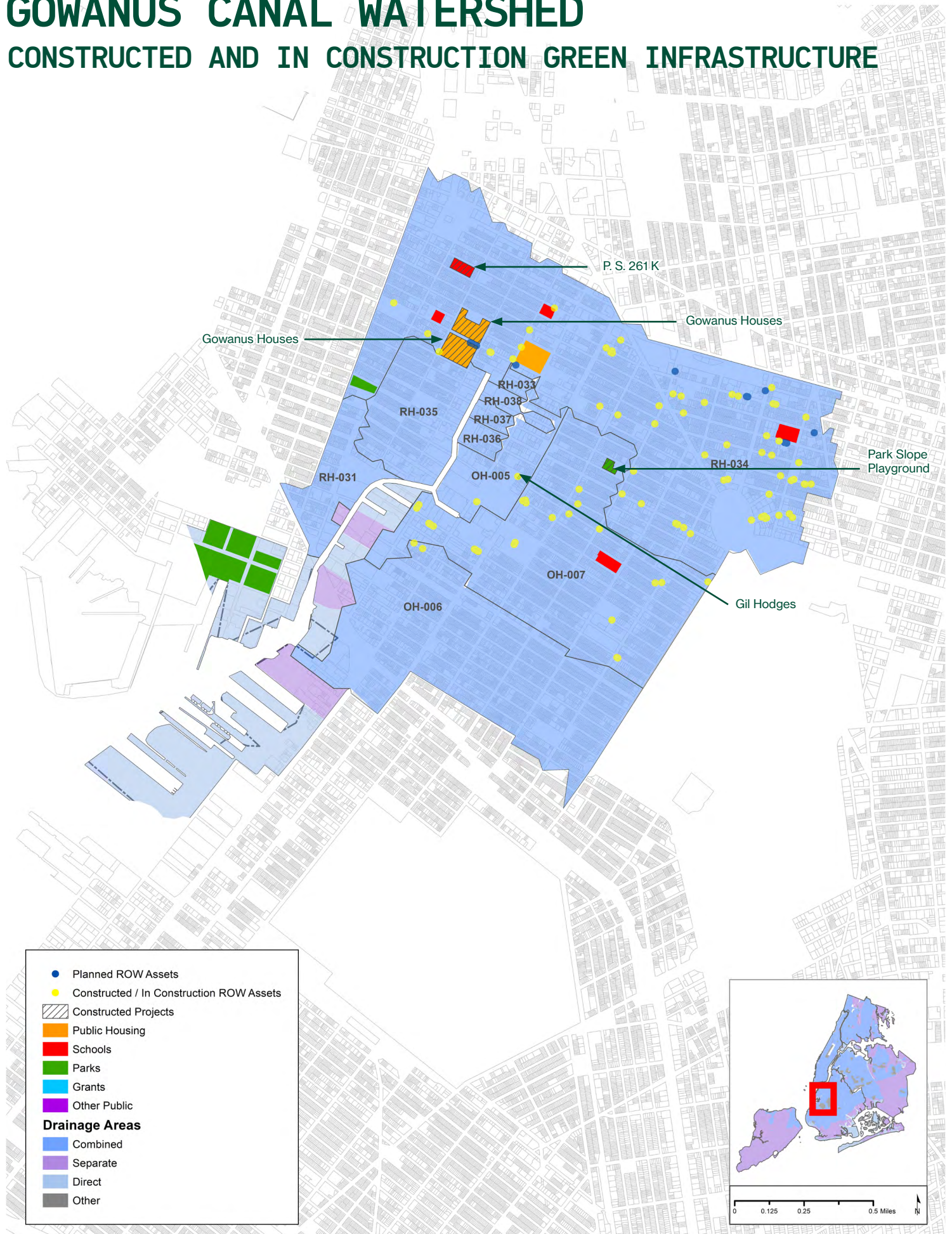
UPCOMING PUBLIC & GRANT PROJECTS**

- 107th Precinct
- Auburndale Playground
- Bayside Fields
- Bayside High School Athletic Field
- Bland Houses
- Bland Playground
- Cedar Grove Playground
- College Point Park
- Cunningham Park
- Farm Playground (JOP)
- Flushing Fields
- Flushing High School
- Flushing High School Athletic Field (Levitts Field)
- Flushing Memorial Athletic Field
- Holy Cow Playground
- I.S. 237 Q
- J.H.S. 216 Q
- J.H.S. 25 Q
- John Bowne High School
- Judge Moses Weinstein Playground
- Kissena Corridor Park (JOP)
- Kissena Park
- Latimer Gardens Houses
- Margaret I. Carman Green - Weeping Beech
- Murray Hill Playground (JOP)
- P.S. 107 Q
- P.S. 130 Q
- P.S. 159 Q
- P.S. 162 Q
- P.S. 163 Q
- P.S. 178 Q
- P.S. 179 Q
- Playground Seventy Five
- Pomonok Houses
- Queens Academy High School
- Queens College Dining Hall
- Queens Gateway to Health Sciences Secondary School
- Queens North Task Force - Flushing Armory
- Queens Valley Playground
- Thomas A. Edison Vocational High School
- Townsend Harris High School
- Turtle Playground
- Utopia Playground

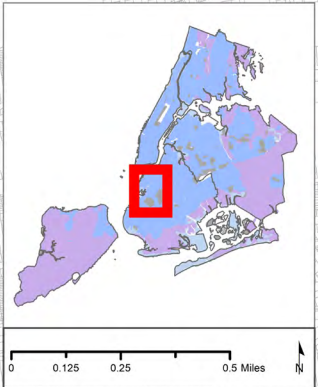
** Not counted toward stormwater managed or greened acres above. Subject to change based on feasibility and/or other project constraints.

GOWANUS CANAL WATERSHED

CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



● Planned ROW Assets
● Constructed / In Construction ROW Assets
 Constructed Projects
 Public Housing
 Schools
 Parks
 Grants
 Other Public
Drainage Areas
 Combined
 Separate
 Direct
 Other



GOWANUS CANAL WATERSHED

2010-2018 ACCOMPLISHMENTS

116 Assets Constructed and In Construction

16.6M Annual Gallons of Stormwater Managed*

13 Equivalent Greened Acres

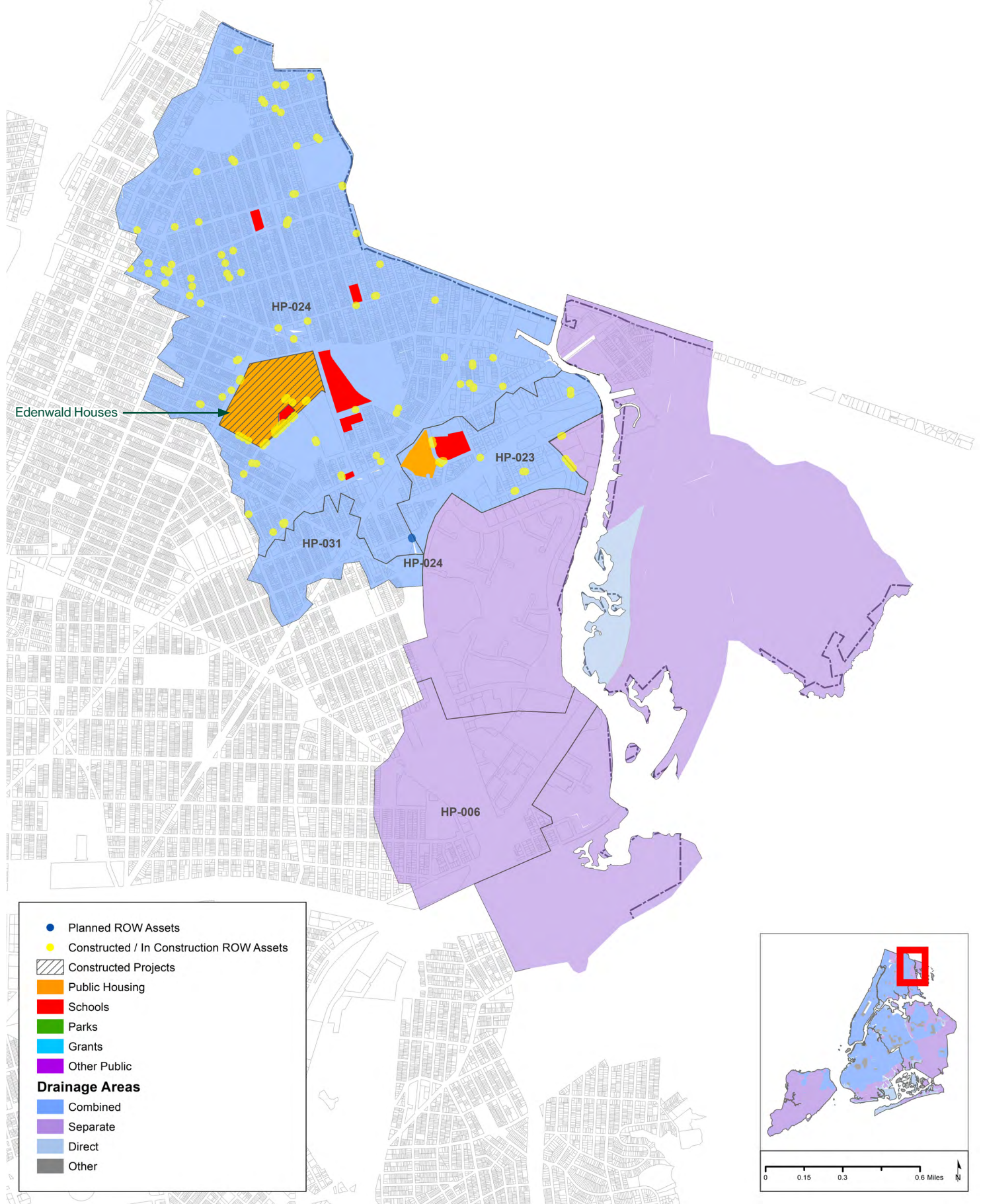
* Annual gallons of stormwater managed = asset capacity (cf/1 in rainfall)*46.25 (in/yr) (typical annual rainfall)*7.48 (gal/cf)

UPCOMING PUBLIC & GRANT PROJECTS**

- Boerum Park
- Carroll Park
- P.S. 321K
- P.S. 373/Cobble Hill School of American Studies
- P.S. 38 K
- P.S. 9 K
- Prospect Park Shops
- Red Hook Recreation Center
- Wyckoff Gardens

HUTCHINSON RIVER WATERSHED

CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



HUTCHINSON RIVER WATERSHED

2010-2018 ACCOMPLISHMENTS

213 Assets Constructed and In Construction

52.5M Annual Gallons of Stormwater Managed*

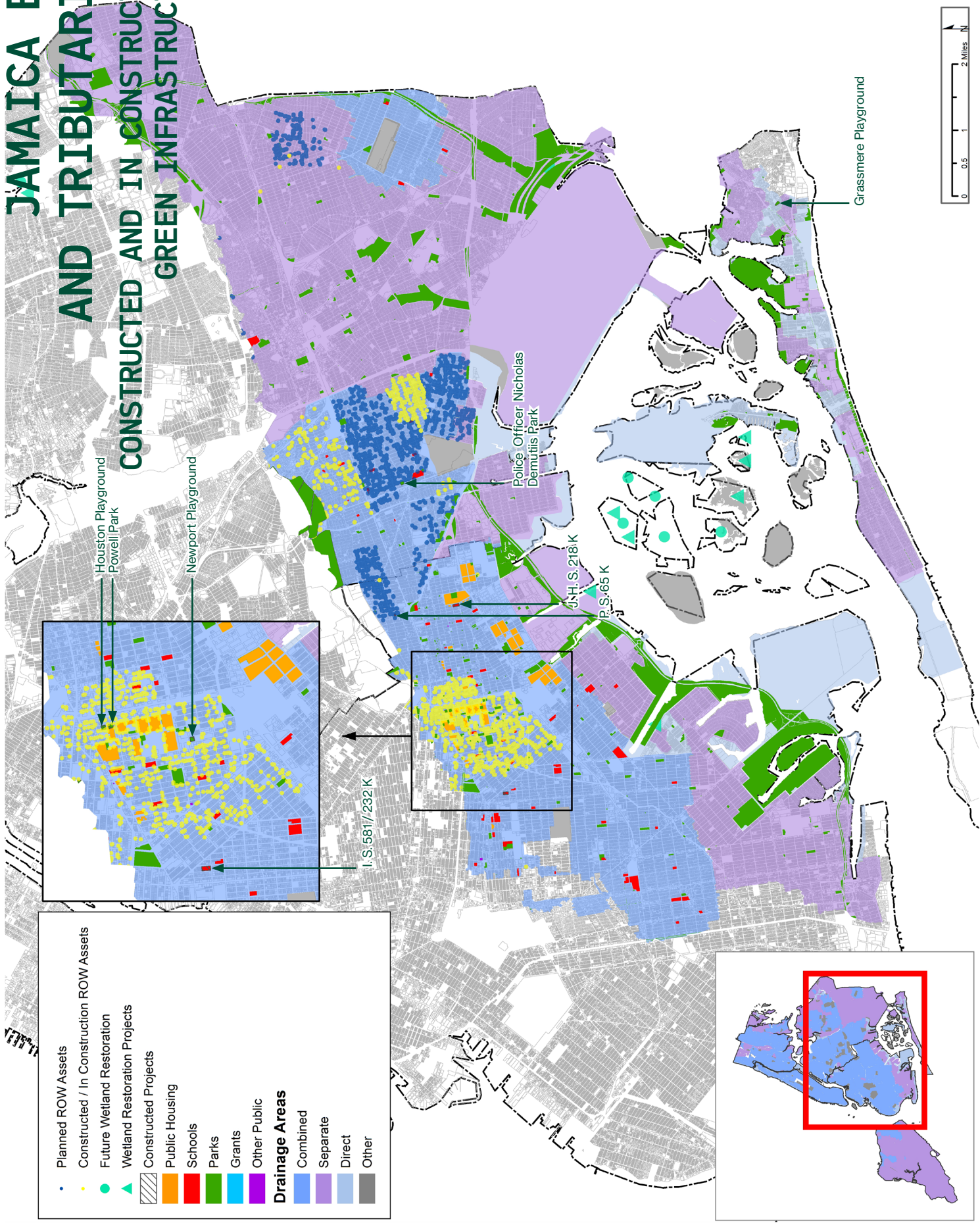
42 Equivalent Greened Acres

* Annual gallons of stormwater managed = asset capacity (cf/1 in rainfall)*46.25 (in/yr) (typical annual rainfall)*7.48 (gal/cf)

UPCOMING PUBLIC & GRANT PROJECTS**

- Boston Secor Houses
- P.S. 111 X
- P.S. 112 X
- P.S. 68 X
- P.S. 87 X
- P.S./I.S. 189 X/P.S. 723 X
- Stars & Stripes Playground
- The Willie Ella Paschal Bowman Campus

JAMAICA BAY AND TRIBUTARIES CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



Planned ROW Assets	•
Constructed / In Construction ROW Assets	•
Future Wetland Restoration	●
Wetland Restoration Projects	▲
Constructed Projects	▨
Public Housing	■
Schools	■
Parks	■
Grants	■
Other Public	■
Drainage Areas	
Combined	■
Separate	■
Direct	■
Other	■

Houston Playground
Powell Park

Newport Playground

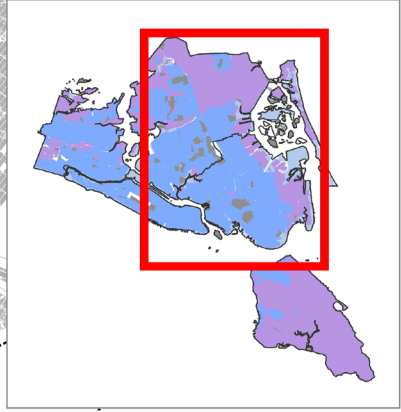
I.S. 581/232 K

Police Officer Nicholas
Demutis Park

J.H.S. 218 K

P.S. 65 K

Grassmere Playground



JAMAICA BAY AND TRIBUTARIES

2010-2018 ACCOMPLISHMENTS

1,322 Assets Constructed and In Construction

169.1M Annual Gallons of Stormwater Managed*

135 Equivalent Greened Acres

* Annual gallons of stormwater managed = asset capacity (cf/1 in rainfall)*46.25 (in/yr) (typical annual rainfall)*7.48 (gal/cf)

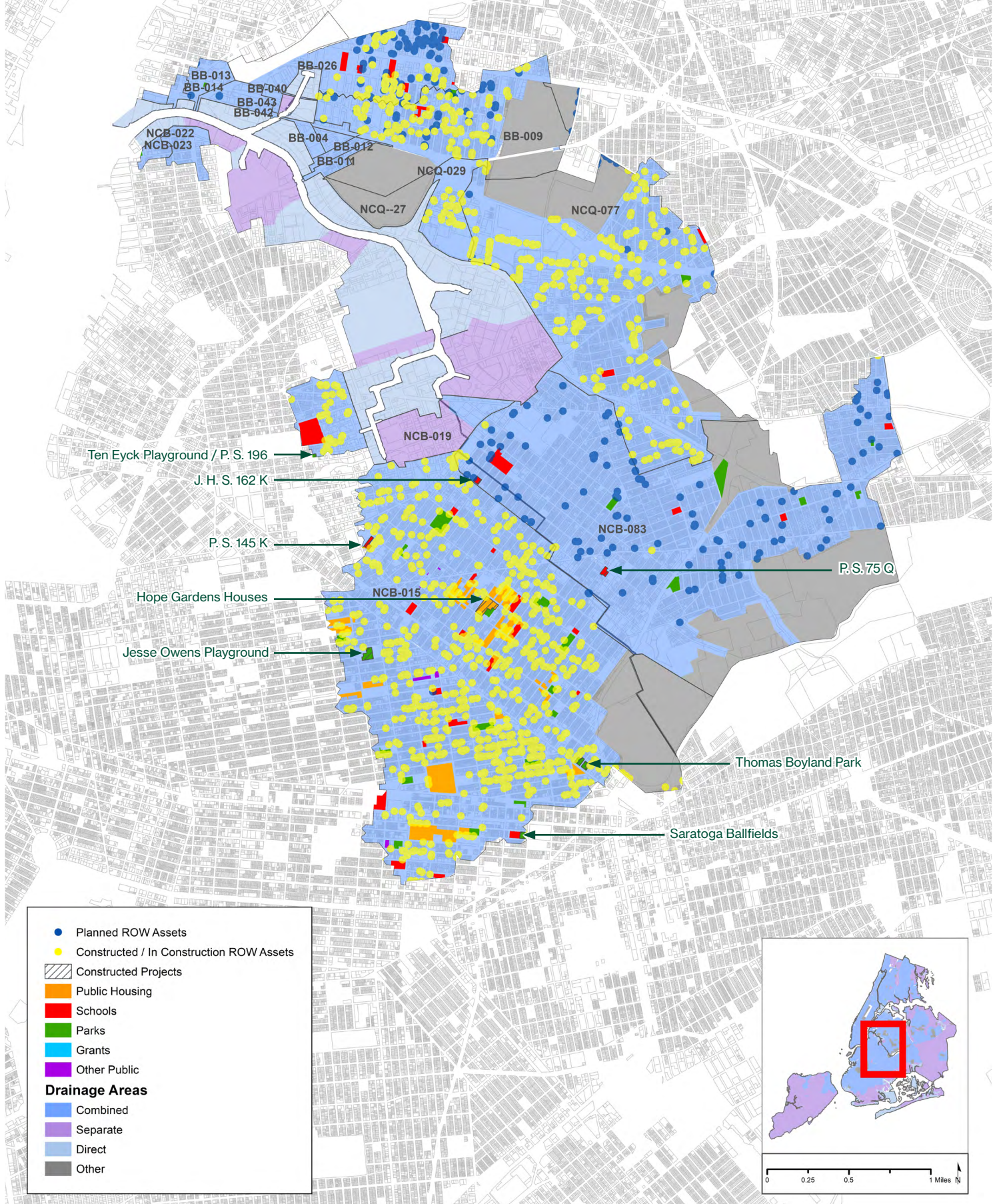
UPCOMING PUBLIC & GRANT PROJECTS**

- 100% Playground
- 71st Precinct
- 73rd Precinct Off Street Parking C
- 73rd Precinct Off Street Parking D
- 75th Precinct Evidence Storage Lot
- 75th Precinct Off Street Parking
- Amersfort Park
- Andries Playground
- Belmont Playground / PS 214
- Belmont Sutter Houses
- Betsy Head Park Building
- Boulevard Houses
- Boys and Girls H.S. Athletic Field (Old)
- Breukelen Ballfields
- Breukelen Houses
- Brooklyn College Academy
- Brownsville Houses
- Brownsville Playground
- Brownsville Recreation Center
- Cambria Playground
- Canarsie High School
- Carter G. Woodson Children's Park (JOP)
- Centreville Playground
- Chester Playground
- City Line Park
- Curtis Playground
- Cypress Hills Houses
- District #18 CEC
- Dr. Richard Green Playground
- East New York City Line Houses
- East New York Vocational High School
- Edward R. Murrow High School
- Engine 283
- Ethan Allen Playground (PS 306K)
- Fiorentino Plaza Houses
- Fox Playground (Brooklyn)
- Garvey (Group A) Houses
- George W. Wingate High School
- George Walker Jr. Park
- Glenmore Plaza
- Grace Playground
- Hamilton Metz Field
- Harry Maze Playground
- High School for Construction Trades, Engineering, and Architecture
- High School Suspension Center
- Highland Park (Brooklyn)
- Highland Park (Queens)
- Howard Avenue Houses
- Howard Houses
- Howard Playground
- Howard Pool
- Howard Pool Building
- Hughes Apartments
- I.S. 2 K
- I.S. 252 K
- I.S. 285 K
- I.S. 292 K
- I.S. 323 K
- I.S. 391 K
- I.S. 59 Q
- Jamaica High School
- Jerome Playground
- John Adams High School
- John Adams Playground (JOP)
- Kennedy King Playground
- Lincoln Terrace / Arthur S. Somers Park
- Linden Houses
- Linden Park (Gershwyn Park - J.H.S. 166)
- London Planetree Playground
- M.S. 156 Q
- Marc And Jason's Playground
- Martin Luther King Jr. Playground
- Maurice A Fitzgerald Playground
- Midwood High School
- Midwood High School Athletic Field - Brooklyn
- Nehemiah Park
- Nostrand Playground
- Officer Reinaldo Salgado Playground
- PS. 100 Q
- PS. 108 Q
- PS. 115 K
- PS. 119 K
- PS. 13 K
- PS. 135 K
- PS. 156 / I.S. 392 K
- PS. 161 K
- PS. 165 K
- PS. 174 K
- PS. 176 Q
- PS. 183 / 446 K
- PS. 193 K
- PS. 198 K
- PS. 199 K
- PS. 202 K
- PS. 203 K
- PS. 22 K
- PS. 221 K
- PS. 262 Q
- PS. 268 K
- PS. 269 K
- PS. 273 Q
- PS. 308 K
- PS. 315 / 152 K
- PS. 328 K
- PS. 345 K
- PS. 399 K
- P.S. 51 Q
- P.S. 56 Q
- P.S. 62 Q
- P.S. 66 K
- P.S. 66 X
- P.S. 72 K
- P.S. 91 K
- P.S. 96 Q
- P.S. 99 K
- Paerdegat Park
- Passages Academy
- Pennsylvania-Wortman Ave Houses
- Phil "Scooter" Rizzuto Park
- Pink Houses
- Pink Playground
- Police Officer Edward Byrne Park
- Railroad Playground
- Reid Apartments
- Remsen Playground
- Richmond Hill High School
- Rocket Park / Goddard PG (J.H.S. 202Q)
- Roy Wilkins Recreation Center
- Samuel J. Tilden Educational Campus
- Sarsfield Playground
- Seth Low Houses
- South Shore Educational Campus
- Sperandeo Brothers Playground (JOP)
- Sutter Ballfields
- The Ozone Park Educational Campus
- Thomas Jefferson High School
- Tilden Houses
- Van Dyke Houses
- Van Dyke Playground
- Vito Locascio Field
- Wingate Park (JOP)
- Woodruff Playground

** Not counted toward stormwater managed or greened acres above. Subject to change based on feasibility and/or other project constraints.

NEWTOWN CREEK WATERSHED

CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



NEWTOWN CREEK WATERSHED

2010-2018 ACCOMPLISHMENTS

1,327 Assets Constructed and In Construction

152.8M Annual Gallons of Stormwater Managed*

122 Equivalent Greened Acres

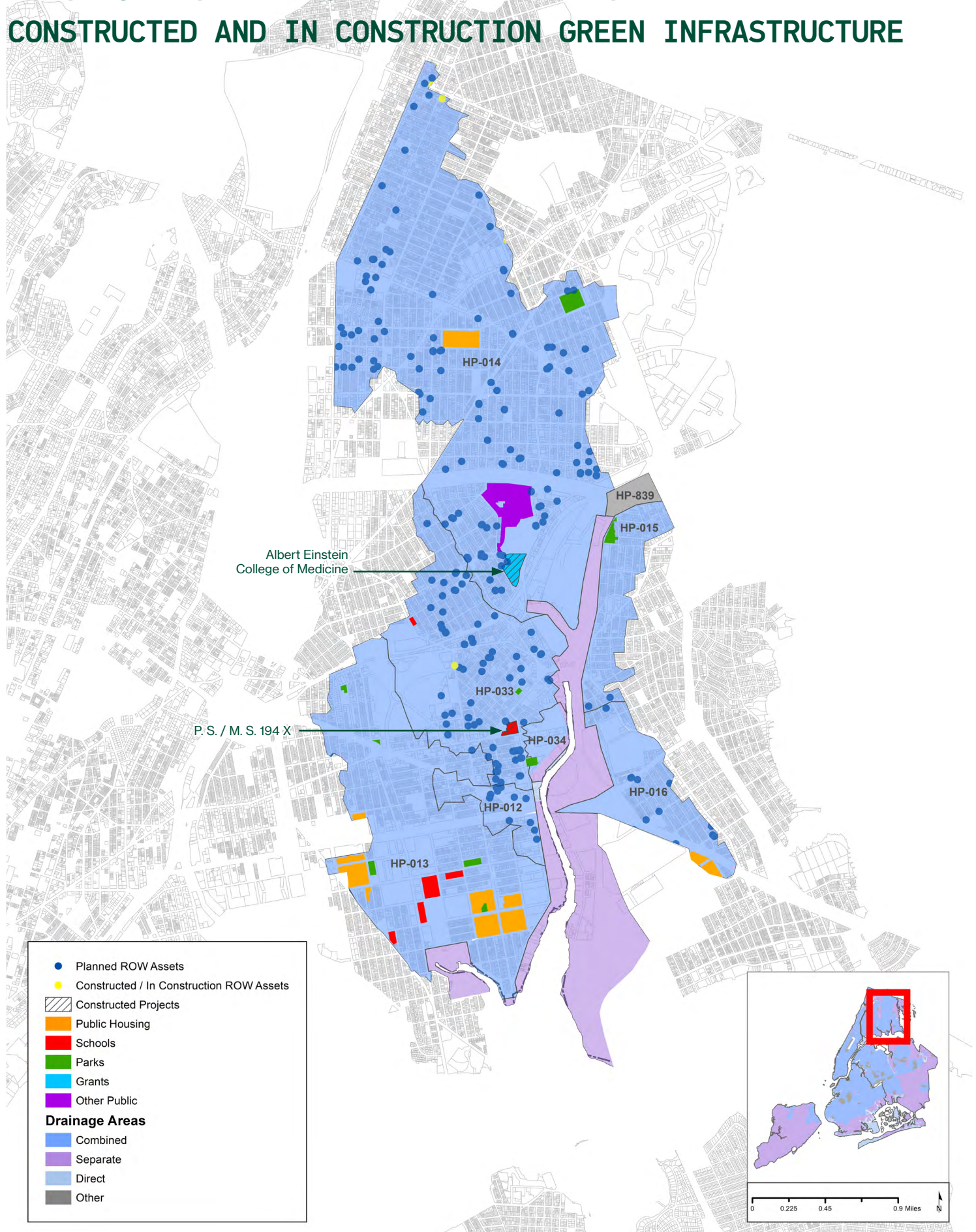
* Annual gallons of stormwater managed = asset capacity (cf/1 in rainfall)*46.25 (in/yr) (typical annual rainfall)*7.48 (gal/cf)

UPCOMING PUBLIC & GRANT PROJECTS**

- "Uncle" Vito E. Maranzano Glendale Playground
- P.S. 41 Q
- 77th Precinct
- 79th Precinct
- 79th Precinct Off Street Parking B&C
- 81st Precinct Off Street Parking
- 83rd Precinct Off Street Parking C
- 83rd Precinct Off Street Parking D
- 83rd Precinct Off Street Parking E
- Aviation High School
- Brevoort Houses
- Bridge and Tunnel Park
- Bushwick Houses
- Bushwick Playground
- Charter School of Excellence
- Cleveland High School Athletic Field No. 2
- El Shabazz Playground
- Eleanor Roosevelt Playground
- Engine 222
- Evergreen Park
- Evergreen Playground
- Fermi Playground
- Fish Playground (JOP)
- Frontera Park
- Grand Street Campus
- Heckscher Playground
- I.S. 119/Pinocchio Playground
- I.S. 291 K
- I.S. 394 K
- Irving Square Park
- Jackie Robinson Playground
- Kingsborough Houses
- La Guardia Community College
- Lt Corporal Thomas P. Noonan Jr. Playground
- Mafera Park
- Maria Hernandez Park
- Marion Hopkinson Playground
- Middle College Campus
- Middle Village Playground
- Ocean Hill Apartments
- P.S. 123 K
- P.S. 150 Q
- P.S. 151 K
- P.S. 153 Q
- P.S. 178 K
- P.S. 191 K
- P.S. 199 Q
- P.S. 28 K
- P.S. 299 K
- P.S. 309 K
- P.S. 376A K
- P.S. 377 K
- P.S. 45 AX
- P.S. 5 K
- P.S. 75 K
- P.S. 86 K
- P.S. 87 Q
- P.S. 88 Q
- P.S. 91 Q
- Queens Vocational and Technical High School
- Roosevelt Houses
- Rosemarys Playground
- Saratoga Houses
- Saratoga Park
- Second Opportunity School
- South Pacific Playground
- Stuyvesant Gardens
- The Walter McCaffrey Campus
- Tiger Playground
- Woods Playground

WESTCHESTER CREEK WATERSHED

CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



WESTCHESTER CREEK WATERSHED

2010-2018 ACCOMPLISHMENTS

8

Assets Constructed and In Construction

2.3M

Annual Gallons of Stormwater Managed*

2

Equivalent Greened Acres

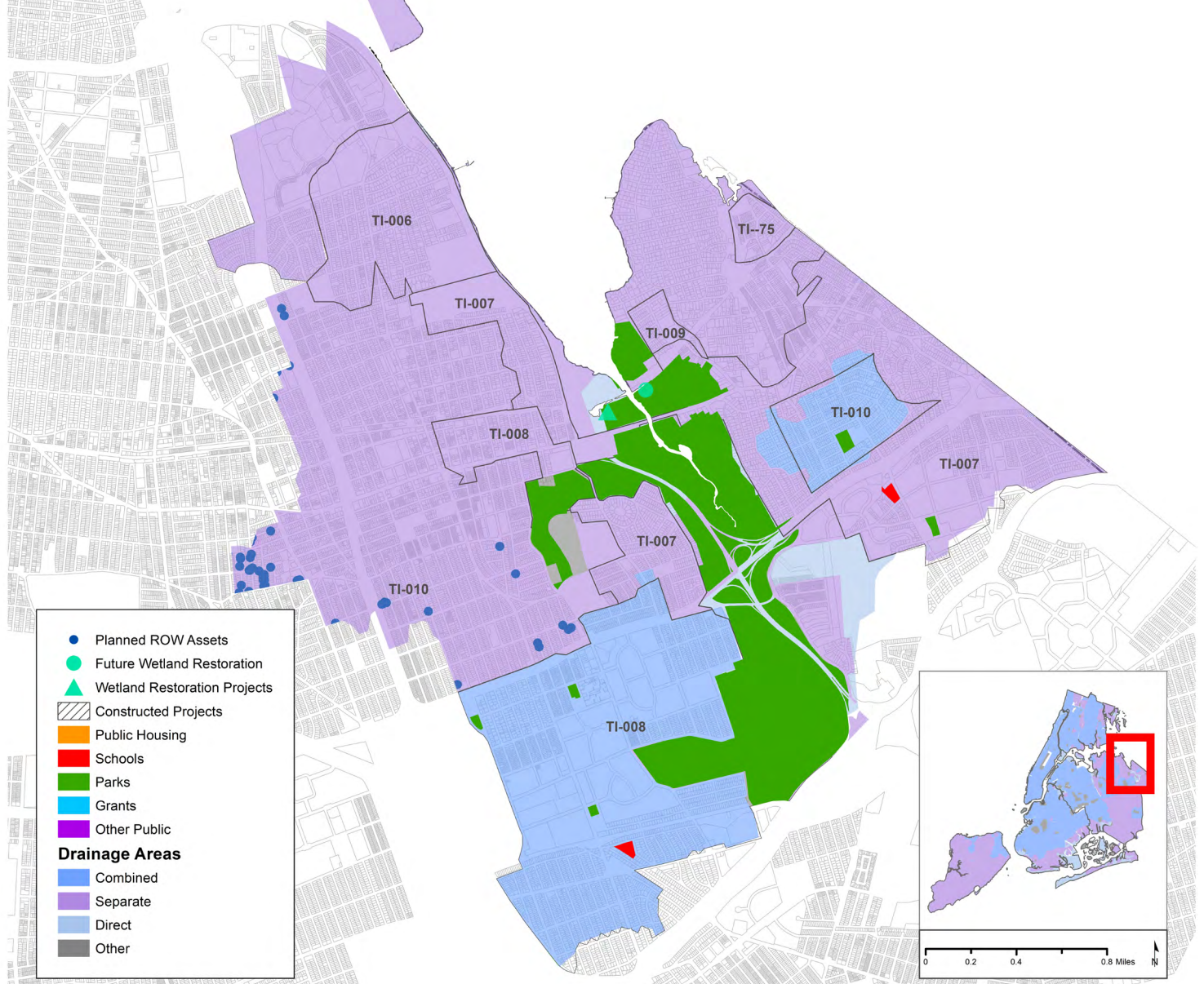
* Annual gallons of stormwater managed = asset capacity (cf/1 in rainfall event)*46.25 (in/yr) (typical annual rainfall)*7.48 (gal/cf)

UPCOMING PUBLIC & GRANT PROJECTS**

- 49th Precinct
- Adlai E. Stevenson Educational Campus
- Castle Hill Houses
- Castle Hill Little League Field
- Colucci Playground
- Eastchester Playground
- Haffen Park
- Monroe Houses
- P.O. Serrano Playground
- P.S. 138 X
- P.S. 182 X
- P.S. 69 X
- Randall Playground
- Story Playground
- Taylor Playground
- The Lt. Curtis Meyran and John Bellew Ed Complex
- The Pearly Gates
- Throggs Neck Houses
- Virginia Playground

ALLEY CREEK WATERSHED

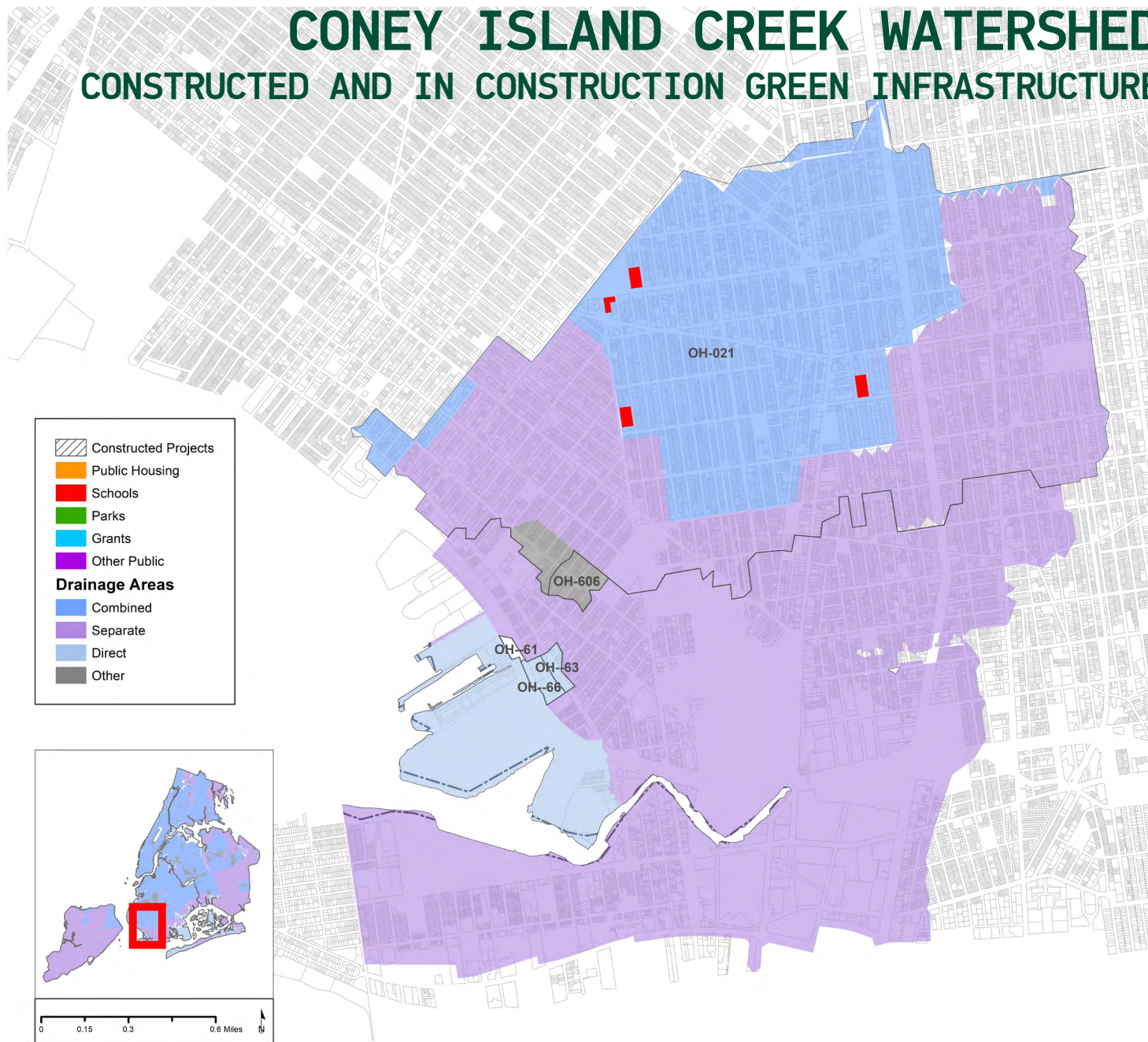
CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



The Alley Creek and Little Neck Bay watershed is a tributary to the Tallman Island Wastewater Treatment Plan (WWTP), and contains a complex wastewater and stormwater system comprised of combined and separately sewered areas as well as direct drainage. The annual wet weather discharge volume to the watershed is predominately dominated by stormwater and direct drainage runoff. DEP has completed a 5 million gallon (MG) Alley Creek CSO retention facility that has been in operation since 2011, reducing overflows by 132 million gallons per year. Accordingly, the watershed has not been considered a priority for right-of-way green infrastructure implementation in the combined sewer areas. However, DEP is pursuing retrofit opportunities under the new contracts for design of public schools and parks and has identified six park properties and one public school to further investigate for green infrastructure implementation. There is one TPL green infrastructure schoolyard to be constructed in 2019 in the separate sewer area of the watershed, P.S. 221Q.

In addition, there have been past and will be future efforts to restore and build wetlands in Alley Creek for water quality improvements and ecological habitat benefits. The Alley Creek wetland is an enormous natural resource in northern Queens and DEP is expanding it by adding 1.5 acres. DEP is also designing a “treatment wetland” in Alley Creek to target pollutant load reductions and to better quantify water quality and environmental improvements of wetland expansions in the receiving waters. DEP is collaborating with Jamaica Bay Science and Resiliency Institute for treatment wetland sampling design and data collection and analysis (see Related Initiatives).

CONEY ISLAND CREEK WATERSHED CONSTRUCTED AND IN CONSTRUCTION GREEN INFRASTRUCTURE



The Coney Island Creek watershed is an urban tributary to Gravesend Bay, and the Bay is tributary to the Lower New York Bay. Water quality in Coney Island Creek is influenced by multiple sources, including stormwater discharges, dry-weather sources and CSOs. The annual wet weather discharge volume to the watershed is predominately dominated by stormwater and direct drainage runoff.

DEP has completed pump station upgrades which have been operational since 2014, reducing overflows by 68% from 245 million gallons a year to 75 million gallons a year. Accordingly, the watershed had not been considered a priority for right-of-way green infrastructure implementation in the combined sewer areas in the early years of the program. However, DEP is continuing efforts to apply an integrated approach for stormwater management. DEP will investigate green infrastructure opportunities at four public schools in the combined sewer areas, and as part of the City's MS4 Stormwater Management Program, eight schools and two parks have been identified for future work in the separate sewer areas. There are also green infrastructure projects funded through the New York Rising program in development now with planned construction in 2020.

GREEN INFRASTRUCTURE MAINTENANCE



RIGHT-OF-WAY MAINTENANCE

The rain garden maintenance crews provide maintenance for the thousands of constructed green infrastructure practices in the ROW. Planning for hiring and training is paced with new construction and transition of assets from contractor guarantee to full maintenance, so that DEP’s maintenance program grows as the number of new rain gardens increases. Table 6 below shows the growth of the team since 2014. DEP has two maintenance facilities, one in Brooklyn and one in the Bronx, to eliminate excess travel time and to improve the overall efficiency of the teams. Additional facilities planning is underway.

The maintenance crews perform a variety of tasks to keep the rain gardens functional and attractive. To ensure performance, the teams typically remove weeds, prune, and replace dead plants as well as remove sediment from inlets, outlets, stone columns and soil to make sure

stormwater flows into and within the rain garden properly. For appearance, the teams remove litter and trim plants. These actions keep the curb appeal of the rain gardens and preserve sight lines to keep pedestrians and vehicles safe. Although the amount of maintenance each rain garden needs varies by size, neighborhood (commercial or residential areas), and by season, every rain garden is visited about once a week.

New staff is trained using the ROW Green Infrastructure Operations and Maintenance Manual, along with on-the-job-training courses taught by current crew leaders and Gardeners. Additional training is offered for select staff to undergo horticulture and plant care training or certifications through a continued partnership with the New York Botanical Garden.

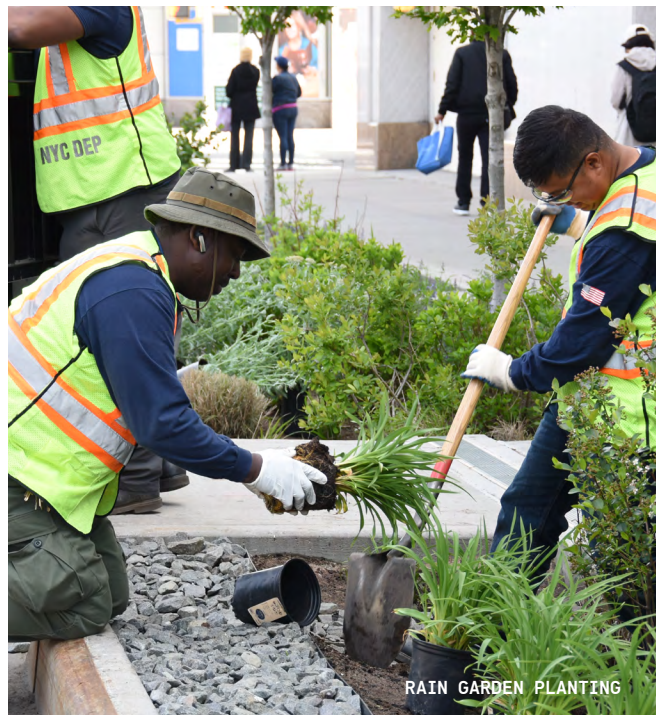
TABLE 6: DEP ROW GREEN INFRASTRUCTURE MAINTENANCE STAFFING BY YEAR

Total Headcount Per Calendar Year*				
2014	2015	2016	2017	2018
15	23	25	62	103

* Total Headcount includes both full-time and seasonal titles.

To manage the operations of the rain gardens, crew leaders conduct evaluations before beginning site maintenance. Maintenance data allows program managers to understand where and how frequently rain gardens are being maintained, the type of work being done, the level of effort required, and any reoccurring issues. By understanding the level of effort required to keep rain gardens in good condition, managers can allocate resources as needed. These evaluations also allow the maintenance team to resolve larger issues like damage from construction or utility work that cannot be corrected through routine maintenance alone.

If the public witnesses any issues with a particular rain garden between visits, they can call 311 as indicated on the blue “rain garden” decals on each rain garden. Staff at the City’s 311 call centers are trained to process rain garden-related requests. The public can also use 311 online to report a broken tree guard, trash, or flooding. Through 311, public requests are directed to DEP’s maintenance staff and the response is tracked.



PUBLIC PROPERTY RETROFITS MAINTENANCE

DEP and its partners have ensured that all other green infrastructure will be maintained over the long term. DEP has accepted maintenance responsibility for green infrastructure implemented within developments owned by the NYCHA. The Department of Education’s Division of School Facilities has agreed to incorporate the maintenance of green infrastructure practices into their typical schoolyard tasks. Similarly, the Department of Parks and Recreation has incorporated green infrastructure maintenance into the borough maintenance and operations crew responsibilities. DEP has committed to an ongoing and open dialogue with all of our partnering agencies to provide support, adjust designs, and consider other changes to implementation practices as the Program proceeds.



RELATED INITIATIVES



MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) PROGRAM

DEC approved the City's Stormwater Management Program (SWMP) on March 14, 2019. The SWMP includes numerous measures to reduce the pollution potential in stormwater discharging into and from the municipal separate storm sewer system (MS4). As part of the SWMP, the City will evaluate the feasibility of implementing green infrastructure during planned municipal upgrades in the MS4 area using a standardized criteria.

The City also identified opportunities to implement green infrastructure projects in MS4 areas draining to Priority MS4 Waterbodies, which currently only includes Coney Island Creek. DEP prioritized City-owned sites for green infrastructure in the Coney Island Creek MS4 area and is moving forward with a more thorough site assessment at eight schools and two parks. For those sites in which green infrastructure is considered feasible, the projects will be designed to accommodate a 90th percentile storm (1.5" of rainfall).

Overall, the three MS4 programs that include green infrastructure components are: Construction and Post-Construction Requirements, Pollution Prevention/Good Housekeeping for Municipal Facilities and Operations (PPGH), and Special Conditions for Impaired Waters.

PARKING LOT STORMWATER FEE PILOT

First initiated in 2011, DEP's Parking Lot Stormwater Pilot Program generates revenue for operation and maintenance of the City's wastewater system. The program applies a stormwater discharge fee to stand-alone parking lots that contribute runoff to the City's wastewater system, but do not receive (or pay for) City water service. Effective July 1, 2018, DEP's stormwater charge is currently \$0.0662 per square foot. On July 1, 2018, DEP billed 505 accounts for \$310,595.39. Parking lot owners who implement green infrastructure practices are exempt from the stormwater discharge fee. To date, no parking lot owners have implemented green infrastructure practices to become exempt from the stormwater discharge fee.

The City's Stormwater Management Program (SWMP) was Approved on March 14, 2019.

SOUTHEAST QUEENS AND THE CLOUDBURST PILOT PROJECTS

Flooding has been a problem in Southeast Queens for over 70 years. Increasing rainfall, loss of permeable surfaces, and reduced groundwater use have worsened conditions. Over the past ten years, Community Boards 12 and 13 have had more flooding complaints than any other area of New York City. In OneNYC, Mayor De Blasio identifies alleviating flooding in Southeast Queens as a priority initiative. DEP's 10 Year Capital Budget allocates \$1.5 billion over the next decade to plan and begin full sewer build-out and to provide short term relief wherever possible. Full build-out requires approximately 450 miles of new storm sewers, upgrades to 260 miles of sanitary sewers, and 30 miles of combined sewers to be completed over many years. DEP is additionally partnering with other City agencies to implement green infrastructure in the ROW and on public properties as another tool to reduce localized flooding.

To complement storm sewer and green infrastructure work in Southeast Queens, DEP is also implementing pilot projects identified as part of a study to assess risks, prioritize responses, develop neighborhood-based solutions, and assess costs and benefits for managing extreme rain events, or "cloudbursts." The Cloudburst Resiliency Planning Study adapted an approach developed in Copenhagen to manage large volumes of stormwater using streets and open space, and has created a unique learning exchange between Copenhagen and New York City. By modeling the flow of floodwater over the local topography, the study determines opportunities to slow and safely convey water to minimize damages and maximize co-benefits to the community. DEP is initiating design of two cloudburst pilot projects in Southeast Queens, one in the St Albans neighborhood and another at NYCHA's South Jamaica Houses, which will maximize stormwater capture for up to 2.3 inches of rainfall per hour for climate resiliency.



NEW YORK RISING – GREEN INFRASTRUCTURE

DEP, in partnership with the Mayor's Office, has been working with the New York Rising Community Reconstruction Program (NYRCR) and the Governor's Office of Storm Recovery (GOSR) on a series of projects in neighborhoods heavily impacted by Hurricane Sandy and Irene. NYRCR's role is to facilitate rebuilding and revitalization assistance and work with local agencies to help implement projects. The projects include the planning and design of green infrastructure within the boundaries of six NYRCR Planning Areas:

- Gravesend / Bensonhurst
- Southeast Brooklyn Waterfront
- Canarsie
- Rockaway West
- Idlewild Watershed

These projects are limited by the grant funds allocated for each planning area, which has limited the scope to mostly right-of-way rain gardens and one project at a public school in Queens. The projects are planned to be completed in 2020.

JAMAICA BAY LONG-TERM CONTROL PLAN

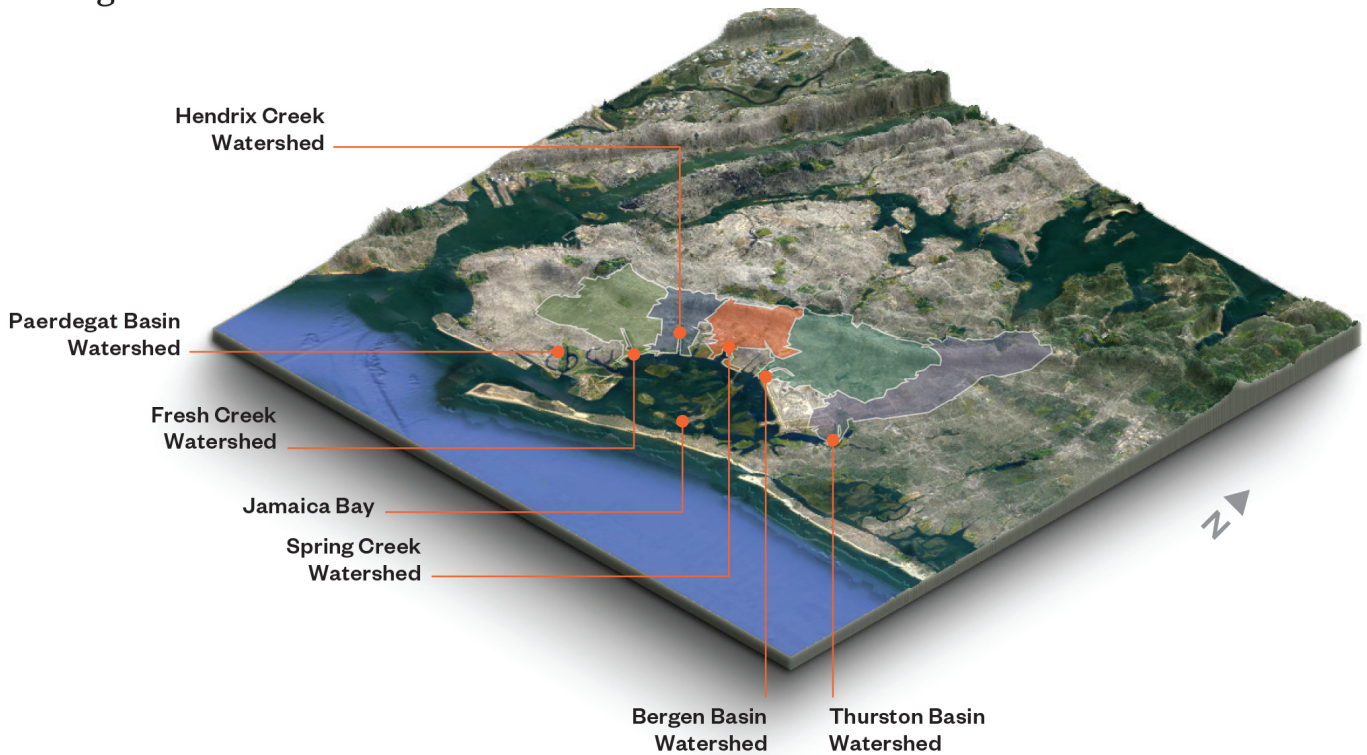
DEP's June 2018 Jamaica Bay and Tributaries Long-Term Control Plan (LTCP) outlined DEP's plan for water quality improvements through the expansion of green infrastructure, wetland creation, ribbed mussel colony creation, and environmental dredging in Bergen and Thurston Basins. DEP estimates 202 million gallons a year in CSO reduction as a result of ongoing and planned green infrastructure projects, and an additional reduction of 15 million gallons a year as a result of the LTCP's Recommended Plan. The Recommended Plan is also expected to reduce the stormwater loads by 234 MGY. These stormwater reductions will be updated in the supplemental LTCP submitting in summer 2019.

The Recommended Plan will result in 379 Greened Acres in Bergen and Thurston Basins, seven acres of ribbed mussel colonies, and 50 acres of wetland restoration; all of which will provide increased co-benefits for the watershed in the form of improved air quality, carbon footprint reduction, reduced urban heat island effect, habitat creation, and water quality improvements (see Figure 1). The complete LTCP can be found on DEP's [website](#). As of the date of this Report, the Jamaica Bay LTCP is still under review by DEC.

FIGURE 1: RECOMMENDED PLAN FOR JAMAICA BAY

The Recommended Plan for Jamaica Bay and Tributaries

Provides *economic, social and environmental co-benefits* beyond what can be achieved through a traditional Grey Infrastructure approach of underground CSO Storage Tunnels.



Jamaica Bay

26 000 acres of water, islands, marshes and shorelines



Historically, Jamaica Bay has served as an important ecological resource for many flora and fauna. The Bay has evolved as an important and complex network of open water, salt marsh, grasslands, coastal woodlands, maritime shrub lands, brackish and freshwater wetlands. Jamaica Bay, one of the largest coastal wetland ecosystems in New York State, is a component of the National Park Service's Gateway National Recreation Area.



This LTCP has been developed in an effort to better understand and address CSO impacts on water quality within Jamaica Bay. Throughout the process for developing this LTCP, DEP collected water quality data, performed extensive collection system and water quality modeling, held multiple public meetings and analyzed potential CSO control alternatives based on costs and model predicted water quality improvement.



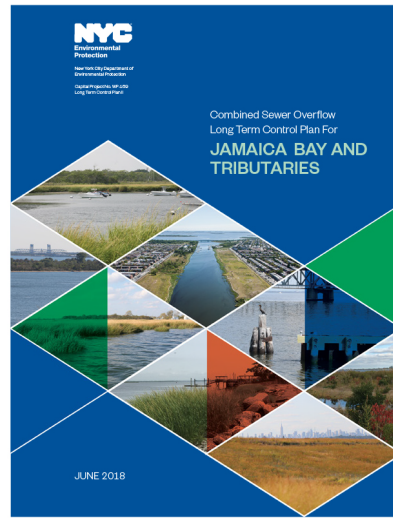
The selection of the Recommended Plan was based on multiple considerations including:


- Public input
- Environmental and water quality benefits
- Community and societal impacts
- Issues related to implementation, operation and maintenance (O&M)
- Cost-performance and cost-attainment evaluations

FIGURE 1: RECOMMENDED PLAN FOR JAMAICA BAY (CONTINUED)

THE RECOMMENDED PLAN

- Can be implemented in 14 years as opposed to retained grey alternatives projected to take over 25 years
- Provides higher levels of water quality attainment at much lower cost than grey alternatives
- Supplements prior grey infrastructure improvements while providing holistic environmental, social, and economic benefits



 Additional 379 greened acres in Bergen and Thurston Basin tributary areas	 7 acres of ribbed mussel colony creation	 50,000 CY of environmental dredging in Bergen Basin	 50 acres of wetland restoration
 Reduce CSO discharges to Bergen and Thurston Basins by 15 MGY	 Reduce Stormwater discharges by 234 MGY	 Provide air quality improvement	 Carbon footprint reduction
 Habitat creation	 Heat island construction reduction	 Property value improvement	 Water quality improvement through the filtering of the ribbed mussels

WATER QUALITY IMPROVEMENTS Achieved through Strategic Investments



\$600 Million Biological Nutrient Reduction (BNR) Upgrades across four wastewater treatment plants (JA, 26W, RK, and CI) that discharge to Jamaica Bay



\$32 Million Ecosystem Restoration and Research Efforts to support pathogen reduction and dissolved oxygen improvement under the Jamaica Bay Watershed Protection Plan



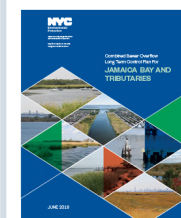
\$1 Billion Past and Existing Grey Infrastructure investments to reduce combined sewer overflows



\$1.7 Billion Southeast Queens Sewer Buildout commitment over the next decade under the OneNYC Plan



\$300 Million Existing and Planned Green Infrastructure commitment over the next decade under the OneNYC Plan



LTCP Recommended Plan will build upon these past investments and provide further water quality improvements.

ECOLOGICAL SERVICES AND WETLAND RESTORATION

In the academic and wetland restoration communities, there has been recent attention and studies on the ability of wetlands to sequester pathogens, improve water quality, and reduce nutrient levels. With this knowledge, natural and constructed wetlands have been widely utilized for water quality enhancement. Within a tidal environment, marshes are able to dissipate tidal flow energies approximately one order of magnitude when the flows encounter vegetated marsh surface and flow velocity continues to decrease as vegetation density increases. These tidal patterns have important implications concerning the assessment of water quality parameters associated with Fecal Indicator Bacteria (FIB) because they may provide a method to remove suspended bacteria and deposit them within marshes. This flooding and ebbing of salt marsh habitats can increase the mortality, and subsequently decrease negative impacts, of FIB by sequestering these bacteria within the marsh sediments and increasing the Ultraviolet (UV) light exposure, which kills FIB.

In Alley Creek, DEP has designed a 1-acre tidal marsh that will provide the opportunity for monitoring and data collection of various spatial configurations of wetland and tidal channels to achieve maximum water quality benefits. This project is currently under construction and will be completed spring 2019. The Alley Creek project has the potential to provide meaningful local data on the water quality improvements and benefits related to wetland restoration. The existing marshes within Alley Creek can provide an opportunity to examine how natural and anthropogenic sources of FIB can be sequestered and differentiated within wetland systems. The Alley Creek Pilot Wetland FIB sampling program will include 54 sampling events. Monitoring of the pilot tidal wetland will begin after one full growing season in order for the marsh soils to stabilize and plantings to become established (approximately April 2020).

This monitoring effort is anticipated to be undertaken by researchers from the Science and Resiliency Institute at Jamaica Bay (SRIJB). SRIJB has extensive knowledge and vast expertise in wetland research programs that promote cutting edge techniques across many disciplines. This effort will advance the core understanding of changes and ecosystem services provided by urban coastal systems, as well as further DEP and SRIJB's wish



to continue engaging in activities of mutual interest in the field of research and development of strategies for improved water quality and ecological habitat.

Table 7 summarizes the total acres of tidal wetland restoration resulting from DEP funded or cost shared projects to date.

**DEP has
restored over
170 acres of
tidal wetlands.**

TABLE 7: TIDAL WETLANDS RESTORED OR FUNDED BY DEP

Site	Acres
Elders East (cost share)	38
Paerdegat	8
Idlewild	5
Powell's Cove	1
Hendrix Creek (cost share)	2
Elders West (cost share)	34
Yellow Bar (cost share)	42
Black Wall (cost share)	20.5
Ruler's Bar (cost share)	9.8
Brookfield	3.5
Alley Creek	8
Future	
Alley Creek (2019)	1.5
Oakwood Beach (cost share)	35
Additional Jamaica Bay Marsh Islands (cost share)	20
Total Installed	171.8
Total Planned	56.5



ADAPTIVE MANAGEMENT



RESEARCH AND DEVELOPMENT PROGRAM

DEP's \$10 million comprehensive Research and Development (R&D) Program collects crucial performance and co-benefit data for a variety of green infrastructure practices. Work completed under the R&D Program supports the Program as well as the development and execution of LTCPs by reviewing performance over time, ensuring performance-based maintenance and operations, and conducting cost-benefit analyses of various green infrastructure designs.

DEP has been collecting and analyzing data on rain gardens and other types of green infrastructure following completion of the Green Infrastructure Monitoring Strategy and Protocols report in June 2016.

Key highlights from work conducted during 2018 included analysis of real-time data during and after storm events, simulated runoff tests, surface infiltration tests, development of computational fluid dynamic (CFD) models, statistical analyses, and literature reviews. From these studies, DEP identified the following relationships between rain garden design features and stormwater management capacity:

1. How much stormwater that can enter a rain garden during a storm event is largely impacted by:
 - Inlet configuration (inlet type, opening width, slope of surface feeding into inlet opening, etc)
 - Characteristics of flow paths within rain gardens (soil contours, placement of vegetation, elevation of outlet, etc)
2. Factors that affect how much stormwater can be retained by a rain garden include:
 - Size of storm event
 - Hydraulic connectivity between the engineered soil and broken stone layers
 - Tree interception capacity, which is correlated to bark roughness

Overall, the rain gardens that DEP is monitoring under this program showed performance that is consistent with initial estimates in regards to stormwater performance.

In addition to stormwater performance analyses, DEP also conducted analyses of microbial diversity within rain gardens and found that green infrastructure systems harbor similar microbiology to other urban green spaces.

In 2018, porous pavement was constructed along several blocks in the Flushing Bay watershed.

Under the R&D Program, DEP also developed training materials focusing on critical elements for rain garden construction as well as a Rain Garden Maintenance Manual for DEP maintenance crews.

For 2019, DEP will continue to collect and analyze data on factors that impact green infrastructure including hydraulics, plants and trees, and co-benefits.

PERMEABLE PAVEMENT PILOT – LOCAL LAW 80 (2013)

In 2013, the New York City Council passed Local Law 80 (2013) requiring DEP and DOT to study three permeable pavement installations in the City's streets and sidewalks. In 2014, the agencies worked together to identify pilot locations in the Hutchinson River and Flushing Bay Priority CSO Tributary Areas and developed the monitoring protocol. The third pilot area in the Newtown Creek Priority CSO Tributary Areas was identified in 2016, and is being pursued in coordination with DDC.

The precast porous concrete installations were completed for the Flushing Bay pilot in 2018 and DEP is currently collecting and analyzing post-construction monitoring data. Construction of the Hutchinson River pilot is expected to be complete in early 2019, also followed by post-construction monitoring. The Newtown Creek porous asphalt designs were finalized in 2018.

A final report will be prepared by DEP and DOT after all post-construction data is collected and analyzed.



LOOKING AHEAD TO 2019



01 RAIN GARDEN STEWARDSHIP

In 2018, DEP announced a rain garden stewardship program to partner with New Yorkers to keep the rain gardens in our communities beautiful and functional. During Earth Week 2019, DEP maintenance staff launched the stewardship program, starting with in-field training with four community groups who have expressed interest in becoming rain garden stewards. DEP will continue to grow the stewardship program throughout 2019 and search for additional community groups to partners with.

02 INFORMATIONAL SIGNAGE AT RAIN GARDENS

In 2019, DEP is planning to begin installing informational signs at a portion of the rain gardens. These signs will identify the rain garden by name, describe how it functions, and provide contact information for questions or concerns. The designs and mounting details are in progress at the time of this printing. Next steps are Public Design Commission approval and installation.

03 PUBLIC PROPERTY RETROFIT DESIGN MANUAL

DEP has worked throughout 2018 to develop a comprehensive guide for designing green infrastructure on public property. This enormous effort will be a critical tool as the scaling up of our parks, schools, and housing projects rolls out. The manual will be available online in 2019 and updated as the Program progresses.

04 POROUS PAVEMENT PLANNING AND DESIGN

DEP continues to evaluate the best location and maintenance methods for porous pavements in NYC as part of the Green Infrastructure Program. In 2019, DEP will continue to evaluate and design a neighborhood-scale porous pavement installation in Westchester Creek watershed.

05 STREAMLINE STORMWATER POLICY FOR NEW DEVELOPMENT

In 2012, DEP and DOB passed new regulations for stormwater management on new development in combined sewer areas called the Stormwater Performance Standard. In 2019, as part of DEP's MS4 Construction-Post Construction Program, DEP will begin to permit and enforce post-construction stormwater management practices constructed as part of covered development projects in the MS4 area disturbing 1 acre or greater of soil. There is consensus within DEP that aligning and streamlining the stormwater regulations for new development and new site connection applications citywide is warranted and in the best interest of the development community and DEP. Over the next year, DEP will work internally towards that goal.

06 INVESTIGATE LARGE-SCALE RIGHT-OF-WAY PROJECTS

In 2018, DEP dedicated resources toward designing and building large-scale right-of-way green infrastructure projects. The first project is expected to be bid in 2019 and several more will be in design. This portfolio of potential projects represent unique circumstances within the city's roadways and take time to design and coordinate with various stakeholder groups within DEP and other City agencies. However, the volume of stormwater capture will be much larger than the standard rain gardens or stormwater greenstreets.

07 DEVELOP FRAMEWORK FOR A NEW, COMMUNITY-ORIENTED GRANT PROGRAM

Throughout 2019, DEP will develop the framework for a new grant program geared toward community groups and other organizations that want to get involved in NYC green infrastructure. Multiple funding categories for this program are under consideration including funding for structural stormwater controls (rain gardens and other green infrastructure practices) and non-structural categories such as maintenance, assessment of ROW green infrastructure, and more. Work is underway now, in collaboration with Brooklyn College, to survey interest levels and capacity of community groups.

08 CREATE A CONSTRUCTION MANAGEMENT, INSPECTION, AND ENFORCEMENT TEAM

A new team within the Green Infrastructure Program is in the works for 2019. Given the number of assets in the ground now and the thousands more coming online soon, DEP is ramping up the number of staff out in the field providing construction oversight, inspecting assets during and after construction, ensuring that assets are performing as designed, and taking action against any activities that may inhibit performance. This new team will be essential to the continued growth of the Program.

EXHIBIT A - PROGRAM SPENDING AND BUDGET

CAPITAL ENCUMBRANCE, 10-YEAR BUDGET AND EXPENSE BUDGET

TABLE 8: ENCUMBERED CAPITAL FUNDING BY FISCAL YEAR

Fiscal Year	Encumbered Capital Funding
FY12	\$9,015,345
FY13	\$15,202,880
FY14	\$152,935,549
FY15	\$58,041,000
FY16	\$114,976,316
FY17	\$118,115,231
FY18	\$69,811,175
FY19 ¹	\$74,733,887
Total	\$612,831,383

TABLE 9: CAPITAL IMPROVEMENT PROGRAM BUDGET, FY 19-29

Fiscal Year	Approved FY 2019 Preliminary Capital Improvement Program
FY19 ²	\$273,959,113
FY20 - FY29	\$740,184,000
Total	\$1,014,143,113
PROGRAM GRAND TOTAL³	\$1,626,974,496

TABLE 10: EXPENSE BUDGET - OTHER THAN PERSONNEL SERVICES ONLY (OTPS)

Fiscal Year	OTPS Expenditures
FY12	\$60,265
FY13	\$2,039,773
FY14	\$1,989,918
FY15	\$2,006,620
FY16	\$2,234,715
FY17	\$4,134,828
FY18	\$4,300,363
Total	\$16,766,482
Fiscal Year	OTPS Budget, as of FY19 Preliminary Plan
FY19	\$5,303,758
FY20	\$5,916,618
GRAND TOTAL	\$27,986,858

1 FY19 encumbered to date.

2 FY19 remaining.

3 Estimated total is based on the total encumbered and the Approved FY20 Preliminary January Capital Improvement Plan (FY19-29).

EXHIBIT B - COMMUNITY OUTREACH

GREEN INFRASTRUCTURE PUBLIC OUTREACH MEETINGS

TABLE 11: 2018 PUBLIC GREEN INFRASTRUCTURE MEETINGS

Date	Community Member(s)	Type of Outreach	Attendees
January			
1	LTCP Public Kickoff (East River)	Meeting	25
February			
20	Council Member Cohen and BX CB 8's Environmental Committee	Meeting	15
March			
1	Alley Creek Symposium	Panel Discussion	60
14	Prospect Park South Board Members	Meeting	12
14	Green Infrastructure Grant Program Workshop	Presentation	12
16	ReLeaf Conference	Presentation	50
20	South Ozone Park Civic Association	Presentation	30
27	ER/OW LTCP Kick-Off (Staten Island)	Presentation	22
29	Kingsborough Houses Residents Association	Presentation	10
April			
4	Locust Point Civic Association	Presentation	30
9	Woodlawn Heights Taxpayers and Community Association	Presentation	80
17	Ground-Breaking for I.S. 250Q – The Robert F. Kennedy Community School	Ceremony	75
May			
15	Chauncey Street Block Association	Tour	3
16	CB 3 – Brooklyn, District Manager's City Agency Town Hall	Panel Discussion	50
25	Green Infrastructure Briefing for Council Member Gjonaj	Meeting	5
31	Treatment: The Plan for Rain Exhibit	Panel Discussion	15
June			
4	Ribbon Cutting JHS 189 and Flushing International School	Ceremony	75
4	Green Infrastructure Briefing for Council Member Diaz	Meeting	10
7	Maspeth Industrial Business Association	Presentation	20
13	Green Infrastructure Grant Program Workshop	Workshop	51
15	Meeting with Gowanus Canal Conservancy	Meeting	5
18	Green Infrastructure Briefing for Council Member Williams	Meeting	5
19	Green Infrastructure Briefing for Council Member Barron	Meeting	6
21	Meeting with Newtown Creek Alliance	Meeting	5

TABLE 11: 2018 PUBLIC GREEN INFRASTRUCTURE MEETINGS (CONTINUED)

Date	Community Member(s)	Type of Outreach	Attendees
July			
1	Jamaica Bay LTCP – Community Support Event	Community/Press Event	20
9	Green Infrastructure Briefing for Council Member Ampry-Samuel	Information Session	4
18	Green Infrastructure Briefing for Bronx Borough President’s Office	Information Session	5
September			
12	Green Infrastructure Grant Program Workshop	Workshop	15
21	Clinton DeWitt High School	Educational Meeting	15
24	Flushing Heights Civic Association	Community Meeting	45
October			
9	Green Infrastructure Presentation for Prospect Park South Neighborhood District	Public Meeting	50
December			
3	CB7 Green Infrastructure Grant Program Presentation	Community Board Meeting	--
5	2018 Annual LTCP Public Meeting	Community Meeting	100
12	Green Infrastructure Grant Program Workshop	Workshop	27

EXHIBIT C - 2015 CONTINGENCY PLAN

The 2015 Contingency Plan submitted on June 27, 2016 and approved by DEC on July 5, 2017, outlined the plan for managing 1,181 impervious equivalent greened acres. The table below is the list of planned projects that will provide those greened acres by 2020 and the status.

TABLE 12: STATUS OF GREEN INFRASTRUCTURE 1.5% CONTINGENCY PLAN PROJECTS

Waterbodies	Area-Wide ROW Project	Status as of January 15, 2019		Reported Substantial Construction Completion Date ¹	Projected Substantial Construction Completion Date as of 1/15/19
		Number of Bids	Issued/Anticipated NTP Date		
Flushing Creek	TI-011	Construction Bid 1	June 2016	December 2019	June 2017
		Construction Bid 2	September 2018		December 2020
Newtown Creek	BB Cluster	Construction Bid 1	January 2017	December 2019	March 2019
		Construction Bid 2	August 2019		December 2020
Jamaica Bay	JAM-003	Construction Bid 1	August 2016	December 2019	December 2017
		Construction Bid 2	June 2019		December 2020
		Construction Bid 3	September 2019		December 2020
		Construction Bid 4	January 2019		December 2020
		Construction Bid 5	August 2019		December 2020
EROW/Wallabout	NCB-014	Construction Bid 1	September 2018	December 2020	December 2020
		Construction Bid 2	September 2019		
EROW/Bowery Bay	BB-005	Construction Bid 1	October 2019	December 2020	December 2020
		Construction Bid 2	October 2019		
Westchester Creek	HP-014/033/016	Construction Bid 1	April 2019	December 2020	December 2020
		Construction Bid 2	April 2019		
Flushing Creek	TI-010	Construction Bid 1	July 2019	December 2020	December 2020
		Construction Bid 2	September 2019		
		Construction Bid 3	November 2019		
		Construction Bid 4	November 2019		
		Construction Bid 5	November 2019		
Bronx River	HP-007/004/002	Construction Bid 1	June 2019	December 2020	December 2020
		Construction Bid 2	July 2019		
Jamaica Bay	26W-005/-004	Construction Bid 1	June 2019	December 2020	December 2020
		Construction Bid 2	July 2019		
		Construction Bid 3	June 2019		
		Construction Bid 4	July 2019		
		Construction Bid 5	June 2019		

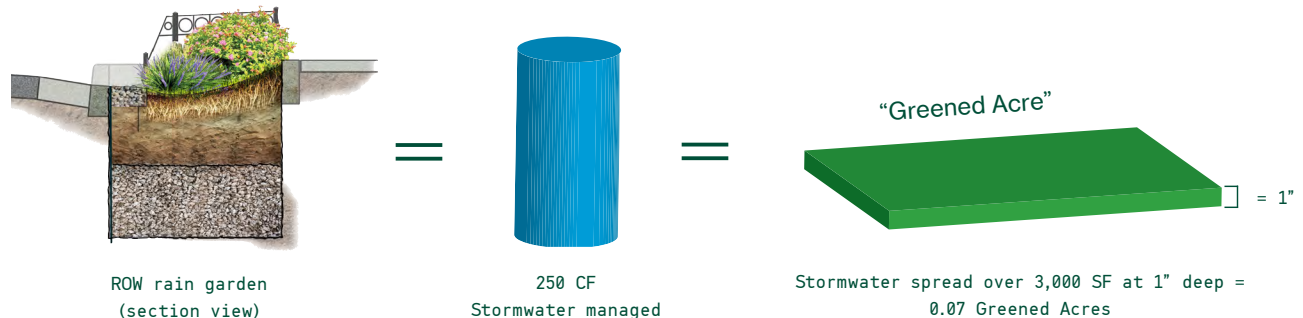
¹ The Anticipated Construction Completion date as reported in the June 27, 2016 Contingency Plan.

EXHIBIT D - WHAT IS A “GREENED ACRE”?

A “greened acre” is another way of saying “equivalent impervious acre” but it’s easier to say and understand. It represents a volume of runoff managed by a green infrastructure practice. If you take that volume and spread it out evenly at a 1” depth over an impervious area – that area represents a “greened acre.” Here are some questions we think our stakeholders might ask:

HOW DO YOU CALCULATE A “GREENED ACRE”?

Let’s use a rain garden on the sidewalk as an example – a particular rain garden might hold 250 cubic feet of runoff. If you spread that volume over an area at 1” deep, its greened acres would be 3,000 square feet, or 0.07 greened acres (GA). Like many other U.S. cities, DEP starts with the water holding capacity of each green infrastructure practice and “backs out” the equivalent impervious area that would be managed if that volume was spread over an area at 1” depth.



WHY CHANGE THE TERMINOLOGY?

DEC approved DEP’s Performance Metrics Report (PMR) in the summer of 2017, thereby establishing the 2030 CSO volume reduction target for the Program. Because the PMR established a relationship between the green infrastructure projects to runoff reduction and actual CSO reduction, it is time to update and more accurately represent the metrics and targets in a volumetric unit. The “greened acre” metric is just that.

Additionally, updating the public and stormwater stakeholders on our CSO volume reduction progress will be much easier going forward. DEP works hard to measure the green infrastructure’s performance, or the volume of stormwater managed, in all types of rain events. Ultimately, that performance data is used to assess CSO volume reductions. Rain events can vary in a typical year – some are short and intense, some are long with less than a few inches over many hours. These variations in precipitation affect the way the green infrastructure practices perform and also dictate how much runoff during that particular rain event will be managed and ultimately the resulting CSO volume reduction.

WILL THE GREEN INFRASTRUCTURE PROGRAM REPORTING CHANGE?

Fundamentally, no. DEP will continue to report on greened acres, annual stormwater volume managed, and funding expended and budgeted (see Exhibit A) in each Annual Report, in accordance with the CSO Order. Additionally, at each milestone DEP will update the CSO volume reductions for all green infrastructure practices implemented by the milestone date. The next milestone is December 2020 and must be certified by June 30, 2021.



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