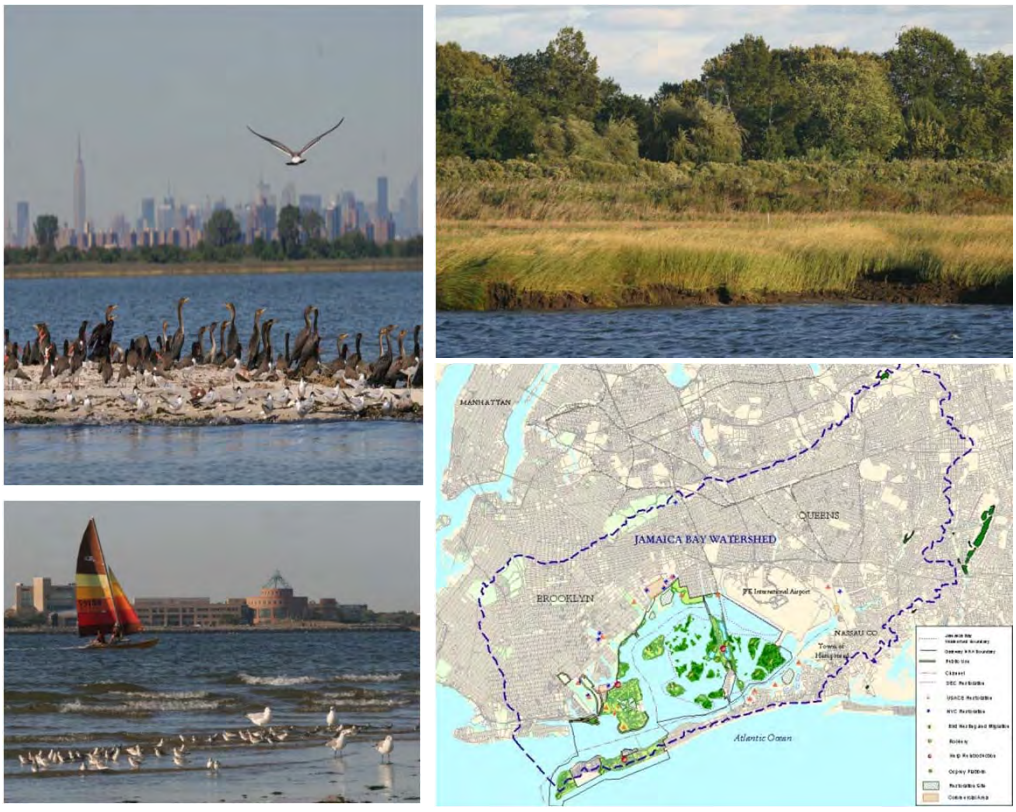

Jamaica Bay Watershed Protection Plan Update 2010

New York City Department of Environmental Protection
Caswell Holloway, Commissioner
October 1, 2010

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Jamaica Bay Watershed Protection Plan Update 2010

1. WATER QUALITY

***The matrix includes blacklined text for several implementation strategies that have been modified based on updated information.**

Reduce Nitrogen Loading to the Tributaries and Jamaica Bay

	Implementation Strategy	Description	Updated Schedule	Status/Comment
Nitrogen Reduction & Other	*Jamaica Bay WWTP Upgrades* ~~*Carbon Addition*~~ ~~*Interim Carbon Addition*~~	Improve the overall ecology of Jamaica Bay by reducing nitrogen discharges from Jamaica Bay's WWTPs. Landmark agreement set out in negoiations with DEC and environmental stakeholder groups with respect to nitrogen loading reductions is pending submittal and approval. This first phase of the 26th Ward WWTP upgrade will reduce nitrogen discharges by more than 4,000 pounds per day, or 10% of the total nitrogen discharges from treatment plants into the bay.	Additional DEP investments to reduce the nitrogen loads discharged into Jamaica Bay by nearly 50% over the next ten years.	See attached status report.
	Minimize Centrate Processing from other WWTPs in Jamaica Bay	DEP will continue its efforts to minimize transshipment of sludge for processing in Jamaica Bay.	DEP continues to limit shipments.	DEP to submit Sludge Management Plan to DEC by September 30, 2010. This plan will identify strategies for minimizing sludge import to Jamaica Bay. In keeping with current practice, sludge import to Jamaica Bay from outside WWTPs is on an as-needed basis.
	Sea Lettuce Harvesting Pilot	DEP skimmer boats used to harvest sea lettuce where it amasses in the waters of Jamaica Bay to determine if this approach is feasible and to chemically analyze sea lettuce for its use as biofuel.	Harvesting completed in September 2010.	See attached status report.
	Algal Turf Scrubbers Pilot	An ATS was constructed at the Rockaway WWTP. This technology will use algae to filter WWTP effluent for nutrient removal and as a source for biofuel.	Construction of ATS unit began in July 2010 and was completed in September 2010.	See attached status report.
	Oyster Bed Pilot	A small oyster bed and a field of reef balls will be placed within Jamaica Bay to evaluate oyster growth, survival, reproduction, water quality and ecological benefits given existing environmental conditions in the bay.	Workshops and design completion in early 2010. Permitting process was completed in September 2010. Construction is expected in October 2010.	See attached status report.
	Reintroduction of Eel Grass (Zostera marina) Pilot	Limited plantings of eelgrass established and monitored around the bay to evaluate the potential to restore eelgrass in the region.	Initial plantings in April 2009 and 2010. Additional plantings planned for fall 2010 and potentially fall 2011.	See attached status report.
	Ribbed Mussel Pilot	Several artificial structures will be constructed to encourage the growth of ribbed mussels within one of the tributaries of Jamaica Bay. The study will monitor mussel growth to measure the effectiveness of ribbed mussels in removing nutrients and particulate organic matter from the water.	Workshops and preliminary design completed in July 2010. Permits submitted on August 30, 2010. Construction anticipated to start March 2011.	See attached status report.

Reduce CSO and Other Discharges to Improve Pathogen and DO levels				
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Sewer System Maintenance	*Expanded Sewer Cleaning Program*	Clean sewers more proactively. Use newly purchased vactor trucks to continue cleaning lateral sewer system to remove sediment and debris. Launch an enhanced fats, oil and grease enforcement and inspection program to keep sewers clean. Approximately 214,086 linear feet has been cleaned in the 26th Ward WWTP drainage area.	Ongoing	
	26th Ward/Fresh Creek Combined Sewer and Interceptor Cleaning	Clean sediment in 26th Ward WWTP drainage area.	Cleaning was completed in June 2010.	Completed; cleaning removed approximately 15,000 tons of debris.
	Expanded Interceptor Inspection and Maintenance	Inspection program to determine cleaning and maintenance needs throughout the City.	Inspection of pilot project (East Rockaway Interceptor) completed; development of ongoing Citywide inspection program using video and sonar will be based on information collected from pilot.	Approximately half of the City's interceptors have been inspected. In June 2010, DEP announced a comprehensive plan to survey all interceptors within two years and to remove sediment and rehabilitate as necessary, depending upon the survey results. To do so, DEP purchased two additional vactor trucks at a cost of $450,000 and will staff each with dedicated crews that will also be supplemented by contractors.
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Sewer & Treatment Facility Infrastructure Improvements	*26th Ward 50 MGD Expansion*	Increase wet weather capacity from 170 MGD to 220 MGD.	Reevaluation of expansion and other alternatives currently being conducted to determine most cost-effective CSO reduction methods.	Reevaluation required to assess the feasability of implementing original proposal.
	Paerdegat CSO Detention	50 MGD facility to capture CSOs.	Construction to be completed in May 2011.	
	Inflow/Infiltration Study with Corrective Measures	Identify and resolve sewer system anomalies.	Began in July 2010 using DEP in-house resources.	Study focused only within Coney Island drainage area.
	Regulators in Bergen Basin	Modifications to Regulators 3 and 4 to reduce CSO overflows and a new 48" conveyance sewer under the Belt Parkway to bring wet weather flow to the Jamaica WWTP.	Project in design.	
	Complete Storm Sewer Build out in Rockaways	Storm sewer construction in the Rockaways.	Total of 18 projects identified; 2 are in construction, designs of 8 are nearly complete with construction pending and 8 are in early design. Additional projects are currently being identified and scoped.	

	Implementation Strategy	Description	Updated Schedule	Status/Comment
New Sanitary and Storm Sewers	*Southeast Queens Drainage Plan*	Sewer modifications to convert existing system to a mainly separated system with High Level Storm Sewers in the Laurelton area.	The drainage plans are complete. Project in Twin Ponds and Springfield Park areas near design completion.	Currently identifying additional storm sewer proejcts for design and construction.
	Warnerville / Meadowmere Sewer Project	On February 17, 2010 DEP announced the completion of a project that will allow homeowners in the Meadowmere and Warnerville sections of southeast Queens, along Jamaica Bay, to connect to the City's sewer system.	Certified construction completion July 31, 2009. Of 85 homeowners, 67 have connected to system (79%) , 1 is under construction, 6 are obtaining permits and remaining lots are vacant land.	
	Jewel Streets Storm and Sanitary Sewers	Install storm and sanitary sewers.	Joint DEP and DOT project is funded for FY 2018. Currently in design by DDC.	
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Boat Pumpouts	*Install a Third Boat Pumpout Facility at Rockaway WWTP and Seek a No Discharge Designation for Jamaica Bay*	Reduce wastewater discharges from recreational boats directly into Bay, and will initiate proceedings to create a NDZ for Jamaica Bay.	Application for NDZ will be filed with DEC by October 31, 2010.	Landmark agreement set out in negoiations with DEC and environmental stakeholder groups with respect to NDZ is pending submittal and approval. EPA's 2012 VGP includes all discharges incidental to normal vessel operation. Previously unregulated, VGP includes graywater-discharge water used for washing, laundering, bathing or showering from vessels 79 feet and above. VGP provides specific effluent limits for treated and untreated graywater discharges.

Increase DO Levels to Improve Ecological Productivity

	Implementation Strategy	Description	Updated Schedule	Status/Comment
Remove CSO Sediment Mounds	*Dredge and Recontour Hendrix Creek*	To address CSO mounds, DO and ecological goals.	Dredging initiated in August 2010, and is anticipated to be completed in summer 2011.	
	Pursue Dredging of Paerdegat Basin, Fresh Creek, Bergen Basin and Thurston Basin	To address CSO mounds, DO and ecological goals.	Joint Application Permit for Paerdegat Basin was submitted on December 30, 2009. Final design of dredging is underway. Permits from DEC were issued for a five-year period (i.e., March 19, 2010 to December 31, 2015) and USACE permits pending. Dredging of other Jamaica Bay tributaries is pending approval of LTCP.	
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Dissolved Oxygen	*Pursue Aerators at Fresh Creek, Bergen Basin and Thurston Basin.*	Add oxygen to improve dissolved oxygen levels.	NA	No change.
	Investigate Potential for Future Aeration in other CSO and Non-CSO Tributaries	Determine the need and efficacy of in-stream aeration for other creeks in Jamaica Bay.	NA	No change.
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Monitor-ing	*Enhanced Scientific Monitoring Program*	Develop enhanced water quality and ecological monitoring program. Coordinate monitoring among various entities.	DEP has incresed the number of sampling sites in Jamaica Bay by 50% – from 13 to 20 locations, including CSO post-construction monitoring in select tributaries.	

2. RESTORATION ECOLOGY

Restoration Ecology				
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Wetland Restoration	*Establish Salt Marsh Island Wetlands Priority Restoration Review Board*	Committee of various agency partners continue to meet and discuss advancing additional wetland restorations. DEP has provided letters of support for the restoration of future wetlands beyond Yellow Bar Hassock.	Landmark agreement set out is pending submittal and approval.	
	Marsh Island Wave Attenuator Study	A wave attenuator pilot study will be developed and implemented around a section of a salt marsh island in Jamaica Bay. This study will determine if the attenuator would be a cost-effective method to slow the rate of wetland loss and accrete marsh building sediments.	Preliminary designs completed for both timber wave attenuator and floating islands in July 2010. Construction and deployment expected spring 2011.	See attached status report.
	Wetland Restoration	Elders West, completed in summer 2010, restored an additional 35 acres of interior wetlands.	USACE currently developing plans and specifications for Yellow Bar Hassock.	DEP will be a local cost share sponsor for Yellow Bar Hassock and additional future wetland restorations.
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Land Acquisition and Restoration Along Periphery of Bay	*Complete Restoration of Penn Avenue Landfill and Fountain Avenue Landfill*	Comprehensive and innovative ecological restoration and remediation of Class 2 inactive hazardous waste sites.	Remediation and ecological restoration completed in fall 2008.	
	Paerdegat Basin Restoration	Improve water quality, create Ecology Park and restore Jamaica Bay wetlands and adjacent upland habitat.	Currently under construction; completion expected January 2012.	See attached status report.
	Identify Opportunities for Green Infrastructure ~~*Transfer HPD Properties in the Edgemere Section of Queens to Parks*~~	Identification of land uses such as the public ROW that present significant opportunities for stormwater source controls which would also shade and cool the City, improve air quality, increase property values and provide urban wildlife habitat.	20-year implementation period in *NYC Green Infrastructure Plan.*	See attached status report.
	Identify Opportunities for Green Infrastructure ~~*Pursue Acquisition and Restoration Efforts in Vacant Areas*~~	See above.	See above.	See above.
	Identify Opportunities for Green Infrastructure ~~*Acquire Seagirt Avenue Properties in Rockaway, Queens*~~	See above.	See above.	See above.
	Ecological Atlas and LIDAR Imagery ~~*Update and Inventory Dune and Beach and Other Habitats*~~	Use existing sources of information along with newly captured satellite imagery to develop a GIS-based Jamaica Bay Watershed Ecological Atlas.	Satellite wetland mapping began in spring 2010; development of the Ecological Atlas is expected to start in fall 2010.	See attached status report.
	Ecological Atlas and LIDAR Imagery ~~*Reduce the Extent of Invasive Vegetation*~~	See above.	See above.	See above.
	Ecological Atlas and LIDAR Imagery ~~*Determine RTE Restoration Priorities and Targets*~~	See above.	See above.	See above.
	Continue Beach Clean Up Efforts	DEP sponsored clean-ups and plantings; extend trash collection beyond Labor Day.	Ongoing.	No change.

3. STORMWATER MANAGEMENT THROUGH SOUND LAND USE

On-Site BMPs for New and Existing Development				
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Pilot and Demonstration Projects	*Green Roof / Blue Roof Pilot*	Design, construct and monitor the effectiveness of a blue roof vs. green roof on the same existing building.	Construction completed in August 2010. Monitoring equipment is currently being installed to commence 3-year monitoring period.	See attached status report.
	Rain Barrel Giveaway Program	Distribute 1,000 rain barrels to homeowners.	1,000 rain barrels distributed to homeowners in 2008 and 2009. Pilot completed.	See attached status report.
	Parking Lot Pilots	Install and monitor pervious pavement applications on two DOT municipal parking lots.	Design for one facility is complete; construction is scheduled for fall 2010. Design for second facility is nearly complete and construction is anticipated for spring 2011.	See attached status report.
	Bronx River Houses Stormwater Pilots	Retrofit an existing NYCHA property with stormwater infiltration and detention source controls.	Preliminary designs complete. Construction anticipated to start in October 2010.	See attached status report. While not in the Jamaica Bay Watershed, the technologies being tested can be applicable to other housing facilities.
	Evaluate Rooftop Detention	Promote rooftop detention for new construction and assess practicality for existing large rooftops.	Design and construction underway for three different blue roof pilots on existing buildings. Rooftop detention brochure completed in fall 2009.	See attached status report.
	Porous Pavement on DEP Property	Install and monitor pervious pavement on DEP facility parking lots and other areas.	Porous pavement materials were installed at Paerdegat Basin CSO Detention Facility in 2010 and at English Kills Aeration Facility Spring 2009. Monitoring for maintenance activities at installations is ongoing.	
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Economic Incentives	*Stormwater Rate Structure Study*	Evaluate alternative water, sewer and stormwater rate structures.	Two-year Rate Structure Study completed in June 2009. Parking Facility Pilot to be implemented in January 2011.	See attached status report.
	Incentive Programs	Being investigated under the Mayor's Interagency Task Force.	Green Roof Tax Abatement was approved by the State legislature and implemented as law on August 5, 2008. It is scheduled to sunset on March 15, 2013. OLTPS and DEP exploration of additional incentive programs is ongoing.	
	Cost Sharing Programs	Develop potential framework for design/build services incentive program.	Ongoing.	The State and City have implemented a green infrastructure grant program in other areas of the City. Dependent on program results, a similar program may be implemented in the Jamaica Bay or other watersheds.

	Water Conservation Program	60 MGD savings through low flow fixture rebates and cost sharing.	Water conservation or reduced flow strategies are expected to require little incremental expenditure as water consumption and wastewater flows have been on the decline in recent years. The combination of AMR, the ability of customers to track water usage, and national water efficient fixture standards is expected to keep flows stable. Should flows begin to increase over the next 20 years beyond levels modeled here, DEP is prepared to implement additional conservation measures, such as toilet and other fixture rebate programs.	
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Regulatory and Design Changes	*Zoning Code Parking Lot Design Requirements*	Add landscaping and bioretention components to commercial and community facility parking lots over 6,000 sf or 18 spaces. Parking lot amendment adopted on November 28, 2007.	NA	Completed.
	Code Review	Review sewer code and make recommendations for potential revisions to facilitate BMP installation.	Task force formed in March 2008. Draft language for new stormwater performance standard was developed. Stakeholder outreach began in fall 2010 and the rulemaking process is expected to be initiated in winter 2010/2011.	
	Guidelines for the Design and Construction of Approvable Stormwater Management Systems	Create companion guidance document to sewer code revisions specific to NYC conditions.	Ongoing; to be completed and distributed with the promulgation of DEP's stormwater performance standard.	See attached status report.
	CEQR Technical Manual Revision	Revise CEQR Technical Manual to include a specific section to address proposed developments in Jamaica Bay.	Completed and released to public in May 2010.	The updated *CEQR Technical Manual* includes several new requirements for the tracking of proposed projects in the Jamaica Bay watershed through a standardized form and improved assessments of proposed projects' potential impacts on natural resources and water and sewer infrastructure. The Jamaica Bay Watershed Protection Plan form can be found in the Natural Rescources section of the *CEQR Technical Manual.* The complete updated Technical Manual, including the additions described above, is available for downloading at: http://www.nyc.gov/oec.
	Monitor Benefits of BMP Implementation	Develop indicators to track effects of BMP installations throughout the City over time.	Tracking of BMP implementation is ongoing and a database for data collection is currently being developed. All DEP BMP pilot projects will be monitored upon construction completion for a period of two-three years.	Monitoring protocols are currently being developed for DEP BMP pilots and instrumentation is being installed for BMP pilots within Jamaica Bay watershed, i.e., green/blue roof pilot study, streetside swales and enhanced tree pits.

	Zoning Code Pervious Surfaces Requirements	Potential front yard pervious requirements in R1-R5 zoning districts. Yards text amendment adopted on April 30, 2008.	NA	Completed.
Off-Site BMPs on Streets, Sidewalks, Highway Right-of-Ways, and Vacant Lands				
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Pilot and Demonstration Projects	*NYCDOT Belt Parkway Bridges Demonstration Project*	Roadway improvement project with stormwater treatment and attenuation from section of Belt Parkway.	Design completed in 2008 and reconstruction of parkway began in 2010. BMPs to be constructed after roadway construction is complete. Construction completion is expected in 2015.	
	Streetside Swale/Tree Pit Pilots ~~*Streetside Infiltration Swales Pilot Study*~~	Design and installation of 40'x 5' swales and 20' x 5' enhanced tree pits to capture, treat and monitor stormwater runoff from public right of way.	Swales and enhanced tree pits were constructed in summer 2010 and monitoring equipment is currently being installed.	See attached status report.
	Streetside Swale/Tree Pit Pilots ~~*Tree Pit Pilot Study*~~	See above.	See above.	
	North and South Conduit Stormwater Pilot	Use of an existing large highway median to maximize stormwater capture, subsurface infiltration and storage through ecologically-based soil manipulations and vegetative plantings.	Design complete; construction anticipated to start in November 2010.	See attached status report.
	Parking Lot Pilots ~~*Streetside Infiltration Swales Pilot Study*~~	See *Parking Lot Pilots* .	See *Parking Lot Pilots* .	
	Identify Opportunities for Green Infrastructure ~~*Vacant Parcels Pilot Study*~~	See *Identify Opportunties for Green Infrastructure.*	See *Identify Opportunties for Green Infrastructure.*	
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Regulat-ory	*Zoning Code Review - Street Trees*	Potential requirement for new developments/enlargements to provide street trees.	NA	Completed.
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Open Space and Greening Projects	*PlaNYC Street Tree Planting*	Street tree planting throughout the City including Jamaica Bay watershed.	Ongoing	Since October 9, 2007, the MillionTreesNYC initiative has planted an astounding 378,941 trees.
	PlaNYC Greenstreets Initiative	Ongoing.	DPR built 35 new Greenstreets in the Jamaica Bay Watershed between fall 2008 and spring 2010.	8 additional Greenstreets are planned for construction in the Jamaica Bay watershed.
	East New York Community Forestry Management Plan	Increase street tree stocking level in East New York.	Ongoing	Since publishing the Greening East New York report in June 2007, DPR has planted 2,218 trees in the neighborhood and sponsored at least four tree stewardship workshops. 658 additional trees are expected to be planted in fall 2010.
	Baisley Pond Park Project	Using stormwater BMPs, storm sewers will route stormwater into Baisley Pond.	Currently in design. Construction expected to begin in FY 12.	
	Springfield Park Project	Using stormwater BMPs, storm sewers will route stormwater into Springfield Lake.	Currently in design. Construction expected to begin in 2011.	Project will direct stormwater through a system of BMPs and open water in Springfield and Idlewild Parks before discharging into Jamaica Bay. This will be the first project built in Queens designed to reflect the success of the Staten Island Bluebelt Program.

4. PUBLIC EDUCATION AND OUTREACH

Public Education and Outreach				
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Public Awareness	*Enhance Jamaica Bay-related Educational Curriculum*	Educational Resource Directory	Completed in fall 2010 for posting on DEP's website.	
	Organize "State of the Bay" Scientific Symposium	Coordinate/guide scientific investigations and report scientific findings, and inform JBWPP Updates.	First symposium was held on June 27, 2008. Second symposium was held on October 28-29, 2008. The third symposium will be scheduled for 2011.	Discussions about preliminary logistics have been initiated with HEP and USACE.
	Create a targeted campaign for developers, residents, and business owners to protect Jamaica Bay	Brochure on importance of the Bay, human activities in watershed, and pollutant reducing practices.	Brochure completed in 2007 and distributed at Jamaica Bay symposiums.	

5. PUBLIC USE AND ENJOYMENT

Public Use and Enjoyment				
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Public Access	*Rockaway /Gateway Greenway*	Establish an approximately 20-mile continuous greenway loop around the Bay.	The Shore Parkway Greenway is complete to 84th Street.	Federal grant in place for future buildout. DPR and New York State DOT continue to coordinate on ROW plans and designs.
	Laurelton and Cross Island Parkway Greenways	DOT and DPR to establish a 22-mile path through parkland; linking parks between Brooklyn/Queens Greenway and Jamaica Bay waterfront.	NA	No change.
	Southern Parkway Path and Conduit Boulevard	DOT to establish a greenway to connect Brooklyn/Queens Greenway system to Jamaica Bay waterfront.	NA	No change.
	Far Rockaway North Shore Greenway	Establish a greenway to connect Far Rockaway with Rockaway Gateway Greenway	NA	No change.
	Floyd Bennett Field/Gateway National Recreation Area	NPS capital project improvements within Gateway National Recreation Area.	Public meetings held on September 21, 2010 and September 27, 2010.	Senator Charles Schumer and Congressman Anthony Weiner formed a Blue Ribbon Panel to provide recommendations on possible improvements to Floyd Bennett Field.
	Brooklyn/Queens Greenway -Eastern Parkway Extension	Greenway improvement including landscaping, multi-use paths, bike racks, pedestrian ramps, traffic signals, etc.	DOT/DDC construction start date scheduled for September 2010.	

6. IMPLEMENTATION AND COORDINATION

Implementation and Coordination				
	Implementation Strategy	**Description**	**Updated Schedule**	**Status/Comment**
Plan Implementation	*Jamaica Bay Ecological Improvement Projects* ~~*Jamaica Bay Water Quality and Ecological Restoration Steering Committee*~~	Improve the overall ecology of Jamaica Bay by restoring or enhancing existing natural areas and champion need for additional projects and funding.	Ongoing.	See attached status report.
	Jamaica Bay Ecological Improvement Projects ~~*Support Army Corps ecological restoration projects*~~	See above.	See above.	CRP was created collaboratively by scientists, professionals, government agencies, nonprofit organizations, academic institutions, and environmental advocates to protect and preserve habitats that still exist and restore habitats that have been lost (HEP, 2010). On July 26, 2010, Secretary of Interior Kenneth L. Salazar lead a summit to explore how the DOI can advance the conservation agenda for urban national parks, in particular within Jamaica Bay, through the adoption of the HRE.
	BMP Implementation through Mayor's Office Interagency BMP Task Force	Mayor's BMP Task Force to coordinate BMP implementation strategies.	Ongoing	
	Education Steering Committee	Continue committee's efforts to implement education and outreach strategies.	Education Steering Committee met again between 2008-2010. The Committee provided the programmatic information and served as reviewers for the development of the Jamaica Bay Education Resource Directory.	
	Waterfront Planning	Cooperative effort between agencies and stakeholder groups to create a blueprint for the future of the City's waterfront.	DCPs Vision 2020 Comprehensive Waterfront Plan is expected to be completed by December 2010. EDC's Waterfront Action Agenda is anticipated to be completed by mid 2011.	See attached status report.
	Monitor and Review Changes to the Watershed	Track new development, BMP implementation, and overall growth in the watershed in coordination with other agencies.	Ongoing	

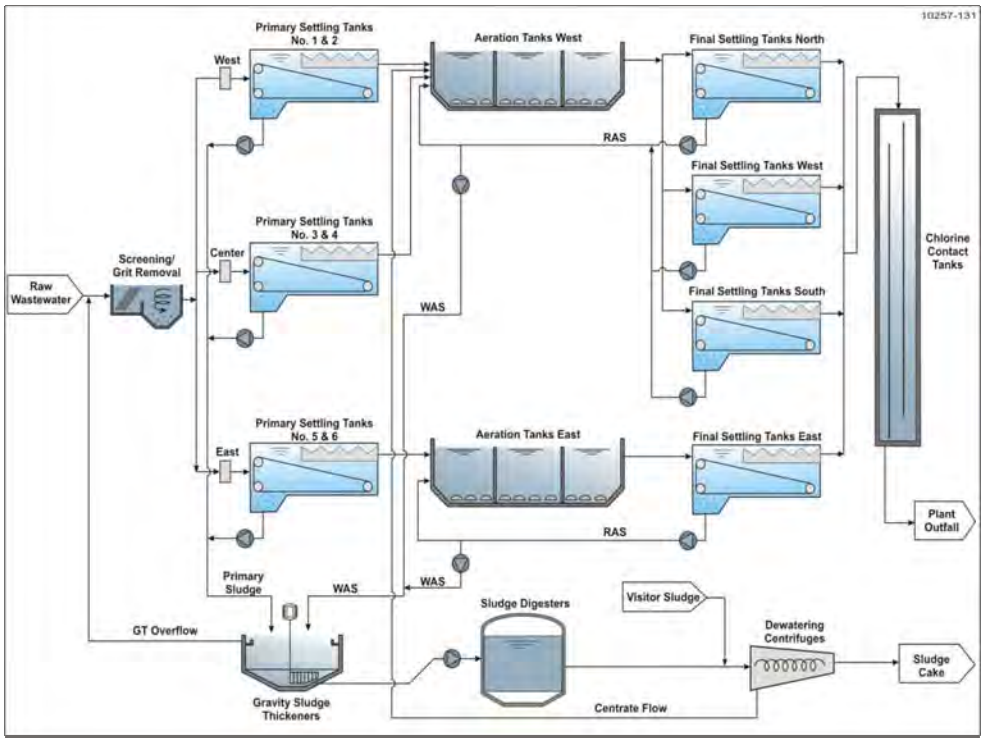
Jamaica Bay Wastewater Treatment Plant Upgrades

Description: Improve the overall ecology of Jamaica Bay by reducing nitrogen discharges from Jamaica Bay's Wastewater Treatment Plants.

Schedule: Ongoing through 2020.

Estimated Cost: $100M

In February 2010, the New York City Department of Environmental Protection (DEP) announced that the City will dedicate $100 million to installing new nitrogen control technologies at wastewater treatment plants located on Jamaica Bay. These investments, made in concert with $95 million the City already has committed for nitrogen control upgrades, will reduce the nitrogen loads discharged into Jamaica Bay by nearly 50 percent over the next ten years.



Conceptual diagram of WWTP treatment process

In June 2010, DEP launched the first phase of enhanced treatment measures to reduce the amount of nitrogen being discharged into Jamaica Bay. This was the installation of a biological nitrogen removal (BNR) technology at the 26th Ward Wastewater Treatment Plant (WWTP) that will reduce nitrogen discharges by more than 4,000 pounds per day, or 10% of the total nitrogen

discharges from treatment plants into the bay. DEP has also started an enhanced water quality testing program in Jamaica Bay, increasing the number of sampling sites there by 50% – from 13 to 20 locations, including combined sewer overflow (CSO) post construction monitoring in select tributaries.

High levels of nitrogen can lead to reduced levels of dissolved oxygen in waterways and excessive algae growth, especially in warm weather months. Currently, the 240 million gallons of daily wastewater handled by the four wastewater treatment plants on Jamaica Bay result in the discharge of approximately 40,000 pounds of nitrogen each day. The Rockaway Peninsula and other anthropogenic constrictions prevent the circulation of oxygenated water with the ocean, which exacerbates nitrogen impacts in the bay. DEP's wastewater treatment plants were not originally designed to remove nitrogen, a naturally-occurring component of all wastewater. The project at 26th Ward includes upgrades that will address this issue by retrofitting existing equipment to increase the treatment capacity of the existing infrastructure, which facilitates the underlying biological reactions that remove nitrogen from wastewater via the activated sludge process. An innovative technology, called the Ammonia Recovery Process, is now being designed, which will further reduce nitrogen discharges from the 26th Ward WWTP by 3,000 pounds per day by December 2014.

In addition, DEP is making additional water quality improvements by pursuing the proposal of Jamaica Bay for designation as a "No Discharge Zone (NDZ)." Such a designation would provide significant protection for the bay from the release of sewage from boat toilets and holding tanks. This would further reduce the amount of nitrogen and other pollution that negatively impacts the area’s wetland habitat.

Environmental Protection

Sea Lettuce Harvesting Pilot

Description: DEP skimmer boats used to harvest sea lettuce where it amasses in the waters of Jamaica Bay to determine if this approach is feasible and to chemically analyze sea lettuce for its use as biofuel.

Schedule: Harvests completed in August and September 2010. Testing of sea lettuce for its use as biofuel is ongoing and results are expected in late 2010.

Estimated Cost: $387K

Excess nutrients help feed growing masses of algae. In non-eutrophic estuaries, algae attached to the shoreline provides beneficial habitat for juvenile crabs and fish. However, with an excess of nutrients, algae rapidly multiply and potentially create mats on the bottom of the bay that restrict healthy benthic communities. When the algae dies, the nutrients consumed are released back into the water and microorganisms feeding on the dead algae use up the oxygen in the water. The resulting eutrophication creates oxygen depleted zones and can impair populations of fish, crabs, and other species. In addition, this buildup of algae becomes an environmental concern when the thick algal mats detach and accumulate along shorelines.

The primary algae of concern in Jamaica Bay is sea lettuce (Ulva lactuca). Harvesting the detached mats of sea lettuce in the shallow waters of Jamaica Bay may alleviate stress to invertebrate and fish populations, especially during mid-summer when oxygen depletion is most likely.

DEP skimmer boat removing sea lettuce from the Bay

DEP is undertaking a pilot study to demonstrate the effectiveness of sea lettuce harvesting on improving water quality and environmental conditions in selected areas of Jamaica Bay. The pilot project will also provide information towards restoring habitat that is currently degraded with dense mats of detached sea lettuce. This pilot project will form the foundation for future macroalgae removal projects that could ultimately benefit a variety of associated marine species. In addition to the improved aquatic conditions, the harvested algae is also being evaluated for its potential use as a biofuel.

DEP characterized potential pilot study sites during the summers of 2009 and 2010 based on site location, recent history of algae accumulation, hydrology, sediment, bathymetric surveys and aquatic organism communities. DEP has also tested their skimmer boats and found them to be effective at skimming sea lettuce. In 90 minutes, the DEP skimmer boat collected approximately 2.5 cubic yards of sea lettuce, a collection rate of nearly 1.67 cubic yards per hour.

In tandem with the sea lettuce reconnaissance studies that have occurred through the summer of 2010, sea lettuce has been manually harvested and sent to various university laboratories for processing of biofuel. To date, approximately 100 gallons of wet sea lettuce has been sent to the University of Arkansas for processing into biofuel. A sample liter of biofuel, all from sea lettuce gathered from Jamaica Bay, is expected to be obtained in the fall of 2010.

Monitoring at the pilot sites will be conducted for a minimum of one year. DEP will also coordinate with other macroalgae removal programs within the NY Harbor area as well as other areas along the east coast to compare results and learn from others' experiences.

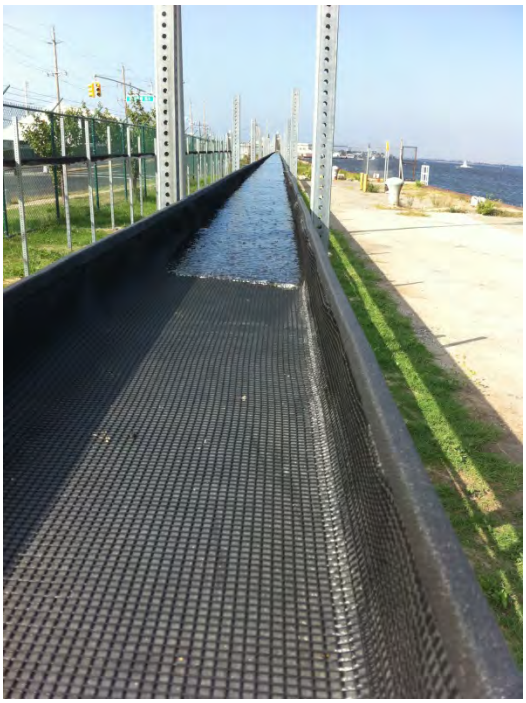
Algal Turf Scrubbers Pilot

Description: An Algal Turf Scrubber (ATS) was constructed at the Rockaway WWTP. This technology will use algae to filter WWTP effluent for nutrient removal and as a source for biofuel.

Schedule: Construction complete in September 2010.

Estimated Cost: $387K

In September 2010, DEP completed construction of an Algal Turf Scrubber (ATS) pilot study. The system uses wild algae to filter nutrients from a small portion of the Rockaway WWTP effluent flow (~3,600 gallons per hour) and provide a source of feedstock for biofuel production.



Algal turf scrubber floway during initial run

Algal turf scrubbers are unique wastewater treatment technologies that harness the natural abilities of algae, bacteria, and phytoplankton to remove a variety of pollutants from water. The ATS is a patented water treatment technology developed by Dr. Walter Adey and held by the Smithsonian Institution.

The ATS mimics a stream ecosystem in a constructed environment designed to promote algal growth. It consists of an inclined floway - a long, slightly sloped, shallow trough made of waterproof materials and raised on a support frame - and a screen liner. Wastewater effluent is pumped into the floway in regular pulses and algae uptakes pollutants from water pumped through the floway.

Algal turf scrubber floway at Rockaway

Periodic harvesting of the algal turf removes nutrients and pollutants from the system while stimulating continued algal growth and dramatically increasing algal uptake efficiencies (Adey and Loveland, 1991). The algae harvested from the ATS can be reused as a source of biofuel. The additional use of the algae as a beneficial by-product makes the treatment of wastewater with ATS

potentially cost-efficient. If current efforts to utilize algae oils for biofuel production prove effective, large volumes of algae produced from the ATS could potentially fuel vehicles used within the WWTP facility.

To offset some of the energy requirements of the system, DEP is evaluating the potential for using hydropower generated from the Rockaway WWTP. In addition, WWTPs have utilized the methane produced from anaerobic digestion to augment power and heating at the plant. If this option is found to be viable, heating and lighting of the ATS system from this energy source would increase nitrogen uptake and removal rates, especially during the non-summer seasons, but would require the construction of enclosed greenhouses.

To date, land availability is the primary limiting factor to consider when evaluating the treatment potential of ATS at WWTPs with large discharges. However, the pilot ATS at the Rockaway WWTP will continue to evaluate the ability of algal turf scrubbers to assist in the removal of nitrogen and other pollutants.

Oyster Bed Pilot

Description: A small oyster bed and a field of reef balls will be placed within Jamaica Bay to evaluate oyster growth, survival, reproduction, water quality and ecological benefits given existing environmental conditions in the bay.

Schedule: Construction in October 2010.

Estimated Cost: $600K

Mock-up of the oyster bed that will be placed below water at Dubos Point.

DEP is undertaking two oyster bed reintroduction pilot studies within Jamaica Bay – the design and implementation of an oyster bed off of Dubos Point, Queens, and the placement of oyster reef balls in Gerritsen Creek, Brooklyn. The oyster study will evaluate whether climatic and environmental conditions within the bay are suitable for oyster growth and reproduction. The study will also measure how effective these bivalves are at filtering various pollutants affecting the bay such as nitrogen, other nutrients, and particulate organic matter. If the pilot is successful, the oysters could not only help regenerate the natural environment of the bay, but also provide additional water quality benefits.

In June 2009, DEP convened an oyster workshop that brought together local scientists working on oyster restoration issues. In August 2009, DEP participated in a workshop developed by the Hudson River Foundation that brought together Federal and State regulators and oyster experts from the east coast to discuss restoration efforts and permit implications. Using information and recommendations generated by these workshops, DEP has been working closely with the Suffolk County Cornell Cooperative Extension (CCE) Service to implant oyster larvae (spat) on New York State Department of Environmental Conservation (DEC)

Oyster spat successfully set on bagged surf clam shell

approved shell and reef balls. The spat on shell and reef balls are being maintained in appropriate environments at CCE's facilities until expected deployment within the bay in October 2010.

To date, DEP has secured all State and Federal regulatory approvals for the pilots. The two pilot projects will be placed in Jamaica Bay and monitored on a weekly basis during the warmer months to determine oyster survival rates, recruitment potential, and water quality and ecological benefits. During cooler months, the frequency of monitoring will be adjusted accordingly. Monitoring parameters will include the health of the oysters, ambient water quality, sediment and current patterns.

Oyster reefs once thrived in Jamaica Bay, forming an important type of habitat for many species and filtering water in the bay. The findings generated throughout this study will inform future attempts to restore oyster habitat in the bay. DEP will continue to coordinate with other organizations and researchers undertaking similar efforts in the New York/New Jersey Harbor Estuary to help form a foundation for future oyster habitat development projects, ultimately benefiting a variety of associated marine species.

Eel Grass (*Zostera marina*) Pilot

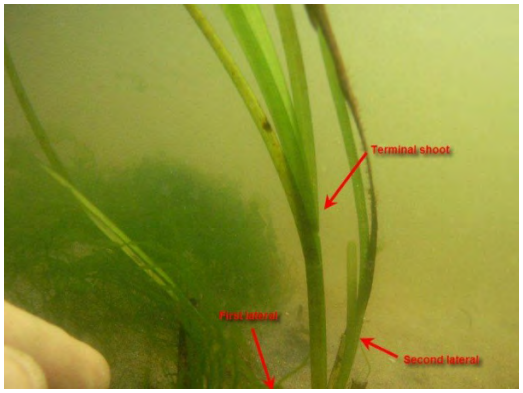
Description: Limited plantings of eelgrass established and monitored around the bay to evaluate the potential to restore eelgrass in the region.

Schedule: Initial planting April 2009 and 2010. Additional plantings planned for fall 2010 and potentially fall 2011.

Estimated Cost: $350K

Sea grass accumulation on eelgrass

Submerged aquatic vegetation (SAV) beds are important for a number of fish and shellfish species. For this reason, various planning and scoping documents developed for the Hudson Raritan Estuary, including the Jamaica Bay Watershed Protection Plan (JBWPP), call for determining the potential of restoring SAV such as eelgrass in the region.



Eelgrass plant structure including stem, leaves and roots

To better understand how to restore eelgrass within Jamaica Bay, CCE of Suffolk County, in cooperation with DEP, conducted a test planting of eelgrass at three sites in the spring of 2009. These initial plantings near Floyd Bennett Field, Little Egg wetland and the Breezy Point Yacht Club were conducted to better refine site selection parameters and planting methodology since historically there has never been an attempt to restore eelgrass in Jamaica Bay. Additional objectives of the pilot were to determine appropriate planting depths, timing of plantings and propagule (seed vs. adult shoot) selection.

Relative size of young eelgrass

Although this initial planting of approximately 2,500 plants did not result in the sustainable establishment of eelgrass in Jamaica Bay, it did provide additional insight about the limiting factors for planting and restoration success. Building on these results, the second phase of planting was undertaken in spring 2010. This planting included approximately 1,000 plants at three sites in the waters off of Breezy Point Tip, Breezy Point Yacht Club and Dubos Point, all located north of the Rockaway Peninsula in Queens. After the eelgrass was planted in May 2010,

the sites were monitored on a weekly basis to determine the health of the eelgrass, the ambient water conditions (light and temperature included), and any potential disturbances from predators, boat traffic, or sedimentation. Enclosures are being used on a few of the plots to determine if the predator disturbances could be overcome to restore eelgrass in the area.

As with the spring 2009 plantings, the spring plantings did not result in establishing a sustainable plot of eelgrass, and the causes for this are currently being investigated. It was determined that the Breezy Point Tip area exhibited the most favorable conditions for eelgrass viability, and will be the focus of the fall 2010 planting. In this phase of the pilot study, the project will be scaled up to include potentially 3,000 more eelgrass plants. Again, the sites will be continuously monitored, and if successful, a larger-scale planting is scheduled to occur in the fall of 2011. The pilot project has provided DEP a continuous learning opportunity not just about eelgrass but about the overall conditions within the bay.

Ribbed Mussel Pilot

Description: Several artificial structures will be constructed to encourage the growth of ribbed mussels within one of the tributaries of Jamaica Bay. The study will monitor mussel growth to measure the effectiveness of ribbed mussels in removing nutrients and particulate organic matter from the water.

Schedule: Construction anticipated to start in March 2011.

Estimated Cost: $360K

Mussels have the potential to remove nutrients and other pollutants from the water column. The filtering capacity of mussels is well known, but it is unclear if that capacity could be adapted to the practical application of filtering discharges to Jamaica Bay to improve water quality.

Ribbed mussels

Ribbed mussels are very abundant in some locations. Thus, they are a local species that can tolerate existing water quality conditions in Jamaica Bay. They also are desirable in that they are not sought after by humans for food which minimizes the attractive nuisance potential.

DEP is undertaking a pilot study to evaluate the effectiveness of ribbed mussels to filter nutrients and other pollutants from the water column. A challenge in developing and implementing this pilot study is creating the correct physical conditions near discharge points which will support a large enough concentration of mussels to carry out effective filtration. Removal of a significant percentage of the nutrients and organic particulate matter from CSO and stormwater discharges could improve water quality in Jamaica Bay, particularly in combination with other actions to reduce nutrient levels and improve habitat conditions for aquatic life. This pilot study will provide baseline information on the practicality of this concept and help identify next steps to advance this approach.

To advance the mussel pilot project, DEP held a workshop in January 2010, inviting mussel researchers and restoration practitioners to discuss potential alternatives for Jamaica Bay. Participants in the workshop discussed site selection, monitoring, and water quality effects. The knowledge and advice

from the team of technical advisors was considered during the development DEP's pilot project.

Based on the discussions held at the workshop and field reconnaissance, DEP selected Fresh Creek as a pilot site. Fresh Creek has several suitable characteristics for the study including a CSO discharge and a number of stormwater outfalls, but is free of other obvious potential pollution sources. The Creek currently supports ribbed mussels and there is a wetland edge over most of its length. In addition, the Creek has little boating activity so that structures placed in the water will have little interaction with navigation vessels. Based on a more site-specific field reconnaissance in March 2010, a section near the middle of Fresh Creek was selected due to its narrow channel which concentrates tidal flows in the pilot project area. This location will enhance the chances of detecting water quality differences across the array of artificial substrates.

A permit application for this pilot was submitted for regulatory approval in August 2010, and a spring 2011 construction of the pilot project is anticipated.

Environmental Protection

Marsh Island Wave Attenuator Study

Description: A wave attenuator pilot study will be developed and implemented around a section of a salt marsh island in Jamaica Bay. This study will determine if the attenuator would be a cost-effective method to slow the rate of wetland loss and accrete marsh building sediments.

Initial Schedule: Construction and deployment expected spring 2011.

Estimated Cost: $576K

Two wave attenuator pilot study sites in Jamaica Bay

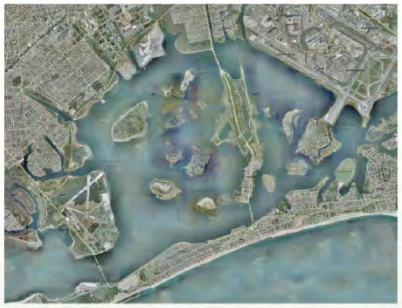
A wave attenuator is an anchored island of floating materials offshore of a wetland or shoreline which deflects and reduces the energy of waves.

This pilot study will evaluate the potential of for wave attenuation on a section of a salt marsh island to investigate the rate of wetland loss and accretion of beneficial marsh building sediments. These temporary structures are a "proxy" for future oyster beds around wetland islands to evaluate wave energy reduction potential. There are no plans to use these structures other than for their use as a proxy for oyster beds.

DEP identified seven potential sites with wetland loss and low marsh accretion within Jamaica Bay. Two sites - Elders West Marsh Island (newly restored) and East High Island - were identified as the highest priority sites. Both wave attenuator sites are located within the Gateway National Recreation Area (GNRA) DEP is working with local and regional NPS representatives to gain acceptance and approval for these temporary pilots in advance of construction and deployment planned for spring 2011.

Two types of wave attenuators - a floating island and a timber wave break - were selected for the pilot sites based on an exhaustive study of available technologies. The technologies had to meet specific criteria related to: sufficient water depth, dominant wind direction, reflective effects and impact on bottom habitat conditions. Several key parameters determined the design of the wave attenuators. These site specific considerations included: water elevation, storm data, wave action, water depth, and soil conditions. DEP determined the placement, sizing and anchoring of the attenuators using modeling, field characterization and research on historical weather patterns.

Paerdegat Basin Restoration



Description: Improve water quality, create Ecology Park and restore Jamaica Bay wetlands and adjacent upland habitat.

Schedule: Currently under construction; completion expected January 2012.

Estimated Construction Cost: $15M

In January 2010, DEP announced the registration of a $15 million American Resource and Recovery Act (ARRA) funded contract to restore 38 acres of wetlands and coastal grasslands adjacent to the Paerdegat Basin CSO Facility located entirely within Paerdegat Basin, a tributary of Jamaica Bay. This investment will greatly improve the ecology of the Paerdegat Basin area and, when finished, will enable the community to enjoy a five-acre 'Ecology Park' surrounded by native plant and animal life. The combination of absorbing more stormwater and the creation of tidal wetlands will improve water quality in Paedergat Basin. This is just one part of DEP's larger commitment to improve water quality and ecology throughout Jamaica Bay.

Paerdegat Basin CSO Facility taken from Belt Parkway Bridge

The "Ecology Park," will offer access to salt marsh intertidal mudflats, grassland, shrublands and include educational exhibits about coastal habitats. Construction began in spring 2010 and is expected to be completed in January 2012. The project is funded through Clean Water State Revolving Funds — a program administered by the New York State Environmental Facilities Corporation and authorized under ARRA.

The restoration will complement the $357 million capital investment that DEP is making in building the Paerdegat Basin CSO abatement project, which will store 50 million gallons of CSOs during storms. When stormwater surges into sewers it can trigger CSOs when sewers and treatment plants reach capacity, which protects the sewer system and treatment plants by design. CSO tanks reduce this problem by storing flows until storms pass, allowing for release and treatment. The City continues to invest in major infrastructure projects that improve the wastewater treatment system and has budgeted $1.9 billion in capital improvements. The City is also taking steps to incorporate sustainable strategies that keep stormwater from reaching sewers in the first place.

Identify Opportunities for Green Infrastructure

Description: Identification of land uses such as the public right-of-way that present significant opportunities for stormwater source controls which would also shade and cool the City, improve air quality, increase property values and provide urban wildlife habitat.

Schedule: *NYC Green Infrastructure Plan* released to the public on September 28, 2010 and includes a 20-year implementation period.

On September 28, 2010, Mayor Bloomberg, Commissioner Holloway and Office of Long Term Planning and Sustainability (OLTPS) Director David Bragdon announced a comprehensive approach toward harbor water quality improvements that would replace the City's current CSO strategy with the *NYC Green Infrastructure Plan*. The *Plan* is expected to improve water quality, enhance conservation, create green neighborhoods, and reduce the costs required for grey infrastructure.

Green infrastructure utilizes vegetation, soils, and other structural elements to mimic natural hydrologic cycles by slowing down, absorbing and evaporating stormwater. The City's *Plan* combines effective, current technologies for green infrastructure with cost-effective grey infrastructure, system-wide optimization, reduced flows to WWTPs and adaptive management.

The *NYC Green Infrastructure Plan* builds on the *2008 Sustainable Stormwater Management Plan*, a component of PlaNYC that examined and identified immediate and long-term solutions to capture stormwater. The analysis and findings of that plan laid the foundation for the detailed sewer overflow reduction strategies that have now been designed for each distinct watershed drainage area. The *NYC Green Infrastructure Plan* identifies green infrastructure opportunities, strategies, and technologies specific to 12 watersheds Citywide including those tributary to Jamaica Bay. Specifically, the opportunities identified for capturing runoff from the City's impervious surfaces included: streets and sidewalks, multi-family residential complexes, commercial development parking lots and new development/redevelopment. The opportunity analysis was based on DEP's comprehensive review of land uses, impervious surfaces, development trends, planned road reconstruction projects, and other opportunities throughout the City.

The City already has more than 30 demonstration projects including the pilots described in this Update that have been built, are under construction, or are in design, to test the performance and costs of green infrastructure over time. A robust monitoring program will measure and analyze the effectiveness of each demonstration project, and allow the City to fine-tune the green infrastructure approach as it is scaled up to meet the goals of the *Plan*.

Ecological Atlas and Dynamic Reconnaissance Mapping of Wetlands

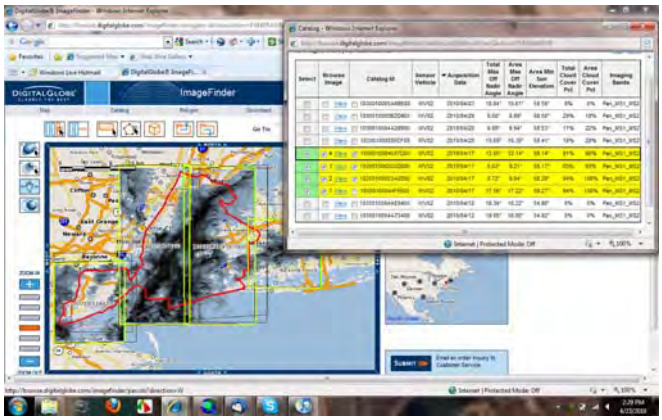
Description: Use existing sources of information along with newly captured satellite imagery to develop a GIS-based Jamaica Bay Watershed Ecological Atlas.

Schedule: Satellite wetland mapping began in spring 2010; development of the Ecological Atlas is expected to start in fall 2010.

Estimated Cost: $500K Ecological Atlas and $187K for Wetland Mapping

Ecological Atlas

Building on the completed JBWPP, DEP will develop a Jamaica Bay Watershed Ecological Atlas. Work will include inventory and field verification of all Jamaica Bay watershed habitat locations, GIS mapping and data compilation to use for project identification and tracking, and prioritization of identified restoration projects for all woodland, shrubland, grassland, dune and beach habitats in the watershed.

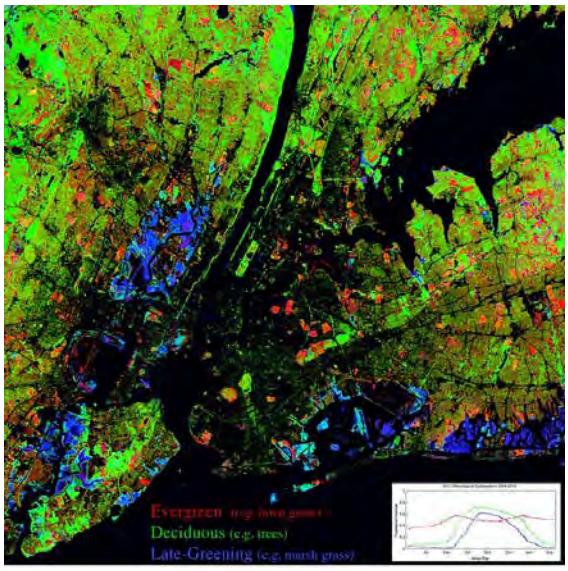


Screen shot illustrating GIS capabilities for data collection and mapping

Consistent with New York City's Waterfront Revitalization Plan (WRP), the Jamaica Bay Watershed Ecological Atlas project proposes to provide (1) a complete and updated inventory of all existing upland and wetland habitat locations; (2) a GIS mapping and information data layer that can be used by restoration practitioners to develop and leverage future ecological restoration designs; and (3) a prioritized list and map of potential sites for restoration and conservation.

The restoration and conservation actions enabled by this project will ultimately provide critical benefits for plant and animal species, and will be integrated with urban stormwater runoff management practices to benefit comprehensive ecological improvements for the Jamaica Bay watershed.

Wetland Mapping



Satellite infrared of vegetation in New York City

Traditional methods of mapping wetland extent by manual interpretation of air photos are labor intensive and result in a static product that is difficult to update. The increasing availability and diminishing cost of high resolution satellite imagery combined with deep archives of moderate resolution imagery collected since the early 1980s allows for an alternative approach to wetland mapping and monitoring. Decision tree classification systems, combined with multi-temporal satellite imagery and geographic positioning system (GPS)-enabled field observations, make it feasible for New York City to develop a Dynamic Reconnaissance Mapping (DRM) system. Decision tree classification allows wetland extent maps to be produced and updated continuously without the need for collection and manual interpretation of air photos. Combining current, relatively inexpensive, high resolution satellite imagery with archival imagery makes it possible to identify potential wetland areas on the basis of multiple factors such as topography, soil moisture, standing water and vegetation dynamics (Small 2010)

The process of mapping inevitably results in some distortion and loss of information. It is important to understand the limitations of any map before drawing conclusions from it. Mapping wetlands is challenging because of their complex and dynamic nature. Mapping wetlands using remotely sensed imagery is particularly challenging because some of the most important features of wetlands can be very difficult to identify. However, remotely sensed imagery does provide a valuable reconnaissance tool to help scientists and decision makers focus field validation.

The DRM is intended to demonstrate a process for iterative mapping. As such, it is not a definitive wetland map – although it has the potential to evolve into one. Like all maps, the DRM is subject to both *error of commission* (misidentification) and *error of omission* (missed identification). It is important to recognize the DRM as the first step in a process of iterative refinement. The intention is to develop the DRM as a tool for both scientists and decision makers to produce and utilize a dynamic map.

Green Roof / Blue Roof Pilot

Description: Design, construct and monitor the effectiveness of a blue roof versus a green roof on the same existing building.

Schedule: Construction completed in August 2010. Monitoring equipment is currently being installed to commence 3-year monitoring period.

Estimated Cost: $360K

DEP is undertaking a blue and green roof comparison pilot study in the Jamaica Bay watershed on an existing roof to allow for a direct comparison of design, installation, performance, maintenance and cost between two stormwater source controls. This comparative pilot study is being implemented under a settlement of an enforcement action taken by DEC for violations of New York State law and DEC regulations.

In partnership with the New York City Department of Education (DOE) and School Construction Authority (SCA), DEP selected PS118 Lorraine Hansberry School in Queens as the site for the rooftop pilot in August 2010 based on various evaluation criteria including: public ownership, available staging areas, sufficient loading bearing capacity on rooftop and no major leaks or plumbing issues.

Blue roof portion of rooftop at PS118 constructed with intermediate check dams to

In addition to the blue and green roof installations, a section of the roof will remain unmodified to serve as the control in the study. The blue, green and control roofs are each approximately 3,200 square feet in size. The green roof component is a conventional extensive installation that provides both retention and detention of stormwater. Water drains from the roof to existing drains at existing slopes. Design features include a root barrier to protect the membrane from root penetration, a drainage mat to facilitate flow of excess water in the soil to the roof drain, and a 4-inch depth growing media to support plants.

Green roof portion constructed with 4" of soil media and planted with a variety of native plants and sedums

The blue roof component regulates flow to the sewer system and provides temporary storage of stormwater. Design components include controlled flow roof

drains with an overflow to limit ponding at the drain to two inches, intermediate check dams to address roof slope and distribute ponding across the roof surface, and 1” gravel placed on the upgrade side of the dams to intercept debris, minimize clogging and reduce maintenance.

Construction included the replacement of the existing roofing systems as well the blue and green roof components. The duration of construction was 8 weeks.

Monitoring equipment will be installed to compare the stormwater management performance of green, blue, and control roofs for a period of three years. Parameters to be monitored include runoff rates from each roof drain to the sewer system, percent volume capture compared to drainage area, evapotranspiration rates, weather conditions, rooftop temperature affects, and maintenance requirements.

Rain Barrel Giveaway Program

Description: Distribute 1,000 rain barrels to homeowners.

Schedule: 250 rain barrels distributed in summer 2008 and 750 rain barrels distributed in summer 2009; pilot complete.

Estimated Cost: $100K

The Rain Barrel Giveaway pilot program involved the distribution of approximately 1,000 rain barrels to homeowners in the Jamaica Bay watershed. In spring 2008, DEP worked with local elected officials, community boards and church groups to reach out low-density residential neighborhoods and distributed 250 barrels to homeowners in Queens Community Boards 12 and 13. The second phase of the pilot program was initiated in spring 2009 and distributed an additional 750 barrels to homeowners.

Homeowners and DEP staff at a 2008 workshop

The goal of the pilot program was to gauge homeowners' interest in rain barrels and their willingness to install, maintain, and regularly use them.

Low-density residential neighborhoods were targeted for pilot participation because these areas typically contain the following characteristics suitable for rainwater harvesting: homeowners residing on property, gutters and external downspouts to fill rain barrels, physical space to place barrels and landscaping or gardens to irrigate with stored stormwater.

Rain barrel and diverter connected to a homeowner's roof leader

The performance of the rain barrel and the overall program was evaluated through a survey-based questionnaire distributed to all participants. Program satisfaction was high: 84% of survey respondents were likely to recommend a rain barrel to a friend or neighbor and 95% said they would reconnect their barrel in the spring. 80% said that the barrel satisfied at least half of their landscape watering needs.

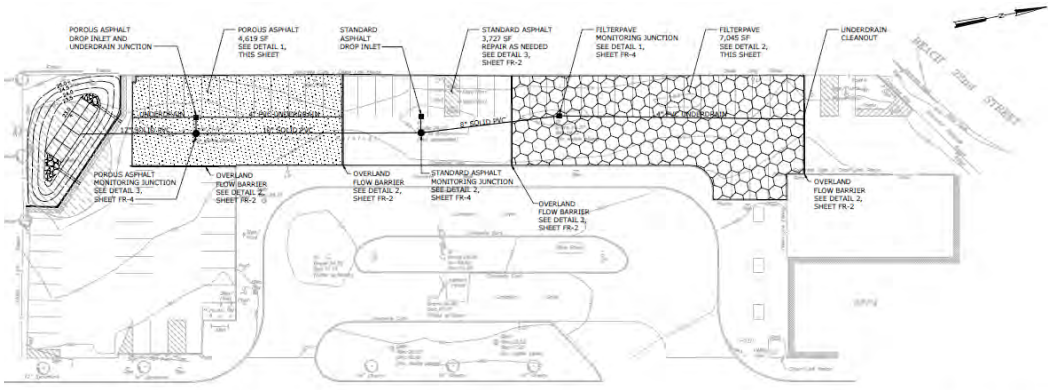
For more information, please visit the Rain Barrel Giveaway homepage on the DEP website: www.nyc.gov/dep.

Parking Lot Pilots

Description: Install and monitor pervious pavement applications on two DOT municipal parking lots.

Schedule: Design for one facility is complete; construction is scheduled for fall 2010. Design for second facility is nearly complete; construction is anticipated for spring 2011.

Porous pavement systems function by allowing rainfall to infiltrate through the pavement surface material while providing a subsurface gravel storage zone to encourage infiltration into the subsoil and attenuate outflow rates. DEP is collaborating with DOT to examine various stormwater capture treatment technologies for parking lots. The treatment technologies under design include the use of vegetated swales with enhanced subsurface stormwater storage, soil infiltration and various porous pavement materials at a park and ride facility in Far Rockaway, Queens and Canarsie, Brooklyn. The proposed porous pavement systems are expected to decrease runoff rates and volumes, as well as provide water quality improvements directly through sub-surface infiltration processes and indirectly through the reduction of flow to the sewer system.



Plan view of pervious pavement and vegetated swales to be installed at parking lot in Far Rockaway

The parking lot pilots will be monitored for a minimum of two years following construction. The purpose of monitoring is to analyze overall system functionality, quantify inflow and outflow rates and volumes, monitor seasonal freeze/thaw effects and document maintenance needs. The proposed sites are configured to allow for comparisons of up to three pavement systems. Upon completion of the pilot study, recommendations can be made regarding the suitability of porous pavement systems at other locations in New York City.

To gain a better understanding of treating parking lot stormwater runoff with vegetation, an additional pilot has been designed with the Metropolitan Transportation Authority (MTA) that will treat and absorb stormwater runoff from a New York City Transit Bus Depot parking lot through the use of a constructed wetland meadow. In addition to the infiltration, water quality

treatment and water-storage capacity of vegetated soil, we will also be monitoring evapotranspiration rates to determine the dissipation of water to the atmosphere.

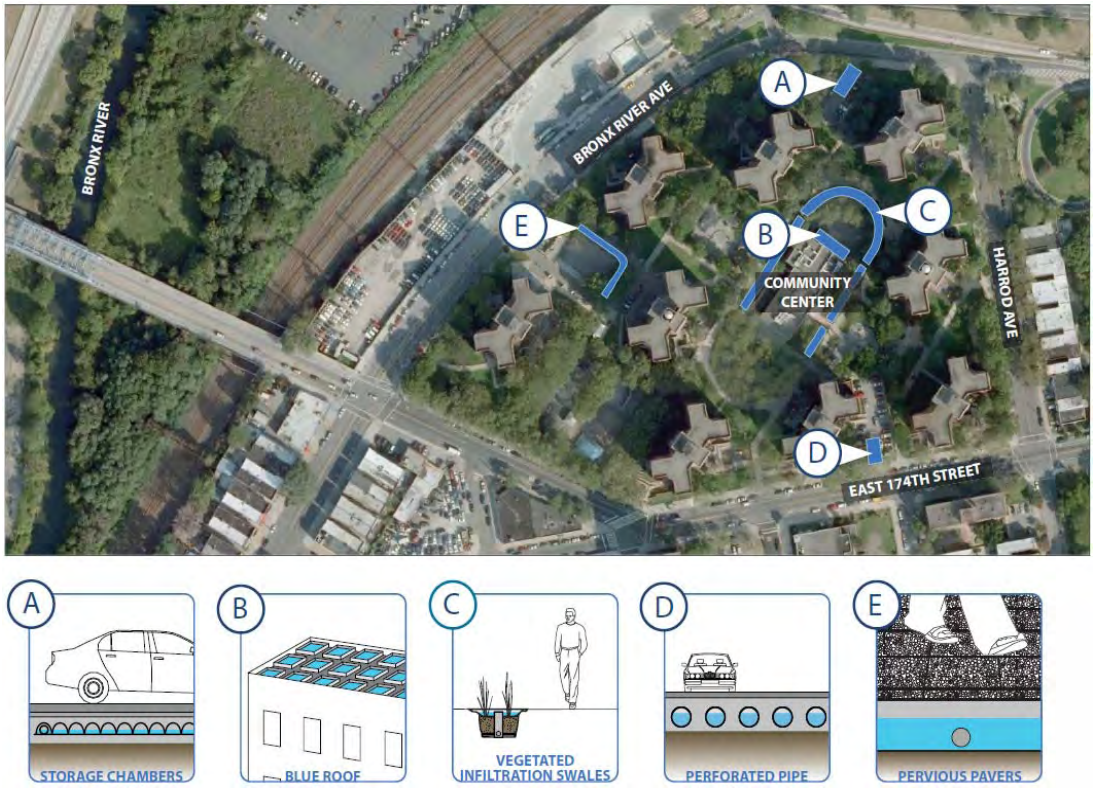
Bronx River Houses Stormwater Pilots

Description: Retrofit an existing New York City Housing Authority (NYCHA) property with stormwater infiltration and detention source controls.

Schedule: Design completed August 2010; construction start anticipated for October 2010

DEP is partnering with the NYCHA to pilot various stormwater retrofits at the Bronx River Houses (BRH) located at 1605 E 174th Street in the Bronx. Dependent on the monitoring results, other existing high-density residential complexes may be considered as opportunities for multiple stormwater source controls.

The proposed pilots will involve the retrofits of existing buildings, paved areas and parking lots to demonstrate the effectiveness of green infrastructure for slowing and reducing stormwater runoff that enters the combined sewer system. In addition, the pilots are being designed to provide water quality treatment of stormwater before it enters the sewer system, more pervious surfaces, site drainage improvements, and other ancillary benefits such as improved habitat and reductions in heat island affects.



Conceptual diagram of different stormwater source controls to be demonstrated at BRH

As part of this pilot, DEP and NYCHA are designing and constructing five types of stormwater source controls based on green infrastructure, as shown in the graphic above and described below.

The blue roof pilot consists of a modular tray system on top of the back roof of the Community Center. Each tray will include a layer of geotextile fabric that will regulate outflow to the existing roof drains. The bioretention pilots are directing runoff from sidewalks near the Community Center and routing the runoff into shallow vegetated basins designed with engineered soil to allow for quick infiltration. As part of the porous pavers retrofit, stormwater runoff from the basketball court and associated sidewalk will flow to the pavers installed around the basketball court and infiltrate through the pavers into the underlying soil. The subsurface stormwater retrofits include underground storage chambers as well as an underground perforated pipe system beneath two of the BRH parking lots.

BRH - due to the larger rooftops, grassed areas, parking lots and other paved areas onsite - was selected to allow for multiple types of source controls to be installed and the cumulative performance of source controls in a given area to be evaluated. The stormwater retrofit pilots will be monitored for a two-year period after construction is completed.

Evaluate Rooftop Detention

Description: Promote rooftop detention for new construction and assess practicality for existing large rooftops.

Schedule: Rooftop detention brochure completed in fall 2009. Contract awarded in May 2009 for design and construction of blue roof pilot project at a DEP facility; construction to begin in early October 2010.

Rooftop detention, or blue roofs, is a low-cost alternative for complying with New York City's stormwater detention requirements and slowing peak rates of urban runoff. A brochure describing rooftop detention benefits, design considerations and case studies was developed to promote blue roof installations among developers, architects, engineers and plumbers. DEP is also designing and constructing multiple blue roofs to evaluate stormwater performance when constructed on existing development.

DEP has also designed a blue roof pilot for a DEP storage facility located at 1201 Metropolitan Avenue in Brooklyn. The purpose of this pilot study is to develop and test different blue roof technologies to address existing roof conditions such as slope, size and number of drainage areas to each drain, space constraints due to existing rooftop equipment, and structural loading capacity, and detain maximum stormwater volumes that would otherwise runoff into the combined sewer system.

1201 Metropolitan Avenue has a 27,500 square foot roof and was chosen for the pilot because inspections indicated that the roof is suitable for water ponding, has no plumbing or leak issues and has a substantial existing slope (i.e., 2%) to evaluate the impact of slopes on rooftop storage capacity.

The first rooftop drainage area is about 5,300 square feet and will remain unmodified, functioning as the control roof for the pilot. The second drainage area, about 5,140 square feet, will be used to pilot controlled flow roof drains. The orifice will be sized to restrict the flow rate to the slowest release rate possible given the maximum ponding depth feasible for existing rooftop conditions. The third drainage area is about 5,950 square feet and will be used to assess intermediate check dams for detaining stormwater on sloped roofs. The fourth drainage area is about 10,500 square feet and will be equipped with a modular tray system to capture stormwater for slow release to the drainage system. A layer of geotextile will be placed beneath the trays to control the runoff rate.

Similar pilots are being constructed at Lorraine Hansberry School – PS118 in St. Albans, Queens and NYCHA's Bronx River Houses (see status reports for more information about these pilots). Monitoring results will be compared to other pilot results to determine the most appropriate stormwater technologies for implementation in watersheds Citywide including the Jamaica Bay watershed.

Stormwater Rate Structure Study

Description: Evaluate alternative water, sewer and stormwater rate structures.

Schedule: Study began in July 2008 and was be completed in December 2009. Sewer charge for stormwater for parking lots to be implemented in January 2011.

The Water Board completed a study in December 2009 that that evaluated expenditures, revenue sources, and alternative water, wastewater and stormwater rate structures. A primary goal of the study was to research possible structures that could be implemented in New York City to enhance revenue stability, equity for customers, and resource conservation.

One strategy resulting from the study is a Sewer Charge for Stormwater for Parking Lots. Parking lots are typically completely impervious and therefore, generate large amounts of stormwater. The charge would apply to parking lots that have no water service and therefore do not pay for wastewater services, yet are generating demands on the wastewater system. Parking lots will be charged an annual wastewater charge for stormwater of $0.05 per square foot of property area. A credit program will be in place when DEP implements this charge to incentivize approvable green infrastructure technologies. The charge is to be implemented in January 2011.

Guidelines for the Design and Construction of Approvable Stormwater Management Systems

Description: Create companion guidance document to sewer code revisions specific to New York City conditions.

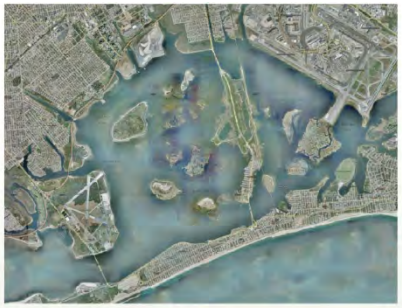
Schedule: Ongoing; to be completed and distributed with the promulgation of DEP's stormwater performance standard.

To assist New York City's development community and their engineering professionals, DEP is partnering with the New York City Department of Buildings (DOB) to develop guidelines for the design and construction of approvable stormwater source controls. The goal of the manual is to assist these groups in the design of several different onsite stormwater controls for new development and expansions of existing development. The guidelines will assist compliance with the City's building and sewer connection requirements, and are consistent with the water quality and stormwater management goals of PlaNYC 2030.

Specifically, the design guidelines provide general concepts for incorporating source controls into new development plans and expansions. The source controls detailed in the guidelines are considered "approvable systems" by DEP and DOB if such systems are developed according to the siting, sizing, construction and operation and maintenance guidance provided within the guidelines and submitted for DEP review as part of a developer's site connection application.

Sample diagram in draft guidelines illustrating potential subsurface configuration of a gravel bed under a parking lot

Streetside Swale/Enhanced Tree Pit Pilots



Description: Design and installation of 40'x 5' swales and 20' x 5' enhanced tree pits to capture, treat and monitor stormwater runoff from public right of way.

Schedule: Swales and enhanced tree pits were constructed in summer 2010 and currently installing monitoring equipment.

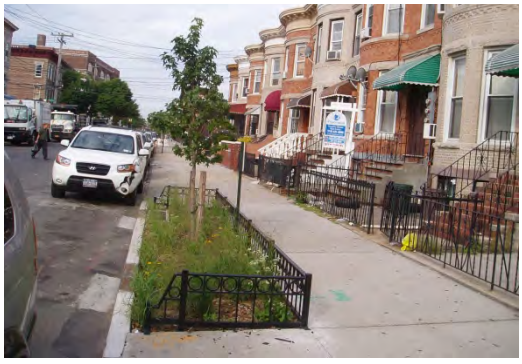
Construction Cost: $325K

Stormwater management source controls work by slowing down or absorbing rainfall before it can enter the sewers. Impervious surfaces do not allow water to infiltrate the ground or to be absorbed by plants, which are part of the natural hydrologic cycle. Rather, impervious surfaces shed water, which becomes runoff that eventually reaches the City's sewer system or is discharged directly to adjacent waterbodies.

Before installation of enhanced tree pit

In response to this problem, DEP is in the process of piloting green stormwater technologies, or green infrastructure, to capture and treat the runoff. Runoff from the street is diverted by curb cuts and routed into innovative source control green infrastructure sites that have specially engineered soils and native plant species to absorb water and filter pollutants.

The results of this pilot study will provide specific information about feasible inflow/outflow rates, water quality treatment potential and the overall cost-effectiveness of green infrastructure given New York City's climatic and environmental conditions. Once this information has been gathered, it will be used to develop effective green infrastructure designs and implementation strategies that can provide stormwater benefits as well as reductions of urban heat island effects, urban wildlife habitat and aesthetically pleasing neighborhood design.



After installation of enhanced tree pit

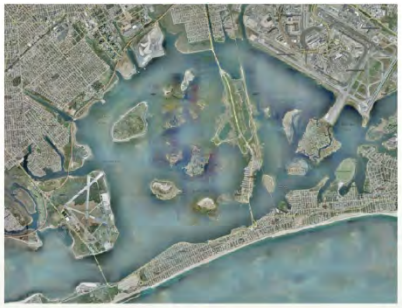
Site selection and design of a total of 5 enhanced tree pits with subsurface storage capability and 5 streetside infiltration swales within the Jamaica Bay watershed was completed in

December 2009. Construction began in late April 2010. The enhanced tree pits are 20' x 5' and contain additional subsurface storage capacity. Different subsurface storage technologies are being evaluated as part of the pilot including stormwater chambers, 2" crushed stone and 3/8" recycled crushed glass. Stormwater flow will be directed to each tree pit through a series of approved curb-cut inlets. In the event of heavy rainfall, the tree pits also have curb-cut outlets to relieve additional flow volumes.

The streetside swales are 40' x 5' and, in addition to infiltration, these green infrastructure installations also provide depression storage on the surface for increased stormwater capture volumes. Each system will be closely monitored for three years after installation and will collect data for stormwater mass balance measurements by monitoring stormwater flow inputs and outputs from each system. Infiltration and evapotranspiration are anticipated to serve as the primary stormwater treatment mechanisms.

These pilots are the first fully permitted green infrastructure installations in New York City. Anticipated maintenance activities will be similar to those of normal landscaped areas with some additional maintenance requirements to maintain infiltration rates. The project will look more closely at maintenance procedures, costs and will address agency concerns.

North and South Conduit Avenue Stormwater Pilot



Description: Use of an existing large highway median to maximize stormwater capture, subsurface infiltration and storage through ecologically-based soil manipulations and vegetative plantings.

Schedule: Design complete; construction anticipated to start in November 2010.

Estimated Construction Cost: $575K

The objective of the North and South Conduit Avenue stormwater pilot is to construct a stormwater source control within an existing roadway median, diverting drainage from surrounding impervious surfaces away from the existing drainage infrastructure into green infrastructure. The project is located between North and South Conduit Avenues, near the intersection of Sutter Avenue in Queens. It is anticipated that drainage from approximately 9.0 total acres, of which 1.9 acres is impervious, will be captured and treated by the proposed project.

A pair of bioretention areas, will be constructed within the median to treat and capture runoff that would otherwise flow directly into the combined sewer system (see figure below). A bioretention area consists of a shallow basin underlain by an engineered sandy soil media that removes pollutants from infiltrating runoff, provides temporary storage to reduce runoff flow rates, and increases groundwater recharge. Vegetation within the bioretention area assists in pollutant removal and adds an attractive landscaping feature. The project bioretention cells are designed with an extended detention element consisting of a shallow vegetated area underlain by in-situ soil. This element is intended to provide increased runoff storage capacity and attenuation, relieving the combined sewer system during larger storm events. Stormwater pretreatment is achieved through the use of vegetated conveyance swales.

One major element of the retrofit design is implementation of drainage modifications that divert runoff into the median without disrupting the existing drainage infrastructure or negatively impacting system capacity. Street drainage modifications are being implemented through a combination of curb cuts, catch basin modifications, and installation of new catch basins.

A major design objective for the bioretention retrofit is to maximize runoff captured, while minimizing cost. Another design objective was to design a green infrastructure system that could be systematically replicated throughout New York City. Various components of this pilot will be monitored and design recommendations for bioretention systems on other highway medians of New York City will be established based on the results.

Conceptual illustration of North and South Conduit Stormwater Pilot

Bioretention facilities are generally effective at reducing runoff volumes for small storm events, which constitute the majority of total annual precipitation volume. Specific volume reductions will be estimated upon collection of information on subsoil properties, and evaluated during the course of the monitoring study. Based upon DEC sizing criteria, the western bioretention cell will treat the entire water quality volume (90% precipitation event), while the eastern cell will treat two-thirds of the water quality volume. Due to the specific configuration of the proposed bioretention cells, the pilots are expected to infiltrate most of the water volume entering the treatment area. Additionally, variations in sizing between the two cells will be analyzed during the monitoring study to provide information on sizing for future stormwater retrofits.

Jamaica Bay
Ecological Improvements

Description: Improve the overall ecology of Jamaica Bay by restoring or enhancing existing natural areas and champion need for additional projects and funding.

Schedule: Ongoing.

In February 2010, DEP announced an agreement to improve the overall water quality and mitigate marshland loss in Jamaica Bay through a total of $115 million in new investments. As part of this agreement, the City also will invest $15 million for salt marsh restoration projects around the bay. The agreement is a good example of government and environmental stakeholder groups working together to meet a major goal of the City's PlaNYC agenda: improving the quality of waterways around the City.

Jamaica Bay has experienced wetland loss due to many factors, including sea level rise, anthropogenic manipulation (dredging and filling) throughout the bay, a loss of sediment and increased tidal heights from the extension of the Rockaway peninsula. The City's $15 million investment will be spent on wetland restoration projects in the interior of Jamaica Bay. In addition, since 2002, the City has invested $37.4 million to reclaim more than 440 acres of environmentally sensitive land adjoining Jamaica Bay and plans to remediate nearly 100 additional acres. The City will leverage its new $15 million investment in the bay's wetlands by applying for Federal matching funds, which could net an additional $30 million in funding for Jamaica Bay marshland preservation projects.

Additionally, habitat restoration along the periphery of Jamaica Bay has been part of DEP's comprehensive plan to address man made alterations and create highly productive ecological areas. Improved ecology for function includes habitat for aquatic life, shoreline stabilization and flood control. As such, the City is a major local contributor of matching funds for wetland restoration.

Large ecosystem restoration projects within Jamaica Bay depend on the involvement of multiple government agencies and private stakeholder groups. DEP, along with many other government agencies such as the DEC, US Army Corps of Engineers (USACE), National Park Service (NPS), New York City Department of Parks and Recreation (DPR) and the Port Authority of New York and New Jersey (PANYNJ), is an active participant in the restoration and ecological improvements of Jamaica Bay. The significance of partnerships between different agencies is illustrated by the following restoration efforts:

- Construction of the **Elders Point East** wetland took place in 2006-2007. This $13M restoration restored 48-acres of wetland habitat, placed approximately

300,000 cubic yards of sand and planted more than 700,000 wetland plugs. DEP provided a cost-share of approximately $2.5M.

- Construction of the **Elders Point West** wetland began in November 2009. This $11.6M project will restore 35 acres of wetland habitat, placed approximately 200,000 cubic yards of sand and planted more than 200,000 wetland plugs. DEP provided a cost-share of approximately $2.75M.

- An additional 60 acres of wetland habitat is proposed for restoration at **Yellow Bar Hassock** that will place approximately 320,000 cubic yards of sand. Designs are currently being developed the USACE and are expected to be completed by fall 2010. DEP cost-share for this project is will be based on final designs.

- DPR is the local cost-sharing construction sponsor ($2.7M of the restoration of **Gerritsen Creek**. This project has restored salt marsh and coastal grassland habitat along Gerritsen Creek (adjacent to the Marine Park Nature Center) by removing historic fill material. A total of 31 acres of wetland has been restored and 23-acres of coastal grassland. Project was completed in July 2010.

Hudson Raritan Estuary – Comprehensive Restoration Plan

In 2007, under the Congressionally-authorized Hudson Raritan Estuary Ecosystem Restoration Project, the USACE and PANYNJ published the draft Comprehensive Restoration Plan (CRP). It was created collaboratively by scientists, professionals, government agencies, nonprofit organizations, academic institutions, and environmental advocates. It's a plan to protect and preserve those habitats that still exist and restore habitats that have been lost (Harbor Estuary Program, HEP, 2010).

The CRP centers around eleven Target Ecosystem Characteristics. They are the "ecological goals" in the plan and keys to a healthy estuary which is essential for successful restoration. The creation of the CRP is the first of many steps that will support a thriving estuary in the New York/New Jersey Harbor region. The CRP is a guide for the many collaborators to determine specific restoration projects within the estuary (HEP, 2010).

PANYNJ was the local cost-sharing sponsor ($9.5M) to develop the Draft CRP that was released in March 2009. DEP provided input and is actively implementing parts of the plan.

Ken Salazar Visit

On July 26, 2010 Secretary of Interior Kenneth L. Salazar was invited by the National Parks of New York Harbor to lead a summit that would explore how the US Department of the Interior (DOI) could advance the conservation agenda for

urban national parks, in particular Jamaica Bay, through the adoption of the Hudson-Raritan Estuary CRP.

The summit was attended by 150 leaders from government, business and the non-profit sectors that shared ideas and provided written strategies for the Secretary's agenda. Secretary Salazar asked the audience to share their ideas with him for the improvement of Jamaica Bay and adoption of the Hudson-Raritan Estuary CRP.

Many attending the summit suggested that an organizational group be established to oversee this effort; some called for a Federal Advisory Committee. Participants said the establishment of this committee should decrease regulatory red tape that currently slows the restoration process and allow Federal funding to go directly to private partners for projects. Such a committee could ultimately promote lasting partnerships between Federal, State and local government and private organizations (National Parks of New York Harbor Conservancy, 2010).

Waterfront Planning

Description: Cooperative effort between different agencies and stakeholders to create a blueprint for the future of the City's waterfront.

Schedule: *Vision 2020,* the Comprehensive Waterfront Plan, is expected to be completed at the end of the 2010; the Waterfront Action Agenda is to be completed in early 2011.

On April 13, 2010, Mayor Bloomberg and City Council Speaker Christine Quinn launched the City's Waterfront Vision and Enhancement Strategy (WAVES), an interagency initiative that will establish long-term goals for New York City's 500-mile waterfront.

The New York City Economic Development Corporation (EDC) is leading the effort to create a *Waterfront Action Agenda*, which will complement the Department of City Planning's (DCP) *Vision 2020 Comprehensive Waterfront Plan* by promoting the short term priorities (within the next three years) for implementing the recommendations identified in the Comprehensive Waterfront Plan. Both initiatives will be shaped by the cooperation and expertise of city, State and Federal agencies, as well as members of the Waterfront Management Advisory Board which includes DEP Commissioner Holloway as a Board Member.

The *Action Agenda* is a working document that will continue to be an implementation mechanism for addressing the complexity of waterfront issues and finding balance among the different uses of the City's waterfront and waterways. Specifically, the Action Agenda will cover the following categories: natural waterfront habitats, the working waterfront, open space and recreation, housing and economic development, climate change adaptation and waterborne transportation.

For each initiative, the *Action Agenda* will identify current conditions and desired outcomes, specific steps to achieve goals, benchmarks to measure its success, agency responsibilities and financial investment.

In September 2010, DCP released draft recommendations in order to foster further public discussion of *Vision 2020*. The draft document contains programmatic recommendations, which focus on Citywide policy and programmatic changes, and reach recommendations, which are goals and policy recommendations for specific sites and areas along the 22 reaches or segments of the City's waterfront. In Reach 17, which encompasses all of Jamaica Bay, the draft recommendations identify several sites for improving public access and/or promoting habitat restoration, such as Floyd Bennett Field, Canarsie Pier, Fresh Creek and Spring Creek Parks, the Pennsylvania and Fountain Avenue landfills, Beach 88th St., the former Schmitt's Marina site, and Edgemere Landfill/Rockaway Community

Park. These draft recommendations and others are currently posted online at www.nyc.gov/waterfront. Final recommendations will be released with the final Comprehensive Waterfront Plan at the end of the 2010.

Acronyms

AMR	Automated Meter Reading
ARRA	American Recovery and Reinvestment Act
ATS	Algal Turf Scrubbers
BMP	Best Management Practice
CB	Community Board
CEQR	City Environmental Quality Review
CFS	Cubic Feet per Second
CRP	Comprehensive Restoration Plan
CSO	Combined Sewer Overflow
DCP	New York City Department of City Planning
DDC	New York City Department of Design & Construction
DEC	New York State Department of Environmental Conservation
DEP	New York City Department of Environmental Protection
DO	Dissolved Oxygen
DOB	New York City Department of Buildings
DOE	New York City Department of Education
DOI	United States Department of the Interior
DOT	New York City Department of Transportation
DPR	New York City Department of Parks & Recreation
DRM	Dynamic Reconnaissance Mapping
EDC	New York City Economic Development Corporation
EPA	United States Environmental Protection Agency
FY	Fiscal Year
GIS	Geographic Information System
GNRA	Gateway National Recreation Area
GPS	Geographic Positioning System
HEP	Harbor Estuary Program
HPD	New York City Department of Housing Preservation & Department
HRE	Hudson-Raritan Estuary Comprehensive Restoration Plan
JBWPP	Jamaica Bay Watershed Protection Plan
LTCP	Long Term Control Plan
MGD	Million Gallons per Day
MTA	New York City Metropolitan Transit Authority
NOI	Notice of Intent
NPS	National Park Service
NYCHA	New York City Housing Authority
NDZ	No Discharge Zone

OLTPS	Mayor’s Office of Long Term Planning and Sustainability
OMB	New York City Office of Management and Budget
PANYNJ	Port Authority of New York and New Jersey
ROW	Right-of-Way
SCA	New York City School Construction Authority
SPDES	State Pollutant Discharge Elimination System
USACE	United States Army Corps of Engineers
VGP	Vessel General Permit
WRP	New York City's Waterfront Revitalization Program
WWTP	Wastewater Treatment Plant

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