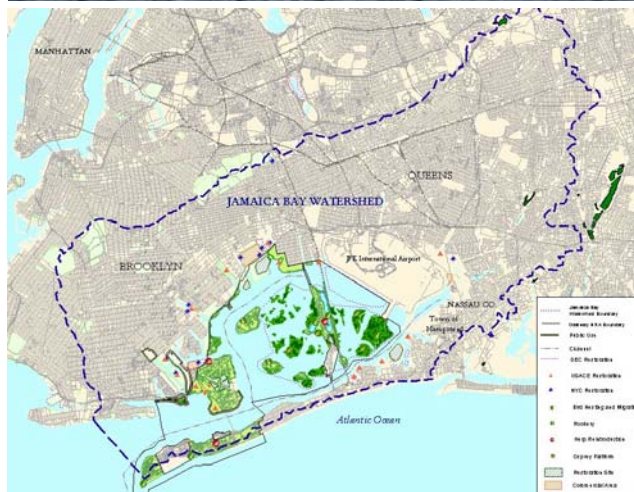


WATERSHED PROTECTION PLAN

Jamaica Bay



Jamaica Bay Watershed Protection Plan

New York City Department of Environmental Protection
Emily Lloyd, Commissioner
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JAMAICA BAY WATERSHED PROTECTION PLAN EXECUTIVE SUMMARY

Importance of the Bay

The value of Jamaica Bay is evident to all who have watched a glowing sunset while on its waters, or a flight of waterfowl coasting in for a landing. The residents who grew up fishing along its shorelines, boating around the tidal marshes, or exploring the natural areas of the estuary will attest to the value of the Bay as an important part of their lives and their identities. At the same time, the Jamaica Bay landscape is a living-space, work-space, and travel corridor. These two values reflect an important aesthetic and function, but represent only a fraction of the myriad values and roles associated with Jamaica Bay.

For thousands of years, Jamaica Bay has served as an important ecological resource for flora and fauna. The Bay has evolved over the last 25,000 years as an important and complex network of open water, salt marsh, grasslands, coastal woodlands, maritime shrublands, brackish and freshwater wetlands. The wildlife use of these systems is commensurate with this complex network of natural systems. These natural communities support 91 species of fish, 325 bird species (of which 62 are confirmed to breed locally) and are an important habitat for many species of reptiles, amphibians and mammals. The Bay is a critical stopover area along the Atlantic Flyway migration route and is one of the best bird-watching locations in the western hemisphere. The 20,000 acres of water, islands, marshes, and shorelines support seasonal or year round populations of 214 species of special concern, including state and federally endangered and threatened species.



The Gateway National Recreation Area at Jamaica Bay, despite its location in an ultra-urban environment, is a nationally and internationally renowned birding destination. Source: Don Riepe.

Because of its geographic size and very diverse functioning natural habitats, it is no surprise that Jamaica Bay is a nationally and internationally renowned birding location. Jamaica Bay retains irreplaceable value for its self-sustaining ecological functions, as well as the proximity of its assets by foot, rail and car to the urban metropolis. A walk along the beaches of Breezy Point or a kayaking adventure among the Bay's wetland islands can be a true wilderness escape, with Manhattan as a backdrop.

Issues Facing the Bay

The valuable resources that comprise Jamaica Bay are being lost. The current Jamaica Bay estuary is only about half of its pre-colonial extent and the salt marsh wetlands that have been a defining ecological feature of the Bay are decreasing at an accelerating rate. Over the last 150 years, interior wetland islands and perimeter wetlands have been permanently removed as a result of extensive filling operations;

shorelines have been hardened and bulkheaded to stabilize and protect existing communities and infrastructure; deep channels and borrow areas have been dredged, altering bottom contours and affecting natural flows; and natural tributaries along with their important benefits of balanced fresh water and coarse sediment exchanges have essentially disappeared leaving behind deposits of silts and particulates from urban runoff. The quality of the water is degraded from discharges via Water Pollution Control Plants (WPCPs), combined sewer outfalls, and storm sewers. These activities have synergistically affected historic flow patterns in the Bay, eradicated natural habitat, impacted water quality, and modified the rich ecosystem that was present prior to the extensive urban development of the watershed.

Plan Purpose and Intent

Under Local Law 71 (LL 71), signed by Mayor Bloomberg on July 20, 2005, the New York City Department of Environmental Protection (NYCDEP) is required to “assess the technical, legal, environmental and economical feasibility” of a variety of protection measures as part of the JBWPP development process. The objective of the bill is to ensure a comprehensive watershed approach toward restoring and maintaining the water quality and ecological integrity of the Bay. The final JBWPP is intended to provide an evaluation of the current and future threats to the Bay and ensure that environmental remediation and protection efforts are coordinated in a focused and cost-effective manner. LL 71 was amended (Introduction No. 376) on August 16, 2006 to extend the development of the JBWPP by one year. Under that amendment, the Draft *Jamaica Bay Watershed Protection Plan* was completed on March 1, 2007 and this *Final Jamaica Bay Watershed Protection Plan* has been submitted to the City Council on October 1, 2007.

NYCDEP and other City agencies, the Federal Government through the National Park Service (NPS) and other federal agencies, and New York State through the New York State Department of Environmental Conservation (NYSDEC) and other state departments, have been making considerable efforts to improve the water quality of Jamaica Bay. These city, state and federal agencies are taking steps to protect and restore the Bay’s ecological systems and are studying further options to improve the ecological values of the Bay’s watershed. Additionally, non-governmental organizations, community groups, and individuals have dedicated countless hours to improve conditions in the Bay and its watershed, and to encourage others to take up that cause. This Plan builds upon the positive impact made by the combined energies and resources of all of these entities.

The Plan contains two volumes. Volume 1, *Jamaica Bay Watershed Regional Profile*, a comprehensive reference document for Jamaica Bay, provides information about the diverse landscape of the Bay and its watershed, water quality of the Bay and current status of the ecological system as a whole. It also provides the information needed to identify issues of concern that face the Bay, setting the stage for developing strategies to address these issues in Volume 2.

Volume 2, the *Watershed Protection Plan*, is intended to serve as a blueprint for the future management of the Bay and its watershed. Volume 2 starts with the vision for the Bay and issues that need to be overcome to achieve the vision. For each of the issues, objectives for the Bay were developed and, for each objective, strategies or actions are identified to address the objective.

Volume 2 includes six major “Categories” that identify the significant issues to be addressed to restore the Bay including:



- Water Quality
- Restoration Ecology
- Stormwater Management through Sound Land Use
- Public Education and Outreach
- Public Use and Enjoyment
- Implementation and Coordination

Volume 2 includes recommendations for the implementation of hard and soft infrastructure projects, innovative alternatives, pilot studies, regulatory initiatives and public outreach efforts. Collectively these small and large projects will begin to address water quality and ecological issues facing Jamaica Bay. The following sections provide a brief discussion of the many Implementation Strategies that have been identified in the Plan. The Implementation Strategies are also summarized on Table ES-1 at the end of this Executive Summary.

NYCDEP has traditionally solved the City's need for water and wastewater services with large, infrastructure solutions. Much of our current infrastructure system is a testament to these historic engineering marvels such as the City's magnificent high quality drinking water supply system and colossal wastewater system that has led to major improvements in the quality of the City's waterbodies. Today, new infrastructure projects come at a significant cost, while achieving more modest incremental improvements. Therefore, the agency is looking for decentralized and integrated solutions that might be more financially and environmentally sustainable. NYCDEP views sustainability as a central theme in its approach to protect and preserve Jamaica Bay, an approach consistent with the cornerstone of the Mayor's PlaNYC 2030: to build a sustainable New York City based

on sound development and infrastructure practices at multiple levels.

Although there are many important steps that individual citizens and individual agencies can take, significant additional resources and multi-agency cooperation will be needed to undertake this huge initiative. The solutions to the problems that face Jamaica Bay are not cheap. Despite a robust capital investment program, NYCDEP's budget for capital investments is not limitless and there are many competing needs for these funds citywide. These dollars must be carefully programmed for drinking water protection, infrastructure repair and maintenance as well as for water quality protection of all the City's waterways.

In addition, many of the recommendations are outside NYCDEP's authority or mission. For many of these recommendations, NYCDEP recognizes the direct benefits to the Bay that these strategies offer and will continue to work with other agencies and entities to pursue them. However, other City, state and federal agencies experience similar levels of financial responsibility to program limited funds throughout the City. Therefore, support for projects must be considered in the context of other agency mandates. Ultimately, the responsible parties overseeing the Bay must share responsibility for developing a financial plan for the Bay.

The JBWPP is not a document that is fixed in time. The issues facing the Bay are expected to evolve, and will be recognized in regular Plan updates. Implementation for many of the recommended strategies will begin immediately and will be an ongoing collaborative effort.

Water Quality

The Objectives and Management Strategies discussed under this Category address a variety of approaches designed to improve the water quality and ecosystem of the Bay and its tributary basins. Included are engineered solutions, ecologically sustainable practices, and innovative techniques. Engineered solutions rely on facilities/infrastructure upgrades that have the potential to eliminate additional nutrient and contaminant loading to the Bay or to maximize the potential of existing facilities. Foremost, the Plan suggests new initiatives to reduce nitrogen levels in the Bay beyond those previously proposed by NYCDEP. Secondary benefits of reduced nitrogen loadings to the Bay include potential reductions in algae production and chlorophyll as well as slight improvements in dissolved oxygen.

The Objectives and Implementation Strategies designed to improve the water quality of the Bay are discussed briefly below. Several of these strategies are already mandated/proposed under the CSO consent order and the CSO Long Term Control Plan (LTCP) as identified in the Jamaica Bay and CSO Tributaries Waterbody/Watershed Facility Plan (WB/WS Plan) submitted to the NYSDEC in June 2007.

OBJECTIVE 1A: REDUCE NITROGEN LOADINGS

Carbon Addition Facilities at 26th Ward and Jamaica WPCPs

NYCDEP will propose carbon addition at 26th Ward and Jamaica WPCPs as potential strategies to reduce nitrogen loadings as part of ongoing discussions on the Comprehensive Jamaica Bay Water Quality Protection Plan (CJBWQP) with NYSDEC. This strategy also includes interim carbon

addition facilities at 26th Ward WPCP. These changes will result in a reduction in the amount of total nitrogen (TN) that is currently being discharged to the Bay.

Continue to Minimize Sludge Processing from other WPCPs in Jamaica Bay

NYCDEP will continue its efforts to minimize transshipment of sludge for processing in Jamaica Bay. In addition, it will not ship sludge from Bowery Bay and Tallman Island to Jamaica Bay. However, NYCDEP requires flexibility because there are limited options and facilities where sludge can be treated and at times construction and repair work will further limit access to facilities.

Algae and Sea Lettuce Harvesting Pilot Study

Algae contains one to six percent nitrogen (dry weight), and masses of sea lettuce have been identified as potentially smothering saltmarsh vegetation. On a limited temporal and spatial basis, skimmer boats will be used to harvest sea lettuce and algae where it amasses in the waters. This pilot will determine if skimmer boats are a feasible and cost-effective method to remove these plants. Their removal will also reduce negative aesthetic issues and if processed, the removed material has the potential to provide biofuel.

Algal Turf Scrubbers®

Algal Turf Scrubbers® are an ecologically-based technology that has the potential to “polish” a percentage of the wastewater flow, removing up to an additional 20% of total nitrogen for that portion of wastewater treated, prior to discharge. A small scale algal turf scrubber pilot will be installed at the 26th Ward WPCP to determine its potential for more expanded use.

Oyster and Eel Grass Restoration Pilot Study



Oysters are known as a keystone species and an “ecosystem engineer” that has the ability to modify its environs through its life processes. A single mature oyster can filter

approximately 2.5 gallons of water per hour or 35 gallons per day and can remove and sequester within the sediments approximately 20% of the nitrogen it takes in. The natural filtering capabilities of oysters can help remove nitrogen and suspended sediments from the water column near an eel grass bed and may provide sufficient environmental conditions to support eel grass. While not typically occupying the same ecological “niche”, recent studies have recognized the potential benefits of linking these restorations. Small scale pilot projects will be implemented to establish costs, benefits and success.

Ribbed Mussel Restoration Pilot Study

Through a pilot study, the filtering capacity and required densities of ribbed mussels to improve water quality will be evaluated.

OBJECTIVE 1B: REDUCE CSO AND OTHER DISCHARGES INTO THE TRIBUTARIES TO REDUCE PATHOGENS AND IMPROVE DISSOLVED OXYGEN

Expanded Sewer Cleaning Program

An expanded sewer inspection and cleaning program is under development that will

increase the current inspection rate. This would create a preventative program rather than the current one that is complaint driven.

26th Ward Sewer Cleaning Project

A sewer cleaning project in the 26th Ward WPCP drainage area will be implemented to remove sediments from sewers that have been identified as bottlenecks in the system along Williams Street, Hegeman Avenue and Flatlands Avenue. The cleaning project will result in an overall annual 212 MG reduction of combined sewage discharging to Jamaica Bay.

Expanded Interceptor Inspection and Maintenance

The expanded interceptor inspection and maintenance program will be piloted in the Rockaway and Oakwood Beach WPCP drainage areas and subsequently carried out citywide. This program will use sonar equipment to identify interceptor cleaning priorities.

26th Ward WPCP 50 MGD Expansion

The 26th Ward WPCP will be upgraded to increase the wet weather capacity from 170 MGD to 220 MGD. This will require the construction of new primary settling tanks, a new chlorine contact chamber, and other related items.

Paerdegat CSO Retention Facility

NYCDEP is currently constructing an off-line CSO storage facility adjacent to Paerdegat Basin. This facility will have the ability to capture and temporarily store 50 MGD of CSO that would otherwise discharge from the Paerdegat Basin outfall. Once a storm event passes, the stored flow will be redirected to the Coney Island WPCP for treatment.

Hendrix Creek – Evaluating In-line Storage

As part of the Long Term Control Plan (LTCP), further evaluation will be performed for a two foot bending weir that would be placed on top of the existing concrete weir to provide 100% CSO capture. A hydraulic analysis will be performed to determine if there is a risk of flooding.

Laurelton HLSS

High level sewer systems (HLSS) provide separation of storm and sanitary sewers. An implementation plan for the development of a HLSS in the Laurelton Area will be developed following completion of the Southeast Queens Drainage Plan in January 2008. HLSSs have the potential to reduce CSO discharges during storm events.

Regulators in Bergen Basin

Hydraulic limitations currently constrict wet weather flow to the Jamaica WPCP. A new 48-inch inverted siphon and regulator improvements will address back-up and overflow problems and will redirect flows to provide more effective treatment.

Complete Sewer Separation in the Rockaways

Sewers in the western section of the Rockaway WPCP drainage area have been separated; however additional sewer separation in other areas will continue.

Warnerville / Meadowmere Sewer Project

The sewerage of the Warnerville and Meadowmere portions of Queens is underway and should be completed in the near-term. This project will eliminate the direct discharge of sewage to the Bay.

Jewel Streets Sewer Project

Sanitary and storm sewers, a new water main, and a stilling basin will be constructed to alleviate contamination from failing septic systems, provide additional stormwater treatment and reduce flooding within the Jewel Street area (Ruby, Sapphire and Amber Streets).

Assess Inflow, Infiltration and Other Sewer Problems

NYCDEP will conduct an in-field study of inflows and outflows to identify potential problems such as inappropriate connections.

Additional Boat Pump-Out Facilities at the Rockaway WPCP

Personal watercraft in Jamaica Bay sometimes “pump-out” wastewaters directly into the Bay. This water contains high concentrations of pathogens and other pollutants associated with human waste products. To help improve water quality and provide an important free service to local area boaters, using matching funds from the Clean Vessel Act program, NYCDEP has installed two pump-out facilities on Jamaica Bay. NYCDEP is currently developing the designs for a third facility at the Rockaway WPCP and is obtaining required NYSDEC permits. NYCDEP will continue to explore a potential additional location for a fourth boat pump-out station, which would allow for designating Jamaica Bay as a “No Discharge Zone” for boaters.



A boat pump-out unit installed in 2000 located at the Coney Island WPCP, Source: NYCDEP Boat Pump Out Remote Unit.



OBJECTIVE 1C: INCREASE DISSOLVED OXYGEN LEVELS IN TRIBUTARY BASIN AREAS TO IMPROVE ECOLOGICAL PRODUCTIVITY

Dredge and Recontour Hendrix Creek

Hendrix Creek includes a large CSO sediment deposit that has formed at the head end of the Creek. NYCDEP has undertaken the design process to begin dredging Hendrix Creek. Following removal of sediment, the bottom will be “capped” with clean sand. This project should improve water quality and reduce the noxious odors from CSO buildup.

Dredging of Paerdegat Fresh Creek, Bergen, and Thurston Basins

Implementation schedules for dredging and recontouring of Paerdegat Basin, Fresh Creek, Bergen Basin and Thurston Basin have been developed and submitted to NYSDEC for approval in the Paerdegat Basin LTCP report and the Jamaica Bay and Tributary Waterbody/Watershed Plan report.

Fresh Creek, Bergen and Thurston Basins – In-stream Aeration

Increased DO levels in Fresh Creek can be attained by adding in-stream aeration coupled with dredging to create a water column deep enough to achieve effective aeration through the full range of tidal exchange.

Support Army Corps Ecological Restoration Projects in Paerdegat Basin and Fresh Creek

The JBWPP strongly supports the ecological restoration projects proposed by the US Army Corps of Engineers (USACE) for tributaries in Jamaica Bay.

OBJECTIVE 1D: DEVELOP A ROBUST SCIENTIFIC MONITORING PROGRAM

Develop an Enhanced Monitoring Plan Through Partnerships

A collaborative effort between the academic realm and government agencies is essential to adequately address the enormous scope and complexity of the interacting ecosystems of the Bay and watershed. In the short term, NYCDEP will coordinate existing monitoring efforts of DEC, NPS, USACE and other entities to maximize the effectiveness of current monitoring efforts. NYCDEP will also coordinate with academic institutions to potentially direct research efforts of students and faculty to Jamaica Bay. Within a year, NYCDEP will evaluate the development of an enhanced water quality and ecosystem monitoring program. The following parameters will be considered for future monitoring: enhanced water quality sampling, sediment sampling, biological and ecosystem modeling, and salt marsh monitoring. In addition, NYCDEP is completing a pilot study and developing a full-scale program to monitor floatables in New York Harbor and Jamaica Bay.

Ecological Restoration

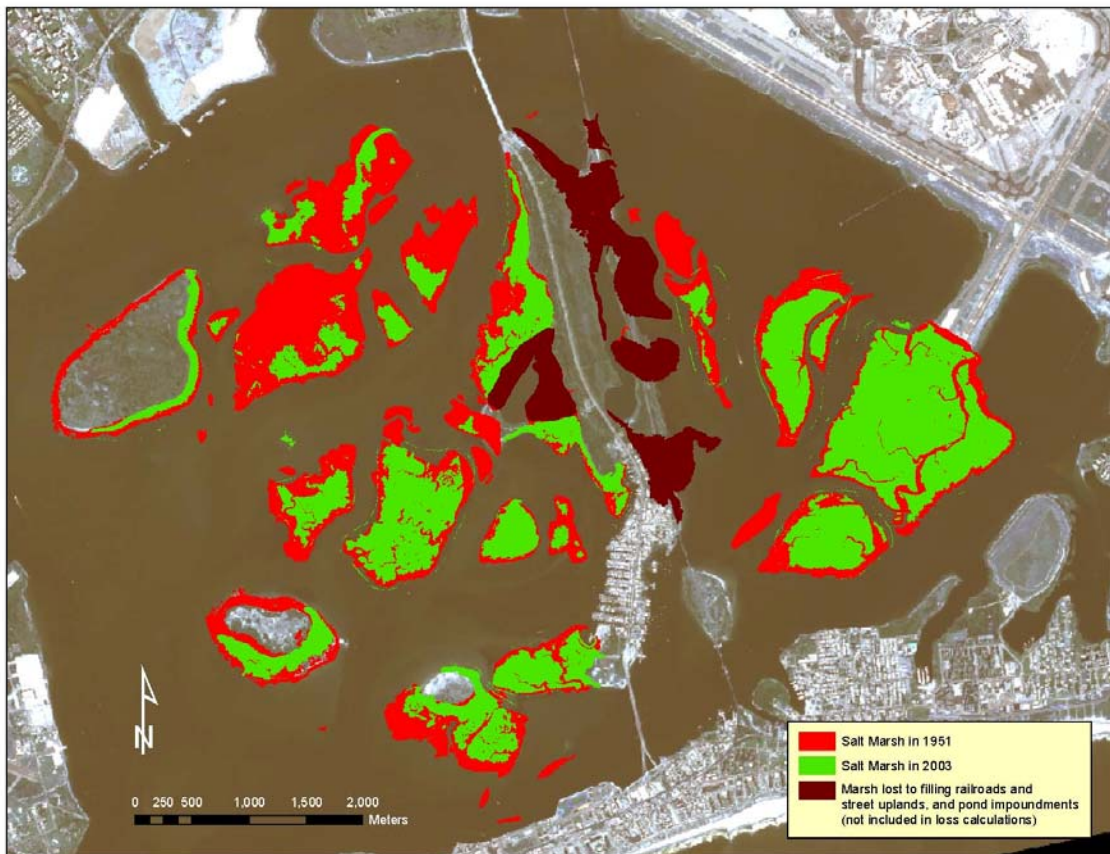
This Category addresses initiatives that will promote the restoration of the ecology of the Bay. This effort is focused on tidal wetland communities, particularly marsh islands and peripheral wetlands, but also includes a variety of other habitats that are important to the great diversity of wildlife that frequent the Bay. This Category also recommends the identification of remaining public and private vacant lands that may be suitable for acquisition for preservation and/or restoration. Mapping and restoration may include dunes, beaches, grassland, tidal marsh, and areas dominated by invasive species. Monitoring the success of

restoration efforts is recommended in all cases to help ensure future success through adaptive management.

OBJECTIVE 2A: RESTORE THE SALT MARSH ISLANDS IN JAMAICA BAY

Establish Salt Marsh Islands Wetlands Priority Restoration Review Board

It is recommended that within 6-months of the final JBWPP that a Salt Marsh Islands Wetlands Priority Restoration Review Board of multi-agency and local environmental group representation, possibly under the



On August 2, 2007, the Jamaica Bay Watershed Protection Plan Advisory Committee and National Park Service released a report concluding that the rate of salt marsh loss is accelerating. Their analysis utilized satellite imagery and aerial photography over time to determine recent trends in salt marsh loss. The findings in the report suggest that the rate of loss which was approximately 33 acres per year during 1989-2003 has accelerated for certain marsh islands to 54 acres per year. Source: Jamaica Bay Watershed Protection Plan Advisory Committee.

proposed Jamaica Bay sub-workgroup of the New York-New Jersey Harbor Estuary Program (HEP), review restoration logistics and begin to establish a priority list of wetland restorations. It is recommended that those wetland complexes that appear to be relatively stable based on the data to date be given higher consideration for potential restoration efforts as these likely have the greatest potential for buffering capacity and a reasonable expectation of long term stability as compared to those identified with the most loss and a high likelihood that they will fail in the short term.

Salt Marsh Island Wave Attenuator Pilot Study

NYCDEP will develop and implement a pilot study to determine if the installation of a wave attenuator around a section of a salt marsh island would be a cost-effective method to slow the rate of wetland loss and if the attenuator can capture marsh building sediments. Recently restored salt marsh islands are extremely vulnerable to the damaging effects of wind and wave energies due to their limited vegetative cover and the limited benefits of sediment anchoring from an underdeveloped root system. These areas are also vulnerable to erosive forces from ice flows during the winter months. The use of geotextile fabrics, temporary floating breakwater systems or other biodegradable materials may be able to effectively armor the vulnerable windward fringe of these marshes, allowing sufficient protection while the smooth cordgrass (*Spartina alterniflora*) becomes fully established.

OBJECTIVE 2B: PROTECT NATURAL AREAS ALONG THE PERIPHERY OF THE BAY

Transfer HPD Properties in the Edgemere Section of Queens to DPR

A number of undeveloped parcels, totaling approximately ten acres, located in the Edgemere Section of Queens are currently

under the ownership of the New York City Department of Housing Preservation and Development (HPD). NYCDEP is working with HPD and DPR to protect these parcels as open space. Protection will eliminate illegal dumping and may provide future stormwater parks or community gardens and will improve connectivity between the Bay and the land. Restoration plans would be developed following site assessments.

Pursue Acquisition and Restoration Efforts in Cluster Areas

A preliminary review of public and privately owned vacant land within a one-mile radius of the Bay was performed. The review focused on identifying vacant parcels that could potentially be acquired to provide the most ecological benefit, based on size, proximity to the Bay, and proximity to existing parks and open space. The groups of parcels are collectively termed “cluster areas.” A total of 214 public properties having a combined acreage of 208 acres were identified. The NYCDEP will work with the Department of Citywide Administrative Services (DCAS) to evaluate these “cluster areas” and to place a “study hold” until each property can be fully assessed for its potential to provide environmental benefits. There could be a potential benefit to acquire private properties to develop a continuous cluster of parcels, pending funding availability.

Seagirt Avenue Wetland Properties, Far Rockaway, Queens

The JBWPP recommends that multiple entities/agencies leverage funding to acquire additional Seagirt Avenue wetland properties, which are located in Far Rockaway, Queens, and contain a tidal creek with steep eroding shorelines, fringing wetland, ponds, and filled uplands. This site is considered a high-priority acquisition site by the New York/New Jersey Harbor Estuary Program and is also identified on

the New York State Open Space list for acquisition.

Complete the Restoration of the Jamaica Bay Marsh Islands Ecosystem Project (Elders Point and Yellow Bar) and the 8 JBERRT sites

The eight Jamaica Bay Ecosystem Research and Restoration Team (JBERRT) sites (including Dead Horse Bay, Paerdegat Basin, Fresh Creek, Spring Creek South, Hawtree Point, Bayswater State Park, Dubos Point, and Brant Point) have been identified by the USACE as high priority restoration sites around Jamaica Bay. These sites have gone through an extensive review process and have excellent potential for restoration and providing environmental benefits. Conceptual plans and costs have already been developed for these projects. The Jamaica Bay Marsh Islands Ecosystem Project at Elders Point East was completed in 2006 and Elder’s Point West is scheduled to be completed in 2008. However, at this point, additional restoration of marsh islands, such as the restoration of Yellow Bar Hassock has not been scheduled. The JBWPP recommends that the funding for the eight JBERRT Projects and for Yellow Bar Hassock be secured and that the restoration efforts move forward.

Track and Inventory Restoration Sites

An extensive inventory of sites recommended by others for potential acquisition and restoration within the Jamaica Bay watershed has been compiled as part of the preparation of the JBWPP. This inventory, identified as the “Jamaica Bay Conservation and Restoration Project Inventory” will be updated and utilized for interagency coordination and to prioritize acquisition, preservation and restoration projects.

Update and Inventory Dune and Beach Habitats

Beaches and dunes are important natural buffers against the forces of wave and wind erosion, and are dynamic landscape features that quickly change as a result of wind erosion and deposition. These areas support several rare plant species, serve as vital foraging and breeding habitat for selected birds and aquatic organisms, and provide aesthetic and recreational opportunities for residents and tourists. In coordination and collaboration with multiple agencies and environmental groups, NYCDEP will update an inventory of all existing dune and beach habitats to create a base GIS map. This information can be then used by restoration practitioners in developing and leveraging future ecological restoration designs.



Existing upland marshes and dunes of Jamaica Bay, Source: Don Riepe.

Expand Litter Removal and Reduction Programs

NYCDEP will work with New York City Department of Parks and Recreation (NYCDPR) to determine whether trash collection along the beaches and parks can be extended beyond Labor Day. In addition, NYCDEP will continue to work with local groups on future shoreline clean ups and restoration plantings. NYCDEP encourages participation from other agencies and organizations in these efforts.

Reduce the Extent of Invasive Vegetation

NYCDEP will work with other government agencies and environmental organizations to promote the importance of invasive species management to the overall health and ecological function of the Jamaica Bay watershed. Invasive species management plans that each land managing entity can implement will be developed in partnership with other agencies and organizations

Determine RTE Restoration Priorities and Targets

Ecological assessments of Jamaica Bay should continue to refine the identification of where current rare, threatened, and endangered (RTE) critical habitat areas exist. In coordination and consultation with multiple agencies and other relevant stakeholder groups, determine realistic RTE restoration priorities and targets (e.g., which species populations are the most desirable and practical to restore).

Stormwater BMPs

Controlling stormwater at the source – at residences, commercial establishments, and streets – through Stormwater Best Management Practices (BMPs) can be effective in reducing CSO and other untreated discharges to the Bay. Modeling performed for this Plan shows that after a ten-year period, lower capture BMPs, such as rain barrels, rain gardens, and swales for existing development and streets and sidewalks, could achieve a 6% reduction in untreated discharges to the Bay, which includes CSOs, and storm sewer discharges. A very aggressive BMP implementation effort for new and existing development in the Jamaica Bay watershed could yield reductions of 24% in untreated discharges to the Bay. An alternative approach that focuses on large rooftops (>5,000 square feet) through either rooftop detention or green roofs could achieve a 13% reduction in untreated discharges to the Bay. Pollutant load reductions including pathogens, nutrients and toxins are comparable to volume reductions.

These benefits need to be understood in the context of what is achievable. For purposes of this Plan, a number of what-if scenarios were developed. “What if all new development and 10% of existing development were to implement BMPs?” “What if all existing large rooftops were to implement BMPs?” While the Plan answers

these questions to a certain degree, a much more difficult question is: “How much can be implemented?” The answer to this question will depend on the development of a comprehensive program that will potentially include regulatory measures, incentive programs, and public outreach. This effort, being orchestrated through the Mayor’s Interagency BMP Task Force, will require coordination between many City agencies, private interests, and other stakeholders.

As positive as the potential benefits are, they come at a hefty price. However, there is still much to be resolved on the costing side of BMPs. The JBWPP utilizes the best available information on the cost of BMP installation in New York City, but there is little information to draw from that is specific to New York City implementation and there are many uncertainties. One of the key purposes of the pilot studies proposed in this Plan is to develop better cost estimates for both capital and maintenance costs and to determine which BMPs provide the most cost-effective results under New York City conditions.

The cost-benefit equation will also differ from area to area in the City. In Jamaica Bay, large CSO storage tanks are cost-effective because there is typically one CSO outfall per tributary basin and a storage facility can be located so as to capture CSOs in one location. In other areas of the City,

CSOs are more diffuse. Either more, smaller tanks would need to be built, or sewer construction would be needed to reroute and concentrate flows at a tank location.

The benefits of BMPs should not be compared only to hard infrastructure costs. In fact, BMPs are embraced by many municipalities around the country that do not have CSOs. By addressing stormwater generation at its source and fostering low-impact development, BMPs can provide many benefits that end-of-pipe treatments cannot. In addition to controlling stormwater runoff volumes and pollutant loads, some of the many benefits BMPs and source controls provide include reducing the urban heat island effect, greenhouse gas reductions, flood mitigation, habitat, erosion control, and aesthetic amenities.

As BMPs become more widely used and as contractors and developers incorporate more BMPs into their developments, lessons will be learned, cost efficiencies will be identified, and economies of scale will be accrued. It is NYCDEP's hope that the Implementation Strategies suggested in this Plan, from the many pilot studies that will be conducted to the code reviews and the incentive programs that will be explored, will help lay the groundwork for more widespread acceptance of BMPs in New York City.



One of Gaia Institute's green roof projects in the New York City area. Source: Gaia Institute 2006.

The future for BMPs is encouraging, but it will take time to see the benefits. It will involve harnessing the resources of many city agencies, private developers,

homeowners and environmental organizations. End-of-pipe solutions also take long periods of time to become facts on the ground, involving very lengthy design and construction processes. The City has patiently awaited these facilities to be built and their effects to be made known; it is now time to pursue BMPs with the same patience and commitment.

The following are Implementation Strategies that will facilitate the broader use of BMPs.

OBJECTIVE 3A: PROMOTE THE USE OF ON-SITE BEST MANAGEMENT PRACTICES IN NEW AND EXISTING DEVELOPMENT

Pilot and Demonstration Projects

NYCDEP will pursue several pilot studies to gather information and address uncertainties related to costs, benefits, public acceptance, maintenance requirements, and site conditions. The pilots will be carefully monitored once installed to evaluate their effectiveness. Examples of pilots may include:

- Comparison of green roofs and blue roofs (rooftop detention) technologies.
- Rain barrel give-away program.
- Parking lot BMP pilot study.
- Residential pilot study at an existing affordable housing complex.
- Porous pavement pilot study.

Through the Mayor's Interagency BMP Task Force, strategies for incorporating BMPs into the design and construction of City capital projects will be developed.

Evaluate Rooftop Detention

Rooftop detention consists of collars installed around the rooftop leaders that detain flow on the rooftop. Despite its considerably lower cost, only a small

number of developers now choose rooftop detention over subsurface detention when required to provide detention as part of their projects. NYCDEP will work to identify opportunities to promote rooftop detention earlier in the permit process.

In addition, NYCDEP will investigate the potential for a program to target the implementation of rooftop detention on existing large roofs in the Jamaica Bay watershed; 2.5% of the rooftops are over 5,000 square feet and represent approximately 29% of the rooftop area within the watershed.

Economic Incentives

Economic incentives such as water and sewer rate discounts and public/private cost-sharing may be needed to encourage the implementation of BMPs, particularly for existing development. Stormwater rates are currently being used by municipalities across the country to achieve local and regional goals of reducing stormwater generation and paying for infrastructure needs to meet more stringent regulatory requirements. NYCDEP will undertake a study to evaluate alternative stormwater rate structures and their potential revenue and ratepayer impacts.

PlaNYC includes an incentive program for green roofs. Under PlaNYC, the City will support the installation of green roofs by enacting a property tax rebate to offset 35% of the installation cost of a green roof. A role of the Mayor's Office Interagency BMP Task Force is to investigate possible incentives that can be used to encourage BMP implementation, and this will be part of the Task Force's Plan to be completed in late 2008.

To expedite the implementation of BMPs on existing development, NYCDEP will work with the New York City Soil and Water Conservation District (NYCSWCD) to identify a potential framework for an incentive program. While funding for

exploratory work is available, funding for an incentive program is not. Other planned NYCDEP cost-sharing programs to promote water conservation include rebates for toilets, urinals, and washing machine replacements.

Regulatory and Design Code Changes

The current City Administrative Codes (Sewer Code and Building Code) are directed to controlling the flow of stormwater away from lots and into sewers with the primary purpose of avoiding flooding and standing water and the public health concerns associated with these conditions. They do not routinely require or promote the use of stormwater detention or infiltration BMPs for the purpose of minimizing CSOs. The Sewer Code and potentially the Building Code may need to be revised to better facilitate installation of BMPs on a wider scale. NYCDEP will conduct a review and study of the Sewer Code and closely coordinate with the New York City Department of Buildings (NYCDOB) and other agencies on related codes to evaluate possible code changes.

The New York City Department of City Planning (NYCDCP) has recently proposed parking lot design standards in the Zoning Resolution that apply to commercial and community facilities with parking lots that contain 18 or more parking stalls or are 6,000 sq ft or more in size. NYCDEP worked with NYCDCP to incorporate stormwater BMPs into the design standards such as street trees and perimeter and interior landscaping that would provide infiltration to the soils. Additional revisions to the Zoning Resolution are being planned to require more pervious areas and landscaping within new and existing development and additional street trees.

Technical Assistance

A BMP Design Manual, specific to the New York City urban environment, will be developed as a companion to the Sewer

Code. The manual would address high density development areas, drainage issues, Sewer Code and permitting process interface, and soil, bedrock, groundwater, and climate conditions. The manual would include detailed design requirements for public and private development projects and would be developed with input from multiple city agencies. In addition, revisions to the City Environmental Quality Review (CEQR) Technical Manual will be proposed to include a specific section addressing proposed developments in the Jamaica Bay watershed that are subject to CEQR.

- Enhanced tree pit pilot study to incorporate infiltration, retention and water harvesting practices into tree planting areas.



Vegetated swale installed in road median. Source : USDA Natural Resources Conservation Service

Monitor Benefits

A database of public and private BMPs within the city will be created and the success of various BMPs will be tracked.

OBJECTIVE 3B: PROMOTE THE USE OF OFF-SITE BEST MANAGEMENT PRACTICES

Pilot and Demonstration Projects for Roadways, Streets, and Sidewalks

Impervious surface analyses of the watershed estimate that approximately 30% of the Jamaica Bay watershed is covered by streets and sidewalks alone. Locating off-site BMPs along roadways would help to capture runoff that contains high levels of pollutants. Therefore, a variety of off-site BMP pilot studies will be undertaken to evaluate their effectiveness and address uncertainties related to costs, benefits, public acceptance, maintenance requirements, and site conditions. Examples of pilots may include:

- BMPs for the reconstruction of the Fresh Creek, Paerdegat and Rockaway Bridges along the Belt Parkway;
- Streetside infiltration swales along streets and sidewalks;
- Constructed wetlands to capture and treat stormwater runoff from roadways;

Tree Planting Initiatives

Trees capture and transpire significant quantities of rainwater and provide multiple additional ecological benefits. A number of tree planting efforts are planned, many of which will be undertaken as part of the Mayor’s PlaNYC 2030. PlaNYC 2030 has committed to planting one million new street trees throughout the City and includes installing 14 new Greenstreets within the Jamaica Bay Watershed. Another tree planting effort is planned within East New York to increase the street tree stocking level from 52 to 100 percent in the next ten years. East New York was selected under the Trees for Public Health program to improve air quality.

Pilot and Demonstration Projects for Vacant Lands

Publicly-owned parcels and abandoned railroad corridors may provide opportunities for the development of “stormwater parks.” Stormwater parks could treat stormwater from multiple adjacent parcels and would create additional benefits such as opportunities for multi-use, pocket parks, green spaces, and urban habitat. NYCDEP



will develop a constructed wetland pilot project within a vacant parcel.

Restoration of Existing Parks to Provide Enhanced Stormwater Treatment

Existing open space (such as parks, plazas, community gardens, etc.) can be retrofitted with BMPs to treat stormwater runoff.



Particular projects that will be pursued include the redirection of stormwater flow from adjacent areas and construction of BMPs within Baisley Pond Park and Springfield Park.

Public Education and Outreach

This Category includes strategies to increase public understanding of the importance of Jamaica Bay and the impacts of individual actions on the health and sustainability of the Bay. Long-term ecological sustainability is directly linked to the actions and attitudes of the people that live, work, and play in the watershed. The concept of environmental stewardship is that residents understand, value, and care for their environmental resources, and thus are motivated to make decisions that improve the health of the watershed and the Jamaica Bay estuary. As people understand the Bay through exploration, study, and play, they will gain a sense of environmental stewardship and voluntarily modify their behaviors and practices in ways that will have positive effects on water quality, human health, and ecological processes.

The Implementation Strategies focus on ways to build upon existing education and outreach programs to address learning of all types of citizens – watershed residents, property owners, business owners, developers, school children, visitors, civic officials – and include individuals of all ages. Each Implementation Strategy is discussed briefly below.

OBJECTIVE 4A: RAISE AWARENESS OF JAMAICA BAY’S UNIQUE ASSETS AND CHALLENGES

Enhance Jamaica Bay-Related Educational Curriculum

This Implementation Strategy involves continuing to develop the Jamaica Bay Educators’ Resource Guide – a document currently being developed by the Jamaica Bay Watershed Education Coordinating Committee – to provide a comprehensive directory of environmental education curricula for kindergarten through 12th grade school teachers and other educators within the Jamaica Bay watershed. The resource guide, once completed, will align existing curricula and programs with key topics related to Jamaica Bay and identify gaps in existing educational curricula.

Organize a “State of the Bay” Scientific Symposium

NYCDEP, working with the NYCSWCD and the Jamaica Bay Institute, will organize a formalized biennial “State of the Bay” Symposium. Jamaica Bay Institute’s March 2004 conference on the state of the Bay will be used as a model for symposium development. A formalized biennial conference would allow continuing information-sharing and coordination between citizens and the scientific

community, and potentially compel more research efforts in the watershed. In addition, the symposium could be timed with the biennial Jamaica Bay Watershed Protection Plan update process.

Campaign to Protect Jamaica Bay

NYCDEP will work to create a targeted campaign to provide information to developers, residents, and business owners about how to protect Jamaica Bay through simple pollution prevention steps and best management practices where they live and work. As a first step, NYCDEP is in the process of developing a brochure to identify actions that can be taken to conserve water and energy, install on-site stormwater runoff management, minimize the use of household

chemicals, and promote sound landscaping practices.



Encouraging Stewardship.
Source : NYCDEP

Public Use/Enjoyment

The goal of this Category is to enhance public access, recreation, and enjoyment opportunities within the Jamaica Bay watershed. Jamaica Bay is the largest natural area in New York City, and provides opportunities to view wildlife, fish, and relax and enjoy nature that are a rarity in the City’s highly urbanized environment. Gateway National Recreation Area (GNRA) is an unparalleled regional resource. Public access to many parts of the Bay is currently limited due to commercial, industrial, and transportation infrastructure running along the perimeter of the Jamaica Bay estuary, privately-owned property (such as JFK Airport), and bulkheading of much of the Bay’s shoreline.

The Implementation Strategies discussed in this Category are being undertaken by NYCDPR, NYCDOT, the National Park Service (NPS) and other agencies to build upon existing open space, parks, and greenways within the Jamaica Bay watershed by providing greater access and amenities to both the Bay and upper

watershed. Each Implementation Strategy is discussed briefly below.

OBJECTIVE 5A: INCREASE PUBLIC ACCESS TO JAMAICA BAY

Rockaway Gateway Greenway

The Rockaway Gateway Greenway will establish a continuous approximately 20-mile greenway loop around the Bay. When completed, the loop will connect Floyd Bennett Field, Fort Tilden, Jacob Riis Park, and the Jamaica Bay Wildlife Refuge, providing bike access around the Bay, across bridges and to the Rockaway’s ocean beaches. The specific segments, in various stages of implementation, to be addressed are: Shore Parkway Path: Pennsylvania Avenue to 84th Street and 84th Street to JFK Airport; Rockaway/Gateway Greenway: Flatbush Avenue, Spring Creek Portion, Cross Bay Boulevard, and Rockaway Boulevard along Beach Channel Drive.

Laurelton and Cross Island Parkway Greenways

This 22-mile path through parkland is being planned and designed by NYCDPR and NYCDOT. The route will be located adjacent to the roadways and will provide a link between the Brooklyn/Queens Greenway system, which connects to the rest of New York City and beyond, through the upper Jamaica Bay watershed area, and to the Jamaica Bay waterfront.

Southern Parkway Greenway and Conduit Boulevard

This greenway will also connect the Brooklyn/Queens Greenway system to the waterfront, via the Laurelton Greenway and through Nassau County.

Far Rockaway North Shore Greenway

This greenway will connect communities in Far Rockaway with the Rockaway/Gateway Greenway discussed above.

Floyd Bennett Field/Gateway National Recreation Area

The NPS has identified numerous capital improvement projects within GNRA, including rehabilitating visitor centers and stabilizing the historic hangars at Floyd Bennett Field.

OBJECTIVE 5B: INCREASE PUBLIC ACCESS TO A WIDER RANGE OF LANDSCAPE TYPES IN THE UPPER WATERSHED

Brooklyn/Queens Greenway - Queens

The Greenway Plan for New York City includes plans to connect existing parks, open spaces, cultural locations, and the waterfront at Coney Island via existing natural or man-made corridors. The *Eastern Parkway Extension*, one of the remaining segments of the Brooklyn/Queens Greenway to be constructed, will enhance these connections within the Jamaica Bay watershed.

Implementation and Coordination

There are a myriad of federal, state, and city government agencies, non-governmental organizations, academic institutions, and private interests working to preserve and enhance the unique resources of Jamaica Bay and reverse the trends of water quality degradation and wetland loss. Despite all of these efforts, there is a lack of resources to do all that needs to get done. Neither individual organizations nor individual agencies, acting alone, can accomplish the aggressive agenda outlined in this *Jamaica Bay Watershed Protection Plan*. Only through coordinating separate efforts and pooling resources will the strategies recommended in this Plan be realized.

A key issue for Plan implementation is funding. A number of the priority Implementation Strategies are currently unfunded. Partnerships will need to be developed between the public and private sectors to fund these initiatives. And coordinated advocacy efforts are needed across the many non-governmental organizations working in the Jamaica Bay watershed to help to leverage additional funding from state and federal agencies. NYCDEP also suggests fostering the development of a Conservancy that would act as an umbrella organization to support efforts to preserve and enhance the Bay.

Four strategies should be pursued to coordinate the implementation of this Plan and ensure that its recommendations become actions:



- Form a Jamaica Bay Water Quality and Ecological Restoration Committee under the auspices of the NY/NJ Harbor Estuary Program (HEP) to coordinate the implementation of Water Quality and Ecological Restoration strategies under this Plan. The Collaborative could be modeled after, or incorporated into, the NY/NJ HEP which provides a working example of multi-entity coordination within this region.
- Continue to work through the Mayor's Office Interagency BMP Task Force to implement BMPs by providing a vehicle for cross-agency communication. The Task Force will also play a key role in formulating City policy with respect to regulating and/or incentivizing BMP implementation.
- Continue the Jamaica Bay Education Coordinating Committee under the auspices of the Soil and Water Conservation District to coordinate the public education and outreach components of the plan.
- Monitor and review growth and changes in the watershed over time. NYCDEP will track new development in the watershed and coordinate this effort with the Office of Environmental Coordination and appropriate federal, State, and City governmental entities that have jurisdiction over the Jamaica Bay area. The tracking of development data and BMP implementation data coupled with developing a robust scientific monitoring program to track water quality and ecological restoration efforts over time (see Water Quality above), will ensure a comprehensive review of the impacts of changes in the watershed over time.

TABLE ES-1: Jamaica Bay Watershed Protection Plan Implementation Strategies

Reduce Nitrogen Loading to the Tributaries and Jamaica Bay						
	Implementation Strategy	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Nitrogen Reduction & Other	<i>Carbon Addition</i>	NYCDEP will propose carbon addition at 26th Ward and Jamaica WPCPs as potential strategies to reduce nitrogen loadings during ongoing LTCP negotiations with NYSDEC.	TBD	TBD	N	DEP
	<i>Carbon Addition</i>	Interim temporary facilities at 26 th Ward will also be considered.	36-40 months	TBD	N	DEP
	<i>Minimize Centrate Processing from other WPCPs in Jamaica Bay</i>	NYCDEP will continue its efforts to minimize transshipment of sludge for processing in Jamaica Bay.	Ongoing	NA	NA	DEP
	<i>Algal and Sea Lettuce Harvesting Pilot Study</i>	Harvest excess algae and sea lettuce to reduce nitrogen and produce biodiesel fuels.	Design anticipated to begin Summer 2009.	\$387,000	Y	DEP
	<i>Algal Turf Scrubbers Pilot Study</i>	Remove nutrients and contaminants through benthic organisms, bacteria and phytoplankton.	Design anticipated to begin Summer 2009.	\$350,000	Y	DEP
	<i>Oyster Reef Pilot Study</i>	Provide clearer water, improved fisheries habitat through reintroduction of oyster reef.	Design anticipated to begin Summer 2008.	\$600,000	Y	DEP
	<i>Reintroduction of Eel Grass (Zostera marina) Pilot Study</i>	Fish habitat/Decreased wetland erosion loss.	Design anticipated to begin Summer 2008.	\$350,000	Y	DEP
	<i>Ribbed Mussel Pilot Study</i>	Improve water quality and increase fish habitat.	Design anticipated to begin Summer 2008.	\$300,000	Y	DEP
Reduce CSO and Other Discharges to Improve Pathogen and DO levels						
	Implementation Strategy	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Sewer System Maintenance	<i>Expanded Sewer Cleaning Program</i>	Clean sewers programmatically; entire sewer system would be cleaned every 7-10 years.	Pilot project 2007; annual program to clean 7% of sewers.	\$2.5 million annually plus new personnel and vehicles(\$876,500)	Partial	DEP
	<i>26th Ward/Fresh Creek Sewer Cleaning</i>	Clean sediment from selected sewers in 26th Ward.	Final design in 2007. Project scheduled to be completed in 2010.	\$4 million	Y	DEP
	<i>Expanded Interceptor Inspection and Maintenance</i>	Inspection program to determine cleaning and maintenance needs throughout the City. Pilot project in fall to inspect E Rockaway interceptor.	Pilot studies in 2008; Citywide inspection completed in 2010.	\$200,000 for pilot; \$4-5 million over next 1-2 years	Y	DEP
	Implementation Strategy	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Sewer & Treatment Facility Infrastructure Improvements	<i>26th Ward 50 MGD Expansion</i>	Increase wet weather capacity from 170 MGD to 220 MGD.	Final design in 2010. Project scheduled to be completed in 2015.	\$467 million	Partial	DEP
	<i>Paerdegat CSO Retention Basin</i>	50 MGD facility to capture CSOs.	Construction to be completed in 2012.	\$318 million	Y	DEP
	<i>Inflow/Infiltration Study with Corrective Measures</i>	Identify and resolve sewer system anomalies.	TBD	\$2 million/yr for engineering and \$5 million/yr for corrective measures	N	DEP
	<i>Regulators in Bergen Basin</i>	Automation for#2; enlarge #3 orifice; new 48" siphon under Belt Parkway.	Regulator #2 construction to begin in 2007. Remainder TBD.	\$14 million	Partial	DEP
	<i>Complete Sewer Separation in Rockaways</i>	Approximately 2,500 acres remain to be separated in the Rockaways	Ongoing	\$500 million	Partial	DEP

TABLE ES-1: Jamaica Bay Watershed Protection Plan Implementation Strategies

	<i>Implementation Strategy</i>	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
New Sanitary and Storm Sewers	<i>Laurelton High Level Storm Sewers</i>	Separate storm sewers from sanitary sewers.	Drainage Plan completed by Jan 2008. Then cost and project timeline will be developed.	TBD	N	DEP, DDC
	<i>Warmerville / Meadowmere Sewer Project</i>	Sanitary sewers, pump station and force main to deliver sewage to Jamaica WPCP.	Under construction; to be completed in 2009.	\$30 million	Y	DEP
	<i>Jewel Streets Storm and Sanitary Sewers</i>	Install storm and sanitary sewers.	In Design	\$26 million	Partial	DEP, DDC
	<i>Implementation Strategy</i>	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Boat Pumpouts	<i>Install a Third Boat Pumpout Facility at Rockaway WPCP</i>	Reduce wastewater discharges from recreational boats directly into Bay.	Operational for 2008 boating season.	\$21,500	Y	DEP
	<i>Seek 4th Boat Pump Out and a No Discharge Designation for Jamaica Bay</i>	Once a fourth boat pumpout facility has been installed, DEP will initiate proceedings to create a No Discharge Zone for Jamaica Bay.	TBD	TBD	N	DEP
Increase DO Levels to Improve Ecological Productivity						
	<i>Implementation Strategy</i>	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Remove CSO Sediment Mounds	<i>Dredge and Recontour Hendrix Creek</i>	To address CSO mounds, DO and ecological goals.	Final Design complete. Dredging schedule TBD.	\$15.7 million	Partial	DEP
	<i>Pursue Dredging of Paerdegat Basin, Fresh Creek, Bergen Basin and Thurston Basin</i>	To address CSO mounds, DO and ecological goals.	TBD	\$203 million for aeration and dredging	Partial	DEP
	<i>Support Army Corps ecological restoration projects in Paerdegat Basin and Fresh Creek</i>	To address DO and ecological goals.	TBD	NA	NA	USACE
	<i>Implementation Strategy</i>	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Dissolved Oxygen	<i>Pursue Aerators at Fresh Creek, Bergen Basin and Thurston Basin.</i>	Add oxygen to improve dissolved oxygen levels.	Design from 2015 to 2017. Construction from 2018 to 2021.	\$112.3 million	N	DEP
	<i>Investigate Potential for Future Aeration in other CSO and Non-CSO Tributaries</i>	Determine the need and efficacy of in-stream aeration for other creeks in Jamaica Bay.	TBD	TBD	N	DEP
Robust Scientific Monitoring						
	<i>Implementation Strategy</i>	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
	<i>Enhanced Scientific Monitoring Program</i>	Develop enhanced water quality and ecological monitoring program. Coordinate monitoring among various entities.	Announce enhanced monitoring program Oct 2008.	TBD	N	DEP with other agencies/

TABLE ES-1: Jamaica Bay Watershed Protection Plan Implementation Strategies

Restoration Ecology						
	Implementation Strategy	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Salt Marsh Restoration	<i>Establish Salt Marsh Island Wetlands Priority Restoration Review Board</i>	Board would review restoration logistics and begin to establish a priority list of wetland restorations.	Review Board to be initiated shortly	NA	NA	Multi-agency
	<i>Marsh Island Wave Attenuator Pilot</i>	Install prefabricated attenuators to reduce wetland erosion loss.	Design anticipated to begin Summer 2009.	\$576,000	Y	DEP
	<i>Marsh Island Restoration</i>	Elders Point and others.	Summer 2008 - Elders Point	Elders Point: \$3 million from DEP - cost sharing from others.	Y (NYCDEP portion)	USACE, DEC, DEP
	Implementation Strategy	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Land Acquisition and Restoration Along Periphery of Bay	<i>Complete Restoration of Penn Avenue Landfill, Fountain Avenue Landfill, Paerdegat Basin and Springfield Lake</i>	Ecological restoration of public land.	Landfills currently in construction and will be completed in 2008; Paerdegat start construction 2009. See below for Springfield Lake.	\$20 million landfills; \$10 million Paerdegat.	Y	DEP
	<i>Transfer HPD Properties in the Edgemere Section of Queens to Parks</i>	Continue to transfer 10 acres of land; design and implement restoration project.	Transfer to occur shortly. Restoration efforts TBD.	TBD	N	DEP, HPD, DPR
	<i>Pursue Acquisition and Restoration Efforts in Other Periphery Areas</i>	Determine status of subject properties; design and implement stormwater BMPs or restoration.	Field verify sites, place holds on property within 6 mos. Restoration TBD.	TBD	N	Multi-agency
	<i>Acquire Seagirt Avenue Properties in Rockaway, Queens</i>	Leverage funds from multiple agencies to acquire lands.	TBD	NA	NA	Multi-agency
	<i>Update and Inventory Dune and Beach and Other Habitats</i>	Update inventory of existing habitats and coverage using GIS.	Begin inventory update in 2008; approximately 1 year to complete.	\$400,000	Y	DEP, other agencies
	<i>Expand Litter Removal and Reduction Programs</i>	Extend trash collection beyond Labor Day; NYCDEP sponsored clean-ups and plantings.	Ongoing	NA	NA	DEP, DPR
	<i>Reduce the Extent of Invasive Vegetation</i>	Promote the importance of invasive species management.	Ongoing	TBD	TBD	DEP, other agencies
	<i>Determine RTE Restoration Priorities and Targets</i>	Determine RTE Restoration Priorities and Targets in coordinate with relevant stakeholders.	Establish priorities species by October 2008.	NA	NA	DEP, other agencies

TABLE ES-1: Jamaica Bay Watershed Protection Plan Implementation Strategies

On-Site BMPs for New and Existing Development						
	Implementation Strategy	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Pilot and Demonstration Projects	<i>Green Roof / Blue Roof Pilot Study</i>	Monitor effectiveness of blue roof vs. green roof on two existing commercial buildings. Compare results between blue and green roofs.	Design anticipated to begin late 2007.	\$352,500 for design/construction; Plus monitoring costs	Y	DEP
	<i>Rain Barrel Give-away Pilot Study</i>	Distribute 1,000 rain barrels to homeowners.	Design anticipated to begin Summer 2008.	\$138,000	Y	DEP
	<i>Parking Lot Pilot Study</i>	Two 1.5 acre parking lots retrofitted to comply with new DCP zoning regulations.	Design anticipated to begin late 2007.	\$290,000 for design/construction; Plus monitoring costs	Y	DEP
	<i>NYCHA or HPD Pilot Study</i>	Retrofit an existing NYCHA or HPD property with infiltration and detention BMPs.	Design anticipated to begin Summer 2009.	\$550,000	Y	DEP
	<i>Evaluate Rooftop Detention</i>	Promote on new construction; assess existing large rooftops.	Begin in late 2007.	\$40,000 (see also cost sharing below)	Y	DEP & SWCD
	<i>Porous Pavement on DEP Property</i>	Install and monitor pervious pavement on DEP facility parking lots and other areas.	Design anticipated to begin Summer 2008.	\$442,000	Y	DEP
	Implementation Strategy	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Economic Incentives	<i>Stormwater Rate Structure Study</i>	Evaluate alternative water, sewer, and stormwater rate structures and potential credit programs for BMPs.	Anticipated to begin in early 2008.	TBD	Anticipated shortly	DEP
	<i>Incentive Programs</i>	Being investigated under the Mayor's Interagency Task Force	Mayor's Interagency Task Force Report anticipated to be completed in Fall 2008.	NA	NA	Mayor's Office
	<i>Cost-Sharing Program Investigations</i>	Develop potential framework for design/build services incentive program.	Begin in late 2008.	\$40,000	Y	DEP & SWCD
	<i>Water Conservation Program</i>	60 MGD savings through low flow fixture rebates and cost sharing.	2008-2012	\$186 million	Partial	DEP
	Implementation Strategy	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Regulatory and Design Changes	<i>Zoning Code Parking Lot Design Requirements</i>	Add landscaping and bioretention components to commercial and community facility parking lots over 6,000 sf or 18 spaces.	Text change certified on June 18, 2007. Currently in approval process.	NA	NA	DCP with DEP and DPR
	<i>Code Review</i>	Review Sewer Code and make recommendations for potential revisions to facilitate BMP installation.	Anticipated to begin Summer 2008.	\$1 million (including BMP Design Manual)	Y	DEP
	<i>BMP Design Manual</i>	Create companion guidance document to sewer code revisions specific to NYC conditions.	Anticipated to begin Summer 2008.	Part of Code Review cost	Y	DEP
	<i>CEQR Technical Manual Revision</i>	Revise CEQR Technical Manual to include a specific section to address proposed developments in Jamaica Bay.	End of FY 2008	NA	NA	DEP/OEC
	<i>Monitor Benefits of BMP Implementation</i>	Develop indicators to track effects of BMP installations throughout the City over time.	To begin once implementation strategies begin.	TBD	TBD	DEP & Mayor's Office
	<i>Zoning Code Pervious Surfaces Requirements</i>	Potential front yard pervious requirements in R1-R5 zoning districts.	Fall 2007	NA	NA	DCP

TABLE ES-1: Jamaica Bay Watershed Protection Plan Implementation Strategies

Off-Site BMPs on Streets, Sidewalks, Highway Right-of-Ways, and Vacant Lands						
	<i>Implementation Strategy</i>	<i>Description</i>	<i>Schedule</i>	<i>Estimated NYCDEP Cost</i>	<i>Funded?</i>	<i>Agency</i>
Pilot and Demonstration Projects	<i>Belt Parkway Bridges Demonstration Project</i>	Attenuate and reduce the direct stormwater discharge through BMPs.	In design	\$95,000 for design; \$1.2 million for construction	Y	DEP, DOT
	<i>Streetside Infiltration Swales Pilot Study</i>	Install three swales on six sites to capture runoff from a roadway.	Design anticipated to begin late 2007.	\$510,000 for design/construction; Plus monitoring costs	Y	DEP
	<i>Constructed Wetlands Pilot Study</i>	Construct wetland to capture runoff from a roadway.	Design anticipated to begin late 2007.	\$510,000 for design/construction; Plus monitoring costs	Y	DEP
	<i>Tree Pit Pilot Study</i>	Install five enhanced tree pits with stormwater subsurface cistern.	Design anticipated to begin late 2007.	\$112,500 for design/construction; Plus monitoring costs	Y	DEP
	<i>Vacant Parcels Pilot Study</i>	Implement stormwater parks on additional publicly-owned vacant parcels to capture stormwater runoff.	TBD based on Constructed Wetlands Pilot Study.	TBD	N	DEP
	<i>Implementation Strategy</i>	<i>Description</i>	<i>Schedule</i>	<i>Estimated NYCDEP Cost</i>	<i>Funded?</i>	<i>Agency</i>
Regulatory	<i>Zoning Code Review - Street Trees</i>	Potential requirement for new developments/enlargements to provide street trees.	Fall 2007	NA	NA	DCP
	<i>Implementation Strategy</i>	<i>Description</i>	<i>Schedule</i>	<i>Estimated NYCDEP Cost</i>	<i>Funded?</i>	<i>Agency</i>
Open Space and Greening Projects	<i>PlaNYC Street Tree Planting</i>	Street tree planting throughout the city including Jamaica Bay watershed.	23,000 trees planted annually citywide.	NA	NA	DPR & Mayor's Office
	<i>PlaNYC Greenstreets Initiative</i>	Fourteen new Greenstreets within Jamaica Bay watershed.	Fall 2007; 3,000 new Greenstreets citywide by 2017.	NA	NA	DPR & Mayor's Office
	<i>East New York Community Forestry Management Plan</i>	Increase street tree stocking level in East New York.	Plant 850 trees in Brooklyn CB 5 over next 10 years through PlaNYC Street Tree Initiative.	NA	NA	DPR & Mayor's Office
	<i>Baisley Pond Park Project</i>	Using stormwater BMPs, storm sewers will route stormwater into Baisley Pond.	Slated for construction in 2010.	\$3-4 million (estimated)	Y	DEP
	<i>Springfield Park Project</i>	Using stormwater BMPs, storm sewers will route stormwater into Springfield Lake.	In Design; construction is slated to begin in 2009.	\$15 million (estimated)	Y	DEP

TABLE ES-1: Jamaica Bay Watershed Protection Plan Implementation Strategies

Public Education and Outreach						
	<i>Implementation Strategy</i>	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Raise Awareness	<i>Enhance Jamaica Bay-related Educational Curriculum</i>	Educational Resource Directory	Prototype to be completed late 2007.	\$6,000	Y	DEP, NYCSWCD
	<i>Organize "State of the Bay" Scientific Symposium</i>	Coordinate/guide scientific investigations and report scientific findings. Inform Plan updates.	First symposium Summer 2008.	\$20,000 not including venue	Partial	DEP, NYCSWCD
	<i>Create a targeted campaign for developers, residents, and business owners to protect Jamaica Bay</i>	Brochure on importance of the Bay, human activities in watershed, and pollutant reducing practices.	Brochure to be completed in late 2007.	\$6,000	Y	DEP, NYCSWCD
Public Use and Enjoyment						
	<i>Implementation Strategy</i>	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Public Access	<i>Rockaway /Gateway Greenway</i>	Establish an approximately 20-mile continuous greenway loop around the Bay.	Some portions are complete or nearing completion, others are to be determined.	NA	NA	DOT, DPR
	<i>Laurelton and Cross Island Parkway Greenways</i>	Establish a 22-mile path through parkland; link between Brooklyn/Queens Greenway and Jamaica Bay waterfront.	Phase I was completed in 2006; Phase II is pending additional funding	NA	NA	DOT, DPR
	<i>Southern Parkway Path and Conduit Boulevard</i>	Establish a greenway to connect Brooklyn/Queens Greenway system to Jamaica Bay waterfront.	TBD	NA	NA	DOT, DPR
	<i>Far Rockaway North Shore Greenway</i>	Establish a greenway to connect Far Rockaway with Rockaway Gateway Greenway	In process with current HUD development.	NA	NA	HUD
	<i>Floyd Bennett Field/Gateway National Recreation Area</i>	Capital projects within Gateway National Recreation Area.	TBD	NA	NA	NPS
	<i>Brooklyn/Queens Greenway -Eastern Parkway Extension</i>	Greenway improvement including landscaping, multi-use paths, bike racks, pedestrian ramps, traffic signals, etc.	Design underway; to be completed in June 2010.	NA	NA	DOT, DPR, DCP
Implementation and Coordination						
	<i>Implementation Strategy</i>	Description	Schedule	Estimated NYCDEP Cost	Funded?	Agency
Plan Implementation	<i>Jamaica Bay Water Quality and Ecological Restoration Steering Committee</i>	Under Harbor Estuary Program organizational structure.	TBD	NA	N	Multi-agency
	<i>BMP Implementation through Mayor's Office Interagency BMP Task Force</i>	Mayor's BMP Task Force to coordinate BMP implementation strategies.	Ongoing	NA	NA	Multi-agency
	<i>Education Steering Committee</i>	Continue committee's efforts to implement education and outreach strategies.	Ongoing	\$75,000	Partial	DEP, NYCSWCD
	<i>Monitor and Review Changes to the Watershed</i>	Track new development, BMP implementation, and overall growth in the watershed in coordination with other agencies.	Ongoing	TBD	N	DEP/OEC