



Interim Report

September 1, 2006



New York City Department of Environmental Protection

Emily Lloyd, Commissioner



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Jamaica Bay Watershed Protection Plan

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Opening Remarks from Commissioner Lloyd...

"Although its watershed is highly developed, Jamaica Bay remains one of the most sensitive and important estuaries on the Atlantic Coast, the host of 325 species of birds and 100 species of fish. To improve the water quality in Jamaica Bay, DEP has already invested over \$1 billion in improving the four wastewater treatment plants in the Jamaica Bay watershed, constructing two combined sewer overflow facilities, and capturing and treating leachate from the two landfills bordering the Bay. As part of a commitment we have made to our regulators, DEP is continuing to evaluate additional facilities and projects that could further improve Jamaica Bay.

At the same time, DEP is carrying out its mandate under Local Law 71 of 2005 to create a Jamaica Bay watershed protection plan. This is one of DEP's most urgent and important projects. Through monthly meetings with the Advisory Committee and additional meetings with the general public, DEP has actively sought the input of the many stakeholders who have some expertise with respect to Jamaica Bay. The preservation of the Jamaica Bay watershed is essential to maintaining its function as an ecological wetland as well as a recreational location for City residents who use the Bay for fishing and boating. Over the years, Jamaica Bay has been harmed by overdevelopment and pollution. DEP's current mission is to investigate sources affecting pollution and to develop an action plan for the future. The scope of the watershed protection plan required by Local Law 71 is extremely broad, and the schedule for its completion extremely ambitious. We also want to ensure that interested citizens have a voice in our planning process."

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1. Introduction

The residents and visitors of New York City are fortunate to have such a unique and valuable natural resource within an extensively urban environment. Jamaica Bay not only serves as a premier wildlife refuge at the National Parks Services' Gateway National Recreation Area, but it provides ample recreational opportunities including fishing, birding and boating and a much needed respite for residents of an otherwise hectic city. Jamaica Bay also includes natural settings that provide opportunities for people of all ages to learn about natural systems and estuarine environments. Finally, Jamaica Bay is home to many communities in Brooklyn and Queens, including Broad Channel, Howard Beach, Mill Basin and the Rockaways, just to name a few.

As can be concluded from the Jamaica Bay Watershed Protection Plan Advisory Committee's (JBWPPAC's) preliminary recommendations, NYCDEP is not alone in its respect and concern for Jamaica Bay. On behalf of the City of New York and its Mayoral agencies, the New York City Department of Environmental Protection's (NYCDEP) goals are to support and promote the diversity of uses experienced at Jamaica Bay. To that end, NYCDEP carefully considered the recommendations of the JBWPPAC. NYCDEP is also diligently pursuing a thorough list of goals, objectives and potential management strategies for Jamaica Bay as part of the Jamaica Bay Watershed Protection Plan (JBWPP) development process and will continue

the process of evaluating strategies to attain multiple goals and objectives.

NYCDEP generally supports all of the recommendations that promote Jamaica Bay as a natural and recreational resource. However, despite a robust capital investment program, the Department's budget for capital investments is not limitless and there are many competing needs for these funds. 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. Other City, State and Federal agencies experience similar levels of financial responsibility to program limited funds throughout the City. Therefore, support for projects, or ideas must offer a demonstrated return before large investments can be made. With that in mind, NYCDEP was careful not to prejudice the Interim Report with a bias for or against certain recommendations where further study or analysis is needed to guide this decision making process. NYCDEP's responses to the JBWPPAC's recommendations are summarized in this report and generally characterized by a statement in conclusion to support, reject or retain for further study, as appropriate.

This Interim Report provides information about the current status of the JBWPP development process and steps to be taken in the future to complete the final JBWPP by October 1, 2007. As required by Local Law 71 (LL 71) and Introduction No. 376, this Interim Report also provides NYCDEP's

initial responses to the preliminary recommendations of the JBWPPAC. Notwithstanding the limited time provided to thoroughly review and evaluate the very complex issues raised by these recommendations, the NYCDEP project team carefully reviewed each recommendation to compile the most appropriate response. It is important to note that additional information, assessment and further discussion with the JBWPPAC is necessary before specific recommendations can be recommended in or deleted from the final JBWPP. To adequately determine the feasibility, anticipated benefits and projected costs of these recommendations, a coordinated effort is required of many involved Federal, State and City agencies, as well as many private stakeholders. Over the course of the next year, NYCDEP will rely on a collaborative effort to continue to review, assess and adapt, as necessary, the recommendations and management strategies that provide the most effective and beneficial environmental improvements while understanding the potential cost implications of these actions.

The results of this current review, or NYCDEP's initial responses to the recommendations, are described in



The wetlands and adjacent protective vegetated buffers of Jamaica Bay serve invaluable natural functions including habitat, flood control and protection, natural pollutant attenuation and local marine research.

Section 4.0 of this Interim Report. Specifically, related information for each recommendation is provided as part of the Department's responses. For those identified as requiring further assessment, an explanation is provided along with schedule information for such assessment's completion. Information explaining the rationale for not including specific recommendations is also described as part of the Department's responses.

As described on the following pages of this Interim Report, the future development of the JBWPP will involve further refinement and assessment of specific Advisory Committee recommendations along with potential management strategies currently under consideration by the JBWPP project team.

1.1. Local Law 71 and Introduction 376

NYCDEP is responsible for developing a watershed protection plan for the Jamaica Bay, per LL 71 signed by Mayor Bloomberg on July 20, 2005. The bill was originally sponsored by the City Council Committee on Environmental Protection chaired by Council Member Gennaro. The Council Member's objective in sponsoring the bill was to ensure a comprehensive watershed approach toward restoring and maintaining the water quality and ecological integrity of the Bay. Implementation of 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 also required that an advisory committee be formed to assist NYCDEP in fulfilling its responsibilities. On June 29, 2006, the JBWPPAC submitted its

preliminary recommendations to the City Council and NYCDEP.

At the June 26, 2006 City Council hearing, Council Member Gennaro introduced legislation (Introduction No. 376) to amend the administrative code, in relation to the watershed protection plan for Jamaica Bay. Council Member Gennaro specifically requested that NYCDEP be granted an extension for the development of the JBWPP. At the August 16, 2006 City Council hearing, the Council passed Introduction No. 376 and granted NYCDEP the one-year extension to October 1, 2007 for the completion of the JBWPP.

A typical watershed protection plan can take three to five years to complete. This, combined with the unique and complex nature of the Jamaica Bay watershed, necessitated an extension of one-year minimum allowing for a total completion time of two-years. As such, the extension will allow NYCDEP to further assess the following activities necessary for the completion of an effective watershed protection plan for this unique urban watershed:

- Incorporate important findings and recommendations of two parallel NYCDEP projects—the Jamaica Bay Comprehensive Water Quality Plan (JBCWQP) due in October 2006 and the Long-Term Control Plan (LTCP) due in June 2007;
- Conduct additional modeling and analyses to fully assess the complicated issues and information gathered to date, and allow NYCDEP to adequately and correctly evaluate the proposed recommendations and scientific findings; and
- Continue discussions with the JBWPPAC and other agencies such as NYC Department of City Planning (NYCDECP), NYC Economic

Development Corporation (NYCEDC), National Parks Service (NPS), etc. about how to implement specific potential management strategies, and identify cost-sharing partners and alternative funding sources.

1.2. Role of the Advisory Committee

LL71, Section 2.h. (2), required NYCDEP to develop a plan in consultation with an advisory committee. The JBWPPAC is composed of seven members: four selected by the Mayor and three selected by the Speaker of the Council. While each member was selected based on their affiliation with a specific organization, the group was also responsible, in part, for representing the broader public interest in the process. Member representation includes NPS, Natural Resources Defense Council (NRDC), Jamaica Bay Eco Watchers, Marine Sciences Research Center at Stony Brook University, Port Authority of New York and New Jersey (PANYNJ), U.S. Army Corps of Engineers (USACE), and a community/environmental activist.

Since the beginning of the plan development process, NYCDEP met monthly with the JBWPPAC to review issues of concern, existing data and a framework for developing potential strategies. To initiate the dialogue between NYCDEP and the JBWPPAC, the first meeting included a boat tour of Jamaica Bay with NYCDEP Commissioner Emily Lloyd and members of the project team.

Using information from these meetings as well as independent analyses, the JBWPPAC formulated and submitted their preliminary recommendations for the JBWPP to NYCDEP on June 29, 2006. NYCDEP's preliminary responses

to these recommendations are included in Section 4.0 of this Interim Report.

1.3. The Value of the Bay

For thousands of years, Jamaica Bay has served as an important ecological resource for flora and fauna populations. 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. For example, these natural communities support 91 species of fish, 325 bird species (of which 62 are confirmed to breed) and are an important habitat for many species of reptiles, amphibians and small mammals. The Bay is a critical stop-over area along the Eastern Flyway migration route and is one of the best bird-watching locations in the western hemisphere. The 12,000 acres of water and shorelines support seasonal or year round populations of 214 species of special concern, including state and federally listed species. Because of its



Balancing the different uses of Jamaica Bay is a significant challenge for environmental managers. Public education and outreach strategies and actions are necessary to minimize conflicts and foster stewardship throughout the watershed.

geographic size and very diverse functioning natural habitats, it is no surprise that Jamaica Bay is a national and international renowned birding location.¹

Jamaica Bay, one of the largest coastal wetland ecosystems in New York State, is a component of the National Park Services' Gateway National Recreation Area (GNRA). In addition, a significant portion of the bay, approximately 9,100 acres has also been designated as the Jamaica Bay Wildlife Refuge and is designated by the New York State Department of State as a Significant Coastal Fish and Wildlife Habitat. The diversity of bird species and breeding habitats within the bay were important factors in these designations. The Jamaica Bay Wildlife Refuge was also the first site to be designated by the National Audubon Society as an "Important Bird Area." It is clear that Jamaica Bay is currently functioning as a regional habitat for many different types of wildlife.²

In one sense, 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. For others, the Jamaica Bay landscape has a more practical use, as a living-space, work-space, or travel corridor. These values reflect an important aesthetic and function, but represent only a fraction of the myriad of values and roles associated with Jamaica Bay.

The Jamaica Bay estuary is only about half of its pre-colonial extent. The more estuarine features and functions that are lost within the Bay's watershed

and elsewhere in the Northeast and Mid-Atlantic regions, the more valuable and delicate the remaining ecological assets such as habitat in Jamaica Bay becomes. Consequently, and unfortunately, other non-use values or non-market benefits, as they are commonly referred to as, are expected to decrease as the degradation of estuarine resources along NYC's coastal areas continues to occur including:

- The ecological value of the tidal estuary, locally, regionally and internationally;
- Diverse habitats including salt marsh, coastal grasslands, woodlands, maritime shrubland, and brackish and freshwater wetlands;
- The on site recreational use for bird watching, wildlife viewing and fishing, as well as for other recreational activities such as bicycling, swimming, walking, boating/canoeing and picnicking;
- The local value of the viewshed;
- Aesthetic values to adjacent landowners;
- The socioeconomic benefits to the City of having the Bay as a resource, and of the City's identification with the Bay;
- Local marine research and site of an outdoor classroom;
- The natural functions of flood control and infrastructure protection against storm surges; and
- The natural function of pollutant attenuation.

It is important to understand the ecological effects of substantial and, in some situations, irreversible modifications that have occurred to the Bay 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 freshwater and coarse sediment exchanges have essentially disappeared leaving behind deposits of silts and particulates from urban runoff. 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.

It has become apparent that some ecological functions and valuable environmental resources provided by the Bay to the surrounding communities and region are at risk. Living resources and natural processes that have been self-sustaining since the last glacial epoch are in jeopardy and may need to be sustained by some type of environmental intervention in perpetuity. It is only now, when we are realizing the effects of centuries of urban development that the true value of sustaining and maintaining our natural heritage in this ecologically productive area has become starkly evident.

1.4. The Need for Watershed Planning

LL 71 mandated the development of a plan "to restore and maintain the water

quality and ecological integrity of Jamaica Bay.” As a result, the JBWPP must investigate water quality issues such as low dissolved oxygen in select locations of the open waters and specific tributaries, high nitrogen loadings into the Bay, and high pathogen loadings into the tributaries. At the same time, the JBWPP must address adverse impacts on the watershed’s ecological system and especially the loss of salt marsh island wetlands. Research suggests that interior island wetland loss has accelerated over the last 90 years and that up to 44-acres of wetlands were lost for each year in the 1990s. At this rate, it is projected that all salt marsh island wetlands could be lost by 2045.³

While the direct cause(s) of this accelerated rate of wetland loss remains unknown, the primary mechanisms of transformation in the Bay and its watershed have been directly or indirectly related to human disturbance. Urban development—including residential, commercial, industrial, public facilities, and transportation infrastructure—and the near complete loss of upland natural features had a direct impact on the ecological integrity of perimeter areas and water quality in the receiving waters of the Jamaica Bay estuary. The



Water quality improvements, as one of the goals of the JBWPP, would help to support a healthy and self-sustaining ecosystem for natural wildlife communities and enhance recreational uses for New York City’s residents and visitors.

degradation of the Bay’s wetland and estuarine ecosystems has resulted in impaired or reduced functions of the local environment. Climate change, whether associated with anthropogenic activities or changing climate cycles, also influences local environmental conditions, in terms of sea level rise in the estuary and changes in temperature and precipitation trends in the watershed. Finally, ongoing natural geophysical and ecological processes continue to shape, change and redefine the Bay and its watershed.

The Jamaica Bay watershed is readily partitioned into two separate “zones” of disturbance: those areas that have been impacted by direct human settlement, and those areas which still remain ecologically functional, where no human habitations or few structures exist. This latter zone is encompassed by the remaining undeveloped shoreline, protected areas and islands of the Jamaica Bay estuary. The vast majority of the watershed has been converted to urban development and beneficial upland ecological functions that once existed have been substantially modified.

The combination of human disturbances and natural processes has resulted in water quality, ecosystem health, and human use impairments. The JBWPP is an attempt to identify and assess the specific causes of these types of watershed impairments. Although many direct causes of specific impairments remain unknown, the following factors have been identified during the plan development process to date:

Water Quality

- Increasing human populations in Brooklyn and Queens and the

associated increase in sanitary waste generation.

- Increasing volumes of surface runoff as a result of urban development and the spread of impervious surfaces.
- Elimination of natural streams and inputs to the Bay deprives the Bay of natural sediment and consistent freshwater flushing.
- Prior landfill operations displacing freshwater wetlands in the upper watershed and tidal wetlands in the estuary, impeding natural wetland filtration processes and altering tidal circulation patterns.
- The continuing westward extension of the Rockaway spit, which may be contributing to the lack of circulation and mixing of Bay waters in the estuary.
- Dredging operations in the Jamaica Bay estuary, which have increased the bathymetric depth of the Bay and resulted in a decrease in circulation and tidal mixing.

Ecosystem Health

- Direct displacement and fragmentation of habitat by residential, commercial, industrial, and transportation infrastructure.
- Landfilling of ecologically sensitive areas, especially tidal wetlands around the perimeter of the Jamaica Bay estuary and freshwater wetlands and riparian areas in the upper watershed.
- The introduction of invasive exotic flora and fauna into the watershed, which can prey on or out-compete the native species for available resources.

- Degraded water quality (discussed above) in marine and brackish environments that can lead to direct and indirect health problems for aquatic organisms.
- Changing climate patterns, which has a myriad of effects (many of them poorly understood or unforeseen) on ecosystems in the Jamaica Bay watershed.

Human Uses

- Impaired water quality and contaminated sediments in the Jamaica Bay estuary that results in human health hazards. This limits recreational uses such as fishing (including shellfish harvesting).
- Limited access to recreational uses within the Bay due to the lack of coordinated recreational planning and competing uses.
- Impaired recreational value as a fishery and bird watching location as a result of negative ecosystem impacts, including the loss of vital wildlife habitats.
- Bad odors in the tributary basins as a result of combined sewer overflow (CSO) loadings and untreated wastes in the water and sediments.
- Impaired aesthetic value from pollution (floatables and debris) and ecosystem impacts (loss of salt marsh islands and shoreline buffer).

The key impairments or issues and the interrelationships between the sources of perturbation, the resulting stressors, ecosystem effects, and human use impacts are displayed in an Ecosystem Model (see model on next page). This diagram displays the cause and effect

of various disturbances that historically or presently occur in the Jamaica Bay watershed, detailing how natural and human-influenced processes have altered the environment. It is hierarchical in organization, meaning that the higher up in the diagram an element is located, the greater range of influence it has over other factors. For instance, the "sources" are ultimately the root causes of alteration, which lead to a series of environmental "stressors". If a "source" of alteration is mitigated, then the "stressor" will ultimately disappear. "Stressors" influence ecosystem elements, triggering an "ecosystem response". Finally, changes to the ecosystem influence the "human uses" of the landscape, which feed directly back to the original driver of perturbation, urbanization and landscape alteration. It is important to note that given the existing configuration and urban characteristics of the watershed, some "stressors" may prove themselves difficult to mitigate entirely (e.g., high degree of impervious surfaces, transportation routes, population, etc.).

This diagram helps to explain the complex interrelationships between ecosystem and urban elements within the watershed and provides a tool for evaluating recommendations intended to alleviate the sources and stressors associated with ecosystem and human use impacts.

1.5. Current and Planned Watershed Protection Efforts

The watershed/sewershed consists of approximately 91,000 acres (140-sq. miles) of land area and open waters. An estimated 1,000 acres (2-sq miles) of salt marsh wetlands currently exist with the Bay's open waters.⁴ Due to the size of the land area and Bay's open waters, approximately twenty-two

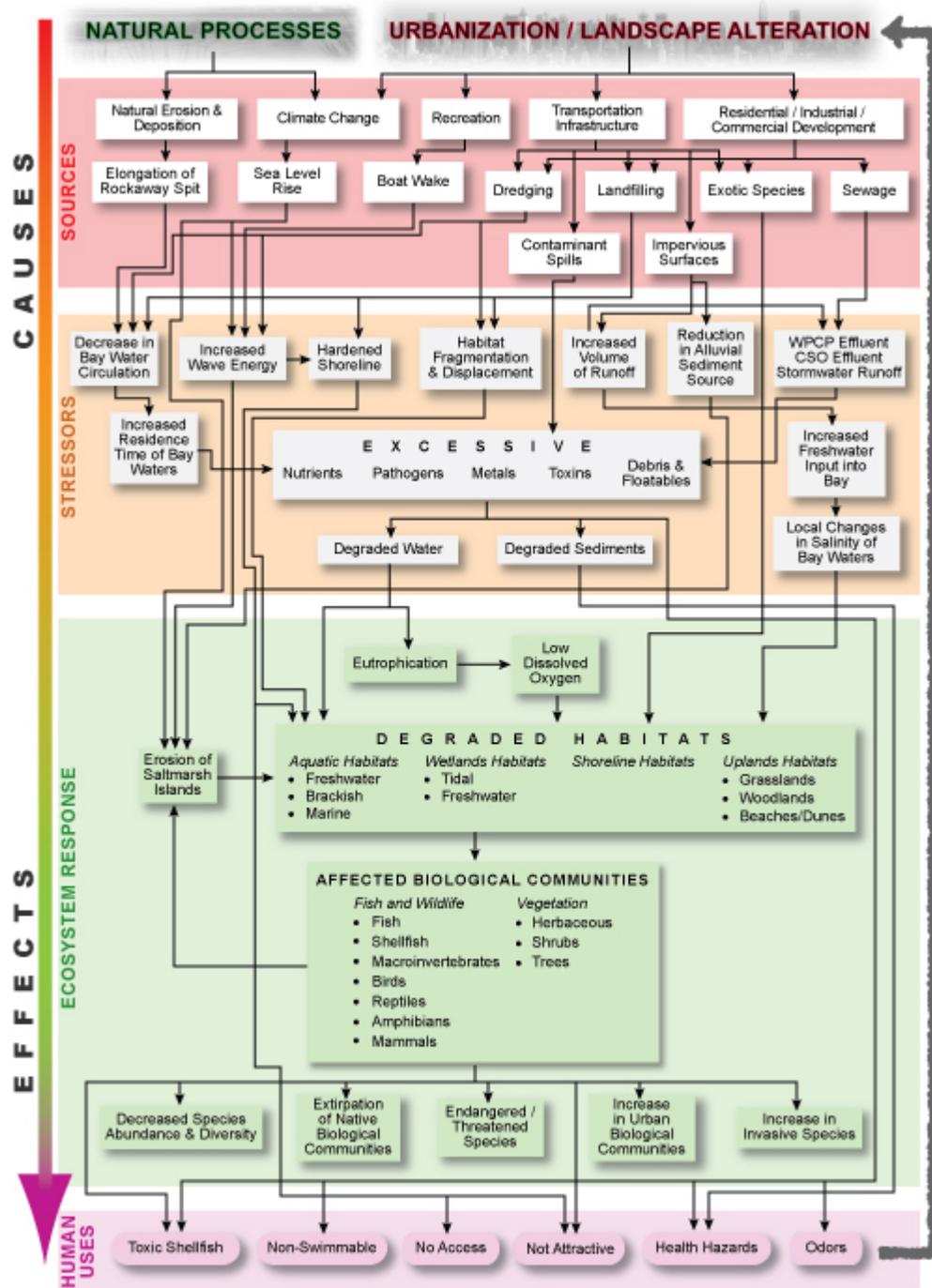
government agencies have jurisdiction within the Bay and/or its watershed. As a result, differing agency missions or programs can promote potential conflicts between human uses and the ecological functions of the Bay and its watershed. However, a second result is that many different agencies, including NYCDEP, are responsible for implementing a variety of protection efforts including restoration/conservation projects and engineering controls. Particularly for restoration/conservation, the number of entities that have planned or implemented restoration projects is great due to non-governmental organizations that are also involved in watershed protection efforts.

The list of current and planned protection efforts below is organized by either restoration/conservation or engineering controls. The efforts below do not represent an exhaustive list but do provide a snapshot of the types of efforts currently taking place. The final JBWPP will provide detailed information about the efforts below as well information about additional efforts.

Restoration and Conservation

- Yellow Bar and Elder's Point Interior Wetland Islands Restoration (USACE, NPS, New York State Department of Environmental Conservation, NYSDEC, and PANYNJ)
- Wetland Restoration and Demonstration of Thin-layer Spraying of Big Egg marsh (NPS)
- Jamaica Bay Ecosystem Restoration Projects (NYCDEP and USACE)
- Closure Remediation and Ecological Restoration of the Pennsylvania and Fountain Landfills (NYCDEP) Paerdegat Basin Wetland and Upland Restoration (NYCDEP)

Jamaica Bay Watershed Ecological Model



- Restoration Projects within Idlewild Park (NYCDEP and NYC Department of Parks and Recreation, *NYCDPR*)
- New York State Bond Act Wetland and Upland Buffer Restoration Projects (NYCDEP and NYCDPR)
- NY/NJ Harbor Estuary Program (HEP)
- Blue Ribbon Panel (NPS)
- New York City Wetlands Task Force

Engineering Controls

- 26th Ward WPCP Upgrade (NYCDEP)
- Paerdegat Basin CSO Retention Facility (NYCDEP)
- City-Wide Comprehensive CSO Floatables Plan (NYCDEP)
- City-wide Long-Term CSO Control Planning including Jamaica Bay Tributaries CSO Plans and Jamaica Bay CSO Abatement Facility Plan (NYCDEP)
- Comprehensive Jamaica Bay Water Quality Plan (NYCDEP)

2. Development of Plan to Date

2.1. Development of Vision and Goals

Early in the planning process, NYCDEP and the Advisory Committee participated in discussions of a shared vision of what a future Jamaica Bay could be to direct and coordinate water quality improvement and ecosystem restoration efforts. Recognizing that the JBWPP is a continuously evolving or living document, an Adaptive Management approach is being utilized to incorporate findings from diverse

studies of the Bay, results and observations of existing management efforts and new information to better guide the JBWPP in providing the most environmentally beneficial and cost effective strategies. With that in mind, the following vision was developed to support the planning process and help identify the most appropriate and effective potential management strategies:

The Jamaica Bay watershed is a place where New Yorkers and visitors co-exist with natural areas and clean water that harbor healthy waterfowl, fish, and shellfish populations. It is a place where urban communities embrace environmental stewardship and where wetlands and other natural areas are protected and restored for future generations. The Jamaica Bay estuary is once again a cultural and recreational hub for New York City, where residents swim, fish, boat and enjoy nature.

To accomplish this vision, a set of seven distinct goals that broadly address the issues facing the watershed were developed for the JBWPP. Ideally, the vision would be achieved if all of the goals were met. For each goal, a set of specific objectives is being developed to provide the basis for achieving the goal and metrics for tracking progress toward that goal. Finally, each objective can be further broken into individual management strategies or actions which must be completed to achieve the objective. In essence, the development and refinement of these management strategies or actions will be the "roadmap" for attaining the future vision of a healthy, sustainable Jamaica Bay.

The seven draft goals are:

- 1) Improve and maintain water quality in Jamaica Bay to support a healthy and self sustaining ecosystem and to improve recreational use.
- 2) Protect, restore or create wetlands and adjacent upland buffers.
- 3) Protect, restore, and maintain indigenous fish, shellfish, birds, other native wildlife and invasive species control.
- 4) Provide public access and recreational opportunities along Jamaica Bay and in its watershed.
- 5) Promote watershed protection practices in land use planning and development within the watershed.
- 6) Foster local watershed stewardship among all stakeholders by increasing public awareness and community involvement through outreach and education activities.
- 7) Provide a framework for the implementation and coordination of recommended protection and restoration actions into the future.⁵

2.2. Public Involvement and Stakeholder Meetings

Public involvement and stakeholder input are critical components of watershed protection and planning. This involvement and input ensures that the plan and proposed management strategies/actions are based on a comprehensive knowledge of the issues facing the Bay and broad acceptance of specific solutions for implementation throughout the watershed.

As previously mentioned, a number of agencies—Federal, State and City—

have jurisdiction in the Bay and throughout the watershed. In addition, there are many non-governmental groups and individuals that have implemented programs and activities in the watershed focused on a range of objectives, including preserving habitat; enhancing quality of life in communities surrounding the Bay and raising awareness about the local ecology and critical issues facing the Bay. The final JBWPP will describe the programs and activities of governmental and non-governmental stakeholders in detail to identify overlapping or conflicting objectives with potential impact on the Bay.

The development of the JBWPP to date has utilized three mechanisms for obtaining stakeholder input from the governmental and nongovernmental organizations mentioned above: monthly Advisory Committee meetings; public meetings in the watershed; and interagency meetings and communications.

To date, three public meetings have been held specifically to obtain public input for the JBWPP. The first two were scoping meetings—in Brooklyn and Queens—in which LL 71 information was presented along with the priority issues facing the Bay and a potential process for developing a plan to address these issues. Individual members of the public as well as representatives of various groups were provided the opportunity to respond to the information presented and inform the plan development process during the early stages of the process. A third watershed-wide public meeting was held in Queens to provide the public with a status report just prior to the plan extension request presented to City Council in June 2006.

Similar information was shared with representatives of various New York

City agencies at the beginning of the plan development process to obtain a better understanding of City programs and efforts with impact on the Bay and to inform other departments of NYCDEP's charge per LL 71. A large interagency meeting was held in April 2006 with the following City agencies represented: NYCDPC; NYCEDC; NYCDPR; Borough Presidents Offices (Brooklyn and Queens); Design and Construction (NYCDDC); Transportation (NYCDOT); Sanitation (DSNY); Housing, Preservation and Development (NYCHPD); Office of Environmental Coordination (NYCOEC); and Buildings (NYCDOB).

In addition, a series of meetings were held with individual agencies to discuss potential management strategies that could impact different agency objectives or programs. As required by LL 71, several ongoing discussions were held with NYCOEC staff to discuss a protocol for coordination that would ensure future projects proposed within the watershed are reviewed for potential environmental impacts on the Bay and surrounding land areas. NYCDEP has met with NYCDPC to discuss applicable zoning regulations and potential strategies for reducing watershed surface imperviousness. A meeting was held with NYCEDC to discuss future development projects in the watershed. Finally, a separate meeting was held with the NYCDPR to discuss ways to "green" the watershed.

The NYCDEP and Advisory Committee will continue to use and expand upon the above public and stakeholder involvement approaches until the final JBWPP is completed and submitted to the City Council on October 1, 2007.

2.3. Existing Conditions Assessment

The NYCDEP consultant team completed an extensive review of existing research and literature to provide a comprehensive report of the existing conditions of the Bay and its watershed. The information compiled and analyzed provides the technical information needed to understand the issues facing the Bay and, consequently, the most appropriate solutions for evaluation. Specifically, the first third of the existing conditions assessment presents the current set of geographical, geophysical, water quality, and ecological data that can be used to inform potential management decisions. The second third presents information on the human uses of the watershed, including land use, zoning, recreation and access. Finally, the last third of this assessment catalogues the stakeholder institutions, their distinctive jurisdictions and mandates, current planning efforts, and public outreach programs.

As a result of this assessment, the Bay impairments and watershed factors were identified (see brief summary in Section 1.4 of this Interim Report). The detailed information that resulted from the existing conditions assessment will continue to be used to guide the development of appropriate management strategies and recommended actions to be included in the final JBWPP. In addition, this type of information will be made available to other agencies and organizations to provide a comprehensive existing conditions report and to assist future management decisions with potential impact in the watershed.

2.4. Watershed Modeling

Computer modeling is a critical component of the plan development

process. Modeling enables the project team to test hypotheses regarding the issues and high priority problems facing the Bay. Although modeling has limitations and may not provide conclusive findings to the issues involved, the results provide valuable information that can be used to further improve the focus of the JBWPP, refine potential management strategies, and develop final recommended actions.

Several different modeling tools and methodologies were employed during initial modeling efforts to understand both the direct and indirect impacts of specific alternatives. The 26th Ward Water Pollution Control Plant (WPCP) drainage area was the sewershed/watershed used for this landside modeling effort and analysis of population growth, water conservation activities, and application of Best Management Practices (BMP's).⁶ InfoWorks software, a GIS-compatible model system, was used to model the sewer system including baseline (or current) and future (year 2045) sanitary flows. The preliminary results of this modeling provided encouraging information about the potential impact of current and future conditions on CSO volumes and number of CSO events.⁷

The results of the above landside modeling effort were then applied to a water quality model to assess the impact of potential changes to the sewershed on water quality.⁸ The water quality modeling system used—the North Channel Eutrophication Model (NCEM)—is a full eutrophication model with a sediment nutrient flux submodel developed specifically for Jamaica Bay tributaries. Water quality modeling results using the NCEM were compiled for Fresh, Hendrix and Spring Creeks.

The next step in that exercise is to identify actual BMP's and sites that might be capable of capturing,

detaining and treating a meaningful percentage (e.g., 10 percent) of the Bay's stormwater runoff. At this time, it is unclear whether this percentage could actually be reached and the following results are for illustrative purposes, as additional modeling refinement and analyses are required.

Landside Modeling Preliminary Findings

- As baseline dry weather flows (DWF's) increase, capacity for wet weather flows (WWF's) will decrease, resulting in increased CSO volumes and frequencies of discharge.
- A 10 percent reduction in DWF due to conservation efforts could reduce CSO volumes from 5-7 percent.
- A combination of conservation efforts (10 percent) and implementation of BMP's (reduced percent imperviousness) could reduce CSO's by 20-25 percent, if successful.
- Full sewer separation would eliminate CSO's, with all runoff now discharged as storm water to area receiving waters. The potential for capturing the "first flush" from separated storm sewers must be closely examined.
- BMP's should be included as measures to reduce wet weather impacts as part of the development of the JBWPP and the CSO LTCP.
- The preliminary findings summarized above should also be considered in the context of pollutant loadings, in addition to CSO discharge volumes.

Water Quality Modeling Preliminary Findings

- CSO and stormwater loadings have small impacts on water quality in Jamaica Bay, but have larger impacts on the tributaries.
- For Fresh Creek, and most likely other CSO creeks, BMP's will result in minor improvements in water quality above WPCP upgrades and sediment removal. However, this preliminary finding must be further examined because of the potential water quality benefits BMP's provide.
- Full sewer separation would have some positive effects on water quality in Fresh Creek, but would have negative impacts on water quality in Hendrix and Spring Creeks.

The above results will be used to direct the future development of the plan; in particular, the results have assisted the project team in the identification of additional modeling needs. For example, additional modeling will be conducted based on estimates of load and volume reductions from BMP's at varying penetration rates within the watershed. In addition, water quality modeling results for the open waters of the Bay will be obtained from the Department's JBCWQP being developed pursuant to the nitrogen agreement for the Long Island Sound signed by the City and State. Therefore, the modeling effort conducted to date for the JBWPP should be considered preliminary. Additional modeling to be completed in the future is discussed in greater detail in Section 4.4 below.

2.5. Development of Potential Management Strategies

The tasks described above as part of the plan development process to date allowed the project team to draft potential management strategies that

would address the issues identified in the existing conditions assessment and achieve the long-term vision for Jamaica Bay watershed. Through a continuously iterative process, the project team identified preliminary management strategies to cover each one of the goals and related objectives identified for the JBWPP.

The "draft" strategies being developed are based on existing literature from other model watersheds and planning processes as well as diverse expert and stakeholder input to address the unique characteristics—environmental, social and political—that comprise this highly urbanized watershed. In addition, other current activities or existing programs are being considered during the development of these potential management strategies in order to understand the complete picture of watershed protection and restoration efforts required to improve conditions in the Bay and achieve the long-term vision for the watershed.

The potential management strategies developed to date are considered "works in progress." Over the course of the next year, the strategies will be further assessed, refined, and evaluated. The final JBWPP will include a set of recommended strategies for near and long-term implementation based on the findings of these analyses.

3. Future Development of Plan

3.1. Further Assessment and Refinement of Potential Management Strategies

The potential management strategies described above and the specific JBWPPAC recommendations to be incorporated or assessed as part of the final JBWPP will be further developed

over the next year to enable NYCDEP to submit its recommended actions to the City Council on October 1, 2007. The future assessment of these potential management strategies requires additional information to be compiled through the completion of specific tasks. These tasks are described in detail in this section of the Interim Report and include: coordinate with the JBCWQP; provide opportunities for additional public involvement and stakeholder participation; conduct additional modeling; and develop education and outreach materials.

A primary focus of future work is to perform a detailed analyses of new, innovative stormwater treatment technologies and BMP's for potential application in the Jamaica Bay watershed. Specific stormwater technologies and BMP's will be analyzed to determine how these technologies have been applied in other locations, their actual effectiveness and how these may be applied in the unique setting of the Jamaica Bay watershed/sewershed. The applicability of specific technologies will be evaluated for categories of land uses, along with a detailed evaluation of applicable parcels within the watershed to identify parcel and community level opportunities for specific types of on-site and off-site BMP's. The overall objective of these analyses is to strategically implement BMP's in the watershed that would reduce flow into the combined sewer system, increase soil infiltration and pollutant attenuation, provide ecological restoration opportunities, and increase overall green spaces within the watershed/sewershed.

The unexplained loss of Jamaica Bay's marsh islands has prompted significant scientific study and community interest to determine its root cause(s). The

disappearance of these marsh islands was a major impetus for creating a watershed protection plan for Jamaica Bay. While no one single cause has been identified, urban development, nutrient rich waters, sediment deprivation, altered flow patterns and the erosive forces of wind and water are just a few that have been mentioned as potential causes. There may not be just a single cause, but the complex interaction of many different factors may amplify the effects of one or more factors. Further study is required to better understand these complex interactions.

While more is certainly needed, a number of first steps to offset some of these losses have been taken. These include NPS's pilot program of "thin-layer" spreading techniques on Big Egg Marsh, the current restoration efforts of Elder's Point marsh and the fall 06/spring 07 planned restoration of Yellow-Bar. Also, the cost sharing program that enabled the restoration of Elder's and Yellow Bar will be expanded to include other marsh island restorations. Local sponsorship is a requirement of this program. NYCDEP supports the expansion of this program and will continue as a local sponsor for many of these efforts into the future.

Through the tasks described in this section, the potential management strategies will be further refined to provide a comprehensive and accurate representation of each and to determine feasibility and appropriateness for potential implementation in the Jamaica Bay watershed. The potential management strategies will then be evaluated and prioritized to select the recommended actions for inclusion in the final JBWPP.

3.2. Coordination with the Comprehensive Water Quality Plan

Several NYCDEP planning studies currently in progress will be further along or completed during the intervening period between the September 1, 2006 Interim Draft Report and the October 1, 2007 final JBWPP. Specifically, the Jamaica Bay Comprehensive Water Quality Plan (JBCWQP), being developed pursuant to the nitrogen agreement for the Long Island Sound signed by the City and State, is scheduled to be submitted to the State in October 2006. Although the information contained in the report will not be publicly available until NYSDEC officially approves the JBCWQP, the project team for the JBWPP will use the following information from the JBCWQP to refine the potential management strategies in the JBWPP and achieve water quality related goals:

- Water quality modeling and modeling results;
- Analytical data from environmental sampling in the watershed;
- Engineering evaluations of options to control CSO's and/or stormwater; and
- Engineering options for the control of nutrients, pathogens and other water quality constituents to the tributaries and open waters of Jamaica Bay.

With the above information, the "draft" potential management strategies developed to date for the JBWPP will be modified or eliminated if determined that specific strategies do not provide meaningful environmental benefits or are not cost effective. Also dependent on the findings of the JBCWQP, new management strategies or evaluation

exercises may be added as part of the continued development of the JBWPP. The coordination of these NYCDEP planning projects will ensure that the findings and recommendations in the final plans are consistent and comprehensive in order for the Department to effectively improve water quality standards and broader watershed protection goals.

3.3. Additional Public Involvement and Stakeholder Participation

As mentioned earlier in this report, public and stakeholder involvement is a critical component for protecting the Jamaica Bay watershed and will continue to be used as a primary mechanism for compiling appropriate information. Over the course of the next year, public and stakeholder involvement will be collected to refine the potential management strategies and prioritize the strategies for implementation.

The mechanisms described in Section 2.2—monthly JBWPPAC meetings, public meetings, and interagency meetings and communications—will be used during the future development of the plan. The NYCDEP and JBWPPAC will continue to meet regularly during the future development of the plan to further refine the potential management strategies identified by NYCDEP to date as well as the JBWPPAC's preliminary recommendations that require further assessment and discussion. NYCDEP staff will continue to meet with representatives of other City agencies as well as State and Federal agencies to evaluate the potential management strategies being considered and identify implementation strategies for each of the priority or recommended actions to be included in the final plan. Two public meetings (one in Brooklyn

and one in Queens) will be held to obtain public input upon completion of the draft plan and before the final plan is completed.

In addition, two workshops will be convened at different points in the future plan development process to bring together representatives of identified stakeholder groups and conduct focused discussions of specific watershed protection topics. The first workshop will involve breakout discussions about specific watershed issues and related potential management strategies for consideration. Subsequently, the second workshop may include discussions of specific implementation strategies or other topics based on the results of the first workshop. Use of the workshop format will enable stakeholders to add value to watershed protection discussions and management decisions based on their interests and expertise.

Finally, NYCDEP has convened a small group of experts to discuss existing public education programs and identify needs for additional support of specific current programs or creation of new programs. NYCDEP plans to hold a series of these meetings to coordinate existing efforts and collaboratively identify future needs to promote community stewardship in the watershed. Based on this model, NYCDEP will be convening similar small groups or coordinating committees to discuss public outreach efforts and public access needs.

The final JBWPP will be developed with stakeholder and public input obtained through the above mechanism where appropriate for addressing the problems facing the Bay.

3.4. Additional Modeling

Modeling completed to date as part of the JBWPP development process has raised additional issues with respect to the potential management strategies being considered. In particular, while preliminary modeling findings appear to suggest that they hold promise, the realistic penetration rates of stormwater treatment technologies and BMP's as they relate to environmental improvements requires further assessment.

Questions about specific management strategies can be modeled with varying levels of detail using the landside and water quality model programs previously used as part of the watershed planning process. For BMP's, future modeling efforts will be based on estimates of load and volume reductions from stormwater BMP's at varying penetration rates or implementation rates. NYCDEP has already progressed in developing modeling parameters for such an effort in other projects such as the CSO LTCP development process.

A number of other potential modeling runs have been identified by both the NYCDEP and JBWPPAC to date; these will be discussed in the near-term to select appropriate and feasible modeling runs based on identified information needs and time and cost limitations.⁹ Landside and water quality modeling results developed for the JBWPP will be used to evaluate specific management strategies and identify recommended actions based on a demonstration of favorable water quality outcomes particularly where a series of options is available.

3.5. Development of Education and Outreach Materials

The working goal related to public education and outreach strategies is concerned with the idea of creating an informed citizenry in the near-term to promote watershed stewardship in the future. Watershed protection efforts in other watersheds have benefited from the development and dissemination of education and outreach materials to achieve similar goals.

Different media and messages can be used to reach a broad audience and raise awareness for various issues facing the Bay. NYCDEP will continue to collaborate with other agencies and non-governmental organizations to develop appropriate education and outreach materials and resources. The information developed can be distributed or implemented through this collaborative effort that includes other City agencies, local schools, and Bay-oriented organizations to garner support for protection efforts and inform residents about NYCDEP's commitment toward protecting the Bay.

3.6. Development of Implementation Strategies

Each of the potential management strategies, after further refinement and assessment, will be evaluated to produce a prioritized list of recommended actions which can be used to direct resources towards achieving the respective goals and objectives. The recommended actions resulting from the prioritization process will reflect the best opportunities for watershed protection and restoration.

Once the recommended actions are identified, strategies for implementing the recommended actions will be

developed for inclusion in the final JBWPP. These implementation strategies will provide the necessary information to ensure each recommended action is able to be implemented in a timely manner and with minimal need for additional study. Information such as potential funding opportunities, lead responsible entity, and mechanism for implementation (e.g., policy change, legislative action, code modification, etc.) will be developed for the recommended actions, where appropriate.

4. JBWPPAC Recommendations and NYCDEP Responses

This section of the Interim Report includes the preliminary recommendations of the JBWPPAC and the Department's response to each. Per LL71 and Introduction No. 376, the Department was required to make a determination—to support, reject or retain for further study—for each recommendation. The responses below should be considered preliminary given that many of the JBWPPAC's recommendations require further data collection and analysis before the Department can firmly accept as part of the JBWPP. When considering the preliminary recommendations submitted by the JBWPPAC, NYCDEP collected known available information as of the date of this report. As a result, sufficient and appropriate information was not available for all recommendations to enable a firm determination of the benefits derived from the implementation of each recommendation. For instance, several of the recommendations require more scientific data or cost-benefit analysis to inform decision-makers about the impacts of specific recommendations before incorporation into the final

JBWPP. Therefore, many recommendations were retained to provide NYCDEP the opportunity to further study specific recommendations.

The JBWPPAC's recommendations are organized below according to broad goal categories—water quality, ecological, and planning and outreach—similar to the organization of their June 29, 2006 report. The Department's response including its initial determination for future consideration of each recommendation can be found directly under the related recommendation.

Water Quality

JBWPPAC Recommendation 1:

Upgrade the 26th Ward and Jamaica wastewater treatment plants to tertiary treatment to reduce nitrogen inputs into the Bay. Right now, sewage is screened for floatables (preliminary treatment), biologically treated to reduce the wastewater's organic content (primary and secondary treatment), and disinfected with chlorine. Adding tertiary treatment would further remove nitrogen from the continuous effluent stream released into Jamaica Bay, and may assist in screening out endocrine disrupters. Both plants have nearby vacant property which could accommodate these new facilities. DEP pilot projects utilizing the nitrogen capture technologies of SHARON (single reactor system for high activity ammonium removal over nitrite), which uses biological methods to convert ammonia to nitrogen gas, and ARP (ammonia recovery process), which uses physical methods to convert ammonia to commercial fertilizer, should be carefully reviewed for possible adoption in the Bay and fast-tracked.

NYCDEP Response: *Tertiary treatment is defined as "the removal of suspended solids (after secondary treatment) usually by granular medium filtration or microscreens. Disinfection is also typically a part of tertiary treatment. Nutrient removal is often included in this definition."¹⁰ Wastewater effluent purified by this process is typically reserved for industrial, agricultural purposes, or when used as a potential drinking water supply. The nitrogen concentration of the effluent discharge from this process is typically on the order of 3 to 8 mg/l.*

Prior to the current upgrading of the 26th Ward WPCP, the nitrogen effluent concentration was on the order of 20 mg/l. However, upon completion of the current upgrades, the plant will be able to more reliably achieve higher levels of nitrogen removal on a year-round basis. Once the upgrade phase is completed, the plant will operate year-round in a mid-level Biological Nutrient Removal (BNR) mode with separate centrate treatment and the nitrogen concentration of the effluent will have been reduced to 8 to 12 mg/l down from 20 mg/l. Overall, a 40 to 60 percent reduction in nitrogen concentrations over existing conditions. In addition, future upgrading further reduces the nitrogen concentration to 5 to 8 mg/l or a total reduction of 60 to 75 percent over current conditions. Current conventional Limit of Technology (LOT) can reduce the nitrogen loadings to 3 to 5 mg/l. However, we believe that the current proposed strategies are the most cost effective and provide substantial high quality environmental improvements.

Additional upgrade enhancements are planned for the 26th Ward WPCP during the early part of the next decade. These improvements will allow for expanded wet weather capacity. At

present, there is no future plan specifically tailored to upgrading for higher levels of nitrogen removal beyond previously mentioned. However, under the JBWPP, NYCDEP is evaluating several ecological engineering ends of the pipe technologies (such as algal turf scrubbers, wetland treatment, and bivalve treatment) that could be considered a form of tertiary treatment. These softer technologies can provide additional nutrient uptake and provide improved habitat for the Bay.

The Jamaica WPCP is currently under consideration for upgrade to Step Feed BNR, similar to the 26th Ward WPCP and the Upper East River WPCP's. Modeling analyses that have been performed have shown that upgrading the Jamaica WPCP for BNR could reduce nitrogen loading to the Bay by approximately 6,000 pounds per day from present loadings. The current total nitrogen loading from the four WPCP's to the Bay is approximately 38,000 pounds per day. This represents an approximate 16 percent reduction in nitrogen loading from the Jamaica WPCP.

The SHARON Process is an innovative centrate treatment process, capable of removing 90 percent of the nitrogen from the centrate stream, and a demonstration project will be constructed at the Wards Island WPCP in Manhattan. The 1.85 MG process units will be the only installation of its kind in the United States and will be used as a demonstration test of the process. If successful, it could be applied for use at other NYCDEP facilities. However, it is important to note that the current separate centrate treatment process provides close to 90 percent removal of nitrogen from centrate and provides additional

process benefits to the main plant stream.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 2: Stop centrate processing at Jamaica Bay's sewage treatment plants or further treat centrate for nitrogen removal. DEP analyses show that removing 26th Ward centrate processing alone would result in a decrease of 2,170 pounds of nitrogen per day – approximately a six percent reduction in total daily nitrogen loading to the Bay. The JBWPPAC believes that centrate treatment at the 26th Ward and Jamaica plants could be better handled through reuse or by treating at other city plants that discharge into waters with more efficient discharge rates, rather than into Jamaica Bay.

NYCDEP Response: *The 26th Ward WPCP is currently utilizing one of its three aeration tanks to treat the nitrogen-rich centrate stream. As previously stated in the response to recommendation #1, this process has been very effective in reducing the available nitrogen in the centrate by 90 percent and in total represents a very small percentage (5 percent) of the nitrogen input to the WPCP. In addition, the process has been shown to provide an advantage to the main-stream treatment process, whereby the nitrified centrate stream has been shown to 'seed' the main process with beneficial nitrifiers to further oxidize and reduce the potential harmful effects of ammonia and nitrites on aquatic life.*

NYCDEP has discontinued the shipment of imported centrate from other WPCP's

for processing at the 26th Ward WPCP. However, due to operational concerns, routine plant maintenance or some other unforeseen event at the other WPCP facilities, the Department needs to keep this treatment process "open" for potential future use through at least mid 2009 so as not to incur potential violations within other waterbodies. However, as a result of the Nitrogen Consent Judgment, beginning in July 2009, NYCDEP agreed to ship sludge or centrate from the Bowery Bay and Tallman Island WPCP's in the Upper East River to a location other than Jamaica Bay for treatment.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 3:

Explore alternative treatment plant disinfection methods. Conventional chlorine treatment results in the formation of chlorinated organic compounds in plant effluent; such chlorinated compounds are increasingly considered to be environmentally harmful. Ultraviolet (UV) and ozone are two alternate methods of disinfection that should be considered.

NYCDEP Response: Under the Citywide Residual Chlorine Study, the Department looked at a number of alternative disinfection options, including ozone and ultraviolet (UV). With regard to ozone, based upon significantly higher capital and O&M costs associated with its implementation, as well as the complexity of operating ozone systems and maintaining the system and disinfection effectiveness, it was not one of the technologies recommended for full-scale implementation. Previously, ozone was one of the

technologies piloted at the Spring Creek AUX WPCP; due to operational concerns, it was not one of the short-listed alternatives.

However, based upon the encouraging results of the bench scale testing and an alternative technology evaluation, NYCDEP is investigating UV disinfection for potential implementation only at WPCP's that have BNR treatment. Another alternative being evaluated is the dechlorination treatment of the effluent at several WPCP's. The dechlorination treatment is a process to lower free chlorine in the water, with chloride ions as the primary end result. A side-by-side demonstration program and evaluation of UV-disinfection and chlorination/dechlorination technologies will be conducted at the 26th Ward WPCP for one year. Based upon the results of this study, and the results of the full-scale testing of optimized chlorination/dechlorination evaluation at the Port Richmond WPCP, NYCDEP will select the most appropriate and cost effective technologies for implementation at 26th Ward and the East River BNR WPCP's.

The following disinfection treatments are currently being considered as the most appropriate and cost effective for the other Jamaica Bay WPCP's: optimized chlorination/dechlorination at Coney Island; optimized chlorination (with the potential for dechlorination, in the future if necessary) at Jamaica; and optimization of the existing chlorination system at Rockaway.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 4:

Revise JFK's State Pollutant Discharge

Elimination System (SPDES) permit. This permit has not been significantly modified since it was first issued in 1987 and it no longer meets Environmental Protection Agency and state regulatory requirements. A draft permit was recently released for public comment. The final permit should incorporate requirements for monitoring and stormwater pollution prevention planning, and include effluent limits that ensure that the permit fully protects Jamaica Bay's water quality from harmful contaminants in the airport's runoff.

NYCDEP Response: *This issue is currently being addressed under a regulatory permit process and ensuing litigation between the PANYNJ, NYSDEC, and NRDC; as this particular issue is in litigation and the resolutions of the dispute are not available, the final JBWPP will provide details of the final disposition. Additional details of the SPDES permit, if available, could be used for future modeling runs.*

Recommendation for Incorporation into Final JBWPP: *The details of the disposition of this case will be provided in the October 1, 2007 final JBWPP.*

JBWPPAC Recommendation 5: Develop and implement strategies to trap initial stormwater runoff, known as the "first flush," in communities that are separately sewered. Initial runoff is usually more polluted than runoff originating later on in a storm event and such strategies can prevent high pollutant loads from reaching the bay. A first flush collection system can capture the most polluted stormwater during a rain event for treatment and allow for less polluted stormwater discharges.

NYCDEP Response: *The Department is investigating a variety of land use appropriate stormwater management*

BMP's and strategies for the Jamaica Bay watershed. For example, the placement of specific and adequately sized BMP's adjacent to major thoroughfares may help to capture a portion of the first flush contaminated run-off from road surfaces before they enter the sewer system. The location of these BMP's could be strategically located and placed in series to maximize the benefits. In areas, that are suitable, the use of soil infiltration techniques may also be appropriate. NYCDEP agrees to further evaluate "first flush" strategies, however, it is important to consider that "in pipe" or "end of the pipe" treatments tend to be maintenance intensive and potentially subject to failure (e.g., clogging). Further investigative engineering studies of prefabricated devices that can potentially be incorporated into sewer designs would need to be undertaken.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 6: Use natural resource damage (NRD) assessment procedures to impose fines for illegal discharges to the bay that could have been avoided by proper maintenance, and create a dedicated fund for restoration programs arising from these claims. During New York City's 2003 power failure, backup generators at two sewage treatment plants failed, causing thirty million gallons of untreated sewage to spill into the East River and more than two hundred and thirty million gallons to spill into the Hudson River. DEP's inadequate backup generator maintenance and the resulting sewage discharges violated federal and state laws. Harsher sanctions would help

reinforce the importance of proper maintenance and timely repairs.

NYCDEP Response: NYCDEP has been informed that the Jamaica Bay Damages Account (JBDA) was modified by NYSDEC to accept additional funding from both private and public sources as a result of regulatory violations. The account had been "closed" and could not accrue new funding for potential restoration activities around the Bay. According to NYSDEC, JBDA was established for the purpose of "restoring, replacing, or acquiring the equivalent of any natural resources determined to have been injured, destroyed, or lost as a result of the release of hazardous substances from five municipal landfills owned and operated by New York City. The creation and enhancement of existing habitats to offset the significant loss of natural resources is a major function of this program."¹¹ JBDA funds can be leveraged to provide greater habitat restoration and improvements in partnership with other local, state and federal agencies. We strongly support a priority status to divert mitigation to the Jamaica Bay area when mitigation for projects outside of Jamaica Bay are not practical or would not provide a functional restoration.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 7: Identify chemicals in treatment plant effluent which may have harmful ecological effects, such as components from pharmaceuticals. Characterize the levels and amounts of such chemicals entering Jamaica Bay and implement treatment and/or pretreatment measures as necessary.

NYCDEP Response / Recommendation for Incorporation into Final JBWPP: Due to a large uncertainty of the strategies required to identify particular chemicals and assess appropriate and effective removal technologies, at this time, this recommendation of the JBWPPAC will not be further assessed for inclusion in the final JBWPP. However, NYCDEP is watching this issue closely and will initiate dialogue with the US Environmental Protection Agency (USEPA).

JBWPPAC Recommendation 8: Clean out accumulated sediments in sewer lines and catch basins to enhance their water storage capacity, and schedule regular cleanings to remove debris. Sewer lines and catch basins are the Bay's first defense against oil, grease, trash and organic matter in stormwater – the cleaner these routes to the plants are, the more room they have to hold their full capacity of water and prevent CSO's. Where possible, these structures should be visually marked to increase public awareness of their purpose.

NYCDEP Response: NYCDEP inspects and cleans catch basins on a three year cycle within each community board. Any non-working catch basin is typically cleaned in a few days following the receipt of a complaint. Problematic sewer lines are inspected and cleaned on an as needed basis to remove silts and sediments that help cause surcharging in the pipe. Additional cleaning of the combined sewers within the 26th Ward drainage area will be cleaned as part of the CSO abatement of Fresh Creek. Current catch basin cleaning schedules will be re-evaluated and adjusted as necessary. The results of this evaluation will be included in the final JBWPP.

Regarding public awareness and the stenciling of catch basins, the Department's Bluebelt Program initiated a program in areas of Staten Island that brand catch basin curb pieces stating, "Don't Dump, Drains to Bluebelt." This same principle is being reviewed and evaluated for the rest of the City. The standard catch basin curb piece could say, "Dump No Waste – Drains to Waterways".

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 9: Restore tributaries leading into Jamaica Bay. Improving these water corridors could help increase the natural flow of water and sediments to the Bay, and reduce the impact of CSO events.

NYCDEP Response: *Under the Jamaica Bay Ecosystem Restoration Project (JABERP), several tributaries have been extensively evaluated for potential restoration including Paerdegat Basin, Fresh Creek and Spring Creek. In addition, NYCDEP has applied for restoration funding under the Water Resources Development Act (WRDA) for the restoration of the Bay sides of Hendrix and Fresh Creeks. Under a New York State Bond Act project, NYCDEP is restoring wetlands along a portion of Hendrix Creek adjacent to the Pennsylvania Landfill. The Department is also working closely with local environmental groups (e.g., Eastern Queens Alliance) and NYCDPR in supplementing previous Department restoration within Idlewild Park, headwaters of Jamaica Bay, in the hopes of developing a more comprehensive restoration strategy for the remaining sections of the park. All restorations are selected based on the*

identified potential for effective ecological and cost benefits. NYCDEP, in coordination with other local, state and federal agencies, will continue to explore restoration and funding opportunities for additional wetland and upland restoration sites around Jamaica Bay.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 10: Review DEP's portfolio of industrial pre-treatment permittees within the Jamaica Bay watershed with the goal of instituting BMP's with respect to their industrial processes in order to reduce loading of harmful chemicals in the influent to the treatment plants and ultimately in what is discharged to the Bay.

NYCDEP Response: *Under the Administrative Code, Chapter 5 of Title 24 the discharging of any chemical into a sewer or catch basin that may be detrimental to the health of people, wildlife or aquatic habitat is strictly prohibited. Upon direction, any user of the sewer system is required to measure and sample for the purposes of determining volume and characteristics of effluents which are discharged to the sewer. Where applicable, the user must develop and implement appropriate pre-treatment methods prior to the wastewater entering the sewer system.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 11:

Revise codes, guidelines and requirements that govern construction, reconstruction and landscaping of the city's public infrastructure, including sidewalk, street, median and public spaces, to incorporate minimum standards of performance for stormwater retention and infiltration. Over the last decade, advances in technologies and a first wave of applications around the country have made certain BMP's for stormwater appropriate for widespread use in the public infrastructure. For the Jamaica Bay watershed/sewershed, measures to increase infiltration hold particular promise, as many (although not all) parts of the bay's watershed/sewershed have a low groundwater table. For example, both urban and suburban areas in Pennsylvania and Michigan have used porous asphalt pavement successfully to increase infiltration and decrease stormwater runoff. Porous asphalt makes use of stone aggregates that are fine enough to allow water infiltration into an underlying stone bed, allowing the removal of suspended solids, metals, oils and grease at very high rates.

NYCDEP Response: *As part of the JBWPP, NYCDEP will perform an analysis of BMP's to identify those that are applicable and practical to the Jamaica Bay Watershed based on land uses within the watershed (and accordingly the appropriate responsible City agency), parcel-level information of appropriate site characteristics, and performance data related to stormwater load and volume reductions. Such assessment is important because there are concerns about specific new technologies regarding storm water retention and infiltration. For example, research and related literature about porous pavement materials suggests that oils, grease and fine silts can fill the pores*

and the pavement can lose its integrity when water freezes in the pores and expands. While some research indicates that when the infiltration rates of porous pavement are compromised, a power washing of the pavement can restore a substantial amount of function. Also, NYC streets are also pitched to bring storm water to the catch basins at a fairly quick pace that could reduce the rate of infiltration through the porous pavement. Proper placement and maintenance of these and any BMP is crucial to their success. These and other issues will need to be fully investigated before a recommendation of a particular BMP type can be made.

Should the BMP parcel level assessment yield very effective results, NYCDEP will, as part of the overall BMP analysis, conduct a review and assessment of the NYC Building Code, Sewer Use Regulations, and other City codes and regulations to determine whether they appropriately encourage the use of BMP's. Recommended changes to codes for certain public and private development and re-development scenarios and other potential implementation mechanisms for specific BMP's will be considered.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 12:

Implement a city pilot program that aggressively tests a variety of stormwater BMP's (e.g. green strips/medians, enhanced curb designs, use of porous sidewalk pavement) including through one or more area specific pilot projects within the watershed area in both Brooklyn and Queens that would maximize use of

such BMP's. Monitor and adapt the projects to generate a better base of information on the efficacy of different BMP's. For example, Seattle's Street Edge Alternative (SEA) project, which replaced impervious surfaces with porous materials, added vegetation along streets to enhance natural drainage and narrowed streets to reduce runoff, showed that stormwater BMPs are feasible in a large, metropolitan city. The SEA project's success led to its expansion throughout the city, and so far has reduced stormwater discharge in project areas by a factor of ten. Actual implementation and monitoring of these types of projects, rather than lengthy modeling exercises, is also important, as experiences across the country have frequently shown that benefits are greater upon implementation than had been initially calculated. Such pilot projects also have educational and public awareness value.

NYCDEP Response: *Currently, under the LTCP and JBWPP, an evaluation of land-use specific BMP's for implementation in the Jamaica Bay watershed/sewershed is being performed. This evaluation will provide information about the types of BMP's and appropriate locations for implementation in the Jamaica Bay watershed. A demonstration BMP project could be developed that would evaluate the efficiency and practicality of several BMP types side-by-side under controlled conditions. However, current LTCP/JBWPP BMP evaluation efforts will compute theoretical runoff volume reductions associated with various penetration rates of each BMP and the projected modeling results on water quality. The demonstration project could be used to verify and help calibrate the BMP modeling efforts for the LTCP/JBWPP analyses.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 13:

Create a list of city-approved stormwater runoff/pollution BMP's for buildings and associated landscaping, and encourage their adoption by eliminating barriers in city building codes against their use, providing incentives to private developers who adopt BMP's (e.g. perhaps offering a reduced water rate) and requiring a certain percentage of city-funded new and redevelopment projects to incorporate BMP's. A review of city building codes to eliminate any barriers to stormwater BMP's should be conducted as soon as possible. The city has already begun promotion of green building technologies with Local Law 86, which requires new city construction to qualify for the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) silver certification. This requirement should be incorporated into all agreements dealing with real estate property which the city leases to others for development as well. Further, the city should consider adopting the following standards/incentives to reduce inputs into the sewer system: require publicly financed buildings to devote a portion of their roofs for vegetated cover, increase the availability of green tax credits that private developers can use for green building technologies, and compel new tenancies on city-owned property requiring new buildings or substantial renovation of existing buildings to comply with Executive Order 111. With approximately 300,000 square feet of green roof space constructed in 2005, Chicago is generally recognized as the current

leader among American cities in green roofs. New York City should aspire to take over this ranking over the next five years; the large number of industrial and/or commercial establishments with significant roof areas in the Bay's watershed/sewershed should make it a prime area for such a focused effort by the city.

NYCDEP Response: *As mentioned in the previous recommendation, under the LTCP and JBWPP, an evaluation of land-use specific BMP's for implementation in the Jamaica Bay watershed/sewershed is being performed. This evaluation will provide information about the types of BMP's and appropriate locations for implementation in the Jamaica Bay watershed. In this evaluation, the potential for the application of green roofs is being considered. A full list of appropriate BMP's will be developed for their effectiveness, removal efficiency rates and overall volume reduction of stormwater into the sewer system. As part of the overall BMP analysis, NYCDEP will conduct a review and assessment of the NYC Building Code, Sewer Use Regulations, and other City codes and regulations to determine whether they appropriately encourage the use of BMP's. Changes to codes and other implementation mechanisms for BMP's will be considered.*

As mentioned by the JBWPPAC, the City adopted Local Law 86 to promote green buildings throughout the City. In addition, the Mayor's Task Force on Sustainability convened eight Working Groups, consisting of nearly two dozen city agencies to address a variety of sustainability issues and help the Task Force establish New York City's official policy on sustainability.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will*

be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 14:

With the goals of reducing water waste and lessening the impact on sewer systems, require that the city implement an aggressive public education program and a system of requirements and incentives to decrease residential and industrial water use in the Jamaica Bay sewershed by 15 percent within 10 years. Reducing the amount of water entering treatment plants will both increase plant capacity during storm events and allow for an increase in the residence time of wastewater in the plant, aiding in the implementation of nitrogen removal technologies. New York City's sewage has been described as weak; therefore, water conservation efforts should not increase the concentration of sewage solids to the point of causing treatment difficulties.⁶⁰ Previous city water conservation efforts aggressively focused on leak detection and repair, replacement of old toilets with water efficient ones, installation of water meters and education about efficient water use. Largely thanks to these programs, New Yorkers decreased their water consumption by 25 percent from 1988 to 2001, but more can be done.⁶¹ Approximately 14 percent of household water is still wasted due to faucet leaks and drips, running water, and toilet seepage, among other causes.⁶² It has been almost a decade since the last major public campaign to increase water conservation, and, given this amount of time and recent technological advances, it is time for a renewed push.

NYCDEP Response: *NYCDEP is currently evaluating a number of water conservation efforts that will be proposed in the near future. Our goal*

is to implement programs to reduce water use usage by 60 million gallons per day (mgd) citywide over the next 6 to 10 years for a minimum reduction of 5 percent. Further efforts during this time period may be made depending on the return of investment, which is currently being evaluated. Although water conservation programs would require capital and labor expenditures, potential savings in infrastructure investments can offset these costs. Benefits of new proposals and of previous successful programs will be further evaluated.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 15: Designate Jamaica Bay as a "no discharge zone." Establishing Jamaica Bay's waters as a no discharge zone would prohibit any vessels from dumping treated or untreated waste into the waters. As an adequate number of waste disposal "pump out" stations would be required before this change could legally be approved; an analysis of the current number of recreational vessels against the number of pump out stations should be conducted.

NYCDEP Response: Under the federal Clean Water Act, a "no discharge zone" (NDZ) can be designated for waterbodies that are in need of improved environmental protection. NYSDEC is the responsible entity that petitions the United States Environmental Protection Agency (USEPA) for the recommended designation of a NDZ. We would strongly support the designation of a NDZ for Jamaica Bay.

NYCDEP has installed seven Boat Pumpout Facilities throughout New York City, with two operating in Jamaica Bay. A third pumpout system for Jamaica Bay is currently being developed. NYCDEP will continue to explore potential future locations of pumpout facilities for Jamaica Bay and the rest of New York Harbor.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 16: Pass legislation prohibiting the use of treated or untreated contaminated sediment materials from outside of Jamaica Bay for restoration activities within the Jamaica Bay watershed. Existing Jamaica Bay sediments can be moved throughout the Bay or clean sediments similar in grain size and sediment type to existing sediments can be used for filling activities within the Bay, but any materials treated or untreated that would be characterized by their nature as in need of disposal should not be placed in Jamaica Bay.

NYCDEP Response: See response for recommendation # 17.

JBWPPAC Recommendation 17: Establish for Jamaica Bay the right of first refusal for any navigational or construction-related dredged bay floor sediment. In instances where sediments are dredged from the Bay, for example in Rockaway Inlet, the potential beneficial use for these sediments within Jamaica Bay should be considered before their uses elsewhere.

NYCDEP Response: Using sediment only from Jamaica Bay for restoration and re-grading projects within the Bay

may not be a realistic nor economically feasible scenario given the extent of re-contouring necessary to provide large-scale improvements to the Bay as suggested by preliminary modeling results. An obvious continuous source of clean material is provided from the Rockaway Inlet, which yields 200,000 to 250,000 cubic yards of clean sediment every regular dredging period, or 2-3 years. This material is frequently used in beach replenishment projects and the quantity may not be sufficient to provide the amount of material ultimately needed. For example, the Elders Point Marsh restoration effort will use approximately 270,000 cubic yards of dredge material alone and the restoration of Yellow-Bar may require similar amounts of material.

It is important that consensus be reached on use of materials in Jamaica Bay based on scientific studies and information about cost-effectiveness and environmental benefits. As this issue crosses many jurisdictions, NYCDEP on behalf of New York City wishes to engage the appropriate entities for further discussion and evaluation. In order to comply with water quality standards, NYCDEP is of the opinion of not using contaminated material unless it can effectively be proven to cause no additional harm to Jamaica Bay. However, this would limit many beneficial reuse options. As such, an assessment of the Norton Basin – Little Bay re-contouring project will be necessary to determine potential issues and impacts. From this point, sediment quality standards, first refusal procedures, and sediment source policies can be decided.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1,*

2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 18: *Comprehensively identify the toxic organic compounds, including pesticides, and metals in CSOs and stormwater entering the Bay and develop strategies for reducing and eliminating harmful inputs. In the limited research conducted to date, DEC's Contaminant Assessment and Reduction Program has identified possible significant levels of toxic compounds in certain CSOs entering the Bay. This research should be expanded and solutions to any problems sources identified.*

NYCDEP Response: *The Harbor Estuary Program's (HEP) Contamination Assessment and Reduction Project (CARP) is already developing strategies that will identify which toxic organic compounds are entering NY Harbor through CSO outfalls. The CARP program will further evaluate whether these sources need to be further reduced. The HEP program is also conducting a NY Harbor toxic compound TMDL. This TMDL will identify sources of contaminants that need to be controlled and the level to which these contaminants need to be reduced.*

NYCDEP has no activities planned to further assess the amount of CSO and stormwater toxic organics. NYCDEP could conduct a sampling program at each of the major CSO locations in Jamaica Bay such as Paerdegat Basin, Fresh Creek, Hendrix St. Canal, Spring Creek, Bergen Basin and Thurston Basin (6 creeks and 8 sampling locations). In addition, stormwater samples could be collected at another 7 locations (total of 15 locations). Composite samples would be required over a few different storm events to quantify the concentrations of toxic

organic compounds. Further, samples would need to be collected from the surficial sediments from locations within the CSO sediment mounds in each Jamaica Bay tributary. A total of 4 sites should be sampled from each of the 6 CSO sediment mounds.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 19: Develop standards for identifying toxic sediment areas within the Bay and assess and prioritize the need for their removal, isolation and/or treatment based on whether or not these areas will erode over time or impact the water column. Toxic sediments should be classified as those that may pose a human health hazard and those that may impair the ecological and biological functioning of the ecosystem. Identify pilot projects to safely reduce the risks caused by these hot spots.

NYCDEP Response: The hydrodynamic models developed for the Bay and the adjacent tributaries contain a wealth of information that can be used to assess areas where re-suspension of toxic sediments could potentially occur. The model outputs could be post-processed to assess the shear stresses at locations throughout the Bay. A sampling grid would need to be set-up in the Bay and sediment samples would need to be developed and samples of sediments collected. These samples would need to be analyzed for several key toxins or pesticides. Other sediments would need to be analyzed for the shear stress required to re-suspend those sediments. This would require mapping of sediment types and testing of sediment samples in a re-suspension

channel for erosion potential and shear stress. As a start, JABERP has proposed the re-contouring of several tributaries to determine potential habitat improvements.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 20: Examine the sources and impacts of airborne contamination to Jamaica Bay. The New York Academy of Sciences Harbor Consortium found that airborne pollution plays a major role in the level of mercury found in New York-New Jersey Harbor waterways; other airborne contaminants may also be impacting Jamaica Bay.

NYCDEP Response: Airborne Pollution may play a significant role in diminished water quality in Jamaica Bay. Air pollution may also affect the ecological viability of the Jamaica Bay, either as a result of diminished water quality or as an independent influence on biology or as a correlated effect. Currently there are no ongoing DEP efforts to identify possible effects of airborne pollution on Jamaica Bay. Air pollution affecting the Bay is likely to arise from ambient air degradation rather than from any one point source with the exception of perhaps JFK airport; prevention or mitigation strategies for any potential pollutants—be they heavy metals or volatile organic compounds (VOC's)—are likely to be tied geographically to an area much larger than Jamaica Bay, and therefore tied to perhaps less stringent standards than might be ideal for the Jamaica Bay watershed. A deficit of information encourages at least a preliminary investigation of possible

correlation between air pollution and water quality.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 21: Develop and implement a Jamaica Bay shellfish remediation and management plan to secure the long-term revitalization of oysters and other local shellfish for improved water quality, biodiversity and public consumption while safeguarding human health.

NYCDEP Response: *NYCDEP recognizes the significance of restoring sizable and sustainable shellfish populations in Jamaica Bay. In general, it is recognized that shellfish can play important roles in many aspects of wetlands' existence and contribute to ecological health and water quality improvements. Oysters are a keystone species, providing filtration, increased water clarity, physical stability, and a range of other attributes that increase overall wetlands health. The survival of shellfish populations in Jamaica Bay may be predicated on a positive feedback mechanism: improving water and ecological quality provides for the increasing abundance of these populations, and vice versa. Nevertheless, the recommendation will require further consideration to determine the historic extent of shellfish populations and the measures required to be protective of human health by prohibiting their harvesting.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1,*

2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 22: Examine the possibility of creating one or more reefs to serve as fish and shellfish habitat, and potentially as a diving ground for recreational users, in appropriate locations within the Bay.

NYCDEP Response: *See response for recommendation # 21.*

JBWPPAC Recommendation 23: Dedicate a skimmer boat to Jamaica Bay clean up. A shallow draft pontoon-type skimmer vessel powered by two four-cycle outboard motors with a detachable height pickup net is needed to remove the floatable debris from Jamaica Bay's waters. The boat should be designed to move quickly through the Bay to collect and drop off trash, but also be able to navigate the shallow waters.

NYCDEP Response: *NYCDEP operates several skimmer vessels that routinely remove floatables within Jamaica Bay as part of DEP's Floatables Reduction Program, managed by the Bureau of Wastewater Treatment. The Floatables Reduction Program includes Booming and Skimming Operations; these operations remove floating material that is captured in the five boomed or netted installations in Jamaica Bay. These installations are located in Paerdegat Basin, Fresh Creek, Hendrix Creek, Bergen Basin, and Thurston Basin, and are inspected by a high speed vessel after every rain event in which rainfall exceeds ½" within one hour. In the absence of rain, they are inspected no less than three days since the last inspection. A skimmer is deployed to remove the debris when a substantial amount of debris has been contained. The existing program covers approximately 50 percent of the City's combined sewer drainage area. Based*

on testing of containment systems, boomed outfall locations have the effectiveness of approximately 75 percent capture.

NYCDEP purchased another skimmer boat, named the "Jamaica Bay" that may also be rotated between service in Jamaica Bay and other water bodies as needed. The "Jamaica Bay" vessel is a diesel powered catamaran type vessel with a hydraulically driven conveyor belt that requires approximately four feet of draft. It is a boat able to navigate shallow waters and will also be used in other locations where other skimmer vessels are unable to be sent. In addition to the skimmer vessels operated by NYCDEP and boom and net installations, NYCDEP also operates the "Cormorant," a large open water skimmer vessel capable of large floatables slicks recovery.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 24:

Remove, treat or isolate CSO sediment deposits where appropriate, for example from Paerdegat Basin. As a result of continued CSO discharges, Paerdegat Basin has a mound of settled solids extending approximately 1,000 feet south from the basin's head, 12 to 13 feet deep in areas. At the current accumulation rate, parts of the mound could be exposed during low tide within ten years. Such sediments and accompanying field conditions have an unpleasant odor and create hypoxic or anoxic conditions, and should be addressed immediately.

NYCDEP Response: Dredging in Paerdegat Basin is being considered as part of the LTCP. A bathymetric survey

was conducted during April 2006 to estimate dredge quantities at the head end based on achieving a depth of not less than 3 feet below mean lower low water (MLLW). Previous dredge permit materials included dredge quantities at the mouth.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 25:

Increase trash receptacles and collection in the Refuge's off-season. After Labor Day, most of the trash receptacles are removed throughout the Refuge, as NPS' funding for trash collection is reduced. Exploring the use of animal-proof containers and solar-powered trash compactors, such as the "Big Belly," which can hold trash for longer periods of time, or possibly negotiating additional disposal options with the New York City Department of Sanitation might allow for increased receptacles or more frequent trash pick up during the off-season.

NYCDEP Response: NYCDEP has received comments similar to the above recommendation from community members for the JBWPP as well as for the LTCP development processes. While the Refuge is not under NYCDEP's jurisdiction, the Department agrees that the above recommendation would help to achieve multiple Department objectives and will discuss with the appropriate agencies about how to implement increased trash collection during the off-season including potential funding opportunities and cost-effective technologies. This would also be applicable to the parks and beaches under the jurisdiction of NYCDPR.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 26:

Develop an "Adopt a Waterfront" effort that allows private and public interests to be responsible for keeping areas of the Bay clean. Similar efforts have been made in the city parks with the Partnerships for Parks program, which can serve as a model for Jamaica Bay.

NYCDEP Response: NYCDEP currently employs different strategies for controlling floatables entering into the Bay as part of its Floatables Reduction Program and currently participates in the City's Litter Prevention Working Group. The Department relies on the Working Group to collaboratively develop a range of litter reduction strategies for city-wide implementation. The Working Group can provide information about different strategies and implementation schedules for the Jamaica Bay watershed. The above recommendation is one potential strategy that would provide a potential funding mechanism for litter removal as well as a tax-deductible opportunity for watershed residents and businesses to make a visible impact along the Bay. An assessment of current land ownership and easements along the waterfront would be needed to identify potential issues for private property owners.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 27:

Develop city codes requiring Jamaica

Bay waterfront Property owners - public and private - to keep their shorelines clean of floatable debris. Similar to how adjacent property owners currently must keep sidewalks clean, bay front owners could be responsible for removing the refuse that collects on their land.

NYCDEP Response: NYCDEP currently employs different strategies for controlling floatables entering into the Bay as part of its Floatables Reduction Program including the addition of a new skimmer vessel, the "Jamaica Bay." The JBWPP will include additional strategies for floatables control specific to Jamaica Bay, if necessary. Enforcement of such codes would be difficult on private waterfront properties. Implementing such practices for public waterfront would require coordination with the various governmental agencies that represent the larger land owners along the Bay (i.e., NPS and PANYNJ).

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 28:

Develop a permanent and ongoing program for collection and removal of large-scale debris visible above the high tide mark that has been demonstrated to affect aesthetic or ecological uses within the Bay.

NYCDEP Response: An evaluation of known problem debris areas within Jamaica Bay will be identified and mapped along with the development of strategies and potential funding mechanisms to address these concerns. An expansion of annual beach cleanups such as those associated with events like the American Littoral Society's

International Coastal Cleanup (ICC) would be a logical starting point for this effort. We have already initiated dialogue with the American Littoral Society to begin looking at problem areas that would benefit from debris removal operations.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 29:

Support the passage of an expanded New York State bottle bill, "The Bigger, Better, Bottle Bill." An extension of current returnable container deposit laws to cover non-carbonated beverages, such as bottled water, fruit juice, and teas, would reduce the number of bottles entering the waste stream and found as litter across the city's streets and waterways. The current bill would also require bottle distributors to transfer unclaimed deposits to the state's Environmental Protection Fund. Since 1982, when the city passed its current returnable container deposit law, more than 80 million bottles and cans have been recycled.

NYCDEP Response: *On May 10, 2006, the State assembly passed legislation (State Assembly # A02517D; Senate # 1290D) and referred the bill to the Senate's Environmental Conservation Committee. The new "Better, Bigger, Bottle Bill" would expand New York's beverage container deposit and recycling programs to include non-carbonated beverages. The legislation would expand the current bottle bill to include a five-cent deposit on non-carbonated beverages. New York's container deposit law has proven to be an effective recycling program that captures 76 percent of the containers*

that are subject to deposit.¹² Curbside recycling programs generally capture a lower percentage of eligible materials. The deposit system creates a financial incentive for people to return bottles and cans. In those instances where the \$.05 deposit does not motivate a particular person to return the container, it serves as a bounty for other people to do so. NYSDEC's estimate of the current amount of unclaimed deposits is \$85 million annually. The Container Recycling Institute (CRI) estimates that unclaimed deposits in New York State actually total \$137 million and that under an expanded bottle bill there would be \$179 million in unclaimed deposits.¹³ These monies would be deposited in the Environmental Protection Fund.

The Bill is expected to clear the Senate, but may not reach the floor for a full vote before the legislative summer recess. In the event of the adoption of the Bigger Better Bottle Bill by NY State, the Bill shall take effect on the first day of January succeeding the date on which the Bill becomes law.¹⁴

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

Ecological

JBWPPAC Recommendation 30:

Expediently transfer city-owned wetlands and adjacent areas within the Jamaica Bay watershed/sewershed to a responsible public agency, per the recommendations of the Wetlands Task Force created by Local Law 83 (a seven-member group to "inventory city-

owned wetlands in the City of New York). The JBWPPAC recommends that the wetlands and adjacent areas identified by the Task Force within the Jamaica Bay watershed be protected from development immediately.

NYCDEP Response: *The City established the Wetlands Task Force to inventory City-owned wetlands and determine the technical, legal, environmental and economical feasibility of transferring these wetlands to the jurisdiction of NYCDPR. NYCDEP will work with the Wetlands Task Force to summarize their findings and prioritize these sites for protection as appropriate. NYCDEP will include the Wetlands Task Forces' prioritization of property transfers to NYCDPR in the final JBWPP. However, it is important to consider the ecological value and access to some of these wetland properties, particularly if they are small, isolated and fragmented from larger more contiguous wetland parcels. It may be more ecological advantageous to secure those sites that provide the most ecological function and require little additional maintenance. Intensive maintenance of some of the parcels may impact the ability of NYCDPR to maintain existing higher value wetland locations. In addition, NYCDEP will continue to reference other existing studies and reports to recommend tidal wetland and upland buffer areas for acquisition and restoration as part of the JBWPP development process.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 31:
Expand the buffer zone on tidal wetlands in Jamaica Bay from 150 to

300 feet. The DEC requires a permit for most activity in the area adjacent to tidal wetlands extending 300 feet; however, in New York City, the adjacent area is defined to include only up to 150 feet. This definition should be changed to ensure protection of the city's ever-shrinking number of wetlands. Shoreline buffer zones are very effective in filtering pollutants and excess nutrients and providing erosion and flood control, sediment trapping, and wildlife habitat. Furthermore, as apparent sea level rise continues due to local subsidence and global warming, landward migration of wetlands is inevitable and needs to be accommodated through expanded buffer zones.

NYCDEP Response: *NYC is the only municipality in the State with a 150 foot buffer zone on tidal wetlands (all other coastal areas have 300 foot buffers). This buffer (either 150 feet or where land elevation contour equals 10 feet) was developed in recognition of the already hardened (e.g., bulk-headed) shoreline of many of NYC's coastal areas. Because of these hardened shorelines, there would be very limited applicability and benefit gained from such a difficult change and efforts should be focused more on improving and restoring those areas adjacent to the upland.*

It is expected that many of the unprotected areas within the larger buffer zone have been developed. The JBWPP will identify undeveloped and unprotected properties containing or adjacent to wetlands. NYCDEP will work with the Wetlands Task Force to include their findings and prioritize these sites for protection as appropriate.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will*

be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 32:

Implement a Transfer of Development Rights (TDR) program in the Jamaica Bay watershed to encourage the preservation of existing open space. TDR programs protect open space by allowing landowners in conservation zones to be compensated by selling their development rights for a particular parcel of land to the municipality or developers in another district. TDR programs have proven successful in the Pine Barrens on Long Island and the Pinelands in New Jersey by limiting development of ecologically important areas while providing for growth in compatible areas. New York City has already instituted TDR programs as part of the Landmarks Preservation Ordinance and Broadway theater district.

NYCDEP Response: *NYC has implemented a number of TDR programs in defined areas of the City. Under a TDR program a potential sending (e.g. sensitive area) area and a receiving (e.g., non-sensitive area) area must be identified. As part of the JBWPP, the City will further evaluate existing TDR programs that protect sensitive areas of concern by lowering densities and, consequently, minimizing adverse impacts. However, TDR programs have the potential to increase environmental impacts such as traffic and noise in receiving areas due to increased density.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to October 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 33:

Evaluate the utility of a state or other formal designation that capitalizes on the history and natural resources of Jamaica Bay. Signage throughout the watershed would increase public understanding of the role that upland areas, as well as wetlands, have on the Bay. Enhanced use of BMP's could also be encouraged within the area.

NYCDEP Response: *While signage exists throughout Gateway National Recreation Area, NYCDEP is interested in expanding the coverage of this signage to raise awareness of Jamaica Bay throughout the watershed. As part of the JBWPP development process, NYCDEP has initiated dialogue with NYCDOT and NYCDPR to explore the implementation of signage throughout the watershed including at the watershed's boundaries in Brooklyn and Queens. Implementing such signage will require continued coordination with these City agencies as well as State agencies such as New York State Department of Transportation (NYSDOT). NYCDEP will consider the development of a common Jamaica Bay image or brand to increase the visibility of the Bay and interconnections between human activities in the watershed and impacts on bay conditions for government officials, residents and visitors in the farthest reaches of the watershed. NYCDEP will look to other watershed protection programs, as well as historic or natural resources programs, for model brands and signage. Potentially, a State or other formal designation could assist with funding such a program in the Jamaica Bay watershed.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 34:

Review additional vacant city-owned waterfront properties which may not have been identified by the Wetlands Task Force to evaluate returning these areas to a more natural state, including through transferring them to the appropriate city agency for such purpose. For example, transferring and restoring natural areas on the east side of Thurston Basin would provide additional bay access for the Queens community. Indeed, the headwaters of Thurston Basin in Idlewild Park and environs are Jamaica Bay's most pristine. The intact salt marsh and tidal creeks in the Idlewild Park area should be targeted for restoration activities, and there should be an effort to expand the spatial extent of this unique portion of Jamaica Bay's watershed.

NYCDEP Response: NYCDEP in coordination with NYCDPR has restored extensive wetland and upland sections of Idlewild Park to return tidal flow to areas that were disconnected in the 1950's. NYCDEP has been working with the Eastern Queens Alliance and NYCDPR to develop additional strategies for restoration and protection efforts. NYCDEP will continue to explore measures that improve the ecological function of this area. NYCDEP will also incorporate existing information from reports like the list of HEP Priority Acquisition and Restoration sites, *Buffer the Bay, Revisited* and the *New York State Open Space Plan*, to identify valuable and ecologically functional sites that are in need of protection.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 35:

Revise New York City's Waterfront Revitalization Plan, as authorized by the New York State Department of State Coastal Zone Management Plan, to be consistent with the JBWPPAC's recommendations. Zoning changes should be formulated and adopted as necessary to provide compatible uses within the Bay environment while creating upland buffer areas and increased tidal wetlands adjacent to the Bay through more stringent setback and building density requirements.

NYCDEP Response: NYCDEP requires further clarification and discussion with the JBWPPAC for this recommendation. Zoning changes and revisions to the NYC's Waterfront Revitalization Plan (WRP) could be potential mechanisms for implementing these watershed protections. However, the Waterfront Revitalization Program already identifies Jamaica Bay as a Special Natural Waterfront Area with designated protected habitat areas. Revisions to the WRP would require a potentially lengthy 197-A process.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed after clarification and discussions with the Committee.

JBWPPAC Recommendation 36: Fill degraded low-lying areas of marshes with sediment to help restore their historic footprint, and monitor results. In 2003, NPS used a small hydraulic dredge mounted on an open boat to spray slurry of sediment and bay water taken from a trench in an adjacent tidal creek on to the surface of Big Egg Marsh. The restoration has been "technically successful...as the [sprayed] sand is transforming into a silty and organic saltmarsh soil." 100 Assuming results continue to be positive, this technique of "spot filling"

through jet or slurry spray should be used to fill in additional low-lying areas of Big Egg Marsh, and sections of Little Egg, Yellow Bar, Goose Pond, Black Bank, Silver Hole, and JoCo Marshes. Spot filling activities should be monitored using an adaptive management strategy, including for purposes of informing future restoration efforts in the Bay and elsewhere.

NYCDEP Response: *Based on initial monitoring results, the pilot wetland restoration of Big Egg Marsh using the "thin-layer" spraying technique has been successful and over the last two years, the restoration has naturally expanded beyond the original limits. However, NYCDEP should not limit potential for restoration techniques as some may be better suited for specific locations. Information from this project and the current restorations of Yellow-Bar and Elder's Point will provide important information on future marsh island restoration. Similar to the restorations of Yellow-Bar and Elder's Point, a cost-sharing program (75/25) between NYSDEC and local sponsors is currently under development. Under this new program, several additional interior marsh islands will be identified for future restoration. NYCDEP strongly supports these restoration efforts and will consider local cost-sharing opportunities.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 37: Remove artificial barriers and obstructions to increase tidal flushing within Jamaica Bay. For example, repairing the drainage culverts located under the Federal Aviation

Administration roads to the east of the Rockaway Turnpike and reinstalling the culvert under New York Metropolitan Transportation Authority's "A" line at 5th Road in Broad Channel would improve the area's tidal flushing.

NYCDEP Response: *Removing smaller less influential barriers may provide localized benefits near the vicinity of the removal. The repair of the culvert under the Federal Aviation Administration (FAA) light tower road could increase tidal flushing and help restore wetland vegetation – without planting - simply by restoring the proper hydrology. The JBWPP will evaluate this potential recommendation/action and others that show promise for ecological health and water quality improvements. Scenarios that include the removal of very extensive and perhaps impractical landforms to determine improvements could also be modeled.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 38: Examine various technologies for non-hardened structure stabilization to protect the windward side of marsh islands from natural wind and water erosion. Erosion armor of sand-filled biodegradable tubes or other geotextiles made of natural or biodegradable fiber could reduce wave erosion and perhaps reduce marsh loss.

NYCDEP Response: *The "Blue Ribbon Panel" of scientists convened by NPS conducted numerous studies and investigated several theories to determine the causes and rate of Jamaica Bay's disappearing marshes.¹⁵ Recommendations made by the panel*

as to what research needs still exist should be evaluated and supported. In addition, the marsh island restorations of Yellow-Bar and Elder's Point should provide valuable information about the most appropriate techniques for protecting the windward (long-fetched) marsh island perimeters. Due to a limited initial root mat, these new restorations would be the most vulnerable from erosion due to wave and wind energy. The protection measures also used for the restoration of Big Egg Marsh may provide important wave and wind energy protection measures. A review of the monitoring data of these projects will determine the most appropriate and effective measures.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 39: Ensure that the U.S. Army Corps of Engineers' (Corps') larger-scale marsh restoration projects, such as those on Elders Point and Yellow Bar, are on schedule and properly funded. The Corps is currently undertaking a restoration project in a portion of Elders Point, with construction and planting scheduled for spring and summer 2006. The plan calls for the Corps to place 315,000 cubic yards of sand on the marsh islands and to construct 61 acres of low-lying marsh. Presently, there are nine acres of marshland on Elders Point. The Corps has scheduled Yellow Bar construction and planting for winter 2006 through spring 2007. The Corps will place 80,000 cubic yards of sand on Yellow Bar and will construct 31 acres of low-lying marsh to supplement the existing 77.5 acres of marshland.

NYCDEP Response: *The United States Congress has authority and ability to control the funding of federally sponsored construction projects. However, it is our understanding that the restoration of Elder's Point is funded and proceeding on or near schedule. Furthermore, the USACE has similar expectations for the restoration of Yellow-Bar. We strongly support the USACE's efforts in these restorations and NYCDEP will continue to be a cost-sharing partner in future restoration efforts.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 40: Using lessons learned from the Elders Point and Yellow Bar restorations fund and conduct feasibility studies for restoration of Black Wall, Rulers Bar, Duck Point, and Stony Point Marshes. These sites have been severely impacted by marsh loss, and would benefit from additional sediment. Moreover, sediment could easily be moved on to these locations and monitored by community groups. Feasibility studies are needed before restoration efforts can be begun however, and should be undertaken for these sites as soon as possible.

NYCDEP Response: *Similar to the information provided about Yellow-Bar and Elder's Point restorations in the response under recommendation #35, NYSDEC is currently developing a feasibility study for the future restoration of several additional interior marsh islands, such as those mentioned by JBWPPAC. The restoration efforts will be part of a cost-sharing program (75/25) between NYSDEC and local sponsors. NYCDEP strongly supports*

these restoration efforts and will consider local cost-sharing opportunities.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 41: Require significantly higher mitigation ratios (amount of land mitigated in exchange for losing land to development) for tidal wetland impacts in Jamaica Bay than those required thus far. Throughout the Hudson-Raritan Estuary, the Corps and DEC have typically required mitigation ratios of 2:1 to 3:1 for projects with unavoidable impacts to tidal wetlands and adjacent areas. Given the Bay's historic wetland loss, mitigation for unavoidable tidal wetlands impacts in Jamaica Bay should use a 5:1 ratio as a minimum, with higher ratios required as appropriate.

NYCDEP Response: *With many NYCDEP restoration projects throughout the City and the Jamaica Bay watershed, the amount of natural area restored often far exceeds the actual physical disturbance and the typical restoration ratios required by the NYSDEC and USACE. The development of a restoration is based on a number of factors such as available opportunities at a specific location, potential for re-creating ecologically sustainable functions and cost implications as opposed to simply meeting a number. Each location is different and needs to be assessed according to the ecological functions currently provided. NYCDEP strongly encourages the development of restoration plans, where the ecological benefits and functions are the primary elements that guide and determine the*

scope of a particular restoration. In addition, when restoration opportunities are not practical or functional at the impact site, an opportunity may exist to re-locate the restoration to another more functional location or to become part of an existing restoration project.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 42: Examine the list of brownfields within the Jamaica Bay watershed/sewershed and evaluate on a case by-case basis how to improve their ecological functioning. Remediation and reuse of sites where toxics continue to leach into groundwater could improve conditions in the Bay; however, some sites in which natural resources have reemerged may be better left undeveloped. Incentives to help enhance these areas, such as called for in the "Brownfields to Greenfields" program proposed by NY/NJ Baykeeper, should be instituted.

NYCDEP Response: *NYCOEC coordinates the City's brownfields efforts and develops brownfields policy. Funding opportunities exist to assist in the remediation of eligible sites and are available from federal and state remediation programs. Therefore, it would be beneficial to examine a list of existing brownfields in the Jamaica Bay watershed to obtain specific information about these sites. Many of these sites are in private ownership and are not available for ecological restoration. Those that may be in public ownership must be examined for their prior and intended uses since not all brownfield sites can be reclaimed for ecological restoration. Those*

brownfield sites that are listed for priority acquisition by HEP, should be considered for ecological restoration or hazardous materials remediation prior to their anticipated end use.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 43: Pursue alternate sources of marshland restoration funding, including from private foundations, such as the National Fish and Wildlife Foundation, and from alternative government sources, such as the Environmental Benefits Fund to be created by DEP under the January 2006 Consent Decree with DEC.

NYCDEP Response: *Many different existing funding sources for restoration (including those mentioned above) are currently being investigated and compiled by the JBWPP project team. A detailed list of funding sources and related requirements will be included in the final JBWPP. As many of these programs can be utilized by both the private and public sectors, partnering to increase the overall awareness and effectiveness of the restoration can be important part of this process.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 44: Develop a graduated real estate property transfer tax for new development within the Jamaica Bay watershed to fund marsh restoration. This impact fee could be modeled on

an existing program that the East End of Long Island operates by which a portion of the real estate tax helps mitigate the ecological damage of open space loss. Alternatively, a portion of the city's sales tax could be dedicated to marsh restoration in Jamaica Bay.

NYCDEP Response: *The City does not have the legal authority to implement impact fees. Enabling such authority would require legislative action at the State level. All tax dollars go into the City's General Fund; allocations of General Fund monies are made as part of the budget review process. The JBWPP will identify a variety of potential funding sources and mechanisms for specific protection actions and strategies identified during the plan development process.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 45: Secure funding for New York/New Jersey Harbor Estuary Program (HEP) priority habitat acquisition and restoration sites located in Jamaica Bay. HEP is part of U.S. Environmental Protection Agency's National Estuary Program and is a stakeholder partnership that works to "develop and implement a plan to protect, conserve, and restore the estuary." One of HEP's priorities is to acquire, restore, and protect habitat throughout the harbor estuary. HEP's habitat workgroup is charged with identifying priority acquisition and restoration sites; as of February 2006, HEP has designated 26 sites in Jamaica Bay as priority acquisition and restoration sites. It is also important that the involved agencies ensure that designated sites

are not developed prior to the opportunity for acquisition.

NYCDEP Response: *Numerous reports have been developed with recommendations for the acquisition and restoration of wetland and upland buffer areas around the periphery of Jamaica Bay including Buffer of the Bay, Revisited (1993), JABERRT (2002), HEP Priority Acquisition and Restoration Sites list (revised 2004), USACE Jamaica Bay Study Area Report (2004), and New York State Open Space Conservation Plan (2005). Based on these reports, a number of efforts have been implemented or planned for the Bay including restoration projects at locations such as Four Sparrows Marsh, Idlewild Park, Spring Creek, Fresh Creek, and Big Egg Marsh and acquisition of some of the Buffer of the Bay recommended sites. NYCDEP will continue to be an active participant on these programs, including the HEP Habitat Work Group. In addition, NYCDEP will continue to reference other existing studies and reports such as HEP's designated site information to recommend habitat areas for acquisition and restoration as part of the JBWPP development process. The JBWPP will identify a variety of potential funding sources and mechanisms for specific protection actions and recommendations including those related to site acquisition and restoration.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 46: If filling of borrow pits in Norton Basin and Little Bay moves forward, use subsequent monitoring data to examine the potential benefits and drawbacks

that such recontouring actions might have for the Bay's remaining borrow pits.

NYCDEP Response: *The USACE and NYSDEC have produced an extensive literature database regarding the proposed Norton Basin and Little Bay borrow pit remediation projects. Should this project move forward into the construction phase, monitoring data and observations from this project will be summarized in the JBWPP. However, in the event this project moves forward after the completion of the October 1, 2007 final JBWPP, it will be included in the biennial update of the JBWPP.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 47: Initiate long-term planning related to the Belt Parkway's renovation and reconstruction that assesses use of design and construction elements that will decrease the highway's footprint around the rim of Jamaica Bay, increase wetlands and hydrologic connectivity and decrease pollution inputs into the Bay.

NYCDEP Response: *NYCDEP has reached out to NYCDOT and will continue to initiate dialogue with all appropriate agencies to promote the use of ecologically designed elements that receive and capture stormwater pollutants from roadways before they reach outlet structures. As part of the JBWPP's BMP analysis, specific BMP types (e.g., vegetated swales, constructed wetlands, soil infiltration, etc.) will be developed and recommended to help reduce and/or attenuate urban runoff from areas such*

as the Belt Parkway and other transportation routes throughout the watershed/sewershed.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 48:

Develop a plan to monitor the spread of invasive species, assess impact on Jamaica Bay's health, and develop programs for control. For example, Asian shore crabs were recently discovered in areas throughout the Bay and more information on the potential impacts these crabs have on green and black fingered mud crabs is needed, as well as how to eliminate or control their presence in the Bay as necessary. NPS staff is currently developing a draft invasive plant management plan (to be released in 2007) that identifies target species and areas, and recommends management approaches.

NYCDEP Response: *NPS's Jamaica Bay Institute (JBI) has compiled an extensive database of past, current and proposed (or needed) research efforts for Jamaica Bay. The primary stewards of the Bay, NPS, comprises environmental managers and scientists, a real time presence on the Bay and access to existing databases; therefore, NPS is best suited for developing an invasive species management plan. NYCDEP can assist this effort by providing information on exotic or invasive aquatic species compiled from previous and on-going restoration projects, studies and programs. In addition, NYCDEP, along with other federal, state and local agencies, use only indigenous plants for restoration projects. Where applicable, NYCDEP has increased these efforts by contracting growing plant material used*

in restoration efforts from local genotypes and the use of seed grown plants when possible to promote additional genetic diversity.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 49:

Widely publicize lists of invasive plant and animal species in Jamaica Bay and set up a hotline or Web site for local residents to notify officials about new invasive species.

NYCDEP Response: *In response to the invasive species problem within New York State, Governor Pataki signed legislation in 2003 calling for a team to explore the invasive species issue and to provide recommendations to the Governor and the Legislature. The Task Force was co-led by two New York State agencies: NYSDEC and the Department of Agriculture and Markets (NYSDAM). NYCDEP and NYCDPR were also contributors to this Task Force. The recommendations from this panel resulted in several programs to address invasives throughout New York State. The Invasive Plant Council of New York State publishes lists of invasive plants and receives information from the public reporting of invasive species. A copy of the summer 2005 public review draft is available on the NYSDEC's website. In addition to this Task Force, several other federal, state and local efforts have addressed this issue and have ongoing programs to identify and eradicate invasive plant and animal pest species as they arise. NYCDPR has also published lists of invasive species common in New York City.*

In addition, the 2002 JABERRT Report included a vegetation analysis

performed for 12 sites, from the waters edge to several hundred meters inland within the Jamaica Bay watershed. Three of the commonly identified vegetation cover types were dominated by invasive species and are identified as *Phragmites* Reeds, *Mugwort* and *Japanese Knotweed Thicket*. *Phragmites* and other exotic plant species have invaded disturbed wetlands and moist upland areas in the Jamaica Bay watershed, degrading habitat value and function.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 50: Incorporate invasive species control into restoration projects that target marshes along the Bay's periphery. By returning areas to natural elevations, invasive species, such as *Phragmites*, will be reduced and the recovered area will be more likely to repopulate with native species.

NYCDEP Response: *Invasive species proliferation in many areas of the country have severely degraded and compromised the ecological integrity of many different ecosystems. The areas surrounding Jamaica Bay are no different, as a number of non-native and invasive species have colonized wetlands and uplands within the Jamaica Bay watershed. Many of these invasive plant species are a result of past filling operations that have severely restricted tidal flushing in some areas of the Bay's tributaries, improper hydrologic elevations required to support *Spartina alterniflora* and the wide scale use of construction fill-derived soils that are incapable of supporting upland indigenous plant species. To be successful, all*

restoration projects, including those of NYCDEP, must address these issues to promote a self-sustaining ecosystem. The replacement of high pH and nutrient rich construction fill-derived soils with sandy infertile and nutrient poor soils will allow the indigenous species to better compete with and help to control the spread of invasive species.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 51: Restore eelgrass beds in appropriate locations within the Bay, possibly the south side of Little Egg Marsh. Eelgrass beds, which are found in estuarine waters less than eight feet deep, serve as important nurseries and habitats for fishes and shellfishes, help absorb wave action, and improve nutrient uptake and cycling. Once found throughout the Bay, these beds died off from disease and have been prevented from returning due to degraded water quality and dredging and deepening of former habitat. Little Egg Marsh may be an appropriate area for a pilot project because the area is clear of boat traffic and it receives ocean water through the Rockaway Inlet, which are beneficial conditions for eelgrass establishment.

NYCDEP Response: *Submerged aquatic vegetation (SAV) was historically present in Jamaica Bay (i.e., Grassy Bay); today its coverage is non-existent due to historic disease, dredging, and reduced light penetration from nutrient induced turbidity in waters above existing shallow water habitats. There has been little identified work in this area of wetland restoration in Jamaica Bay and*

additional work to identify potential suitable locations is necessary. As the growing requirements (e.g., clear waters, high light, calm waters, etc.) for this species are very narrow, it is expected that this is a longer term restoration strategy. As current and proposed environmental efforts begin to close the gap between existing conditions and the conditions required for the successful implementation of this species, a more detailed assessment of the restoration of this species can be undertaken. The successful completion of future SAV habitat suitability models, will provide information about appropriate locations for SAV restoration.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 52: Design and implement community planting programs using native species. Develop educational materials and a protocol to standardize Jamaica Bay restoration efforts to make them more efficient. The New York City Parks Department serves as a good example as it has implemented similar projects, most notably the Forever Wild Program.

NYCDEP Response: *As previously described for recommendation # 47, all restoration projects on Jamaica Bay use only indigenous plant material. Many standardized specifications have been developed for restoration projects that have been compiled from a number of sources, including those from field observations and those recommended by the Society for Ecological Restoration (SER).*

NYCDEP believes that multiple watershed protection goals and

objectives—including those related to water quality, land use, public access, public education and outreach—can be achieved by preserving or creating natural areas throughout the watershed and implementing or expanding programs that are community organized or administered. Community planting programs such as community gardens or watershed-wide tree plantings would help to achieve the above mentioned goals. NYCDEP also has an existing program that distributes plants to local schools to help the students understand the importance of indigenous plants. This program also allows teachers to implement “active” environmental lessons that provide opportunities for children to get their hands “dirty” for a good cause.

As part of the JBWPP development process, a review of existing educational materials related to Jamaica Bay and New York City’s natural environment would be completed through a collaborative effort with different government agencies and local organizations. In addition, the development of a brochure that highlights many important features of these existing as well as newly developed educational materials is currently being considered.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

Planning and Outreach

JBWPPAC Recommendation 53: Increase the number of remote real time monitoring stations in Jamaica Bay and the infrastructure necessary to

support these. Current technology allows for marine water quality stations (buoys) to transmit real time data to DEP offices. Routine water quality parameters that should be monitored include salinity, dissolved oxygen, pH, temperature, and nitrogen levels. The selection of station locations should allow for a broad assessment of the Bay's water quality at any point in time. Increased monitoring data will reduce the city's reliance on analytical modeling and provide a more accurate picture of the ecological system.

NYCDEP Response: *DEP presently operates two stations for monitoring marine water quality in Jamaica Bay: one station sited near Broad Channel and another at a Kingsborough College site. Each monitoring station includes a full range of sensors along with data management and web service capabilities at a cost of approximately \$18,000. We concur that increasing the number of stations would provide additional information in that changes in water quality would be more immediately noted and possibly linked to triggering events. Additionally, by increasing the number of stations, our analytical models used to study the Bay would be validated and calibrated and thereby improving our ability to better understand the Bay's complex ecosystem. Sites should be selected in order to focus on areas of concern, while remaining out of the way of navigation and habitation.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 54: New York City, acting through its various agencies and academic institutions, should facilitate a scientific symposium

at least every two years to coordinate and guide scientific investigations on issues pertinent to the ecology of Jamaica Bay and to inform the greater public on the status of the bay's ecology. Scientific symposiums, such as the Jamaica Bay Institute's March 2004 "Jamaica Bay's Disappearing Marshes," help to not only coordinate and guide scientific work, but also to inform the larger public and encourage increased policy action and funding. The city should provide a Web site for the Jamaica Bay community that is regularly updated, coordinated with other relevant Web sites, and made as user-friendly as possible to encourage community groups to interact and network. The Jamaica Bay Research and Management Information Network Web site could fill this need.

NYCDEP Response: *NYCDEP agrees that a regularly scheduled symposium would serve as a mechanism for sharing and coordinating research and information which is particularly important for the Jamaica Bay watershed due to the extensive amount and diverse types of research resulting from studies of the Bay. In addition, several initial meetings with Jamaica Bay Institute staff, environmental education professionals and outreach experts have all identified information dissemination, and not lack of information, as the real challenge in terms of understanding the Bay's issues and conditions. The above mentioned symposium organized by the Jamaica Bay Institute provides an excellent model for future symposiums. NYCDEP would like to also coordinate future symposiums with the JBWPP update schedule to ensure expert knowledge and researchers' findings are linked to the future evolution of the Plan and management of the watershed. A general format that will guide the development of these conferences and*

symposiums will be part of the JBWPP efforts.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 55:

Direct the Mayor's Office of Environmental Coordination to ensure that all relevant state, municipal and federal agencies are notified of construction and restoration activities and their impacts within the Jamaica Bay watershed/sewershed. Create a new Jamaica Bay watershed/sewershed environmental assessment form that ensures additional scrutiny of projects within the Jamaica Bay watershed, with an emphasis on environmental issues pertinent to the Bay. The assessment should incorporate an analysis of cumulative impacts, including from related projects; after all, it has been the cumulative effects of countless projects, large and small, over the past 100 years that have so degraded Jamaica Bay. The committee also specifically notes that as the redevelopment of Rockaway Beach and other bay areas continues, standards and requirements must be developed to ensure that such development is fully compatible with the goal of protecting and restoring the Bay.

NYCDEP Response: *As per Local Law 71, NYCDEP is specifically required to develop a protocol for coordination with the Mayor's Office of Environmental Coordination (NYCOEC). To the extent that City and other agencies provide NYCOEC with information on construction and restoration activities and their impacts within the Jamaica Bay watershed/sewershed, it would be*

possible for NYCOEC to make this information available on its website.

NYCOEC chairs the CEQR Task Force (currently comprised of representatives from NYCDOT, NYCDEP, NYCDCP and the Law Department), which has begun the process of reviewing the CEQR Technical Manual, last revised in 2001, to determine how it should be revised and updated. In addition, the CEQR Task Force anticipates updating the City's EAS form. Although a schedule for completion of the revision of the CEQR Technical Manual has not been agreed upon, an examination of Jamaica Bay issues, and revision of the City's EAS form or creation of a separate form for Jamaica Bay projects, can be incorporated into the CEQR Task Force's agenda.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 56: Add access points in Southwestern and Southeastern Queens. There is currently no access of any kind to Jamaica Bay from Southeastern Queens. Crumbling bulkheads, abandoned street ends, and vacant lands cut off communities that lie along the northern shore of the Rockaways and near JFK from the Bay. The New York Waterfront Blueprint identified public access opportunities in this area that would provide a natural link for Brooklyn and Queens residents to each other and to the Bay; these should be considered.

NYCDEP Response: *A number of potential access points along Jamaica Bay were recommended as part of several access studies including the New York Waterfront Blueprint and the*

NYC Comprehensive Waterfront Plan. NYCDEP will work with the appropriate agencies and community groups to determine the status of these recommendations and potential funding mechanisms.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 57:
Incorporate a unit on the JB watershed into city science and social studies curricula. Create a program about water and debris entering street catch basins and/or designate one week per year as "Jamaica Bay Conservation Week," during which students would write essays about the Bay.

NYCDEP Response: *NYCDEP has initiated meetings and discussions with environmental educators and teaching professionals to begin the process of developing a multi-disciplinary school based curricula focused on Jamaica Bay's ecological system and watershed. As a result, several key themes related to environmental education curricula have resulted including the need to evaluate similar or existing programs for potential modification or implementation so not to "reinvent the wheel" and to take advantage of existing effective programs. In addition, new or modified K-12th grade curricula must be standards based and tailored to teacher and student needs given current testing requirements. However, the education of youth in the watershed to promote awareness and stewardship at an early age is an important objective for the JBWPP and models of successful curricula and environmental education programs already exist within the watershed.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 58:
Develop and distribute a detailed map displaying access points, boat ramps, parking areas, and walking/biking paths. This map should also include guidelines for how to both enjoy and take care of the resource.

NYCDEP Response: *The JBWPP will involve a comprehensive review of current public access opportunities (as well as proposed access sites) to identify specific areas where gaps remain. Geographic Information Systems (GIS) is the most effective tool for conducting such an analysis and the maps that are produced could serve as public education and outreach tool materials about currently existing access points and amenities and how best to enjoy Jamaica Bay. NYCDEP will work with the appropriate agencies and community groups to collect the necessary data to analyze/map public access points and amenities and to identify potential funding mechanisms for distributing maps, if appropriate. However, this recommendation will not be able to be further assessed until additional information is obtained and analyzed related to current and proposed public access opportunities.*

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 59:
Develop a local nomination process that will allow the public, according to certain criteria, to nominate additional

sites for access and consideration for protection and acquisition.

NYCDEP Response: Existing programs and plans such as the HEP and New York State Open Space Plan and existing organizations such as the Regional Plan Association have a nomination process to select for inclusion on a list of priority habitat acquisition and restoration sites. Forms for the site nomination process under HEP are available on their website. In addition, maps locating many of these priority sites have been produced and are available online from each of these groups. A list of these priority sites will be included as part of the final JBWPP.

As an extension of this existing process, although there are many groups that are stewards of the bay, perhaps the creation of a centralized new sub-group within the Harbor Estuary Program that is dedicated to monitoring and tracking the issues of Jamaica Bay could be assembled. The sub-group would be comprised of existing environmental groups and government agencies.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 60: Require the New York City Dept. of Health and Mental Hygiene to conduct a public health survey of people who regularly eat fish from Jamaica Bay and, based on this report, review existing fishing policies. Based on anecdotal information, a significant number of subsistence anglers and their families eat fish from the Bay despite New York State Department of Health advisories; the possibility for

additional outreach specific to Jamaica Bay should be explored.

NYCDEP Response: Epidemiological studies of this kind typically require a population cohort study which observes a large number of individuals in a population over a period of time by comparing individuals who are exposed for instance to a certain chemical to others without that exposure or with a different level of exposure.¹⁶ As this is not directly related to the intent of the JBWPP, we would not include this as part of the JBWPP. However, we could request the New York State Department of Health (NYSDOH) to increase their public outreach on this important issue.

Recommendation for Incorporation into Final JBWPP: This recommendation of the JBWPPAC will not be further assessed for potential inclusion in the final JBWPP.

JBWPPAC Recommendation 61: Strengthen enforcement activities and sanctions against illegal dumping into Jamaica Bay. Businesses with records of polluting behaviors should face additional requirements, such as performance bonds or letters of credit in favor of city permit issuing agencies (DEP, New York City Department of Buildings) when undertaking work within the Jamaica Bay watershed.

NYCDEP Response: Per LL 71, NYCDEP is specifically required to develop and assess measures to "target enforcement efforts that will help reduce polluting behaviors and operations that may adversely impact Jamaica Bay." To date, NYCDEP has identified existing City regulations and enforcement authorities; the Department will continue this effort by comparing the sources of pollution with current environmental regulatory provisions and identifying mechanisms

(i.e., funding, staffing, etc.) for enforcing existing regulations.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

JBWPPAC Recommendation 62: Produce an economic analysis of the benefits that Jamaica Bay's wetlands provide to the area as a way of encouraging community and business support for investment in the resource.

NYCDEP Response: *Economic or valuation studies of non-market or environmental benefits can be a lengthy and challenging undertaking; thus, the results of such study may be a long ways away and the benefits of using this information to change*

behaviors or develop management strategies even longer. The JBWPP could be used to prioritize actions with potential for immediate positive impacts given the rate of wetland loss and potential long construction schedules for the water quality improvements in the Bay being evaluated. However, NYCDEP recognizes the value of this information in light of the commercial and residential development occurring around the Bay concurrent with increasing capital infrastructure costs.

Recommendation for Incorporation into Final JBWPP: *This recommendation of the JBWPPAC will be further assessed prior to March 1, 2007 for potential inclusion in the final JBWPP.*

Endnotes

- ¹ National Park Service, Gateway National Recreation Area and Jamaica Bay Institute. The Evolving Legacy of Jamaica Bay. 2003.
- ² US Fish and Wildlife Service. Significant Habitats and Habitat Complexes of the New York Bight Watershed, Jamaica Bay and Breezy Point, Complex # 16. 2005.
- ³ New York State Department of Environmental Conservation website. <http://www.dec.state.ny.us/website/dfwmr/marine/twloss.html>. Last accessed August 23, 2006.
- ⁴ National Park Service, Gateway National Recreation Area and Jamaica Bay Institute. The Evolving Legacy of Jamaica Bay. 2003.
- ⁵ The goal related to implementation and coordination is the least developed to date since it is dependent on the types of recommended actions that result from the complete development of the other six goal categories.
- ⁶ The 26th Ward WPCP drainage area was selected because it is the least separated sewer drainage area in the watershed and, therefore, the potential water quality impacts associated with modeled changes in the watershed would be most perceptible compared to the other three drainage areas.
- ⁷ In general, sanitary flow is approximately 10 – 20 percent of the CSO flow
- ⁸ Since loading from CSO's and storm sewers is a small fraction of the total nitrogen load to the Bay, the impacts on tributary water quality were assessed.
- ⁹ The Jamaica Bay JBWPP modeling consultant team responded to Advisory Committee questions and modeling requests in a memo dated March 14, 2006 on behalf of NYCDEP.
- ¹⁰ Metcalfe and Eddy. Wastewater Engineering, Treatment and Reuse. 4th Edition. 2003.
- ¹¹ McDonald, Jodi. Wetland Management's Influence on Water Quality in the Metropolitan New York City/Long Island Region, Jamaica Bay Damages Account Mitigation for Natural Resource Damage in New York City. NYSDEC conference abstract. November 1999.
- ¹² Atlantic Chapter of the Sierra Club website. <http://newyork.sierraclub.org/tracker/a2517.html>. Last accessed August 24, 2006.
- ¹³ Container Recycling Institute website. <http://www.container-recycling.org/mediafold/newsarticles/bottlebills/2006/5-11-NY-AssemblyPasses.htm>. Last accessed August 24, 2006.
- ¹⁴ New York State Assembly website. <http://assembly.state.ny.us/leg/?bn=A2517d>. Last accessed August 24, 2006.
- ¹⁵ Blue Ribbon Panel. National Park Service. Proceedings of Jamaica Bay's Disappearing Marshes, Future Directions and Research Needs. March 2004.
- ¹⁶ GreenFacts website. www.greenfacts.org. Last accessed August 24, 2006.