City-Wide Long Term CSO
Control Planning Project

Hutchinson River Waterbody/Watershed Facility Plan Report

The City of New York
Department of Environmental Protection
Bureau of Engineering Design & Construction

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Executive Summary

The New York City Department of Environmental Protection (NYCDEP) has prepared this watershed-specific Waterbody/Watershed Facility Plan Report for controlling combined sewer overflows (CSO) to the Hutchinson River, as required by the Administrative Consent Order between NYCDEP and the New York State Department of Environmental Conservation (NYSDEC) known as DEC Case #CO2-20000107-8 (January 14, 2005) or "the CSO Consent Order." This WB/WS Facility Plan expanded on the numerous CSO facility planning studies conducted over the past 20 years in the Upper East River and its tributaries.

This report represents the WB/WS Facility Plan for the Hutchinson River. This is one element of the City's extensive multiphase approach to CSO control that was started in the early 1970's. As described in more detail in Section 5, New York City has been investing in CSO control for decades. Elements already part of the City's CSO program and listed in the 2004 CSO Consent Order amount to over $2.1 billion of infrastructure investment. This does not include millions spent annually on control of CSOs through the Nine Minimum Controls that have been in place since 1994.

This WB/WS Facility Plan has been developed in fulfillment of the 2004 CSO Consent Order requirements. This Plan represents one in a series of WB/WS Facility Plans that will be developed prior to development of a final Long Term CSO Control Plan for the City, scheduled for completion by 2017. This WB/WS Facility Plan, as do the other plans, contains all the elements required by the United States Environmental Protection Agency (USEPA) of a Long Term CSO Control Plan.

The purpose of this WB/WS Facility Plan is to take the first step toward development of a Long Term Control Plan for the Hutchinson River. This Plan assesses the ability of existing NYC CSO Facility Plan for the Hutchinson River to provide compliance with the existing water quality standards. Where these facilities will not result in full attainment of the existing standards additional alternatives are evaluated.

The goal of this WB/WS Facility Plan is to reduce CSO floatables to the tidal Hutchinson River. This WB/WS Facility Plan assesses the effectiveness of CSO controls, now in place within New York City or required by the Consent Order to be put in place, to attain water quality that complies with the NYSDEC water quality standards. This WB/WS Facility Plan also assesses additional cost effective CSO control alternatives or strategies (i.e. water quality standards revisions) that can be employed to provide attainment with the water quality standards.

Post-construction compliance monitoring (including modeling), discussed in detail in Section 8, is an integral part of the WB/WS Facility Plan, and provides the basis for adaptive management for the Hutchinson River. Post-construction compliance monitoring will commence just prior to implementation of CSO controls and will continue for several years in order to quantify the difference between the expected performance (as described in this report) and the actual performance once those controls are fully implemented. Any performance gap identified by the monitoring program can then be addressed through operations adjustments, retrofitting additional controls, or initiating a Use Attainability Analysis (UAA) if it becomes clear that CSO control will not result in full attainment of applicable standards.

In addition, protocols established by NYCDEP and the City of New York for capital expenditures require certain evaluations to be completed prior to the construction of the CSO controls recommended in this report. Depending on the technology implemented and on the engineer's cost estimate for the project, these evaluations may include pilot testing, detailed facility planning, preliminary design, and value engineering. Each of these steps provides additional opportunities for refinement and adaptation so that the fully implemented program achieves the goals of the original WB/WS Facility Plan.

The Hutchinson River begins in Westchester County, flows through the Borough of the Bronx, and empties into Eastchester Bay. This system is a tributary of the East River, which lies immediately to the west of Long Island Sound. The Hutchinson River runs through the areas of Eastchester, Co-Op City, Baychester, Spencer Estates, Country Club, Eastchester Bay and Edgewater Park. The river is tidal throughout the Bronx, but receives freshwater input in Westchester County. The watershed is bordered on the north by Westchester County, the west by the Westchester Creek watershed, the east by Long Island Sound and the south by the Eastchester Bay. The Hutchinson River watershed is served by the Hunts Point Water Pollution Control Plant (WPCP), which first came on-line in 1952 and has been providing full secondary treatment since that time.

Currently, the land surrounding northern reaches of the river near the Bronx border is highly industrial with scrap metal plants and other industrial facilities surrounding its banks, as shown in Exhibit ES-1. The middle and southern portion of the Hutchinson River is bordered by the residential development Co-op City on the west bank and a more natural area, Pelham Bay Park to the east and to the west on the southern end.

During the colonial era, the area to the west of the New Engand Thruway (I-95) and north of the Bronx and Pelham Parkway was predominantly a rural farming community, while the area to the east of the Thruway was marshland with rock outcroppings. The early settlers used the salt marsh primarily for cattle grazing. The salt marsh was also used for a tidal mill called Reeds Mill in the nineteenth century as well as a cucumber and pickle operation in the early twentieth century. With the exception of the pickle farm and tidal mill, most of the salt marsh, remained undeveloped until the 1950s.

A summary of the hydrologic changes caused by urbanization in the NYC Hutchinson River watershed is presented in Table ES-1. The pre-urbanized condition is assumed circa 1900. The table demonstrates that although the overall size of the watershed has been reduced by approximately 24 percent as a result of sewer construction, the runoff volume has increased. Runoff yield for an average precipitation year as calculated by sewer system model has increased from approximately 370 MG of natural runoff to 660 MG discharged by

Exhibit ES-1. Northernmost portion of the Hutchinson River within NYC (looking northeast)

combined and separate sewer systems to the Hutchinson River, an increase of 77 percent. Significantly large discharges are now made directly to the Hutchinson River at higher rates since they are no longer attenuated, filtered, and mitigated by "natural" overland mechanisms.

Table ES-1 Effects of Urbanization on NYC Hutchinson River Watershed

Watershed Characteristics	Pre-urbanized	Urbanized(1)
Drainage Area (acres)	3,370	2,572
Population(2)	Unknown	79,100
Imperviousness	10%	49%
Annual Yield (MG)(3,4)	372	658

Notes: (1) Existing Condition
(2) Year 2000 U.S. Census
(3) Design rainfall – JFK 1988
(4) Total wet weather run off (CSO + Stormwater)

The NYSDEC had previously designated the tidal section of the Hutchinson River as a high priority waterbody for TMDL development with its inclusion on the 2004 Section 303(d) List for low dissolved oxygen conditions.

A variety of CSO control alternatives have been examined to reduce CSO pollution impacts to Hutchinson River. Evaluated alternatives corresponded to a range of CSO reductions from the Baseline condition up to 100 percent CSO abatement. As suggested in USEPA guidance for long-term CSO control plans, water quality modeling was performed for a host of alternatives providing a reasonable range of CSO volume and frequency reduction and attainment of goals for water-quality and uses. Full-year model simulations were performed for each engineering alternative and the results were compared to those for a baseline condition to determine the relative benefit of the engineering alternatives. After reviewing the the modeling results (see Section 7.4), the alternative that provided the greatest benefit per unit cost, Floatables Controls, was selected. This alternative consists of pathogen loading source investigation, in-line netting at HP-023 and HP-024, and continuing to work with neighboring jurisdictions to promote water quality throughout the river.

The evaluation of alternatives conducted by the NYCDEP was consistent with the "watershed" approach defined by the policy, in which a permittee evaluates pollutant contributors throughout the watershed and their impact on achieving the water quality-based requirements of the Clean Water Act (CWA). Over two-thirds of the Hutchinson River watershed is outside of NYCDEP jurisdiction, in Westchester County. This portion of the watershed accounts for approximately 74 percent of the flow on an annual basis. When evaluating the water quality of the Hutchinson River, a scenario was examined which attempted to quantify the impact on the Hutchinson River from upstream sources, outside of the jurisdiction of the NYCDEP. The selected WB/WS Facility Plan , which includes interjurisdictional cooperation, is based on a cost benefit analysis and is expected to have a high level attainment with the existing numerical criteria for a Class SB waterbody under typical conditions. Attainment may not occur at all times, but the WB/WS Facility Plan is adaptive enough to address any shortcoming identified during post-construction monitoring.

The Federal CSO Control Policy recognizes that "data and modeling of wet weather events often do not give a clear picture of the level of CSO controls necessary to protect water quality standards" and thus requires a post-construction monitoring program to address the uncertainty inherent in mathematical water quality modeling of future conditions. Post-construction monitoring will provide feedback to facility operations, data for modeling, and information for compliance evaluations by the NYSDEC. Each year's data set will be compiled and evaluated to refine the understanding of the interaction between the Hutchinson River and CSOs tributary to it, with the ultimate goal of improving water quality and fully attaining the numerical water quality criteria protective of the existing designated uses. The NYCDEP will monitor the performance of the proposed elements of the WB/WS Facility Plan for a number of years, during which the SPDES Permit for the Hunts Point WPCP may require a variance if contraventions of the standards occur. If water quality standards are demonstrated to be unrealistic given the performance of the facilities, the NYCDEP will request that the NYSDEC re-classify Hutchinson River based on a Use Attainability Analysis (UAA). Consideration should also be given to modifying the standards to allow independent designations of aquatic life protection and recreation water uses and recognition of the level of control provided by the WB/WS Facility Plan and subsequent Long-Term CSO Control Plan.

In addition to the proposed WB/WS Facility Plan for Hutchinson River, the NYCDEP currently operates several programs designed to reduce CSO to a minimum and to provide levels of treatment appropriate to protect waterbody uses. As the effects of the WB/WS Facility Plan become understood through long-term monitoring, ongoing programs will be routinely evaluated based on receiving water quality considerations. Floatables reduction plans, targeted sewer cleaning, real-time level monitoring, and other operations and maintenance controls and evaluations will continue, in addition to the following:

- The 14 BMPs for CSO control required under the City's 14 SPDES permits address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO and reduce contaminants in the combined sewer system, thereby reducing water quality impacts.
- The City-Wide Comprehensive CSO Floatable Plan (Modified Facility Planning Report, July 2005) will provide substantial reductions in floatables discharges from CSOs throughout the City to a level appropriate to NYSDEC and IEC requirements. Like the LTCP, the Floatables Plan is a living program which is expected to change over time based on continual assessment and changes in related programs.

Using the watershed-based approach the Federal CSO Control Policy expects, the WB/WS Facility Plan builds on the previous work, and with the benefit of increased computational ability, a low-cost alternative was identified that achieves similiar water quality benefits to the more cost-intensive tank construction while saving the ratepayers of New York approximately $200 million.

1.0. Introduction

The City of New York owns and operates 14 water pollution control plants (WPCPs) and their associated collection systems through the New York City Department of Environmental Protection (NYCDEP). The system contains approximately 450 combined sewer overflows (CSOs) located throughout the New York Harbor complex. The NYCDEP is executing a comprehensive watershed-based approach to long-term CSO control planning to address the impacts of these CSOs on the water quality and use of the waters of New York Harbor. As illustrated in Figure 1-1, multiple waterbody assessments are being conducted that consider causes of non-attainment of water quality standards (WQS) and identify opportunities and requirements for maximizing beneficial uses. This WB/WS Facility Plan provides the details of the assessment and the actions that will be taken to improve water quality in one of these waterbodies, the Hutchinson River.

New York City's environmental stewardship of the New York Harbor began in 1909 with water quality monitoring "to assess the effectiveness of New York City's various water pollution control programs and their combined impact on water quality" that continues today (NYCDEP, 2000). CSO abatement has been ongoing since at least the 1950s, when conceptual plans were first developed for the reduction of CSO discharges into Spring Creek and other confined tributaries in Jamaica Bay and reduction of CSO discharges to confined tributaries in the East River. From 1975 through 1977, the City conducted a harbor-wide water quality study funded by a Federal Grant under Section 208 of the Water Pollution Control Act Amendments of 1972. This study confirmed tributary waters in the New York Harbor were negatively affected by CSOs. In 1984 a City-wide CSO abatement program was developed that initially focused on establishing planning areas and defining how facility planning should be accomplished. The City was divided into eight individual project areas that together encompass the entire harbor area. Four open water project areas were developed (East River, Jamaica Bay, Inner Harbor and Outer Harbor), and four tributary project areas were defined (Flushing Bay, Paerdegat Basin, Newtown Creek, and Jamaica Tributaries). At the time, dry weather discharges were occurring that have since been eliminated by the NYCDEP. These facility plans were required under the State Pollutant Discharge Elimination System (SPDES) permits for each WPCP, which apply to CSO outfalls as well as plant discharges and therefore contain conditions for compliance with applicable CSO federal and state requirements. The current permits, issued by the New York State Department of Environmental Conservation (NYSDEC) in April 2003 and modified February 2004 contain requirements for development of the WB/WS Facility Plans and Long-Term Control Plans (LTCP).

In 1992, the NYCDEP entered into an Administrative Consent Order with the NYSDEC that was incorporated into the SPDES permits with a provision stating that the consent order governs the NYCDEP's obligations for its CSO program. The 1992 Order was modified in 1996 to add a catch basin cleaning, construction, and repair program. A new Consent Order became effective in 2005 that supersedes the 1992 Consent Order and its 1996 modifications with the intent to bring all CSO-related matters into compliance with the provisions of the Clean Water Act and Environmental Conservation Law. The new Consent Order contains requirements to evaluate and implement CSO abatement strategies on an enforceable timetable for eighteen waterbodies and, ultimately, for City-wide long-term CSO control. The NYCDEP and the

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Waterbody/Watershed Assessment Areas

FIGURE 1-1

NYSDEC also entered into a separate Memorandum of Understanding (MOU) to facilitate WQS reviews in accordance with the Federal CSO Control Policy.

This WB/WS Facility Plan is required by the 2005 Consent Order in accordance with the schedule presented in Appendix A of the 2004 Consent Order, and is intended to support the Long-Term Control planning process as outlined in the United States Environmental Protection Agency's (USEPA) CSO Control Policy. In 1994 the USEPA issued a national CSO Control Policy, which requires municipalities to develop a long-term plan for controlling CSOs (i.e. a Long-Term Control Plan or LTCP). The CSO Control Policy became law in December 2000 with the passage of the Wet Weather Water Quality Act of 2000. The approach to developing the LTCP is specified in USEPA's CSO Control Policy and Guidance Documents, and involves the following nine minimum elements:

1. System Characterization, Monitoring and Modeling
2. Public Participation
3. Consideration of Sensitive Areas
4. Evaluation of Alternatives
5. Cost/Performance Consideration
6. Operational Plan
7. Maximizing Treatment at the Treatment Plant
8. Implementation Schedule
9. Post Construction Compliance Monitoring Program

As dictated by the Consent Order, a WB/WS Facility Plan is required for each drainage area cited in Appendix A and each will briefly describe the status with the nine USEPA recommended elements of a LTCP. Subsequent sections this WB/WS Facility Plan will discuss each of these elements in more depth, along with the simultaneous coordination with state WQS review and revision, as appropriate.

1.1. ASSESSMENT AREA

This WB/WS Facility Plan addresses the Hutchinson River and surrounding watershed and sewershed. Located in eastern Bronx the Hutchinson River begins in Westchester County, flows through the Borough of the Bronx, and empties into Eastchester Bay. This system is a tributary of the East River, which lies immediately to the west of Long Island Sound. The Hutchinson River runs through the areas of Eastchester, Baychester, and Co-Op City. The river is tidal throughout the Bronx, but receives freshwater input in Westchester County. The watershed is bordered on the north by Westchester County, on the west by the NYC Westchester Creek Watershed, on the east by Pelham Bay Park East and on the south by the Eastchester Bay. Currently, five CSO outfalls are permitted to discharge to the river. The Hutchinson River watershed is largely residential with a high percentage of open space and recreation area, thanks in large part to Pelham Bay Park, the largest park within New York City.

Based on topography, the natural tributary watershed would be approximately 3,377 acres. Due to sewer system construction, urban development and other alterations to the watershed and runoff pathways the resulting watershed within the City is approximately 2,795 acres with approximately 640 acres within Pelham Park. The sewershed assessment area is shown in Figure 1-2.

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Hutchinson River Assessment Area

The legal definitions of waterbodies are codified in Title 6 of the New York State Code of Rules and Regulations under 6 NYCRR 891. The Hutchinson River is classified by New York State as Class SB saline surface waters with best uses designated for primary contact recreation and fishing.

1.2. REGULATORY CONSIDERATIONS

The waters of the City of New York are primarily subject to New York State regulation, but must also comply with USEPA policies, as well as WQS established by the Interstate Environmental Commission (IEC). The following sections detail the regulatory issues relevant to long-term CSO control planning.

1.2.1. Clean Water Act

Although federal laws protecting water quality were passed as early as 1948, the most comprehensive approach to clean water protection was enacted in 1972, with the adoption of the Federal Water Pollution Control Act Amendments became commonly known as the Clean Water Act (CWA), including the amendments adopted in 1977. The CWA established the regulatory framework to control surface water pollution, and gave USEPA the authority to implement pollution control programs. Among the key elements of the CWA was the establishment of the National Pollution Discharge Elimination System (NPDES) permit program, which regulates point sources that discharge pollutants into waters of the United States. Combined sewer overflows and municipal separate storm sewer systems (MS4) are also subject to regulatory control under the NPDES program. In New York State, the NPDES permit program is administered by the State through NYSDEC, and is thus a SPDES permit program. New York has had an approved SPDES program since 1975.

The CWA requires that discharge permit limits are based on receiving WQS established by the State. These standards should "wherever attainable, provide water quality for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water and take into consideration their use and value of public water supplies, propagation of fish, shellfish, and wildlife, recreation in and on the water, and agricultural, industrial, and other purposes including navigation" (40 CFR 131.2). The standards must also have an antidegradation policy for maintaining water quality at acceptable levels, and a strategy for meeting these standards must be developed for those waters not meeting WQS. The most common type of strategy is the development of a Total Maximum Daily Load (TMDL). TMDLs determine what level of pollutant would be consistent with meeting WQS. TMDLs also allocate acceptable loads among sources of the relevant pollutants.

Section 305(b) of the CWA requires states to periodically report the water quality of waterbodies under their respective jurisdictions, and Section 303(d) requires states to identify impaired waters where specific designated uses are not fully supported. The NYSDEC Division of Water addresses these requirements by following its Consolidated Assessment and Listing Methodology (CALM). The CALM includes monitoring and assessment components that determine WQS attainment and designated use support for all waters of New York State. Waterbodies are monitored and evaluated on a five-year cycle. Information developed during monitoring and assessment is inventoried in the Waterbody Inventory/Priority Waterbody List (WI/PWL). The WI/PWL incorporates monitoring data, information from state and other agencies, and public participation. The Waterbody Inventory refers to the listing of all waters, identified as specific individual waterbodies, within the state that is being assessed. The Priority Waterbodies List is the subset of waters in the Waterbody Inventory that have documented water quality impacts, impairments, or threats. The Priority Waterbodies List provides the candidate list of waters to be considered for inclusion on the Section 303(d) List.

Another important component of the CWA is the protection of uses. USEPA regulations state that a designated use for a waterbody may be refined under limited circumstances through a Use Attainability Analysis (UAA). In the UAA, the state would demonstrate that one or more of a limited set of circumstances exists to make such a modification. First, it could be shown that the current designated use cannot be achieved through implementation of applicable technology-based limits on point sources or cost-effective and reasonable best management practices (BMPs) for non-point sources. Additionally, a determination could be made that the cause of non-attainment is due to natural background conditions or irreversible human-caused conditions. Another alternative would be to established that attaining the designated use would cause substantial environmental damage or substantial and widespread social and economic costs. If the findings of a UAA suggest authorizing the revision to a use or modification of a water quality standard is appropriate, the analysis and the accompanying proposal for such a modification must go through the public review and participation process and the USEPA approval process.

1.2.2. Federal CSO Control Policy

The first national CSO Control Strategy was published by USEPA in the Federal Register on September 8, 1989 (54 FR 37370). The goals of that strategy were to minimize water quality, aquatic biota, and human health impacts from CSOs by ensuring that CSO discharges comply with the technology and water quality based requirements of the CWA. On April 19, 1994, USEPA officially noticed the CSO Control Policy (59 FR 18688), which established a consistent national approach for controlling discharges from all CSOs to the waters of the United States. The CSO Control Policy provides guidance to permittees and NPDES permitting authorities such as the NYSDEC on the development and implementation of a Long-Term CSO Control Plan in accordance with the provisions of the CWA to attain WQS. On December 15, 2000, amendments to Section 402 of the CWA (known as the Wet Weather Water Quality Act of 2000) were enacted, incorporating the CSO Control Policy by reference.

USEPA has stated that its CSO Control Policy represents a comprehensive national strategy to ensure that municipalities, permitting authorities, WQS authorities and the public engage in a comprehensive and coordinated planning effort to achieve cost effective CSO controls that ultimately meet appropriate health and environmental objectives and requirements (USEPA, 1995a). Four key principles of the CSO Control Policy ensure that CSO controls are cost-effective and meet the objectives of the CWA:

1. Clear levels of control are provided that would be presumed to meet appropriate health and environmental objectives;
2. Sufficient flexibility is allowed to municipalities to consider the site-specific nature of CSOs and to determine the most cost-effective means of reducing pollutants and meeting CWA objectives and requirements;
3. A phased approach to implementation of CSO controls is acceptable; and

4. Water quality standards and their implementation procedures may be reviewed and revised, as appropriate, when developing CSO control plans to reflect the site-specific wet weather impacts of CSOs.

In addition, the CSO Control Policy clearly defines expectations for permittees, state WQS authorities, and NPDES permitting and enforcement authorities. Permittees were expected to have implemented USEPA's nine minimum controls (NMCs) by 1997, after which long-term control plans should be developed. The NMCs are embodied in the 14 BMPs required by the NYSDEC as discussed in Section 5.3 and include:

1. Proper operation and maintenance of combined sewer systems and combined sewer overflows;
2. Maximum use of the collection system for storage;
3. Review and modification of pretreatment requirements to determine whether non-domestic sources are contributing to CSO impacts;
4. Maximizing flow to the Publicly Owned Treatment Works (POTW);
5. Elimination of CSOs during dry weather;
6. Control of solid and floatable material in CSOs;
7. Pollution prevention programs to reduce contaminants in CSOs;
8. Public notification; and
9. Monitoring to characterize CSO impacts and the efficacy of CSO controls.

WQS authorities should review and revise, as appropriate, state WQS during the CSO long-term planning process. NPDES permitting authorities should consider the financial capability of permittees when reviewing CSO control plans.

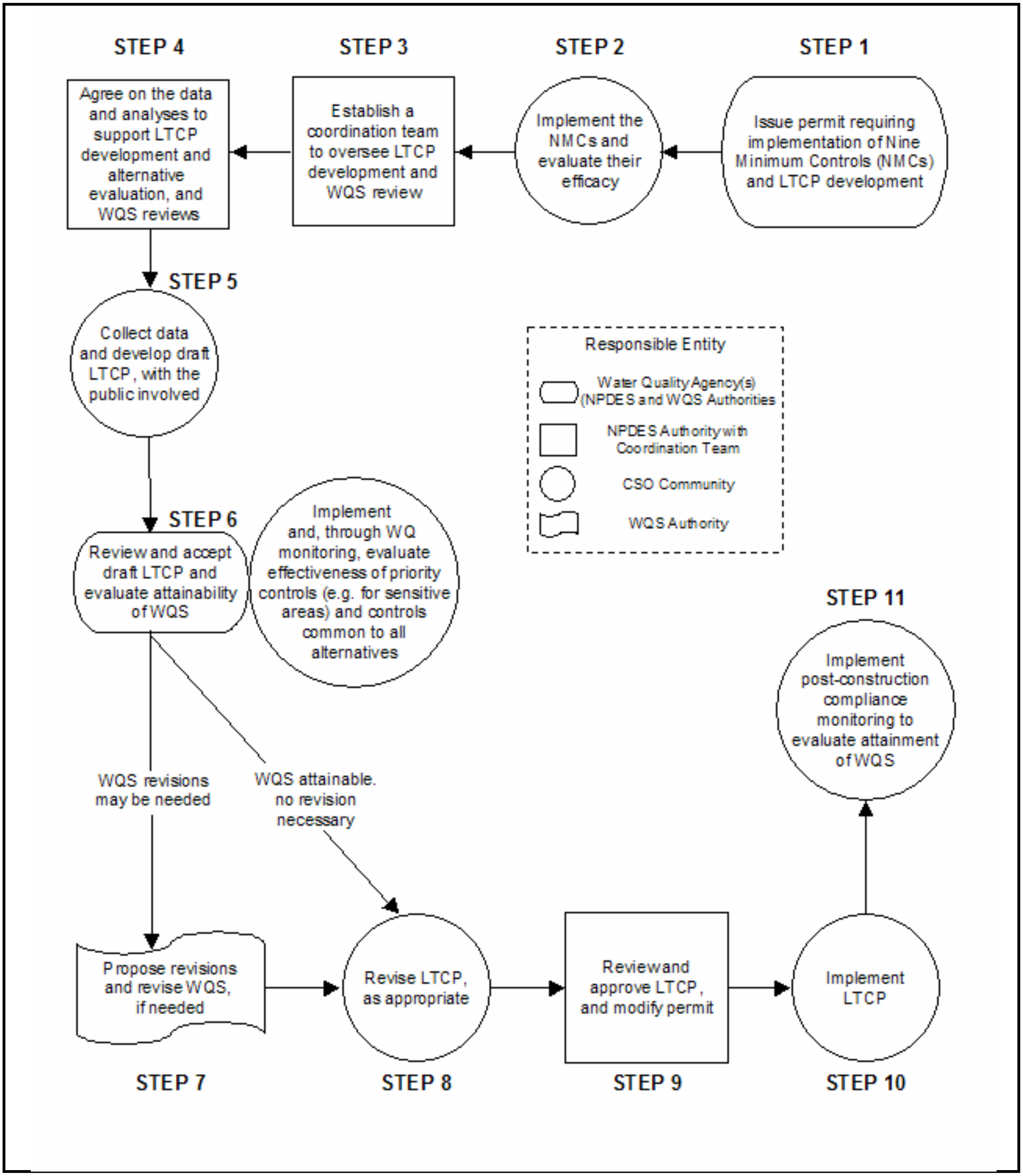
In July 2001, USEPA published *Coordinating CSO Long-Term Planning with Water Quality Standards Reviews*, additional guidance to address questions and describe the process of integrating development of CSO long-term control plans with WQS reviews (USEPA, 2001d). The guidance acknowledges that the successful implementation of an LTCP requires coordination and cooperation among CSO communities, constituency groups, states and USEPA using a watershed approach. As part of the LTCP development, USEPA recommends that WQS authorities need to review the LTCP to evaluate the attainability of applicable WQS. The data collected, analyses, and planning performed by all parties may be sufficient to justify a WQS revision if a higher level of designated uses is attainable or if existing designated uses are not reasonably attainable. If the latter is true, USEPA allows the state WQS authorities several options to consider:

1. Apply site-specific criteria;
2. Apply criteria at point of contact rather than at the end of pipe through the establishment of a mixing zone, waterbody segmentation, or similar;
3. Apply less stringent criteria when it is unlikely that recreational uses will occur or when water is unlikely to be ingested;

4. Subcategories of uses, such as precluding swimming during or immediately following a CSO event or developing a CSO subcategory of recreational uses; and
5. A tiered aquatic life system with subcategories for urban systems.

If the waterbody supports a use with more stringent water quality requirements than the designated use, USEPA requires the State to revise the designated use to reflect the higher use being supported. Conversely, USEPA requires that a UAA be performed whenever the state proposes to reduce the level of protection for the waterbody. States are not required to conduct UAAs when adopting more stringent criteria for a waterbody. Once WQS are revised, the CSO Control Policy requires post-implementation compliance monitoring to evaluate the attainment of designated uses and WQS and to determine if further water quality revisions and/or additional long-term control planning is necessary. USEPA provides a schematic chart (see Figure 1-3) in its guidance for describing the coordination of LTCP development and WQS review and revision.

It is important to note that New York City's CSO abatement efforts were prominently displayed as model case studies by USEPA during a series of seminars held across the United States in 1994 to discuss the CSO Control Policy with permittees, WQS authorities, and NPDES permitting authorities (USEPA, 1994). New York City's field investigations, watershed and receiving water modeling, and facility planning conducted during the Paerdegat Basin Water Quality Facility Planning Project were specifically described as a case study during the seminars. Additional City efforts in combined sewer system characterization, mathematical modeling, water quality monitoring, floatables source and impact assessments, and use attainment were also displayed as model approaches to these elements of long-term CSO planning.



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Long-term CSO Control Planning Procedures

FIGURE 1-3

1.2.3. New York State Policies and Regulations

In accordance with the provisions of the Clean Water Act, the State of New York has promulgated WQS for all waters within its jurisdiction. The State has developed a system of waterbody classifications based on designated uses that includes freshwater and marine classifications, as shown in Table 1-1.

Table 1-1. New York State Numeric Surface Water Quality Standards

Class	Usage	DO (mg/L)	Total Coliform	Fecal Coliform
Freshwater				
A	Source of water supply for drinking, culinary or food processing purposes. Primary and secondary contact recreation; and fishing. Suitable for fish propagation and survival.	> 5.0 (4) >4	2,400 (1) 5,000 (3)	200 (2)
B	Primary and secondary contact recreation and fishing. Suitable for fish propagation and survival.	> 5.0 (4) >4	2,400 (1) 5,000 (3)	200 (2)
C	Limited primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	> 5.0 (4) >4	2,400 (1) 5,000 (3)	200 (2)
D	Best usage is fishing. Not conducive to propagation of game fishery and waters will not support fish propagation.	> 3.0	2,400 (1) 5,000 (3)	200 (2)
Saline				
SA	Shellfishing for market purposes, primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	> 5.0	70 (1)	n/a
SB	Primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	> 5.0	2,400 (1) 5,000 (3)	200 (2)
SC	Limited primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	> 5.0	2,400 (1) 5,000 (3)	200 (2)
I	Secondary contact recreation, fishing. Suitable for fish propagation and survival.	> 4.0	10,000 (2)	2,000 (2)
SD	Fishing, Suitable for fish survival. Waters with natural or man-made conditions limiting attainment of higher standards.	> 3.0	n/a	n/a

Notes: Coliform concentrations are maximum counts per 100 mL based on (1) monthly median, (2) monthly geometric mean, or (3) monthly 80 percentile of samples. (4) Daily avg. min for non-trout waters. n/a: not applicable

The NYSDEC considers the A, B, SA and SB classifications to fulfill the CWA goals of fully supporting aquatic life and recreation. Class C, D, and SC support aquatic life and recreation but the recreational use of the waterbody is limited due to other factors. Class I supports the CWA goal of aquatic life protection and supports secondary contact recreation. SD waters shall be suitable for fish survival only because natural or manmade conditions limit the attainment of higher standards.

Dissolved Oxygen

Dissolved oxygen is the numerical standard that the NYSDEC uses to establish whether a waterbody supports aquatic life uses. The numerical dissolved oxygen standards for the Hutchinson River (Class SB) require that dissolved oxygen concentrations shall not be less than 5.0 mg/L at any time at any location within the waterbody.

Bacteria

Total and fecal coliform bacteria concentrations are the numerical standards that the NYSDEC uses to establish whether a waterbody supports recreational uses. The numerical bacteria standards for the Hutchinson River (Class SB) require that total coliform bacteria must have a monthly geometric mean of less than 2,400 per 100 mL from a minimum of five examinations. Fecal coliform (Class SB) must have a monthly geometric mean of less than 200 per 100 mL from a minimum of five examinations.

An additional NYSDEC standard for primary contact recreational waters is a maximum allowable enterococci concentration of a geometric mean of 35 per 100 mL for a representative number of samples. This standard, although not promulgated, is now an enforceable standard in New York State since USEPA established January 1, 2005 as the date upon which the criteria must be adopted for all coastal recreational waters.

For non-designated beach areas of primary contact recreation, which are used infrequently, the USEPA criteria suggest that a reference level indicative of pollution events be considered to be 501 per 100 mL. These reference levels according to the USEPA documents are not standards but are to be used as determined by the state agencies in making decisions related to recreational uses and pollution control needs. For bathing beaches, these reference levels are to be used for announcing bathing advisories or beach closings in response to pollution events.

Narrative Standards

In addition to numerical standards, New York State also has narrative criteria to protect aesthetics in all waters within its jurisdiction, regardless of classification. Unlike the numeric standards, which provide an acceptable concentration, narrative criteria generally prohibit quantities that would impair the designated use or have a substantial deleterious effect on aesthetics. Garbage, cinders, ashes, oils, sludge and other refuse are prohibited in any amounts. The term “other refuse” has been interpreted to include floatable materials such as street litter that finds its way into receiving waters via uncontrolled CSO and storm sewer discharges. It should be noted that, in August 2004, USEPA Region II recommended NYSDEC “revise the narrative criteria for aesthetics to clarify that these criteria are meant to protect the best use(s) of the water, and not literally require ‘none’ in any amount, or provide a written clarification to this end.” Table 1-2 summarizes the narrative WQS.

Table 1-2. New York State Narrative Water Quality Standards

Parameters	Classes	Standard
Taste-, color-, and odor producing toxic and other deleterious substances	SA, SB, SC, I, SD A, B, C, D	None in amounts that will adversely affect the taste, color or odor thereof, or impair the waters for their best usages.
Turbidity	SA, SB, SC, I, SD A, B, C, D	No increase that will cause a substantial visible contrast to natural conditions.
Suspended, colloidal and settleable solids	SA, SB, SC, I, SD A, B, C, D	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.
Oil and floating substances	SA, SB, SC, I, SD A, B, C, D	No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease.
Garbage, cinders, ashes, oils, sludge and other refuse	SA, SB, SC, I, SD A, B, C, D	None in any amounts.
Phosphorus and nitrogen	SA, SB, SC, I, SD A, B, C, D	None in any amounts that will result in growth of algae, weeds and slimes that will impair the waters for their best usages.

1.2.4. Interstate Environmental Commission

The states of New York, New Jersey, and Connecticut are signatory to the Tri-State Compact that designated the Interstate Environmental District and created the IEC. The Interstate Environmental District includes all tidal waters of greater New York City. Originally established as the Interstate Sanitation Commission, the IEC may develop and enforce waterbody classifications and effluent standards to protect waterbody uses within the Interstate Environmental District. The applied classifications and effluent standards are intended to be consistent with those applied by the signatory states. There are three waterbody classifications defined by the IEC, as shown in Table 1-3.

In general, IEC water quality regulations require that all waters of the Interstate Environmental District are free from floating and settleable solids, oil, grease, sludge deposits, and unnatural color or turbidity to the extent necessary to avoid unpleasant aesthetics, detrimental impacts to the natural biota, or use impacts. The regulations also prohibit the presence of toxic or deleterious substances that would be detrimental to fish, offensive to humans, or unhealthful in biota used for human consumption. The IEC also restricts CSO discharges to within 24 hours of a precipitation event. The IEC effluent quality regulations do not apply to CSOs if the combined sewer system is being operated with reasonable care, maintenance, and efficiency. Although IEC regulations are intended to be consistent with state WQS, the three-tiered IEC system and the five New York State marine classifications in New York Harbor do not spatially overlap exactly.

Table 1-3. Interstate Environmental Commission Numeric Water Quality Standards

Class	Usage	DO (mg/L)	Waterbodies
A	All forms of primary and secondary contact recreation, fish propagation, and shellfish harvesting in designated areas	> 5.0	East R. east of the Whitestone Br.; Hudson R. north of confluence with the Harlem R; Raritan R. east of the Victory Br. into Raritan Bay; Sandy Hook Bay; lower New York Bay; Atlantic Ocean
B-1	Fishing and secondary contact recreation, growth and maintenance of fish and other forms of marine life naturally occurring therein, but may not be suitable for fish propagation.	> 4.0	Hudson R. south of confluence with Harlem R.; upper New York Harbor; East R. from the Battery to the Whitestone Bridge; Harlem R.; Arthur Kill between Raritan Bay and Outerbridge Crossing.
B-2	Passage of anadromous fish, maintenance of fish life	> 3.0	Arthur Kill north of Outerbridge Crossing; Newark Bay; Kill Van Kull

1.2.5. Administrative Consent Order

New York City's 14 SPDES permits contain conditions designed to comply with federal and state CSO requirements. The NYCDEP was unable to comply with deadlines imposed in their 1988 permits for completion of four CSO abatement projects initiated in the early 1980s. As a result, the NYCDEP entered into an Administrative Consent Order with the NYSDEC on June 26, 1992 which was incorporated into the SPDES permits with a provision stating that the Consent Order governs the NYCDEP's obligations for its CSO program. It also required the NYCDEP to implement CSO abatement projects in nine facility planning areas divided into two tracks: those areas where dissolved oxygen and coliform standards were being contravened (Track One), and those areas for which floatables control was necessary (Track Two). The 1992 Order was modified on September 19, 1996 to add a catch basin cleaning, construction, and repair program.

The NYCDEP and the NYSDEC negotiated a new Consent Order that was signed January 15, 2005 that supersedes the 1992 Order and its 1996 Modifications with the intent to bring all NYCDEP CSO-related matters into compliance with the provisions of the Federal Clean Water Act and New York State Environmental Conservation Law. The new Order, noticed by the NYSDEC in September 2004, contains requirements to evaluate and implement CSO abatement strategies on an enforceable timetable for 18 waterbodies and, ultimately, for City-wide long-term CSO control in accordance with USEPA CSO Control Policy. The NYCDEP and the NYSDEC also entered into a separate MOU to facilitate WQS reviews in accordance with the CSO Control Policy.

1.3. CITY POLICIES AND OTHER LOCAL CONSIDERATIONS

New York City's waterfront is approximately 578 miles long, encompassing 17 percent of the total shoreline of the State. This resource is managed through multiple tiers of zoning, regulation, public policy, and investment incentives to accommodate the diverse interests of the waterfront communities and encourage environmental stewardship. The local regulatory considerations are primarily applicable to proposed projects and, as such, do not preclude the existence of non-conforming waterfront uses. However, evaluation of existing conditions within the context of these land use controls and public policy can anticipate the nature of long-term growth in the watershed.

1.3.1. New York City Waterfront Revitalization Program

The New York City Waterfront Revitalization Program (WRP) is the City's principal coastal zone management tool and is implemented by the New York City Department of City Planning (NYCDCP). The WRP establishes the City's policies for development and use of the waterfront and provides a framework for evaluating the consistency of all discretionary actions in the coastal zone with City coastal management policies. Projects subject to consistency review include any project located within the coastal zone requiring a local, state, or federal discretionary action, such as the Uniform Land Use Review Procedure (ULURP) or a City Environmental Quality Review (CEQR). An action is determined to be consistent with the WRP if it would not substantially hinder and, where practicable, would advance one or more of the 10 WRP policies. The New York City WRP is authorized under the New York State Waterfront Revitalization and Coastal Resource Act of 1981, which stems from the Federal Coastal Zone Management Act of 1972. The original WRP was adopted in 1982 as a local plan in accordance with Section 197-a of the City Charter, and incorporated the 44 state policies, added 12 local policies, and delineated a coastal zone to which the policies would apply. The program was revised in 1999 and the new WRP Policies were issued in September 2002. The revised WRP condensed the 12 original policies into 10 policies: (1) residential and commercial redevelopment; (2) water-dependent and industrial uses; (3) commercial and recreational boating; (4) coastal ecological systems; (5) water quality; (6) flooding and erosion; (7) solid waste and hazardous substances; (8) public access; (9) scenic resources; and (10) historical and cultural resources.

1.3.2. New York City Comprehensive Waterfront Plan

The City's long-range goals are contained in the Comprehensive Waterfront Plan (CWP). The CWP identifies four principal waterfront functional areas (natural, public, working, and redeveloping) and promotes use, protection, and redevelopment in appropriate waterfront areas. The companion Borough Waterfront Plans (1993-1994) assess local conditions and propose strategies to guide land use change, planning and coordination, and public investment for each of the waterfront functional areas. The CWP has been incorporated into local law through land use changes, zoning text amendments, public investment strategies, and regulatory revisions, providing geographic specificity to the WRP and acknowledging that certain policies are more relevant than others on particular portions of the waterfront. The NYCDEP's CSO control efforts support the City's WRP and CWP.

1.3.3. Department of City Planning Actions

The NYCDCP was contacted to identify any projects either under consideration or in the planning stages that could substantially alter the land use in the vicinity of the waterbody. NYCDCP reviews any proposal that would result in a fundamental alteration in land use, such as zoning map and text amendments, special permits under the Zoning Resolution, changes in the City Map, the disposition of city-owned property, and the siting of public facilities. In addition, NYCDCP maintains a library of City-wide plans, assessments of infrastructure, community needs evaluations, and land use impact studies. These records were reviewed and evaluated for their potential impacts to waterbody use and runoff characteristics, and the NYCDCP community district liaisons for the Community Districts were contacted to determine whether any proposals in process that required NYCDCP review might impact the WB/WS Facility Plan.

The following information pertaining to the Hutchinson River watershed was obtained from the NYCDCP website:

> "The NYCDCP is proposing zoning map changes for all or portions of 163 blocks in the northeastern Bronx neighborhoods of Pelham Gardens, Laconia and Baychester in Community Districts 11 and 12. Located north of Pelham Parkway and east of Williamsbridge and Boston roads, these neighborhoods were developed primarily with a mixture of one- and two-family detached and semi-detached homes during the early to mid 20th century. Existing zoning in much of the area, however, does not reflect that context. The proposed rezoning seeks to address community concerns about new development that is out-of-character with the neighborhood context, and to encourage new mixed residential/retail development near the local subway stop on East Gun Hill Road.
>
> The Pelham Gardens rezoning area is primarily residential; 93 percent of the lots are residentially developed, about half with detached homes and one-third with semi-detached houses. Some multifamily housing is scattered throughout the rezoning area, though it tends to be clustered toward the northern edges of the area and in the center near Allerton Avenue."

No other current NYCDCP actions were found to impact the Hutchinson River watershed. Several other projects are occurring outside of the Hutchinson watershed but within the Borough of the Bronx and the Hunt Point sewershed.

1.3.4. New York City Economic Development Corporation

The New York City Economic Development Corporation (NYCEDC) was contacted to identify projects either under consideration or in the planning stages that could substantially alter the land use in the vicinity of the waterbody. The NYCEDC is charged with dispensing City-owned property to businesses as a means of stimulating economic growth, employment, and tax revenue in the City of New York while simultaneously encouraging specific types of land use in targeted neighborhoods. As such, NYCEDC has the potential to alter land use on a large scale.

In addition, NYCEDC serves as a policy instrument for the Mayor's Office, and recently issued a white paper on industrial zoning intended to create and protect industrial land uses throughout the City (Office of the Mayor, 2005). The policy directs the replacement of the current In-Place Industrial Parks (IPIP) with IBZs that more accurately reflect the City's industrial areas. Policies of this nature can have implications on future uses of a waterbody as well as impacts to collection systems, so a thorough review of NYCEDC policy and future projects was performed to determine the extent to which they may impact the WB/WS Facility Plan. No impacts were found to be related to any areas in the Hutchinson River watershed.

1.3.5. Local Law

Bathing beaches in New York City are regulated, monitored and permitted by the City and State under Article 167 of the New York City Health Code and Section 6-2.19 of the New York City Sanitary Code.

Article 167 of the New York City Health Code explicitly prohibits the operation, construction, maintenance, and/or establishment of a bathing beach along the Hudson River, from the boundary line between the cities of New York and Yonkers to the to the Harlem River; along the Harlem River, from the Hudson River to the East River; or, along the East River, from the Harlem River to Fort Schuyler. Further, siting requirements imposed by State and City codes must be considered to evaluate the potential use of a waterbody for primary contact recreation. These requirements include minimum distances from certain types of regulated discharges such as CSO outfalls, maximum bottom slopes, acceptable bottom materials, minimum water quality levels, and physical conditions that ensure the highest level of safety for bathers.

1.4. REPORT ORGANIZATION

This report has been organized to clearly describe the proposed WB/WS Facility Plan that supports the Long-Term CSO Control Planning process and the environmental factors and engineering considerations that were evaluated in its development. The nine elements of long-term CSO control planning are listed in Table 1-4 along with relevant sections within the present document for cross-referencing.

Section 1 presents general planning information and regulatory considerations that informed the LTCP development. Sections 2, 3, and 4 describe the existing watershed, collection system, and waterbody characteristics, respectively. Section 5 describes related waterbody improvement projects within the waterbody and the greater New York Harbor. Section 6 describes the public participation and agency interaction that was part of the development of this WB/WS Facility Plan, as well as an overview of the NYCDEP public outreach program. Sections 7 and 8 describe the development of the plan for the waterbody. Section 9 discusses the review and revision of WQS. The WB/WS Facility Plan concludes with references in Section 10 and a list of terms and abbreviations in Section 11.

Table 1-4. Locations of the Nine Elements of Long-Term Control Planning

No.	Element	Location(s) within Report
1	Characterization of the Combined Sewer System	3.0
2	Public Participation	6.0
3	Consideration of Sensitive Areas	4.7
4	Evaluation of Alternatives	7.0
5	Cost/Performance Considerations	7.0
6	Operational Plan	8.0
7	Maximizing Treatment at the Existing WPCP	7.0 8.0
8	Implementation Schedule	8.0
9	Post-Construction Compliance Monitoring	8.0

NO TEXT ON THIS PAGE

2.0. Watershed Characteristics

This section details the land uses and shoreline characteristics in the Hutchinson River watershed. The information used to conduct this analysis was gathered from field visits and documented sources.

The Hutchinson River begins in Westchester County, flows through the Borough of the Bronx, and empties into Eastchester Bay. This system is a tributary of the East River, which lies immediately to the west of Long Island Sound. The Hutchinson River runs through the areas of Eastchester, Co-Op City, Baychester, Spencer Estates, Country Club, Eastchester Bay and Edgewater Park. The river is tidal throughout the Bronx, but receives freshwater input in Westchester County. The watershed is bordered on the north by Westchester County, the west by the Westchester Creek watershed, the east by Long Island Sound and the south by the Eastchester Bay.

2.1. HISTORICAL CONTEXT OF WATERSHED URBANIZATION

Currently, the land surrounding northern reaches of the river near the Bronx border is highly industrial with scrap metal plants and other industrial facilities surrounding its banks, as shown in Exhibit 2-1. The middle and southern portion of the Hutchinson River is bordered by the residential development Co-op City on the west bank and a more natural area, Pelham Bay Park to the east and to the west on the southern end.

Exhibit 2-1. Northernmost portion of the Hutchinson River within NYC (looking northeast)

Figure 2-1 illustrates the historical streams and marshlands that have been filled throughout the twentieth century. The green colored area represents land that was once marshland that has since been filled, while the dark blue area represents tributaries that once flowed into the Hutchinson River, Westchester Creek, and Eastchester Bay. Approximately 2,900 acres of marshland has been filled in the Hutchinson River watershed and surrounding area since the beginning of the twentieth century.

During the colonial era, the area to the west of the New Engand Thruway (I-95) and north of the Bronx and Pelham Parkway was predominantly a rural farming community, while the area to the east of the Thruway was marshland with rock outcroppings. The early settlers used the salt marsh primarily for cattle grazing. The salt marsh was also used for a tidal mill called Reeds Mill in the nineteenth century as well as a cucumber and pickle operation in the early twentieth century. With the exception of the pickle farm and tidal mill, most of the salt marsh, remained undeveloped until the 1950s.

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Hutchinson River and Eastchester Bay Prior to Fill and Construction

Exhibit 2-2. Givans Creek Park Aerial (looking south)

Curtis Airfield was proposed to be built on the marsh following World War II, the plan made it to paper, but was never built. In August 1959, construction began for the Freedomland U.S.A. amusement park on the site of the previously proposed airfield. The park opened in the summer of 1960 and lasted only four years. Following its closure in 1964, plans were made for Co-op City, a large quasi-cooperative housing complex consisting of 15,382 apartment units in about thirty-six high-rise buildings and a number of townhouses. Construction on the complex began in 1968 on the 205-acre parcel of land that was previously owned by the short-lived amusement park. Co-op City was a result of New York State's Mitchell-Lama Bill, creating affordable housing to keep tax revenue collected from middle class families in New York City, rather than having the families flee to the suburbs.

Neighboring Co-op City is the 11-acre Givans Creek Woods Park, a natural area shown in Exhibit 2-2, preserves fragments of several original habitats otherwise lost on the west bank of the Hutchinson River. The park is home to approximately 150 species of plants and 45 species of animals. It also consists of upland forests of oak and hickory, a low-lying wooded wetland, surrounding meadows, and rocky outcrops covered with mosses and lichens. Givans Creek Woods Park owes its existence to community activists and environmental groups pushing to preserve natural areas in the mid-1980s. Their efforts prompted former mayor Rudy Giuliani to designate Givans Creek Woods as passive parkland in 1995. A preservation and citizen participation group was also created for the park called "Friends of Givans Creek Woods." Givan Creek, once a navigable water emptying into the Hutchinson River is now covered by Co-op City.

The natural areas in Pelham Bay Park including the swamps and salt marshes on Twin Island are representative of those that once existed on the western shore of the Hutchinson River. Pelham Bay Park is New York City's largest park, encompassing an area over 2,700 acres. The park owes its existence to the founder of the New York Parks Association, John Mullally who spearheaded a movement in the 1800s to preserve some

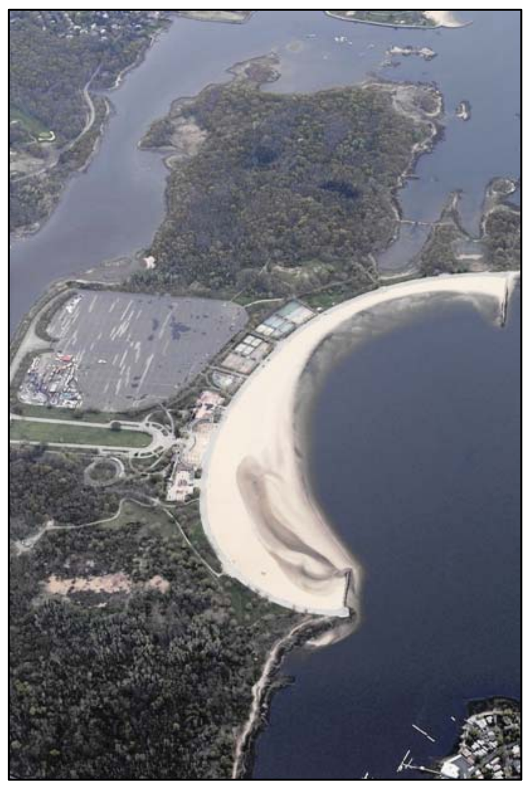


Exhibit 2-3. Orchard Beach in Pelham Bay Park (looking east)

of the natural areas before they were destroyed by overdevelopment. The park has several noteworthy environmental features including a variety of habitats for wildlife and a swamp located in the Central Woodlands that attracts migrant songbirds and hummingbirds. Another feature of Pelham Bay Park is the 115-acre, 1.1-mile-long Orchard Beach (shown in Exhibit 2-3), created in the 1930s by filling in one-third of Pelham Bay with rubbish, fill, and sand. The filled area replaced a very low narrow sandbar that linked Rodman Neck to Hunters Island. The area between Hunters Island and Twin Island were also filled in to create the beach.

Exhibit 2-4. Pelham Bay Landfill (looking north)

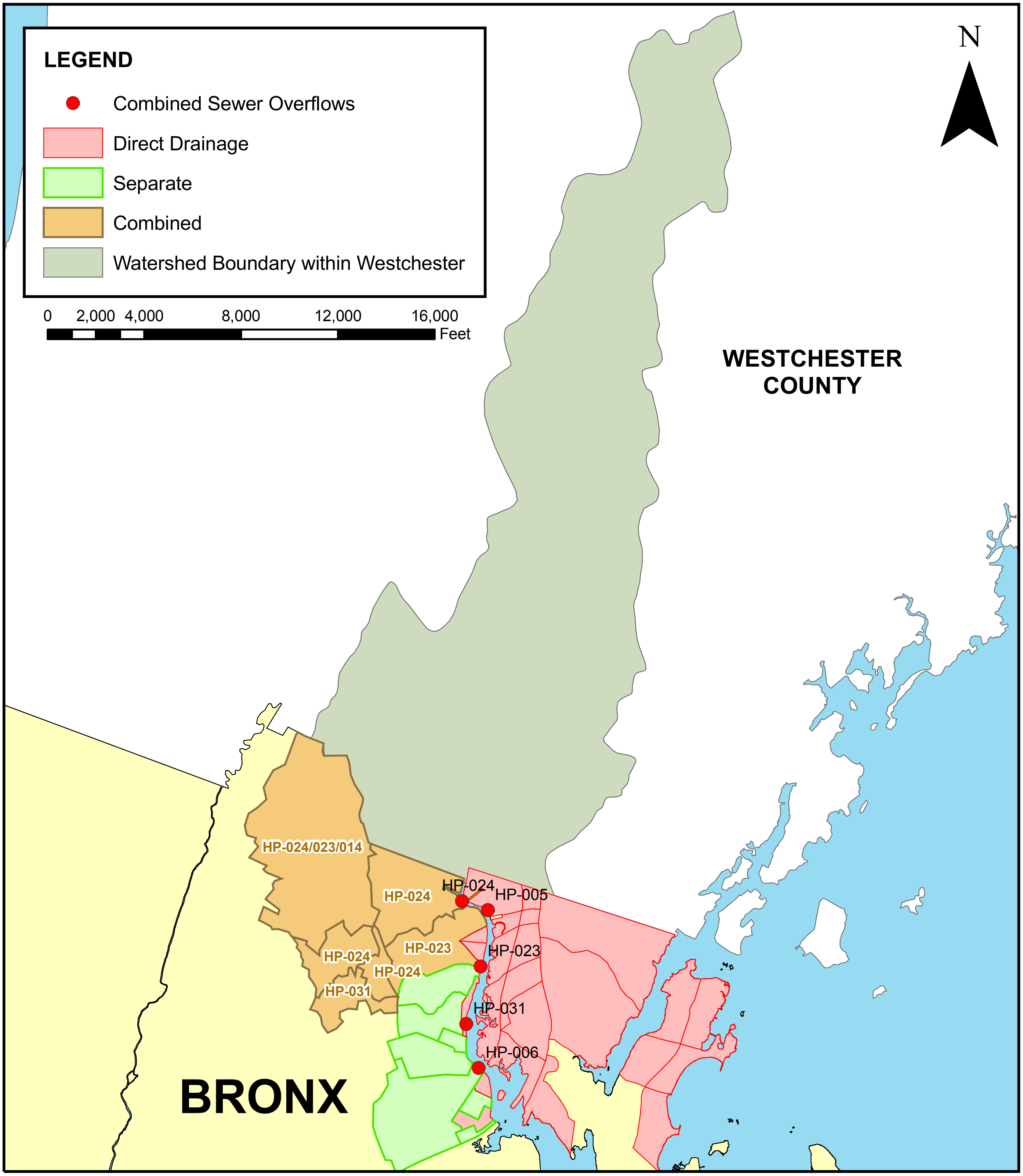
The Pelham Bay Landfill (PBL) site, shown in Exhibit 2-4, is an 81-acre inactive municipal solid waste landfill located on the western shore of the Hutchinson River. The landfill is bordered by the Eastchester Bay to the east and south, Pelham Bay Park to the southwest, and Bruckner Boulevard Extension to the northwest. PBL was opened in 1968 by New York City Department of Sanitation and handled wastes including; residential wastes, rubbish, street dirt, demolition debris, and construction waste. The PBL was capped in December 1994 and equipped with a high-density polyethylene (HDPE) geomembrane, soil-gas collection and treatment system, leachate collection system and a soil-bentonite slurry wall. The leachate is pumped via an underground force main to the Burr Avenue Junction in the combined sewer system for conveyance to the Hunts Point WPCP for treatment.

2.2. LAND USE CHARACTERISTICS

2.2.1. Existing Land Use

Land use throughout the Hutchinson River watershed is generally composed of parkland and residential areas with a few large pockets of commerce and industry. Figure 2-2 delineates the watershed area within the Bronx and a description of the land uses in the watershed is provided below:

Pelham Bay Park – Eastern Section: Pelham Bay Park, which spans the Hutchinson River, is the largest single feature of the watershed. The park is one of New York City's flagship parks and holds the distinction of the City's largest park at over 2,700 acres, nearly a quarter of this area is underwater most of the time, providing a lush wetland environment to the park. A significant portion of the park is included in the Hutchinson River watershed. The eastern portion of the park contains the *Thomas Pell Wildlife Sanctuary*, *Glover Rock**, a Revolutionary War memorial; *Hunter Island**, housing a historic mansion; *The Bartow-Pell Mansion & Museum**, a City and national landmark; *The Split Rock/Split Rock Trail,* a trail and geologically significant formation; *Kazimiroff*



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Nature Trail,* a trail through some of the parks wetland areas; *Orchard Beach*,* a hugely popular 115 acre, 1.1 mile beach; *The Meadow*,* a unique plant community and wildlife viewing area; and the *Salt Marsh,* 195 acres of salt marshes throughout the park. Rodman's Neck*, at the southern tip of Pelham Bay Park, contains a police firing range. (*Park landmarks marked with an asterisk are contained in the park but in portions outside of the Hutchinson River watershed.)

Northeastern Watershed Region: North of Pelham Bay Park on the eastern bank of the Hutchinson River there is a small residential area. This area is also the location of the Hollers Avenue Pump Station. North of the residential area on both the eastern and western banks of the river there is an industrial region. This area is generally located north of the Interstate 95 Bridge. Area industries include two scrap metal businesses, a concrete plant and an asphalt plant.

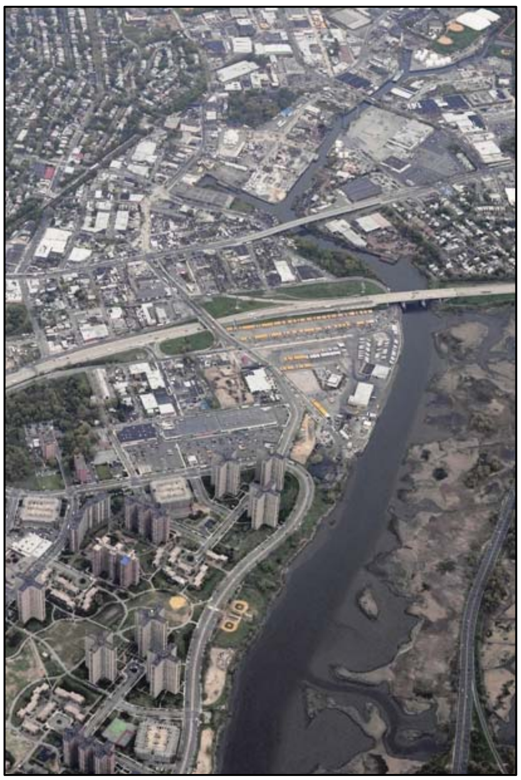

Exhibit 2-5. Northwestern Watershed

Northwestern Watershed Region: The northwestern most portion of the watershed, west of I-95, is primarily residential but contains a small industrial sector and the watershed's only significant industrial user (SIU), as shown in Exhibit 2-5. Additionally, the area includes, Seton Falls Park, named after a historically important family in the area and used today for recreation.

Co-Op City: South of the industrial section on the eastern shore of the Hutchinson there between I-95 and Amtrak/Conrail river-crossing is a large housing cooperative known as Co-Op City. This 330-acre medium density housing area consists of a number of high-rises overlooking the river and Pelham Park as well as two large shopping areas, Bay Plaza and the Mall at Bay Plaza as well as an undeveloped strip of land along the shoreline.

Pelham Bay Park – Western Section: South of Co-Op City lays the western portion of Pelham Bay Park. This portion of the park houses *The Bronx Victory Column & Memorial Grove*, a war memorial and the western portion of the *Thomas Pell Wildlife Sanctuary*.

2.2.2. Zoning

The northwestern portion of the watershed is zoned primarily residential (R4 and R5). There is an industrial area in the northern portion of the subsection (M1-1) and some small industrial areas in the southern portion of the subsection (M1-1). There are also some small commercial sections along Boston Road (C8-1). This area contains the watershed's only significant industrial user. Figure 2-3 shows the overall zoning of the watershed.

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Zoning in the NYC Hutchinson River Watershed

The northernmost section of the watershed within New York City, adjacent to the Hutchinson River, just north and south of the New England Thruway (I-95), is the most industrially dense sector in the watershed. This region includes light, medium and heavy industrial zoning (M1-1, M2-1 and M3-1) and contains several scrap metal plants as well as both an asphalt and cement plant. This is also the location of Outfall HP-005 and HP-024 and HP-023 of the combined sewer system.

South of this industrial region, lies Co-Op City, a high rise housing cooperative, that includes residential, commercial and industrial zones. The housing units themselves are zoned R6. The Co-Op City region also includes a large mall, Bay Plaza Shopping Center, zoned C4-3, C7 and C4-1. There is also some industry in the region on the west side of I-95 zoned M1-1. The small area west of the interstate also includes some residential (R3-2) and commercial areas (C4-1). There is a small strip of land that runs between the river and Co-Op City Blvd that is public land. Currently, this land contains a two baseball fields, the remainder is unused. There is another section of R6 residential housing just south of the Bay Plaza Shopping Center, and north of the Amtrak/Conrail railway, also zoned R6.

South of Co-Op City and the Amtrak/Conrail railway lies the southernmost area in the Hutchinson River watershed. This area is primary composed of the western portion of Pelham Bay Park, north of the closed landfill. In addition to the parkland the area is largely occupied by the interchange of I-95 and the Bronx and Pelham Parkway. The area also includes a small residential area (R3-2) just west of the intersection.

The eastern shoreline of the Hutchinson River is much more homogeneous in its zoning. With the exception of a small area north of I-95 along the river that is zoned industrial (M3-1, M1-1) and a small residential area (R3-2) to the east of that, the entire shoreline is taken up by Pelham Bay Park.

2.2.3. Proposed Land Uses

Currently there are no large development plans for the Hutchinson River communities.

2.2.4. Neighborhood and Community Character

There are several distinct regions within the Hutchinson River watershed, each with their own character. The watershed contains industrial, residential, commercial and parkland areas. The northernmost parcels of land include the industrial uses of scrap metal yards, a concrete plant and an asphalt plant.

The residential area south of this, on the western shore, is Co-Op City. Besides two post offices, a library and two baseball fields, Co-Op City also surrounds the Hebrew Hospital Home. South of Co-Op City there are two large shopping complexes, Bay Plaza and The Mall at Bay Plaza.

Exhibit 2-6. Hutchinson River Shoreline (looking east)

The western shore side of Pelham Bay Park (Exhibit 2-6) contains a baseball field, football and soccer fields, tennis courts, a nearby horse stable and bridle path and two running tracks. The residential areas between the south of Pelham Bay Park and the mouth of Eastchester Bay contain single-family homes, single- and two-family detached homes, garden apartments and row houses.

The eastern shore half of Pelham Bay Park (Exhibit 2-6) contains many recreational activity opportunities, including a baseball field, a horse stable and bridle path, a multiple use field, two golf courses and a driving range. Also in the park are the Thomas Pell Wildlife Refuge and Sanctuary and the Bartow Pell Mansion.

2.2.5. Consistency with Waterfront Revitalization Program

The New York City Department of Parks and Recreation Waterfront Revitalization Program (WRP) have designated all of Pelham Bay Park and all shorelines south of the New England Thruway (I-95) as Special Natural Waterfront Areas (SNWA). The eastern shore of the Hutchinson River south of I-95 and sizable portions of Pelham Bay Park are designated a Significant Coastal Fish and Wildlife Habitat by the NYS DOS Division of Coastal Resources.

The WRP consist of ten policies for working within the NYC waterfront. Policy 4 specifically addresses work within City's SNWAs in the following manner:

> *"This policy seeks the protection and, where appropriate, restoration of specific designated natural resources including:*
>
> - *State and Federal regulated tidal and freshwater wetlands,*
> - *designated Significant Coastal Fish and Wildlife Habitats,*
> - *vulnerable plants and animals,*
> - *rare ecological communities, and*
> - *natural ecological communities.*
>
> *Public investment within the SNWAs should focus on habitat protection and improvement and should not encourage activities that interfere with the habitat functions of the area. ... Further fragmentation or loss of habitat areas within the SNWAs should be avoided and could be the basis for a determination of inconsistency with the WRP."*

Before any projects can be completed along the shorelines of NYC the WRP Consistency Assessment Form must be completed and reviewed by the City. Specific mitigation projects being considered under the LTCP will be reviewed to ensure compliance with the WRP policies.

2.3. INDUSTRIAL USERS

The NYCDEP has an approved local industrial pretreatment program (IPP) consistent with the CWA and its amendments, General Pretreatment Regulations (40 CFR 403), and as incorporated in the NYCDEP's SPDES permit. The purpose of the pretreatment program is to implement the National Pretreatment Standards to control the discharge of non-domestic sources of pollutants to the WPCPs. The main objectives of the program include the following:

- Prevention of the introduction of pollutants into the wastewater stream which will interfere with the operation of the system and contaminate the sludge generated at the treatment plant (thus limiting disposal options);
- Prevent the introduction of pollutants into the wastewater system which will pass through the system, inadequately treated, into the receiving waters or the atmosphere;
- Protect the health of both NYCDEP personnel and the general public who may come in contact with the wastewater or sludge; and
- Ensure compliance with NYCDEP's NPDES permit as well as other federal or local laws which the NYCDEP is subject to.

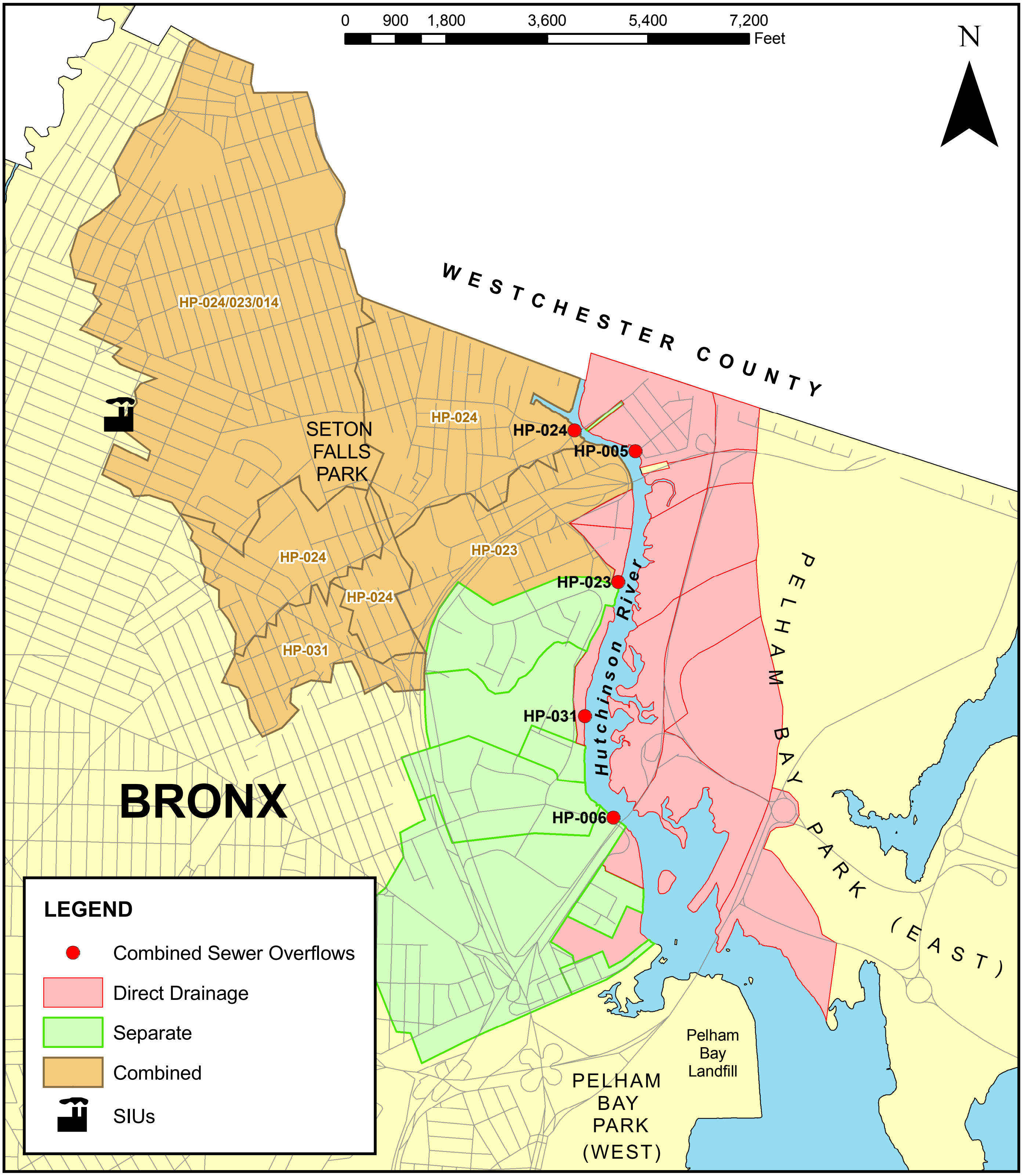
The USEPA General Pretreatment Regulations apply to all non-domestic sources which introduce pollutants into a POTW and are defined as follows:

> *These sources of "indirect discharge" are more commonly referred to as industrial users (IUs). Since IUs can be as simple as an unmanned coin operated car wash to as complex as an automobile manufacturing plant or a synthetic organic chemical producer, US EPA developed four criteria that define a Significant Industrial User (SIU). Many of the General Pretreatment Regulations apply to SIUs as opposed to IUs, based on the fact that control of SIUs should provide adequate protection of the POTW. These four criteria are as follows:*
>
> - *an IU that discharges an average of 25,000 gallons per day or more of process wastewater to the POTW;*
> - *an IU that contributes a process wastestream making up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant;*
> - *an IU designated by the Control Authority as such because of its reasonable potential to adversely affect the POTW's operation or violate any pretreatment standard or requirement; or*
> - *an IU subject to Federal categorical pretreatment standards (USEPA, 1999d).*

Currently, there is one SIU, Bronxwood Dyeing Co., located within the sewershed associated with combined sewer outfalls that discharge to the Hutchinson River watershed as shown in Figure 2-4.

2.4. REGULATED SHORELINE ACTIVITIES

An investigation of selected existing federal and state databases was performed in order to gather information on potential land-side sites that have the potential to affect water quality in the Hutchinson River. The extent of the study area was generally limited to an area in immediate proximity to the Hutchinson River, which extended from the Bronx County line in the north to Eastchester Bay in the south. Within this geographic area, the study area extended from the river over to the nearest adjacent mapped street. For the purposes of this assessment, potential sources included the existence of underground storage tanks (UST), major oil storage facilities (MOSF),



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Locations of SIUs in New York City Portion of Hutchinson River Watershed

known contaminant spills, the existence of state or federal superfund sites, the presence of SPDES permitted discharges to the waterbody, as well as other sources that may have the potential to adversely affect water quality.

The USEPA Superfund Information System, which contains several databases with information on existing superfund sites, was accessed. These databases include: the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS), Resource Conservation and Recovery Act Information (RCRAinfo), Brownfields Management System, Site Spill Identifier List (SPIL), and the National Priorities List (NPL). In addition to these federal databases, several databases managed and maintained by the NYSDEC were also reviewed. These included: the NYSDEC Spill Incident database and the Environmental Site Remediation database, which allows searches of the NYSDEC Brownfield cleanup, state superfund (inactive hazardous waste disposal sites), environmental restoration and voluntary cleanup programs. In addition, the NYSDEC Petroleum Bulk Storage Program database was also reviewed.

A review of the USEPA Superfund Information System indicated that there are no federally-listed sites located in proximity to the Hutchinson River. A review of the NPL and Brownfields Management System database indicated that there were no sites within the study area. The NYSDEC State Superfund Program indicated that the Pelham Bay Landfill is a state superfund site. The Pelham Bay Landfill is located along the southwestern shoreline of the Hutchinson River, approximately one-half mile east of I-95 and southeast of the Bruckner Boulevard Extension. The landfill is located near the mouth of the Hutchinson River. Remediation activities associated with the closure of landfill were completed in 1998. A review of the RCRA databases indicated that there is one large quantity generator, three small quantity generators, two conditionally-exempt, small quantity generators, and eight non-specified generator types within proximity to Hutchinson River. Under RCRA, a large quantity generator produces over 1000 kilograms of hazardous waste or over 1 kilogram of acutely hazardous waste per month, while small quantity generators produce between 100 kilograms and 1000 kilograms of waste per month. Conditionally-exempt, small quantity generators generate 100 kilograms or less per month of hazardous waste, or 1 kilogram or less per month of acutely hazardous waste. RCRA sites in proximity to the study area are listed in Table 2-1.

Table 2-1. RCRA Sites Located in the Vicinity of Hutchinson River

Site Name	Address
RCRA Large Quantity Generators	
NYCDOT Bridge Bin #229579	Boston Post Road Bridge over Hutchinson River
RCRA Small Quantity Generators	
NYCDOT Bin 2240200	Shore Road over Hutchinson River
Riverbay Corp.	98 Co-Op City Boulevard
NYCDEP Co-Op City North	Co-Op City Boulevard and Bellamy Loop
RCRA Conditionally-Exempt Small Generator	
United Parcel Service	4215 Boston Post Road
NYCDOT Bridges Bin 2241390	Shore Road Circle Bridge over Westchester Creek
Non-Specified RCRA Sites (1)	
NYCDOS Bronx 12 Garage	1635 223rd Street
Peckham Materials Corp. Plant 22	3966 Provost Avenue
Pelham Bay Gas Research	Pelham Parkway and Shore Road
NYSDOT – Contract D253284	4250-B Hutchinson River Parkway
NYC-TA Gun Hill Bus Depot	1910 Bartow Avenue
NYSDOT Conner Street Garage	3200 Conner Street
Hi-Tide Auto Body	1684 East 233rd Street
Salomone & Co. LLC	3957 Provost Avenue

Notes: (1) Indicates sites that do not have a specified handler type description.

For this assessment, the complete NYSDEC Petroleum Bulk Storage database was not available. Due to security reasons, certain information from the database that was reviewed was filtered out by the NYSDEC prior to its release. Therefore, the NYSDEC petroleum bulk storage information presented within this section may not be comprehensive. The NYSDEC Petroleum Bulk Storage database identified several USTs in the immediate vicinity of the Hutchinson River. According to the database, there are three UST sites in close proximity to the river. These sites contain 10 USTs that are in-service or closed. The storage capacities of these USTs range between 500 and 4,000 gallons. They have been used for the storage of gasoline, diesel and/or No. 2 fuel oil. These UST sites and additional information are identified in Table 2-2. The review of the NYSDEC Petroleum Bulk Storage database revealed no MOSFs within the limits of Bronx County, however, according to the SPDES database, petroleum bulk storage terminals are located in the immediate vicinity of Hutchinson River within the boundaries of Westchester County.

Table 2-2. Underground Storage Tanks (UST) In Proximity to Hutchinson River

Site	Address	Tank Capacity	Product Stored	No. of Tanks	Status
Gaseteria	3327 Conner Street	4,000 4,000	Gasoline Diesel	4 1	In Service In Service
Pelham Bay Park Sewage Disposal	City Island Road & Bridge Road	2,500	#2 Fuel Oil	1	In Service
Pascap Company, Inc.	4251-4301 Boston Road	4,000 2,000 2,000 2,500 500 4,000 4,000	Diesel Gasoline #2 Fuel Oil #2 Fuel Oil #2 Fuel Oil Gasoline Diesel	1 1 1 1 1 1 1	In Service In Service In Service Closed – Removed Closed – Removed Closed – Removed Closed – Removed

A review of the NYSDEC SPILL databases indicated that there have been 25 spills that have occurred within one-block of the Hutchinson River within the past 10 years. These spills involved the discharge of various materials including diesel, gasoline, transmission fluid, waste oil/used oil and other substances to surface waters, groundwaters and soil. Of these 25 spills, only three remained open as of April 2006 and these are listed in Table 2-3. All three open spills involved the release of less than one gallon of material and affected surface water, groundwater and soil.

Table 2-3. NYSDEC Open Spills through 2006 in the Vicinity of Hutchinson River

Location	Spill Date	Spill Number	Quantity	Material	Resource Affected	Spill Cause
NY Bus Service 3320 Hutchinson Avenue	9/04/97	9706698	< 1 Gallon	Diesel	Surface Water	Unknown
United Postal Service 4215 Boston Post Road	2/19/92	0330065	< 1 Gallon	Gasoline	Ground-water	Unknown
Pascap Scrap 4250 Boston Road	9/10/98	9830006	< 1 Gallon < 1 Gallon < 1 Gallon	Transmission Fluid Waste Oil/ Used Oil Other	Soil	House-keeping

3.0. Existing Sewer System Facilities

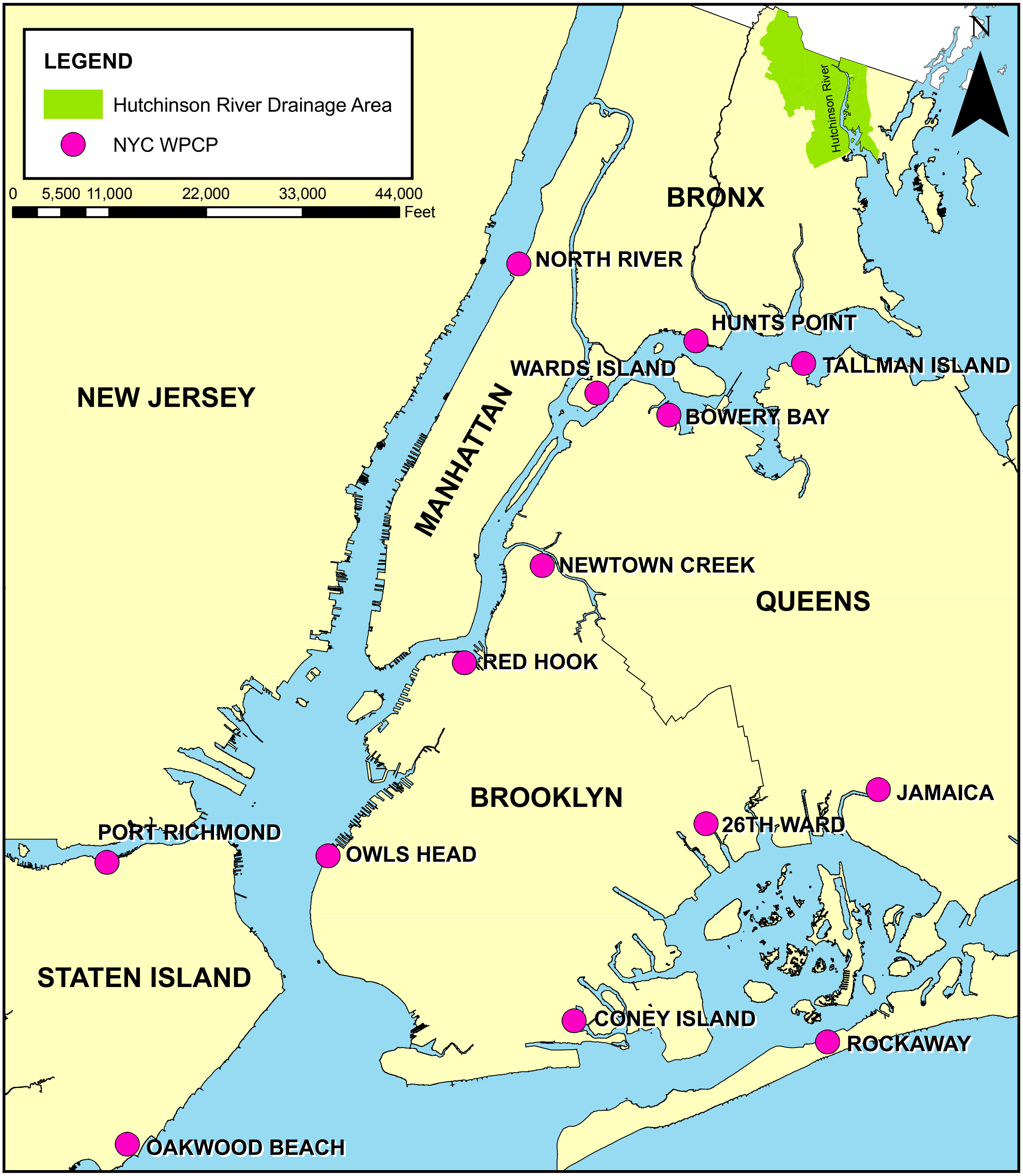
The NYCDEP operates and maintains 14 WPCPs as shown in Figure 3-1. The communities surrounding Hutchinson River are served by the Hunts Point combined sewer system and WPCP. The Hunts Point combined sewer system covers over 16,000 acres and serves a population of approximately 600,000 in the northeast section of the Bronx, New York.

The following sections provide specific information on the configuration of the existing systems.

3.1. HUNTS POINT WPCP

The Hunts Point WPCP is permitted by the NYSDEC under SPDES permit number NY-0026191. The facility is located at 1270 Ryawa Avenue, Bronx, NY, 10474 in the Hunts Point section of the Bronx, on a 45 acre site adjacent to the Upper East River located between Halleck Street and Manida Street. Figure 3-2 shows the current layout of the Hunts Point WPCP. The Hunts Point WPCP serves an area of approximately 16,664 acres in the East Side of the Bronx, including the communities of City Island, Throgs Neck, Edgewater Park, Schuylerville, Country Club, Pelham Bay, Westchester Square, Clason Point, Castle Hill, Union Port, Soundview, Parkchester, Van Nest, Co-op City, Morris Park, Pelham Parkway, Pelham Gardens, Baychester, Olinville, Willimasbridge, Edenwald, Eastchester, Hunts Point, Woodlawn, Wakefield, East Tremont, West Farms, and Longwood. Figure 3-3 presents the neighborhoods located in the Hunts Point drainage area. The total sewer length, including sanitary, combined, and interceptor sewers, that feeds into the Hunts Point WPCP is 424 miles.

The Hunts Point WPCP has been providing full secondary treatment since 1952. Processes include primary screening, raw sewage pumping, secondary screening, grit removal and primary settling, air activated sludge capable of operating in the step aeration mode, final settling, and chlorine disinfection (see Figure 3-4). The Hunts Point WPCP has a design dry weather flow (DDWF) capacity of 200 million gallons per day (MGD), and is designed to receive a maximum flow of 400 MGD (2 times DDWF) with up to 300 MGD receiving secondary treatment (the wet weather operating plan, discusssed in detail in Section 3.1.2, has recommended limiting this to 240-260 MGD, or 1.2 to 1.3 times DDWF) to protect nitrogen control processes once the Biological Nutrient Removal (BNR) project work is completed. Flows over 300 MGD (260 MGD upon completion of BNR construction) receive primary treatment and disinfection. The daily average flow during 2004 was 110 MGD, with a dry weather flow average of 100 MGD. Table 3-1 summarizes the Hunts Point WPCP permit limits.



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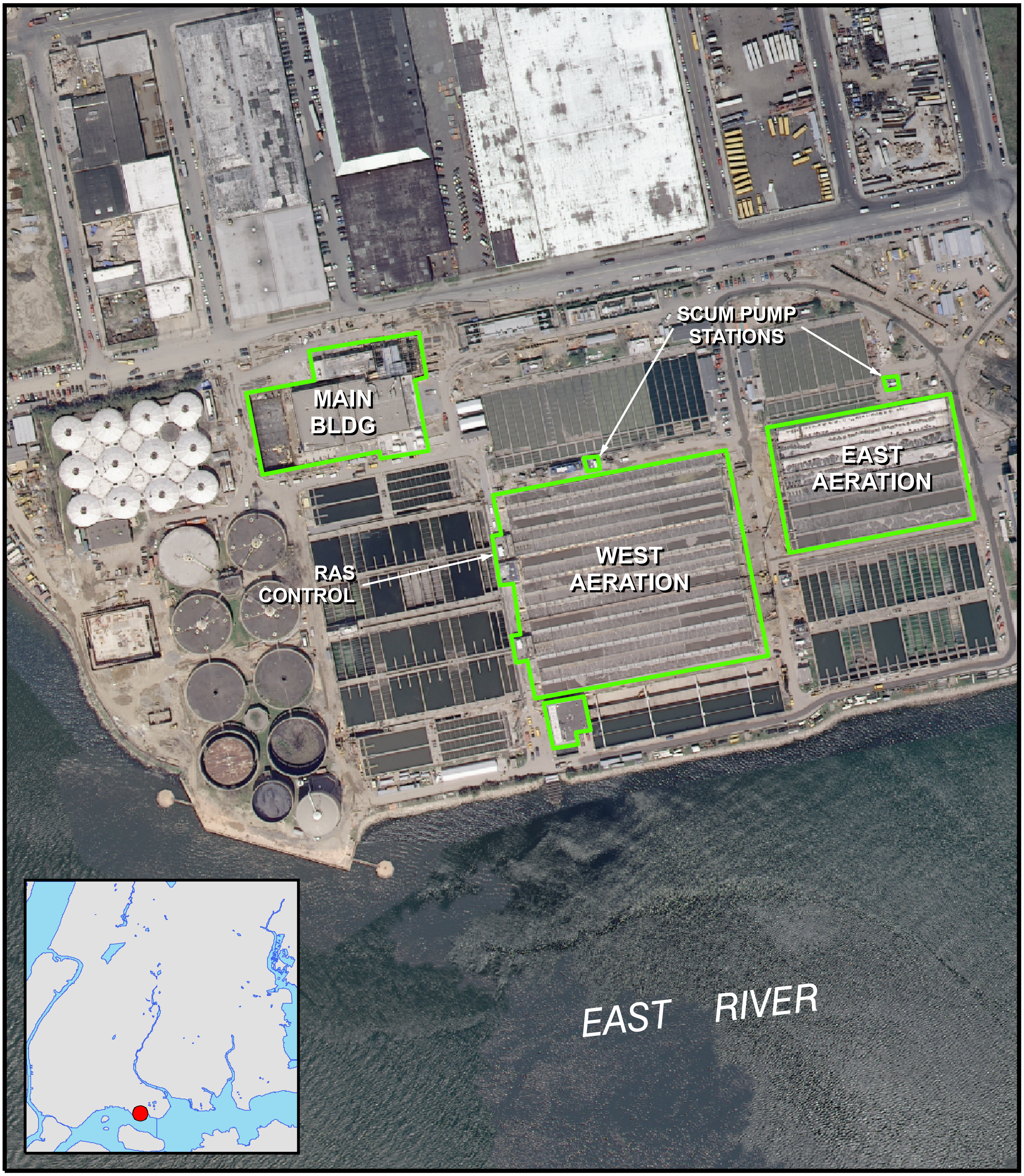
Locations of WPCPs within New York City

FIGURE 3-1



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Hunts Point WPCP Aerial Photo and Layout

Hutchinson River Waterbody/Watershed Facility Plan

FIGURE 3-2

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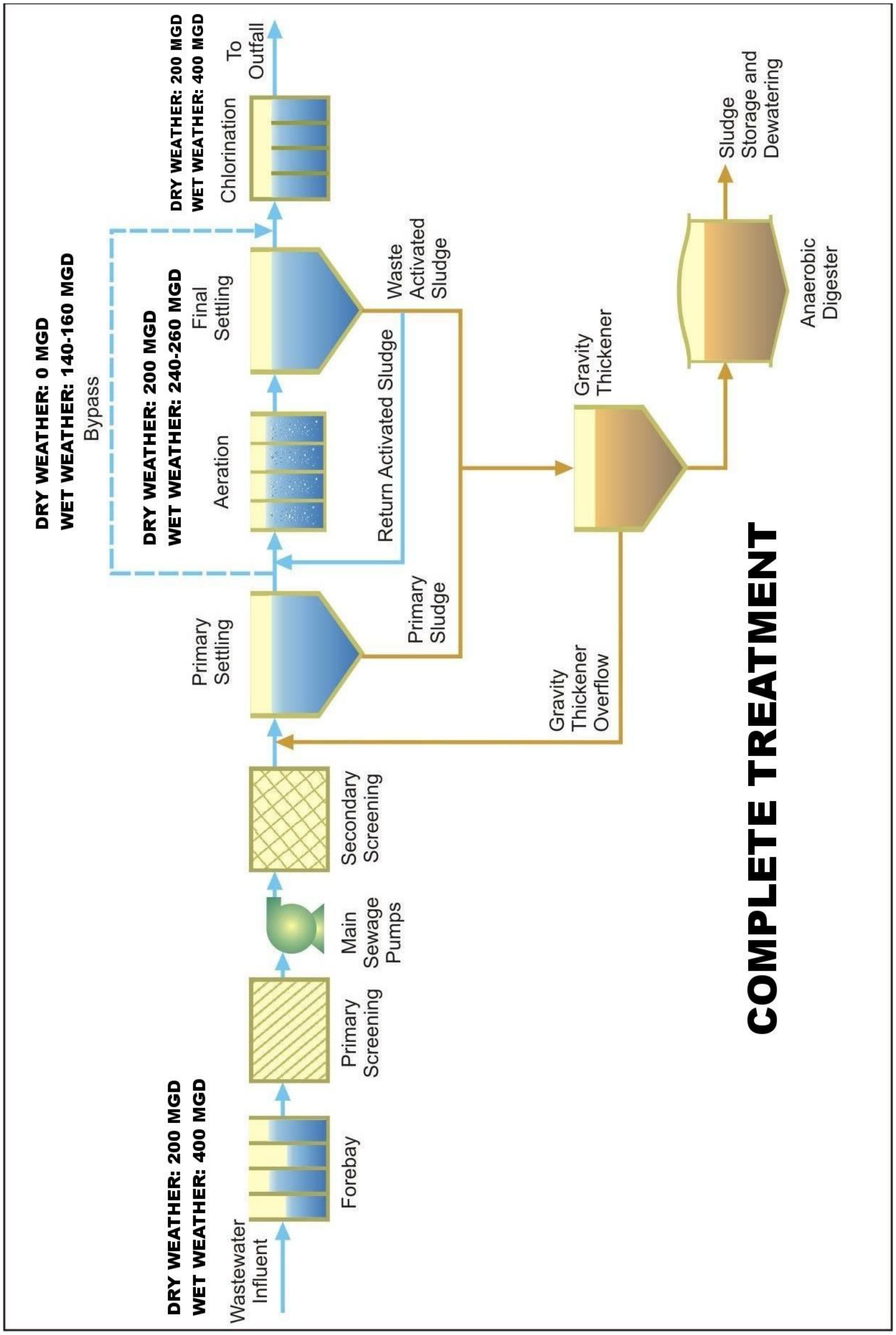
Hunts Point Drainage Area Neighborhoods



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Hunts Point WPCP Process Flow Diagram After Phase II BNR

Table 3-1. Select Hunts Point WPCP Effluent Permit Limits

Parameter	Basis	Value	Units
Flow	DDWF Maximum secondary treatment Maximum primary treatment	200 300 (1) 400	MGD
$CBOD_5$	Monthly average 7-day average	25 40	mg/L
TSS	Monthly average 7-day average	30 45	mg/L
Total Nitrogen	12-month rolling average	108,375 (2)	lb/day

Notes: (1) As recommended in the WWOP max. secondary flow should be 260 MGD upon completion of Phase II BNR upgrades to maintain biological nitrogen removal.
(2) Nitrogen limit for the Combined East River Management zone, calculated as the sum of the discharges from the four Upper East River WPCPs (Bowery Bay, Hunts Point, Wards Island, Tallman Island) and one quarter of the discharges from the 2 Lower East River WPCPs (Newtown Creek, Red Hook). This limit is effective through November 2009, then decreases stepwise until the limit of 44,325 lb/day takes effect in 2017.

The Hunts Point plant began operation in 1952, with a design average flow capacity of 120 MGD. The plant was expanded in capacity in 1962 to 150 MGD, and again in the 1970s to its current design average dry weather flow capacity of 200 MGD. The upgraded plant was designed to provide primary treatment and chlorination to a wet weather peak flow of twice design average dry weather flow (400 MGD) and secondary treatment to 1.5 times average dry weather flow. In the 1990s, a sludge dewatering building was constructed at the plant under the City-Wide Sludge Management System. In December 1999, construction was completed for Basic Step Feed BNR retrofit at Hunts Point. This included the installation of baffles in each pass of the aerations tanks to create anoxic zones, submersible mixers in each anoxic zone to prevent solids settling, and froth-control chlorine spray hoods for filament suppression. Currently, the Hunts Point WPCP is undergoing construction to rehabilitate and upgrade its facilities to provide stable BNR operation. This Phase II BNR upgrade is scheduled for completion in mid-2008.

3.1.1. Process Information

Figure 3-4 shows the current process treatment for the Hunts Point WPCP. Flow is conveyed to the Hunts Point WPCP in a 12-foot wide by 10-foot high interceptor. A forebay gate chamber has recently been constructed, as part of Phase I of the plant upgrade. It is located at the terminus of the 12-foot by 10-foot interceptor, approximately 50 feet north of the screening building. The hydraulically operated 10-foot by 9-foot roller gate is intended to be used to control flow from the interceptor maintaining it at the maximum plant capacity of 400 MGD during wet weather. The forebay gate chamber is connected to the screening forebay by an influent conduit that splits into four screen channel influent conduits. The intent is for the high velocities from under the roller gate during wet weather throttling to be dissipated within the influent conduit, prior to entry to the screenings channels. At the entrance to the screen chamber, there is a set of stop log grooves in each channel that can isolate the flow to the screen channel, in the event that repair work downstream becomes necessary.

Four screening channels connect the screenings forebay to the afterbay. Each screening channel has a 60-inch by 84-inch hydraulically operated influent sluice gate and an effluent sluice gate that can isolate the channel when the screen is not needed or in the event that screen or channel repair work becomes necessary.

The new screens are 6-feet wide with 1-inch openings and are cleaned with a vertical traveling rake. Each screen is designed to handle 133 MGD. Three screens are required for two times DDWF of 400 MGD, resulting in a plant rating of N+1 for primary screening capacity ("N" being the number of screens operated with "1" screen on standby and/or under repair). The primary screens were renovated in 2004 as part of the Phase I upgrade project.

There are six new vertical, centrifugal, mixed-flow, bottom suction, flooded suction main sewage pumps. The pumps are rated at 98.6 MGD each, at a total dynamic head of 32.5 feet, at a speed of 360 revolutions per minute (RPM). The pumps are driven by 800 horse power (HP), 360 RPM, vertical, close coupled, variable frequency drive motors. With a two times DDWF of 400 MGD, the plant pumping capacity rating is N+1+1, where four pumps are operated ("N" being the number of pumps operating with one in standby or brought in as needed, and one under repair or out of service). The pumps were installed in 2004 as part of the Phase I upgrade project and became fully operational in late October 2004.

Each pump draws flow from one of the two pump suction channels that are connected to the screening chamber afterbay. The cast-in-place pump suction conduit is 49 inches in diameter. Discharge from each pump is via a 42-inch line that includes a cone check valve. Each pump discharge line terminates in a separate enclosed discharge chambers. Each discharge chamber is connected to the secondary screen forebay with an opening that has a sluice gate and stop log channels.

There are five new secondary screens with 1/2-inch bar openings and vertical traveling rakes. The secondary screens were installed in 2004 as part of the Phase I upgrade project. Each screen is designed to handle 100 MGD. Four screens are required for two times DDWF of 400 MGD, resulting in a plant rating of N+1 for secondary screening capacity. There are two secondary screen bypass channels that are used to bypass some of the flow, if some of the secondary screens are out of service or become blinded with screenings.

Effluent from the secondary screens afterbay is conveyed through an effluent conduit and venturi meter to the primary settling tanks. The distribution structure divides the flow to three conduits to the primary settling tanks. There are six primary settling tanks with a total volume of 9.4 million gallons (MG) and a surface overflow rate of 1,914 gallons per day per square foot (gpd/sf) at average design flow.

Primary tank effluent is conveyed to the aeration tanks in a primary effluent channel. The plant has a secondary bypass channel, which conveys primary effluent to the chlorine contact tanks when the flow into the secondary treatment process exceeds 260 MGD. The bypass channel capacity is estimated to be 140 MGD.

Five 4-pass aeration tanks provide biological treatment and one aeration tank provides centrate nitrification. The total aeration tank volume is 27.9 MG and five 42,000 standard cubic feet per minute (scfm) blowers provide air through fine bubble diffusers.

Aeration tank effluent is conveyed to the final settling tanks in an aeration tank effluent channel. There are 30 final settling tanks where solids are settled. The total volume of the final settling tanks is 25.8 MG with a surface overflow rate of 760 gpd/sf at average design flow.

Final settling tank effluent is conveyed to the two chlorine contact tanks in a final settling tank effluent channel. The two tanks have a total volume of 4.4 MG and a detention time of 15.8 minutes. Chlorinated effluent is discharged to the East River via an outfall.

Primary sludge is degritted in cyclones and mixed with waste activated sludge. The combined mixed sludge is thickened in twelve 65-foot diameter gravity thickeners. Each thickening tank unit has a 10-foot side water depth (SWD) and a total surface area of 39,800 square feet. The gravity thickener overflow is returned upstream of the venturi meter, with effluent from the secondary screens, and the thickened sludge is sent to the anaerobic digesters. Sludge digestion is accomplished in four 118-foot diameter digestion tanks arranged so that all four tanks are run as primary digesters with a total volume of 11 MG. Five sludge storage tanks provide 9.2 MG for the storage of digested sludge. Digested sludge is dewatered with centrifuges on site in preparation for final disposal and the centrate is recycled through the plant. Sludge cake, grit, scum, and screenings are removed from the plant by truck for disposal to an off-site facility.

3.1.2. Wet Weather Operating Plan

The NYCDEP is required by its SPDES permit to maximize the treatment of combined sewage at the Hunts Point WPCP. The NYSDEC has approved the wet weather operating plan WWOP, which limits flow to 300 MGD through the secondary treatment processes and up to 260 MGD upon completion of Phase II BNR upgrades in mid-2007. The Biological Nutrient Removal BNR process is more sensitive to flow variation than the conventional activated sludge process, thus there is a greater need to limit the flows through the BNR tanks to protect the BNR biology. This allowance allows the plant to remove a much greater amount of ammonia and nitrate, pollutants which impact fish populations in natural waterbodies. Further to maximize combined sewage treatment, the SPDES permit requires flows of up to 400 MGD to be processed through all processes of the WPCP except in the aeration basins and final sedimentation.

New York State requires the development of a WWOP as one of the 14 BMPs for collection systems that include combined sewers. The goal of the WWOP is to maximize flow to the WPCP, one of the nine elements of long-term CSO control planning. The NYCDEP has developed a WWOP for each of its 14 WPCPs, and Table 3-2 summarizes the requirements for the Hunts Point WPCP. As noted in the table, flows above 1.2 to 1.3 times DDWF (240 to 260 MGD) could potentially cause excessive loss of biological solids in the aeration tanks. The WWOP for Hunts Point was submitted to the NYSDEC on July 18, 2003 as required by the SPDES permit and is provided herein as Appendix A.

Table 3-2. Wet Weather Operating Plan for Hunts Point WPCP after Completion of Phase II BNR

Unit Operation	General Protocols	Rationale
Influent Gates and Screens	Leave gate in full open position until pump capacity is hit, screen channel level exceeds acceptable level with maximum pumping, bar screens become overloaded, or grit removal exceeds capacity. Put additional primary or secondary screens into operation and set screen rakes to continuous operation in order to accommodate increased flow.	To regulate flow to the plant and prevent excessive flows from destabilizing plant performance.
Main Sewage Pumps	As afterbay level rises, put off-line pumps in service and increase speed of variable speed pumps up to maximum capacity.	Maximize flow to treatment plant and minimize need for flow storage in collection system and associated overflow from collection system into receiving water body.
Primary Settling Tanks	Make sure one primary sludge pump per tank is on-line and watch water surface elevations at the weirs for flooding and flow imbalances. Reduce flow if sludge cannot be withdrawn quick enough from the primaries, grit accumulation exceeds the plant's ability to handle it, or a primary tank must be taken out of service.	Provide settling for the increased flows.
Bypass Channel	Open/lower the bypass gate to the bypass channel to maintain a flow of 240-260 MGD to secondary treatment if the primary clarifier weirs flood or if final clarifier blanket levels go over the weirs. The BNR treatment process must be protected against high wet weather flows due to the limitations on the secondary clarifier solids separation capability. The Step BNR process will demand a higher aerator effluent suspended solids concentration and higher solids load on the final settling tanks. Solids may be washed out of the final clarifiers due to the higher solids loading and deeper sludge blanket during major storm events. The BNR treatment process can be protected against such high wet weather flows due to the constraints on the secondary clarifier solids separation capability by limiting the secondary treatment flow to 1.3 x DDWF. The washout of solids is also prevented by flexibility in the pass configuration.	To relieve flow to the aeration system and avoid excessive loss of biological solids and to relieve primary clarifier flooding. Also to maintain a nitrogen removal by limiting secondary treatment to 1.2 to 1.3 times DDWF.
Aeration Tanks	Keep all available aeration tanks in operation and adjust the airflow to maintain a dissolved oxygen greater than 2 mg/L.	To provide effective secondary treatment to storm flows up to 260 MGD.

Unit Operation	General Protocols	Rationale
Final Settling Tanks	Balance flows to the tanks to keep the blanket levels even, observe the clarity of the effluent and watch for solids loss, and increase the RAS/WAS rate to maintain low blanket levels.	High flows will substantially increase solids loadings to the clarifiers, which may result in high clarifier sludge blankets or high effluent TSS. This can lead to loss of biological solids that may destabilize treatment efficiency in dry weather conditions.
Chlorination	Check, adjust, and maintain the hypochlorite feed rates to maintain the target chlorine residual.	Hypochlorite demand will increase as flow rises and secondary bypasses occur.
Sludge Handling	Proceed as normal.	Uninfluenced by wet weather.

3.1.3. Other Operational Constraints

The NYSDEC and the NYCDEP entered into a Nitrogen Control Consent Order that updated the New York City SPDES permits to reduce nitrogen discharges to the Long Island Sound and Jamaica Bay to reduce the occurrence of eutrophic conditions and improve attainment of dissolved oxygen numerical criteria. The Consent Order was partly a result of the Long Island Sound Study, which recommended a 58.5 percent load reduction of nitrogen discharge. The Consent Order specified process modifications at the four WPCPs that discharge into the Upper East River (Bowery Bay, Hunts Point, Tallman Island, Ward Island) and one of the WPCPs that discharge to Jamaica Bay (26th Ward) for nitrogen removal. "The Modified Phase I BNR Facility Plan for the Upper East River and the 26th Ward Water Pollution Control Plants" was prepared by the NYCDEP and submitted to the NYSDEC in 2005, and outlines the modifications necessary to upgrade these five WPCPs. The critical BNR upgrade items for Phase I construction are as follows:

1. Aeration tank equipment modifications:
   - Baffles for the creation of anoxic/switch zones and pre-anoxic zones
   - Mixers in the anoxic zones
2. Process aeration system upgrades:
   - New blowers or retrofit of existing blowers
   - New diffusers (fine bubble)
   - Air distribution control equipment
   - Metering and dissolved oxygen (DO) monitoring and control
3. Return activated sludge (RAS) / Waste activated sludge (WAS) systems;
   - Expanded capacity or upgrade of existing RAS/WAS system, as applicable
4. Froth control system:
   - Implemented to prevent or control filamentous growth
5. Chemical addition facilities:
   - Sodium hypochlorite for froth control (RAS and surface chlorination)

- Alkalinity addition for nitrification and pH buffering (except at Tallman Island)

The NYCDEP has pledged to perform interim measures during the Phase I construction period to make best efforts to reduce the levels of nitrogen being discharged into the East River. These measures include:

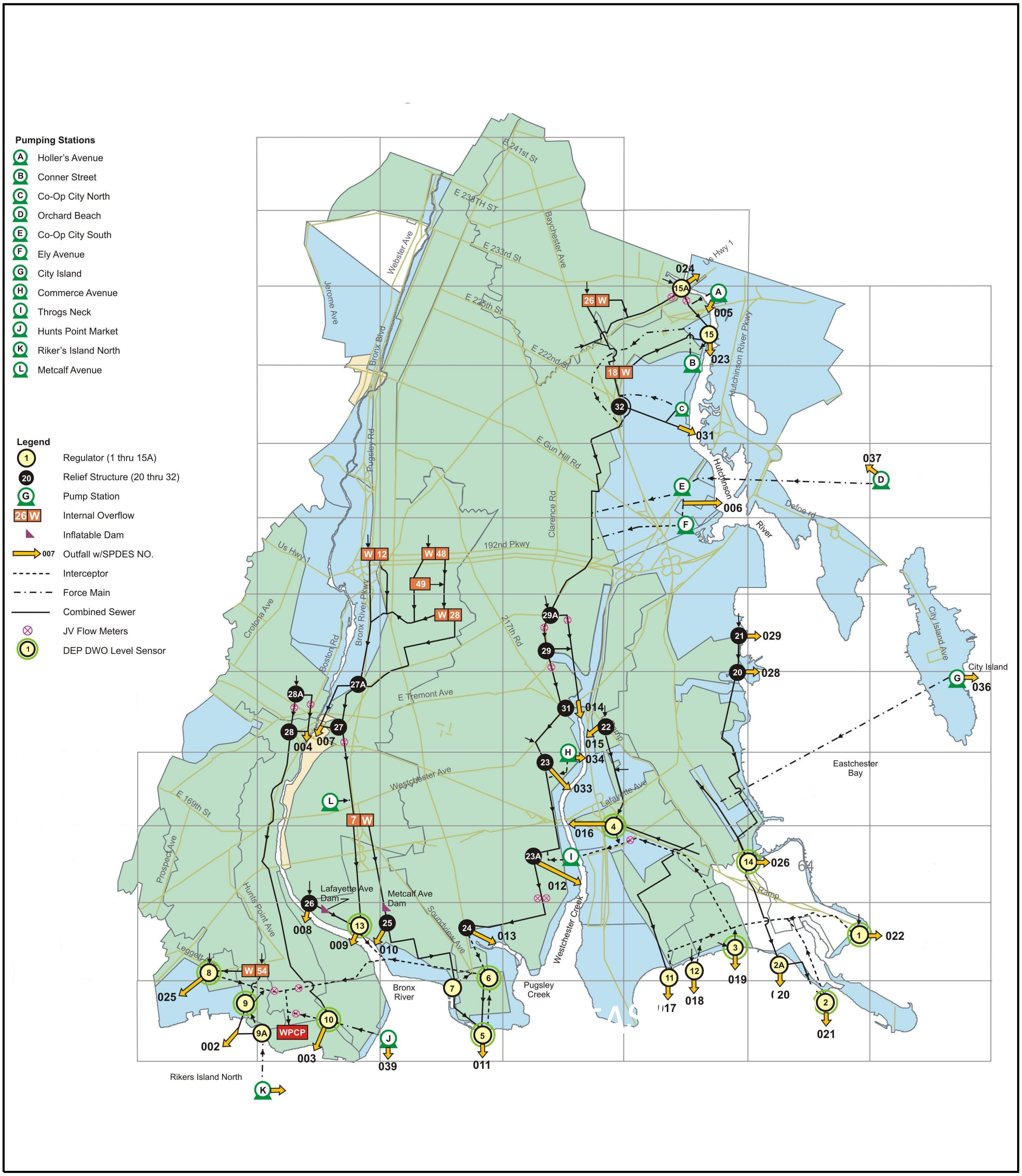
1. Wards Island Battery E additional upgrades:
   - Enhanced Flow Control in the Aeration Tanks
   - Supplemental carbon addition facilities
   - Additional baffles to enhance flow distribution and settling in final settling tanks
2. The SHARON Process (a high-rate nitrification/denitrification process) will be constructed at Wards Island including:
   - Reactor tanks with both aerated and anoxic zones;
   - Influent centrate pumping station and controls;
   - Blowers and process air piping, distribution grid and diffusers;
   - Mixers for the denitrification zone;
   - Alkalinity storage and pumping station;
   - Supplemental carbon (methanol) storage and pumping station;
   - Recycle pumps;
   - Temperature control units; and
   - Electrical power substation.
3. Relocation of Bowery Bay and Tallman Island digested sludge and/or centrate via shipping with NYCDEP marine vessels or contract services. The NYCDEP can send this material to either a NYC facility or an out-of-city facility.

Concurrent with the BNR upgrades, the NYCDEP continues to perform extensive upgrade work as part of the Plant Upgrade (PU) Program at all WPCPs, including the five that are undergoing BNR retrofits. Plant upgrades are required to stabilize or replace equipment that has reached its intended design life to ensure reliable plant performance that is in compliance with the existing SPDES permits for each WPCP.

3.2. COLLECTION SYSTEM

3.2.1. Sewer System Overview

A schematic of the CSO outfalls, pump stations, regulators, and major conveyance pipelines is presented in Figure 3-5. There are 15 pumping stations located in the Hunts Point WPCP drainage area. Of these, 12 handle combined sewage; the remaining three pump storm water only. Table 3-3 lists the pump stations for the Hunts Point WPCP drainage area.



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System Schematic for Hunts Point Drainage Area

Table 3-3. Summary of Pump Stations

PS - Name	Address	Type	Capacity (MGD)	DWF (MGD)	PUMP DATA	
					Total # of Pumps	Minimum # Req.
Conner St.	Foot of Conner St./Eastchester Creek, BX, NY 10475	Comb.	11.52	4.26	3	2
Co-op City North	Co-op City Blvd. & Bellamy Loop, BX, NY 10475	San.	16.10	1.67	3	2
Ely Ave.	Ely Ave. & Waring Ave., BX, NY 10475	San.	1.55	0.41	3	2
Hollers Ave.	Foot of Hollers Ave. at Eastchester Creek, BX, NY 10475	San.	1.40	0.30	2	1
Co-op City South	Hutchinson Riv. Pkwy. E. & Einstein Loop, BX, NY 10475	San.	3.80	1.20	3	2

The following describes the pump station located in the Hutchinson River drainage area:

- Conner Street Pumping Station: This pump station has combined flow coming from Regulator 15 that has a drainage area of 107 acres. The station has three pumps. Two operate in lead/lag mode with the third reserved as a spare. A bubbler system controls the running status of the lead and lag pumps. The pump station overflow is Regulator 15.
- Co-Op City North Pumping Station: This pump station serves a drainage area of 92 acres and has one incoming line. The station has two operable pumps and one standby pump that are operated in lead/lag mode. The emergency overflow discharges to the combined sewer to outfall HP-031. The pump station is scheduled for upgrades in the near future.
- Ely Avenue Pumping Station: This pump station has one incoming line. The station has three operable pumps that are operated in lead/lag mode. The emergency overflow discharges to outfall HP-006.
- Hollers Avenue Pumping Station: This pump station has a drainage area of 58 acres and two operable pumps that are operated in lead/lag mode. The emergency overflow discharges to outfall HP-005.
- Co-Op City South Pumping Station: This pump station has a drainage area of 49 acres and two operable variable frequency drives (VFD) pumps and one standby pump. The emergency overflow discharges to outfall HP-006.

3.2.2. Combined Sewer System

The Hutchinson River watershed includes portions of Westchester County and the Bronx in New York City. The Westchester County watershed is 5,779 acres. In New York City, the topographical watershed of the Hutchinson River is 3,370 acres. However, sewer system construction, urban development and other alterations to the watershed and runoff pathways have altered the watershed such that approximately 2,795 acres within in New York City boundaries now drain to the Hutchinson River. Combined sewers serve about 1,478 acres of this area and may discharge to the river during wet weather at three CSOs in the saline reach, HP-023, HP-024, and HP-031. Two pump stations have emergency overflows at HP-005 and HP-006. HP-006 is unique in that it has a drainage area of 288 acres of stormwater from nearby Interstate 95 in addition to the emergency overflow. There are over 15 stormwater and other discharges to the river along the entire length from Westchester County to Eastchester Bay.

Table 3-4 lists the permitted CSO outfalls in the Hunts Point WPCP collection system by waterbody. Five of the listed outfalls (HP-005, 006, 023, 024, and 031) discharge into the Hutchinson River.

Table 3-4. Summary of Permitted Outfalls

SPDES Outfall No.	Permitted Outfall Location	Size (W x H)	Waterbody	Drainage Area (Acres)
HP-005	Hollers Ave. (Hollers Ave. P.S.)	12' DIA	Hutchinson River	Emer. Overflow
HP-006	Bartow Ave. (Co-op City South P.S.)	15' X 8'-6"	Hutchinson River	Emer. Overflow + 288 (1)
HP-023	Conner St. (REG #15)	12' X 6'-6"	Hutchinson River	169
HP-024	E. 233rd St. (REG #15A)	12'-6" X 10'	Hutchinson River	408
HP-031	Bellamy Loop (CSO-32, Co-op City North P.S.)	6' DIA	Hutchinson River	91

Notes: (1) HP-006 drainage area is stormwater only. This outfall also serves as an emergency overflow for Ely and Co-op City South pumping stations.

Regulators associated with each CSO outfall control the amount of flow diverted to interceptors, which convey wastewater to the WPCP. During wet weather events, the regulators divert combined sanitary and stormwater within the system up to design capacities. When flows from larger storm events exceed design capacities, the excess flow is diverted to CSO outfalls. The frequency and amount of discharge varies depending on the relative capacity of the downstream interceptor, hydraulic geometry of the regulator overflow, the storm intensity and duration, and the size of the drainage area.

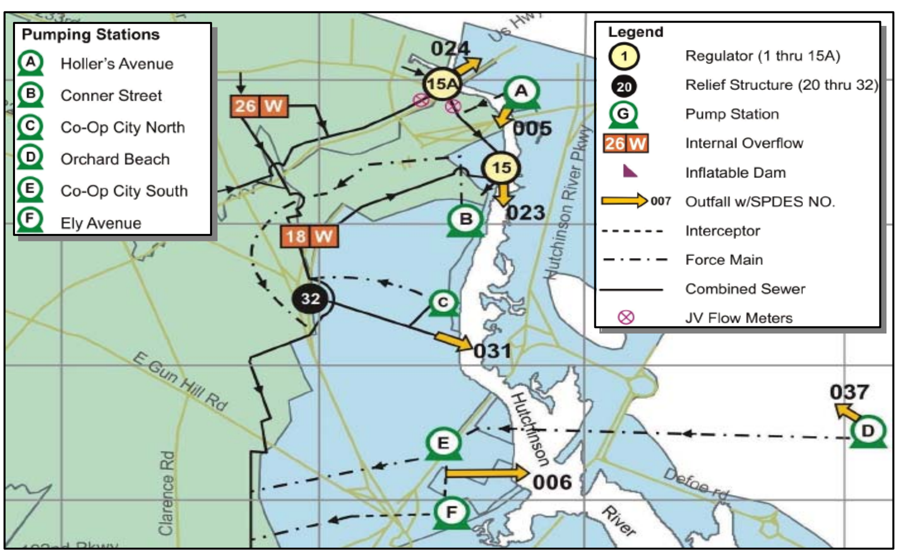

Exhibit 3-1. Enlarged System Schematic for the Hutchinson River

The Hutchinson River drainage area includes two Regulators, 15 and 15A upstream of outfalls HP-023 and HP-024, respectively. An enlarged view is shown in Exhibit 3-1 and reveals the combined system flow schematics. Part of the combined sewer drainage areas flows into internal overflow (26W) and to Regulator 15A, which feeds HP-024. This flow can also divert down to internal overflow 18 or to Regulator 15 from 15A, leading to Outfall HP 023. Relief structure 32 drains a smaller defined area and is connected to Outfall HP-031. Outfalls HP-005 and HP-006 provide emergency relief for Holler's Avenue and Ely Avenue pump stations, respectively.

3.2.3. Sanitary Sewer System

The previous section focused on the combined portions of the collection system. As a matter of terminology there are primarily three types of sewers within the collection system:

- Sanitary Sewers are those that collect only sanitary waste. Such as home, commercial and industrial drains.
- Separate Storm Sewers collect rain and runoff primarily through street drains but also through roof leaders and foundation drains.
- Combined Sewers collect both sanitary waste and rainfall run-off in a single pipe.

Figure 3-6 includes areas labeled as "direct drainage" this means that there are no combined sewers or storm sewers in these areas and that rainfall flows over land to the receiving waterbody. These areas are typically coastal parks or other undeveloped or underdeveloped areas. These areas may still have sanitary sewers.

There are areas in the collection system that contain only combined sewers, only sanitary sewers, only storm sewers or both storm and sanitary sewers. Areas that contain both storm and sanitary sewers are referred to as "separate areas" or "separate sewer systems" since the sanitary wastewater and storm water are conveyed by separate piping systems.

Portions of the Hutchinson River Drainage Area are served by separate sewer systems. Approximately 533 acres of the Hutchinson River watershed is served by separated sewer systems. Figure 3-6 shows those separated areas in the Hunts Point drainage area and in the Hutchinson River drainage system. These areas have separate sanitary sewer systems that ultimately convey flow to the interceptors to Hunts Point WPCP. It is important to note that these separate sanitary lines convey flow into the combined system downstream of the separated area.

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CSOs in the Hutchinson River Assessment Area

3.2.4. Stormwater System

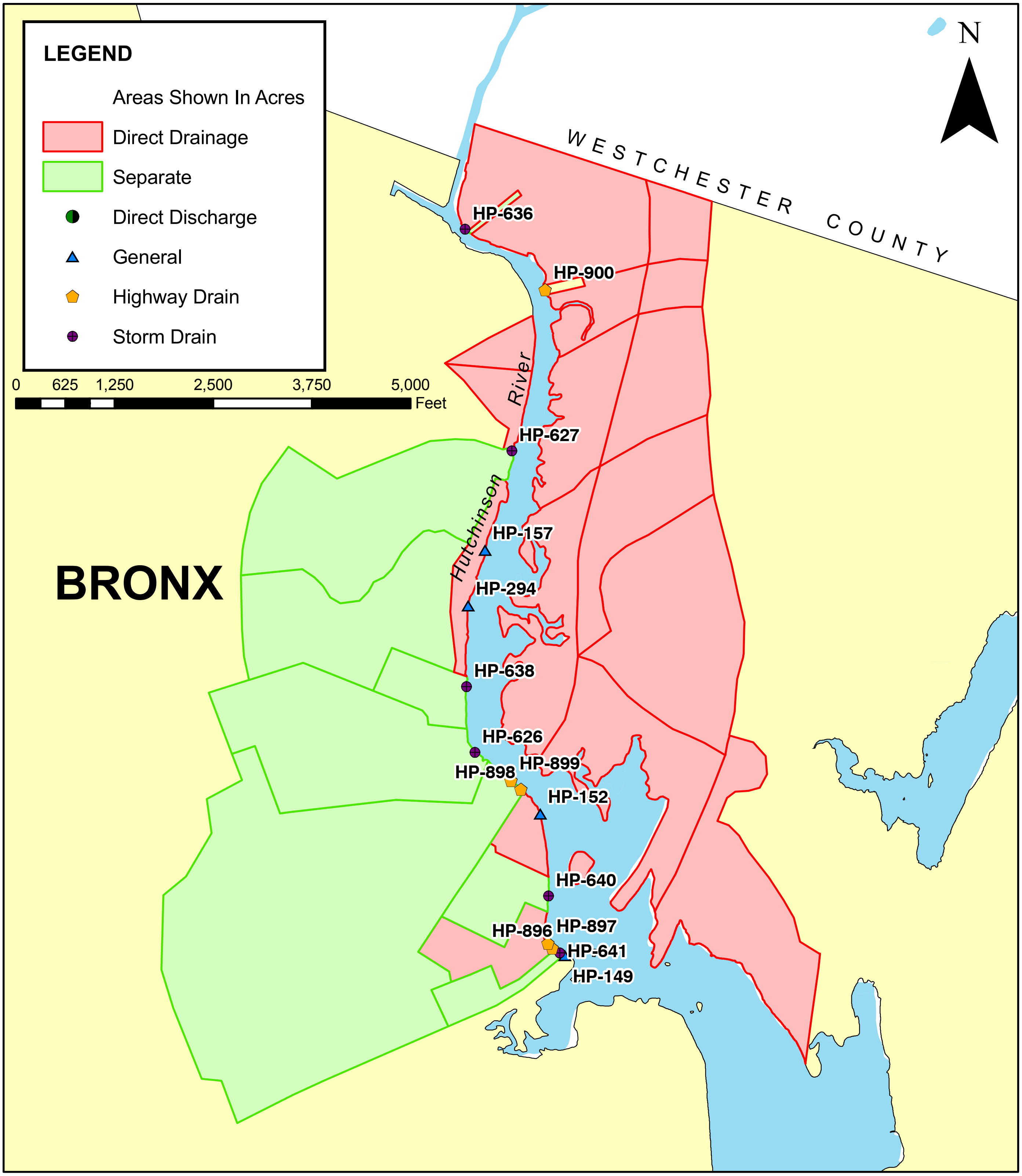
A significant area in the Hutchinson River sewershed is served by a separate storm sewer system. The separately sewered area is located on the west side of the river, predominantly in the southern portion of the sewershed at Cop-Op City. The total separately sewered drainage area is 612 acres. The NYCDEP Shoreline Survey included water- and land-based surveys of all New York City shorelines to identify, characterize, and document all untreated discharges from the New York City sewer system. The NYCDEP was further required to execute abatement programs to eliminate all untreated discharges. CSOs, stormwater discharges, highway drains, industrial discharges, etc. were all identified and mapped during the program, including those for Hutchinson River. Building on their SPDES numbering system, stormwater discharges are numbered in the Shoreline Survey program with a 600 series. One stormwater discharge is located on the eastern shore in the north (HP-636) and five discharges are on the eastern shore (HP-626, HP-627, HP-638, HP-640, and HP-641). Outfall locations are illustrated on Figure 3-7.

In 2004, the NYCDEP completed a stormwater sampling program to support the Harbor Estuary Program (HEP) Pathogen model (PATH) for the development of Harbor-wide TMDLs. The program focused its efforts on the collection of enterococci data, but also collected measurements of total/fecal coliform concentrations. Before this program was completed there was limited data available for enterococci concentrations in stormwater, sewage water, and CSOs. The sampling program allowed for stormwater (runoff) characterization, which is critical to the calibration of the PATH enterococci model, since stormwater makes up approximately 70 to 90 % of a CSOs flow volume.

The sampling program covered only a small percentage of the 1,000-plus direct stormwater discharges in New York City. Storm outfalls HP-626, HP-627, and HP-638, which discharge from the west bank of the Hutchinson River, were monitored during the sampling program. The results of the three outfalls are listed below in Table 3-5, while Table 3-6 illustrates "high level urban" and "low level urban" concentrations.

Table 3-5. Summary Results of Stormwater Sampling Program

Outfall No.	Location	Date	Total Coliform	Fecal Coliform	Entero-cocci
			#/100 mL x 10^3		
HP-638	Bellamy Loop	08-14-04	164	103	35
		10-15-04	275	137	51
		10-19-04	122	62	26.5
		Avg.	187	101	38
HP-627	Carver Loop	08-15-04	379	54.6	144
		10-15-04	452	257	105
		01-06-05	450	160	52
		Avg.	427	157	100
HP-626	Asch Loop	09-18-04	670	288	107
		10-15-04	335	153	70
		01-06-05	335	92	31
		Avg.	447	178	69



New York City
Department of Environmental Protection

Separate Storm Areas

Hutchinson River Waterbody/Watershed Facility Plan

FIGURE 3-7

Table 3-6. "High Level Urban" and "Low Level Urban" Concentrations

Concentration	Total Coliform	Fecal Coliform	Entero-cocci
	#/100 mL x 10^3		
High Level	300	120	50
Low Level	150	35	15

The September 18 sample taken at Asch Loop monitoring station was unusually high when compared to the rest of the samples. A review of the concentrations at Asch Loop showed that the first three collection times during a storm event had extremely high bacteria concentrations indicating the possibility of additional pathogen sources and/or scour in the system. These pathogen sources may be illegal and/or improper waste discharges into storm drainage systems and receiving waters.

Examination of the population densities in the 14 NYC Sewer districts indicated that the sewer districts could be characterized and grouped into two categories of residential populations – "low density urban" and "high density urban." The Hunts Point drainage area including outfalls HP-626, HP-627, and HP-638 was classified as "high level urban" or a sewer district that has densities greater than 20,000 persons/mi^2.

3.3. DISCHARGE CHARACTERISTICS

Because long-term monitoring of outfalls is difficult and sometimes not possible in tidal areas, sewer-system models that have been calibrated to available measurements of water levels and flows can offer a useful characterization of discharge quantities. Sewer-system models can also be used to estimate the relative percentage of sanitary sewage versus rainfall runoff discharged stormwater from a CSO. This is particularly helpful when developing pollutant concentrations, since this sanitary/runoff split for discharge volume can be used to develop pollutant loadings based on concentrations associated with sanitary and runoff, which are somewhat more reliable than concentrations assigned based on pollutant concentrations measured in combined sewage, which are particularly variable.

Mathematical watershed models are used to simulate the hydrology (rainfall runoff) and hydraulics (sewer system flows and water levels) of a watershed, and are particularly useful in characterizing sewer system response to rainfall conditions and in evaluating engineering alternatives on a performance basis. In the hydrology portion of the model, climatic conditions (such as hourly rainfall intensity) and physical watershed characteristics (such as slope, imperviousness, and infiltration) are used to calculate rainfall-runoff hydrographs from individual subcatchments. These runoff hydrographs are then applied at corresponding locations in the sewer system as inputs to the hydraulic portion of the model, where the resulting hydraulic grade lines and flows are calculated based on the characteristics and physical features of the sewer system, such as pipe sizes, pipe slopes, and flow-control mechanisms like weirs. Model output includes sewer-system discharges which, when coupled with pollutant concentration information, provide input necessary for receiving-water models to determine water-quality conditions. The following generally describes the tools employed to model the Hutchinson River watershed. A more detailed write up describing the calibration of the model-calibration and model-projection process is provided under separate cover *City-Wide LTCP Landside Modeling Report, Volume 4- Hunts Point WPCP*.

3.3.1. Landside Modeling

The hydraulic modeling framework used in this effort is a commercially available, proprietary software package called InfoWorks CS™, developed by Wallingford Software of the United Kingdom. InfoWorks CS™ (hereafter referred to as the sewer system model) is a hydrologic/hydraulic modeling package capable of performing time-varying simulations in complex urban settings for either short-term events or long-term periods, with output of calculated hydraulic grade lines and flows within the sewer system network and at discharge points. The sewer system model solves the complete St. Venant hydraulic equations representing conservation of mass and momentum for sewer-system flow and accounts for backwater effects, flow reversals, surcharging, looped connections, pressure flow, and tidally affected outfalls. Similar in many respects to the USEPA's older Storm Water Management Model (SWMM), the sewer system model offers a state-of-the-art graphical user interface with greater flexibility and enhanced post-processing tools for analysis of model calculations. In addition, the sewer system model utilizes a four-point implicit numerical solution technique that is generally more stable than the explicit solution procedure used in SWMM.

Model input for the sewer system model includes watershed characteristics for individual subcatchments, including area, surface imperviousness and slope, as well as sewer-system characteristics, such as information describing the network (connectivity, pipe sizes, pipe slopes, pipe roughness, etc.) and flow-control structures (pump stations, regulators, outfalls, WPCP headworks, etc.). Hourly rainfall patterns and tidal conditions are also important model inputs. The sewer system model allows interface with graphical information system (GIS) data to facilitate model construction and analysis.

Model output includes flow and/or hydraulic gradeline at virtually any point in the modeled system, at virtually any time during the modeled period. The sewer system model provides full interactive views of data using geographical plan views, longitudinal sections, spreadsheet-style grids and time-varying graphs. A three-dimensional junction view provides an effective visual presentation of manholes. Additional post-processing of model output allows the user to view the results in various ways as necessary to evaluate system response.

3.3.2. Application of Model to Hunts Point Collection System

The sewer system model for the Hunts Point Collection System was constructed using information and data compiled from the NYCDEP's as-built drawings, WPCP data, previous and ongoing planning projects, regulator improvement programs, and inflow/infiltration analyses. This information includes invert and ground elevations for manholes, pipe dimensions, pump-station characteristics, and regulator configurations and dimensions.

Model simulations include WPCP headworks, interceptors, branch interceptors, major trunk sewers, all sewers greater than 48-inches in diameter plus other smaller, significant sewers, and control structures such as pump stations, diversion chambers, tipping locations, reliefs, regulators and tide gates. As presented in the LTCP WB/WS Facility Plan Landside Modeling Report, the model was calibrated and validated using flow and hydraulic-elevation data collected for this purpose. All CSO and stormwater outfalls permitted by the State of New York are represented in the models, with stormwater discharges from separately sewered areas simulated using separate models as necessary.

Conceptual alternative scenarios representing no-action and other alternatives were simulated for the average year (1988 JFK rainfall). Tidally influenced discharges were calculated on a time-variable basis. Pollutant concentrations selected from field data and best professional judgment were assigned to the sanitary and stormwater components of the combined sewer discharges to calculate variable pollutant discharges. Similar assignments were made for stormwater discharges in separated areas. Discharges and pollutant loadings were then post-processed and used as inputs to the receiving-water model, described in Section 4.

3.3.3. Baseline Design Condition

Watershed modeling can be an important tool in evaluating the impact of proposed physical changes to the sewer system and/or of proposed changes to the operation of the system. In order to provide a basis for these comparisons, a "Baseline condition" was developed. For the Hunts Point Model, the Baseline conditions parameters were as follows:

- Dry-weather flow rates reflect year 2045 projections
- Wet-weather treatment capacity of 259 MGD at the Hunts Point WPCP

Establishing the future Hunts Point WPCP dry weather sewage flow is a critical step in the WB/WS planning analysis since one key element in City's CSO control program is the use of its' WPCPs to reduce CSO overflows. Increases in sanitary sewage flows associated with increased populations will reduce the amount of CSO flow that can be treated at the existing WPCPs since the increase sewage flows will use part of the WPCP wet weather capacity.

Dry weather sanitary sewage flows used in the baseline modeling were escalated to reflect anticipated growth within the City. The Mayor's Office along with City Planning has made assessments of the growth and movement of the City's population between the year 2000 census and 2010 and 2030 (NYCDCP, 2006). This information is contained in a set of projections made for some 188 neighborhoods within the City. The NYCDEP has escalated these populations forward to 2045 by assuming the rate of growth between 2045 and 2030 could be 50% of the rate of growth between 2000 and 2030. These populations were associated with each of the landside modeling sub-catchment areas tributary to each CSO regulator using geographical information system (GIS) calculations. Dry sanitary sewage flows were then calculated for each of these sub-catchment areas by associating a conservatively high per capita sanitary sewage flow with the population estimate. The per capita sewage flow was established as the ratio of the year 2000 dry weather sanitary sewage flow for the Hunts Point WPCP service area and the year 2000 population of the Hunts Point WPCP area.

Increasing the sewage flows for the Hunts Point WPCP from the current 2004 average dry weather flow of 113.8 MGD to an estimated dry weather flow of 130 MGD will properly account for the potential reduction in wet weather treatment capacity associated with projections of a larger population.

In addition to the above watershed/sewer-system conditions, a comparison between model calculations also dictates that the same meteorological (rainfall) conditions are used in each case. In accordance with the Federal CSO Control Policy the average rainfall year was used. Long-term rainfall records measured in the New York City metropolitan area were analyzed to identify potential rainfall design years to represent long-term, annual average conditions. Statistics were compiled to determine:

- Annual total rainfall depth
- Annual total number of storms
- Annual average storm volume
- Annual average storm intensity
- Annual total duration of storms
- Annual average storm duration
- Annual average time between storms

A more detailed description of these analyses is provided under separate cover (HydroQual, 2004). Although no year was found having the long-term average statistics for all of these parameters, the rainfall record measured at the National Weather Service gage at John F. Kennedy (JFK) International Airport during calendar year 1988 is representative of overall, long-term average conditions in terms of annual total rainfall and storm duration. Table 3-7 summarizes some of the statistics for 1988 and a long-term (1970-2002) record at JFK. Furthermore, the JFK 1988 rainfall record also includes high-rainfall conditions during July (recreational) and November (shellfish) periods, which is useful for evaluating potential CSO impacts on water quality during those particular periods. As a result, the JFK 1988 rainfall record was selected as an appropriate design condition for which to evaluate sewer system response to rainfall. The JFK 1988 record has also been adopted as a design condition by New York Harbor Estuary Program (to evaluate water-quality conditions in the New York/New Jersey Harbor Estuary).

Table 3-7. Comparison of Annual 1988 and Long-Term Statistics JFK Rainfall Record (1970-2002)

Rainfall Statistic	1988 Statistics	Long-Term Median (1970-2002)
Annual Total Rainfall Depth (inches) Return Period (years)	40.7 2.6	39.4 2.0
Average Storm Intensity (inch/hour) Return Period (years)	0.068 11.3	0.057 2.0
Annual Average Number of Storms Return Period (years)	100 1.1	112 2.0
Average Storm Duration (hours) Return Period (years)	6.12 2.1	6.08 2.0

3.3.4. Characterization of Discharged Volumes, Baseline Condition

The calibrated watershed models previously described were used to characterize discharges to Hutchinson River for the Baseline condition. Table 3-8 summarizes the results with statistics relating the annual CSO and stormwater discharges from each point-source outfall for the Baseline condition. Approximately 65 percent of the total annual CSO volume to the

Hutchinson is discharged at HP-024, the outfall located near the border between the Bronx and Westchester County. Six percent of the total annual CSO volume is discharged from HP-031, while 29 percent is discharged from HP-023.

Table 3-8. Hutchinson River Discharge Summary for Baseline Condition (1,2,3)

Combined Sewer Outfall	Discharge Volume (MG)	Percentage of CSO Volume	Number of Discharges
HP-024	254	65	43
HP-023	115	29	42
HP-031	21	6	38
Total CSO	390	100	NA

Notes: (1) Baseline condition reflects design precipitation record (JFK, 1988) and sanitary flows projected for year 2045
(2) Totals may not sum precisely due to rounding.
(3) Hunt Point Operating Capacity 259 MGD

3.3.5. Characterization of Pollutant Concentrations, Baseline Condition

Pollutant concentrations associated with intermittent, weather-related discharges are highly variable. In part for this reason, analyses to characterize discharged pollutants utilized estimates of the relative split of sanitary sewage versus rainfall runoff in discharged flows. Pollutant concentrations for sanitary sewage are attributed to the sanitary portion, and concentrations for stormwater are attributed to the rainfall runoff portion of the discharged flow volumes.

Table 3-9 presents the pollutant concentrations associated with the sanitary and stormwater components of discharges to the Hutchinson River. Sanitary concentrations were developed based on sampling of WPCP influent during dry-weather periods, as described elsewhere in more detail (NYCDEP, 2002). Stormwater concentrations were developed based on sampling conducted citywide as part of the Inner Harbor Facility Planning Study (NYCDEP, 1994), and sampling conducted citywide by the NYCDEP for the USEPA Harbor Estuary Program (HyrdoQual, 2005).

Table 3-9. Sanitary and Stormwater Discharge Concentrations, Baseline Condition

Constituent	Sanitary Concentration (1)	Stormwater Concentration (2,3)
CBOD (mg/L)	110	15
TSS (mg/L)	110	15
Total Coliform Bacteria (MPN/100mL) (4)	$25x10^6$	300,000
Fecal Coliform Bacteria (MPN/100mL) (4)	$4x10^6$	120,000
Enterococci (MPN/100mL) (4)	$1x10^6$	50,000

Notes: (1) (NYCDEP, 2002) (2) (NYCDEP, 1994) (3) (HydroQual, 2005)
(4) Bacterial concentrations expressed as "most probable number" of cells per 100 mL.

The Hutchinson River hydrograph at the Westchester County inflow boundary of ERTM for the 1988 LTCP projections was developed using daily discharge data from USGS gauge 01301500. The USGS gauge was located about 1 mile upstream of the model boundary in Pelham, Westchester County. Between the gauge and the model boundary was an unmetered drainage area of 1,505 acres. The landside model was used to estimate the additional wet-weather inflow to the river from this intervening drainage area using the 1988 hourly rainfall record for LaGuardia Airport (LGA). For the 2005 Hutchinson River calibration, LGA rainfall was used, since it was more representative for the Hunts Point drainage area than JFK. The wet-weather hydrograph was added to the gauged flow to produce a total inflow hydrograph for the model.

In the upstream Westchester County portion of the river, high and low boundary conditions were assigned to ERTM for pathogens concentrations. The high conditions used for ERTM were based on dry weather 2005 summer sampling results (see Section 4.1.2 for results). Low conditions were based on the pathogen standards for a Class SB waterbody. The same concentrations apply for wet weather, but the loadings would be different when applied to the hydrograph. Table 3-10 presents these high and low boundary conditions for the Westchester County portion of the river.

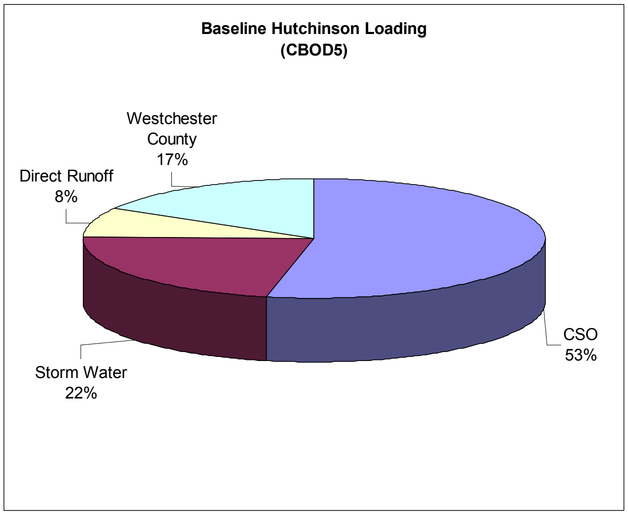
Table 3-10. Westchester Pathogen Boundary Conditions

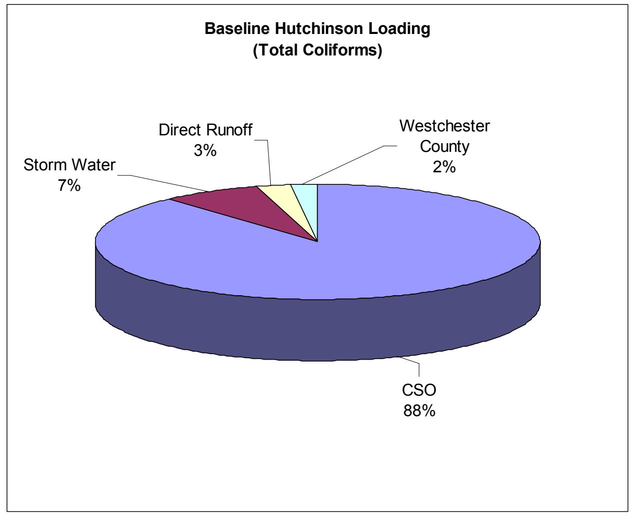
Constituent	High Concentration	Low Concentration
Total Coliform Bacteria (MPN/100mL)	10,000	2,399
Fecal Coliform Bacteria (MPN/100mL)	1,500	199
Enterococci (MPN/100mL)	100	34

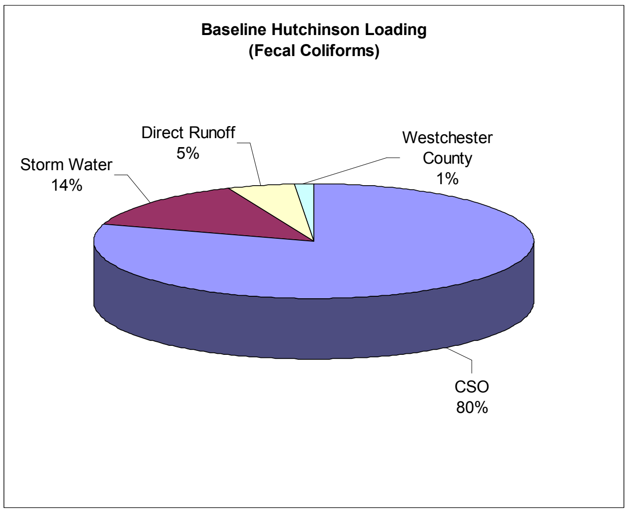
3.3.6. Characterization of Pollutant Loads, Baseline Condition

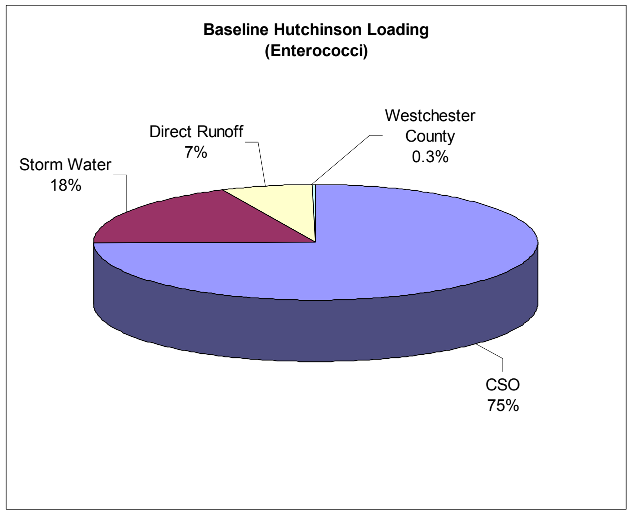
Pollutant-mass loadings were calculated using the pollutant concentrations shown in Table 3-9, applied to the discharge volumes and sanitary/rainfall-runoff splits provided by the watershed model, as described above.

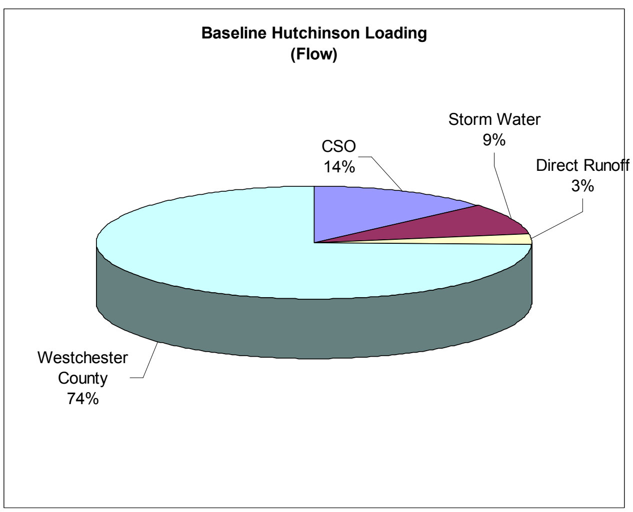
As shown in Table 3-11 and summarized on Figure 3-8, CSOs dominate the loadings of BOD, fecal and total coliform bacteria as well as enterococci bacteria to the Hutchinson River. On an annual basis, CSOs contribute approximately 14 percent of the total flow to the Hutchinson River yet constitute 53 to 88 percent of the pollutant and pathogen loading. Storm water and direct runoff from the New York City portion of the Hutchinson River contribute approximately 12 percent of the total flow to the river and together contribute 10 to 25 percent of the pollutant and pathogen loading. The upstream portion of the river, in Westchester County, accounts for 74 percent of the river's flow and is responsible for about 17 percent of the pollutant loadings and less than 2 percent of pathogen loading.











New York City
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Hutchinson River Baseline Loading Sources

Table 3-11. CSO and Stormwater Discharge Loadings for the Hutchinson River, Baseline Condition [1,2]

Constituent	CSO Loading	Direct Runoff	NYC Stormwater Loading	Upstream Loading [3]
BOD (1000 lb/yr)	84,947	12,801	35,254	26,560
TSS (1000 lb/yr)	84,947	12,801	35,254	N.D.
Total Coliform Bacteria (#/yr)	3.97×10^{16}	1.16×10^{15}	3.20×10^{15}	8.99×10^{14}
Fecal Coliform Bacteria (#/yr)	7.44×10^{15}	4.65×10^{14}	1.28×10^{15}	1.35×10^{14}
Enterococci (#/yr)	2.16×10^{15}	1.94×10^{14}	5.33×10^{14}	8.99×10^{14}

Notes: (1) Loadings represent annual total during baseline condition.
(2) Hunts Point operating capacity equals 259 MGD
(3) From flows entering from Westchester County
N.D. – no data available

3.3.7. Effects of Urbanization on Discharge

The urbanization of the Hutchinson River drainage area from a pastoral watershed to an urban sewershed is described in Section 2. The pastoral condition featured undeveloped uplands that provided infiltration of incident rainfall and contributed continuous freshwater inputs. Urbanization brought increased population, increased pollutants from sewage and industry, construction of sewer systems, and physical changes affecting the surface topography and imperviousness of the watershed. Increased surface imperviousness generates more runoff that is less attenuated by infiltration processes, and the sewer systems replaced natural overland runoff pathways with a conveyance system that routes the runoff directly to the waterbody - without the attenuation formerly provided by surrounding wetlands. As a result, more runoff is generated, and it is conveyed more quickly and directly to the waterbody. These changes also affect how pollutants are transferred along with the runoff on its way to the waterbody. Furthermore, the urbanized condition also features additional sources of pollution from CSOs and industrial/commercial activities.

Urbanization of the watershed has altered its runoff yield tributary to Hutchinson River by increasing its imperviousness. Imperviousness is a characteristic of the ground surface that reflects the percentage of incident rainfall that runs off the surface rather than is absorbed into the ground. While natural areas typically exhibit imperviousness of 10 to 15 percent, imperviousness in urban areas can be 70 percent or higher.

In a pastoral condition, runoff from a watershed typically reaches the receiving waters through a combination of overland surface flow and subsurface transport, typically with ponding and other opportunities for retention and infiltration. Tidal wetland areas previously surrounding Hutchinson River would have further attenuated wet-weather discharges. The urbanization of the Hutchinson River watershed reduced infiltration and natural subsurface transport and eliminated natural streams previously tributary to the Hutchinson River. Runoff is transported via roof leaders, street gutters and catch basins into the combined and separate sewer system, which then discharges directly to Hutchinson River since the wetlands have been eliminated. Urbanization has thus simultaneously decreased retention and absorption of runoff during transport and decreased the travel time for runoff to reach the waterbody. When combined with the increased runoff due to increased imperviousness of the watershed, the end result is increased peak discharge rates and higher total discharge volumes to the waterbody during wet weather.

Urbanization has also altered the pollutant character of wet-weather discharges from the watershed. The original rural landscape of forests, fields and wetlands represents pristine conditions with pollutant loadings resulting from natural processes (USEPA, 1997). These natural loadings, while having an impact on water quality in the receiving water, are insignificant compared to the urbanized-condition loadings from CSO and stormwater point sources.

Wet-weather discharges from urbanized areas are significantly stronger in pollutant concentrations than natural runoff. These pollutants include coliform bacteria, oxygen-demanding materials, suspended and settleable solids, floatables, oil and grease, and other materials.

A summary of the hydrologic changes caused by urbanization in the NYC Hutchinson River watershed is presented in Table 3-12. The pre-urbanized condition is assumed circa 1900. The table demonstrates that although the overall size of the watershed has been reduced by approximately 24 percent as a result of sewer construction, the runoff volume has increased. Runoff yield for an average precipitation year as calculated by the sewer system model has increased from approximately 370 MG of natural runoff to 660 MG discharged by combined and separate sewer systems to the Hutchinson River, an increase of 77 percent. Significantly larger discharges are now made directly to the Hutchinson River at higher rates since they are no longer attenuated, filtered, and mitigated by “natural” overland mechanisms.

A pollutant loading comparison is summarized in Table 3-13 using typical pollutant concentrations from literature sources. The table compares pre-urbanized pollutant loadings of total suspended solids and biochemical oxygen demand to the existing urbanized condition. The annual volumes used for this table are taken from those of Table 3-12 assuming an average precipitation year. Typical stormwater concentrations are used for the pre-urbanized condition. The urbanized condition accounts for existing CSO and stormwater discharges. The table demonstrates that urbanization of the watershed has increased pollutant loadings to the Hutchinson River Basin by a factor of about 2.3.

Table 3-12. Effects of Urbanization on NYC Hutchinson River Watershed

Watershed Characteristics	Pre-urbanized	Urbanized (1)
Drainage Area (acres)	3,370	2,572
Population	Unknown	79,100 (2)
Imperviousness	10%	49%
Annual Yield (MG) (3,4)	372	658

Notes: (1) Existing Condition
(2) Year 2000 U.S. Census
(3) Design rainfall – JFK 1988
(4) Total wet weather run off (CSO + Stormwater)

Table 3-13. Effects of Urbanization on NYC Hutchinson River Watershed Loadings

Annual Pollutant Load	Pre-Urbanized	Urbanized	Change (%)
Total Suspended Solids (lb/year)	46,540	107,240	230
Biochemical Oxygen Demand (lb/year)	46,540	107,240	230

3.3.8. Toxics Discharge Potential

Early efforts to reduce the amount of toxic contaminants being discharged to the New York City open and tributary waters focused on industrial sources and metals. For industrial source control for separate and combined sewer systems, USEPA requires approximately 1,500 municipalities nationwide to implement IPPs. The intent of the IPP is to control toxic discharges to public sewers that are tributary to sewage treatment plants by regulating SIU. If a proposed IPP is deemed acceptable, USEPA will decree the local municipality a "control authority." NYCDEP has been a control authority since January 1987, and enforces the IPP through Chapter 19 of Title 15 of the Rules of the City of New York (Use of the Public Sewers), which specifies excluded and conditionally accepted toxic substances along with required BMPs for several common discharges such as photographic processing waste, grease from restaurants and other non-residential users, and perchloroethylene from dry cleaning. The NYCDEP has been submitting annual reports on its activities since 1996. The 310 SIUs that were active citywide at the end of 2004 discharged an estimated average total mass of 38.2 pounds per day (lbs/day) of the following metals of concern: arsenic, cadmium, copper, chromium, lead, mercury, nickel, silver and zinc.

As part of the IPP, the NYCDEP analyzed the toxic metals contribution of sanitary flow to CSOs by measuring toxic metals concentrations in WPCP influent during dry weather in 1993. This program determined that of the 177 lbs/day of regulated metals being discharged by regulated industrial users only 2.6 lbs/day (1.5 percent) were bypassed to CSOs. Of the remaining 174.4 lbs, approximately 100 lbs ended up in biosolids, and the remainder was discharged through the main WPCP outfalls. Recent data suggest even lower discharges. In 2003, the average mass of total metals discharged by all regulated industries to the New York City WPCPs was less than 39.1 lbs/day, which would translate into less than 1 lb/day bypassed to CSOs from year 2003 regulated industries if the mass balance calculated in 1993 is assumed to be maintained. A similarly developed projection was cited by the 1997 NYCDEP report on meeting the nine minimum CSO control standards required by federal CSO policy, in which NYCDEP considered the impacts of discharges of toxic pollutants from SIUs tributary to CSOs (NYCDEP, 1997). The report, audited and accepted by USEPA, includes evaluations of sewer system requirements and industrial user practices to minimize toxic discharges through CSOs. It was determined that most regulated industrial users (of which SIUs are a subset) were discharging relatively small quantities of toxic metals to the NYC sewer system.

As discussed in Section 2.3, currently there is only one SIU located within the sewershed associated with combined sewer outfalls that discharge to the Hutchinson River. In addition, the NYSDEC has not listed the Hutchinson River as being impaired by toxic pollutants. As such, metals and toxic pollutants are not considered to be pollutants of concern for the development of this WB/WS Facility Plan.

4.0. Waterbody Characteristics

Hutchinson River is classified as a tidal tributary to the East River according to Title 6 of the New York Code of Rules and Regulations (NYCRR), Chapter X, Part 890. All of Hutchinson River is classified as a tidal tributary, although the only freshwater inflows to the waterbody are CSO and stormwater discharges. It flows 5 miles (8 kilometers) south from Scarsdale, through Westchester County and the Bronx, until it empties into Eastchester Bay.

The following sections discuss the physical, chemical, and ecological conditions in Hutchinson River.

4.1 CHARACTERIZATION METHODOLOGY

The USEPA guidance for monitoring and modeling notes that the watershed-based methodology represents a holistic approach to understanding and addressing all surface water, ground water, and habitat stressors within a geographically defined area, instead of addressing appropriate quantitative measures of both water quality conditions and the success of long-term control plans based on site-specific conditions, and in a manner that illustrates trends and results over time. Measures may be based on administrative (programmatic), end-of-pipe, ecological, or human health and use. Collection data and background information to establish a solid understanding of “baseline” conditions is critical to analyzing CSO impacts and evaluation the results of CSO control. Although essential elements of many of the CSO facility planning projects undertaken by the NYCDEP were initiated prior to the establishment of long-term CSO control policy, these elements were consistent with this guidance in most cases. Nonetheless, the waterbody assessment began with the compilation and analysis of existing data from investigations conducted by the NYCDEP and other agencies spanning several decades. Deficiencies in these existing data sets were identified and sampling programs were developed to address those data gaps. Characterization activities followed the Work Plans developed for the Use and Attainability (USA) Project, the progenitor of the current LTCP Project. These efforts yielded valuable information in support of characterization, mathematical modeling, and engineering efforts. The following describes these activities.

4.1.1 Compilation of Existing Data

A comprehensive review of past and ongoing data collection efforts was conducted to identify programs focused on or including the Hutchinson River and nearby waterbodies. Several other parallel projects by the NYCDEP and other have also been conducted that further contribute to the data available (see Section 5). The NYCDEP continues to conduct investigative programs yielding useful watershed and waterbody data to address these limitations. Additional sources of data are available from other stakeholders in the New York Harbor, including the US Army Corps of Engineers, and various utility concerns.

4.1.2 Biological and Habitat Assessments

The USEPA has for a long time indicated that water quality based planning should follow a watershed based approach. Such an approach considers all factors impacting water quality including both point and nonpoint (watershed) impacts on the waterbody. A key component of such watershed based planning is an assessment of the biological quality of the waterbody. Fish and aquatic life use evaluations require identifying regulatory issues (aquatic life protection and fish survival), selecting and applying the appropriate criteria, and determining the attainability of criteria and uses. According to guidance published by the Water Environment Research Foundation (Michael & Moore, 1997; Novotny et. al., 1997) biological assessments of use attainability should include "contemporaneous and comprehensive" fielded sampling and analysis of all ecosystem components. These components include phytoplankton, macrophytes, zooplankton, benthic invertebrates, fish and wildlife. The relevant factors are dissolved oxygen, habitat (substrate composition, organic carbon deposition, sediment pore water chemistry), and toxicity. Biological components and factors were prioritized to determine the greatest need of contemporary information relative to existing data or information expected to be generated by other ongoing studies, and/or, which biotic communities would provide the most information relative to the definition of use classifications and the applicability of particular water quality criteria and standards. The biotic communities selected for sampling included subtidal benthic invertebrates (which being largely sessile, have historically been used as indicators of environmental quality); epibenthic organisms colonizing standardized substrate arrays suspended in the water column (thus eliminating substrate type as a variable in assessing water quality); fish eggs and larvae (their presence being related to fish procreation); and juvenile and adult fish (their presence being a function of habitat preferences and/or dissolved oxygen tolerances).

These field investigations were executed under a harbor-wide biological Field Sampling and Analysis Program (FSAP) designed to fill ecosystems data gaps in New York Harbor. Field and laboratory standard operating procedures (SOP) were developed and implemented for each element of the FSAP in conformance with USEPA's Quality Assurance Project Plan guidance (USEPA, 1998; USEPA, 2001a; USEPA, 2001b), its standard operation and procedure guidance (USEPA, 2001c), and in consultation with USEPA's Division of Environmental Science and Assessment in Edison, NJ. The FSAPs collected information to identify uses and use limitations within waterbodies assessing aquatic organisms and factors that contribute to use limitations (dissolved oxygen, substrate, habitat and toxicity). Some of these FSAPs were related to specific waterbodies; others to specific ecological communities or habitat variables throughout the harbor; and still others to trying to answer specific questions about habitat and/or water quality effects on aquatic life.

Several FSAPs were conducted by the NYCDEP during the USA Project that included investigations of the Hutchinson River. Following review by the USEPA, the NYSDEC and other members of the Project Steering Committee, the Hutchinson River FSAP was initiated in early summer, 2000. Simultaneously, other FSAPs were developed to complement this FSAP, while also providing data for each of the other USA Project waterbodies. These FSAPs, including one dealing with the East River and the rest of its tributaries (HydroQual, 2001a), one dealing with waterbody wide (i.e. all 23 waterbodies) assessment of fish propagation (HydroQual, 2001b) and one dealing with epibenthic invertebrate recruitment (HydroQual, 2001c), were implemented in 2001. Figure 4-1 shows locations of sampling stations used in the first summer 2000 Hutchinson River FSAP, while Figure 4-2 illustrates a composite of the Hutchinson River area sampling station locations specified in the 2001 through 2003 East River and related FSAPs.

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Sampling Stations for Hutchinson River FSAP (HydroQual, 2000)

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Sampling Stations for Hutchinson River FSAP, 2001-2003

The NYCDEP conducted its Harbor-Wide Ichthyoplankton FSAP in 2001 to identify and characterize ichthyoplankton communities in the open waters and tributaries of New York Harbor (HydroQual, 2001b). Information developed by this FSAP identified what species are spawning, as well as where and when spawning may be occurring in New York City's waterbodies. The FSAP was executed on a harbor-wide basis to assure that evaluations would be performed at the same time and general water quality conditions for all waterbodies. Sampling was performed at 50 stations throughout New York Harbor, its tributaries, and at reference stations outside the harbor complex. The locations of sampling stations are shown on Figure 4-3. Two stations were located in the Hutchinson River watershed. Samples were collected using fine-mesh plankton nets with two replicate tows taken at 50 stations in March, May, and July 2001. In August 2001, 21 of the stations were re-sampled to evaluate ichthyoplankton during generally the worst cast temperature and dissolved oxygen conditions.

The NYCDEP conducted a Harbor-Wide Epibenthic Recruitment and Survival FSAP in 2001 to characterize the abundance and community structure of epibenthic organisms in the open waters and tributaries of New York Harbor (HydroQual, 2001c). The recruitment and survival epibenthic communities on hard substrates were evaluated because these sessile organisms are good indicators of long-term water quality. This FSAP provided a good indication of both intra- and inter-waterbody variation in organism recruitment and community composition. Artificial substrate arrays were deployed at 37 stations throughout New York Harbor, its tributaries, and at reference stations outside the harbor complex. The locations of sampling stations are shown on Figure 4-4. One station was located in the Hutchinson River. The findings of previous waterbody-specific FSAPs indicated that six months was sufficient time to characterize the peak times of recruitment, which are the spring and summer seasons. Therefore, arrays were deployed in April 2001 at two depths (where depth permitted) and retrieved in September 2001.

A special field investigation was conducted during the summer of 2002 to evaluate benthic substrate characteristics in New York Harbor tributaries (HydroQual, 2002b). The goals of this FSAP were to assist in the assessment of physical habitat components on overall habitat suitability and water quality and, assist in the calibration of the water quality models as they compute bottom sediment concentrations of total organic carbon (TOC). Physical characteristics of benthic habitat directly and critically relate to the variety and abundance of the organisms living on the waterbody bottom. These benthic organisms represent a crucial component of the food web, and, therefore, the survival and propagation of fish. Samples were collected from 103 stations in New York Harbor tributaries using a petit Ponar® Grab sampler in July 2002. The locations of sampling stations are shown on Figure 4-5. Eight stations were located in the Hutchinson River. Two samples from each station were tested for TOC, grain size, and percent solids.

In order to calibrate the model effectively, further data needed to be collected in the upper reaches of the river. In order to collect the necessary data, two new monitoring station locations were added to the existing sampling stations and sampling began in June 2005 and continued through September 2005. Existing stations, E12A, HR1, and HR2, were maintained for the 2005 sampling but were renamed HR01, HR02, and HR04, respectively. Figure 4-6 shows the locations of the monitoring stations used for this project, which are also listed in Table 4-1.

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Harbor-Wide Ichthyoplankton Sampling Stations

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Harbor-Wide Epibenthic Recruitment and Survival Sampling Stations

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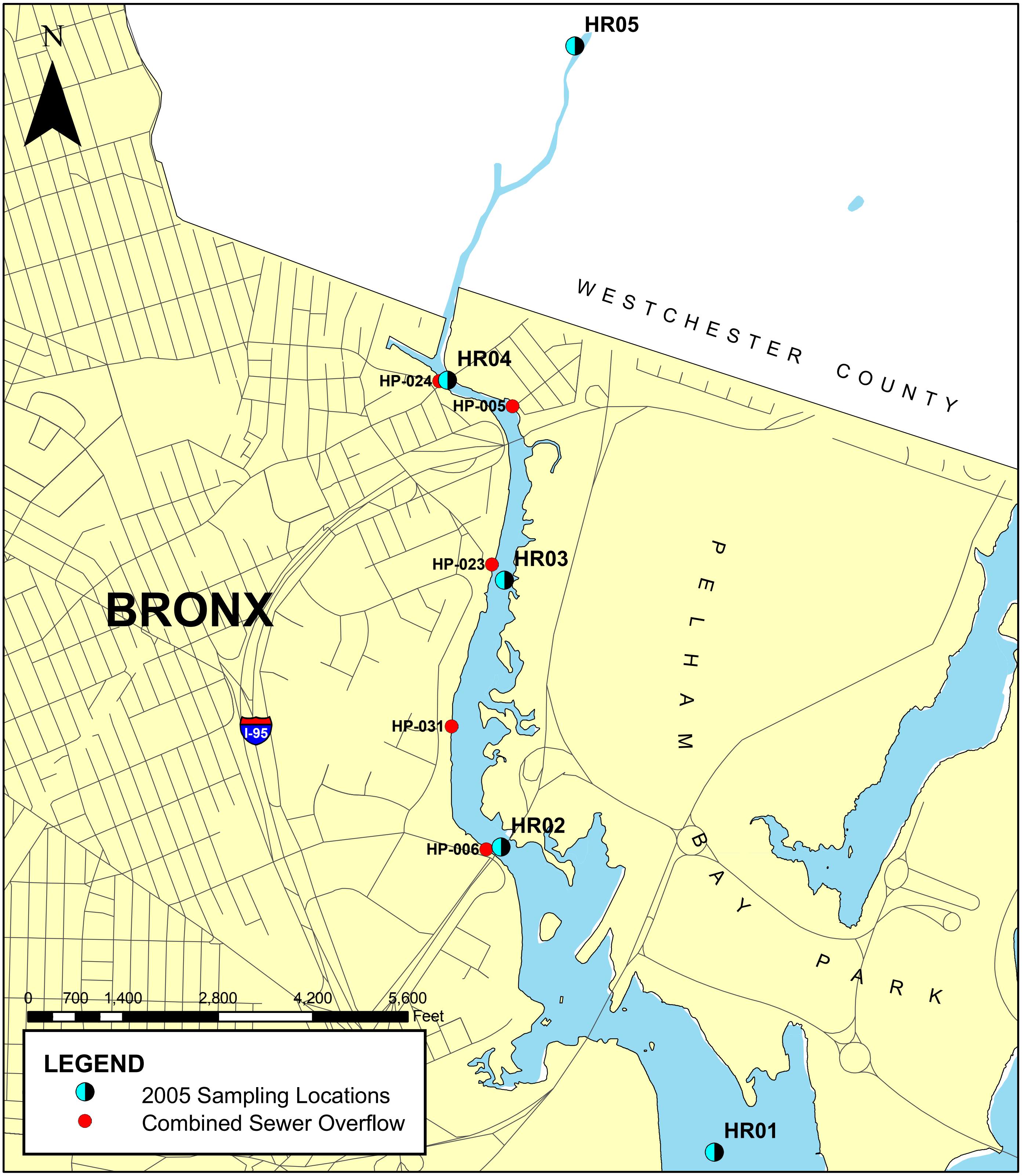
Tributary Benthos Characterization Sampling Stations



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2005 Hutchinson River Water Quality Sampling Locations

Table 4-1. Monitoring station locations

New Monitoring Station	Latitude/ Longitude	Location
HR01	40.85654 N; 73.80967 W	At the mouth of the Hutchinson River, east of Pelham Bay Landfill (HHS E12A)
HR02	40.86891 N; 73.82100 W	At Hutchinson River Parkway and Bartow Avenue, near HP-006 (HHS HR1)
HR03	40.87970 N; 73.82080 W	At Conner Street extension, near HP-023
HR04	40.88780 N; 73.82382 W	At Boston Road Bridge, near HP-024 (HHS HR2)
HR05	Sampled from land	In Clover Field Park (Mt. Vernon, Westchester Co.), downstream of E. Sandford Blvd. Bridge

Station HR05 was located upstream of the navigable portion of the Hutchinson River, where it first takes on characteristics of a more natural stream. Sampling at HR05 was conducted late on an ebbing tide since the station may have been influenced by the tide. Sampling late on an ebbing tide ensured better characterization of the upstream drainage area.

The dry weather water quality survey was done once a month for a total of 4 sampling days. Paired surface and bottom samples were collected at all five of the stations. Samples from Station HR05 were taken late on an ebbing tide, in order to better provide Westchester County upstream conditions.

Two wet weather events, one in July and one in August were sampled during the monitoring period. During wet weather paired surface and bottom samples were taken every 4-6 hours during daylight, bracketing the wet-weather event as well as possible. Generally, a storm generating ½-inch of rainfall or greater was considered large enough to induce a CSO event.

The parameters that were analyzed during the receiving water monitoring program are listed in Table 4-2. Sediment-quality samples taken at stations located near CSO outfalls were collected within 20 feet of the outfall to sample any associated sediment mound.

Table 4-2. Parameters for receiving water monitoring

Parameter	Method	Method Detection Limit Required	Units	Number of Samples Taken		
				Dry Weather	Wet Weather	Total
Total Coliform	SM 9222B	<10 cfu/100mL	n/a	96	432	528
Fecal Coliform	SM 9222D	<10 cfu/100mL	n/a	96	432	528
Enterococci	SM 9230C	5 cfu/100mL	n/a	96	432	528
Dissolved Oxygen	EPA 360.1	1	mg/L	96	432	528
CBOD-5	SM 5210B	1	mg/L	96	432	528
Particulate Organic Carbon	EPA 440.0	0.065	mg/L	96	432	528
Total Suspended Solids	EPA 160.2	1	mg/L	96	432	528

Parameter	Method	Method Detection Limit Required	Units	Number of Samples Taken		
				Dry Weather	Wet Weather	Total
Chlorophyl a	SM10200	0.005	mg/L	96	432	528
Ammonia	EPA 350.1+.2	0.01	mg/L	80	--	80
Nitrate/Nitrite	EPA 353.2	0.01	mg/L	80	--	80
Total Kjeldahl Nitrogen	EPA 351.x	0.005	mg/L	80	--	80
Total Phosphorous	EPA365.2	0.005	mg/L	80	--	80
Orthophosphate	EPA 365.x	0.001	mg/L	80	--	80
Dissolved Silica	EPA 200.7	0.1	mg/L	80	--	80

4.1.3 Other Data Gathering Programs

From 1975 through 1977, the City conducted a harbor-wide water quality study funded by a Federal Grant under Section 208 of the Water Pollution Control Act Amendments of 1972. This study confirmed tributary waters in the New York Harbor were negatively affected by CSOs. In 1984 a City-wide CSO abatement program was developed that initially focused on establishing planning areas and defining how facility planning should be accomplished. The City was divided into eight individual project areas that together encompass the entire harbor area. Four open water project areas were developed (East River, Jamaica Bay, Inner Harbor and Outer Harbor), and four tributary project areas were defined (Flushing Bay, Paerdegat Basin, Newtown Creek, and Jamaica Tributaries). Samples were collected from sewer discharges at several locations that characterized dry and wet weather discharges. Receiving water sampling locations were established from receiving water modeling support. Physical measurements of tidal dynamics, current velocity, and bathymetry were made in addition to sample collection for chemical analysis.

The NYCDEP and its predecessor city agencies have been monitoring water quality in New York Harbor waters since 1909, reporting annually in the New York City Regional Harbor Survey. The stated purpose of the program is "to assess the effectiveness of New York City's various water pollution control programs and their combined impact on water quality" (NYCDEP, 2000). Among the harbor-wide sampling locations, data has been collected at two points in the Hutchinson River, one at the upper and one at the lower sections of the river, respectively as shown on Figure 4-7.

Data has been collected by agencies and organizations throughout New York Harbor in addition to harbor monitoring and project-specific sampling programs conducted by the NYCDEP. The USEPA Regional Environmental Monitoring and Assessment Program (REMAP) (Adams et al., 1998) has evaluated sediment quality throughout New York Harbor, as has the agency's more recent five-year National Coastal Assessment (a.k.a. "Coastal 2000") program. Sampling locations are shown in Figure 4-8. The New York State Department of Transportation (TAMS, 1999) conducted studies of the biota of the East River at the Queensboro

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Hutchinson River Harbor Survey Sampling Locations

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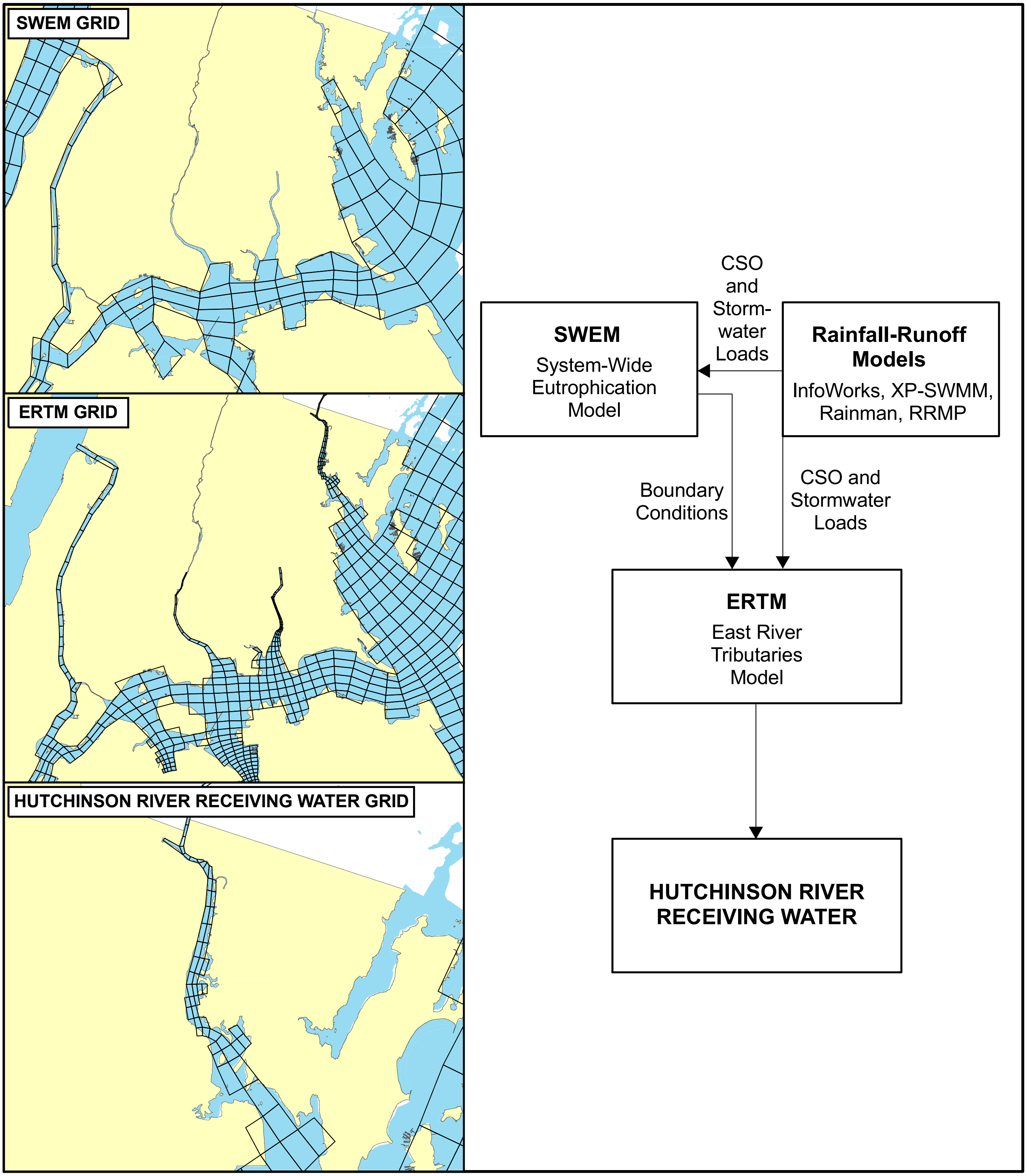
Coastal 2000 Sampling Locations in New York Harbor

Bridge, while the New York City Public Development Corporation (EEA, 1991) studied the ecology of Wallabout Bay in the East River. The USACE performed sediment profile imagery and benthic sampling in Jamaica, Upper New York, and USACE conducted a two-year study of flatfish distribution and abundance. The data from these programs are useful for comparing the Hutchinson River to similar waterbodies in the New York Harbor to ascertain its relative aquatic and ecological health. A more detailed discussion on the biology of the Hutchinson River can be found in Section 4.5.

A significant source of data on fish populations in the New York Harbor comes from the numerous studies associated with electric power generating station cooling water systems. Along with cooling water, intakes inadvertently withdraw planktonic biota and smaller fish incapable of escaping the pressure gradients generated by pumping. These organisms either pass through the cooling system (entrainment), or are trapped against the screens and other protective barriers (impingement). Permit conditions at these facilities require entrainment and impingement sampling, providing an abundance of data on fish populations and other aquatic organisms. These data are biased towards younger life-stages (fish eggs and larvae) and smaller fish species, but can provide evidence of the viability of fish species in the waterbody. Local power plants include the East River plant in lower Manhattan; the Arthur Kill plant on Staten Island; and the Ravenswood, Astoria and Poletti plants on the Queens side of the East River. ENSR (1999) reported on the East River generating station, but the most recent summary of these data was produced by Sunset Energy Fleet LLC, in its Article X application to the New York State Public Service Commission, to build and operate a power plant in Gowanus Bay (Sunset Energy Fleet, 2002). Sunset Energy also collected and analyzed numerous samples of benthic infauna, and ichthyoplankton, in Gowanus Bay in 1999 and 2000. Again, these data are useful for comparative and baseline evaluations, but do not generally provide meaningful information on the effects of water pollution control efforts by the NYCDEP.

4.1.4 Receiving Water Modeling

A set of coupled mathematical models were developed and calibrated to simulate the influence of CSO and stormwater loads on water quality in the Hutchinson River. A schematic of the mathematical models used in the Hutchinson River analysis is shown on Figure 4-9. The Hutchinson River is part of the East River Tributaries Model (ERTM), which encompasses the lower and upper East River and its principal tributaries and embayments, as well as part of western Long Island Sound. Hydrodynamic and water-quality information at ERTM's open boundaries are provided by the larger-scale System-Wide Eutrophication Model (SWEM), which encompasses all of NY-NJ Harbor, the Hudson River as far upstream as Poughkeepsie, the East River, Long Island Sound, and the continental shelf of the New York-New Jersey Bight from Cape May, New Jersey in the southwest to the Nantucket Shoals in the northeast (HydroQual, 2001d). Whereas SWEM's coarse-resolution grid provides basic hydrodynamic and water-quality results in the open waters of the model's large domain, ERTM's finer-resolution grid was designed specifically to provide more detailed hydrodynamic and water-quality results in the smaller CSO-impacted waterbodies of New York City's East River. ERTM and SWEM are both three-dimensional, time-variable, coupled hydrodynamic and water-quality models based on finite-difference approximations. A variety of calibrated watershed/ sewershed models (InfoWorks CS™, XP-SWMM, RAINMAN, RMMP) were used to determine stormwater and CSO flows and loads to the receiving waters in different parts of the model domains.



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Hutchinson River Receiving Water Modeling

FIGURE 4-9

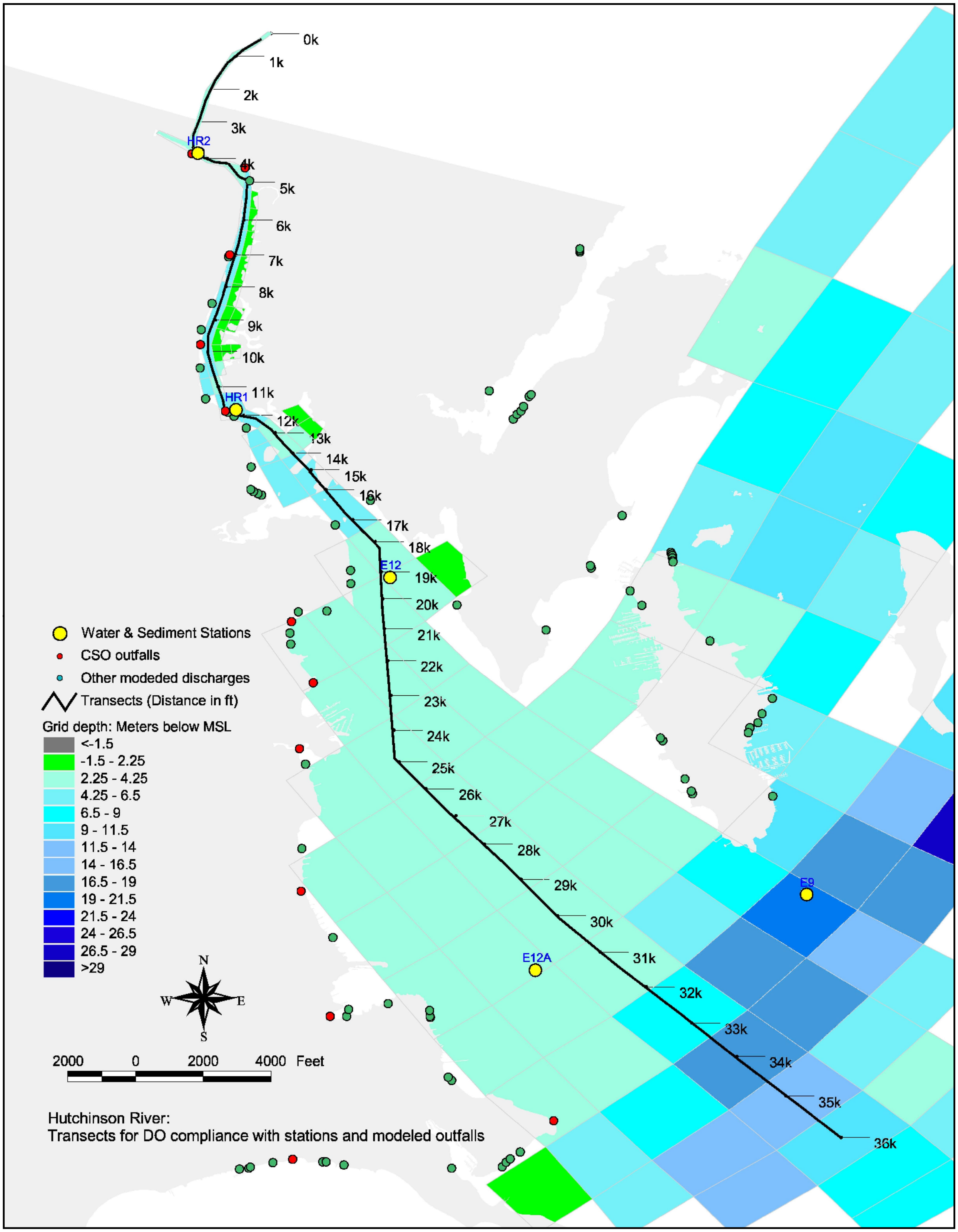
The hydrodynamic component solves the three-dimensional advection-diffusion equations for water motion and includes forcing due to winds, tides, surface heat flux, freshwater discharge, and other lateral boundary conditions. Vertical turbulent mixing is driven by a Mellor Yamada (1982) level-2.5 turbulence closure scheme as modified by Galerpin et al. (1988). ERTM hydrodynamics include a "wetting and drying" algorithm that allows the model to simulate the emergence and submergence of extensive intertidal mudflats that occur in many of the East River tributaries and embayments.

The water-quality component incorporates advection-diffusion and temperature-salinity results from the hydrodynamic models to solve three-dimensional coupled kinetic mass-balance equations describing the biochemical interactions between aquatic biota (phytoplankton, zooplankton, and benthic bivalves), nutrients (nitrogen, phosphorus, and silica), various forms of organic carbon, dissolved oxygen (DO), as well as special contaminants of interest (e.g., total and fecal coliforms and enterococci). A sediment-flux submodel couples water-column biochemistry with sediment diagenesis, remineralization of settled particulate organic matter (POM), and the resultant uptake of near-bottom DO through sediment oxygen demand (SOD). Sources of nutrient and contaminant loads to the water-quality models include wet and dry atmospheric deposition, rivers and creeks, stormwater, CSOs, and effluent from major municipal and industrial wastewater treatment plants. DO kinetics include surface reaeration, nitrification, photosythesis, metabolic oxidation, and SOD. In-stream aeration can be included as required to by water-quality projection alternatives. Figure 4-10 presents the DO transect for Hutchinson River with stations and outfalls.

The model system described above was used to establish baseline conditions against which all alternatives are compared for quantifying water-quality benefits. Table 4-3 summarizes the assumptions used for the Baseline simulation.

Table 4-3. Baseline Water-Quality Modeling Conditions

Model Component	Model	Baseline Conditions
Watershed Pollutant Flows and Loads	InfoWorks CS™, XP-SWMM, RRMP, RAINMAN	1988 precipitation for wet-weather flows; 2045 population projection for dry-weather flows; twice design dry-weather flow capacity at Hunts Point WPCP
Boundary Conditions	SWEM	1988 precipitation, meteorological and tidal forcing, river and creek discharge, and insolation; nitrogen loads in Long Island Sound adjusted to meet Phase III TMDL requirements
Regional Water Quality	ERTM	1988 precipitation, meteorological and tidal forcing, river and creek discharge, and insolation; 2045 projected WPCP loads
Receiving Water	Hutchinson River	Calculated results



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Water Quality Model Transect

4.2 PHYSICAL WATERBODY CHARACTERIZATION

The Hutchinson River, a tributary to the East River, runs 5 miles south from Scarsdale, through Westchester County and the Bronx, until it empties into Eastchester Bay. For the purpose of this report, the study area includes only the portion of the river within New York City.

The Hutchinson River exhibits diverse characteristics throughout its reaches. Much of the shoreline consists of natural areas interspersed with altered area. Exhibit 4-1 shows both the eastern and western shoreline of the river looking north. Natural areas in the southern reaches of the river generally consist of sandy areas. Natural areas located in the northern reaches of the river are comprised of vegetated parkland owned by New York City Department of Parks and Recreation (NYCDPR). Altered areas consist primarily of rip rap and bulkhead. Upland areas are generally altered, with the main exception being Pelham Bay Park.

Exhibit 4-1. Eastern and Western Shoreline of the Hutchinson River with Co-op City in the background (looking north)

4.2.1 Physical Shoreline Characterization

The shorelines of the Hutchinson River consist primarily of natural areas. The following describes the shoreline physical characteristics in detail. Refer to Figure 4-11 for a geographic presentation of the shoreline characteristics.

Shore Road to north of Boston Road (eastern shore): Nearly the entire eastern shoreline of the Hutchinson River between Shore Road and just north of Boston Road is natural as shown adjacently in Exhibit 4-2. This is a result of the majority of this stretch belonging to Pelham Bay Park. The shoreline is mostly inaccessible along this stretch, being bound by the Hutchinson River Parkway.

Exhibit 4-2. Natural Eastern Shoreline of the Hutchinson River

Shore Road to Erskine Place (western shoreline): A portion of Pelham Bay Park is located between Shore Road and Erskine Place. This area consists of natural, vegetated shoreline and extends along the shores of an inlet just west of the Bronx and Pelham Parkway. A closed landfill is located south of Shore Road. The shoreline along the perimeter of the landfill and is mainly rip-rap.

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Hutchinson River Existing Shoreline Physical Characteristics

Exhibit 4-3. Western shoreline near Co-op City

Erskine Place to Bellamy Loop North (western shoreline): The shoreline of the Hutchinson River between Erskine Place and the northern Bellamy Loop consists primarily of rip rap. This area stretches along the parkland for Co-op City South and Co-op City North. This is also one of the few areas where the river is easily accessible.

Bellamy Loop North to the New England Thruway (western shore): The western shoreline between the Bellamy Loop North and the New England Thruway (I-95) consists predominantly of altered areas of rip rap and bulkheaded shoreline. A portion of this shoreline near the Co-op City housing development is shown above in Exhibit 4-3. This area is also part of The Eastchester Bus Depot, currently owned by New York Bus Service and leased to MTA Bus.

New England Thruway to Boston Road (western shore): The western shoreline between the New England Thruway (I-95) and Boston Road consists predominantly of natural areas in a highly industrial area of the Bronx.

Exhibit 4-4. Northernmost portion of the Hutchinson River within NYC (looking north)

Boston Road to the Bronx-Westchester County Line: The western shoreline in this stretch is entirely altered. It consists of bulkheaded shoreline in a highly industrial area that includes a DSNY garage and other industrial sites. Exhibits 4-4 and 4-5 illustrate the industrial activity surrounding Outfall HP-024 in the northernmost portion of the Hutchinson River within New York City. As seen from the images, the eastern shoreline consists of bulkheaded shoreline, with areas of natural shoreline. Though some natural shoreline exists, the area is part of a metal salvage yard, where part of the property consists of a bulkheaded pier for barge docking.

For the purposes of this project, slope has been qualitatively characterized along shoreline banks where applicable and where the banks are not channelized or otherwise developed with regard to physical condition. Steep is defined as greater than 20 degrees or 40-foot vertical rise for each 100-foot horizontal distance. Intermediate is defined as 5 to 20 degrees. Gentle is defined as less than 5 degrees or 18-foot vertical rise for each 200-foot horizontal distance. In general, the classification parameters describe the shoreline slope well for the purposes of this project.

Exhibit 4-5. Western shoreline just north of Boston Road (looking south)

The slope of the Hutchinson River shoreline ranges from gentle (less than 5 degrees) to intermediate (from 5-20 degrees), as shown on Figure 4-12. The eastern shoreline of Pelham Bay Park, from the Hutchinson River Parkway to the border of Westchester County, consists generally of areas of intermediate slope interspersed with areas of gentle slope. The western shoreline of the Hutchinson River, from the Hutchinson River Parkway to the border of Westchester County, consists generally of areas of gentle slope interspersed with areas of intermediate slope.

Table 4-4 lists slope classifications for general locations along the Hutchinson River shoreline. These were determined through a review of USGS topographic maps and site field investigations.

Table 4-4: Shoreline Slope Classifications

General Location	Predominant Slope	Field Observations (see Figure 4-12)
Western Shoreline		
Shore Road to Hutchinson River Parkway	Gentle	Areas of gentle, natural slopes interspersed with intermediate slopes
Hutchinson River Parkway to Conner Street	Intermediate	Areas of gentle and intermediate slopes interspersed along this stretch
Conner Street to the New England Thruway	Intermediate/ Gentle	Length is mostly intermediate slope with rip-rap and bulkhead interspersed along this stretch
New England Thruway to Bronx-Westchester County Line	Intermediate/ Bulkhead	Areas of intermediate slope with rip-rap and bulkhead interspersed along this stretch; All bulkhead north of Boston Rd.
Eastern Shoreline		
Shore Road to Hutchinson River Parkway	Gentle	Areas of gentle, natural slopes interspersed with intermediate slopes
Hutchinson River Parkway to New England Thruway	Intermediate	Virtually all intermediate slopes
New England Thruway to the Bronx-Westchester County Line	Gentle	Dominated by gentle slopes with an occasional intermediate slope
Slope Gentle: Less than 5 degrees Intermediate: 5 to 20 degrees Steep: Greater than 20 degrees		

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Hutchinson River Existing Shoreline Slope

4.2.2 Surficial Geology/Substrata

Limited available bottom data indicate that the primary material comprising the shoreline bottom of the Hutchinson River is qualitatively classified as sand. The primary source on information utilized to identify this information is from observations of river bottom characteristics from three sampling stations using a Ponar® dredge.

4.2.3 Waterbody Type

Based on Title 6 NYCRR, Chapter X, Part 935, the Hutchinson River is classified as a Minor River – Tidal Tributary. It is a tributary of the East River. Figure 4-13 shows the Hutchinson River waterbody type.

Freshwater Systems: A review of NYSDEC Freshwater Wetland Maps indicates that there are no freshwater wetlands located within 150 feet of the Hutchinson River shoreline. National Wetlands Inventory (NWI) maps, however, define one freshwater wetland system along the shorelines of the Hutchinson River. This is discussed in more detail in Section 4.5.1.

Upland Habitat: The upland habitat of Hutchinson River is a mix of natural and altered. Figure 4-14 shows the Hutchinson River upland habitat types.

Shore Road to Bronx-Westchester County Line (western shoreline): The majority of the upland habitat between Shore Road and the Bronx-Westchester County Line is composed of altered areas. Areas of natural upland are generally scarcely vegetated. Such areas are located at the end if Watt Avenue, just south of Erskine Place, between Debbs Place and the northernmost point of Co-op City Boulevard, and between Hollers Avenue and Boston Road. An area of herbaceous communities is located just west of the Bronx and Pelham Parkway.

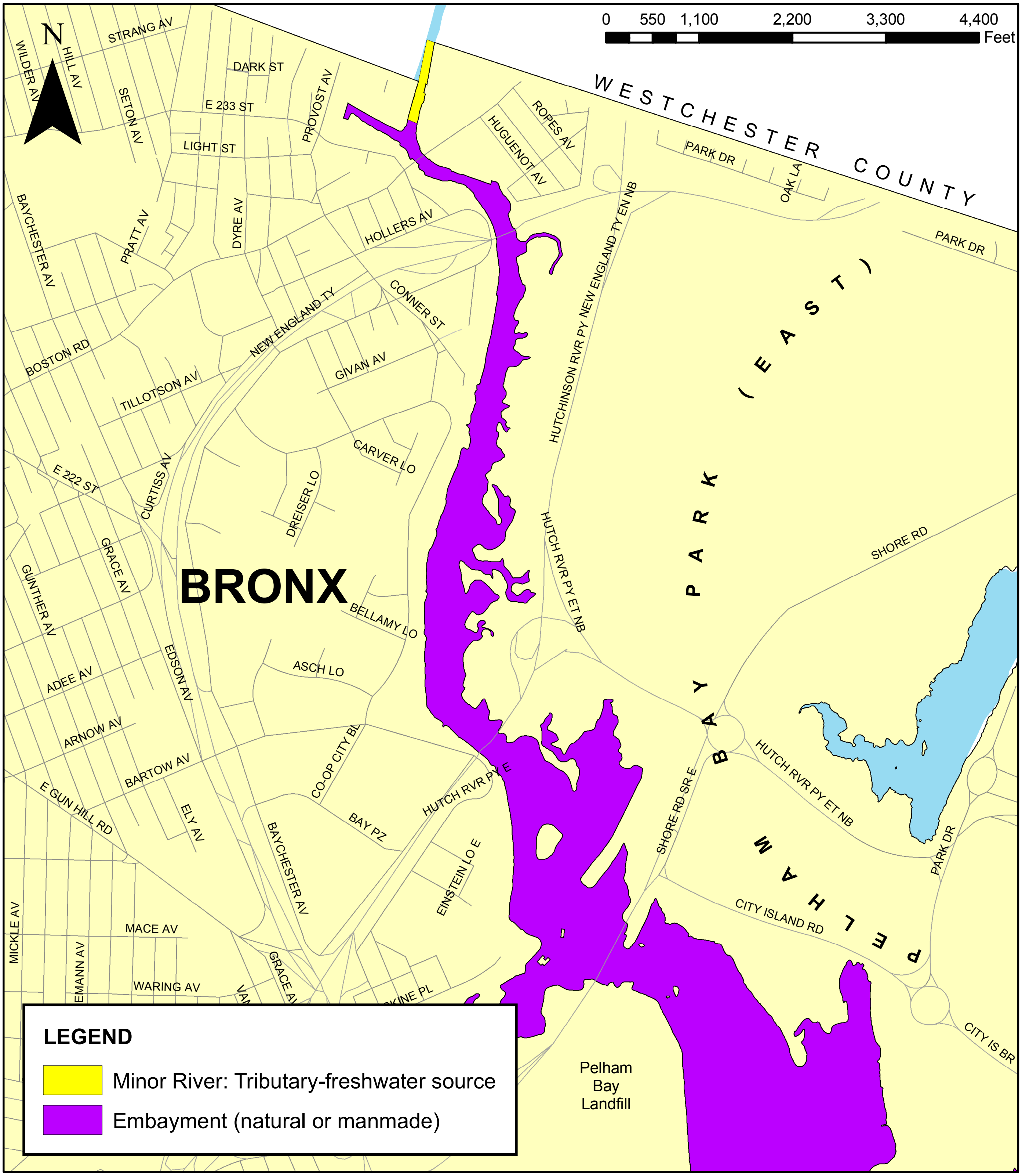
Shore Road to Bronx-Westchester County Line (eastern shoreline): The majority of the upland habitat between Shore Road and the Bronx-Westchester County Line on the eastern shore consists of natural areas with intermittent altered areas. The natural areas area generally scarcely vegetated. A stretch of herbaceous communities stretches from Conrail-Amtrak railroad to the Pelham Bay Parkway. Between the Pelham Bay Parkway and the Bronx-Westchester County line, the upland habitat is composed of altered areas.

4.2.4 Waterbody Access

The waterfront area surrounding the Hutchinson River is dominated by industry to the north and parkland in the central and southern reaches of the eastern shore. Areas of access to the waterfront are shown in Figure 4-15. The following describes the location, type, and use access of these areas:

Co-Op City North: This section of Hutchinson River north of Bellamy Loop South is part of the park area for Co-op City North. The park includes walking paths and two ball fields just north of Bellamy Loop North. The river is accessible here however canoe/kayak put-in may be difficult due to rip-rap along the shoreline.

Co-Op City South: This section of Hutchinson River north of Erskine Place and south of the Hutchinson River Parkway East is part of the park area for Co-op City South. The park includes a walking path near the water and a ball field at the termination of Einstein Loop North. The river is also accessible here and again, the canoe/kayak put-in may be difficult due to rip-rap.



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Hutchinson River Waterbody Type

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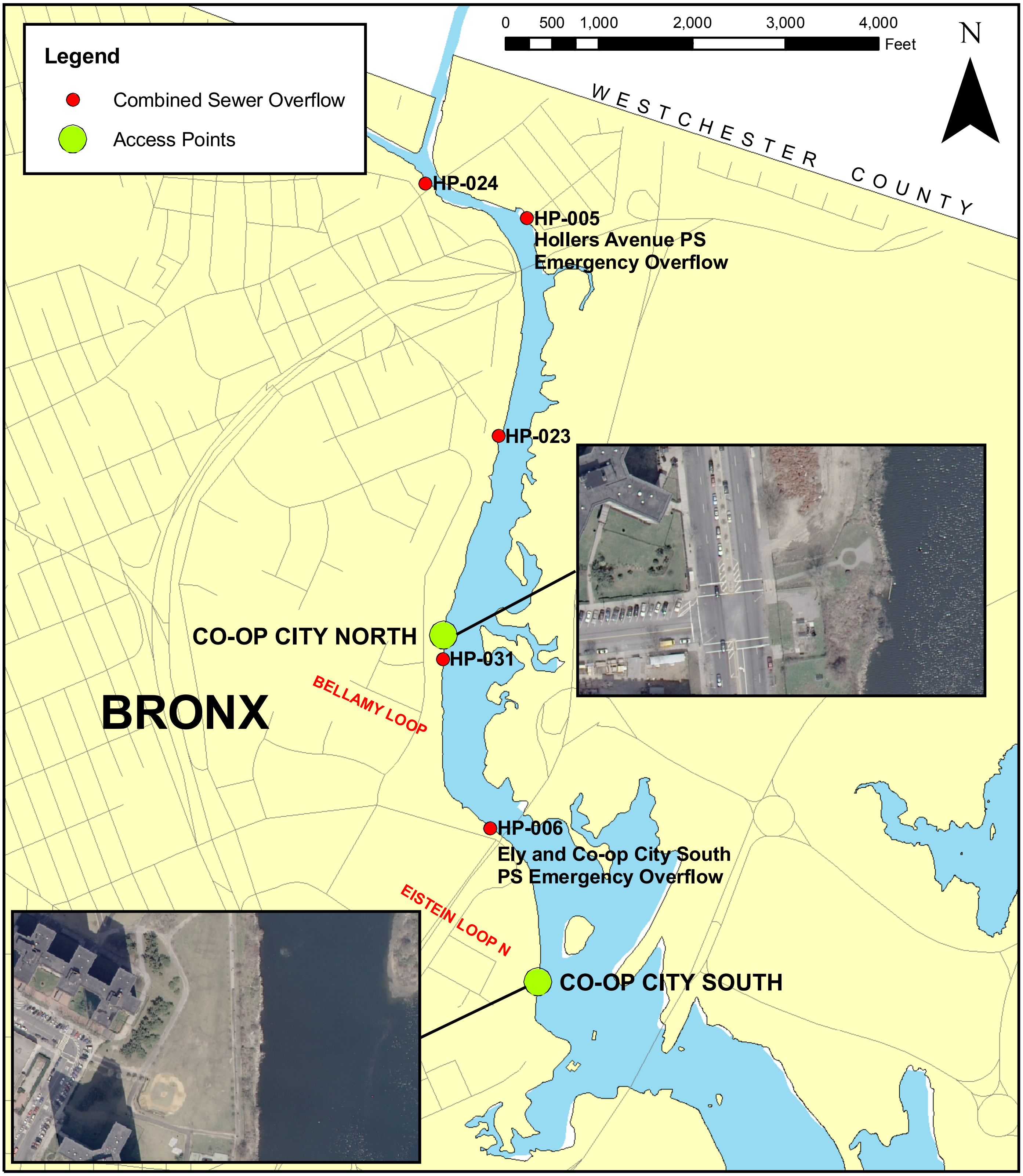
Hutchinson River Existing Upland Habitat



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Hutchinson River Access Points

There are no known areas within the study area where access is provided directly to the river for the purposes of primary or secondary contact recreation.

4.2.5 Hydrodynamics

The Hutchinson River watershed includes portions of Westchester County and the Borough of the Bronx in New York City. The Westchester County watershed is 5,779 acres. In New York City, the topographical watershed of the Hutchinson River is 3,370 acres. However, sewer system construction, urban development and other alterations to the watershed and runoff pathways have altered the watershed such that approximately 2,795 acres now drain to the Hutchinson River. The Hutchinson River drainage area in Westchester County to the location of the USGS flow gage (#01301500) at Pelham, New York is 6.04 square miles (3,866 acres). The Westchester County drainage area is 67 percent of the total Hutchinson River drainage area.

As with any coastal embayment, actual tidal conditions depend on meteorological conditions, local bathymetry, and celestial periodicities. However, the lack of natural freshwater flow and its narrow configuration makes Westchester Creek water quality particularly dependant on tidal flushing with the Upper East River waters. The Upper East River is a tidal strait, bound on the east by the Long Island Sound and on the west by Hell Gate, a narrow strait that connects to the Lower East River, which opens to the Upper New York Bay and is tidally dominated by the New York Bight. By convention, the tide is ebbing when the Upper East River is flowing towards the Long Island Sound to the east, and flooding when flowing westward.

According to Title 6 NYCRR, Chapter X, Part 935, the Hutchinson River boundary between fresh and saline surface waters is East Colonial Avenue Bridge (also known as Pelham Bridge). The river north of the East Tremont Colonial bridge is classified as a minor river-freshwater source. South of the East Tremont Colonial bridge, the Hutchinson River is classified as a tidal tributary influenced by the waters of the East River.

The Hutchinson River estuary portion has a tidal cycle diurnal with a tidal range of 2.25 to 4.25 feet. Freshwater input to the tidal Hutchinson River is the freshwater Hutchinson River, CSO, and stormwater discharges. Depths in the tidal Hutchinson River range from 4.25 to 6.5 feet at the mouth. Widths range from 200 to 350 feet at the head end to 1,600 feet at the mouth at Eastchester Bay.

4.3 CURRENT WATERBODY USES

The most common use of the Hutchinson River is for commercial boating. Secondary contact recreation in the form of boating is an additional use, although this activity is mainly prevalent in Eastchester Bay. Eastchester Bay is home to several marinas and the private beach clubs located near the mouth of the Hutchinson River.

There are no official or even un-official swimming areas currently being used in the Hutchinson River. In fact, the establishment of bathing beaches within the river is prohibited by local law (New York City Health Code).

4.4 OTHER POINT SOURCES AND LOADS

SPDES permits are issued to all individuals that discharge from a point source to waters of the United States (or storm sewers connected to them). In addition to the WPCPs discussed previously, there are a number of other individuals/businesses that meet these criteria in the Hutchinson River watershed. Each of these permit holders has the potential to impact the water quality of the Hutchinson River.

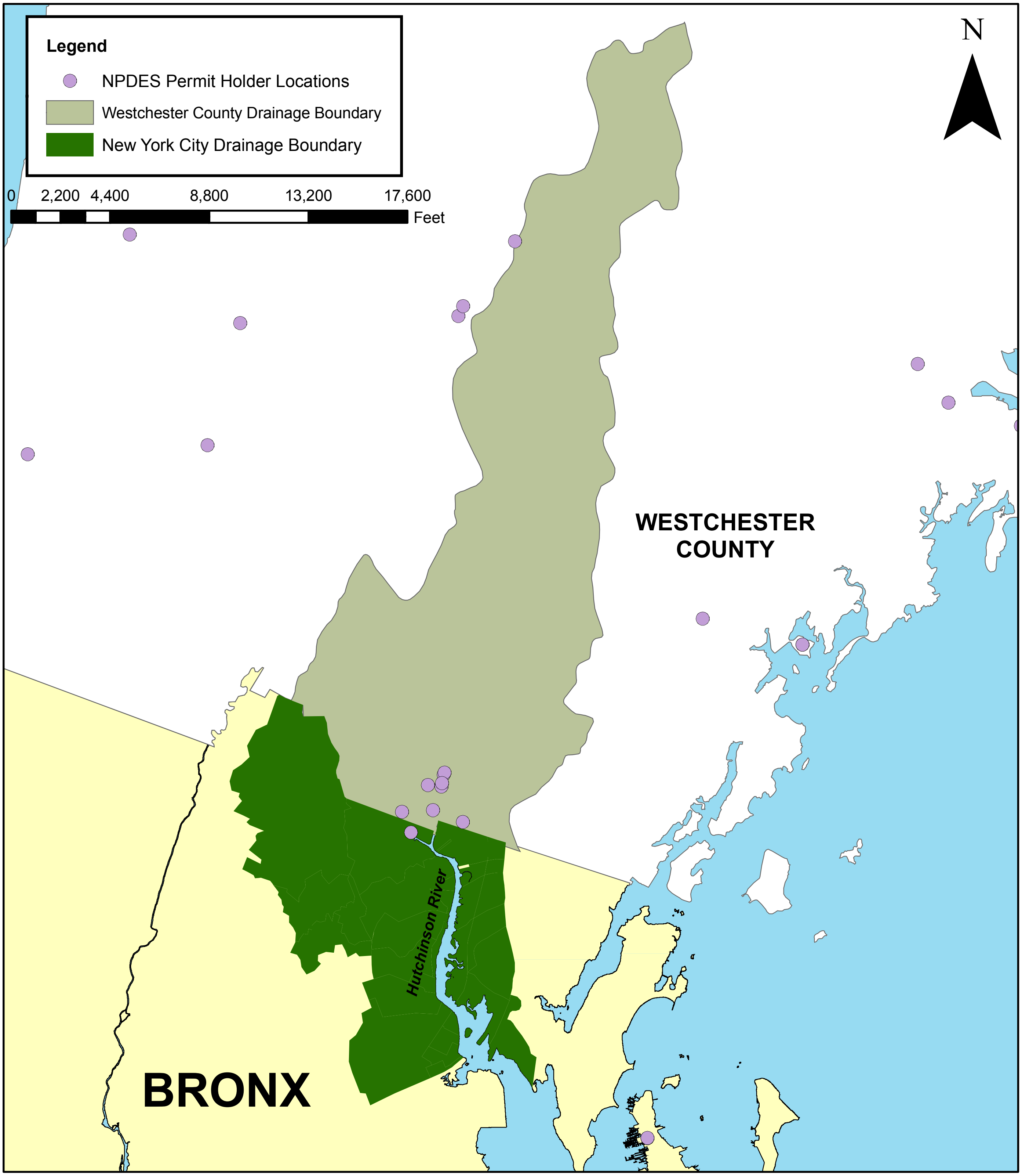
In order to determine the number and nature of the SPDES permit holders in the Hutchinson River watershed USEPA's Envirofact Warehouse (http://www.epa.gov/enviro/index.html) was used to query all NPDES permit holders in "Bronx, NY" and "Westchester County". This information was then assembled into a GIS database and overlaid with the natural water boundaries in the City and County. The review found that there are a total of nine SPDES permit holders in the Hutchinson River watershed, where eight of these are in Westchester County and one is located within the City of New York. These are located on the western and eastern shorelines of the river and encompass discharges from facilities operated by Sprague, Exxon Mobil Oil Corp, Getty Petroleum Corporation, Mount Vernon Department of Public Works City Yard, West Vernon Petroleum Corporation and the Ball Chain Manufacturing Company.

The review of environmental databases and other available information indicates that none of these potential sources of contamination are associated with existing or previous combined overflows. These sources, however, have the potential to affect water quality in the Hutchinson River. Figure 4-16 below shows the location of the permit holders within the watershed.

4.5 CURRENT WATER QUALITY CONDITONS

Water quality conditions in the Hutchinson River have been characterized by field investigations performed by the NYCDEP in association with the East River CSO Facility Planning Project, the Harbor Survey, the USA Project, and the LTCP Project under which the present document was developed. Water quality monitoring began in 1988 under the Harbor Survey and continued with the monitoring program developed for this project. Water quality parameters including dissolved oxygen, salinity, turbidity, chlorophyll, fecal coliform, ammonia, nitrate, nitrite, total kjehldahl nitrogen (TKN), phosphorus, total suspended solids, temperature, and silica have all been documented by the NYCDEP.

As part of the LTCP Project, an additional water- and sediment-quality field investigation was conducted in the Hutchinson River over an approximately four-month period from 14 June 2005 to 17 September 2005. Paired dry-weather water and sediment samples were taken approximately monthly at three stations, and two three-day wet-weather surveys were conducted for selected stations during rain events in late June and mid September 2005. These data were used to validate the tributary-specific processes developed for ERTM during the Summer 2000 Flushing Creek calibration, as well as to better assess contemporary water and sediment quality in the Hutchinson River. Table 4-5 summarizes the sediment sampling for SOD.



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NPDES Permit Holder Locations

Table 4-5. Sediment Oxygen Demand Data Summary

Sampling Location	SOD ($g/m^2/d$)	Average SOD ($g/m^2/d$)
HR04	0.76	2.49
	1.37	
	2.06	
	1.25	
	4.72	
	4.77	
HR03	2.24	3.20
	2.40	
	3.16	
	4.17	
	4.11	
	3.09	
HR02	2.47	4.93
	6.89	
	7.28	
	3.77	
	4.24	
	~~13.67~~*	

*Sampling result assumed to be an outlier and not used

4.5.1 Dissolved Oxygen (DO)

DO data collected from the USA Project was used for the analysis of DO in the Hutchinson River since it represented the most recent information (2000-2001). DO data was monitored at two locations in the Hutchinson River near the Westchester Country border and near Co-op City (marked HR2 and HR1 as shown in Figure 4-7).

DO in the Hutchinson River tends to be undersaturated in summer months. There have also been instances where the DO concentration falls below the New York State Water Quality Standard Class SB Criterion of never less than 5.0 mg/L. There are also times when DO exceeds saturation, which is usually associated with algal blooms. Typically, these concentrations are seen only when the water temperature exceeds 15°C. Each sampling location had associated DO measurements at three depths, top, middle, and bottom. The concentrations of DO did not vary significantly with depth indicating that the river is well mixed and not thermally stratified. Generally, there was no correlation between DO concentrations and location in the river, meaning that one section of the river did not have poorer/better DO levels than another section.

Table 4-6 summarizes all readily available data. The data are presented by sampling program, and year. Data have been combined for all stations to characterize the entire section of the Hutchinson River. The number of data points and statistics are given.

Table 4-6. NYC Hutchinson River Dissolved Oxygen Data Summary

Data Program	Data Period	No. of Stations	No. of Data Points	Dissolved Oxygen Average (mg/L)	Dissolved Oxygen Minimum (mg/L)
NYCDEP Harbor Survey	Summer 2000	3	6	6.2	5.6
USA Project	July-August 2000	3	22	6.6	4.4
	October 2000	2	6	3.9	3.3
	July-September 2001	5	50	8.6	0.5
	April-August 2002	2	34	8.3	1.5
LTCP Project	Summer 2005				
	Dry Weather	5	72	4.7	1.4
	Wet Weather	5	132	3.6	0.8

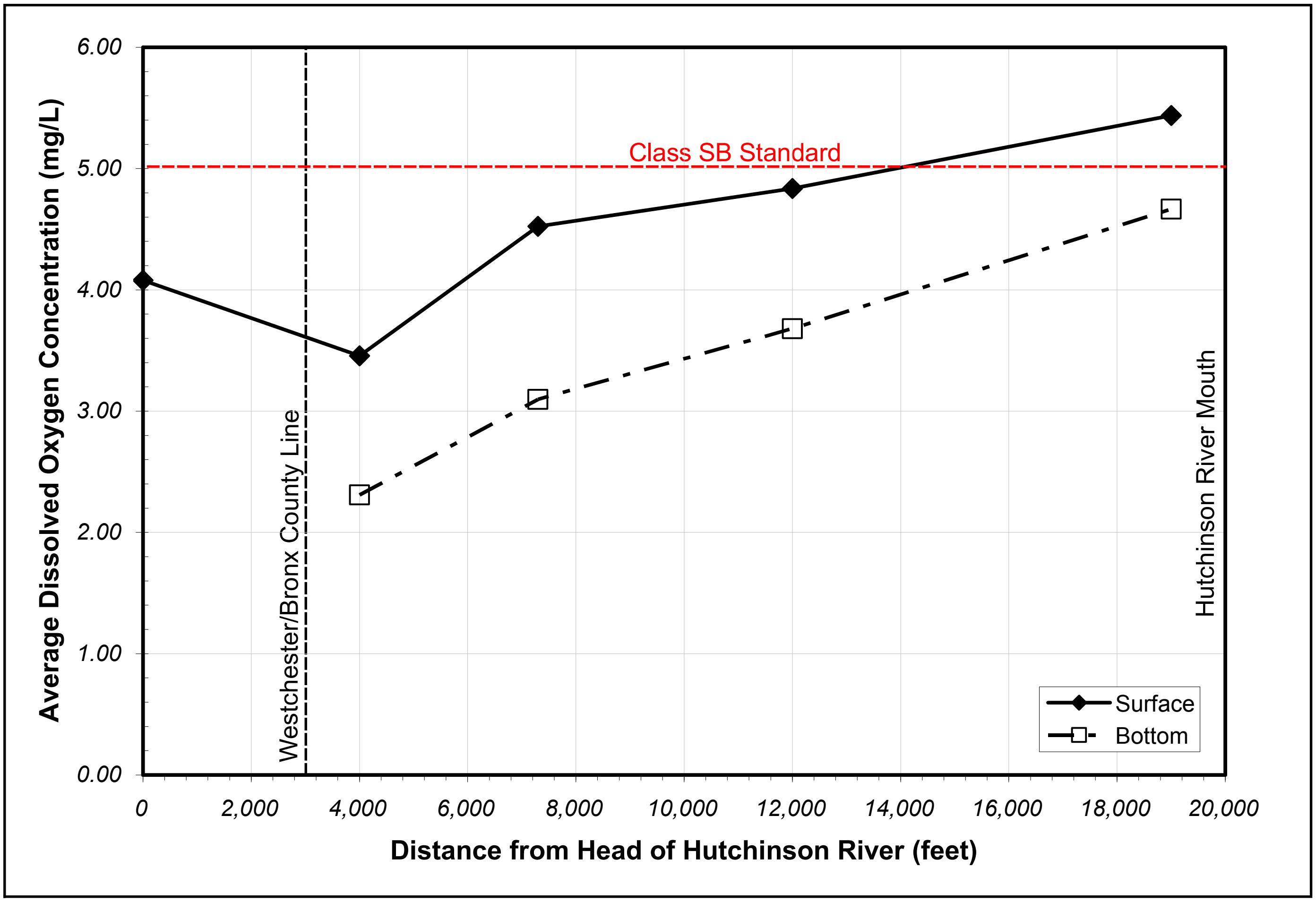
The Summer 2005 Hutchinson River DO results indicate that Baseline Case compliance with the current NYSDEC dissolved oxygen standard of never less than 5 mg/L is not achieved for bottom samples. Surface samples are in compliance only near the mouth of the river. These results are presented in Figure 4-17.

4.5.2 Bacteria

Bacteria samples were collected in the summer of 2000 at two monitoring stations located in the upper and lower portions of the Hutchinson River under the Harbor Survey. The lower portion of the Hutchinson River is located within New York City; the data collected in this location are shown in Figure 4-18. The upper portion is located within Westchester County; the data collected in this location are shown in Figure 4-19. Samples were collected at two different depths, a sample from the top of the river and a deeper sample collected at the bottom. The bacteria measurements were analyzed as fecal coliforms using the membrane filter methodology described in *The Standard Methods for the Examination of Waters and Wastewaters Sections 9222 D, 20th Edition*.

The monthly geometric mean for fecal coliforms in a class SB waterbody should be less than 200 counts per 100 mL sample. This standard has been established by the State of New York in accordance with provisions of the Clean Water Act. Table 4-7 shows the geometric mean of samples collected at the Lower Hutchinson monitoring stations for the sampling period. The geometric mean was exceeded at both monitoring stations in May and June, while the samples collected in the upper portion exceeded the standard in all three sampling months.

Fecal coliform concentrations measured at the top of the water in the Lower Hutchinson were 9 and 22 times the standard in the months of May and June, respectively. Samples collected at the top in the Upper Hutchinson in the months of May and June exceeded the standard by 16 and 30 fold, respectively.



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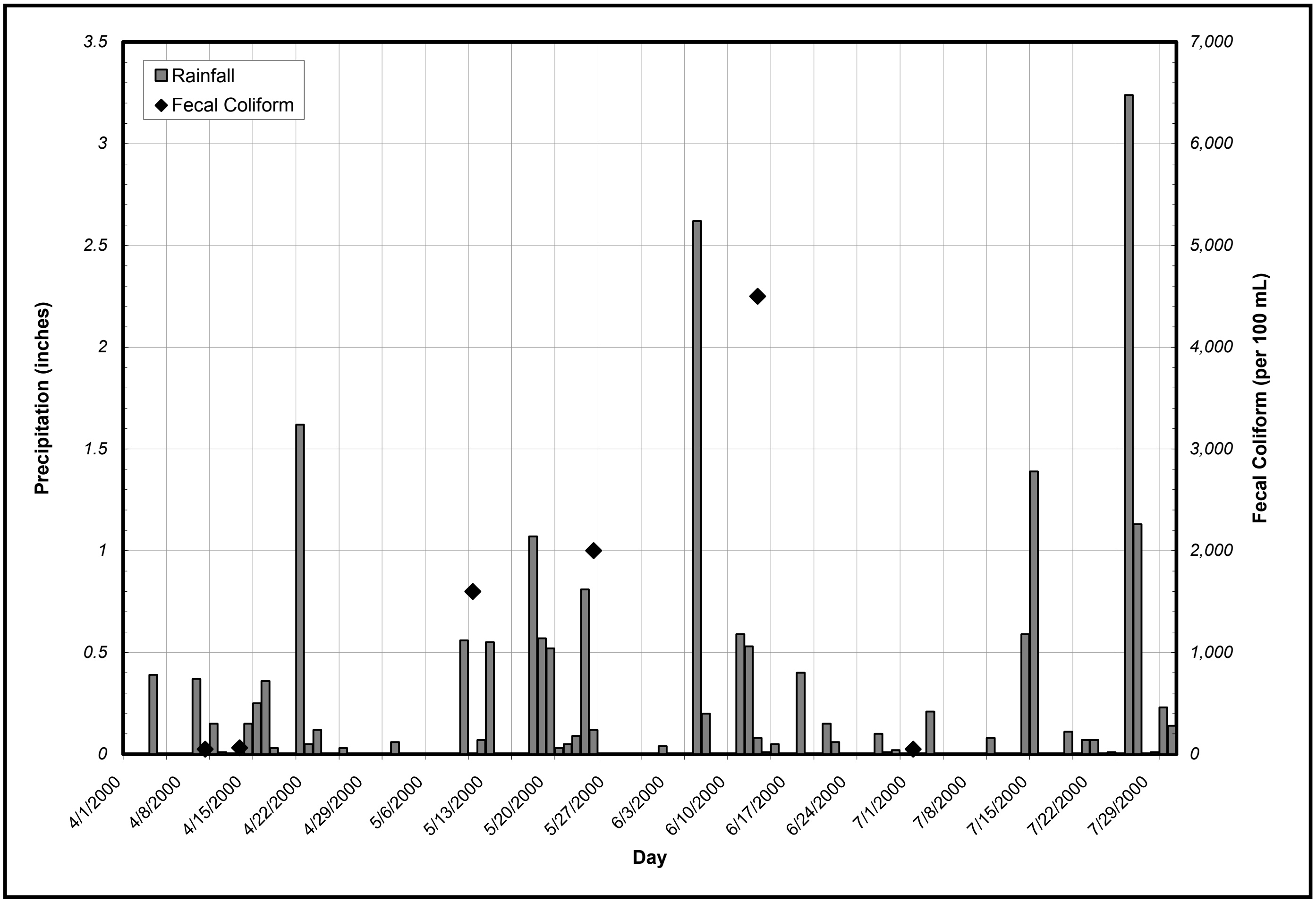
Hutchinson River Summer 2005 Dissolved Oxygen Sampling Results

FIGURE 4-17



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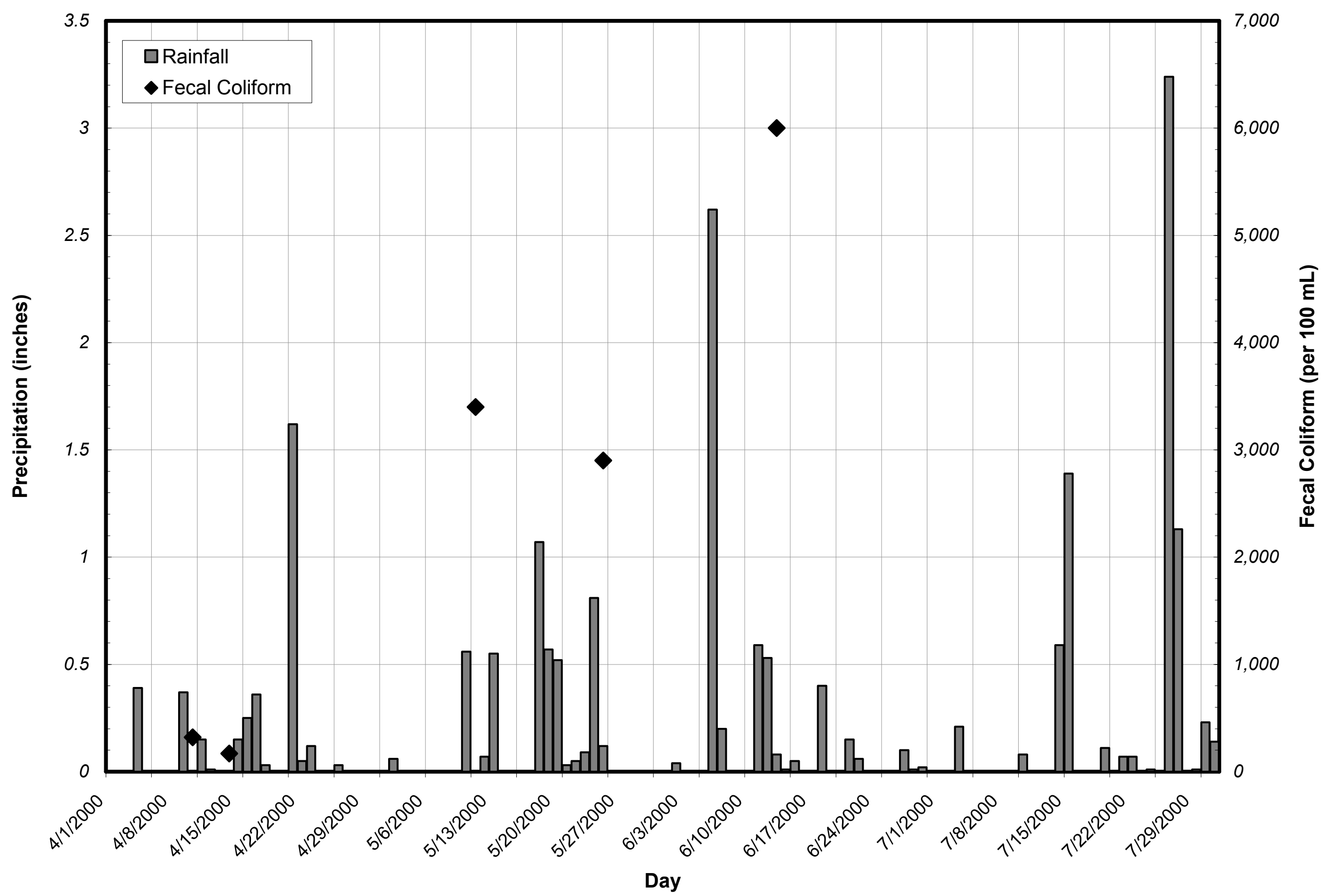
Precipitation Events and Fecal Coliform Concentrations for the Lower Hutchinson River



Precipitation Events and Fecal Coliform Concentrations for the Upper Hutchinson River

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FIGURE 4-19

Table 4-7. Fecal Coliform Results for the Hutchinson River

Monitoring Station	Month	Sample Location	Monthly Geometric Mean/100 mL
Lower Hutchinson (New York City)	April 2000	Bottom	54
		Top	57
	May 2000	Bottom	611
		Top	1789
	June 2000	Bottom	1427
		Top	4500
	July 2000	Bottom	67
		Top	50
Upper Hutchinson (Westchester County)	April 2000	Bottom	126
		Top	233
	May 2000	Bottom	1224
		Top	3140
	June 2000	Bottom	3000
		Top	6000

The data also showed that the upper portion of the Hutchinson River had higher fecal coliform concentrations than those measured downstream. There are a few different factors that could contribute to increased concentrations in the upper reaches of the river. Since the Hutchinson River watershed is shared by Westchester County and New York City, one factor that would cause higher fecal concentrations is high background concentrations from Westchester County. Another reason for the decrease in fecal coliforms downstream could be due to the fact that more of the area in the lower portion of the Hutchinson River has natural drainage, whereas the upper portion is highly urbanized and industrial. More of the stormwater runoff in the lower river is direct discharge from more natural areas such as Pelham Bay Park, while most of the stormwater in the area surrounding the northern section of the river is collected and discharged via storm and/or combined sewer outfalls. The upstream sampling location was also located adjacent to outfall HP-024, which overflows about 43 times a year for a total of 256 million gallons in an average year. Since HP-024 is such an active CSO, it would most likely influence fecal coliform concentrations in the Upper Hutchinson. One final explanation for the decrease in fecal coliforms downstream would be dilution with water from Eastchester Bay.

Additional sampling was performed, as discussed before, in the summer of 2005 in both the wet and dry conditions. The monthly geometric mean, from a minimum of five examinations, shall not exceed 200. Table 4-8 illustrates the fecal and total coliform concentrations for this period.

Table 4-8. Total and Fecal Coliform Sampling Results from Summer 2005

Sample	Cond.	HR01 Surface #/100mL	HR01 Bottom #/100mL	HR02 Surface #/100mL	HR02 Bottom #/100mL	HR03 Surface #/100mL	HR03 Bottom #/100mL	HR04 Surface #/100mL	HR04 Bottom #/100mL	HR05 Surface #/100mL
Total Coliform	Avg. Dry	4,300	2,175	9,150	8,975	20,725	14,225	36,500	55,775	109,250
	Avg. Wet	42,467	23,487	371,600	147,667	493,467	353,333	684,667	387,333	883,583
Fecal Coliform	Avg. Dry	978	164	908	569	1,275	905	1,233	6,130	4,868
	Avg. Wet	3,019	1,950	21,487	24,780	30,767	27,160	76,400	45,255	62,211

The results from the wet (during rain or shortly after) are significantly higher in both the total and fecal coliform tests. This demonstrates the effect of the combined sewer overflows during wet events adding to the coliform counts. In addition, the coliform concentration generally increases moving upstream (refer to Figure 4-6 for sample locations) with the greatest load coming above the county line in Westchester from Station HR-05. Most of the samples from the summer months did not meet the standards of the monthly geometric mean for fecal coliforms in a class SB waterbody (less than 200 counts per 100 mL) or for total coliform (less than 2,400 counts per 100 mL and 20-percent of samples not to exceed 5,000 counts per 100mL).

4.5.3 Other Pollutants of Concern

In 2004, the NYSDEC listed Lower Hutchinson River (NYC reach) as a high priority waterbody for TMDL development with its inclusion on the Section 303(d) List for Depressed DO levels. The Upper Hutchinson River (listed as Middle and Tribs) (Westchester County freshwater) were listed for the first time in 2002 for oil and grease, depressed DO, and pathogens.

The analyses discussed above in Section 4 confirm these findings. Based on this NYSDEC 303(d) List and the analyses conducted herein, no additional pollutants beyond those previously identified are pollutants of concern with respect to CSO discharges to the Hutchinson River.

However, in 2006, the Lower Hutchinson River (NYC reach) was de-listed for reasons discussed in Section 7.1. This WB/WS Facility Plan references the 2004 list to note the reason that caused the original listing.

4.6 BIOLOGY

The Hutchinson River supports aquatic communities which are similar to those found throughout the New York/New Jersey (NY/NJ) Harbor. The Hutchinson River and Eastchester Bay are situated such that they have a substantial exchange of water with western Long Island Sound, which provides somewhat higher water quality than many other tributary and bay systems around the Harbor. These aquatic communities contain typical estuarine species, but they have been highly modified by physical changes to the original watershed, shoreline, and to water and sediment quality. These changes represent constraints to the Hutchinson River in reaching its full potential to support a diverse aquatic life community and to provide a fishery resource for anglers.

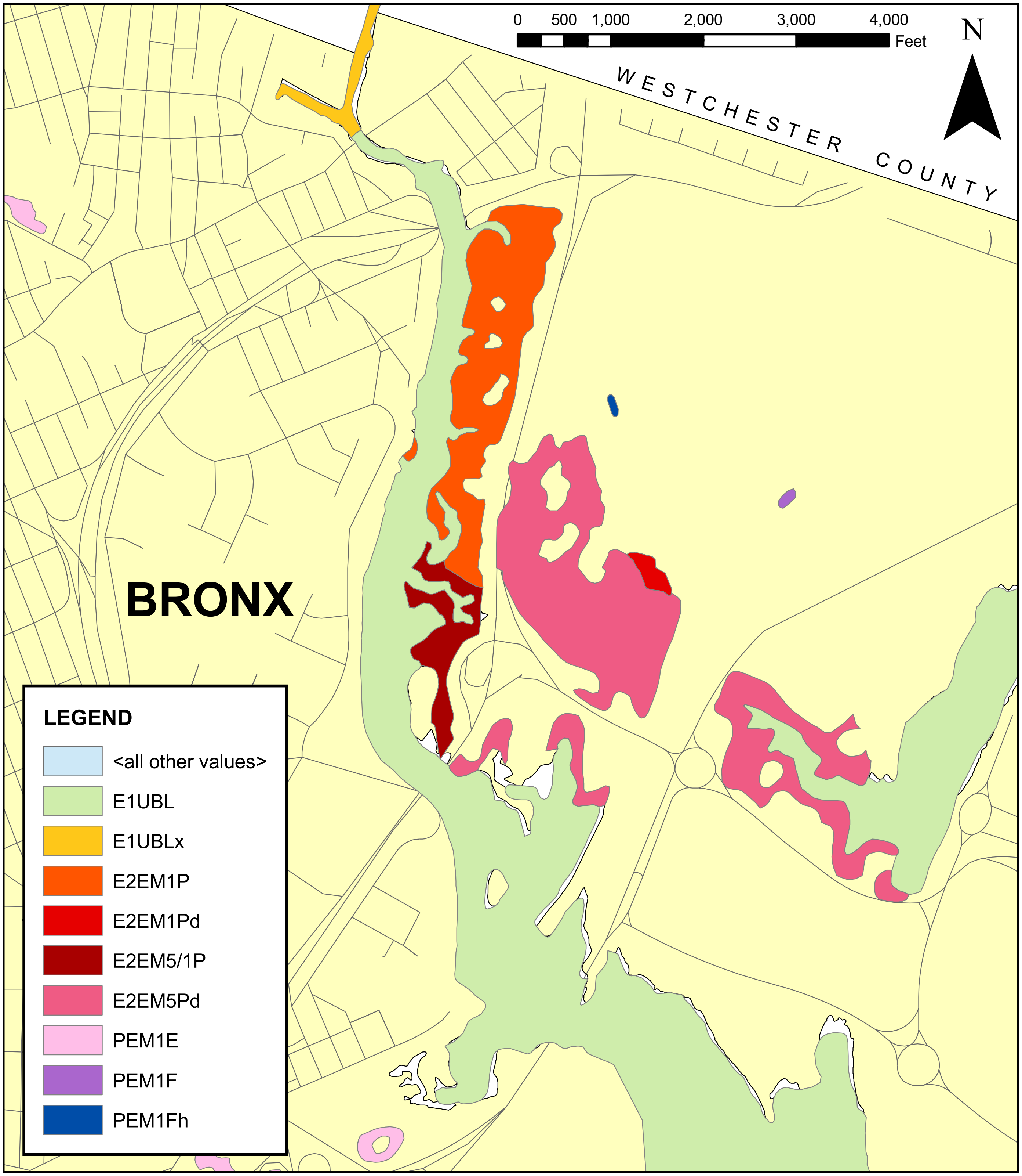
Adverse physical effects on aquatic habitats interact with degraded water and sediment quality to limit the diversity and productivity of aquatic systems. Water and sediment quality can be limiting to aquatic life when they are below thresholds for survival, growth, and reproduction. However, when these thresholds are reached or exceeded, physical habitat factors may continue to limit diversity and productivity. Improvements to water and sediment quality can enhance aquatic life use in degraded areas such as the Hutchinson River, but major irreversible changes to the watershed and the waterbody place limits on the extent of these enhancements. The Hutchinson River is part of a much larger modified estuarine/marine system, which is a major source of recruitment of aquatic life to the River; therefore, its ability to attain use standards is closely tied to overall ecological conditions in the NY/NJ Harbor. In addition, ecological conditions in Long Island Sound, and the abundance and distribution of aquatic life in this waterbody will have a significant influence on the use of Hutchinson River and Eastchester Bay.

This section describes existing aquatic communities in the Hutchinson River and provides comparison to aquatic communities found in the nearby Bronx River and Westchester Creek, as well as the open waters of the NY/NJ Harbor. This baseline information, in conjunction with projections of water and sediment quality from modeling, technical literature on the water quality and habitat tolerances of aquatic life, long term baseline aquatic life sampling data from the NY/NJ Harbor, and experience with the response of aquatic life to water quality and habitat restoration in the NY/NJ Harbor provides the foundation for assessing the response of aquatic life to CSO treatment alternatives for the Hutchinson River.

4.6.1 Wetlands

There are approximately 175 acres of wetlands along the shoreline of the Hutchinson River, with the majority of acreage on the eastern shore, south of the New England Thruway crossing. Information about these wetlands is based on a review of United States Fish and Wildlife Service NWI wetland maps (Figure 4-20).

Cowardin (1979) developed the classification scheme used for these wetlands. There are six classifications of wetlands found along the Hutchinson River: E2EM1P, E2EM5P, E2EM5/1P, E2EM5Pd, E2EM5N and E2FLN. All six wetland types are estuarine (E) and intertidal (2). In this classification scheme, estuarine describes deepwater tidal habitats and adjacent tidal wetlands with low energy and variable salinity. Intertidal is defined as the area from extreme low water to extreme high water and the associated splash zone. The wetlands are either flat (FL) or have emergent vegetation (EM). Emergent vegetation is characterized by erect, rooted, herbaceous hydrophytes (excluding mosses and lichens) that are present for most of the growing season in most years. Emergent wetlands are typically dominated by perennial plants. The emergent vegetation is classified as either persistent (1), species that normally remain standing until at least the beginning of the next growing season, or Phragmites dominated (5). Phragmites is an invasive emergent plant that forms monocultures. The flooding regime of these wetlands is classified as either irregularly flooded (P) or regularly flooded (N) and some wetlands may be affected by partial drainage (d), in which case the water table has been artificially lowered but the area can still support hydrophytes.



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Hutchinson River NWI Wetlands

The largest wetland along the Hutchinson River (68.3 acres) is estuarine and intertidal with emergent vegetation dominated by Phragmites, and is irregularly flooded and affected by partial drainage (E2EM5Pd). This wetland is located near mid-reach of the tidal Hutchinson River and is not directly adjacent to the shoreline. A small wetland (2.4 acres) classified as E2EM1Pd is adjacent to the larger wetland on the inland side. The second largest wetland (51.7 acres) is estuarine and intertidal with persistent emergent vegetation and irregular flooding (E2EM1P). This wetland is adjacent to the shoreline and extends from near the head of the tidal river (New England Thruway crossing) to mid-reach. An area of 14.6 acres has a mixed classification of E2EM5/1P and is adjacent to the shoreline and the 51.7 acre area. The distribution of the remaining wetland areas is fragmented. Four areas totaling 18 acres are classified as E2EM5P, the largest of which (9.9 acres) is on the western shore of the river. Two small wetlands (5 acres and 3.8 acres) are classified as E2M5Pd and one very small wetland (0.42 acres) on the western shore is classified as E2EM1P. Three areas totaling 11 acres are regularly flooded and classified as E2EM5N. Finally, two areas totaling 3 acres are regularly flooded flats classified as E2FLN.

All tidal wetlands are regulated by the NYSDEC. There are no New York State regulated freshwater wetlands (>12.4 acres) in the watershed of the tidal Hutchinson River. One small freshwater wetland (2.8 acres) classified as palustrine with persistent emergent vegetation and seasonal flooding (PEM1E) surrounds a small pond on the western shore of the River.

4.6.2 Benthic Invertebrates

The benthic community consists of a wide variety of small aquatic invertebrates, such as worms, mollusks and crustaceans, which live burrowed into or in contact with bottom sediments. Benthic organisms cycle nutrients from the sediment and water column to higher trophic levels through feeding activities. Suspension feeders filter particles out of the water column and deposit feeders consume particles on or in the sediment. The sediment is modified by the benthos through bioturbation and formation of fecal pellets (Wildish and Kristmanson, 1997). Grain size, chemistry and physical properties of the sediment are the primary factors determining which organisms inhabit a given area of the substrate. Because benthic organisms are closely associated with the sediment and have limited mobility, the benthic community structure reflects local water and sediment quality.

Benthic inventories have been conducted in Hutchinson River as part of the Field Sampling and Analysis Program (Hydroqual, 2002b). In July 2000, benthic sampling was conducted in three locations in the Hutchinson River, near the mouth of the river, a short distance upstream of the mouth, and near the head of the tidally influenced portion of the River at the crossing of the New England Thruway. Subtidal benthic samples were collected using a Ponar® Grab. One sediment sample per station was taken for analysis of sediment grain size and TOC content.

Overall, the Hutchinson River benthic community was moderate in diversity and abundance. The benthic community near the head of the tidally influenced Hutchinson River was low in diversity (9 taxa). At this location, polychaete worms comprised 99.4 percent of the benthic community. Oligochaete worms and the clam Tellina agilis were the only non-polychaete taxa. Streplospio benedicti was the dominant polychaete species (9,000/ m^2) and Scolecolepides viridis was the second most abundant polychaete species (248/m^2). Streplospio benedicti is a pollution tolerant organism and is an important indicator of degraded habitats because of its tolerance to organic enrichment (Gosner, 1978; Llanso, 1991; Weiss, 1995).

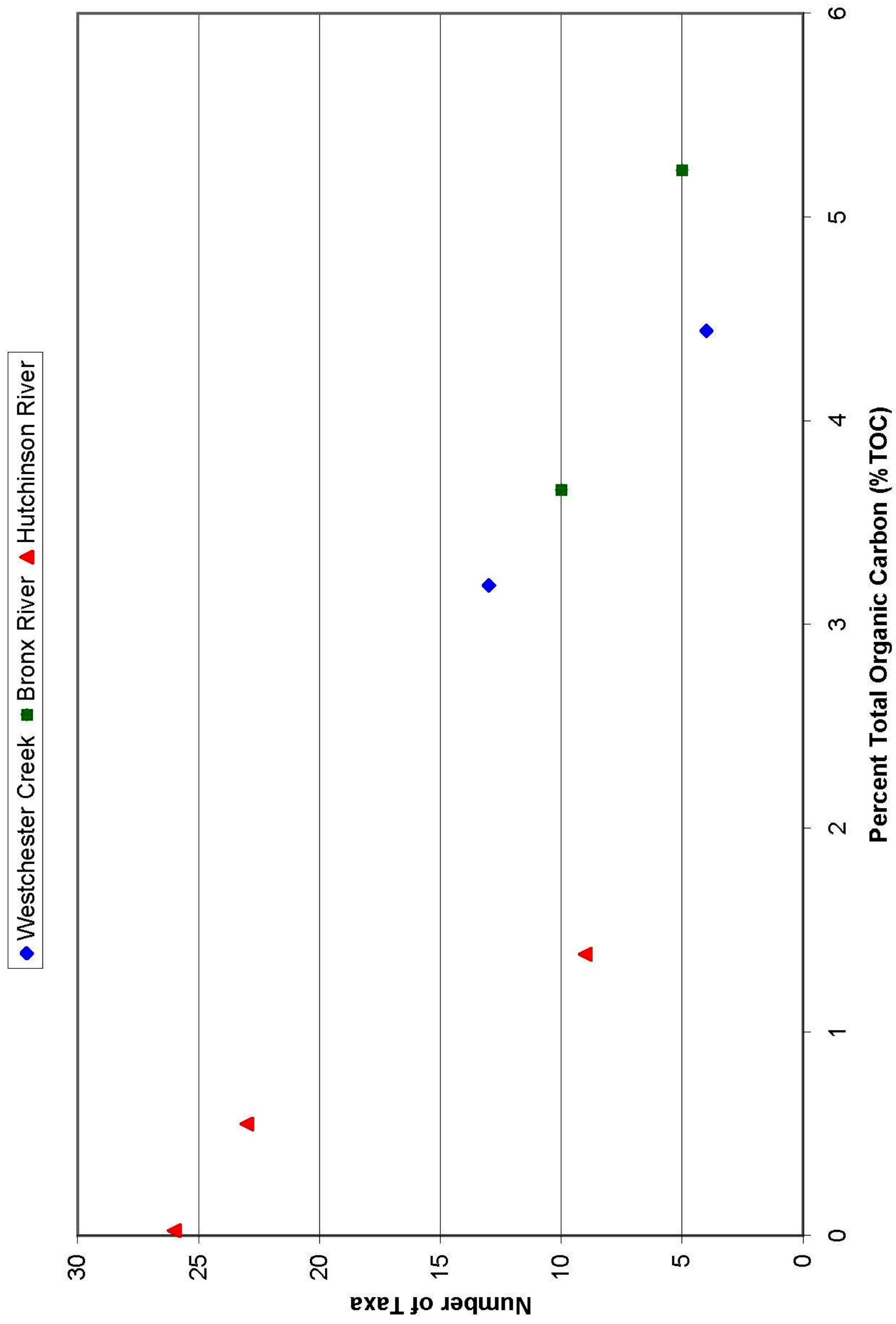
The benthic community at the sampling location upstream of the mouth of the Hutchinson River had higher diversity (23 taxa) and abundance. At this location, polychaete worms comprised 98 percent of the benthic community. Streblospio benedicti was the dominant polychaete species (22,744/ m^2). Capitella capitata was the second most abundant polychaete (1,360/ m^2), and like Streblospio benedicti, this species is pollution tolerant. Clams, amphipods and shrimp were also present, but in low numbers.

The benthic community at the sampling location at the mouth of the Hutchinson River had the highest diversity (26 taxa) and abundance. The dominant species at this location was the amphipod Ampelisca sp. (27,824/m^2). Streplospio benedicti, the amphipod Microdeutopus gryllotalpa, and the polychaete Arabella iricolor were also abundant.

The benthic community at the most upstream sampling location had low diversity and was dominated by pollution tolerant polychaetes, which indicates degraded benthic habitat quality in the upper portions of the tidal Hutchinson River. The benthic community diversity and abundance increased at the downstream stations and the benthic community at the station closest to the mouth of the River had the greatest abundance and diversity and included a large number of amphipods. This suggests that benthic habitat quality improves toward the mouth of the River.

The increase in the number of taxa at the stations near mouth of the River reflects the relationship between diversity and percent TOC presented in the FSAP (Figure 4-21). Sediments at the head of the tidal river had a TOC of 1.4 percent, and sediments upstream of the mouth and at the mouth of the River had a TOC of 0.55 percent and 0.02 percent, respectively. The station at the head of the tidal river had a greater amount of fine-grained material (23.7percent silt/clay) and lower percent solids (65.3 mg/L) than the stations upstream of the mouth (3.8percent silt/clay, 75.5 mg/L total solids) and at the mouth of the River (4.5 percent silt/clay, 70.3 mg/L total solids). Larger amounts of fine-grained material and lower percent solids, combined with higher TOC, are correlated with greater amounts of organic material in the sediment.

In areas of high levels of organic enrichment benthic communities are composed of a few small, rapidly breeding, short-lived species with high genetic variability (Pearson and Rosenberg, 1978). The Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational Scientific and Cultural Organization (UNESCO) suggested that stress to the benthic community will be greatest in sediment with TOC greater than 3 percent (Hyland *et. al.,* 2000). The range of 1 to 3 percent TOC is considered to be intermediate. This is reflected in the benthic community structure near the head of the tidal reach of the Hutchinson River. The community is dominated by pollution tolerant polychates, but small numbers of the pollution sensitive clam, Telina agilis, were also present. This suggests that the benthic community at this location is moderately impacted by organic material in the sediment. The benthic communities at the stations near the mouth of the Hutchinson River are likely not affected by excess organic material in the sediment.



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Number of Taxa versus Percent Total Organic Carbon (%TOC)

4.6.3 Epibenthic Organisms

Epibenthos live on or move over the substrate surface. Epibenthic organisms include sessile suspension feeders (mussels and barnacles), free swimming crustaceans (amphipods, shrimp, and blue crabs) and tube-dwelling polychaete worms found around the base of attached organisms. Epibenthic organisms require hard substrate, they cannot attach to substrates composed of soft mud and fine sands (Dean and Bellis, 1975). In general, the main factors that limit the distribution of epibenthic communities are: the amount of available hard substrate for settlement, species interactions, and water exchange rates. In the Hutchinson River, pier piles and bulkheads likely provide the majority of underwater substrates that can support epibenthic communities. The epibenthic communities living on underwater structures impact the ecology of the nearshore zone. Suspension feeding organisms continuously filter large volumes of water, removing seston (particulate matter which is in suspension in the water) and releasing organic particles to the sediment. This flux of organic particles (from feeding and feces) enriches the benthic community living in the sediment below piers and bulkheads (Zappala, 2001).

The epibenthic community was studied in the Hutchinson River by suspending multi-plate arrays of 8-inch x 8-inch synthetic plates in the water column. Epibenthic arrays were deployed in July 2000 in one location, upstream of the mouth of the Hutchinson River. Plates were retrieved in October 2000 and in January, April and June of 2001. Upon retrieval, the arrays were inspected and weighed and motile organisms clinging to or stuck in the arrays (e.g., crabs and fish) were counted and identified.

In the Hutchinson River 21 taxa were identified on the epibenthic arrays. The major groups were tunicates, hydroids, barnacles and polychaetes. Some plates contained mussels, gastropods, sponges, shrimp and crabs.

Only three sets of bottom arrays were recovered from the Hutchinson River, in April 2001 (3 month exposure) and June 2001 (3 and 6 month exposures). For the exposure periods where top and bottom arrays could be compared, the species diversity was similar between the arrays, but greater weights of individual species were collected from the bottom array. Typically, epibenthic communities in the NY/NJ Harbor exhibit a vertical distribution on pier piles and bulkheads (Zappala, 2001). This vertical distribution coincides with changes in water level, salinity and dissolved oxygen (DO) associated with the tides and water stratification. In the Hutchinson River, the epibenthic community that developed on test plates did not exhibit a specific vertical distribution. Most organisms were present on both top and bottom arrays. Exceptions include the fan worm Sabella microphthalma, which was only present on top arrays, and the blue mussel Mytulis edulis, which was only present on the bottom arrays. This suggests that the entire water column is being used as habitat for epibenthic organisms and that stratification and low dissolved oxygen levels do not limit epibenthic organism growth in the lower water column. Further evidence is provided by the presence of the mud crab Dyspanopeus sayi on bottom plates collected from both the middle and the mouth of the Creek. In laboratory studies, this species of mud crab has a low tolerance to hypoxia and the sensitivity of D. sayi to low DO was a main factor in USEPA's calculation of larval growth criteria (USEPA, 2000a). In the Hutchinson River it appears as if DO concentrations may be less limiting to the development of epibenthic communities than the amount of available hard substrate for settlement, recruitment and species interactions (predation and competition).

4.6.4 Phytoplankton and Zooplankton

There is little historical published data on the phytoplankton and zooplankton communities of the Hutchinson River and sampling for these communities was not conducted as part of the Hutchinson River FSAP program (NYCDEP, 2004). As part of the New York Harbor Water Quality Survey, NYCDEP collected plankton samples at a station in Weir Creek in Eastchester Bay, near the mouth of the Hutchinson River (Station E12). Samples were collected in the spring, summer and fall from 1991 to 2000. Seventy-nine samples were collected during this time period. In addition, the phytoplankton and zooplankton communities of the lower East River were investigated in the 1980s (Hazen and Sawyer, 1981). Western Long Island Sound and the East River are the sources of plankton in the Hutchinson River. One would expect a mix of these plankton communities in the Hutchinson River and Eastchester Bay.

Phytoplankton

Factors that affect phytoplankton community structure include: temperature, light, nutrients, and grazing by other organisms. Phytoplankton are also affected by all hydrodynamic forces in a waterbody. Resident times of phytoplankton species within the NY/NJ Harbor are short and these organisms move quickly through the system, limiting the time they are available to grazers (NYSDOT and MTA, 2004).

A total of 75 species of phytoplankton were collected in Eastchester Bay, near the mouth of the Hutchinson River over the course of the NYCDEP sampling. Diatoms were the dominant class of phytoplankton, followed by dinoflagellates and green algae. The most frequently collected species were Nannochloris atomus (green algae), Skeletonema costatum (diatom), Rhizosolenia delicatula (diatom), Prorocentrum redfieldii (dinoflagellate), and Perindinium sp. (dinoflagellate). Hazen and Sawyer (1981) found that the East River phytoplankton community was dominated by diatoms, and Skeletonema costatum comprised 25 percent of the community in May, July, August, and September.

Three toxic species of phytoplankton were collected in the Hutchinson River over the course of the NYCDEP sampling. Pseudo nitzchia pungens (diatom) is associated with amnesic shellfish poisoning and was collected eight times. Prorocentrum micans (dinoflagellate) is associated with diarrhetic shellfish poisoning and was collected nine times. Dinophysis acuta is also associated with diarrhetic shellfish poisoning and was collected once in Eastchester Bay. Although these species occur throughout the NY/NJ Harbor complex, they apparently do not occur in concentrations great enough to cause major problems for shellfish.

Zooplankton

A total of 17 species of zooplankton were collected in Eastchester Bay, near the mouth of the Hutchinson River over the course of the NYCDEP sampling period from 1991 to 2000. Protozoans and copepods comprised the zooplankton community. Tintinnopsis sp. (Protozoa), Eutreptia sp. (Protozoa), and copepod nauplii were the most frequently collected forms.

Hazen and Sawyer (1981) identified 26 zooplankton species in the East River. The zooplankton community was composed of three different groups based on biological and life cycle characteristics: holoplankton (organisms planktonic throughout their life cycle); meroplankton (free swimming larvae of benthic organisms) and tychoplankton (benthic organisms swept into the water column) (Hazen and Sawyer 1981). Holoplankton comprised about 70 percent of the abundance of the zooplankton community and was dominated by larval and adult forms of the copepods Acartia clausi and A. tonsa (Hazen and Sawyer 1981). Barnacle larvae were dominant in the meroplankton. The tychoplankton was comprised of amphipods, isopods and benthic protozoans.

The difference in the composition of the zooplankton measured by the two studies may be due to the fact that the NYCDEP study was targeting phytoplankton and zooplankton collections were incidental, whereas the study conducted by Hazen and Sawyer (1981) specifically targeted the zooplankton community.

4.6.5 Ichthyoplankton

Because the issue of fish propagation is integral to defining use classifications and attainment of associated water quality standards and criteria, ichthyoplankton sampling was conducted to identify any fish species spawning in the Hutchinson River or using its waters during the planktonic larval stage. Sampling was conducted in the middle and lower reaches of the Hutchinson River in March, May, July and August 2001 as part of the Hutchinson River FSAP (NYCDEP, 2004). March and May were chosen based on spawning of a variety of important species, and July and August were chosen to observe activity during anticipated worst case DO conditions.

A total of 16 taxa were collected in the Hutchinson River. Cunner, herrings, Atlantic menhaden and tautog eggs and larvae were collected in the largest numbers. The composition of the ichthyoplankton community in the Hutchinson River varied seasonally. In March, fourbeard rockling eggs dominated the ichthyoplankton community. In May, the community shifted to greater numbers of eggs of Atlantic menhaden, herrings, tautog and cunner. In July, the ichthyoplankton was dominated by larval gobies, which were the only remaining icthyoplankton by August. This shift in community structure follows seasonal species spawning activity. Overall, abundances were highest in March and May when the majority of estuarine species are spawning. In addition to gobies, larvae of bay anchovy, menhaden, herrings, weakfish, pipefish and cunner were present in the Hutchinson River during July when bottom DO concentrations tend to decrease. However, the larvae of these species were found in near-surface waters where DO concentrations tend to be higher than in bottom waters.

A greater number of species and greater numbers of individuals were collected at the station near the mouth of the River compared to the station near the middle of the River. Ichthyoplankton are planktonic (organisms drift in the water column) and some questions remain as to whether fish are spawning in the Hutchinson River or if fish are spawning in the East River and western Long Island Sound and their eggs and larvae are transported into the Hutchinson River by the tides. Because the duration of the egg stage is short (about two days after fertilization) compared to the larval stage (2-3 months depending on species) there is a relatively higher degree of confidence that an egg found in the middle of the Hutchinson River may have been spawned there. Eggs collected in the middle of the Hutchinson River were of cunner, tautog, bay anchovy, Atlantic menhaden, fourbeard rockling, and windowpane. Cunner, tautog and fourbeard rockling are structure oriented species, windowpane are bottom dwellers, and bay anchovy and Atlantic menhaden are pelagic. These species may be spawning in the Hutchinson River.

4.6.6 Adult and Juvenile Fish

The fish community of the Hutchinson River was sampled in August 2000, July and August 2001, and in April and August 2002 at one station near the mouth of the river, as part of the Hutchinson River FSAP (NYCDEP, 2004). An additional upriver station was sampled in April and August 2002. Sampling was concentrated in August to capture the period when bottom water DO concentrations are at their lowest. Sampling was performed with an otter trawl to catch bottom oriented species and a gill net suspended in the water column to capture pelagic species.

A total of 23 taxa were collected from the Hutchinson River. A greater number of species and individuals of each species were caught at the station near the mouth of the River, which reflects the greater sampling effort at this location. However, greater numbers of weakfish, blueback herring and striped bass were caught at the upriver station compared to the station near the mouth of the River. In addition, low numbers of pipefish, American eel, Atlantic herring and Atlantic silversides were caught at the upriver station but these species were not caught at the station near the mouth of the River.

At both sampling stations in the Hutchinson River, species diversity of the catches was relatively constant regardless of month or year, but species composition varied. Striped bass dominated catches in August 2000 and weakfish were the dominant species caught in July 2001. In August 2001, the number of species caught was similar to other months, but the number of fish caught was much lower. In April 2002, Atlantic menhaden dominated catches and a large number of striped bass were caught at the upriver station. In August 2002, relatively large numbers of bay anchovy, weakfish (upriver station) and striped bass (both stations) were caught, but the dominant species at the station near the mouth of the River was Stenotomus chrysops (scup).

Winter flounder, summer flounder, windowpane and scup are all bottom-dwelling or bottom-feeding species. Winter flounder and windowpane were collected in July and summer flounder and scup were collected in July and August, which suggests that they were able to tolerate DO levels in the bottom water during the summer, when DO concentrations tend to be lowest.

4.6.7 Inter-Waterbody Comparison

Comparison of the aquatic communities of the Hutchinson River with those found in the Bronx River and Westchester Creek allows further evaluation of both the potential of the Hutchinson River to support fish propagation and survival and the interactions of the tributaries with the ecology of the upper East River. The FSAP conducted in 2000 and 2001 characterized the existing water quality and aquatic communities in the Bronx River, Westchester Creek, and the Hutchinson River. The following sections briefly compare the data collected from sampling stations in these three tributaries of the upper East River.

The aquatic communities found in the Hutchinson River are similar to those found in Westchester Creek the Bronx River in terms of the species composition of the invertebrate and fish communities. However, the differences in water quality, available substrate, and food resources have resulted in differences in relative abundance and diversity of the aquatic communities in these three tributaries of the East River. In addition, the Hutchinson River is physically different than both Westchester Creek and the Bronx River, a factor which contributes to differences in the aquatic communities. The Hutchinson River has the greatest amount of natural shoreline and greater exchange with western Long Island Sound than the other two tributaries. The Hutchinson and Bronx Rivers both have non-tidal freshwater reaches, but Westchester Creek is a smaller waterbody with very limited natural freshwater inflows, and is thus dominated by tidal exchange.

As part of the FSAP, the benthic community was sampled to determine the community composition, number of species (richness), and the relationship between the number of species and their relative abundance (diversity). Sediment sampling was also conducted in order to determine grain size distribution and percent TOC. Results of the FSAP showed that the benthic community abundance and diversity in the Hutchinson River was significantly higher than both the Bronx River and Westchester Creek (Hydroqual, 2000; NYCDEP, 2004). The total number of individuals per station ranged from a low of 326/m^2 in the middle of the Bronx River to 26,128/m^2 at the mouth of the Hutchinson River. The total number of species per station ranged from four species in the middle of Westchester Creek to 23 species at the mouth of the Hutchinson River. In all three tributaries, the upper stations generally had lower diversity than the stations near the mouth. Overall the benthic community was dominated by polychaetes and pollution tolerant organisms in all three tributaries. The only exceptions were the two stations at the mouth of the Hutchinson River which had a large number of amphipods and the pollution sensitive fingernail clam, Telina agilis.

Sediment quality in the Hutchinson River appeared to be much better than in Westchester Creek and the Bronx River. Percent TOC ranged from 0.5 to 1.4 percent in the Hutchinson River, compared to 3.2 to 4.4 percent in Westchester Creek and 3.7 to 5.2 percent in the Bronx River. In addition, the percent of fine-grained material was much less in the Hutchinson River (3.8 - 23.7 percent) compared to Westchester Creek (68 - 96.8 percent) and the Bronx River (70.1 - 94 percent). Thus, it appears as if the Hutchinson River is not as affected by organic enrichment as the other two tributaries, which likely contributes to the greater benthic community diversity and abundance in the Hutchinson River.

The recruitment and survival of epibenthic communities on hard substrates was evaluated because these assemblages reflect the average water quality conditions of an area over an extended period of time (Day *et. al*., 1989). The epibenthic communities were compared among multi-plate arrays placed near the mouth of Westchester Creek, Bronx River and Hutchinson River. A total of 23 epibenthic taxa were identified at these three sites. Barnacles, tunicates, hydrozoans, and polychaetes were the dominant organisms. Green algae was also identified on plates in the Hutchinson River and Westchester Creek. The epibenthic community colonizing the plates in the top array was generally more diverse in the Hutchinson River than in the Bronx River and Westchester Creek with tunicates, polychaetes, crabs, hydroids, and algae dominating the community. The Bronx River community was dominated by barnacles. In Westchester Creek, barnacles were present but these communities did not exclude crabs, tunicates and a variety of polychaetes from settling. Total weights of species colonizing the top plates in the Hutchinson River were intermediate compared to the other two tributaries. Only one bottom array was recovered from the Hutchinson River (three-month exposure) and species composition and total weights of species colonizing the plates was similar to Westchester Creek and the Bronx River. The differences in the epibenthic community between the three tributaries may be due to differences in recruitment. Recruitment is affected by the presence of a spawning population, which is determined by availability of substrates, DO concentrations, temperature, and salinity (Dean and Bellis, 1975). Differences in salinity between the three tributaries may be caused by differences in the amount of freshwater discharge. The Bronx River and Hutchinson River have non-tidal freshwater sources but Westchester Creek does not. Recruitment can also result from transport of planktonic life stages from other areas, and this may differ between the tributaries. The Hutchinson River is closest in proximity to western Long Island Sound, which is likely a major source of recruitment to this tributary.

The ichthyoplankton community in the upper Hutchinson River was less diverse than the communities in upper Westchester Creek and the Bronx River, but abundance was similar between the three tributaries. The station near the mouth of the Hutchinson River had the highest diversity and abundance of all the stations sampled. This could be due to the availability of several different habitat types not available in Westchester Creek and the Bronx River and its proximity to relatively good habitat conditions in western Long Island Sound. The abundance and diversity of an ichthyoplankton community is dependent on several factors (NYCDEP 2004):

- spawning season;
- proximity to spawning areas;
- type of eggs and larvae (demersal or pelagic); and
- adult life stage habitat requirements.

The spawning season of a fish species will determine if water quality is a limiting factor in the potential survivability of the eggs and larvae. Bay anchovy spawn in the summer, when DO levels are at their lowest, but their eggs and larvae are found in surface waters. In May and July, bay anchovy eggs and larvae were present in all three tributaries, with the greatest abundances in the Hutchinson River. Anchovy larvae could be exposed to low DO conditions; their duration of exposure dependent upon the location of adult spawning and larval dispersal by tidal currents.

Winter flounder spawn in the winter and larvae are present in the spring, when hypoxia is infrequent. Winter flounder larvae were collected in the greatest numbers in the Hutchinson River relative to the other tributaries. However, no eggs were collected. Based on the DO levels in the Hutchinson River winter flounder eggs and larvae would be able to survive there. However, winter flounder spawn on sandy substrates and although the bottom substrates in the Hutchinson River are only 4 – 24 percent fine-grained material, this may still be outside of the preferred range of this species.

The development of the ichthyoplankton community is affected by the type of bottom substrate, type of habitat present for juvenile and adult fish, the differences in habitat diversity, and relative habitat quality. Based on the results of the FSAP, the eggs and larvae of tautog, cunner, Atlantic menhaden and herrings dominated the ichthyoplankton community found in the Hutchinson River. Atlantic menhaden and herring eggs and larvae may be transported form Long Island Sound into the Hutchinson River or the marshes along the shoreline may be used as spawning habitat for herrings. These species were not collected in large numbers from the other tributaries which could reflect both their greater distance from Long Island Sound and greater percentage of developed shoreline. Tautog and cunner are structure oriented species and eggs and larvae were present in all three tributaries. Structure in the Hutchinson River is probably provided by a combination of pier pilings and natural structure such as complex shorelines, whereas structure in Westchester Creek is likely provided almost entirely by man-made structures. Eggs and larvae of fourbeard rockling, also a structure oriented species, was present in much greater numbers in both Westchester Creek and the Bronx River relative to the Hutchinson River.

Fish are motile organisms that can choose which habitats they enter and utilize. As such, their presence or absence can be used to evaluate water quality. The lower Hutchinson River had the greatest fish diversity compared to Westchester Creek and the Bronx River. In addition, the Hutchinson River trawl samples caught more invertebrate taxa including starfish, sponges, clams, shrimp, and crabs than the other tributaries (NYCDEP, 2004). The Bronx River had the highest abundance of fish, due to collection of large numbers of weakfish and blueback herring. The Westchester Creek fish community was substantially lower in diversity and abundance than the other two tributaries.

The greater diversity of fish species in the Hutchinson River reflects the more diverse and higher quality habitat of this tributary relative to the other tributaries. In addition, greater numbers of bottom-dwelling and bottom-feeding species such as winter flounder, summer flounder, windowpane and scup, were collected from the Hutchinson River. This may be reflective of better sediment quality and less stress from low DO concentrations in the Hutchinson River relative to the other upper East River tributaries.

4.6.8 Fish and Aquatic Life Uses

Fish and aquatic life use of the Hutchinson River and Eastchester Bay has been impaired since development in the watershed permanently modified virtually all of the factors that can have a major influence on the ecological health of an estuarine waterbody. The improvement in water quality conditions through CSO abatement will enhance aquatic life uses, but other factors, primarily physical habitat, may become limiting. Enhanced aquatic life use will reach a threshold that cannot be exceeded due to irreversible alterations to the physical environment. In addition, most of the adjacent waterbodies and tributary watersheds have undergone similar physical impairments.

Long term sampling for aquatic life throughout the NY/NJ Harbor has shown how fish and benthic life are distributed with regard to a range of DO and physical habitat conditions. Generally, a wide array of fish and benthic life can use habitats with DO levels slightly below the regulatory limit of 4.0 mg/L and tolerant species can use habitats with very low DO. Harbor sampling has shown that many species will respond quickly to changes in DO by avoiding localized areas of low DO and making use of habitat during seasonally elevated DO conditions. This response to changing DO is consistent with the adaptability of estuarine species to changing environmental conditions. Aquatic life use of existing habitats when DO is near the regulatory limit involves many desirable fish and invertebrates, which are not regarded as pollution tolerant. As a result of these relationships one can expect substantial aquatic life use of the Hutchinson River at the projected DO levels for the selected treatment alternative.

The use of the Hutchinson River by aquatic life is partially limited by its degraded physical habitat. Even with DO near or about the regulatory limit, the loss of extensive fringing wetlands, diverse natural shorelines, and benthic habitat suitable for colonization have substantially reduced biological diversity. However, the Hutchinson River has an advantage over other Harbor tributaries in that there are substantial lengths of shoreline that retain natural or semi-natural conditions, which represents relatively high quality habitat. Improvement in DO and a reduction in the discharge of organic matter will result in an improvement in the sediments through reduction in the percentage of TOC in the sediment. A reduction in TOC has been shown to correlate well with an increase in benthic diversity in the substrate (NYCDEP, 2004). A review of organic enrichment of estuaries and marine waters by Pearson and Rosenberg (1978) and a recent review by Hyland et al. (2000) under the auspices of the United Nations Educational, Scientific and Cultural Organization (UNESCO) confirm the general applicability of the relationship of TOC to benthic diversity. The Hutchinson River sediments have relatively low levels of TOC and a corresponding more diverse benthic community, which tends to confirm the general relationships regarding percent TOC and benthic habitat quality.

A comparison of the upper East River tributaries supports the position that physical habitat diversity is important for biological diversity. For example, the abundance of the eggs/larvae of cunner, tautog and fourbeard rockling in the upper East River suggests that these species could increase in number if desirable physical habitat were more abundant. These species prefer structure with irregularities and interstices. Vertical bulkhead walls and piles provide some of this habitat, but man-made bulkheads tend to be smooth and regular over extensive lengths. The high productivity among a few pollution tolerant species in fine-grained sediments represents another example of poor ecological conditions. The potential gain in aquatic life usage in the Hutchinson River is less than other East River tributaries because the level of habitat degradation is less.

Seasonal non-compliance with DO standards in the Hutchinson River would not inhibit any habitat restoration programs or the development of waterfront amenities such as parkland and shoreline greenways that may be developed by other stakeholders. Wetland restoration is underway at Turtle Cove, which could result in a greater expanse of high quality wetlands. Use of these facilities for fishing or other recreational uses would not be contingent upon full compliance with water quality standards. Many of the target species for anglers in the NY/NJ Harbor, striped bass, bluefish, and weakfish are transient on a daily time scale so that angling success is not closely tied to water quality once the regulatory limit is approached or slightly exceeded.

Currently, there is a strong interest in waterfront amenities harborwide which, in part, reflects the public recognition that water quality has improved over past conditions and that the aquatic resources can be used with some limitations. The cumulative effects of improving conditions for water quality and physical habitat throughout the NY/NJ Harbor minimizes the residual effects of small areas with temporary seasonal declines in water quality on the ecosystem scale. There are continuing trends of improving water quality in adjacent waterbodies such as the East River and the tributaries of western Long Island Sound. While these trends in water quality improvement continue, the significance of small areas of non-compliance with water quality standards will be minimized.

4.7 SENSITIVE AREAS

4.7.1 CSO Policy Requirements

The CSO Policy states that sensitive areas are to be determined by the NPDES Permitting Authority in coordination with State and Federal Agencies. For NYC DEP, the permit authority is NYS DEC. The CSO Policy indicates that sensitive areas may include the following:

- Waters designated as Outstanding National Resource Waters (ONRW)
- National Marine Sanctuaries
- Public drinking water intakes
- Waters designated as protected areas for public water supply intakes
- Shellfish beds
- Waters with threatened or endangered species and their habitats
- Water with primary contact recreation

For such areas, the CSO Policy indicates the LTCP should:

a) *Prohibit new or significantly increased overflows;*

   i) *Eliminate or relocate overflows that discharge to sensitive areas wherever physically possible and economically achievable, except where elimination or relocation would provide less environmental protection than additional treatment; or*

   ii) *Where elimination or relocation is not physically possible and economically achievable, or would provide less environmental protection than additional treatment, provide the level of treatment for remaining overflows deemed necessary to meet WQS for full protection of existing and designated uses. In any event, the level of control should not be less than those described in Evaluation of Alternatives below; and*

b) *Where elimination or relocation has been proven not to be physically possible and economically achievable, permitting authorities should require, for each subsequent permit term, a reassessment based on new or improved techniques to eliminate or relocate, or on changed circumstances that influence economic achievability. (USEPA, 1994)*

4.7.2 General Assessment

An analysis of the waters of the Hutchinson River with respect to the CSO Policy was conducted and is summarized in Table 4-9.

Table 4-9 Sensitive Areas Assessment

CSO Discharge Receiving Water Segments	Current Uses Classification of Waters Receiving CSO Discharges Compared to Sensitive Areas Classifications or Designations (1)						
	ONRW	National Marine Sanctuaries	Threatened or Endangered Species or Habitat	Primary Contact Recreation	Public Water Supply Intake	PWS Protected Area	Shellfish Bed
Hutchinson River	None	None (2)	None (3)	None (4)	None (5)	None (5)	None

Notes: (1) Classifications or Designations per CSO Policy
(2) As shown at http://www.sanctuaries.noaa.gov/oms/omsmaplarge.html
(3) No endangered or threatened animals/fish per correspondence from the U.S. Fish and Wildlife Service and the National Marine Fisheries Services (NOAA Fisheries)
(4) Existing uses include secondary contact recreation and fishing.
(5) These water bodies contain salt water.

4.7.3 Waters with Threatened or Endangered Species or Their Habitat

Based on a review of Federal, State and Local listings, there are currently no threatened or endangered fish or marine animals present in the Hutchinson River.

4.7.4 Waters with Primary Contact Recreation

According to the New York State Water Quality Classifications the Hutchinson River is currently considered a Class SB saline surface water:

> *"The best usages of Class SB waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival."*

After an investigation into the Hutchinson River shoreline it was found that while the river is classified SB there are no public access points along the river for primary contact recreation (swimming). Pelham Bay Park does allow for secondary contact recreation in that it provides a location that small boats (canoes and kayaks) may be launched into the river. This launch site is however located at Orchard Beach Lagoon on the Long Island Sound side.

4.7.5 Findings

While there are wetlands present throughout Pelham Bay Park there are no sensitive areas present within the Hutchinson Bay as defined by the USEPA Long Term Control Plan Policy.

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5.0. Waterbody Improvement Projects

New York City is served primarily by a combined sewer system. Approximately 70 percent of the City is comprised of combined sewers totaling 4,800 miles within the five boroughs. The sewer system drains some 200,000 acres and serves a population of approximately 8 million New Yorkers. Approximately 460 outfalls are permitted to discharge during wet-weather through CSOs to the receiving waters of the New York Harbor. These discharges result in localized water-quality problems such as periodically high levels of coliform bacteria, nuisance levels of floatables, depressed dissolved oxygen, and, in some cases, sediment mounds and unpleasant odors.

The City of New York is committed to its role as an environmental steward of its waterways and began addressing the issue of CSO discharges in the 1950's. To date, the NYCDEP has spent or committed over $2.1 billion in its city-wide CSO abatement program. As a result of this and other ongoing programs, water quality has improved dramatically over the past 30 years (NYCDEP, 2000). Implementation of many of these solutions within the current NYCDEP 10-year capital plan will continue that trend as the NYCDEP continues to address CSO-related water quality issues through its City-Wide CSO Floatables program, pump station and collection system improvements, and the ongoing analysis and implementation of CSO abatement solutions. The following sections present the history of NYCDEP CSO abatement and describe the current and ongoing programs in detail.

5.1. CSO PROGRAMS 1950 TO 1992

Early CSO assessment programs began in the 1950s and culminated with the Spring Creek Auxiliary WPCP, a 12-million gallon CSO retention tank, constructed on a tributary to Jamaica Bay in 1972. This project was one of the first such facilities constructed in the United States. Shortly thereafter, New York City was designated by USEPA to conduct an Area-Wide Wastewater Management Plan authorized by Section 208 of the then recently enacted CWA. This plan was completed in 1979 and, in part, identified a number of urban tributary waterways throughout the City in need of CSO abatement. During the period from the mid-1970s through the mid-1980s New York City's resources were devoted to the construction of wastewater treatment plant upgrades.

In 1983, the NYCDEP invigorated its CSO facility-planning program in accordance with NYSDEC-issued SPDES permits for its wastewater treatment plants with a project in Flushing Bay and Creek. In 1985, a City-wide CSO Assessment was undertaken which assessed the existing CSO problem and established the framework for additional facility planning. From this program, the City was divided into eight areas, which together cover the entire harbor area. Four area-wide projects were developed (East River, Jamaica Bay, Inner Harbor and Outer Harbor) and four tributary project areas were defined (Flushing Bay, Paerdegat Basin, Newtown Creek, and the Jamaica tributaries). Detailed CSO Facility Planning Projects were conducted in each of these areas in the 1980s and early 1990s resulting in a series of detailed plans.

In 1989, the NYCDEP initiated the City-Wide Floatables Study in response to a series of medical waste and floating material wash-ups and resulting bathing beach closures in New York and New Jersey in the late 1980s. This comprehensive investigation identified the primary sources of floatable materials in metropolitan urban area waters, aside from illegal dumping, as CSO and stormwater discharges. The study also concluded that street litter in surface runoff is the origin of floatable materials in these sources. The Floatables Control Program is discussed in Section 5.4.

5.2. 1992 CONSENT ORDER

In 1992, the NYSDEC and the NYCDEP entered into the original CSO Administrative Consent Order (1992 ACO). As a goal, the 1992 ACO required the NYCDEP to develop and implement a CSO abatement program to effectively address the contravention of water quality standards for coliforms, dissolved oxygen, and floatables attributable to CSOs. The 1992 ACO contained compliance schedules for the planning, design and construction of the numerous CSO projects in the eight CSO planning areas.

The Flushing Bay and Paerdegat Basin CSO Retention Tanks now under construction were included in the 1992 ACO. In addition, two parallel tracks were identified for CSO planning purposes. Track 1 addressed dissolved oxygen (aquatic life protection) and coliform bacteria (recreation) issues. Track 2 addressed floatables, settleable solids and other water use impairment issues. The 1992 ACO also provided for an Interim Floatables Containment Program to be implemented consisting of a booming and skimming program in confined tributaries, skimming in the open waters of the harbor, and an inventory of street catch basins where floatable materials enter the sewer systems.

In accordance with the 1992 ACO, the NYCDEP continued to implement its work for CSO abatement through the facility-planning phase into the preliminary engineering phase. Work proceeded on the planning and design of eight CSO retention tanks located on confined and highly urbanized tributaries throughout the City. The CSO retention tanks at Flushing Bay and Paerdegat Basin proceeded to final design. The Interim Floatables Containment Program was fully developed and implemented. The Corona Avenue Vortex Facility pilot project for the floatables and settleable solids control was designed and implemented. The City's 130,000 catch basins were inventoried and a re-hooding program for floatables containment was implemented and substantially completed. Reconstruction and re-hooding of the remaining basins (less than 4 percent) will be completed by 2010.

For CSOs discharging to the open waters of the Inner and Outer Harbors areas, efforts were directed to the design of sewer system improvements and wastewater treatment plant modifications to increase the capture of combined sewage for processing at the plants. For the Jamaica Tributaries, efforts focused on correction of illegal connections to the sewer system and evaluation of sewer separation as control alternatives. For Coney Island Creek, attention was directed to corrections of illegal connections and other sewer system/pumping station improvements. These efforts and the combination of the preliminary engineering design phase work at six retention tank sites resulted in changes to some of the original CSO Facility Plans included in the 1992 ACO and the development of additional CSO Facility Plans in 1999. CSO projects currently under design or construction are presented in Table 5-1.

Table 5-1. CSO Projects Under Design or Construction

Planning Area	Project	Design Completion	Construction Completion
Alley Creek	Outfall & Sewer System Improvements	Mar2002	Dec 2006
	CSO Retention Facility	Dec 2005	Dec 2009
Outer Harbor	Regulator Improvements – Fixed Orifices	Apr 2005	Jul 2008
	Regulator Improvements – Automation	Nov 2006	Jun 2010
	Port Richmond Throttling Facility	Aug 2005	Dec 2008
Inner Harbor	Regulator Improvements – Fixed Orifices	Sep 2002	Apr 2006
	Regulator Improvements – Automation	Nov 2006	Jun 2010
	In-Line Storage	Nov 2006	Aug 2010
Paerdegat Basin	Influent Channel	Mar 1997	Feb 2002
	Foundations and Substructures	Aug 2001	Dec 2006
	Structures and Equipment	Nov 2004	Aug 2011
Flushing Bay	CS4-1 Reroute & Construct Effluent Channel	Sep 1994	Jun 1996
	CS4-2 Relocate Ball fields	Sep 1994	Aug 1995
	CS4-3 Storage Tank	Sep 1996	Aug 2001
	CS4-4 Mechanical Structures	Feb 2000	Dec 2004
	CS4-5 Tide Gates	Nov 1999	Apr 2002
	CD-8 Manual Sluice Gates	May 2003	Jun 2005
Jamaica Tributaries	Meadowmere & Warnerville DWO Abatement	May 2005	Mar 2009
	Expansion of Jamaica WPCP Wet Weather Capacity	Jun 2011	Jun 2015
	Destratification Facility	Oct 2006	Dec 2008
	Laurelton & Springfield Stormwater Buildout Drainage Plan	Jan 2008	
	Regulator Automation	Nov 2006	Jun 2010
Coney Island Creek	Avenue V Pumping Station Upgrade	Jan 2005	Apr 2011
	Avenue V Force Main	Sep 2006	Jun 2012
Newtown Creek	Aeration Zone I	Dec 2004	Dec 2008
	Aeration Zone II	Jun 2010	Jun 2014
	Relief Sewer/Regulator Modification	Jun 2009	Jun 2014
	Throttling Facility	Jun 2008	Dec 2012
	CSO Storage Facility	Nov 2014	Dec 2022
Westchester Creek	Phase 1 (Influent Sewers)	Jun 2010	Jun 2015
	CSO Storage Facility		Dec 2022
Bronx River	Floatables Control	Jul 2008	Jun 2012
Hutchinson River	Phase I of Storage Facility	Jun 2010	Jun 2015
	Future Phases		Dec 2023
Jamaica Bay	Spring Creek AWPCP Upgrade	Feb 2002	Apr 2007
	26th Ward Drainage Area Sewer Cleaning & Evaluation	Jun 2007	Jun 2010
	Hendrix Creek Dredging	Jun 2007	Jun 2010
	26th Ward Wet Weather Expansion	Jun 2010	Dec 2015

5.3. BEST MANAGEMENT PRACTICES

The SPDES permits for all 14 WPCPs in New York City require NYCDEP to report annually on the progress of 14 BMPs related to CSOs. The BMPs are equivalent to the NMCs required under the USEPA National Combined Sewer Overflow policy, which were developed by USEPA to represent best management practices that would serve as technology based CSO controls. They were intended to be the best available technology based controls that could be implemented within 2-years by permittees. USEPA developed two guidance manuals that embodied the underlying intent of the NMCs (USEPA, 1995b; USEPA, 1995c) for permit writers and municipalities, offering suggested language for SPDES permits and programmatic controls that may accomplish the goals of the NMCs.

A list of BMPs excerpted directly from the most recent SPDES permits follows, along with brief summaries of each BMP and their respective relationships to the federal NMCs. In general, the BMPs address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO and reduce contaminants in the combined sewer system, thereby reducing water quality impacts. Through the annual reports, which were initiated in 2004 for the reporting year 2003, the NYCDEP provides brief descriptions of the City-wide programs and any notable WPCP drainage area specific projects that address each BMP.

5.3.1. CSO Maintenance and Inspection Program

This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and NMC 9 (Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls). Through regularly scheduled inspection of the CSOs and the performance of required repair, cleaning, and maintenance, dry weather overflows and leakage can be prevented and maximization of flow to the WPCP can be ensured. Specific components of this BMP include:

- Inspection and maintenance of CSO tide gates;
- Telemetering of regulators;
- Reporting of regulator telemetry results;
- Recording and reporting of rain events that cause dry weather overflows; and
- NYSDEC review of inspection program reports.

The NYCDEP reports on the status of the City-wide program components and highlights specific maintenance projects, such as the Enhanced Beach Protection Program, where additional inspections of infrastructure in proximity to sensitive beach areas was performed.

5.3.2. Maximum Use of Collection System for Storage

This BMP addresses NMC 2 (Maximum Use of the Collection System for Storage) and requires the performance of cleaning and flushing to remove and prevent solids deposition within the collection system as well as an evaluation of hydraulic capacity so that regulators and weirs can be adjusted to maximize the use of system capacity for CSO storage and thereby reduce the amount of overflow. The NYCDEP provides general information describing the status of City-wide SCADA, regulators, tide gates, interceptors, and collection system cleaning in the BMP Annual Report.

Sediment Removal

Sediment buildup was detected within Internal Overflow 18 (IO-18), which is located at the intersection of Palmer and Givan Avenues and diverts overflows to Outfall HP-023. The cost to remove the sediment is estimated at approximately $50,000. The NYCDEP will continue to provide regular inspections and cleaning in the future to assure that the condition does not redevelop and result in a loss of storage capacity in the sewer system.

5.3.3. Maximize Flow to WPCP

This BMP addresses NMC 4 (Maximizing Flow to the Publicly Owned Treatment Works) and reiterates the WPCP operating targets established by the SPDES permits with regard to the ability of the WPCP to receive and treat minimum flows during wet weather. The collection systems are required to deliver and the WPCPs are required to accept the following flows for the associated levels of treatment:

- Receipt of flow through the headworks of the WPCP: 2×DDWF;
- Primary treatment capacity: 2×DDWF; and
- Secondary treatment capacity: 1.5×DDWF.

The BMP also refers to the establishment of collection system control points in the system's Wet Weather Operating Plan as required in BMP #4, and requires the creation of a capital compliance schedule within six months of the NYSDEC approval of the Wet Weather Operating Plan should any physical limitations in flow delivery be detected.

In addition to describing WPCP upgrades and efforts underway to ensure appropriate flows to all 14 WPCPs, the BMP Annual Report provides analysis of the largest 10 storms of the year and WPCP flow results for each of these storms.

5.3.4. Wet Weather Operating Plan

In order to maximize treatment during wet weather events, WWOPs are required for each WPCP drainage area. Each WWOP should be written in accordance with the NYSDEC publication entitled *Wet Weather Operations and Wet Weather Operating Plan Development for Wastewater Treatment Plants*, and should contain the following components:

- Unit process operating procedures;
- CSO retention/treatment facility operating procedures, if relevant for that drainage area; and
- Process control procedures and set points to maintain the stability and efficiency of BNR processes, if required.

This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and NMC 4 (Maximizing Flow to the Publicly Owned Treatment Works). The NYCDEP provides a schedule of plan submittal dates as part of the BMP Annual Report.

5.3.5. Prohibition of Dry Weather Overflow

This BMP addresses NMC 5 (Elimination of CSOs During Dry Weather) and NMC 9 (Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls) and requires that any dry weather flow event be promptly abated and reported to NYSDEC within 24 hours. A written report must follow within 14 days and contain information per SPDES permit requirements. The status of the shoreline survey, the Dry Weather Discharge Investigation report, and a summary of the total bypasses from the treatment and collection system were provided in the BMP Annual Report.

5.3.6. Industrial Pretreatment

This BMP addresses three NMCs: NMC 3 (Review and Modification of Pretreatment Requirements to Determine Whether Nondomestic Sources are Contributing to CSO Impacts); NMC 7 (Pollution Prevention Programs to Reduce Contaminants in CSOs); and NMC 9 (Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls). By regulating the discharges of toxic pollutants from unregulated, relocated, or new SIUs tributary to CSOs, this BMP addresses the maximization of persistent toxics treatment from industrial sources upstream of CSOs. Specific components of this BMP include:

- Consideration of CSOs in the calculation of local limits for indirect discharges of toxic pollutants;
- Scheduled discharge during conditions of non-CSO, if appropriate for batch discharges of industrial wastewater;
- Analysis of system capacity to maximize delivery of industrial wastewater to the WPCP, especially for continuous discharges;
- Exclusion of non-contact cooling water from the combined sewer system and permitting of direct discharges of cooling water; and
- Prioritization of industrial waste containing toxic pollutants for capture and treatment by the POTW over residential/commercial service areas.

The BMP Annual Report addresses the components of the industrial pretreatment BMP through a description of the City-wide program.

5.3.7. Control of Floatable and Settleable Solids

This BMP addresses NMC 6 (Control of Solid and Floatable Material in CSOs), NMC 7 (Pollution Prevention Programs to Reduce Contaminants in CSOs), and NMC 9 (Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls) by requiring the implementation of four practices to eliminate or minimize the discharge of floating solids, oil and grease, or solids of sewage origin which cause deposition in receiving waters, i.e.:

- Catch Basin Repair and Maintenance: This practice includes inspection and maintenance schedules to ensure proper operation of basins;
- Catch Basin Retrofitting: By upgrading basins with obsolete designs to contemporary designs with appropriate street litter capture capability, this program is intended to increase the control of floatable and settleable solids, City-wide;

- Booming, Skimming and Netting: This practice establishes the implementation of floatables containment systems within the receiving waterbody associated with applicable CSO outfalls. Requirements for system inspection, service, and maintenance are established, as well; and
- Institutional, Regulatory, and Public Education - A one-time report must be submitted examining the institutional, regulatory, and public education programs in place City-wide to reduce the generation of floatable litter. The report must also include recommendations for alternative City programs and an implementation schedule that will reduce the water quality impacts of street and toilet litter.

The annual report provides summary information regarding the status of the catch basin and booming, skimming, and netting programs City-wide.

5.3.8. Combined Sewer System Replacement

This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls), requiring all combined sewer replacements to be approved by New York State Department of Health (NYSDOH) and to be specified within the NYCDEP Master Plan for Sewage and Drainage. Whenever possible, separate sanitary and storm sewers should be used to replace combined sewers. The BMP Annual Report describes the general, City-wide plan and addresses specific projects occurring in the reporting year.

5.3.9. Combined Sewer/Extension

In order to minimize storm water entering the combined sewer system, this BMP requires combined sewer extensions to be accomplished using separate sewers whenever possible. If separate sewers must be extended from combined sewers, analysis must occur to ensure that the sewage system and treatment plant are able to convey and treat the increased dry weather flows with minimal impact on receiving water quality.

This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and a brief status report is provided in each BMP Annual Report, including specific projects occurring in the reporting year.

5.3.10. Sewer Connection & Extension Prohibitions

This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and prohibits sewer connections and extensions that would exacerbate recurrent instances of either sewer back-up or manhole overflows. Wastewater connections to the combined sewer system downstream of the last regulator or diversion chamber are also prohibited. The BMP Annual Report contains a brief status report for this BMP and provides details pertaining to chronic sewer back-up and manhole overflow notifications submitted to the NYSDEC when necessary.

5.3.11. Septage and Hauled Waste

The discharge or release of septage or hauled waste upstream of a CSO (i.e., scavenger waste) is prohibited under this BMP. Scavenger wastes may only be discharged at designated manholes that never drain into a CSO, and only with a valid permit. This BMP addresses NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer

Overflow Outfalls). The BMP Annual Report summarizes the three scavenger waste acceptance facilities controlled by NYCDEP, all of which are downstream of CSO regulators, and the regulations governing discharge of such material at the facilities.

5.3.12. Control of Run-off

This BMP addresses NMC 7 (Pollution Prevention Programs to Reduce Contaminants in CSOs) by requiring all sewer certifications for new development to follow NYCDEP rules and regulations, to be consistent with the NYCDEP Master Plan for Sewers and Drainage, and to be permitted by NYCDEP. This BMP ensures that only allowable flow is discharged into the combined or storm sewer system.

The BMP Annual Report refers to the NYCDEP permit regulations required of new development and sewer connections.

5.3.13. Public Notification

This BMP requires easy-to-read identification signage to be placed at or near CSO outfalls with contact information for the NYCDEP to allow the public to report observed dry weather overflows. All signage information and appearance must comply with the Discharge Notification Requirements listed in the SPDES permit. This BMP also requires that a system be in place to determine the nature and duration of an overflow event, and that potential users of the receiving waters are notified of any resulting, potentially harmful conditions. The BMP does allow NYCDHMH to implement and manage the notification program.

This BMP addresses NMC 8 (Public Notification) as well as NMC 1 (Proper Operations and Maintenance of Combined Sewer Systems and Combined Sewer Overflow Outfalls) and NMC 9 (Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls). The NYCDEP provides the status of the CSO signage program in the BMP Annual Report and lists those former CSO outfalls that no longer require signs. In addition, descriptions of new educational signage and public education-related partnerships are described. The NYCDHMH CSO public notification program is also summarized.

5.3.14. Annual Report

This BMP requires an annual report summarizing implementation of the BMPs, including lists of all existing documentation of implementation of the BMPs, be submitted by April 1st of each year. This BMP addresses all nine minimum controls. As of June 2007, the most recent BMP Annual Report submitted was for calendar year 2006.

5.4. CITY-WIDE CSO PLAN FOR FLOATABLES ABATEMENT

The NYCDEP developed a floatables abatement plan for the CSO areas of New York City in June 1997. An update of the Comprehensive Plan was subsequently drafted in 2004 and further modified in 2005 (City-Wide Comprehensive CSO Floatable Plan, Modified Facility Planning Report, July 2005) to reflect the completion of some proposed action elements, as well as changes appurtenant to SPDES permits and modifications of regional WB/WS Facility Plans and CSO Facility Plans. The objectives of this plan are to provide substantial reductions in floatables discharges from CSOs throughout the City and to provide for compliance with appropriate NYSDEC and IEC requirements pertaining to floatables.

The City-Wide Comprehensive CSO Floatables Plan consists of the following action elements:

- Monitor city-wide street litter levels and inform DSNY and/or the New York City Mayor's Office of Operations when changes in litter levels at or in City policies would potentially result in increased discharges of CSO floatables;
- Continue the three-year cycle to inspect catch basins city-wide for missing hoods and to replace missing hoods to prevent floatables from entering the sewer system. In addition, proceed with the retrofit, repair, or reconstruction of catch basins requiring extensive repairs or reconstruction to accommodate a hood;
- Maximize collection system storage and capacity;
- Maximize wet-weather flow capture at WPCPs;
- Capture floatables at wet-weather CSO storage/treatment facilities;
- Capture floatables at end-of-pipe and in-water facilities, including the Interim Floatables Containment Program (IFCP);
- Continue the Illegal Dumping Notification Program (IDNP) in which NYCDEP field personnel report any observed evidence of illegal shoreline dumping to the Sanitation Police section of DSNY, who have the authority to arrest dumpers who, if convicted, are responsible for proper disposal of the material;
- Engage in public outreach programs to increase public awareness of the consequences of littering and the importance of conserving water;
- As new floatables-control technologies emerge, continue to investigate their applicability, performance and cost-effectiveness in New York City;
- Review and revise water quality standards to provide for achievable goals; and
- Develop a floatables-monitoring program to track floatables levels in the Harbor and inform decisions to address both short- and long-term floatables-control requirements.

The City-Wide Comprehensive CSO Floatables Plan is a living program that will undergo various changes over time in response to ongoing assessment of the program itself as well as changing facility plans associated with other ongoing programs. A key part of the City-Wide Comprehensive CSO Floatables Plan is a self-assessment component including a new floatables-monitoring program to evaluate the effectiveness of Plan elements and to provide for actions to address both short- and long-term floatables-control requirements (see Section 8.3.1). Evidence of increasing floatables levels that impede uses could require the addition of new floatables controls, expansion of BMPs, and modifications of WB/WS Facility Plans and/or drainage-basin specific LTCPs, as appropriate.

5.4.1. Shoreline Cleanup Pilot Program

The NYCDEP will be conducting a pilot program using Environmental Benefit Program funds to cleanup shorelines at locations known to be chronic areas where floatables are known to accumulate due to CSO overflows as well as careless behaviors and illegal dumping. The NYCDEP's existing floatables collection program only addresses CSO and storm outfalls, which have boom and netting containment facilities. This Shoreline Cleanup project will address CSO and storm outfall locations, which do not have containment facilities and based on inspection, warrant a manual clean up effort to remove near-shore floatables and trash on an as needed basis throughout the year. The NYCDEP has identified several specific areas as examples of areas that may benefit from these efforts including:

- Coney Island Creek, Brooklyn
- Kaiser Park, Brooklyn
- Sheepshead Bay, Brooklyn
- Cryders Land, Queens
- Flushing Bay, Queens
- Owls Head, Brooklyn

These cleanup efforts will be consist of three primary methods of cleanup.

- Mechanical cleanup – Where debris is caught up in riprap on the shoreline, high-pressure pumps will be employed to spray water onto the shoreline in an effort to dislodge the debris and floatables, flushing them out of the rip-rap back into the water where a skimmer vessel can gather the debris. There will be a containment boom placed in the water surrounding the skimmer vessel and the riprap area being cleaned to hold the debris so that the skimmer vessel can remove it.
- Workboat assisted cleanup – At a few locations where the shoreline is not readily accessible from the landside, a small workboat will be deployed with an operator and two crew-members who will collect debris by hand or with nets and other tools. The debris will be placed onto the workboat for transport to a skimmer boat for ultimate disposal.
- Manual cleanup – At some locations simply raking and hand cleaning will be the cleanup method of choice. Debris will be removed and placed in plastic garbage bags or containers to be transported away with a pickup truck for disposal.

The NYCDEP is currently planning on performing three cleanups each year for a four-year period at each of the above locations. Pending the outcome of this program as well as the findings of the floatables monitoring program an evaluation will be made of how the NYCDEP will proceed in the future.

5.5. LONG-TERM CSO CONTROL PLANNING

In June 2004, the NYCDEP authorized the LTCP Project. This work will integrate all Track I and Track II CSO Facility Planning Projects and the Comprehensive City-wide Floatables Abatement Plan, will incorporate on-going USA Project work in the remaining waterbodies, and will develop WB/WS Facility Plan reports and the LTCP for each waterbody area. The LTCP Project also monitors to assist with maintaining compliance with applicable Administrative Consent Orders. This document is a work product of the LTCP Project.

5.6. HUTCHINSON RIVER CSO FACILITY PLANS

Previous Hutchinson River CSO Abatement Facility Plans were included as part of the East River Combined Sewer Overflow Facility Planning Project prepared for the NYSDEC in June 1994, February 1996, October 2000, June 2003, and December 2005, respectively. Based on the facility plans completed in the 1990s and early 2000s as well as additional facility planning in 2005, 7 MG of off-line storage was proposed for CSO abatement. Since the original facility plan was completed in the mid-1990s, the project has undergone several changes with regard to the types and locations of facilities to provide the 7 MG of CSO storage.

In October 2000, the NYCDEP submitted the 2000 Hutchinson River CSO Facility Plan updating previous facility planning reports. That plan provided for the development of a 7 MG San Francisco Type Collector system to serve Outfalls HP-023 and HP-024 and would have been partially located under a city street. The San Francisco Collector system is comprised of a large storage conduit with an adjoining overflow conduit. The larger conduit typically provides CSO storage for most storms, excess CSO volumes would overflow to the smaller adjoining conduit via side overflow weirs. Once the smaller conduit fills, the remaining combined sewage would overflow to the receiving water. In this arrangement, a measure of settling is achieved for the flow that passes through the larger conduit.

The principal elements of the proposed 2000 Hutchinson River Facility CSO Plan included:

- A 4.7 MG storage conduit would collect combined sewage from Regulator 15A drainage area (Outfall HP-024), while combined sewage from Regulator 15 drainage area would be stored in a 2.3 MG storage conduit.
- Allow space for disinfection facilities as well as dechlorination facilities if sodium hypochlorite is used for disinfection of overflows that exceed facility capacity.
- An air treatment system to treat exhaust air from the storage conduit.
- A new combined sewer outfall downstream of Outfall HP-023 to discharge overflows from the storage conduit.
- Upgrades of the Conner Street and Co-op City North Pumping Stations, in addition to the connection of the pumping stations to drain lines of the conduits to convey the captured combined sewage to the Hunts Point WPCP collection system for treatment.

The facility plan was modified again after October 2000 in June 2003 as a result of additional planning efforts. The additional planning efforts aimed to address the concerns of the general public and elected officials regarding the likely disruptions to traffic and parking that would occur in the vicinity of the facility during its construction.

The principal elements of the proposed 2003 Hutchinson River CSO Facility Plan:

- A 3 MG underground storage tank to serve Outfall HP-024 which would include mechanical bar screens, a pumping station to empty the tank, and an air treatments system to treat the exhaust air.
- A 4 MG underground storage conduit to serve Outfall HP-023 that would empty by gravity to the wet well of the existing Conner Street Pumping Station.
- Allow space for disinfection facilities as well as dechlorination facilities if sodium hypochlorite is used for disinfection of overflows that exceed facility capacity.
- An air treatment system to treat exhaust air from the storage conduit.

Storage and siting issues coupled with property and ownership considerations resulted in the re-configuration of the June 2003 plan in December of 2005. This new configuration is shown in Section 7 as part of the alternatives evaluation. The principal elements of the revised 2005 Hutchinson River CSO Facility Plan include two phases of construction:

- Phase I – Southern Storage Tank: A 4 MG underground storage tank to serve Outfall HP-023. The storage tank would include mechanical bar screens, a pumping station to empty the tank following storm events, and an air treatment system to treat exhaust air from the storage tank. Captured combined sewage would be pumped through the existing 24-inch diameter force main used by the Conner Street Pumping Station back to the existing combined sewer system for conveyance to Hunts Point WPCP.
- Phase II – Northern Storage Tank: A 3 MG underground storage tank to serve Outfall HP-024. The storage tank would include mechanical bar screens, a pumping station to empty the tank following storm events, and an air treatment system to treat exhaust air from the storage tank. Captured combined sewage would be transmitted to the Conner Street Pumping Station wet well and then conveyed to the Hunts Point WPCP via the collection system.
- The 3 MG and 4 MG storage tanks will include provisions in their design for the future installation of disinfection and dechlorination facilities, if necessary to comply with NYSDEC regulations.

The aforementioned facilities plans were modeled using a 40-storm sequence for the period of June through September 1990. Modeling results for the 2005 Hutchinson River CSO Facility Plan showed improvements in overall the water quality of the Hutchinson River by increasing DO concentrations, decreasing coliform levels, and decreasing settleable solids and floatables. Based on the modeling method used, the 7 MG capture volume resulted in 100 percent CSO capture for 34 storms of the 40 storms, while reducing the overall volume of CSOs discharged to the Hutchinson River from those 40 storms by approximately 68 percent. The projected water quality improvements to the Hutchinson River under 2005 Hutchinson River CSO Facility Plan would include:

- the increase of the minimum baseline DO concentration from 1.49 mg/L to 2.98 mg/L;

- the increase of the average baseline DO concentration from 2.87 mg/L to 4.11 mg/L;
- the decrease of the monthly median total coliform concentration;
- a level of compliance with the NYCDOH total coliform criteria for bathing beaches from 90 to 100 percent, and;
- the substantial removal of floatables and settleable solids.

The 7 MG off-line storage configuration (December 2005 configuration) is being analyzed and modeled in this WB/WS Facility Plan in accordance with the USEPA CSO Policy. Modeling was completed using an average year rainfall record. Modeling results and projected water quality benefits on an average year basis are further discussed in Section 7. According to the Consent Order, "In the Newtown Creek, Westchester Creek and Hutchinson River drainage basins only, the WB/WS Facility Plans may propose final modifications to the scope of the projects set forth in the existing CSO Facility Plans."

5.7. LOCALLY SPONSORED WATERBODY IMPOVEMENT PROJECTS

As part of an agreement between the NYCDEP and the NYCDPR, more than $220 million of NYCDEP funds generated from water and sewer revenue will be spent on improvements to more than 70 Bronx parks. The agreement presents an opportunity to invest more than triple the amount that would normally be spent on Bronx parks over the next 5 years. Years of input from the community coupled with the assistance of community groups, elected officials, and Bronx residents helped to identify the Bronx Parks Projects. Additionally, the NYCDPR focused on projects that would be challenging to fund through the capital budget. The projects fall into five categories including:

- Neighborhood Parks
- Regional Recreation Facilities
- Greening the borough
- Develop waterfront parks
- Expanding the Bronx greenway

Under the agreement, over 20 neighborhood parks and playgrounds throughout the Bronx will be renovated with new play equipment, comfort stations, seating areas, fencing, and landscaping. Regional recreation facilities, including ballfields, running tracks and tennis courts will be reconstructed or built throughout the borough. In addition, new waterfront parks will be developed along the Long Island Sound and East and Harlem Rivers.

The project will also complete major sections of the Bronx Greenway, including the Hutchinson River, Bronx River, and Soundview to Ferry Point sections. Work on the Greenway will include the restoration of existing parkland, with improvements to pathways and public access, as well as the transformation of underutilized property into new parkland. In addition to the various park improvements, a comprehensive program to "green" the Bronx will include the creation of Greenstreets, improvement and expansion of horticultural plantings, and the addition of street trees in under-served neighborhoods. The State Energy Research and Development Authority will also establish a comprehensive Urban Forestry Program for further greening of the Bronx.

Table 5-2 discusses the projects that will be completed within the Hutchinson River drainage area.

Table 5-2. Bronx Parks Improvement Projects within the Hutchinson River Drainage Area

Project	Projected Cost	Description
Seton Falls Park	$1,000,000	Trail upgrade and associated fencing repair work.
Edenwald Playground	$2,000,000	Reconstruction of playground to include new play equipment, spray shower, and landscaping.
Hutchinson River Greenway	$2,500,000	Implementation of the greenway between Pelham Parkway and the City's northern border.
Pelham Bay Park Bridle Trails	$1,000,000	Reconstruction of the Bridle Trails.
Pelham Bay Park Middletown Road Perimeter	$1,500,000	Reconstruction of stone retaining wall with fencing on top and sidewalks along Middletown Road .
Pelham Bay Park Tennis Courts	$2,250,000	Reconstruction of tennis courts to include new fencing, drainage, and water supply, and reconstruction of the parking lot.
Pelham Bay Park Waterfront Development	$8,000,000	Development of waterfront area near landfill, plus greenway link and seawall repair.
Pelham Parkway Malls Soccer Field and Skate Park	$1,500,000	Reconstruction of the Pelham Bay Malls from the Hutchinson River Parkway to Boston Road .

6.0. Public Participation and Agency Interaction

One of the nine elements of a long-term control plan is a public participation and agency interaction process that actively involves the affected public and regulators in decision-making to select long-term CSO controls. USEPA CSO guidance states that establishing early communication with both the public and regulatory agencies is an important first step in the long-term planning approach and crucial to the success of a CSO control program (USEPA, 1995a). The NYCDEP is committed to involving the public and regulators early in the planning process by describing the scope and goals of its facility planning projects and continuing public involvement during its development, evaluation, and selection of plan elements.

The CSO Control Policy emphasizes that state water quality standards authorities, permitting authorities, USEPA regional offices and permittees should meet early and frequently throughout the long-term planning process. It also describes several issues involving regulatory agencies that could affect the development of the long-term control plan, including the review and appropriate revision of water quality standards and agreement on the data, analyses, monitoring, and modeling necessary to support the development of the long-term control plan toward that end. A Harbor-Wide Government Steering Committee was convened by the NYCDEP consisting of city, state, interstate, and federal stakeholders representing regulatory, planning, and public concerns in the New York Harbor watershed.

The NYCDEP has also formed local and city-wide citizen advisory committees, has involved other municipal officials, local community government representatives, permitting agencies, and the general public in its planning process. Public meetings were conducted to present technical information and obtain input from interested individuals and organizations. Potential CSO alternatives, costs (to the NYCDEP and to the public via water usage rates) and benefits were discussed before completing engineering evaluations. Comments are sought regarding the selection of a recommended plan. The NYCDEP regularly met with its Citizens Advisory Committee on Water Quality to discuss the goals, progress and findings of its ongoing planning projects such as waterbody/watershed assessments.

The following section describes the formation and activities of the NYCDEP's Harbor-Wide Government Steering Committee, its Citizens Advisory Committee on Water Quality, and its Hutchinson River Waterbody/Watershed Stakeholder Team that represented the NYCDEP's public participation and agency interaction components of its waterbody/watershed assessment of the Hutchinson River.

6.1 HARBOR-WIDE STEERING COMMITTEE

The NYCDEP convened a Harbor-Wide Government Steering Committee to assure overall program coordination and integration of management planning and implementation activities by holding quarterly meetings, exploring regulatory issues, prioritizing planning and goals, developing strategies, reviewing and approving assessment-related work plans and coordinating actions. A Steering Committee was comprised of city, state, interstate, and federal stakeholders representing regulatory, planning and public concerns in the New York Harbor Watershed. The Citizens Advisory Committee on Water Quality (CAC), which reviews and comments on NYCDEP water quality improvement programs is represented on the Steering Committee and separately monitors and comments on the progress of CSO projects, among other NYCDEP activities.

Federal government members of the Harbor-Wide Government Steering Committee included representatives of the USEPA, USACE and the National Park Service. USEPA Region 2 was represented by its Deputy Director and its Water Quality Standards Coordinator. The USACE was represented by its Chief of the Technical Support Section, Planning Division, New York District. The National Park Service member was a representative of its Division of Natural Resources at the Gateway National Recreational Area.

The State of New York was represented by the central and regional offices of the NYSDEC. The Central Office of NYSDEC in Albany was represented by its Associate Director of the Division of Water, the Director of the Bureau of Water Permits in the Division of Water, the Director of the Bureau of Water Permits in the Division of Water, the Director of the Bureau of Water Assessment and Management Branch of the Division of Water, and the Director of the Bureau of Water Compliance in the Division of Water. The Region II office of the NYSDEC was represented by the Regional Engineer for the Region II Water Division.

Several departments of The City of New York were represented on the Harbor-Wide Government Steering Committee. The Deputy Commissioner of the Bureau of Environmental Engineering and its Director of Planning and Capital Budget represented the NYCDEP. The Department of City Planning was represented by its Director of Waterfront/Open Space. The NYCDPR was represented by the Chief of its Natural Resources Group.

Public interests were represented on the Steering Committee by the General Counsel of Environmental Defense at the New York Headquarters and the Real Estate Board of New York. These two members also co-chaired the Citizens Advisory Committee on Water Quality.

Interstate interests were represented by the Executive Director and Chief Engineer of the IEC. The IEC is a joint agency of the States of New York, New Jersey, and Connecticut. The IEC was established in 1936 under a Compact between New York and New Jersey and approved by Congress. The State of Connecticut joined the IEC in 1941. The mandates of the IEC are governed by the Tri-State Compact, Statutes, and the IEC's Water Quality Regulations. Its responsibilities and programs include activities in areas such as air pollution, resource recovery facilities and toxics; however, the IEC's continuing emphasis is on water quality, an area in which the IEC is a regulatory and enforcement agency. The IEC's area of jurisdiction runs west from Port Jefferson and New Haven on Long Island Sound, from Bear Mountain on the Hudson River down to Sandy Hook, New Jersey (including Upper and Lower New York Bays, Newark

Bay, Arthur Kill and Kill Van Kull), the Atlantic Ocean out to Fire Island Inlet on the southern shore of Long Island, and the waters abutting all five boroughs of New York City.

The Steering Committee is responsible for reviewing the methodology and findings of NYCDEP water quality-related projects, and to offer recommendations for improvement. The Steering Committee reviewed and approved the waterbody work plan developed by the USA Project (HydroQual, 2001e), and was fully briefed on the ongoing assessments and analyses for each waterbody. Among the recommendations provided by the Steering Committee was the investigation of cost-effective engineering alternatives that improve water quality conditions to remove harbor waters from the State of New York 303(d) list, to pursue ecosystem restoration actions with the USACE, and to coordinate use attainment evaluations with the NYSDEC. Representatives of the NYSDEC reported that its agency was awaiting the results of the NYCDEP waterbody/watershed assessment before completing the 303(d) evaluation.

The GSC met regularly between 2000 and 2004 under the NYCDEP's USA project. The GSC has recently been reconvened as part of the LTCP activities having met twice over this past year.

6.2 WATER QUALITY CITIZENS ADVISORY COMMITTEE

The NYCDEP's CAC on Water Quality was formed in 1996 and was active through 2004. The CAC reviewed and commented on the NYCDEP's water quality improvement program, was represented on the Harbor-Wide Government Steering Committee and separately monitoreds and commented on NYCDEP's progress. The CAC represented the interests of New York City agencies, borough offices, real estate interests, and non-governmental environmental advocacy groups. The NYCDEP supported and regularly informed the CAC on all of its ongoing planning projects and programs related to water quality in New York Harbor waterbodies. In turn, the CAC commented on NYCDEP's activities and facilitated dissemination of information back to the organizations and constituencies it represents.

Recognizing the magnitude and complexity of planning, implementation and regulatory issues being addressed by the NYCDEP in its water quality facility planning projects, the CAC was a proponent of conducting waterbody/watershed assessments of CSO waterbodies. Prior to and after initiation of the NYCDEP's USA Project, the CAC was regularly informed of the goals and strategy of the NYCDEP's waterbody/watershed assessment methodology.

This city-wide CAC is being re-stated under the LTCP. The mission of this reorganized CAC will be to represent a stakeholder group for the larger open waters of New York Harbor.

6.3 WATERBODY/WATERSHED STAKEHOLDER TEAM

Public participation is a component of each step in the long-term control planning process described in USEPA guidance. It is a recommended element of system characterization, development and evaluation of alternatives for CSO controls, and selection and implementation of a long-term plan. The NYCDEP convened a local waterbody/watershed stakeholder team for the assessment of Hutchinson River that represented local residents, businesses, non-governmental organizations, community government, and riparian and waterbody users. The stakeholder team was included in identifying existing conditions and goals for aquatic life, recreation and aesthetic uses. The following describes NYCDEP's efforts in convening the stakeholder team, its public representation, and its participation in the waterbody/watershed assessment of Hutchinson River.

6.3.1 Public Opinion Survey

The NYCDEP conducted a telephone survey in order to assess and measure the use of waterbodies in New York City, and obtain feedback from New York City residents about their attitudes towards the water resources in their community and elsewhere. Surveys addressed city-wide issues as well as those for local waterbodies. Primary and secondary waterbody survey results (dependent on residential location within watersheds) were analyzed discreetly and summarized to provide additional insight public into waterbody uses and goals in addition to those identified via other public participation programs run by the NYCDEP.

Survey interviews were conducted using Computer Assisted Telephone Interviews (CATI) among residents of the five New York City boroughs that were 18 years of age or older. Residents were asked about specific waterways depending on their zip code. A total of 7,424 interviews with New York City residents were conducted during these telephone surveys and a total of 8,031 primary waterway responses were recorded. Questionnaire development involved a pre-test prior to the full field application of the survey to ensure that the survey covered all relevant issues and it was presented in a way that would be clear to respondents. The pre-test was conducted via a series of five focus groups representing residents of each of the five New York City boroughs. Final presentation of results involved editing, cleaning, and weighting collected data. The weights were applied to the data to correct for unequal probability of household selection due to households with more than one telephone number, and different numbers of individuals available to be interviewed in different households. Post-stratification weighting was also applied for each waterbody to balance the sample data to 2000 U.S. Census population data that takes into account household composition, age, gender, and race/ethnicity. The survey data then was projected to actual population counts from the 2000 U.S. Census so that areas could easily be combined to yield an appropriate weighted sample for all five boroughs of New York City.

The telephone survey included 7,424 interviews with New York City residents, and a minimum of 300 interviews for each of the 26 watersheds within the scope of the USA Project. The survey was analyzed to quantify the extent of existing uses of the waterbody and riparian areas, and to record interest in future uses. Elements of the survey focused on awareness of the waterbody, uses of the waterbody and riparian areas, recreational activities involving these areas and how enjoyable these activities were, reasons why residents do not partake in recreational activities in or around the waterbody, overall perceptions of New York City waterbodies; and what improvements have been recognized or are desired.

6.3.2 Waterbody Awareness

Approximately 90 percent of Hutchinson River area residents that participated in the survey were aware of the River but only 10 percent could identify Hutchinson River as their primary waterbody without any prompting or aid in their response. Only 8 percent of all area residents who participated in the survey recognized Hutchinson River as the waterway closest to their home. Most of the City residents identified the Long Island Sound, Orchard Beach, or the Hudson River as the waterways closest to their home.

6.3.3 Water and Riparian Uses

Approximately 17 percent of Hutchinson River area residents that participated in the survey visit waterbodies in their community or elsewhere in New York City on a regular basis and 36 percent occasionally visit waterbodies. The remaining percentage visit waterbodies rarely or never. This is less frequent than New York City residents in general, 60 percent of whom visit city waterbodies either regularly or occasionally. 27 percent of area residents have visited Hutchinson River at some point, and 15 percent have done so in the prior 12 months. Among those area residents who are aware of Hutchinson River but have never visited the river, the majority (50 percent) responded that there was no particular reason, seven percent cited waterbody conditions, and nine percent cited riparian conditions.

The number of area residents that have participated in water-related activities at Hutchinson River represents 16 percent of those who have ever visited the river. This equates to four percent of the area residents surveyed (those that have visited and those that have not). In comparison, 18 percent of NYC residents who have visited the primary waterway in their assessment area have participated in water activities there. Due to the small base sizes, no data was collected for Hutchinson River regarding the most frequent activities participated in, how enjoyable activities are, what makes activities enjoyable or not enjoyable, or why residents never participate in activities.

Riparian-based activities appear to be more popular in general than in-water activities. Thirty-seven percent of area residents that have visited Hutchinson River responded that they have participated in land-based activities along the river. In comparison to all New York City residents who have ever visited Hutchinson River, riparian activities at Hutchinson River is a slightly less popular activity than at other primary waterways in New York City. The most popular land activity at Hutchinson River among area visitors is eating or dining (11 percent), followed by sports (10 percent).

6.3.4 Improvements Noted

The number of area resident respondents to the telephone survey that mentioned noticing an overall improvement to the New York City waterways was 45 percent, however only 3 percent of Hutchinson River area residents responded that they have noticed improvements specifically in the river. Thirty-one percent of New York City residents have not noticed water quality improvements in any city waters.

Given the option of choosing one waterway for improvement, 15 percent of Hutchinson River residents chose their primary waterway for improvement, which comparable to the median of 18 percent of City-wide respondents who would like the primary waterway in their assessment area to be the one improved. Forty-two percent of Hutchinson River area residents, who were aware of the basin as their primary waterbody, cited water quality appearance or odor as the most important aspect of the river to be improved. Another 14 percent cited improvements to cleanliness, sanitation, or maintenance as desirable, compared to a city-wide median of 11 percent.

When asked how much they would be willing to pay, 36 percent of residents who felt primary waterbody improvements were extremely important responded that they would be willing to pay a range of $10 to $25 a year for that improvement, but 24 percent responded that they would not be willing to pay for the desired improvement at all. In general, 39 percent of the New York City residents with similar attitudes towards improvements to their primary waterbody responded that they would be willing to pay for those improvements, and 22 percent responded that they would not be willing to pay for anything. Of area residents that specifically felt water quality improvements were extremely important, 38 percent responded that they would be willing to pay a range of $10 to $25 a year for that improvement, but 21 percent responded that they would not be willing to pay anything at all. For New York City residents desiring water quality improvements in their primary waterway, 41 percent responded that they would be willing to pay for those improvements, and 22 percent responded that they would not be willing to pay for anything.

6.4 ADMINISTRATIVE CONSENT ORDER

The Administrative Consent Order was published for public comments on September 8, 2004, as part of the overall responsiveness effort on behalf of the NYSDEC. The public comment period, originally limited to 30 days, was extended twice to November 15, 2004, to allow for additional commentary. Comments were received from public agencies, elected officials, private and non-profit organizations, and private individuals. In total, the NYSDEC received in excess of 600 official comments via letter, facsimile, or email during the comment period. All comments received were carefully reviewed and evaluated, then categorized by thematic elements deemed similar in nature by NYSDEC. Each set of similar comments received a specific, focused response. Many of the comments received, although differing in detail, contained thematic elements similar in nature regarding NYSDEC and NYCDEP efforts toward CSO abatement, water quality issues, standards, and regulatory requirements.

None of the comments received changed the terms of the Order, but the volume of commentary was interpreted by the NYSDEC to indicate that "NYC citizenry places CSO abatement as a high ongoing priority" (NYSDEC, 2005). The terms of the Order offer numerous opportunities for public participation and input for future CSO abatement measures and regulatory decisions, such as the requirement to comply with federal CSO policy with regard to public participation during LTCP development.

6.5 SPDES PERMITTING AUTHORITY

Any facilities built as part of this Waterbody/Watershed Facility Plan would be subject to the conditions of the Hunts Point WPCP SPDES permit.

6.6 LOCAL WATERBODY/WATERSHED STAKEHOLDER TEAM

A local waterbody/watershed stakeholder team was convened specifically for the Hutchinson River by the NYCDEP. In order to create a representative and inclusive Stakeholder Team, the NYCDEP reached out to the local Community Boards and to other organizations interested in the river. The resulting Stakeholder Team consisted of local government representatives, organizations, residents, and waterbody users. The stakeholder team was recruited through outreach meetings at the local community boards and other neighborhood organizations. The Stakeholder Team is scheduled to meet at least three times throughout the waterbody/watershed assessment period.

6.6.1 Summary of Stakeholder Team Meetings

The Stakeholder Team met in the evening at Bronx Community Board 10, located at 3165 E. Tremont Avenue. These meetings are broadly summarized below.

The first Hutchison River Stakeholder Team meeting was held on September 6th, 2006. The purpose of the meeting was to introduce the LTCP for Combined Sewer Overflow (CSO) and discuss the implications for the Hutchinson River and Westchester Creek. After general introductions of meeting attendees, the definition of CSO was explained and the regulatory process leading up to current LTCP projects was discussed. Characteristics of the Hutchinson River area were presented, including drainage area, lack of federally defined sensitive areas, waterbody uses, shoreline uses, land uses, and related water quality issues. Discussion of sensitive areas, public access points, and previously considered storage projects was conducted regarding Hutchinson River. The following items highlight a few of the points expressed by the Stakeholders:

- Information regarding current storage tank construction projects specifically near Flushing Creek
- Water sampling program used for plan development
- Quality of life issues including waterfront access and beautification
- Traffic and construction related disruptions

The second Hutchison River Stakeholder Team meeting was held on October 26th, 2006. The purpose of this meeting was to introduce the basis of CSO abatement alternatives including water quality sampling and modeling. Some of the items the Stakeholders expressed an interest in are as follows:

- Request for Flushing Tank site visit
- Contact information for the Natural Heritage Trust
- Discussion of historical water quality sampling and 2005 sampling

The third Hutchison River Stakeholder Team meeting was held on May 8th, 2007. The purpose of the meeting was to present the selected WB/WS Facility Plan for the Hutchinson River. The alternatives evaluation conducted prior to plan selection was reviewed. Alternative cost estimation, knee-of-the-curve analysis, and cost-benefit analysis with respect to dissolved oxygen and indicator pathogen concentrations was presented. The impact of Westchester County water quality was discussed, suggesting that inflowing water quality has a greater impact in the Hutchinson River than CSO. As a result of these analyses, the selected WB/WS Facility Plan for the Hutchinson River provides floatables control through in-line netting at HP-023 and at HP-024, which will be located in the pipe and not visible to the public. The continued investigation into Low Impact Development (LID) is also included in the WB/WS Facility Plan. This investigation into LID stormwater management, which will be incorporated in the LTCP at a later date, was described as part of the Jamaica Bay Protection Plan. Finally, the downstream Eastchester Bay beaches do not appear to be affected by the pathogen concentrations, which are highest during summer bathing season, with the selected Hutchinson River WB/WS Facility Plan.

Some of the items the Stakeholders expressed an interest in are as follows:

- Why raising weirs and system cleaning were not selected as alternatives. It was stated that raising weirs did not appear to have any substantial impact in the modeling scenario and that there is ongoing system cleaning.
- Concerns of construction impacts for the presented plan. Construction is expected to be localized with minimal vehicular and pedestrian interruptions.
- Interest in whether the community could expect the passive park, which the Co-op City Community was promised when DEP was considering a storage tank in the previous facility plan.

After the NYSDEC submits its comments to the NYCDEP regarding this WB/WS Facility Plan, there will be a public meeting. An additional public meeting will be held at the ratification of the WB/WS Facility Plan into a LTCP, at which point it will become enforceable legislation.

7.0. Evaluation of Alternatives

7.1. INTRODUCTION

The NYSDEC historically placed both the upper and lower portions of the Hutchinson River on the Section 303(d) list of waters requiring TMDL development. This WB/WS Facility Plan references the 2004 list to note the reason that caused the original listing in Section 4.5.3. However, the 2006 Draft Section 303(d) list does not list the lower, tidal section of the Hutchinson River, which is under the jurisdiction of the NYCDEP. The upper, freshwater section, which is under the jurisdiction of Westchester County, remains on the 2006 Draft Section 303(d) list. The reason for the de-list of the Lower Hutchinson River is given as follows:

> "In 2005 NYSDEC signed an Order on Consent with NYC directing the city to develop and implement watershed and facility plans to address CSO discharges and bring New York City waters into compliance with the Clean Water Act. This may include a revision to the water quality standards based on a Use Attainability Analysis if fishable/swimmable goals of the CWA are not attainable. This Order on Consent represents an acceptable "other pollution control requirements and precludes the need to develop a TMDL."

In this section alternatives are evaluated for the Tidal section of the Hutchinson, within the jurisdiction of the NYCDEP, in accordance with the CSO Policy requirements. This evaluation was undertaken to determine the potential benefits associated with each alternative for improving water quality and achieving water quality standards. The results of the evaluations are then used to select CSO controls which will comply with water quality-based requirements of the CWA.

7.1.1. Regulatory Framework for Evaluation of Alternatives

The CSO Policy calls for an evaluation of a reasonable range of alternatives in the selection process within the following framework:

<u>Frequency of Overflow</u>

In accordance with the CSO Policy, alternatives were evaluated which included controls able to reduce overflows to between zero and 12 events per average year.

<u>Maximizing Treatment at the Treatment Plant</u>

One goal of the CSO Control Policy is to increase the amount of wet weather flow receiving full treatment.

The SPDES permit for the WPCPs require 2×DDWF; and Wet Weather Operating Plans have been submitted to the NYSDEC for each of the plants. Analysis of the benefits from this operation scheme is incorporated in this report. A feasible alternatives analysis to determine if additional measures at the plant are recommended is underway for the Hunts Point WPCP. If additional measures are recommended, they will be included in the subsequent LTCP for the Hutchinson River.

Cost/Performance Consideration

Analysis of the CSO control alternatives included development of a set of cost performance curves that compare the projected performance of an alternative to its estimated cost. The curves demonstrate the relationship between a comprehensive set of reasonable control alternatives within a specified range of control levels. This effort includes the analysis for determining where the increment of pollution reduction achieved in the receiving water diminishes as compared to increased cost or as more commonly called the "knee of the curve". The "knee" is generally considered the point at which the benefit/cost slope flattens such that there is a much greater increase in cost compared to the corresponding increase in benefit.

Analysis of Alternatives' Benefits for Water Quality Attainment

The effect of CSO controls on the ability to meet the existing water quality standards for dissolved oxygen and pathogens was evaluated to select the recommended WB/WS Facility Plan. Additional analyses were also completed to analyze the Clean Water Act "fishable and swimmable" goals, and are discussed in Section 9. For bacteria, enterococci was evaluated where appropriate for application to bathing beach and NYSDEC SB classifications. For all classifications, bacteria compliance included evaluations of application total and/or fecal coliform bacteria. The following summarizes the water quality standards which were evaluated for attainment and evaluation procedures:

- Dissolved Oxygen – The water quality standards require a maximum dissolved oxygen concentration greater than the criteria for the specified water use classification. Compliance of these criteria for this project is calculated on an hourly basis. According to the sampled DO data presented in Section 4, the DO levels do not always meet the Class SB standard of never less than 5.0 mg/L.
- Bacteria – The water quality standards require a minimum bacteria concentration less than the criteria for the specified water use classification. Compliance of these criteria for this project is calculated on an hourly basis. For Class SB waterbodies, the limit for total coliforms (calculated as a 30-day geometric mean) is 2,400 MPN/100 mL, where no more than 20 percent of samples may exceed 5000 MPN/100 mL. The limit for fecal coliforms (calculated as a 30-day monthly median) is 200 MPN/ 100mL. Although no disinfection is practiced in the Hutchinson River watershed, the numerical limits are analyzed herein as a measure of water quality and not as an assessment of compliance.
- Enterococci – Enterococci bacteriological criteria are currently in force in New York State waters. The following parameters were evaluated in waterbodies with bathing beaches – the existing water quality standard for Class SB is a 35/100 ml geometric mean. The receiving water model produced a daily average enterococci concentration for each day in each month. Geometric means were calculated on a monthly basis using the daily values. The number of months achieving the standard of 35 /100 ml was then tabulated and graphically shown along the length of the waterbody.

Consideration of Non CSO Loads

Load sources other than CSOs were included in the receiving water modeling to assess water quality conditions. Analyses were conducted to evaluate if CSO control alone could improve the water quality in the receiving waters to a level that would meet the existing water quality standards. Once those analyses were completed, screening analyses were also conducted to assess whether storm water or other sources of pollutants cause or contribute to excursions beyond the WQS. This was found to be the case for flow entering from Westchester County, as shown in sampling results in Section 4.4.2. Receiving water modeling was conducted for different bacteria counts in the flow from Westchester County to assess contributing pollutants to the New York City Section of the Hutchinson River.

Constructability Analysis

In addition, the NYCDEP conducted a constructability and cost review of the proposed alternatives to assist in selecting the recommended plan.

7.1.2. Collection System and Receiving Water Quality Modeling

System characterization, monitoring and modeling, which includes compilation of background information, field monitoring and development of predictive models tailored to the complexity of the CSO system and information needs associated with evaluation of CSO control options and water quality impacts were completed and are discussed in more detail in Sections 3 and 4 of this report. These predictive models were utilized to assess existing conditions and then to evaluate the various alternatives effect on improving water quality. The following section documents the screening of technologies utilized to develop a range of alternatives which would proceed to modeling and further analysis.

7.2. SCREENING OF CSO TECHNOLOGIES

A wide range of CSO control technologies was considered for application to New York City's Combined Sewer System (CSS). The technologies are grouped into the following general categories:

- Source Control
- Inflow Control
- Sewer System Optimization
- Green Solutions
- Sewer Separation
- Storage
- Treatment
- Receiving Water Improvement
- Floatables Control

Each technology is described below, and a summary assessment is provided in Table 7-1.

Table 7-1. Assessment of CSO Control Technologies

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume	Bacteria	Floatables	Suspended Solids	
Source Control					
Public Education	None	Low	Medium	Low	Cannot reduce the volume, frequency or duration of CSO overflows.
Street Sweeping	None	Low	Medium	Medium	Effective at floatables removal, cost-intensive O&M. Ineffective at reducing CSO volume, bacteria and very fine particulate pollution.
Construction Site Erosion Control	None	Low	Low	Medium	Reduces sewer sediment loading, enforcement required. Contractor pays for controls.
Catch Basin Cleaning	None	Very Low	Medium	Low	Labor intensive, requires specialized equipment.
Industrial Pretreatment	Low	Low	Low	Low	There is limited industrial activity in and out of combined sewer area.
Inflow Control					
Storm Water Detention	Medium	Medium	Medium	Medium	Requires large area in congested urban environment, potential siting difficulties and public opposition, construction would be disruptive to affected areas, increased O&M.
Street Storage of Storm Water	Medium	Medium	Medium	Medium	Potential flooding and freezing problems, public opposition, low operational cost.
Water Conservation	Low	Low	Low	Low	Potentially reduces dry weather flow making room for CSO, ancillary benefit is reduced water consumption
Inflow/Infiltration Control	Low	Low	Low	Low	Infiltration usually lower volume than inflow, infiltration can be difficult to control
Green Solutions					
Bioretention	Medium	Medium	Medium	Medium	Site specific, requires widespread application across city to be effective, potential to be cost intensive in some areas.
Dry Wells	Medium	Medium	Low	Medium	Site specific, low cost, good BMP for residential areas, requires interaction with homeowners and businesses, widespread participation required to be effective.
Filter Strips	Medium	Medium	Low	Medium	Site specific, low cost, good BMP for parking lots, requires interaction with private owners in residential areas, requires widespread application across

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume	Bacteria	Floatables	Suspended Solids	
					city to be effective.
Vegetated Buffers	Medium	Medium	Medium	Medium	Site specific, low cost, good BMP for parking lots, requires interaction with homeowners in residential areas, requires widespread application across city to be effective.
Level Spreader	Low	Low	Low	Medium	Site specific, must be used in conjunction with other Green Solution techniques, low cost.
Grassed Swales	Medium	Medium	Low	Medium	Site specific, requires widespread application across city to be effective, potential to be cost-intensive in some areas.
Rain Barrels	Low	Low	Low	Low	Good BMP for residential areas, minimal capture of total runoff volume, requires barrel coverage to inhibit mosquitoes, low cost, requires interaction with home and business owners.
Cisterns	Medium	Medium	Low	Medium	Site specific, requires widespread application across city to be effective, potential to be cost-intensive in some areas.
Infiltration Trenches/Catch Basins	Medium	Medium	Medium	Medium	Site specific, low cost, good BMP for residential areas, widespread participation required to be effective.
Rooftop Greening	Medium	Low	Low	Medium	Site specific, cost intensive, non-intrusive construction, other beneficial effects to city, requires widespread application to be effective, requires interaction with all property owners.
Increased Tree Cover	Low	Low	None	Low	Site specific, low cost, little capture of stormwater runoff, other beneficial effects to city.
Permeable Pavements	Medium	Medium	Low	Medium	Site specific, cost intensive, subject to clogging, increased O&M costs, labor intensive.
Sewer System Optimization					
Optimize Existing System	Medium	Medium	Medium	Medium	Low cost relative to large scale structural BMPs, limited by existing system volume and dry weather flow dam elevations.
Real Time Control	Medium	Medium	Medium	Medium	Highly automated system, increased O&M, increased potential for sewer backups.
Sewer Separation					

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume	Bacteria	Floatables	Suspended Solids	
Complete Separation	High	Medium	Low	Low	Disruptive to affected areas, cost intensive, potential for increased stormwater pollutant loads, requires homeowner participation.
Partial Separation	High	Medium	Low	Low	Disruptive to affected areas, cost intensive, potential for increased stormwater pollutant loads.
Rain Leader Disconnection	Medium	Medium	Low	Low	Low cost, requires home and business owner participation, potential for increased storm water pollutant loads.
Storage					
Closed Concrete Tanks	High	High	High	High	Requires large space, disruptive to affected area, cost intensive, aesthetically acceptable.
Storage Pipelines/Conduits	High	High	High	High	Disruptive to affected areas, potentially expensive in congested urban areas, aesthetically acceptable, provides storage and conveyance.
Tunnels	High	High	High	High	Non-disruptive, requires little area at ground level, capital intensive, provides storage and conveyance, pump station required to lift stored flow out of tunnel.
Treatment					
Screening/ Netting Systems	None	None	High	None	Controls only floatables.
Primary Sedimentation[1]	Low	Medium	High	Medium	Limited space at WPCP, difficult to site in urban areas.
Vortex Separator (includes Swirl Concentrators)	None	Low	High	Low	Variable pollutant removal performance. Depending on available head, may require foul sewer flows to be pumped to the WPCP and other flow controls with increased O&M.
High Rate Physical/Chemical Treatment[1]	None	Medium	High	High	Limited space at WPCP, requires construction of extensive new conveyance conduits, high O&M costs.
Disinfection	None	High	None	None	Cost Intensive/Increased O&M.
Expansion of WPCP	High	High	High	High	Limited by space at WPCP and by sewer system capacity, increased O&M.
Receiving Water Improvement					
Outfall Relocation	High	High	High	High	Relocates discharge to different area, requires the construction of extensive new conveyance conduits.
In-stream Aeration	None	None	None	None	High O&M, only effective for increasing DO, limited effective area.

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume	Bacteria	Floatables	Suspended Solids	
Maintenance Dredging	None	None	None	None	Removes deposited solids after build-up occurs.
Solids and Floatables Controls					
Netting Systems	None	None	High	None	Easy to implement, potential negative aesthetic impact
Containment Booms	None	None	High	None	Simple to install, difficult to clean, negative aesthetic impact
Manual Bar Screens	None	None	High	None	Prone to clogging, requires manual maintenance
Weir Mounted Screens	None	None	High	None	Relatively low maintenance, requires suitable physical configuration, must bring power to site
Fixed baffles	None	None	High	None	Low maintenance, easy to install, requires proper hydraulic configuration
Floating Baffles	None	None	High	None	Moving parts make them susceptible to failure
Catch Basin Modifications/Hooding	None	None	High	None	Requires suitable catch basin configuration and increases maintenance efforts

Notes: (1) Process includes pretreatment screening and disinfection.

7.2.1. Source Control

To control pollutants at their source, management practices can be applied where pollutants accumulate. Source management practices are described below:

- Public Education – Public education programs can be aimed at reducing (1) littering by the public and the potential for litter to be discharged to receiving waters during CSO events and (2) illegal dumping of contaminants in the sewer system that could be discharged to receiving waters during rain events. Public education programs cannot reduce the volume, frequency or duration of CSO overflows, but can help improve CSO quality by reducing floatable debris in particular. Public education and information is an integral part of any LTCP. Public Education is also an ongoing activity within NYCDEP (NYCDEP, 2005a).
- Street Sweeping – The major objectives of municipal street cleaning are to enhance the aesthetic appearance of streets by periodically removing the surface accumulation of litter, debris, dust and dirt, and to prevent these pollutants from entering storm or combined sewers. Common methods of street cleaning are manual, mechanical and vacuum sweepers, and street flushing. Studies on the effect of street sweeping on the reduction of floatables and pollutants in runoff have been conducted. New York City found that street cleaning can be effective in removing floatables. Increasing street

cleaning frequency from twice per week to six times per week reduced floatables by about 42 percent on an item count basis at a very high cost. A significant quantity of floatables was found to be located on sidewalks that were not cleanable by conventional equipment. (HydroQual, 1995). However, in spite of these limitations, the Department of Sanitation of New York City (DSNY) does have a regular street sweeping program targeting litter reduction. The DSNY also has an aggressive enforcement program targeting property owners to minimize the amount of litter on their sidewalks. These programs are elements of New York City's City-Wide Comprehensive CSO Floatables Plan (NYCDEP, 2005b)

- Studies, funded by the National Urban Renewal Program (NURP) during the late 1970s to the early 1980s, reported that street sweeping was generally ineffective at removing pollutants and improving the quality of urban runoff (MWCOG, 1983; USEPA, 1983). The principal reason for this is that mechanical sweepers, employed at the time, cannot pick up the finer particles (diameter < 60 microns). Studies have shown that these fine particles contain a majority of the target pollutants on city streets that are washed into sewer systems (Sutherland, 1995). In the early 1990s new vacuum-assisted sweeper technology was introduced that can pick up the finer particles along city streets. A recent study showed that these vacuum-assisted sweepers have a 70 percent pickup efficiency for particles less than 60 microns (Sutherland, 1995).
- Street sweeping only affects the pollutant concentration in the runoff component of combined sewer flows. Thus, a street sweeping program is ineffective at reducing the volume and frequency of CSO events. Furthermore, the total area accessible to sweepers is limited. Areas such as sidewalks, traffic islands, and congested street parking areas cannot be cleaned using this method.
- Although a street sweeping program employing high efficiency sweepers could reduce the concentrations of some pollutants in CSOs, bacteriological pollution originates primarily from the sanitary component of sewer flows. Thus, minimal reductions in fecal coliform and e. coli concentrations of CSOs would be expected.
- <u>Construction Site Erosion Control</u> – Construction site erosion control involves management practices aimed at controlling the washing of sediment and silt from disturbed land associated with construction activity. Erosion control has the potential to reduce solids concentrations in CSOs and reduce sewer cleanout O&M costs.
- <u>Catch Basin Cleaning</u> – The major objective of catch basin cleaning is to reduce conveyance of solids and floatables to the combined sewer system by regularly removing accumulated catch basin deposits. Methods to clean catch basins include manual, bucket, and vacuum removal. Cleaning catch basins can only remove an average of 1-2 percent of the BOD_5 produced by a combined sewer watershed (USEPA, 1977). As a result catch basins cannot be considered an effective pollution control alternative for BOD removal. While catch basins can be effective in reducing floatables in combined sewers, catch basin cleaning does not necessarily increase floatables retention in the catch basin.
- New York City has an aggressive catch basin hooding program to contain floatables within catch basins and remove the material through catch basin cleaning (NYCDEP, 2005b).

- Industrial Pretreatment – Industrial pretreatment programs are geared toward reducing potential contaminants in CSO by controlling industrial discharges to the sewer system.

7.2.2. Inflow Control

Inflow control involves eliminating or retarding storm water inflow to the combined sewer system, lowering the magnitude of the peak flow through the system, and thereby reducing overflows. Methods for inflow control are described below:

- Water Conservation, Infiltration/Inflow (I/I) Reduction - Water conservation and infiltration control are both geared toward reducing the dry weather flow in the system, thereby allowing the system to accommodate more CSO. Water conservation includes measures such as installing low flow fixtures, public education to reduce wasted water, leak detection and correction, and other programs. The City of New York has an on-going water conservation and public education program. The NYCDEP's ongoing efforts to save water include: installing home meters to encourage conservation; use of sonar equipment to survey all water piping for leaks; replacement of approximately 70 miles of old water supply pipe a year; and equipping fire hydrants with special locking devices. These programs in conjunction with other on-going water conservation programs have resulted in the reduction of water consumption by approximately 200 million gallons per day over a 12 year period.
- Infiltration is ground water that enters the collection system through leaking pipe joints, cracked pipes, manholes, and other similar sources. Excessive amounts of infiltration can take up hydraulic capacity in the collection system. In contrast, inflow in the form of surface drainage is intended to enter the combined sewer system (CSS). For combined sewer communities, sources of inflow that might be controlled include leaking or missing tide gates and inflow in the separate sanitary system located upstream of the CSS. New York City has achieved significant reductions in wastewater flow through its existing water conservation program.
- Green Solutions – Green solutions is a broad term covering a range of techniques offering the potential to reduce peak storm overflow rates. The goal of Green Solutions is to mimic predevelopment site hydrology by using site design techniques that store, infiltrate, evaporate and detain runoff. Green solutions have the potential to reduce both the volume of storm water generated by a site and its peak overflow rate, thereby improving the quality of the storm water.
- Data is available to assess the cost and benefits of green solutions to undeveloped sites. However, due to the complications of existing infrastructure and the cost of acquiring land, few studies have been conducted for applying them to urban areas. These costs are also highly site specific. In addition, in urban settings such as New York City, implementation would be under the domain of other City agencies with some solutions requiring more than one agency interface and these agencies may require regulatory changes prior to proceeding with any initiative. These agencies include, at a minimum, the NYCDPR, the Department of Transportation, and the Department of Building.

  Common Green Solutions techniques are described below:

- Bioretention (rain garden) – a planting bed or landscaped area used to hold runoff and to allow it to infiltrate.
- Dry Wells – an excavated pit, backfilled with granular material to allow infiltration.
- Filter Strips – a band of vegetation located between the runoff location and the receiving channel or water body. Overland flow over the filter strip allows infiltration and filtering of storm water.
- Vegetated Buffers – a strip of vegetation around sensitive areas such as water bodies that provides infiltration, slows and disperses storm water and allows some trapping of sediment.
- Level Spreader – an aggregate filled trench designed to convert concentrated flow to sheet flow to promote infiltration and reduce erosion.
- Grassed Swales – depressions designed to collect, treat, and retain runoff from a storm event. Swales can be designed to be dry or wet (with standing water) between rain events. Wet swales typically contain water tolerant vegetation and use natural processes to remove pollutants.
- Rain Barrels – a barrel placed at the end of a roof downspout to capture and hold runoff from roofs. The water in the barrel must be manually emptied onto the ground, or it can be put to beneficial use to water vegetation. The barrel top typically has a protective screen to inhibit mosquitoes.
- Cisterns – an underground tank that stores rain water from roofs is diverted into underground tanks and stored for non-potable uses.
- Infiltration Trenches – an excavated trench backfilled with stone to create a subsurface basin that provides storage for water and allows infiltration.
- Rooftop Greening – the practice of constructing pre-cultivated vegetation mats on rooftops to capture rainfall, thereby reducing runoff and CSO.
- Increased Tree Cover – planting trees in the City to capture a portion of rainfall.
- Permeable Pavements – a type of surface material that reduces runoff to the combined sewer drainage system by allowing precipitation to infiltrate through the paving material and into the earth.

As green solutions techniques are distributive by design, they must be applied over a large area in order to achieve any significant reductions in runoff volume and/or flow rate to the CSS. In urban areas, it is not cost-effective to demolish existing infrastructure just for the purpose of green solutions applications alone. It is generally accepted that green solutions becomes cost-effective when redevelopment is under construction simultaneously within an urban area. This is because the streets and sidewalks are already dug up, allowing substantial construction cost savings. In the case of roof top greening, it requires significant participation and cooperation of business and private property owners as well as evaluation and possibly revisions to the Building Code.

New York City is currently piloting several green solutions and is encouraging private group participation through a grants program. In addition, the City Council of New York has also passed legislation requiring the NYCDEP to create a watershed protection plan for the watershed/sewershed of Jamaica Bay. This legislation established the initial pathway towards restoring and maintaining the water quality and ecological integrity of the Bay by comprehensively assessing threats to the bay and coordinating environmental remediation and protective efforts in a focused and cost effective manner. The WB/WS Facility Plan is required to address areas such as best management practices to minimize and control both point and non-point source pollution and is to assess the technical, legal, environmental and economic feasibility of implementing these measures. The Council resolution dictated that the WB/WS Facility Plan is to be completed no later than September 1, 2006. This date was extended to October 2007.

Further, the City Council also passed a Local Law requiring City owned buildings or those being reconstructed with City funding to include certain sustainable practices. The City is currently in the process of issuing guidance on what those practices must be.

BMPs, such as Source Controls (Section 7.2.1) and Inflow Controls (Section 7.2.2) also known as Low-Impact Development practices (LIDs), are currently being evaluated through the NYCDEP Bureau of Environmental Planning and Assessment and the Mayor's Office of Sustainability. Both of these groups are evaluating the most practical BMPs and LIDS and working with other City agencies beyond the NYCDEP to encourage the adoption of these practices. The NYCDEP is also working with these agencies to understand where new regulations or modifications to such rules that governing building construction, zoning regulations and other institutional actions would be required to institute these BMPs/LIDs.

In addition, as part of the ongoing Jamaica Bay Watershed Protection Plan initiative, the NYCDEP will be conducting a number of pilot studies to assess the effectiveness of BMPs in New York City's urban environment. While there are numerous published studies of conventional stormwater BMPs from various public agencies and private environmental groups; there is a critical data gap of specific information related to the effectiveness and appropriateness of the use of these technologies within New York City.

This pilot project, using Environmental Benefit Project (EBP) funding, will fill that data gap by conducting a three year pilot study to implement and monitor several new and innovative pilot stormwater treatment technologies and volume reduction stormwater BMPs for potential application within the Jamaica Bay watershed. These technologies aim to reduce the

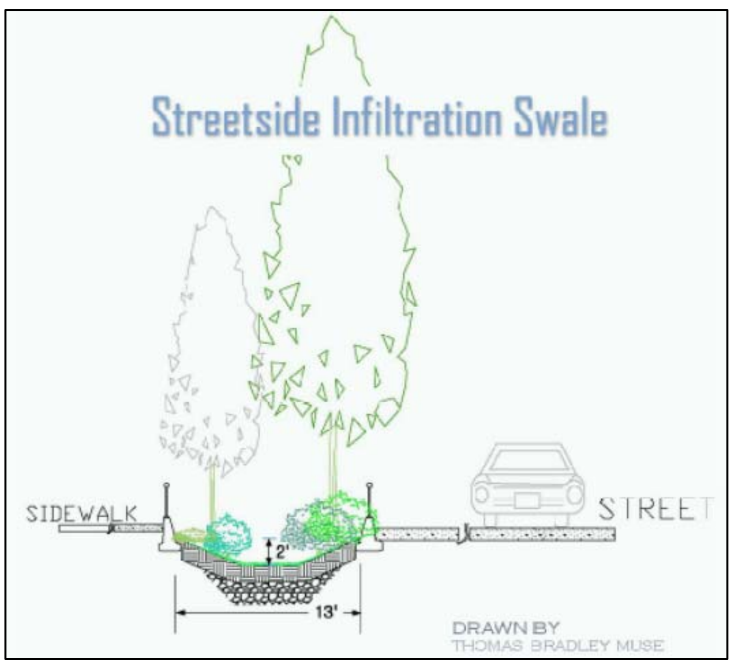


Exhibit 7-1. Diagram example of a street side infiltration swale

volume of stormwater that enters the sewer system thereby reducing the frequency and volume of CSO events, including reducing nitrogen inputs into Jamaica Bay from stormwater.

The approach in these BMP pilot studies is to assess the BMPs that decentralize stormwater treatment, by capturing and treating stormwater at the source where it can be most handled in lower quantities and overall pollutants.

The anticipated environmental benefits of identifying Green Site Design (GSD) BMPs for use in New York City can be grouped into three categories. The first category relates to the capture of the "first flush" of stormwater that contains the highest concentration of nitrogen, other nutrients and urban pollutants. The GSD BMPs identified under this pilot study will assist in improving the water quality of the receiving waters by capturing and treating many of the impurities found within urban stormwater. The removal of suspended sediments, nutrients (nitrogen/phosphorus), and trace metals will be attenuated through complex biogeochemical processes occurring within these "man-made", but natural filtering systems.

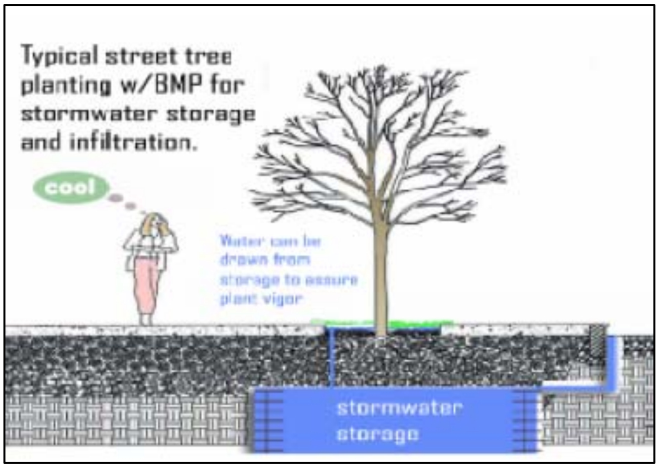


Exhibit 7-2. Diagram example of stormwater storage and infiltration BMP with tree planting

The second category relates to reducing the volume of stormwater entering the combined sewer system. A reduction in the volume of stormwater entering the combined sewer system will also increase the ability of the City's WPCPs to properly treat a greater volume of sanitary wastewater and reduce the volume of sanitary wastewater discharged in CSOs.

The third category relates to returning stormwater to the landscape and subsurface environments in order to benefit ecological communities and provide opportunities for open space. Precipitation capture can be approached either by centralizing its flows through stormwater infrastructure or using decentralized techniques to capture and treat water closer to where it falls. Thus, water can be conveyed off the land in pipes or captured, treated and re-used in soils and wetlands. Once the water enters the pipe, the natural filtering of stormwater by soils, wetlands and ground water systems are eliminated. As water is removed from the land, plant growth and ecological health is diminished proportionally, and the urban heat island effect is increased.

The Jamaica Bay BMP pilot study will provide designs, which divert runoff and associated stormwater nitrogen inputs from storm sewers. Runoff will be directed to flow into swales, soils, wetlands, and groundwater. The quantity of water diverted into the landscape and subsurface environments can become a resource for ecological communities on the land. By measuring and modeling the quantity of water diverted from the combined sewers, these pilot projects aim at making it possible to diminish the volume and/or frequency of CSO discharges into Jamaica Bay while at the same time allowing stormwater to act as an ecological resource for the landscape.

This pilot study will document the quality of New York City stormwater and refine the specific capture rates and treatment efficiencies for nitrogen and other nutrients and pollutants. Once this information has been gathered, it can be used to develop an effective GSD stormwater strategy that can provide improvements of stormwater quality. As part of the pilot studies, stormwater capture volume and pollutant removal rates of each of the technologies will be documented. Once these technologies are proven to be effective, a much wider citywide application of these technologies would be evaluated. The overall objective of this project is to implement on a pilot scale those GSD BMP's that would reduce stormwatwer flow into the combined sewer system, increase soil infiltration and pollutant removal, provide urban ecological restoration opportunities and increase overall green spaces within the watershed and applied elsewhere in the City.

The timeline of these evaluations and regulatory actions will extend beyond the June 2007 milestone for delivery of an approvable WB/WS Facility Plan to the NYSDEC and therefore inclusion of specific Source or Inflow Controls in this WB/WS Facility Plan is not possible.

The NYCDEP will, however, review the rules, regulations and/or incentives and environmental benefits that evolve out of these efforts and where possible, include these proposed solutions in a future modification when the WB/WS Facility Plan is converted to a Drainage Basin Specific Long Term Control Plan and/or in the City-Wide Long Term Control Plan.

7.2.3. Sewer System Optimization

This CSO control technology involves making the best use of existing facilities to limit overflows. The techniques are described below:

- Optimize Existing System – This approach involves evaluating the current standard operating procedures for facilities such as pump stations, control gates, inflatable dams, and treatment facilities to determine if improved operating procedures can be developed to provide benefit in terms of CSO control. This CSO control technology will be considered further in the alternatives development and evaluation screening.
- Real Time Control (RTC) – RTC is any response – manual or automatic – made in response to changes in the sewer system condition. For example, sewer level and flow data can be measured in "real time" at key points in the sewer system and transferred to a control device such as a central computer where decisions are made to operate control components (such as gates, pump stations or inflatable dams) to maximize use of the existing sewer system and to limit overflows. Data monitoring need not be centralized; local dynamic controls can be used to control regulators to prevent localized flooding. However, system wide dynamic controls are typically used to implement control objectives such as maximizing flow to the WPCP or transferring flows from one portion of the CSS to another to fully utilize the system. Predictive control, which incorporates use of weather forecast data is also possible, but is complex and requires sophisticated operational capabilities. RTC can reduce CSO volumes where in-system storage capacity

is available. In-system storage is a method of using excess sewer capacity by containing combined sewage within a sewer and releasing it to the WPCP after a storm event when capacity for treatment becomes available. Methods of equipping sewers for in-system storage include inflatable dams, mechanical gates and increased overflow weir elevations. RTC has been used in other cities such as Louisville, Kentucky; Cleveland, Ohio; and Quebec, Canada. Refer to Figure 7-1 for a diagram of an example inflatable dam system.

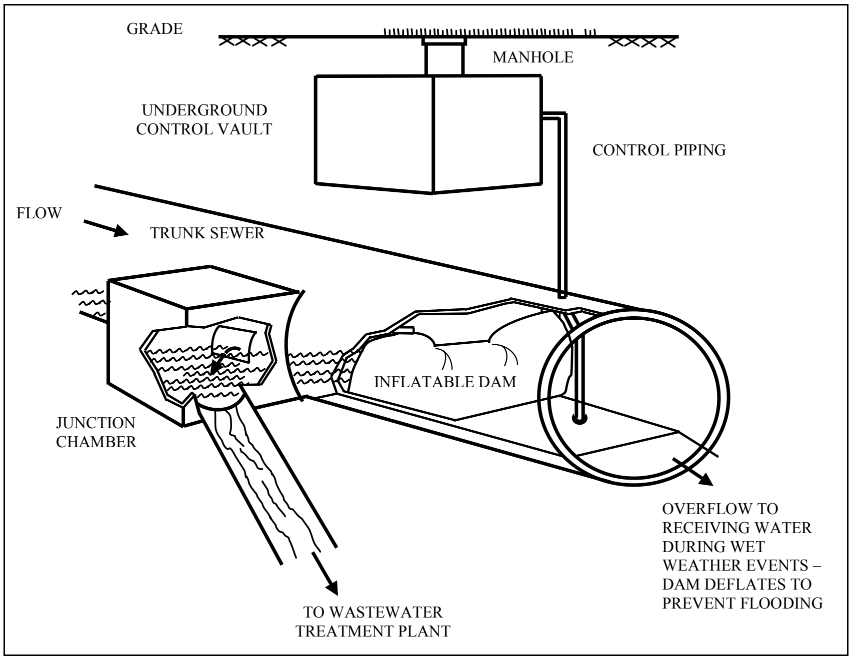


Figure 7-1. Inflatable Dam System

New York City has conducted an extensive pilot study of the use of inflatable dams (O'Brien & Gere, 2004) within the City's combined sewers. The results of this study have led to the use of inflatable dams and RTC to control them at two locations (Metcalf Avenue and Lafayette Avenue) in the Bronx. However, widespread application of inflatable dams and RTC is limited in NYC as it does not provide for storage of large enough volumes of combined sewage, in areas where tributary water quality is degraded, to provide adequate improvements in water quality. As such, real time control, as a CSO control technology, will not be included in the alternatives development and analyses.

7.2.4. Sewer Separation

Sewer separation is the conversion of a combined sewer system into a system of separate sanitary sewers and storm sewers. This alternative prevents sanitary wastewater from being discharged to receiving waters. However, when combined sewers are separated, storm sewer discharges to the receiving waters will increase since storm water will no longer be captured and treated in the combined sewer system. Loading of some pollutants, such as floatables, would increase with sewer separation because concentrations of these pollutants are higher in storm water than in sanitary sewage. In addition, this alternative involves substantial city-wide excavation that would exacerbate street disruption problems within the City.

Varying degrees of sewer separation could be achieved as follows:

- Rain Leader (Gutters and Downspouts) Disconnection – Rain leaders are disconnected from the combined sewer system with storm runoff diverted elsewhere. Depending on the locale, leaders may be run to a dry well, vegetation bed, a lawn, a storm sewer or the street. Unfortunately, this scheme contributes to nuisance street flooding and may only briefly delays the water from entering the combined sewer system through catch basins. As such, it is eliminated from further consideration.
- Partial Separation – Combined sewers are separated in the streets only, or other public rights-of way. This is accomplished by constructing either a new sanitary wastewater system or a new storm water system. Since partial separation does not completely eliminate combined sewer overflows other control mechanisms must also be implemented. As such, only complete separation will be considered for further evaluation.
- Complete Separation – In addition to separation of sewers in the streets, storm water runoff from private residences or buildings (i.e. rooftops and parking lots) is also separated. Complete separation is almost impossible to attain in New York City since it requires re-plumbing of apartment buildings, office buildings and commercial buildings where roof drains are interconnected to the sanitary plumbing inside the building. However, because complete separation eliminates combined sewer overflows, it was evaluated further as an alternative for the Hutchinson River.

Figure 7-2 shows a diagram of these methods of separation.

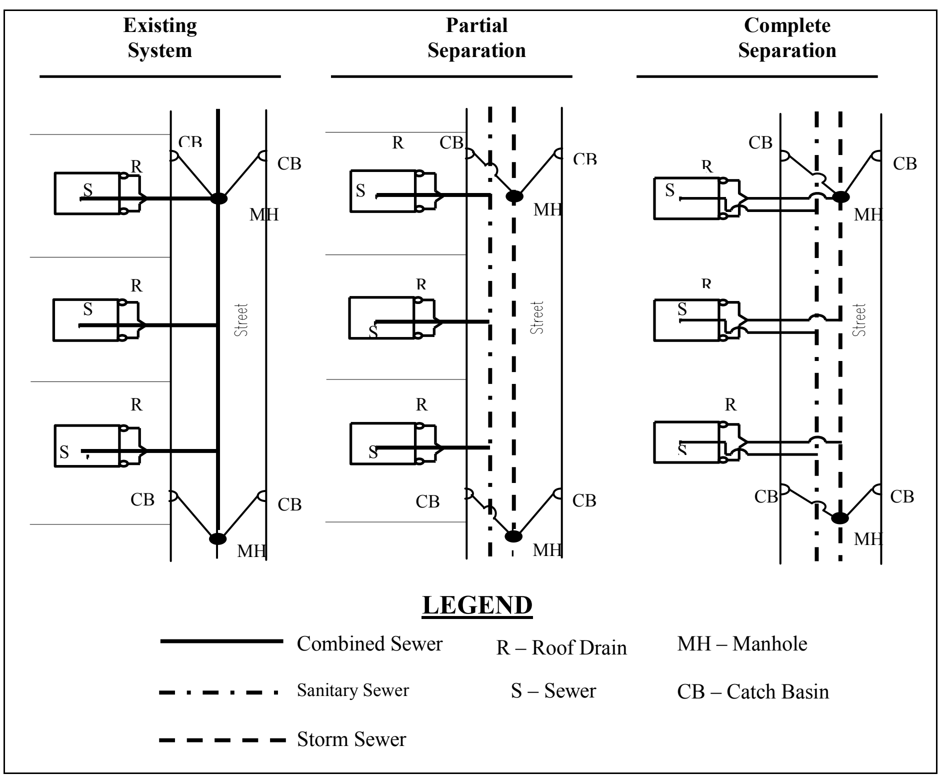


Figure 7-2. Sewer Separation Alternatives

7.2.5. Storage

The objective of retention basins (also referred to as off-line storage) is to reduce overflows by capturing combined sewage in excess of WPCP capacity during wet weather for controlled release into wastewater treatment facilities after the storm. Retention basins can provide a relatively constant flow into the treatment plant and thus reduce the size of treatment facilities required. Retention basins have had considerable use and are well documented. Retention facilities may be located at overflow points or near dry weather or wet weather treatment facilities. A major factor determining the feasibility of using retention basins is land availability. Operation and maintenance costs are generally small, typically requiring only collection and disposal cost for residual sludge solids, unless inlet or outlet pumping is required. Many demonstration projects have included storage of peak storm water flows, including those in Richmond, Virginia; Chippewa Falls, Wisconsin; Boston, Massachusetts; Milwaukee, Wisconsin; and Columbus, Ohio.

The following are types of CSO retention facilities:

- Closed Concrete Tanks – Closed concrete tanks are similar to open tanks except that the tanks are covered and include many mechanical facilities to minimize their aesthetic and environmental impact. Closed concrete tanks typically include odor control systems, washdown/solids removal systems, and access for cleaning and maintenance. Closed concrete tanks have been constructed below grade such that the overlying surface can be used for parks, playgrounds, parking or other light public uses.
- Storage Pipelines/Conduits – Large diameter pipelines or conduits can provide significant storage in addition to the ability to convey flow. The pipelines are fitted with some type of discharge control to allow flow to be stored within the pipeline during wet weather. After the rain event, the contents of the pipeline are allowed to flow by gravity along its length. A pipeline has the advantage of requiring a relatively small right-of-way for construction. The primary disadvantage is that it takes a relatively large diameter pipeline or cast-in-place conduit to provide the volume required to accommodate large periodic CSO flows requiring a greater construction effort than a pipeline used only for conveyance. For large CSO areas, pipeline size requirements may be so large that construction of a tunnel is more feasible.
- Tunnels – Tunnels are similar to storage pipelines in that they can provide both significant storage volume and conveyance capacity. Tunnels have the advantage of causing minimal surface disruption and of requiring little right-of-way for construction. Excavation to construct the tunnel is carried out deep beneath the city and therefore would not impact traffic. The ability to construct tunnels at a reasonable cost depends on the geology. Tunnels have been used in many CSO control plans including Chicago, Illinois; Rochester, New York; Cleveland, Ohio; Richmond, Virginia; and Toronto, Canada, among others. A schematic diagram of a typical storage tunnel system is shown in Figure 7-3. The storage tunnel stores flow and then conveys it to a dewatering station where floatables are removed at a screening house and then flows are lifted for conveyance to the WPCP.

Due to the operating history of concrete tanks, storage pipelines and conduits, and tunnels in New York City and other locales, the three types of storage and conveyance technologies will be retained for further consideration.

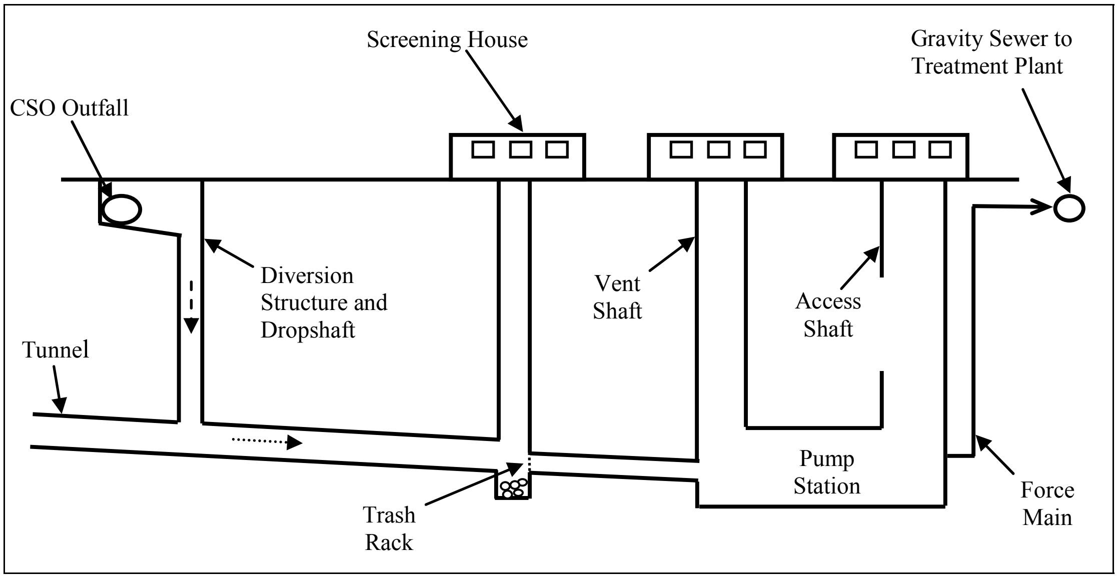


Figure 7-3. Storage Tunnel Schematic

7.2.6. Treatment

- Screening – The major objective of screening is to provide high rate solids/liquid separation for combined sewer floatables and debris thereby preventing floatables from entering receiving waters. The following categories of screens are applicable to CSO outfall applications.
  - Trash Racks and Manually Cleaned Bar Racks – Trash racks are intended to remove large objects from overflow and have a clear spacing between approximately 1.5 to 3.0 inches. Manually cleaned bar racks are similar and have clear spacings between 1.0 to 2.0 inches. Both screens must be manually raked and the screenings allowed to drain before disposal.
  - Netting Systems – Netting Systems are intended to remove floatables and debris at CSO outfalls. A system of disposable mesh bags is installed in either a floating structure at the end of the outfall or in an underground chamber on the land side of the outfall. Nets and captured debris must be periodically removed using a boom truck and disposed of in a landfill.
  - Mechanically Cleaned Bar Screens – Mechanically cleaned bar screens typically have clear spacing between 0.25 and 1.0 inches. Bars are mounted 0 to 39 degrees from the vertical and rake mechanisms periodically remove material trapped on the bar screen. Facilities are typically located in a building to house collected screenings that must be collected after a CSO event and then transported to a landfill.
  - Fine Screens – Fine screens in CSO facilities typically follow bar screens and have openings between 0.010 and 0.5 inches. Flow is passed through the openings and solids are retained on the surface. Screens can be in the shape of a rotary drum or linear horizontal or vertical screens. Proprietary screens such as ROMAG have been specifically designed for wet weather applications. These screens retain solids on the dry weather side of the system so they can be conveyed to the wastewater treatment

plant with the sanitary wastewater thereby minimizing the need for manual collection of screenings.

Manually cleaned screens for CSO control at remote locations have not been widely applied due to the need to clean screens, and the potential to cause flooding if screens blind. Mechanically cleaned screens have had much greater application at CSO facilities. Due to the widely varying nature of CSO flow rates, even mechanically cleaned screens are subject to blinding under certain conditions. In addition, the screening must be housed in a building to address aesthetic concerns and may require odor facilities as well. Fine screens have had more limited application for CSOs in the United States. ROMAG reports that over 250 fine screens have been installed in Europe and several screens have been installed in the United States (USEPA, 1999a).

- Primary Sedimentation – The objective of sedimentation is to produce a clarified effluent by gravitational settling of the suspended particles that are heavier than water. It is one of the most common and well-established unit operations for wastewater treatment. Sedimentation tanks also provide storage capacity, and disinfection can occur concurrently in the same tank. It is also very adaptable to chemical additives, such as lime, alum, ferric chloride, and polymers, which provide higher suspended solids and BOD removal. Many CSO control demonstration projects have included sedimentation. These include Dallas, Texas; Saginaw, Michigan; and Mt. Clements, Michigan (USEPA, 1978). Studies on existing storm water basins indicate suspended solids removals of 15 to 89 percent; BOD_5 removals of 10 to 52 percent (Fair and Geyer, 1965; USEPA, 1978; Oliver and Gigoropolulos, 1981; Ferrara and Witkowski, 1983).
- The NYCDEP's WPCPs are designed to accept their respective 2×DDWF for primary treatment during wet weather events. As such, NYC already controls a significant portion of combined sewage through the use of this technology.
- Vortex Separation – Vortex separation technologies currently marketed include: USEPA Swirl Concentrator, Storm King Hydrodynamic Separator of British design, and the FluidSep vortex separator of German design. Although each of the three is configured somewhat differently, the operation of each unit and the mechanisms for solids separation are similar. Flow enters the unit tangentially and is directed around the perimeter of a cylinder, creating a swirling, vortex pattern. The swirling action causes solids to move to the outside wall and fall toward the bottom, where the solids concentrated flow is conveyed through a sewer line to the WPCP. The overflow is discharged over a weir at the top of the unit. Various baffle arrangements capture floatables that are subsequently carried out in the underflow. Principal attributes of the vortex separator are the ability to treat high flows in a very small footprint, and a lack of mechanical components and moving parts, thereby reducing operation and maintenance.
- Vortex separators have been operated in Decatur Illinois; Columbus, Georgia; Syracuse, New York; West Roxbury, Massachusetts; Rochester, New York; Lancaster, Pennsylvania; Toronto, Ontario, Canada. Vortex separator prototypes have achieved suspended solids removals of 12 to 86 percent in Lancaster, Pennsylvania; 18 to 55 percent in Syracuse, New York; and 6 to 36 percent in West Roxbury, Massachusetts. BOD_5 removals from 29 to 79 percent have been achieved with the swirl concentrator prototype in Syracuse New York. (Alquier, 1982).

- New York City evaluated the performance of three swirl/vortex technologies at a full-scale test facility (133 MGD each) at the Corona Avenue Vortex Facility. The purpose of the test was to demonstrate the effectiveness of the vortex technology for control of CSO pollutants, primarily floatables, oil and grease, settleable solids and total suspended solids. The two-year testing program, completed in late 1999, evaluated the floatables-removal performance of the facility for a total of 22 wet weather events. Overall, the results indicated that the vortex units provided an average floatables removal of approximately 60 percent during the tested events. Based on the results of the testing, NYCDEP concluded that widespread application of the vortex technology is not effective for control of settleable solids and was not a cost effective way to control floatables. As such, the application of this technology will be limited and other methods to control floatable discharges into receiving waters will need to be assessed.
- Also, the performance of vortex separators has been found to be inconsistent in other demonstrations. A pilot study in Richmond, Virginia showed that the performance of two vortex separators was irregular and ranged from <0 percent to 26 percent with an average removal efficiency of about 6 percent (Greeley and Hansen, 1995). The performance of vortex separators is also a strong function of influent TSS concentrations. A high average influent TSS concentration will yield a higher percent removal. As a result, if influent CSO is very dilute with storm water, the overall TSS removal will be low. Suspended solids removal in the beginning of a storm may be better if there is a pronounced first flush period with high solids concentrations (City of Indianapolis, 1996). Removal effectiveness is also a function of the hydraulic loading rate with better performance observed at lower loading rates. Furthermore, one of the advantages of vortex separation – the lack of required moving parts – requires sufficient driving head. Based on the poor results of the testing at the Corona Vortex Facility (NYCDEP, 2005c), and the general lack of available head, vortex separators have been removed from further consideration in New York City.
- <u>High Rate Physical Chemical Treatment (HRPCT)</u> – High rate physical/chemical treatment is a traditional gravity settling process enhanced with flocculation and settling aids to increase loading rates and improve performance. The pretreatment requirements for high rate treatment are screening and degritting, identical to that required prior to primary sedimentation. The first stage of HRPCT is coagulant addition, where ferric chloride, alum or a similar coagulant is added and rapidly mixed into solution. Degritting may be incorporated into the coagulation stage with a larger tank designed for gravity settling of grit material. The coagulation stage is followed by a flocculation stage where polymer is added and mixed to form floc particles that will settle in the following stage. Also in this stage recycled sludge or micro sand from the settling stage is added back in to improve the flocculation process. Finally, the wastewater enters the gravity settling stage that is enhanced by lamella tubes or plates. Disinfection, which is not part of the HRPCT process, typically is completed after treatment to the HRPCT effluent. Sludge is collected at the bottom of the clarifier and either pumped back to the flocculation stage or wasted periodically when sludge blanket depths become too high. The two principal manufacturers of HRPCT processes are Infilco Degremont Incorporated, which manufacturers the DensaDeg process, and Kruger, which manufactures the Actiflo

process. U.S. Filter also markets mobile clarification (a semi-trailer unit) that features the Kruger, Inc. Actiflo process. Each is described in more detail below:

- IDI DensaDeg – Infilco Degremont offers the DensaDeg 2D and 4D processes, both of which require screening upstream. The 2D process requires upstream grit removal as well, but the 4D process integrates grit removal into the coagulation stage. Otherwise the 2D and 4D processes are identical.
- DensaDeg performance varies with surface overflow rate and chemical dosages, but in general removal rates of 80 – 95 percent for TSS and 30 – 60 percent for BOD can be expected. Phosphorous and nitrogen are also removable with this process, although the removal efficiencies are dependent on the solubility of these compounds present in the wastewater. Removal efficiencies are also dependent on start-up time. Typically the DensaDeg process takes about 30 minutes before optimum removal rates are achieved to allow for the build-up of sludge solids.
- Kruger Actiflo – The Kruger Actiflo process is different from the DensaDeg process in that fine sand is used to ballast the sludge solids. As a result, the solids settle faster, but specialized equipment must be incorporated in the system to accommodate the handling sand throughout the system. Figure 7-4 shows the components of a typical Kruger Actiflo system.
- The Kruger Actiflo process does require screening upstream. Grit removal is recommended, but since the system uses microsand as ballast in the process, the presence of grit is tolerable in the system. If grit removal does not precede the process, the tanks must be flushed of accumulated grit every few months to a year, depending on the accumulation of grit and system run times.
- Actiflo performance varies with surface overflow rate and chemical dosages, but in general removal rates of 80 – 95 percent for TSS and 30 – 60 percent for BOD are typical. Phosphorous and nitrogen are also removable with this process, although the removal efficiencies are dependent on the solubility of these compounds present in the wastewater. Phosphorous removal is typically between 60 – 90 percent, and nitrogen removal is typically between 15 – 35 percent. Removal efficiencies are also dependent on start-up time. Typically the Actiflo process takes about 15 minutes before optimum removal rates are achieved.
- Pilot testing of HRPCT was performed at the 26th Ward WPCP in Brooklyn, and consisted of evaluating equipment from three leading HRPCT manufacturers from May through August 1999. The three leading processes tested during the pilot test were the Ballasted Floc Reactor™ from Microsep/US Filter, the Actiflow™ from Kruger, and the Densadeg 4D™ from Infilco Degremont. Pilot testing suggested good to excellent performance on all units, often in excess of 80 percent for TSS and 50 percent for BOD_5. Based on this past success of the technology, a HRPCT demonstration facility will be undertaken to encompass three different process units. The proposed 9,400 square foot demonstration facility will be located on a newly acquired property east of the Port Richmond WPCP on Staten Island and will operate over an 18-month period once construction is complete.

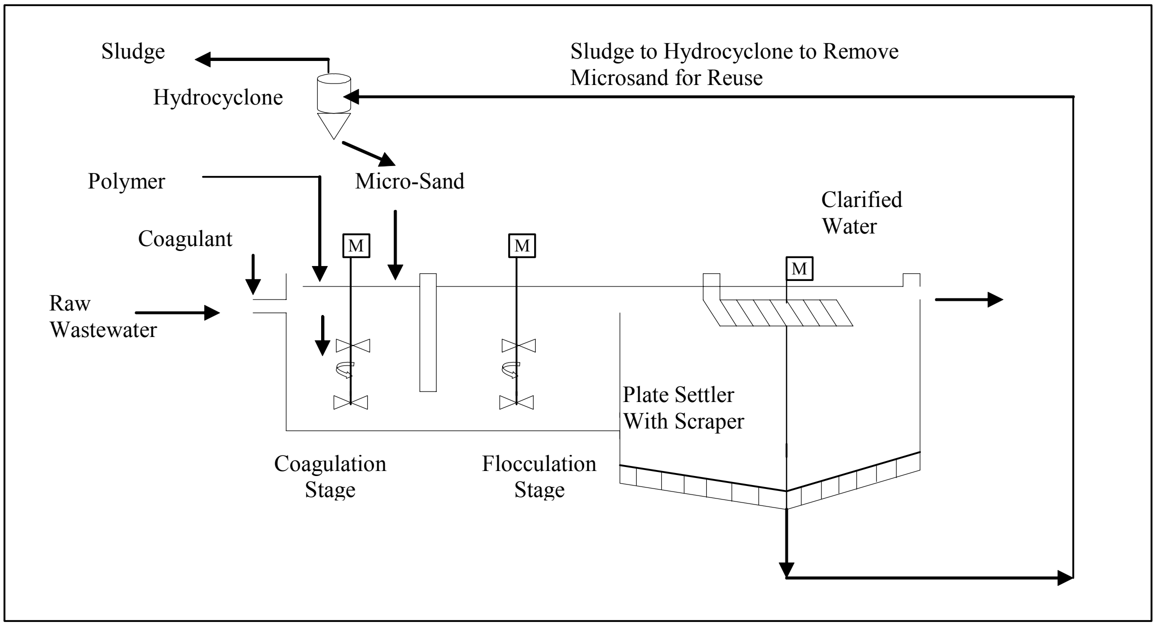


Figure 7-4. Kruger Actiflo HRPCT

- Disinfection – The major objective of disinfection is to control the discharge of pathogenic microorganisms in receiving waters. Disinfection of combined sewer overflow is included as part of many CSO treatment facilities, including those in Washington, D.C.; Boston, Massachusetts; Rochester, New York; and Syracuse, New York. The disinfection methods considered for use in combined sewer overflow treatment are chlorine gas, calcium or sodium hypochlorite, chloride dioxide, peracetic acid, ozone, ultraviolet radiation, and electron beam irradiation. The chemicals are all oxidizing agents that are corrosive to equipment and in concentrated forms are highly toxic to both microorganisms and people. Each is described below.
  - Chlorine gas – Chlorine gas is extremely effective and relatively inexpensive. However, it is extremely toxic and its use and transportation must be monitored or controlled to protect the public. Chlorine gas is a respiratory irritant and in high concentrations can be deadly. Therefore, it is not well suited to populous or potentially non-secure areas.
  - Calcium or Sodium Hypochlorite – Hypochlorite systems are common in wastewater treatment installations. For years, large, densely populated metropolitan areas have employed hypochlorite systems in lieu of chlorine gas for safety reasons. The hypochlorite system uses sodium hypochlorite in a liquid form much like household bleach and is similarly effective as chlorine gas although more expensive. It can be delivered in tank trucks and stored in aboveground tanks. The storage life of the solution is 60 to 90 days (before the disinfecting ability of the solution starts to degrade).
  - Chlorine Dioxide – Chlorine dioxide is an extremely unstable and explosive gas and any means of transport is potentially very hazardous. Therefore, it must be generated

on site. The overall system is relatively complex to operate and maintain compared to more conventional chlorination.

- Ozone – Ozone is a strong oxidizer and must be applied to CSO as a gas. Due to the instability of ozone, it must also be generated on site. The principle advantage of ozone is that there is no trace residual chlorine remaining in the treated effluent. Disadvantages associated with ozone use as a disinfectant is that it is relatively expensive, with the cost of the ozone generation equipment being the primary capital cost item. Operating costs can be very high depending on power costs, since ozonation is a power intensive system. Ozonation is also relatively complex to operate and maintain compared to chlorination. Ozone is not considered practical for CSO applications because it must be generated on site in an intermittent fashion in response to variable and fluctuating CSO flow rates.
- UV Disinfection – UV disinfection uses light with wavelengths between 40 and 400 nanometers for disinfection. Light of the correct wavelength can penetrate cells of pathogenic organisms, structurally altering DNA and preventing cell function. As with ozone, the principle advantage of UV disinfection is that no trace chlorine residual remains in the treated effluent. However, because UV light must penetrate the water to be effective, the TSS level of CSOs can affect the disinfection ability. As such, to be effective UV must be preceded by thorough separation of solids from the combined sewage. Pretreatment by sedimentation, high-rate sedimentation, and/or filtration maybe required to reduce suspended solids concentrations to less than 20 to 40 mg/l or so depending on the water quality goals.

Disinfection reduces potential public health impacts from CSOs but needs to be used in conjunction with other technologies.

In order to protect aquatic life in the receiving waters, dechlorination facilities would need to be installed whenever chlorination is used as a disinfectant. Dechlorination would be accomplished by injection of sodium bisulfite in the flow stream before discharge of treated CSO flow to waterways. Dechlorination with sodium bisulfite is rapid; hence no contact chamber is required. However, even with the addition of dechlorination, NYCDEP believes that there could be a residual of as much as 1mg/l from a CSO disinfection facility and has considered this factor in analyses contained herein.

- Expansion of Hunts Point WPCP – Hunts Point WPC Plant recently completed a major headworks upgrade to consistently achieve primary treatment and disinfection for wet weather flows up to 400 MGD. Prior to this upgrade, the plant was only capable of handling a wet weather flow of approximate 259 MGD. A Wet Weather Operating Plan for the Hunts Point WPCP (NYCDEP, 2003) was required as part of the Nitrogen Consent Order. This report provided recommendations for maximizing treatment of wet weather events during construction. The report outlined three primary objectives in maximizing treatment for wet weather flows: (1) consistently achieve primary treatment and disinfection for wet weather flows up to 400 MGD; (2) consistently provide secondary treatment for wet weather flows up to 200 mgd before bypassing the secondary treatment system (the plant will have the ability to provide a secondary level of treatment for 1.3 x DDWF); and (3) do not appreciably diminish the effluent quality or destabilize treatment upon return to dry weather operations.

- The Citywide Comprehensive Nitrogen Management Plan (March 30th, 2001) recommends that the maximum flow through the BNR System is to be 1.2 x DDWF along with plant recycles, for a total of 1.3 x DDWF. The remaining flow would be diverted as secondary bypass flow, based on calculations and field observations.
- The BNR treatment process must be protected against high wet weather flows due to the limitations on the secondary clarifier solids separation capability. The Step BNR process will demand a higher aerator effluent suspended solids concentration and higher solids load on the final settling tanks. Solids may be washed out of the final clarifiers due to the higher solids loading and deeper sludge blanket during major storm events. The BNR treatment process can be protected against such high wet weather flows due to the constraints on the secondary clarifier solids separation capability by limiting the secondary treatment flow to 1.3×DDWF, altering pass configurations under Construction Phase II, and by changing flow configurations to Contact Stabilization Mode during the wet weather flow in order to minimize the loss of the autotrophic organisms essential for BNR.

7.2.7. Receiving Water Improvement

- Receiving waters can also be treated directly with various technologies that improve water quality. Below are described the different treatment options that could aid in improving water quality in conjunction with CSO control measures:
- <u>Outfall Relocation</u> – Outfall relocation involves moving the combined sewer outfall to another location. For example, an outfall may be relocated away from a sensitive area to prevent negative impacts to that area. The Hutchinson River is located upstream of several private beaches and near one public Beach (Orchard Beach) the distance that would be required to relocate the outfalls in watershed to a point that they would not have the potential to impact the beaches is too great for this option to be considered.
- <u>Aeration</u> – Aeration improves the dissolved oxygen content of the river by adding air. Air could be added directly to the river (“in stream”). Air could possibly be added in large enough volumes to bring any waterbody into compliance with the ambient water quality standards. However, depending on the amount of air that would be required to be transferred into the water column, the facilities necessary and the delivery systems could be extensive an impractical. An alternative would be to deliver a lower volume of air and control short term anoxic conditions that may result from intermittent wet weather overflows. NYCDEP has investigated in-stream aeration as a method of meeting dissolved oxygen standards and will be conducting pilot tested this technology within Newtown Creek over the next few years. This alternative will be evaluated for the Hutchinson River due to the fact that the tidal (NYC) portion of the River is on the State’s 303d list for dissolved oxygen.
- <u>Maintenance Dredging</u> - Maintenance dredging technology is essentially the dredging of settled CSO solids from the bottom of waterbodies on an interim basis. The settled solids would be dredged from the receiving waterbody as needed to prevent use impairments such as access by recreational boater/kayakers and/or abate nuisance conditions such as odors. The concept would be to conduct dredging periodically or routinely to prevent the use impairment/nuisance conditions from occurring. Dredging would be conducted as an

alternative to structural CSO controls such as storage. Bottom water conditions between dredging operations would likely not comply with dissolved oxygen standards and bottom habitat would degrade following each dredging.

- This technology allows CSO settleable solids to exit the sewer system and settle in the waterbody generally immediately downstream of the outfall, but without regular or periodic dredging, such mounds can extend a thousand feet or more. The settled solids usually combine with leaves and accumulate into a "CSO" mound. This CSO mound would then be dredged and removed from the water environment. The assumption is that dredging would occur prior to the CSO mound creating an impairment or nuisance condition. Generally, it is envisioned that maintenance dredging would be preformed prior to a CSO mound building to an elevation that it becomes exposed at low tide or mean lower low tide. The extent and depth of dredging would depend on the rate of accretion, or build-up of settleable solids, and preferred years between dredging.
- The technology could be considered similar to the DSNY practice of dredging their marine transfer station barge slips. Every 5 to 10 years DSNY must conduct dredging of the barge slips at the stations because sediments accumulate and prevent the use of the barge slip. DSNY has investigated methods to prevent the accumulation of solids but decided that the routine or periodic dredging technology is the most cost-effective approach. This concept could potentially be applied to certain CSO sediment accumulation conditions.
- Dredging can be accomplished by a number of acceptable methods. Methods of dredging generally fall into either floating mechanical or hydraulic techniques, with a variety of variants for both of these techniques. The actual method of dredging selected would depend on the physical characteristics (grain size, viscosity, etc.) of the materials that require removal, the extent of entrained pollutants (metals, etc), and local water currents, depth and width of waterbody and other conditions such as bridges that could interfere with dredge movements. It is likely that CSO sediments would require removal with a closed bucket mechanical dredge or an auger/suction-head hydraulic dredge. Removal techniques, however, would be site specific.
- After removal of CSO sediments, the material would likely be placed onto a barge for transport away from the site. On-site dewatering may be considered as well. Sediments would then be off-loaded from the barge and shipped by land methods to a landfill that accepts New York Harbor sediments. Recently, harbor sediments have been shipped to a landfill in Virginia for final disposal.
- No sediment mounts have been found in the Hutchinson River, therefore this option is not necessary in the waterbody.

7.2.8. Solids and Floatables Control

Technologies that provide solids and floatables control do not reduce the frequency or magnitude of CSO overflows, but can reduce the presence of aesthetically objectionable items such as plastic, paper, polystyrene and sanitary "toilet litter" matter, etc. These technologies include both end-of-pipe technologies such as netting and screens, as well as BMPs such as catch basin modifications and street cleaning which could be implemented upstream of outfalls in the drainage area. Each of these technologies is summarized below:

- <u>Netting Devices</u> **-** Netting devices can be used to separate floatables from CSOs by passing the flow through a set of netted bags. Floatables are retained in the bags, and the bags are periodically removed for disposal. Netting systems can be located in-water at the end of the pipe, or can be placed in-line to remove the floatables before discharge to the receiving waters. A typical in-line netting facility is shown in Figure 7-5. NYCDEP has installed a floating end of pipe netting system at CSO TI-023 located in Little Bay. The Hutchinson River WB/WS Facility Plan will look at this alternative in the watershed as a means of maintaining the beauty of the waterway, particularly in the area of Pelham Bay Park.

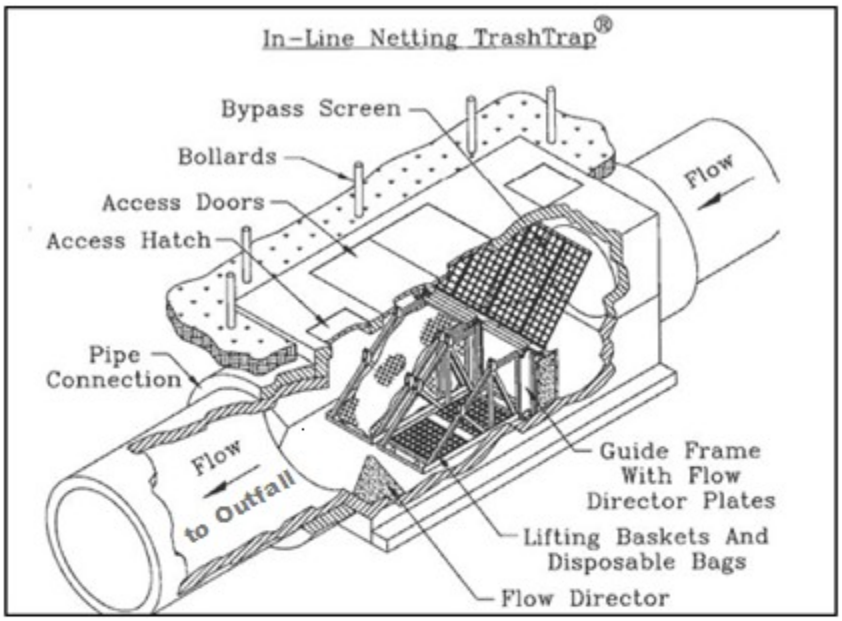


Figure 7-5. In-Line Netting in Outfall Pipeline
(Image Source: Fresh Creek Technologies)

- <u>Containment Booms</u> - Containment booms are specially fabricated floatation structures with suspended curtains designed to capture buoyant materials. They are typically anchored to a shoreline structure and to the bottom of the receiving water. After a rain event, collected materials can be removed using either a skimmer vessel or a land-based vacuum truck. A 2-year pilot study of containment booms was conducted by New York City in Jamaica Bay. An assessment of the effectiveness indicated that the containment booms provided a retention efficiency of approximately 75 percent. A containment boom schematic is provided below as Figure 7-6. Containment booms will not be considered in the Hutchinson River, as it is felt that in-line netting is better floatables control technology for this region due to the need to keep this waterway navigable and the width of the river.

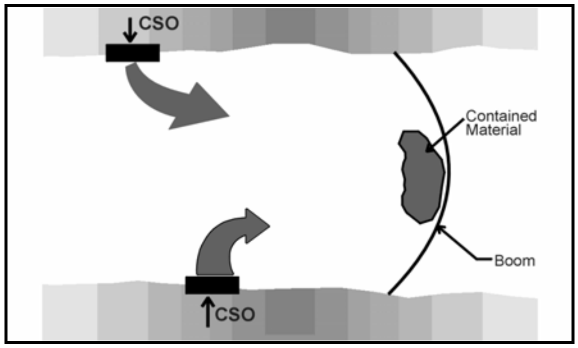


Figure 7-6. Containment Boom

- Bar Screens - Manually Cleaned **-** Manually cleaned bar screens can be located within in-line CSO chambers or at the point of outfall to capture floatables. The configuration of the screen would be similar to that found in the influent channels of small wastewater pumping stations or treatment facilities. Retained materials must be manually raked and removed from the sites after every storm. For multiple CSOs, this would result in very high maintenance requirements. Previous experience with manually cleaned screens in CSO applications has shown these units to have a propensity for clogging. In Louisville, KY, screens installed in CSO locations became almost completely clogged with leaves from fall runoff. Because of the high frequency of cleaning required, it was decided to remove the screens.
- Weir-Mounted Screens - Mechanically Cleaned - Horizontal mechanical screens are weir-mounted mechanically cleaned screens driven by electric motors or hydraulic power packs. The rake mechanism is triggered by a float switch in the influent channel and returns the screened materials to the interceptor sewer. Various screen configurations and bar openings are available depending on the manufacturer. Horizontal screens can be installed in new overflow weir chambers or retrofitted into existing structures if adequate space is available. Electric power service must be brought to each site. This option will be considered for use in the Hutchinson River waterbody when considering floatables control technologies.
- Baffles Mounted in Regulator
  - Fixed Underflow Baffles - Underflow baffles consist of a transverse baffle mounted in front of and typically perpendicular to the overflow pipe. During a storm event, the baffle prevents the discharge of floatables by blocking their path to the overflow pipe. As the storm subsides, the floatables are conveyed to downstream facilities by the dry weather flow in the interceptor sewer. The applicability and effectiveness of the baffle depends on the configuration and hydraulic conditions at the regulator structure. Baffles are being used in CSO applications in several locations including Boston, Massachusetts and Louisville, Kentucky. However, the typical regular structures in New York City are not amenable to fixed baffle retrofits.
  - Floating Underflow Baffles - A variation on the fixed underflow baffle is the floating underflow baffle developed in Germany and marketed under the name HydroSwitch by Gabriel Novac & Associates. The floating baffle is mounted within a regulator chamber sized to provide floatables storage during wet weather events. All floatables

trapped behind the floating baffle are directed to the WWTP through the dry weather flow pipe. By allowing the baffle to float, a greater range of hydraulic conditions can be accommodated. Although there are operating units in Germany, this technology has not yet been demonstrated in the United States and, for this reason, is eliminated from further consideration.

  - Hinged Baffle – The hinged baffle system incorporates two technologies, the hinged baffle and the bending weir. The system design is intended to retain floatables in regulators during storm events. During a storm event, the hinged baffle provides floatables retention while the bending weir increases flow to the plant. After a storm event, retained floatables drop into the regulator channel and then into the sewer interceptor to be removed at the treatment plant. During large storm events that exceed the capacity of the regulator, more flow backs up behind the baffle. To prevent flooding, the hinged baffle opens to allow more flow to pass through the regulator. The bending weir provides additional storage of storm water and floatables within the regulator during storm events by raising the overflow weir elevation. Similar to the hinged baffle, the bending weir also helps to prevent flooding during large storm events by opening and allowing additional combined sewage to overflow the weir. The bending weir allows an increasing volume of combined sewage to overflow the weir as the water level inside the regulators rise. The major benefit of the system is that it includes a built-in mechanical emergency release mechanism. This feature eliminates the need for the construction of an emergency bypass that many other in-line CSO control technologies require. In addition, the system has no utility requirements and is associated with low O&M costs. This option will not be considered within the Hutchinson River watershed due to a desire to implement a floatables control technology that provides a higher level of effectiveness.

- Catch Basin Modifications - Catch basin modifications consist of various devices to prevent floatables from entering the CSS. Inlet grates and closed curb pieces reduce the amount of street litter and debris that enters the catch basin. Catch basin modifications such as hoods, submerged outlets, and vortex valves, alter the outlet pipe conditions and keep floatables from entering the CSS. Catch basin hoods are similar to the underflow baffle concept described previously for installation in regulator chambers. These devices also provide a water seal for containing sewer gas. The success of a catch basin modification program is dependent on having catch basins with sumps deep enough to accommodate hood-type devices. A potential disadvantage of catch basin outlet modifications and other insert-type devices is the fact that retained materials could clog the outlet if cleaning is not performed frequently enough. This could result in backup of storm flows and increased street flooding. New York City has moved forward with a program to hood all of its catch basins.

- Best Management Practices (BMPs) – BMPs such as street cleaning and public education have the potential to reduce solids and floatables in CSO. These are described in the beginning of this section.

Table 7-2 provides a comparison of the floatables control technologies discussed above in terms of the effort to implement the technology, its required maintenance, effectives and relative cost. For implementation effort and required maintenance, technologies that require little to low effort are preferable to those requiring moderate or high effort. When considering effectiveness, a technology is preferable if the rating is high.

Table 7-2. Comparison of Solids and Floatable Control Technologies

Technology	Implementation Effort	Required Maintenance	Effectiveness	Relative Capital Cost
Public Education	Moderate	High	Variable	Moderate
Street Cleaning	Low	High	Moderate	Moderate
Catch Basin Modifications	Low	Moderate	Moderate	Low
Weir-Mounted Screens	Low	Moderate	High	Moderate
Screen with Backwash	High	Low	High	High
Fixed Baffles	Low	Low	Moderate	Low
Floating Baffles	High	Low	Moderate	Moderate
Bar Screens - Manual	Low	High	Moderate	Low
In-Line Netting	High	Moderate	High	High
End-of-Pipe Netting	Moderate	Moderate	High	Moderate
Containment Booms	Moderate	Moderate	Moderate	Moderate

Preliminary Screening Summary

Table 7-3 presents a tabular summary of the results of the preliminary technology screening discussed. Technologies that will advance to the alternatives development screening are noted under the column entitled “Retain for Consideration”. These technologies have proven experience and have the potential for producing some level of CSO control.

Other technologies were considered as having a positive effect on CSOs but either could only be implemented to a certain degree or could only provide a specific benefit level and, thusly, would have a variable effect on CSO overflow. For instance, NYCDEP has implemented a water conservation program which, to date, has been largely effective. This program, which will be maintained in the future, directly affects dry weather flow since it pertains to water usage patterns. As such, technologies included in this category provide some level of CSO control but in-of-themselves do not provide the level of control sought by this program.

Technologies included under the heading “Consider Combining with Other Control Technologies” are those that would be more effective if combined with another control or would provide an added benefit if coupled with another control technology.

The last classification is for those technologies which did not advance through the preliminary screening process.

Table 7-3. Screening of CSO Control Technologies

CSO Control Technology	Retain for Consideration	Implemented to Satisfactory Level	Consider Combining with Other Control Technologies	Eliminate from Further Consideration
Source Control				
Public Education		X		
Street Sweeping		X		
Construction Site Erosion Control		X		
Catch Basin Cleaning		X		
Industrial Pretreatment		X		
Inflow Control				
Storm Water Detention				X
Street Storage of Storm Water				X
Water Conservation		X		
Infiltration/Inflow Reduction		X		
Green Solutions			X	
Bioretention			X	
Dry Wells			X	
Filter Strips			X	
Vegetated Buffers			X	
Level Spreader			X	
Grassed Swales			X	
Rain Barrels			X	
Cisterns			X	
Infiltration Trenches/catch basins			X	
Rooftop Greening			X	
Increased Tree cover			X	
Permeable Pavements			X	
Sewer System Optimization				
Optimize Existing System	X			
Real Time Control				X

CSO Control Technology	Retain for Consideration	Implemented to Satisfactory Level	Consider Combining with Other Control Technologies	Eliminate from Further Consideration
Sewer Separation				
Complete Separation	X			
Partial Separation				X
Rain Leader Disconnection				X
Storage				
Closed Concrete Tanks	X			
Storage Pipelines/Conduits	X			
Tunnels	X			
Treatment				
Screening (see Floatables Control below)	X			
Primary Sedimentation		X		
Vortex Separator				X
High Rate Physical Chemical Treatment				X
Disinfection				X
Expansion of WPCP	X			
Receiving Water Improvement				
Outfall Relocation				X
In-stream Aeration	X			
Maintenance Dredging				X
Solids and Floatable Controls				
Netting Systems	X			
Containment Booms				X
Trash Racks/Manual Cleaned Bar Screens				X
Weir Mounted Screens	X			
Fixed baffles				X
Floating Baffles				X
Catch Basin Modifications		X		

The technologies successively moving through the preliminary screening process are formed into alternatives that are further screened in subsequent subsections of this section.

7.3. WATERSHED ALTERNATIVES

This section describes the development of preliminary control plan alternatives and the factors used to evaluate the alternative plans. The landside modeling results of the proposed alternatives are compared against the base conditions shown in Table 7-4 to determine the level of CSO reduction provided.

Table 7-4. Hutchinson River Discharge Summary for Baseline Condition (1,2,3)

Outfall	Discharge Volume (MG/yr)	Number of Events per year
HP-023	115	42
HP-024	254	43
HP-031	21	38
Total CSO	**390**	**NA**

Notes: (1) Baseline condition reflects design precipitation record (JFK, 1988) and sanitary flows projected for year 2045
(2) Totals may not sum precisely due to rounding.
(3) Hunts Point Wet Weather Capacity 259 MGD

7.3.1. Evaluation of Viable Waterbody Alternatives

The development of viable waterbody alternatives continued on from the June 2003 East River Combined CSO Abatement Facilities Plan (URS, 2003). This report builds on the previous report findings by analyzing alternatives in the context of CSO Policy requirements. The alternatives were evaluated based on criteria such as ability to comply with regulatory requirements, public acceptance, feasibility, and ease of operation and maintenance. The viable alternatives and actions include:

- Pathogen Loading Source Investigation
- Maximization of Flow to the WPCP
- System Optimization
    - Relief Sewers, Raised Weirs, PS Upgrade
- Green Alternatives / Low Impact Development (LID)
- Floatables Control
- Storage Tanks and Tunnels
- Sewer Separation
- Aeration/Oxygenation
- Interjurisdictional Coordination with Westchester County

7.3.2. Pathogen Loading Source Investigation

The first action that was evaluated within the Hutchinson River watershed was the implementation of a program to identify sources of pathogen loading to the river.

In 2004, the NYCDEP completed a stormwater sampling program to support the Harbor Estuary Program (HEP) Pathogen model (PATH) for the development of Harbor-wide TMDLs. The program focused its efforts on the collection of enterococci data, but also collected measurements of total/fecal coliform concentrations. These data were used to develop the loading concentrations for stormwater entering the Hutchinson River through Storm and CSO outfalls.

The sampling program covered only a small percentage of the 1,000-plus direct stormwater discharges in New York City. Within the Hutchinson River, storm outfalls HP-626, HP-627, and HP-638 were monitored during the sampling program. The results of the three outfalls are listed below in Table 7-5, while Table 7-6 illustrates "high level urban" and "low level urban" concentrations ultimately used in the water quality model as representative concentrations based on relative population density. The Hutchinson River watershed was determined to be in a "high level urban area" with a population density greater than 20,000 people per square mile.

Examination of the sampling data reveals that the September 18th sample taken at the Asch Loop monitoring station was unusually high when compared to the rest of the samples. A review of the concentrations at Asch Loop showed that the first three collection times during a storm event had extremely high bacteria concentrations indicating the presence of additional pathogen sources. In addition, Summer 2005 sampling, discussed in Section 4, indicates high pathogen levels in both Westchester County and the City. Potential benefits of interjurisdictional cooperation are further discussed in Section 7.3.12.

These pathogen sources to the river may be from residential, commercial or industrial connections or other sources and may be a result of intentional or accidental action. In some cases sanitary lines from residences or businesses are accidentally connected to the storm sewer by plumbers or builders that have not paid adequate attention to which pipe in the street they are tying into. The City routinely works to identify and remove these connections within the stormwater systems. Until these data were collected, there was no evidence specifically pointing to the Hutchinson River sewershed and therefore no action targeted specifically to this region.

Table 7-5. Summary Results of Stormwater Sampling Program – Hutchinson River

Outfall No.	Location	Date	Total Coliform	Fecal Coliform	Entero-Cocci
			#/100 mL x 10^3		
HP-638	Bellamy Loop	08-14-04	164	103	35
		10-15-04	275	137	51
		10-19-04	122	62	27
		Avg.	**187**	**101**	**38**
HP-627	Carver Loop	08-15-04	379	144	55
		10-15-04	452	257	105
		01-06-05	450	160	52
		Avg.	**427**	**187**	**71**
HP-626	Asch Loop	09-18-04 (1)	670	288	107
		10-15-04	335	153	70
		01-06-05	335	92	31
		Avg.	**447**	**178**	**69**

Notes: (1) Unusually high concentrations

Table 7-6. "High Level Urban" and "Low Level Urban" Concentrations

	Total Coliform	Fecal Coliform	Entero-Cocci
	#/100 mL x 10^3		
High Level	300	120	50
Low Level	150	35	15

As part of this action it is recommended that an interjurisdicional program, between Westchester County and NYC, of identifying and removing pathogen sources be developed within the Hutchinson River watershed. This program should be similar to the program recently completed for the Bronx River.

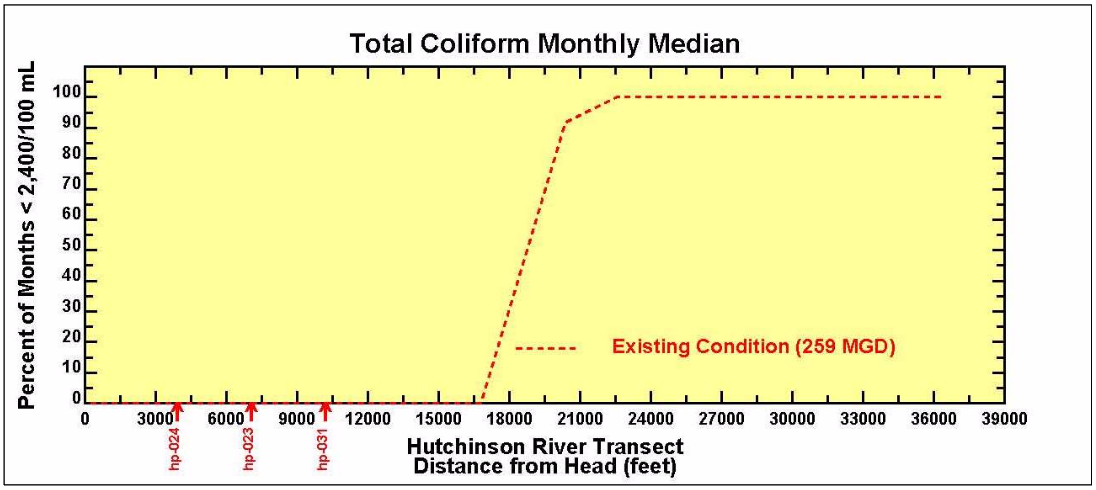
Water quality modeling indicates that the removal of these pathogen sources will improve the condition of the Hutchinson River by reducing the pollutant loads to the river. This is illustrated in Figures 7-7 and 7-8; these figures show the percent of months that the Hutchinson River will be in compliance with SB standards for fecal and total coliforms under three different conditions. Conditions one and two can be compared to demonstrate the effect of identifying and removing pathogen sources within the watershed. Subsequent water quality results presented in this section assume that these pathogen sources have been identified and removed (Figures 7-15, 7-16, and 7-17).

7.3.3. Maximization of Flow to the WPCP

Although the Hunts Point WPCP had a design capacity to treat up to 300 MGD through secondary treatment and up to 400 MGD through screenings, primary treatment and disinfection, the WPCP had limitations at the headworks that precluded flows from reaching these levels. Through late 2004, the Hunts Point WPCP was generally only able to treat peak flows up to 260

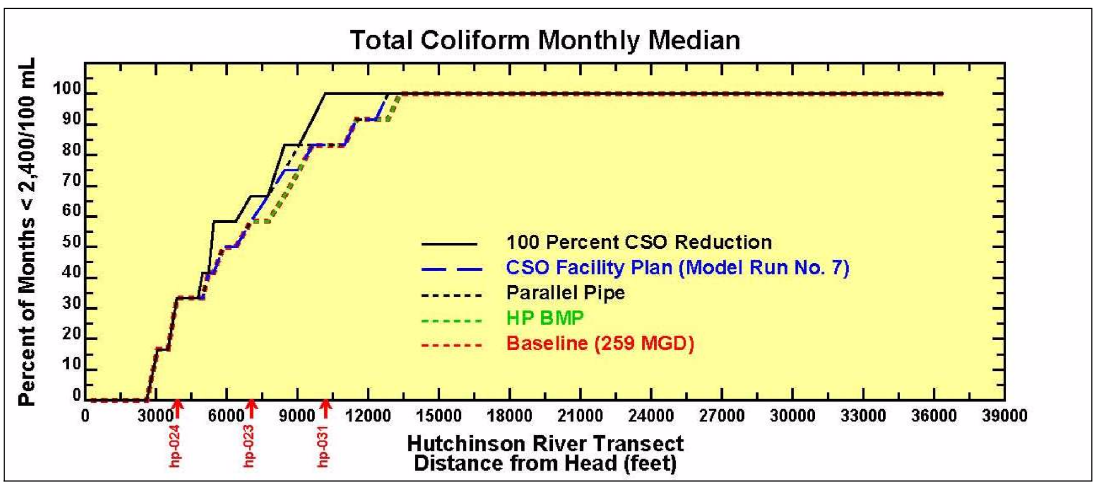
Condition #1

- Sources of Pathogen Loading Present
- Westchester County Out of Compliance



Condition #2

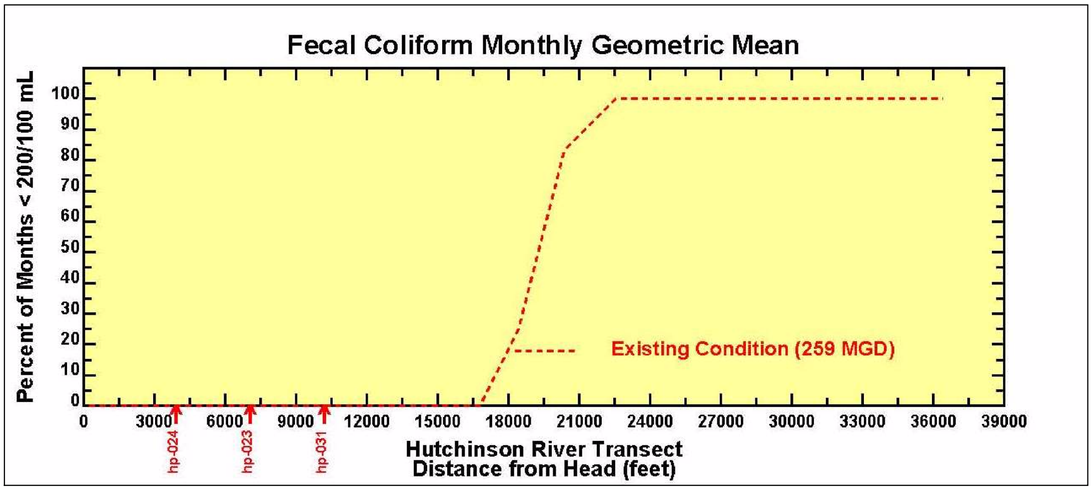
- Sources of Pathogen Loading Located and Removed
- Westchester County Out of Compliance



Total Coliform Water Quality Model Results Model Conditions Comparison

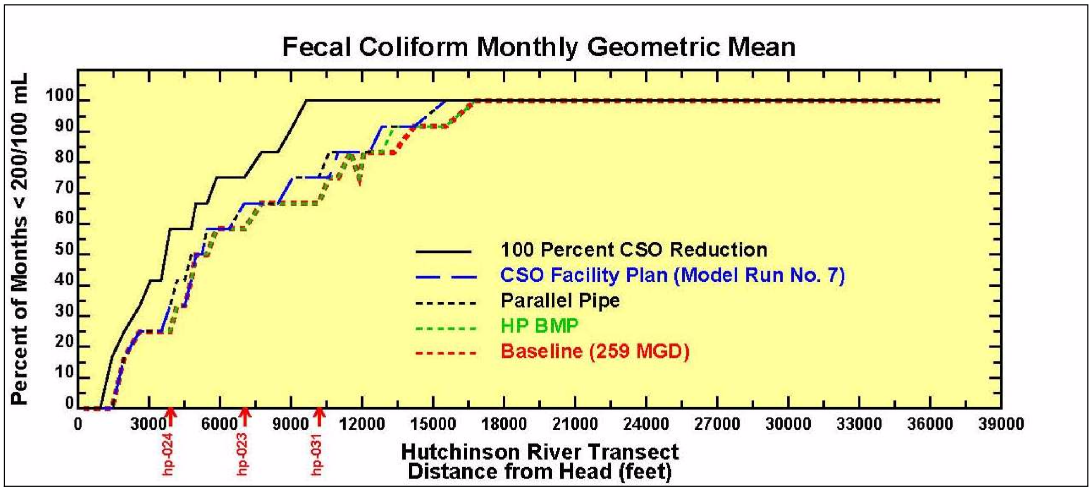
Condition #1

- Sources of Pathogen Loading Present
- Westchester County Out of Compliance



Condition #2

- Sources of Pathogen Loading Located and Removed
- Westchester County Out of Compliance



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Fecal Coliform Water Quality Model Results Model Conditions Comparison

MGD. As part of CSO reduction activities and as required by the Omnibus IV Consent Order, the NYCDEP redesigned the headworks as part of a major upgrade to the WPCP. Headwork improvements included new pumps, new headworks influent structures, new screens and influent throttling facility (See Section 3.1.1). These new facilities were installed at a cost of $26.0 million. To ensure treatment of 2×DDWF (400 MGD), a new forebay gate chamber to improve throttling of wet weather flows to the plant and an upgrade of the headworks and main sewage pump station (6 new VFD pumps) were accomplished as part of Phase I of the construction upgrade. Since November 2004, the NYCDEP has been going through the start-up debugging efforts of the new headworks equipment. As a result of this construction, in late 2004, WPCP peak flows have generally been between 385 and 400 MGD. A number of storms analyzed in 2005 have resulted in the WPCP processing between 400 and 415 MGD.

The design capacity of the WPCP allows 1.5×DDWF through the secondary portions of the WPCP. Prior to late 2004, the WPCP passed almost all of the influent flow through secondary treatment as at that time, sustained wet weather flows were generally at or below 265 MGD. Since completion of the headworks improvements in late 2004 and the ability to process influent flows on the order of 400 MGD, the WPCP normally processed about 300 MGD through secondary treatment. Upon completion of the Phase II BNR upgrade in mid-2007, the City plans to reduce secondary flows to 1.3×DDWF (260 MGD). This will be the practice at the WPCP since the base sanitary flow is now only about 110 MGD and processing 300 MGD (1.5×DDWF) through the aeration/BNR tanks would upset the process as this would result in a total of 2.7 times the actual dry weather flow being processed. The Citywide Comprehensive Nitrogen Management Plan (March 30, 2001) recommended that the maximum flow through the BNR System is to be 1.2×DDWF. With plant recycles, the total maximum flow is 1.3×DDWF. The remaining flow will be diverted as secondary bypass flow to final chlorination, as previously discussed in Section 3.

The sewer system model indicates that the upgrade substantially reduced total overflow volume from the Hunts Point sewershed, but had a negligible impact on the Hutchinson River outfalls. This can be attributed to the fact that the Hutchinson River's portion of the sewershed is the farthest from the treatment plant. However, the NYCDEP will maintain the Hunts Point WPCP's ability to deliver 2×DDWF (400 MGD) to the plant. Therefore, all subsequent alternatives were modeled to incorporate the improvements to Hunts Points WPCP headworks.

7.3.4. System Optimization

Parallel Relief Sewers

Several versions of this alternative were considered on the same section of sewer in the Hutchinson River sewershed. Two versions are discussed below, both of which seek the same result; increasing the conveyance of the sewer segment connecting IO-26, IO-18, CSO32 and CSO29A (in the Westchester Creek Watershed). By expanding this trunk line more flow can be sent downstream, thus reducing the overflows from three Hutchinson outfalls: HP-024, HP-023, and HP-031, which receive overflows from IO-18, IO-26, and CSO32, respectively.

In the first version of this alternative, approximately 2.5 miles of 60-inch parallel relief sewers would be constructed adjacent to the existing sewer lines, increasing the conveyance capacity for the section of sewer in question. The sections of existing sewer to be enlarged are illustrated in Figure 7-9. This version envisions two distinct segments of parallel relief sewers, one segment running from just downstream of IO-26 for 2,400-feet to Tillotson Avenue and a second segment starting at IO-18 and continuing some 11,000-feet to CSO29A. Modeling indicated that the alternative would result in a 25 percent reduction in CSO volume from the Hutchinson River outfalls compared to the baseline condition. It also indicated that this alternative would reduce overflows to 37 events per year, a reduction of 6 events from the baseline. The cost for this version of the alternative is estimated at $149 million.

The second version of this alternative covered the same reach of pipe in four shorter segments rather than two longer segments, the end result of which was about 1.6 miles of 60-inch relief pipe being constructed with a greater number of junction chambers required to interconnect the relief sewer segments to the existing segments. Modeling indicated that the alternative would result in a 21 percent reduction in CSO volume from the Hutchinson River outfalls. It also indicated that this alternative would reduce overflows to 40 events per year, a reduction of 3 events per year when compared to the baseline. The cost for this version of the alternative is estimated at $98.8 million.

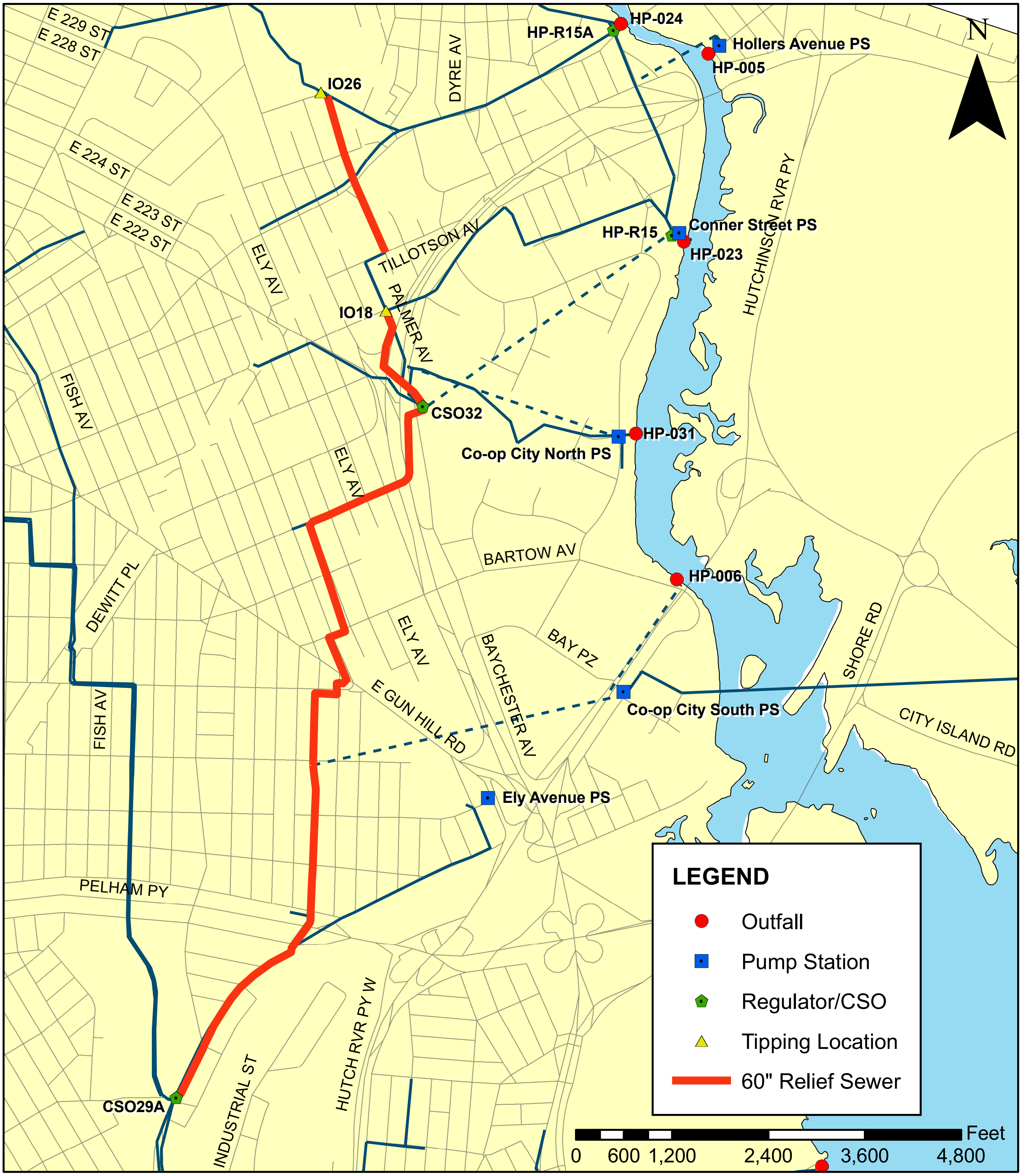
Construction of the parallel line would result in added conveyance capacity of the system, thereby reducing overflow volume. Modeling results showed that the net overflow volume to the Hutchinson River from all three outfalls would be decreased as described above, however, approximately 90 percent of this volume would exit the collection system downstream through the Westchester Creek waterbody CSOs. The net effect of this alternative is to shift the overflows from the Hutchinson River to Westchester Creek. However, the system as currently constructed is not capable of handling this additional flow from the Hutchinson Watershed. In addition, during public meetings, stakeholders expressed their preference that no facilities for the WB/WS Facility Plan be constructed within the streets, due to potential traffic impacts. As such, construction of a parallel relief sewer was not carried forward as one of the recommended alternatives.

Raised Weirs

This alternative involves raising the weir at Regulator HP-R15A, tributary to Outfall HP-024. By doing this CSO volume (HP-024) would be reduced to the Hutchinson River. This results only in a slight decrease in Hutchinson River CSO overflows. As such, due to the minimal benefit and concerns about potential backups caused by the reduced conveyance capacity in downstream pipes, this alternative was not considered further.

Conner Street Pumping Station Upgrade

Another alternative that was investigated was the upgrade of the Conner Street Pumping Station from 11 MGD to 30 MGD in conjunction with raising the weir at Regulator HP-R15A. Modeling results indicated that the overflow volume to the Hutchinson River would be reduced. However, modeling also showed that this resulted in a significant increase in the overflow volume to Outfall HP-014 (Westchester Creek). For this reason, this alternative was not carried forward as one of the recommended alternatives.



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Parallel Relief Sewer Alternative

7.3.5. Green Alternatives / Low Impact Development (LID)

Public comments indicated a preference for consideration and inclusion of Low Impact Development (LID). LID technologies are described in detail in Section 7.2. Examples of such facilities include biofilters, tree planting, rain gardens, sand filters, porous pavement, storm water detention, rooftop greening and others. LID technologies have positive benefits of storm water control, and can also have quality of life and other benefits. However, there are implementation issues associated with LIDs. The City of New York is highly developed and with most areas in private ownership, to apply LID technologies current properties must be modified. The most practical and cost effective way to implement LID is during redevelopment.

However, the NYCDEP will continue to review opportunities for the use of LID technologies and research and assess these best management practices for stormwater and their potential benefits for CSO reduction and water quality improvement through the recently initiated Jamaica Bay Watershed Protection Plan (JBWPP) effort. The JWBWPP initiative by the City Council in July 2005 specifically requires the following:

> *b. The commissioner shall assess the technical, legal, environmental and economical feasibility of including the following measures, at a minimum in the plan……(1) best management practices for the minimization and control of soil erosion and stormwater runoff, the minimization of impervious area surfaces and the creation of natural systems to control and minimize stormwater runoff*

The findings of that effort will be utilized by the NYCDEP when working with communities and private development throughout the City. The NYCDEP will look for opportunities to work with the community to identify sources of funding to possibly pilot BMPs identified in the JBWPP effort.

7.3.6. Floatables Control

While there are a number of technologies available for floatables control as described in Section 7.2 the alternative considered for use in the Hutchinson River sewershed was in-line netting. In-line netting was more cost effective than other floatable control technologies, such as bar screens. The Hutchinson River is the watershed most upstream from the treatment plant, therefore a technology is needed that will capture the debris rather than sending it downstream in the collection system. If the debris is sent downstream in the collection system then it would likely exit one of the downstream outfalls and enter the NYC waterways before reaching the Hunt's Point WPCP.

In-line netting devices can be used to separate floatables from CSOs by passing the flow through a set of netted bags. Floatables are retained in the bags, and the bags are periodically removed for disposal. Netting systems remove the floatables before discharge to the receiving waters. The NYCDEP has installed a floating end of pipe netting system at CSO TI-023 located in Little Bay and is considering their installation at other locations throughout the City. In-line netting facilities allow the debris to accumulate inside the overflow pipe, keeping it out of sight as well as out of the waterbody.

In-line netting was considered at outfalls HP-023 and HP-024, which together account for approximately 95 percent of the CSO flow into the Hutchinson River; resulting in a significant reduction in floatables attributable to CSOs in the Hutchinson River.

The netting facilities would consist primarily of:

- Concrete Chambers: flow-through chambers in the outfall pipe, housing the in-line netting components. These are accessed via hatches, which allow the nets to be removed and emptied on a regular maintenance cycled.
- Lifting baskets and disposable bags for collection of the floatable debris
- Bypass screens to allow flow-through the chamber even if the lifting basket and screens are full.

A schematic of a typical in-line netting facility is provided in Section 7.2, Figure 7-5.

Due to its deteriorated condition, the Outfall HP-024 structure will be rehabilitated under this project to ensure the serviceability of the outfall over the long-term. The work being done on the outfall pipeline as part of this alternative offers the opportunity to perform this work.

This alternative is expected to significantly reduce floatables such as cans, bottles, container debris and other items that wash into the Hutchinson River from city streets during wet-weather. This alternative is not expected to significantly reduce pathogen or oxygen depleting loading to the river. The total cost of this alternative is estimated at $27.7 million.

7.3.7. Storage Tanks

Storage tanks were originally proposed for the Hutchinson River sewershed under the 2003 East River Combined CSO Abatement Facilities Plan and the 2005 Hutchinson River Facility Plan, as previously discussed under Subsection 5.6. Under the Consent Order with the NYSDEC the NYCDEP is permitted to re-examine the 2005 Hutchinson River Facility Plan as an alternative under the WB/WS Facility Plan Project and LTCP Project as stated below (from Consent Order):

> "Pursuant to the milestones set forth in Appendix A, Respondents will submit Waterbody/watershed Facility Plans that will support the Long Term Control Planning process on a site specific planning basis, and will briefly describe the status with the nine EPA recommended elements of a Long Term Control Plan for each waterbody. The Plans will also provide the technical framework to complete facility planning in those drainage basins (Westchester Creek, Hutchinson River, and Newtown Creek) contained in Appendix A, that do not have final conceptual designs. Subject to the Department's approval, the Waterbody/Watershed Facility Plans may refine, and/or propose minor modifications to, the existing approved and/or pending CSO facility plans. In the Newtown Creek, Westchester Creek and Hutchinson River drainage basins only, the Waterbody/watershed Facility Plans may propose final modifications to the scope of the projects set forth in the existing Facility Plans. Upon DEC approval, the scope of the projects listed in Appendix A for those three basins will be as set forth in the approved Waterbody/Watershed Facility Plans. For all drainage basins

the Waterbody/watershed Facility Plans will also examine the extent to which additional cost effective CSO control measures may result in WQS being met."

The storage tanks originally proposed in the 2005 Hutchinson River CSO Facility Plan were evaluated for use at two of the three Hutchinson River outfalls, HP-023 and HO-024. The plan included a southern 4 MG storage tank at HP-023, with a second 3 MG storage tank at HP-024. The locations of these tanks are shown in Figure 7-10.

The 4 MG underground storage tank to provide for CSO abatement at Outfall HP-023 would be located entirely within Public Place Site, a publicly owned parcel of land bordered by Conner Street to the north, Peartree Avenue to the west, Hutchinson River to the east, and Co-op City Boulevard to the south. The 2.4 acre site is designated by the New York City Bronx Borough Tax Assessor's Office as Block 5141, Lot 440 and under the jurisdiction of NYCDPR and used by NYCDOT for vehicle parking and storage of materials and equipment.

The 4 MG storage tank would have approximate dimensions of 195-feet long × 160-feet wide × 40-feet deep and would be provided with the following:

- mechanical bar screens to screen the influent flow;
- an air treatment system to reduce the hydrogen sulfide concentration in exhaust air from the wet areas within the tank prior to atmosphere discharge;
- and an 11.5 MGD pumping station to convey the stored combined storage through the existing 24-inch diameter force main used by the Conner Street Pumping Station back to the existing combined sewer system after rainfall events for conveyance to the Hunts Point WPCP for treatment. The existing 24-inch diameter force main is approximately 5,000 feet long and discharges into the existing 8-foot wide × 5-foot high combined sewer at the intersection of Baychester Avenue and Donizetti Place, located southwest of the proposed storage tank site.

In addition to the storage tank, an above-grade operations building would be constructed to house administrative areas, air treatment system facilities and equipment, and electrical and control facilities and equipment. A new pumping station would be constructed to replace the existing Conner Street Pumping Station located on the north side of Conner Street directly across the street from the public place site. The existing Conner Street Pumping Station with a rated capacity at 11.5 MGD would remain in service until the 4 MG storage tank is operational, at which time the existing station would be taken out of service. Furthermore, provisions would be made in the design for chemical feed systems and for the future installation of disinfection and dechlorination facilities, if such facilities are later determined to be necessary for compliance with NYSDEC regulations.

The northern 3 MG underground flow-through storage tank would provide CSO abatement at Outfall HP-024. The storage tank would be located on the 4.5 acre parcel of land designated by the New York City Bronx Borough Tax Assessor's Office as Block 5288, Lot 1 and owned by Pascap Export, Inc. The owner does not currently utilize this property. The lot is bounded by Boston Road to the north, Hutchinson and Pinkney Avenues to the west, Hutchinson River to the east, and Hollers Avenue to the south.

The proposed 3 MG storage tank would collect flows from Regulator HP-R15A, which currently discharges overflows to Outfall HP-024. Regulator HP-R15A would need to be

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7MG Storage Tanks Alternative

modified to discharge overflows into the storage tank. Combined sewage in excess of the storage capacity of the tank would be discharged to the Hutchinson River via a new 16-foot wide × 10-foot high outfall to be constructed in conjunction with the storage tank. Existing Outfall HP-024 would be rehabilitated due to its deteriorated condition and would remain in service to discharge overflows from the modified Regulator HP-R15A.

The storage tank would have the approximate dimensions of 263-feet long × 133-feet wide × 20-feet deep and would be provided with the following:

- mechanical bar screens;
- an air treatment system;
- a pumping station, and;
- an above-grade operations building to house the same facilities as the 4 MG storage tank.

The combined sewage from the 3 MG storage tank would be discharged via a force main into the existing combined sewer system at a location near the storage tank for conveyance to the pumping station located at the 4 MG storage tank. The stored combined sewage from both tanks would be combined at the southern pumping station and be pumped into the existing combined sewer system for conveyance to Hunts Point WPCP for treatment.

The tanks are expected to reduce overflow volumes to the Hutchinson River by approximately 32 percent when compared to baseline condition. Modeling indicated that the number of overflow events per year remained unchanged, at 43.

7.3.8. Storage Tunnel

Tunnel systems were evaluated to reduce CSOs in the Hutchinson River to a range of 0 to 12 overflow events per year with the associated percent reduction in overflow volume then calculated. The geology of the area surrounding the Hutchinson River allowed use of rock tunnels. The type of bedrock in the vicinity of the Hutchinson River outfalls of concern is Hartland Formation (Middle Ordovician to Lower Cambrian). Tunnels are similar to storage pipelines that provide significant storage volume in addition to offering the ability to convey flow. Excavation to construct the tunnel is carried out deep beneath the City, and would therefore not impede traffic during construction and operation.

The alternative would include the connection of the active Outfalls HP-031, HP-023 and HP-024, with a tunnel about 1 mile long, ranging in diameter from 22 to 36 feet, depending on the storage volume. Drop shafts and deaeration chambers would connect individual outfalls to the tunnel to store overflows from the collection system. Regulator structures at CSO locations would direct overflow to drop shafts and into the tunnel. Diversion structures and drop shafts would be sited in the same locations proposed for the tanks discussed in Section 7.3.5.

After the storm event, the tunnel would be dewatered via a dewatering pump station, located near HP-031, over a period of 24 hours. The pump station would provide screening for floatables control and an odor control system. Once pumped out of the storage tunnel the wastewater would be pumped through a new forcemain connecting the pump station to the existing collections system. The tunnel would begin dewatering some time after the end of the storm to ensure that both the collection system and treatment plant are capable of handling the additional flow. Once at the plant the wastewater would receive treatment similar to other dry weather flows.

Major components of a storage tunnel in the Hutchinson watershed would include:

- Diversion structures at HP-031, HP-023 and HP-024
- Drop structures at the same outfalls
- Deaeration Chambers in the dropshafts
- Lateral tunnels connecting the dropshafts to the main tunnel
- Main storage tunnels connecting the three outfalls
- Dewatering pump station with odor control and screening facilities near outfall HP-031
- Forcemain connecting the dewatering pump station to the collection system

Figure 7-11 illustrates the rock tunnel system alignment for the Hutchinson River. Table 7-7 below shows the volume required and the overflow volume remaining after implementation, the percent reduction from the baseline and the estimated cost.

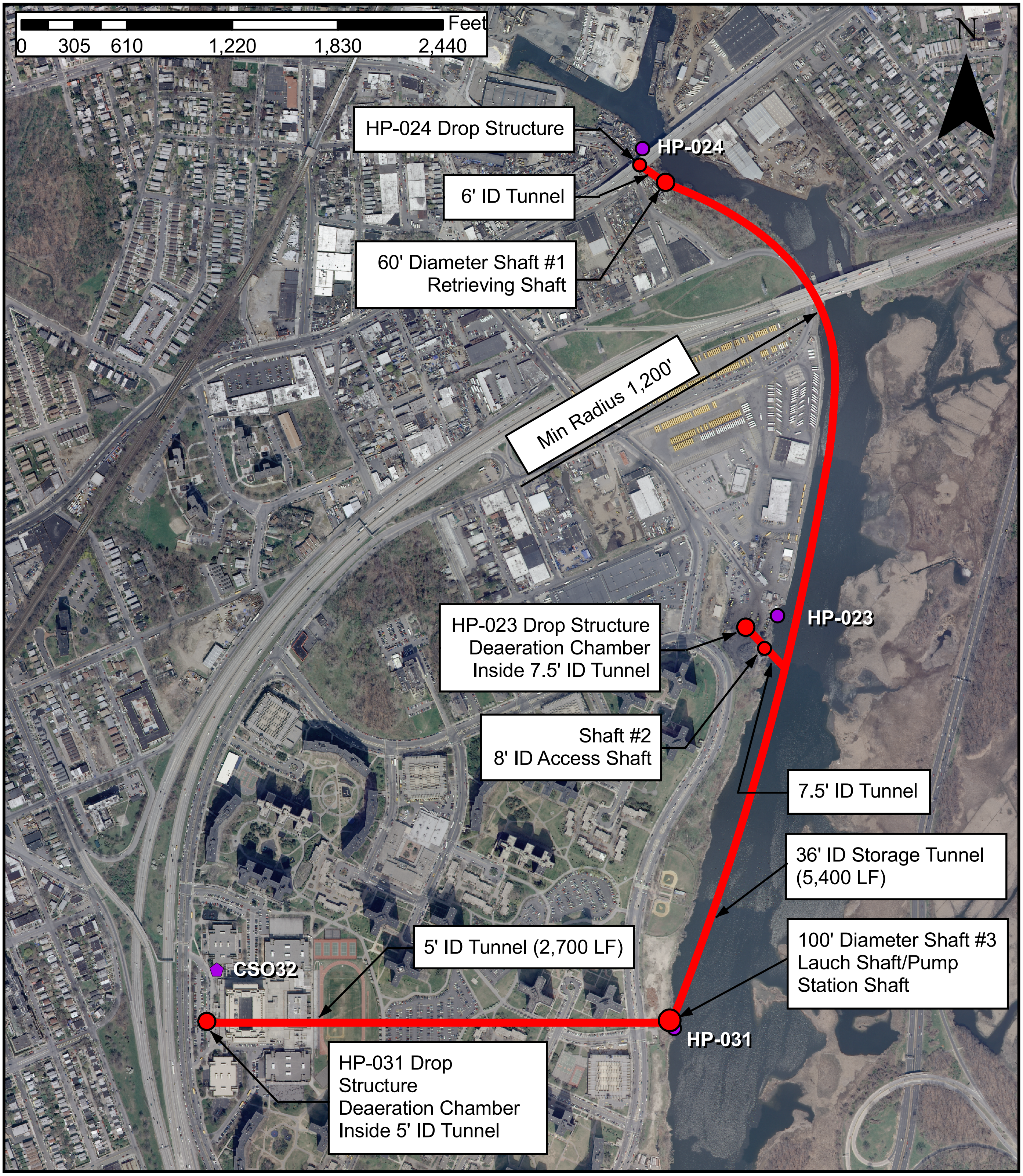
Table 7-7. Storage Tunnel Alternatives Analysis

Overflow Events (#/yr)	Tunnel Volume (MG)	Overflow Volume Remaining (MG/yr)	Reduction (%)	PTPC ($M)
12	12.8	112.7	71	426
8	15.4	107.8	72	446
4	28.6	18.6	95	531
0	41.1	0	100	621

7.3.9. Sewer Separation

For this alternative, the benefits of complete separation of the combined sewer were evaluated. The alternative was evaluated on the premise that a new separate sanitary system would be constructed and the existing combined sewer system piping converted to a separate stormwater system discharging to the receiving water.

Separation involves constructing a duplicate sewer system for the entire combined sewer areas discharging into the Hutchinson River. Sewer construction would be necessary in every neighborhood and in the vast majority of streets in each neighborhood. Disruption associated with construction would be significant, widespread, and long lasting. The installation of a separate sewer system would generally require periodic closing of streets during construction, which could last 5 to 10 years or more. Figure 7-12 shows the areas that need to be separated in the Hutchinson watershed. The deep red color indicates high density zoned areas while the orange color represents medium density zoned areas. The estimated cost to carry out this alternative is presented in Table 7-8.



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Hutchinson River Storage Tunnel Alignment

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CSO Drainage Area Zoning Density for Hutchinson River Sewer Separation Analysis

Table 7-8. Estimated Construction Cost for Completed Separation

Zoning Density	Area (acres)	Cost/acre	Cost to Separate
Low	0	$253,000	$0
Medium	751	$423,500	$318,048,500
High	524	$676,500	$354,486,000
		Total	$672,534,500

In addition to the costs associated with sewer separation in public right-of-ways, there are impacts which would be borne directly by individual private property owners. A majority of buildings in the combined sewer area have roof drains and gutters discharging to the building sanitary system, which in turn discharges to the combined sewer system. Separation on private property would thus be required. Obtaining access and permission from private property owners could prove to be difficult, time consuming, and, in some cases, not achievable.

Other cities have discovered some separation projects to be much more difficult to construct than originally anticipated. In some cases, the efforts to separate sewer systems have been abandoned. Part of the reason for this is that there are many unknowns involved in working with sewer systems that have been constructed over a long period of time. Records showing the location and nature of the existing facilities may not exist. Cost and difficulties of construction can be much greater than originally anticipated depending on what is actually discovered once construction begins. In addition, public opposition to such a program may increase as actual construction proceeds.

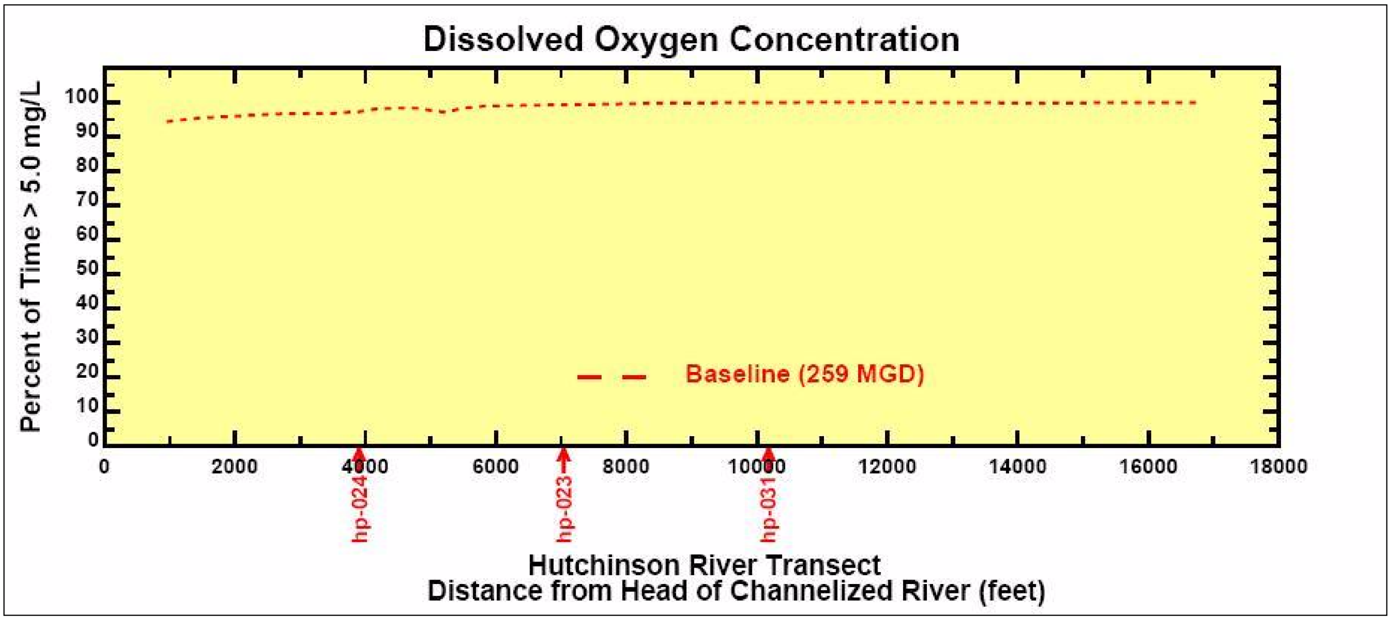
Due to these concerns and the high costs associated with this alternative it was not considered viable for further consideration.

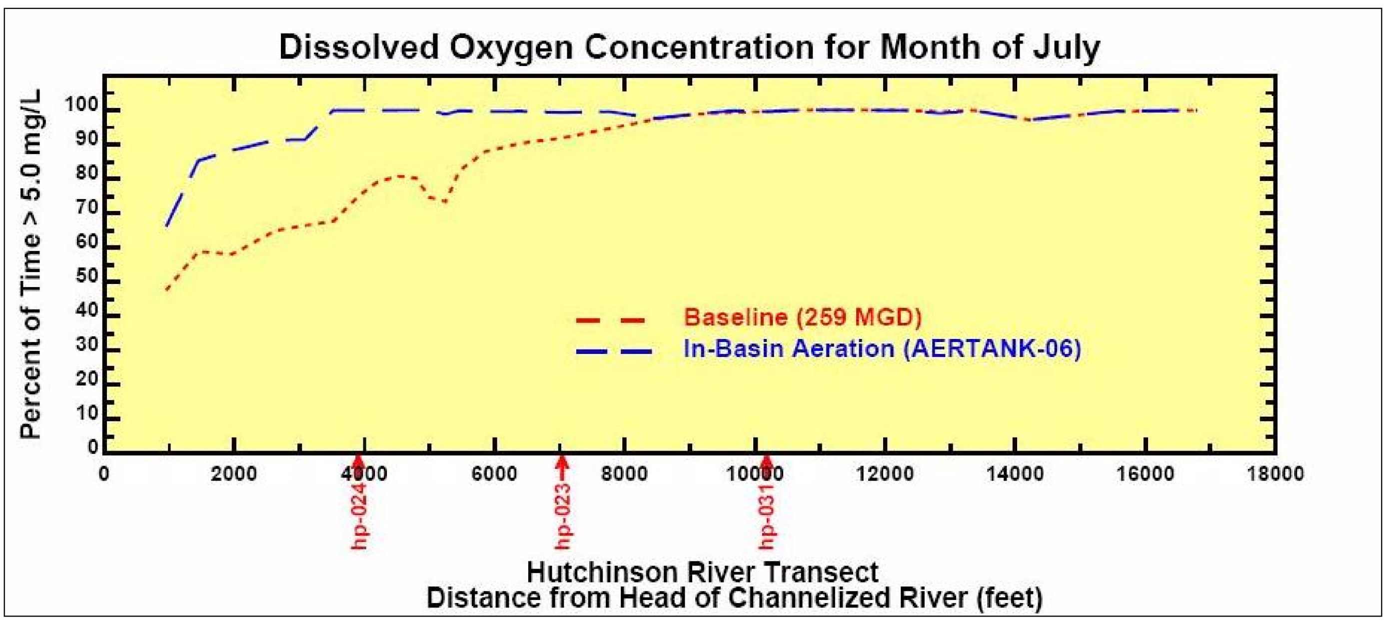
7.3.10. In-Stream Aeration

Analysis of the baseline conditions conducted using the calibrated Water Quality model demonstrates that DO concentrations are greater than or equal to 5 mg/L 95 percent of the time along the length of the Hutchinson River, when assessed annually (Figure 7-13). Water Quality modeling also indicates that as flow moves further away from the border with Westchester County (WC) the water quality improves to above 95 percent. At 4,000-feet from the WC border the Hutchinson River is in compliance with Class SB DO standards 98 percent of the year. At 7,000-feet from the WC border, the river is compliant with SB dissolved oxygen standards 100 percent of the time.

During the month of July, calculated DO concentrations fall below 5 mg/L as much as 50 percent of the time at the upstream end of the Hutchinson River (Figure 7-13). These DO deficits are experienced during a seasonal period of the increased rainfall, and thus increased CSOs. July also experiences a higher water temperature, which has a lower DO saturation point than colder water. Finally, algal blooms are more common in the summer, which themselves consume oxygen. Since these deficient DO concentrations, demonstrated under baseline conditions, are of concern, an in-stream aeration alternative was evaluated.

In-stream aeration consists of installing air diffusers across the bottom of the Hutchinson River from HP-023 to the New York City Line as shown in Figure 7-14. Air for the system





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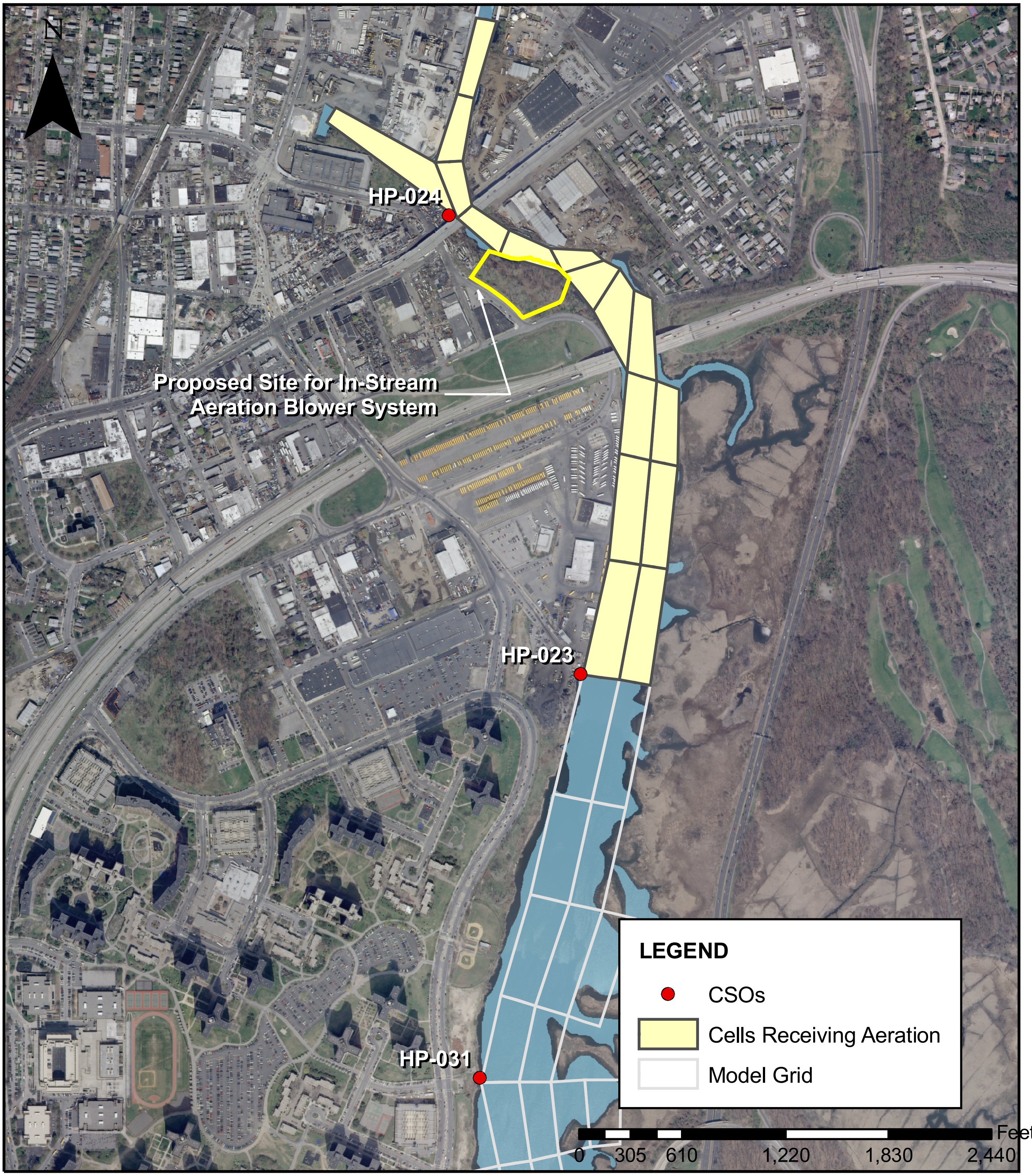
In-Stream Aeration DO Compliance Plot



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Hutchinson River In-Stream Aeration Alternative

FIGURE 7-14

would be provided by a blower facility on the shore. This facility would be equipped with blowers and controls linked to real-time DO sensors in the river. When a drop in DO is detected the blowers will operate, delivering air through the diffuser array into the river. This air is absorbed in the water column and the DO level in the river is raised.

Process piping will consist of a single main transmission line with numerous distribution lines extending out into the water body from the transmission line. Diffusers, attached along the length of the distribution lines, evenly distribute air to the waterbody. When costing this option it was assumed that the water column was sufficient to maintain navigation without disturbing the fixed air distribution system. Furthermore, it was assumed that no dredging would be required for installation.

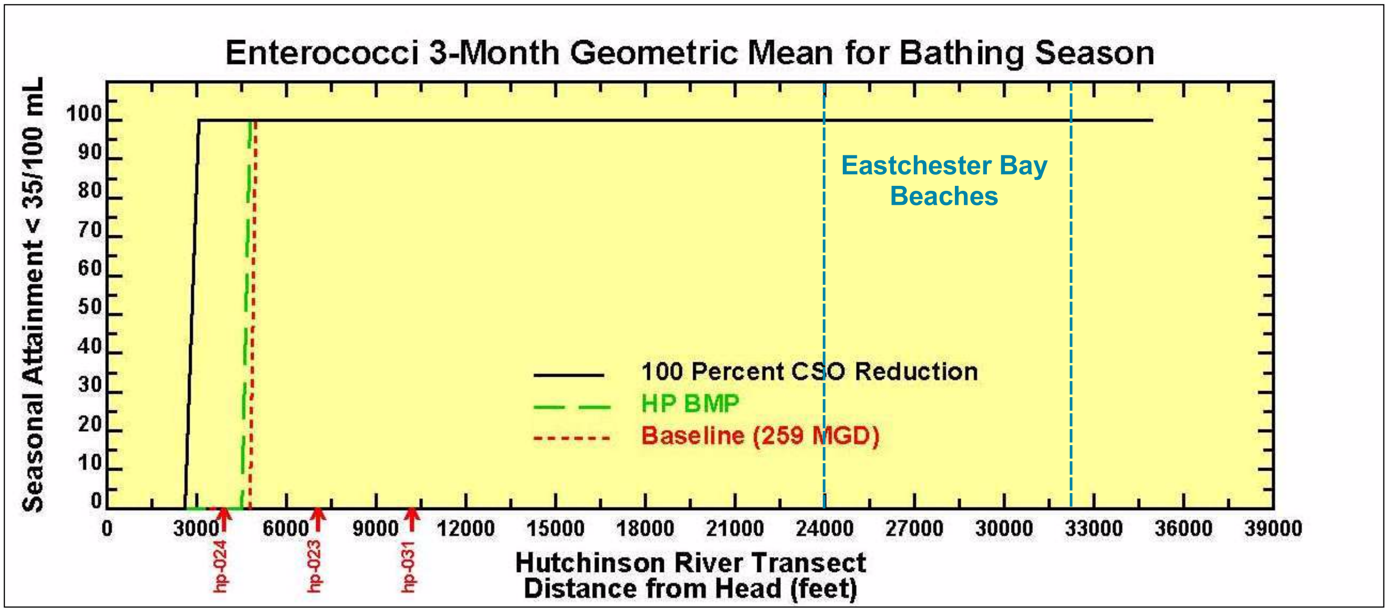
Water quality modeling indicates that a system that is capable of raising the DO in the River during the summer months, to 5 mg/L or greater close to 100-percent of the time requires an aeration system sized for 10,000 scfm. The cost of this alternative is estimated at $29.8 million.

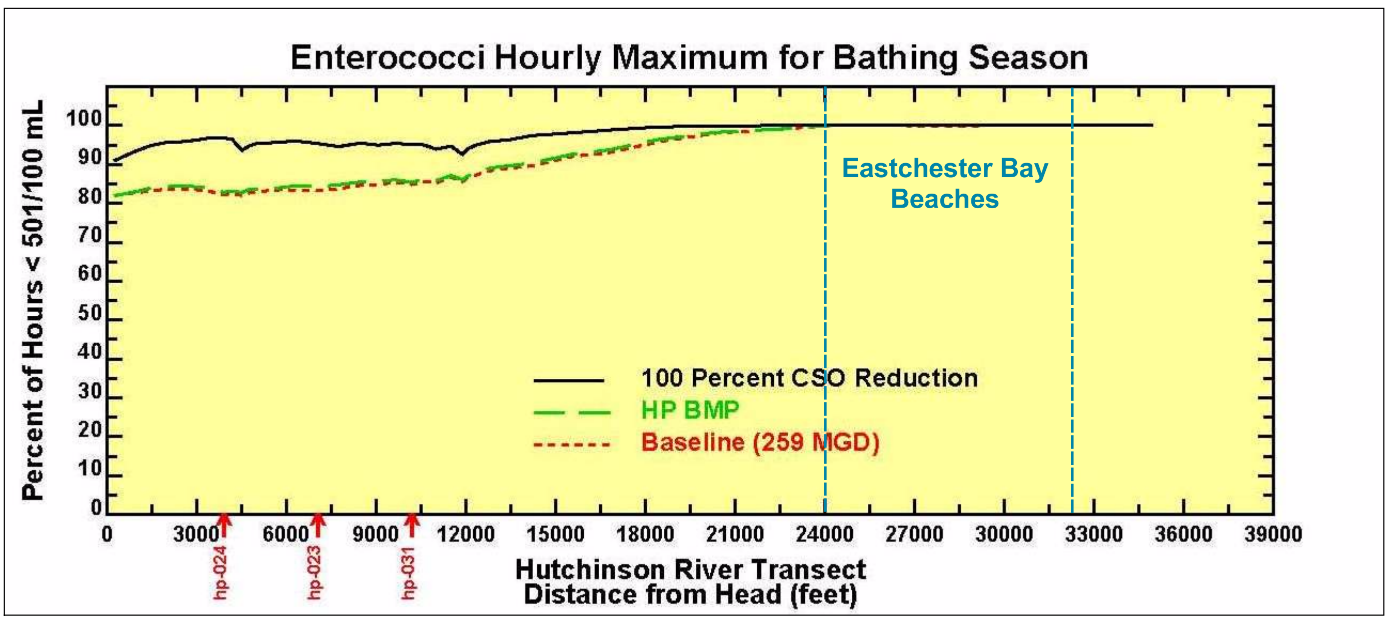
7.3.11. Disinfection/Impact on Beaches

Since the Hutchinson River is a tributary to the East River and empties into Eastchester Bay, it is necessary to examine the effects of CSO inputs on downstream beaches. There are currently 19 private and public beaches permitted by the New York City Department of Health & Mental Hygiene. Seven of these permitted public bathing facilities are located in Eastchester Bay and operated by private beach associations. The majority of these private beaches are clustered along western shore of Eastchester Bay. Orchard Beach is the only public beach in this area and is located in Pelham Bay Park on Long Island Sound. It is run and operated by the NYCDPR. Due to the presence of beaches, pathogen concentration is a primary water quality concern in the area. An alternative that controls the discharge of pathogenic microorganisms in receiving waters is disinfection, as described in Section 7.2.6.

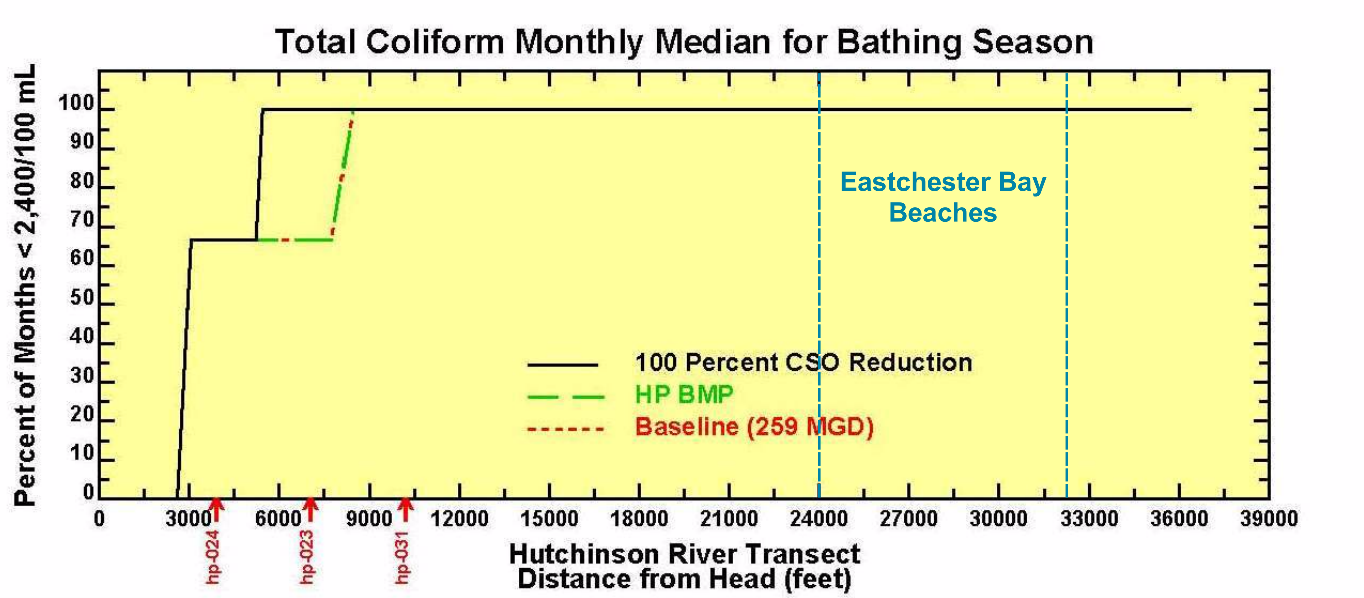
Enterococci bacteriological criteria for Class SB is a 35/100 ml geometric mean. The receiving water model produced a daily average enterococci concentration for each day in each month. Geometric means were calculated on a seasonal basis using the daily values. The attainment of the standard of 35 /100 ml was then tabulated and graphically shown along the length of the waterbody.

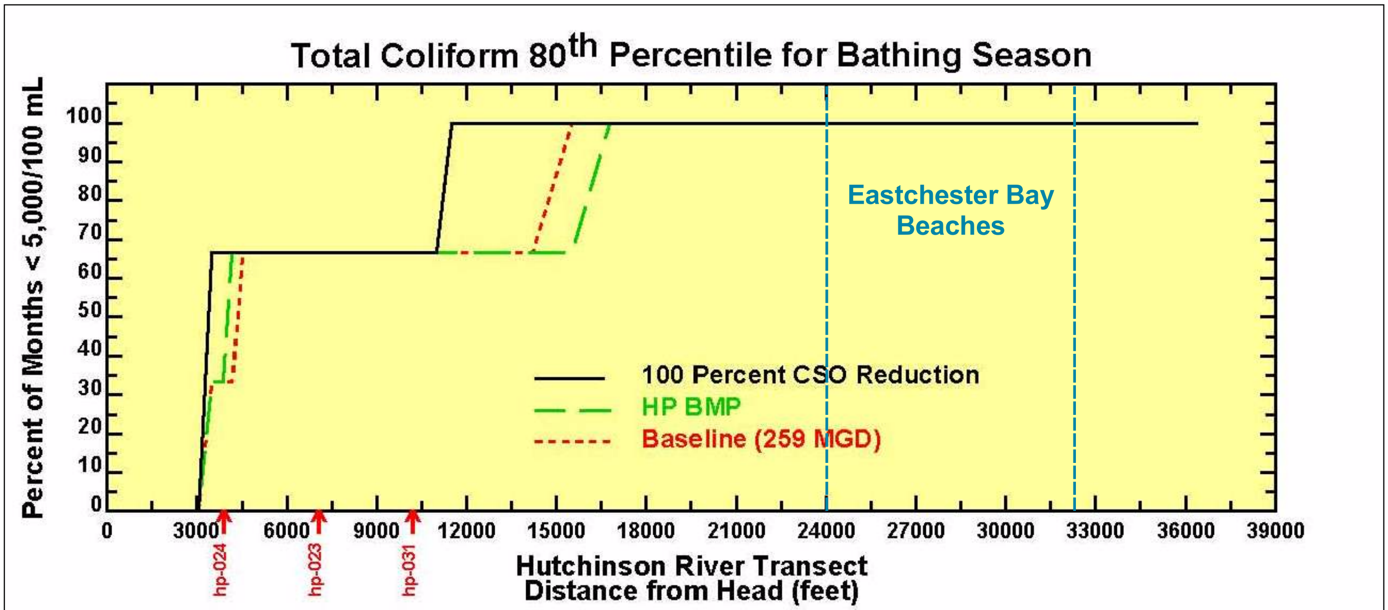
Analysis of the baseline conditions conducted using the calibrated Water Quality model shows the percent of time in attainment with pathogen standards along the transect of the Hutchinson River during bathing season (June, July, and August) (Figures 7-15, 16 and 17). The Water Quality model shows that the Hutchinson River is already achieving standards 100 percent of the time approximately 8,000 to 16,700-feet upstream of the Eastchester Bay beach area and remains in attainment as it flows to the East River. Attainment is demonstrated under baseline conditions during bathing season for four indicator measurements: enterococci hourly maximum, total coliform monthly median, total coliform 80th percentile, and fecal coliform monthly geometric mean. Therefore, CSO outfalls in the Hutchinson River do not cause non-attainment with pathogen standards in the Eastchester Bay private beach area.





Hutchinson River CSO Impacts on Eastchester Bay Beaches - Enterococci





Hutchinson River CSO Impacts on Eastchester Bay Beaches - Total Coliform

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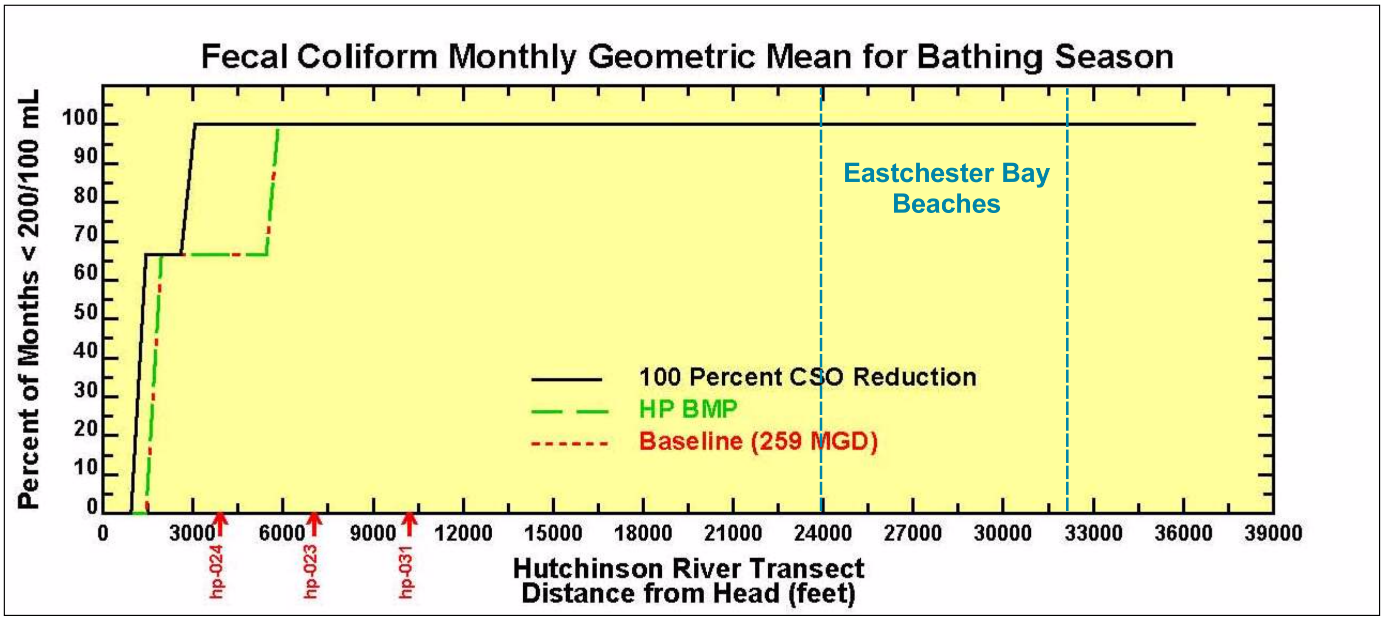

Hutchinson River CSO Impacts on Eastchester Bay Beaches - Fecal Coliform

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Hutchinson River Waterbody/Watershed Facility Plan

FIGURE 7-17

Orchard Beach is located facing the Long Island Sound and separated from the Hutchinson River by Pelham Bay Park. Considering this location, the percent time in attainment at approximately 22,900-feet from the River head is used as an indicator of the water quality that may reach Orchard Beach from the Hutchinson River. Since nearly 100 percent attainment is demonstrated at this location for the four indicator measurements, CSO outfalls in the Hutchinson River do not cause non-attainment with pathogen standards near Orchard Beach.

The water quality model results indicate that the disinfection alternative would not change pathogen attainment in Eastchester Bay and is not considered for further investigation.

7.3.12. Interjurisdictional Cooperation

Over two-thirds of the Hutchinson River watershed is outside of NYCDEP jurisdiction, in Westchester County. This portion of the watershed accounts for approximately 74 percent of the flow on an annual basis. When evaluating the water quality of the Hutchinson River, a scenario was examined which attempted to quantify the impact on the Hutchinson River from upstream sources, outside of the jurisdiction of the NYCDEP. This analysis was done by running the water quality model based on existing water quality data, with the upstream, waters out of compliance. A second run was then completed in which the upstream waters were in compliance with SB standards.

The impact of the upstream waters was demonstrated in the results. Figures 7-18 and 7-19 illustrate the results for total and fecal coliform compliance in the Hutchinson River. In the case of fecal coliforms, the number of months in compliance with SB standards for the alternatives selected in Section 7.3 changes from 3 months in compliance under existing conditions to 10 months in compliance if the upstream water quality meets standards. Total coliform goes from 1 month in compliance to 9 months in compliance.

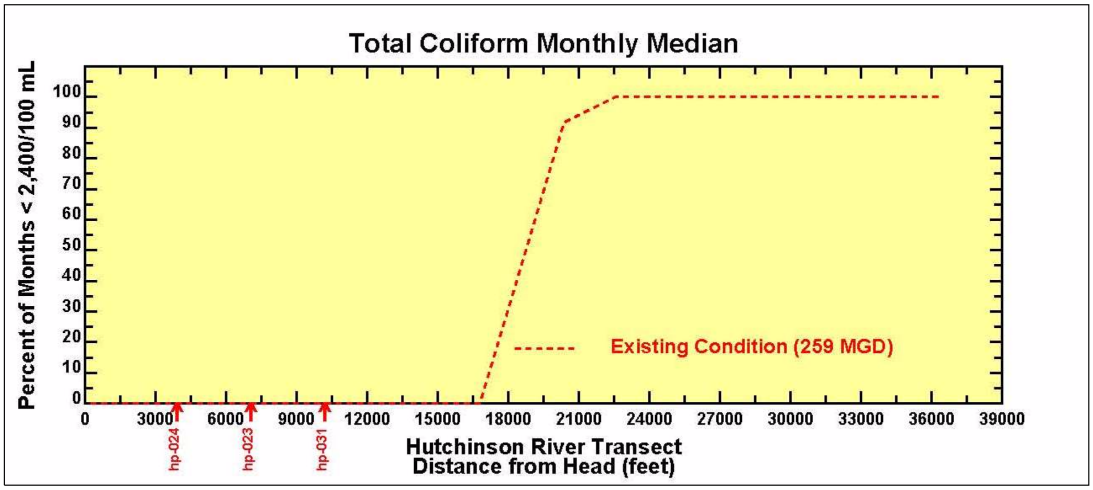
The NYCDEP has already begun a dialogue with Westchester County to initiate interjurisdictional coordination. This effort is being conducted through existing NYCDEP track down programs but is discussed here to fully inform the LTCP process.

7.4. COST PERFORMANCE ANALYSIS

Each of the alternatives carried forward from the above analysis was analyzed for its performance in four categories: CSO volume, number of overflow events, DO impact, and Pathogen Indicator reduction. Based on its performance and relative costs (cost/benefit) a WB/WS Facility Plan was chosen with the best balance of costs and performance. The selected alternative must also meet other criteria not expressed in theses graphs, such as public acceptance and aesthetic improvements to the waterbody/watershed. The alternatives discussed above in Section 7.3 are summarized in Table 7-9.

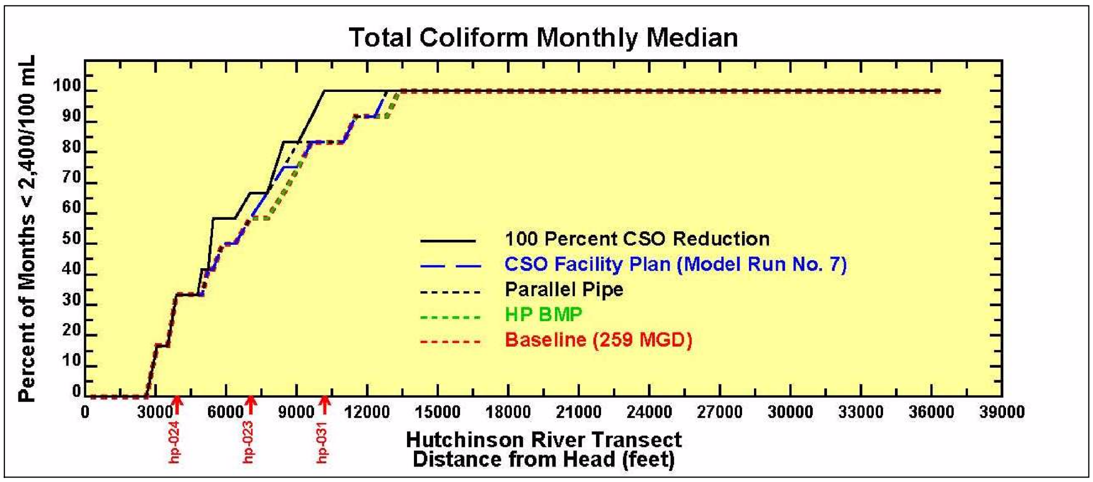
Condition #1

- Sources of Pathogen Loading Present
- Westchester County Out of Compliance



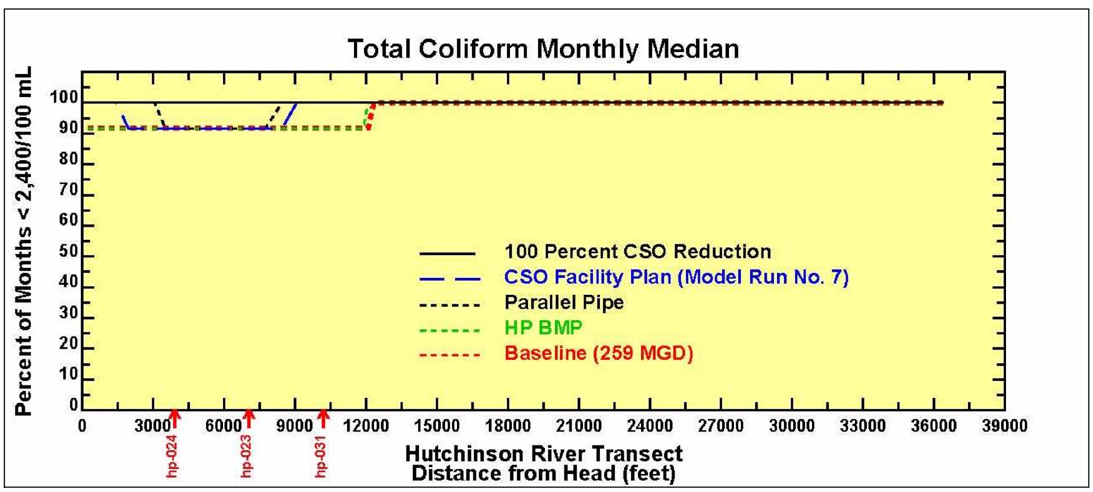
Condition #2

- Sources of Pathogen Loading Located and Removed
- Westchester County Out of Compliance



Condition #3

- Sources of Pathogen Loading Located and Removed
- Westchester In Compliance



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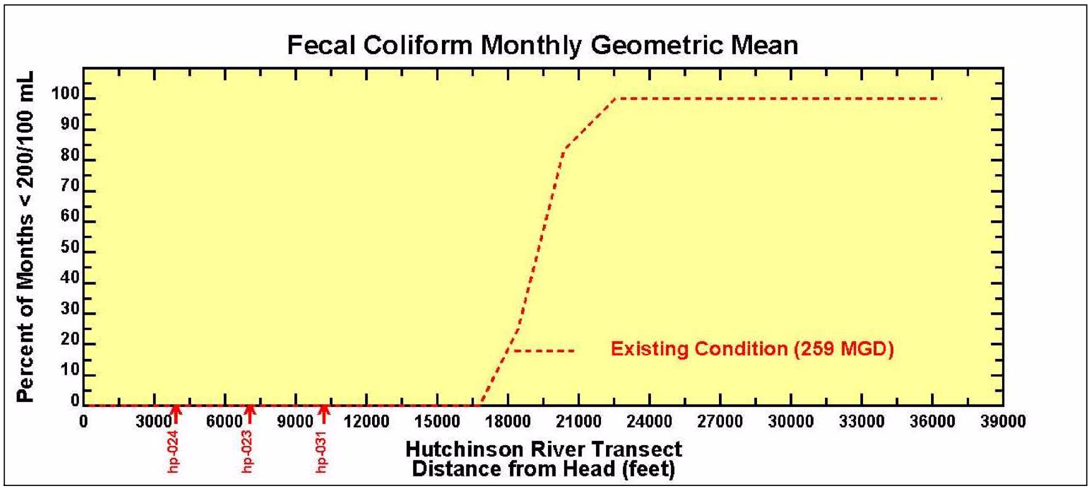
Total Coliform Water Quality Model Results Model Conditions Comparison

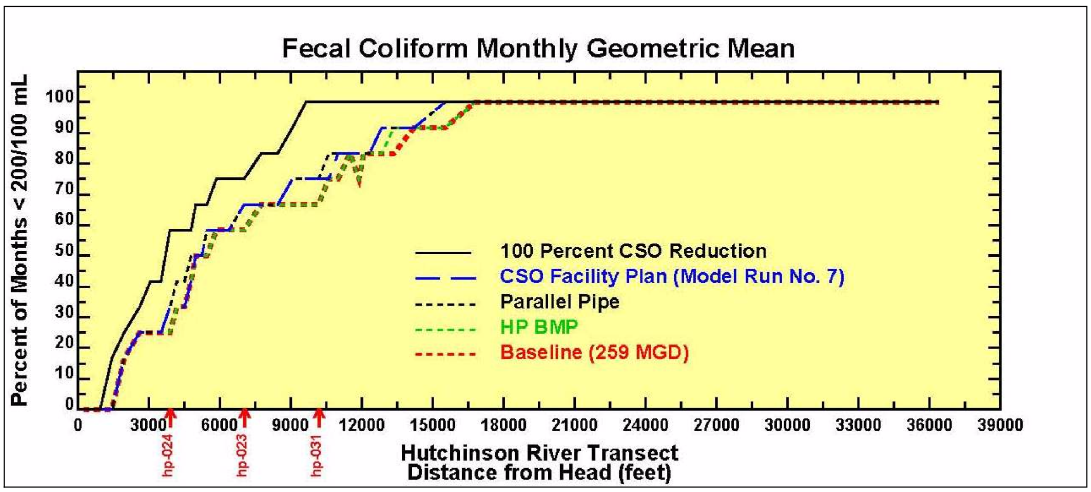
Condition #1

- Sources of Pathogen Loading Present
- Westchester County Out of Compliance



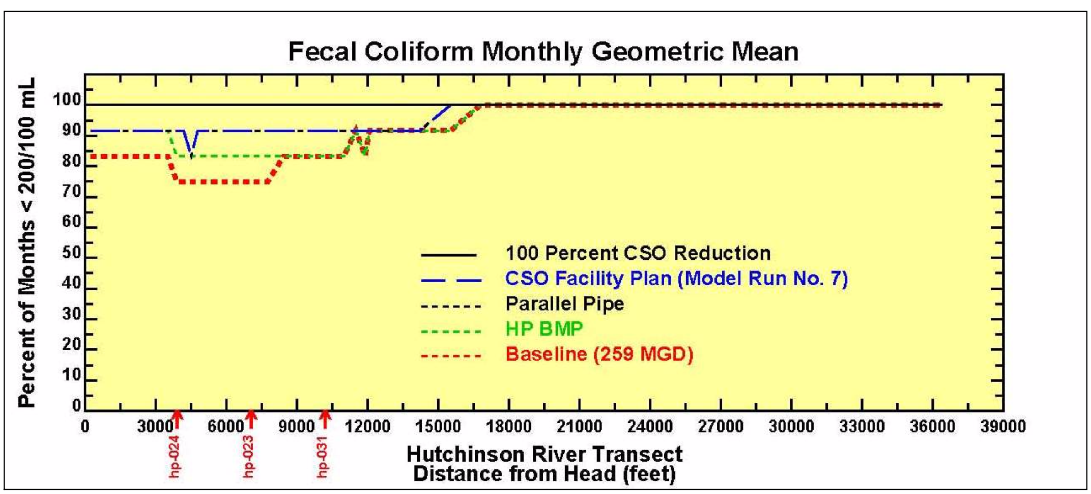
Condition #2

- Sources of Pathogen Loading Located and Removed
- Westchester County Out of Compliance



Condition #3

- Sources of Pathogen Loading Located and Removed
- Westchester In Compliance



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Fecal Coliform Water Quality Model Results Model Conditions Comparison

Table 7-9. Summary of Cost Performance Data - CSO Volume and Overflow Events

	Storage Volume (MG)	Overflow Volume (MG)	Overflow Events	Reduction of Volume (%)	PTPC ($ Million) July 2005 Dollars
Baseline Plant at 259 MGD	-	390	43	0.0%	$0.0
Floatables Control In-Line Netting w/ HP-024 Rehabilitation and Land Acquisition	-	390	43	0.0%	$18.7
In-Stream Aeration	-	390	43	0.0%	$29.8
Relief Sewers					
8,600 ft Alternative (1)	-	307	40	21.2%	$98.8
13,400 ft Alternative	-	292	37	25.2%	$149.4
Storage Tanks (old FP)	7.0	265	43	32.2%	$213.6
Storage Tunnels	12.8	113	12	71.1%	$425.6
	15.4	108	8	72.4%	$445.7
	28.6	19	4	95.2%	$530.4
	41.1	0	0	100.0%	$620.7

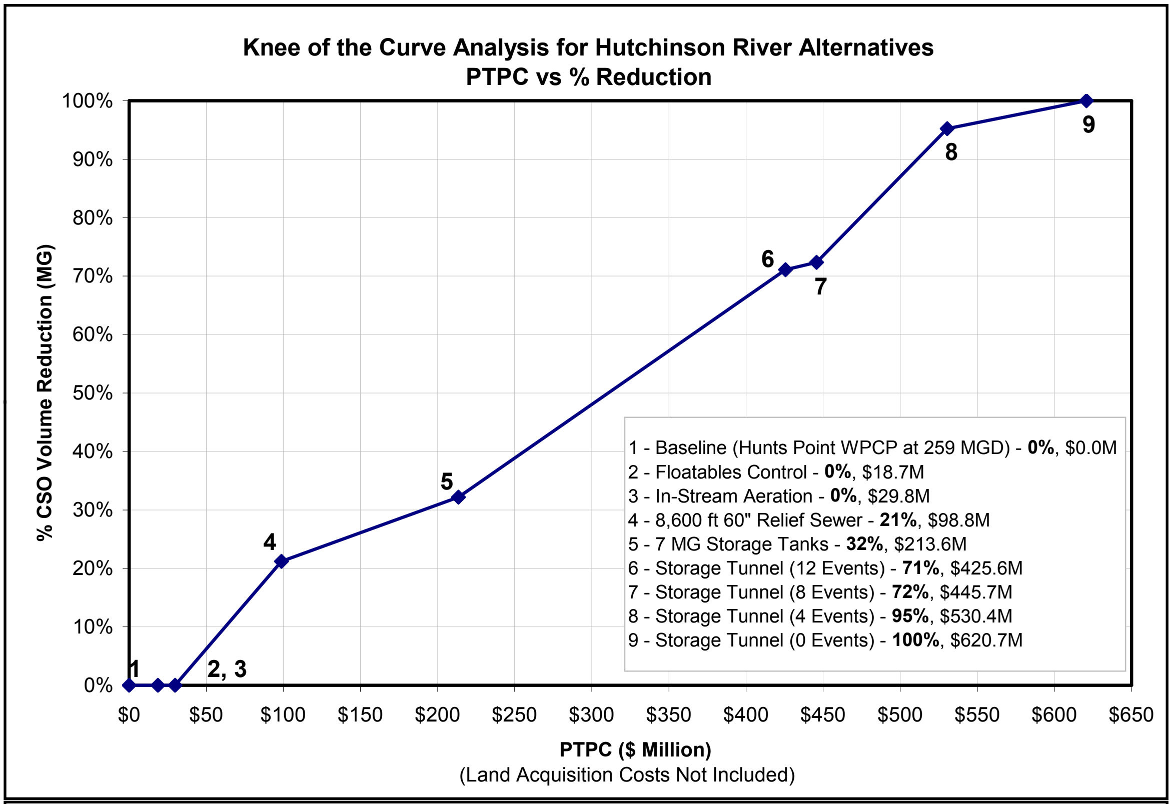
Notes: (1) Only 8,600-feet relief sewer is included on DO, TC and FC costs performance curves due to much higher cost and lower benefit

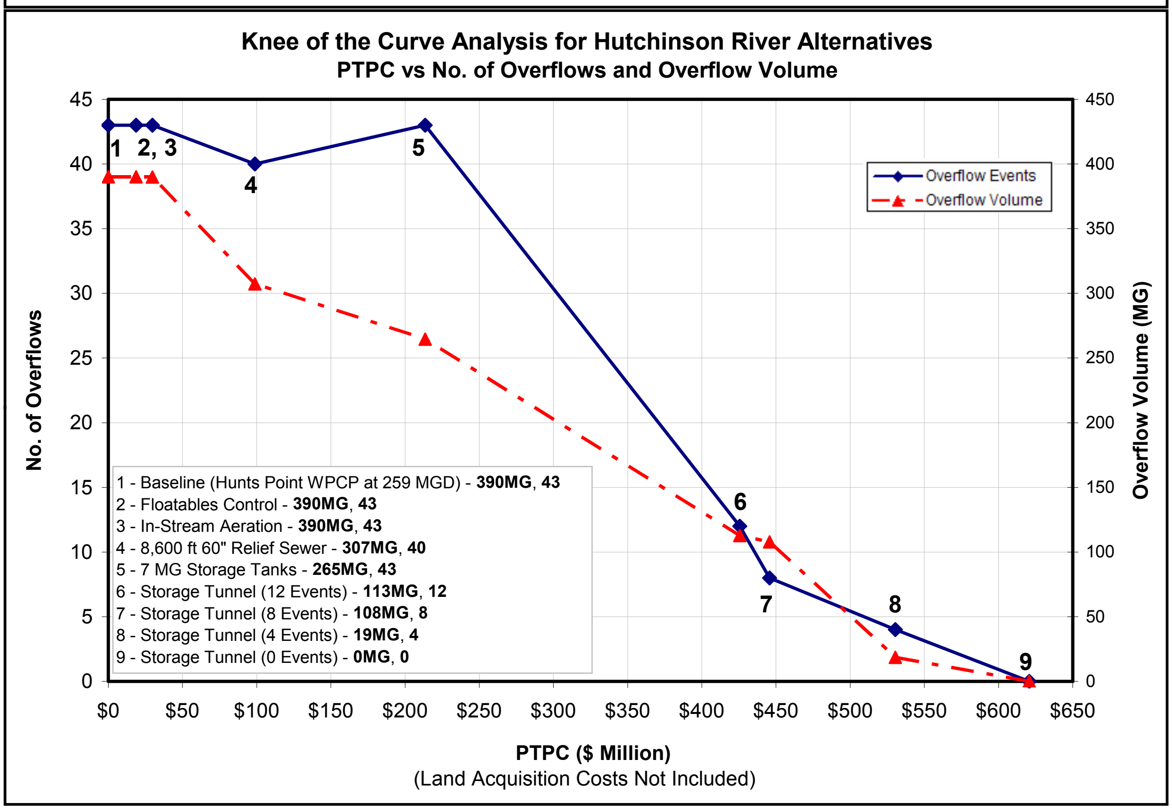
Volume Reduction

The USEPA LTCP Policy requires that CSO volume reduction be examined as part of the program. The tunnel alternatives previously presented in Table 7-7 were evaluated on this basis of volume reduction and comparative cost. This evaluation was expanded to include the remaining alternatives and is shown graphically in Figure 7-20. Floatables Control and in-stream aeration provide no reduction in CSO volume and therefore the curve begins as a straight line at zero percent reduction. Costs are fairly linear from in-stream aeration to the storage tunnel (12 events) alternative, with the cost per percent reduction of $5.6 million. These alternatives can not be evaluated in terms of percent reduction alone though. The impact of the alternatives on the water quality must also be evaluated. This evaluation is presented below.

Number of Events

This analysis is shown on the same figure as volume reduction. The USEPA's LTCP policy requires that data be evaluated in terms of overflows per year. The baseline number of overflows for the Hutchinson River is 43 overflows per year. The Floatables Control alternative and the 2005 Hutchinson River CSO Facility Plan's recommendation of storage tanks would not reduce the number of overflows. The parallel sewer options provided a modest incremental benefit of reducing the total number of events by 3 to 6 for a total of 40 events per year. The cost per event reduced is $25 million to $33 million with the parallel sewer options. Additionally, as discussed in Section 7.3.4, these reduced flows are transferred to the Westchester Creek watershed, where the majority of the volume becomes CSO overflows to that waterbody.





Hutchinson River
Knee of the Curve Analysis

Tunnels provide a more cost effective solution on a cost per event reduced basis of $13 million to $14 million but at a very high absolute cost.

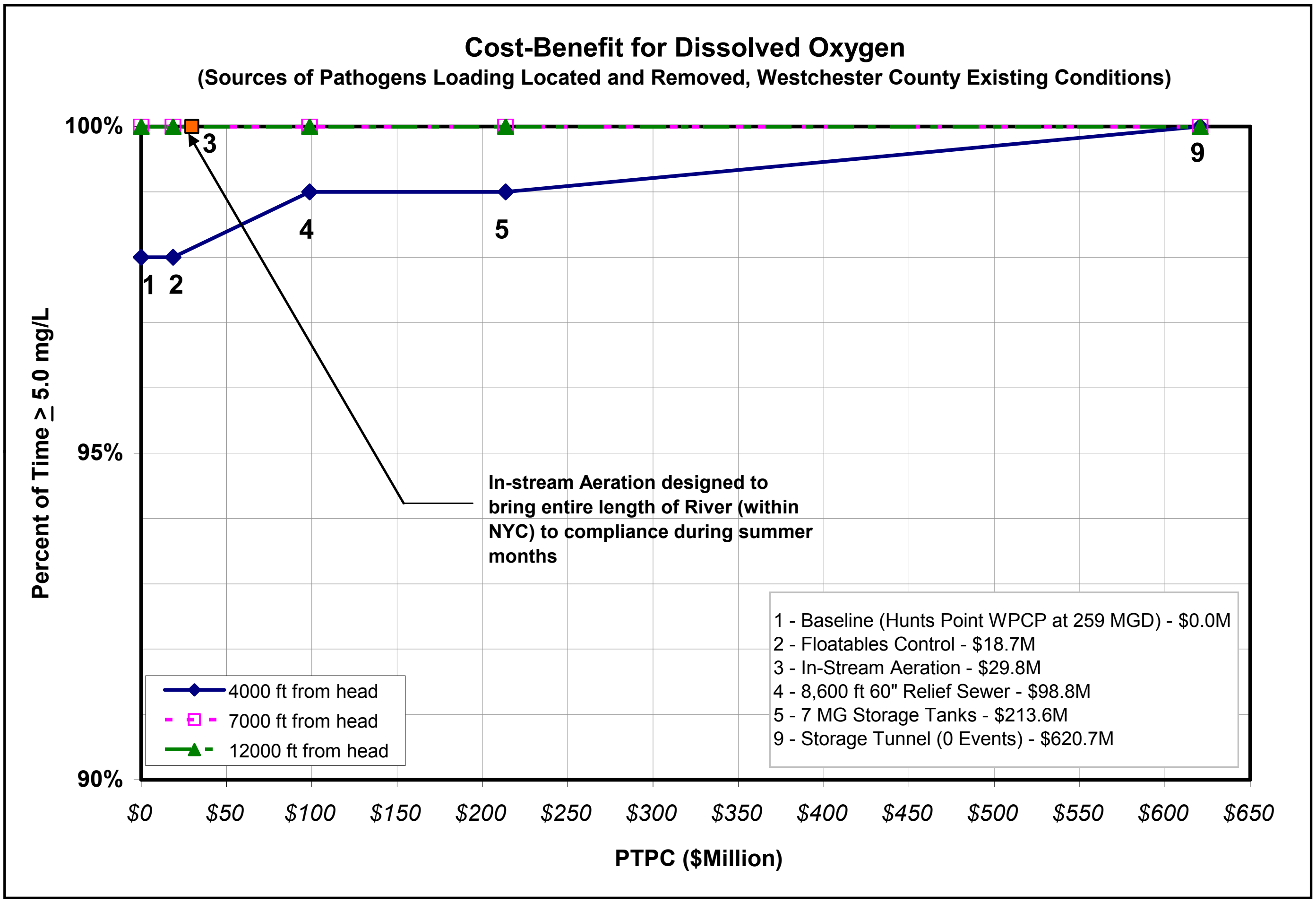
Dissolved Oxygen

The tidal portion of the Hutchinson River was on in the NYCDEC's 2004 303(d) list of impaired waters for Dissolved Oxygen. Water quality sampling was conducted as part of this project as described in Sections 3 and 4 of this report. Modeling indicates that on an annual basis, the Hutchinson River is in compliance with the SB standard of DO >5mg/L, 98 percent of the time. In-stream aeration was evaluated to elevate the DO above 5mg/l the remaining 2 percent of the time. It was found that the system necessary to achieve this relatively low gain would require an in-stream aeration system capable of producing greater than 10,000 scfm of air, as illustrated in Figure 7-13. Other options such as parallel sewers and tanks are capable of raising annual DO compliance by only 1 percent. Only a 100 percent capture tunnel is capable of achieving 100 percent DO compliance at a cost of $621 million as illustrated in Figure 7-21. This high cost is not justified by the relatively low gain of 2 percent of DO compliance.

Pathogen Indicators

The alternatives were examined for their impact on pathogen indicators, Total Coliform and Fecal Coliform. As discussed in Sections 7.3.2 and 7.3.11, the biggest impact on pathogen indicators seems to be dry-weather pathogen loading sources and Westchester County. Figures 7-22 and 7-23 presume that the pathogen loading sources have been successfully identified and removed. The top plot in both figures shows the impact of the alternatives on pathogen indicator levels in the Hutchinson River with Westchester County at existing condition. The bottom plot in both figures shows the impact of the same alternatives under the condition that Westchester County is in compliance with water quality standards throughout the year.

The figures illustrate compliance as a function of distance from the head of the river, at the NYC/WC line. It is clear that as the distance from the head of the river increases, so does compliance with SB standards for pathogen indicators. There are no swimming beaches in the Hutchinson watershed, however some are present downstream as discussed in Section 7.3.10. Based on the analysis presented in that section, the Hutchinson River CSOs do not impact these beaches. The alternatives analysis indicates that Floatables Control, parallel tunnels and storage tanks provide approximately the same level of benefit, especially at reaches further from the head of the river, with Floatables Control providing the most cost effective performance. Storage tunnels provide some additional benefit, but at a much higher cost.



Hutchinson River Dissolved Oxygen Compliance vs. Costs

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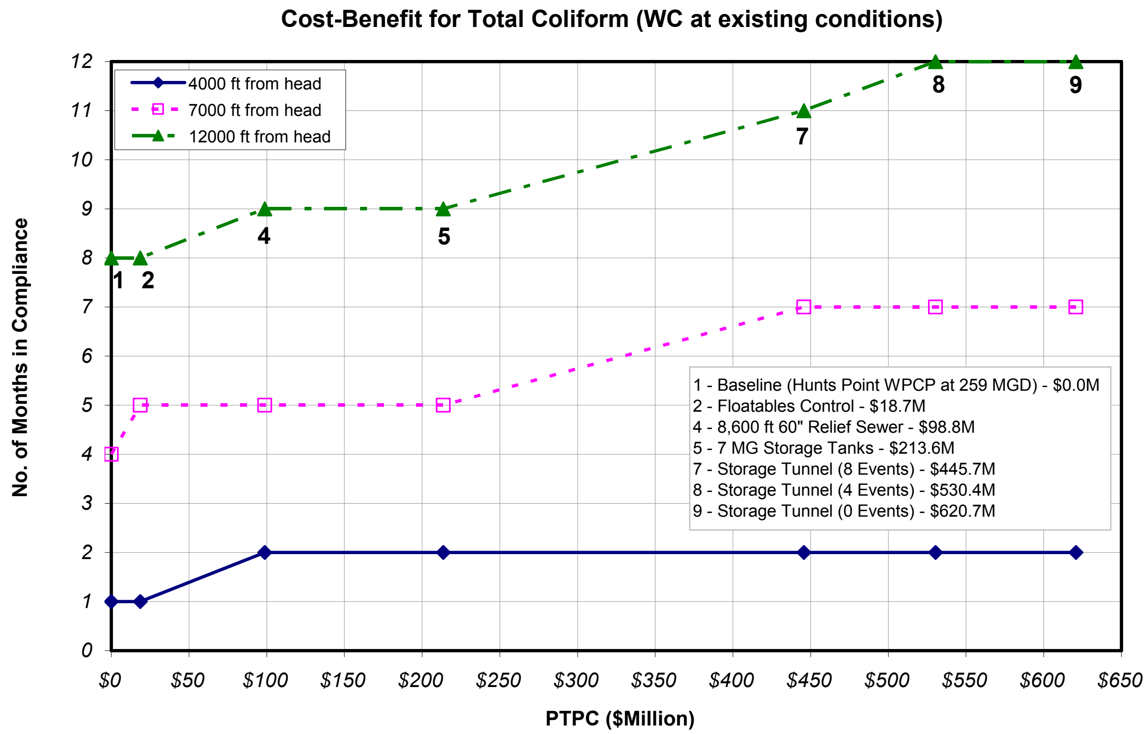

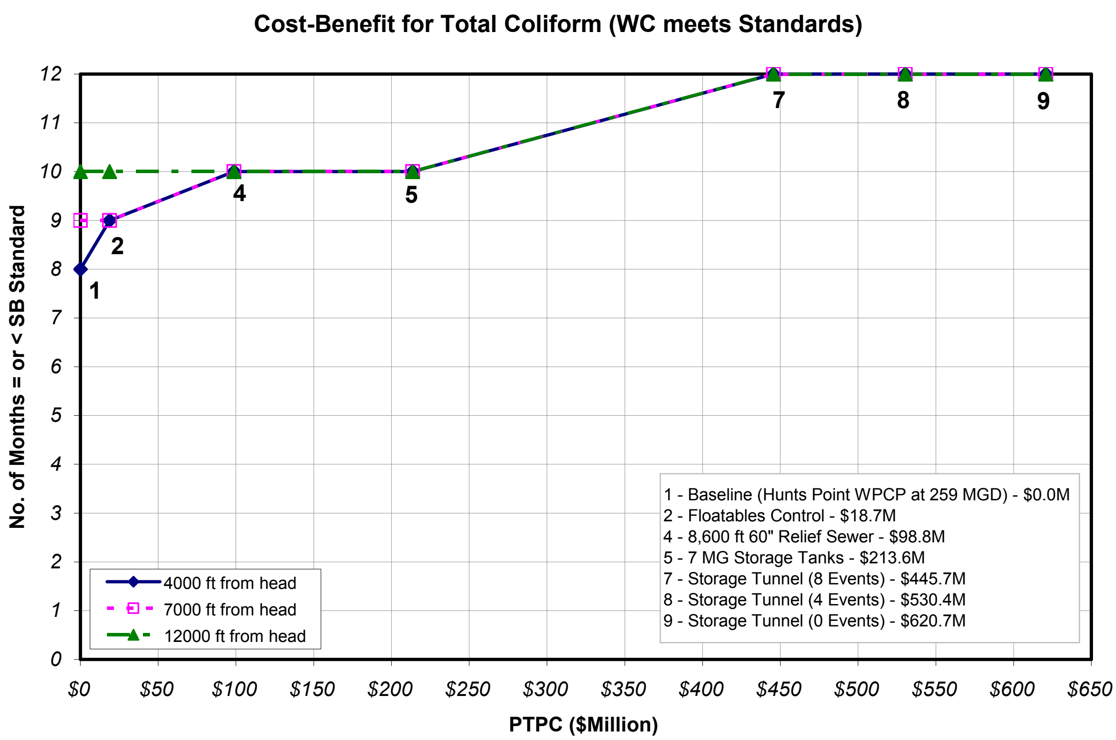

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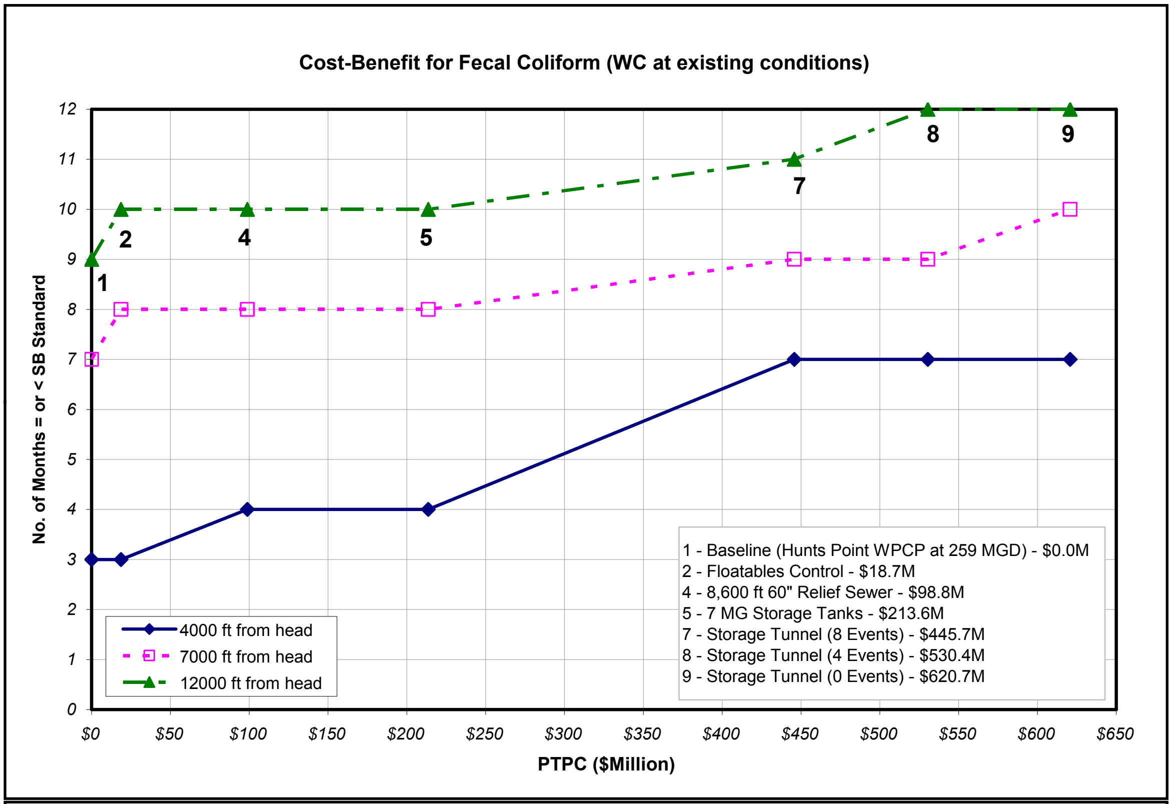
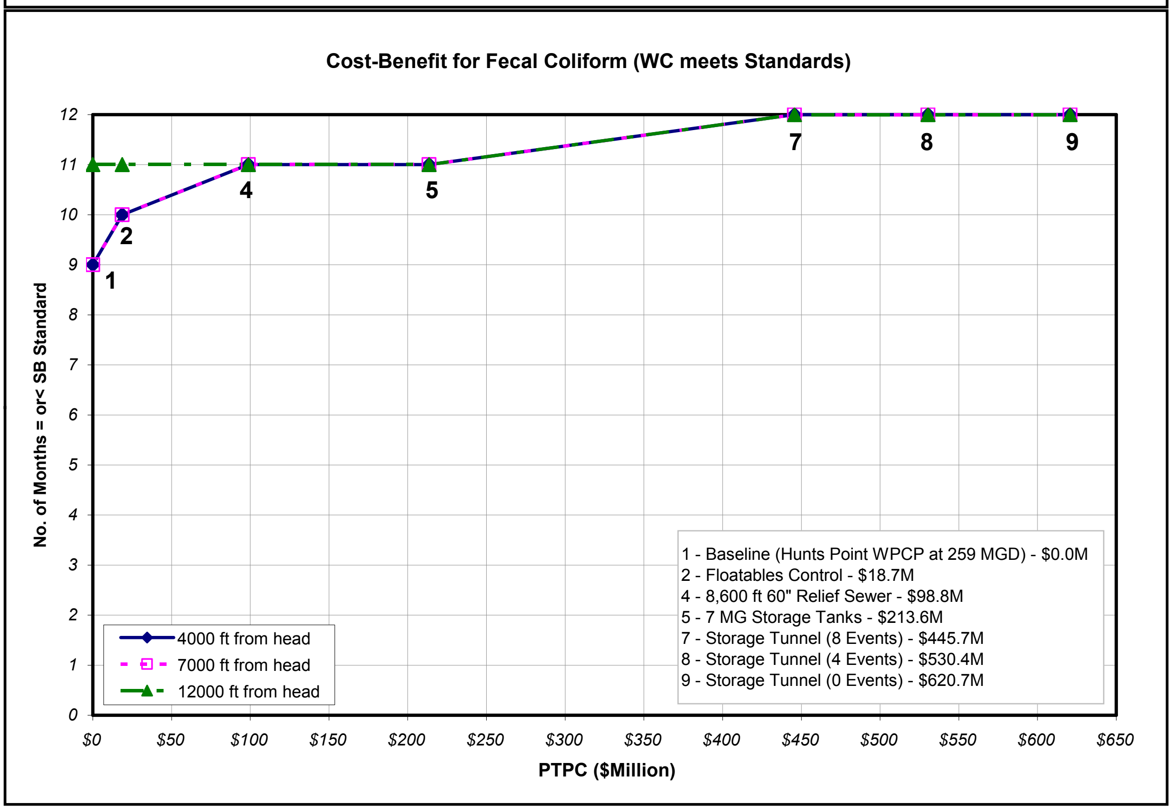
Hutchinson River Total Coliform Cost Benefit Curves





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Hutchinson River Fecal Coliform Cost Benefit Curves

7.5. SELECTED ALTERNATIVES

After reviewing the information presented in Section 7.4 it was clear that the alternative that provided the greatest benefit per unit cost was Floatables Controls. This alternative consists of in-line netting at HP-023 and HP-024 and continuing to work with neighboring jurisdictions to promote water quality throughout the river. The location of these alternatives is shown in Figure 7-24. Table 7-10 summarizes the recommended alternatives and their costs.

Table 7-10. Selected Alternative Cost Opinion Baselined to July 2005 (ENR = 7422)

Component	Capital Cost ($ M)
In-Line Netting at HP-023 and HP-024 (Includes Outfall Rehabilitation at HP-024 and Land Acquisition Cost)	$18.7
Work with neighboring jurisdictions to improve water quality throughout the river	N/A*

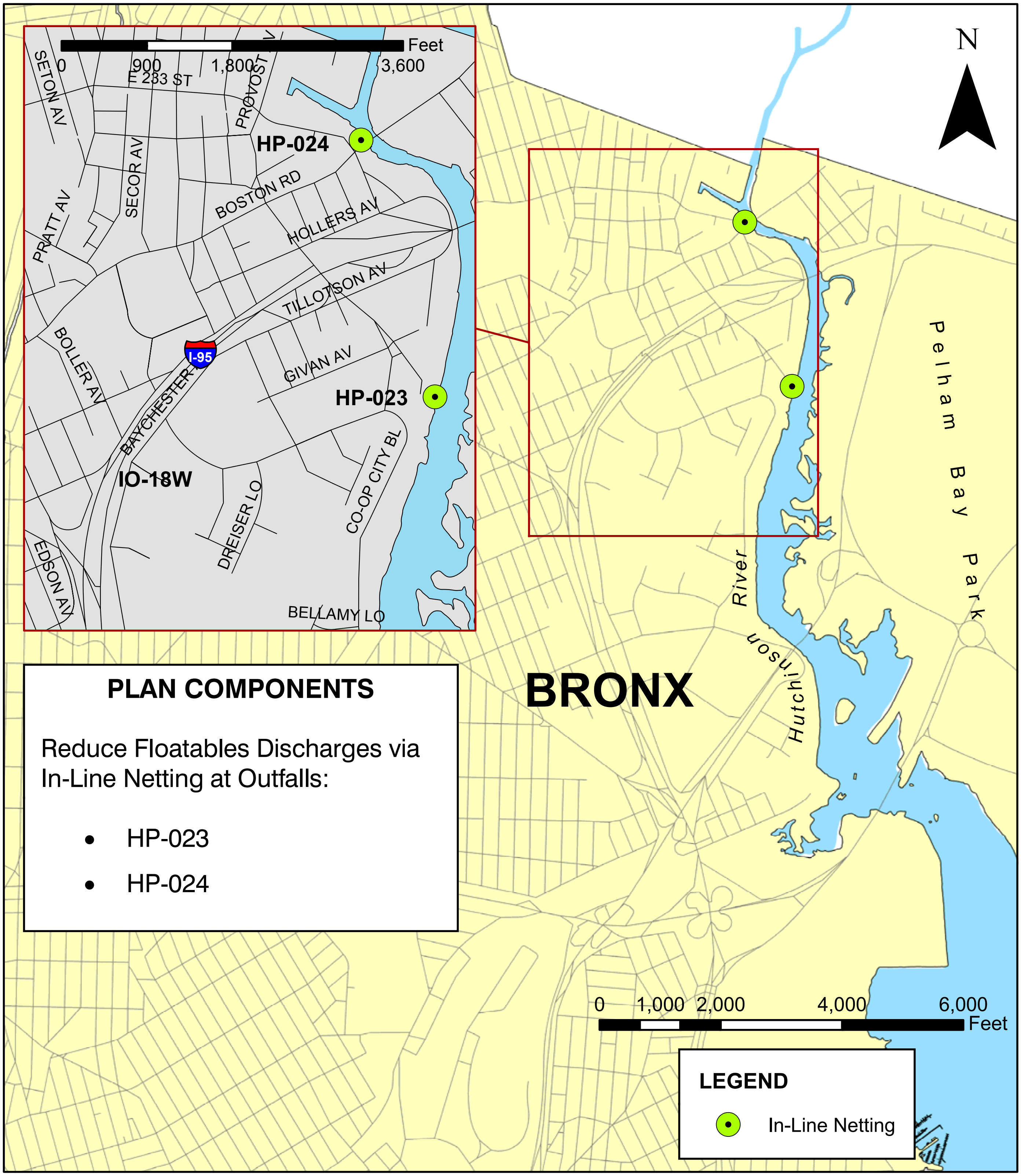
Note: *To be carried out under existing NYCDEP Programs

The in-line netting system for floatables control at HP-023 and HP-024 will catch debris from approximately 95 percent of flows exiting the Hutchinson River outfalls. This will benefit the river by significantly reducing the number of floatable entering the waterbody and help maintain the beauty of the river, especially around Pelham Bay Park.

The NYCDEP will continue to work with neighboring jurisdictions, Westchester County in the case of the Hutchinson River, to reduce pollutant loads to the River.

Benefits Summary

The recommended WB/WS Facility Plan is expected to provide significant aesthetic improvements to the Hutchinson River waterbody. Under the WB/WS Facility Plan the City will continue to comply with DO requirements 98 percent of year under this alternative. An approximate reduction of 95 percent in floatables such as cans, bottles, bags and other debris is expected.



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Selected Alternative

8.0. Waterbody/Watershed Facility Plan

8.1 PLAN OVERVIEW

As outlined in Section 7.0, a variety of CSO control alternatives to reduce CSO pollution impacts to Hutchinson River have been examined based on a “knee of the curve” type analysis, ranging from watershed management approaches to total CSO retention/storage. This analysis was used to select a cost effective program appropriate for existing water quality standards and highest reasonably attainable uses.

The central element of the Hutchinson River WB/WS Facility Plan is floatable control facilities at CSO Outfalls of HP-023 and HP-024, which are frequently active during the 1988 average year analyzed. This WB/WS Facility Plan is expected to result in significant improvements in reducing floatables from CSO sources in the Hutchinson River and improve water quality.

Best management practices such as sewer cleaning will continue to reduce CSO overflows and improve water quality in the Hutchinson River by allowing more wet weather flow to remain within the sewer system. The NYCDEP remains committed to attaining the highest reasonable use of Hutchinson River, and the Hutchinson River WB/WS Facility Plan coupled with the flexibility of adaptive management and the continuation of proven programs will further advance this cause.

The NYCDEP will continue to work with other City Agencies to fully investigate BMPs and LIDs and to develop rules, regulations, and incentives as appropriate to encourage the use of these sustainable practices. Once New York City has developed a City-Wide program that includes sustainable practices that include source controls or other practices that will reduce surface runoff into combined sewers, then the NYCDEP will incorporate those practices into either the Drainage Basin Specific Long Term Control Plan for this waterbody or in the City-Wide Long Term Control Plan.

This WB/WS Facility Plan is expected to result in significant improvements in reducing floatables from CSO sources in the Hutchinson River and improve water quality. The subsections that follow present the recommended CSO control components of the proposed WB/WS Facility Plan as well as present some additional assessments required to ensure the full implementation of the Hutchinson River WB/WS Facility Plan goals. Post-construction compliance monitoring (including modeling), discussed in detail in Section 8.3, is an integral part of the WB/WS Facility Plan, and provides the basis for adaptive management for the Hutchinson River.

In addition, protocols established by the NYCDEP and the City of New York for capital expenditures require certain evaluations to be completed prior to the construction of the CSO controls recommended in this report. Depending on the technology implemented and on the engineer’s cost estimate for the project, these evaluations may include pilot testing, detailed facility planning, preliminary design, and value engineering. Each of these steps provides additional opportunities for refinement and adaptation so that the fully implemented program achieves the goals of the original WB/WS Facility Plan.

8.2 WATERBODY/WATERSHED FACILITY PLAN COMPONENTS

8.2.1 Floatable Control Facilities

The Hutchinson River floatables facilities will be designed to capture floatables via in-line netting systems for outfalls HP-023 and HP–024 as described in Section 7 of this report. A location figure for these facilities is shown in Figure 8-1 and a schematic of the proposed facilities is shown in Figure 8-2.

8.2.2 Continue Implementation of Programmatic Controls

The NYCDEP currently operates several programs intended to reduce CSOs to a minimum and provide levels of treatment appropriate to protect waterbody uses. As the effects of the WB/WS Facility Plan become understood through long-term monitoring, ongoing programs will be routinely evaluated based on receiving water quality considerations. Floatables reduction via catchbasin hooding, targeted sewer cleaning, and other operations and maintenance controls and evaluations will continue, such as the following specific activities:

- The 14 BMPs for CSO control required under the City's 14 SPDES permits. In general, the BMPs address operation and maintenance procedures, maximum use of existing systems and facilities and reduce contaminants in the combined sewer system, thereby reducing water quality impacts. A detailed discussion of the existing BMP program is included in Section 5.3.

8.2.3 Best Management Practices/Low Impact Development Practices

The NYCDEP will continue to work with other City Agencies to fully investigate BMPs and LIDs and to develop rules, regulations and incentives as appropriate to encourage the use of these sustainable practices. Once New York City has developed a City-Wide program that includes sustainable practices (i.e. source controls or other practices that will reduce surface runoff into combined sewers) then the NYCDEP will incorporate those practices into either the Drainage Basin Specific Long Term Control Plan for this waterbody or in the City-Wide Long Term Control Plan.

8.2.4 Other Components

In addition to the proposed components, the NYCDEP proposes a cooperative water quality monitoring program with Westchester County to improve the water quality and overall health of the river. This effort will be conducted through NYCDEP existing programs in conjunction with the LTCP project.

8.2.5 WB/WS Facility Plan Costs

The central element of this WB/WS Facility Plan is floatables control facilities. For comparison purposes the alternative probable total project costs (PTPC) were evaluated in July 2005 dollars. The PTPC for construction of in-line netting facilities at HP-023 and HP-024, including rehabilitation of HP-024 and land acquisition costs is $18.7 million (July 2005$). The estimated PTPC escalated to the mid-point of construction is $35 million in June 2012 dollars.

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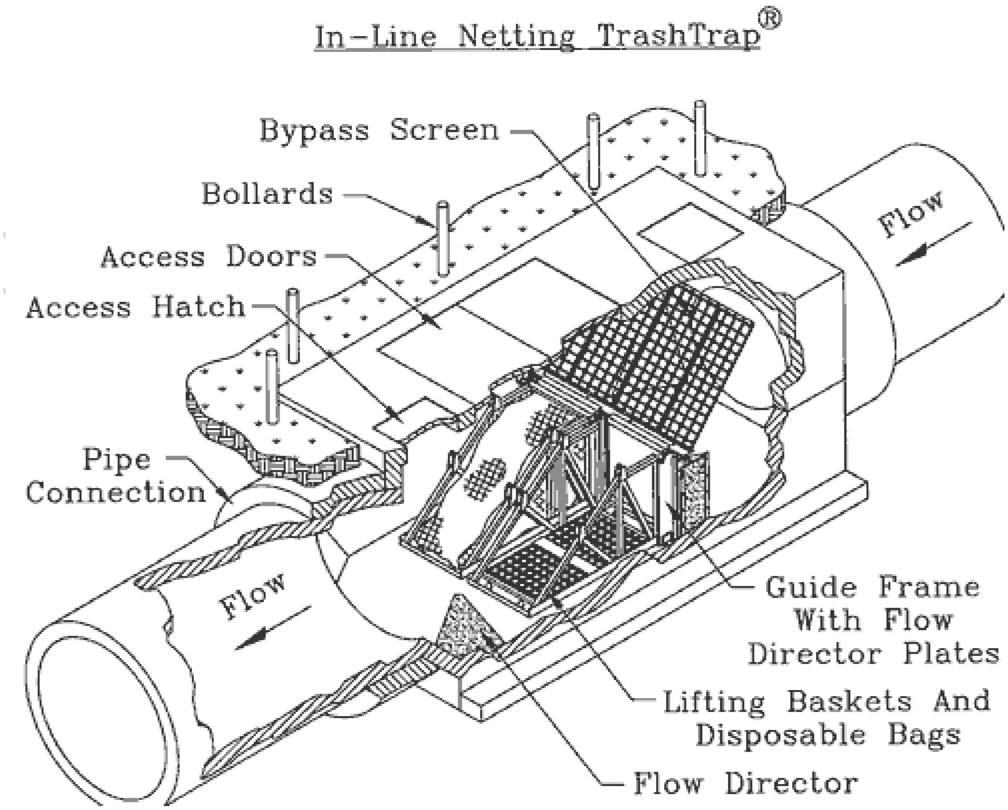
Hutchinson River CSO Outfalls Floatables Control Facilities

Hutchinson River Waterbody/Watershed Facility Plan

FIGURE 8-1



In-Line Netting Facility Schematic

8.3 POST-CONSTRUCTION COMPLIANCE MONITORING

Post-construction compliance monitoring will commence just prior to implementation of CSO controls and will continue for several years in order to quantify the difference between the expected performance (as described in this report) and the actual performance once those controls are fully implemented. Any performance gap identified by the monitoring program can then be addressed through operations adjustments, retrofitting additional controls, or initiating a Use Attainability Analysis (UAA) if it becomes clear that CSO control will not result in full attainment of applicable standards. Due to the dynamic nature of water quality standards and approaches to non-compliance conditions, a period of ten years of operation will be necessary to generate the minimal amount of data necessary to perform meaningful statistical analyses for water quality standards review and for any formal Use Attainability Analysis (UAA) that may be indicated.

Each year's data set will be compiled and evaluated to refine the understanding of the interaction between the New York City collection system and the Hutchinson River, with the ultimate goal of improving water quality and fully attaining compliance with water quality standards. The monitoring will contain two basic components:

1. Modification to the current NYCDEP Harbor Survey program to more rigorously collect data in Hutchinson River and nearby upper East River locations; and
2. Modeling of the Hutchinson River to characterize attainment with numerical water quality standards.

These programs are discussed in detail below, along with anticipated data analyses and mechanisms for responsiveness.

8.3.1 Receiving Water Monitoring

The New York City Harbor Survey primarily measures four parameters related to water quality: dissolved oxygen, fecal coliform, chlorophyll a, and secchi depth. These parameters have been used by the City to identify historical and spatial trends in water quality throughout New York Harbor. Secchi depth and chlorophyll a have been monitored since 1986; DO and fecal coliform have been monitored since before 1972. Recently, enterococci analysis has been added to the program. Except for secchi depth and pathogens, each parameter is collected and analyzed at surface and bottom locations, which are three feet from the surface and bottom, respectively, to eliminate influences external to the water column chemistry itself, such as wind and precipitation influences near the surface or benthic and near-bottom suspended sediments and aquatic vegetation near the bottom. The NYCDEP regularly samples 33 open water stations annually, which is supplemented each year with approximately 20 rotating tributary stations or periodic special stations sampled in coordination with capital projects, planning, changes in facility operation, or in response to regulatory changes.

The post-construction compliance monitoring program will continue along the protocols of the Harbor Survey initially. As shown in Figure 8-3, the Hutchinson River contains two locations that are currently sampled or have been sampled historically. These two stations will serve as the WB/WS Facility Plan post-construction monitoring sites. All stations related to the

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Post Contruction Monitoring
Hutchinson River Sampling Locations

WB/WS Facility Plan post-construction compliance monitoring program will be sampled a minimum of twice per month from May through September and monthly during the remainder of the year.

Data collected during this program will be used primarily to verify the water quality model that will be used to demonstrate relative compliance levels in the Hutchinson River. Therefore, during each annual cycle of compliance monitoring, the data collected will be evaluated for its utility in model verification, and stations may be added, eliminated, or relocated depending on this evaluation. Similarly, the parameters measured will be evaluated for their utility and appropriateness for verifying the receiving water model calibration. At a minimum, the program will collect those parameters with numerical water quality criteria (e.g., DO, fecal coliform, and enterococci). In addition, moored instrumentation may be added or substituted at one or more of these locations if continuous monitoring is determined to be beneficial to model verification, or if logistical considerations preclude the routine operation of the program (navigational limits, laboratory issues, etc.).

Post-construction monitoring protocols, QA/QC, and other details are being fully developed under the City-wide LTCP to assure adequate spatial coverage and a technically sound sampling program. The monitoring within each waterbody under NYCDEP's purview will commence no later than the activation of any constructed CSO abatement facility. In those waterbodies where constructed facilities are not proposed, sampling will commence no later than the summer following NYSDEC approval of the WB/WS Facility Plan.

8.3.2 Floatables Monitoring Program

This WB/WS Facility Plan incorporates by reference the City-Wide Comprehensive CSO Floatables Plan Modified Facility Planning Report (NYCDEP, 2005a) and Addendum 1 – Pilot Floatables Monitoring Program (December 2005) to the Floatables Plan. These documents contain a conceptual framework for the monitoring of floatables conditions in New York Harbor and a work plan for the ongoing pilot program to develop and test the monitoring methodology envisioned in the framework. The objectives set forth in the Floatables Plan provides a metric for LTCP performance, and floatables monitoring will be conducted in conjunction with post-construction compliance monitoring with regard to staffing, timing, and location of monitoring sites. The program will include the collection of basic floatables presence / absence data from monitoring sites throughout the harbor that will be used to rate and track floatables conditions, correlate rating trends to floatables control programs where applicable, and trigger investigations into the possible causes of consistently poor ratings should they occur. Actions based on the floatables monitoring data and investigations could include short-term remediation in areas where monitored floatables conditions create acute human or navigation hazards and, as appropriate, longer-term remediation actions and modifications to the WB/WS Facility Plan if monitored floatables trends indicate impairment of waters relative to their intended uses.

8.3.3 Meteorological Conditions

The performance of any CSO control cannot be fully evaluated without a detailed analysis of precipitation, including the intensity, duration, total rainfall volume, and precipitation event distribution that led to an overflow or, conversely, the statistical bounds within which the control may be expected to eliminate CSO completely. The NYCDEP has established 1988 as representative of long-term average conditions and therefore uses it for analyzing facilities where "typical" conditions (rather than extreme conditions) serve as the basis for design. The comparison of rainfall records at JFK airport from 1988 to the long-term rainfall record is shown on Table 8-1, and includes the return period for 1988 conditions.

In addition to its aggregate statistics indicating that 1988 was representative of overall long-term average conditions, 1988 also includes critical rainfall conditions during both recreational and shellfishing periods. Further, the average storm intensity for 1988 is greater than one standard deviation from the mean, so that using 1988 as a design rainfall year would be conservative with regard to water quality impacts since CSOs and stormwater discharges are driven primarily by rainfall intensity. However, considering the complexity and stochastic nature of rainfall, selection of any year as "typical" is ultimately qualitative.

Table 8-1. Rainfall Statistics, JFK Airport, 1988 and Long-Term Average

Statistic	1970-2002 Median	1988	
		Value	Return Period (years)
Total Volume (inches)	39.4	40.7	2.6
Intensity, (in/hr)	0.057	0.068	11.3
Number of Storms	112	100	1.1
Storm Duration (hours)	6.08	6.12	2.1

Given the uncertainty of the actual performance of the facility and the response of the Hutchinson River with respect to widely varying precipitation conditions, rainfall analysis is an essential component of the post-construction compliance monitoring. Multiple sources of rainfall data will be compiled as part of the post-construction monitoring. The primary source of rainfall data will be from the local airports (JFK and La Guardia) and from the meteorological station at Central Park. A second source of rainfall data will be from the rain gages maintained by the NYCDEP at its WPCPs and other facilities. A final source of rainfall data will come from the National Weather Service radar NEXRAD data. NEXRAD provides cloud reflectivity data, which must be calibrated to local rainfall data before application. For the purpose of this analysis, one month of radar based rainfall will be purchased for use in the landside modeling analysis. This will provide interpolated data over the entire Bronx River tributary drainage area for use in the assessments described in the following section. If any of these data sets is determined to be of limited value in the analysis of compliance, the NYCDEP may discontinue its use for that purpose.

8.3.4 Analysis

The performance of the WB/WS Facility Plan will be evaluated on an annual basis using landside mathematical computer models as approved by the NYCDEP. The collection system model that was used in the development of the present WB/WS Facility Plan is expected to serve as the basis for future model-related activities. The NYCDEP believes that the analysis of water quality compliance is best accomplished using computer modeling supported and verified with a water quality monitoring program. Modeling has several advantages over monitoring:

1. Modeling provides a comprehensive vertical, spatial and temporal coverage that cannot reasonably be equaled with a monitoring program;
2. Modeling provides the data volume necessary to compute aggregate statistical compliance values, such as a geometric mean, an absolute limit (e.g., "never-less-than" or "not-to-exceed"), or a cumulative statistic (e.g., the 66-day deficit-duration standard for dissolved oxygen to be promulgated by NYSDEC in the near future);
3. Discrete grab sampling for data collection is necessarily biased to locations and periods of logistical advantage, such as navigable waters, safe weather conditions, daylight hours, etc.; and
4. Quantification of certain chemical parameters must be performed in a laboratory setting which either (a) complicates the use of a smaller sampling vessel that is necessary to access shallower waters not navigable by a vessel with on-board laboratory facilities or (b) limits the number sampling locations that can be accessed due to holding times and other laboratory quality assurance requirements if remote laboratory (non-vessel mounted) facilities are used.

CSO volumes will be quantitatively analyzed on a monthly basis to isolate any periods of apparent noncompliance or performance issues and their impact on water quality. Water quality modeling re-assessment will be conducted every two years based on the previous two years water quality field data. Water quality modeling conditions will be based on the hydrodynamic and meteorological conditions for the study year, documented operational issues that may have impacted the facility performance, and water quality boundary conditions based on Station E12. Results will be compared to the relevant Harbor Survey data to validate the water quality modeling system, and performance will be expressed in a quantitative compliance level for applicable standards. Should this analysis indicate that progress towards the desired results is not being made, the analysis will:

- Re-verify all model inputs, collected data and available QA/QC reports;
- Consult with operations personnel to ensure unusual operational problems (e.g., screening channel o/s, pump repair, etc.) were adequately documented;
- Evaluate specific periods of noncompliance to identify attributable causes;
- Confirm that all operational protocols were implemented, and that these protocols are sufficient to avoid operationally-induced underperformance;
- Re-evaluate protocols as higher frequency and routine problems reveal themselves; and finally,
- Revise protocols as appropriate and conduct Use Attainability Analysis (UAA) and, if necessary, revise the WB/WS Facility Plan.

Following completion of the tenth annual report containing data during facility operation, a more detailed evaluation of the capability of the WB/WS Facility Plan to achieve the desired water quality goals will take place, with appropriate weight given to the various issues identified during the evaluations documented in the annual reports. If it is determined that the desired results are not achieved, the NYCDEP will implement additional measures to improve levels of attainment under typical precipitation conditions. Alternately, the water quality standards revision process may commence with a UAA that would likely rely in part on the findings of the post-construction monitoring annual reports. The approach to future improvements beyond the 10-year post-construction monitoring program will be dictated by the findings of that program as well as the input from NYSDEC SPDES permit and CSO Consent Order administrators.

8.3.5 Reporting

Post-construction compliance monitoring will be added to the BMP Annual Report submitted by the NYCDEP in accordance with their SPDES permits, and will therefore constitute a permit modification. The monitoring report will include an overview of the performance of the Hutchinson River Floatable Control Facilities, and will provide summary statistics on rainfall and the amount of floatables captured. The SPDES DMR requirements will remain in force and will continue in addition to the reporting modifications to the annual BMP described above.

8.3.6 Pathogen Loading Source Investigation

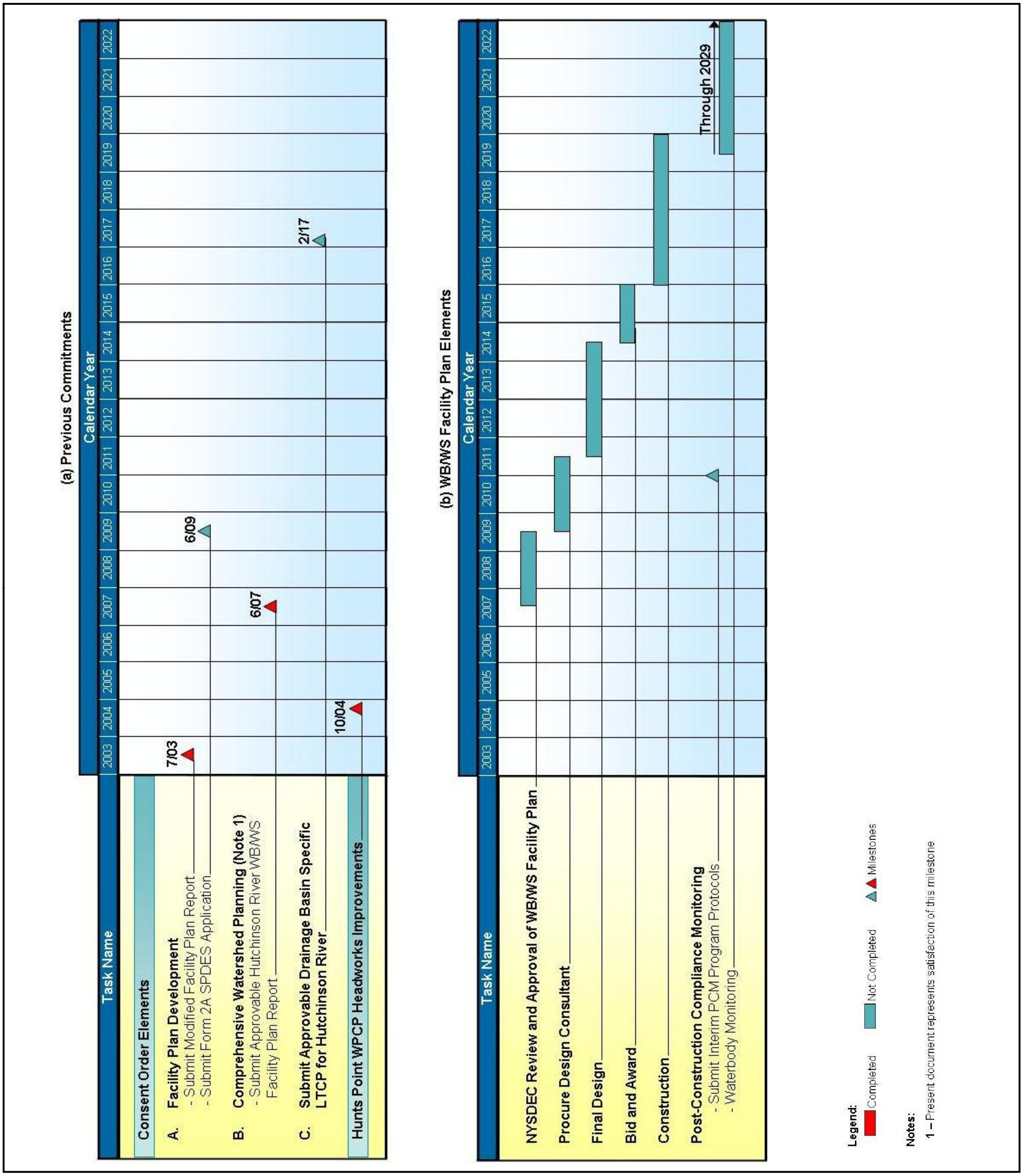
Post-construction monitoring may include pathogen sampling. If high levels of pathogens are detected in the Hutchinson River during dry weather sampling, additional pathogen sources may be the suspected cause. In such cases, the NYCDEP will pass this information to the appropriate internal bureau for subsequent track down and removal of these pathogen sources.

8.4 OPERATIONAL PLAN

The operation of the Hutchinson River WB/WS Facility Plan will be carried out in conjunction with the existing Hunts Point WPCP WWOP. The NYCDEP intends to operate these facilities in strict accordance with their WWOP. The annual analysis of monitoring data will trigger a sequence of detailed investigations if needed. The WWOP for the Hunts Point WPCP is presented in Appendix A. The wet weather operating plans for the floatables facilities will be developed during the final design of the facilities and will be appended to the final Hutchinson River Long Term Control Plan when it is developed in February 2017.

8.5 SCHEDULE

Figure 8-4 shows the proposed construction schedule for the Hutchinson River Floatables Control Facilities, along with relevant aspects of the programmatic controls and post-construction compliance monitoring schedules. It should be noted that elements shown in this schedule address the implementation of the recommended WB/WS Facility Plan elements only. As noted in the Order on Consent (Section III.C.2) “once the Department approves a Drainage Specific LTCP, the approved Drainage Specific LTCP is hereby incorporated by reference, and made an enforceable part of this Order”. As such, a schedule will be incorporated by reference only when this WB/WS Facility Plan is further developed and submitted as an LTCP in accordance with dates presented in Appendix A of the Order on Consent.


(a) Previous Commitments
Task Name
Calendar Year
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Consent Order Elements
A. Facility Plan Development
- Submit Modified Facility Plan Report
- Submit Form 2A SPDES Application
B. Comprehensive Watershed Planning (Note 1)
- Submit Approvable Hutchinson River WB/WS Facility Plan Report
C. Submit Approvable Drainage Basin Specific LTCP for Hutchinson River
Hunts Point WPCP Headworks Improvements
7/03
6/09
6/07
2/17
10/04
(b) WB/WS Facility Plan Elements
Task Name
Calendar Year
NYSDEC Review and Approval of WB/WS Facility Plan
Procure Design Consultant
Final Design
Bid and Award
Construction
Post-Construction Compliance Monitoring
- Submit Interim PCM Program Protocols
- Waterbody Monitoring
Through 2029
Legend:
Completed
Not Completed
Milestones
Notes:
1 – Present document represents satisfaction of this milestone

Schedules

8.6 CONSISTENCY WITH FEDERAL CSO POLICY

Through extensive water quality and sewer system modeling, data collection, community involvement, and engineering analysis, the NYCDEP has adopted a plan that incorporates the findings of over a decade of inquiry to achieve the highest reasonably attainable use of the Hutchinson River. The LTCP addresses each of the nine control elements of long-term CSO control as defined by federal policy and shown in Table 8-2.

Table 8-2. Nine Elements of the Long Term CSO Control Program

Element	Section	Summary
1. Charcterization, Monitoring, and Modeling of the Combined Sewer System	3.0	Addressed during facility planning (1990s), and supplemented during the USA Project (2000-2001), and current WB/WS Facility Plan development (2006).
2. Public Participation	6.0	The WB/WS Facility Plan was developed with active involvement from the affected public and other stakeholders during plan development and environmental quality assessments.
3. Consideration of Sensitive Areas	4.7	There are no sensitive areas identified within Hutchinson River that are directly impacted by CSO discharges.
4. Evaluation of Alternatives	7.0	Detailed evaluations during facility planning point to floatables control.
5. Cost/Performance Considerations	7.0	Facility planning evaluations of cost suggest that higher level controls such as sewer separation, storage, and 100% CSO capture do not provide water quality benefits that merit their inordinate costs.
6. Operational Plan	8.0	The NYCDEP will continue to satisfy the operational requirements of the 14BMPs for CSO control, including the Hunt's Point WPCP Wet Weather Operating Plan. The BMPs satisfy the nine minimum control requirement of federal CSO policy. The NYCDEP will also continue implementation of other programmatic controls.
7. Maximizing Treatment at the Existing WPCP	7.0	Implementation of wet-weather protocols at the Hunt's Point WPCP and its recent upgrade to 2×DWF will enable the WPCP to treat substantially larger flows than previously possible.
8. Implementation Schedule	8.0	WB/WS Facility Plan complete and all components operational by 2015.
9. Post-Construction Compliance Monitoring	8.0	Hutchinson River Floatable Control Facilities will be monitored per SPDES requirements; monitoring data will be used to assess effectiveness, optimize facility performance, and trigger adaptive management alternatives.

8.7 ANTICIPATED WATER QUALITY IMPROVEMENTS

Implementing the WB/WS Facility Plan is expected to have significant improvements on floatables control from CSO sources in the Hutchinson River. Floatables discharged to the Hutchinson River via CSO discharges will be reduced by approximately 95 percent.

8.7.1 WB/WS Facility Plan Dissolved Oxygen Improvements

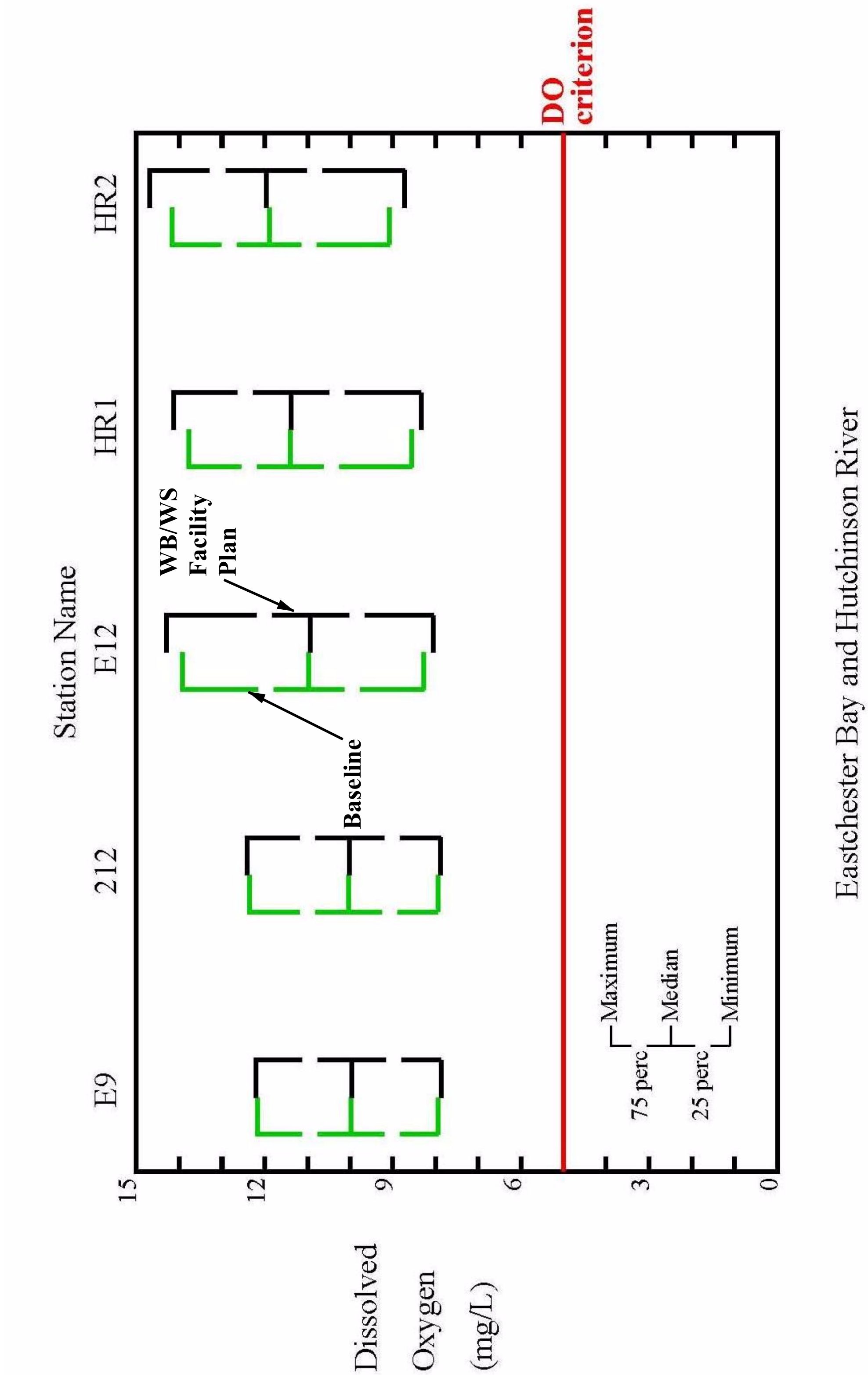
Hourly average and hourly minimum dissolved oxygen concentrations are projected to be compliant with the Class SB standard of 5.0 mg/L 100 percent of the time during the months of January through April, June, and October through December. Projected dissolved oxygen improvements with the implementation of the WB/WS Facility Plan are shown in Figures 8-5 through 8-8 for the winter, spring, summer, and autumn seasons, respectively.

8.7.2 WB/WS Facility Plan Pathogens Improvements

Figures 8-9 and 8-10 show the projected total and fecal coliform annual attainment plots for the baseline condition, the WB/WS Facility Plan, and with Westchester County in attainment with the water-quality standards. A description of the attainment plot curves for total and fecal coliform concentrations is as follows:

- Condition 1 (Baseline): Sources of pathogen loading are present, and the Westchester County portion of the Hutchinson River is out of compliance with standards.
- Condition 2: Sources of pathogen loading are located and removed, and the Westchester County portion of the Hutchinson River is out of compliance with standards.
- Condition 3: Sources of pathogen loading are located and removed, and the Westchester County portion of the Hutchinson River is in compliance with standards.

Significant total and fecal coliform standards attainment is gained in the Hutchinson River by implementing the WB/WS Facility Plan in conjunction with other NYCDEP programs. Approximately, a 60 percent increase in total and fecal coliform attainment south of Outfall HP-023 is projected with the implementation of the WB/WS Facility Plan and other NYCDEP programs. Furthermore, the graphs show that Westchester County has a significant impact on the water-quality of the Hutchinson River within New York City. When Westchester County meets the water-quality standards, total and fecal coliform attainment is estimated to increase by approximately 90 percent together with the implementation of the WB/WS Facility Plan.



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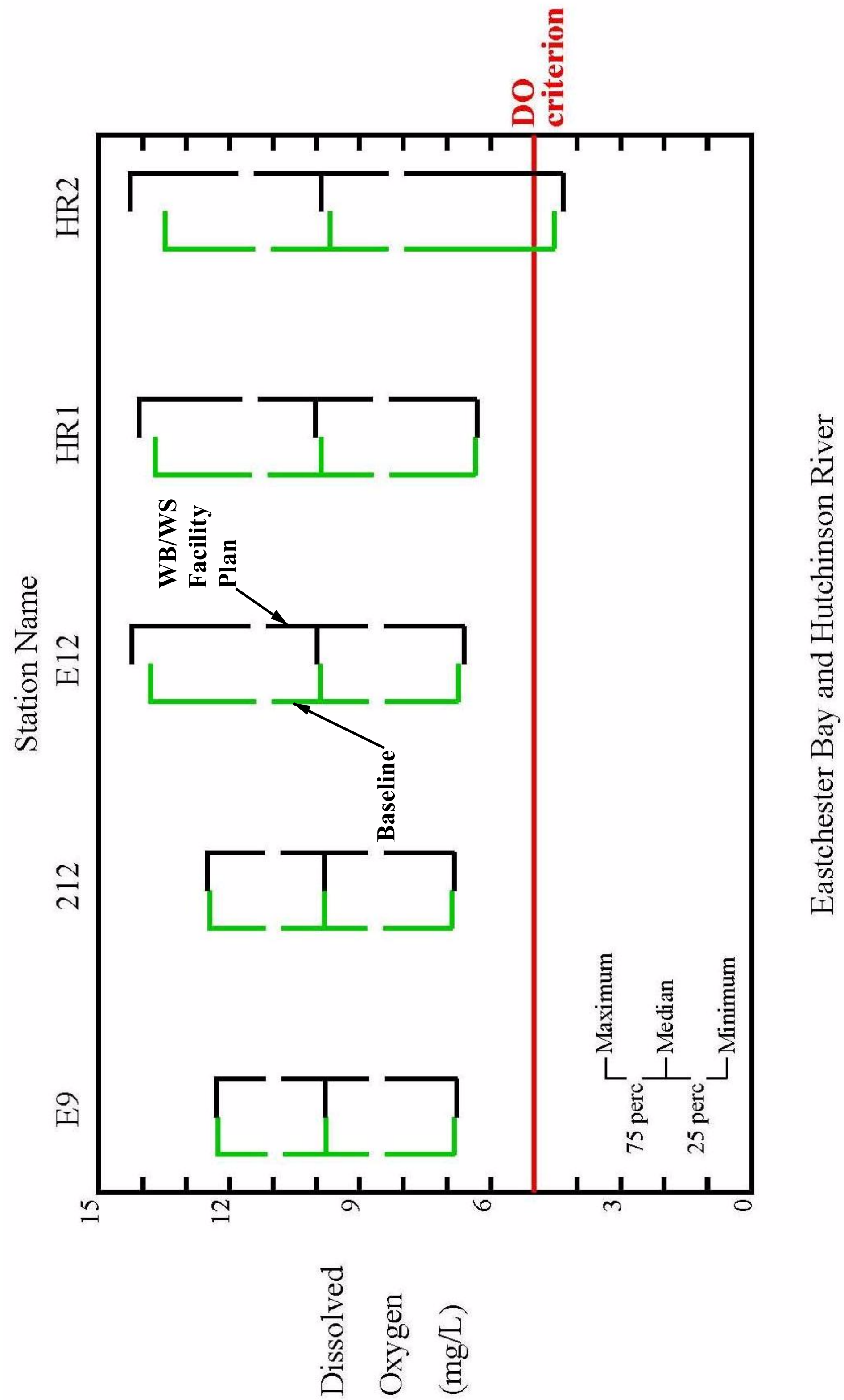
Hutchinson River Winter (Dec-Feb) Dissolved Oxygen Comparison (based on hourly average DO)



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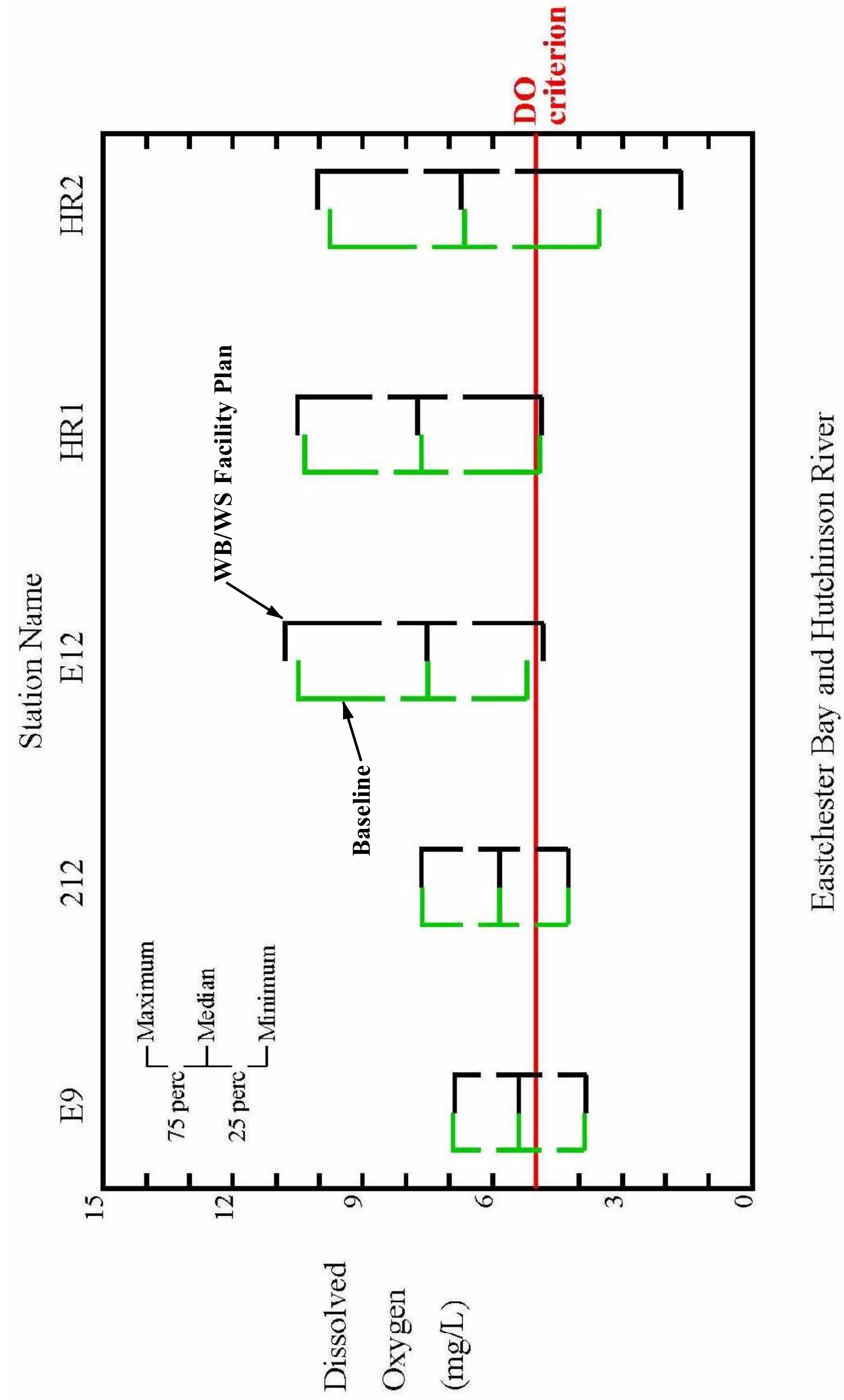
Hutchinson River Spring (March-May) Dissolved Oxygen Comparison (based on hourly average DO)



Hutchinson River Summer (June-Aug) Dissolved Oxygen Comparison (based on hourly average DO)

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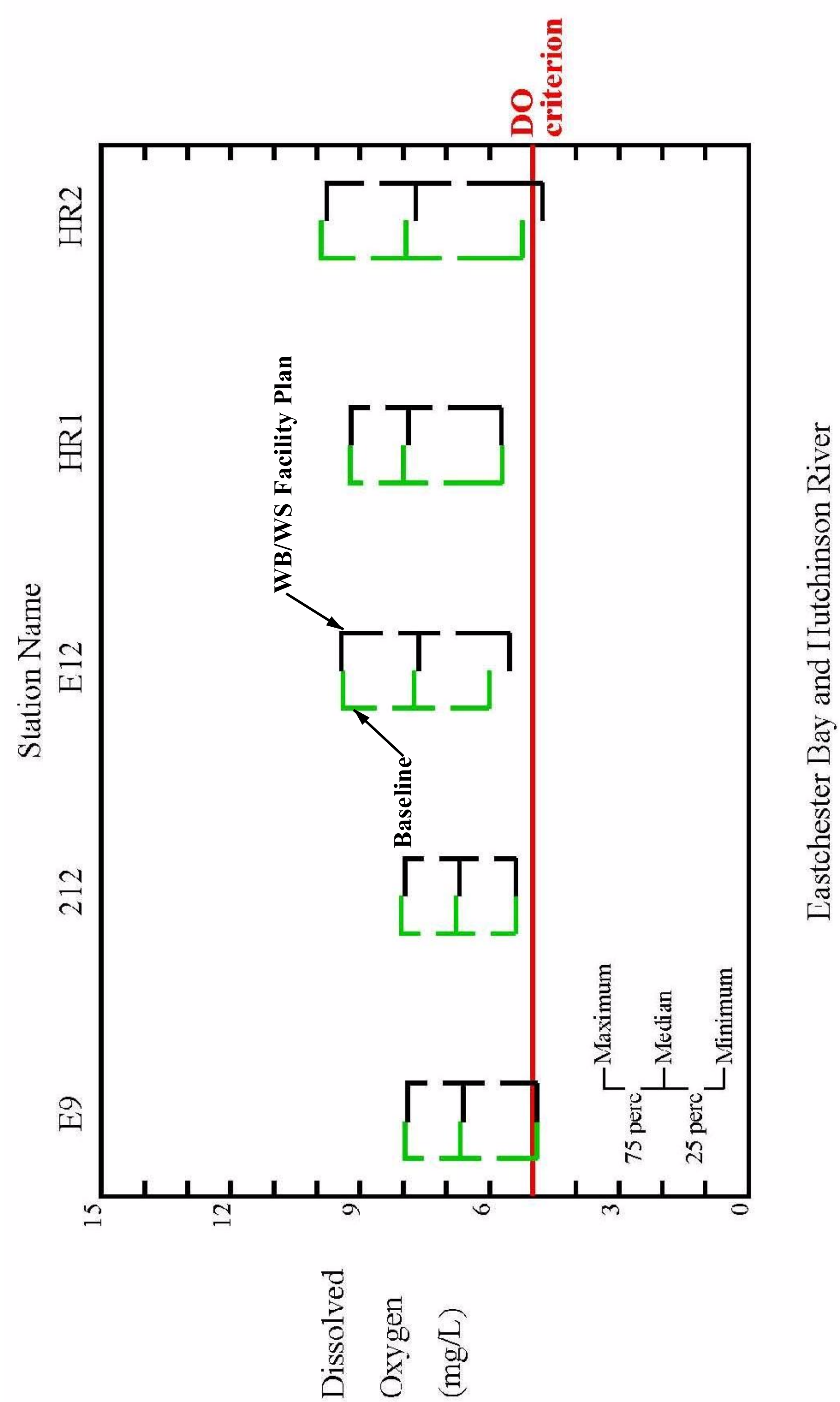

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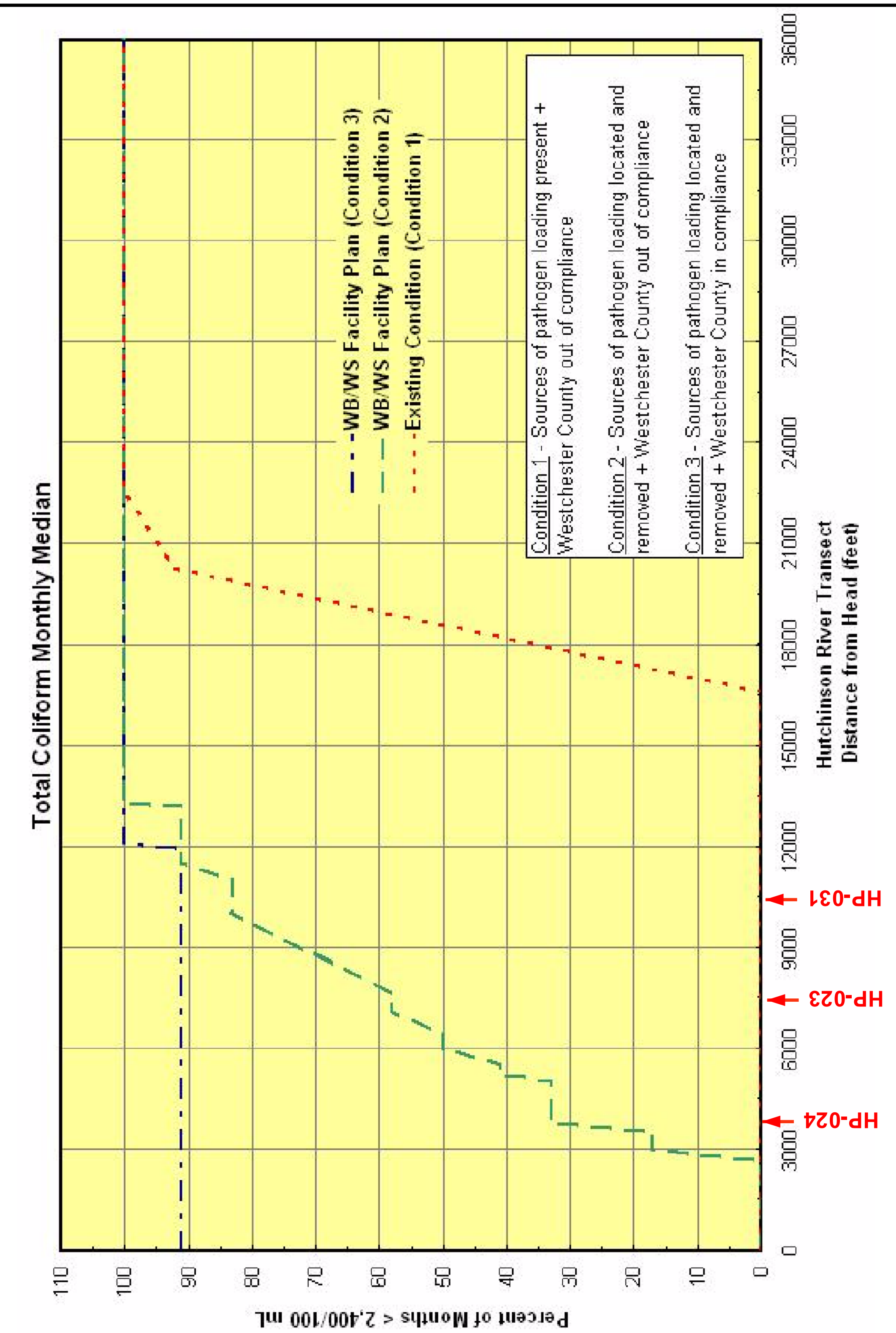
Hutchinson River Autumn (Sept-Nov) Dissolved Oxygen Comparison (based on hourly average DO)



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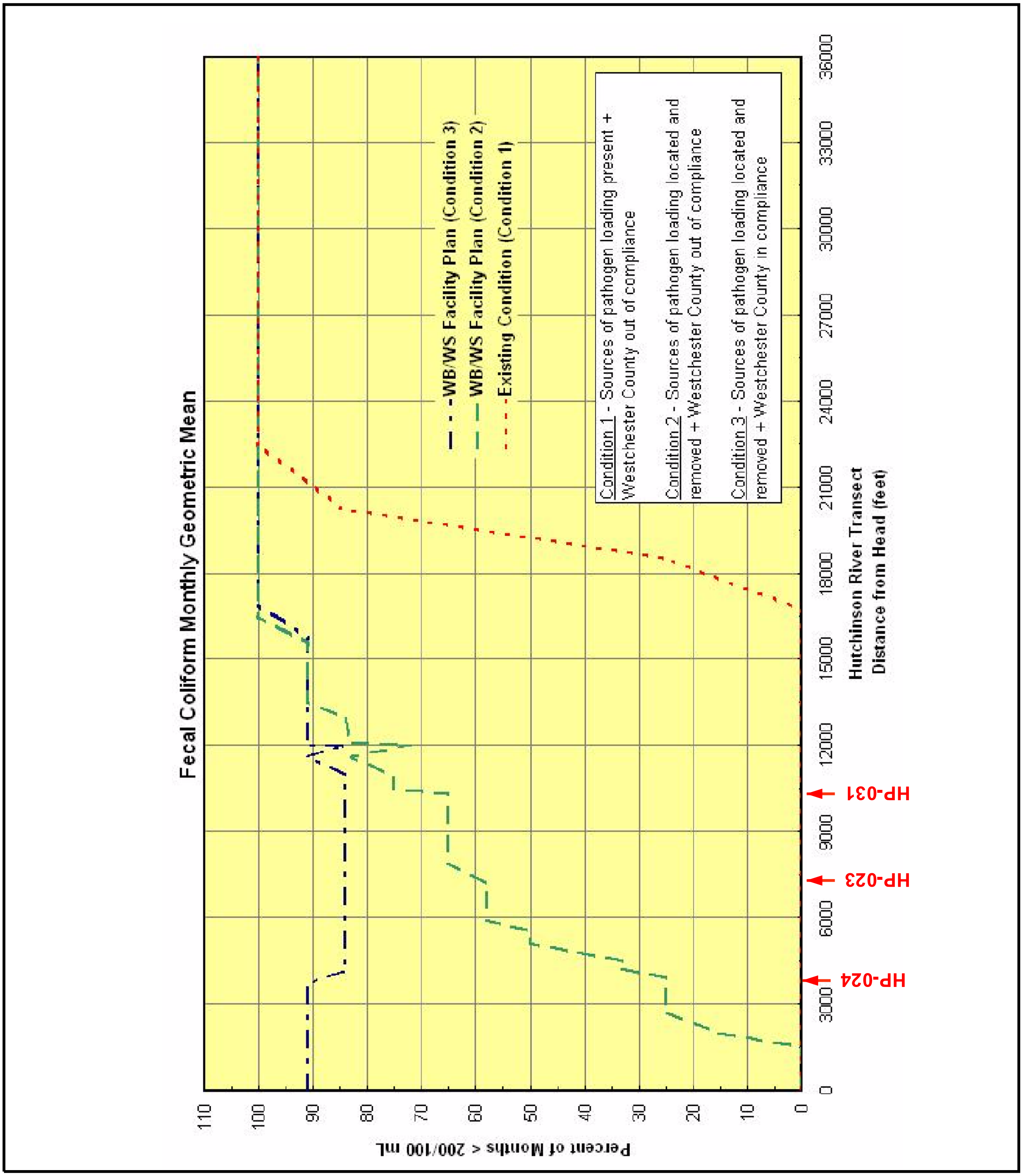
Total Coliform Annual Attainment Plots



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Fecal Coliform Annual Attainment Plots

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9.0. Water Quality Standards Review

The Hutchinson River Waterbody/Watershed Facility Plan is a component of the New York City Department of Environmental Protection's Combined Sewer Overflow Long-Term Control Plan. This Plan is being prepared in a manner fully consistent with USEPA's CSO Control Policy, the Wet Weather Water Quality Act of 2000 and applicable USEPA guidance.

As noted in Section 1.2 and as stated in the Clean Water Act (CWA), it is a national goal to achieve "fishable/swimmable" water quality in the nation's waters wherever attainable. The CSO Policy also reflects the CWA's objectives to achieve high water quality standards (WQS) by controlling CSO impacts, but the Policy recognizes the site-specific nature of CSOs and their impacts and provides the necessary flexibility to tailor controls to local situations. The key principles of the CSO Policy were developed to ensure that CSO controls are cost-effective and meet the objectives of the CWA. In doing so, the Policy provides flexibility to municipalities to consider the site-specific nature of CSOs and to determine the most cost-effective means of reducing pollutants and meeting CWA objectives and requirements. The Policy also provides for the review and revision, as appropriate, of water quality standards when developing CSO control plans to reflect the site-specific wet weather impacts of CSOs.

In 2001, USEPA published guidance for coordinating CSO long-term planning with water quality standards reviews. This guidance re-affirmed that USEPA regulations and guidance provide States with the opportunity to adapt their WQS to reflect site-specific conditions related to CSOs. The guidance encouraged the States to define more explicitly their recreational and aquatic life uses and then, if appropriate, modify the criteria accordingly to protect the designated uses.

The Hutchinson River Waterbody/Watershed Facility Plan was developed in a manner consistent with the CSO Policy and applicable guidance. Specifically, cost-effectiveness and knee-of-the-curve evaluations were performed for CSO load reduction evaluations using long-term rainfall records. Baseline and Waterbody/Watershed Facility Plan receiving water impact evaluations were performed for average annual rainfall conditions consistent with CSO Policy guidance. The plan resulting from following EPA regulations and guidance results in benefits as summarized below. However, it does not fully attain the "fishable/swimmable" goal. When the planning process has this result, the national policy calls for a review and, where appropriate, a revision to water quality standards. The purpose of this section therefore is to address the water quality standards review and revision guidance applicable to the CSO Policy.

9.1 WATER QUALITY STANDARDS REVIEW

9.1.1 Numeric Water Quality Standards

New York State waterbody classifications and numerical criteria which are applicable to the Hutchinson River are shown in Table 9-1.

Table 9-1. New York State Numeric Surface Water Quality Standards (Saline)

Class	DO (mg/L)	Bacteria (Pathogens) Total Coliform(1,4) (per 100 mL)	Fecal Coliform(2,4) (per 100 mL)	Enterococci(3,4) (per 100 mL)
SB	≥5.0	≤2,400; ≤5,000	≤200	≤35

Notes: (1) Total coliform criteria are based on monthly medians for Classes SB and SC; second criterion for SC and SB is for 80% of samples. (2) Fecal coliform criteria are based on monthly geometric means. (3) The enterococci standard is based on monthly geometric means per the USEPA Bacteria Rule and applies to the bathing season. The enterococci coastal recreation water infrequent use reference level (upper 95% confidence limit) = 501/100 mL. (4) Per 6 NYCRR 703.4(c), bacteria standards are only applicable when disinfection is practiced.

Hutchinson River is classified as Class SB with best usages of primary and secondary contact recreation and fishing. Class SB waters shall also be suitable for fish propagation and survival. The Class SB waterbody classification is fully consistent with the "fishable/ swimmable" goals of the CWA.

The Interstate Environmental Commission (IEC) waterbody classifications applicable to waters within the Interstate Environmental District are shown in Table 9-2. The Upper East River and its tidal tributaries including the Hutchinson River are classified as Class A with best intended uses of primary and secondary contact recreation and fish propagation.

Table 9-2. Interstate Environmental Commission Classification, Criteria and Best Uses

Class	Dissolved Oxygen	Best Intended Use
A	>5.0 mg/L	Suitable for all forms of primary and secondary contact recreation and for fish propagation. In designated areas, they also shall be suitable for shellfish harvesting.
B-1	>4.0 mg/L	Suitable for fishing and secondary contact recreation. They shall be suitable for the growth and maintenance of fish life and other forms of marine life naturally occurring therein, but may not be suitable for fish propagation.
B-2	>3.0 mg/L	Suitable for passage of anadromous fish and for the maintenance of fish life in a manner consistent with the criteria established in Sections 1.01 and 1.02 of these regulations.

IEC bacterial standards apply to effluent discharges from municipal and industrial wastewater treatment plants and do not apply to receiving waters.

9.1.2 Narrative Water Quality Standards

The New York State narrative water quality standards which are applicable to Hutchinson River and all waterbody classifications are shown in Table 1-2 and restated here in Table 9-3.

Table 9-3. New York State Narrative Water Quality Standards

Parameters	Classes	Standard
Taste-, color-, and odor producing toxic and other deleterious substances	SA, SB, SC, I, SD A, B, C, D	None in amounts that will adversely affect the taste, color or odor thereof, or impair the waters for their best usages.
Turbidity	SA, SB, SC, I, SD A, B, C, D	No increase that will cause a substantial visible contrast to natural conditions.
Suspended, colloidal and settleable solids	SA, SB, SC, I, SD A, B, C, D	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.
Oil and floating substances	SA, SB, SC, I, SD A, B, C, D	No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease.
Garbage, cinders, ashes, oils, sludge and other refuse	SA, SB, SC, I, SD A, B, C, D	None in any amounts.
Phosphorus and nitrogen	SA, SB, SC, I, SD A, B, C, D	None in any amounts that will result in growth of algae, weeds and slimes that will impair the waters for their best usages.

It is noted that, in all cases, the narrative water quality standards apply a limit of "no" or "none" and only for selected parameters are these restrictions conditioned on the impairment of waters for their best usages.

The IEC narrative water quality regulations which are applicable to the Hutchinson River and all waters of the Interstate Environmental District are shown in Table 9-4.

Table 9-4. Interstate Environmental Commission Narrative Regulations

Classes	Regulation
A, B-1, B-2	All waters of the Interstate Environmental District (whether of Class A, Class B, or any subclass thereof) shall be of such quality and condition that they will be free from floating solids, settleable solids, oil, grease, sludge deposits, color or turbidity to the extent that none of the foregoing shall be noticeable in the water or deposited along the shore or on aquatic substrata in quantities detrimental to the natural biota; nor shall any of the foregoing be present in quantities that would render the waters in question unsuitable for use in accordance with their respective classifications.
A, B-1, B-2	No toxic or deleterious substances shall be present, either alone or in combination with other substances, in such concentrations as to be detrimental to fish or inhibit their natural migration or that will be offensive to humans or which would produce offensive tastes or odors or be unhealthful in biota used for human consumption.
A, B-1, B-2	No sewage or other polluting matters shall be discharged or permitted to flow into, or be placed in, or permitted to fall or move into the waters of the District, except in conformity with these regulations.

9.1.3 Attainability of Water Quality Standards

Section 7.3 summarizes water quality modeling analyses which were performed to evaluate attainability of water quality standards under Baseline and Waterbody/Watershed (WB/WS) Facility Plan conditions. The results of these analyses are summarized graphically in Section 7.3 and in tabular form in Table 9-5 through Table 9-11 for the various numerical criteria for dissolved oxygen and bacteria for the Class SB and IEC Class A classifications for the Hutchinson River.

Table 9-5 summarizes the projected percentage annual attainability of dissolved oxygen for current Class SB and IEC Class A criteria for Baseline and WB/WS Facility Plan conditions at a number of locations throughout the Hutchinson River: City Line (4,000 feet below the head near the New York City – Westchester County border), Upper River (7,000 feet below the head near CSO outfall HP-23), Lower River (12,000 feet below the head near CSO outfall HP-006), and the Mouth (Hutchinson River confluence with Eastchester Bay). As shown, nearly full annual attainment of the dissolved oxygen criteria is projected for most river locations except at the City Line and Upper River, where 98 and 99 percent attainment are expected, respectively, relatively high levels.

Table 9-5. Annual Attainability of Dissolved Oxygen Criteria for Design Year

Location	Class SB & IEC Class A (≥5.0 mg/L) Percent Attainment	
	Baseline	WB/WS FP
City Line	98	98
Upper River	99	99
Lower River	100	100
Mouth	100	100

Table 9-6 presents the annual attainability of Class SB primary contract criteria for total coliform. Two conditions are presented: upstream total coliform concentrations in Westchester County inflows at historical values; and upstream concentrations assuming that the applicable Class B primary contact criteria are attained in the Westchester County freshwater section of the Hutchinson River. Table 9-6 indicates attainment of the Class SB criteria is not expected in either case until the mouth is reached at the confluence of Eastchester Bay. The WB/WS Facility Plan is more effective in improving attainment above Baseline conditions with Westchester County waters at the Class B standard.

Table 9-6. Annual Attainability of Total Coliform Criteria for Design Year

Location	Class SB Median <2,400; 80% <5,000 Percent Attainment			
	Historical Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
City Line	8	8	67	75
Upper River	33	33	67	75
Lower River	67	67	83	83
Mouth	100	100	100	100

Table 9-7 shows monthly attainment during the recreation season, the three summer months of June, July, August which encompass the official public bathing season at New York City's seven public bathing beaches. Under the WB/WS Facility Plan case, criteria for two of the three summer months is expected to be attained during the recreation season for both upstream conditions.

Table 9-7. Recreation Season Attainability of Total Coliform Criteria for Design Year

Location	Class SB Median <2,400; 80% <5,000 Percent Attainment			
	Historical Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
City Line	33	67	67	67
Upper River	67	67	67	67
Lower River	67	67	67	67
Mouth	100	100	100	100

Table 9-8 presents expected annual attainment of the Class SB primary contact criterion for fecal coliform. As for total coliform, attainment is not expected for most of the Hutchinson River except near the mouth under any of the conditions evaluated. .

Table 9-8. Annual Attainability of Fecal Coliform Criteria for Design Year

Location	Class SB GM <200 Percent Attainment			
	Historical Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
City Line	25	25	75	83
Upper River	58	58	75	83
Lower River	83	83	92	92
Mouth	100	100	100	100

Table 9-9 shows projected Class SB fecal coliform conditions for recreational season attainment. As shown, the WB/WS Facility Plan is expected to attain the criterion during the recreational season for most of the river except near the City Line with historical upstream conditions; complete attainment along the length of the Hutchinson River is projected if Class B criteria are achieved in the Westchester County freshwater section.

Table 9-9. Recreation Season Attainability of Fecal Coliform Criteria for Design Year

Location	Class SB GM <200 Percent Attainment			
	Historical Upstream		Class B Upstream	
	Baseline	WB/WS FP	Baseline	WB/WS FP
City Line	67	67	100	100
Upper River	100	100	100	100
Lower River	100	100	100	100
Mouth	100	100	100	100

Table 9-10 and Table 9-11 show projected attainability of primary contact enterococci criteria for the recreation season on a seasonally averaged basis. Table 9-10 shows expected attainment of the Class SB geometric mean standard for most of the Hutchinson River except near the City Line with historical upstream conditions for both the Baseline and WB/WS Facility Plan conditions. Complete attainment along the river length is expected if this criterion is achieved upstream. Table 9-11 provides expected recreation season attainment with USEPA's infrequent use coastal recreation water reference level (upper 95% confidence limit) for all conditions evaluated.

Table 9-10. Recreation Season Attainability of Enterococci Bacteria Criteria for Design Year

Location	Class SB GM <35/100 mL Percent Attainment			
	Historical Upstream(1)		GM = 35/100 mL Upstream	
	Baseline	WWFP	Baseline	WWFP
City Line	0	0	100	100
Upper River	100	100	100	100
Lower River	100	100	100	100
Mouth	100	100	100	100
Notes: (1) Estimated as enterococci geometric mean 1,000/100 mL from sparse data.				

Table 9-11. Recreation Season Attainability of Enterococci Bacteria Criteria for Design Year

Location	Class SB Infrequent Use Reference Level <501/100 mL Percent Attainment			
	Historical Upstream		GM = 35/100 mL Upstream	
	Baseline	WWFP	Baseline	WWFP
City Line	83	83	84	84
Upper River	84	84	85	85
Lower River	86	86	88	88
Mouth	98	98	98	98

9.1.4 Attainment of Narrative Water Quality Standards

Table 9-3 summarizes NYSDEC narrative water quality standards which are applicable to the Hutchinson River and all waters of the state. The existing CSO discharges to the area and the direct and separately sewered stormwater discharge some amounts of materials which affect the listed parameters to some degree; some amounts of oil and floating substances and floatable materials (refuse) are discharged.

The WB/WS Facility Plan will not completely eliminate, but will reduce, the discharge of these materials to the Hutchinson River. The in-line netting systems for CSO outfalls HP-023 and HP-024 will reduce the discharge of floatable materials by 95 percent. Consequently, the adverse impacts of the current CSO discharges of floatable materials will be diminished although not completely eliminated as required by the narrative standards. Additionally, best management practices applied to the separate stormwater discharges also can not completely eliminate impacts from that source but will reduce loadings to the extent feasible.

The WB/WS Facility Plan, although not completely eliminating all of the parameters of concern, will reduce floatable materials and improve the aesthetic uses of the Hutchinson River to the maximum extent practicable.

9.1.5 Water Uses Restored

Fish and Aquatic Life Protection Use

Table 9-5 presents the expected dissolved oxygen conditions in the Hutchinson River for both the WB/WS Facility Plan and Baseline conditions for current NYSDEC and IEC dissolved oxygen criteria. For both the Baseline and WB/WS Facility Plan conditions, 98 to 100 percent attainment for the current Class SB and IEC Class A criteria are expected on an annual basis. The projected area of excursion in New York City from the current criteria is projected to be confined to the upper 3,000 ft below the City line. This is considered to be a high level of attainment in terms of the protection of fish and aquatic life, various forms of which spawn throughout almost the entire year.

Primary and Secondary Contact Recreation Use

Table 9-6 through Table 9-11 present the expected attainability of Class SB primary contact criteria in the Hutchinson River. As shown in the tables, complete compliance with primary contact recreation criteria is not projected annually for WB/WS Facility Plan conditions. However, on the basis of the results presented in Table 9-7, Table 9-9, and Table 9-10, it is expected that the WB/WS Facility Plan may achieve a level of bacteriological water quality during the summer recreation period nearly sufficient to satisfy the numerical criteria for fecal coliform and enterococci supportive of primary contact if the Class B and enterococci criteria can be attained in the Westchester County freshwater area.

Aesthetic Use

As discussed in Section 9.1.4, the WB/WS Facility Plan will not completely eliminate all regulated parameters in the NYSDEC narrative water quality standards to zero discharge levels. The effect of floatable materials from CSOs will be decreased by the in-line netting systems and the effect of narrative materials from stormwater inputs will be reduced to the maximum extent practicable. Accordingly, the aesthetic conditions in the Hutchinson River should improve to a level consistent with the other attained water uses and the nature of the adjacent shoreline uses.

9.1.6 Practical Considerations

The previous section describes the levels of attainment of the NYSDEC Class I and IEC Class A dissolved oxygen criteria which is expected to result from the WB/WS Facility Plan. As noted, the annual attainment is expected to be very high in the Hutchinson River.

For the majority of months, complete attainment throughout the project area is expected. In the other months where some limited criterion excursions are expected in the upper reach of the Hutchinson River, it should be noted that any adverse impact on fish larval propagation may be limited. Fish larvae spawning in the Hutchinson River will be exchanged with, and transported to, Eastchester Bay waters where dissolved oxygen will be greater. The organisms will therefore not be continuously exposed to Hutchinson River dissolved oxygen which may be depressed periodically below the criterion. Consequently, the impact on larval survival will be less than expected based on laboratory studies where organisms are confined and exposed continuously to the same depressed dissolved oxygen level. Because of the significant amount of larval transport which occurs in the Hutchinson River, and the exposure of the organisms to continuously varying, rather than static, dissolved oxygen concentrations, it is considered to be reasonable to view the ecosystem in its entirety rather than by individual tributary or sub-region for purposes of fish and aquatic life protection.

Additionally, direct kills of juvenile fish at the head end of the Hutchinson River should not occur as there exists no fish passage and the organisms would avoid any temporarily depressed dissolved oxygen. As noted, minimum dissolved oxygen projected for the head end should be fully sufficient for protection of benthic organisms.

For these reasons, it is considered that, for practical purposes, conditions in the Hutchinson River would be supportive of the fishable goal of the CWA.

Section 9.1.5 also notes that during the summer recreation season, water quality in the Hutchinson River may be supportive of numerical criteria for the swimmable (primary contact recreation) goal of the CWA during the summer recreation season under certain conditions. However, swimming should not be considered as a best use in this waterbody due to periodic overflows from the WB/WS Facility Plan, other regional CSO discharges and continuing stormwater discharges. It is also noted that the bacteriological criteria for the Hutchinson River are not applicable under State Water Quality Regulations unless disinfection is practiced to protect primary contact as a best use.

9.2 WATER QUALITY STANDARDS REVISION

9.2.1 Overview of Use Attainability and Recommendations

Section 9.1 summarizes the existing and potential water quality standards for the Hutchinson River and expected levels of attainment based on modeling calculations. For aquatic life protection, the attainment of the water use can be expected to be greater than that suggested by the attainability of numerical criteria during the summer period due to the limited larval residence time in the Hutchinson River, organism transport to Eastchester Bay and beyond and the appropriateness of considering the ecosystem, both open waters and tributary, in its entirety rather than as individual components.

For recreational activity, the currently designated use of primary contact recreation in the Hutchinson River is not expected to be fully attained under WB/WS Facility Plan conditions on an annual basis. However, numerical water quality conditions suitable to support primary contact may be attained possibly during the summer recreation season in the Hutchinson River for the fecal coliform and enterococci indicators as described, although bathing and swimming activities would not be considered the best use.

As a result of the water quality conditions and uses expected to be attained in the Hutchinson River with the WB/WS Facility Plan, it is recommended that the current waterbody classification of Class SB be retained at this time. The water use goals for the Class SB classification in the Hutchinson River are expected to be achieved, either numerically, partially or for practical purposes, once the WB/WS Facility Plan is constructed and operational except periodically following overflows after heavy rainfall events. However, the attainment of the designated uses should be evaluated from long-term post construction water quality monitoring data and numerical modeling.

As noted previously, expected levels of water quality criteria compliance are based on modeling calculations which are subject to some level of uncertainty. In addition, calculations are based on a typical year with an average amount of annual rainfall. Therefore, it is recommended that the actual improvements in water quality conditions resulting from the WB/WS Facility Plan be assessed from the multi-year long-term post construction monitoring program described elsewhere in the WB/WS Facility Plan report. The monitoring program will document the actual attainment of uses: whether the current Class SB uses are attained as expected; whether other levels of usage are actually experienced supporting a waterbody reclassification or whether CWA "fishable/swimmable" goals are not attained therefore requiring a Use Attainability Analysis and subsequent water quality standards revision.

As described in this report, modeling calculations indicate that complete attainment throughout the Hutchinson River area of all of the Class SB water quality criteria on an annual basis, both numerical and narrative, would require 100 percent retention of the area CSO discharges and attainment of Class B water quality criteria in the Westchester Creek freshwater section. This water quality based effluent limit (WQBEL) of zero annual overflows is not cost effective nor consistent with the CSO Control Policy. Therefore, until the long-term post-construction monitoring program is completed for the Hutchinson River to document conditions actually attained, it is recommended that a variance to the WQBEL be applied for, and approved, for the Hutchinson River WB/WS Facility Plan for appropriate effluent variables.

9.2.2 NYSDEC Requirements for Variances to Effluent Limitations

The requirements for variances to water quality based effluent limitations are described in Section 702.17 of NYSDEC's Water Quality Regulations. The following is an abbreviated summary of the variance requirements which are considered applicable to Hutchinson River. The lettering and numbering are those used in Section 702.17.

(a) The department may grant, to a SPDES permittee, a variance to a water quality-based effluent limitation included in a SPDES permit.

(1) A variance applies only to the permittee identified in such variance and only to the pollutant specified in the variance. A variance does not affect or require the department to modify a corresponding standard or guidance value.

(5) A variance term shall not exceed the term of the SPDES permit. Where the term of the variance is the same as the permit, the variance shall stay in effect until the permit is reissued, modified or revoked.

(b) A variance may be granted if the requester demonstrates that achieving the effluent limitation is not feasible because:

(1) Naturally occurring pollutant concentrations prevent attainment of the standard or guidance value;

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent attainment, unless these conditions may be compensated for by the discharge of sufficient volume of effluent to enable the standard or guidance value to be met without violating water conservation requirements.

(3) human-caused conditions or sources of pollution prevent attainment of the standard or guidance value and cannot be remedied or would cause more environmental damage to correct them to leave in place.

(4) Dams, diversions or other types of hydrologic modifications preclude attainment of the standard or guidance value, and it is not feasible to restore the waterbody to its original condition or to operate such modification in a way that would result in such attainment.

(5) Physical conditions related to the natural features of the waterbody, such as the lack of a proper substrate cover, flow, depth, pools, riffles, and the like, unrelated to chemical water quality, preclude attainment of the standard or guidance value; or

(6) Controls more stringent than those required by section 754.1(a)(1) and (2) of this Title would result in substantial and widespread economic and social impact.

(c) In addition to the requirements of subdivision (b) of this section, the requestor shall also characterize, using adequate and sufficient data and principles, any increased risk to human health and the environment associated with granting the variance compared with attainment of the standard or guidance value absent the variance, and demonstrate to the satisfaction of the department that the risk will not adversely affect the public health, safety and welfare.

(d) The requestor shall submit a written application for a variance to the department. The application shall include:

> *(1) all relevant information demonstrating that achieving the effluent limitation is not feasible based on subdivision (b) of this section; and*
>
> *(2) All relevant information demonstrating compliance with the conditions is subdivision (c) of this section.*

(e) Where a request for a variance satisfies the requirements of this section, the department shall authorize the variance through the SPDES permit. The variance request shall be available to the public for review during the public notice period for the permit. The permit shall contain all conditions needed to implement the variance. Such conditions shall, at minimum, include:

> *(1) Compliance with an initial effluent limitation that, at the time the variance is granted represents the level currently achievable by the requestor, and that is no less stringent than that achieved under the previous permit where applicable.*
>
> *(2) that reasonable progress be made toward achieving the effluent limitations based on the standard or guidance value, including, where reasonable, an effluent limitation more stringent than the initial effluent limitations;*
>
> *(3) Additional monitoring, biological studies and pollutant minimization measures as deemed necessary by the department.*
>
> *(4) when the duration of a variance is shorter than the duration of a permit, compliance with an effluent limitation sufficient to meet the underlying standard or guidance value, upon the expiration of the variance; and*
>
> *(5) A provision that allows the department to reopen and modify the permit for revisions to the variance.*

(g) A variance may be renewed, subject to the requirements of this section. As part of any renewal application, the permittee shall again demonstrate that achieving the effluent limitation is not feasible based on the requirements of this section.

(i) The department will make available to the public a list of every variance that has been granted and that remains in effect.

9.2.3 Manner of Compliance with the Variance Requirements

Subdivision (a) authorizes NYSDEC to grant a variance to a "water quality based effluent limitation…included in a SPDES permit." It is understood that the Hutchinson River WB/WS Facility Plan, when referenced in the Hunts Point WPCP SPDES permit along with other presumed actions necessary to attain water quality standards, can be interpreted as the equivalent of an "effluent limitation" in accordance with the "alternative effluent control strategies" provision of Section 302(a) of the CWA.

Subdivision (a)(1) indicates that a variance will apply only to a specific permittee, in this case, NYCDEP, and only to the pollutant specified in the variance. It is understood that "pollutant" can be interpreted in the plural, and one application and variance can be used for one or more relevant pollutants. In the Hutchinson River, a variance would be needed for effluent constituents covered by narrative water quality standards (suspended, colloidal and settleable solids; oil and floating substances). A variance for dissolved oxygen would not be requested due to the high levels of expected attainment and a variance for bacteriological criteria would not be requested as the Class SB bacteriological requirements do not apply as disinfection is not practiced in the Hutchinson River.

Subdivision (b) requires the permittee to demonstrate that achieving the water quality based effluent limitation is not feasible due to a number of factors. It is noted that these factors are the same as those in 40 CFR 131.10(g) which indicate federal requirements for a Use Attainability Analysis. As with the federal regulations, it is assumed that any one of the six factors is justification for the granting of a variance. The Hutchinson River Use Attainability Evaluation report in the Appendix documents the applicability of two of the six factors cited in Subdivision (b): (3) human caused conditions and (4) hydrologic modifications.

Subdivision (c) requires the applicant to demonstrate to the department any increased risk to human health associated with granting of the variance compared with attainment of the water quality standards absent the granting of the variance. As noted above, the variance application is needed in part for suspended, colloidal and settleable solids, and oil and floating substances in the periodic overflows remaining after WB/WS Facility Plan implementation. These substances pose no significant risk to human health. Further, as described above in Section 9.1.4, a 10 percent volumetric reduction is expected from Baseline CSO loadings to the Hutchinson River, with additional capture of floatables from the installation of in-line netting systems at two outfalls. As discussed above, bacteriological criteria are not applicable to the Hutchinson River and therefore no variance is requested for bacteriological conditions. The Hutchinson River WB/WS Facility Plan will achieve a relatively high level of attainment of the current Class SB dissolved oxygen criterion in the Hutchinson River, and for the reasons described above in Section 9.1.5 and Section 9.1.6, very limited risk to the environment is expected absent attainment of the standard.

Subdivision (d) of the variance regulations requires that the requestor submit a written application for a variance to NYSDEC which includes all relevant information pertaining to Subdivisions (b) and (c). NYCDEP will submit a variance application for the Hutchinson River WB/WS Facility Plan to NYSDEC six months before the plan is placed in operation. The application will be accompanied by the Hutchinson River WB/WS Facility Plan report, the Hutchinson River Use Attainability Evaluation, and all other supporting documentation pertaining to Subdivisions (b) and (c) and as required by any other subdivisions of the variance requirements.

Subdivision (e) stipulates that approved variances be authorized through the appropriate SPDES permit, be available to the public for review and contain a number of conditions:

- It is assumed that the initial effluent limitation achievable by the permittee at the time the variance becomes effective, after WB/WS Facility Plan construction, will be based upon the performance characteristics of the WB/WS Facility Plan as agreed upon between NYSDEC and NYCDEP. These interim operational conditions will be based on the WB/WS Facility Plan's design specifications. It is expected that a fact sheet outlining the basis for the WQBEL and interim operational conditions will be appended to the SPDES permits.
- It is assumed that the requirement for demonstration of reasonable progress after construction as required in the permit will include NYCDEP activities such as implementation of the long-term monitoring program and additional waterbody improvement projects as delineated in Section 5 of this WB/WS Facility Plan report. Such actions and projects include: 14 best management practices, the City-wide CSO plan for floatables abatement, other long-term CSO control planning activities which may affect the Hutchinson River, various East River water quality improvement projects, and various ecosystem restoration activities. These activities are also required under section (3) of the Subdivision.
- It is assumed that the SPDES permit authorizing the Hutchinson River WB/WS Facility Plan variance will contain a provision that allows the department to reopen and modify the permit for revisions to the variance.

Subdivision (g) indicates that a variance may be renewed. It is anticipated that a variance for the Hutchinson River WB/WS Facility Plan would require renewals to allow for sufficient long-term monitoring to assess the degree of water quality standards attainment. As appropriate, a variance renewal application will be submitted 180 days before SPDES permit expiration.

At the completion of the variance period(s), it is expected that the results of the long-term monitoring program will demonstrate each of the following:

- The degree to which the WB/WS Facility Plan attains the current Class SB classification water quality criteria and uses;
- The degree to which the WB/WS Facility Plan achieves water quality criteria consistent with the fishable/swimmable goals of the CWA, whether any new low-cost technology is available to enhance the WB/WS Facility Plan performance, if needed, whether all or portions of the Hutchinson River should be reclassified, or whether a Use Attainability Analysis should be approved.

In this manner, the approval of a WQBEL variance for the Hutchinson River together with an appropriate long-term monitoring program can be considered as a step toward a determination of the following:

- Can water quality in the Hutchinson River be attained in a manner which is wholly or partially compatible with the fishable/swimmable goals of the Clean Water Act or
- Is a Use Attainability Analysis needed for Hutchinson River and for which water quality criteria?

Although the Hutchinson River's current waterbody classification, Class SB, is wholly compatible with the goals of the Clean Water Act and therefore does not require reclassification or a UAA in the State's triennial review obligation, it is considered to be more appropriate to proceed with the more deliberative variance approval/monitoring procedure outlined above. The recommended procedure will determine actual improvements resulting from WB/WS Facility Plan implementation, enable a proper determination for the appropriate waterbody classification for the Hutchinson River and perhaps avoid unnecessary, repetitive and possibly contradictory rulemaking.

9.2.4 Future Considerations

Urban Tributary Classification

The possibility is recognized that the long-term monitoring program recommended for the Hutchinson River, and ultimately for other confined waterbodies throughout the City, may indicate that the highest attainable uses are not compatible with the use goals of the Clean Water Act and State Water Quality Regulations. It is therefore recommended that consideration be given to the development of a new waterbody classification in NYSDEC Water Quality Regulations, that being "Urban Tributary."

The Urban Tributary classification would have the following attributes:

- Recognition of wet weather conditions in the designation of uses and water quality criteria;
- Application to urban confined waterbodies which satisfy any of the UAA criteria enumerated in 40CFR131.10(g);
- Definition of required baseline water uses;
- Fish and aquatic life survival (if attainable);
- Secondary contact recreation (if attainable).

Other attainable higher uses would be waterbody specific and dependent upon the effectiveness of the site-specific CSO WB/WS Facility Plan /LTCP based upon knee-of-the-curve considerations, technical feasibility and ease of implementation.

The Urban Tributary classification could be implemented through the application of a generic UAA procedure for confined urban waterbodies based on the criteria of 40CFR131.10(g). This procedure could avoid the necessity for repeated UAAs on different waterbodies with similar characteristics. Those waterbodies which comply with the designation criteria can be identified at one time, and the reclassification completed in one rulemaking.

If either of the designated baseline uses of fish and aquatic life survival and secondary contact recreation did not appear to be attainable in a particular setting, then a site-specific UAA would be required.

Narrative Criteria

The recommendation for a WQBEL variance for the Hutchinson River WB/WS Facility Plan would apply with regard to the narrative water quality criteria previously cited as well as to the Class SB water quality criterion for dissolved oxygen. However, a broad issue remains with the practical ability to attain the requirements of the narrative criteria in situations where wet weather discharges are unavoidable and will occasionally occur after controls. Therefore, it is recommended that NYSDEC review the application of the narrative criteria, provide for a wet weather exclusion with demonstrated need, or make all narrative criteria conditional upon the impairment of waters for their best usage.

Synopsis

Although this WB/WS Facility Plan is expected to result in improvements to the water quality in the Hutchinson River, it is not expected to completely attain all applicable water quality criteria. As such, the SPDES Permit for the Hunts Point WPCP may require a WQBEL variance for the Hutchinson River WB/WS Facility Plan if contravention of some criteria continues to occur. If water quality criteria are demonstrated to be unrealistic after a period of monitoring, NYCDEP would request reclassification of portions of the Hutchinson River based on a Use Attainability Analysis (UAA). Until the recommended UAAs and required regulatory processes are completed, the current NYSDEC classification of the Hutchinson River, Class SB, should be retained.

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11.0. Glossary and Abbreviations

A

A Posteriori Classification: A classification based on the results of experimentation.

A Priori Classification: A classification made prior to experimentation.

ACO: Administrative Consent Order

Activated Sludge: The product that results when primary effluent is mixed with bacteria-laden sludge and then agitated and aerated to promote biological treatment, speeding the breakdown of organic matter in raw sewage undergoing secondary waste treatment.

Acute Toxicity: The ability of a substance to cause severe biological harm or death soon after a single exposure or dose. Also, any poisonous effect resulting from a single short-term exposure to a toxic substance (see chronic toxicity, toxicity).

Administrative Consent Order (ACO): A legal agreement between a regulatory authority and an individual, business, or other entity through which the violator agrees to pay for correction of violations, take the required corrective or cleanup actions, or refrain from an activity. It describes the actions to be taken, may be subject to a comment period, applies to civil actions, and can be enforced in court.

Administrative Law Judge (ALJ): An officer in a government agency with quasi-judicial functions including conducting hearings, making findings of fact, and making recommendations for resolution of disputes concerning the agency's actions.

Advanced Treatment: A level of wastewater treatment more stringent than secondary treatment; requires an 85-percent reduction in conventional pollutant concentration or a significant reduction in non-conventional pollutants. Sometimes called tertiary treatment.

Advanced Wastewater Treatment: Any treatment of sewage that goes beyond the secondary or biological water treatment stage and includes the removal of nutrients such as phosphorus and nitrogen and a high percentage of suspended solids. (See primary, secondary treatment.)

Advection: Bulk transport of the mass of discrete chemical or biological constituents by fluid flow within a receiving water. Advection describes the mass transport due to the velocity, or flow, of the waterbody. Example: The transport of pollution in a river: the motion of the water carries the polluted water downstream.

ADWF: Average Dry Weather Flow

Aeration: A process that promotes biological degradation of organic matter in water. The process may be passive (as when waste is exposed to air), or active (as when a mixing or bubbling device introduces the air). Exposure to additional air may be by means of natural of engineered systems.

Aerobic: Environmental conditions characterized by the presence of dissolved oxygen; used to describe biological or chemical processes that occur in the presence of oxygen.

Algae: Simple rootless plants that live floating or suspended in sunlit water or may be attached to structures, rocks or other submerged surfaces. Algae grow in proportion to the amount of available nutrients. They can affect water quality adversely since their biological activities can appreciably affect pH and low dissolved oxygen of the water. They are food for fish and small aquatic animals.

Algal Bloom: A heavy sudden growth of algae in and on a body of water which can affect water quality adversely and indicate potentially hazardous changes in local water chemistry. The growth results from excessive nutrient levels or other physical and chemical conditions that enable algae to reproduce rapidly.

ALJ: Administrative Law Judge

Allocations: Allocations are that portion of a receiving water's loading capacity that is attributed to one of its existing or future sources (non-point or point) of pollution or to natural background sources. (Wasteload allocation (WLA) is that portion of the loading capacity allocated to an existing or future point source and a load allocation (LA) is that portion allocated to an existing or future non-point source or to a natural background source. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading.)

Ambient Water Quality: Concentration of water quality constituent as measured within the waterbody.

Ammonia (NH_3): An inorganic form of nitrogen, is contained in fertilizers, septic system effluent, and animal wastes. It is also a product of bacterial decomposition of organic matter. NH3-N becomes a concern if high levels of the un-ionized form are present. In this form NH3-N can be toxic to aquatic organisms.

Anaerobic: Environmental condition characterized by zero oxygen levels. Describes biological and chemical processes that occur in the absence of oxygen. Anoxia. No dissolved oxygen in water.

Anthropogenic: Pertains to the [environmental] influence of human activities.

Antidegradation: Part of federal water quality requirements. Calls for all existing uses to be protected, for deterioration to be avoided or at least minimized when water quality meets or exceeds standards, and for outstanding waters to be strictly protected.

Aquatic Biota: Collective term describing the organisms living in or depending on the aquatic environment.

Aquatic Community: An association of interacting populations of aquatic organisms in a given waterbody or habitat.

Aquatic Ecosystem: Complex of biotic and abiotic components of natural waters. The aquatic ecosystem is an ecological unit that includes the physical characteristics (such as flow or velocity and depth), the biological community of the water column and benthos, and the chemical characteristics such as dissolved solids, dissolved oxygen, and nutrients. Both living and nonliving components of the aquatic ecosystem interact and influence the properties and status of each component.

Aquatic Life Uses: A beneficial use designation in which the waterbody provides suitable habitat for survival and reproduction of desirable fish, shellfish, and other aquatic organisms.

Assemblage: An association of interacting populations of organisms in a given waterbody (e.g., fish assemblage or benthic macro-invertebrate assemblage).

Assessed Waters: Waters that states, tribes and other jurisdictions have assessed according to physical, chemical and biological parameters to determine whether or not the waters meet water quality standards and support designated beneficial uses.

Assimilation: The ability of a body of water to purify itself of pollutants.

Assimilative Capacity: The capacity of a natural body of water to receive wastewaters or toxic materials without deleterious efforts and without damage to aquatic life or humans who consume the water. Also, the amount of pollutant load that can be discharged to a specific waterbody without exceeding water quality standards. Assimilative capacity is used to define the ability of a waterbody to naturally absorb and use a discharged substance without impairing water quality or harming aquatic life.

Attribute: Physical and biological characteristics of habitats which can be measured or described.

Average Dry Weather Flow (ADWF): The average non-storm flow over 24 hours during the dry months of the year (May through September). It is composed of the average dry weather inflow/infiltration.

B

Bacteria: (Singular: bacterium) Microscopic living organisms that can aid in pollution control by metabolizing organic matter in sewage, oil spills or other pollutants. However, some types of bacteria in soil, water or air can also cause human, animal and plant health problems. Bacteria of the coliform group are considered the primary indicators of fecal contamination and are often used to assess water quality. Measured in number of bacteria organisms per 100 milliliters of sample (No./ml or #/100 ml).

BASINS: Better Assessment Science Integrating Point and Non-point Sources

BEACH: Beaches Environmental Assessment and Coastal Health

Beaches Environmental Assessment and Coastal Health (BEACH): The BEACH Act requires coastal and Great Lakes States to adopt the 1986 USEPA Water Quality Criteria for Bacteria and to develop and implement beach monitoring and notification plans for bathing beaches.

Benthic: Refers to material, especially sediment, at the bottom of an aquatic ecosystem. It can be used to describe the organisms that live on, or in, the bottom of a waterbody.

Benthic Macroinvertebrates: See benthos.

Benthos: Animals without backbones, living in or on the sediments, of a size large enough to be seen by the unaided eye, and which can be retained by a U.S. Standard No. 30 sieve (28 openings/in, 0.595-mm openings). Also referred to as benthic macroinvertebrates, infauna, or macrobenthos.

Best Available Technology (BAT): The most stringent technology available for controlling emissions; major sources of emissions are required to use BAT, unless it can be demonstrated that it is unfeasible for energy, environmental, or economic reasons.

Best Management Practice (BMP): Methods, measures or practices that have been determined to be the most effective, practical and cost effective means of preventing or reducing pollution from non-point sources.

Better Assessment Science Integrating Point and Non-point Sources (BASINS): A computer tool that contains an assessment and planning component that allows users to organize and display geographic information for selected watersheds. It also contains a modeling component to examine impacts of pollutant loadings from point and non-point sources and to characterize the overall condition of specific watersheds.

Bioaccumulation: A process by which chemicals are taken up by aquatic organisms and plants directly from water as well as through exposure via other routes, such as consumption of food and sediment containing the chemicals.

Biochemical Oxygen Demand (BOD): A measure of the amount of oxygen per unit volume of water required to bacterially or chemically breakdown (stabilize) the organic matter in water. Biochemical oxygen demand measurements are usually conducted over specific time intervals (5,10,20,30 days). The term BOD generally refers to a standard 5-day BOD test. It is also considered a standard measure of the organic content in water and is expressed as mg/L. The greater the BOD, the greater the degree of pollution.

Bioconcentration: A process by which there is a net accumulation of a chemical directly from water into aquatic organisms resulting from simultaneous uptake (e.g., via gill or epithelial tissue) and elimination. In other words, the accumulation of a chemical in tissues of a fish or other organism to levels greater than the surrounding medium.

Biocriteria: A combination of narrative and numerical measures, such as the number and kinds of benthic, or bottom-dwelling, insects living in a stream, that describe the biological condition (structure and function) of aquatic communities inhabiting waters of a designated aquatic life use. Biocriteria are regulatory-based biological measurements and are part of a state's water quality standards.

Biodegradable: A substance or material that is capable of being decomposed (broken down) by natural biological processes.

Biodiversity: Refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequencies. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the biological structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species and genes.

Biological Assemblage: A group of phylogenetically (e.g., fish) or ecologically (e.g., benthic macroinvertebrates) related organisms that are part of an aquatic community.

Biological Assessment or Bioassessment: An evaluation of the condition of a waterbody using biological surveys and other direct measures of the resident biota of the surface waters, in conjunction with biological criteria.

Biological Criteria or Biocriteria: Guidelines or benchmarks adopted by States to evaluate the relative biological integrity of surface waters. Biocriteria are narrative expressions or numerical values that describe biological integrity of aquatic communities inhabiting waters of a given classification or designated aquatic life use.

Biological Indicators: Plant or animal species or communities with a narrow range of environmental tolerances that may be selected for monitoring because their absence or presence and relative abundances serve as barometers of environmental conditions.

Biological Integrity: The condition of the aquatic community inhabiting unimpaired waterbodies of a specified habitat as measured by community structure and function.

Biological Monitoring or Biomonitoring: Multiple, routine biological surveys over time using consistent sampling and analysis methods for detection of changes in biological condition.

Biological Nutrient Removal (BNR): The removal of nutrients, such as nitrogen and/or phosphorous during wastewater treatment.

Biological Oxygen Demand (BOD): An indirect measure of the concentration of biologically degradable material present in organic wastes. It usually reflects the amount of oxygen consumed in five days by biological processes breaking down organic wastes.

Biological Survey or Biosurvey: Collecting, processing and analyzing representative portions of an estuarine or marine community to determine its structure and function.

Biological Magnification: Refers to the process whereby certain substances such as pesticides or heavy metals move up the food chain, work their way into rivers and lakes, and are eaten by aquatic organisms such as fish, which in turn are eaten by large birds, animals or humans. The substances become concentrated in tissues or internal organs as they move up the food chain. he result of the processes of bioconcentration and bioaccumulation by which tissue concentrations of bioaccumulated chemicals increase as the chemical passes up through two or more trophic levels in the food chain. (See bioaccumulation.)

Biota: Plants, animals and other living resources in a given area.

Biotic Community: A naturally occurring assemblage of plants and animals that live in the same environment and are mutually sustaining and interdependent.

BMP: Best Management Practice

BNR: Biological Nutrient Removal

BOD: Biological Oxygen Demand; Biochemical Demand

Borrow Pit: See Subaqueous Borrow Pit.

Brackish: Water with salt content ranging between that of sea water and fresh water; commonly used to refer to Oligohaline waters.

C

CAC: Citizens Advisory Committee

Calcareous: Pertaining to or containing calcium carbonate; Calibration; The process of adjusting model parameters within physically defensible ranges until the resulting predictions give a best possible fit to observed data.

Calibration: The process of adjusting model parameters within physically defensible ranges until the resulting predictions give a best possible fit to observed data.

CALM: Consolidated Assessment and Listing Methodology

Capital Improvement Program (CIP): A budget and planning tool used to implement non-recurring expenditures or any expenditure for physical improvements, including costs for: acquisition of existing buildings, land, or interests in land; construction of new buildings or other structures, including additions and major alterations; construction of streets and highways or utility lines; acquisition of fixed equipment; landscaping; and similar expenditures.

Capture: The total volume of flow collected in the combined sewer system during precipitation events on a system-wide, annual average basis (not percent of volume being discharged).

Catch Basin: (1) A buried chamber, usually built below curb grates seen at the curbline of a street, to relieve street flooding, which admits surface water for discharge into the sewer system and/or a receiving waterbody. (2) A sedimentation area designed to remove pollutants from runoff before being discharged into a stream or pond.

Carbonaceous Biochemical Oxygen Demand ($CBOD_5$): The amount of oxygen required to oxidize any carbon containing matter present in water in five days.

CATI: Computer Assisted Telephone Interviews

$CBOD_5$: Carbonaceous Biochemical Oxygen Demand

CEA: Critical Environmental Area

CEQR: City Environmental Quality Review

CERCLIS: Comprehensive Environmental Response, Compensation and Liability Information System

CFR: Code of Federal Regulation

Channel: A natural stream that conveys water; a ditch or channel excavated for the flow of water.

Channelization: Straightening and deepening streams so water will move faster or facilitate navigation - a tactic that can interfere with waste assimilation capacity, disturb fish and wildlife habitats, and aggravate flooding.

Chemical Oxygen Demand (COD): A measure of the oxygen required to oxidize all compounds, both organic and inorganic, in water.

Chlorination: The application of chlorine to drinking water, sewage, or industrial waste to disinfect or to oxidize undesirable compounds. Typically employed as a final process in water and wastewater treatment.

Chrome+6 (Cr+6): Chromium is a steel-gray, lustrous, hard metal that takes a high polish, is fusible with difficulty, and is resistant to corrosion and tarnishing. The most common oxidation states of chromium are +2, +3, and +6, with +3 being the most stable. +4 and +5 are relatively rare. Chromium compounds of oxidation state 6 are powerful oxidants.

Chronic Toxicity: The capacity of a substance to cause long-term poisonous health effects in humans, animals, fish and other organisms (see acute toxicity).

CIP: Capital Improvement Program

Citizens Advisory Committee (CAC): Committee comprised of various community stakeholders formed to provide input into a planning process.

City Environmental Quality Review (CEQR): CEQR is a process by which agencies of the City of New York review proposed discretionary actions to identify the effects those actions may have on the environment.

Clean Water Act (CWA): The Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972), Public Law 92-500, as amended by Public Law 96-483 and Public Law 97-117, 33 U.S.C. 1251 et seq. The CWA contains a number of provisions to restore and maintain the quality of the nation's water resources. One of these provisions is section 303(d), which establishes the Total maximum Daily Load (TMDL) program.

Coastal Waters: Marine waters adjacent to and receiving estuarine discharges and extending seaward over the continental shelf and/or the edge of the U.S. territorial sea.

Coastal Zone Boundary (CZB): Generally, the part of the land affected by its proximity to the sea and that part of the sea affected by its proximity to the land as the extent to which man's land-based activities have a measurable influence on water chemistry and marine ecology. Specifically, New York's Coastal zone varies from region to region while incorporating the following conditions: The inland boundary is approximately 1,000 feet from the shoreline of the mainland. In urbanized and developed coastal locations the landward boundary is approximately 500 feet from the mainland's shoreline, or less than 500 feet where a roadway or railroad line runs parallel to the shoreline at a distance of under 500 feet and defines the boundary. In locations where major state-owned lands and facilities or electric power generating facilities abut the shoreline, the boundary extends inland to include them. In some areas, such as Long Island Sound and the Hudson River Valley, the boundary may extend inland up to 10,000 feet to encompass significant coastal resources, such as areas of exceptional scenic value, agricultural ore recreational lands, and major tributaries and headlands.

Coastal Zone: Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its ecology, or whose uses and ecology are affected by the sea.

COD: Chemical Oxygen Demand

Code of Federal Regulations (CFR): Document that codifies all rules of the executive departments and agencies of the federal government. It is divided into fifty volumes, known as titles. Title 40 of the CFR (references as 40 CFR) lists most environmental regulations.

Coliform Bacteria: Common name for Escherichia coli that is used as an indicator of fecal contamination of water, measured in terms of coliform count. (See Total Coliform Bacteria)

Coliforms: Bacteria found in the intestinal tract of warm-blooded animals; used as indicators of fecal contamination in water.

Collection System: Pipes used to collect and carry wastewater from individual sources to an interceptor sewer that will carry it to a treatment facility.

Collector Sewer: The first element of a wastewater collection system used to collect and carry wastewater from one or more building sewers to a main sewer. Also called a lateral sewer.

Combined Sewage: Wastewater and storm drainage carried in the same pipe.

Combined Sewer Overflow (CSO): Discharge of a mixture of storm water and domestic waste when the flow capacity of a sewer system is exceeded during rainstorms. CSOs discharged to receiving water can result in contamination problems that may prevent the attainment of water quality standards.

Combined Sewer Overflow Event: The discharges from any number of points in the combined sewer system resulting from a single wet weather event that do not receive minimum treatment (i.e., primary clarification, solids disposal, and disinfection, where appropriate). For example, if a storm occurs that results in untreated overflows from 50 different CSO outfalls within the combined sewer system (CSS), this is considered one overflow event.

Combined Sewer System (CSS): A sewer system that carries both sewage and storm-water runoff. Normally, its entire flow goes to a waste treatment plant, but during a heavy storm, the volume of water may be so great as to cause overflows of untreated mixtures of storm water and sewage into receiving waters. Storm-water runoff may also carry toxic chemicals from industrial areas or streets into the sewer system.

Comment Period: Time provided for the public to review and comment on a proposed USEPA action or rulemaking after publication in the Federal Register.

Community: In ecology, any group of organisms belonging to a number of different species that co-occur in the same habitat or area; an association of interacting assemblages in a given waterbody. Sometimes, a particular subgrouping may be specified, such as the fish community in a lake.

Compliance Monitoring: Collection and evaluation of data, including self-monitoring reports, and verification to show whether pollutant concentrations and loads contained in permitted discharges are in compliance with the limits and conditions specified in the permit.

Compost: An aerobic mixture of decaying organic matter, such as leaves and manure, used as fertilizer.

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS): Database that contains information on hazardous waste sites, potentially hazardous waste sites and remedial activities across the nation. The database includes sites that are on the National Priorities List or being considered for the List.

Comprehensive Waterfront Plan (CWP): Plan proposed by the Department of City Planning that provides a framework to guide land use along the city's entire 578-mile shoreline in a way that recognizes its value as a natural resource and celebrates its diversity. The plan presents a long-range vision that balances the needs of environmentally sensitive areas and the working port with opportunities for waterside public access, open space, housing and commercial activity.

Computer Assisted Telephone Interviews (CATI): CATI is the use of computers to automate and control the key activities of a telephone interview.

Conc: Abbreviation for "Concentration".

Concentration: Amount of a substance or material in a given unit volume of solution. Usually measured in milligrams per liter (mg/l) or parts per million (ppm).

Consolidated Assessment and Listing Methodology (CALM): EPA framework for states and other jurisdictions to document how they collect and use water quality data and information for environmental decision making. The primary purposes of these data analyses are to determine the extent that all waters are attaining water quality standards, to identify waters that are impaired and need to be added to the 303(d) list, and to identify waters that can be removed from the list because they are attaining standards.

Contamination: Introduction into the water, air and soil of microorganisms, chemicals, toxic substances, wastes or wastewater in a concentration that makes the medium unfit for its next intended use.

Conventional Pollutants: Statutorily listed pollutants understood well by scientists. These may be in the form or organic waste, sediment, acid, bacteria, viruses, nutrients, oil and grease, or heat.

Cost-Benefit Analysis: A quantitative evaluation of the costs, which would be incurred by implementing an alternative versus the overall benefits to society of the proposed alternative.

Cost-Share Program: A publicly financed program through which society, as a beneficiary of environmental protection, allocates project funds to pay a percentage of the cost of constructing or implementing a best management practice. The producer pays the remainder of the costs.

Cr+6: Chrome +6

Critical Condition: The combination of environmental factors that results in just meeting water quality criterion and has an acceptably low frequency of occurrence.

Critical Environmental Area (CEA): A CEA is a specific geographic area designated by a state or local agency as having exceptional or unique environmental characteristics. In establishing a CEA, the fragile or threatened environmental conditions in the area are identified so that they will be taken into consideration in the site-specific environmental review under the State Environmental Quality Review Act.

Cross-Sectional Area: Wet area of a waterbody normal to the longitudinal component of the flow.

Cryptosporidium: A protozoan microbe associated with the disease cryptosporidiosis in man. The disease can be transmitted through ingestion of drinking water, person-to-person contact, or other pathways, and can cause acute diarrhea, abdominal pain, vomiting, fever and can be fatal. (See protozoa).

CSO: Combined Sewer Overflow

CSS: Combined Sewer System

Cumulative Exposure: The summation of exposures of an organism to a chemical over a period of time.

Clean Water Act (CWA): Federal law stipulating actions to be carried out to improve water quality in U.S. waters.

CWA: Clean Water Act

CWP: Comprehensive Waterfront Plan

CZB: Coastal Zone Boundary

D

DDWF: design dry weather flow

Decay: Gradual decrease in the amount of a given substance in a given system due to various sink processes including chemical and biological transformation, dissipation to other environmental media, or deposition into storage areas.

Decomposition: Metabolic breakdown of organic materials; that releases energy and simple organics and inorganic compounds. (See Respiration)

Degradable: A substance or material that is capable of decomposition; chemical or biological.

Delegated State: A state (or other governmental entity such as a tribal government) that has received authority to administer an environmental regulatory program in lieu of a federal counterpart.

Demersal: Living on or near the bottom of a body of water (e.g., mid-water and bottom-dwelling fish and shellfish, as opposed to surface fish).

Department of Sanitation of New York (DSNY): New York City agency responsible for solid waste and refuse disposal in New York City

Design Capacity: The average daily flow that a treatment plant or other facility is designed to accommodate.

Design Dry Weather Flow (DDWF): The flow basis for design of New York City wastewater treatment plants. In general, the plants have been designed to treat 1.5 times this value to full secondary treatment standards and 2.0 times this value, through at least primary settling and disinfection, during stormwater events.

Designated Uses: Those water uses specified in state water quality standards for a waterbody, or segment of a waterbody, that must be achieved and maintained as required under the Clean Water Act. The uses, as defined by states, can include cold-water fisheries, natural fisheries, public water supply, irrigation, recreation, transportation, or mixed uses.

Deoxyribonucleic Acid (DNA): The genetic material of living organisms; the substance of heredity. It is a large, double-stranded, helical molecule that contains genetic instructions for growth, development, and replication.

Destratification: Vertical mixing within a lake or reservoir to totally or partially eliminate separate layers of temperature, plant, or animal life.

Deterministic Model: A model that does not include built-in variability: same input will always equal the same output.

Die-Off Rate: The first-order decay rate for bacteria, pathogens, and viruses. Die-off depends on the particular type of waterbody (i.e. stream, estuary , lake) and associated factors that influence mortality.

Dilution: Addition of less concentrated liquid (water) that results in a decrease in the original concentration.

Direct Runoff: Water that flows over the ground surface or through the ground directly into streams, rivers, and lakes.

Discharge Permits (NPDES): A permit issued by the USEPA or a state regulatory agency that sets specific limits on the type and amount of pollutants that a municipality or industry can discharge to a receiving water; it also includes a compliance schedule for achieving those limits. It is called the NPDES because the permit process was established under the National Pollutant Discharge Elimination System, under provisions of the Federal Clean Water Act.

Discharge: Flow of surface water in a stream or canal or the outflow of ground water from a flowing artesian well, ditch, or spring. It can also apply to discharges of liquid effluent from a facility or to chemical emissions into the air through designated venting mechanisms.

Discriminant Analysis: A type of multivariate analysis used to distinguish between two groups.

Disinfect (Disinfected): A water and wastewater treatment process that kills harmful microorganisms and bacteria by means of physical, chemical and alternative processes such as ultraviolet radiation.

Disinfectant: A chemical or physical process that kills disease-causing organisms in water, air, or on surfaces. Chlorine is often used to disinfect sewage treatment effluent, water supplies, wells, and swimming pools.

Dispersion: The spreading of chemical or biological constituents, including pollutants, in various directions from a point source, at varying velocities depending on the differential instream flow characteristics.

Dissolved Organic Carbon (DOC): All organic carbon (eg, compounds such as acids and sugars, leached from soils, excreted from roots, etc) dissolved in a given volume of water at a particular temperature and pressure.

Dissolved Oxygen (DO): The dissolved oxygen freely available in water that is vital to fish and other aquatic life and is needed for the prevention of odors. DO levels are considered a most important indicator of a water body's ability to support desirable aquatic life. Secondary and advanced waste treatments are generally designed to ensure adequate DO in waste-receiving waters. It also refers to a measure of the amount of oxygen available for biochemical activity in a waterbody, and as an indicator of the quality of that water.

Dissolved Solids: The organic and inorganic particles that enter a waterbody in a solid phase and then dissolve in water.

DNA: deoxyribonucleic acid

DO: dissolved oxygen

DOC: Dissolved Organic Carbon

Drainage Area or Drainage Basin: An area drained by a main river and its tributaries (see Watershed).

Dredging: Dredging is the removal of mud from the bottom of waterbodies to facilitate navigation or remediate contamination. This can disturb the ecosystem and cause silting that can kill or harm aquatic life. Dredging of contaminated mud can expose biota to heavy metals and other toxics. Dredging activities are subject to regulation under Section 404 of the Clean Water Act.

Dry Weather Flow (DWF): Hydraulic flow conditions within a combined sewer system resulting from one or more of the following: flows of domestic sewage, ground water infiltration, commercial and industrial wastewaters, and any other non-precipitation event related flows (e.g., tidal infiltration under certain circumstances).

Dry Weather Overflow: A combined sewer overflow that occurs during dry weather flow conditions.

DSNY: Department of Sanitation of New York

DWF: Dry weather flow

Dynamic Model: A mathematical formulation describing the physical behavior of a system or a process and its temporal variability. Ecological Integrity. The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes.

E

E. Coli: Escherichia Coli.

Ecoregion: Geographic regions of ecological similarity defined by similar climate, landform, soil, natural vegetation, hydrology or other ecologically relevant variables.

Ecosystem: An interactive system that includes the organisms of a natural community association together with their abiotic physical, chemical, and geochemical environment.

Effects Range-Low: Concentration of a chemical in sediment below which toxic effects were rarely observed among sensitive species (10th percentile of all toxic effects).

Effects Range-Median: Concentration of a chemical in sediment above which toxic effects are frequently observed among sensitive species (50th percentile of all toxic effects).

Effluent: Wastewater, either municipal sewage or industrial liquid waste that flows out of a treatment plant, sewer or outfall untreated, partially treated, or completely treated.

Effluent Guidelines: Technical USEPA documents which set effluent limitations for given industries and pollutants.

Effluent Limitation: Restrictions established by a state or USEPA on quantities, rates, and concentrations in wastewater discharges.

Effluent Standard: See effluent limitation.

EIS: Environmental Impact Statement

EMAP: Environmental Monitoring and Assessment Program

EMC: Event Mean Concentration

Emergency Planning and Community Right-to-Know Act of 1986, The (SARA Title III): Law requiring federal, state and local governments and industry, which are involved in either emergency planning and/or reporting of hazardous chemicals, to allow public access to information about the presence of hazardous chemicals in the community and releases of such substances into the environment.

Endpoint: An endpoint is a characteristic of an ecosystem that may be affected by exposure to a stressor. Assessment endpoints and measurement endpoints are two distinct types of endpoints that are commonly used by resource managers. An assessment endpoint is the formal expression of a valued environmental characteristic and should have societal relevance. A measurement endpoint is the expression of an observed or measured response to a stress or disturbance. It is a measurable environmental characteristic that is related to the valued environmental characteristic chosen as the assessment endpoint. The numeric criteria that are part of traditional water quality standards are good examples of measurement endpoints.

Enforceable Requirements: Conditions or limitations in permits issued under the Clean Water Act Section 402 or 404 that, if violated, could result in the issuance of a compliance order or initiation of a civil or criminal action under federal or applicable state laws.

Enhancement: In the context of restoration ecology, any improvement of a structural or functional attribute.

Enteric: Of or within the gastrointestinal tract.

Enterococci: A subgroup of the fecal streptococci that includes S. faecalis and S. faecium. The enterococci are differentiated from other streptococci by their ability to grow in 6.5% sodium chloride, at pH 9.6, and at 10°C and 45°C. Enterococci are a valuable bacterial indicator for determining the extent of fecal contamination of recreational surface waters.

Environment: The sum of all external conditions and influences affecting the development and life of organisms.

Environmental Impact Statement (EIS): A document required of federal agencies by the National Environmental Policy Act for major projects or legislative proposals significantly affecting the environment. A tool for decision making, it describes the positive and negative effects of the undertaking and cites alternative actions.

Environmental Monitoring and Assessment Program (EMAP): The Environmental Monitoring and Assessment Program (EMAP) is a research program to develop the tools necessary to monitor and assess the status and trends of national ecological resources. EMAP's goal is to develop the scientific understanding for translating environmental monitoring data from multiple spatial and temporal scales into assessments of current ecological condition and forecasts of future risks to our natural resources.

Epibenthic: Those animals/organisms located at the surface of the sediments on the bay bottom, generally referring to algae.

Epibenthos: Those animals (usually excluding fishes) living on the top of the sediment surface.

Epidemiology: All the elements contributing to the occurrence or non-occurrence of a disease in a population; ecology of a disease.

Epifauna: Benthic animals living on the sediment or on and among rocks and other structures.

EPMC: Engineering Program Management Consultant

Escherichia Coli: A subgroup of the fecal coliform bacteria. E. coli is part of the normal intestinal flora in humans and animals and is, therefore, a direct indicator of fecal contamination in a waterbody. The O157 strain, sometimes transmitted in contaminated waterbodies, can cause serious infection resulting in gastroenteritis. (See Fecal coliform bacteria)

Estuarine Number: Nondimensional parameter accounting for decay, tidal dispersion, and advection velocity. Used for classification of tidal rivers and estuarine systems.

Estuarine or Coastal Marine Classes: Classes that reflect basic biological communities and that are based on physical parameters such as salinity, depth, sediment grain size, dissolved oxygen and basin geomorphology.

Estuarine Waters: Semi-enclosed body of water which has a free connection with the open sea and within which seawater is measurably diluted with fresh water derived from land drainage.

Estuary: Region of interaction between rivers and near-shore ocean waters, where tidal action and river flow mix fresh and salt water. Such areas include bays, mouths of rivers, salt marshes, and lagoons. These brackish water ecosystems shelter and feed marine life, birds, and wildlife (see wetlands).

Eutrophication: A process in which a waterbody becomes rich in dissolved nutrients, often leading to algal blooms, low dissolved oxygen and changes in the composition of plants and animals in the waterbody. This occurs naturally, but can be exacerbated by human activity which increases nutrient inputs to the waterbody.

Event Mean Concentration (EMC): Input data, typically for urban areas, for a water quality model. EMC represents the concentration of a specific pollutant contained in stormwater runoff coming from a particular land use type within a watershed.

Existing Use: Describes the use actually attained in the waterbody on or after November 28, 1975, whether or not it is included in the water quality standards (40 CFR 131.3).

F

Facility Plan: A planning project that uses engineering and science to address pollution control issues and will most likely result in the enhancement of existing water pollution control facilities or the construction of new facilities.

Facultative: Capable of adaptive response to varying environments.

Fecal Coliform Bacteria: A subset of total coliform bacteria that are present in the intestines or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of water. They are measured by running the standard total coliform test at an elevated temperature (44.5EC). Fecal coliform is approximately 20 percent of total coliform. (See Total Coliform Bacteria)

Fecal Streptococci: These bacteria include several varieties of streptococci that originate in the gastrointestinal tract of warm-blooded animals such as humans (Streptococcus faecalis) and domesticated animals such as cattle (Streptococcus bovis) and horses (Streptococcus equinus).

Feedlot: A confined area for the controlled feeding of animals. The area tends to concentrate large amounts of animal waste that cannot be absorbed by the soil and, hence, may be carried to nearby streams or lakes by rainfall runoff.

FEIS: Final Environmental Impact Statement

Field Sampling and Analysis Program (FSAP): Biological sampling program undertaken to fill-in ecosystem data gaps in New York Harbor.

Final Environmental Impact Statement (FEIS): A document that responds to comments received on the Draft EIS and provides updated information that has become available after publication of the Draft EIS.

Fish Kill: A natural or artificial condition in which the sudden death of fish occurs due to the introduction of pollutants or the reduction of the dissolved oxygen concentration in a waterbody.

Floatables: Large waterborne materials, including litter and trash, that are buoyant or semi-buoyant and float either on or below the water surface. These materials, which are generally man-made and sometimes characteristic of sanitary wastewater and storm runoff, may be transported to sensitive environmental areas such as bathing beaches where they can become an aesthetic nuisance. Certain types of floatables also cause harm to marine wildlife and can be hazardous to navigation.

Flocculation: The process by which suspended colloidal or very fine particles are assembled into larger masses or floccules that eventually settle out of suspension.

Flux: Movement and transport of mass of any water quality constituent over a given period of time. Units of mass flux are mass per unit time.

FOIA: Freedom of Information Act

Food Chain: A sequence of organisms, each of which uses the next, lower member of the sequence as a food source.

Freedom of Information Act (FOIA): A federal statute which allows any person the right to obtain federal agency records unless the records (or part of the records) are protected from disclosure by any of the nine exemptions in the law.

FSAP: Field Sampling and Analysis Program

G

gallons per day per foot (gpd/ft): unit of measure

Gastroenteritis: An inflammation of the stomach and the intestines.

General Permit: A permit applicable to a class or category of discharges.

Geochemical: Refers to chemical reactions related to earth materials such as soil, rocks, and water.

Geographical Information System (GIS): A computer system that combines database management system functionality with information about location. In this way it is able to capture, manage, integrate, manipulate, analyse and display data that is spatially referenced to the earth's surface.

Giardia lamblia: Protozoan in the feces of humans and animals that can cause severe gastrointestinal Ailments. It is a common contaminant of surface waters. (See protozoa).

GIS: Geographical Information System

Global Positioning System (GPS): A GPS comprises a group of satellites orbiting the earth (24 are now maintained by the U.S. Government) and a receiver, which can be highly portable. The receiver can generate accurate coordinates for a point, including elevation, by calculating its own position relative to three or more satellites that are above the visible horizon at the time of measurement.

GPD: Gallons per Day

gpd/ft: gallons per day per foot

gpd/sq ft: gallons per day per square foot

GPS: Global Positioning System

Gradient: The rate of decrease (or increase) of one quantity with respect to another; for example, the rate of decrease of temperature with depth in a lake.

Groundwater: The supply of fresh water found beneath the earth's surface, usually in aquifers, which supply wells and springs. Because groundwater is a major source of drinking water, there is growing concern over contamination from leaching agricultural or industrial pollutants and leaking underground storage tanks.

H

H_2S: Hydrogen Sulfide

Habitat Conservation Plans (HCPs): As part of the Endangered Species Act, Habitat Conservation Plans are designed to protect a species while allowing development. HCP's give the U.S. Fish and Wildlife Service the authority to permit "taking" of endangered or threatened species as long as the impact is reduced by conservation measures. They allow a landowner to determine how best to meet the agreed-upon fish and wildlife goals.

Habitat: A place where the physical and biological elements of ecosystems provide an environment and elements of the food, cover and space resources needed for plant and animal survival.

Halocline: A vertical gradient in salinity.

HCP: Habitat Conservation Plan

Heavy Metals: Metallic elements with high atomic weights (e.g., mercury, chromium, cadmium, arsenic, and lead); can damage living things at low concentrations and tend to accumulate in the food chain.

High Rate Treatment (HRT): A traditional gravity settling process enhanced with flocculation and settling aids to increase loading rates and improve performance.

Holding Pond: A pond or reservoir, usually made of earth, built to store polluted runoff.

Holoplankton: An aggregate of passively floating, drifting or somewhat motile organisms throughout their entire life cycle; Hot spot locations in waterbodies or sediments where hazardous substances have accumulated to levels which may pose risks to aquatic life, wildlife, fisheries, or human health.

HRT: High Rate Treatment

Hydrogen Sulfide (H_2S): A flammable, toxic, colorless gas with an offensive odor (similar to rotten eggs) that is a byproduct of degradation in anaerobic conditions.

Hydrology: The study of the distribution, properties, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hypoxia: The condition of low dissolved oxygen in aquatic systems (typically with a dissolved oxygen concentration less than 3.0 mg/L).

Hypoxia/Hypoxic Waters: Waters with dissolved oxygen concentrations of less than 2 ppm, the level generally accepted as the minimum required for most marine life to survive and reproduce.

I

I/I: Inflow/Infiltration

Index of Biotic Integrity: A fish community assessment approach that incorporates the zoogeographic, ecosystem, community and population aspects of fisheries biology into a single ecologically-based index of the quality of a water resource.

IBI: Indices of Biological Integrity

IDNP: Illegal Dumping Notification Program

IEC: Interstate Environmental Commission

IFCP: Interim Floatables Containment Program

Illegal Dumping Notification Program (IDNP): New York City program wherein the NYCDEP field personnel report any observed evidence of illegal shoreline dumping to the Sanitation Police section of DSNY, who have the authority to arrest dumpers who, if convicted, are responsible for proper disposal of the material.

Impact: A change in the chemical, physical or biological quality or condition of a waterbody caused by external sources.

Impaired Waters: Waterbodies not fully supporting their designated uses.

Impairment: A detrimental effect on the biological integrity of a waterbody caused by an impact.

Impermeable: Impassable; not permitting the passage of a fluid through it.

In situ: Measurements taken in the natural environment.

in.: Abbreviation for "Inches".

Index Period: A sampling period, with selection based on temporal behavior of the indicator(s) and the practical considerations for sampling.

Indicator Organism: Organism used to indicate the potential presence of other (usually pathogenic) organisms. Indicator organisms are usually associated with the other organisms, but are usually more easily sampled and measured.

Indicator Taxa or Indicator Species: Those organisms whose presence (or absence) at a site is indicative of specific environmental conditions.

Indicator: Measurable quantity that can be used to evaluate the relationship between pollutant sources and their impact on water quality. Abiotic and biotic indicators can provide quantitative information on environmental conditions.

Indices of Biological Integrity (IBI): A usually dimensionless numeric combination of scores derived from biological measures called metrics.

Industrial Pretreatment Programs (IPP): Program mandated by USEPA to control toxic discharges to public sewers that are tributary to sewage treatment plants by regulating Significant Industrial Users

(SIUs). NYCDEP enforces the IPP through Chapter 19 of Title 15 of the Rules of the City of New York (Use of Public Sewers).

Infauna: Animals living within submerged sediments. (See benthos.)

Infectivity: Ability to infect a host. Infiltration. 1. Water other than wastewater that enters a wastewater system and building sewers from the ground through such means as defective pipes, pipe joints, connections or manholes. (Infiltration does not include inflow.) 2. The gradual downward flow of water from the ground surfaces into the soil.

Infiltration: The penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

Infiltration/Inflow (I/I): The total quantity of water entering a sewer system from both infiltration and inflow.

Inflow: Water other than wastewater that enters a wastewater system and building sewer from sources such as roof leaders, cellar drains, yard drains, foundation drains, drains from springs and swampy areas, manhole covers, cross connections between storm drains and sanitary sewers, catch basins, cooling towers, stormwaters, surface runoff, street wash waters or drainage. (Inflow does not include infiltration.)

Influent: Water, wastewater, or other liquid flowing into a reservoir, basin, or treatment plant.

Initial Mixing Zone: Region immediately downstream of an outfall where effluent dilution processes occur. Because of the combined effects of the effluent buoyancy, ambient stratification, and current, the prediction of initial dilution can be involved.

Insolation: Exposure to the sun's rays.

Instream Flow: The amount of flow required to sustain stream values, including fish, wildlife, and recreation.

Interceptor Sewers: Large sewer lines that, in a combined system, collect and carry sewage flows from main and trunk sewers to the treatment plant for treatment and discharge. The sewer has no building sewer connections. During some storm events, their capacity is exceeded and regulator structures relieve excess flow to receiving waters to prevent flooding basements, businesses and streets.

Interim Floatables Containment Program (IFCP): A New York City Program that includes containment booms at 24 locations, end-of-pipe nets, skimmer vessels that pick up floatables and transports them to loading stations.

Interstate Environmental Commission (IEC): The Interstate Environmental Commission is a joint agency of the States of New York, New Jersey, and Connecticut. The IEC was established in 1936 under a Compact between New York and New Jersey and approved by Congress. The State of Connecticut joined the Commission in 1941. The mission of the IEC is to protect and enhance environmental quality through cooperation, regulation, coordination, and mutual dialogue between government and citizens in the tri-state region.

Intertidal: The area between the high- and low-tide lines.

IPP: Industrial Pretreatment Programs

Irrigation: Applying water or wastewater to land areas to supply the water and nutrient needs of plants.

J

Jamaica Eutrophication Model (JEM): Model developed for Jamaica Bay in 1996 as a result of a cost-sharing agreement between the NYCDEP and US Army Corps of Engineers.

JEM: Jamaica Eutrophication Model

K

Karst Geology: Solution cavities and closely-spaced sinkholes formed as a result of dissolution of carbonate bedrock.

Knee-of-the-Curve: The point where the incremental change in the cost of the control alternative per change in performance of the control alternative changes most rapidly.

KOTC: Knee-of-the-Curve

Kurtosis: A measure of the departure of a frequency distribution from a normal distribution, in terms of its relative peakedness or flatness.

L

LA: Load Allocation

Land Application: Discharge of wastewater onto the ground for treatment or reuse. (See irrigation)

Land Use: How a certain area of land is utilized (examples: forestry, agriculture, urban, industry).

Landfill: A large, outdoor area for waste disposal; landfills where waste is exposed to the atmosphere (open dumps) are now illegal; in constructed landfills, waste is layered, covered with soil, and is built upon impermeable materials or barriers to prevent contamination of surroundings.

lb/day/cf: pounds per day per cubic foot

lbs/day: pounds per day

LC: Loading Capacity

Leachate: Water that collects contaminants as it trickles through wastes, pesticides, or fertilizers. Leaching can occur in farming areas, feedlots, and landfills and can result in hazardous substances entering surface water, groundwater, or soil.

Leaking Underground Storage Tank (LUST): An underground container used to store gasoline, diesel fuel, home heating oil, or other chemicals that is damaged in some way and is leaking its contents into the ground; may contaminate groundwater.

LID: Low Impact Development

LID-R: Low Impact Development - Retrofit

Limiting Factor: A factor whose absence exerts influence upon a population or organism and may be responsible for no growth, limited growth (decline) or rapid growth.

Littoral Zone: The intertidal zone of the estuarine or seashore; i.e., the shore zone between the highest and lowest tides.

Load Allocation (LA): The portion of a receiving water's loading capacity that is attributed either to one of its existing or future non-point sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and non-point source loads should be distinguished. (40 CFR 130.2(g))

Load, Loading, Loading Rate: The total amount of material (pollutants) entering the system from one or multiple sources; measured as a rate in mass per unit time.

Loading Capacity (LC): The greatest amount of loading that a water can receive without violating water quality standards.

Long Term Control Plan (LTCP): A document developed by CSO communities to describe existing waterway conditions and various CSO abatement technologies that will be used to control overflows.

Low-Flow: Stream flow during time periods where no precipitation is contributing to runoff to the stream and contributions from groundwater recharge are low. Low flow results in less water available for dilution of pollutants in the stream. Due to the limited flow, direct discharges to the stream dominate during low flow periods. Exceedences of water quality standards during low flow conditions are likely to be caused by direct discharges such as point sources, illicit discharges, and livestock or wildlife in the stream.

Low Impact Development (LID): A sustainable storm water management strategy implemented in response to burgeoning infrastructural costs of new development and redevelopment projects, more rigorous environmental regulations, concerns about the urban heat island effect, and the impacts of natural resources due to growth and development. The LID strategy controls water at the source—both rainfall and storm water runoff—which is known as 'source-control' technology. It is a decentralized system that distributes storm water across a project site in order to replenish groundwater supplies rather than sending it into a system of storm drain pipes and channelized networks that control water downstream in a large storm water management facility. The LID approach promotes the use of various devices that filter water and infiltrate water into the ground. It promotes the use of roofs of buildings, parking lots, and other horizontal surfaces to convey water to either distribute it into the ground or collect it for reuse.

Low Impact Development – Retrofit (LID-R): Modification of an existing site to accomplish LID goals.

LTCP: Long-Term CSO Control Plan

LUST: leaking underground storage tank

M

Macrobenthos: Benthic organisms (animals or plants) whose shortest dimension is greater than or equal to 0.5 mm. (See benthos.)

Macrofauna: Animals of a size large enough to be seen by the unaided eye and which can be retained by a U.S. Standard No. 30 sieve (28 meshes/in, 0.595-mm openings).

Macro-invertebrate: Animals/organism without backbones (Invertebrate) that is too large to pass through a No. 40 Screen (0.417mm) but can be retained by a U.S. Standard No. 30 sieve (28 meshes/in, 0.595-mm openings). The organism size is of sufficient size for it to be seen by the unaided eye and which can be retained

Macrophytes: Large aquatic plants that may be rooted, non-rooted, vascular or algiform (such as kelp); including submerged aquatic vegetation, emergent aquatic vegetation, and floating aquatic vegetation.

Major Oil Storage Facilities (MOSF): Onshore facility with a total combined storage capacity of 400,000 gallons or more of petroleum and/or vessels involved in the transport of petroleum on the waters of New York State.

Margin of Safety (MOS): A required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving waterbody (CWA section 303(d)(1)(C)). The MOS is normally incorporated into the conservative assumptions used to develop TMDLs (generally within the calculations or models) and approved by EPA either individually or in state/EPA agreements. If the MOS needs to be larger than that which is allowed through the conservative assumptions, additional MOS can be added as a separate component of the TMDL (in this case, quantitatively, a TMDL = LC = WLA + LA + MOS).

Marine Protection, Research and Sanctuaries Act of 1972, The Ocean Dumping Act: Legislation regulating the dumping of any material in the ocean that may adversely affect human health, marine environments or the economic potential of the ocean.

Mass Balance: A mathematical accounting of substances entering and leaving a system, such as a waterbody, from all sources. A mass balance model for a waterbody is useful to help understand the relationship between the loadings of a pollutant and the levels in the water, biota and sediments, as well as the amounts that can be safely assimilated by the waterbody.

Mass Loading: The quantity of a pollutant transported to a waterbody.
Mathematical Model: A system of mathematical expressions that describe the spatial and temporal distribution of water quality constituents resulting from fluid transport and the one, or more, individual processes and interactions within some prototype aquatic ecosystem. A mathematical water quality model is used as the basis for wasteload allocation evaluations.

Mean Low Water (MLW): A tidal level. The average of all low waters observed over a sufficiently long period.

Median Household Income (MHI): The median household income is one measure of average household income. It divides the household income distribution into two equal parts: one-half of the cases fall below the median household income, and one-half above it.

Meiofauna: Small interstitial; i.e., occurring between sediment particles, animals that pass through a 1-mm mesh sieve but are retained by a 0.1-mm mesh.

Memorandum of Understanding (MOU): An agreement between two or more public agencies defining the roles and responsibilities of each agency in relation to the other or others with respect to an issue over which the agencies have concurrent jurisdiction.

Meningitis: Inflammation of the meninges, especially as a result of infection by bacteria or viruses.

Meroplankton: Organisms that are planktonic only during the larval stage of their life history.

Mesohaline: The estuarine salinity zone with a salinity range of 5-18-ppt.

Metric: A calculated term or enumeration which represents some aspect of biological assemblage structure, function, or other measurable characteristic of the biota that changes in some predictable way in response to impacts to the waterbody.

mf/L: Million fibers per liter – A measure of concentration.

MG: Million Gallons – A measure of volume.

mg/L: Milligrams Per Liter – A measure of concentration.

MGD: Million Gallons Per Day – A measure of the rate of water flow.

MHI: Median Household Income

Microgram per liter (ug/L): A measure of concentration

Microorganisms: Organisms too small to be seen with the unaided eye, including bacteria, protozoans, yeasts, viruses and algae.

milligrams per liter (mg/L): This weight per volume designation is used in water and wastewater analysis. 1 mg/l=1 ppm.

milliliters (mL): A unit of length equal to one thousandth (10^{-3}) of a meter, or 0.0394 inch.

Million fibers per liter (mf/L): A measure of concentration.
million gallons (MG): A unit of measure used in water and wastewater to express volume. To visualize this volume, if a good-sized bath holds 50 gallons, so a million gallons would be equal to 20,000 baths.

million gallons per day (MGD): Term used to express water-use data. Denotes the volume of water utilized in a single day.

Mitigation: Actions taken to avoid, reduce, or compensate for the effects of environmental damage. Among the broad spectrum of possible actions are those which restore, enhance, create, or replace damaged ecosystems.

Mixing Zone: A portion of a waterbody where water quality criteria or rules are waived in order to allow for dilution of pollution. Mixing zones have been allowed by states in many NPDES permits when discharges were expected to have difficulty providing enough treatment to avoid violating standards for the receiving water at the point of discharge.

mL: milliliters

MLW: mean low water

Modeling: An investigative technique using a mathematical or physical representation of a system or theory, usually on a computer, that accounts for all or some of its known properties. Models are often used to test the effect of changes of system components on the overall performance of the system.

Monitoring: Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.

Monte Carlo Simulation: A stochastic modeling technique that involves the random selection of sets of input data for use in repetitive model runs. Probability distributions of receiving water quality concentrations are generated as the output of a Monte Carlo simulation.

MOS: Margin of Safety

MOSF: major oil storage facilities

Most Probable Number (MPN): An estimate of microbial density per unit volume of water sample, based on probability theory.

MOU: Memorandum of Understanding

MOUSE: Computer model developed by the Danish Hydraulic Institute used to model the combined sewer system.

MPN: Most Probable Number

MS4: municipal separate storm sewer systems

Multimetric Approach: An analysis technique that uses a combination of several measurable characteristics of the biological assemblage to provide an assessment of the status of water resources.

Multivariate Community Analysis: Statistical methods (e.g., ordination or discriminant analysis) for analyzing physical and biological community data using multiple variables.
municipal separate storm sewer systems.

Municipal Separate Sewer Systems (MS4): A conveyance or system of conveyances (roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, storm drains) that is 1) Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage districts, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges to waters of the United States; 2) Designed or used for collecting or conveying stormwater; 3) Which is not a combined sewer; and 4) Which is not part of a publicly owned treatment works.

Municipal Sewage: Wastes (mostly liquid) originating from a community; may be composed of domestic wastewater and/or industrial discharges.

National Estuary Program: A program established under the Clean Water Act Amendments of 1987 to develop and implement conservation and management plans for protecting estuaries and restoring and maintaining their chemical, physical, and biological integrity, as well as controlling point and non-point pollution sources.

N

National Marine Fisheries Service (NMFS): A federal agency - with scientists, research vessels, and a data collection system - responsible for managing the nation's saltwater fish. It oversees the actions of the Councils under the Fishery Conservation and Management Act.

National Pollutant Discharge Elimination System (NPDES): The national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318, and 405 of the Clean Water Act. The program imposes discharge limitations on point sources by basing them on the effluent limitation capabilities of a control technology or on local water quality standards. It prohibits discharge of pollutants into water of the United States unless a special permit is issued by EPA, a state, or, where delegated, a tribal government on an Indian reservation.

National Priorities List (NPL): EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund. The list is based primarily on the score a site receives from the Hazard Ranking System. EPA is required to update the NPL at least once a year. A site must be on the NPL to receive money from the Trust Fund for remedial action.

National Wetland Inventory (NWI): The National Wetlands Inventory (NWI) of the U.S. Fish & Wildlife Service produces information on the characteristics, extent, and status of the Nation's wetlands and deepwater habitats. The National Wetlands Inventory information is used by Federal, State, and local agencies, academic institutions, U.S. Congress, and the private sector. Congressional mandates in the Emergency Wetlands Resources Act requires the Service to map wetlands, and to digitize, archive and distribute the maps.

Natural Background Levels: Natural background levels represent the chemical, physical, and biological conditions that would result from natural geomorphological processes such as weathering or dissolution.

Natural Waters: Flowing water within a physical system that has developed without human intervention, in which natural processes continue to take place.

Navigable Waters: Traditionally, waters sufficiently deep and wide for navigation; such waters in the United States come under federal jurisdiction and are protected by the Clean Water Act.

New York City Department of City Planning (NYCDCP): New York City agency responsible for the city's physical and socioeconomic planning, including land use and environmental review; preparation of plans and policies; and provision of technical assistance and planning information to government agencies, public officials, and community boards.

New York City Department of Environmental Protection (NYCDEP): New York City agency responsible for addressing the environmental needs of the City's residents in areas including water, wastewater, air, noise and hazmat.

New York City Department of Parks and Recreation (NYCDPR): The New York City Department of Parks and Recreation is the branch of government of the City of New York responsible for maintaining the city's parks system, preserving and maintaining the ecological diversity of the city's natural areas, and furnishing recreational opportunities for city's residents.

New York City Department of Transportation (NYCDOT): New York City agency responsible for maintaining and improving New York City's transportation network.

New York City Economic Development Corporation (NYCEDC): City's primary vehicle for promoting economic growth in each of the five boroughs. NYCEDC works to stimulate investment in New York and broaden the City's tax and employment base, while meeting the needs of businesses large and small. To realize these objectives, NYCEDC uses its real estate and financing tools to help companies that are expanding or relocating anywhere within the city.

New York City Regional Harbor Survey: Program to assess the effectiveness of New York City's various water pollution control programs and their combined impact on water quality

New York District (NYD): The local division of the United States Army Corps of Engineers,

New York State Code of Rules and Regulations (NYCRR): Official statement of the policy(ies) that implement or apply the Laws of New York.

New York State Department of Environmental Conservation (NYSDEC): New York State agency that conserves, improves, and protects New York State's natural resources and environment, and controls water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well being.

New York State Department of State (NYSDOS): Known as the "keeper of records" for the State of New York. Composed of two main divisions including the Office of Business and Licensing Services and the Office of Local Government Services. The latter office includes the Division of Coastal Resources and Waterfront Revitalization.

NH_3: Ammonia

Nine Minimum Controls (NMC): Controls recommended by the USEPA to minimize CSO impacts. The controls include: (1) proper operation and maintenance for sewer systems and CSOs; (2) maximum use of the collection system for storage; (3) review pretreatment requirements to minimize CSO impacts; (4) maximize flow to treatment facility; (5) prohibit combines sewer discharge during dry weather; (6) control solid and floatable materials in CSOs; (7) pollution prevention; (8) public notification of CSO occurrences and impacts; and, (9) monitor CSOs to characterize impacts and efficacy of CSO controls.

NMC: nine minimum controls

NMFS: National Marine Fisheries Service

No./mL (or #/mL): number of bacteria organisms per milliliter – measure of concentration

Non-Compliance: Not obeying all promulgated regulations, policies or standards that apply.

Non-Permeable Surfaces: Surfaces which will not allow water to penetrate, such as sidewalks and parking lots.

Non-Point Source (NPS): Pollution that is not released through pipes but rather originates from multiple sources over a relatively large area (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land by storm water. Non-point sources can be divided into source activities related to either land or water use including failing septic tanks, improper animal-keeping practices, forest practices, and urban and rural runoff. Common non-point sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets.

NPDES: National Pollution Discharge Elimination System

NPL: National Priorities List

NPS: Non-Point Source

Numeric Targets: A measurable value determined for the pollutant of concern which is expected to result in the attainment of water quality standards in the listed waterbody.

Nutrient Pollution: Contamination of water resources by excessive inputs of nutrients. In surface waters, excess algal production as a result of nutrient pollution is a major concern.

Nutrient: Any substance assimilated by living things that promotes growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

NWI: National Wetland Inventory

NYCDCP: New York City Department of City Planning

NYCDEP: New York City Department of Environmental Protection

NYCDOT: New York City Department of Transportation

NYCDPR: New York City Department of Parks and Recreation

NYCEDC: New York City Economic Development Corporation

NYCRR: New York State Code of Rules and Regulations

NYD: New York District

NYSDEC: New York State Department of Environmental Conservation

NYSDOS: New York State Department of State

O

O&M: Operation and Maintenance

Oligohaline: The estuarine salinity zone with a salinity range of 0.5-5-ppt.

ONRW: Outstanding National Resource Waters

Operation and Maintenance (O&M): Actions taken after construction to ensure that facilities constructed will be properly operated and maintained to achieve normative efficiency levels and prescribed effluent eliminations in an optimum manner.

Optimal: Most favorable point, degree, or amount of something for obtaining a given result; in ecology most natural or minimally disturbed sites.

Organic Chemicals/Compounds: Naturally occurring (animal or plant-produced or synthetic) substances containing mainly carbon, hydrogen, nitrogen, and oxygen.

Organic Material: Material derived from organic, or living, things; also, relating to or containing carbon compounds.

Organic Matter: Carbonaceous waste (organic fraction) that includes plant and animal residue at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population originating from domestic or industrial sources. It is commonly determined as the amount of organic material contained in a soil or water sample.

Organic: (1) Referring to other derived from living organisms. (2) In chemistry, any compound containing carbon.

Ortho P: Ortho Phosphorus

Ortho Phosphorus: Soluble reactive phosphorous readily available for uptake by plants. The amount found in a waterbody is an indicator of how much phosphorous is available for algae and plant growth. Since aquatic plant growth is typically limited by phosphorous, added phosphorous especially in the dissolved, bioavailable form can fuel plant growth and cause algae blooms.

Outfall: Point where water flows from a conduit, stream, or drain into a receiving water.

Outstanding National Resource Waters (ONRW): Outstanding national resource waters (ONRW) designations offer special protection (i.e., no degradation) for designated waters, including wetlands. These are areas of exceptional water quality or recreational/ecological significance. State antidegradation policies should provide special protection to wetlands designated as outstanding national resource waters in the same manner as other surface waters; see Section 131.12(a)(3) of the WQS regulation and EPA guidance (Water Quality Standards Handbook (USEPA 1983b), and Questions and Answers on: Antidegradation (USEPA 1985a)).

Overflow Rate: A measurement used in wastewater treatment calculations for determining solids settling. It is also used for CSO storage facility calculations and is defined as the flow through a storage

basin divided by the surface area of the basin. It can be thought of as an average flow rate through the basin. Generally expressed as gallons per day per square foot (gpd/sq.ft.).
Oxidation Pond: A relatively shallow body of wastewater contained in an earthen basin; lagoon; stabilization pond.

Oxidation: The chemical union of oxygen with metals or organic compounds accompanied by a removal of hydrogen or another atom. It is an important factor for soil formation and permits the release of energy from cellular fuels.

Oxygen Demand: Measure of the dissolved oxygen used by a system (microorganisms) in the oxidation of organic matter. (See also biochemical oxygen demand)

Oxygen Depletion: The reduction of dissolved oxygen in a waterbody.

P

PAH: Polycyclic Aromatic Hydrocarbons

Partition Coefficients: Chemicals in solution are partitioned into dissolved and particulate adsorbed phase based on their corresponding sediment-to-water partitioning coefficient.

Parts per Million (ppm): The number of "parts" by weight of a substance per million parts of water. This unit is commonly used to represent pollutant concentrations. Large concentrations are expressed in percentages.

Pathogen: Disease-causing agent, especially microorganisms such as bacteria, protozoa, and viruses.

PCBs: Polychlorinated biphenyls

PCS: Permit Compliance System

PE: Primary Effluent

Peak Flow: The maximum flow that occurs over a specific length of time (e.g., daily, hourly, instantaneous).
Pelagic Zone: The area of open water beyond the littoral zone.

Pelagic: Pertaining to open waters or the organisms which inhabit those waters.

Percent Fines: In analysis of sediment grain size, the percent of fine (.062-mm) grained fraction of sediment in a sample.

Permit Compliance System (PCS): Computerized management information system which contains data on NPDES permit-holding facilities. PCS keeps extensive records on more than 65,000 active water-discharge permits on sites located throughout the nation. PCS tracks permit, compliance, and enforcement status of NPDES facilities.

Permit: An authorization, license, or equivalent control document issued by EPA or an approved federal, state, or local agency to implement the requirements of an environmental regulation; e.g., a permit to operate a wastewater treatment plant or to operate a facility that may generate harmful emissions.

Petit Ponar Grab Sampler: Dredge designed to take samples from all types of benthos sediments on all varieties of waterbody bottoms, except those of the hardest clay. When the jaws contact the bottom they obtain a good penetration with very little sample disturbance. Can be used in both fresh and salt water.

pH: An expression of the intensity of the basic or acid condition of a liquid. The pH may range from 0 to 14, where 0 is most acid, 14 most basic and 7 neutral. Natural waters usually have a pH between 6.5 and 8.5.

Phased Approach: Under the phased approach to TMDL development, load allocations (LAs) and wasteload allocations (WLAs) are calculated using the best available data and information recognizing the need for additional monitoring data to accurately characterize sources and loadings. The phased approach is typically employed when non-point sources dominate. It provides for the implementation of load reduction strategies while collecting additional data.

Photic Zone: The region in a waterbody extending from the surface to the depth of light penetration.

Photosynthesis: The process by which chlorophyll-containing plants make carbohydrates from water, and from carbon dioxide in the air, using energy derived from sunlight.

Phytoplankton: Free-floating or drifting microscopic algae with movements determined by the motion of the water.

Point Source: (1) A stationary location or fixed facility from which pollutant loads are discharged. (2) Any single identifiable source of pollutants including pipes, outfalls, and conveyance channels from either municipal wastewater treatment systems or industrial waste treatment facilities. (3) Point sources can also include pollutant loads contributed by tributaries to the main receiving water stream or river.

Pollutant: Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water. (CWA Section 502(6)).

Pollution: Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water.

Polychaete: Marine worms of the class Polychaeta of the invertebrate worm order Annelida. Polychaete species dominate the marine benthos, with dozens of species present in natural marine environments. These worms are highly diversified, ranging from detritivores to predators, with some species serving as good indicators of environmental stress.

Polychlorinated Biphenyls (PCBs): A group of synthetic polychlorinated aromatic hydrocarbons formerly used for such purposes as insulation in transformers and capacitors and lubrication in gas pipeline systems. Production, sale and new use was banned by law in 1977 following passage of the Toxic Substances Control Act. PCBs have a strong tendency to bioaccumulate. They are quite stable, and therefore persist in the environment for long periods of time. They are classified by EPA as probable human carcinogens.

Polycyclic Aromatic Hydrocarbons (PAHs): A group of petroleum-derived hydrocarbon compounds, present in petroleum and related materials, and used in the manufacture of materials such as dyes, insecticides and solvents.

Population: An aggregate of interbreeding individuals of a biological species within a specified location.

POTW: Publicly Owned Treatment Plant

pounds per day per cubic foot: lb/day/cf

pounds per day: lbs/day; unit of measure

ppm: parts per million

Precipitation Event: An occurrence of rain, snow, sleet, hail, or other form of precipitation that is generally characterized by parameters of duration and intensity (inches or millimeters per unit of time).

Pretreatment: The treatment of wastewater from non-domestic sources using processes that reduce, eliminate, or alter contaminants in the wastewater before they are discharged into Publicly Owned Treatment Works (POTWs).

Primary Effluent (PE): Partially treated water (screened and undergoing settling) passing from the primary treatment processes a wastewater treatment plant.

Primary Treatment: A basic wastewater treatment method, typically the first step in treatment, that uses skimming, settling in tanks to remove most materials that float or will settle. Usually chlorination follows to remove pathogens from wastewater. Primary treatment typically removes about 35 percent of biochemical oxygen demand (BOD) and less than half of the metals and toxic organic substances.

Priority Pollutants: A list of 129 toxic pollutants including metals developed by the USEPA as a basis for defining toxics and is commonly referred to as "priority pollutants".

Protozoa: Single-celled organisms that reproduce by fission and occur primarily in the aquatic environment. Waterborne pathogenic protozoans of primary concern include Giardia lamblia and Cryptosporidium, both of which affect the gastrointestinal tract.

PS: Pump Station or Pumping Station

Pseudoreplication: The repeated measurement of a single experimental unit or sampling unit, with the treatment of the measurements as if they were independent replicates of the sampling unit.

PTPC (Probable Total Project Cost): Represent the realistic total of all hard costs, soft costs, and ancillary costs associated with a particular CSO abatement technology per the definitions provided in O'Brien & Gere, April 2006. All PTPCs shown in this report are adjusted to July 2005 dollars (ENR CCI = 11667.99).

Public Comment Period: The time allowed for the public to express its views and concerns regarding action by USEPA or states (e.g., a Federal Register notice of a proposed rule-making, a public notice of a draft permit, or a Notice of Intent to Deny).

Publicly Owned Treatment Works (POTW): Any device or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature that is owned by a state or municipality. This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

Pump Station or Pumping Station: Sewer pipes are generally gravity driven. Wastewater flows slowly downhill until it reaches a certain low point. Then pump, or "lift," stations push the wastewater back uphill to a high point where gravity can once again take over the process.

Pycnocline: A zone of marked density gradient.

Q

Q: Symbol for Flow (designation when used in equations)

R

R.L: Reporting Limit

Rainfall Duration: The length of time of a rainfall event.

Rainfall Intensity: The amount of rainfall occurring in a unit of time, usually expressed in inches per hour.

Raw Sewage: Untreated municipal sewage (wastewater) and its contents.

RCRAInfo: Resource Conservation and Recovery Act Information

Real-Time Control (RTC): A system of data gathering instrumentation used in conjunction with control components such as dams, gates and pumps to maximize storage in the existing sewer system.

Receiving Waters: Creeks, streams, rivers, lakes, estuaries, groundwater formations, or other bodies of water into which surface water and/or treated or untreated waste are discharged, either naturally or in man-made systems.

Red Tide: A reddish discoloration of coastal surface waters due to concentrations of certain toxin producing algae.

Reference Condition: The chemical, physical or biological quality or condition exhibited at either a single site or an aggregation of sites that represents the least impaired condition of a classification of waters to which the reference condition applies.

Reference Sites: Minimally impaired locations in similar waterbodies and habitat types at which data are collected for comparison with test sites. A separate set of reference sites are defined for each estuarine or coastal marine class.

Regional Environmental Monitoring and Assessment Program (REMAP): The Environmental Monitoring and Assessment Program (EMAP) is a research program to develop the tools necessary to monitor and assess the status and trends of national ecological resources. EMAP's goal is to develop the scientific understanding for translating environmental monitoring data from multiple spatial and temporal scales into assessments of current ecological condition and forecasts of future risks to our natural resources.

Regulator: A device in combined sewer systems for diverting wet weather flows which exceed downstream capacity to an overflow.

REMAP: Regional Environmental Monitoring and Assessment Program

Replicate: Taking more than one sample or performing more than one analysis.

Reporting Limit (RL): The lowest concentration at which a contaminant is reported.

Residence Time: Length of time that a pollutant remains within a section of a waterbody. The residence time is determined by the streamflow and the volume of the river reach or the average stream velocity and the length of the river reach.

Resource Conservation and Recovery Act Information (RCRAinfo): Database with information on existing hazardous materials sites. USEPA was authorized to develop a hazardous waste management system, including plans for the handling and storage of wastes and the licensing of treatment and disposal facilities. The states were required to implement the plans under authorized grants from the USEPA. The act generally encouraged “cradle to grave” management of certain products and emphasized the need for recycling and conservation.

Respiration: Biochemical process by means of which cellular fuels are oxidized with the aid of oxygen to permit the release of the energy required to sustain life; during respiration, oxygen is consumed and carbon dioxide is released.

Restoration: Return of an ecosystem to a close approximation of its condition prior to disturbance. Re-establishing the original character of an area such as a wetland or forest.

Riparian Zone: The border or banks of a stream. Although this term is sometimes used interchangeably with floodplain, the riparian zone is generally regarded as relatively narrow compared to a floodplain. The duration of flooding is generally much shorter, and the timing less predictable, in a riparian zone than in a river floodplain.

Ribonucleic acid (RNA): RNA is the generic term for polynucleotides, similar to DNA but containing ribose in place of deoxyribose and uracil in place of thymine. These molecules are involved in the transfer of information from DNA, programming protein synthesis and maintaining ribosome structure.

Riparian Habitat: Areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands.

Riparian: Relating to or living or located on the bank of a natural watercourse (as a river) or sometimes of a lake or a tidewater.

RNA: ribonucleic acid

RTC: Real-Time Control

Runoff: That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into receiving waters.

S

Safe Drinking Water Act: The Safe Drinking Water Act authorizes EPA to set national health-based standards for drinking water to protect against both naturally occurring and man-made contaminants that may be found in drinking water. USEPA, states, and water systems then work together to make sure these standards are met.

Sanitary Sewer Overflow (SSO): When wastewater treatment systems overflow due to unforseen pipe blockages or breaks, unforseen structural, mechanical, or electrical failures, unusually wet weather conditions, insufficient system capacity, or a deteriorating system.

Sanitary Sewer: Underground pipes that transport only wastewaters from domestic residences and/or industries to a wastewater treatment plant. No stormwater is carried.

Saprobien System: An ecological classification of a polluted aquatic system that is undergoing self-purification. Classification is based on relative levels of pollution, oxygen concentration and types of indicator microorganisms; i.e., saprophagic microorganisms – feeding on dead or decaying organic matter.

SCADA: Supervisory Control and Data Acquisition

scfm: standard cubic feet per minute

Scoping Modeling: Involves simple, steady-state analytical solutions for a rough analysis of the problem.

Scour: To abrade and wear away. Used to describe the weathering away of a terrace or diversion channel or streambed. The clearing and digging action of flowing water, especially the downward erosion by stream water in sweeping away mud and silt on the outside of a meander or during flood events.

Secchi Disk: Measures the transparency of water. Transparency can be affected by the color of the water, algae and suspended sediments. Transparency decreases as color, suspended sediments or algal abundance increases.

Secondary Treatment: The second step in most publicly owned waste treatment systems in which bacteria consume the organic parts of the waste. It is accomplished by bringing together waste, bacteria, and oxygen in trickling filters or in the activated sludge process. This treatment removes floating and settleable solids and about 90 percent of the oxygen-demanding substances and suspended solids. Disinfection is the final stage of secondary treatment. (See primary, tertiary treatment.)

Sediment Oxygen Demand (SOD): A measure of the amount of oxygen consumed in the biological process that breaks down organic matter in the sediment.

Sediment: Insoluble organic or inorganic material often suspended in liquid that consists mainly of particles derived from rocks, soils, and organic materials that eventually settles to the bottom of a waterbody; a major non-point source pollutant to which other pollutants may attach.

Sedimentation: Deposition or settling of suspended solids settle out of water, wastewater or other liquids by gravity during treatment.

Sediments: Soil, sand, and minerals washed from land into water, usually after rain. They pile up in reservoirs, rivers and harbors, destroying fish and wildlife habitat, and clouding the water so that sunlight cannot reach aquatic plants. Careless farming, mining, and building activities will expose sediment materials, allowing them to wash off the land after rainfall.

Seiche: A wave that oscillates (for a period of a few minutes to hours) in lakes, bays, lagoons or gulfs as a result of seismic or atmospheric disturbances (e.g., "wind tides").

Sensitive Areas: Areas of particular environmental significance or sensitivity that could be adversely affected by discharges, including Outstanding National Resource Waters, National Marine Sanctuaries, waters with threatened or endangered species, waters with primary contact recreation, public drinking water intakes, shellfish beds, and other areas identified by State or Federal agencies.

Separate Sewer System: Sewer systems that receive domestic wastewater, commercial and industrial wastewaters, and other sources but do not have connections to surface runoff and are not directly influenced by rainfall events.

Separate Storm Water System (SSWS): A system of catch basin, pipes, and other components that carry only surface run off to receiving waters.

Septic System: An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a system of tile lines or a pit for disposal of the liquid effluent (sludge) that remains after decomposition of the solids by bacteria in the tank; must be pumped out periodically.

SEQRA: State Environmental Quality Review Act

Settleable Solids: Material heavy enough to sink to the bottom of a wastewater treatment tank.

Settling Tank: A vessel in which solids settle out of water by gravity during drinking and wastewater treatment processes.

Sewage: The waste and wastewater produced by residential and commercial sources and discharged into sewers.

Sewer Sludge: Sludge produced at a Publicly Owned Treatment Works (POTW), the disposal of which is regulated under the Clean Water Act.

Sewer: A channel or conduit that carries wastewater and storm-water runoff from the source to a treatment plant or receiving stream. “Sanitary” sewers carry household, industrial, and commercial waste. “Storm” sewers carry runoff from rain or snow. “Combined” sewers handle both.

Sewerage: The entire system of sewage collection, treatment, and disposal.

Sewershed: A defined area that is tributary to a single point along an interceptor pipe (a community connection to an interceptor) or is tributary to a single lift station. Community boundaries are also used to define sewer-shed boundaries.

SF: Square foot, unit of area

Significant Industrial User (SIU): A Significant Industrial User is defined by the USEPA as an industrial user that discharges process wastewater into a publicly owned treatment works and meets at least one of the following: (1) All industrial users subject to *Categorical Pretreatment Standards* under the Code of Federal Regulations - Title 40 (40 CFR) Part 403.6, and CFR Title 40 Chapter I, Subchapter N- Effluent Guidelines and Standards; and (2) Any other industrial user that discharges an average of 25,000 gallons per day or more of process wastewater to the treatment plant (excluding sanitary, non-contact cooling and boiler blowdown wastewater); or contributes a process waste stream which makes up 5 percent or more of any design capacity of the treatment plant; or is designated as such by the municipal Industrial Waste Section on the basis that the industrial user has a reasonable potential for adversely affecting the treatment plants operation or for violating any pretreatment standard or requirement.

Siltation: The deposition of finely divided soil and rock particles upon the bottom of stream and river beds and reservoirs.

Simulation Models: Mathematical models (logical constructs following from first principles and assumptions), statistical models (built from observed relationships between variables), or a combination of the two.

Simulation: Refers to the use of mathematical models to approximate the observed behavior of a natural water system in response to a specific known set of input and forcing conditions. Models that have been validated, or verified, are then used to predict the response of a natural water system to changes in the input or forcing conditions.

Single Sample Maximum (SSM): A maximum allowable enterococci or E. Coli density for a single sample.

Site Spill Identifier List (SPIL): Federal database with information on existing Superfund Sites.

SIU: Significant Industrial User

Skewness: The degree of statistical asymmetry (or departure from symmetry) of a population. Positive or negative skewness indicates the presence of a long, thin tail on the right or left of a distribution respectively.

Slope: The degree of inclination to the horizontal. Usually expressed as a ratio, such as 1:25 or 1 on 25, indicating one unit vertical rise in 25 units of horizontal distance, or in a decimal fraction (0.04); degrees (2 degrees 18 minutes), or percent (4 percent).

Sludge: Organic and Inorganic solid matter that settles to the bottom of septic or wastewater treatment plant sedimentation tanks, must be disposed of by bacterial digestion or other methods or pumped out for land disposal, incineration or recycled for fertilizer application.

SNWA: Special Natural Waterfront Area

SOD: Sediment Oxygen Demand

SOP: Standard Operating Procedure

Sorption: The adherence of ions or molecules in a gas or liquid to the surface of a solid particle with which they are in contact.

SPDES: State Pollutant Discharge Elimination System

Special Natural Waterfront Area (SNWA): A large area with concentrations of important coastal ecosystem features such as wetlands, habitats and buffer areas, many of which are regulated under other programs.

SPIL: Site Spill Identifier List

SRF: State Revolving Fund

SSM: single sample maximum

SSO: Sanitary Sewer Overflow

SSWS: Separate Storm Water System

Stakeholder: One who is interested in or impacted by a project.

Standard Cubic Feet per Minute (SCFM): A standard measurement of airflow that indicates how many cubic feet of air pass by a stationary point in one minute. The higher the number, the more air is being forced through the system. The volumetric flow rate of a liquid or gas in cubic feet per minute. 1 CFM equals approximately 2 liters per second.

State Environmental Quality Review Act (SEQRA): New York State program requiring all local government agencies to consider environmental impacts equally with social and economic factors during discretionary decision-making. This means these agencies must assess the environmental significance of all actions they have discretion to approve, fund or directly undertake. SEQR requires the agencies to balance the environmental impacts with social and economic factors when deciding to approve or undertake an action.

Standard Operating Procedure (SOP): Document describing a procedure or set of procedures to perform a given operation or evolutions or in reaction to a given event.

State Pollutant Discharge Elimination System (SPDES): New York State has a state program which has been approved by the United States Environmental Protection Agency for the control of wastewater and stormwater discharges in accordance with the Clean Water Act. Under New York State law the program is known as the State Pollutant Discharge Elimination System (SPDES) and is broader in scope than that required by the Clean Water Act in that it controls point source discharges to groundwaters as well as surface waters.

State Revolving Fund (SRF): Revolving funds are financial institutions that make loans for specific water pollution control purposes and use loan repayment, including interest, to make new loans for additional water pollution control activities. The SRF program is based on the 1987 Amendments to the Clean Water Act, which established the SRF program as the CWA's original Construction Grants Program was phased out.

Steady-State Model: Mathematical model of fate and transport that uses constant values of input variables to predict constant values of receiving water quality concentrations.

Storage: Treatment holding of waste pending treatment or disposal, as in containers, tanks, waste piles, and surface impoundments.

STORET: U.S. Environmental Protection Agency (EPA) national water quality database for STORage and RETrieval (STORET). Mainframe water quality database that includes physical, chemical, and biological data measured in waterbodies throughout the United States.

Storm Runoff: Stormwater runoff, snowmelt runoff, and surface runoff and drainage; rainfall that does not evaporate or infiltrate the ground because of impervious land surfaces or a soil infiltration rate lower than rainfall intensity, but instead flows onto adjacent land or waterbodies or is routed into a drain or sewer system.

Storm Sewer: A system of pipes (separate from sanitary sewers) that carries waste runoff from buildings and land surfaces.

Storm Sewer: Pipes (separate from sanitary sewers) that carry water runoff from buildings and land surfaces.

Stormwater: The portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels or pipes into a defined surface water channel, or a constructed infiltration facility.

Stormwater Management Models (SWMM): USEPA mathematical model that simulates the hydraulic operation of the combined sewer system and storm drainage sewershed.

Stormwater Protection Plan (SWPP): A plan to describe a process whereby a facility thoroughly evaluates potential pollutant sources at a site and selects and implements appropriate measures designed to prevent or control the discharge of pollutants in stormwater runoff.

Stratification (of waterbody): Formation of water layers each with specific physical, chemical, and biological characteristics. As the density of water decreases due to surface heating, a stable situation develops with lighter water overlaying heavier and denser water.

Stressor: Any physical, chemical, or biological entity that can induce an adverse response.

Subaqueous Burrow Pit: An underwater depression left after the mining of large volumes of sand and gravel for projects ranging from landfilling and highway construction to beach nourishment.

Substrate: The substance acted upon by an enzyme or a fermenter, such as yeast, mold or bacteria.

Subtidal: The portion of a tidal-flat environment that lies below the level of mean low water for spring tides. Normally it is covered by water at all stages of the tide.

Supervisory Control and Data Acquisition (SCADA): System for controlling and collecting and recording data on certain elements of WASA combined sewer system.

Surcharge Flow: Flow in which the water level is above the crown of the pipe causing pressurized flow in pipe segments.

Surface Runoff: Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of non-point source pollutants in rivers, streams, and lakes.

Surface Water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other groundwater collectors directly influenced by surface water.

Surficial Geology: Geology relating to surface layers, such as soil, exposed bedrock, or glacial deposits.

Suspended Loads: Specific sediment particles maintained in the water column by turbulence and carried with the flow of water.

Suspended Solids or Load: Organic and inorganic particles (sediment) suspended in and carried by a fluid (water). The suspension is governed by the upward components of turbulence, currents, or colloidal suspension. Suspended sediment usually consists of particles <0.1 mm, although size may vary according to current hydrological conditions. Particles between 0.1 mm and 1 mm may move as suspended or bedload. It is a standard measure of the concentration of particulate matter in wastewater, expressed in mg/L. Technology-Based Standards. Minimum pollutant control standards for numerous categories of industrial discharges, sewage discharges and for a growing number of other types of discharges. In each industrial category, they represent levels of technology and pollution control performance that the EPA expects all discharges in that category to employ.

SWEM: System-wide Eutrophication Model

SWMM: Stormwater Management Model

SWPP: Stormwater Protection Plan

System-wide Eutrophication Model (SWEM): Comprehensive hydrodynamic model developed for the New York/New Jersey Harbor System.

T

Taxa:

TC: Total coliform

TDS: Total Dissolved Solids

Technical and Operational Guidance Series (TOGS): Memorandums that provide information on determining compliance with a standard.

Tertiary Treatment: Advanced cleaning of wastewater that goes beyond the secondary or biological stage, removing nutrients such as phosphorus, nitrogen, and most biochemical oxygen demand (BOD) and suspended solids.

Test Sites: Those sites being tested for biological impairment.

Threatened Waters: Water whose quality supports beneficial uses now but may not in the future unless action is taken.

Three-Dimensional Model (3-D): Mathematical model defined along three spatial coordinates where the water quality constituents are considered to vary over all three spatial coordinates of length, width, and depth.

TKN: Total Kjeldahl Nitrogen

TMDL: Total Maximum Daily Loads

TOC: Total Organic Carbon

TOGS: Technical and Operational Guidance Series

Topography: The physical features of a surface area including relative elevations and the position of natural and man-made features.

Total Coliform Bacteria: A particular group of bacteria, found in the feces of warm-blooded animals, that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°. Note that many common soil bacteria are also total coliforms, but do not indicate fecal contamination. (See also fecal coliform bacteria)

Total Coliform (TC): The coliform bacteria group consists of several genera of bacteria belonging to the family *enterobacteriaceae*. These mostly harmless bacteria live in soil, water, and the digestive system of animals. Fecal coliform bacteria, which belong to this group, are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals, and can enter water bodies from human and animal waste. If a large number of fecal coliform bacteria (over 200 colonies/100 milliliters (ml) of water sample) are found in water, it is possible that pathogenic (disease- or illness-causing) organisms are also present in the water. Swimming in waters with high levels of fecal coliform bacteria increases the chance of developing illness (fever, nausea or stomach cramps) from pathogens entering the body through the mouth, nose, ears, or cuts in the skin.

Total Dissolved Solids (TDS): Solids that pass through a filter with a pore size of 2.0 micron or smaller. They are said to be non-filterable. After filtration the filtrate (liquid) is dried and the remaining residue is weighed and calculated as mg/L of Total Dissolved Solids.

Total Kjeldahl Nitrogen (TKN): The sum of organic nitrogen and ammonia nitrogen.

Total Maximum Daily Load (TMDL): The sum of the individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for non-point sources and natural background, and a margin of safety (MOS). TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.

Total Organic Carbon (TOC): A measure of the concentration of organic carbon in water, determined by oxidation of the organic matter into carbon dioxide (CO2). TOC includes all the carbon atoms covalently bonded in organic molecules. Most of the organic carbon in drinking water supplies is dissolved organic carbon, with the remainder referred to as particulate organic carbon. In natural waters, total organic carbon is composed primarily of nonspecific humic materials.

Total P: Total Phosphorus

Total Phosphorus (Total P): A nutrient essential to the growth of organisms, and is commonly the limiting factor in the primary productivity of surface water bodies. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particle form. Agricultural drainage, wastewater, and certain industrial discharges are typical sources of phosphorus, and can contribute to the eutrophication of surface water bodies. Measured in milligrams per liter (mg/L).

Total Suspended Solids (TSS): See Suspended Solids Toxic Substances. Those chemical substances which can potentially cause adverse effects on living organisms. Toxic substances include pesticides, plastics, heavy metals, detergent, solvent, or any other materials that are poisonous, carcinogenic, or otherwise directly harmful to human health and the environment as a result of dose or exposure concentration and exposure time. The toxicity of toxic substances is modified by variables such as temperature, chemical form, and availability.

Total Volatile Suspended Solids (VSS): Volatile solids are those solids lost on ignition (heating to 550 degrees C.) They are useful to the treatment plant operator because they give a rough approximation of the amount of organic matter present in the solid fraction of wastewater, activated sludge and industrial wastes.

Toxic Pollutants: Materials that cause death, disease, or birth defects in organisms that ingests or absorbs them. The quantities and exposures necessary to cause these effects can vary widely.

Toxicity: The degree to which a substance or mixture of substances can harm humans or animals. Acute toxicity involves harmful effects in an organism through a single or short-term exposure. Chronic toxicity is the ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism.

Treated Wastewater: Wastewater that has been subjected to one or more physical, chemical, and biological processes to reduce its potential of being a health hazard.

Treatment Plant: Facility for cleaning and treating freshwater for drinking, or cleaning and treating wastewater before discharging into a water body.

Treatment: (1) Any method, technique, or process designed to remove solids and/or pollutants from solid waste, waste-streams, effluents, and air emissions. (2) Methods used to change the biological character or composition of any regulated medical waste so as to substantially reduce or eliminate its potential for causing disease.

Tributary: A lower order stream compared to a receiving waterbody. "Tributary to" indicates the largest stream into which the reported stream or tributary flows.

Trophic Level: The functional classification of organisms in an ecological community based on feeding relationships. The first trophic level includes green plants; the second trophic level includes herbivores; and so on.

TSS: Total Suspended Solids

Turbidity: The cloudy or muddy appearance of a naturally clear liquid caused by the suspension of particulate matter. It can be measured by the amount of light that is scattered or absorbed by a fluid.

Two-Dimensional Model (2-D): Mathematical model defined along two spatial coordinates where the water quality constituents are considered averaged over the third remaining spatial coordinate. Examples of 2-D models include descriptions of the variability of water quality properties along: (a) the length and width of a river that incorporates vertical averaging or (b) length and depth of a river that incorporates lateral averaging across the width of the waterbody.

U

U.S. Army Corps of Engineers (USACE): The United States Army Corps of Engineers, or USACE, is made up of some 34,600 civilian and 650 military men and women. The Corps' mission is to provide engineering services to the United States, including: Planning, designing, building and operating dams and other civil engineering projects ; Designing and managing the construction of military facilities for the Army and Air Force; and, Providing design and construction management support for other Defense and federal agencies

United States Environmental Protection Agency (USEPA): The Environmental Protection Agency (EPA or sometimes USEPA) is an agency of the United States federal government charged with protecting human health and with safeguarding the natural environment: air, water, and land. The USEPA began operation on December 2, 1970. It is led by its Administrator, who is appointed by the President of the United States. The USEPA is not a cabinet agency, but the Administrator is normally given cabinet rank.

U.S. Fish and Wildlife Service (USFWS): The United States Fish and Wildlife Service is a unit of the United States Department of the Interior that is dedicated to managing and preserving wildlife. It began as the U.S. Commission on Fish and Fisheries in the United States Department of Commerce and the Division of Economic Ornithology and Mammalogy in the United States Department of Agriculture and took its present form in 1939.

U.S. Geological Survey (USGS): The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

UAA: Use Attainability Analysis

ug/L: Microgram per liter – A measure of concentration

Ultraviolet Light (UV): Similar to light produced by the sun; produced in treatment processes by special lamps. As organisms are exposed to this light, they are damaged or killed.

ULURP: Uniform Land Use Review Procedure

Underground Storage Tanks (UST): Buried storage tank systems that store petroleum or hazardous substances that can harm the environment and human health if the USTs release their stored contents.

Uniform Land Use Review Procedure (ULURP): New York City program wherein a standardized program would be used to publicly review and approve applications affecting the land use of the city would be publicly reviewed. The program also includes mandated time frames within which application review must take place.

Unstratified: Indicates a vertically uniform or well-mixed condition in a waterbody. (See also Stratification)

Urban Runoff: Storm water from city streets and adjacent domestic or commercial properties that carries pollutants of various kinds into the sewer systems and receiving waters.

Urban Runoff: Water containing pollutants like oil and grease from leaking cars and trucks; heavy metals from vehicle exhaust; soaps and grease removers; pesticides from gardens; domestic animal waste; and street debris, which washes into storm drains and enters receiving waters.

USA: Use and Standards Attainability Project

USACE: United States Army Corps of Engineers

Use and Standards Attainability Project (USA): A DEP program that supplements existing Harbor water quality achievements. The program involves the development of a four-year, expanded, comprehensive plan (the Use and Standards Attainment or "USA" Project) that is to be directed towards increasing water quality improvements in 26 specific bodies of water located throughout the entire City. These waterbodies were selected by DEP based on the City's drainage patterns and on New York State Department of Environmental Conservation (NYSDEC) waterbody classification standards.

Use Attainability Analysis (UAA): An evaluation that provides the scientific and economic basis for a determination that the designated use of a water body is not attainable based on one or more factors (physical, chemical, biological, and economic) proscribed in federal regulations.

Use Designations: Predominant uses each State determines appropriate for a particular estuary, region, or area within the class.

USEPA: United States Environmental Protection Agency

USFWS: U.S. Fish and Wildlife Service

USGS: United States Geological Survey

UST: underground storage tanks

UV: ultraviolet light

V

Validation (of a model): Process of determining how well the mathematical representation of the physical processes of the model code describes the actual system behavior.

Verification (of a model): Testing the accuracy and predictive capabilities of the calibrated model on a data set independent of the data set used for calibration.

Viewsheds: The major segments of the natural terrain which are visible above the natural vegetation from designated scenic viewpoints.

Virus: Submicroscopic pathogen consisting of a nucleic acid core surrounded by a protein coat. Requires a host in which to replicate (reproduce).

VSS: Total Volatile Suspended Solids

W

Wasteload Allocation (WLA): The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation (40 CFR 130.2(h)).

Wastewater Treatment Plant (WWTP): A facility that receives wastewaters (and sometimes runoff) from domestic and/or industrial sources, and by a combination of physical, chemical, and biological processes reduces (treats) the wastewaters to less harmful byproducts; known by the acronyms, STP (sewage treatment plant), POTW (publicly owned treatment works), WPCP (water pollution control plant) and WWTP.

Wastewater Treatment: Chemical, biological, and mechanical procedures applied to an industrial or municipal discharge or to any other sources of contaminated water in order to remove, reduce, or neutralize contaminants.

Wastewater: The used water and solids from a community (including used water from industrial processes) that flows to a treatment plant. Stormwater, surface water and groundwater infiltration also may be included in the wastewater that enters a wastewater treatment plant. The term sewage usually refers to household wastes, but this word is being replaced by the term wastewater.

Water Pollution Control Plant (WPCP): A facility that receives wastewaters (and sometimes runoff) from domestic and/or industrial sources, and by a combination of physical, chemical, and biological processes reduces (treats) the wastewaters to less harmful byproducts; known by the acronyms, STP (sewage treatment plant), POTW (publicly owned treatment works), WWTP (wastewater treatment) and WPCP.

Water Pollution: The presence in water of enough harmful or objectionable material to damage the water's quality.

Water Quality Criteria: Levels of water quality expected to render a body of water suitable for its designated use. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

Water Quality Standard (WQS): State or federal law or regulation consisting of a designated use or uses for the waters of the United States, water quality criteria for such waters based upon such uses, and an antidegradation policy and implementation procedures. Water quality standards protect the public health or welfare, enhance the quality of water and serve the purposes of the Clean Water Act. Water Quality Standards may include numerical or narrative criteria.

Water Quality: The biological, chemical, and physical conditions of a waterbody. It is a measure of a waterbody's ability to support beneficial uses.

Water Quality-Based Limitations: Effluent limitations applied to discharges when mere technology-based limitations would cause violations of water quality standards.

Water Quality-Based Permit: A permit with an effluent limit more stringent than technologybased standards. Such limits may be necessary to protect the designated uses of receiving waters (e.g., recreation, aquatic life protection).

Waterbody Inventory/Priority Waterbody List (WI/PWL): The WI/PWL incorporates monitoring data, information from state and local communities and public participation. The Waterbody Inventory portion refers to the listing of all waters, identified as specific individual waterbodies, within the state that are assessed. The Priority Waterbodies List is the subset of waters in the Waterbody Inventory that have documented water quality impacts, impairments or threats.

Waterbody Segmentation: Implementation of a more systematic approach to defining the bounds of individual waterbodies using waterbody type, stream classification, hydrologic drainage, waterbody length/size and homogeneity of land use and watershed character as criteria.

Waterfront Revitalization Program (WRP): New York City's principal coastal zone management tool. As originally adopted in 1982 and revised in 1999, it establishes the city's policies for development and use of the waterfront and provides the framework for evaluating the consistency of all discretionary actions in the coastal zone with those policies. When a proposed project is located within the coastal zone and it requires a local, state, or federal discretionary action, a determination of the project's consistency with the policies and intent of the WRP must be made before the project can move forward.

Watershed Approach: A coordinated framework for environmental management that focuses public and private efforts on the highest priority problems within hydrologically-defined geographic area taking into consideration both ground and surface water flow.

Watershed: A drainage area or basin that drains or flows toward a central collector such as a stream, river, estuary or bay: the watershed for a major river may encompass a number of smaller watersheds that ultimately combined at a common point.

Weir: (1) A wall or plate placed in an open channel to measure the flow of water. (2) A wall or obstruction used to control flow from settling tanks and clarifiers to ensure a uniform flow rate and avoid short-circuiting.

Wet Weather Flow: Hydraulic flow conditions within a combined sewer system resulting from a precipitation event. Flow within a combined sewer system under these conditions may include street runoff, domestic sewage, ground water infiltration, commercial and industrial wastewaters, and any other non-precipitation event related flows. In a separately sewered system, this type of flow could result from dry weather flow being combined with inflow.

Wet Weather Operating Plan (WWOP): Document required by a permit holder's SPDES permit that optimizes the plant's wet weather performance.

Wetlands: An area that is constantly or seasonally saturated by surface water or groundwater with vegetation adapted for life under those soil conditions, as in swamps, bogs, fens, marshes, and estuaries. Wetlands form an interface between terrestrial (land-based) and aquatic environments; include freshwater marshes around ponds and channels (rivers and streams), brackish and salt marshes.

WI/PWL: Waterbody Inventory/Priority Waterbody List

WLA: Waste Load Allocation

WPCP: Water Pollution Control Plant

WQS: Water Quality Standards

WRP: Waterfront Revitalization Program

WWOP: Wet Weather Operating Plan

WWTP: Wastewater Treatment Plant

Z

Zooplankton: Free-floating or drifting animals with movements determined by the motion of the water.

APPENDIX A

WET WEATHER OPERATING PLAN
HUNTS POINTS WPCP

City of New York
Department of Environmental Protection

WP-56, Hunts Point WPCP Wet Weather Operating Plan

July 2003

URS

Mack-Cali Centre II
Mack Center Drive
Paramus, NJ 07652

Storage\chack\hp wwpc cover 7.15.03.cdr

Hunts Point Water Pollution Control Plant
Bronx, New York

Wet Weather Operating Plan for Maximizing Treatment of Wet Weather Flows at the Hunts Point Water Pollution Control Plant

Prepared for:
The New York City Department of Environmental Protection
Bureau of Environmental Engineering

Prepared by: URS Corporation

7/14/03

July 15, 2003 10980425 (32333)

Keith Mahoney
Project Manager
Division of Water Quality Improvement
Bureau of Environmental Engineering
NYC Department of Environmental Protection
96-05 Horace Harding Expressway, 4th Floor
Corona, NY 11368

Re: **WP-56, Hunts Point WPCP**
Letter of Transmittal
Final Wet Weather Operating Plan

Dear Mr. Mahoney:

We are pleased to transmit thirty (30) copies of the final Wet Weather Operating Plan for the Hunts Point WPCP. This report provides recommendations for maximizing treatment of wet weather events during construction, and is a requirement of the Nitrogen Control Administrative Order on Consent.

Very truly yours,

URS Corporation

John J. Chack, P.E.
Senior Project Manager

JJC:lr
Enclosures

cc: BEE: Taffe, Osit
HQ: Grey
URS: Geran (6)

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SECTION 1

INTRODUCTION

1.0 Introduction

One effective strategy to abate pollution resulting from CSOs is to maximize the delivery of flows during wet weather to a wastewater treatment plant for processing. Delivering these flows would maximize the use of available wastewater treatment plant capacity for wet weather flows and would ensure that combined sewer overflow would receive at least primary treatment prior to discharge. To implement this goal, New York State requires the development of a Wet Weather Operating Plan (WWOP) for collection systems that include combined sewers. This requirement is one of 13 Best Management Practices (BMPs) that New York includes in the SPDES permit requirements of plants with Combined Sewer Overflows (CSOs). This particular provision has been included in consideration of the Federal CSO policy that mandates maximization of flow to Publicly Owned Treatment Works (POTWs).

The Nitrogen Administrative Order on Consent, DEC Case # CO2-2001O131-7 (the "Order" entered into by the City of New York ("City") and the New York State Department of Environmental Conservation ("DEC") was effective as of April 22, 2002. Pursuant to Appendix A: Upper East River WPCPs Upgrade Schedule and Compliance Deadlines, the City must submit a Wet Weather Operating Plan (WWOP) for the Hunts Point Water Pollution Control Plant (WPCP) by July 20,2003. The WWOP shall describe procedures to maximize treatment during wet weather events while the Hunts Point WPCP is under construction. This shall be accomplished by having the WWOP specify procedures for the operation of unit processes to treat maximum flows, without materially diminishing effluent quality or destabilizing treatment upon return to dry weather operation. The WWOP will establish process control procedures and set points to maintain stability and efficiency of Biological Nutrient Removal (BNR) Processes. The WWOP will specify the treatment facilities that will be available at each WPCP during the construction period, as identified in the Hunts Point plan. The WWOP shall be based on operations of process units that are available during the construction period operated at the peak hydraulic loading rate. The actual process control set points will be established by the WWOP. Upon completion of construction, the WWOP shall be revised to reflect the operation of the fully upgraded Facility. The revised WWOP for Hunts Point shall be submitted to DEC within 18 months of the completion of the construction of the Facility.

This document contains the WWOP for the Hunts Point WPCP operation during construction. The implementation of these plans will help the City to improve treatment of sewage during wet weather events, and will allow them to demonstrate compliance with the State and Federal BMP requirements.

1.1 Background

The Hunts Point Water Pollution Control Plant (WPCP) is located in the Hunts Point section of the Bronx, New York, on the shore of the upper East River **(**see **Figure 1-1).** The Hunts Point WPCP treats wastewater from a combined sewage collection system which serves a population of approximately 600,000 and which drains stormwater flow from an area of almost 16,000 acres.

The Hunts Point plant began operation in 1952, with a design average flow capacity of 120 mgd. The plant was expanded in capacity in 1962 to 150 mgd, and again in the 1970's to its current design average dry weather flow capacity of 200 mgd. The upgraded plant was designed to provide primary treatment and chlorination to wet weather peak flow of twice design average dry weather flow (400 mgd), and secondary treatment to 1.5 times average dry weather flow. In the 1990's, a sludge Dewatering Building was constructed at the plant under the City –Wide Sludge Management Program.

The Hunts Point WPCP design average dry weather flow capacity is 200 mgd. In fiscal year 2000, flow to the plant averaged 121 mgd. The trend of actual influent flow to the plant has been downward over the past several years, from 148 mgd in the early 1990's when the Hunts Point Stabilization began, to 121 mgd in 2000. The average readings from temporary meters installed under Task 8 (of the additional facility planning phase of the Hunts Point Interim Plant Upgrading) corroborated the plant operating records.

The Long Island Sound Study determined that a 58.5% load reduction of nitrogen discharge is necessary to meet the water quality standards in the western Long Island Sound. In response to this study, The New York State Department of Environmental Conservation (NYSDEC) modified New York City's Water Pollution Control Plants (WPCPs) State Pollutant Discharge Elimination System (SPDES) permits to reduce their allowable nitrogen discharge, thereby initiating nitrogen control actions. The Nitrogen Control Order or Consent requires completion of construction of a Step BNR Upgrade at the Hunts Point WPCP by June 30th ,2007.

The Step BNR process will be operated at a higher sludge age, which will require a higher aerator effluent SS concentration and higher solids load on the final settling tanks. During storms, solids may be washed out of the final clarifiers because of the higher solids loading and deeper sludge blanket. The BNR treatment process must be protected against such high wet weather flows due to the constraints on the secondary-clarifier solids separation capability.

MAP SOURCE:
USGS 7.5 MINUTE SERIES
TOPOGRAPHIC QUADRANGLE
MAP OF CENTRAL PARK, N.Y.

0 2000 4000
SCALE IN FEET

URS

WP–56 HUNTS POINT WPCP
PLANT UPGRADE

SITE LOCATION MAP

FIGURE 1

Time: 4:31 P.M. Date: 5/11/2001 PCDJJP Drawing File: H:\32333\PHASE2\PREL_DESN_RPT\FIG1.dwg

Maximum design wet weather flow to the plant is 400 mgd. The design maximum flow to secondary treatment is 1.5 times average flow, or 300 mgd. In order to protect the secondary BNR treatment process during storms, the secondary bypass system at Hunts Point will be designed with the capability to limit the peak flow to secondary treatment to 1.3 x DDWF, or 260 mgd. The design maximum capacity of the bypass system will be 140 mgd, or 0.7 time design average flow. This figure is referenced from Table 5.2 of the March 30th , 2001 Citywide Comprehensive Nitrogen Management Plan: Revised Interim Plant Upgrade Guidance Technical Memorandum. The table indicates that the maximum flow through the BNR System for Hunts Point is recommended to be 1.2 x DDWF + plant recycles or a total of 1.3 DDWF, the remaining flow would be diverted as Secondary Bypass Flow. Peak wet weather flow to secondary treatment should be reduced below 1.5 x DDWF only if problems develop with the BNR process and nitrogen effluent limits are not being met

Another design objective developed to protect the BNR process includes the diversion of excess wet weather flow to Pass C of the Aeration Tank during wet weather events. This operational procedure is outlined further on in this manual under Section 2.6 Aeration Tanks.

1.2 Drainage Area

The Hunts Point regulation system is comprised of fifteen regulator stations (twelve of which incorporate tide gate chambers) and two independent tide gate chambers. A typical regulator consists of one or more float controlled sluice gates which regulate the flow to the interceptors.

During dry weather the sluice gate is wide open to admit all sanitary flow. During storms each sluice gate is positioned to maintain a predetermined sewage depth downstream of the gate. Excess flow is discharged to tidal waters directly or through tide gates. In addition to the fifteen regulators, the City Island pumping station has an associated regulator. This regulator is controlled by wet well level in the pump station.

There are fifteen pumping stations located in the Hunts Point WPCP Drainage Area. Of these, twelve pump combined sewage; the remaining three pump storm water only. The following **Tables 1-1, 1-1A & 1-1B** list the regulators, outfalls and pump stations for the Hunts Point WWTP drainage area. **Figure 1-2** is a schematic diagram of the wastewater collection system for the Hunts Point Drainage Area.

Table 1-1 Regulator Locations				
Regulator No.	**Regulator Location**	**Outfall Location**	**SPDES No.**	**Outfall Size**
	Hunts Point		**NY0026191**	
1	E 177th St. s/o Tierney Pl.	E. 177th St. & Eastchester Bay	022	8'-0"x 8'-0"
2	Ivy Pl. s/o Pennyfield Ave.	Pennyfield Ave. & East River	021	6'-3'x6'-6"
2A	Oak Ave. s/o Chaffee Ave.	Throgs Neck Blvd. & East River	020	8'-0'x6'-6"
3	Calhoun Ave. s/o Schurz Ave.	Calhoun Ave., & East River	019	7'-0'x5'-6"
4	Brush Ave., & Bruckner Blvd.	Bruckner Expwy & Westchester Creek	016	10'-0"x9'-6"
5	White Pl. Rd. s/o River Ave.	White Plains Rd. & East River	011	DBL 13'-0"x9'-0"
6	White Pl. Rd. & O'Brian Ave.	White Plains Rd. & East River	011	DBL 13'-0"x9'-0"
7	Leland Ave. & O'brian Ave.	White Plains Rd. & East River	011	DBL 13'-0"x9'-0"
8	Truxton St. & Oakpoint Ave	Truxton St. & East River	025	11'-6"x7'-3"
9	Tiffany St. & East Bay Ave.	Tiffany St., & East River	022	12'-0"x8'-2"
9A	Tiffany St. & Viele Ave.	Tiffany St., & East River	002	12'-0"x8'-2"
10	Hunts Point Ave & Ryawa Ave.	Faragut St. & East River	003	DBL 12'-0"x9'-5 3/4"
11	Emerson Ave. & Schurz Ave.	Emerson Ave. & East River	017	14'-0"x8'-0"
12	Robinson Ave. & Schurz Ave.	Robinson Ave. & East River	018	48" Diam.
13	Metcalf Ave. & Soundview Park	Metcalf Ave. & East River	009	14'x0"x8'-0"
14	Edgewater Park	Ellsworth Ave. & East River	026	9'-0"x9'-0"
15	Conners St e/o Hutchinson Ave.	Conners St e/o Hutchinson River	023	12'-0"x6'-6"
15A	E 233rd St. & Boston Post Rd.	E233rd St. & Hutchinson River	024	12'-6"x10'-0"
CSO	Bayshore Ave. & Griswold Ave.	Outlook Ave. & Eastchester Bay	028	12" Diam.
CSO	Watt Ave. & East chester Bay	Watt Ave. & Eastchester Bay	029	15" Diam. , 12" Diam.
CSO	Barkley Ave. & Shore Drive	Barkley Ave. & Eastchester Bay	030	15" Diam.
CSO	Balcom Ave. & Latting St.	Latting St., & Westchester Creek	015	4'-9"x4'-0"
CSO	Waterbury Ave., & Zerera Ave.	Lafayette Ave., & Westchester Creek	012	12'-0"x9'-0"
CSO	Barrett Ave. & Lacombe Ave.	Newman Ave. & Pugsley's Creek	013	10'-6"x8'-0"
CSO	Metcalf Ave. & Watson Ave.	Lacombe Ave. & Bronx River	010	9'-0"x6'-0"
CSO	Randell Ave. & Metcalf Ave.	Lacombe Ave. & Bronx River	010	9'-0"x6'-0"
CSO	Lafayette Ave. & Colgate Ave.	Lafayette Ave. & Bronx River	008	54" Diam.
CSO	Van Buren St. & Bronx Park Ave.	E. 177th St. & Bronx River	007	DBL 11'-6"x6'-6"
CSO	E. 177th St. & Bronx Park Ave.	E. 177th St. & Bronx River	007	DBL 11'-6"x6'-6"
CSO	Potters Place & Waterbury Ave.	Westchester Ave. & Eastchester Bay	027	12" Diam.
CSO	West Farm Rd. e/o East Tremont Ave.	West Farm Rd. & Bronx River	004	12'-0"x8'-0"
CSO	Eastchester Rd. & Waters Place	East Tremont Ave. & Westchester Creek	014	14'-0"x8'-6"
CSO	Morris Park Ave. & Eastchester Rd.	East Tremont Ave. & Westchester Creek	014	14'-0"x8'-6"
CSO	178th St. & Boston Rd.	West Farm Rd. & Bronx River	004	12'-0"x8'-0"
CSO	Pelham Pkway & Bronx Park East	E. 177th St. & Bronx River	007	DBL 11'-6"x6-'6"
CSO	Hollers Ave. Pump Station	Holler Ave & Hutchinson River	005	12" Diam.
Overflow	Co-op City (South) Pump Sation	Bartow Ave. & Hutchinson River	006	15'-0"x8'-6"
Overflow	Co-op City (North) Pump Sation	Bellamy Loop North & Hutchinson River	031	72" Diam.
Overflow	Rikers Island (North) Pump Station	Pump Station & East River	032	14" Diam.

Source: New York City Regulator Improvement Program, April 1985

Table 1-1A Regulator Weir Elevations						
Reg. No.	**Regulator Location**	**Outfall Location**	**SPDES No.**	**Sluice Gate Size (W x H)**	**Weir Length**	**Weir Elevation**
	Hunts Point		**NY0026191**			
1	E 177th St. s/o Tierney Pl.	E. 177th St. & Eastchester Bay	022	18" x 12"	9' 2"	-5.00
2	Ivy Pl. s/o Pennyfield Ave.	Pennyfield Ave. & East River	021	30" x 30"	8'-0"	-4.77
2A	Oak Ave. s/o Chaffee Ave.	Throgs Neck Blvd. & East River	020	-	-	-
3	Calhoun Ave. s/o Schurz Ave.	Calhoun Ave., & East River	019	12" x 12"	8'-0"	-2.88
4	Brush Ave., & Bruckner Blvd.	Bruckner Expwy & Westchester Creek	016	30" x 30"	8'-10"	-4.50
5	White Pl. Rd. s/o River Ave.	White Plains Rd. & East River	011	18" x 12"	26'-0"	-4.50
6	White Pl. Rd. & O'Brian Ave.	White Plains Rd. & East River	011	(2) 72" x 48"	8'-0"	-5.00
7	Leland Ave. & O'brian Ave.	White Plains Rd. & East River	011	36" x 30"	8'-9"	-2.35
8	Truxton St. & Oakpoint Ave	Truxton St. & East River	025	24" x 24"	9'-0"	-2.92
9	Tiffany St. & East Bay Ave.	Tiffany St., & East River	022	48" x 36"	12'-0"	-3.60
9A	Tiffany St. & Viele Ave.	Tiffany St., & East River	002	-	4'-0"	-2.33
10	Hunts Point Ave & Ryawa Ave.	Faragut St. & East River	003	(2) 36" x 30"	15'-0"	-3.65
11	Emerson Ave. & Schurz Ave.	Emerson Ave. & East River	017	18" x 18"	16'-6"	-4.00
12	Robinson Ave. & Schurz Ave.	Robinson Ave. & East River	018	12" x 12"	4'-0"	-2.72
13	Metcalf Ave. & Soundview Park	Metcalf Ave. & East River	009	36" x 30"	21'-0"	-5.00
14	Edgewater Park	Ellsworth Ave. & East River	026	-	-	-
15	Conners St e/o Hutchinson Ave.	Conners St e/o Hutchinson River	023	30" x 24"	14'-0"	-4.50

Source: New York City Regulator Improvement Program, April 1985

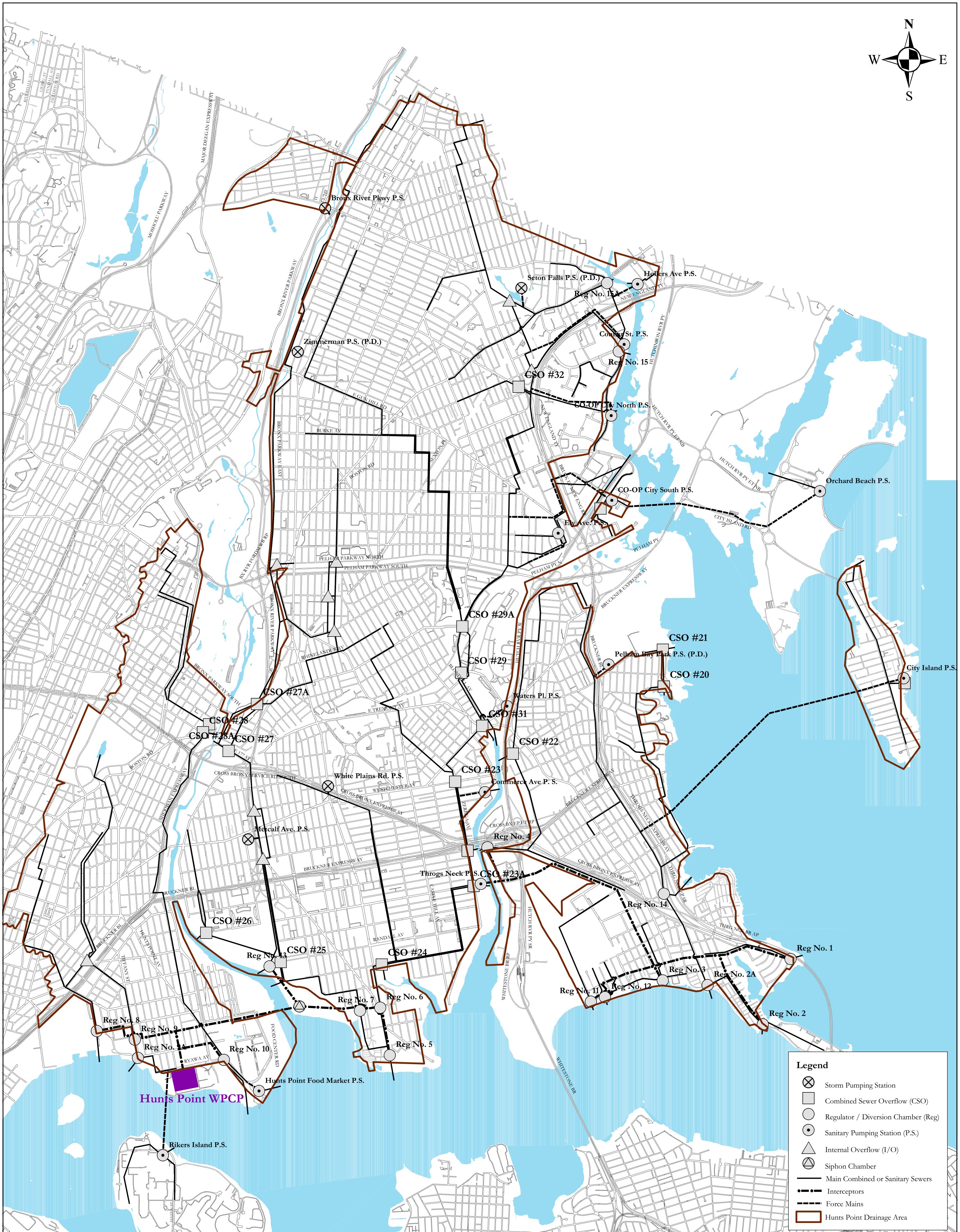
Table 1-1B

Pump Station within Hunts Point WPCP Tributary Area

Name	Location	No. Pumps	Pump Size
A. Storm Water			
Metcalf Avenue P.S.	Metcalf Ave. & Gleason St.	3	7000 gpm
White Plains Road P.S.	Cross Bronx Exp. & White Plains Rd.	3	7000 gpm
Seton Park P.S.	Marolla & Pratt Aves. (NYC Pks. & Rec.)	N/A	N/A
Bronx River Pkwy	South of 233rd Street	2	1430 gpm
B. Sanitary / Combined			
Hollers Ave. P.S.	Eastchester Creek & Hollers Ave.	2	610 gpm
Conners St. P.S.	Conners St. & Eastchester Creek	3	4000 gpm
Co-op City North P.S.	Co-Op City Blvd.	3	5600 gpm
Co-op City South P.S.	Co-Op City Blvd. & Einstein Loop	3	2620 gpm
Throgs Neck P.S.	Zerega & Lafayette Avenues	3	13,600 gpm
Ely Ave. P.S.	Ely & Waring Ave.	3	540 gpm
Commerce Ave. P.S.	Commerce, Seabury & Ellis Aves.	2	850 gpm
Hunts Point Market P.S.	Rywawa Ave. and Hunts Point Ave.	4	900 gpm
Pelham Bay Park P.S.	Pelham Bay Park (NYC Pks. & Rec.)	2	N/A
City Island P.S.	Schofield St. & City Island Blvd.	3	1800 gpm
Orchard Beach P.S.	Orchard Beach	2	600-1000 gpm
Rikers Island North P.S.	Rikers Island Oppos. Auto Mainten. Bldg.	2	1000 gpm
Waters Place P.S.	Bronx Occupational Training Center	2	N/A
Hart Island P.S.	Hart Island (No longer in use)	N/A	N/A
Zimmerman P.S.	Britton Olinville & Barker Aves. (NYC Pks. & Rec.)	2	N/A

N/A - Not Available

Source: Hunts Point I/I Analysis Report, December 1986



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URS Corporation
Hunts Point WPCP Drainage Area Map
Wet Weather Operating Plan

FIGURE 1-2

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1.3 Wet Weather Flow Control

Original design of the collection system assumed that when it was necessary to limit flow to the plant, the regulators should be used in preference to throttling the plant inlet gates. Throttling at the inlet gates surcharges the interceptors which in turn may cause deposition behind the gates or produce damaging velocities through the inlet gates and into the screen units located just downstream.

Under Phase I of the upgrading, a new forebay gate chamber is being constructed in Ryawa Avenue to improve throttling of wet weather flows to the plant. The new forebay gate chamber is located far enough upstream from the influent bar screens to eliminate problems with high velocity flow impinging on the screens. The plant's headworks and main sewage pump station are also being upgraded under Phase I to ensure that the plant can reliably accept and treat two times design dry weather flow (DDWF), as required by the Omnibus IV Consent Decree.

1.4 Wastewater Treatment Plant Description

Wastewater treatment at the plant consists of screening, primary settling, step aeration activated sludge, final settling and chlorination with sodium hypochlorite. The existing aeration tanks have been retrofitted with the basic Step BNR (Biological Nutrient Removal) process to provide an intermediate degree of nitrogen removal. Sludge treatment consists of cyclone degritting of primary sludge, gravity thickening of combined waste activated and primary sludge, anaerobic digestion and centrifuge dewatering. Sludge from other DEP plants is transported to the plant by vessel and is stored and dewatered along with the Hunts Point plant's sludge. Centrate from the sludge dewatering facility is recycled through the plant, which adds a significant nitrogen load on the plant. Sludge cake, grit, scum and screenings are removed from the plant by truck for disposal to an off-site facility. The capacities of the unit processes at the existing Hunts Point plant are shown in **Table 1-2.**

Table 1-2 Unit Process Capacities			
Process Equipment	**Number of Units in Service**	**Maximum Plant Influent Flow / MGD**	**Maximum Secondary Treatment Flow / MGD**
Screens	1 Primary & 2 Secondary Screens	133	
	2 Primary & 3 Secondary Screens	267	
	3 Primary & 4 Secondary Screens	400	
Main Sewage Pumps* **	1 Pump	70	
	2 Pumps	140	
	3 Pumps	210	
	4 Pumps	280	
	5 Pumps	350	
Primary Settling Tanks	1 Tank	140	
	2 Tanks	220	
	3 Tanks	300	
	4 Tanks	370	
	5 Tanks	400	
	6 Tanks	400	
Aeration Tanks	1 West Tank		60
	2 West Tanks		120
	3 West Tanks		180
	4 West Tanks		240
	1 East Tank		300
	2 East Tanks		300
	Total Design Capacity *		300
Final Settling Tanks**	West Tanks Numbered 31 thru 34, 41 thru 44 51 thru 54 & 61 thru 64		12 tanks @ 9.1 mgd each
	West Tanks Numbered 35, 45, 55 & 65		4 tanks @ 3.2 mgd each
	North & South Tanks 10, 20, 70, & 80		4 tanks @ 14.6 mgd each
	East Tanks 91 thru 96		6 tanks @ 23.4 mgd each
	Total Capacity, All Tanks in Service		320 MGD
Chlorine Contact Tanks	1 Tank		330 MGD
	2 Tanks		400 MGD

*One east tank is used for centrate treatment.

**Maximum capacity based on maximum overflow rate of 1,200 gpd/sf.

***Indicates reduced capacity of existing pumps due to wear; to be increased to 100 mgd per pump under the plant upgrade.

Plant Upgrading

Construction of the plant upgrading has been divided into multiple phases. The proposed master site plan of the plant is shown in **Figure 1-3.** Phase I of the plant upgrading for the Hunts Point WPCP will include installation of facilities to improve the plant's overall wastewater treatment process reliability and operation. The schedule for Phase I includes a milestone under the Omnibus IV Consent Decree to complete construction of all facilities required to treat 2X DDWF (400MGD) by October 31st, 2004. The proposed Phase I improvements include the following:

Phase I, Wastewater Treatment Facilities Improvements:

- Main Building improvements including new forebay gate chamber, screen chamber modifications, new main sewage pumps, personnel facilities expansion, new centralized residuals handling facilities with odor control, new boiler room, secondary screen replacement and architectural repairs.
- Primary sludge and degritting system, including primary sludge pump and piping replacement, architectural repairs to Primary Sludge Pump Stations, and degritting equipment replacement.
- Aeration system upgrade, including replacement of the foam spray system, new froth chlorination hoods and architectural repairs to Aeration Buildings.
- Chlorination system improvements, including replacement of hypochlorite feed and storage equipment, new fill station spill containment, CCT sludge and floatables removal equipment, and architectural repair of the Chlorination Building.
- Return Activated Sludge Pump, Waste Activated Sludge Pump and East Effluent Pump replacements, new RAS Control Room and VFDs, and upgrade of the east effluent pump station.
- New Scum Processing System, including new scum removal equipment in primary and final settling tanks, six new scum pumping stations, and a new centralized scum concentration system.
- Site work improvements, including raw sewage conduit modifications, city water service loop replacement, new site security booth, new handrails, paving and landscaping.
- All associated controls and instrumentation, electrical HVAC, and plumbing work.

Phase II, Step BNR Facilities:

Phase II of the plant upgrading will include improvements required to enhance nitrogen removal as required by the plant's State discharge permit and the Nitrogen Order of Consent. The milestone date for completing the step BNR facilities is June 30th , 2007. The proposed Phase II improvements include the following:

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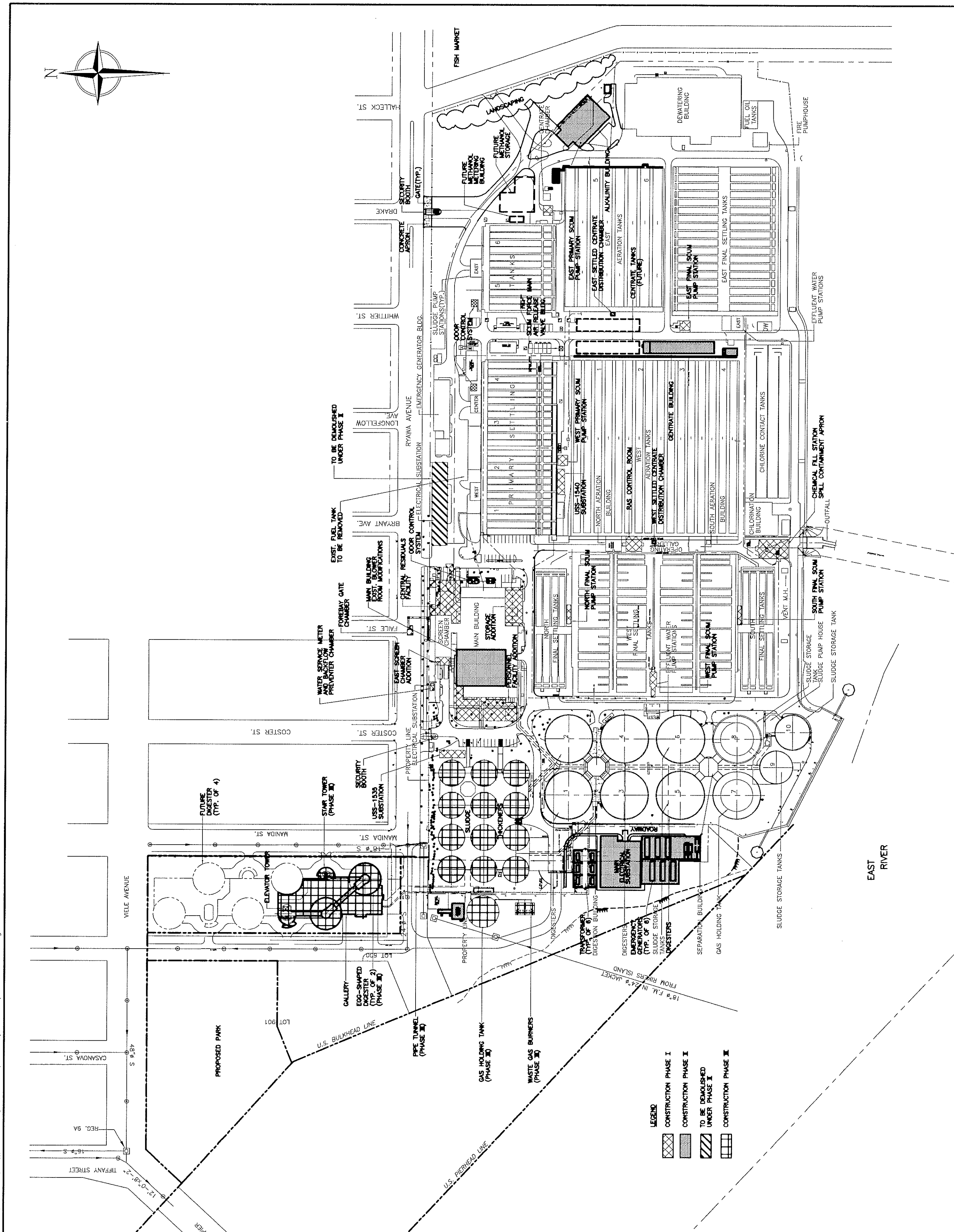


URS

WP-56 HUNTS POINT WPCP
PLANT UPGRADE

PROPOSED MASTER SITE PLAN

- Process air system improvements including new blowers, silencers, air filters, and diffusers.
- New channel air system including blowers, filters, silencers, piping, and diffusers.
- Aeration tank improvements, including new anoxic mixers, baffles, and motor operated influent gates.
- New alkalinity feed and storage facility.
- New centrate pumping and distribution facilities
- Associated instrumentation and control systems, including automatic DO control, flow monitoring and control systems, and ammonia, nitrate, and pH analyzers.

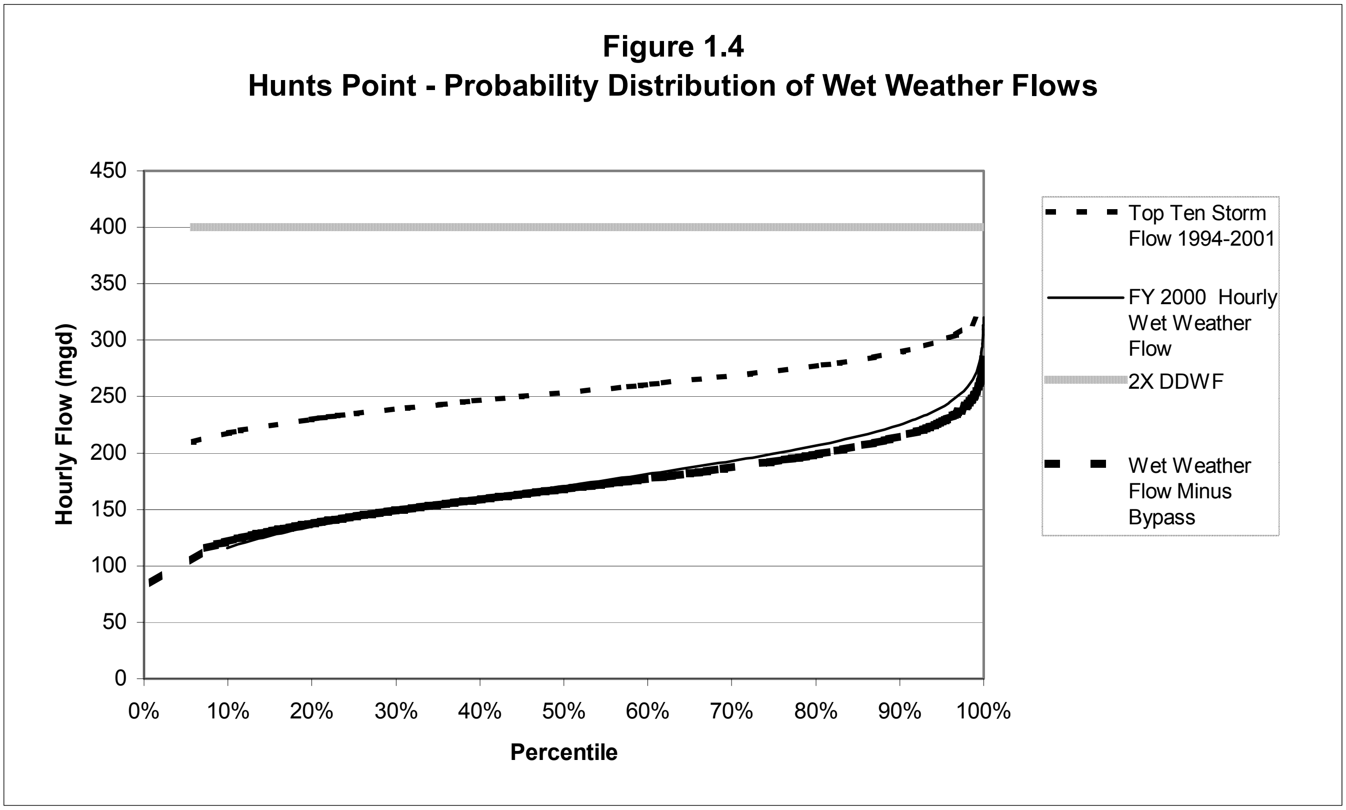
New main electrical substation and emergency generators

1.5 Observed Wet Weather Treatment Capacity

An analysis was performed for the top ten storms of the year for the Hunts Point WPCP. These storms are sufficient to produce CSO's; therefore, the plant should be at its maximum wet weather capacities during these events.

Figure 1.4 shows a statistical plot of the Top Ten Storm Data (1994 through 2001) including a plot of hourly flow data for Fiscal Year 2000. This was done to determine how the near-term operations (hourly) compare with the long-term operations (Top Ten Storm Data). It would be expected that there would be some peak hourly data that exceeds the Top Ten Storm data because the Top Ten Storm data is based on sustained peak flows lasting 3 to 4 hours or more. This however is not the case. The statistical distribution demonstrated in Figure 1.4, indicates that the plant handled flows since 1994 as high as 327 MGD (peak Top Ten Storm) and 320 MGD (peak hourly). This difference at the extreme end of flows is only 7 MGD at the extreme end, but diverges significantly as the percentile range decreases.

The average by-pass flow for the Fiscal year 2000 during wet weather events is approximately 29 MGD over four hours or ten percent of the average peak hourly flow rate for the same data set. This means that roughly 90% of the wet weather influent received full secondary treatment.



The review of the Hunts Point WPCP operating data indicates that wet weather flows have not caused any excursions in effluent quality or any permit compliance violations. This suggests that the plant has capacity to accept additional wet weather flow. The flow analysis suggests an observed wet weather capacity of 320 MGD.

The Hunts Point WPCP currently cannot meet 2 x DDWF (400 mgd) because of limitations to the plant headworks and main sewage pump station (examples include throttling and/or influent gate controls, screening operations, pump capacity, and grit/sludge handling capacities) which is not outlined in the performance data. The limitations to plant facilities will be corrected under Phase I of the plant upgrading. Until Phase I construction is complete, the plant will not be capable of treating 2 x DDWF. Even after Phase I is complete, removal of tanks from service during Phase II construction will impact the plant's secondary treatment capacity.

1.6 Performance Goals for Wet Weather Events

The goal of this Wet Weather Operating Plan is to maximize treatment of wet weather flows at the Hunts Point WPCP and, in doing so, reduce the volume of untreated CSO being discharged to the Long Island Sound and its tributaries. The Hunts Point WPCP will be maintained in continuous operation by the NYCDEP during the entire construction period of the stabilization contracts. The major operating requirements include:

- The minimum acceptable level of treatment at the plant throughout the duration of the construction period shall be secondary treatment and disinfection.
- Dewatering and trucking of sludge, screenings, scum and grit, and the delivery of chemicals and fuel oil shall proceed throughout the duration of the Contract.

There are three primary objectives in maximizing treatment for wet weather flows:

1. Consistently achieve primary treatment and disinfection for wet weather flows up to 400 MGD. In doing so this the plant will satisfy the SPDES requirement of providing this level of treatment for 2 xDDWF.

2. Consistently provide secondary treatment for wet weather flows up to 300 MGD before bypassing the secondary treatment system. The plant will have the ability to provide a secondary level of treatment for 1.3 x DDWF (an amount adjusted downward from the original goal of 1.5 x DDWF). A lower volume treatment configuration will be instituted if needed in order to maintain and protect the Step BNR Process which is more susceptible to wet-weather shock loads. This scenario is in accordance with the recommendations of the Comprehensive Nitrogen Management Team found in their March 2001 Refined Plant Upgrading Guidance Technical Memorandum.

3. Do not appreciably diminish the effluent quality or destabilize treatment upon return to dry weather operations. (This objective ties into the previous goal of protecting the dry weather Step BNR operation by providing secondary treatment for 1.3 x DDWF.)

1.7 Purpose of This Manual

The purpose of this manual is to provide a set of operating guidelines to assist the Hunts Point WPCP staff in making operational decisions which will best meet their performance goals and the requirements of the SPDES discharge permit. During a wet weather event, numerous operational decisions must be made to effectively manage and optimize treatment of wet weather flows. Plant flow is controlled through influent pump operations and adjustment of regulators. Flow rates at which the secondary bypass is used are dependant upon a complex set of factors, including conditions within specific treatment processes (such as sludge settling characteristics) and anticipated storm intensity and duration. Each storm event produces a unique combination of flow patterns and plant conditions. No manual can describe the decision making process for every possible wet weather scenario which will be encountered at the Hunts Point WPCP. This manual can, however, serve as a useful reference which both new and experienced operators can utilize during wet weather events. The manual can be useful in preparing for a coming wet weather event, a source of ideas for controlling specific processes during the storm, and a checklist to avoid missing critical steps in monitoring and controlling processes during wet weather.

1.8 Using the Manual

This manual is designed to allow use as a reference during wet weather events. It is broken down into sections that cover major unit processes at the Hunts Point WPCP. Each protocol for the unit processes includes the following information:

- List of unit processes and equipment covered in the section
- Steps to take before a wet weather event and who is responsible for these steps
- Steps to take during a wet weather event and who is responsible for these steps
- Steps to take after a wet weather event and who is responsible for these steps
- Discussion of why the recommended control steps are performed
- Identification of specific circumstances that trigger the recommended changes
- Identification of things that can go wrong with the process

This manual is a living document. Users of the manual are encouraged to identify new steps, procedures, and recommendations to further the objectives of the manual. Modifications which improve upon the manual's procedures to maximize treatment of wet weather are encouraged. With continued input from the plant's experienced operations staff this manual will become a useful and effective tool.

1.9 Revisions to This Manual

In additions to revisions based on plant operating experience, this manual will also be revised as modifications and stabilizations are made to the collection system and the Hunts Point WPCP that affect the plants ability to receive and treat wet weather flows. Applicable changes are listed as follows:

- **Regulator Automation**- Under DEP's SCADA system project, automatic control of the regulators will be provided to plant operators. Control strategies for these regulators should be incorporated into this manual in the future after automation is complete. Currently, Regulator HP-6 has an existing remote control system which has been in operation for over five years. Approximately one-third to one half of the rainfall in the sewer system is controlled by Regulator HP-6. The plant has experienced problems with signal telemetry between the regulator and the plant.

- **Throttling Gate Automation**- A new forebay gate chamber with a new gate actuated by a hydraulic cylinder will be installed under Phase I of the plant upgrading. The objective of the Forebay throttling gate system is to automatically throttle maximum flow into the plant to 400 MGD during wet weather conditions, and to prevent the level in the Afterbay channel from exceeding Elevation (-)8.00. The revisions to the operating procedure for the gate should be incorporated into this manual after automation is complete.

- **Step BNR Process**- The increased sensitivity of the Step BNR system to wet weather flows and possible upsets will have to be alleviated with possible process flow changes during wet weather. Increased monitoring of system components such as flow, dissolved oxygen, sludge blankets, froth etc will certainly be a part of the new flow train. The operation protocol for this type of treatment should be reviewed and revised as necessary and incorporated into this manual after completion.

- **Future Construction Phases-** Future construction phases may impact the operation of the plant and may require revisions to this manual.

SECTION 2
UNIT PROCESS OPERATIONS

This section presents equipment summaries and wet weather operating protocols for each major unit operation of the plant The protocols are divided into steps to be followed before, during and after a wet weather event that address the rational trigger mechanisms and potential problem areas for wet weather operations. A flow diagram of the plant headworks following completion of the plant upgrading is shown in **Figure 2-1.**

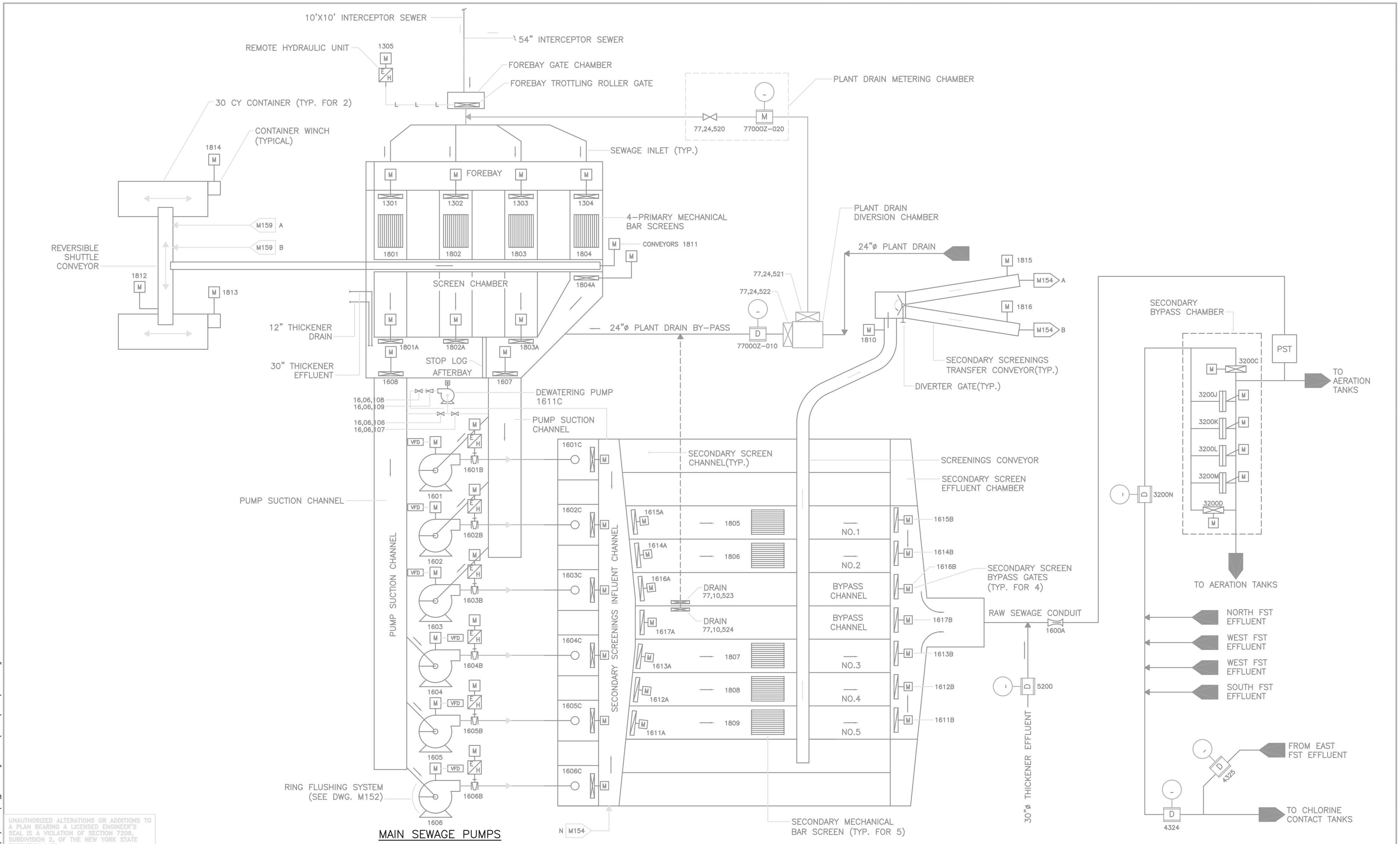
An analysis of Hunts Point wet weather flow performance has shown favorable results with respect to effluent quality at the high end of observed flows. Unfortunately the peak flow to the plant never reached NYS DEC's objective of 2 x DDWF. The FY 2000 data suggests that the first half of the year 2000 was an unusually low flow year. The Hunts Point WPCP cannot meet 2 x DDWF because of limitations with the headworks and main sewage pump station that include problems with: throttling and/or influent gate controls, screening operations, pumping capacity, or grit/sludge handling capacities. These limitations are being corrected under Phase I of the plant upgrading.

2.1 Throttling Gate

Forebay Chamber (Proposed)	
Number of Gates	1
Service	Throttling
Type Operator	Hydraulic Actuator

During the plant upgrading, a forebay gate chamber will be constructed without interrupting flow in the interceptor sewer. A cofferdam shall be installed inside the existing interceptor to anchor the roller gate frame to the conduit walls.

The objective of the future forebay throttling gate system is to automatically throttle flow into the plant when flows exceed 400 mgd during maximum wet weather conditions, and to prevent the level in the Afterbay channel from exceeding Elevation (-)8.00. To achieve both objectives the gate shall be controlled inversely proportional to the level in the Afterbay. The gate shall be fully open when the level in the Afterbay falls below Elevation (-) 10.5, and shall be at its lowest position when the level rises above Elevation (-)8.00. The closure of the gate is physically limited such that the gate cannot be lowered below a fixed elevation corresponding to the maximum wet weather flow of 400 mgd



UNAUTHORIZED ALTERATIONS OR ADDITIONS TO A PLAN BEARING A LICENSED ENGINEER'S SEAL IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.

NO.	DATE	ISSUED FOR	BY

DESIGNED —
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SECT. CHIEF —
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SCALE
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APPROVED FOR THE CITY OF NEW YORK
P.E. PROJECT MANAGER
P.E. CHIEF, DIVISION OF FACILITIES DESIGN NORTH

CITY OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL ENGINEERING
DIVISION OF FACILITIES DESIGN
WP-56 HUNTS POINT WPCP
INTERIM PLANT UPGRADE

CONTRACT NO.1G
STRUCTURES & EQUIPMENT
MECHANICAL

HEADWORKS
FLOW DIAGRAM

DATE
SHEET ___ OF ___
FIGURE 2-1

Time: 8:50 A.M. Date: 6/16/2003 pcdjlp Drawing File: H:\32333\WWOP\FIG.2-1.dwg entering the plant. Key hydraulic control elevations for the plant headworks are shown on **Figure 2-2**. The hydraulic elevations in the screen chamber shown on Figure 2-2 are the operating levels after Phase I of the upgrading is complete. These levels are higher than the current operating levels and can not be used until the existing primary bar screens are modified to prevent submergence of the bar screen drive motors.

Until the new forebay gate chamber is complete, wet weather flow to the plant will be throttled by the current practice of manually positioning the existing screen channel influent gates as described below. If the telemetry to Regulator 6 is operational, the gates at the regulator should be throttled before the screen channel influent gates are throttled.

Before Wet Weather Event

1. Gates should be in full open position during dry weather and prior to wet weather.
2. Check gate operation.

During Wet Weather Event

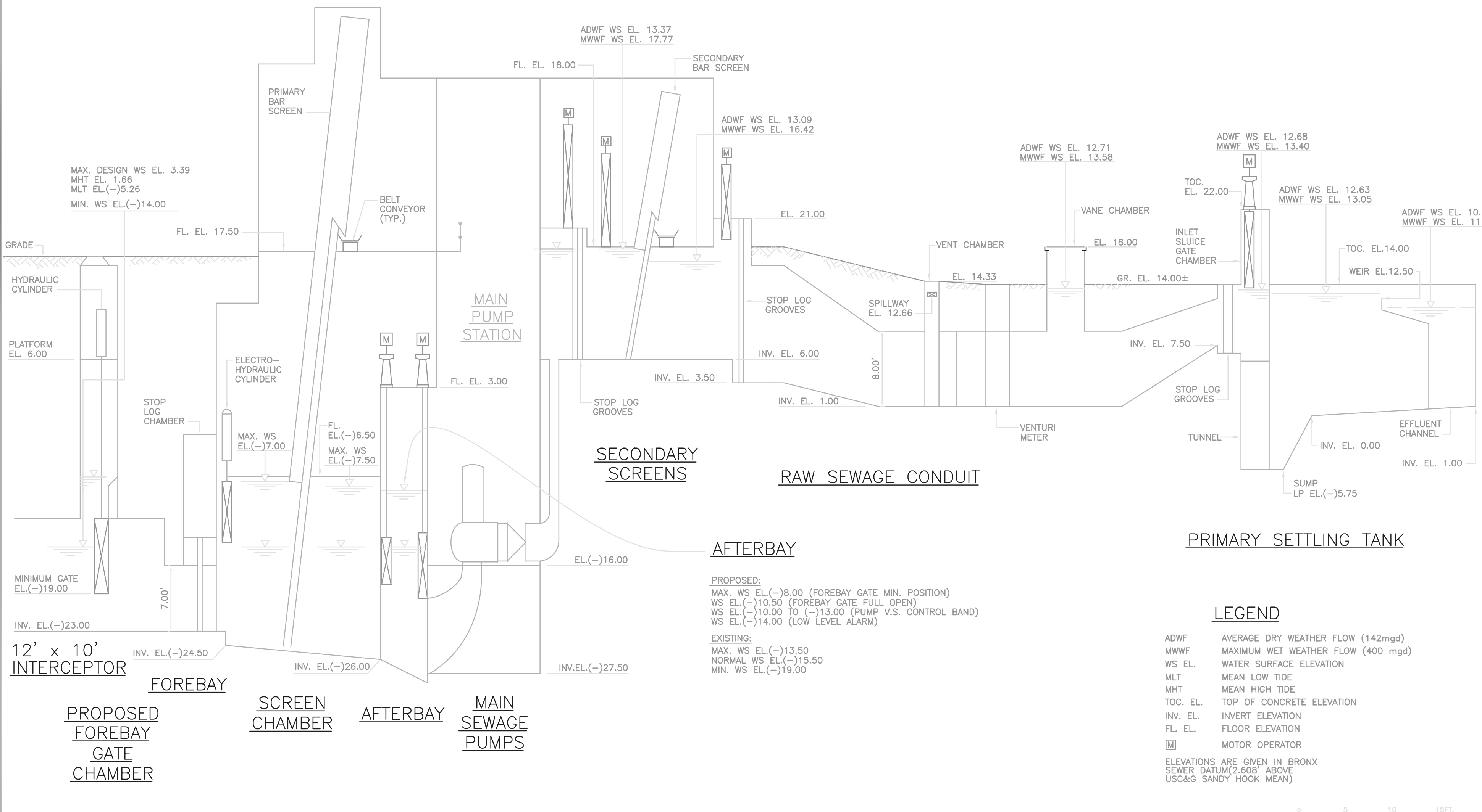
1. Leave gate in full open position until:
    a. plant flow approaches capacity of pumps in service or
    b. screen channel level exceeds acceptable level with maximum pumping, or
    c. bar screens become overloaded with screenings or
    d. grit removal exceeds the plants grit handling capacity
2. Set the gate to maintain acceptable wet well water level
3. Record all throttling gate adjustments on the Throttling Gate Log
4. As wet weather event subsides open the gate to maintain the wet well water level until the gate is completely open.

After Wet Weather Event

1. Make sure the throttling gate is in the full open position.
2. Conduct maintenance or repair of the throttling gate as necessary.

Why Do We Do This?

To regulate flow to the WWTP and prevent excessive flows from destabilizing plant performance.



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URS

WP-56 HUNTS POINT WPCP
PLANT UPGRADE
WET WEATHER OPERATING PLAN
HYDRAULIC PROFILE PLANT HEADWORKS

FIGURE 2-2

What Triggers The Change?

High water levels in the screen channels or other unacceptable plant conditions related to high flows.

What Can Go Wrong?

If the throttling gate is not operated when necessary, or fails to operate, high water levels in the wet well may result. Flooding of the screen chamber may occur. If the forebay gate fails to operate, flow to the plant should be manually throttled with the screen channel influent gates. If extreme high tide or storm surge conditions occur, the water level in the interceptor may exceed the maximum design water level of the throttling gate (EL. +3.39). If this occurs, the screen chamber influent gates should be throttled manually.

2.2 Wastewater Screening

The Hunts Point Plant has primary bar screens upstream of the main sewage pumps and secondary screens downstream. The following information and protocol apply to the existing screens. At the time of preparing this protocol the existing screens are being renovated. This protocol will be revised as appropriate when upgrading of the screens is completed. At design average conditions, approach velocities to the screens should be no less than 1.25 feet per second to prevent settling in the channel. The velocity through the bars should normally be no greater than 3.0 feet per second to prevent forcing material through the openings.

Screens	
Primary Screens	
Number of Units	4 units
Bar Openings	1"
Screen Channel Width (nominal)	8' - 0"
Screen Channel Invert Elevation @ Screen	(-)23.5'
Operating Lower Floor Elevation	(-)6.5
Operating Higher Floor Elevation	17' - 6"
Secondary Screens	
Number of Units	5 units
Bar Openings	1/2"
Screen Channel Width (nominal)	7'-0"
Screen Channel Invert Elevation @ Screen	6'-0"
Operating Floor Elevation	18' -0"

Secondary Screen Bypass Channel

Under the plant upgrading, existing channels will be modified to provide a bypass around the secondary screens to prevent flooding. The proposed secondary screen bypass channel operation will be designed to operate as follows: The screen channel bypass gates shall open on high influent channel level and an alarm shall sound. As wastewater in the screen influent channel reaches high level, both upstream and downstream gates in the LEAD channel shall open. If the water level does not drop after a certain time period, the gates in the LAG bypass channel will fully open for additional relief. A sustained drop in the wastewater level will cause the gates in the LAG and LEAD channels to close in reverse order. LEAD/LAG selector switches shall be provided on the process control panel. Alarms shall be sounded at the process control panel and the DCS. Gate position shall be transmitted to the DCS.

Before Wet Weather Event

1. During normal dry weather operations, operating experience will dictate the number of screens required based on parameters such as grit settling problems, and quantity of screenable material. General guides for number of primary and secondary screens in service for various flow ranges and the containers usage associated with the flow ranges during maximum and average conditions follows:

		Primary Screens			Secondary Screens		
	Flow, mgd	Number of Channels in Service	Flow per Channel, mgd	Approach Velocity, fps	Number of Channels in Service	Flow per Channel, mgd	Approach Velocity, fps
Minimum DWF	60	1	60	1.79	1	60	1.89
Current Average DWF	130	2	65	1.57	2	65	1.95
Daily Maximum DWF	170	2	85	1.64	2	85	2.43
Design Maximum DWF	300	3	100	1.93	3	100	1.98
Maximum WWF	400	3	133.3	2.58	4	100	1.96

2. Rotate screen operation to ensure that all available screens are in working order.
3. Make sure sufficient empty screenings containers are available. Additional empty containers should be kept on-site before weekends and large storms.

During Wet Weather Event

1. Put additional primary or secondary screens into operation.

2. Set all screen rakes to continuous operation.
3. Regulate the plant flow with the throttling gate if the screens become overwhelmed or the water elevation in the screen channel exceeds EL. -14.0 (or EL. -8.0 when Phase I upgrading is complete).
4. Remove and replace screenings containers as necessary.

After Wet Weather Event

1. Take extra screen out of operation. Return to two screens online.
2. Remove screenings for disposal.

Why Do We Do This?

Two primary screens can accommodate the plant design average dry weather flow of 200 mgd . Three primary screens are required to handle peak wet weather flows up to 400 mgd. This leaves the fourth screen on standby in case of a screen failure or excessive loadings. The same logic applies to the secondary screens except that there is an additional secondary screen so that the fifth can be left as standby.

What Triggers The Change?

Flows in excess of 267 mgd will require a third primary screen to be put online. Screen rakes will operate on time mode or if the head differential across the screens exceeds 2 to 4 inches. If this occurs the fourth screen should be put on line.

What Can Go Wrong?

1. If an insufficient number of screens are online the screen channel may surcharge above acceptable levels (EL. -14.0 currently; EL. -8.0 after Phase I upgrading is complete).

2. If screens clog with debris, the level in the screen channel may flood above acceptable levels. The influent gate to the clogged screen channel should be throttled to reduce flow. To clear an obstruction, the screen mechanism can be manually reversed and jogged forward. If the obstruction is not cleared by doing this, a standby screen channel should be placed in service, and the obstructed channel removed from service.

3. If an overload or other alarm condition occurs and the screen mechanism automatically stops, place a standby channel in service and attempt to determine the cause of the failure.

4. If the screening belt conveyors fail, the conveyor bypass chute should be installed, and screenings removed manually using 1¼ cu. yd. containers and a forklift truck.

2.3 Wastewater Pumping

At the time of preparing this protocol, the existing main wastewater pumps are being upgraded. The design capacity of the existing and proposed pumps are indicated in the following table. It should be noted that the impellers of the existing pumps are worn, and the existing pumps have an actual capacity of about 70 mgd per pump.

Wastewater Pumping		
	Existing	***Proposed***
Number of Pumps	6	6
Number of Standby Pumps	1	2
Type of Pump	Mixed flow Centrifugal pumps	Vertical, mixed flow pumps
Suction and Discharge Size, In.		42/48
Motor Horsepower/Type of Drive	600 Hp/WRM	800 HP/VFD
Maximum Speed , RPM		345
Minimum Speed, RPM		232
	Rating Point At Maximum Speed	
Flow, MGD	80	100
Head, Ft.	35	32.5

Before Wet Weather Event

1. Monitor afterbay elevation.
2. Number and speed of pumps in service are selected and manually adjusted by operator in the pump control room

3. Adjustments made based on maintaining the level in the screen chamber afterbay at a nominally constant level
4. Check that afterbay level monitors are functional.
5. If possible, prior to an anticipated wet weather event, draw down the interceptor by 1 to 3 feet

During Wet Weather Event

1. Monitor afterbay elevation.
2. As afterbay level rises put off-line pumps in service and increase speed of variable speed pumps as necessary
3. Pump to maximum available capacity during wet weather events.
4. All adjustments are made manually by operators in the pump control room based on maintaining a nominal reference level of -15.0 ft. +/- 6″ in the afterbay. The reference level was chosen to allow the most efficient operation of both the screening equipment and main pumps.
5. Restrict flow through influent screen gates if pumping rate is maximized and wet well level continues to rise (see influent gate operations)

After Wet Weather Event

1. Maintain pumping rate as required to keep wet well level in operating range.
2. If the influent gates have been throttled, maintain maximum pumping rate until all previously constricted influent gates are returned to fully open position and flow begins to decrease lowering wet well level.
3. Reduce pump speeds and number in service to maintain wet well level and return to dry weather operation. The operator will decrease pumping by 10 MGD if the afterbay level drops below -15.5 ft. After an interval of approximately 10 minutes, the level remains below –15.5 ft, the operator will again decrease pumping.

Why Do We Do This?

Maximize flow to treatment plant, and minimize need for flow storage in collection system and associated overflow from collection system into receiving water body.

What Triggers The Change?

High flows, and the subsequent increase in the level of the screen chamber afterbay.

What Can Go Wrong?

Pump fails to start. Pump fails while running. Screens blind, necessitating pump speed reduction or slowdown. Subsequent flooding of wet well and bar screen equipment.

2.4 Primary Tanks

The primary settling tanks are designed to effectively treat approximately 80 MGD each. If taking tanks out of service increases the flow to each tank above this amount, the primary settling effluent quality should be checked to avoid overloading and degradation of the secondary treatment process.

Number of Primary Settling Tanks in Service	Maximum Tolerable Flow Rate (Approx.)
6	432 MGD
5	432 MGD
4	370 MGD
3	300 MGD
2	220 MGD
1	140 MGD

Number of Tanks	4 Units - West Side	2 Units - East Side
Unit Dimensions (Ft)		
Length	168.0	
Width	108.5	
Sidewater Depth	12.0	
Total Weir Length (Ft)	3,822	
	Design Average	Design Peak
Overflow Rate (gpd/sf)	1,829	3,657
Weir Loading (gpd/lf)	52,389	104,657
Detention Time (Hr)	1.17	0.59

Before Wet Weather Event

1. Under normal operations all available primary tanks should be in service.
2. Check the flow balance to all tanks in service by looking at the effluent weirs.
3. Check the sludge collector operation and inspect tanks for broken flights.

4. Check for floating sludge or bubbles on the tank surface as an indication of sludge collector problems.
5. Check sludge pump operation.
6. Repair any malfunctions or equipment out of service.

During Wet Weather Event

1. Make sure one primary sludge pump per tank is on-line.
2. Watch water surface elevations at the weirs for flooding and flow imbalances.
3. Check the collector and drive operation.
4. Make sure grit flushers are operating.
5. Assign additional operators to grit handling if necessary.
6. Reduce flow (sewage pumps and throttling gate) if:
   a. Sludge cannot be withdrawn quick enough from the primaries,
   b. Grit accumulation exceeds the plants ability to handle it,
   c. A primary tank must be taken out of service and maximum tolerable flow rate is exceeded.
7. Postpone dewatering tanks until storm has subsided.

After Wet Weather Event

1. Take tanks out of service for repair or maintenance if necessary.
2. Remove floating debris and scum on the tanks.
3. Repair any failures.
4. Clean the effluent weirs if needed.

2.5 Secondary Bypass Channel

Secondary Bypass		
	Existing	***Proposed***
Bypass Channel	2 Bypass Control Sluice Gates	4 Weir Gates
Location of Sluice Gates	Chamber 1 North of Aeration Gallery	Chamber 1 North of Aeration Gallery

That portion of the primary settling tank flow which is in excess of the secondary treatment process capacity must be bypassed around secondary treatment. This bypass is performed in control chamber Number 1 by a motor operated bypass sluice gate. Under the plant upgrade, downward opening weir gates will be installed to improve control of secondary bypass flow. The bypass gates will automatically lower to limit flow to secondary treatment to 300 MGD (1.5 times DDWF).

Before Wet Weather Event

1. Conduct routine bypass gate preventative maintenance.
2. Check the bypass flow meter operation.

During Wet Weather Event

1. Open or lower the bypass gate to bypass channel to maintain a flow of 260 to 300 mgd to secondary treatment.
2. Open or lower the bypass gate if the primary clarifier weirs flood.
3. Open or lower the bypass gate to protect final clarifier blanket levels from going over the weirs.
4. During bypasses record the bypass flow rate on the Bypass Log.
5. Bypassed primary effluent flow will exert a higher chlorine demand than secondary effluent. Increase hypochlorite dose to maintain target residual.

After Wet Weather Event

1. As the plant flow drops and stays below 300 mgd close or raise the bypass gate.
2. Repair faulty equipment

Why Do We Do This?

1. To relieve flow to the aeration system and avoid excessive loss of biological solids.
2. To relieve primary clarifier flooding.

What Triggers The Change?

High blankets in final clarifiers, as well as primary and/or secondary treatment system flooding.

What Can Go Wrong?

If the bypass gate is not used properly the primary clarifiers may flood and secondary clarifier sludge blankets could rise and discharge large amounts of biological solids.

2.6 Aeration Tanks

During plant upgrade work only one aeration tank at a time may be taken out of service. The upgraded aeration tanks will require a higher air pressure than the existing tanks and can only be operated with the new process air blowers. The Contractor will coordinate the blower installation with the aeration tank upgrade.

Plant operations will attempt to maintain centrate nitrification in a separate aeration tank during construction. Centrate is currently being treated in Aeration Tank No. 5. The improvements to Aeration Tank No. 4 and the centrate pump station and distribution piping shall be completed and placed in service before Aeration Tank No. 5 is taken out of service for upgrading.

Aeration Tanks		
Number of Tanks	4 Units - West Side	2 Units - East Side
Unit Dimensions (Ft)	**West Side**	**East Side**
Length	438	355
Width	25	30
Number of Passes Per Tanks	4	4
Sidewater Depth	15	15

Before Wet Weather Event

1. During normal dry weather operations, at least 5 aeration tanks should be in operation, including one for centrate treatment.
2. The plant operates in a Step BNR feed mode with Inlets at the Head of Passes A, B, C, and D.
3. Check the dissolved oxygen levels and control the air flow to maintain greater than 2 mg/l in the oxic zones of the aeration tanks.
4. Monitor Filamentous Growth

During Wet Weather Event

1. Monitor the dissolved oxygen and adjust the air flow to maintain greater than 2 mg/l in the oxic zones.
2. During wet weather operations, all available aeration tanks should be in operation

After Wet Weather Event

1. Monitor the dissolved oxygen, and maintain greater than 2 mg/l dissolved oxygen in Oxic Zones.

Why Do We Do This?

The Hunts Point WPCP is hydraulically designed to convey peak flows up to 1.5 times the Design Dry Weather Flow (DDWF) through secondary treatment under typical operating conditions; however, the plant may not be able to maintain nitrogen removal under these conditions. The BNR treatment process can be protected against such high wet weather flows due to the constraints on the secondary clarifier solids separation capability by:

- Limiting the secondary treatment flow to 1.3 x DDWF with the balance bypassing the secondary system.
- After the installation of electric actuators at the aeration tank influent gates under Construction Phase II, pass configurations can be easily altered. During wet weather flows, flow configurations can be changed to Contact Stabilization Mode where all of the wet weather flow is diverted into Pass C (4- Pass System) in order to minimize the loss of the autotrophic organisms essential for BNR. BNR is more sensitive to biomass loss due to the relative low growth rate of the autotrophs.

What Triggers The Change?

Increasing speed and/or starting raw wastewater pumps to accommodate high wet weather flows.

What Can Go Wrong?

Potential impacts of wet weather events on the activated sludge process include:

- Loss of biomass from the aeration tanks and secondary clarifiers
- Overloading of the aeration system resulting from high BOD loadings caused by solids washout from the sewer system and solids washout from the primary clarifiers
- Decreased BOD and Nitrogen removal efficiency due to shortened hydraulic retention time in the aeration tanks.

Wet weather impacts on the activated sludge system can be corrected by decreasing the maximum flow to secondary treatment to 1.3 x DDWF.

The operator must be careful not to let the dissolved oxygen levels drop much below 2.0 mg/l in the Oxic Zones because this can adversely affect secondary treatment and nitrogen removal efficiency.

2.7 Final Clarifiers and Distribution

Minimum operating requirements for the settling tanks include that no more than one East Final Settling Tank, and one West, North or South Final Settling Tank may be taken out of service for construction at a time.

Final Settling Tanks			
	North-South Tanks	**East Tanks**	**West Tanks**
Number of Units	4	6	16/4
Sidewater Depth (Ft)	12.5	12.1	14
Unit Dimensions LxW (Ft)	300 x 40.5	325 x 60	
Unit Dimensions LxW (Ft) West Tanks No. 31-34, 41-44, 51-54 & 61-64			94.5 x 80
Unit Dimensions LxW (Ft) West Tanks No. 35, 45, 55 & 65			94.5 x 28.5

Before Wet Weather Event

1. During normal dry weather operation all available final clarifiers should be in service.
2. Check the telescoping valves for plugging. Free any plugged valves.
3. Observe blanket levels, tank surface.
4. Skim tanks as necessary.
5. Check the flow balance to all tanks in service by looking at effluent weirs.
5. Normal operation is to set the RAS rates to maintain a minimal sludge blanket

During Wet Weather Event

1. Balance flow to the tanks to keep the blanket levels even.
2. Observe the clarity of the effluent and watch for solids loss.
3. Monitor the sludge blanket levels.
4. If necessary, increase the RAS/WAS rate to maintain low blanket levels.
5. Open the secondary bypass if:

a. Secondary treatment flow exceeds 300.
b. Sludge blankets rise to within 6 feet of the effluent weirs.
c. Secondary clarifier weirs are flooded.

After Wet Weather Event

1. Modify the sludge wasting based on MLSS levels.
2. Close the secondary bypass when flow drops below 300 mgd.
3. Observe the effluent clarity.
4. Monitor the secondary clarifier blanket levels.
5. Skim the clarifiers if necessary.

Why Do We Do This?

High flows will substantially increase solids loadings to the clarifiers which may result in high clarifier sludge blankets or high effluent TSS. These conditions can lead to loss of biological solids which can destabilize treatment efficiency when the plant returns to dry weather flow conditions.

What Triggers The Change?

Rising sludge blankets that cannot be controlled.

What Can Go Wrong?

Excessive loss of TSS will reduce the biomass inventory of the plant which will adversely affect secondary treatment efficiency when the plant returns to dry weather flow conditions.

2.8 Chlorination

Chlorination System		
Number of Contact Tanks	2	
Number of Bays Per Tank	2	
Hypochlorite Storage Tanks	5	
Total Capacity Hypochlorite Tanks	60000	
Detention Time - Minutes	**2 Tanks in Service**	**1 Tank in Service**
Design Average Flow, 200 mgd	32	16
Dry Weather Maximum, 300 mgd	22	11
Peak Weather Maximum, 400 mgd	16	8

Due to foaming problems at the chlorine contact tanks the overflow weirs were lowered to Elevation +1.00 from Elevation +3.00 to create a smoother flow and less agitation. Unfortunately this solution to the foaming problem created another problem with respect to flooding the effluent weirs when the tide surpasses Elevation +1.00.

Hydraulic computer modeling indicates that the weirs of the upstream final settling tank will be flooded under the following conditions:

- Tide elevation +1.66 (Mean High Water)
- One chlorine contact tank is out of service
- Aeration Tank No. 5 used for centrate treatment
- Plant influent flow exceeds 330 mgd

Influent flow to the plant should be throttled under these conditions to avoid submerging the final settling tank weirs.

Proper chlorine disinfection relies on exposure time to adequately disinfect secondary effluent. Excessive solids in secondary effluent resulting from high flows can hinder disinfection. In spite of the potential for reduced effectiveness, it is preferable to send as much flow through the disinfection units as possible to achieve some level of disinfection. Recommendations for maximizing chlorine disinfection efficiency during high flows include:

- Experiment with chlorine dosage at high flows. Adequate kills may be achievable at detention times of less that 15 minutes with the proper chlorine dosage.
- Optimize chlorine mixing. Poor mixing will greatly reduce chlorination effectiveness.

During construction, when one chlorine contact tank will be taken out of service, the capacity of the plant to pass peak weather flows will be severely restricted as indicated above. Contract stipulations that stem from this construction activity include:

- Two chlorine contact tanks shall be maintained in service during the summer bathing season from May 15th to September 30th
- And all improvements to the chlorine contact tanks shall be completed prior to completion of the upgrading of the main wastewater pump station to 400 mgd capacity.

Before Wet Weather Event

1. Both chlorination tanks must be in service between May 15th and September 30th
2. Normal operation is to maintain hypochlorite storage tanks full during the construction period. The Contractor shall provide access for sodium hypochlorite deliveries to the Chlorination Building at all times.
3. Make sure there are sufficient chlorine residual test kit supplies.
4. Report problems immediately
5. Perform preventative maintenance on equipment if necessary

During Wet Weather Event

1. Check, adjust and maintain the Hypochlorite feed rates to maintain the target chlorine residual. Chlorine demand will increase as primary effluent bypass flow increases.
2. Increase the chlorine residual measurement frequency up to an hourly reading.
3. Check and maintain the Hypochlorite tank levels.

After Wet Weather Event

1. Drop the Hypochlorite feed rates as needed to maintain the chlorine residual.
2. Maintain the Hypochlorite tank levels.
3. Repair equipment as necessary.

Why Do We Do This?

Hypochlorite demand will increase as flow rises and secondary bypasses occur. Increase the Hypochlorite feed rates to maintain the target chlorine residual.

What Triggers The Change?

High flows and secondary bypasses will increase Hypochlorite demand and usage.

What Can Go Wrong?

Manual chlorination control with rapid flow changes and effluent quality changes can cause the chlorine residual to increase or decrease dramatically. Effluent chlorine residual must be monitored closely to maintain the target residual.

2.9 Sludge Thickening, Digestion and Storage

Sludge Dewatering and the tracking of sludge, screenings, scum and grit shall proceed unimpeded throughout the duration of the Stabilization Contracts.

Sludge Thickening Digestion and Storage

	Design Condition	Present Condition
Sludge Thickeners		
Installed	12	12
Operating	10	6
Anaerobic Sludge Digesters		
No. of Units	4	4
No. of Units Operating	4	3
Sludge Storage		
No. of Storage Tanks	5	5
Storage Capacity (Days)	20	35
Sludge Dewatering		
No. of Centrifuges	13	13
Unit Capacity	300	300

During Wet Weather Event

1. Sludge handling activities should proceed as they normally would during dry weather flow. A major component of the plant return stream is centrate which is related to dewatering operations.
2. Balance-Water flow to the thickeners can also be reduced before any changes in sludge wasting are made.

SECTION 3
PROPOSED PLANT UPGRADING

The Hunts Point WPCP is undergoing a major upgrading. Construction of the plant upgrading has been divided into phases. Phase I of the Plant Upgrading will include installation of facilities to improve the plant's overall wastewater treatment process reliability and operation. The schedule for Phase I includes a milestone under the Omnibus IV Consent Decree to complete construction of all facilities required to treat two times DDWF (400MGD) by October 31st, 2004. Phase II of the Plant Upgrading will include improvements required to enhance nitrogen removal as required by the plant's State discharge permit and the Nitrogen Order of Consent. The milestone date for completing the Step BNR facilities is June 30th, 2007. The upgrading of the plant's solids handling systems is included under Phase III of the project.

This section summarizes the major improvements implemented under the Plant Upgrading.

3.1 Influent Throttling, Screening and Main Sewage Pumping

A new throttling gate chamber will be constructed in the existing plant forebay to improve the control of influent flows to the plant. The forebay gate chamber will be constructed without interrupting flow in the interceptor sewer. The existing primary bar screens, Main Sewage Pumps, and secondary screens will be taken out of service one unit at a time for upgrading.

The original capacity of the six Main Sewage Pumps at Hunts Point was 80 mgd per pump. Due to wear on the pump impellers and other components, the current capacity of the Main Sewage Pumps is 65 to 70 mgd per pump. This limits the plant wet weather tyeatment capacity to about 325 mgd. Under the plant upgrading, the existing pumps will be replaced with new pumps with a unit capacity of 100 mgd. This will allow pumping of the design plant wet weather peak flow (400mgd) with two pumps out of service in accordance with standard NYCDEP "n+1+1" design policy. The net positive suction head requirements for the new Main Sewage Pumps will require that the existing screen channels be operated with a higher water depth. The existing bar screen mechanisms will be modified to prevent submergence of the bar screen drive motors while operating with a higher channel water level.

3.2 Primary Settling Tanks

The number of primary settling tanks will remain at 6. The scum and grit handling systems will be upgraded, and scum and grit will be directed to a new central residuals building. The building will contain new scum concentrators, cyclone degritters, grit washers, and container handling systems. New vanes will be installed in the raw sewage conduit to improve the distribution of grit and solids to the primary settling tanks. The primary influent channel will be covered and exhaust air treated with activated carbon to control odors.

3.3 Aeration Tanks

The number of aeration tanks will remain at 6. One aeration tank is currently dedicated for centrate nitrification, and plant operations will attempt to maintain separate nitrification of centrate during construction. The upgrade of the aeration tanks includes installation of new blowers and diffusers to allow the plant nitrogen loads to be completely nitrified. The tanks will have anoxic/oxic switch zones constructed to allow the flexibility of changing the aerobic volume for nitrification. New submersible mixers will be installed in the anoxic zones. Automated gates will be installed to allow automatic diversion of peak storm flows to pass C to protect the biomass and prevent the washout of nitrifiers. Operation of the Step BNR process may require bypassing of the secondary process at flows less than 300 mgd (1.5 times DDWF). New downward opening weir gates are being installed that will increase the bypass channel capacity to allow the peak flow to secondary treatment to be limited to 260 mgd (1.3 times DDWF). This will be done if necessary if nitrification is lost following storms as determined from actual operating experience. New hypochlorite froth spray hoods, spray water piping, and a selective froth wasting system will be installed in the aeration tanks to control froth. The existing aeration tanks and blowers will be upgraded one unit at a time.

3.4 Final Settling Tanks

The number of final settling tanks will remain at 30. The improvements to the existing final settling tanks will include an upgrade of the scum removal system, new baffles to reduce short-circuiting, and new motor operated influent gates. No more than three tanks will be taken out of service at a time for upgrading.

3.5 Effluent Disinfection

The two existing chlorine contact tanks will be upgraded to reduce short-circuiting, improve mixing efficiency, and increase the accuracy of flow measurements. Hypochlorite feed systems will be upgraded to include hypochlorite feed to aeration tank froth control hoods, scum and froth wells, and RAS chlorination.

3.6 RAS and WAS Systems

The existing RAS and WAS pumps will be replaced with new pumps with variable speed drives with the capacity to return 100% of the DDWF. New motor operated telescoping valves will be installed to control the withdrawal of return sludge from the final settling tanks, and new RAS and WAS flow meters will be installed.

3.7 Alkalinity Building

A new Alkalinity Building will be constructed to house the systems to feed sodium hydroxide to the aeration tanks to enhance nitrification.

3.8 Centrate System

A new centrate pump station will be constructed to improve the distribution of centrate to the aeration tanks. The centrate pumping station will also house new channel air blowers.

3.9 Gravity Thickening

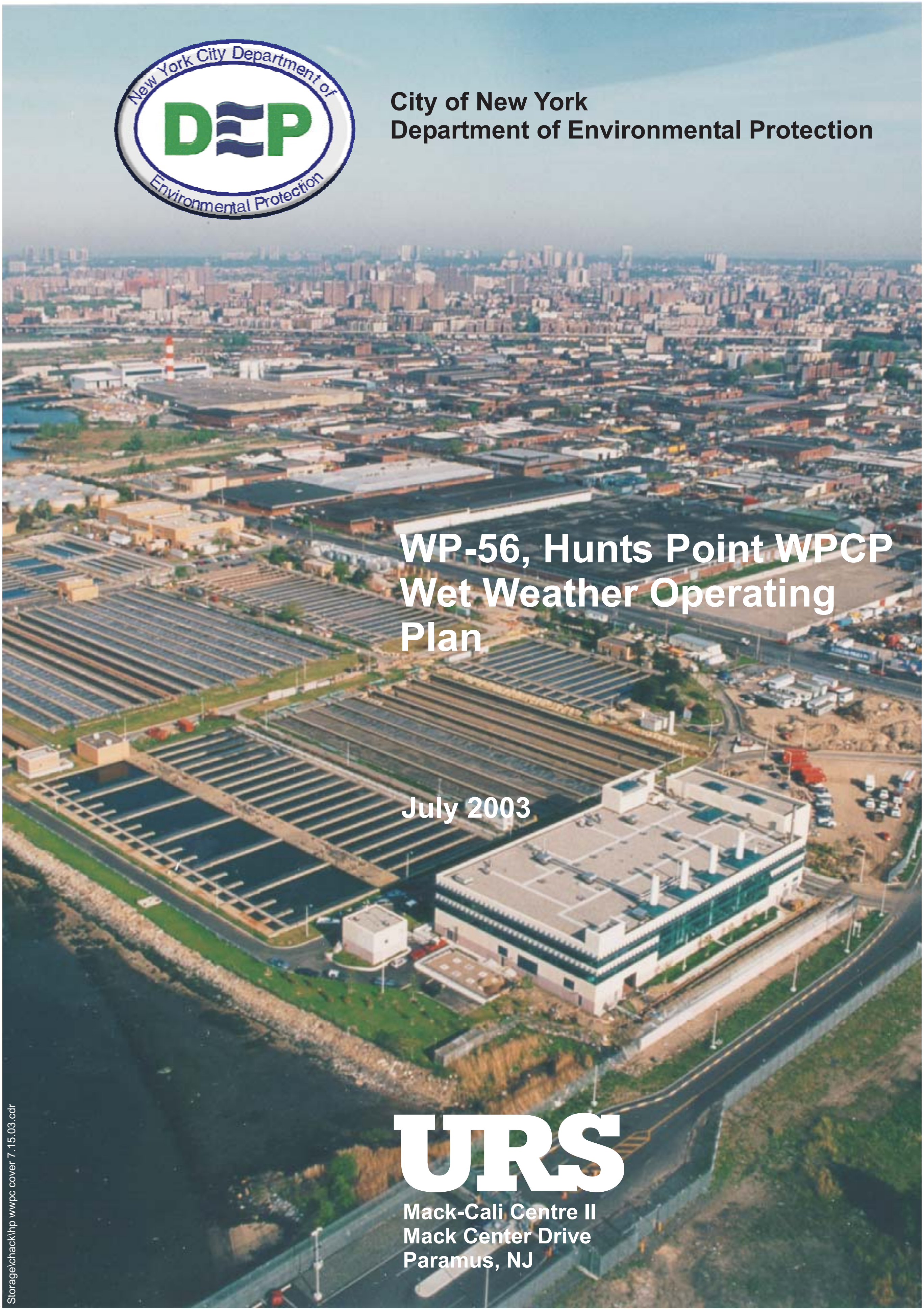
Under Phase III of the upgrading, which is currently under design, ten of the twelve existing gravity thickeners will undergo a complete rehabilitation, including new sludge collection mechanisms, thickened sludge pumps, valves, and piping. Polymer will be added to the gravity thickeners to improve the capture of solids and reduce recycled BOD and TKN loads on the main wastewater flow.

3.10 Sludge Digestion and Storage

Under Phase III of the upgrading, two new egg-shaped digesters will be constructed. The new egg-shaped digesters would be operated in conjunction with the existing conventional digesters in a two-stage mesophilic configuration designed to meet PSRP requirements. Improvements will be made to the four existing digesters, including reconstruction of roofing, sealing of steel liner plates, and modifications to overflow boxes. A new Wiggins gasholding tank and three new high efficiency enclosed digester waste gas flares will be constructed. The five existing sludge storage tanks will be renovated and reused.

3.11 Main Electrical Substation

A new Main Electrical Substation building will be constructed. Six new electrical feeders will be installed to power the new process air blowers and other plant loads. Six new emergency generators will be installed to power essential plant equipment during electrical power failures.



City of New York
Department of Environmental Protection

WP-56, Hunts Point WPCP Wet Weather Operating Plan

July 2003

URS
Mack-Cali Centre II
Mack Center Drive
Paramus, NJ

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APPENDIX C

STAKEHOLDER MEETING MINUTES

Westchester Creek and Hutchinson River Stakeholder Team
Meeting No. 1
September 6, 2006

The first Hutchinson River and Westchester Creek Stakeholder team meeting of the Long Term Control Plan (LTCP) of the NYC Department of Environmental Protection (DEP) was held on September 6th at Bronx Community Board 10, 3165 E. Tremont Avenue. The purpose of the meeting was to introduce the LTCP for Combined Sewer Overflow (CSO) and discuss the implications for the Hutchinson River and Westchester Creek.

Virginia Gallagher and Kenneth Kearns, chair and district manager of Community Board 10, welcomed everyone. Mark Klein, Chief, Division of Water Quality Improvement, introduced the DEP staff, including Chris Villari and Fred Edmond. Introductions were made around the room. Stephen Whitehouse of Starr Whitehouse, the consultant coordinating public participation for the project, opened the meeting. He said the meeting would be introductory and that later meetings will focus on developing abatement alternatives. Stephen added that a city-wide stakeholder group is looking at CSO issues in the harbor and asked for a nominee for that committee.

Stephen began by explaining what a CSO is and showed a map of CSOs in New York. He then described the regulatory process that has led to the current LTCP project. In 2004, a Consent Order between NYS Department of Environmental Conservation and the DEP committed the City to a schedule of CSO abatement projects and set out the specific process and schedule for the LTCP. Part of the Consent Order stipulated that $1.5M of DEP funds be transferred to the State's Natural Heritage Trust for the environmental benefit projects. The Consent Order stipulates the completion of specific projects, including CSO holding tanks at Flushing Creek and Paerdegat Basin. Several stakeholders asked to visit the Flushing Tank, in order to familiarize themselves with tanks in the case that they receive one in their area. There were several questions concerning the construction of the tank, which took 8 years and is now close to completion. The stakeholders asked for information on peripheral construction, the size of the site, and the holding capacity of the tank for the next meeting.

Next, Tim Groninger of Hazen and Sawyer introduced Westchester Creek, a tributary to the Upper East River and its drainage area, which is served by Hunts Point WPCP collection system. He said that there were no sanctioned bathing beaches, endangered species habitat, or shellfish harvesting on the creek (sensitive areas per federal CSO policy). One stakeholder asked for an explanation of the sewage collection system. Tim described how the flow from local pipes goes into the interceptor main. In the case that there is particularly large volume, due to a storm event, the overflow is released at specific locations.

Tim described the waterbody uses, fishing and boating, and went over the shoreline uses, including industrial, commercial, institutional, parkland, and residential. Several stakeholders expressed frustration with the EDC, which is working to maintain industrial uses in the corridor, while the area is currently undergoing a conversion to residential use. Representatives from Community Board 9 added that the area was already residential in part and that quality of life issues, including waterfront access, beautification, and disruption caused by construction, are particularly important. He added that he was interested in seeing wetlands restoration and protection. Representatives from Community Board 10 voiced concern with the condition of Ferry Point Park West. Various stakeholders spoke about construction-related traffic concerns and emphasized that quality of life and traffic disruption issues should be considered while formulating the plan. One stakeholder suggested inviting EDC to the next meeting.

Tim showed pictures of the different land uses of Westchester Creek. He reviewed the CSO-related water quality issues, primarily high bacteria but also dissolved oxygen; odors and visible impairment; and floatable and settleable debris. One stakeholder said that dog droppings and outfalls in Westchester County have a detrimental effect on water quality in the creek. Tim showed pictures of the CSO outfalls and spoke about ongoing DEP initiatives to improve capture of stormwater and water quality. These include improvements to the Hunts Point WPCP, sentinel monitoring which documents discharges from Yonkers, identifying illegal sanitary hookups, and street sweeping. Tim mentioned that the Waters Place storage facility is just one among many alternatives under consideration.

A stakeholder asked how the LTCP will impact flooding during heavy rain. Tim answered that flooding occurs in the local system and the LTCP will likely not have an impact.

A stakeholder spoke about the effort to designate the Thomas Pell Wildlife Sanctuary as a protected wetlands and stated that the community was very interested in wetlands.

Angie Essner, of Greeley and Hansen, introduced the Hutchinson River. Like Westchester Creek, there are no sensitive areas per federal CSO policy. Stakeholders added that the Parks Department considers the Hutchinson to be an important site for wetlands and habitat for menhaden and bluefish.

Angie showed a map of historic infill, pictures of the different conditions along the river banks, and pictures of the outfalls. She also located the two main public access points, at Coop City North and Co-Op City South. One stakeholder expressed concern for the lack of access. A stakeholder asked whether a conduit, previously under consideration, would be constructed under Coop City Boulevard. Angie answered that the plan for the storage conduit under the street was no longer being considered and that a variety of alternatives were being analyzed including other types of storage and these would be discussed in future meetings as the plan is developed. Several stakeholders stated that they did not want any alternatives that would be constructed in the streets.

Stephen Whitehouse wrapped up, presenting the next steps of the process. There will be at least two additional meetings, the next covering the water quality modeling and proposed alternatives and the last presenting the costs and benefits of each alternatives.

The end result will be a Waterbody/Watershed plan that will be submitted to state by June 2007. When DEC approves the plan, it will become a LTCP and will be enforceable. He then opened the floor for discussion.

- One stakeholder asked about water sampling program for the development of the plan. Tim responded that additional sampling took place last summer and that the results of this effort would be presented at the next meeting.

- Another stakeholder wanted to know about efforts to monitor Westchester County and expressed frustration that the City is held to regulatory standards while inheriting Westchester's water quality problems. The consultant team described the seven advisory committees in Westchester that make up the Long Island Sound advisory board, which oversee water quality issues in Westchester.

- A stakeholder asked about DEP construction that he observed on September 4th at Bellamy and Coop City Boulevard. Fred Edmond, of DEP, said he would look into it.

- The community boards asked for the address of the Natural Heritage Trust. The consultant team clarified that DEP has no ongoing role relative to the Natural Heritage Trust's administration of grants for environmental benefit projects. They also expressed to have a Community Center incorporated into the plan like how the Center was built in conjunction with the Flushing Tank.

- A stakeholder asked what DEP is doing to encourage water conservation. Fred Edmund replied that, on the consumer end, there are a number of programs including low flush toilets and a water survey program for residents and for businesses, could be encouraged through incentives, such as a voucher system. Stakeholders expressed interest in Best Management Practices (BMPs), which reduce the volume of stormwater going into the combined sewers. Several stakeholders were very interested in seeing BMPs develop into a program. Stephen spoke about efforts in Jamaica Bay to determine a credible model of the effect of BMPs that will enable DEP to evaluate the performance of these alternatives. He added that BMPs may incrementally provide water quality benefits, but that the focus of the LTCP is to achieve compliance consent order requirements on a fixed schedule. He stated DEP was investigating BMPs and in conjunction with other City agencies on a separate track

The next meeting of the stakeholder team was set for Thursday, October 26th, subsequently confirmed.

Westchester Creek and Hutchinson River Stakeholder Team
Meeting No. 2
October 26, 2006

The second Hutchinson River and Westchester Creek Stakeholder team meeting of the Long Term Control Plan (LTCP) of the NYC Department of Environmental Protection (DEP) was held on October 26th at Bronx Community Board 10, 3165 E. Tremont Avenue. Mark Klein of NYC DEP opened the meeting. He stated that the goal of the Long Term Control Plan project was to bring the waterbodies in question into compliance. A stakeholder said that the group had been informed previously that a CSO retention tank may be constructed in the area and asked whether other alternatives were being considered. Mark said that a number of alternatives, apart from the tank, are being considered and evaluated.

Next, Stephen Whitehouse, Starr Whitehouse, reviewed notes from the last meeting, including the policy framework of the Long Term Control Plan. Stephen said that the result of the process would be an enforceable plan that will bring the Westchester Creek and Hutchinson River in compliance with their water quality classifications. The group reviewed the questions put to the project team at the end of the last meeting. Fred Edmond, DEP, said that construction observed on December 4th near Co-op City was regular maintenance. Stephen Whitehouse said that the information for the disbursal of the Natural Heritage Trust funds by the State was still not available. In response to a discussion at the last meeting about water conservation, the project team spoke about a number of different programs, including green roofs and catch basin replacements. Stephen said that DEP is actively investigating these measures, which are referred to as low impact developments (LIDs). DEP is looking particularly to how LIDs work on the scale of a watershed. This project is on a different time frame from the LTCP. DEP is also collaborating with the Mayor's Office of Long Term Planning and Sustainability on this issue. The stakeholders did not propose changes to the notes. Stephen invited the stakeholders to attend the Open Waters stakeholder group, a city-wide group which is looking at the Open Waters, which include the Harbor, and the Hudson, Harlem and East Rivers. Several Stakeholders expressed interest in attending.

Next, Angela Essner of Greeley and Hansen, discussed water quality sampling programs in the Hutchinson River. She said that water quality sampling tests were completed for dissolved oxygen, pathogenic bacteria, and oxygen consuming chemicals, among other things. She showed graphs of historical trends in dissolved oxygen (DO) in Eastchester Bay and the East River. Angie noted that there has been an upward trend since 1972. She reviewed the Hutchinson River drainage area and outfalls, pointing out the active overflows: HP-023, HP-024, and HP-031. She also reviewed the historical Harbor Survey sampling locations on the Hutchinson River. This survey began at the beginning of the 20th century and is one of the longest running water quality sampling programs in the country. She pointed out the sampling locations where data was collected for the LTCP project in 2005. Angie added that NYCDEP and Westchester County were discussing collaborating on sampling efforts, responding to a question from the previous meeting. Next, she showed the fecal and total coliform concentrations in the river and stated the Hutchinson River was listed for low DO. One stakeholder asked whether the fish in the Hutchinson are edible and stated that, when she was growing up in the area, people ate crabs, eels, scallops, and fish from the river. Angie said that she had not examined fish consumption as those standards as toxics issues are being investigated in a separate program. Angie said that DO, one of the important metrics that the LTCP is being held to, is an important factor for fish survival but not consumption.

A stakeholder asked about the impacts of dredging on the Westchester Creek. Tim said that dredging is particularly useful for abating aesthetic issues, such as odors related to exposed CSO sediments. A stakeholder said that the river used to be significantly deeper and suggested that it be dredged to achieve previous depth. Tim stated that deepening the water does not change the waterbody's ability to absorb pollutants.

Another stakeholder brought up the issue of the lack of bathrooms in Ferry Point Park and the subsequent use of the river for that purpose. Tim Groninger, Hazen and Sawyer, said that if there was a major effect, it would be reflected in the water quality sampling and modeling. It has not been reflected in the model and therefore can be considered to have a negligible impact.

Next, Tim Groninger presented the Westchester Creek drainage area. He showed the sampling locations and the largest CSO outfalls on Westchester Creek. He said that, apart from CSOs, there is no other source of flow to the creek. One stakeholder asked where the original Westchester Creek now flows. Tim said that it joins a sewer pipe and enters the Creek as such. Tim then shared DO data from surveys taken during dry and wet weather. He said that DO responds to rainfall, with an increase in DO during the storm due to turbulence, followed by a decrease caused by the oxygen demand of organic matter in CSO. Tim shared data about fecal and total coliform.

Tim then spoke about the two models that have been developed as tools to guide the project team in evaluating the performance of different alternatives. He said that the landside model takes into account all pipes that are 40 inches or wider in diameter in the whole sewer system. Tim showed a diagram of surcharge conditions and said that this model helps the team to identify and analyze conveyance problems that may affect the system. The model includes sanitary flows based on the anticipated population in 2045. This landside model calculates CSO volumes that are then used in a second model, which is built to look at water quality. The receiving water model takes into account a number of inputs, such as flows, load and temperature. The synthesis of the models will allow the project team to estimate water quality during an average year. For this project in particular, it allows the project team to understand the benefits of different proposed alternatives on the water body. A stakeholder asked about how water sampling fit into the model. Tim said that sampling data is used to calibrate the model, so that the model outputs correspond to real life conditions. Tim added that after the plan is implemented, supplemental post construction monitoring will be performed to measure the real effect on the waterbody. The plan will be evaluated at this point if it is found that a waterbody is not compliant with water quality standards.

Tim then reviewed typical alternatives for abating CSOs. He said that optimizing the existing system is one of the easiest interventions on the table. On the other hand, full separation of storm and sanitary sewage collection systems is prohibitively costly. Storage tanks and tunnels, conveyance enhancements, floatables screening, and best management practices are also being considered.

Stephen led a discussion on the uses and goals for Westchester Creek and the Hutchinson River. The stakeholders said that they would like to boat and paddle on Westchester Creek. Many of them remember swimming on the creek and said that they would like to be able to do so again, particularly at Ferry Point Park. A stakeholder mentioned that the Hindu community in the Bronx uses the park for a yearly cleansing ritual that involves entering the water and casting away old garments into the water.

On the Hutchinson River, stakeholders noted recreational uses including pleasure boating, jet skiing, and fishing. They stated that there were no pervasive problems with access. The stakeholders asked that the request for the contact information for the Natural Heritage Trust remain in this meeting's notes. They reiterated their request for a tour of the Flushing CSO Facility Tank.

The stakeholders recommended a next meeting date of January 25th. The presentation will be put on the website and meeting notes will be distributed several weeks before the meeting. Stephen Whitehouse asked whether the names and contact information of stakeholders could be released and Kenneth Kearns, district manager, requested that all queries be directed to him.

Westchester Creek and Hutchinson River Stakeholder Team
Meeting No. 3
May 8, 2007

The third Hutchinson River and Westchester Creek Stakeholder team meeting of the Long Term Control Plan (LTCP) of the NYC Department of Environmental Protection (DEP) was held on May 8th at Bronx Community Board 10, 3165 E. Tremont Avenue. Kenneth Kearns, District Manager for Community Board 10, welcomed everyone. Stephen Whitehouse, Starr Whitehouse, introduced the project team. He reviewed the notes from the last meeting. There were no comments; the notes were finalized. Stephen also noted that, while Eastchester Bay would be referenced in the presentation, Eastchester Bay is mainly being considered as a component area of the East River and Open Waters Waterbody/Watershed Facility Plan. The East River and Open Waters stakeholder group is discussing the Bay. Their meetings are open to all. Stephen also stressed that the previously considered tank for Co-op City Boulevard was not included in the plans.

Ray Hyland, Greeley and Hansen, presented the plan for the Hutchinson River. He reviewed the drainage areas, outfalls, and current water quality standards. He shared the baseline conditions for CSOs, including the outfalls, number of events at each outfall, and annual volumes. Ray reviewed the alternatives that were assessed for the plan, including: pathogen source investigation.; continued inter-jurisdictional coordination with Westchester Co.; system optimization or improving storage in the existing systems; green alternatives; floatable controls; storage tanks and tunnels; sewer separation; and aeration. Ray said that upgrades to the Hunts Point Water Pollution Control Plan (WCPC), completed prior to this plan, resulted in improvements to water quality. He reviewed the cost of each alternative and shared a knee-of-the-curve analysis, plotting the cost of different combinations of alternatives against their benefit, or the percent reduction of CSO volume. He then showed the different alternatives against other metrics for water quality standard compliance: dissolved oxygen (DO) and pathogens in the form of total coliform. He showed the potential impact of non-compliant with Class B standards in Westchester County waters and said that, if the water quality in Westchester County improves, the water quality in the Hutchinson River would also improve. This suggests that CSOs are not the main source of water quality issues in the Hutchinson River.

Next, Ray presented the selected Waterbody/Watershed Facility plan (WB/WS) resulting from the preceding analysis. Selected alternatives include in-line netting at HP-023 and at HP-024. Each netting facility would be located in the pipe and out of sight. Ray showed the identified sites for the in-line netting but stressed that the team is in the planning stage and has not begun property acquisition. A continued investigation into Low Impact Development (LID) is also included in the plan. Lastly, Ray presented a chart that showed the percent compliance with primary contact standards at the Eastchester Bay beaches. The chart showed that the removal of all CSOs would only nominally improve water quality from baseline condition. Ray reiterated that upstream sources of pathogens from Westchester County are the main water quality issue and not CSO loading on the Hutchinson River. Ray also explained that during this bathing season, pathogens are typically in their highest concentration do not appear to be affecting beaches in Eastchester Bay. A stakeholder asked why raising weirs and system cleaning were not selected as alternatives. Ray said that raising weirs did not appear to have any substantive impact in the modeling. He said that there is a program of ongoing system cleaning. Ray said that the tank alternative, previously discussed, was not included in the plan because new technology had allowed them to better analyze it and it appeared to have no substantive impact. A stakeholder asked about construction impacts for the presented plan. Ray said that the construction would be localized with minimal vehicular and pedestrian interruptions, and would be considerably smaller than the previous proposed storage facilities. Former Assemblyman Stephen Kaufman asked whether the community could expect the passive park, which the Co-op City Community was promised when DEP was considering the tank. Ray responded by describing the differences in the approach to CSO control from the previous plan. He stated that the new EPA Policy requires or water quality based approach and with the advanced modeling we can see what will be the effect in the receiving waterbodies. Mr. Kaufman accepted this approach, but still requested that DEP provide a park. Finally Ray presented the selected plan cost and stressed that since the Hunts Point upgrade does not provide significant benefit in this area, the plan cost does not include the upgrade.

Next, Tim Groninger spoke about the WB/WS plan for Westchester Creek. Tim shared baseline modeling results, including number of CSO events at each outfall and annual volume of CSOs. Tim reviewed the alternatives assessed for the WB/WS plan, including: collection system modifications; floatable controls; a tank carried over from the previous facility plan; in-stream aeration; and storage sized to address alternatives evaluations expected by deferral CSO policy. Tim said that improvements to the Hunts Point WPCP, the construction of a new throttling facility, have decreased CSOs by improving conveyance to the plant, improving the water quality of Westchester Creek. Tim presented the costs for each alternative and noted that storage alternatives are particularly expensive.

Next, Tim presented cost-benefit analysis graphs which plot total project costs against overall benefit: volume reduction of CSO and percent attainment of water quality standards. The graphs suggest that a plan including weir modifications and new netting facilities provide the most benefit compared to their cost. Tim reviewed the selected alternatives. He showed the locations for the weir modifications. He said that approximately 20% of the volume of CSO under baseline conditions would be captured and diverted to the WPCP by raising the weirs. He showed the approximate location of the new netting facility at outfall HP-013. Several stakeholders voiced concern about operational issues such as the cleaning of netting facilities. Tim said that the nets are supposed to be cleaned after major rainfall. A stakeholder asked how other tanks in New York have performed. Tim said that the Flushing Tank was about to start operations and that the Paerdegat Tank was still under construction. One stakeholder expressed dissatisfaction with the plan. She did not feel that the presented plan was sufficiently vigorous. Although she was not pleased with the idea of tanks, she felt that they were, at least, proactive measures.

Next, Tim showed graphs plotting the percent of attainment with existing water quality standards, comparing the baseline conditions, a 100% capture scenario, the 2003 plan which included the tank, and the WB/WS plan currently under consideration. All scenarios were predicted to fully attain total coliform and fecal coliform numerical criteria during the summer months, when swimming and other recreational uses occur. Tim showed graphs looking at how these scenarios compare to DO standards. The graphs indicate that DO is a problem in the upper half of the Creek and show that the proposed WB/WS plan improves DO comparably to the 2003 CSO facility plan. This indicates that the tank brought no added benefit. The modeling results also suggested that the proposed plan would eliminate periods of extremely low DO problems that are believed to be contributing to odor problems in the vicinity.

Next, Sue McCormick, New York State Department of Environmental Conservation (DEC), reviewed the next steps. A WB/WS plan will be drafted and given to the DEC for their review in June 2007. DEC will review the plan and submit comments. When DEC submits its comments to DEP, there will be a public meeting. There will be another meeting at the ratification of the WB/WS plan into a LTCP, when it becomes an enforceable element of the Hunts Point WPCP SPDES permit. Stephen said that DEP was currently on schedule for an on-time submission.

John McLaughlin, DEP, spoke about the Bureau of Environmental Planning and Assessment's (BEPA) work with stormwater management, which will be incorporated in the LTCP at a later date. He described ongoing work on LIDs under the Jamaica Bay Watershed Protection Plan (JBWPP) being developed as mandated by a 2005 local law. Among other things, the JBWPP is required to examine CSOs reduction through LIDs. In addition to abating CSOs, LIDs create open spaces, restore wetlands, and remove pollutants from the water. With the Gaia Institute, BEPA is developing pilot applications, including street tree planting pit modifications and constructed wetlands. They are also investigating different ways to implement LID technologies, such as zoning code modifications, incentives for private property owners, and restructuring water billing rates. Over time, these small measures will aggregate to decrease surges of storm flow. Several homeowners noted that maintenance of the planted strips near the sidewalk are expensive to water during drought conditions. Kenneth Kearns noted that DOT has already built a wetland near to the Long Island Expressway. He also noted that the Bronx Borough President stated that every civic building has should have a green roof.

A stakeholder asked about sewer repairs. Ray said that broken sewers are discovered with with sonar leak detection and repaired to their former state. He added that the team had examined the possibilities for separated sewer but had decided that it provided little benefit against high costs and would cause extensive vehicular and pedestrian disruptions. A stakeholder accused the MTA transit yards of discharging chemicals into Westchester Creek. Ken said that he would look into this issue. The meeting concluded at 8:30pm.