Environmental Protection

City-Wide Long-Term CSO
Control Planning Project

Newtown Creek Waterbody/Watershed Facility Plan Report

The City of New York
Department of Environmental Protection
Bureau of Wastewater Treatment

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EXECUTIVE SUMMARY

The New York City Department of Environmental Protection (DEP) has prepared this Newtown Creek Waterbody/Watershed (WB/WS) Facility Plan Report as required by the Administrative Order on Consent between the DEP and the New York State Department of Environmental Conservation (DEC).

Designated as DEC Case #CO2-20000107-8 (January 14, 2005, as modified April 14, 2008 as DEC Case #CO2-20070101-1 and September 3, 2009 as DEC Case #CO2-20090318-30) and also known as the Combined Sewer Overflow (CSO) Consent Order, the Administrative Consent Order requires the DEP to submit an "approvable WB/WS Facility Plan" for Newtown Creek to the DEC by June 2007.

Newtown Creek is one of 18 waterbodies that together encompass the entirety of the waters of the City of New York. The CSO Consent Order also requires that, by 2017, the DEP complete a final, City-wide CSO Long-Term Control Plan (LTCP) incorporating the plans for all watersheds within the City of New York.

Purpose

The purpose of this WB/WS Facility Plan is to take the first step toward the development of a Long Term Control Plan for Newtown Creek. This WB/WS Facility Plan assesses the ability of existing infrastructure to attain the existing water quality standards in Newtown Creek. Where these facilities will not result in attainment of the existing standards, certain additional alternatives have been evaluated.

Context

This WB/WS Plan is one element of the City's extensive multi-phase 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. DEP has already built or is planning to build over $3.4 billion in targeted grey infrastructure to reduce CSO volumes. This does not include millions spent annually on the Nine Minimum Controls that have been in place since 1994 to control CSOs.

Regulatory Setting

This WB/WS Plan has been developed in fulfillment of and pursuant to the 2005 CSO Consent Order requirements. It represents one in a series of several WB/WS Facility Plans that will be developed prior to development of a final approvable Citywide LTCP. All WB/WS Facility Plans, including the Newtown Creek WB/WS Facility Plan, contain all the elements required by the USEPA of LTCP.

Goal of the Plan

The goal of this WB/WS Facility Plan is to reduce CSO overflows to Westchester Creek through a cost-effective reduction in CSO volume and pollutants to attain existing water quality standards. This WB/WS Facility Plan assesses the effectiveness of CSO controls now in place within New York City and those that are required by the CSO Consent Order to be put in place, to attain water quality that complies with the DEC water quality standards. Where existing or proposed controls are expected to fall short of attaining water quality standards, this WB/WS Facility Plan also assesses certain additional cost-effective CSO control alternatives and strategies (i.e., water quality standards revisions) that can be employed to provide attainment with the water quality standards. The goal of the LTCP will be to quantify effectiveness of the WB/WS Facility Plan recommended CSO controls and to evaluate additional CSO controls necessary to attain existing water quality standards and/or highest attainable appropriate use.

Adaptive Management Approach

Post-construction compliance monitoring discussed in detail in Section 8, is an integral part of this WB/WS Facility Plan and provides the basis for adaptive management for Newtown Creek. Monitoring will commence just prior to implementation of CSO controls and will continue for several years thereafter in order to quantify the difference once controls are fully implemented. Any performance gap identified by the monitoring program can then be addressed through design modifications, operational adjustments, or additional controls. If further CSO reductions are needed to attain water quality standards, the DEP will identify and implement additional technically feasible and cost-effective alternatives under the Long-Term Control Plan. If it becomes clear that the implemented plan will not result in full attainment of applicable standards, DEP will pursue the necessary regulatory mechanism for a Variance and/or Water Quality Standards Revision.

If additional controls are required, best engineering practices and protocols established by the DEP and the City of New York for capital expenditures require that certain evaluations are completed prior to the construction of additional CSO controls Depending on the technology implemented and the engineer's cost estimate for the project, these evaluations may include pilor 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.

Waterbody Background

The present character of Newtown Creek and its drainage area is considerably different than the character of its pre-urbanized condition (Table ES-1). Originally a stream draining the uplands of western Long Island, the waterbody was dredged, straightened and bulkheaded as the surrounding area was drained, urbanized and industrialized early during the development of New York City. By 1930, the waterbody had been transformed to very near its present configuration, and Newtown Creek was serving as a major industrial waterway through which materials were brought to and from area industries, including major oil refineries and terminals, smelting operations, manufactured gas plants, and other heavy industries. The surrounding area had been fully urbanized and industrialized, with sewage and industrial wastes discharging directly to the Creek without treatment, and the natural marshlands and freshwater streams replaced with combined sewers and storm drains. The urbanization of the surrounding drainage area resulted in an estimated five-fold increase in imperviousness and a two-fold

Table ES-1. Urbanization of Newtown Creek Watershed

Watershed Characteristic	*Pre-Urbanized*	*Urbanized* (1)
Drainage area (acres)	*8,948*	*7,440*
Population (2)	*Unknown*	*330,000*
Imperviousness	*10%*	*51%*
Annual Yield (MG) (3)	*988*	*1,985*
Notes: (1) Existing condition (2) Year 2000 U. S. Census (3) Design Rainfall (JFK, 1988).		

increase in the annual runoff volume to the waterbody. Stripped of the surrounding buffers of marshland and its natural freshwater flow, the waterbody was deprived of any natural response mechanisms that might have helped absorb the increased hydraulic and pollutant loads. The Creek's limited circulation and exchange with the East River allowed pollutants to build up within the Creek, and water quality deteriorated to such an extent that Newtown Creek was notorious as a polluted waterway.

Efforts to address water quality in Newtown Creek date back to the 1960s, when New York City was constructing wastewater pollution control plants (WPCPs) to treat sewage and industrial wastes during dry weather and to capture a portion of the combined sewage generated during wet weather. Two WPCPs service the Newtown Creek drainage area: the Bowery Bay WPCP, which began operating in 1938, and the Newtown Creek WPCP, which began operating in 1967.

Currently, about 330,000 people live within the Newtown Creek's 7,441-acre drainage area, over 83 percent of which is served by combined sewers draining to either the Bowery Bay or the Newtown Creek WPCPs. In addition to combined sewer overflows, the Creek takes flow from numerous storm and highway drains and other DEC permitted industrial discharges.

Newtown Creek has benefited from several citywide programs, including the City-Wide Floatables Plan, which addresses discharges of street litter with catch basin controls and a program to remove floatables in the Creek with tributary skimmer vessels and the installation of floatables booms within English Kills, East Branch, and Maspeth Creek. Under the 2004 Inner Harbor CSO Facility Plan, the DEP completed other actions, such as regulator improvements and maximizing wet-weather flow to the WPCPs. In addition to these citywide programs, the Newtown Creek WPCP is currently undergoing a nearly $4 billion upgrade to full secondary treatment to provide 85 percent BOD_5 and TSS removal during dry weather, and treatment capacity of up to 700 mgd during wet weather, and construction of the Zone I aeration facility from the 2003 CSO Facility Plan was completed in 2008. Other projects from the 2003 CSO Facility Plan that have also continued to move forward during concurrent with waterbody/watershed planning includes design of the Zone 2 Aeration Facilities, construction of the Kent Avenue Throttling Facility, and the installation of inflatable dams at Regulator B-6 along the Kent Avenue Interceptor to maximize storage in the Newtown Creek WPCP collection system.

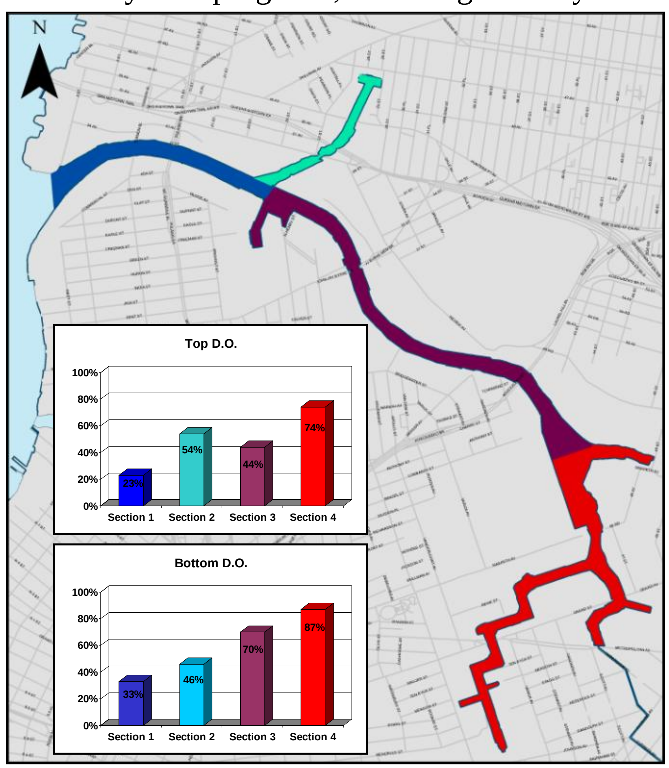


Figure ES-1. Percent of DO Samples < 3.0 mg/L

The State of New York has designated Newtown Creek as a Class SD waterbody, with a designated best use of fishing, with waters suitable for fish survival. Water quality standards specific to Class SD waters require that dissolved oxygen concentrations shall not be less than 3.0 mg/L at any time. Since there is no recreational use classification of Newtown Creek, there are no numerical recreational use water quality standards applied to the waterbody. Narrative standards address aesthetic conditions such as floatables and odors.

In 1998, DEC designated Newtown Creek as a high-priority waterbody for TMDL development with its inclusion on the Section 303(d) list of impaired waterbodies. The cause of the listing was dissolved oxygen/oxygen demand due to CSOs. Despite the advances described above, Newtown Creek remained on the 303(d) list in 2010, again due to low dissolved oxygen concentrations from wet-weather discharges, but the list was updated to acknowledge contributions from urban runoff and storm sewers in addition to CSO. Figure ES-1 demonstrates how measured dissolved oxygen levels in Newtown Creek were below 3.0 mg/L during the majority of the sampling events from 1984 to 2003.

Modeling analyses performed herein indicate that, under the baseline conditions in a typical precipitation year of 82 rainfall events, there would be approximately 71 CSO events lasting 6 to 7 hours on average and discharging a total of 1,408 MG to Newtown Creek and its tributaries (Table ES-2). Separately sewered and direct drainage stormwater inputs contribute an additional 577 MG per year, or roughly 29 percent of the total wet-weather discharge volume to Newtown Creek. As demonstrated on Figure ES-2, the calculated impact of these inputs on dissolved oxygen in the Creek is significant, with minimum-calculated dissolved oxygen concentrations less than 3.0 mg/L throughout much of the Creek.

Table ES-2. CSO & Stormwater Discharges

Type	*Number of Events*	*Total Annual Volume (MG)*
CSO	*71*	*1,408*
Stormwater	*82*	*577*
Total	***-***	***1985***

Planning undertaken by the DEP prior to initiation of its WB/WS Facility Planning Project culminated in the 2003 CSO Facility Plan, which was subsequently incorporated into the 2005 Consent Order. The 2003 Plan consists of a host of planned CSO controls for Newtown Creek such as in-stream aeration, sewer system modifications, regulator improvements, interceptor throttling, and a 9 MG CSO storage tank, implementation of which has continued throughout the WB/WS planning. Despite inclusion in the Consent Order and the ongoing implementation, the 2003 CSO Facility Plan is not considered the final conceptual design for Newtown Creek and the Consent Order allows the

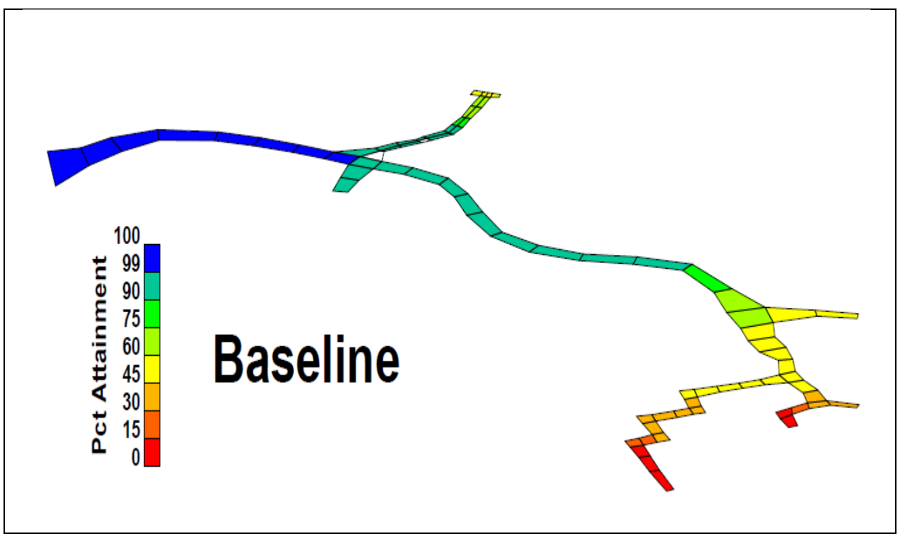


Figure ES-2. Model-Calculated Minimum Dissolved Oxygen (Baseline)

DEP to propose final modifications to the scope of the projects set forth in the 2003 CSO Facility Plan through the completion of an approvable WB/WS Facility Plan for Newtown Creek, which was submitted to the DEC in June 2007 (DEC, 2004b). The present document incorporates comments received from DEC on the June 2007 Newtown Creek WB/WS Facility Plan. Therefore, the WB/WS Facility Plan developed herein reviews these projects, and also examines the extent to which additional or alternative cost effective control measures may result in water quality standards being met.

In September 2010, Newtown Creek was included on the EPA's Superfund National Priority List. Pesticides, metals, PCBs, and volatile organic compounds (VOCs), which are potentially harmful contaminants that can easily evaporate into the air, have been detected at the Creek. The Superfund cleanup process is complex, and involves numerous steps taken to assess sites, place them on the National Priorities List, and establish and implement appropriate cleanup plans. This is the long-term cleanup process.

Waterbody/Watershed Planning Analyses

Acknowledging that the 2003 CSO Facility Plan is not a final conceptual design, all elements of the plan were reviewed with the updated sewer system and water quality models to quantify the projected benefits of the proposed plan. Through this analysis it was determined that several elements of the 2003 CSO Facility Plan are either not feasible (raising the weir in regulator B1) or do not provide any benefit in terms of CSO reduction (Kent Avenue Throttling Facility) and consequently water quality and still others could be cost effectively optimized to further reduce CSOs (St. Nicholas Weir Relief Sewer). It was therefore concluded that the 2003 CSO Facility Plan is not practical to implement as planned, however it does provide another benchmark, in addition to the baseline condition, for comparing CSO reduction and water quality improvement alternatives. Therefore, the DEP considers the projected CSO reduction offered by the 2003 CSO Facility Plan as the minimum acceptable level of CSO reduction. As such, the WB/WS Plan elements shall provide for at least as much projected CSO volume reduction, and be projected to have at least comparable water quality benefits.

Herein, a range of CSO control alternatives have been examined to reduce CSO pollution impacts to Newtown Creek. The evaluated range of alternatives includes the as planned 2003 CSO Facility Plan elements, other "Low Cost" alternatives that address aesthetics issues without reducing CSO volume, collection system improvements to maximize flow to the WPCP and/or to transfer CSO to the East River, and CSO storage facilities to capture up to 100 percent of the typical year CSO volume generated in the drainage area during wet weather. All alternatives include implementation of City-Wide programs such as the City-Wide Comprehensive CSO Floatables Plan and the 14 BMPs for CSO Control (per the SPDES permits) to maximize use of existing systems and facilities for CSO capture and pollutant reduction as well as floatables control beyond what is specifically accounted for in the City-Wide Comprehensive CSO Floatables Plan through CSO volume reduction or through specific floatables control technologies. In addition, with the exception of the CSO Facility Plan, all of the alternatives analyzed include an operational protocol that allows the Brooklyn Pump Station to pump up to 400 MGD during wet weather.

Overall, the estimated costs associated with the evaluated alternatives ranged from $205 million to over $3 billion. For tracking purposes, the alternatives were given an alternative number. All of the alternatives were evaluated using the sewer system model to compute projected CSO volume and number of events for the design year. The alternative number, elements of the evaluated alternative plans, and modeled results are summarized in Table ES-3. The table shows that volume reductions comparable to that projected for the CSO Facility Plan are available within a reasonable range of estimated cost. Additionally, significant CSO reduction beyond that projected for the CSO Facility Plan is available for significantly higher cost.

Table ES-3. Summary of Alternatives

Alt #	Description	Events Per Year	Untreated CSO (MG/Year)	CSO Reduction from Baseline (MG/Year)	% CSO Reduction from Baseline	Total Cost W/O Air (Millions)	Total Cost W/Air [1] (Millions)
Baseline	Baseline	71	1,471.9	-	-	-	-
1	2003 CSO Facility Plan	56	1,069.5	402.4	27%	$549.6	$664.9
2	High Level Aeration and Floatables Control	71	1,372.9	99.0	7%	$89.8	$205.1
3	Alternative 2 and Bending Weirs	71	1,259.9	212.0	14%	$116.0	$231.3
4	Alternative 3 and Dutch Kills Relief Sewer	55	1,208.9	263.0	18%	$210.7	$326
5	Alternative 2, Inflatable Dams, and 48-Inch St. Nicholas Relief Sewer	55	1,218.1	253.8	17%	$119.8	$235.1
6	High Level Aeration, Inflatable Dams, St. Nicholas Relief Sewer, Dutch Kills Relief Sewer, and Additional 96-Inch Interceptor	55	1,037.4	434.5	30%	$505.5	$620.8
7	High Level Aeration, Inflatable Dams, St. Nicholas Relief Sewer, Dutch Kills Relief Sewer, and 9 MG Storage Tank	55	1,012.9	459.0	31%	$680.9	$796.2
8	40 MG CSO Tunnel, Dutch Kills Relief Sewer, and High Level Aeration	55	580.7	891.2	60%	$1,654.5	$1,769.8
9	107 MG Tunnel, Dutch Kills Relief Sewer, and High Level Aeration	48	244.0	1,227.9	83%	$2,332.6	$2,447.9
10	128 MG Tunnel and High Level Aeration	44	68.2	1,403.7	95%	$2,938.8	$3,054.1
11	132.5 MG Tunnel and High Level Aeration	29	14.9	1,457.0	99%	$2,975.0	$3,090.3
100% Reduction	134 MG Tunnel and High Level Aeration	0	0	1471.9	100%	$3,109.3	$3,224.6

[1] The 2003 CSO Facility Plan includes cost for planned low level aeration. All other alternatives include cost for high level aeration, which is the level of aeration projected to bring the waterbody to full attainment of the Class SD numerical DO standard for the Baseline condition.

In addition to sewer system modeling, water quality modeling analyses were performed to project the expected water quality benefits of each of the evaluated alternatives. These analyses considered all alternatives to the CSO Facility Plan with and without high level aeration, which is defined as the level of aeration projected to bring the waterbody into full attainment of the Class SD numerical DO standards under Baseline conditions. This step was to determine the relative impact of CSO volume reduction on water quality.

Dissolved Oxygen Improvements

Figure ES-3 shows dissolved oxygen attainment versus cost for each Alternative, with and without high level aeration. The CSO Facility Plan is included with the planned low level aeration.

The figure shows that without aeration, dissolved oxygen levels are not projected to attain the Class SD criterion of ≥ 3.0 mg/L for any alternative including 100% CSO Removal. It also shows that higher levels of attainment can be achieved beyond what is projected for the CSO Facility Plan (including planned aeration) through either a higher level of aeration (even with little or no CSO volume reduction) or through further reductions in CSO volume alone. This figure shows a clear inflection point, where the change in incremental cost of the control alternative per change in performance of the control alternative changes most rapidly, at Alternative 2. This inflection point is known as the knee-of-the-curve, and is used to identify the where higher levels of control cease to be cost effective. Based on this analysis, high level aeration, with only minimal reduction in CSO volume, provides the largest water quality benefit on a per dollar basis.

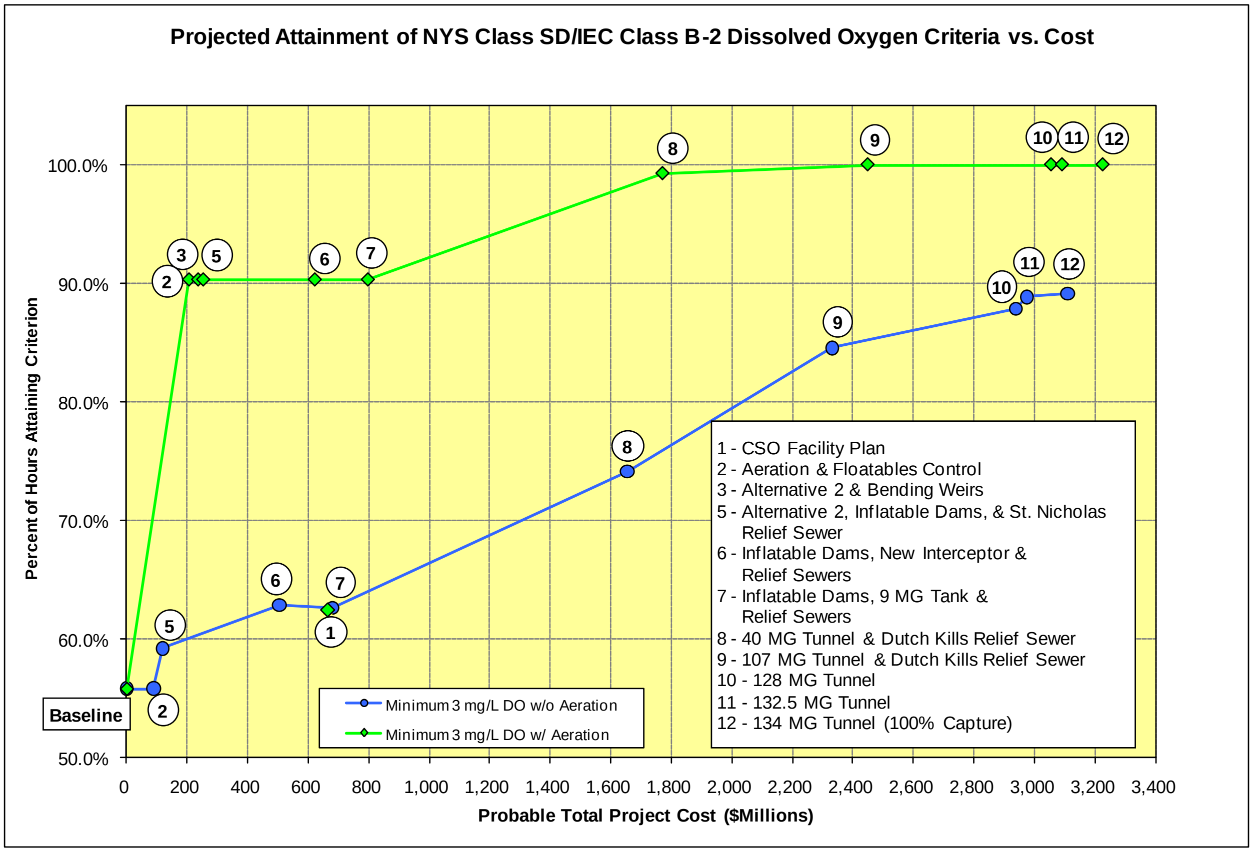
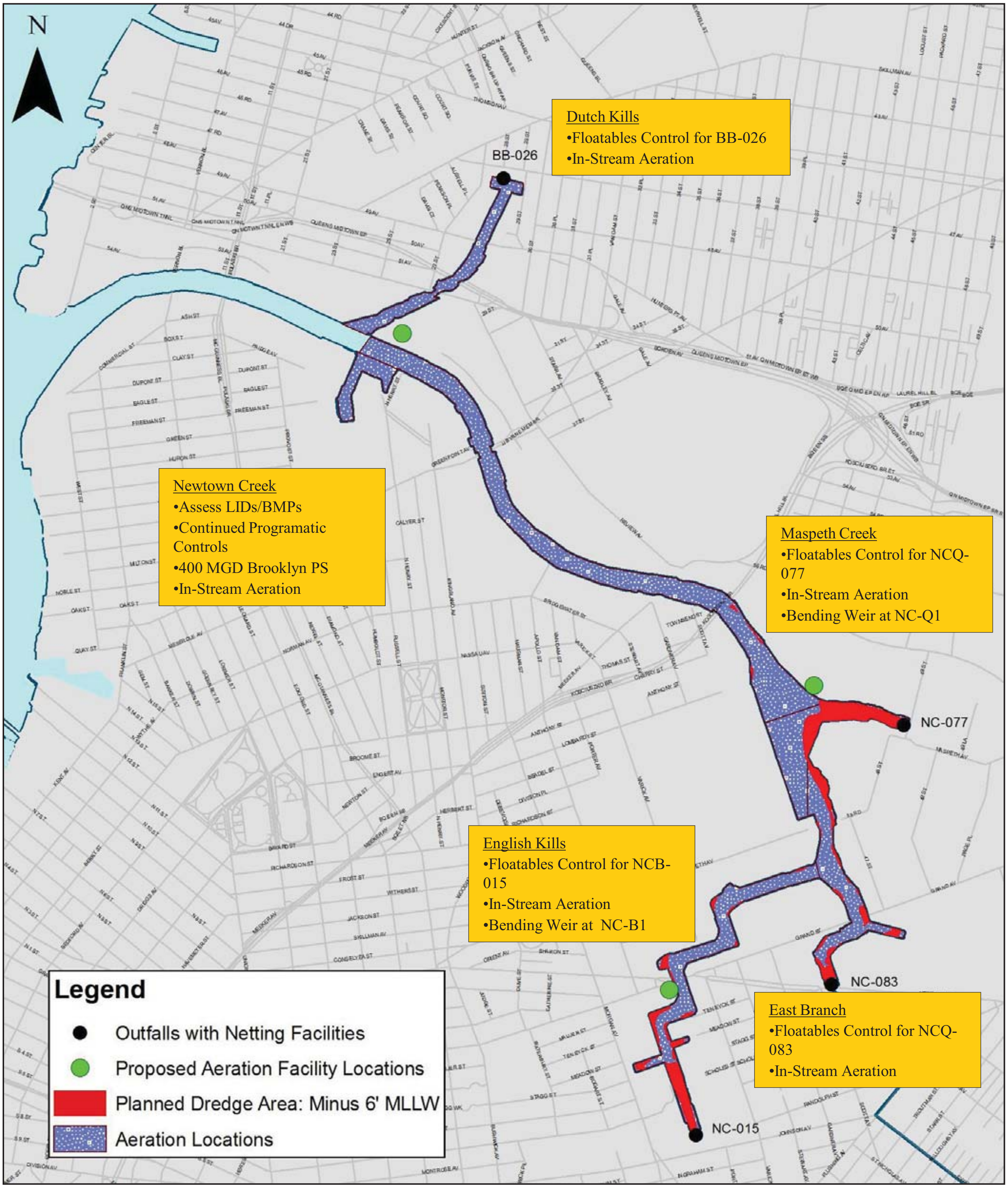


Figure ES-3. Projected Attainment of Dissolved Oxygen Criteria vs. Cost for Evaluated Alternatives

Waterbody/Watershed Facility Plan

As developed herein, the Newtown Creek Waterbody/Watershed Facility Plan intends to solve water quality problems that have faced the Creek for many decades. The central elements of the Plan represent actions that go beyond those already implemented as part of the 2004 Inner Harbor CSO Facility Plan (such as regulator improvements) and other citywide initiatives (such as the CSO Floatables Plan, and implementation of the 14 BMPs for CSO control) and beyond the level of CSO control and water quality improvement projected for the earlier CSO Facility Plan. The elements of the Waterbody/Watershed Facility Plan, which are expected to cost a total of $231.1 million in June 2011 dollars and to be completely implemented by the end of 2019, are shown on Figure ES-4, and include the following elements of Alternative 3:

- Continued operation of the Brooklyn Pumping Station at up to 400 MGD during wet weather.
- Construction of bending weirs at B1 and Q1.
- Floatables Control at or around the four largest annual average volume CSOs in Dutch Kills, Maspeth Creek, East Branch, and English Kills.
- Construction of Enhanced Zone II Aeration.



NYC Environmental Protection

Newtown Creek Waterbody/Watershed Facility Plan

In addition, the City will continue to implement the NYC Green Infrastructure Plan concurrently with this Waterbody/Watershed Facility Plan, and will build green infrastructure in the Newtown Creek areas. The LTCPs will incorporate and analyze that effort.

Bending Weirs

As discussed in Section 7.3.4, two locations for bending weirs were identified to provide considerable CSO reductions. These two locations, Regulator B1 (which overflows to outfall NCB-015) and Regulator Q1 (which overflows to outfall NCQ-077), discharge the second and third largest CSO volumes under Baseline conditions. Bending weirs at these locations also can readily divert wet weather flow into the Morgan Avenue Interceptor and then to the WWTP for treatment. Each regulator will be retrofitted with bending weirs, installed on top of the regulator weirs, and modifications made to the regulator orifices to convey additional flow to the WWTP. A 3 foot tall 140 foot long fixed weir equipped with a two foot tall bending weir is proposed for Regulator B-1 and the orifices will be expanded from the existing 8-ft by 3-ft to 10-ft by 3-ft. At Regulator Q1, the bending weir will be 2 feet tall and the orifice would be expanded from the existing 2-ft square opening to a 3.5-ft square opening. The estimated cost of the bending weirs and regulator modifications is $26.2 million in June 2011 dollars.

Floatables Control

Only minor CSO volume reduction is expected during the Waterbody/Watershed Facility Plan implementation, which focuses on attaining the existing Class SD narrative and numerical water quality standards. Therefore, the DEP will construct floatables control facilities to address floatables at or near the four CSOs with the largest baseline annual overflow volumes (BB-026, NCQ-077, NCB-083, and NCB-015). The feasibility of siting and maintaining such facilities on or around these outfalls will be determined during detailed facility planning. The estimated capital cost of installing facilities to control floatables from the four outfalls with largest baseline annual overflow volume is $89.8 million in June 2011 dollars.

Enhanced Zone II Aeration

As discussed in Section 7.3.3, the CSO Facility Plan proposed two zones of aeration, sized to increase the minimum dissolved oxygen level in Newtown Creek to 1 mg/L. Construction of Zone I in upper English Kills was completed by the Consent Order milestone of December 2008. Zone II aeration, which is included in the Consent Order with a completion milestone of June 2014, was to include aeration of lower English Kills, East Branch and Dutch Kills. However, the Waterbody/Watershed Facility Plan calls for enhancing Zone II to provide enough oxygen to the water column to attain the existing Class SD numerical DO standard throughout the Creek. The DEP has identified constructed Zone I aeration site as a pilot facility to evaluate the effectiveness of aeration. Through this effort the DEP has developed site specific information about transfer efficiency and other related factors that influence the final aeration of the waterbody. Based on the results of the pilot study and follow-up water quality modeling, modeling projections show that 19,000 scfm of air would be required to bring the waterbody into compliance with Class SD numerical DO criteria under baseline conditions. Modeling also projects that to be successful the system would need to be deployed throughout a majority of the waterbody, including the shipping channels. Such an enhanced aeration system will require multiple blower buildings and a vast network of aeration piping. Information from the pilot study will be used during detailed facility planning and design of Enhanced Zone II Aeration to determine the number of blower facilities, system sizing requirements, and any necessary upgrades to the Zone I facility currently being constructed. Aeration will first be implemented in Lower English Kills, followed by East Branch and portions of Newtown Creek. The final aeration project under the Enhanced Zone II Aeration program will be installed at the mouth of Dutch Kills and additional portions of Newtown Creek. The estimated cost of Enhanced Zone II Aeration is $115.3 million in June 2011 dollars.

Continued Implementation of Programmatic Controls

As discussed in detail in Section 5.0 DEP currently operates several programs designed to reduce CSO to a minimum and provide treatment levels appropriate to protect waterbody uses. As the effects of the LTCP 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:

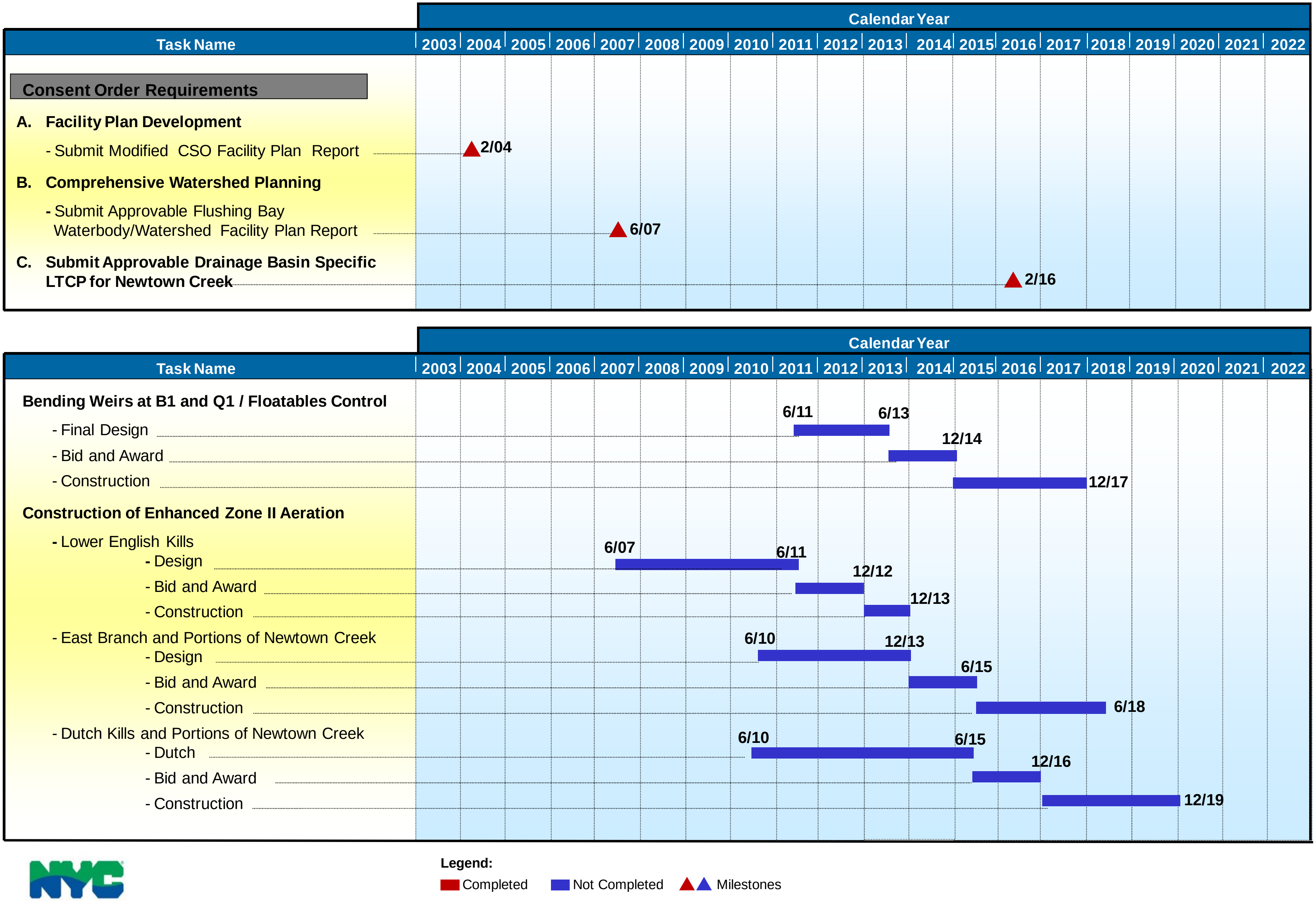
- The 14 BMPs for CSO control required under the City's 14 SPDES permits. In general, the BMPs address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO and reducing contaminants in the combined sewer system,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

Implementation Schedule

The Newtown Creek Waterbody/Watershed Facility Plan implementation schedule is provided in Figure ES-5. As discussed, the Newtown Creek Waterbody/Watershed Facility Plan is phased such that some elements of the plan are instituted before others with all elements implemented by May 2019. If, after implementation of each phase of the plan, monitoring data and advances in technology determine new opportunities may be more effective, later elements of the plan may be revised to provide the most cost effective solution to water quality issues.

Post-Construction Monitoring

Post-construction monitoring will be integral to assessment of the control elements of the Waterbody/Watershed Facility Plan. Monitoring will consist of collecting relevant sampling data from the waterbody, as well as collecting relevant precipitation data and data characterizing the operation of the sewer system and related control facilities. Analysis of these data will provide an indication of how the controls are performing irrespective of natural wet-weather variations. Due to the dynamic nature of both natural precipitation and receiving water conditions, a period of ten years will be necessary to generate the minimal amount of field data necessary to perform meaningful statistical analyses for water quality standards review and for any formal use-attainability analyses that may be indicated.



Environmental Protection

Newtown Creek Waterbody/Watershed Plan

Newtown Creek Waterbody/Watershed Facility Plan
Implementation Schedule
Figure ES-5

Summary of Expected Water Quality Benefits

As documented herein, implementation of the Waterbody/Watershed Facility Plan is projected to substantially improve water quality relative to Baseline conditions. The Waterbody/Watershed Facility Plan is projected to attain the applicable DEC Class SD standard for DO a minimum of 90.3 percent of the time throughout the waterbody, and as shown in Figure ES-6 greater percentages of time for the majority of the waterbody even during the summer. As noted above, additional controls (including 100 percent CSO capture) are not projected to provide full attainment of existing Class SD numerical DO standards.

With respect to the narrative water quality criteria for aesthetics, the Waterbody/Watershed Facility Plan is expected to substantially reduce floatables and odors. The Plan will reduce the volume of CSO discharged to Newtown Creek by 14 percent, with additional reductions expected from green infrastructure over time. Floatables control facilities constructed at or near the four CSOs with the largest baseline annual overflow volumes (BB-026, NCQ-077, NCB-083, and NCB-015) in addition to the CSO volume reduction will reduce floatables by an average of 92 percent annually. Any remaining floatables issues will be addressed through ongoing programmatic controls such as street sweeping, catch basin retrofits, and other best management practices in conjunction with deployment of a skimmer vessel to conduct open-water floatables removal from the Creek on an as-needed basis.

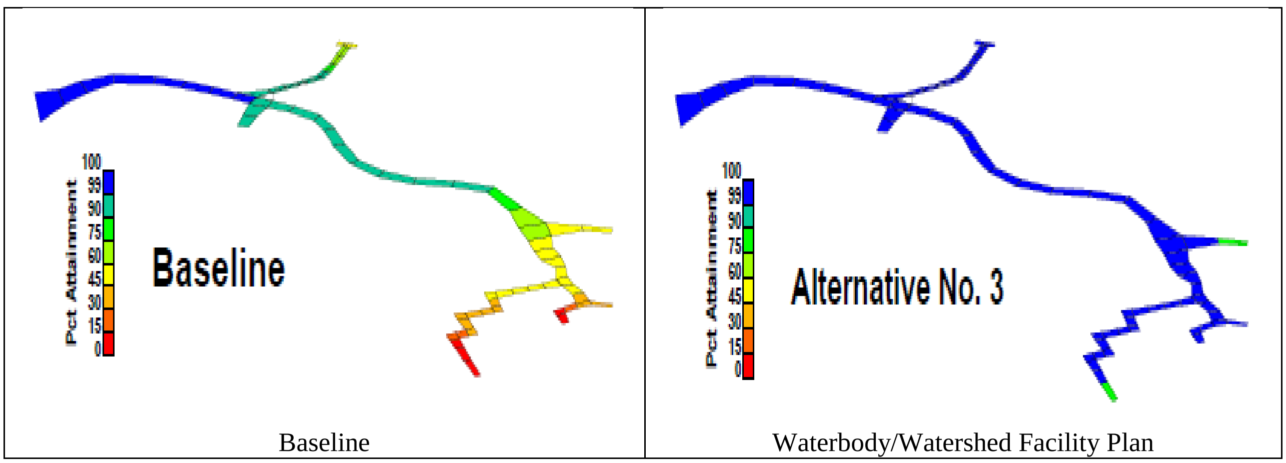


Figure ES-6. Projected Summer Days Attaining 3.0 mg/L at Bottom

Summary

Through extensive water quality and sewer system modeling, data collection, community involvement, and engineering analysis, the DEP has adopted this Plan to incorporate the findings of over a decade of inquiry to achieve the highest reasonably attainable use of Newtown Creek. As detailed in the sections that follow, Newtown Creek Waterbody/Watershed Facility Plan was developed so that it satisfies the requirements of the federal CSO Control Policy and addresses each of the nine elements of long-term CSO control as defined by federal policy.

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1.0 Introduction

The City of New York owns and operates 14 wastewater treatment plants (WWTPs) and their associated collection systems. The system contains approximately 450 combined sewer overflows (CSOs) located throughout the New York Harbor complex. The New York City Department of Environmental Protection (DEP) operates and maintains the wastewater collection system and WWTPs and has executed a comprehensive watershed-based approach to address the impacts of these CSOs on water quality and uses of the waters of New York Harbor. As illustrated in Figure 1-1, multiple waterbody assessments are being conducted that consider all causes of non-attainment of water quality standards and identify opportunities and requirements for maximizing beneficial uses. This Waterbody/Watershed (WB/WS) Facility Plan Report provides the details of the assessment and the actions that will be taken to improve water quality in Newtown Creek (Item 11 on Figure 1-1).

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 (annual DEP NY Harbor Water Quality Survey Reports, 2000-2007). 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, other confined tributaries in Jamaica Bay, and 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. That study confirmed tributary waters in the New York Harbor were negatively impacted by CSOs. In addition, occurrences of dry weather discharges– which DEP has since eliminated – were also confirmed. In 1984 a Citywide CSO abatement program was developed that initially focused on establishing planning areas and defining how facility planning should be accomplished. As part of that plan, the City was divided into eight individual project areas that together encompass the entirety of the New York Harbor. Four open water project areas (East River, Jamaica Bay, Inner Harbor and Outer Harbor), and four tributary project areas (Flushing Bay, Paerdegat Basin, Newtown Creek, and Jamaica Tributaries) were defined. For each project area, water-quality CSO Facility Plans were developed as required under the State Pollutant Discharge Elimination System (SPDES) permits for each WWTP. The SPDES permits for each WWTP, administered by the New York State Department of Environmental Conservation (DEC), apply to CSO outfalls as well as plant discharges and contain conditions for compliance with applicable federal and New York State requirements for CSOs.

In 1992, DEP entered into an Administrative Consent Order with DEC which incorporated into the SPDES permits a provision stating that the consent order governs DEP'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 superseded the 1992 Consent Order and its 1996 modifications with the intent to bring all CSO-related matters into compliance with the provisions of the Federal Clean Water Act (CWA) and New York State Environmental Conservation Law. The new Order contains requirements to evaluate and implement CSO abatement strategies on an enforceable timetable for 18 waterbodies and, ultimately, for Citywide long-term CSO control. DEP and DEC also entered into a separate Memorandum of Understanding (MOU) to facilitate water quality standards (WQS) reviews in accordance with the federal CSO control policy. The 2005 Order was subsequently modified in 2008 and 2009.

This Newtown Creek WB/WS Facility Plan Report is explicitly required by item VIII.B.1, Appendix A of the 2005 Consent Order, and is intended to be consistent with the United States Environmental Protection Agency's (USEPA) CSO Control Policy promulgated in 1994. The policy requires municipalities to develop a long term plan for controlling CSOs (i.e. a Long Term Control Plan or LTCP). The CSO policy became law in December 2000 with the passage of the Wet Weather Water Quality Act. 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; and
9. Post Construction Compliance Monitoring Program

Subsequent sections of this WB/WS Facility Plan report will discuss each of these elements in more depth, along with the simultaneous coordination with State Water Quality Standard (WQS) review and revision as appropriate.

1.1 WATERBODY/WATERSHED ASSESSMENT AREA

Newtown Creek is an estuarine tributary of the East River, located between Community District 1 in Brooklyn and Community Districts 2 and 5 in Queens, and the sewershed also includes sections of Brooklyn Community Districts 3, 4, 8, and 16. The headwaters of the Creek begin at Johnson Avenue in Brooklyn, flowing downstream in a northwest direction to where it enters the East River. Land uses within a quarter mile radius of the Creek are predominantly industrial and commercial, however, moving upland into the watershed, residential uses predominate. Figure 1-2 illustrates the Newtown Creek assessment area. The Creek has several tributaries (Dutch Kills, Whale Creek Canal, and Maspeth Creek), branches (East Branch and English Kills) and turning basins but no freshwater sources. The tributaries and upstream end of the Creek are narrow, bulk headed and shallow with water quality mostly influenced by the watershed. The downstream reach deepens and broadens into the East River and its water quality is influenced most by New York Harbor conditions.

Environmental Protection

City-Wide Assessment Areas

NYC Environmental Protection

Newtown Creek WB/WS Facility Plan
Study Area

The Newtown Creek watershed is approximately 10,741 acres and is drained almost entirely by storm and combined sewers. The watershed has been permanently altered by urbanization such that there is no freshwater flow to the Creek other than stormwater and CSO during wet weather. Sewer systems in the watershed are located in the service areas of the Bowery Bay and Newtown Creek WWTPs, with areas north of the Creek within the Bowery Bay service area and areas south of the Creek serviced by the Newtown Creek WWTP. The Bowery Bay WWTP discharges to the upper East River. The Newtown Creek WWTP primarily discharges to the East River, but sometimes overflows during wet weather to Whale Creek Canal. There are 22 CSO outfalls in addition to the Whale Creek Canal overflow and well over 100 stormwater discharges to Newtown Creek, of which 13 CSO outfalls discharge from the Bowery Bay WWTP service area and nine CSO outfalls discharge from the Newtown Creek WWTP service area. The CSO outfalls are located throughout the length of the waterbody and several significant CSO outfalls are located at the head ends of English Kills, East Branch, Maspeth Creek and Dutch Kills.

The legal definitions of waterbodies are codified in Title 6 of the New York State Code of Rules and Regulations. Table I of 6 NYCRR 890.6 lists waterbodies of the Interstate Sanitation District, and includes Newtown Creek under Item 54. The Newtown Creek waterbody is classified by New York State as Class SD saline surface water with best uses designated for fishing and fish survival. Class SD waters have natural or man-made conditions limiting attainment of higher standards.

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 the policies of the United States Environmental Protection Agency (USEPA), as well as water quality standards established by the Interstate Environmental Commission (IEC). The following sections detail the regulatory issues relevant to long-term CSO 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 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 the USEPA the authority to implement pollution control programs. Among the key elements of the CWA was the establishment of the National Pollutant Discharge Elimination System (NPDES) permit program, which regulates point sources that discharge pollutants into waters of the United States. CSOs 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 DEC, through its SPDES program. New York State has had an approved SPDES program since 1975.

The CWA requires that discharge permit limits be based on receiving water quality standards (WQS) established by the State of New York. 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 include an antidegradation policy for maintaining water quality at acceptable levels, and a strategy for meeting those standards must be developed for those waters not achieving WQS. The most common type of strategy is the development of a Total Maximum Daily Load (TMDL). TMDLs determine what level of pollutant load would be consistent with meeting WQS. TMDLs also allocate acceptable loads among the various sources of the relevant pollutants which discharge to the waterbody.

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 DEC Division of Water addresses these requirements by following its Consolidated Assessment and Listing Methodology (CALM). The CALM includes monitoring and assessment components that determine water quality standards 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 are 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.

Due to low dissolved oxygen (DO) levels and the presence of oxygen demanding substances, Newtown Creek is included in the 2010 New York State 303d list, where it can be found under Part 3c – Waterbodies for which TMDL Development may be Deferred Pending Implementation/Evaluation of Other Restoration Measures. A TMDL may not be required and may in fact delay the ability to meet the DO requirements as compared to the various control measures currently being developed and implemented which include this WB/WS Facility Plan. The Newtown Creek waterbody is classified by New York State as Class SD saline surface water with best uses designated for fishing and fish survival. Class SD waters have natural or man-made conditions limiting attainment of higher standards.

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) which is defined as "*a structured scientific assessment of the chemical, biological, and economic condition in a waterway*" (USEPA, 2000). In the UAA, the DEC would demonstrate that one or more of a limited set of circumstances exists to make such a modification. 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 practice 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 circumstance might be to establish that attaining the designated use would cause substantial environmental damage or substantial and widespread social and economic hardship. If the findings of a UAA suggest authorizing the revision of a use or modification of a WQS 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 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 impacts to water quality, aquatic biota, and human health 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 DEC on the development and implementation of a LTCP in accordance with the provisions of the CWA to attain water quality standards in accordance with the CWA. 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, water quality standards 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, 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 Best Management Practices (BMPs) required by DEC as discussed in Section 5.3, and include:

1. Proper operations and maintenance of combined sewer systems and combined sewer overflow outfalls;

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 (POTWs);

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 water quality standards 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 review the LTCP to evaluate the attainability of applicable water quality standards. The data collected, analyses and planning performed by all parties may be sufficient to justify a water quality standards revision if a higher level of designated uses is attainable or if existing designated uses are not reasonably attainable. If the latter is true, then the USEPA allows the State WQS authorities to consider several options:

- Apply site-specific criteria;
- Apply criteria at the point of contact rather than at the end-of-pipe through the establishment of a mixing zone, waterbody segmentation, or similar;
- Apply less stringent criteria when it is unlikely that recreational uses will occur or when water is unlikely to be ingested;
- Consider subcategories of uses, such as precluding swimming during or immediately following a CSO event or developing a CSO subcategory of recreational uses; and
- Consider 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 water quality standards are revised, the CSO

Control Policy requires post-implementation compliance monitoring to evaluate the attainment of designated uses and water quality standards and to determine if further water quality revisions and/or additional long-term control planning is necessary. USEPA provides a schematic chart (Figure 1-3) in its guidance for describing the coordination of LTCP development and water quality standards 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.

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 water quality standards for all waters within its jurisdiction. The State has developed a system of waterbody classifications based on designated uses that includes five marine classifications, as shown in Table 1-1. New York State Water Quality classifications for the assessment area are shown in Figure 1-4.

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

Classes	Usage	DO (mg/L)	Total Coliform(1,3) (per 100 mL)	Fecal Coliform(2,3) (per 100 mL)
SA	Shellfishing for market purposes, primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	≥ 4.8(1) ≥3.0(2)	70 (3)	N/A
SB	Primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	≥ 4.8(1) ≥3.0(2)	2,400 (4) 5,000 (5)	≤ 200 (6)
SC	Limited primary and secondary contact recreation, fishing. Suitable for fish propagation and survival.	≥ 4.8(1) ≥3.0(2)	2,400 (4) 5,000 (5)	≤ 200 (6)
I	Secondary contact recreation, fishing. Suitable for fish propagation and survival.	≥ 4.0	10,000 (6)	≤ 2,000 (6)
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:

(1) Chronic standard based on daily average. The DO concentration may fall below 4.8 mg/L for a limited number of days, as defined by:

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

$$DO_i = \frac{13.0}{2.80 + 1.84e^{-0.1 t_i}}$$

Where DO_i = DO concentration in mg/L between 3.0-4.8 mg/L and t_i = time in days. This equation is applied by dividing the DO range of 3.0-4.8 mg/L into a number of equal intervals. DO_i is the lower bound of each interval (i) and t_i is the allowable number of days that the DO concentration can be within that interval. The actual number of days that the measured DO concentration falls within each interval (i) is divided by the allowable number of days that the DO can fall within interval (T_i). The sum of the quotients of all intervals (I …. N) cannot exceed 1.0: i.e.,

$$\sum_{i=1}^{n} \frac{t_i\ (actual)}{t_i\ (allowed)} < 1.0$$

(2) Acute standard (never less than 3.0 mg/L)
(3) Median most probable number (MPN) value in any series of representative samples (4) Monthly median value of five or more samples
(5) Monthly 80th percentile of five or more samples
(6) Monthly geometric mean of five or more samples

DEC considers the SA and SB classifications to fulfill the Clean Water Act goals of fully supporting aquatic life and recreation. Class SC supports aquatic life and recreation but the recreational use of the waterbody is limited due to other factors. Class I supports the Clean Water Act 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. It should also be noted that the DEC regulations state that the total and fecal coliform standards for Classes SB, SC and I "shall be met during all periods when disinfection is practiced." As disinfection is practiced at all WWTPs year-round, these standards are applicable to all SA, SB, SC and I New York Harbor waters. The DEC has classified Newtown Creek as Class SD.

Dissolved Oxygen

DO is the water quality parameter that DEC uses to establish whether a waterbody supports aquatic life uses. The numerical DO standards for Newtown Creek (Class SD saline surface waters) require that DO concentrations are at or above 3.0 mg/L at all times at all locations within the waterbody.

Bacteria

Total and fecal coliform bacteria concentrations are the numerical standards used by DEC to establish whether a waterbody supports recreational uses. There are no numerical bacteria standards for Newtown Creek and its tributaries (Class SD).

An additional DEC standard for primary contact recreational waters (not applicable to Newtown Creek, its tributaries, or any other Class SD waters) is a maximum allowable enterococci concentration of a geometric mean of 35 per 100 milliliters (mL) for a representative number of samples. This standard, although not promulgated, is now an enforceable standard in New York State since the USEPA established January 1, 2005 as the date upon which the criteria must be adopted for all coastal recreational waters.

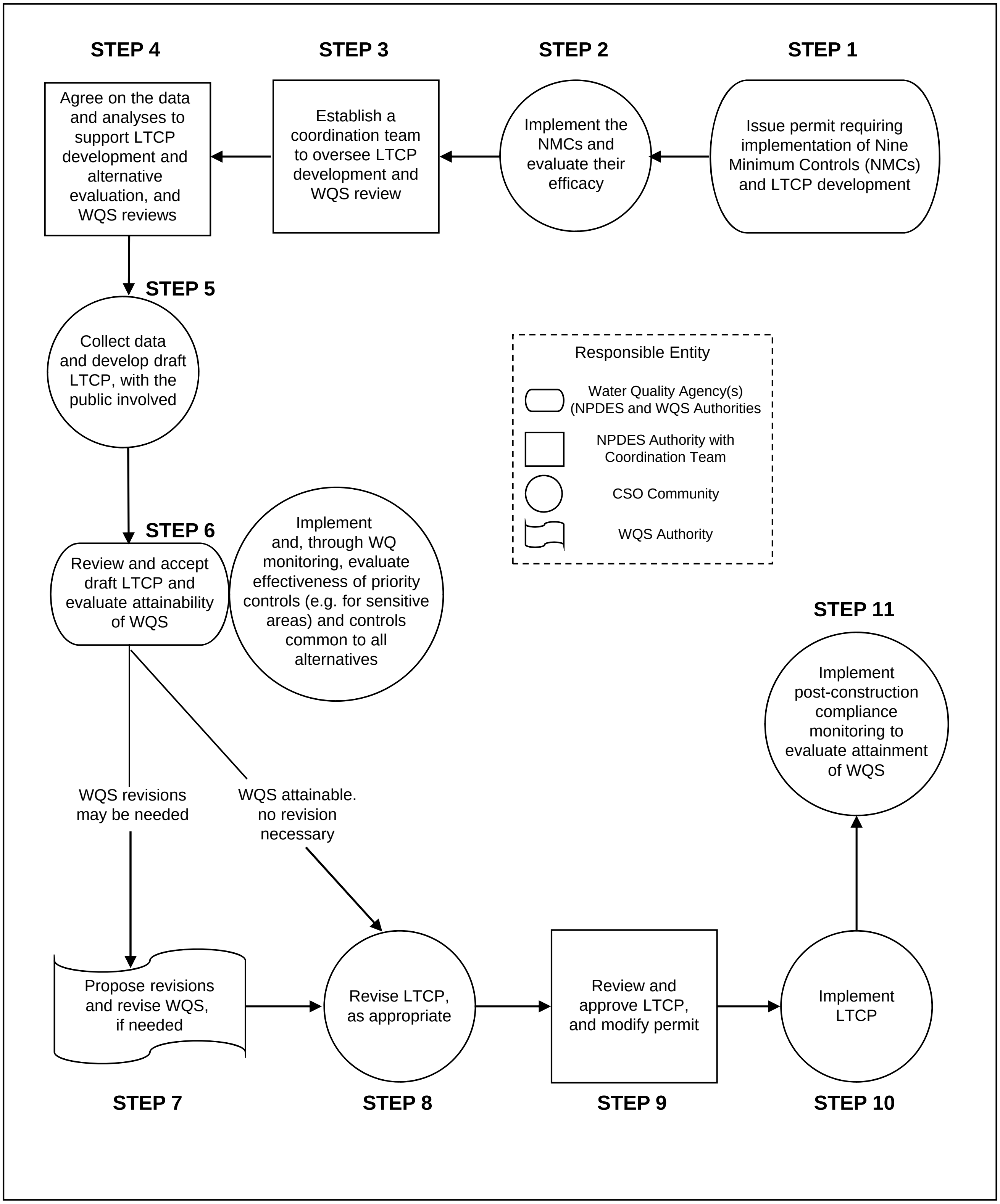
For areas of primary contact recreation that are used infrequently and are not designated as bathing beaches, the USEPA criteria suggest that a reference level indicative of pollution events be considered to be a single sample maxima enterococci concentration of 501 per 100 mL. These reference levels, in accordance with 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 (104 per 100 mL single sample maxima enterococci concentration) are to be used for announcing bathing advisories or beach closings in response to pollution events. In this WB/WS Facility Plan, the reference level of 501 per 100 mL is considered in the assessment of the potential for bathing in Newtown Creek, since there are no bathing beaches in the waterbody. In anticipation of the new bacteria standards, DEP has started measuring enterococci in its Harbor Survey program and at WWTP influents and effluents and the New York City Department of Health and Mental Hygiene has started to monitor enterococci concentrations at designated bathing beaches.

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. These standards also serve as limits on discharges to receiving waters within the State. 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. Important exceptions include garbage, cinders, ashes, oils, sludge and other refuse, which 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 discharges. It should be noted that in August 2004, USEPA Region II recommended that DEC “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 required 'none' in any amount, or provide a written clarification to this end” (Mugdan, 2004). Table 1-2 summarizes the narrative water quality standards.

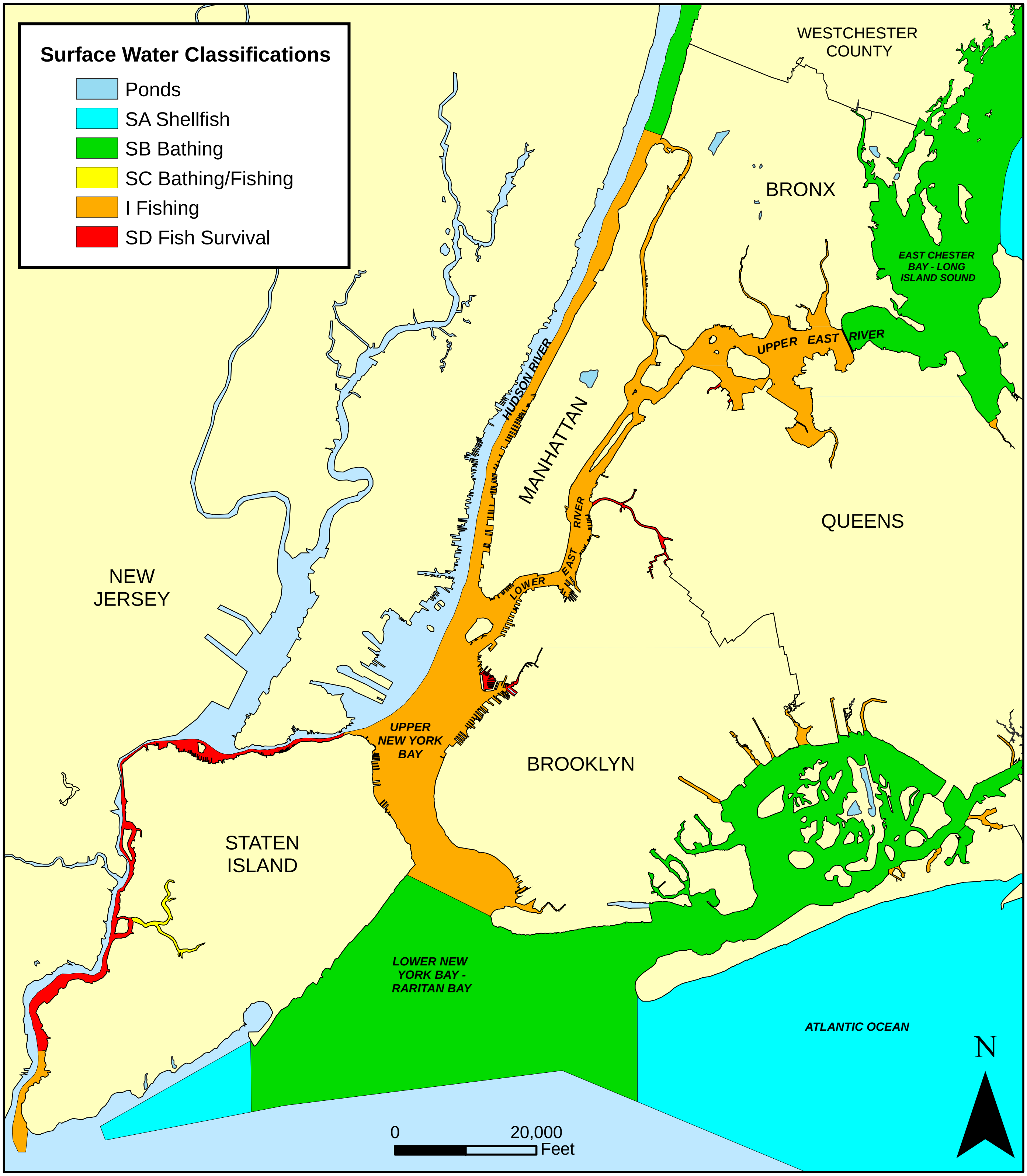
Table 1-2. New York State Narrative Water Quality Standards

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.



NYC Environmental Protection

Long Term CSO Control Planning Procedures



Environmental Protection

New York City
Department of Environmental Protection

Newtown Creek Waterbody/Watershed Facility Plan

Best Use Water Classification

FIGURE 1-4

1.2.4 Interstate Environmental Commission (IEC)

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. 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

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, consistent with the DEC definition of a prohibited dry weather discharge. Beyond that restriction, however, 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 water quality standards, the three-tiered IEC system and the five New York State marine classifications in New York Harbor do not overlap exactly; for example, the Class A DO numeric criterion (5 mg/L) differs from New York State's Class I criterion (4 mg/L). Primary contact recreation is defined in the IEC regulations as recreational activity that involves significant ingestion risk, including but not limited to wading, swimming, diving, surfing, and waterskiing. It defines secondary contact recreation as activities in which the probability of significant contact with the water or water ingestion is minimal including but not limited to boating, fishing and shoreline recreational activities involving limited contact with surface waters. However, the Newtown Creek waterbody is listed as a Class B-2 waterbody by the IEC, with a never-less-thank 3 mg/L DO standard consistent with the existing New York State Class SD classification.

1.2.5 Administrative Consent Order

New York City's 14 WWTP SPDES permits include conditions which require compliance with Federal and State CSO requirements. DEP was unable to comply with deadlines included within their 1988 SPDES permits for completion of CSO abatement projects initiated in the early 1980s. As a result, DEP entered into an Administrative Consent Order with DEC on June 26, 1992 which was incorporated into the SPDES permits with a provision stating that the Consent Order governs DEP's obligations for its CSO program. It also required that DEP implement CSO abatement projects within nine facility planning areas in two tracks: those areas where DO and coliform standards were being contravened (Track One), and those areas where floatables control was necessary (Track Two). The 1992 Order was modified on September 19, 1996 to add catch basin cleaning, construction, and repair programs.

DEP and DEC negotiated a new Consent Order, signed January 14, 2005, that supersedes the 1992 Order and its 1996 Modifications, with the intent to bring all DEP CSO-related matters into compliance with the provisions of the Clean Water Act and Environmental Conservation Law. The new Order contains requirements to evaluate and implement CSO abatement strategies on an enforceable timetable for 18 waterbodies and, ultimately, for Citywide long-term CSO control in accordance with USEPA CSO Control Policy. This Order was recently modified and signed on April 14, 2008 and again on September 3, 2009. DEP and DEC also entered into a separate MOU to facilitate water quality standards 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 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 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 Department of City Planning (DCP). 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 a 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, in turn, 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, which provide geographic specificity to the WRP and acknowledge that certain policies are more relevant than others in particular portions of the waterfront.

1.3.3 Department of City Planning Actions

The DCP 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 Newtown Creek. DCP 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, DCP maintains a library of Citywide 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 DCP community district liaison for the Community District was contacted to determine whether any proposals in process that required DCP review might impact the WB/WS Plan.

1.3.4 New York City Economic Development Corporation

The Economic Development Corporation (EDC) 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 Newtown Creek. The EDC 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, EDC has the potential to alter land use on a large scale.

Additionally, the EDC serves as a policy instrument for the Mayor's Office, and recently issued a white paper on industrial zoning (Office of the Mayor, 2005) intended to create and protect industrial land uses throughout the City. The policy directs the replacement of the current In-Place Industrial Parks (IPIPs) with Industrial Business Zones (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. Accordingly, a thorough review of EDC policy and future projects was performed to determine the extent to which they may impact the WB/WS Plan. La Guardia airport is included in the Steinway Industrial Business Zone.

1.3.5 Local Law

Local law is a form of municipal legislation that has the same status as an act of the State Legislature. The power to enact local laws is granted by the New York State Constitution, with the scope and procedures for implementation established in the Municipal Home Rule Law. In New York City, local laws pertaining to the use of the City waterways and initiatives associated with aquatic health have been adopted beyond the requirements of New York State. Recent adoptions include Local Law 71 of 2005, which required the development of the Jamaica Bay Watershed Protection Plan (JBWPP) and Local Law 5 of 2008 which requires City-owned buildings or City-funded construction to include certain sustainable practices, as well as requiring the City to draft a sustainable stormwater management plan by October 1, 2008. These initiatives are discussed in Section 5 in detail.

1.3.6 Bathing Beaches

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. 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 a 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 this document for cross-referencing.

Section 1 describes general planning information and the regulatory considerations in order to describe the setting and genesis of the LTCP and the CSO Control Policy. 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 went into the development of this WB/WS Facility Plan, as well as an overview of DEP's public outreach program. Sections 7 and 8 describe the development of the plan for the waterbody. Section 9 discusses the review and revision of water quality standards. The report concludes with references in Section 10 and a glossary of terms and abbreviations is included in Section 11. Attached for reference are the Wet Weather Operating Plans for the Bowery Bay and Newtown Creek WWTPs, the Use and Standards Attainment Project Newtown Creek Public Opinion Survey, and the Newtown Creek WB/WS Facility Plan Stakeholder Meeting Minutes.

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

No.	Element	Section(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 Alternative	7.0
5	Cost/Performance Considerations	7.0
6	Operational Plan	8.0
7	Maximizing Treatment at the Existing WWTP	7.0 & 8.0
8	Implementation Schedule	8.0
9	Post-Construction Compliance Monitoring	8.0

2.0 Watershed Characteristics

For the purposes of this Waterbody/Watershed Facility Plan, the Newtown Creek waterbody and watershed includes Newtown Creek, Dutch Kills, Maspeth Creek, East Branch and English Kills waterbodies and watersheds and their associated tributary sewersheds. Newtown Creek is tributary to the East River, and none of its tributary waterbodies receive any natural freshwater flow. The Creek was originally a stream draining the uplands of western Long Island. The natural tributary watershed of Newtown Creek was approximately 5,322 acres, based on topography. However, sewer system construction and other alterations have extensively modified the original drainage area, which is now approximately 7,650 acres of largely impervious urban landscape. Urbanization has also modified the course and channel of Newtown Creek, most notably filling the inland streams, and widening and deepening the downstream end. The Creek generally extends in a northwest direction from the English Kills headwaters at Johnson Avenue. Much of the Creek defines the border between the boroughs of Brooklyn and Queens. Most of the area to the north and west of the watershed drains to the East River, while areas to south and east drain toward Flushing or Jamaica Bay.

The following paragraphs present the historical context of changes in the Newtown Creek watershed, current and future land use, and shoreline characteristics that have impacted pollutant loadings from the watershed to the waterbody.

2.1 HISTORICAL CONTEXT OF WATERSHED URBANIZATION

Dutch explorers completed the first survey of Newtown Creek in 1613-14 and it was acquired from the local Mespatches tribe shortly thereafter. The Creek area, once used primarily for agriculture, became an important industrial zone following the Revolutionary War. Farmland was replaced by glue and tin factories, rope works, tanneries and the Sampson Oil Cloth Factory.

Commerce along the Creek eventually shifted to shipbuilding, with hundreds of boats built in the Pre-Civil War era. In the Post-Civil War era, the industrial revolution began and textile manufacturing and oil refining replaced shipbuilding in the area. The first kerosene refinery and the first modern oil refinery in the United States transformed the Creek into an industrial waterway. By the end of the 19th century, Long Island City had the highest concentration of industry in the United States. By 1880, there were at least 50 petroleum refineries on the Queens side of the creek alone. The influx of industry was accompanied by infrastructure development including the Long Island Railroad Hub (1861), the Queensboro Bridge (1909) and the IRT subway line (1917). In 1865 the city surveyor, J.S. Stoddard, recommended against plans to run sewer lines to the Creek. His advice went unheeded and the city began dumping raw sewage directly into the Creek.

By the 1920s and 30s, Newtown Creek was channelized and deepened to accommodate heavier shipping traffic, thus emerging as a major shipping hub for the Northeast United States. Raw materials were imported from all over the world while manufactured products were exported domestically. The Creek became home to such businesses as sugar refineries, canneries, copper wiring plants and petroleum and oil refineries. The Creek soon became one of the dirtiest bodies of water in America as industries had free reign to dispose of unwanted byproducts.

Water quality degradation was accelerated by the cumulative effects of waterbody and watershed alterations and the lack of wastewater treatment (the Newtown Creek WWTP was not completed until 1967). Water quality problems were so pronounced by the early 1900s that the New York State legislature directed the City of New York to create the Metropolitan Sewerage Commission to study water quality in the New York Harbor (Metropolitan Sewerage Commission, 1912). The Sewerage Commission began sampling the harbor in 1909, and characterized several tributaries of the harbor as "little more than open sewers" based on this investigation. They recommended against swimming in the harbor, and suggested that the oyster industry be abandoned.

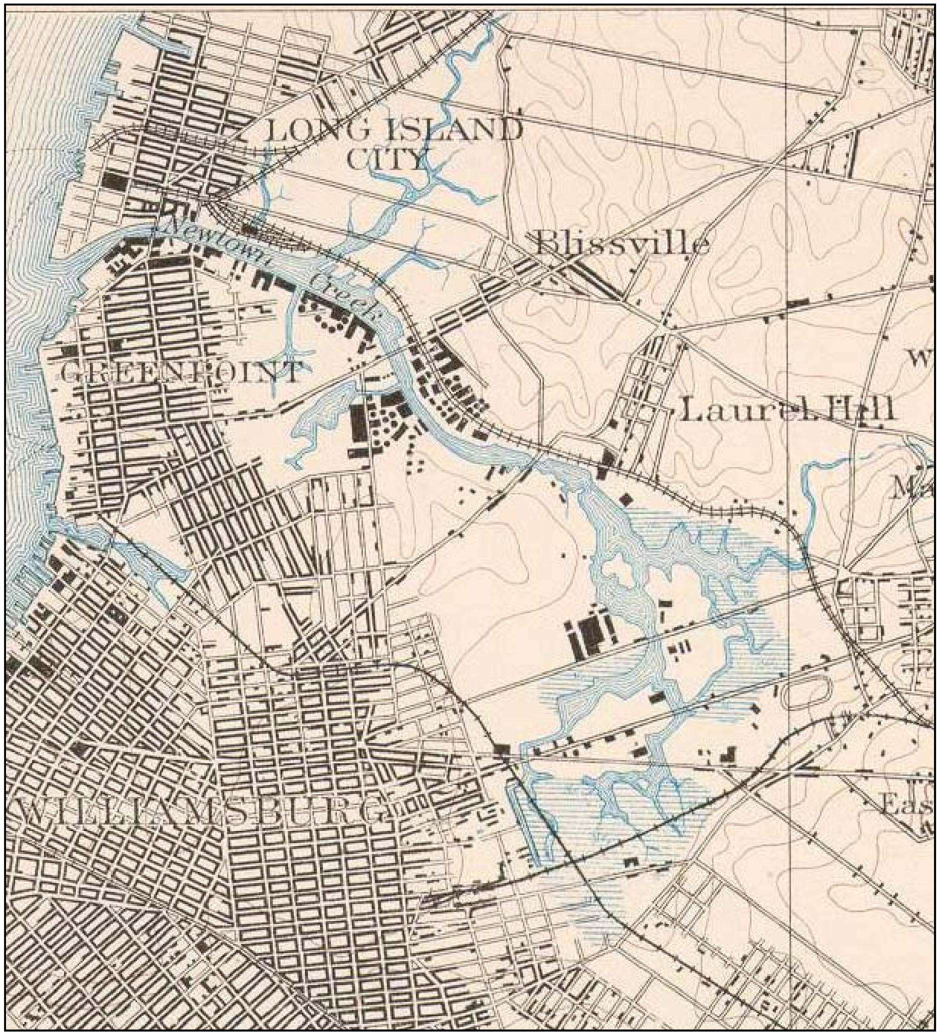
Today the Creek is 3.8 miles from the East River to its farthest reach inland, and has a total surface area of approximately 165 acres. Dredging has provided depths of 15 to 16 feet at mean low water (MLW) and widths between 200 and 300 feet. The tributaries and branches are also relatively deep, between 10 and 17 feet MLW, although shallowing towards their head ends. English Kills, upstream of Metropolitan Avenue, becomes very shallow for a significant distance towards it head end. The downstream reach of Newtown Creek is significantly wider, averaging about 550 feet, and expanding to approximately 820 feet as it enters the East River. These widths and depths accommodate small ship and barge navigation through most of the waterbody, and although waterfront industrial activities have significantly declined over the years, Newtown Creek still remains an active area for manufacturing, wholesale distribution, solid waste handling, oil storage and distribution, and municipal uses. From 1985 through 1987, waterborne commerce averaged approximately 2,000 round trips per year by tankers and barges transporting mostly petroleum products, sand and gravel, scrap metal and solid waste materials (URS, 1993). See Figure 2-1.

2.2 LAND USE CHARACTERIZATION

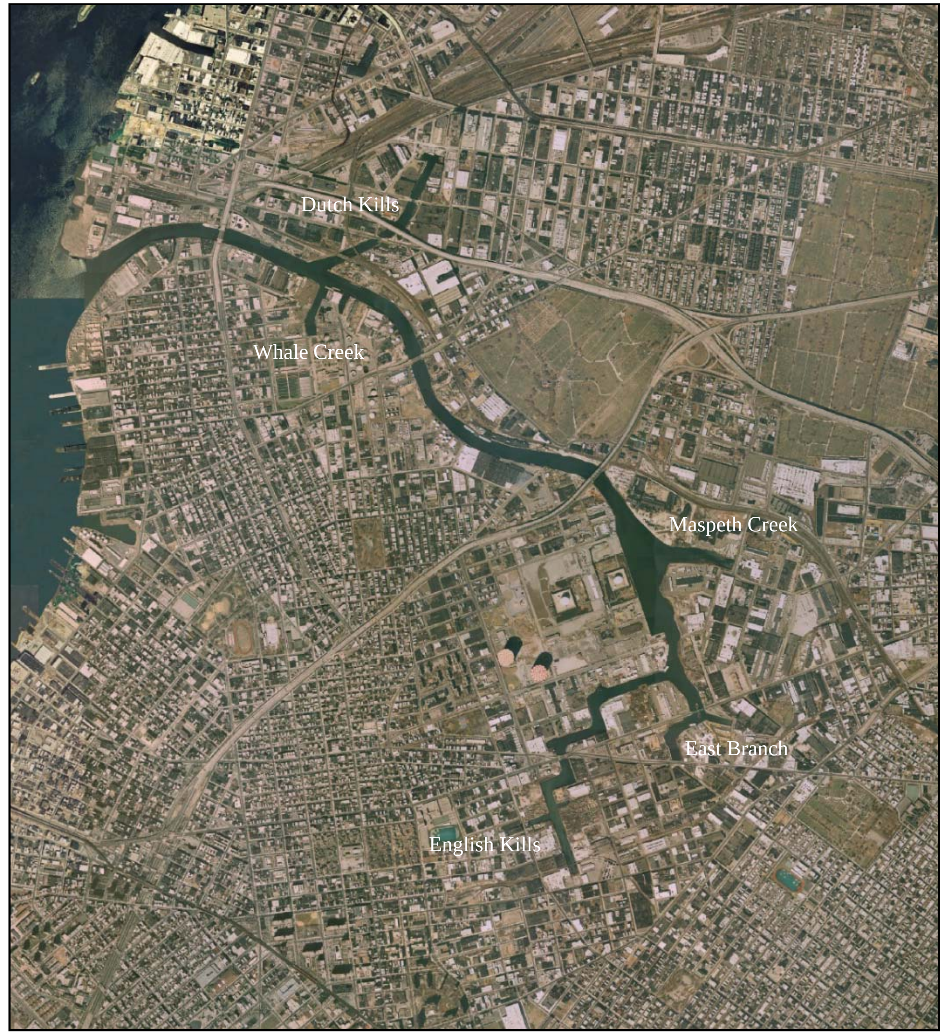
The current use of land in the watershed has a substantial impact on the water quality, volume, frequency, and timing of CSOs. The presence of structures, roads, parking lots, and other impervious surfaces alongside parkland, undeveloped open space, and other vegetated, water-retaining land uses creates a complex runoff dynamic. The current land use is largely an artifact of historical urbanization, but future use is controlled by zoning, public policy, and land use regulations intended to promote activities appropriate to neighborhood character and the larger community. The following sections detail existing land use and future changes based on zoning, known land use proposals, and current consistency with relevant land use policies.

2.2.1 Existing Land Use

Land use in the immediate vicinity of Newtown Creek is generally dominated by industrial, manufacturing, transportation, and utility. The heavy industry in this area includes the storage and handling of petroleum products, scrap metal processing, lumber yards, sand and gravel storage, ready-mix cement plants, and recycling and disposal of solid waste (see Figure 2-2). Beyond the shoreline of the Creek, the watershed includes portions of Brooklyn and Queens spanning the borough boundary.



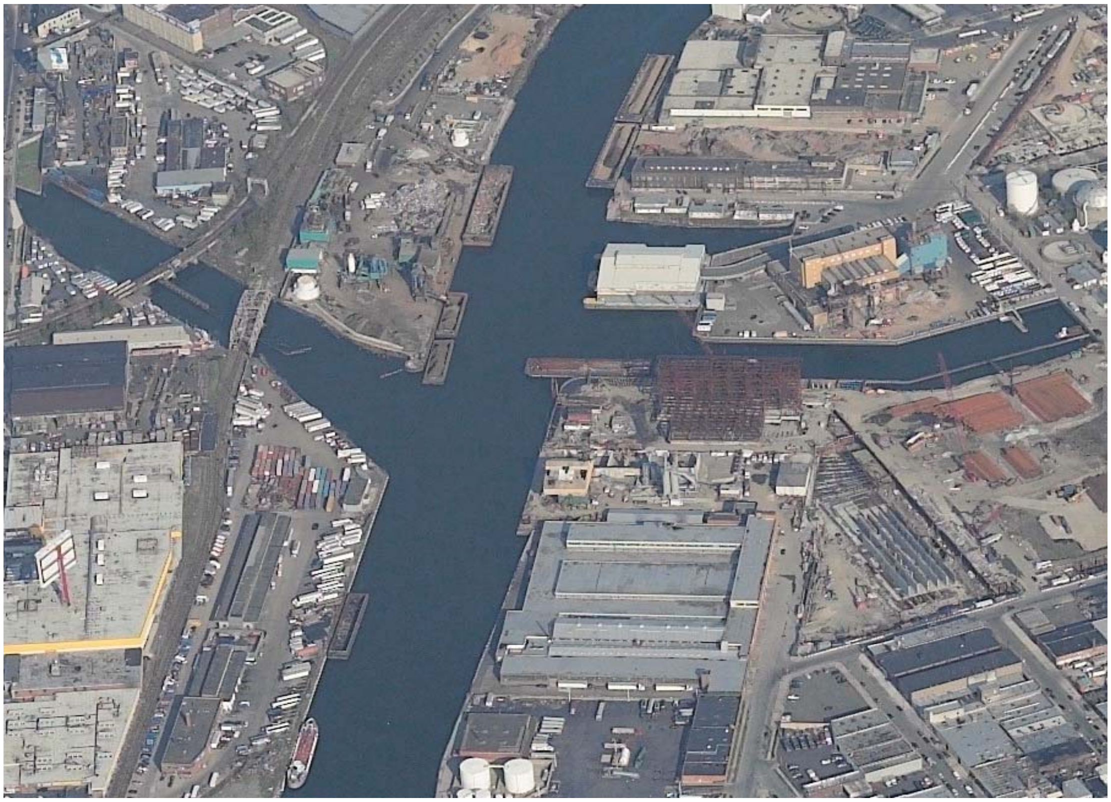
Early Development. c1891 (USGS)

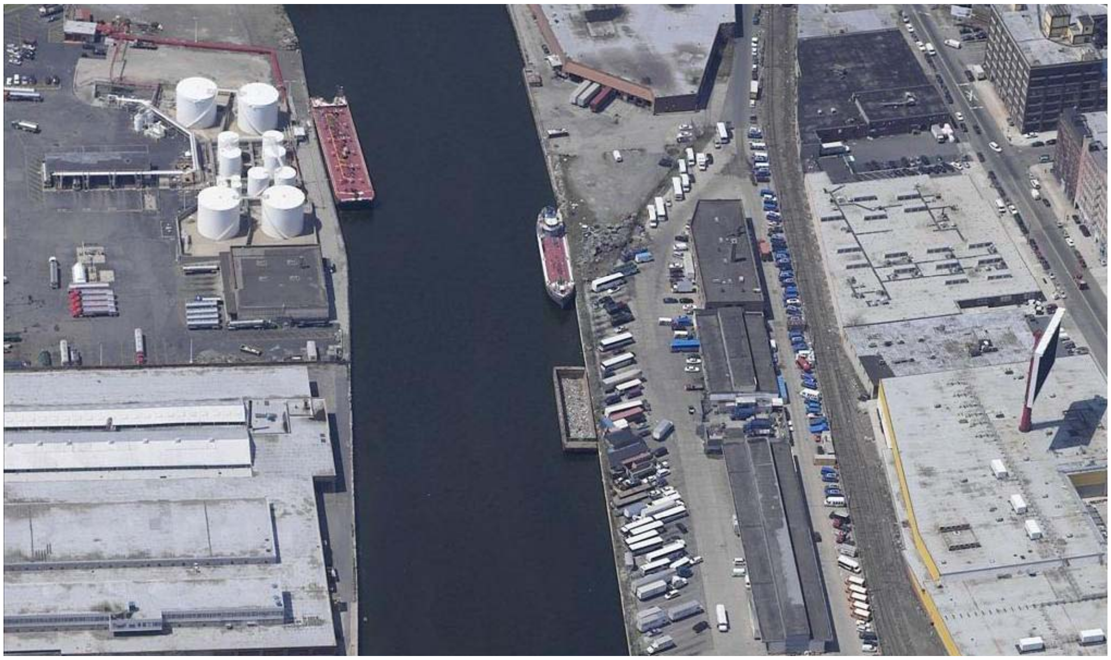


Developed. c2002 (NYSGIS)

Environmental Protection

Comparison of Undeveloped and Developed Conditions Surrounding Newtown Creek





Environmental Protection

Land Use and Water Traffic On Newtown Creek

There is currently one developed park adjacent to the Creek. The Newtown Creek Nature Walk is a public walkway, being implemented in three phases. Phase 1 is a quarter–mile in length and was completed in 2010. Phase 2 will be completed in 2013, and the development of Phase 3 is currently in progress. Even with the nature walk, there is very limited recreational access to the waterbody. There are several tracts of vacant land and miles of rusting unused railroad tracks, dilapidated docks, bulkheads and factories.

The Greenpoint industrial area encompasses the Brooklyn shoreline from McGuiness Blvd. to the Brooklyn Queens Expressway and includes the Newtown Creek Wastewater Treatment Plant. A large Keyspan Energy facility occupies the Brooklyn shoreline north of the mouth of English Kills.

Several cemeteries are located in the Queens portion of the watershed. The larger cemeteries near Newtown Creek include Calvary Cemetery, New Calvary Cemetery, Mount Zion Cemetery, Mount Olivet Cemetery, and Lutheran Cemetery. The Sunnyside Railyards line the northern boundary of the Queens watershed.

Generalized land use in the Newtown Creek drainage area (Figure 2-3) is dominated by a mix of industrial and commercial uses. The relative distribution of land uses in the watershed and riparian area (within a 1/4-mile radius) is summarized in Table 2-1. The Calvary Cemetery (open space) and residential uses constitute a very small portion of the land uses adjacent to the waterbody. However, moving upland into the watershed, residential use increases significantly.

Table 2-1. Land Use Summary by Category

Land Use Category	Watershed Area, %	Riparian Area, % (Within 1/4 Mile Radius) (1)
Residential	32.91	2.37
Open Space	25.56	0.99
Industrial & Manufacturing	19.19	79.98
Transportation & Utility	5.40	5.56
Mixed Use & Other	5.14	7.85
Vacant Land	4.44	0.05
Public Facilities & Institutions	4.43	1.44
Commercial	2.93	1.76
(1) Riparian areas include all blocks wholly or partially within a quarter mile of Newtown Creek. See Figure 2-3.		

2.2.2 Zoning

The Zoning Resolution of the City of New York regulates the size of buildings and properties, the density of populations, and the locations that trades, industries, and other activities are allowed within the City limits. The Resolution divides the City into districts, distinguishing residential, commercial, and manufacturing districts having use, bulk, and other controls. Residential districts are defined by the allowable density of housing, lot widths, and setbacks, with a higher number generally indicating a higher allowable density (e.g., single-family detached residential districts include R1 and R2, whereas R8 and R10 allow apartment buildings).

Commercial Districts are divided primarily by usage type, so that local retail districts (C1) are distinguished from more regional commerce (C8). Manufacturing districts are divided based on the impact of uses on sensitive neighboring districts to ensure that heavy manufacturing (M3) is buffered from residential areas by lighter manufacturing zones (M1 and M2) that have higher performance levels and fewer objectionable influences. Figure 2-4 represents zoning within the Newtown Creek Watershed.

Zoning immediately adjacent to Newtown Creek is dominated by manufacturing districts. The majority of the waterfront is zoned M3, with the exception of a downstream reach in Greenpoint which was re-zoned M1-2, R6 and R8 in 2005. The residential areas in the inland watershed are zoned R4 to R6, with an area of R7 northwest of New Calvary Cemetery.

2.2.3 Neighborhood and Community Character

The character of a neighborhood is defined by both physical patterns such as land use, architecture, and public spaces, as well as activity patterns such as pedestrian traffic, commerce, and industry. The character in the immediate vicinity of Newtown Creek is influenced by its historical significance as a shipping corridor, resulting in an industrial neighborhood that will most likely remain as such through zoning and incentives from the New York City Economic Development Corporation (EDC). The area is zoned for heavy industries and has the highest concentration of solid waste transfer stations in the city.

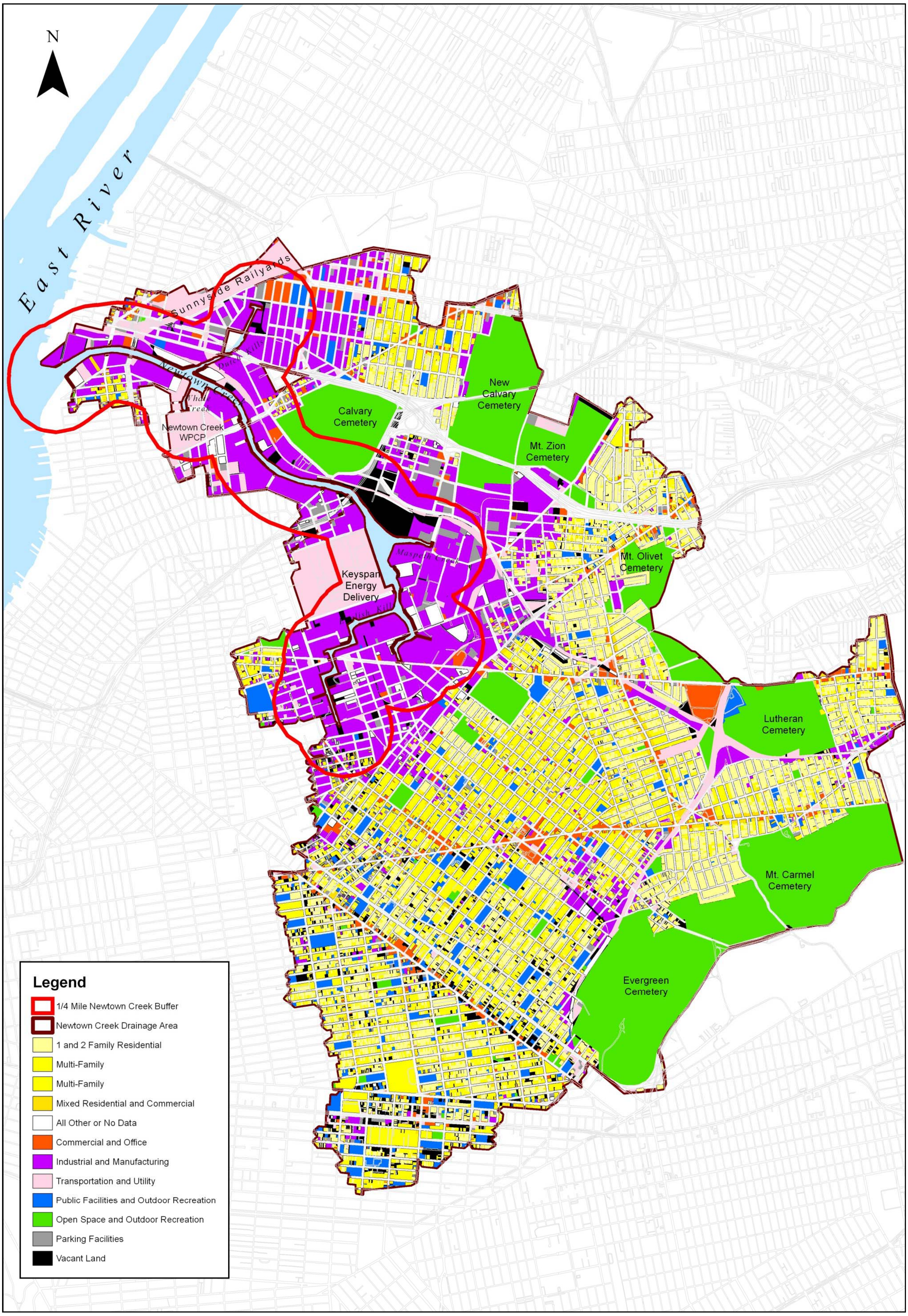
Newtown Creek borders the Brooklyn neighborhoods of Greenpoint and East Williamsburg and the Queens neighborhoods of Hunters Point, Long Island City, Blissville, Maspeth, and Ridgewood (Figure 2-5).

Most of the shoreline area is dedicated to industrial uses with limited public access. However, a waterfront promenade is under construction by the DEP at the Newtown Creek WWTP, and a street end park is also under construction where Manhattan Street ends at (south) Newtown Creek. Another street end park is being planned for the end of Vernon Boulevard directly opposite (north of) Newtown Creek. Other opportunities for public access to Newtown Creek are at bridges and other streets that end at Newtown Creek. A local canoe club, the Newtown Creek Canoe and Kayak Club, makes recreational use of the waterbody, as does the East River Apprenticeshop.

2.2.4 Proposed Land Uses

The New York City Department of City Planning (DCP) 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, among other responsibilities. The DCP has a community district liaison for each community district in the City of New York, including Brooklyn Community District 1 and Queens Community Districts 2 and 5, which are the three community districts bordering Newtown Creek. The community district liaison is responsible for processing all proposals requiring DCP review.

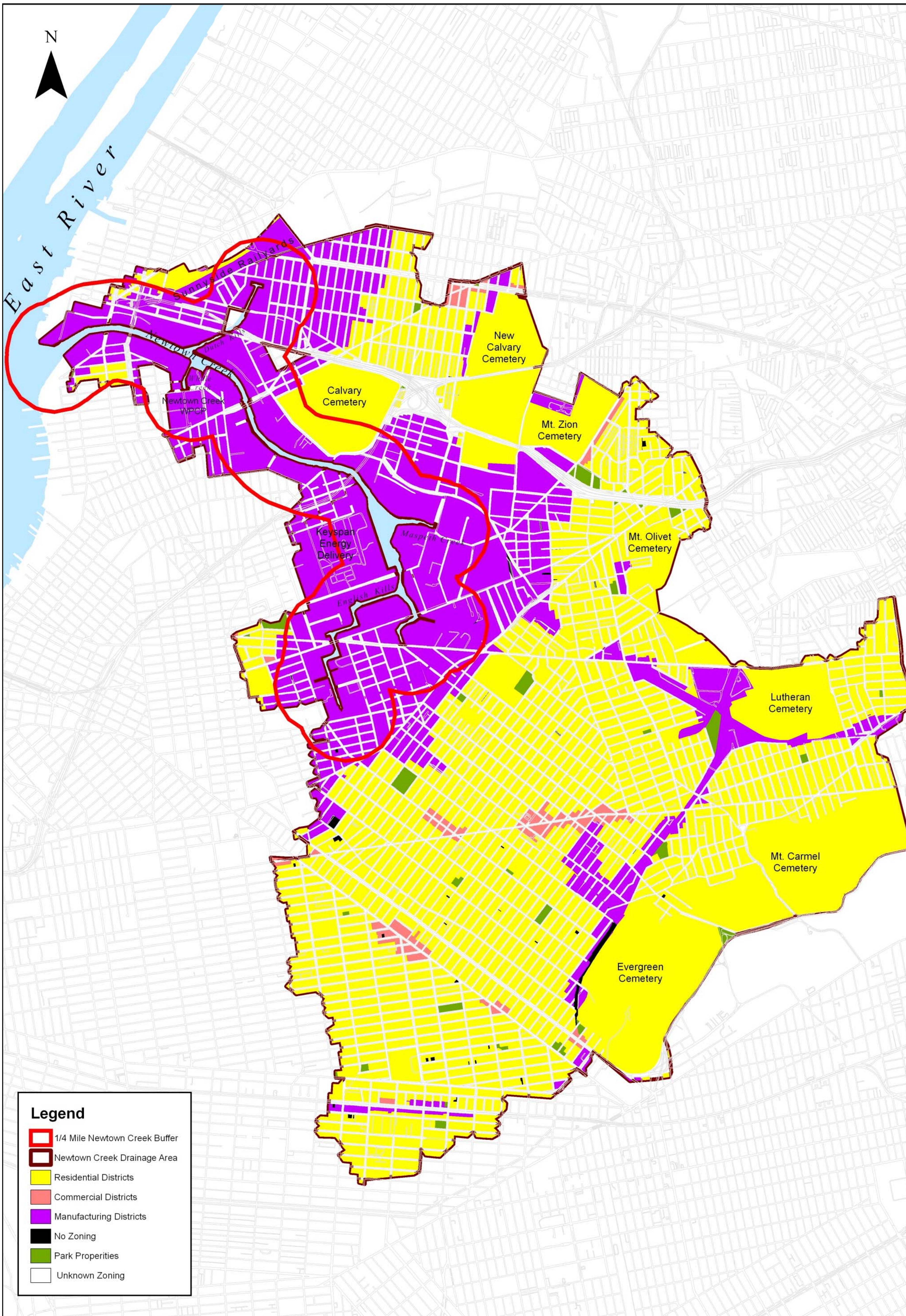
The New York City Economic Development Corporation (EDC) is charged with dispensing City-owned property to businesses as a means of stimulating economic growth, employment, and tax revenue in the City of New York while simultaneously encouraging specific types of land use in targeted neighborhoods. As such, EDC has the potential to alter land use on a large scale.



NYC Environmental Protection

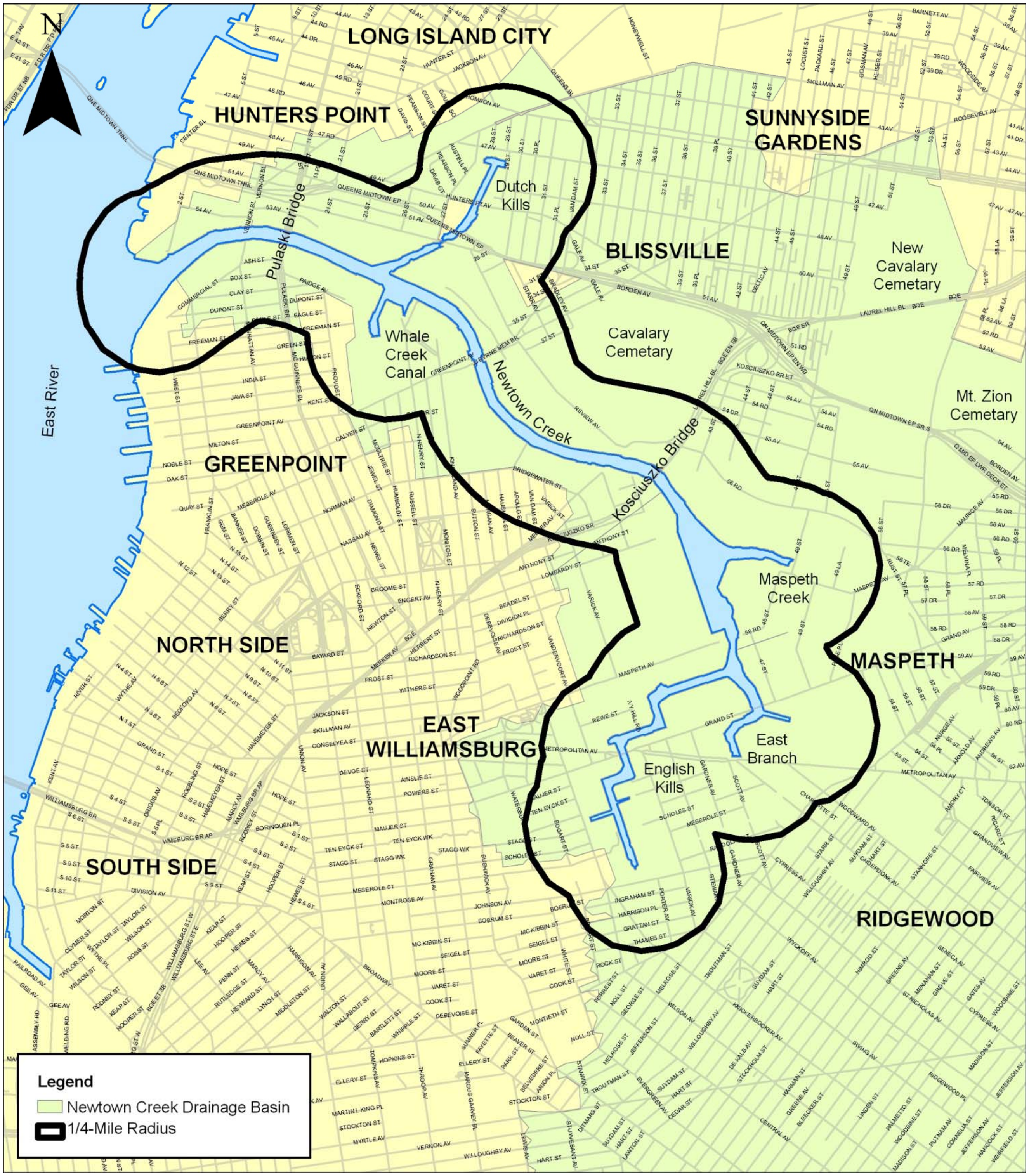
Newtown Creek
Generalized Land Use Map

Figure 2-3



Environmental Protection

Newtown Creek Generalized Zoning Map



Environmental Protection

Neighborhoods Adjacent to Newtown Creek

Both the DCP and the EDC were contacted to identify any projects either under consideration or in the planning stages that could substantially alter the land use in the vicinity of Newtown Creek. At the time of inquiry, the three DCP liaisons had no waterfront projects under review. The Brooklyn Community Board 1 liaison stated that work is proceeding on the review of zoning for sites under the control of DEP and the Department of Sanitation.

In August 2005, the DEC had several projects in the vicinity of Newtown Creek in the early stages of development. There are three brownfield sites in the vicinity of Newtown Creek that are tax delinquent and are being considered for industrial redevelopment. These include Morgan Oil Terminal (200 Morgan Avenue), BCF Oil (362 Maspeth Ave) and a site south of Calvary Cemetery. Another project near English Kills at the intersection of Grand St and 47th street will involve the expansion of an existing recycling facility and the restoration of existing bulkheading. The EDC has long-term plans to accommodate industrial users within the existing zoning in the vicinity of Newtown Creek, particularly as industrial uses throughout other parts of New York City are pushed out through market forces, gentrification, and environmental regulations.

None of the currently proposed land uses and significant new facilities identified within the Newtown Creek waterbody/watershed assessment area will substantially change existing land uses, nor increase the dry weather flow in the collection system significantly.

2.2.5 Consistency with the Waterfront Revitalization Program and Comprehensive Waterfront Plan

Although the New York City WRP policies are intended to be used to evaluate proposed actions to promote activities appropriate to various waterfront locations, evaluating the consistency of existing land use with those policies can be used to anticipate future waterfront conditions. Ten policies are included in the program: (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.

Newtown Creek is entirely within the Coastal Zone Boundary. In addition, all but the downstream reaches of Newtown Creek are within the Newtown Creek Significant Maritime and Industrial Area (SMIA) designated by the WRP (Figure 2-6). An SMIA is an area well-suited to support water-dependent and industrial uses in New York City. These waterfront areas support waterborne cargo, industrial activity, and municipal and public utility services. Newtown Creek is one of six SMIAs recognized as of the 2002 WRP (NYCDCP, 2002). The major criteria used to delineate these areas include: concentrations of M2 and M3 zoned land; suitable hydrographic conditions for maritime related uses; presence or potential for intermodal transportation; marine terminal and pier infrastructure; concentrations of water-dependent and industrial activity; good transportation access and proximity to markets; or availability of publicly-owned land. Public investment within the SMIAs should be targeted to improve transportation access and maritime and industrial operations. In-kind, in-place bulkhead replacement and maintenance and maintenance dredging are essential to the operation and preservation of working waterfront uses and are consistent with the intent of the policy. Since SMIAs are ideally suited for water-dependent uses, priority would be given to maritime uses or uses that incorporate water-dependent activities. However, the SMIAs encompass much of the city's land zoned for heavy industrial uses. Non-water-dependent industrial and commercial uses conforming to zoning may therefore be considered appropriate as long as the shorefront infrastructure is maintained to permit subsequent water-dependent use.

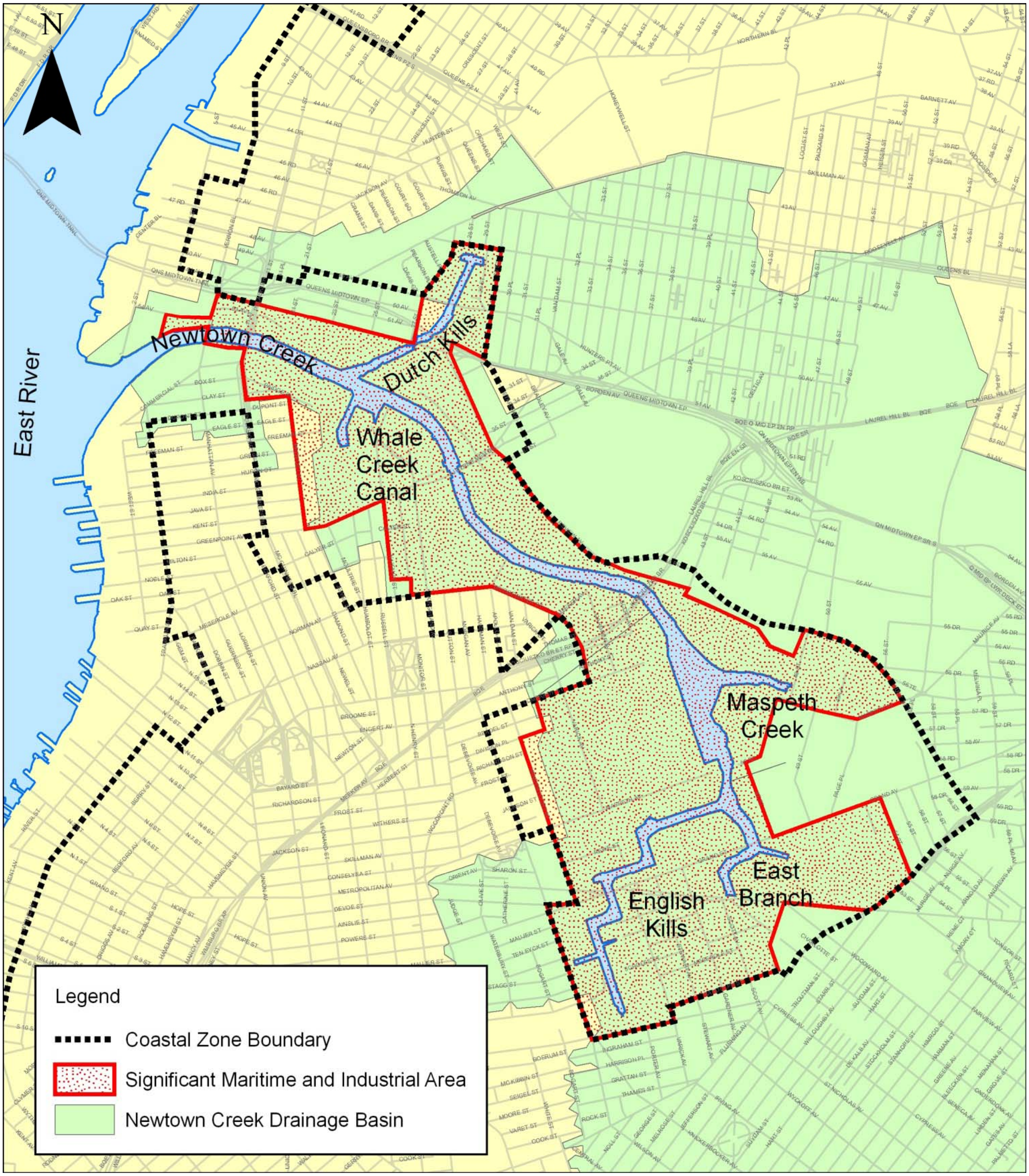
As an SMIA, the Newtown Creek waterbody/watershed assessment area is currently consistent with most policies of the WRP. With well-defined shoreline boundaries channelized for maritime industrial activities and intermodal transportation, Newtown Creek will most likely remain a working waterfront area in the future. There are no specific designated natural resources in the Creek, including tidal wetlands or habitat areas though failure to attain water quality conditions suitable for fish propagation and survival directly contravenes both policy 4 (coastal ecological systems) and policy 5 (water quality). Shorelines along Newtown Creek are almost entirely bulkheaded or supported by riprap. Some sections of the shoreline are in disrepair, which is not consistent with policy 2 (water-dependent and industrial uses). Recent rezoning as discussed in Section 2.2.2 is consistent with policy 1. The remaining policies (6 through 10) are designed to review the impact of proposed actions and are therefore not applicable to existing conditions. A comprehensive WRP consistency determination is typically performed as part of the environmental review process in accordance with CEQR requirements.

2.3 REGULATED SHORELINE ACTIVITIES

As part of plan development, information was gathered from selected existing federal and state databases to identify possible landside sources that have the potential to directly impact water quality in Newtown Creek. For the purposes of this assessment, potential sources included the presence of underground storage tanks (UST), major oil storage facilities (MOSF), known contaminant spills, state and federal Superfund sites, SPDES permitted discharges to the waterbody, as well as other sources that 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 and the National Priorities List (NPL). In addition to these federal databases, several databases managed by the DEC were also reviewed. The DEC Spill Incident Database and the Environmental Site Remediation Database, which allows searches of the DEC Brownfield cleanup, state Superfund (inactive hazardous waste disposal sites), environmental restoration and voluntary cleanup programs (VCP), were reviewed. In addition, an Environmental Data Resources (EDR) Data Map Corridor Study Report was reviewed to provide information with regard to USTs, leaking storage tanks (LTANKS) and MOSFs, as well as additional information from the state and federal databases listed above. The EDR report was primarily reviewed to provide additional information with regard to UST, leaking storage tanks (LTANKS) and MOSFs, which were not readily accessible within the aforementioned databases.

Newtown Creek generally serves as a border between two counties (Queens and Kings) and two water pollution control plants drainage areas (Bowery Bay and Newtown Creek). This assessment has been organized according to WWTP drainage area. The extent of the investigation within each drainage area was generally limited to those areas that are immediately adjacent to the Creek and up to the nearest mapped street.



Environmental Protection

Newtown Creek SMIA and Costal Zone Boundary

2.3.1 USEPA and DEC Database Search Results

The Bowery Bay WWTP is located adjacent and west of Riker's Island along the northern shoreline of the East River in Queens County. The drainage area for the Newtown Creek study area covers Queen's Community District 1. For the purposes of this assessment, the study area was inclusive of land within close proximity to the northern shoreline of Newtown Creek, including areas in close proximity to Dutch Kills, East Branch and Maspeth Creek.

According to the USEPA Superfund Information System database, there is one federally listed Superfund site located in close proximity to Newtown Creek; Phelps Dodge Refining Corporation, located at 42-02 56th Road in Maspeth. The site is listed as a CERCLIS site for lead cleanup. CERCLIS contains sites which are either proposed for or on the NPL or are in the screening and assessment phase for possible inclusion on the NPL. The Phelps Dodge site is undergoing remediation activities and has been sold for development. A Record of Decision was expected at the end of 2006, but has yet to be released. No additional NPL sites were identified within the study area.

A review of the DEC Environmental Site Remediation database identified a Brownfield at the Maspeth Project Site located at 57-15 49th Street, approximately 300 feet north of Maspeth Creek. A preliminary investigation indicated the possible presence of a common plasticizer (bis-2-ethylhexyl phthalate) at elevated levels in the groundwater and soils. The site however, has not been determined to be a significant threat to the environment.

RCRA databases indicated that there are 2 large quantity generators and 46 small quantity generators located in close proximity to Newtown Creek within the Bowery Bay WWTP study area. Under RCRA, large quantity generators produce over 1,000 kilograms of hazardous waste or over 1 kilogram of acutely hazardous waste per month, while small quantity generators produce between 100 kilograms and 1,000 kilograms of waste per month. RCRA sites located within close proximity to Newtown Creek are listed in Table 2-2.

Table 2-2. RCRA Sites in the Bowery Bay WWTP Service Area in Close Proximity to Newtown Creek (December 2006)

Site Name	Address
Large Quantity Generators	
Phelps Dodge Refining Corp.	42-02 56th Road
Galasso Trucking, Inc.	2 Galasso Place
Small Quantity Generators	
Hunt, Philip A. Chemical Corp.	47-50 30th Street
IKG Industries	50-09 27th Street
United Parcel Service	49-10 27th Street
27-11 49th Avenue Reality, LLC	27-11 49th Avenue
Public Service Truck Renting	25-61 49th Avenue
New York Envelope Corporation	29-10 Hunters Point Avenue
Former Thypin Steel Building	49-49 30th Street
Hunters Point Waterfront Site	5500 2nd Street

Table 2-2. RCRA Sites in the Bowery Bay WWTP Service Area in Close Proximity to Newtown Creek (December 2006)

Site Name	Address
Anheuser Busch Distributors of New York, Inc.	55-01 2nd Street 54-12 Foot of 2nd Street
Ditmas Oil Associates	53-02 11th Street
The Exhibit Co., Inc.	30-20 Review Avenue
NYC Department of Environmental Protection	30-03 Review Avenue
NYC Department of Environmental Conservation	30-03 Review Avenue
Access Self Storage	2900 Review Avenue
A. A. Truck Renting Corp.	2890 Review Street
NYSDOT Contract 253037	29-00 Borden Avenue
Spring Scaffolding, Inc.	28-20 Borden Avenue
Waldes Truarc, Inc.	29-01 Borden Avenue
Warner Lambert Company	2901 Borden Avenue
Verderame Construction Co., Inc.	24-16 Queens Plaza
Getty Terminals Corporation	30-23 Greenpoint Avenue
Ciada Service	30-23 Greenpoint Avenue
Prolerized Schiabo Neu Co.	30-27 Greenpoint Avenue
Quanta Resources Corporation	37-80 Review Avenue
Gulf & Western Manufacturing Co.	39-30 Review Avenue
Penn-Grover Envelope Company	38-98 Review Avenue
Dynamic Display, Inc.	38-78 Review Avenue
United Parcel Service	46-05 56th Road
United Parcel Service	45-05 56th Road
Diamandis Brothers, Inc.	1 Galasso Place
Elm Coated Fabrics Division	57-27 49th Street
Davis & Warshow	57-22 49th Street
Larstan Processing Company, Inc.	48-85 Maspeth Avenue
Canover Industries, Inc.	48th Street & Maspeth Avenue
Z. R. Enterprises, Inc.	4710 Grand Avenue
Avis Rent A Car Systems, Inc.	48-05 Grand Avenue
Avis Rent A Car Systems, Inc.	48-05 Grand Avenue
The Radio Station WQXR	5000 Grand Avenue
B & I Fender Trims, Inc.	5000 Grand Avenue
Arrow Louver & Damper	50-00 Grand Avenue
AT Lite	57-47 47th Street
Superior Metal Lithography	4740 Metropolitan Avenue
Con Edison – VS 1829	47-35 Metropolitan Avenue

Table 2-2. RCRA Sites in the Bowery Bay WWTP Service Area in Close Proximity to Newtown Creek (December 2006)

Site Name	Address
Atlantic Express Corporation	46-81 Metropolitan Avenue
Exxon Co. USA – Maspeth Terminal	4763 Metropolitan Avenue
Demaco Division of Howden Food Equipment	46-25 Metropolitan Avenue

The DEC Petroleum Bulk Storage (PBS) database identified 48 USTs within the Bowery Bay WWTP drainage area of Newtown Creek. These sites contain USTs that are either in-service or closed. The storage capacity of the USTs ranged from 350 to 20,000 gallons and stored leaded or unleaded gasoline, diesel, Nos. 1, 2, 4, 5 and/or 6 fuel oil, or other materials. The UST sites are identified in Table 2-3.

Table 2-3. USTs in the Bowery Bay WWTP Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Tank Capacity (Gallons)	Product Stored	Number of Tanks	Status
I G Federal Electrical Supply	47-20 30th Street	4,500	No.1, 2 or 4 Fuel Oil	1	In Service
Patent Construction Systems	50-09 27th Street	3,000 1,500	No.1, 2 or 4 Fuel Oil No.1, 2 or 4 Fuel Oil	1 1	Closed, In Place Closed, In Place
Honey Fashions, LTD.	27-11 49th Avenue	5,000	No.1, 2 or 4 Fuel Oil	1	Closed, Removed
Black Bear Company	27-10 49th Avenue	550 4,000	Other Unleaded Gasoline	1 4	Administratively Closed Administratively Closed
Black Bear Company	27-10 Hunters Point Boulevard	550 5,000 8,050	Used Oil Unleaded Gasoline Unleaded Gasoline	1 3 1	In Service Closed, In Place/Removed Closed, In Place/Removed
Public Service Truck Renting	25-61 49th Avenue	4,000	Diesel	2	In Service
29-10 Hunters Point Avenue	29-10 Hunters Point Avenue	20,000	No.1, 2 or 4 Fuel Oil	1	In Service
Thypin Steel Co., Inc.	49-49 30th Street	2,000	Unleaded Gasoline	1	Closed, Removed
Fink Baking Corp.	5-35 54th Avenue	550	Leaded Gasoline	5	Closed, In Place
Horizon 25 Real Estate Corp.	25-25 Borden Avenue	2,500	No.1, 2 or 4 Fuel Oil	1	In Service
Access Self Storage	29-00 Review Avenue	10,000 550 10,000	No.1, 2, or 4 Fuel Oil Unleaded Gasoline No.1, 2 or 4 Fuel Oil	1 2 1	Closed, Removed Closed, Removed In Service
AA Truck Renting Corp.	28-90 Review Avenue	4,000	Diesel	3	In Service
29-01 Borden Avenue	29-01 Borden Avenue	5,000	No.1, 2 or 4 Fuel Oil	2	In Service
Korean Trade & Distribution Center of New York	34-35 Review Avenue	1,500 2,000 3,000	No.1, 2 or 4 Fuel Oil No.1, 2 or 4 Fuel Oil Diesel	1 1 1	Closed, In Place Closed, In Place Closed, Removed
Local 804 D & W Employees	34-21 Review Avenue	1,080	No.1, 2 or 4 Fuel Oil	1	Converted to Non-Regulated Use

Table 2-3. USTs in the Bowery Bay WWTP Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Tank Capacity (Gallons)	Product Stored	Number of Tanks	Status
Nanco Contracting Corp.	37-30 Review Avenue	4,000 4,000	Unleaded Gasoline Diesel	1 1	Administratively Closed Administratively Closed
Caravan Transportation, Inc.	37-30 Review Avenue	4,000	Diesel	2	In Service
New York Paving, Inc.	37-18 Railroad Avenue	4,000	Diesel	2	In Service
Hugo Neu Schnitzer East	30-27 Greenpoint Avenue	2,000 1,100 2,000	No.1, 2 or 4 Fuel Oil Leaded Gasoline Diesel	1 1 1	Closed, In Place/Removed Closed, In Place/Removed Closed, In Place/Removed
Review Ave Properties, Inc.	36-08 Review Avenue	3,000	No.1, 2 or 4 Fuel Oil	1	Closed, In Place
Phoenix Beverages, Inc.	37-88 Review Avenue	4,000 4,000	Diesel Unleaded Gasoline	1 1	In Service In Service
The Catalano Co.	34-02 Laurel Hill Boulevard	5,000	No.1, 2 or 4 Fuel Oil	1	In Service
United Parcel Service	46-05 56th Road	550	Unleaded Gasoline	5	Closed, Removed
J & J Farms Creamery, Inc.	57-48 49th Street	4,000	No.1, 2 or 4 Fuel Oil	1	Closed, In Place
Davis & Warshow	57-22 49th Street	2,000	Diesel	1	Administratively Closed
Display Systems	57-13 49th Street	5,000	No.1, 2 or 4 Fuel Oil	1	In Service
Wallace Packaging Corp.	57-01 49th Street	5,000	No.1, 2 or 4 Fuel Oil	2	Closed, In Place/ Removed
E Greene & Co, Inc	57-00 49th Street	1,600	Diesel	1	Administratively Closed
57-00 49th Street	57-00 49th Street	550 3,000	Diesel No.1, 2 or 4 Fuel Oil	3 1	Closed, In Place Closed, In Place
Ben-Jo General Trucking, Inc.	56-85 49th Street	550 1,080 275	Diesel No.1, 2 or 4 Fuel Oil No.1, 2 or 4 Fuel Oil	3 1 1	In Service Converted to Non-Regulated Use Converted to Non-Regulated Use
Eldorado Coffee, LTD	56-75 49th Street	2,000	No.1, 2 or 4 Fuel Oil	1	Closed, In Place
PJL Realty Corp.	56-72 49th Place	5,000	No.1, 2 or 4 Fuel Oil	2	Closed, Removed
Goffa International	58-29 48th Street	3,000	No.1, 2 or 4 Fuel Oil	1	In Service
Cipico Construction, Inc.	58-08 48th Street	1,000 2,000	Unleaded Gasoline Diesel	1 1	In Service In Service
Queens District 5 Garage	58-02 48th Street	2,500 4,000 1,000	Unleaded Gasoline Diesel Lube Oil	1 2 1	In Service In Service In Service
Canover Industries, Inc	57-85 48th Street	2,500	No.1, 2 or 4 Fuel Oil	1	Administratively Closed
Geyser Realty, LLC	57-65 48th Street	7,500	No.1, 2 or 4 Fuel Oil	1	In Service
Geyser Realty, LLC	57-65 48th Street	2,500 7,500	No.1, 2 or 4 Fuel Oil No.1, 2 or 4 Fuel Oil	1 1	Closed, In Place Closed, In Place

Table 2-3. USTs in the Bowery Bay WWTP Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Tank Capacity (Gallons)	Product Stored	Number of Tanks	Status
Canover Industries, Inc	57-65 48th Street	7,500	No.1, 2 or 4 Fuel Oil	1	Administratively Closed
Avis Rent A Car Systems, Inc.	48-05 Grand Avenue	4,000 500	Unleaded Gasoline Other	4 1	Closed, In Place/Removed Closed, In Place/Removed
At Lite LTG Equipment, Inc.	57-47 47th Street	5,000	No.1, 2 or 4 Fuel Oil	1	Closed, In Place
Boro Timber Co.	57-45 47th Street	4,000 4,000	Unleaded Gasoline Diesel	1 2	Closed, In Place Closed, In Place
A Lamanna Trucking Co.	57-05 47th Street	4,500	Diesel	1	Closed, Removed
Island Trans Corp.	57-00 47th Street	4,000 4,000 1,080 6,000	Diesel Other Other No.1, 2 or 4 Fuel Oil	1 2 1 1	In Service Closed, Removed Closed, Removed In Service
Bengro Realty	47-40 Metropolitan Avenue	3,000	No.1, 2 or 4 Fuel Oil	1	Closed, Removed
Amboy Bus Co., Inc.	46-81 Metropolitan Avenue	4,000 4,000 2,200 6,050	Diesel Unleaded Gasoline Leaded Gasoline Diesel	2 1 1 1	In Service In Service Closed, In Place Closed, In Place
Williams Maspeth Terminals, Inc.	46-73 Metropolitan Avenue	200,000	No.5 or 6 Fuel Oil	1	Administratively Closed
Ara Smith's Transfer Corp.	46-25 Metropolitan Avenue	500	Diesel	5	Closed, Removed

A review of the EDR report identified several MOSFs within the Bowery Bay study area. MOSFs are facilities that may be onshore facilities or vessels that have a petroleum storage capacity of 400,000 gallons or greater. According to the EDR Report, there is one active and one non-active MOSF in the study area. The active site is the Getty Terminals Corporation located at 30-23 Greenpoint Avenue in Long Island City, and is situated immediately north of Newtown Creek. The USTs and above-ground storage tanks (ASTs) at the facility have a total capacity of 2,887,648 gallons and store diesel and No. 1, 2 or 4 fuel oil. In addition, Getty Terminals has one active chemical bulk storage (CBS) AST that has a capacity of 8,000 gallons and four ASTs that have a total capacity of 1,437,700 gallons. Ditmas Oil at 53-02 11th Street in Long Island City, immediately north of Newtown Creek was also identified as a MOSF, however, this facility was listed as inactive and no additional information was provided.

The LTANKS database, provided by EDR, identified 26 leaking storage tank sites in the Bowery Bay WWTP study area. The LTANKS list identifies leaking USTs (LUST) or leaking ASTs. LUSTs identified within close proximity to Newtown Creek discharged No. 2 or 4 fuel oil, unknown petroleum, gasoline or diesel as a result of tank test failures, tank failures and tank overfills. As of December 2006, all 26 identified leaks had been closed. Based on a review of available information, no other open spills were reported in the study area.

A review of the DEC SPILL databases indicated that 121 spills have occurred within the past 10 years. Of these 121 spills, five remained open as of December 2006 and are listed in

Table 2-4. The spills released gasoline, transformer oil, waste oil, No. 2 fuel oil and unknown petroleum into the soil.

Table 2-4. DEC Open Spills in the Bowery Bay WWTP Service Area in the Vicinity of Newtown Creek (December 2006)

Location	Date	Spill Number	Quantity (Gallons)	Material	Resource Affected	Spill Cause
Block 297, Lot 1 34-45 Review Avenue	09/01/95	9508686	Not Specified	Unknown Petroleum	Soil	Unknown
Getty Terminals 30-23 Greenpoint Avenue	01/27/05	0411574	2	No. 2 Fuel Oil	Soil	Human Error
Former Trucking Co. 57-15 49th Street	03/12/04	0313650	Not Specified Not Specified	No. 2 Fuel Oil Waste Oil	Soil Soil	Unknown Unknown
Manhole No.1080 75 Onderdonk Avenue	02/01/01	0011822	1	Transformer Oil	Soil	Equipment Failure
30-54 Review Avenue	07/21/06	0604498	Not Specified	Gasoline	Soil	Unknown

A review of the DEC SPDES database indicates that the Department of Sanitation Queens District 5 Garage located at 58th Road and 48th Street has a SPDES discharge (SPDES No. NY0200841) to Newtown Creek. No other SPDES permitted discharges were identified within the Bowery Bay WWTP study area.

The Newtown Creek WWTP is located at 329-69 Greenpoint Avenue on the southern shoreline of Newtown Creek in northern Kings County. The drainage area within the Newtown Creek study area covers Brooklyn CD 1. For the purposes of this assessment, the study area was inclusive of land within close proximity to the southern shoreline of Newtown Creek, including areas in close proximity to the English Kills and Whale Creek.

A review of the USEPA Superfund Information System database indicated that there is one federally listed Superfund site, BCF Oil Refining, Inc., which is located at 360 Maspeth Avenue, and is listed as a CERCLIS site. The facility is listed for containing approximately 500,000 gallons of polychlorinated biphenyls (PCB) contaminated waste oil on the site. No other federal or state listed sites were identified within the study area.

A review of the DEC Environmental Site Remediation database indicated that there are no Brownfields in the vicinity of Newtown Creek within the study area. Hazardous Substance Waste Disposal Sites (HSWDS) are eligible to become Superfund sites under the DEC State Superfund Program. There are two such sites near Newtown Creek, the Keyspan Greenpoint Energy Facility located at 287 Maspeth and a facility at 165 Varick Avenue. In addition, the Keyspan facility is also listed under the VCP. The site is contaminated with manufacturing gas plant (MGP) residuals and coal tar. Keyspan has proposed to remediate some of the contamination and to leave the rest in place. This proposal is currently under review by the DEC.

RCRA databases indicated that there are 12 large quantity generators and 51 small quantity generators located in close proximity to the Newtown Creek. RCRA sites located within the Newtown Creek WWTP study area are listed in Table 2-5.

Table 2-5. RCRA Sites in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (December 2006)

Site Name	Address
Large Quantity Generators	
Con Edison – 11th Street	Ash Street & McGuiness Boulevard
Tosco Fleet Maintenance Garage	25 Paidge Avenue
Newtown Creek WWTP	301 Greenpoint Avenue
Non Ferrous Processing Corporation	551 Stewart Avenue
Greenpoint Energy Center	287 Maspeth Avenue
BCF Oil Refining, Inc.	360 Maspeth Avenue
Manhattan Poly Bag Corp.	1150 Metropolitan Avenue
Consolidated Packaging Group	1250 Metropolitan Avenue
Kalex Chemical Products, Inc.	235 Gardner Avenue
Waste Management of NY, LLC	221 Varick Avenue
NYC Department of Sanitation	161 Varick Avenue
Waste Management of New York	123 Varick Avenue
Small Quantity Generators	
NYC Housing Authority – Technical Services	23 Ash Street – Remediation
NYC Housing Authority – Central Shops	23 Ash Street
Minerals & Metals – M & R Corp.	1205 Manhattan Avenue
Cumberland Farms Inc. – Exxon Gas	25 Paidge Avenue – Lot 1B
Shell Oil Company	25 Paidge Avenue
Greenpoint Incinerator	459 North Henry Street
Exxon Co. USA – Brooklyn Terminal	320 Freeman Street
NYCDOT Bin 2240370	Greenpoint Avenue
Metro Fuel Company	500 Kingsland Avenue
Pittston Petroleum, Inc.	498 Kingsland Avenue
Amoco Oil Company	125 Apollo Street
New York Telephone Company	297 Norman Avenue
McKesson Corporation	120 Apollo Street
Dekota Leasing	944 Meeker Avenue
Greymart Metal – A 21st Century	974 Meeker Avenue
Enviro-Shred Corporation	974 Meeker Avenue
Clean Harbors Environmental Services	541 Gardner Avenue
Spiral Metal Company, Inc.	497 Scott Avenue
John Knick Realty Corporation	500 Scott Avenue
Preston Trucking Company	500 Scott Avenue
Morgan Realty Corporation	295 Lombardy Street
Transcon Lines Terminal	430 Maspeth Avenue
NYSDOT – Contract D252291	386 Vandervoort Avenue

Table 2-5. RCRA Sites in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (December 2006)

Site Name	Address
Butler Fleet	300 Maspeth Avenue
Roadway Package Systems, Inc.	300 Maspeth Avenue
Calleia Brothers, Inc.	362 Maspeth Avenue
Ditmas Terminal	364 Maspeth Avenue
Rockower – Sigadel Associates	1 Rewe Street
New York Telephone Company	15 Rewe Street
Charles J. King, Inc.	1301 Grand Street
Roadway Express, Inc.	1313 Grand Street
Acme Albert Steel Drum, Inc.	1050 Grand Street
B. P. Products North America, Inc.	1049 Grand Street
Bayside Fuel Oil Depot	1100 Grand Street
Right-Way Dealer Warehouse, Inc.	1202 Metropolitan Avenue
Buy Rite Garage, Inc.	1188 Metropolitan Avenue
DEP – General Storehouse No.1	1201 Metropolitan Avenue
AID Auto Stores, Inc.	1150 Metropolitan Avenue
Manhattan Poly Bag Corp.	1150 Metropolitan Avenue
Consolidated Carpet Trade Work	1181 Grand Street
NYC Fire Department Engine Co. 206	1201 Grand Street
Greenwald Industries, Inc	1340 Metropolitan Avenue
Aljo Auto Electric Corporation	1250 Metropolitan Avenue
Mione Transit Mix	1301 Metropolitan Avenue
Sunshine Biscuits, Inc.	1251 Metropolitan Avenue
All State Power-Vac	180 Varick Street
Enequist Chemical Company, Inc.	100 Varick Avenue
Wood Tex Panels, Inc.	108 Varick Street
Hi-Tech Resource Recovery, Inc.	130 Varick Avenue
Envelope Manufacturers Corporation	450 Johnson Avenue
Twentieth Century Cosmetics, Inc.	474 Johnson Avenue

The DEC PBS database identified 48 USTs in close proximity to Newtown Creek. These sites contain USTs that are either in-service or closed. The storage capacity of the USTs ranged from 275 to 15,000 gallons and store leaded or unleaded gasoline; diesel; No. 1, 2, 4, 5 or 6 fuel oil; or other materials. The UST sites are identified in Table 2-6.

Table 2-6. USTs in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Tank Capacity (Gallons)	Product Stored	Number of Tanks	Status
Star Candle Company	29 Ash Street	5,000	No. 1, 2 or 4 Fuel Oil	1	Closed – In Place
Aleta Industries, Inc.	40 Ash Street	7,500	No. 5 or 6 Fuel Oil	1	In Service

Table 2-6. USTs in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Tank Capacity (Gallons)	Product Stored	Number of Tanks	Status
Greenpoint Incinerator	N. Henry Street & Kingsland Avenue	5,000	No. 1, 2 or 4 Fuel Oil	1	In Service
Exxon Company, USA	320 Freeman Street	4,000	No. 1, 2 or 4 Fuel Oil	1	Administratively Closed
Yellow Freight Systems	460 Kingsland Avenue	1,000 275 550	Other Other Diesel	1 1 3	Closed – Removed In Service Closed – Removed
Safeway Steel Products	370 Greenpoint Avenue	550 550	Leaded Gasoline Other	1 2	Closed – Removed Temporarily Out of Service
New York Telephone Co.	297 Norman Avenue	2,000 2,000 4,000 2,500	Leaded Gasoline Leaded Gasoline Unleaded Gasoline Diesel	1 1 1 1	Closed – In Place Closed – Removed In Service In Service
United Kingsway Carpet Cleaning, Inc.	301 Norman Avenue	3,000 1,000	No. 1, 2 or 4 Fuel Oil Diesel	1 1	Closed –Removed Closed –Removed
Peerless Importers	942 Meeker Avenue	550	Diesel	3	Closed –Removed
Peerless Importers	944 Meeker Avenue	550	Diesel	3	Closed –Removed
Off Site Free Product Recovery	972 Meeker Avenue	4,000	Other	1	In Service
Recovery Well G UST	1000 Meeker Avenue	4,000	Empty	1	Closed –Removed
Mc Aley Associates, Inc.	515 Garner Avenue	550	Unleaded Gasoline	4	In Service
Emil Realty, Inc.	541 Gardner Avenue & 75 Thomas Street	550 4,000	Unleaded Gasoline Diesel	2 1	Closed – In Place Closed – In Place
Off Site Free Product Recovery	564 Gardner Avenue	4,000	Other	1	In Service
Waste Management of New York, LLC	475 Scott Avenue	4,000	Diesel	1	Closed - In Place
Lehigh Carting Co., Inc.	485 Scott Avenue	15,000 550	No. 1, 2 or 4 Fuel Oil Diesel	1 3	Closed – In Place Closed –Removed
P-I-E Nationwide, Inc. Vacant Truck Terminal	500 Scott Avenue	1,000	Leaded Gasoline	4	Closed –Removed
Non Ferrous Processing Corp.	551 Stewart Avenue	5,000	No. 1, 2 or 4 Fuel Oil	1	Closed – In Place/ Removed
Tose-Fowler, Inc. Vacant Truck Terminal	295 Lombardy Street	500	Diesel	4	Closed –Removed
Acme Steel Corp.	211 Lombardy Street	8,000	No. 1, 2 or 4 Fuel Oil	2	Closed – In Place

Table 2-6. USTs in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Tank Capacity (Gallons)	Product Stored	Number of Tanks	Status
ABF Freight System, Inc.	414 Maspeth Avenue	550	Diesel	1	Closed –Removed
Transcon Lines Terminal	430 Maspeth Avenue	550	Diesel	5	Closed – In Place
RPS, Inc.	300 Maspeth Avenue	550	Other	5	Closed – In Place
Greenpoint Energy Center	287 Maspeth Avenue	1,000 4,000 4,000 550	Diesel Unleaded Gasoline Unleaded Gasoline Unleaded Gasoline	1 1 1 2	In Service In Service Closed – In Place Closed – In Place/Removed
ABF Freight System	320 Maspeth Avenue	550	Diesel	5	Closed – In Place/Removed
1 Rewe Street	1 Rewe Street	7,500	No. 1, 2 or 4 Fuel Oil	1	Closed – Removed
Global Moving Astorage	7 Rewe Street	7,500	No. 5 or 6 Fuel Oil	2	Closed –Removed
M Alders Son, Inc.	8 Rewe Street	7,000	No. 1, 2 or 4 Fuel Oil	1	In Service
Perfect Color Dyeworks, Inc.	307 Vandervoort Avenue	10,000	No. 5 or 6 Fuel Oil	1	In Service
Blinn Drug Co.	16 Rewe Street	3,000	No. 1, 2 or 4 Fuel Oil	1	Administratively Closed
Charles J King, Inc.	1301 Grand Street	550 550 1,080	Unleaded Gasoline Diesel Diesel	2 2 1	Closed –Removed Closed – In Place In Service
Roadway Express	1313 Grand Street	550	Diesel	5	Closed – In Place/Removed
Roadway Express, Inc.	1313 Grand Street	550	Leaded Gasoline	5	Closed – In Place/Removed
Gaseteria Oil Corp. "Metropolitan"	1049 Grand Street	6,000 6,000 550	Unleaded Gasoline Diesel Diesel	2 1 2	In Service In Service Closed –Removed
Right-Way Dealer Warehouse, Inc.	1202 Metropolitan Avenue	1,000 1,500	Empty No. 1, 2 or 4 Fuel Oil	1 1	Closed – In Place Closed – In Place
Buyrite Garage, Inc.	1188 Metropolitan Avenue	550	Unleaded Gasoline	5	In Service
L & H Associates	1105 Metropolitan Avenue	7,500	No. 1, 2 or 4 Fuel Oil	1	In Service
1131 Grand Et IAC	1131 Grand Street	7,500	No. 1, 2 or 4 Fuel Oil	1	Closed – In Place
Consolidated Carpet Trade Workroom, Inc.	1181 Grand Street	2,000 3,000 550	Unleaded Gasoline No. 1, 2 or 4 Fuel Oil Unleaded Gasoline	1 1 3	Closed –Removed Closed – In Place Closed –Removed
Engine Company 206	1201 Grand Street	3,000 1,100	No. 1, 2 or 4 Fuel Oil Diesel	1 1	Closed – In Place Closed – In Place
Union Beer Dist., LLC	1213-17 Grand Street	4,000	Unleaded Gasoline	1	Closed –Removed

Table 2-6. USTs in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Tank Capacity (Gallons)	Product Stored	Number of Tanks	Status
Sunshine Biscuits, Inc.	1251 Metropolitan Avenue	4,000 2,000	Leaded Gasoline Leaded Gasoline	1 1	Closed – In Place Closed –Removed
Manya Corporation F.K.A. Kalex Corp.	235 Gardner Avenue	8,000	No. 1, 2 or 4 Fuel Oil	1	Temporarily Out of Service
Vijax Corporation	210 Varick Avenue	2,750 4,000	No. 1, 2 or 4 Fuel Oil Unleaded Gasoline	1 1	In Service In Service
M. Fine Lumber Co., Inc.	175 Varick Avenue	550	Diesel	1	Closed –Removed
Waste Management of New York, LLC	101 Varick Avenue	3,000 3,000	No. 1, 2 or 4 Fuel Oil Empty	1 2	In Service Closed –Removed
The Enequist Chemical Co., Inc.	100 Varick Avenue	550	Unleaded Gasoline	2	In Service

A review of the MOSF database by EDR identified six MOSFs within the study area. These MOSFs were empty or contained unleaded gasoline, diesel, No. 1, 2 4 5 or 6 fuel oil, or other materials in USTs or ASTs. MOSFs within the study area are identified in Table 2-7.

Table 2-7. MOSFs in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Products Stored	Total Tank Capacity (Gallons)
Motiva Enterprises, LLC	25 Paidge Avenue	Diesel or Empty	2,244,400
Metro Terminals Corp.	498 Kingsland Avenue	No. 1, 2, 4, 5 or 6 Fuel Oil, Diesel, Unleaded Gasoline, or Empty	7,228,840
BP Products North America, Inc.	125 Apollo Street	Unleaded Gasoline, Diesel, No. 1, 2 or 4 Fuel Oil, or Other	6,406,687
BCF Oil Associates, Inc.	360 Maspeth Avenue	No. 1, 2, 4, 5 or 6 Fuel Oil, Diesel, or Other	1,220,598
Ditmas Oil Associates, Inc.	364 Maspeth Avenue	No. 1, 2 or 4 Fuel Oil, Diesel, or Other	4,172,110
Bayside Fuel Oil Depot Corp.	1100 Grand Street	No. 1, 2 or 4 Fuel Oil, Diesel, or Empty	2,307,588

According to the DEC PBS database, there are four CBS UST sites located within the Newtown Creek WWTP study area. These sites contain CBS USTs that are in-service or temporarily out of service. The storage capacities of the CBS USTs range from 3,600 to 10,000 gallons. These sites are listed in Table 2-8.

Table 2-8. CBS USTs in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Tank Capacity (Gallons)	Number of Tanks	Status
Motiva Enterprises, LLC	25 Paidge Avenue	4,000	1	In Service
Exxon Company, USA	320 Freeman Street	4,000	2	Temporarily Out of Service
BP Amoco Oil Company	125 Apollo Street	4,000	1	In Service
Manya Corporation F.K.A. Kalex Chemical	235 Gardner Avenue	3,600 10,000	2 1	Temporarily Out of Service Temporarily Out of Service

In addition, the PBS database revealed seven CBS AST sites located within the Newtown Creek WWTP study area. These sites contain CBS ASTs that are in-service or not specified. The storage capacity of the CBS ASTs ranges from 185 to 12,500 gallons. The CBS ASTs in proximity to the Newtown Creek WWTP study area are summarized in Table 2-9.

Table 2-9. CBS ASTs in the Newtown Creek Service Area in Close Proximity to Newtown Creek (January 2002)

Site	Address	Tank Capacity	Number of Tanks	Product Stored	Status
Motive Enterprises, LLC	25 Paidge Avenue	4,000 5,000 5,014 10,000	1 1 1 1	Xylene Xylene Xylene Xylene	In Service In Service In Service In Service
Metro Terminals Corp.	498 Kingsland Avenue	6,000 4,000 185	2 1 1	Xylene Vinyl Acetate Monomer Xylene	In Service In Service In Service
BP Amoco Oil Company	125 Apollo Street	4,000 500	2 3	Organorhodium complex Methanol	In Service In Service
Newtown Creek Water Pollution Plant	301 Greenpoint Avenue	8,000	4	Ferric Chloride	In Service
Ditmas Oil Associates, Inc.	364 Maspeth Avenue	12,500	1	Xylene	In Service
Grand Chromium Plating Corp.	209 Morgan Avenue	1,500	1	Hydrochloric Acid	Not Specified
Enequist Chemical Company, Inc.	100 Varick Avenue	3,000 6,000	1 2 1	Nitric Acid Sodium Hydroxide Hydrochloric Acid	In Service In Service In Service

The LTANKS database identified 26 leaking storage tank sites within the study area. Leaking USTs and ASTs discharged No. 2 fuel oil, diesel and gasoline as a result of tank overfills, tank failures and test tank failures. As of December 2006, eight of the 26 identified leaks remained open and are summarized in Table 2-10.

Table 2-10. Open LTANKS Sites in the Newtown Creek Service Area in Close Proximity to Newtown Creek (April 2006)

Location	Date	DEC Spill Number	Quantity Released (Gallons)	Material Spilled	Source Affected	Cause
46-25 Metropolitan Avenue	07/07/1992	9204008	<1	Diesel	Soil	Tank Overfill
Engine Company 206 FDNY 1201 Grand Street	03/02/2001	0012768	Not Specified	No. 2 Fuel Oil	Soil	Tank Failure
Waste Management of New York 123 Varick Avenue	08/04/1998	9805562	20	Diesel	Soil	Tank Failure
Motiva Enterprises 25 Paidge Avenue	05/23/1990	9002114	Not Specified	Gasoline	Groundwater	Tank Failure
New York Department of Sanitation 259 North Henry Street	02/22/2001	0012519	Not Specified	No. 2 Fuel Oil	Soil	Test Tank Failure
Newtown Creek WWTP 301 Greenpoint Avenue	09/23/1999	9907560	Not Specified	No. 2 Fuel Oil	Soil	Tank Failure
Keyspan Energy 287 Maspeth Avenue	01/07/1993	9211562	Not Specified	Gasoline	Soil	Test Tank Failure
Cibro Terminals 1100 Grand Street	10/10/1990	9007551	5,000	No. 2 Fuel Oil	Surface Water	Tank Failure

A review of the DEC SPILL databases indicated that 161 spills have occurred within the past 20 years. Of these 161 spills, 18 remained open as of December 2006 and are summarized in Table 2-11. The majority of these spills affected soil, however, contamination to groundwater and surface water was also noted. The largest spill in the study area occurred in 1978 at the Amoco Oil Company. The spill resulted in the release of 17 million gallons of petroleum products. Remediation activities are still ongoing.

Table 2-11. Open Spills in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (April 2006)

Location	Date	Spill Number	Quantity (Gallons)	Material	Resource Affected	Spill Cause
Amoco Oil Company Meeker Avenue	09/02/1978	N/A	17 million	Petroleum Products	Surface Water	Unknown
520 Kingsland Avenue	08/03/01	0104811	Not Specified	Unknown Petroleum	Soil	Human Error
Verizon Facility 297 Norman Avenue	08/24/01	0105605	Not Specified	Hydraulic Oil	Soil	Equipment Failure
Keyspan Greenpoint 287 Maspeth Avenue	09/13/01	0106270	200	Diesel	Soil	Equipment Failure

Table 2-11. Open Spills in the Newtown Creek WWTP Service Area in Close Proximity to Newtown Creek (April 2006)

Location	Date	Spill Number	Quantity (Gallons)	Material	Resource Affected	Spill Cause
Engine Co. 206 FDNY 1201 Grand Street	04/17/03	0300635	Not Specified	Diesel	Soil	Equipment Failure
1188 Metropolitan Avenue	06/17/03	0302832	Not Specified	Gasoline	Soil	Other
Manhole 58772 Morgan Avenue & Norman Avenue	07/10/03	0303808	1	Unknown Petroleum	Soil	Unknown
Manhole No.663 Kingsland Avenue & Norman Avenue	01/06/06	0511539	Not Specified	Unknown Petroleum	Soil	Other
Commercial Property 175 Varick Avenue	05/23/06	0601947	Not Specified	Unknown Material	Groundwater	Unknown
Vacant Property 254 Maspeth Avenue	07/05/06	0603758	Not Specified	Tar	Soil	Unknown
Sheen in Newtown Creek Ash Street & McGuiness Boulevard	11/29/06	0609866	Not Specified	Unknown Petroleum	Surface Water	Unknown
NYC Housing Authority 23 Ash Street	12/05/06	0610155	Not Specified	Unknown Petroleum	Groundwater	Unknown
Cibro Terminals 1100 Grand Street	07/26/91	9104487	Not Specified	No.2 Fuel Oil	Groundwater	Equipment Failure
BCF Oil Refinery, Inc. 360 Maspeth Avenue	08/19/94	9406807	Not Specified	Waste Oil/Used Oil	Groundwater	Equipment Failure
Williamsburg Steel 99 Paidge Avenue	07/17/96	9605209	Not Specified	Unknown Petroleum	Soil	Unknown
ABF Freight Systems 414 Maspeth Avenue	12/18/96	9611489	Not Specified	Unknown Petroleum	Soil	Unknown
Roadway Express, Inc. 1313 Grand Street	09/30/98	9808077	Not Specified	Diesel	Groundwater	Other
11th Street Conduit 460-456 McGuiness Boulevard	10/04/99	9908111	Not Specified	Unknown Petroleum	Soil	Equipment Failure

The SPDES database identified nine sites in the study area with a permitted discharge to Newtown Creek or its tributaries. These sites are summarized in Table 2-12.

Table 2-12. Permitted Discharges to Newtown Creek and its Tributaries
Newtown Creek WWTP
(December 2006)

Site	Permit Number	Address	Receiving Water
Motiva Marketing Terminal	NY0006131	25 Paidge Avenue	Newtown Creek
Metro Terminals Corp.	NY0007676	498 Kingsland Avenue	Newtown Creek
BP Products North America Terminal	NY0004596	125 Apollo Street	Newtown Creek
Waste Management of New York, LLC	NY0201260	123 Varick Avenue	English Kills
Ditmas Terminal	NY0005789	364 Maspeth Avenue	English Kills
BCF Oil Refining, Inc.	NY0036609	360 Maspeth Avenue	Newtown Creek
Getty Terminal Corp.	NY0028452	30-23 Greenpoint Avenue	Newtown Creek
Consolidated Edison – 11th Street Conduit	NY0201138	Ash Avenue & McGuiness Boulevard	Newtown Creek
Charles J. King, Inc.	NYU700230	1301 Grand Street	Newtown Creek

2.3.2 Effects of Regulated Activities on Newtown Creek

A review of available information for each WWTP drainage area within the Newtown Creek study area indicates that some sources of contamination are associated with direct spills to Newtown Creek. Multiple spills have directly affected groundwater and surface waters in the immediate vicinity of Newtown Creek. The largest spill in the study area occurred at the Amoco Oil Company in 1978, which resulted in the direct release of 17 million gallons of petroleum products. The spill spread across 52 acres and impacted water, groundwater, soil and sewer lines. The second largest spill occurred from a leaking tank at the Cibro Terminals site, which resulted in the release of 5,000 gallons of No. 2 fuel oil into the creek.

Water quality within Newtown Creek may be adversely affected as a result of several adjacent industrial activities. There are numerous sites located immediately on or adjacent to the waterbody that represent potential sources of contamination. For example, two inactive hazardous waste sites were identified on or immediately adjacent to Newtown Creek. These sites include the Greenpoint Energy Facility located at 287 Maspeth Avenue and a site located at 165 Varick Avenue in Brooklyn. In addition, several MOSFs were identified in close proximity to the creek or its tributaries.

Newtown Creek and its tributaries were added to the National Priorities List in September 2010. DEP and five other parties are expected to agree with USEPA to conduct a Remedial Investigation/Feasibility Study within the next six to seven years. The study is forecast to conclude by 2018.

Furthermore, sites listed in the DEC Environmental Site Remediation database were also identified on or adjacent to Newtown Creek and represent a potential source of contamination. The Maspeth Project Site located at 57-15 49th Street in Maspeth was identified as a Brownfield site. Initial investigations have identified the possible contamination of groundwater and soils by a common plasticizer. In addition, Keyspan Energy located at 287 Maspeth Avenue in Brooklyn was listed as a VCP site contaminated with MGP residuals and coal tar.

The Phelps Dodge site is still undergoing remediation and has historically had elevated levels of heavy metals in the soil and groundwater plumes. In addition, heavy metals in creek sediments were also indicated in the preliminary investigation.

3.0 Existing Sewer System Facilities

The Newtown Creek watershed is primarily of sewersheds tributary to two different WWTPs; the Bowery Bay and Newtown Creek WWTPs. Figure 3-1 presents the Newtown Creek watershed in relation to the Bowery Bay and Newtown Creek WWTP service areas. During significant rainfall events, Newtown Creek receives discharges of combined sewage via reliefs from the combined sewer system, as well as discharges of stormwater runoff mainly from storm sewers and minor direct overland runoff. This section presents a description of the existing sewer system facilities, the collection system, and characteristics of sewer system discharges to Newtown Creek (Figure 3-2).

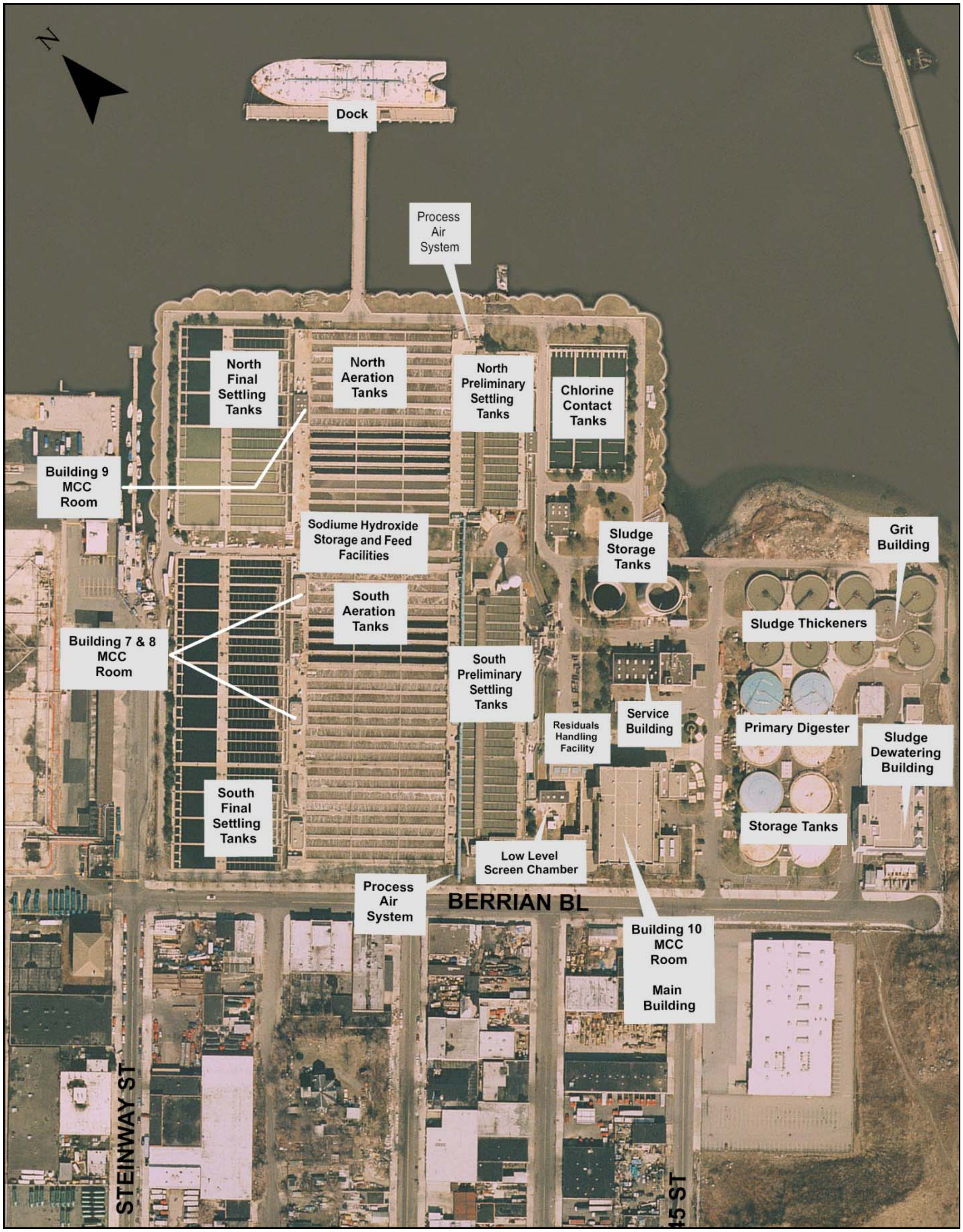
3.1 BOWERY BAY WWTP

The Bowery Bay WWTP is a secondary treatment facility with a DDWF capacity of 150 MGD and a maximum flow capacity of 300 MGD. The Bowery Bay WWTP is permitted by the DEC under SPDES permit number NY-0026158. The facility is located at 43-01 Berrian Blvd., Astoria, NY, 11105 in the Astoria section of Queens, on a 34.6 acre site adjacent to the Rikers Island Channel, leading into the Upper East River, bounded by Berrian Blvd. and Steinway Street. The Bowery Bay WWTP serves an area of approximately 14,089 acres in the Northwest section of Queens, including the communities of Kew Garden Hills, Rego Park, Forest Hills, Forest Hills Gardens, North Corona, South Corona, Lefrak City, Elmhurst, East Elmhurst, Jackson Heights, Maspeth, Woodside, Sunnyside Gardens, Sunnyside, Hunters Point, Long Island City, Astoria, Astoria Heights, Steinway, Ravenswood, and Roosevelt Island. The total sewer length, including sanitary, combined, and interceptor sewers, that feeds into the Bowery Bay WWTP is 398 miles. The Bowery Bay WWTP has been providing full secondary treatment up to 225 MGD since 1978. Processes include primary screening, raw sewage pumping, grit removal and primary settling, air activated sludge capable of operating in the step aeration mode, final settling, and chlorine disinfection. The Bowery Bay WWTP has a DDWF capacity of 150 MGD, and is designed to receive a maximum flow of 300 MGD (2 times DDWF) with 225 MGD (1.5 times DDWF) receiving secondary treatment as required by the SPDES permit. Flows over 225 MGD receive primary treatment and disinfection. The daily average flow during Fiscal Year 2008 was 105 MGD, with a dry weather flow average of 95 MGD. Table 3-1 summarizes the Bowery Bay WWTP permit limits.

The Bowery Bay plant went into operation in 1939 as a 40 MGD primary treatment plant and has undergone a series of upgrades and expansions since that time. In 1940, secondary treatment was implemented using the step aeration process. In 1954, the plant's capacity was increased to 120 MGD and then again in 1971 to 150 MGD. In 1991, sludge dewatering facilities were added. In December 1999, construction was completed for the Basic Step Feed BNR retrofit at Bowery Bay. This included the installation of baffles in each pass of the aeration tanks to create anoxic zones, submersible mixers in each anoxic zone to prevent solids settling, froth-control chlorine spray hoods for filament suppression, and fine bubble membrane diffusers to provide necessary oxygen transfer rates. Currently, Bowery Bay is undergoing upgrades to replace and refurbish aged and outdated facilities and provide additional biological nutrient removal capability.

NYC Environmental Protection

Newtown Creek Watershed and WPCP Service Areas



NYC Environmental Protection

Bowery Bay WPCP
Existing Facility Layout

Table 3-1. Select Bowery Bay WWTP SPDES Effluent Permit Limits

Parameter	Basis	Value	Units
Flow	DDWF Minimum secondary treatment Minimum primary treatment Actual average, FY2005	150 225 300 126	MGD
$CBOD_5$	Monthly average 7-day average	25 40	mg/L
TSS	Monthly average 7-day average	30 45	mg/L
Total Nitrogen(1)	12-month rolling average	101,075	lb/day

(1) Nitrogen limit for the Combined East River Management Zone, calculated as the sum of the discharges from the four Upper East River WWTPs (Bowery Bay, Hunts Point, Wards Island, Tallman Island) and one quarter of the discharges from the 2 Lower East River WWTPs (Newtown Creek, Red Hook). This limit is effective through June 2010, then decreases stepwise until the limit of 44,325 lb/day takes effect in 2017.

3.1.1 WWTP Process Information

Figure 3-3 shows the current layout of the Bowery Bay WWTP. Two interceptors deliver flow to the Bowery Bay WWTP. The low level interceptor is a 96-inch sewer that enters the low level screening chamber. The high level interceptor is a 9-foot by 9-foot sewer that enters the high level screening chamber. There are three low level screens, each four feet wide with 1-inch openings, which are cleaned with a vertical climber rake. Each of the low level screens is designed to handle 47 MGD. There are also three high level screens, each seven feet wide with 1-inch openings, which are also cleaned with a vertical climber rake. Each of the high level screens is designed to handle 53 MGD.

After the interceptor flows enters the plant and passes through the screening channels, it proceeds to the high and low level wet wells. The low level pumps draw flow from the low level wet well via a 36-inch suction line. Discharge from each low level pump is via a 36-inch line that includes a cone check valve and gate valve. The low level pump system has four vertical, centrifugal, mixed-flow, bottom suction, flooded suction main sewage pumps, rated at 47 MGD each, at a total dynamic head of 62-feet. These pumps are in the process of being replaced.The high level pumps draw flow from the high level wet well via a 36-inch suction line. Discharge from each high level pump is via a 36-inch line that includes a cone check valve and gate valve. The high level pump system has four vertical, centrifugal, mixed-flow, bottom suction, flooded suction main sewage pumps, rated at 53 MGD each, at a total dynamic head of 38-feet.

Each low and high level pump discharges into a line connected to the low and high discharge headers which convey raw sewage to the Division Structure. The Division Structure splits into five distribution channels. Each channel has a secondary screen. The secondary screens are 5 feet wide with 1/2-inch openings. Each screen operates continuously and is cleaned on a timed cycle or a differential head with a climber rake.

Flow is divided into two process chains, identified as the north battery and the south battery (See Figure 3-4). Secondary screen effluent is conveyed to the 15 primary settling tanks, nine of which are in the south battery and six in the north battery. All tanks are three–bay, end–

collection, and rectangular clarifiers. Sludge is directed along the tank bottom to the cross collector located at the influent end of the tank by chain and flight collectors. South battery contains a single cross collector then conveys sludge to the draw off sump where it is withdrawn by pump suction to cyclone degritters. The screws are used in the north battery instead of cross collectors. The total volume of the primary settling tanks is 8.1 million gallons (MG) with a surface overflow rate of 1,613 gpd/sf at average design flow.

Primary tank effluent is conveyed to the aeration tanks in a primary effluent channel. Ten 4-pass aeration tanks provide biological treatment; six in the south battery and four in the north battery. The total aeration tank volume is 25.2 MG. There are five aeration blowers each with 35,000 scfm, providing air to the aeration tanks through membrane diffusers. These blowers will be in operation before summer 2011.

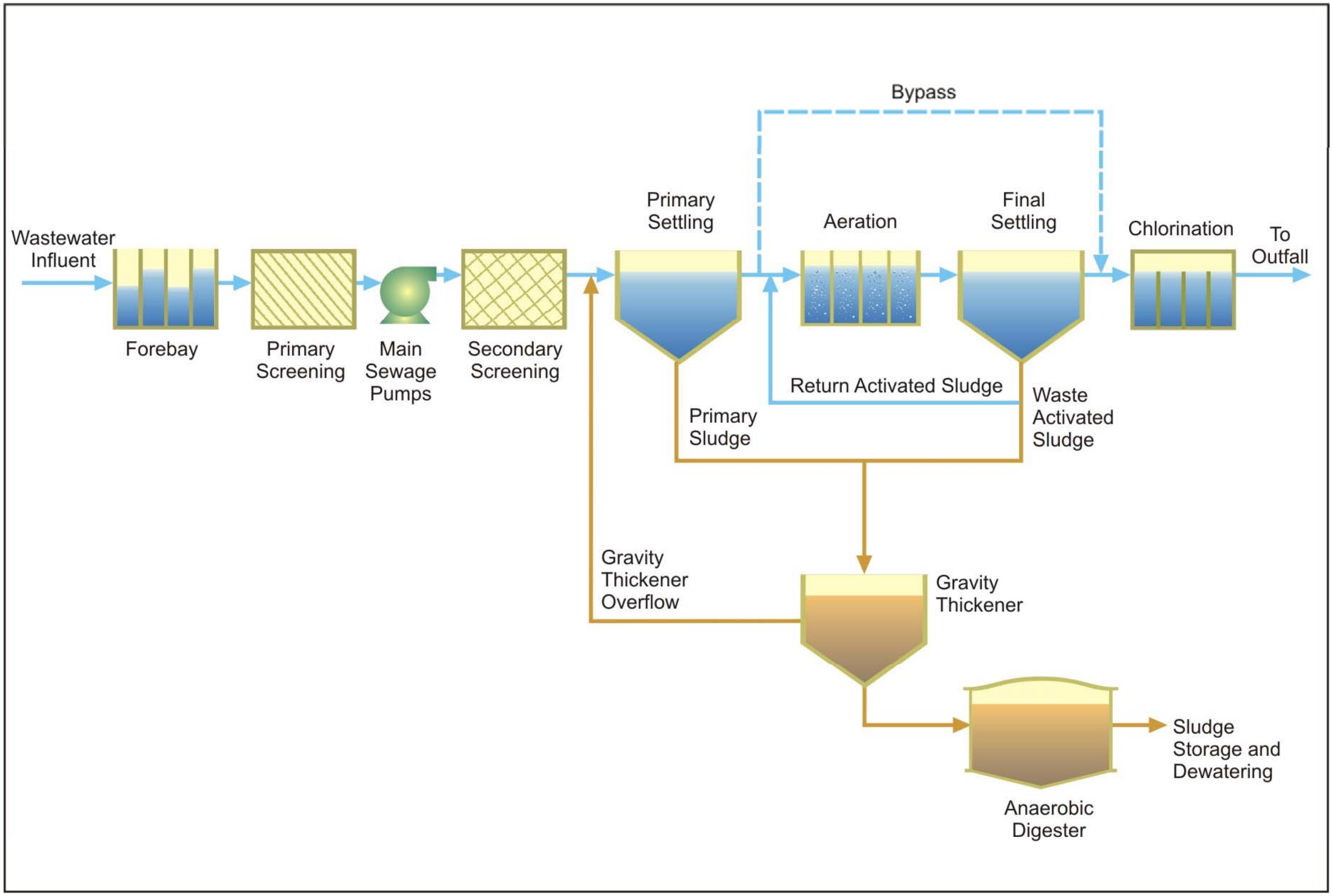
Aeration tank effluent is conveyed to the 17 final settling tanks, eleven in the south battery and six in the north battery. All tanks are three-bay, center–collection, and rectangular clarifiers. Sludge is directed along the tank bottom to the cross collector located past midway of the tank from both the influent end and the effluent end by chain and flight collectors. A single cross collector then conveys sludge to the draw off sump where a hydrostatic lift conveys the sludge to a RAS well. Each final settling tank has a telescoping valve to control the RAS rate located in the sludge well.

Final settling tank effluent is conveyed to the three chlorine contact tanks. The three chlorine contact tanks have a total volume of 3.27 MG and a detention time of 15.7 minutes at the peak design flow rate of 300 MGD. Chlorinated effluent is discharged through the Rikers Island Channel to the Upper East River. Primary sludge is degritted in cyclone degritters before mixing with secondary waste activated sludge in the thickeners. Secondary waste activated sludge is withdrawn from the final settling tank underflow. The combined mixed sludge is thickened in a set of eight gravity thickeners with a total volume of 2.9 MG. The design overflow rate for the eight thickeners is 800 gpd/sf and the design solids loading rate is 7.7 lb/ft^2-day at average flow conditions.

Thickener overflow is returned to the division structure, upstream of the primary settling tanks and thickened sludge is stabilized in a set of six anaerobic digesters. Four digesters are used as primary digesters and two are designed operate as secondary digesters. However, the two secondary digesters are currently being used as sludge storage tanks. The anaerobic digesters are heated and mixed. Digested sludge is stored in four sludge storage tanks. Digested sludge is dewatered by centrifuges and the dewatered sludge cake is hauled offsite for further treatment or use. Centrate produced from Bowery Bay's dewatering facility is currently transported via vessel to the North River WWTP until the completion of the BB-59 contract, expected January 2012. Centrate will be treated onsite in separated centrate treatment tanks.

3.1.2 Bowery Bay WWTP Wet Weather Operating Plan

DEP is required by its SPDES permit to maximize the treatment of combined sewage at the Bowery Bay WWTP. The permit requires treatment of flows of up to 225 MGD through complete secondary treatment. Further, to maximize combined sewage treatment, the SPDES permit requires flows of up to 300 MGD to be processed through all elements of the WWTP except the aeration basins and the final settling clarifiers.



Environmental Protection

Bowery Bay WPCP
Process Flow Diagram

Environmental Protection

Newtown Creek WPCP Facility Layout

New York State requires the development of a Wet Weather Operating Plan (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 WWTP, one of the nine minimum elements of long-term CSO control planning. DEP has developed a WWOP for each of its 14 WWTPs, and Table 3-2 summarizes the requirements for the Bowery Bay WWTP, and notes that flows beyond the maximum capacity of the aeration basins and final clarifiers (i.e., over 300 MGD) would cause damage to the WWTP by creating washout of biological solids and clarifier flooding. The WWOP therefore suggests that the facility is operating at or near its maximum capacity as designed, configured and permitted by the DEC. The WWOP for Bowery Bay was submitted to the DEC in March 2009, as required by the SPDES permit and is attached as Appendix A.

Table 3-2. Wet Weather Operating Plan for Bowery Bay WWTP

Unit Operation	General Protocols	Rationale
Influent Gates and Screens	Maintain wet well level and visually monitor screens for overflow. If screen blinding occurs, close the influent sluice gate until the screen clears.	To protect the main sewage pumps from damage and allow the plant to pump the maximum flow through primary treatment without flooding high/low level wet wells and the high level or bar screen channels.
Main Sewage Pumps	Maintain wet well level by adjusting/adding main sewage pumps and pump to maximum capacity.	To allow the plant to pump the maximum flow through primary treatment without flooding and to minimize the need for flow storage in the collection system and reduce the storm sewer overflows to the East River.
Primary Settling Tanks	Check levels of primary tank influent channel and effluent weirs for flooding. Reduce flow if necessary.	Maximize the amount of flow that receives primary treatment, protect downstream processes from abnormal wear due to grit abrasion, and prevent grit and grease accumulation in the aeration tanks.
Bypass Channel	When flow reaches 225 MGD, fully open the South Bypass Control Gate and bypass flow around the aeration tanks into chlorination. The actual flow that can be bypassed may be lower in order to protect the nitrogen treatment biomass. If flow meter fails, use temporary measurement ruler installed on the wall and convert the inches of water into MGD based on the chart provided.	To maximize the flow that receives primary treatment, chlorination, and secondary treatment without causing nitrification failure, hydraulic failure, or violations.
Aeration Tanks	Adjust/shut off wasting rates and shut off froth hoods.	To maintain a desired solids inventory in the aerators. Also, spray hoods are not effective during wet weather events.
Final Settling Tanks	Check sludge collectors, effluent quality, RAS bell weirs, and RAS pump flow rate.	To prevent solids build-up and washout in the clarifiers.
Chlorination	Adjust chlorine dose as flow increases. When a sixth main sewage pump is started, increase the chlorine dose in anticipation of bypassed flow.	To meet the elevated chlorine residual demand from additional flow and from bypassed flow that has only received primary treatment.
Sludge Handling	No changes are currently made to the thickening operations during wet weather events.	To prevent flooding of the thickener overflow weirs.

3.1.3 Other Bowery Bay WWTP Operational Constraints

The DEC and the DEP entered into a Nitrogen Control Consent Order that updated the New York City SPDES permits to reduce nitrogen. The Consent Order was partly a result of the Long Island Sound Study, which determined that a 58.5 percent load reduction of nitrogen discharge would be needed to meet their water quality standards.

A Phase I Modified BNR Facility Plan, which outlines the DEP modified nitrogen program to upgrade five of its WWTPs that discharge into the Upper East River (Bowery Bay, Hunts Point, Tallman Island, Wards Island) and Jamaica Bay (26th Ward) for nitrogen removal, has agreed upon and was executed on February 1, 2006. The critical BNR upgrade items for Phase I construction at all five of the plants 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. RASWAS 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)

   -Sodium Hydroxide for nitrification and pH buffering (except at Tallman Island)

6. Final settling tanks (Upgrades implemented on a plant specific basis):

   -Maximize solids removal

   -Allow for increased RAS flow requirements

   -Handle higher solids loading from the aeration tanks

DEP is also required to perform interim measures during the Phase I construction period to reduce the levels of nitrogen being discharged into the East River. At the Bowery Bay and Tallman Island WWTPs these measures include transport of digested sludge and/or centrate for processing at another DEP WWTP or an out-of-city facility via shipping with DEP marine vessels or contract services. This requirement to transship took effect July 1, 2009 and will remain in force through the end of Phase I BNR construction.

Phase II upgrades are also a part of the agreed-upon Nitrogen Facility Plan. The Phase II plan was submitted to DEC on December 31, 2009. A major component of Phase II upgrades is expected to be supplemental carbon addition facilities to promote denitrofication and further reduce nitrogen discharges into the Upper East River. Phase II upgrades are projected to be online by January 1, 2016.

Concurrent with the BNR upgrades, the DEP continues to perform upgrade work as part of the Plant Upgrade Program at the Upper East River WWTPs and the 26th Ward WWTP. 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 WWTP.

3.2 NEWTOWN CREEK WWTP

The Newtown Creek WWTP is a secondary treatment plant with a DDWF capacity of 310 MGD. The Newtown Creek WWTP is permitted by the DEC under SPDES permit number NY-0026204. The facility is located at 329 Greenpoint Avenue, Brooklyn, NY, 11222 in the Greenpoint section of Brooklyn, on a 53 acre site adjacent to Newtown Creek, leading into the East River, located between Provost Street and North Henry Street. The Newtown Creek WWTP serves an area of approximately 16,656 acres on the Lower East Side and Lower Manhattan, Northeast Brooklyn, and Western Queens, including the communities of West Village, Greenwich Village, Soho, Little Italy, Tribeca, East Village, Noho, Lower East Side, Stuyvesant Town, Gramercy, Murray Hill, Tudor City, Turtle Bay, Sutton Place, Chinatown, Civic Center, Battery Park, Financial District, Greenpoint, North Side, Southside, Williamsburg, East Williamsburg, Bedford Stuyvesant, Bushwick, Ridgewood, Glendale, Maspeth, Middle Village, Blissville, Ocean Hill, and Weeksville (Figure 3-1). The total sewer length, including sanitary, combined, and interceptor sewers, that feeds into the Newtown Creek WWTP is 593 miles.

The Newtown Creek WWTP is currently under construction and will be capable of providing full secondary treatment in 2008. Processes include primary screening, raw sewage pumping, grit removal, air activated sludge (capable of operating in the step aeration mode post-construction), final settling, and chlorine disinfection. Figure 3-4 shows the current layout of the Newtown Creek WWTP and identifies the facilities currently under construction or to be constructed in the near future. The Newtown Creek WWTP has a DDWF capacity of 310 MGD, and is designed to receive a maximum flow of 700 MGD (2.25 times DDWF) with all of it (because there is no bypass at Newtown Creek, all flow must pass through the aeration tanks) receiving secondary treatment. The daily average flow during 2004 was 229 MGD, with a dry weather flow average of 211 MGD. During severe wet weather events in 2004, the plant treated 580 to 625 MGD. Table 3-3 summarizes the Newtown Creek WWTP permit limits.

Table 3-3. Select Newtown Creek WWTP Effluent Permit Limits

Parameter	Basis	Value	Units
Flow	DDWF Maximum secondary treatment Maximum primary treatment Actual average, 2004	310 700 (1) 700 (2) 229	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 (3)	lb/day

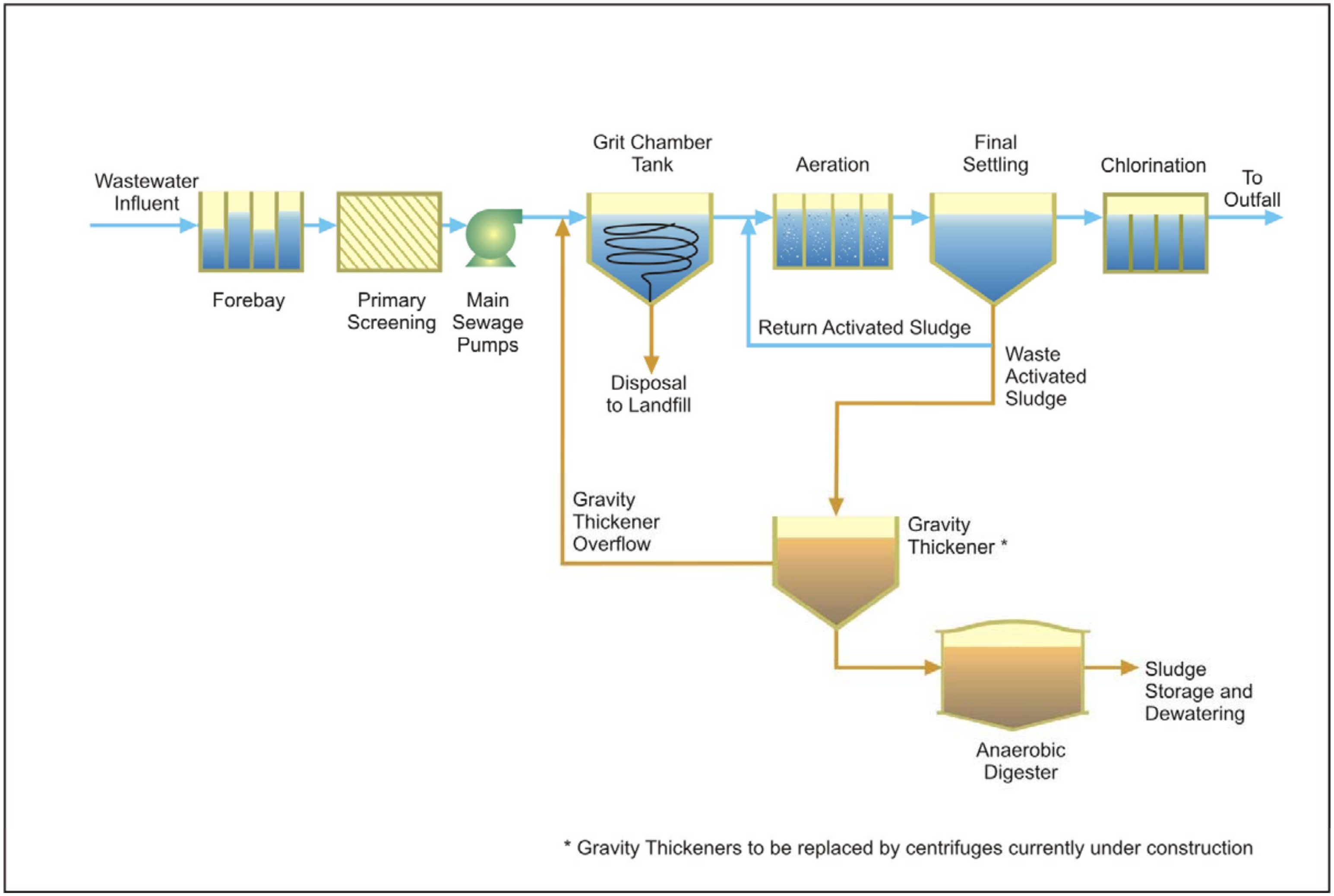
(1) There is no bypass in place at Newtown Creek, all flow passes through the aeration tanks.
(2) The DEP has an agreement with the DEC to provide for treatment beyond the 2XDDWF normally seen at other WWTPs.
(3) Nitrogen limit for the Combined East River Management Zone, calculated as the sum of the discharges from the four Upper East River WWTPs (Bowery Bay, Hunts Point, Wards Island, Tallman Island) and one quarter of the discharges from the 2 Lower East River WWTPs (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 Newtown Creek WWTP opened in 1967 with a modified aeration capacity of 310 MGD to provide 60 percent removal of biochemical oxygen demand and 70 percent removal of suspended solids. The plant is currently being upgraded to meet the wastewater treatment standards of the Clean Water Act within the constraints of a USEPA Consent Order. Facility upgrading will result in construction of additional wastewater treatment facilities to provide secondary treatment and improve the plant's ability to handle combined sanitary and storm flows in wet weather. The annual average dry weather flow will remain at 310 MGD, but the plant will be required to provide 85 percent removal of biochemical oxygen demand and 85 percent removal of suspended solids. For the upgrade, the site area will be enlarged from 36 acres to approximately 53 acres. For the expansion, the City of New York DEP acquired three adjoining properties and demapped two streets.

3.2.1 Newtown Creek WWTP Process Information

Figure 3-5 shows the current process treatment for the Newtown Creek WWTP. The plant receives wastewater from two service areas: Brooklyn/Queens and Manhattan. The Brooklyn/Queens flow enters the Brooklyn/Queens pump station that is located at the plant. The Manhattan flow is pumped from the Manhattan Pump Station, located at Avenue D between East 12th Street and East 13th Street, into the main plant influent conduit where it joins the Brooklyn/Queens pump station flow and internal plant recycles. Throttling gates are being constructed at the Manhattan Pump Station junction chamber. Additional throttling gates will also be constructed on the Kent Avenue interceptor feeding the Brooklyn/Queens Pump Station. The main sewage pumps at both pump stations will be replaced with 100 MGD pumps (five at each pump station).

Plant influent flow from the Manhattan and Brooklyn/Queens Pump Stations passes through four primary screen channels. Each screen channel is 8-feet by 12¼-feet and contains a screen with 1-inch clear openings between the bars.



NYC Environmental Protection

Newtown Creek WPCP Process Flow Diagram

The Newtown Creek WWTP does not use primary tanks; instead, 16 aerated grit tanks are used. Influent flow enters the aerated grit tanks through uptake shafts (two per tank) from the main battery feed conduit. Effluent from each grit tank flows into a single aeration tank influent distribution channel in each aeration tank, which distributes flow to each aeration tank pass through eight individual manual slide gates (two per pass). Sixteen aeration tanks provide biological treatment. Return activated sludge enters the aeration tanks at the head end of the first pass. The aeration tank mixed liquor subsequently passes through a concrete baffle wall directly into the final clarifiers. The total aeration tank volume is 18.7 MG and six 30,000 scfm blowers provide air to the tanks through ceramic tube diffusers.

Aeration tank effluent passes into 16 final settling tanks where solids are settled. The total volume of the final settling tanks is 31.4 MG with a surface overflow rate of 881 gpd/sf at average design flow. Final settling tank effluent is conveyed to the four chlorine contact tanks. The four tanks have a total volume of 6.79 MG and a detention time of 15.8 minutes.

Plant effluent is discharged into the East River via a 12-foot diameter outfall with 25 T-shaped diffusers. The diffusers are used to diffuse effluent from the plant in the East River, approximately 45-feet below the mean water level.

Waste sludge is thickened in eight 70-foot diameter gravity thickeners, six of which are currently in use. The total available volume of gravity thickeners is 2.8 MG. The gravity thickeners will be replaced by centrifuges currently under construction. After thickening, the sludge is sent to six fixed steel cover anaerobic digestion tanks. The digesters operate in a high-rate, complete mix system mode. Four digesters operate as primaries with a total volume of 9.5 MG and two operate as secondaries with a total volume of 3.1 MG. After digestion, the sludge is stored in two sludge storage tanks with a total volume of 1.9 MG on site at Newtown Creek and one sludge storage tank at the East River Sludge Loading Dock. Sludge is hauled by barge to offsite dewatering facilities.

3.2.2 Newtown Creek WWTP Wet Weather Operating Plan

New York State requires development of a WWOP as one of the 13 BMPs for collection systems that include combined sewers. The goal of the WWOP is to maximize flow to the WWTP, one of the nine minimum elements of long-term CSO control planning. DEP has developed a WWOP for each of its 14 WWTPs, and Table 3-4 summarizes the requirements for the Newtown Creek WWTP. The WWOP for Newtown Creek was submitted to the state in April 2010, as required by the SPDES permit and is attached as Appendix B.

Table 3-4. Wet Weather Operating Plan for Newtown Creek WWTP

Unit Operation	General Protocols	Rationale
Influent Gates and Screens	At the Brooklyn pump station, visually monitor influent flow and channel levels. As channel levels rise, open additional channels. If all channels are in service, throttle influent gates as necessary. Increase screenings monitoring and manually switch bar screen rakes to continuous cleaning. If blinding occurs, close the influent gate to the blinded screen. At the Manhattan pump station, visually monitor influent channel levels and throttle the influent gates as necessary to prevent overflow. Increase screenings and equipment monitoring. If screen blinding occurs, close the influent gate to the blinded screen.	To prevent flooding of bar screens/channels and screen room while maximizing flow to the plant and to protect downstream raw wastewater pumps from damage by large objects.

Table 3-4. Wet Weather Operating Plan for Newtown Creek WWTP

Unit Operation	General Protocols	Rationale
Main Sewage Pumps	At both the Brooklyn and Manhattan pump stations, all wet weather events require an increase in screenings and channel monitoring from two times per eight hours to continuous monitoring. Manually switch bar screen rakes to continuous cleaning "hand" operation at the local control panel for each unit (1.5-2 minutes per cycle in continuous cleaning mode). Monitor discharge receiving bin level. When receiving bin is full, empty bin into large contractor bin using forklift. Return receiving bin and shovel any screening that discharged to the floor during emptying back into the bin. Monitor the large contractor bin, notify supervisoer when approaching 75% full for bin to be called in to the contractor for change-out. Visually inspect equipment. Confirm that cleaning rakes are properly meshing with bar screens, and screens have not blinded and are operating properly. If blinding of bar screen occurs, notify supervisor and close influent gate to the blinded screen until screen is cleared and/or high flows decrease	To protect downstream raw wastewater pumps from damage by large objects.
Primary Settling Tanks	For the Brooklyn pump station, monitor wet well elevation. As the wet well level rises, place pumps in service and increase speed of variable speed pumps as necessary to maintain a wet well wastewater elevation of approximately -16 feet. Pump to maximum capacitry of the pumping station of the differnece between the maximum plant flow capacity with process units out of service and the Manhattan Pump Station pumping capacity, whichever is lower. All adjustments are made manually by Operator (STW/SSTW) in the pump control room based on maintaining wet well level within desired operating ranage. Restrict flow through influent throttling gate if pumping rate is maximized and wet well level continues to rise (see Section 2.1.2 for influent throttling gate operations). For the Manhattan pump station, monitor wet well elevation. As the wet well level rises, place pumps in service and increase speed of variable speed pumps as necessary. Pump a minimum of 300 MGD during a wet weather event. All adjustments are made manually by Operator (STW/SSTW) in the pump control room based on maintaining wet well elvel within desired operating range. Restrict flow through influent throttling gates if pumping rate is maximized and wet well level continues to rise (see Section 2.1.3 for influent throttling gate operations).	Maximize flow to treatment plant and minimize need for flow storage in collection system and associated storm overflow from collection system into river.
Bypass Channel	Monitor the grit roll-off containers. Notify Supervisor (Watch Engineer) when approaching 75% full and request additional containers, as determined by Supervisor. Operate up to four Grit Houses as determined by Supervisor based on plant experience. Maintain a maximum number of detritors on line in accordance with Section 1.4.3.	Protect downstream mechanical equipment and pumps from abrasion and accompanying abnormal wear. Prevent accumulation of grit in aeration tanks.
Aeration Tanks	There is no bypass in place at Newtown Creek	N/A
Final Settling Tanks	Flow rates determine aeration tank influent pass gate settings automatically, when influent flow exceeds 400 MGD, open the D pass gate to 100% and then close the B pass gate.	Gate positions are automatically set to park solids to prevent solids washout in the final tanks.

Table 3-4. Wet Weather Operating Plan for Newtown Creek WWTP

Unit Operation	General Protocols	Rationale
Chlor-ination	No changes currently made to final sedimentation tank operations schedule during wet weather event. Check telescoping valve for clogging with rags and other debris and clean debris as necessary. Disable the automatic scum removal system.	High flows will substantially increase solids loading to the clarifiers and may result in high effluent TSS. These conditions can lead to loss of biological solids, which may reduce treatment efficiency when the plant returns to dry weather flow conditions.
Sludge Handling	All three CCTs are needed to maintain a minimum 15 minute detention time during larger storm events. Therefore, all CCT maintenance should be scheduled around storm events, or will need to go back on –line if one is off and a storm event begins. The pumping range for the metering pumps requires one stroke setting for normal flow and a longer stroke setting for storm events (250 MGD dry weather, 500 MGD wet weather). The operator will make the change as the flow increases.	To maintain chlorine residual and coliform kills.

3.2.3 Other Operational Constraints

DEC and DEP 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. Although the permitted effluent nitrogen load established by the Nitrogen Control Consent Order includes the discharge from both Lower East River WWTPs (Red Hook and Newtown Creek), there are currently no plans to implement Biological Nitrogen Removal (BNR) at either facility because the City is meeting its overall nitrogen goals. However, because of ongoing efforts by the Harbor Estuary Program (HEP) for water quality improvements, it is possible that BNR may be required at some point in the future. According to the 1998 DEP Nitrogen Control Feasibility Plan, no retrofit technologies could be identified that would result in a significant increase in nitrogen removal at Newtown Creek WWTP. At Red Hook, infrastructure does exist in the aeration tanks and froth control system that would make it possible to operate at basic step feed BNR, but the plant is not being run in that mode and there are no plans to begin BNR operation.

3.3 NEWTOWN CREEK WATERSHED COLLECTION SYSTEM

The Newtown Creek WWTP collection system is almost entirely a combined sewer system although some localized areas have separate sanitary and storm sewers. Details in this section were derived from URS (1993), Greeley and Hansen (1982), and LTCP-JV (2005).

3.3.1 Combined Sewer System

Combined sewers serve approximately 6,185-acres (81 percent) of the 7, 650-acre Newtown Creek watershed. The combined sewers discharge to regulators where the wastewater flows are diverted to large interceptor sewers. The interceptor sewers then carry the flows to the

WWTP. Flows that exceed interceptor or plant capacity are bypassed at the regulators to the receiving waters as CSOs. Figure 3-6 presents the major components of the drainage system, including pump stations, interceptor sewers, regulators, CSO outfalls, storm outfalls, and associated area delineations. As shown in Figure 3-6, the sewershed is comprised of two distinct subareas, one draining to the Bowery Bay WWTP, and the other to the Newtown Creek WWTP. The following describes the combined sewer system in each of these subareas.

Bowery Bay WWTP Sub-Area

The portion of the Newtown Creek sewershed draining to the Bowery Bay WWTP is north of the lower reach of the Creek in Queens. The drainage area tributary to the Creek is approximately 968-acres (737-acres with combined sewers) and includes the Borden Avenue Pumping Station, and 13 active CSOs. This sub-area is part of the Low Level portion of the Bowery Bay WWTP service area. The Low Level service area contains 46 regulators, of which 19 interconnected regulators discharge to the Newtown Creek during wet weather through the 13 CSOs. Of these 13 CSOs, 6 discharge to the tributary Dutch Kills (BB-004, 009, 010, 026, 040, and 042), and 6 discharge to Newtown Creek (BB-011, 012, 013, 014, 015, and 043). An additional 2-feet, 8-inches x 4-foot outfall, BB-049, is listed in the Bowery Bay WWTP SPDES permit as discharging to Dutch Kills near 21st Street, but no further information is available such as which regulator it is connected to. This outfall is shown on Figure 3-6 to be located adjacent to Newtown Creek and not Dutch Kills, based on the latitude and longitude provided in the SPDES permit. Table 3-5 presents a listing of the permitted CSO outfalls' locations, dimensions, and associated regulators and drainage areas.

Table 3-5. CSO Discharges to Newtown Creek from the Bowery Bay WWTP Service Area

Regulator	Regulator Location	Waterbody	Outfall(3)	Outfall Size	Drainage Area (ac)
BB-L1	Greenpoint Ave. & Newtown Creek	Newtown Creek, north shore, west of Dutch Kills	BB-011	24" diameter	17
BB-L2	35th Street W/O Review Ave.	Newtown Creek, north shore, west of Dutch Kills	BB-012	24" diameter	13
BB-L3	Borden Ave. & Dutch Kills	Dutch Kills, eastern shore	BB-004	6'-6" x 3'-3"	12
BB-L3B	30th Street & Huntington Ave.	Dutch Kills, eastern shore	BB-009	11'-0" x 4'-6"	280
- BB-L3A	Borden Pump Station Influent	Tributary to BB-L3B through Borden P.S.			
- BB-L37	Hunter Point Ave. & Van Dam Street	Tributary to BB-L3B			
- BB-L38	Hunter Point Ave. & 30th Street	Tributary to BB-L3B			
- BB-L41	Borden Ave. & 30th Street	Tributary to BB-L3B			
BB-L3C	Behind Borden P.S.	Dutch Kills, eastern shore	BB-010	30" diameter	25
BB-L4 (1)	47th Ave. between 28th & 29th Streets	Dutch Kills, head end	BB-026	9'-0" x 4'-6"	296
- BB-L39	47th Ave. & 30th Street	Tributary to BB-L4			
- BB-L40	47th Ave. & 31st Street	Tributary to BB-L4			
- BB-L42	27th Street & Skillman Ave.	Tributary to BB-L4			
BB-L5	49th Ave. & 27th Street	Dutch Kills, western shore	BB-040	24" diameter	8

Table 3-5. CSO Discharges to Newtown Creek from the Bowery Bay WWTP Service Area

Regulator	Regulator Location	Waterbody	Outfall(3)	Outfall Size	Drainage Area (ac)
BB-L6	Borden Ave. & 27th Street	Dutch Kills, western shore	BB-042	12" diameter	1
BB-L7	E/S 11th Street, S/O 53rd Ave.	Newtown Creek, north shore, east of Dutch Kills	BB-043	54" diameter	37
BB-L8	W/S 11th Street & S/O 53rd Ave.	Newtown Creek, north shore, east of Dutch Kills	BB-013	72" diameter	31
BB-L9	Vernon Blvd., S/O 54th Ave.	Newtown Creek, north shore, east of Dutch Kills	BB-014	22" diameter	12
BB-L10	5th Street & 55th Ave.	Newtown Creek, north shore, east of Dutch Kills	BB-015	15" diameter	5
Total Combined Sewer Area (Acres)					737

(1) Dry weather flow from BB-L40 bypasses BB-L39 and is sent to BB-L-42 at Equalizing Chamber No. 2.
(2) Outfall BB-049 is listed in SPDES Permit No. NY- 0026158 as being a 2'-8" x 4' outfall discharging into Dutch Kills near 21st St., however, no further information was available to determine the listed parameters.
(3) An additional 2-feet, 8-inches x 4-foot outfall, BB-049, is listed in the Bowery Bay WWTP SPDES permit as discharging to Dutch Kills near 21st Street, but no further information is available such as which regulator it is connected to.

The Borden Avenue Pump Station, located at Borden Avenue and Review Street, operates within the Bowery Bay WWTP Low Level service area and is within the Newtown Creek sewershed. The Borden Avenue Pump Station has one online and two standby pumps for a total capacity of 3.9 MGD, and the average dry weather flow is 453,000 gallons per day (gpd).

The Long Island City Interceptor is a principal element of the Bowery Bay Low Level service area. All of the Newtown Creek overflows from the Bower Bay WWTP service area are from this interceptor, which begins running north along the west side of Dutch Kills, turning east and crossing north of Dutch Kills, and then south along the east side of Dutch Kills back towards Newtown Creek. The interceptor continues east along the north side of Newtown Creek to the mouth of the Creek before heading north to the Bowery Bay WWTP where discharges are diverted to the East River.

Newtown Creek WWTP Sub-Area

The portions of the Newtown Creek sewershed draining to the Newtown Creek WWTP are south and the east of the Creek in Brooklyn, and northwest of the Creek in Queens. The tributary drainage area is approximately 6,473-acres (5,455-acres with combined sewers), includes three pumps stations, and has 10 CSOs. The Brooklyn portion contains 22 regulators, five of which along with an overflow weir at St. Nicholas Avenue and Troutman Street and a high relief at Ash Street and McGuiness Boulevard discharge during wet weather to Newtown Creek. The Queens portion contains two regulators, which also discharge during wet weather to Newtown Creek. Of these 10 CSOs, five discharge to Newtown Creek (NCQ-029, and NCB-021, 22, 23, and 24), and five discharge to its tributaries: English Kills (NCB-015), East Branch (NCB-019 and 83), Whale Creek (NCB-002) and Maspeth Creek (NCQ-077). Outfall NCB-002 is the overflow from Newtown Creek WWTP to Whale Creek Canal. Table 3-6 presents information on these CSO outfalls.

The 49th Street and Glendale Pump Stations operate within the Newtown Creek portion of the Newtown Creek sewershed. The 49th Street Pump Station, located at 49th Street and 57th Avenue, is a sanitary pumping station. The station has one online and two standby pumps for a total capacity of 7.9 MGD, and an average dry weather flow of 280,000 gpd. Although this is a sanitary pumping station, the station discharges via the secondary interceptor from Queens to the combined Morgan Avenue Interceptor for conveyance to the Newtown Creek WWTP.

The Glendale Pump Station, located at Cooper Avenue, west of 76th Street, is a storm pumping station. The station has two online pumps with a total capacity of 1.2 MGD, and pumps to the downstream combined sewer system.

The Brooklyn/Queens pump station, which is located at the WWTP, was built in 1967. With a rated capacity of 300 MGD, the station accepts wastewater from the Brooklyn and Queens portions of the tributary area through the Kent Avenue and Morgan Avenue Interceptors. The five existing 70 MGD pumps are planned to be replaced with five new 107 MGD pumps under Contract NC-36; however, there is currently no planned change in rated capacity.

There are two principal interceptors serving the Newtown Creek portion of the Newtown Creek sewershed, the Kent Avenue Interceptor and the Morgan Avenue Interceptor. The Kent Avenue Interceptor also accepts flow from the West Street Interceptor and together they serve the northeast portion of Brooklyn. The Morgan Avenue Interceptor serves the northwest side of Brooklyn and the southeast portion of Queens and accepts flow from the 49th Street Pumping Station through the Secondary Interceptor from Queens. The Kent and Morgan Avenue Interceptors join just upstream of the Brooklyn/Queens pump station carrying wastewater directly to the Newtown Creek WWTP.

Table 3-6. Newtown Creek CSOs from the Newtown Creek WWTP Service Area

Regulator	Regulator Location	Waterbody	Outfall	Outfall Size	Drainage Area(ac)
NC-Q1	W/O Russel Street	Maspeth Creek, head end	NCQ-077	2 @ 11’-0” x 7’-0"	1,107
NC-Q2	56th Rd &43rd Street	Newtown Creek, north shore, east of Maspeth Creek	NCQ-029	66" diameter	91
NC-B1, B1A	Johnson Ave. W/O Porter Ave.	English Kills, head end	NCB-015	2 @ 15’-8” x 10’-0"	2,275
NC-St. Nich Weir	Metropolitan Ave. & Troutman Ave.	East Branch, head end	NCB-083	206” x 157” arch	1,901
NC-B2	Metropolitan Ave. & Onderdonk Ave.	East Branch, head end	NCB-019	36" diameter	29
NC-B16	E/O Franklin Street	Newtown Creek, south shore near mouth of Creek	NCB-023	24" diameter	15
NC-B15	Dupont St. & Commercial St.	Newtown Creek, south shore near mouth of Creek	NCB-024	18" diameter	1.8
NC-B17	McGuiness Blvd., N/O Ash Street	Newtown Creek, south shore east of Newtown Creek WWTP	NCB-022	4’-6” x 6’-3"	23
High Relief	McGuiness Blvd., N/O Ash Street	Newtown Creek, south shore east of Newtown Creek WWTP	NCB-021	36” diameter	15

Table 3-6. Newtown Creek CSOs from the Newtown Creek WWTP Service Area

Regulator	Regulator Location	Waterbody	Outfall	Outfall Size	Drainage Area(ac)
Newtown Creek WWTP	Newtown Creek WWTP Overflow	Whale Creek Canal	NCB-002[2]	3 @ 7'0" x 8'0"	N/A
Total Combined Sewer Area (Acres)					5,455 [1]

[1] Totals may not sum precisely due to rounding.
[2] Not modeled as a CSO outfall because this flow is treated before discharge.

3.3.2 Stormwater System

Direct drainage areas and separate storm sewers serve approximately 1,249-acres or 17 percent of the 7,440-acre Newtown Creek watershed. Based on the NYC Shoreline Survey there are 218 non-CSO discharges to the Newtown Creek and its tributaries. These discharges include storm drains, highway drains, and other direct discharges. However, the SPDES permits for the Bowery Bay and Newtown Creek WWTPs include only five permitted storm drains that drain to Newtown Creek or its tributaries. All five of the permitted storm outfalls are listed in the Newtown Creek WWTP SPDES permit and are shown on Figure 3-6. The location and size of the permitted stormwater outfalls draining to the Newtown Creek waterbody are also presented in Table 3-7.

Table 3-7. Newtown Creek WWTP Stormwater Discharges to Newtown Creek

Stormwater Outfall	Outfall Location	Waterbody	Outfall Size
NCB-629	Scholes Street	English Kills	60” diameter
NCB-630	Meeker Avenue	Newtown Creek	15” diameter
NCB-631	North Henry Street	Newtown Creek	90” diameter
NCB-632	Grand Avenue Bridge	Newtown Creek	54” diameter
NCB-633	Grand Avenue Bridge	Newtown Creek	60” diameter

3.4 SEWER SYSTEM MODELING

Mathematical watershed models are used to simulate the hydrology (rainfall induced runoff) and hydraulics (sewer system responses) of a watershed, and are particularly useful in characterizing sewer system response to rainfall conditions during wet weather and in evaluating engineering alternatives on a performance basis. In the hydrology portion of the model, climatic conditions (such as rainfall intensity) and physical watershed characteristics (such as slope, imperviousness, and infiltration) are used to calculate rainfall-runoff hydrographs from individual smaller drainage areas (subcatchments). These runoff hydrographs are then applied at corresponding locations (manholes) in the sewer system as inputs to the hydraulic portion of the model. Wherein the hydraulic portion, the resulting hydraulic grade lines and flows are calculated based on the characteristic 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 the pollutant loadings necessary for receiving-water models to assess water quality conditions. The following generally describes the tools employed to model the Newtown Creek watershed. A more detailed description of the model setup, calibration and model-projection processes are provided in the *City-wide Long Term Control Planning Project Landside Modeling Report, Vol. 2, Bowery Bay WPCP and Vol. 6, Newtown Creek WPCP*.

3.4.1 Hydraulic Modeling Framework

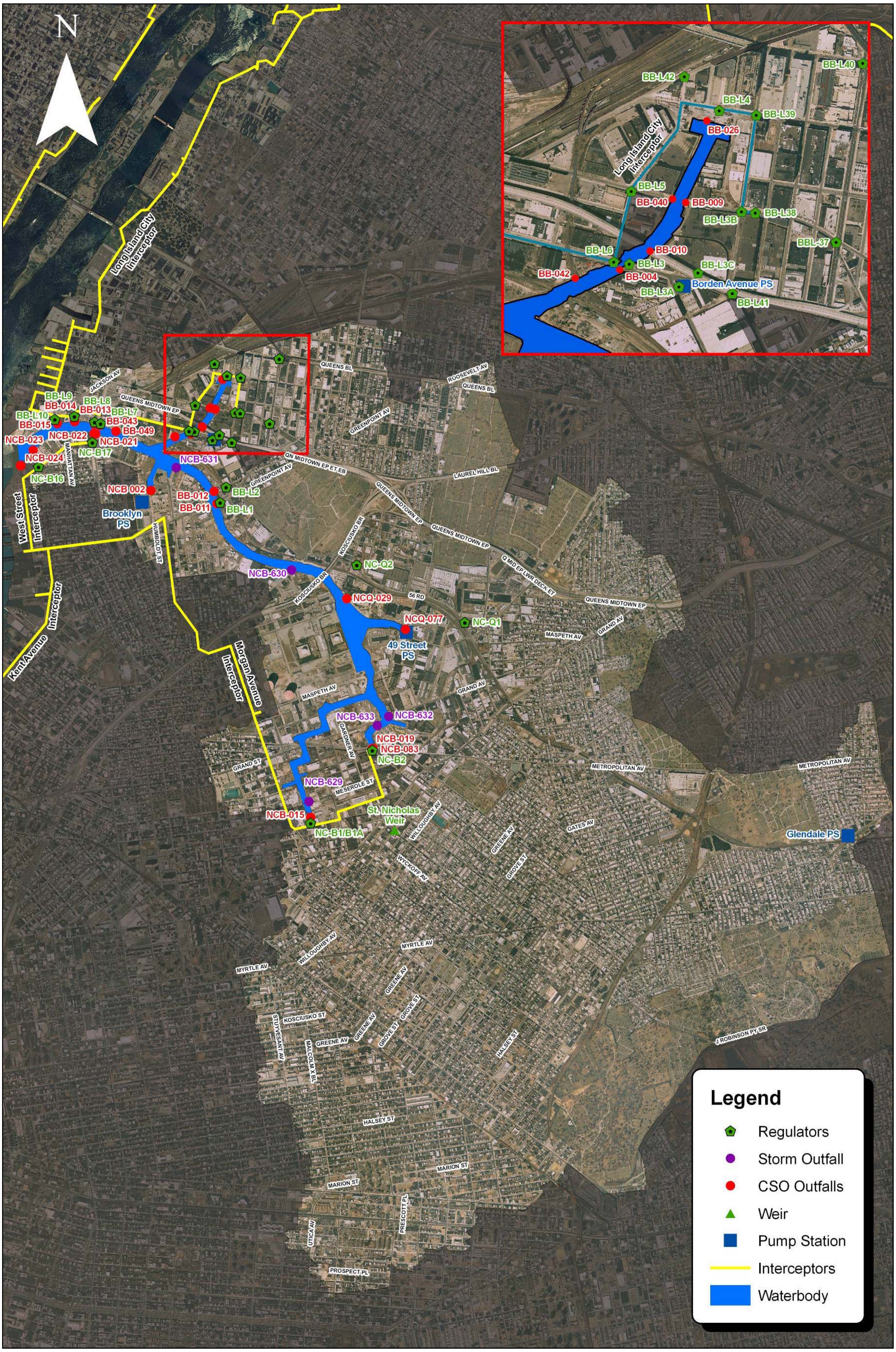
The hydraulic modeling framework used in this effort is a commercially available, proprietary software package called InfoWorks CS™, developed by Wallingford Software, U.K. InfoWorks CS is a hydrologic/hydraulic modeling package capable of performing time-varying simulations in complex urban settings for either individual rain events or long-term periods comprising many rain events. The outputs include calculated hydraulic grade lines and flows within the sewer system network and at discharge points. InfoWorks CS™ solves the complete St. Venant hydraulic routing 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 Storm Water Management Model (SWMM), InfoWorks CS™ offers a state-of-the-art graphical user interface with greater flexibility and enhanced post-processing tools for analysis of model generated outputs. In addition, InfoWorks utilizes a four-point implicit numerical solution technique that is generally more stable than the explicit solution procedure used in SWMM.

Model input for InfoWorks CS™ 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, WWTP headworks, etc.). Hourly rainfall patterns and tidal conditions are also important model inputs. InfoWorks CS™ allows interface with geographic information system (GIS) data to facilitate model construction and analysis.

Model output includes flow and/or hydraulic gradient line (HGL) at virtually any point in the modeled system and also at virtually any time during the modeled period. InfoWorks CS™ 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 hydraulic behavior in manholes during wet or dry weather periods. Additional post-processing of model output allows the user to view the results in various ways as necessary to evaluate the system response, and also to visualize the improvements resulting from various engineering alternatives

3.4.2 Application of Model to Collection Systems

New York City is comprised of 14 independent sewersheds, each having at least one distinct watershed model. Because the Newtown Creek watershed overlaps two different WWTP service areas, two different InfoWorks models were employed for the Newtown Creek study area: one model for the Bowery Bay WWTP low level service area, and a second model for the Newtown Creek WWTP Brooklyn/Queens service area. Each of these models had been previously constructed using information and data compiled from the DEP's as-built drawings, WWTP 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



NYC Environmental Protection

Newtown Creek Sewershed- Sewer System Components

Newtown Creek Waterbody/Watershed Plan

Figure 3-6

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dimensions.

Model elements include WWTP headworks, interceptors, branch interceptors, major trunk sewers, all sewers greater than 60-inches in diameter plus other smaller, significant sewers, and control structures such as pump stations, diversion chambers, tipping locations, reliefs, regulators and tide gates. These models were previously calibrated and validated using flow and hydraulic-elevation data collected during the Inner and Outer Harbor CSO Facility Planning Projects, as well as more recent data collected in the past several years for facility planning. Field verifications were conducted by the DEP during its Use and Standards Attainability (USA) Project and ongoing facility planning projects to confirm and re-measure system components where data or information gaps existed.

Conceptual alternative scenarios representing no-action and other alternatives were simulated for the design condition (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. Discharges and pollutant loadings were then post-processed and used as inputs to the receiving-water model of Newtown Creek, described in Section 4.

3.4.3 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 design condition" was developed. This Baseline condition reflects a set of conditions that are expected to be similar in all subsequent comparisons so that the impact of the specific proposed changes can be determined. In general, the Baseline condition represents the watershed and sewer system in its current condition, with certain exceptions specifically used for planning purposes. These exceptions are:

- Dry-weather flow rates reflect year 2045 projections. For planning purposes, the 2045-projected dry-weather flow rates at each regulator reflect expected future population and water-use patterns in the study area. The total projected dry-weather flow rates are 109 MGD at Bowery Bay WPCP, and 268 MGD at Newtown Creek WPCP.

- The Sustained wet-weather treatment capacity of the Bowery Bay WPCP was 236, and wet-weather treatment capacity of the Newtown Creek WPCP was 585 MGD, based on top-ten-storm analyses for each WPCP as reported to DEC in the 2003 BMP Annual Report. Bowery Bay WWTP has been upgraded to 300 MGD to meet the 2x DDWF requirement, and Newtown Creek WWTP is currently being upgraded to include full secondary treatment of 700 MGD. There are no primary treatment facilities at Newtown Creek WWTP.

- Documented sediment values were included in the model where known, however, if there was no information available, sedimentation in the sewers was assumed to be removed.

- The Brooklyn Pump Station (P.S.) capacity is 400 MGD. The Newtown Creek WPCP Enhanced Track 3 Facility Plan and the Newtown Creek CSO Facility Plan dictate a capacity of 300 MGD. However, as noted above, it is intended that the Newtown Creek WPCP be upgraded to accommodate 300 MGD from the Manhattan service area, as well as to accept up to 400 MGD from the Brooklyn Pump Station, for a total of 700 MGD.

Additionally, establishing the future Bowery Bay and Newtown Creek WWTPs dry weather sewage flows is a critical step in the WB/WS Planning analysis since one key element in the City's CSO control program is the use of the WWTPs to reduce CSO discharges. Increases in sanitary sewage flows associated with increased populations will reduce the amount of CSO flow that can be treated at the existing WWTPs since the increased sanitary sewage flows will use part of the WWTP wet weather capacity.

Dry weather sanitary sewage flows used in the Baseline modeling were escalated to reflect anticipated growth within the City. At the direction of the Mayor's Office, NYCDCP 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 188 neighborhoods within the City. DEP has escalated these populations forward to 2045 by assuming the rate of growth between 2045 and 2030 would be 50 percent 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 weather 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 each WWTP service area and the year 2000 population of each WWTP area.

Increasing the sewage flows for the Bowery Bay WWTP low level system from the current 2005 flow of 29 MGD to an estimated 35 MGD and from the Newtown Creek Brooklyn system from the current 2005 flow of 71 MGD to an estimated 83 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 both WWTP drainage areas. In accordance with the Federal CSO Control Policy a typical/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. Annual statistics were compiled included:

- Total rainfall depth and number of storms;
- Average storm volume and intensity;
- Total and average storm duration; and
- Average inter-event time

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. In addition, the JFK 1988 rainfall record includes high-rainfall conditions during the July (recreational) and November (shellfish) periods, which are 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 by New York Harbor Estuary Program and the New Jersey Department of Environmental Protection for water-quality and CSO performance evaluations. Table 3-8 summarizes some of the statistics for 1988 and a long-term (1970-2002) record at JFK.

Table 3-8. 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
Annual Average Storm Volume (inches)	0.41	0.35
Average Storm Intensity (inch/hour) Return Period (years)	0.068 11.3	0.057 2.0
Annual Total Duration of Storms (hours)	612	681
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
Annual Average Time Between Storms (hours)	88	78

3.5 DISCHARGE CHARACTERISTICS

As indicated in Section 3.4, sewer-system modeling is useful to characterize flows and pollutant loads discharged from various outfalls in the drainage area. Because long-term monitoring of outfalls is difficult and expensive, and sometimes not accurate 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 and rainfall runoff discharged from a CSO. This is particularly helpful when developing CSO pollutant concentrations, since this sanitary/runoff split for the discharge volume can be used to develop CSO concentrations and subsequently loadings. This method of utilizing concentrations associated with sanitary and runoff is somewhat more reliable than developing CSO concentrations based on pollutant concentrations measured in combined sewage (e.g., the event mean concentrations, EMC), which are particularly variable.

3.5.1 Characterization of Discharged Volumes, Baseline Condition

The calibrated watershed models described in Section 3.4 were used to characterize discharges to Newtown Creek for the Baseline condition. Table 3-9 summarizes the results with statistics relating to the annual CSO discharges from each point-source outfall for the Baseline condition. The four largest CSO outfalls, which together account for over 90 percent of the annual average CSO volume, are located at the head ends of East Branch (40.1 percent), Maspeth Creek (19.8 percent), English Kills (17.8 percent), and Dutch Kills (12.7 percent).

Table 3-9. Newtown Creek CSO Discharge Summary for Baseline Condition [(1) (2)]

Outfall [(3)]	Annual CSO Discharge Volume (MG)	Percentage of CSO Volume	Number of Discharges
NCB-083	586.2	39.8%	71
BB-026	186.8	12.7%	47
NCQ-077	261.5	17.8%	49
NCB-015	307.8	20.9%	33
BB-013	39.2	2.7%	44
NCQ-029	18.1	1.2%	48
BB-043	13.9	0.9%	40
BB-009	35.2	2.4%	35
NCB-022	8.4	0.6%	42
BB-014	3.2	0.2%	35
BB-042	2.3	0.2%	29
BB-011	2.8	0.2%	24
BB-040	0.9	0.1%	21
BB-015	3.1	0.2%	39
BB-010	1.6	0.1%	16
NCB-023	0.2	0.0%	5
NCB-019	0.4	0.0%	7
BB-012	0.2	0.0%	5
BB-004	0.1	0.0%	4
NCB-024	0.0	0.0%	0
Total CSO	1471.9	100%	

(1) Baseline condition reflects design precipitation record (JFK, 1988) and sanitary flows projected for year 2045 (Bowery Bay WWTP: 236 MGD, Newtown Creek WWTP: 585 MGD).
(2) Totals may not sum precisely due to rounding.
(3) CSO Outfalls BBL-049 and NCB-021 are not incorporated into the model due to lack of as-built data. The adjacent drainage areas are distributed to nearby outfalls. Outfall 002 is the Newtown Creek WWTP high relief that discharges to Whale Creek Canal. This flow is treated before discharge and is built into the water quality model runs.

Table 3-10 summarizes the results with statistics relating to the annual stormwater discharges from each point-source outfall for the Baseline condition.

Table 3-10. Newtown Creek Stormwater Discharge Summary for Baseline Condition [(1) (2)]

Outfall [(3)(4)]	Discharge Volume (MG)	Percentage of Stormwater Volume	Number of Discharges
NCB-629	62.1	10.8%	71
NCB-631	55.9	9.7%	71
NCB-632	51.9	9.0%	71
NC Non-Permitted	324.1	56.2%	71
BB Non-Permitted	82.7	14.3%	71
Total Stormwater	576.7	100%	

Outfall [3][4]	Discharge Volume (MG)	Percentage of Stormwater Volume	Number of Discharges
[1] Baseline condition reflects design precipitation record (JFK, 1988) and sanitary flows projected for year 2045 (Bowery Bay WWTP: 236 MGD, Newtown Creek WWTP: 585 MGD). [2] Totals may not sum precisely due to rounding. [3] The InfoWorks model includes a total of 44 non-CSO discharges to Newtown Creek. [4] SPDES permitted storm outfalls NCB-630 and 633 are not incorporated into the model due to lack of as-built data.			

Only three of the DEP's five SPDES permitted stormwater outfalls are included in the model due to lack of as-built information. However, the model includes a total of 44 non-CSO point discharges, some of which are direct drainage areas modeled as a point discharge. These discharges are shown in Figure 3-7. DEP's three SPDES permitted outfalls are projected to account for approximately 30 percent of the non-CSO flow to Newtown Creek. Typical year CSO and Stormwater discharges to Newtown Creek under the Baseline condition total 2,040.2 MG.

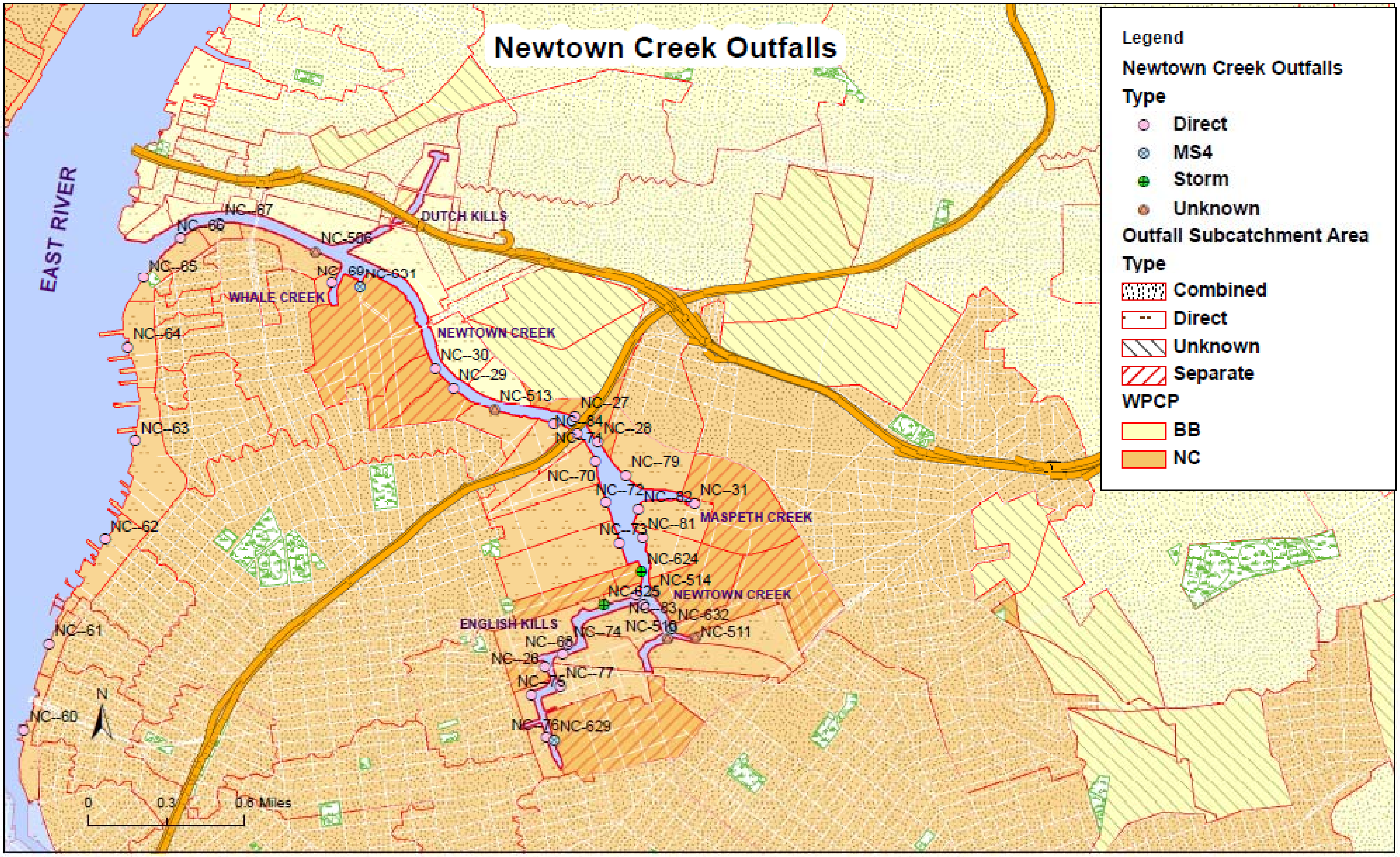
3.5.2 Baseline Pollutant Concentrations

Pollutant concentrations associated with intermittent, wet weather-related discharges are highly variable and difficult to properly characterize without an extensive sampling program. Further, with some 450 CSO overflow locations within the City, characterization of CSOs from each outfall would be prohibitive. For this reason, analyses documented in this report 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 storm water are attributed to the rainfall runoff portion of the discharged flow volumes.

Table 3-11 presents the pollutant concentrations associated with the sanitary and storm water components of discharges to Newtown Creek. Sanitary concentrations were developed based on sampling of WWTP influent during dry-weather periods, as described elsewhere in more detail (DEP, 2002). Storm water concentrations were developed based on sampling conducted citywide as part of the Inner Harbor Facility Planning Study (Hazen and Sawyer, et. al., 1994), and sampling conducted citywide by DEP for the USEPA Harbor Estuary Program (HydroQual, 2005b).

Table 3-11. Sanitary and Stormwater Discharge Concentrations, Baseline Condition

Constituent	Sanitary Concentration	Stormwater Concentration
Dissolved Oxygen (mg/L)	1.0	4.0
Biochemical Oxygen Demand, (BOD) (mg/L)	130 [1]	15 [2]
Total Suspended Solids, (TSS) (mg/L)	160 [1]	15 [2,3]
Total Coliform Bacteria (MPN/100mL) [4]	$250x10^{5}$ [3]	$3.0x10^{5}$ [3]
Fecal Coliform Bacteria (MPN/100mL) [4]	$40x10^{5}$ [3]	$1.2x10^{5}$ [3]
Enterococci (MPN/100mL) [4]	$10x10^{5}$ [3]	$0.5x10^{5}$ [3]
[1] DEP, 2002. [2] DEP, 1994. [3] HydroQual, 2005b. [4] Bacterial concentrations expressed as "most probable number" of cells per 100 mL.		



Environmental Protection

Non-CSO Discharges Included in Baseline Conditions

3.5.3 Baseline Pollutant Loads

Pollutant-mass loadings were calculated using the pollutant concentrations shown in Table 3-11 to the discharge volumes and sanitary/rainfall-runoff splits provided by the watershed model, as described above. Table 3-12 presents a summary of the annual discharges to Newtown Creek for the Baseline condition.

As shown in Table 3-12, and summarized on Figure 3-8, CSOs dominate all of the pollutant loadings shown above. In fact, the three largest CSOs, NCB-083, NCB-015, and NCQ-077, each contribute more of these listed pollutants than all of the stormwater sources combined**.**

Table 3-12. Annual CSO and Stormwater Discharge Loadings, Baseline Condition (1)

Constituent		CSO Loading	Stormwater Loading
Biochemical Oxygen Demand, (BOD)	Lbs	310,000	72,100
Total Suspended Solids, (TSS)	Lbs	345,000	72,100
Total Coliform Bacteria (2)	MPN	146×10^{15}	7×10^{15}
Fecal Coliform Bacteria (2)	MPN	27×10^{15}	3×10^{15}
Enterococci (2)	MPN	8×10^{15}	1×10^{15}

(1) Loadings represent annual total during Baseline simulation.
(2) Bacterial loadings expressed as “most probable number” of cells.

3.5.4 Effects of Urbanization on Drainage

The urbanization of Newtown Creek from pre-Revolutionary War farm lands to the current industrial urban setting has brought increased population, increased pollutants from sewage and industry, construction of sewer systems, and physical changes increasing the size of the drainage area and the imperviousness of the watershed. Increased surface imperviousness generates more runoff that is less attenuated by the infiltration process. Additionally, the sewer systems have 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, which 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.

There has been a significant increase in the amount of runoff discharged to Newtown Creek due to a combination of watershed urbanization and waterbody modifications compared to its undisturbed, pristine condition prior to Dutch acquisition nearly four centuries ago. Based on 2000 U.S. Census Bureau information, the watershed is now home to a population of 330,000 and, as shown in Table 2-1, nearly 75 percent of the watershed is characteristically residential and other developed uses in which ground surfaces are predominately hardened by rooftops, sidewalks, paved playgrounds and schoolyards, and streets, thoroughfares and highways. While natural areas typically exhibit imperviousness of 10 to 15 percent, imperviousness in urban areas can be 70 percent or higher. All natural streams previously tributary to Newtown Creek, including the southeastern most reach of the Creek itself, have been eliminated and there are now no freshwater tributaries to the waterbody. Tidal wetlands and sinuous stream beds would attenuate transport further, but land use pressures have eliminated these features as well. The combined and storm sewers provide the only remaining pathway for runoff, entering via roof leaders, catch basins, manholes, etc., and discharging directly to Newtown Creek in a substantially shorter duration. By decreasing the travel time and infiltration, peak discharge rates and total discharge volumes to the waterbody are correspondingly more severe.

Table 3-13 presents a summary of pre-urbanized conditions for the Newtown Creek watershed. The table demonstrates how wet-weather discharges, estimated using watershed models with the design-condition precipitation record (JFK gage, 1988), are projected to have increased from the pre-urbanized condition to the urbanized condition. The total annual wet-weather discharge in the pre-urbanized condition was approximately 988 MG, compared to 1,985 MG in the urbanized condition, representing more than a two fold increase.

Table 3-13. Effects of Urbanization on Watershed Yield

Watershed Characteristic	Pre-Urbanized	Urbanized (1)
Drainage Area (acres)	8,948	7,440
Population (2)	Unknown	330,000
Imperviousness	10%	51%
Annual Yield (MG) (3)	988	1,985

(1) Existing condition.
(2) Year 2000 U.S. Census.
(3) Design rainfall (JFK, 1988).

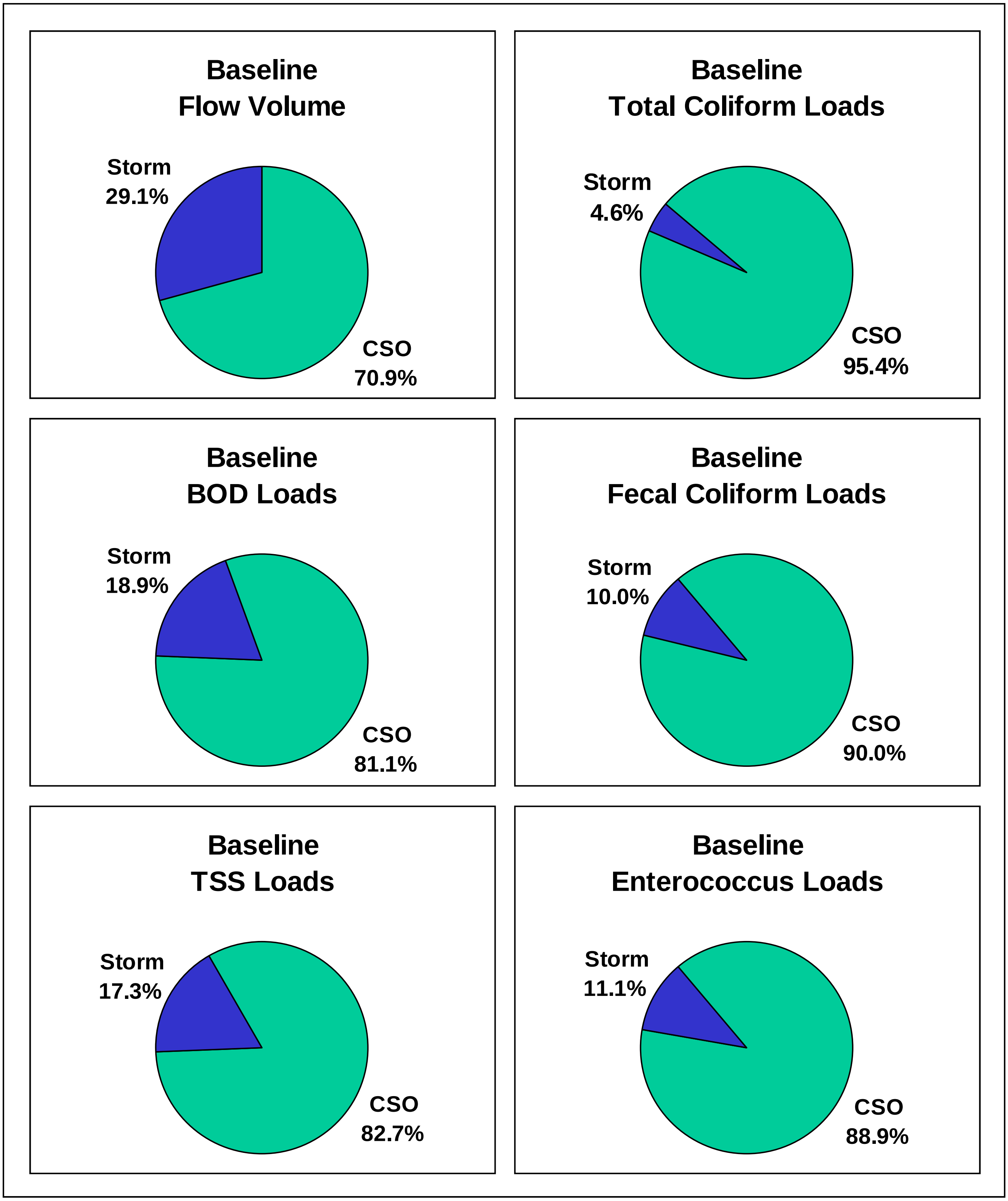
Urbanization has also altered the pollutant character of wet-weather discharges from the watershed. The original rural landscape of forests, fields and wetlands represents pristine conditions with pollutant loadings resulting from natural processes (USEPA 1997). These natural loadings, while having an 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 a combined sewer system contain a mixture of sanitary sewage and urban runoff that is significantly stronger in pollutant concentrations than natural runoff. These pollutants include coliform bacteria, oxygen-demanding materials, suspended and settleable solids, floatables, oil, grease, and other deleterious materials. Table 3-14 presents a loading comparison for TSS and BOD, two pollutants with significant impact on water quality in Newtown Creek. The loadings are based on the watershed model discharge volumes (Table 3-13), and pollutant concentrations taken from literature sources for conditions similar to the pre-urbanization conditions that existed in the past. The stormwater concentrations used for the urbanized condition are typically higher than those for a rural or pristine condition. The table demonstrates that urbanization of the watershed has substantially increased pollutant loadings to Newtown Creek.

Table 3-14. Effects of Urbanization on Watershed Loadings

Annual Pollutant Load (1)	Pre-Urbanized (2)	Urbanized (3)	hange
Total Suspended Solids (lb/year)	124,000	417,100	36%
Biochemical Oxygen Demand (lb/year)	124,000	382,100	08%

(1) For an average precipitation year (JFK, 1988).
(2) Circa 1900, using stormwater concentrations.
(3) Existing condition, including CSO and stormwater discharges.



NYC Environmental Protection

Watershed Loading Comparisons Baseline Conditions

3.5.5 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 in separate and combined sewer systems, USEPA requires approximately 1,500 municipalities nationwide to implement Industrial Pretreatment Programs (IPPs). The intent of the IPP is to control toxic discharges to public sewers that are tributary to sewage treatment plants by regulating Significant Industrial Users (SIUs). If a proposed Industrial Pretreatment Program is deemed acceptable, USEPA will decree the local municipality a Control Authority. DEP 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 management practices for several common discharges such as photographic processing waste, grease from restaurants and other non-residential users, and perchloroethylene from dry cleaning. DEP has been submitting annual reports on its activities since 1996. The 310 SIUs that were active at the end of 2004 discharged an estimated average total mass of 38.2 lbs/day of the following metals of concern: arsenic, cadmium, copper, chromium, lead, mercury, nickel, silver and zinc.

As part of the IPP, DEP analyzed the toxic metals contribution of sanitary flow to CSOs by measuring toxic metals concentrations in WWTP influent during dry weather in 1993. This program determined that only 2.6 lbs/day (1.5 percent) of the 177 lbs/day of regulated metals being discharged by regulated industrial users 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 WWTP outfalls. Recent data suggest even lower discharges. In 2004, the average mass of total metals discharged by all regulated industries to the New York City WWTPs would translate into less than 1 lb/day bypassed to CSOs from regulated industries if the mass balance calculated in 1993 is assumed to be maintained. A similarly developed projection was cited by the 1997 DEP report on meeting the nine minimum CSO control standards required by federal CSO policy, in which DEP considered the impacts of discharges of toxic pollutants from SIUs tributary to CSOs (DEP, 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.

According to the 2004 data, there were 20 SIUs within the Newtown Creek sewershed (Table 3-15). Of these, 12 discharged an average daily flow of approximately 472,000 gallons per day to the Bowery Bay WWTP in 2004, which is less than 2 percent of the existing dry weather flow from the low level system. The other eight SIUs discharged an average daily flow of approximately 119,000 gallons per day to the Newtown Creek WWTP in 2004, which is less than 0.2 percent of the existing dry weather flow from Brooklyn and Queens. Considering how infrequently CSO discharges occur in comparison to the continuous operation of these WWTPs, a significantly smaller portion is actually bypassed as CSO. As a result of the virtually insignificant potential for toxic discharge from SIUs, DEC has not listed Newtown Creek as being impaired by toxic pollutants associated with CSO discharges.

Table 3-15. Permitted Significant Industrial Users within the Newtown Creek Drainage Area (November 2004)

SIU ID	Address	SIU ID	Address
Bowery Bay WWTP			
69	36001 48th Ave.	149	30000 47th Ave.
84	30000 47th Ave.	153	59002 Borden Ave.
101	30000 47th Ave.	198	31000 47th St.
121	30000 47th Ave.	208	48009 37th St.
137	30000 47th Ave.	230	47009 30th St.
149	30000 47th Ave.	260	39030 Review Ave.
Newtown Creek WWTP			
14	1288 Willoughby Ave.	45	323 Mofat St.
15	1261 Willoughby Ave.	47	16033 Centre St.
18	58015 57th Dr.	62	58029 57th Dr.
19	59030 56th Rd.	158	44022 54th Ave.

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4.0. Waterbody Characteristics

Tributary to the East River, Newtown Creek is a tidally influenced, estuarine waterbody experiencing a semi-diurnal tidal cycle varying between 5 and 7 feet. The Creek is 3.8 miles long from the East River to its farthest reach inland and has five tributaries or branches: Dutch Kills, Whale Creek, Maspeth Creek, English Kills, and East Branch. The tributaries and upstream end of the creek are narrow, bulkheaded and shallow with water quality mostly influenced by the watershed. The downstream reach deepens and broadens into the East River and its water quality is influenced most by New York Harbor conditions. The Creek has been dredged to varying depths of about 15 to16 feet at MLW and widths between 200 and 300 feet. The tributaries and branches of the creek are also relatively deep, between 10 and 17 feet MLW, although shallowing towards their head ends where sediments are often exposed at low tides. The downstream reach of Newtown Creek is significantly wider than English Kills and the other tributaries, averaging about 550 feet, and expanding to approximately 820 feet at its confluence with the East River. While there are DEC designated tidal wetlands in Newtown Creek the shoreline of Newtown Creek is almost entirely bulkheaded or supported by riprap with some sections in disrepair and others entirely collapsed. The Creek and its branches cover 165 acres at mean water. The peak tidal depth-averaged current velocity in the system varies from 0.4 feet per second in English Kills to 1.2 feet per second at the confluence of the Newtown Creek with the East River (LMS, 1993). Non-tidal flow enters Newtown Creek from CSOs, storm sewers and direct drainage. There are no measurable upstream freshwater flows in either Newtown Creek or its branches.

The following sections describe the physical, chemical, and ecological conditions in the Newtown Creek and its tributaries and branches.

4.1. CHARACTERIZATION METHODOLOGY

The DEP's comprehensive watershed-based approach to long-term CSO control planning follows the USEPA's guidance for monitoring and modeling (USEPA, 1999a). The watershed approach represents a holistic approach to understanding and addressing all surface water, ground water, and habitat stressors within a geographically defined area, instead of addressing individual pollutant sources in isolation. The guidance recommends identifying appropriate measures of success based on site-specific conditions to both characterize water quality conditions and measure the success of long-term control plans based on site-specific conditions, and in a manner that illustrates trends and results over time. The measures of success are recommended to be objective, measurable, and quantifiable indicators that illustrate trends and results over time. USEPA's recommended measures of success are administrative (programmatic) measures, end-of-pipe measures receiving waterbody measures, and ecological, human health, and use measures. USEPA further states that collecting data and information on CSOs and CSO impacts provides an important opportunity to establish a solid understanding of the "baseline" conditions and to consider what information and data are necessary to evaluate and demonstrate the results of CSO control. USEPA acknowledges that, since CSO controls must ultimately provide for the attainment of water quality standards, the analysis of CSO control alternatives should be tailored to the applicable standards such as those for DO and coliform bacteria. Since the CSO Control Policy recommends periodic review and revision of water quality standards, as appropriate, investigations should reflect the site-specific, wet-weather impacts of CSOs. DEP has implemented its CSO facility-planning projects consistently with this guidance and has developed these categories of information on waterbodies such as the Newtown Creek.

In accordance with this approach, the waterbody/watershed assessment of the Newtown Creek, its tributaries and branches, and its watershed required a compilation of existing data, identification of data gaps, collection of new data, and cooperation with field investigations being conducted by other agencies. Deficiencies in existing data sets were identified and sampling programs were developed to address those data gaps. Waterbody/watershed characterization activities were conducted following the USA Project's Waterbody Work Plan. These efforts yielded valuable information for characterizing the Newtown Creek, its tributaries and branches, and its watershed, as well as for supporting mathematical modeling and engineering efforts. The following describes these activities.

4.1.1. Compilation of Existing Data

In order to properly characterize the Newtown Creek, its tributaries and branches, and its watershed, a comprehensive approach was conducted to identify past and ongoing data-collection efforts that focused on or included the Newtown Creek and the East River. The effort facilitated a compilation of existing biological, water quality and sediment data, and watershed information wherever availaable. Several sources of water quality and sediment data were available for the Newtown Creek. The DEP has conducted facility planning in the Newtown Creek since at least 1980, with the promulgation of the Newtown Creek WPCP 201 Facilities Plan. Facilities planning has been ongoing since that time, resulting in a large body of pertinent data. At the time of the writing of this report, the DEP was conducting several ongoing programs yielding watershed and waterbody data.

The DEP studies from which existing data is available are summarized below, and associated monitoring and sampling locations are presented on Figures 4-1 through 4-11. A discussion on receiving water modeling follows at the end of this subsection.

Harbor Survey ProgramDEP's Harbor Survey Program has been monitoring water quality in New York Harbor since 1909. The Harbor Survey has been monitoring water quality near the mouth of Newtown Creek since 1968, and in the Creek at Station E2A from 1984 to 1999. Three additional stations were added in the Creek in 2003, one near the mouth of Whale Creek (NC3), one halfway between the Kosciuszko and JJ Bryne Memorial bridges (NC2), and one near the mouth of Maspeth Creek (NC1). An additional station (NC0) was added in English Kills in July of 2004. Sampling occurs at Harbor Survey stations on a monthly basis during winter months and weekly during summer months. Harbor Survey monitoring locations are shown on Figure 4-1.

2004 Inner Harbor CSO Facility Planning Project

The receiving waters of the Inner Harbor were sampled to provide background information on existing water quality conditions and data for development of a mathematical water quality model for use in Inner Harbor CSO facility planning. Samples were taken from 10 stations in the Inner Harbor and from five stations in Gowanus Canal using mainly existing stations from the Harbor Survey Program, and included water quality field investigations at station E2 near the mouth of Newtown Creek from May through September 1989. Dry and wet weather surveys and special studies characterized water quality and sediment conditions and identified sources of impairments at this station. Station E2 is shown on Figure 4-1 near the mouth of Newtown Creek.

2003 Newtown Creek Water Quality Facility Planning Project

For the Newtown Creek Water Quality Facility Planning (2003 CSO Facility Plan) Project hydrodynamic surveys of the Newtown Creek system were conducted during two weeks in 1990. In addition, other surveys and special studies were performed between July 1990 and October 1991. The other surveys included dry and wet-weather intensive and diurinal water quality surveys, and weekly water quality surveys. The special studies included analysis of nitrifiers, sediment oxygen demand (SOD) surveys, a solids-settling study, a coliform die-off study, a shoreline survey, an odor study, and a priority pollutants survey (LMS, 1993).

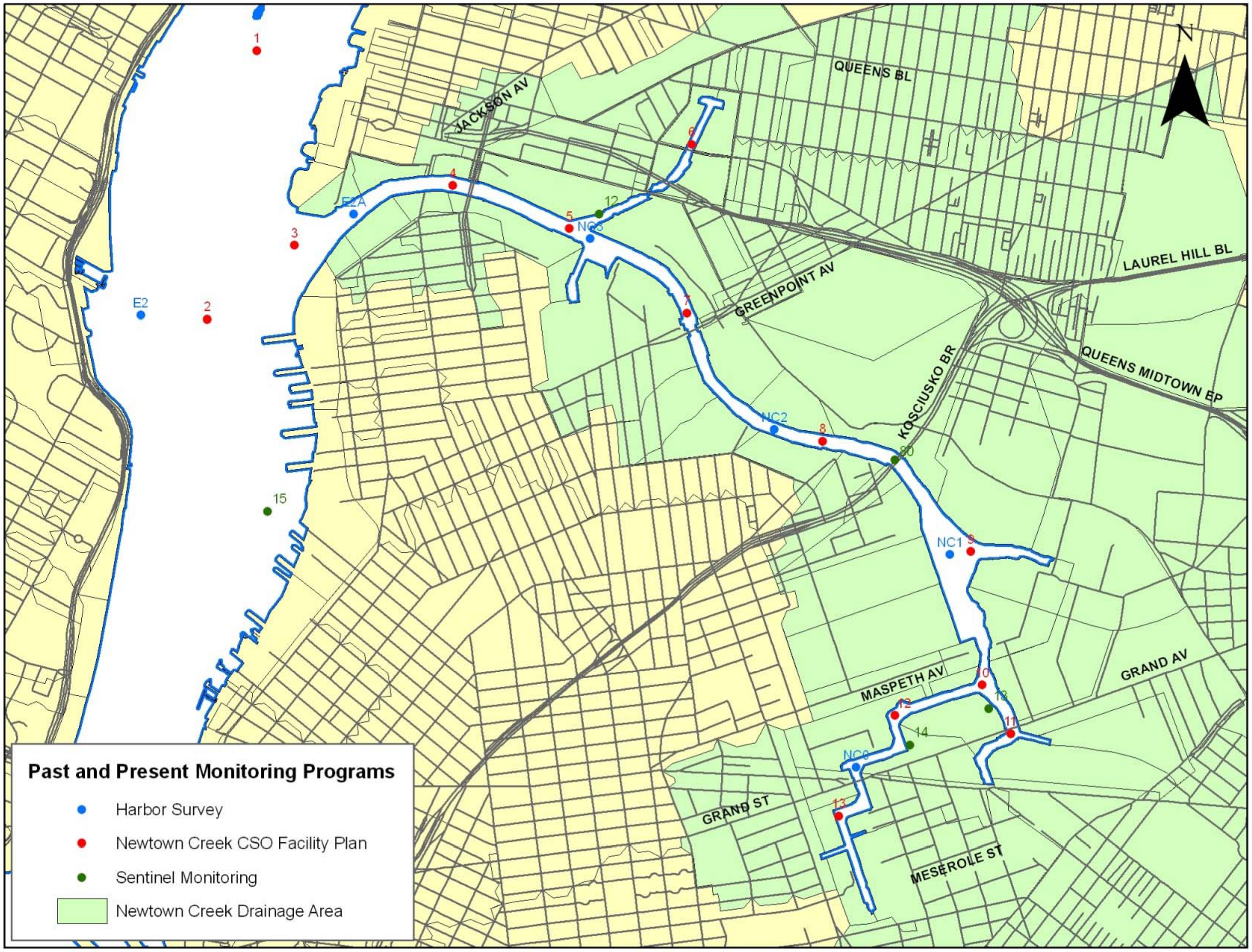
Hydrodynamic measurements for Newtown Creek and its tributaries and branches were taken during from September 17th to the 21st, and from October 13th to 26th, 1990. Velocity stations were deployed near Hunters Point (1), Greenpoint Avenue midway along Newtown Creek (2), and near the confluence of East Branch and English Kills (3). A bathymetric survey was performed to provide data for developing model geometry, and two dye surveys were also executed. Dye and hydrodynamic survey locations are shown on Figure 4-2.

Water quality surveys included two wet-weather and one dry-weather intensive surveys, three diurinal surveys, and 16 weekly water quality surveys from 13 stations, three in the East River, and 10 in Newtown Creek to characterize water quality and sediment conditions and identify sources of impairments. The intensive survey sampling was conducted at five of these stations (nos. 3, 5, 8, 10 and 13). The wet weather surveys covered periods resulting in significant CSO discharge to provide data on receiving water response to CSO loadings. Sampling locations are shown on Figure 4-1.

The data collected as part of the 2003 CSO Facility Planning effort has been used to calibrate the water quality model supporting this WB/WS Facility Plan. Additional information on the modeling completed in support of this plan is presented later in this section and detailed information can be found in the "City-Wide Long-Term CSO Planning, Receiving Water Quality Modeling Report, Volume 11 – Newtown Creek".

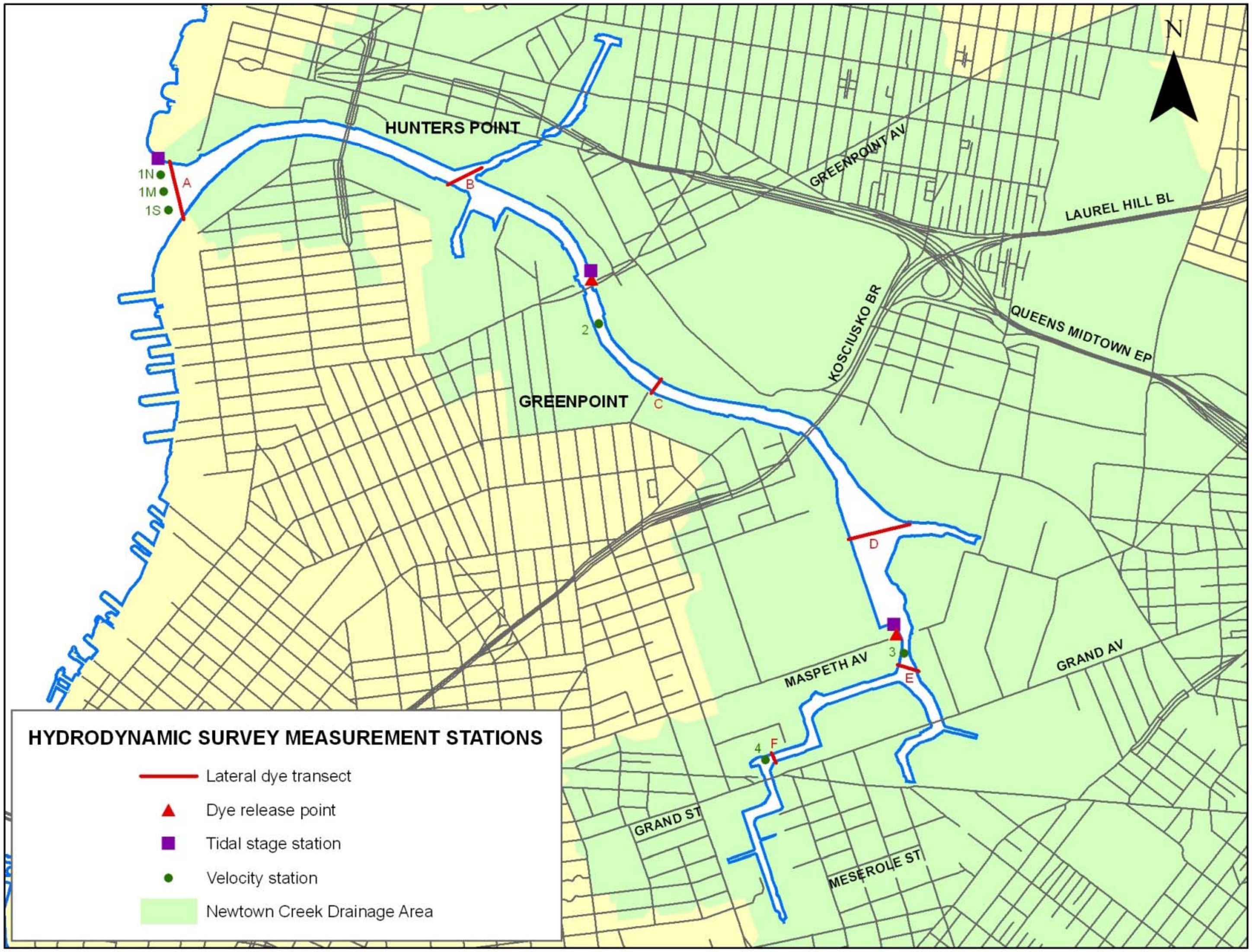
East River Water Quality Planning

To address issues affecting all East River WPCPs, the DEP undertook an East River water quality facilities planning effort concurrent with the Newtown Creek WPCP Track 3 facility planning (HydroQual, 1999). As part of this effort, water quality monitoring was conducted over a 12 month period from October 1994 through September 1995 at over 100 stations in New York Harbor, Long Island Sound, and the New York Bight and was augmented with ongoing monitoring by the DEP Harbor Survey and the Connecticut Department of Environmental Protection. In total, the monitoring included data from 181 stations, including stations E2A and E2 of the Harbor Survey Program, which are in the mouth of Newtown Creek and in the East River just outside the mouth of Newtown Creek, respectively. The locations of Harbor Survey stations E2A and E2 are shown on Figure 4-1.



Newtown Creek Past and Present Monitoring Programs

Environmental Protection



Newtown Creek Hydrodynamic (Dye and Velocity) Survey Locations

Air Curtain Pilot Study

An air curtain pilot study was conducted in English Kills, which is tributary to Newtown Creek, between November and December 1993 under the DEP's City-Wide Floatables Study. Water quality sampling was conducted in English Kills over the period from November 9 through 12, 1993, and measurements included salinity, temperature, DO, suspended solids, and priority pollutants. The first day of sampling was conducted to obtain baseline data and sampling over the following three days was conducted with the air system active to ascertain the affects on DO content of the receiving water and to determine the impacts of the system on resuspension of sediment pollutants. Further sampling occurred at additional stations in Newtown Creek and East Branch on November 12, 1993. A follow-up survey was conducted on November 17, 1993 to assess water quality conditions in English Kills and Newtown Creek after the operation of the system was ended. The locations of the sampling stations in Newtown Creek and English Kills are shown on Figure 4-3.

In-Stream Aeration Pilot Study

An in-stream aeration pilot study was conducted by the DEP in 1996 to evaluate the water quality effects of a diffused aeration system being considered as part of Newtown Creek CSO Facility Planning (LMS, 1997). The pilot study included continuous monitoring, intensive surveys, and routine surveys. Three continuous monitoring stations were deployed in English Kills from April 2nd or 3rd through September 12, 1996 to obtain data inside and outside of the diffuser arrays. Intensive monitoring was conducted four times (April 18, June 6, August 19, and September 5, 1996) utilizing a Data Acquisition System (DAS) located on board a boat to obtain vertical profiles and longitudinal and lateral transects for temperature, conductivity, DO, and turbidity from English Kills and Newtown Creek proper. Grab samples were also collected from CSO Facility Planning stations 8, 10, 12, and 13 and analyzed for hydrogen sulfide, BOD_5 (total and filtered), TSS, total volatile suspended solids (TVSS), total organic carbon (TOC), and dissolved organic carbon (DOC). Routine surveys by boat utilizing the DAS were later added to obtain an alternative data set for DO, temperature, conductivity, and pH. The routine survey locations were concentrated in upper English Kills, and stations were changed when pilot diffuser configurations were modified.

Routine sampling was conducted from June 13, to September 6, 1996, once per week during weeks where intensive monitoring was completed, and twice per week otherwise. CSO Facility Planning stations are shown on Figure 4-1 and continuous and intensive monitoring sites are shown on Figure 4-4.

Sentinel Monitoring Program

The DEP's Sentinel Monitoring Program is a targeted program to sample localized areas of high pathogen levels. As part of this program, water quality data was collected quarterly at four stations in the Newtown Creek from 1999 to 2003 for Fecal Coliform analysis. Sentinel Monitoring Program sampling stations are shown on Figure 4-1.

4.1.2. Biological and Habitat Assessments

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 on the waterbody. The compilation of existing data indicated that recent and ongoing projects and programs have collected a variety of data in and around Newtown Creek and its watershed. The data can be used for waterbody/watershed characterizations, evaluating existing conditions, and identifying use attainability for aquatic life, recreation and aesthetics. Information has been collected in specialized projects to describe sewer system characteristics and performance.

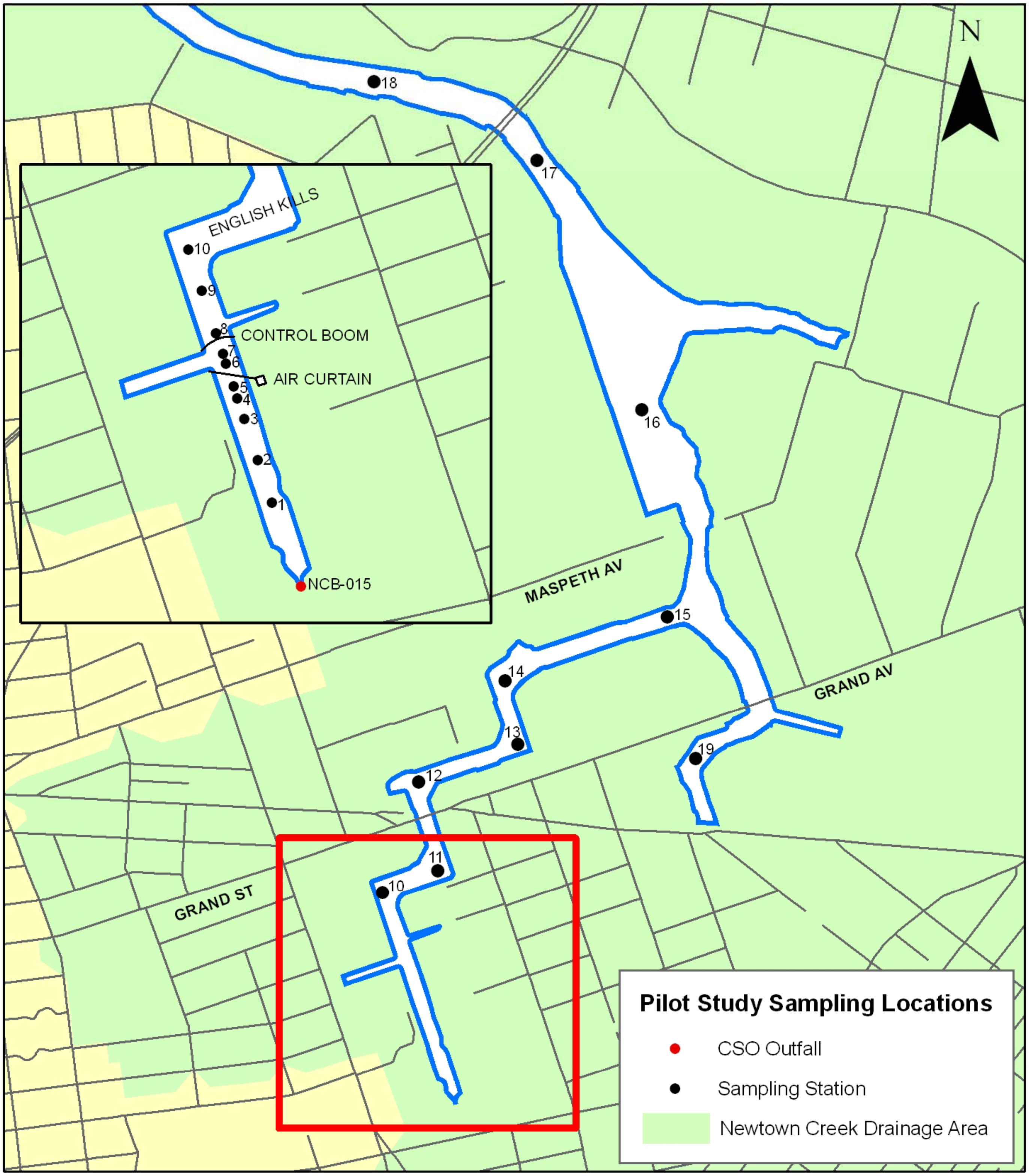
As indicated in the preceding section, a substantial database existed prior to the waterbody/watershed assessment. However, review of the existing database identified several key gaps, including: biotic characterizations; physical, chemical, and biological sediment characterizations; and toxicity characterizations in the water column and sediment, which are addressed in this section, and watershed information relating to runoff characteristics, dry-weather flow conditions, regulator configurations, and outfall status; as well as waterbody bathymetry, which are addressed in the following section.

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" field sampling and analysis of all ecosystem components. These components include phytoplankton, macrophytes, zooplankton, benthic invertebrates, fish and wildlife. The relevant factors are DO, habitat (substrate composition, organic carbon deposition, sediment pore water chemistry), and toxicity.

Biological components and factors were prioritized to determine what was most in 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:

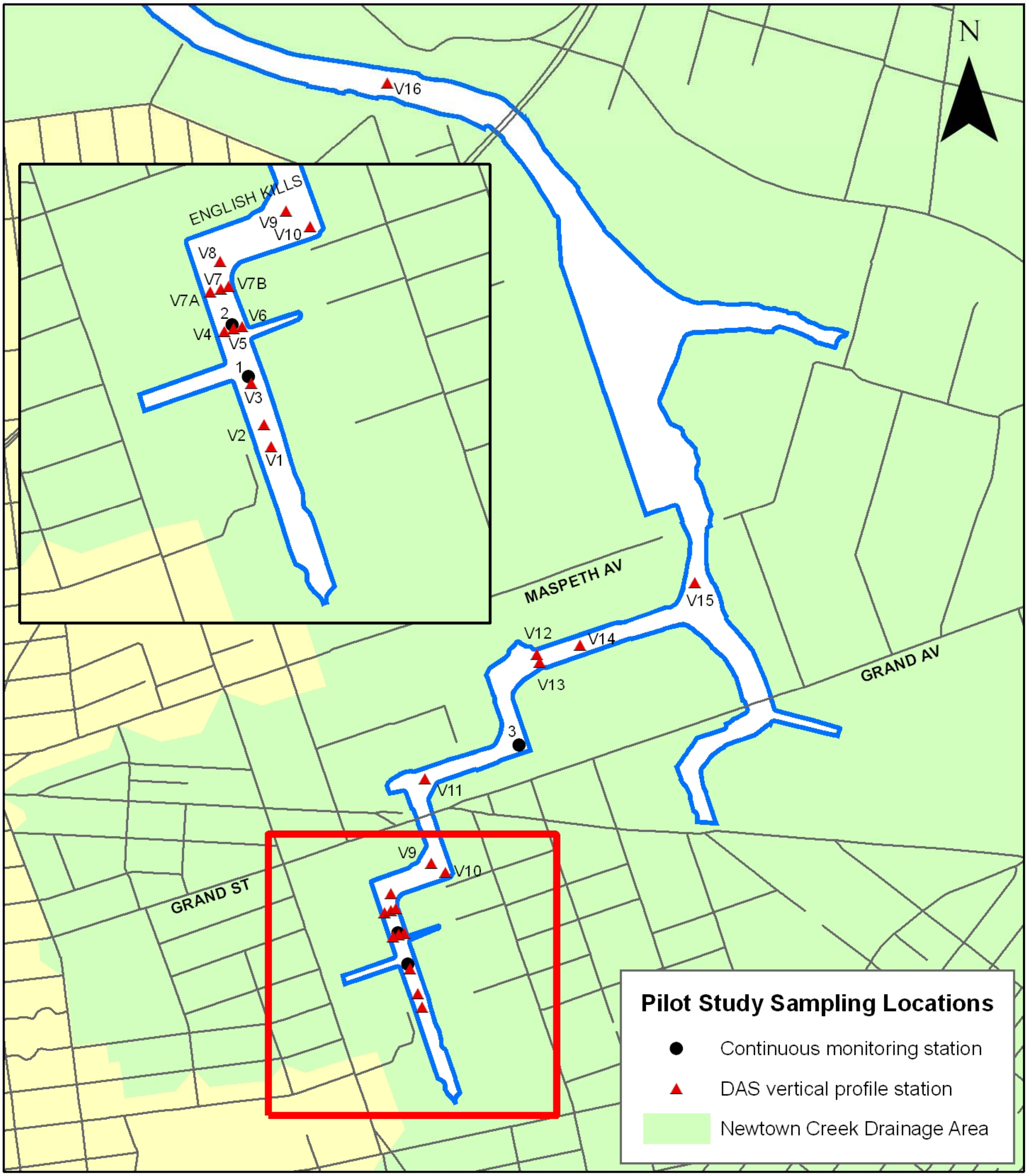
- Subtidal benthic invertebrates, historically used as an indication of environmental quality because most are sessile (i.e. permanently attached and therefore not mobile);
- Epibenthic organisms colonizing standardized substrate arrays suspended in the water column, thus eliminating substrate type as a variable in assessing water quality;
- Fish eggs and larvae, whose presence is related to fish procreation; and
- Juvenile and adult fish, whose presence is related to habitat preferences and water quality tolerances).

A major effort was launched by the DEP in August 1999 under the auspices of the USA Project. The USA Project was part of the DEP's continuing efforts to maintain and improve water quality in New York Harbor and its environs and was designed to initiate a comprehensive watershed-based approach to consider all of the causes of non-attainment of water quality standards and opportunities and requirements for maximizing beneficial uses.



Environmental Protection

Newtown Creek Air Curtain Pilot Study
Water Quality Sampling Locations



NYC Environmental Protection

Newtown Creek In-Stream Aeration Pilot Study
Water Quality Sampling Locations

Under the USA Project, biological components and factors were prioritized to determine what information was most needed 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 field sampling included subtidal benthic invertebrates (which, being largely immobile, 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 DO tolerances).

The waterbody/watershed assessment conducted a biological Field Sampling and Analysis Program (FSAP) designed to fill ecosystem data gaps for Newtown Creek. DEP's FSAPs were designed and implemented in conformance with the USEPA's Quality Assurance Project Plan guidance (USEPA, 1998, 2001a, 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 (DO, substrate, habitat, and toxicity). Some of these FSAPs were related to use limitations (DO, 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 DEP during the USA Project that included investigation of Newtown Creek.DEP 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 4-5. Two stations were located within Newtown Creek and one station was located in the East River just outside the mouth of the Creek. Samples were collected using a fine-mesh plankton net with two replicate tows taken at 50 stations in March, May and July 2001, including all three stations in and around the Newtown Creek. In August 2001, 21 of the stations, including one in Newtown Creek, were re-sampled to evaluate ichthyoplankton during generally the worst case temperature and DO conditions.

DEP conducted an East River Waterbody Biology FSAP in 2001 to help evaluate the use and standards attainment in the East River and its tributaries, including Newtown Creek, by (1) identifying and characterizing the benthic invertebrate communities and bottom sediment composition through benthos sampling, and by (2) inventorying the presence or abundance of fish in the target waterbodies through otter trawling and gill netting (HydroQual, 2001e). Information developed under objective (1) of this FSAP identified whether infaunal benthic invertebrates are more limited by physical habitat or by DO concentrations in the water column.

The locations of sampling stations used to support the analyses completed under objective (1) are shown on Figure 4-6. Additionally, information developed under objective (2) of this FSAP identified the effect of DO and water quality on the abundance of fish in the East River and its tributaries. The locations of sampling station used to support the analyses completed under objective (2) are also shown on Figure 4-6.

The DEP 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 of epibenthic communities on hard substrates was 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 4-7. Two stations were located within Newtown Creek and one station was located in the East River just outside the mouth of the Creek. The findings of earlier waterbody-specific FSAPs in Paerdegat Basin and the Bronx River 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 under the Tributary Benthos Characterization FSAP to evaluate benthic substrate characteristics in New York Harbor tributaries, including Newtown Creek. The goals of the FSAP were to assist in the assessment of physical habitat components and their impacts on overall habitat suitability and water quality, and to assist in the calibration of the water quality models as they compute bottom sediment concentrations of TOC (HydroQual, 2002c). TOC is an indicator of high ammonium (NH_4) and hydrogen sulfide (H_2S) concentrations, and as such is a surrogate for overall substrate quality. 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, directly affect the survival and propagation of fish. Samples were collected from 103 stations in New York Harbor tributaries using a Petite Ponar® grab sampler in July 2002. The locations of sampling stations are shown on Figure 4-8. Ten of the stations were located in the Newtown Creek, its tributaries, and branches. Two samples from each station were tested for TOC, grain size, and percent solids.

A Subtidal Benthos and Ichthyoplankton Characterization FSAP was executed by the DEP during the summer of 2003 (HydroQual, 2003a). There were several main objectives of the FSAP that included: (1) reinforcing relationships between fish propagation and habitat; (2) assessing aquatic life improvements in Gowanus Canal since the DEP's reactivation of the Gowanus Canal Flushing Tunnel; and (3) characterizing benthic invertebrate fauna in Newtown Creek, Coney Island Creek, and Sheepshead Bay. Earlier FSAPs conducted benthic and ichthyoplankton sampling in Newtown Creek, however only one station (NEWTB01, Figure 4-6), was sampled for benthos under a 2001 FSAP (HydroQual, 2001e), and sediment sampling results from the 2002 FSAP (HydroQual 2002c), reveal considerable variations in TOC and grain size within Newtown Creek, and in some cases between replicates at the same station. This, the total length and configuration of the creek, and its more than 20 CSOs, prompted obtaining additional data to describe and evaluate differences in benthic life in Newtown Creek. Therefore Ichthyoplankton sampling and characterization was conducted at one station in Newtown Creek during dry and wet weather conditions to reinforce relationships between fish propagation and physical and water quality habitat, and benthos sampling was conducted using a Petite Ponar® grab sampler at several other stations in the Newtown Creek. Benthic samples from each station were tested for TOC, grain size, and percent solids, while additional samples were collected for characterizing benthic invertebrate communities, with the purpose of comparing benthic taxa and numbers of organisms in different reaches of Newtown Creek with those of other waterbodies, and relative to within-creek distribution of sediment characteristics and CSOs. The locations of sampling stations are shown on Figure 4-9. Six stations were located in the Newtown Creek, its tributaries, and branches. All field investigations were conducted during June and July of 2003.

DEP conducted a Tributary Toxicity Characterization FSAP in 2003 to determine whether toxicity is a significant issue of concern for DEP's waterbody evaluations (HydroQual, 2003b). Water column and sediment samples were collected from a total of twenty locations in Newtown Creek, Gowanus Canal, Flushing Bay and Creek, the Bronx River, and Westchester Creek. Four stations were located in the Newtown Creek, its tributaries and branches (Figure 4-10). Water column toxicity was tested using 7-day survival and growth toxicity tests with Sheepshead minnow and 7-day survival, growth and consistency toxicity tests with mysid shrimp. Sediment chronic toxicity was evaluated using 28-day whole sediment chronic toxicity tests with the amphipod Leptocheirus plumulosus. Survival, growth and fecundity of the species were evaluated. In addition to the toxicity tests, sediment samples were collected using an Ekomar dredge sampler and tested for TOC, percent solids, and grain size to help determine the benthic substrate characteristics of the subtidal sediments related to sediment toxicity (if any). Sampling was conducted in August 2003.

As described above, numerous physical, chemical, and biological FSAPs were executed by DEP to fill several key data groups. The FSAPs were executed according to procedures defined in a Field and Laboratory Standard Operating Procedure (SOP) that was revised and enhanced as new investigations were identified and additional procedures were required. The SOP follows USEPA's Quality Assurance Project Plan (QAPP) guidelines to assure quality assurance and quality control (QA/QC). Data collected during these FSAPs were compiled in a relational database with QA/QC. Figure 4-11 provides a composite map of the biological FSAP sampling station locations in the Newtown Creek, its tributaries, and branches.

4.1.3. Other Data Gathering Programs

The DEP also conducted other field investigations in addition to the FSAPs discussed in the preceding section as part of the Newtown Creek waterbody/watershed assessment and other ongoing DEP projects to fill gaps in watershed characteristics. Runoff characteristics (such as percent imperviousness or runoff coefficients) and dry weather flow conditions were investigated by monitoring sewer system flows. In 2003, the DEP conducted monitoring at several locations in the Newtown Creek and Bowery Bay service areas, including areas tributary to the Newtown Creek. Also in 2003, field inspections were conducted of regulators, tide gates, outfalls, and other system components in the Newtown Creek and Bowery Bay service areas tributary to Newtown Creek. The locations of the monitoring investigations are shown on Figure 4-12.

NYC Environmental Protection

Harbor-Wide Ichthyoplankton Sampling Stations (2001)

Environmental Protection

East River FSAP
Sampling Stations (2001)

Environmental Protection

Harbor-Wide Epibenthic Recruitment and Survival Sampling Stations (2001)

Environmental Protection

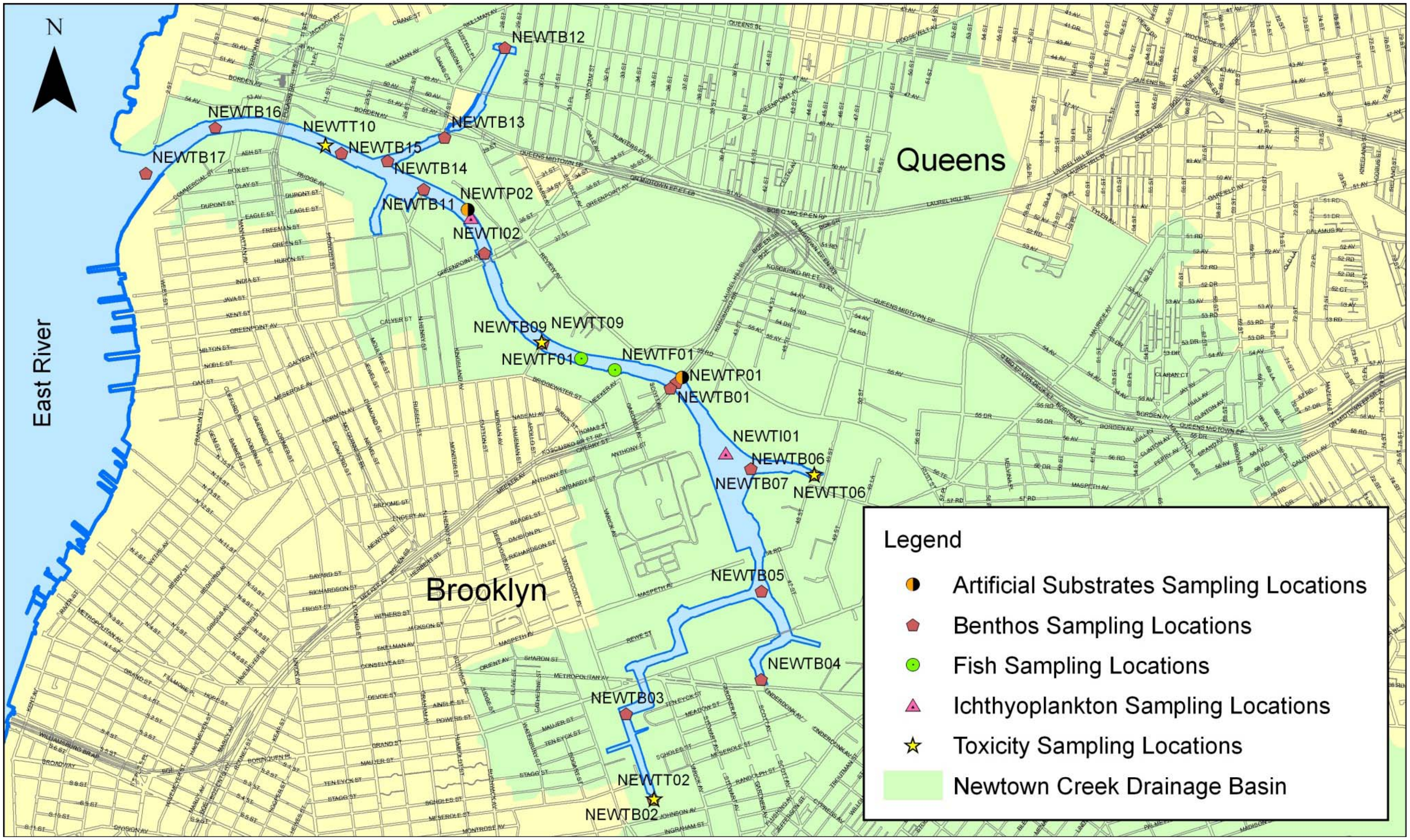
Tributary Benthos Characterization Sampling Stations (2002)

NYC Environmental Protection

Subtidal Benthos and Ichthyoplankton Characterization Sampling Stations (2003)

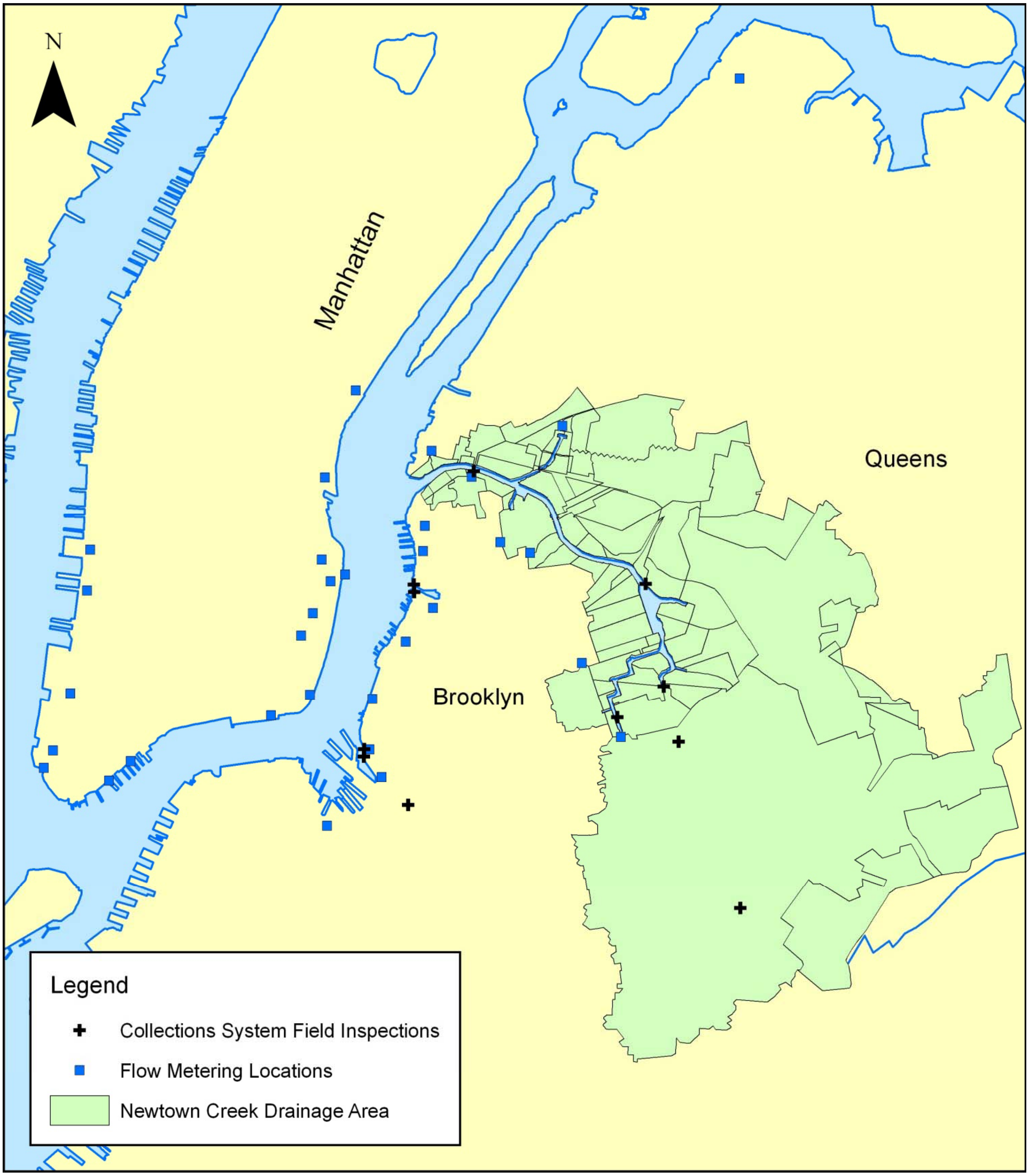
Environmental
Protection

Tributary Toxicity Characterization Sampling Stations (2003)



NYC Environmental Protection

Newtown Creek Biological FSAP Sampling Locations



Newtown Creek and Bowery Bay Collection Systems
Flow Monitoring & Field Sampling Locations

Following long-term control plan guidance, the DEP's waterbody/watershed assessments required characterizations of combined sewer and stormwater discharges to calculate pollutant loads and assess impacts on receiving waters during wet weather events. Sanitary sewage is a component of combined sewage, but very little recent coliform bacteria data were available to characterize New York City's sanitary sewage. Moreover, the federal Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000 requires adoption of state water quality standards for enterococci in coastal recreational waters, but very little local data is available for enterococci. Therefore, a sampling program was conducted during the summer of 2002 to collect total and fecal coliform bacteria and enterococci data that would be reasonably representative of New York City's sanitary sewage. Influent sampling of all 14 DEP WPCPs, including Bowery Bay and Newtown Creek, was conducted. Each WPCP was sampled on at least five distinct days, with samples collected several times during the day and on a random basis such that no WPCP was sampled on two successive days or on the same day of the week. At least one day of dry weather (preferably two or more) was required prior to the sampling event to assure that sample collection represented sanitary sewage only.

A hydrographic survey was completed in 1999 as part of the Dredging Feasibility Study performed under the Newtown Creek CSO Facility Planning Project (URS, 2000b). The survey was conducted in areas affected by larger CSOs in an attempt to determine the location and extent of sediment deposits, and covered English Kills, Dutch Kills, Maspeth Creek, and East Branch. However, because tidal effects and other activities in the study area likely affected bathymetry after 1999, a new bathymetric survey was commissioned as part of this waterbody/watershed assessment and was conducted in December 2005 to characterize contours throughout the tributaries and the head end of the creek. During that survey, parts of the tributaries were inaccessible due to the frozen conditions and the survey was suspended and later completed in the beginning of June 2006. Figure 4-13 shows the bottom contours within the 2005/2006 surveyed areas.

4.1.4. Receiving Water Modeling

Receiving water models are used to simulate both the movement of the water (hydrodynamics) and biological/chemical processes (water quality) within a waterbody. Receiving water models are particularly useful for characterizing a waterbody's response to hypothetical scenarios, such as design environmental conditions and engineering alternatives, and evaluating the resulting compliance with water quality standards and criteria. Major inputs to the receiving water models include landside discharges, exchange at the open boundaries of the waterbody, and other physical and kinetic forcing functions. This section generally describes the tools employed for receiving water modeling of the Newtown Creek waterbody/watershed assessment area. A detailed description of these receiving water models and their calibration is provided in the "City-Wide Long-Term CSO Planning, Receiving Water Quality Modeling Report, Volume 11 – Newtown Creek".

The DEP constructed a receiving water model during its Newtown Creek Water Quality (CSO) Facility Planning Project to simulate hydrodynamics and water quality in the Newtown Creek, its tributaries and branches. Figure 4-14 depicts the segmentation of the receiving water model. The model is three dimensional, as each grid shown in the figure has 5 layers in the vertical to effectively simulate depth-variable DO mechanisms such as reaeration and sediment oxygen demand. The model kinetics are time-variable, with output generally supplied on an hourly basis.

The hydrodynamic component of the Newtown Creek receiving water model simulates the temperature and salinity as well as the physical movement of the waters in the Newtown Creek and tributaries. Given forcing functions at the model boundaries as well as inputs such as landside discharges, the hydrodynamic model determines the volume and velocity of water at any time and at any location within the model domain. These results are then passed to the water quality model, which uses the hydrodynamic model calculations of transport and dispersion to perform kinetic calculations simulating temperature, salinity, total suspended solids, biochemical oxygen demand, DO, and coliform bacteria. The water quality model also includes a time-varying sediment component that computes the interaction between the water column and sediments.

As noted above, landside discharges to the Newtown Creek represent one type of forcing function or input to the receiving water model. These landside discharges are provided by the watershed/collection system model described in Section 3.4. Another type of forcing function is the boundary conditions at the Newtown Creek receiving water model boundary (i.e. the East River). These boundary conditions impact both the hydrodynamics and the water quality within Newtown Creek. To properly simulate the appropriate boundary conditions, another receiving water model was used. This model, DEP's System-Wide Eutrophication Model (SWEM), is a three-dimensional, time variable, coupled hydrodynamic/eutrophication water quality model of the New York/New Jersey Harbor and New York Bight system. SWEM, which was developed to evaluate water quality impacts associated with upgrading WPCPs and improving nutrient removal capabilities, was calibrated using results of a comprehensive field monitoring program convened by the New York/New Jersey Harbor Estuary Program and the Long Island Sound Study Nutrient workgroup. Figure 4-15 illustrates how the watershed and SWEM models provide the appropriate forcing functions for the Newtown Creek receiving water model. A more detailed description of the model is provided in the DEP's Newtown Creek Water Pollution Control Project, East River Water Quality Plan (HydroQual, 2001f, 2001g, 2001h).

The data available for Newtown Creek for model calibration are derived from one primary source. This data source is the sampling program conducted for the Newtown Creek CSO Facility Planning Project conducted during July 1990 through October 1991 (LMS, 1993).

The Newtown Creek CSO Facility Planning Project data set is the most extensive data set collected in the creek. The data are fully described in LMS (1993), but a brief description is provided here. For the Newtown Creek Water Quality Facility Planning Project (2003 CSO Facility Plan) hydrodynamic surveys of the Newtown Creek system were conducted during two weeks in 1990. Data collected for the hydrodynamic modeling included bathymetry, tide stage, and vertical current profiles. Discharge flow was monitored in thirteen locations during 1990 sampling period to provide information with which to calibrate a landside runoff model.

Water quality surveys included two wet-weather and one dry-weather intensive surveys, three diurnal surveys, and sixteen weekly water quality surveys from thirteen stations, three in the East River, and ten in Newtown Creek to characterize water quality and sediment conditions and identify sources of impairments. Each sampling run included temperature, conductivity, salinity, and pH. Primary analyses included DO, and total coliform. Secondary analyses included fecal coliform, TSS, and BOD_5. Tertiary sampling included filtered BOD_5, thirty-day BOD, volatile suspended solids, enterococci, chlorophyll-a, sulfides, oil and grease, ammonia, total Kjeldahl nitrogen, nitrate-nitrite, and total phosphorus. The intensive survey sampling was conducted at five of these stations (nos. 3, 5, 8, 10 and 13). The wet weather surveys covered periods resulting in significant CSO discharge to provide data on receiving water response to CSO loadings. The wet and dry weather intensive surveys were used for model calibration and validation.

Additional detail on the Newtown Creek receiving water model, its calibration and validation is presented in the "City-Wide Long-Term CSO Planning, Receiving Water Quality Modeling Report, Volume 11 – Newtown Creek".

Subsequent sections of this report describe how the Newtown Creek receiving water models were used to characterize certain scenarios and evaluate expected compliance with water quality standards and criteria.

4.2. PHYSICAL WATERBODY CHARACTERISTICS

This section describes the physical characteristics of Newtown Creek. Section 4.21 presents the overall dimensions, depths, branches and classification of Newtown Creek. Section 4.2.2 briefly describes the hydrodynamic features that affect Newtown Creek. Section 4.2.3 discusses the character of the Creek's benthos and substrate. Section 4.2.4 summarizes the shoreline characteristics throughout the Creek. Section 4.2.5 describes waterbody access to the Creek.

4.2.1. General

The Newtown Creek waterbody assessment area is herein considered to extend from its confluence with the lower East River at the westernmost neighborhoods of Greenpoint and Hunters Point to its upstream end in the neighborhood of Maspeth (see Figure 4-14). The entire waterbody is classified as a saline tributary to the Lower East River according to Title 6 of the NYCRR, Chapter X, Part 890. Though this classification implies that the Creek is a tributary, the only significant inflows to the waterbody are wet-weather discharges from CSO and stormwater.

Newtown Creek consists of a main stem and its branches, Dutch Kills, Whale Creek Canal, Maspeth Creek and English Kills. The main stem is approximately 15,700 feet long from its confluence with the East River to the end of the southern arm of the East Branch; Whale Creek Canal is approximately 750 feet long; Dutch Kills is approximately 2,450 feet long; Maspeth Creek is approximately 1,300 feet long; and English Kills is approximately 4,600 feet long.

Numerous bridges cross Newtown Creek and its tributaries (see Figure 4-16). The main branch of Newtown Creek has one fixed bridge, the Koscuiszko Bridge, which is elevated high above the Creek and does not restrict shipping traffic, and three moveable bridges, the Pulaski bascule bridge, the Greenpoint Avenue bascule bridge (J. J. Bryne Memorial Bridge), and the Grand Street swing span bridge. The Pulaski and J. J. Bryne open regularly for shipping traffic. Dutch Kills is crossed by four moveable bridges, the Long Island Rail Road (LIRR) "DK" swing bridge, the LIRR "Cabin M" draw bridge, the Borden Avenue retractile bridge, and the Hunters

Point Avenue bascule bridge, and one fixed bridge carrying the Long Island Expressway. There were also two moveable bridges over English Kills, a bascule bridge at Metropolitan Avenue, and the LIRR Bushwick Branch draw bridge at Montrose Avenue. However, a fixed steel bridge has replaced the old wooden draw bridge at Montrose Avenue.

Newtown Creek averages about 200 – 250 feet wide and ranges in depth from 21 to 25 feet at MLW. Whale Creek is about 200 feet wide and ranges in depth from 18 to 21 feet at MLW. Dutch Kills Creek is about 200 feet wide and ranges in depth from 6 to 15 feet at MLW. The remaining branches of Newtown Creek vary in width from 125 to 250 feet and depths are 18-feet or less at MLW decreasing to about 6 feet at their upstream ends. Figure 4-13 illustrates Newtown Creek bathymetry.

4.2.2. Hydrodynamics

Newtown Creek is a tidal waterbody opening to the Lower East River and as such experiences a semi-diurnal tidal cycle with a vertical tidal range that varies from 2.0 to 6.2 feet with a mean of 3.9 feet based on National Oceanic and Atmospheric Administration (NOAA) tidal predictions at Hunters Point for 2006. As a narrow, dead-end tributary with no freshwater inflow other than intermittent, wet-weather discharges, the Canal has low current speeds and a limited exchange with the Lower East River.

The peak depth-averaged current velocity in Newtown Creek varies from 0.4 ft/sec in English Kills to 1.2 ft/sec at the confluence with the Lower East River. Newtown Creek's limited capacity for exchange and dispersal has led to significant water-quality degradation and low DO during summertime periods and wet-weather events.

4.2.3. Sediments

Newtown Creek's limited capacity for exchange produces a stilling effect that allows suspended solids materials to settle to the bottom of the waterbody.

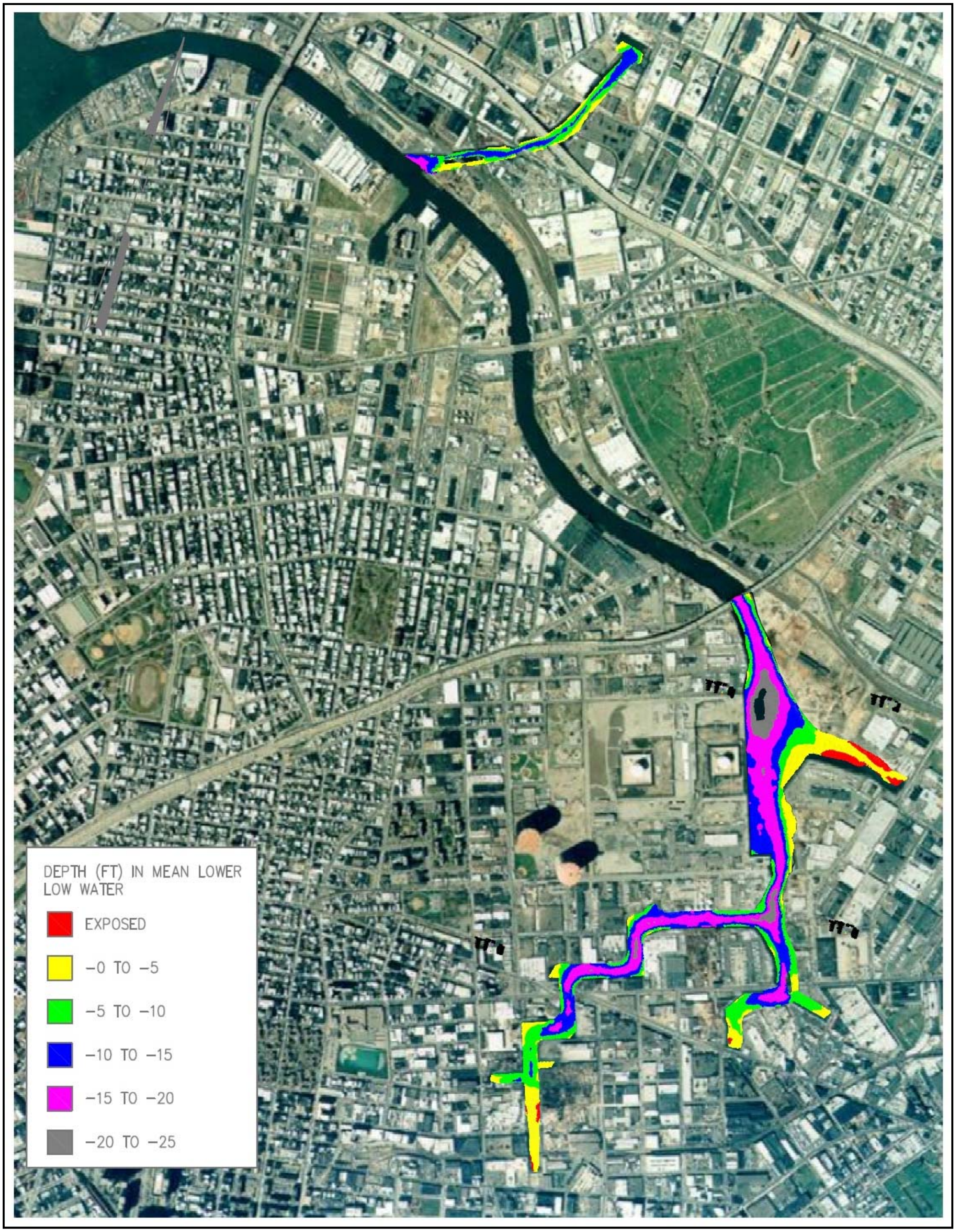
Both CSO and stormwater discharge directly into the Creek and its branches. Heavier solids and organic material discharged during wet-weather from these sources have created sediments throughout Newtown Creek; particularly at the upstream branches in Maspeth Creek, East Branch and English Kills. Sediment mounds have been created at the CSO discharge points and will continue to grow in size due to inadequate flushing of the Creek.

Portions of the mounds become exposed during low tide and allowing noxious odors to be released from the anaerobic decay of the highly organic material. Beyond the sediment mounds sediments continually build up due to CSO and stormwater discharges into the Creek as well as transport and subsequent settling of solids from the Lower East River. The sediments contain metals, PCBs, dioxins/furans, and PAHs.

Currently, no maintenance dredging is performed in Newtown Creek. The USACE is investigating covering the sediment mounds with dredge spoils to prevent release of hazardous and toxic materials to the overlying waters.

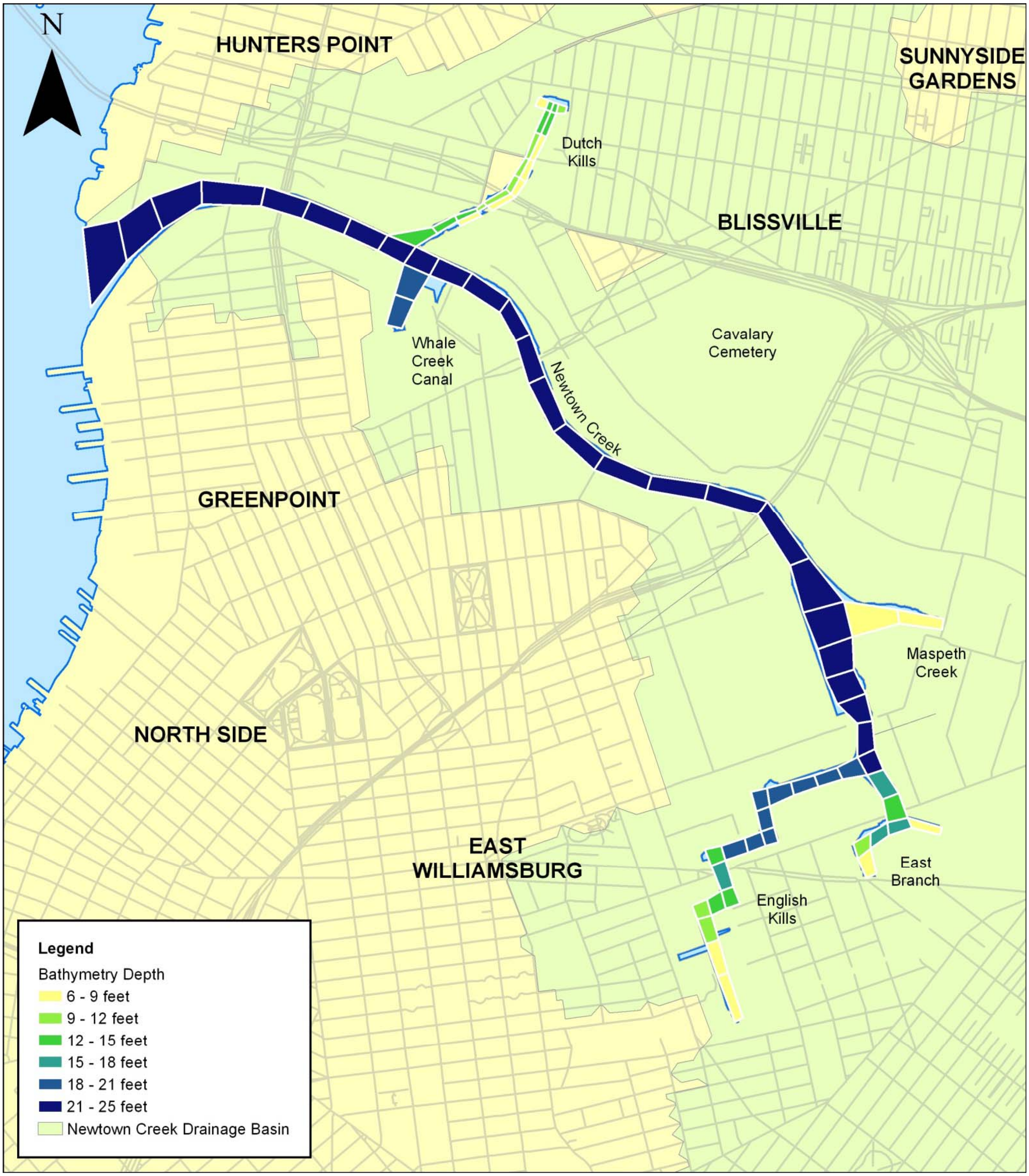
4.2.4. Shoreline

The shorelines of Newtown Creek have been entirely altered, consisting of bulkheads with some rip-rap. The shorelines are generally bulkheaded with wood, steel, cement or stone. Typical shoreline features are shown in Figure 4-17.



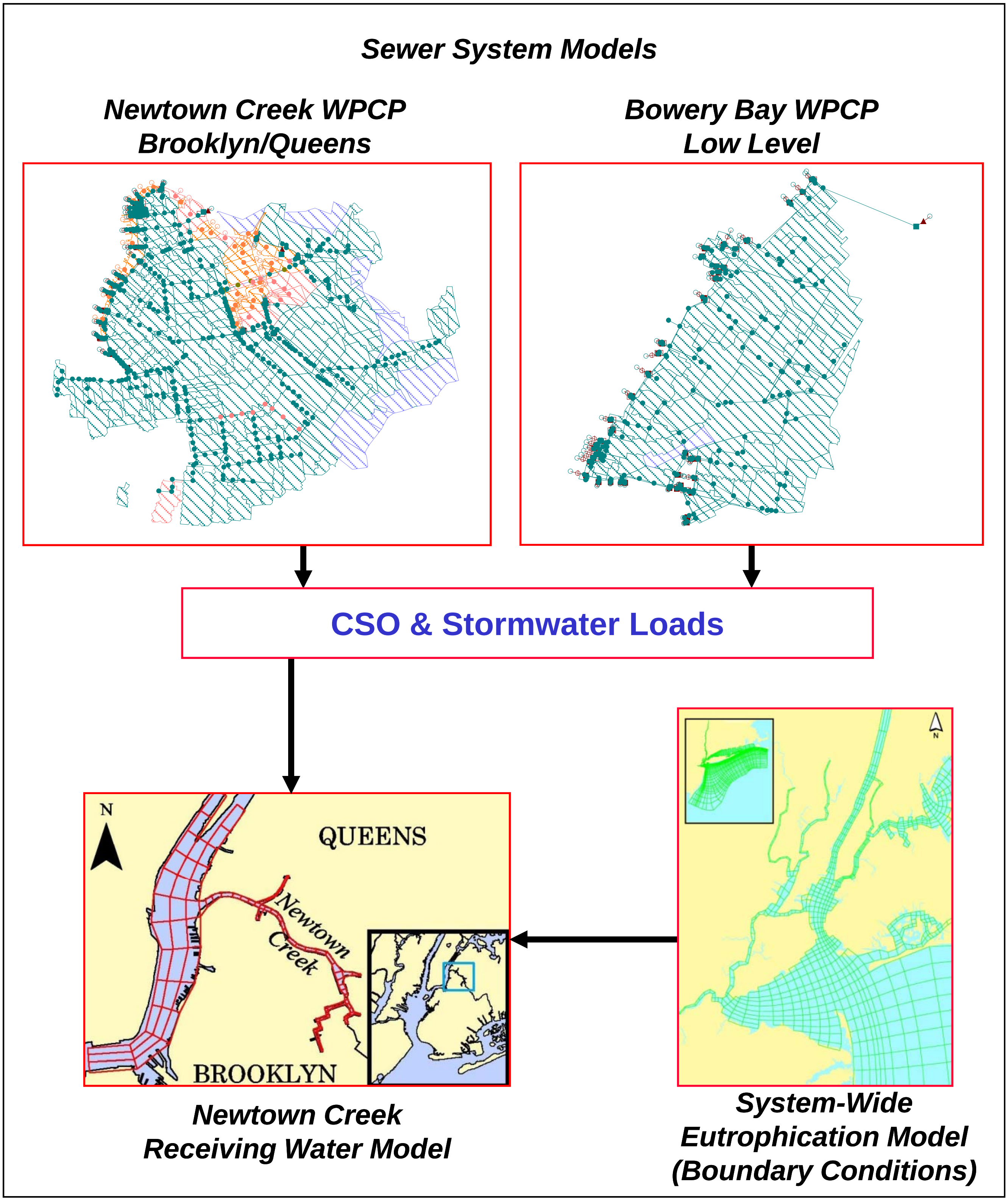
Environmental Protection

2005/2006 Bathymetric Survey
Waterbody Bottom Contours



NYC Environmental Protection

Newtown Creek Receiving Water Quality Model Grid



NYC Environmental Protection

Newtown Creek Mathematical Modeling Framework

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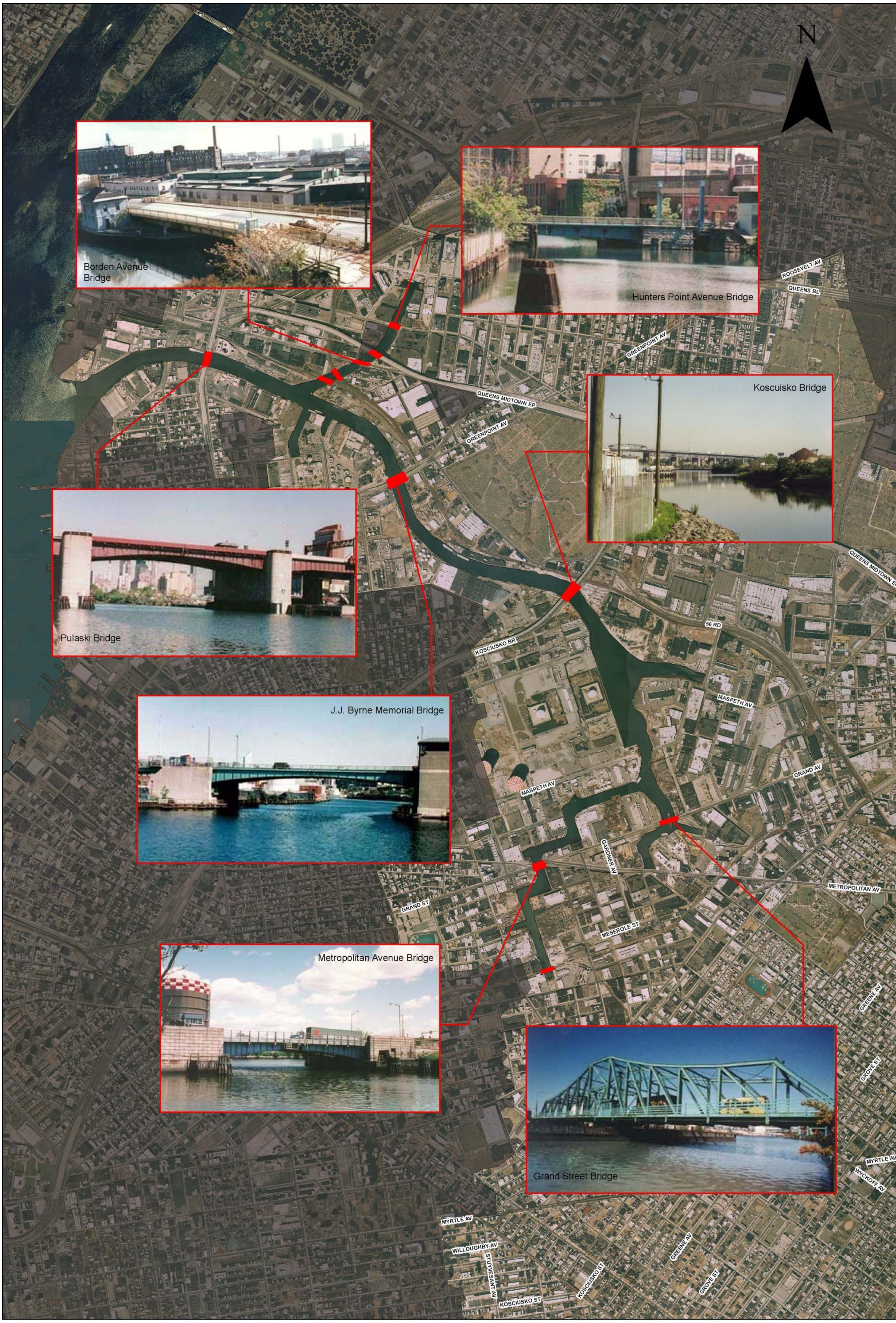

Photo Sources: NYC DOT & HydroQual, Inc.

NYC Environmental Protection

Newtown Creek Bridges

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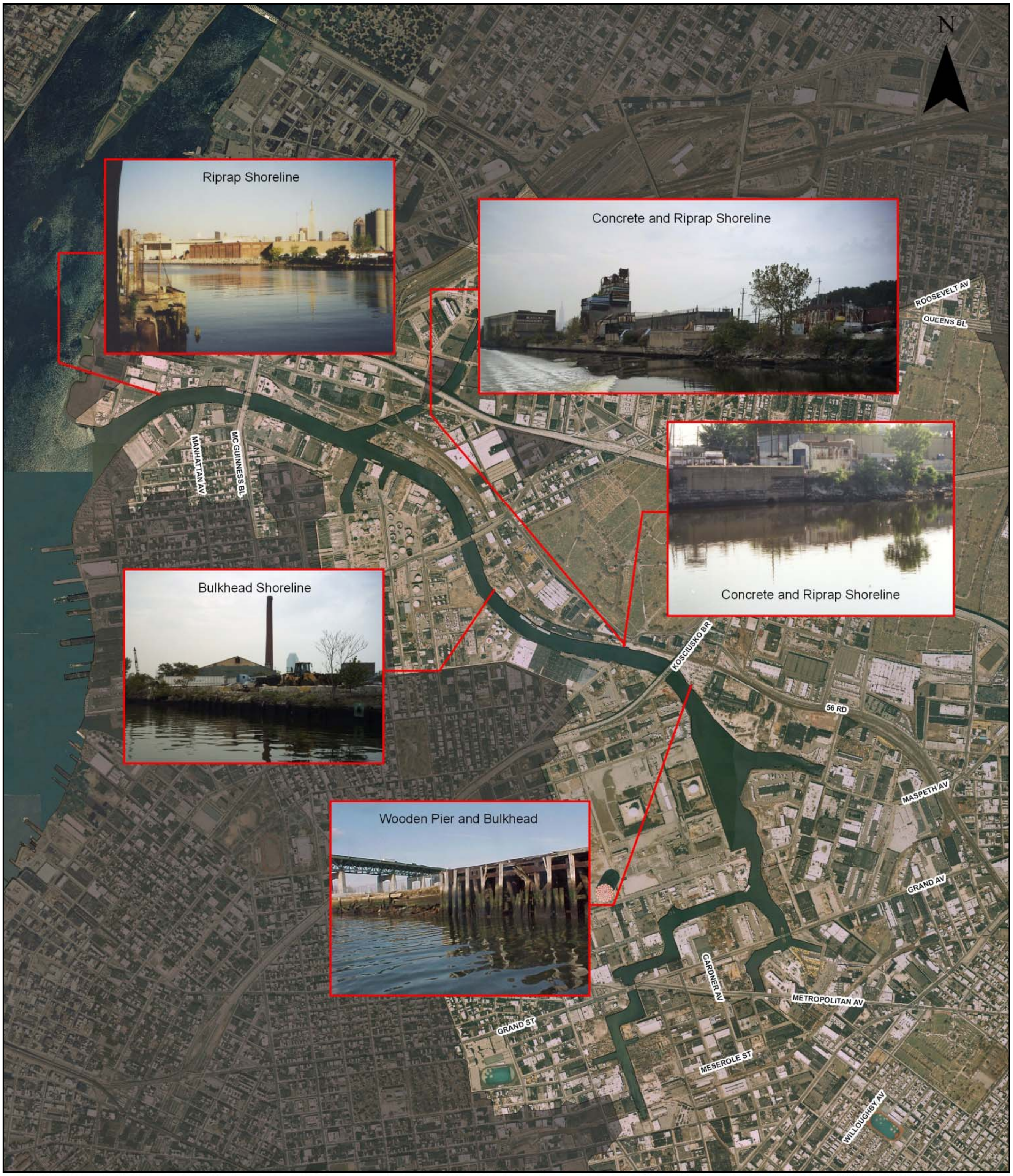


Photo Sources: Hazen and Sawyer, P.C. & HydroQual, Inc.

Environmental Protection

Newtown Creek
Typical Shoreline Features

Most shorelines of Newtown Creek are zoned manufacturing and are owned by private commercial and industrial users, which include many scrap metal and recycling operations. The Creek was formerly home to several oil refinery operators and the former home of a Phelps-Dodge copper smelter. Several improvement projects are currently underway along the Newtown Creek.

A 5,000 square foot park is being developed at the end of Vernon Boulevard on the Queens side of Newtown Creek. Across Newtown Creek, on the Brooklyn side another street-end park is being developed at the end of Manhattan Avenue and a promenade is being constructed as part of the upgrades to the Newtown Creek WPCP. A significant portion of the promenade is planned to be completed by spring of 2007.

4.2.5. Waterbody Access

Public waterbody access to Newton Creek and its branches is limited by the commercial and industrial development along the waterbody. Most city streets terminate before Newtown Creek at the location of businesses abutting the Creek.

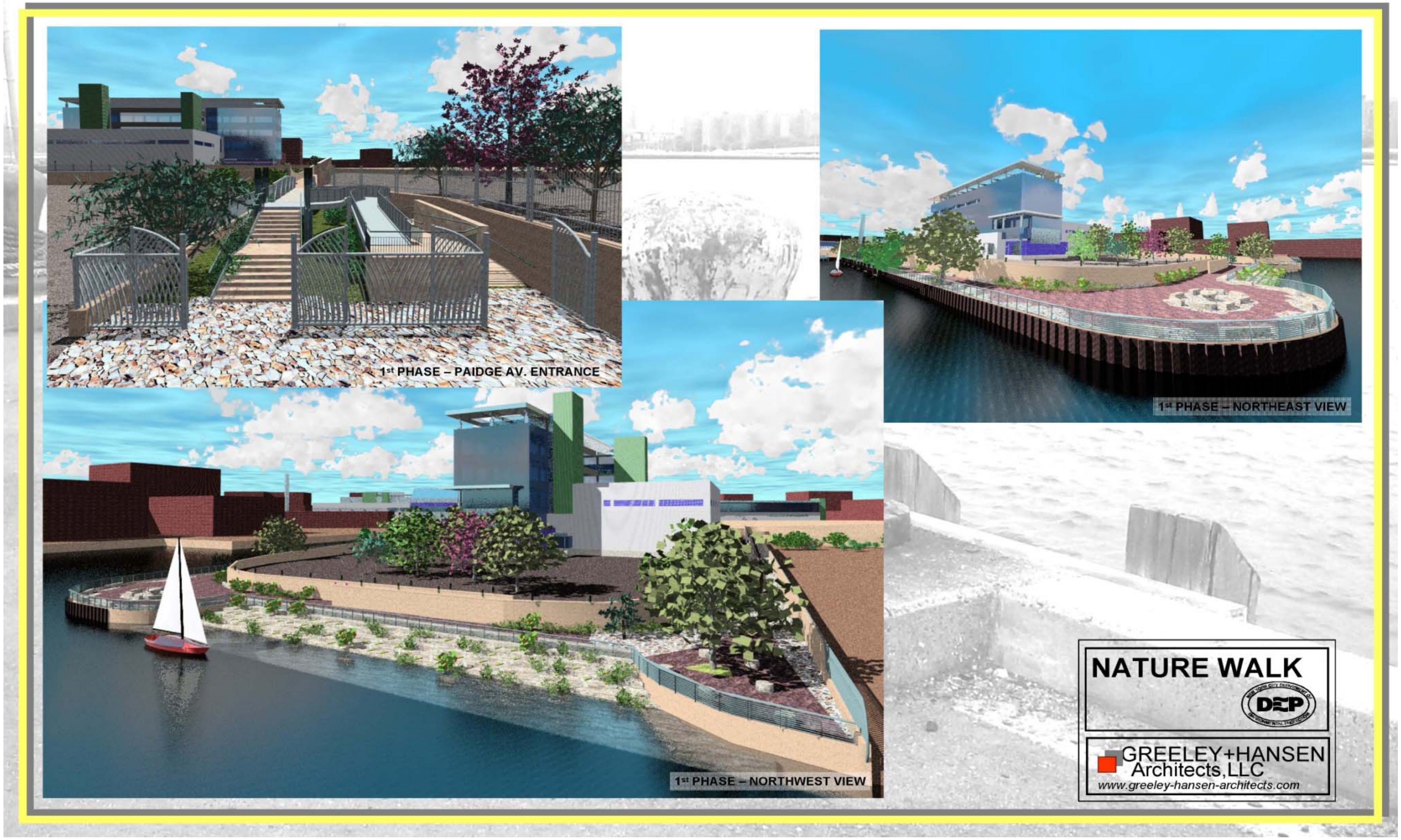
There are no marinas or recreational boat moorings in Newtown Creek. There are no beaches, parks or other recreationally oriented facilities on the Creek. Pedestrian and bike access is available on all of the bridges which cross the waterbody except the Kosciuszko and railroad bridges.

Development of the parks at the ends of Vernon Boulevard on the Queens side and Manhattan Avenue on the Brooklyn side of the Creek will give public access to the waterbody as well as provide recreationally oriented facilities on Newtown Creek. The promenade will provide significant improvement to the adjacent shoreline and additional public access. Renderings of the proposed promenade are included in Figure 4-18. In addition to these elements, the Greenpoint-Williamsburg Waterfront Access Plan has been approved to become part of the zoning text, and envisions a continuous shore public walkway running from the end of Manhattan Avenue on the southern side of Newtown Creek in Greenpoint to the end of N. 3rd Street in Williamsburg. The locations of the street-end parks and the proposed public walkway are shown on Figure 4-19.

4.3. EXISTING WATERBODY USES

Newtown Creek was heavily developed for maritime commerce by the mid 1800's. Currently, usage of Newtown Creek is primarily commercial and industrial with a mixture of oil storage facilities, scrap metal and recycling, asphalt and cement plants, rail yards, warehouses and the like. Water-dependent uses have diminished from historic levels as large industries such as Exxon-Mobil and Phelps Dodge have closed their facilities. Some typical businesses on Newton Creek are (Figure 4-20):

- BP-Amoco Oil Company – south side of Newtown Creek at Apollo Street,
- Diamond Asphalt – south side of Newtown Creek at Paidge Avenue,
- Peerless Importers – south side of Newtown Creek at Bridgewater Street, and
- Republic Auto Repair – north side of Newtown Creek at 11th Street.



NYC Environmental Protection

Newtown Creek WPCP Promenade

Street-end Parks and Proposed Public Walkway in the Vicinity of Newtown Creek

Environmental Protection

Typical Businesses Located Near Newtown Creek

Limited recreational uses such as private boating, fishing/crabbing, and scuba diving occur within the Creek. Most shorelines are bulkheaded and public access to the waterbody is limited to views from bridges and the few street-ends that abut Newtown Creek.

4.4. OTHER POINT SOURCES AND LOADS

Sections 2.3 and 3.3 discuss existing combined and storm sewer discharges, non-point sources, and other potential sources of loading to the Newtown Creek, its tributaries, and branches. In addition to those sources, the DEP Shoreline Survey Program has identified numerous point source discharges to the waterbody/watershed assessment area. The DEP has been surveying the shoreline to catalog outfalls since 1988 and has been producing the SPDES-mandated Shoreline Survey report since 1991, identifying each outfall as a City-owned sewer, highway drain, storm sewer, combined sewer outfall, or other SPDES-permitted discharge line, etc. Approximately 218 non-CSO direct discharges (outfalls) to the Newtown Creek waterbody were identified by the Shoreline Survey. Some (5) of these outfalls are SPDES permitted stormwater discharges and are addressed in Section 3. The Shoreline Survey Program classified most (172) of the remaining outfalls as "general", many (29) as "storm or highway drains", and the rest (12) as "direct discharge". According to the 2003 New York City Shoreline Survey Program report for the Newtown Creek WPCP drainage area, a dry weather discharge at an outfall discharging to the Newtown Creek, or one of its tributaries or branches has been identified 32 times since 1989. The report indicates that 17 of these discharges have been abated by the DEC and 14 abated by the DEP, with one discharge not abated. The report indicates that this discharge was scheduled for abatement in 1990, however, the 2003 report does not list it as being abated, nor does it indicate that further dry weather discharge has been identified from this outfall. No further information was available at the time of the writing of this report.

The New York State SPDES database lists 13 permitted sites in the vicinity of Newtown Creek, its tributaries and branches. Table 4-1 presents the SPDES permittees and the permitted discharges associated with each. While these sites could represent potential sources of toxics-related pollutants, they do not appear to represent significant sources of pollution that would affect DO levels in the waterbody.

Table 4-1. SPDES Permittees Adjacent to Newtown Creek

SPDES No.	Facility Name	Permitted Discharge
NY0201138	Consolidated Edison Co. of New York	Groundwater Infiltration & Stormwater
NY0006131	Motva Enterprises LLC	Stormwater Runoff
NY0200441	Buckeye Pipe Line Co. Long Island	Recovery Well Carbon Treatment
NY0026204	Newtown Creek WPCP	Treated Effluent (Whale Creek Outfall)
NY0007676	Metro Terminals Corporation	Stormwater Loading Rack, Yard
NY0028452	Getty Terminals Corporation	Stormwater
NY0004596	Amoco Oil Company	Stormwater, Truck Washwater, Hydrostatic Test Water, Ground Water Remediation Carbon
NY0200841	NYC Dept. of Sanitation Queens District 5/5 Garage	Terminal Faciliities for Motor Freight Transportation Runoff
NY0007641	Bayside Fuel Oil Depot	Hydrostatic Test Water, Stormwater Runoff From PBS CTM
NY0201260	Waste Management of New York LLC	Treated Stormwater Yard Runoff

Table 4-1. SPDES Permittees Adjacent to Newtown Creek

SPDES No.	Facility Name	Permitted Discharge
Notes: (1) The USEPA PCS database (updated July 21st, 2006) lists 3 additional permittees (Astoria Carting NYU700090, Charles J. King Inc. NYU700230, and Metro Auto Salvage NYU700200) but does not have permitted discharge data for these facilities. (2) Mobile Oil NY0110060 is a Class 10 remediation site, which is not considered a "significant" discharger by the DEC and therefore is only required to monitor and retain information on site.		

Overall, the total contribution of flow from these additional point sources was determined to be insignificant relative to CSO and stormwater inputs addressed in Section 3 of this report.

4.5. CURRENT WATER QUALITY CONDITIONS

As described in Section 1.2.1, the Newtown Creek appears on the DEC Section 303(d) List of Impaired Waters due to DO/oxygen demand from urban runoff, storm sewers and CSO inputs. The following sections describe the current water quality conditions which support this listing using both existing water quality data and model simulations. The advantage of using observed data it is the most reliable source of information; a water quality model may not capture all of the dynamic features of the sewer system and natural water system (i.e. loading spikes, localized circulation patterns, etc.). However, data collection is not continuous and may be somewhat limited. The advantage of a model calculation is that it has a greater spatial resolution (horizontal and vertical) and better represents temporal variability and overall system response. The model also has the ability to distinguish seasonal impacts which may be important depending on the parameter and criteria to be evaluated.

Calculated water column concentrations are the result of three major modeling components:

The sewer system model, which quantifies flow discharges and pollutant loadings to the Newtown Creek, its tributaries, and branches;

The hydrodynamic receiving water model, which defines the water circulation patterns within the Basin; and

The receiving water quality model, which calculates the fate of pollutants and their impact on water quality parameters such as DO.

The analysis of current water quality conditions based on observed measurements and the model analysis of baseline conditions described below.

4.5.1. Measured Water Quality – Existing Data

As described in Section 4.1, the DEP has conducted a number of field investigations in Newtown Creek since 1980. These investigations have documented water quality problems such as low DO and aesthetics problems including exposed sediments, odors, and floatables.

Sampling data along with water quality modeling results show that aquatic life, and aesthetics are frequently impaired throughout the year, and that conditions degrade even further during and following wet weather events when CSOs and storm discharges occur. Because of the limited mixing and the proximity to organic channel sediment fed by settleable solids discharges, DO levels in the bottom waters, especially at the head ends of the tributaries and branches, often reach anoxic conditions. Discharges of total suspended solids (TSS), biochemical oxygen demand (BOD), settleable solids, and floatables induce odors and other poor aesthetic conditions in the waterbody. Sediment mounds have formed at the head ends of several tributaries and branches and are caused by settling solids discharged by the CSOs. The exposed portion of these mounds increases at low tides and chemical/biological reactions within the sediment and overlying water during hypoxic and anoxic conditions produce noticeable odors from the release of hydrogen sulfide and methane gas. The sediment mounds also deplete DO in overlying waters and are of limited habitat value. Floatables discharged by the CSOs and storm sewers are noticeable and represent a nuisance condition throughout the Newtown Creek, where water clarity is poor, especially following these wet weather events. Photographs of the prevailing water quality conditions in the waterbody are shown on Figures 4-21, and 4-22. Figure 4-23 shows pollution in and around the Creek, only some of which is related to CSOs. This figure also shows that some cleanup activity has occurred.

The 2009 Harbor Water Quality Report (DEP, 2009) states that water in the Creek is fully influenced by direct discharges into the creek from CSOs, the Newtown Creek WPCP and from permitted industries, from limited water circulation between the Creek and the Harbor, and from the oil that was spilled in the area years ago and continues to seep out of bulkheads adjacent to the waterway. The compiled water quality data show that waterbody does not always meet the requirements of Class SD waters for DO (i.e. never-less-than 3.0 mg/L).

Water quality deteriorates further into the creek. Conditions become increasingly hypoxic from the mouth to the head of the Creek. Characteristics of hypoxic conditions are: low DO levels, high bacteria levels, increased reduced forms of Nitrogen, decreased oxidized forms of Nitrogen, and high Chlorophyll 'a' levels (DEP, 2009). Further effects of hypoxia were observed in nitrogen levels where oxidized nitrogen decreases and reduced nitrogen increases with distance from the mouth.

Chlorophyll a levels in Newtown Creek were between 23.9 ug/L at the mouth of the creek and 38.4 ug/L ner the head. This is likely ude to nutrient enriched waters from runoff and poor tidal flushing. Large differences between maximum and minimum levels indicate the occurrence of algal blooms. When the algae die they sink to the bottom sediment and are decomposed by bacteria. Algal blooms deteriorate water quality because decomposition of dead algae leads to oxygen depletion.

The 2009 Harbor Water Quality Report indicates Newtown Creek experiences epdisodic high bacteria populations due to rain events causing CSOs. Annual Average Fecal Coliform and Enterococci levels were far higher than levels found in the East River, and bacteria levels increase from the mouth to the head of the Creek. For example the average fecal coliform concentrations (/100mL) ranged from 950 at the head-end, 600 at mid-stream to less than 100 near the mouth. Likewise, the average enterococci concentrations (counts/100mL) ranged from 400 at the head-end, 200 at mid-stream to less than 20 near the mouth.

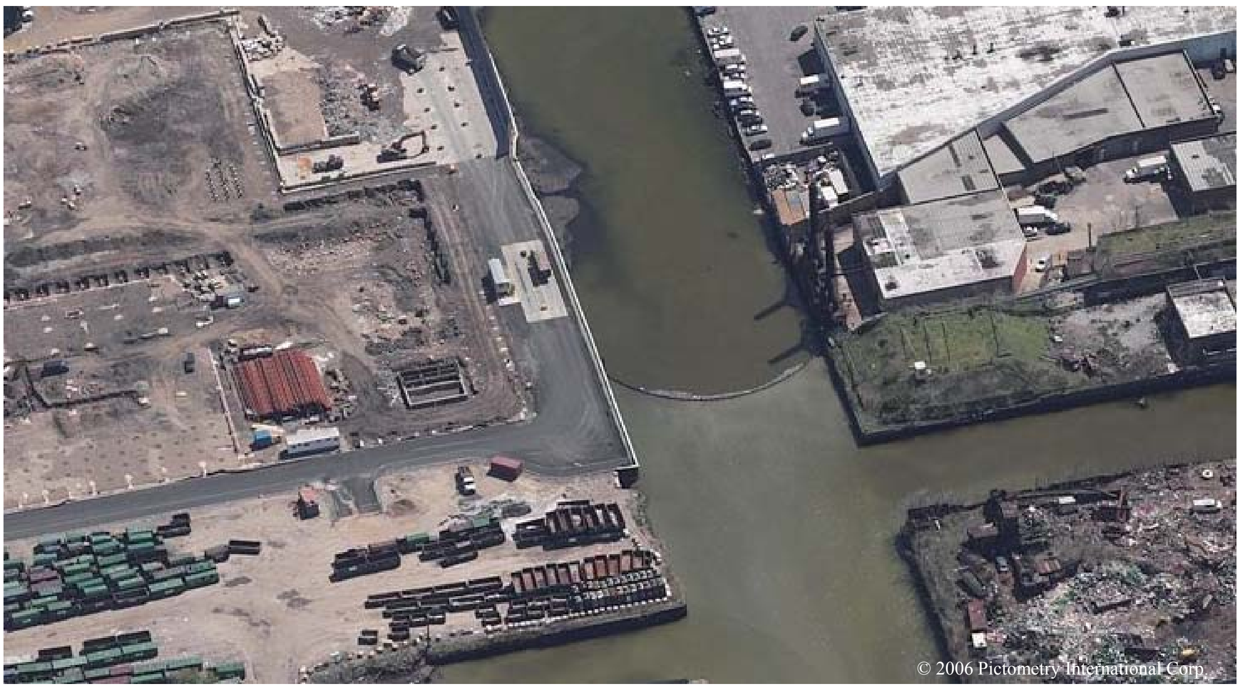
English Kills

Maspeth Creek

NYC Environmental Protection

Sediment Mounds at Head Ends of English Kills and Maspeth Creek

East Branch



English Kills

Environmental Protection

Floatables Containment Booms and Water Clarity in East Branch and English Kills

Maspeth Creek

Refuse Removed as of May 2007

English Kills

NYC Environmental Protection

Waste and Debris in and around Newtown Creek

Lawler, Matusky, & Skelly (1993) summarized the field investigations conducted in 1990 during Newtown Creek CSO Facility Planning. During these earlier investigations, DO was typically measured as being hypoxic or anoxic throughout the waterbody, especially in the bottom waters and farther from the mouth of the Creek (see Figure 4-24). Of all samples collected during the CSO Facility Planning, 51 percent were below the DEC DO criteria. DO levels below the DEC standard were observed during both wet and dry weather surveys, and were especially low when water temperatures were higher and for two to three-days following CSO events. In general, the lowest DO concentrations were observed at the head ends of the tributaries, with conditions in the main branch of the Creek improving toward the East River.

A DO histogram of all available data in the Newtown Creek, its tributaries and branches is shown on Figure 4-25. The figure shows the percentage of data observations between DO intervals of 1.0 mg/L. The observed data were grouped into four spatial sections: (1) Newtown Creek from the mouth to just upstream of Dutch Kills, including Whale Creek Canal, (2) Dutch Kills, (3) Newtown Creek from Dutch Kills to Maspeth Creek, and (4) the head end of the Creek, including Maspeth Creek, East Branch, and English Kills. The figure demonstrates the longitudinal distribution of observed data. The percentage of data below 3.0 mg/L at the near-mouth, Dutch kills, mid-creek, and head-end are 27, 50, 54, and 79 percent respectively. Note also, that more than 35 percent of all samples for the entire waterbody are below 1.0 mg/L. Figure 4-26 shows the average and range of DO levels for each section of the waterbody. Sample locations for this analysis are shown on Figure 4-1. The number of data points used in this analysis are as follows:

- Section 1 – 112 data points
- Section 2 – 54 data points
- Section 3 – 333 data points
- Section 4 – 547 data points

4.5.2. Receiving Water Modeling Analysis

As stated in Section 4.1.4, mathematical modeling is a useful tool to evaluate the impacts of engineering alternatives and other factors on water quality and uses in a particular waterbody. The mathematical modeling framework developed for the Newtown Creek waterbody/watershed assessment area (Figure 4-15) includes a "landside" (rainfall-runoff/collection system) model for the watershed, a receiving water model with hydrodynamic and water quality components for the waterbody, and the SWEM model to establish the boundary conditions in the East River.

A critical issue in evaluating engineering alternatives and assessing the attainment of water quality and water use goals is the selection of a representative condition for which the criteria and standards can be evaluated. Using this representative "Baseline" condition allows a host of different engineering alternatives to be evaluated on a common basis so that differences in impacts are attributable to differences in alternatives. Because water quality conditions in the Newtown Creek waterbody are impacted by wet weather factors, selection of a precipitation condition directly affects the evaluation of whether water quality goals are attained. The selection of a rainfall "design year" can be arbitrary, but for planning purposes, a long-term, annual average condition is appropriate and is consistent with the CSO policy (USEPA, 1995a). The design year should also reflect population and water use conditions that are consistent with the planning horizon. Finally the Baseline condition should reflect the state of facilities prior to implementation of long-term controls.

Section 3.4.3 describes the elements of the Baseline design condition relative to precipitation and landside modeling. In summary, the Baseline design condition utilizes the 1988 meteorological record measured by the National Weather Service at JFK International Airport. This precipitation record is typical in many respects, and represents the long-term average in terms of annual total rainfall and storm duration. The Baseline design condition generally represents the watershed and sewer system in its current condition, with certain exceptions specifically used for planning purposes. These exceptions are:

- Dry-weather flow rates at year 2045 projections for the Bowery Bay (109.8 total, 35.4 low level) and the Newtown Creek (268.0 MGD total, 83.4 MGD Brooklyn/Queens) WPCPs;
- Wet-weather treatment capacity at the Bowery Bay WPCP of 236 MGD and at the Newtown Creek WPCP of 585 MGD;
- Sedimentation levels in sewers associated with reasonable maintenance (modeled as clean conduits).

Relative to receiving water modeling, the Baseline design condition incorporates the conditions listed above, with application of 1988 meteorological, tidal, and other boundary information (water temperature, wind, tidal elevation, tidal currents, etc.) as appropriate. Landside discharges for the Baseline design condition are presented in Section 3.5.

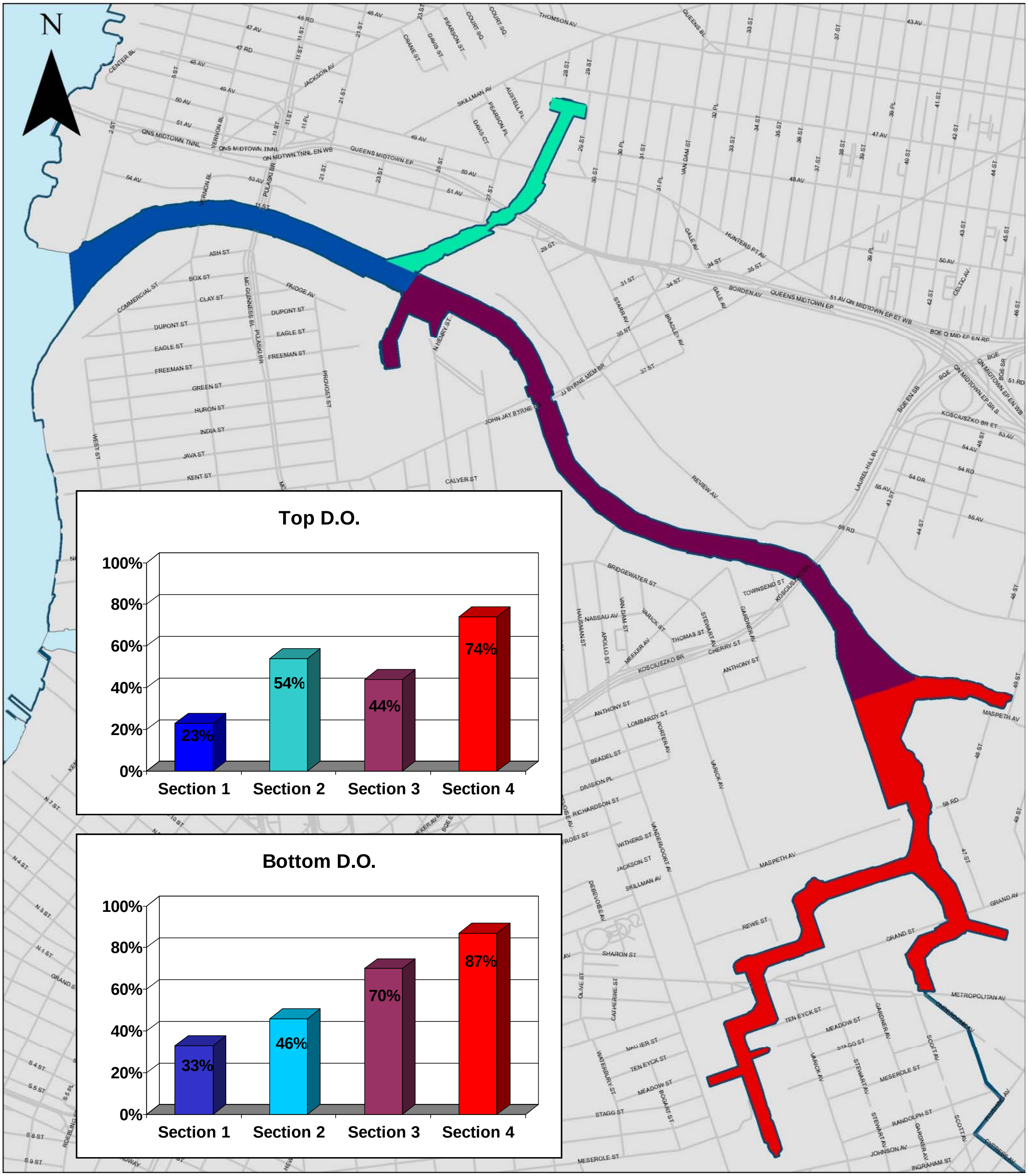
DO results from the receiving water model for the Baseline design condition are summarized on Figure 4-27. Although Newtown Creek's SD classification does not include pathogen standards, Figures 4-28 and 4-29 are included to show the projected percentage of time that the levels in the waterbody would be less than the levels required by the Class I standard (2,000 per 100 mL fecal and 10,000 per 100 mL total coliform).

4.5.3. Pollutants of Concern

As described in Section 1.2.1, the Final New York State 2004 Section 303(d) List of Impaired Waters identifies the Newtown Creek as an impaired waterbody with the cited cause as DO and oxygen demand due to urban runoff, storm water, and CSO discharges. The field investigations and water quality modeling analyses discussed above confirm that the waters are impaired, and also indicate that floatables represent an additional pollutant of concern as an aesthetics issue. Figure 4-30 shows that background conditions outside the boundaries of the Newtown Creek Receiving Water Quality Model are the largest contributor to oxygen deficit within Newtown Creek. Of the sources of oxygen deficit originating from inside the model boundaries, CSO is the largest followed by storm water, the discharge from the Newtown Creek WPCP Whale Creek outfall, and then load in the East River near the mouth of the Creek. Included in the deficit related to the boundary conditions is oxidation of carbon and nitrogen point and non-point sources, and algae respiration and die off.

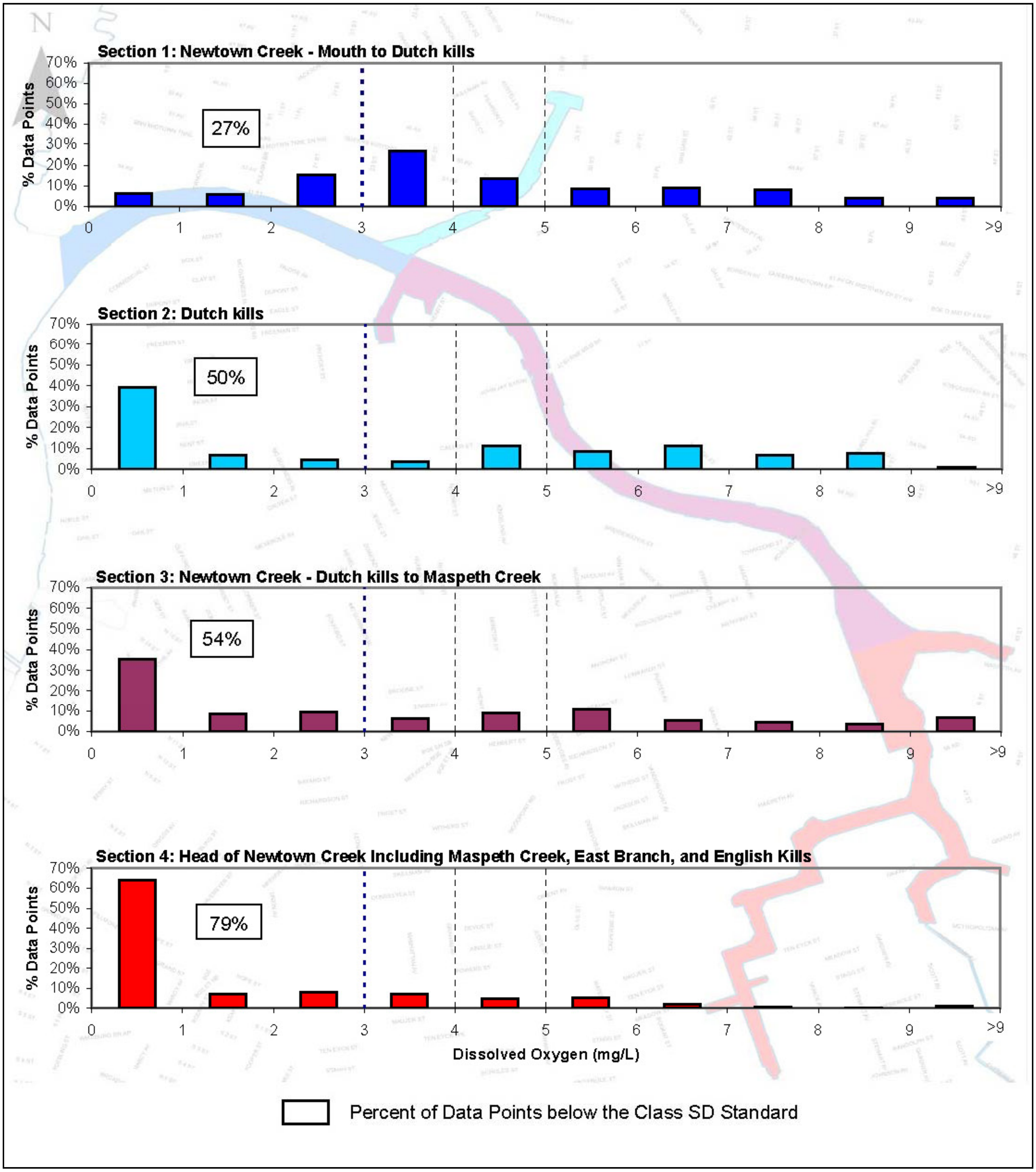
4.5.4. Other Pollutants and Water Quality Issues

Beyond the pollutants of concern described in Section 4.5.3, other water quality issues of interest include levels of indicator bacteria, exposed sediment mounds and associated odors, and toxicity in the water column and sediments.



Environmental Protection

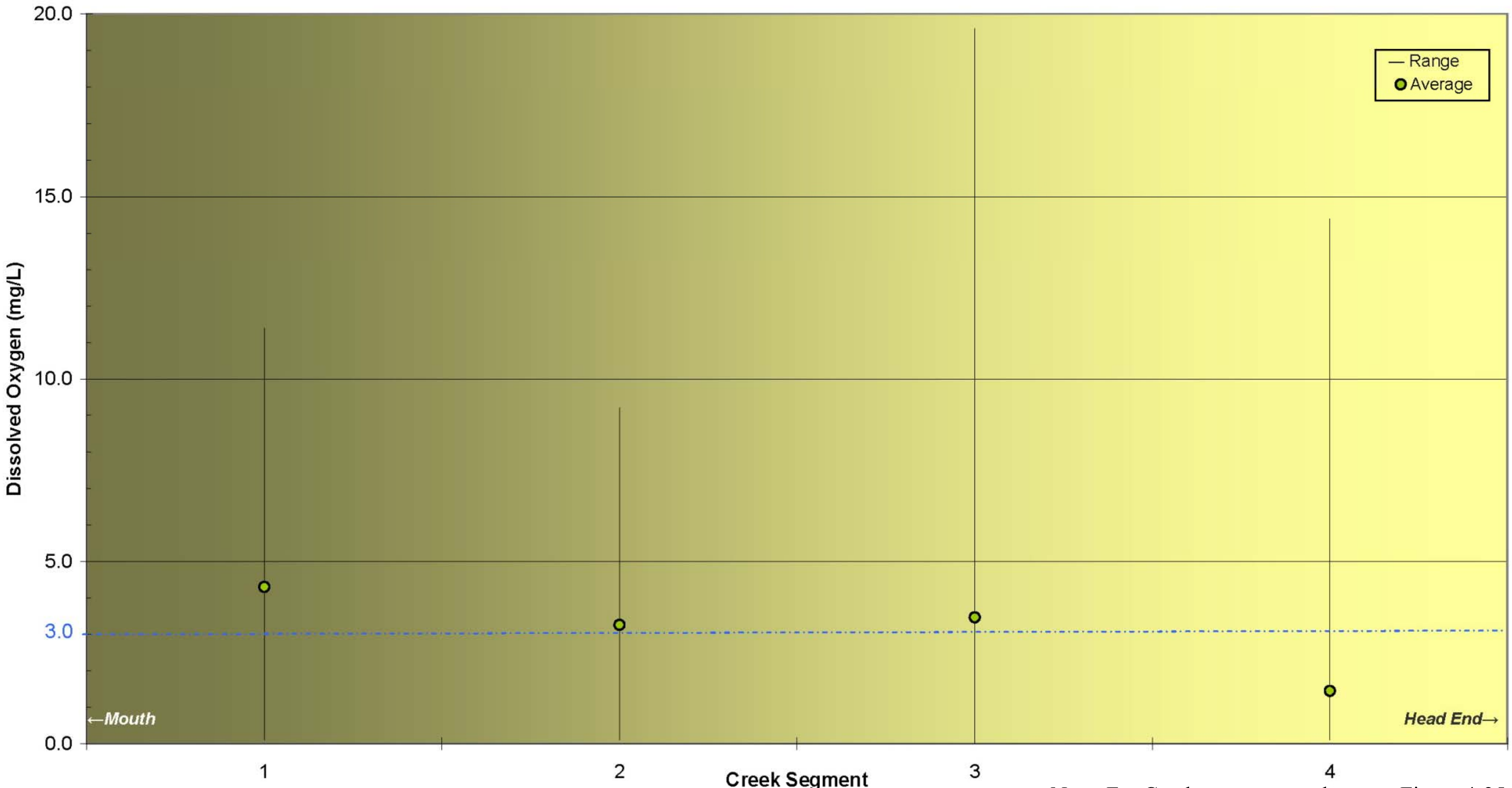
Newtown Creek Dissolved Oxygen (1984 to 2003)
Percent of Samples Less Than 3.0 mg/L



Note: Waterbody Sections are shown in the background

NYC Environmental Protection

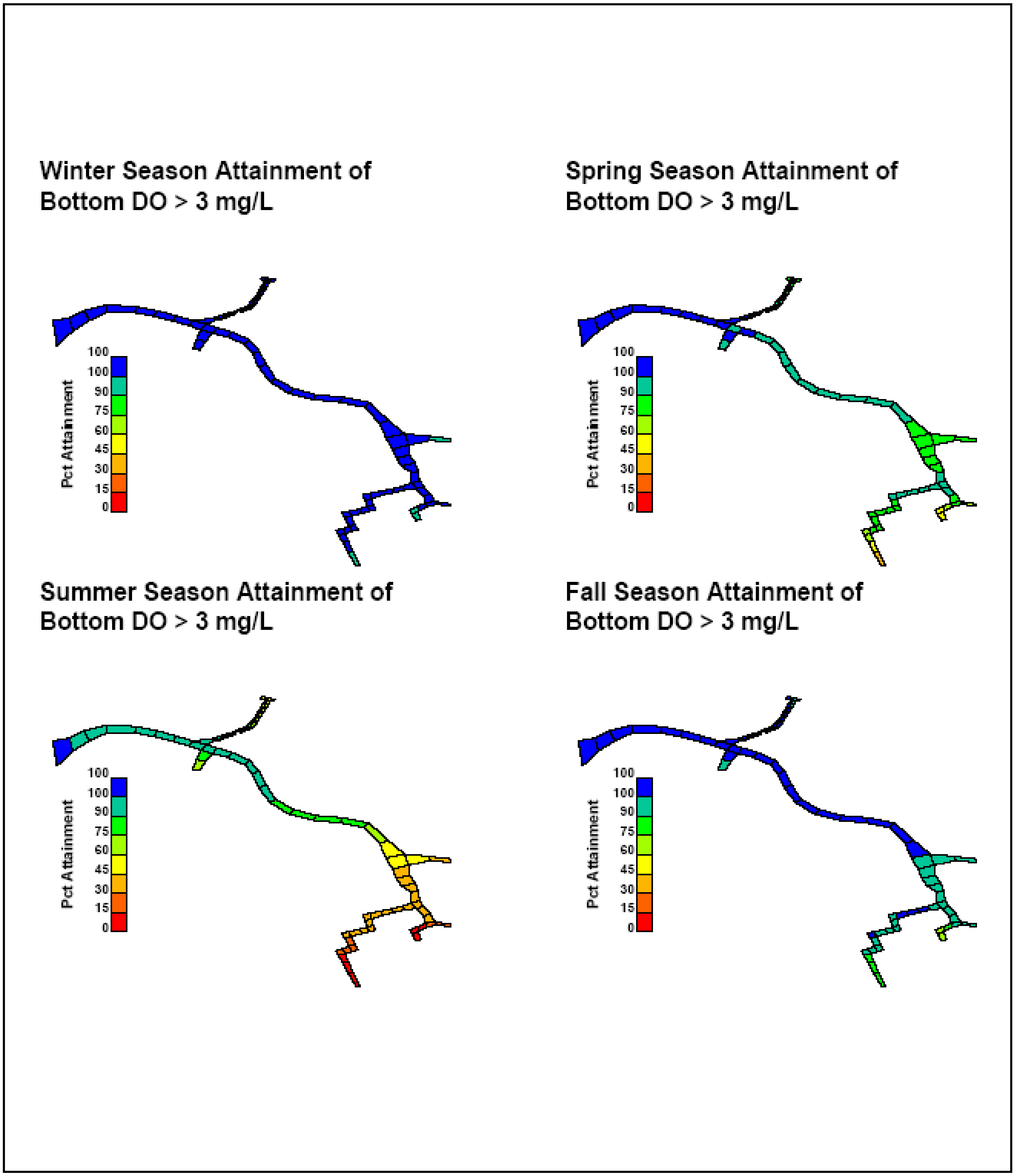
Newtown Creek Dissolved Oxygen (1984 to 2003) Distribution of Measurements by Location



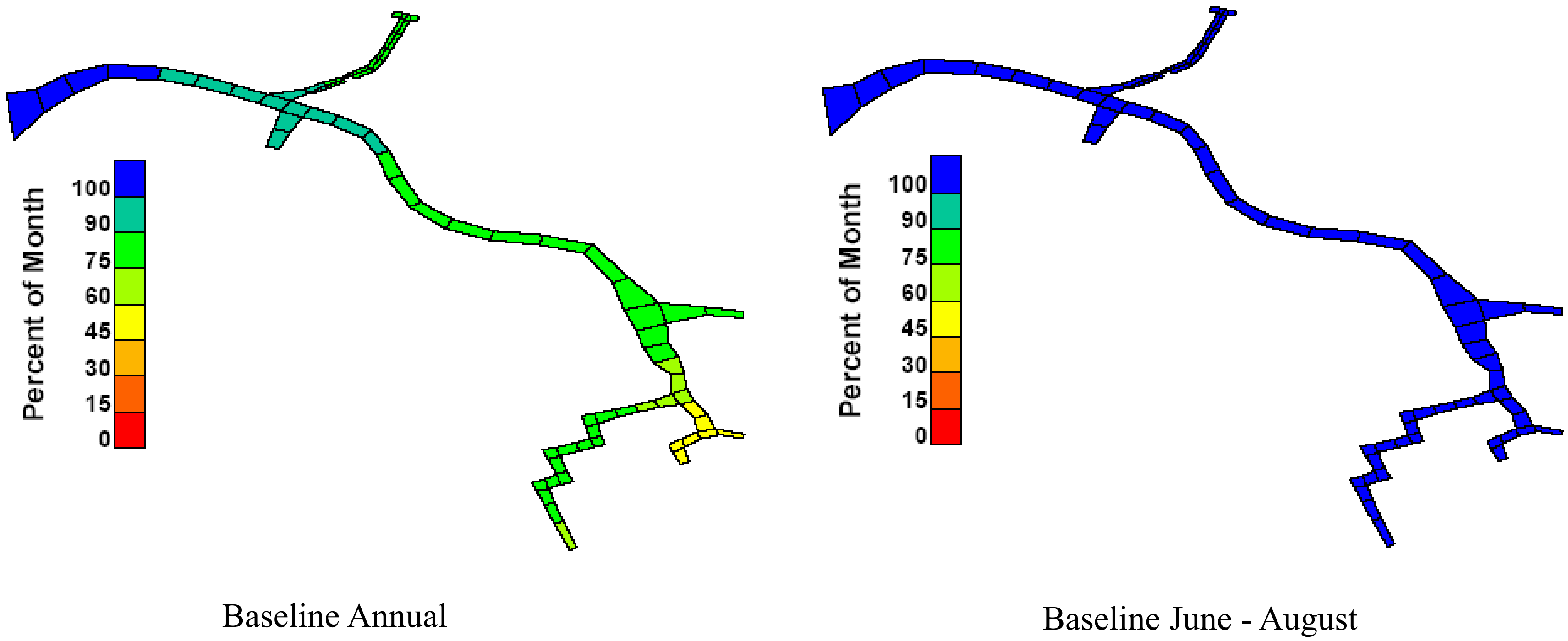
Note: For Creek segment numbers see Figure 4-25

Environmental Protection

Newtown Creek Dissolved Oxygen (1984 to 2003) Average and Range by Location

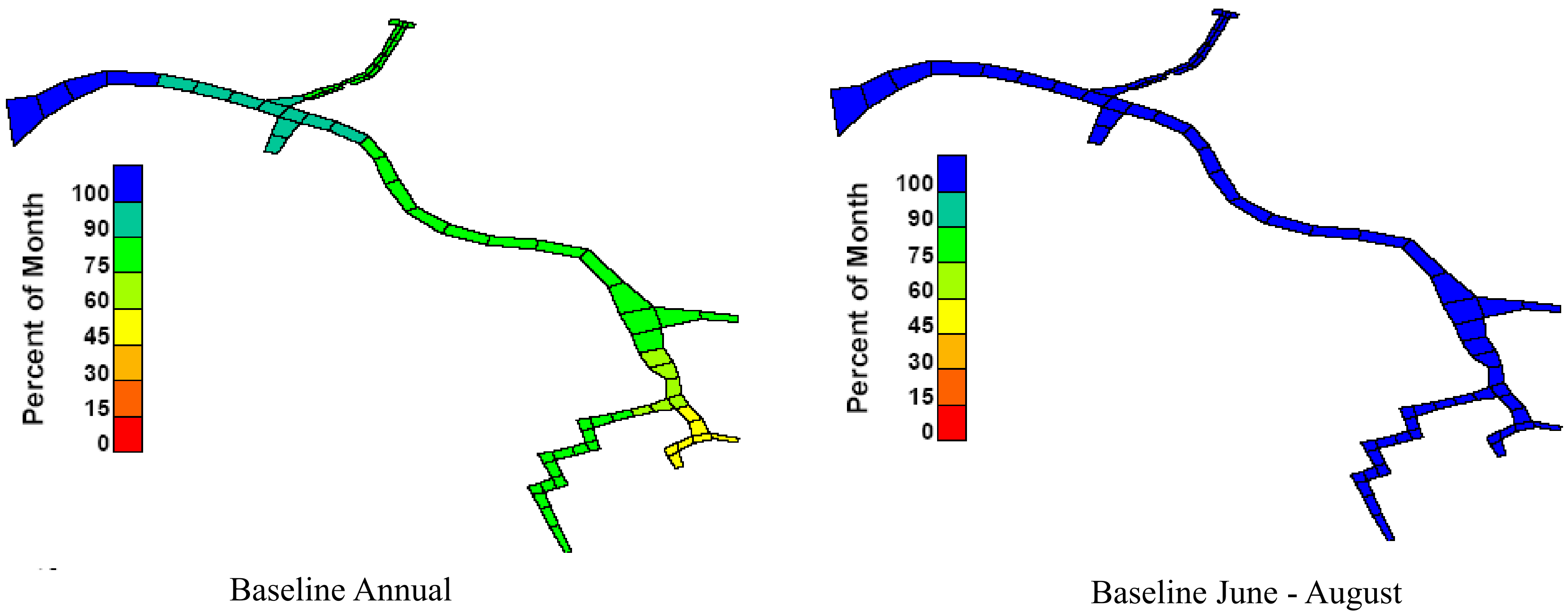


Modeled Baseline Dissolved Oxygen
Percent of Days with DO > 3 mg/L

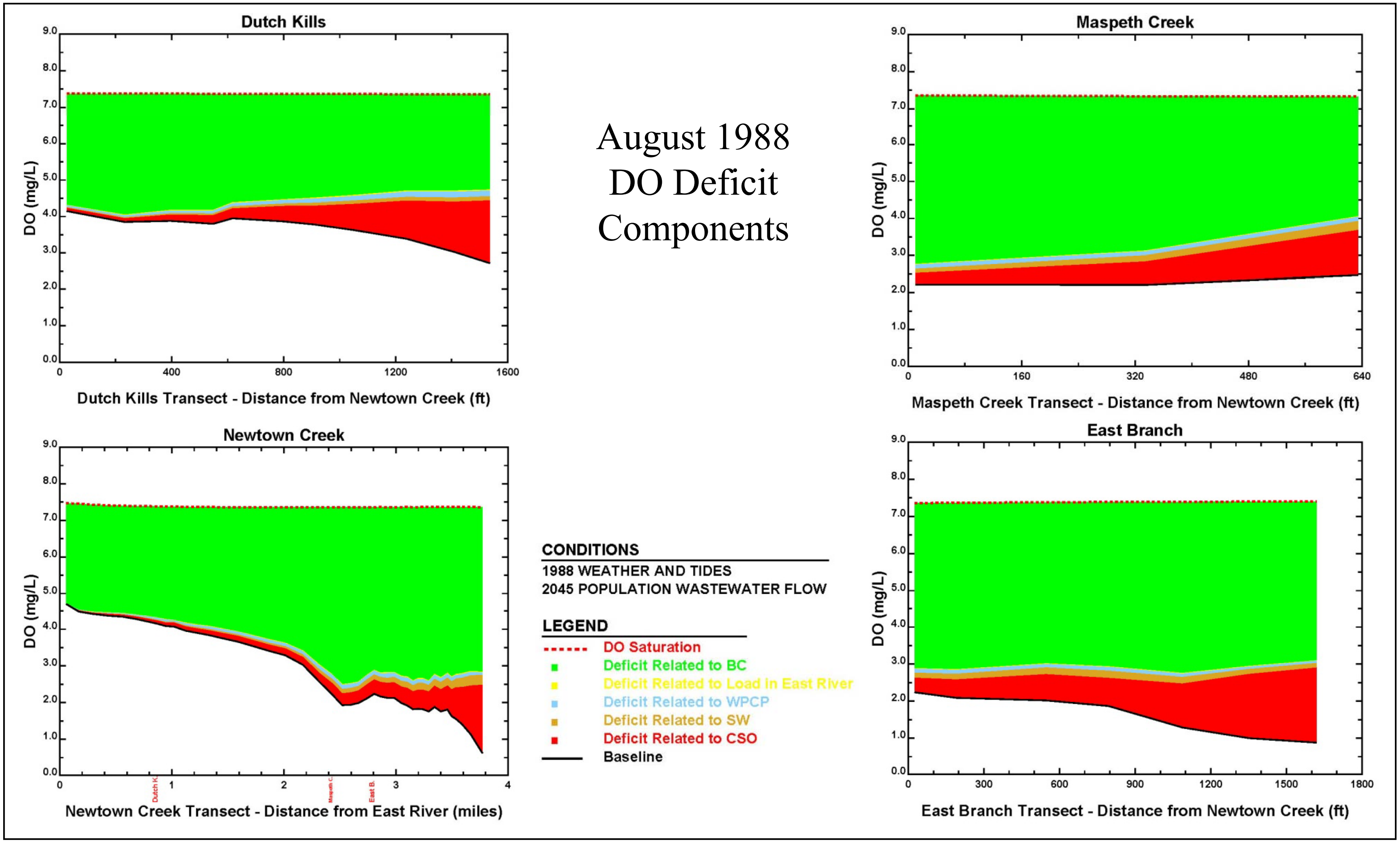


Modeled Monthly Geometric Mean Fecal Coliform
Percent of Months with Geometric Mean < 2,000 per 100 mL

Figure 4-28



Modeled Monthly Geometric Mean Total Coliform
Percent of Months with Geometric Mean < 10,000 per 100 mL



Environmental Protection

Newtown Creek
Dissolved Oxygen Deficit Components

Indicator Bacteria

The Newtown Creek water body classification of SD does not support recreational uses and hence no indicator bacteria standards are applicable. However, indicator bacteria can provide a measure of water quality.

CSO Sediment Mounds and Odors

The CSO sediment mounds in the tributaries and branches of Newtown Creek represent an aesthetic issue, primarily due to the odors that are released when the sediments are exposed at low tide. In addition, SOD contributes to the hypoxic and anoxic conditions that persist in the Newtown Creek waterbody.

Superfund Designation

Newtown Creek and its tributaries were added to the National Priorities List in September 2010. DEP and five other parties are expected to agree with USEPA to conduct a Remedial Investigation/Feasability Study (RI/FS) within the next 6 to seven years. The study is forecast to conclude in 2017 or 2018. Recommendations of the RI/FS will be coordinated with the WB/WS Facility Plan recommended alternatives.

Water Column and Sediment Toxicity

Toxicity tests performed in 2003 as described in Section 4.1.2 used indicator organisms to determine toxicity to organisms, regardless of the cause. Results for the water column tests showed that growth was significantly reduced in the mysid shrimp toxicity tests at 1 of 4 stations (NEWTT-02 on Figure 4-11), although there was 98 percent survival at all 4 stations. Results of the sediment test showed less than 3 percent of the organisms surviving after 10 days at 3 of 4 stations, and both growth and survival were significantly different from the control at the 4th station (NEWTT-10 on Figure 4-11).

These sediment toxicity test findings are consistent with the sediment quality analysis completed during the 2000 Dredging Feasibility Study (URS, 2000b), which detailed results of the laboratory analysis of 21 sediment cores that were collected on November 22 and 23, 1999. Under this study, the sediment cores were analyzed for full Toxicity Characteristic Leaching Procedures (TCLP) and Resource Conservation and Recovery Act (RCRA) characteristics. Based on the NYCDEC Technical & Operational Guidance Series (TOGS) 5.1.9, In-Water and Riparian Management of Sediment and Dredged Material, the results indicate that the Newtown Creek sediments would be classified by the DEC as “Class C – High Contamination (Acute Toxicity to aquatic life)” (DEC, 2004a). Class C dredged material is expected to be acutely toxic to aquatic biota and therefore, dredging and disposal requirements may be stringent, most likely requiring environmental dredging and upland disposal. For Class C dredged material, it is the responsibility of the dredging permit applicant to ensure that the dredged material is not a regulated hazardous material as defined in 6NYCRR Part 371 “Identification and Listing of Hazardous Wastes”.

Under 6NYCRR Part 371, the summary data from the TCLP analysis shows that tested levels are all below the maximum concentration for exhibiting the characteristic of toxicity. Therefore the sediments in Newtown Creek would not be classified as a hazardous waste.

Greenpoint Oil Plumes

Based on the 1996 Newtown Creek WPCP Upgrade Final Environmental Impact Statement (FEIS), in September 1978 the U.S. Coast Guard found a large oil slick on Newtown Creek and later determined it to be seeping from a bulkhead at the end of Meeker Avenue. Later investigations determined that the oil was from one of several distinct underground oil plumes. The oldest and largest plume, termed the Mobil Off-Site Oil Plume, was determined to be from the former Mobil refinery. This plume has since migrated away from the original spill site. This spill has been estimated at approximately 13 million gallons covering an estimated area of 52 acres. A recovery system consisting of seven recovery wells and a ground water treatment system was put in place and is still operating.

The Amoco Plume is located under their bulk storage facility located west of Appollo Street, adjacent to the Newtown Creek. The plume was originally estimated to be 2.2 million gallons. A recovery system consisting of two recovery wells and a ground water treatment system was installed in 1980 and is still operational.

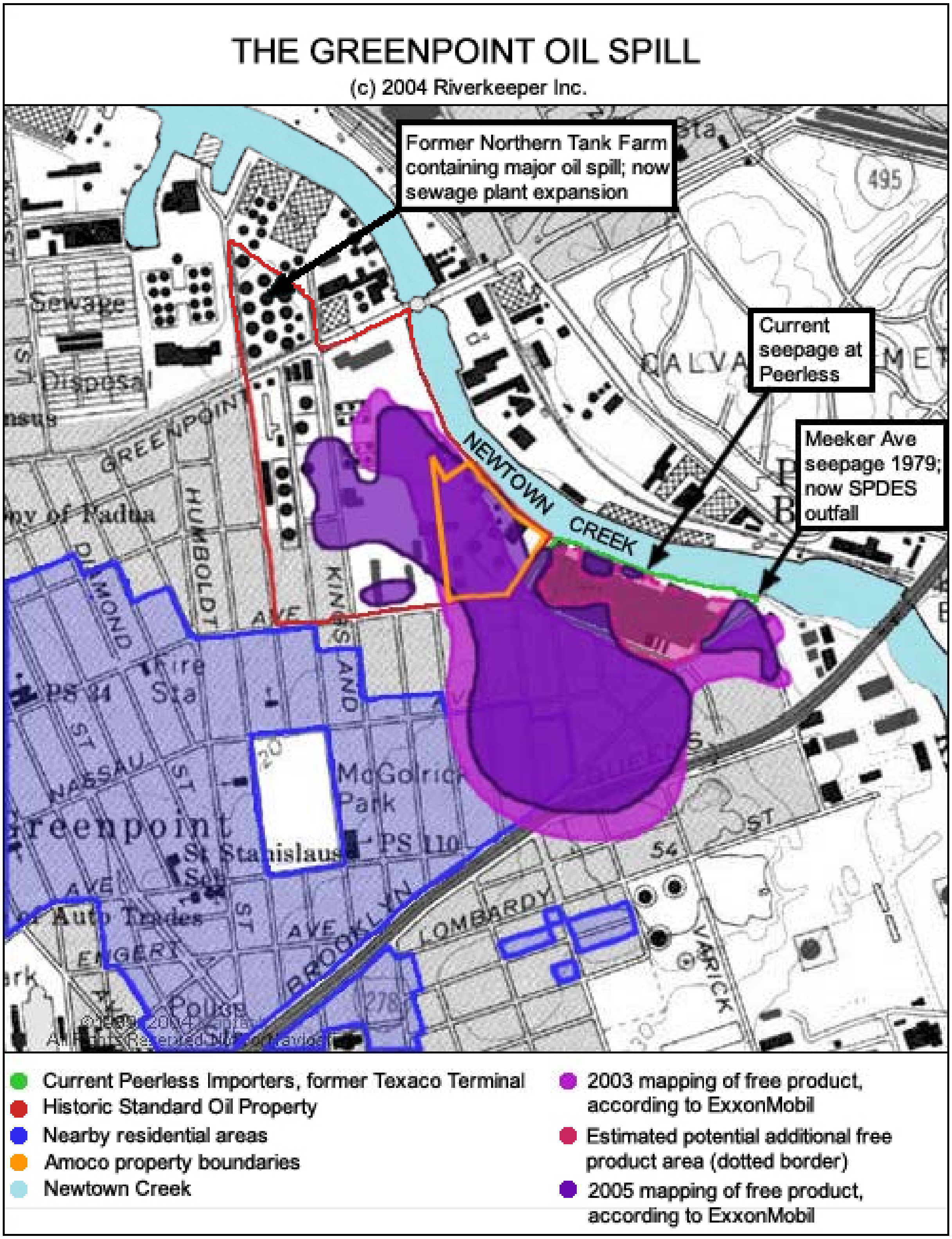
The Mobil On-Site Plume is located on the site of Mobil's North Henry Street Terminal has been determined to have originated from several sources on that site. This plume has been estimated to be around 2 million gallons. A recovery system consisting of seven recovery wells, a ground water treatment system and on-site recovered oil storage was installed and is still operational.

The total volume of oil spilled and the size of the plumes continue to be debated. What is known is that the plumes continue to migrate on the water table and regional aquifer due to seasonal fluctuations in groundwater levels and tidal influence. Several maps of the plumes exist from different sources, but due to the dynamic nature of separate phase oil movement in the subsurface, they only represent a general location at a given time. One such map from the Riverkeeper Inc. is included as Figure 4-31.

On February 8, 2007 the NYC Attorney General's office announced that it was sending five companies, ExxonMobil Corporation, BP PLC, Chevron Corporation, Keyspan Energy, and Phelps Dodge Corporation, Notices of Intent to Sue under the federal Resource Conservation and Recovery Act (RCRA), accusing the companies of "imminent and substantial endangerment to health and the environment" in and around Newtown Creek. These efforts are intended to speed the remediation efforts and to force these companies to do more to clean up the Creek and affected neighborhood.

4.6. BIOLOGY

Newtown Creek supports aquatic communities which are similar to those found throughout the NY/NJ Harbor in areas of comparable water quality and sediment type in portions of its length. These aquatic communities contain typical estuarine species but these communities have been highly modified by physical changes to the original watershed, shoreline, and to water and sediment quality. In addition to seasonally reduced DO due to organic matter loading, Newtown Creek has degraded water quality due to chemical contaminant loading. These changes represent constraints to Newtown Creek in reaching its full potential to support a diverse aquatic life community and to provide a fishery resource for anglers.



Environmental Protection

Map of Greenpoint Oil Plumes from Riverkeeper Inc.

Adverse physical effects on aquatic habitats interact with 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 Newtown Creek, but major irreversible changes to the watershed and the waterbody place limits on the extent of these enhancements. In addition, because Newtown Creek is part of a much larger modified estuarine/marine system, which is a major source of recruitment of aquatic life to Newtown Creek, its ability to attain use standards is closely tied to overall ecological conditions in the NY/NJ Harbor.

This section describes existing aquatic communities in Newtown Creek and provides comparison to aquatic communities found in the nearby Gowanus Canal. This baseline information provides the foundation for assessing the response of aquatic life to CSO treatment alternatives for Newtown Creek.

4.6.1. Wetlands

There are no wetlands located along Newtown Creek based on a review of United States Fish and Wildlife Service National Wetland Inventory (NWI) wetland maps. The Creek itself has been given the designation of estuarine, subtidal with an unconsolidated bottom (E1BUL). The head of Newtown Creek (East Branch) and its branching tributaries, English Kills, Maspeth Creek and Dutch Kills, have been identified as estuarine, subtidal with an unconsolidated bottom excavated by human activities (E1BULx).

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 Newtown Creek as part of the East River Field Sampling and Analysis Program (Hydroqual 2001e, Figure 4-6); and as part of the Subtidal Benthos and Ichthyoplankton Characterization Field Sampling and Analysis Program (Hydroqual, 2003a, Figure 4-9). In 2001 and 2003, benthic sampling was conducted at the mouth of Newtown Creek in the East River, along several points in Newtown Creek and in two of its tributaries (Maspeth Creek and English Kills). Subtidal benthic samples were collected using a Ponar® Grab. One sediment sample per station was taken for analysis of sediment grain size and total TOC content. Results of both the 2001 and 2003 sampling events are presented in Table 4-2 and are discussed below, starting with the headwater areas of the Creek.

Abundance (#/m^2) of benthic organisms collected from Newtown Creek and TOC content of the sediment (%) at each sampling location

Phylum	Taxonomic Group	Location along Newtown Creek							
		Mouth (East River, 2001)	Upstream of mouth	Downstream of middle	Middle	Upstream of middle (2001)	Head of Maspeth	Mouth of English Kills	Head of English Kills
Annelida	*Annelida*		1131	2275	1365		52		39
	Capitellidae	40			234	56			
	Eteone		13	1755	130				
	Glycera			13					
	Harmothoe		13						
	Neanthes succinea		39						
	Nephtys	8			13				
	Oligochaeta		2015	2990	221		78		39
	Ophelia		325	26					
	Phyllodocidae					8			
	Polychaeta	120							
	Polydora		52	39	52				
	Scoloplos		507	130					
	Spionidae					320			
	Streblospio benedictii		91	2470	2275				
	Tharyx	8							
Arthropoda	*Ampeliscidae*		13	13					
	Amphipoda	16							
	Copepoda				52		13	26	
	Cumacea			39					
	Crangon septemspinosa		13	13					
	Idoteidae		13						
	Insecta								13
	Parametopella cypris		13						
	Unciola		39		13				
Mollusca	*Mulinia lateralis*								13
	Nassarius trivittatus					80			
Total Number of Species		**5**	**14**	**11**	**9**	**4**	**3**	**1**	**4**
Total Individuals per Meter^2		**192**	**4277**	**9763**	**4355**	**464**	**143**	**26**	**104**
TOC content of sediment (%)		**2.2**	**3.5**	**5.1**	**4.0**	**3.5**	**5.9**	**2.9**	**3.0**

Notes:
* Data compiled from Hydroqual database
* Eight sample collection locations (EASTB02 and NEWTB01 sampled in 2001, NEWTB16, NEWTB11, NEWTB09, NEWTB06, NEWTB05 and NEWTB02 sampled in 2003)

The sampling site at the head of English Kills had a benthic community with low abundance species diversity and; comprised almost entirely of two types of worms, Annelida sp. (i.e. phylum for segmented worms) and Oligochaeta (a subclass within the Annelida phylum). Worms are important indicators of pollution because of their tolerance to organic enrichment (Gosner 1978, Weiss 1995). Most of the worms found in the Newtown Creek complex have been documented to be tolerant of organic pollution. Insects and one species of mollusk, Mulinia lateralis, were the only other organisms collected at this site and were present in low numbers ($13/m^2$).

Low diversity and abundance were also observed at sampling sites located at the mouth of English Kills and the head of Maspeth Creek. The sampling site at the mouth of the English Kills showed a limited benthic community comprised entirely of Copepoda (i.e. crustaceans in the Arthropoda phylum). The sampling location at mouth of Maspeth Creek showed a benthic community with similarly low diversity and slightly higher abundance. The site was comprised entirely of Annelida sp., Oligochaeta, and Copepoda.

The fourth sampling site was located upstream of the midpoint in the Creek, east of where the Brooklyn-Queens Expressway crosses over the Creek. At this location, the benthic community had similar diversity but greater abundance than the three upstream locations. The benthic community was comprised almost entirely of the pollution tolerant polychaete worms, Spionidae sp., Capitellidae and Phyllodicidae. One species of mollusk, Nassarius trivittatus, was also collected at this location. Similar to the polychaete species, this mollusk is also considered to be a pollution-tolerant organism.

The midpoint of Newtown Creek was the fifth sampling location along the waterway. This location had the second greatest abundance of benthic invertebrates of all locations sampled along the Creek and its tributaries. The benthic community was comprised almost entirely of worms. Streblospio benedictii and other Annelida sp. were the most abundant ($2,275/m^2$ and $1,365/m^2$). Capitellidae polychaetes, Eteone, Polydora, Nephtys and Oligochaeta worms were also present. All of the polychaete species are pollution tolerant organisms. Two arthropod species, Copepoda and Unciola, were also found in a low density ($65/m^2$).

The sixth sampling site was located downstream of the midpoint in the Creek, west of where the Brooklyn-Queens Expressway crosses over the Creek. At this location, the benthic community was observed to have the highest density in Newtown Creek ($9,763/m^2$) and the second highest number of species (11). Similar to the midpoint of the Creek, Streblospio benedictii and other Annelida sp. were the most abundant ($2,470/m^2$ and $2,990/m^2$). Annelida sp., Eteone, Scoloplos, Polydora, Ophelia and Glycera worms were also present. All of these polychaete species are pollution tolerant organisms. In addition to the abundant Annelid community at this location, three species of arthropods were also collected.

The seventh sampling station was located along the waterway upstream of the mouth of Newtown Creek. This location had the third greatest abundance and highest species diversity of all locations sampled along the Creek and its tributaries. Ninety-eight percent of the benthic community was comprised of worms. Oligochaeta and Annelida sp. were the most abundant ($2,015/m^2$ and $1,131/m^2$). Scoloplos and Ophelia also had relatively large populations ($507/m^2$ and $325/m^2$). Streblospio benedictii, Neanthes succinea, Eteone and Harmothoe worms were also present. In addition to the abundant Annelid community at this location, five species of arthropods were also collected. This sampling location had the greatest number and abundance of non-annelid species collected in Newtown Creek.

The benthic community in the East River at the mouth of Newtown Creek, the eighth sampling location, was slightly higher in diversity and similar in abundance (197/m^2) to the benthic community living in the upper portion of the Creek but was lower in both diversity and abundance than the benthic community in the middle to lower portions of the Creek. In the East River, polychaete worms were again the dominant organisms, Capitellidae, Nephtys, Tharyx and an unidentified polychaete species were collected. Amphipods were also present in low numbers (16/m^2).

The benthic community in Newtown Creek was relatively high in numbers of individuals and low to moderate in number of species (see Table 4-2, which includes various levels of taxonomic breakdown). Annelid worms were the dominant organisms, comprising 98.02 percent of the individuals in the community. The pattern of abundance and composition of benthic species, in combination with their documented pollution tolerance, are indicators of degraded benthic habitat quality in Newtown Creek. Based on the greater number of taxa and the presence of amphipods, the habitat quality in the middle to lower portion of the Creek appears to be better than in the upper reaches

The benthic community structure in Newtown Creek is similar to that described in studies of the effects of organic pollution on the benthos. 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 % (Hyland et al 2000). All sampling locations in Newtown Creek had sediment TOC greater than 3 percent, except for the location at the mouth of English Kills where TOC was 2.9 percent (Table 4-2). Almost all of the organisms collected in Newtown Creek are pollution tolerant, and with the exception of the station upstream of the mouth, increases in species diversity were attributed to greater numbers of identified annelid species. TOC content of the sediment is likely contributing to benthic community impairment in Newtown Creek. The station located in the East River had a lower TOC content, but few organisms were collected. Impairment of the benthic community at this site may be due to factors other than TOC. Within the Creek the relationship of diversity (number of species) to the level of TOC is not consistent among stations, suggesting other factors are influencing the quality of benthic habitat.

4.6.3. Epibenthic Invertebrates

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 Newtown Creek, pier piles and bulkheads provide the majority of underwater substrates that can support epibenthic communities. The epibenthic communities living on underwater structures impact the ecology of the near shore 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 Newtown Creek as part of the Harborwide Epibenthic Recruitment and Survival FSAP (Hydroqual 2001c). Epibenthic arrays, consisting of multiple 8-inch x 8-inch synthetic plates, were deployed in April 2001 in the upper and middle-portion of Newtown Creek and in the East River near the mouth of the Creek. Plates were retrieved in June (3 months - spring) and September (6 months). A third set of plates was deployed in June 2001 and retrieved in September (3 months – summer). Upon retrieval, the arrays were inspected and weighed and motile organisms clinging to or stuck in the arrays (i.e., crabs and fish) were counted and identified.

In Newtown Creek , 18 taxa were identified on the epibenthic arrays (Table 4-3). The major groups found were sea squirts, tunicates, hydroids, and barnacles. Worms, crabs, and mussels were also found in lesser quantities. The sampling location in upper Newtown Creek had the least number of species collected and lowest weights of organisms. The epibenthic community was dominated by barnacles at this location. The sampling location in the middle of the Creek had greater diversity and abundance than the upstream location, but both the number of species collected and the weights

of organisms were approximately half of what was collected in the East River near the mouth of Newtown Creek. The epibenthic community in the middle of the creek was dominated by sea squirts and hydroids and the community in the East River had similar dominant species but also had tunicates, crabs, and worms.

The number of species collected from the top and bottom arrays was identical at the site near the upper portion of the Creek and both 3-month and 6-month plates had very low diversity and abundance (Tables 4-4 and 4-5). Weights of organisms were greater on the top arrays than on the bottom arrays. There was an increase in the total weight of organisms on the top plate between 3-months and 6-months but this appears to have been caused by an increase in barnacles on the plate. In the middle of Newtown Creek, the number of species was similar between 3-month and 6-month plates but the weight of organisms was much lower on plates that were in the Creek during the summer months. There was a similar decline in the weights of species during the summer months on top plates deployed in the East River near the mouth of Newtown Creek, but the number of species and weight of organisms increased on the bottom plates. At this sampling location, epibenthic diversity and abundance was greater on the top arrays than on the bottom arrays during the two 3-month deployments but was similar between the two arrays after the 6-month deployment. 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 DO associated with the tides and water stratification. The low diversity and abundance of epibenthic organisms on the bottom plate at the upstream location and the loss of organism biomass during the summer months in the middle of the Creek, suggests that one of these factors may be limiting the epibenthic community in Newtown Creek. These limiting factors along with the potential for lower recruitment due to greater distance from the East River and NY/NJ Harbor complex may account for the differences in the observed epibenthic community in Newtown Creek compared to the nearby East River.

Weight of epibenthic organisms collected from suspended single or multi-plate arrays (top or top and bottom) placed near the upper, middle and mouth of Newtown Creek

Phylum	Species	Common Name	Weight (grams)				
			Upper Creek		Mid-Creek	Mouth	
			Top	Bottom	Top	Top	Bottom
Annelida	*Sabella microphthalma (aka. Demonax microphthalmus)*	Fan Worm	--	--	--	0.2	0.2
	Eumida sanguinea	eumida sanguinea	--	--	--	0.1	--
	Hydroides dianthus	Limy Tube Worm	--	0.1	0.2	--	--
	Nereis succinea	Common Clamworm	--	0.1	--	0.1	--
	Polychaeta	Polychaetes	--	--	--	0.1	--
	Annelida Weight Subtotal (grams)		***0***	***0.2***	***0.2***	***0.5***	***0.2***
Arthropoda	*Balanus eburneus*	Ivory Barnacle	7.7	--	1.1	4.1	2.9
	Dyspanopeus sayi	Say Mud Crab	--	--	--	2.8	--
	Gammarus oceanicus	gammarus oceanicus	0.1	--	--	0.1	0.2
	Leptocjeorus pinguis	leptocheirus pinguis	--	--	--	--	0.1
	Panopeus herbstii	Atlantic Mud Crab	--	--	--	2.4	0.6
	Pleustidae	pleustidae	--	0.1	--	--	--
	Anthropoda Weight Subtotal (grams)		***7.8***	***0.1***	***1.1***	***9.4***	***3.8***
Chordata	*Molgula manhattensis*	Sea Grapes (Sea Squirt)	--	--	23.6	27.7	21.6
	Botryllus schlosseri	Golden Star Tunicate	--	--	--	25.1	0.2
	Chordata Weight Subtotal (grams)		***0***	***0***	***23.6***	***52.8***	***21.8***
Cnidaria	*Hydroida*	Medusae	1.5	0.2	5.6	10.8	0.8
	Tubularia	tubularia	--	--	--	0.1	0.1
	Cnidaria Weight Subtotal (grams)		***1.5***	***0.2***	***5.6***	***10.9***	***0.9***
Mollusca	*Crepidula plana*	Eastern White Slippershell	--	--	0.1	--	0.1
	Mytilus edulis	Edible Blue Mussel	--	--	--	0.1	--
	Onchidorididae	Doridoid Nudibranchs	--	--	0.1	--	--
	Mollusca Weight Subtotal (grams)		***0***	***0***	***0.2***	***0.1***	***0.1***
Total Weight of Samples Collected (grams)			**9.3**	**0.5**	**30.7**	**73.7**	**26.8**
Total Number of Species			**3**	**4**	**6**	**13**	**10**

Notes:
* Data compiled from Hydroqual database
* Three sample collection locations (EASTP02, NEWTP01 and NEWTP02)

TABLE 4-4

Total number of all species collected from suspended multi-plate arrays (top and bottom) placed near the upper, middle and mouth of Newtown Creek

Length of Deployment	Total Number of Species				
	Upper Creek		Mid-Creek	Mouth	
	Top	Bottom	Top	Top	Bottom
3 Months (April - June)	2	2	3	6	4
3 Months (June-September)	1	1	3	6	4
6 Months (April - September)	1	1	4	7	7

Notes:
* Data compiled from Hydroqual database
* Three sample collection locations (EASTP02, NEWTP01 and NEWTP02)

TABLE 4-5

Total weight (grams) of all species collected from suspended multi-plate arrays (top and bottom) placed near the upper, middle and mouth of Newtown Creek

Length of Deployment	Total Weight (grams)				
	Upper Creek		Mid-Creek	Mouth	
	Top	Bottom	Top	Top	Bottom
3 Months (April - June)	1.6	0.3	29.4	39.5	1.8
3 Months (June - September)	1.9	0.1	0.5	16.2	7.9
6 Months (April - September)	5.8	0.1	0.8	18.1	17

Notes:
* Data compiled from Hydroqual database
* Three sample collection locations (EASTP02, NEWTP01 and NEWTP02)

4.6.4. Phytoplankton and Zooplankton

As part of the New York Harbor Water Quality Survey, DEP collected plankton samples at a station in the mouth of Newtown Creek (E2A) in the spring, summer and fall from 1991 to 1999. Eighty-six 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). The East River is the source of plankton to Newtown Creek.

Phytoplankton

Phytoplankton are the dominant primary producers in the East River. 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 2004).

A total of 64 species of phytoplankton were collected in the mouth of Newtown Creek over the course of the DEP sampling (Table 4-6). 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), Peridinium sps (dinoflagellates), Rhizosolenia delicatula (diatom), and Prorocentrum redfieldii (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 Newtown Creek over the course of the DEP sampling. Prorocentrum micans (dinoflagellate) is associated with diarrhetic shellfish poisoning and was collected six times. Prorocentrum minimum (dinoflagellate) is associated with toxic shellfish poisoning and shellfish kiss, however was only collected once. Pseudo nitzchia pungens (diatom) is associated with amnesic shellfish poisoning and was collected five times. Although these species are present, they do not represent a threat because shellfish are excluded from the Creek due to poor substrate conditions. These and related species known to be toxic have been found throughout NY Harbor, but have not been associated with mortalities of aquatic life.

Zooplankton

A total of 15 species of zooplankton were collected in the mouth of Newtown Creek over the course of the DEP sampling (Table 4-7). Protozoans and copepods comprised the zooplankton community. Tintinnopsis 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 clausiand 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 DEP 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 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 Newtown Creek or using its waters during the planktonic larval stage. Ichthyoplankton sampling was conducted as part of the Harborwide Ichthyoplankton FSAP (Hydroqual 2001b, Figure 4-5). Sampling was conducted in the upper reach of Newtown Creek in March, May, July and August 2001. 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 18 ichthyoplankton taxa were collected in Newtown Creek and the nearby East River. As expected, the community structure varied seasonally (Table 4-8). The greatest number of species was collected in July, with large numbers of wrasse eggs and goby larvae. In May, diversity was relatively high and very large numbers of cunner and tautog eggs were collected. Fewer species were collected in March and August, which may be related to spawning activity. However, relatively high numbers of sculpin larvae, fourbeard rockling eggs and winter flounder larvae were collected in March, while a total of only eight larvae were collected in August.

The ichthyoplankton community structure also varied spatially within Newtown Creek and the nearby East River (Table 4-9). The sampling location in upper Newtown Creek had the lowest diversity and abundance. Diversity was similar between the sampling locations in the middle of the Creek and in the East River near the mouth of the Creek, but the number of organisms collected was much greater in the East River. Almost all of the numerically dominant ichthyoplankton species (cunner, wrasse, tautog, fourbeard rockling, menhaden) were collected in the East River near the mouth of Newtown Creek. Sculpin were more evenly distributed between the Creek and the East River and gobies were most prevalent in the middle of the Creek. American sand lance was collected in the greatest numbers at the head of the Creek, but the total number was modest compared to the most abundant species.

Ichthyoplankton drift in the water column, thus, their occurrence at a specific location may not correspond to the spawning location. Given the strong tidal currents in the East River and the short residence time for the water moving through the river, ichthyoplankton in the vicinity of Newtown Creek may have traveled a substantial distance from where they were spawned. 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 upper Newtown Creek may have been spawned there. Very few eggs were collected in upper Newtown Creek, almost all of the eggs were collected at the station in the East River near the mouth of Newtown Creek. This suggests limited spawning in Newtown Creek.

Phytoplankton species collected in Newtown Creek

Phylum	Species	Frequency of Collection (%)
Cyanobacteria (Blue-Green Algae)	*Anabaena sps*	4.7
	Anacystis sps	5.8
	Coccomyxis sps	1.2
	Oscillatoria sps	2.3
Bacillariophyta (Diatoms)	*Amphirora sps*	3.5
	Asterionella japonica / Asterionella glaciallis	23.3
	Asterionella kariana	2.3
	Biddulphia aurita	3.5
	Biddulphia longicruris	3.5
	Biddulphia sps	1.2
	Ceratulina bergonii / Certaulina pelagica	1.2
	Chaetoceros debilis	1.2
	Chaetoceros sps	22.1
	Chaetoceros vistualae	3.5
	Cocconies sps	1.2
	Coscinodiscus granii	1.2
	Coscinodiscus sps	7.0
	Cyclotella sps	19.8
	Diatoma sps	2.3
	Ditylum brightsellii	7.0
	Eucampia zoodiacus	16.3
	Fragillaria sps	1.2
	Guinardia flaccida	4.7
	Lauderia borealis	1.2
	Leptocylindrus danicus	1.2
	Lithodesmium undulatum	1.2
	Melosira moniliformis	1.2
	Melosira sulcata	18.6
	Navicula sps	1.2
	Nitzschia closterium	8.1
	Nitzschia longissima	12.8
	Nitzschia pungens / Pseudo nitzchia	5.8

Notes:

* Data compiled from NYCDEP database
* Frequency of collection based upon 86 collection events between 1991 - 1999

Environmental Protection

Phytoplankton species collected in Newtown Creek

Phylum	Species	Frequency of Collection (%)
Bacillariophyta (Diatoms) (continued)	*Nitzschia sps*	9.3
	Pleorosigma sps	11.6
	Rhizosolenia alata	2.3
	Rhizosolenia delicatula	34.9
	Rhizosolenia robusta	1.2
	Rhizosolenia setigera	2.3
	Schroderella delicatula	3.5
	Skeletonema costatum	84.9
	Synedra sps	1.2
	Thalassionema nitzchoides	19.8
	Thalassiosira decipiens	3.5
	Thalassiosira nordenskioldii	23.3
	Thalassiosira rotula	5.8
Dinoflagellata (Dinoflagellates)	*Dinophysis sps*	1.2
	Massartia roundata / katodinium rotundatum	1.2
	Olisthodiscus luteus	1.2
	Peridinium palatonium	7.0
	Peridinium sps	38.4
	Peridinium trochoideum	15.1
	Prorocentrum micans	7.0
	Prorocentrum minimum	1.2
	Prorocentrum redfieldii	32.6
	Prorocentrum scutellum	11.6
	Prorocentrum sps	5.8
Chrysophyta (Golden Algae)	*Chroomonas sps*	1.2
Chlorophyta (Green Algae)	*Ankistrodesmus sps*	7.0
	Chlorella sps	11.6
	Crucigenia sps	1.2
	Hydrodictyon sps	1.2
	Nannochloris atomus	98.8
	Sphaerocystis sps	1.2
	Spirogyra sps	1.2

Notes:

* Data compiled from NYCDEP database

* Frequency of collection based upon 86 collection events between 1991 - 1999

Environmental Protection

Microzooplankton species collected in Newtown Creek

Phylum	Species	Frequency of Collection (%)
Arthropoda	*Nauplius of copepods*	11.6
Protozoa	*Acanthostomelia norvegica*	5.8
	Euglena sps	2.3
	Eutreptia sps	4.7
	Flavella sps	2.3
	Helicostomella sps	2.3
	Hetrocapsa triquetra	1.2
	Salpingella acuminata	1.2
	Steenstrupia steenstrupii	1.2
	Strombidium sps	1.2
	Strombilidium sps	1.2
	Thalassicolla sps	3.5
	Tintinnids sps	5.8
	Tintinnopsis sps	31.4
	Un spec. ciliate	4.7

Notes:
* Data compiled from NYCDEP database
* Frequency of collection based upon 86 collection events between 1991 - 1999

NYC Environmental Protection

Seasonal distribution of fish eggs and larvae collected in Newtown Creek

Species	Common Name	Egg or Larvae	March	May	July	August
Ammodytes americanus	American Sand Lance	Egg				
		Larvae	44			
Anchoa	Anchovies	Egg				
		Larvae			8	
Anchoa mitchelli	Bay Anchovy	Egg		16	16	
		Larvae				
Brevoortia tyrannus	Atlantic Menhaden	Egg				
		Larvae			18	
Clupeidae	Herrings	Egg		164		
		Larvae		18		
Cynoscion regalis	Weakfish	Egg				
		Larvae			2	
Enchelyopus cimbrius	Fourbeard Rockling	Egg	162	8		
		Larvae				
Gasterosteus aculeatus	Threespine Stickleback	Egg				
		Larvae		6		
Gobiidae	True Gobies	Egg				
		Larvae			209	4
Hypsoblennius hentzi	Feather Blenny	Egg				
		Larvae			2	2
Labridae	Wrasses	Egg			2,520	
		Larvae				
Myoxocephalus	Myoxocephalus	Egg				
		Larvae	256			
Prionotus	North American Searobins	Egg			20	
		Larvae				
Pseudopleuronectes americanus	Winter Flounder	Egg				
		Larvae	80			
Scophthalmus aquosus	Windowpane	Egg		48	8	
		Larvae				
Syngnathus fuscus	Northern Pipefish	Egg				
		Larvae			2	2
Tautoga onitis	Tautog	Egg		960		
		Larvae				
Tautogolabrus adspersus	Cunner	Egg		6,044		
		Larvae			6	
Total Eggs Collected			**162**	**7,240**	**2,564**	**0**
Total Larvae Collected			**380**	**24**	**247**	**8**
Total Ichthyoplankton Collected			**542**	**7,264**	**2,811**	**8**

Notes:

* Data compiled from Hydroqual database

* Three sample collection locations (EASTP02, NEWTP01 and NEWTP02)

Environmental Protection

Total number of fish eggs and larvae colleted from Newtown Creek

Species	Common Name	Newtown Creek			
		Upper Creek	Mid- Creek	Mouth	Total
Ammodytes americanus	American Sand Lance	32	8	4	**44**
Anchoa	Anchovies	--	8	--	**8**
Anchoa mitchelli	Bay Anchovy	4	4	24	**32**
Brevoortia tyrannus	Atlantic Menhaden	--	18	--	**18**
Clupeidae	Herrings	--	6	176	**182**
Cynoscion regalis	Weakfish	--	2	--	**2**
Enchelyopus cimbrius	Fourbeard Rockling	--	--	170	**170**
Gasterosteus aculeatus	Threespine Stickleback	4	2	--	**6**
Gobiidae	True Gobies	49	162	2	**213**
Hypsoblennius hentzi	Feather Blenny	--	4	--	**4**
Labridae	Wrasses	2	226	2292	**2520**
Myoxocephalus	Myoxocephalus	128	128	56	**312**
Prionotus	North American Searobins	--	--	20	**20**
Pseudopleuronectes americanus	Winter Flounder	40	--	40	**80**
Scophthalmus aquosus	Windowpane	--	--	56	**56**
Syngnathus fuscus	Northern Pipefish	--	4	--	**4**
Tautoga Onitis	Tautog	6	4	952	**962**
Tautogolabrus adspersus	Cunner	12	86	5952	**6050**
Total Number of Species Sampled		**9**	**14**	**12**	**18**
Total Number of Individuals Collected		**277**	**662**	**9744**	**10683**

Notes:

* Data compiled from Hydroqual database
* Three sample collection locations (EASTP02, NEWTP01 and NEWTP02)

NYC Environmental Protection

4.6.6. Adult and Juvenile Fish

The fish community of Newtown Creek was sampled as part of the East River FSAP (Hydroqual 2001, Figure 4-6). Sampling was conducted in the middle of the Creek in August, when bottom water DO concentrations are at their lowest. Sampling gear included an otter trawl to catch bottom oriented species and a gill net suspended in the water column to capture pelagic species.

A total of 3 fish species were collected with an otter trawl from the Newtown Creek in August 2001 (Table 4-10). Nine weakfish, three striped bass and one winter flounder were collected. Low numbers of invertebrates including blue crabs, brown shrimp, a ctenophore, a mud snail and a hermit crab were collected as incidental catch. This shows that the fish community is very sparse in Newtown Creek during the summer.

4.6.7. Inter-Waterbody Comparison

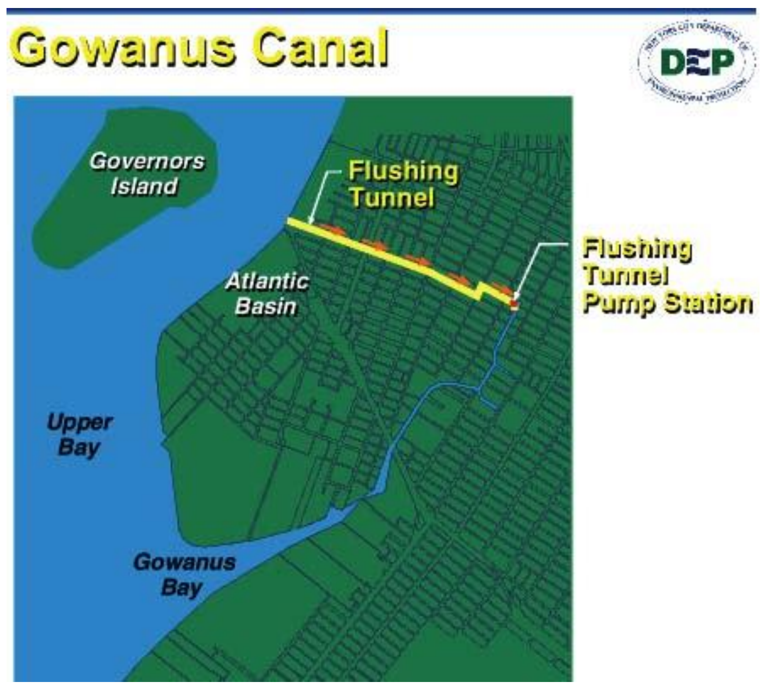
The aquatic communities and water quality of Newtown Creek were compared with those found in the Gowanus Canal (Canal) in order to further evaluate the potential of Newtown Creek to support fish propagation and survival, and to evaluate the interactions of the tributaries with the adjacent waterbody. The FSAP conducted in 2001 included sampling stations located in the Gowanus Canal and Newtown Creek. This study characterized the historic land use, regional contamination, existing water quality and aquatic communities of these two tributaries of the East River. The following sections briefly compare the results from these two tributaries.

The history, development and environmental issues surrounding Newtown Creek and Gowanus Canal are similar. Both waterbodies were formerly long tidal creeks with surrounding wetlands and freshwater inflow from an undeveloped upland. Brooklyn was settled during the 1600’s by the Dutch farming settlements. As the settlements grew, demands on the water bodies increased. During the 1700’s and into the 1800’s the Creek and Canal were modified to support fishing, farming, and general commercial and industrial activities. By the mid-1800’s the physical and ecological characteristics were permanently altered by dredging, straightening, bulk-heading and landfills. Wetlands and open space in the area were replaced with urban developments. The urban developments eliminated the natural watershed for both the Creek and Canal. Widespread paving, building development and city-wide sewers came to replace the freshwater stream flow into the two tidal tributaries. Natural tidal or freshwater wetlands no longer exist within the immediate riparian area of either waterbody.

Due to the urbanization of the greater Brooklyn area, many environmental complications have arisen in Newtown Creek and the Gowanus Canal. In the July 2004 New York Harbor Water Quality Report (Harbor Report), the New York City Department of Environmental Protection (DEP) repeatedly compared the levels of environmental degradation in Newtown Creek to those of Gowanus Canal. On a broad scale, both tributaries are highly susceptible to non-point pollution, including runoff from impermeable paved surfaces, deposition of airborne mercury, nutrients, soot and particulate matter, and leaching from former industrial sites and historic landfills.

The Harbor Report also specifically identifies Newtown Creek and Gowanus Canal as exhibiting “hot spots” of historic pollution, being general “problem areas” for Enterococcus faecium, and having frequent spikes in fecal coliform associated with heavy rainfall and CSO overflow events. The DEP considers historic pollution to be mostly attributed to the history of industrialization along the shores of utilized water bodies. The sediments of the shorelines contain concentrations of various contaminants such as metals, polychlorinated biphenols (PCBs) and other organics. Areas with high contaminant concentrations directly affecting estuarine waterways are thus deemed "hot spots". Until 2004, fecal coliform was used as the primary indicator for water quality by the USEPA. However in 2004, Enterococcus faecium replaced the primary role of fecal coliform as it is believed to, "… provide a higher correlation than fecal coliform with many of the human pathogens often found in sewage."

In addition, the DEC has classified both water bodies as littoral zones. The DEC definition for "littoral zones" is: "shallow water habitat that is not designated as a coastal fresh marsh, intertidal marsh, or coastal shoal, bar or flat and is comprised of tidal water habitats that are less than six feet deep at low tides". The United States Fish and Wildlife Service (USFWS) has classified the entire length of the Gowanus Canal and the small tributaries branching off Newtown Creek, as estuarine, subtidal with an unconsolidated bottom excavated by human activities (E1BULx).Newtown Creek shares many similarities with Gowanus Canal, however there are two important differences in the physical characteristics of these waterbodies that influence their aquatic ecology. One primary difference is that the Gowanus Canal has an embayment at the mouth and Newtown Creek does not. The Gowanus Canal embayment, known as Gowanus Bay, is an interface between the Canal and the Upper New York Bay. In contrast, Newtown Creek is directly influenced by the tidal flows of the East River and has no embayment to buffer the flow of water and biological communities.The second major difference between Newtown Creek and the Gowanus Canal is the existence and operation of a flushing tunnel feeding Gowanus Canal. In 1911 the Gowanus Canal Flushing Tunnel construction was completed beneath Douglass Street and Degraw Street in South Brooklyn (see inset). The tunnel is approximately 6,280 feet long and 12 feet in diameter. Through the rotations of a large turbine in the associated pumphouse near the head of Gowanus Canal, between 150 and 300 million gallons of water per day is transported from Buttermilk Channel to the head of the Canal.



Gowanus Canal Flushing Tunnel Alignment

Total number juvenile and adult fish and invertebrate bycatch collected from the middle of Newtown Creek

Group	Species	Common Name	Newtown Creek
Fish	*Morone saxatilis*	Striped Bass	3
	Cynoscion regalis	Weakfish	9
	Pseudopleuronextes americanus	Winter Flounder	1
Invertebrates	*Ctenophora*	Sea Walnuts	1
	Ilyanassa obsoleta	Eastern Mudsnail	1
	Penaeus aztecus	Northern Brown Shrimp	2
	Pagurus longicarpus	Longwrist Hermit	1
	Callinectes sapidus	Blue Crab	6
	Morone saxatilis	Striped Bass	3
	Cynoscion regalis	Weakfish	9
	Pseudopleuronextes americanus	Winter Flounder	1

Notes:

* Data compiled from Hydroqual database

* One sample collection location (NEWTP01)

Environmental Protection

Benthic Comparison

The fresh, oxygenated water brought to the head of the Canal also brings in a wide variety of biota from the Buttermilk Channel. The Flushing Tunnel was in operation from 1911 until the 1960's when a mechanical failure took place. The tunnel sat dormant for over thirty years. Dredging and repairs to the Flushing Tunnel began in 1992 and concluded with the restart of operations in April 1999. The tunnel now operates 24 hours per day, seven days per week bringing Upper Bay water to the head of the Gowanus Canal. Newtown Creek lacks an exterior source of water which could enhance water quality and provide organisms which could take advantage of enhanced water quality.

Benthic sampling was conducted in Gowanus Canal as part of the Subtidal Benthos and Ichthyoplankton Characterization Field Sampling and Analysis Program (Hydroqual 2003a). Three locations in the Canal were sampled: the head of the Canal near the flushing tunnel, the middle of the Canal, and upstream of the mouth of the Canal (Figure 4-9). Results of this sampling effort demonstrate the influence of the flushing tunnel on the biological communities of the Canal. The location at the head of the Canal had the greatest number of species collected (20). Arthropods and mollusks comprised approximately half of the species collected and Annelid worms comprised the other half. Species diversity and abundance were similar between the middle of the Canal and the location upstream of the mouth of the Canal, but both locations had approximately half the number of species as were collected near the flushing tunnel, and the benthic community was dominated by Annelid worms at both downstream locations.

The number of benthic species collected at the head of Gowanus Canal was over five times the number of species collected at the upstream locations of Newtown Creek and twice that collected from locations in the middle of the Creek (Table 4-11). Species composition was similar at the "middle" sampling locations in Gowanus Canal and Newtown Creek. The benthic community at the sampling locations "upstream of the mouth" of Newtown Creek was more diverse than at the similar sampling location in Gowanus Canal. The greater diversity was due to a greater number of Arthropod species, but overall both communities were dominated by Annelid worms. This suggests that the flushing tunnel greatly improves the conditions at the head of Gowanus Canal compared to Newtown Creek. The effects may diminish toward the middle of the Canal, as the benthic community in the middle of the two waterbodies was similar.

As in Newtown Creek, the epibenthic community was sampled in Gowanus Bay using multi-plate arrays as part of the Harborwide Epibenthic Recruitment and Survival FSAP (Hydroqual 2001c). Epibenthic arrays were deployed in one location in Gowanus Bay, near the mouth of Gowanus Canal. Not surprisingly, the total number of species and weights of organisms on the top and bottom plates were very similar to those found in the East River near the mouth of Newtown Creek (Table 4-12). Both sites had similar species diversity on both top and bottom plates (10-13 species) and both were dominated by sea squirts and tunicates. At both locations, species composition was similar between the top and bottom plates, but the total weight of organisms was much greater on the top plates (Tables 4-13 and 4-14). Similarities between the epibenthic communities are likely due to the fact that both sampling locations were located in open water areas (East River and Gowanus Bay) compared to the upper reaches of the Creek and the Canal, where water quality conditions are expected to be more limiting.

The ichthyoplankton community in Gowanus Canal and Bay was sampled in 2003 as part of the Subtidal Benthos and Ichthyoplankton Characterization Field Sampling and Analysis Program (Hydroqual 2003a). Ichthyoplankton were collected in June and July from two locations: the middle of Gowanus Canal and from Gowanus Bay. The greatest number of species and organisms were collected in Gowanus Bay in June. Anchovy and bay anchovy eggs dominated the ichthyoplankton in June. In July, a greater number of eggs and larvae were collected in the middle of Gowanus Canal than were collected in Gowanus Bay. Wrasse eggs and bay anchovy eggs comprised the majority of ichthyoplankton caught. Comparison of the July sampling results between the middle of Gowanus Canal and the middle of Newtown Creek shows different species composition in the two areas (Table 4-15). Both communities were dominated by wrasse eggs, but Gowanus Canal also had relatively large numbers of bay anchovy eggs, which were absent in Newtown Creek and Newtown Creek had a relatively large number of true goby larvae, which were absent in Gowanus Canal. In addition, a greater number of species were collected as larvae in Newtown Creek while a greater number of species were collected as eggs in Gowanus Canal. These differences could be due to differences in recruitment between the two water bodies, with the flushing tunnel having an important influence on ichthyoplankton.

The significance of maintaining water circulation within confined areas of the harbor is evident in the data collected from Newtown Creek and Gowanus Canal. Because of its complex channels, Newtown Creek will likely have a limited aquatic life community. Circulation of water from the East River is constrained by the configuration of Newtown Creek, thus the movements of planktonic life forms will be limited.

4.6.8. Fish and Aquatic Life Uses

Fish and aquatic life use of Newtown Creek 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, including non-CSO sources of water quality degradation and especially physical habitat, will remain as limiting factors. In the long term, 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 3.0 mg/L and that 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 habitats 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 area of Newtown Creek at its mouth and upstream to near the middle of the creek. Other reaches in the side channels and the upper end of the creek will have limited aquatic life use under existing conditions.

The use of Newtown Creek by aquatic life is apparently limited by a variety of factors including low D.O., chemical contaminants and degraded physical habitat conditions. The loss of extensive fringing wetlands, diverse natural shorelines, and benthic habitat suitable for colonization, has substantially reduced biological diversity. 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 (NYCDOT, 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 confirm the general applicability of the relationship of TOC to benthic diversity. However, as long as the substrate is dominated by fine grain material, many invertebrate species will be excluded. Although the productivity of soft sediments can be high, because of a lack of diversity in the benthic community, many fishes will make limited use of the habitat due to a lack of their preferred prey.

Potential gains in aquatic life use in Newtown Creek are contingent upon improvements in water quality, sediment quality and physical habitat. The aquatic life community in Gowanus Canal improved quickly after the restart of the flushing tunnel, illustrating the importance of both adequate D.O. and a source of aquatic life recruitment. However, Gowanus Canal remains limited by the conditions in Gowanus Bay and the degraded physical habitat conditions represented by the continuous bulkheading, which provides little physical habitat diversity. Newtown Creek with improved D.O. conditions would have more diversity and numbers of individuals in the community, but it would still be a relatively poor habitat for aquatic life.

Use of Newtown Creek by aquatic life in the near future will be limited by the poor water and sediment quality that prevents aquatic life from recolonizing the area. If these limitations can be corrected or minimized, angling on limited basis would be possible. Desirable species can be expected to move into the creek. 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 the enhancement of 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. While these trends in water quality improvement continue, the significance of small areas of non-compliance with water quality standards will be minimized.

The extensive development of the shorelines for industrial, commercial and residential uses in Newtown Creek is a factor which places limits on aquatic habitat availability and quality. In a highly modified system such as Newtown Creek, the protection and use of aquatic resources need to reflect that water quality and habitat will always be less than ideal due to irreversible changes in the watershed.

Abundance (#/m^2) of benthic organisms collected and TOC content of the sediment (%) at each sampling location from Newtown Creek and Gowanus Canal

Phylum	Lowest Taxonomic Order	Newtown Creek								Gowanus Canal		
		Mouth (East River)	Upstream of mouth	Down-stream of middle	Middle	Upstream of middle	Head of Maspeth	Mouth of English Kills	Head of English Kills	Upstream of mouth	Middle	Head
Annelida	*Annelida*		1131	2275	1365		52		39	1840	1685	1000
	Ampharetidae											5
	Capitellidae	40			234	56				835	3185	285
	Cirratulidae											5
	Eteone		13	1755	130					35		295
	Glycera			13								
	Harmothoe		13									
	Neanthes succinea		39							20	5	50
	Nephtys	8			13							
	Oligochaeta		2015	2990	221		78		39	730	855	95
	Ophelia		325	26							5	65
	Phyllodocidae					8						5
	Polychaeta	120										
	Polydora		52	39	52					85	30	690
	Scoloplos		507	130						5		55
	Spionidae					320						
	Streblospio benedictii		91	2470	2275							90
	Tharyx	8										
	Trochophore									110		
Arthropoda	*Ampeliscidae*		13	13								15
	Amphipoda	16										15
	Copepoda				52		13	26				
	Crangonidae		13	13								95
	Cumacea			39								40
	Decapoda											10
	Gammaridae									10	10	
	Idoteidae		13									5
	Insecta								13		5	
	Parametopella cypris		13									
	Unciola		39		13							30
Mollusca	*Bivalvia*											5
	Mulinia lateralis								13			
	Nassarius trivittatus					80						
Total Number of Species		**5**	**14**	**11**	**9**	**4**	**3**	**1**	**4**	**9**	**8**	**20**
Total Individuals per Meter^2		**192**	**4277**	**9763**	**4355**	**464**	**143**	**26**	**104**	**3670**	**5780**	**2855**

Notes:
* Data compiled from Hydroqual database
* Eleven sample collection locations (EASTB02, NEWTB16, NEWTB11, NEWTB09, NEWTB01, NEWTB06, NEWTB05, NEWTB02, GOWCB05, GOWCB03, and GOWCB01)

Weight of epibenthic organisms collected from suspended single or multi-plate arrays (top or top and bottom) place near the mouth of Gowanus Canal

Phylum	Species	Common Name	Weight (grams) Mouth Top	Weight (grams) Mouth Bottom
Annelida	*Eumida sanguinea*	eumida sanguinea	--	0.1
	Nereis succinea	Common Clamworm	0.2	0.1
	Sabella microphthalma (aka. Demonax microphthalmus)	Fan Worm	0.2	0.1
	Annelida Weight Subtotal (grams)		***0.4***	***0.3***
Arthropoda	*Ampithoidae*	ampithoidae	0.1	--
	Balanus eburneus	Ivory Barnacle	1.5	0.7
	Dyspanopeus sayi	Say Mud Crab	0.7	5.6
	Leptocheirus pinguis	leptocheirus pinguis	0.1	--
	Panopeus herbstii	Atlantic Mud Crab	0.2	--
	Xanthidae	Mud Crab	--	0.1
	Anthropoda Weight Subtotal (grams)		***2.6***	***6.4***
Chordata	*Botryllus schlosseri*	Golden Star Tunicate	28.9	20
	Molgula Manhattensis	Sea Grapes (Sea Squirt)	27.3	0.8
	Chordata Weight Subtotal (grams)		***56.2***	***20.8***
Cnidaria	*Diadumene lineata (aka Haliplanella lineata)*	Orangestriped Green Anenome	--	0.1
	Hydroida	Medusae	0.2	0.1
	Cnidaria Weight Subtotal (grams)		***0.2***	***0.2***
Mollusca	*Crepidula plana*	Eastern White Slippersnail	--	0.1
	Mytilus edulis	Edible Blue Mussel	0.1	0.1
	Mollusca Weight Subtotal (grams)		***0.1***	***0.2***
Total Weight of Samples Collected (grams)			**59.5**	**27.9**
Total Number of Species			**11**	**12**

Notes:
* Data compiled from Hydroqual database
* One sample collection location (GOWCP01)

NYC Environmental Protection

Epibenthos Comparison

TABLE 4-13 (compare with Table 4-4)
Total number of all species collected from suspended multi-plate arrays (top and bottom) placed near the mouth of Gowanus Canal

Length of Deployment	Total Number of Species	
	Mouth	
	Top	Bottom
3 Months (April - June)	7	4
3 Months (June - September)	6	9
6 Months (April - September)	6	4

Notes:
* Data compiled from Hydroqual database
* One sample collection location (GOWCI01)

TABLE 4-14 (compare with Table 4-5)
Total weight (grams) of all species collected from suspended multi-plate arrays (top and bottom) placed near the mouth of Gowanus Canal

Length of Deployment	Total Weight (grams)	
	Mouth	
	Top	Bottom
3 Months (April - June)	29	15.7
3 Months (June - September)	3.1	3.1
6 Months (April - September)	27.4	6.4

Notes:
* Data compiled from Hydroqual database
* One sample collection location (GOWCI01)

NYC Environmental Protection

Seasonal distribution of fish eggs and larvae collected in Newtown Creek and Gowanus Canal

Species	Common Name	Egg or Larvae	Gowanus Canal				Newtown Creek
			Mouth (June)	Middle (June)	Mouth (July)	Middle (July)	Middle (July)
Anchoa	Anchovies	Egg	117	55			
		Larvae	5				8
Anchoa mitchelli	Bay Anchovy	Egg	219		47	85	
		Larvae			1	13	
Brevoortia tyrannus	Atlantic Menhaden	Egg	4	1			
		Larvae	13				18
Cynoscion regalis	Weakfish	Egg					
		Larvae					2
Gobidae	True Goby	Egg					
		Larvae					158
Hypsobloennius hent	Feather Blenny	Egg					
		Larvae					2
Labridae	Wrasse	Egg				135	226
		Larvae	81				
Menidia menidia	Atlantic Silverside	Egg					
		Larvae			3		
Prionotus	North American Searobin	Egg			1	2	
		Larvae					
Sciaenidae	Roncadores	Egg	8	8	7	6	
		Larvae					
Syngnathus fuscus	Northern Pipefish	Egg					
		Larvae					2
Tautogolabrus adspersus	Cunner	Egg					
		Larvae					6
Total Number of Species Collected			**5**	**3**	**4**	**4**	**8**
Total Egg Samples Collected			**348**	**64**	**8**	**143**	**226**
Total Larvae Samples Collected			**99**	**0**	**4**	**13**	**196**
Total Samples Collected			**447**	**64**	**12**	**156**	**422**

Notes:

* Data compiled from Hydroqual database

* Two sample collection location, (GOWCI02, GOWC103)

Environmental Protection

Icthyoplankton Comparisons

4.7. SENSITIVE AREAS

Federal CSO Policy requires that the long-term CSO control plan give the highest priority to controlling overflows to sensitive areas. For such areas, the CSO Policy indicates the LTCP should: (a) prohibit new or significantly increased overflows; (b) eliminate or relocate overflows that discharge to sensitive areas if physically possible, economically achievable, and as protective as additional treatment, or provide a level of treatment for remaining overflows adequate to meet standards; and (c) provide assessments in each permit term based on changes in technology, economics, or other circumstances for those locations not eliminated or relocated (USEPA, 1995a). The policy defines sensitive areas as:

- 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 habitat;
- Water with primary contact recreation; and
- Additional areas determined by the Permitting Authority (i.e. the DEC).

The last item in the list was derived from the policy statement that the final determination should be the prerogative of the NPDES Permitting Authority. The Natural Resources Division of the DEC was consulted during development of the assessment approach, and provided additional sensitive areas for CSO abatement prioritization based on local environmental issues (Vogel, 2005). Their response listed the following: Jamaica Bay; Bird Conservation Areas; Hudson River Park; 'important tributaries' such as the Bronx River in the Bronx, and Mill Richmond, Old Place, and Main Creeks in Staten Island; the Raritan Bay shellfish harvest area; waterbodies targeted for regional watershed management plans (Newtown Creek and Gowanus Canal).

The federal CSO Control Policy specifies a consideration of sensitive areas at a variety of steps in developing and implementing a long-term control plan (USEPA, 1994). The following reviews the CSO Control Policy's sensitive areas specifications in further detail and their applicability to long-term control planning for the Newtown Creek waterbody.

There are no Outstanding National Resource Waters, National Marine Sanctuaries, public drinking water intakes or their designated protection areas, or shellfish beds within the Newtown Creek waterbody.

There are no threatened or endangered species or their designated critical habitat within the Newtown Creek waterbody.

The Newtown Creek, its tributaries and branches, are not designated by the State of New York for recreational uses. There are no primary contact recreation waters such as bathing beaches in the waterbody.

The majority of riparian areas are zoned for industrial or manufacturing uses, and all of the waterbody, except for the mouth of Newtown Creek, is included in the Newtown Creek Significant Maritime and Industrial Area. As discussed in Section 2.2, an SMIA is a designated area in which industrial or maritime activity is encouraged, such as waterborne and airborne cargo and passenger transportation, industrial activity, and municipal and public utility services. These designated uses imply an absence of sensitive areas. Working waterfront uses have locational requirements that make portions of the coastal zone especially valuable as industrial areas. This most likely precludes future designation for primary contact recreational uses in the waterbody due to the potential use conflict it would represent.

The DEC's determination that the Newtown Creek waterbody as a whole is a sensitive area. The sensitive area designation is intended to provide a prioritization for controlling overflows. For such an area, the LTCP should either (a) prohibit new or significantly increased overflows or (b) eliminate or relocate overflows that discharge to sensitive areas if physically possible and economically achievable, unless elimination or relocation creates more environmental impact than continued discharge, with additional treatment as necessary to meet water quality standards. However, the designation does not assist in prioritizing outfalls or evaluating alternatives to addressing CSO discharges within the waterbody itself and therefore, prioritization of goals, and selection of control alternatives and their implementation can be driven by those that most reasonably attain maximum benefit to water quality throughout the Newtown Creek, its tributaries, and branches. Additionally, this waterbody/watershed assessment and planning effort includes alternatives which prohibit new or significantly increased overflows, and eliminates or relocates overflows that discharge to the waterbody in accordance with the requirements of Federal CSO Policy for sensitive areas.

NO TEXT ON THIS PAGE

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 complex. These discharges result in localized water-quality problems such as periodically high levels of coliform bacteria, nuisance levels of floatables, depressed DO, and, in some cases, sediment mounds and unpleasant odors.

The City of New York is committed to its role as an environmental steward of the New York Harbor and began addressing the issue of CSO discharges in the 1950s. To date, DEP has spent or committed over $2.1 billion in its Citywide CSO abatement program. As a result of this and other ongoing programs, water quality has improved dramatically over the past 30 years (DEP Harbor Survey Annual Reports). Implementation of many of these solutions within the current DEP 10-year capital plan will continue that trend as DEP continues to address CSO-related water quality issues through its Citywide 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 DEP 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 WWTP, a 12-million gallon CSO retention facility, constructed on a tributary to Jamaica Bay. Completed in 1972, this project was one of the first such facilities constructed in the United States. Shortly thereafter, New York City was designated by the USEPA to conduct an Area-Wide Wastewater Management Plan authorized by Section 208 of the then recently enacted CWA. This plan, completed in 1979, identified a number of urban tributary waterways in need of CSO abatement throughout the City. 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, DEP re-invigorated its CSO facility-planning program in accordance with DEC-issued SPDES permits for its WWTPs with a project in Flushing Bay and Creek. In 1985, a Citywide 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 and resulted in a series of detailed, area-specific plans.

In 1989, DEP initiated the Citywide 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 determined that medical wastes were a small component of the full spectrum of material found in metropolitan area waters and beach wash-ups and that the likely source of the medical wastes was illegal dumping. The study also found that, aside from natural materials and wood from decaying piers and vessels, the primary component of the floatable material is street litter in surface runoff that is discharged to area waters via CSOs and storm sewers. The Floatables Control Program is discussed in Section 5.4.

5.2. CITYWIDE CSO ABATEMENT ORDERS (1992, 1996, 2005, 2008, 2009)

In 1992, DEC and DEP entered into the original CSO Administrative Consent Order (1992 ACO). As a goal, the 1992 ACO required DEP to develop and implement a CSO abatement program to effectively address the contravention of water quality standards for coliforms, DO, 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 1992 ACO was modified in 1996 to add a program for catch basin cleaning, construction, and repair to further control floatables.

The Flushing Bay and Paerdegat Basin CSO Retention Tanks were included in the 1992 ACO. In addition, two parallel tracks were identified for CSO planning purposes. Track 1 addressed DO (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. Open waters are defined as the Inner and Outer Harbors as well as Jamaica Bay.

In accordance with the 1992 ACO, DEP 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 number of planned retention tank facilities was reduced from eight to six during the CSO facility planning phase. The Interim Floatables Containment Program was fully developed and implemented. The Corona Avenue Vortex Facility (CAVF) pilot project for the floatables and settleable solids control was designed and implemented. The City’s 141,000 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 were completed in 2009.

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 amendments to some of the original CSO Facility Plans included in the 1992 ACO and the development of additional CSO Facility Plans in 1999.

DEP and DEC negotiated a new Consent Order that was signed January 14, 2005 that supersedes the 1992 Order and its 1996 Modifications with the intent to bring all DEP CSO-related matters into compliance with the provisions of the Clean Water Act and Environmental Conservation Law. The new Order, noticed by DEC in September 2004, contains requirements to evaluate and implement CSO abatement strategies on an enforceable timetable for 18 waterbodies and, ultimately, for Citywide long-term CSO control in accordance with USEPA CSO Control Policy. DEP and DEC also entered into a separate Memorandum of Understanding to facilitate water quality standards reviews in accordance with the CSO Control Policy. The 2005 Consent Order was modified in 2008 and 2009. Table 5-1 presents the design and construction milestone dates for capital projects in the most current CSO Consent Order.

Table 5-1. CSO Consent Order Milestone Dates for Capital Projects

Planning Area	Project	Design Completion	Construction Completion
Alley Creek	Outfall & Sewer System Improvements	Mar 2002	Dec 2006
	CSO Retention Facility	Dec 2005	Dec 2009[1]
Outer Harbor	Regulator Improvements – Fixed Orifices	Apr 2005	Jul 2008
	Regulator Improvements – Automation	Nov 2006	Jun 2010
	Port Richmond Throttling Facility	Aug 2005	Nov 2009 as modified
	In-Line Storage (Deleted per 2008 CSO Consent Order)	Nov 2006	Deleted
Inner Harbor	Regulator Improvements – Fixed Orifices	Sep 2002	Apr 2006
	Regulator Improvements – Automation	Nov 2006	Jun 2010
	In-Line Storage	Nov 2006	Aug 2010
	Gowanus Flushing Tunnel Modernization	-	Sep 2014
	Gowanus Pumping Station Reconstruction	-	Sep 2014
	Dredging Gowanus Canal	Dec 2010	See Note 1
Paerdegat Basin	Influent Channel	Mar 1997	Feb 2002
	Foundations and Substructures	Aug 2001	Dec 2009
	Structures and Equipment	Nov 2004	May 2011
	Dredging Paerdegat Basin	See Note 2	See Note 2
Flushing Bay/Creek	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	Sep 2009
	CS4-5 Tide Gates	Nov 1999	Apr 2002
	CD-8 Manual Sluice Gates	May 2003	Jun 2005
	Tallman Island WWTP 2xDDWF	Dec 2010	Jul 2015
Jamaica Tributaries	Meadowmere & Warnerville DWO Abatement	May 2005	Jul 2009 as modified
	Expansion of Jamaica WWTP Wet Weather Capacity	Jun 2011	Jun 2015
	Destratification Facility	Dec 2007	Mar 2012
	Laurelton & Springfield Stormwater Buildout Drainage Plan	May 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

Table 5-1. CSO Consent Order Milestone Dates for Capital Projects

Planning Area	Project	Design Completion	Construction Completion
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	Feb 2012
	26th Ward Wet Weather Expansion	Jun 2010	Dec 2015
	Rockaway WWTP 2xDDWF	-	Dec 2017

Notes: 1) A modification to the completion date from 12/31/2009 to 11/10/2010 was submitted to DEC on 10/30/2009 and a revised modification request was submitted for an extension to 2/28/2011.
2) Dredging must be completed with 5 years of final permit issuance.
3) Design Completion = Permit + 18 months; Construction Completion = Permit + 60 months.

5.3. BEST MANAGEMENT PRACTICES (BMPS)

The SPDES permits for all 14 WWTP in New York City require the DEP to report annually on the progress of 14 BMPs related to CSOs. The BMPs are equivalent to the Nine Minimum Controls (NMCs) required under the USEPA National Combined Sewer Overflow policy, which were developed by the USEPA to represent best management practices that would serve as technology based CSO controls. They were intended to be determined on a best professional judgment basis by the NPDES permitting authority and to be the best available technology based controls that could be implemented within two years by permittees. USEPA developed two guidance manuals that embodied the underlying intent of the NMCs (USEPA 1995b, 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 CSO BMP Annual Reports, which were initiated in 2004 for the reporting year 2003, DEP provides brief descriptions of the Citywide programs and any notable WWTP 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 WWTP 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
- DEC review of inspection program reports.

DEP reports on the status of the Citywide 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 were performed. Table 5-2 lists all of the maintenance preformed on regulators within the Newtown Creek service area in the 2010 calendar year.

Table 5-2. CSO Maintenance and Inspection Programs in Newtown Creek (2010)

Regulator	Description of Work[1]
BB-L1	Preventative tide gate maintenance; Adjusted tide gate; removed plastic bags and rags from regulator chamber; Removed bricks and debris from diversion chamber
BB-L2	Server down sent crew OK
BB-L3	Preventative tide gate maintenance; hosed diversion and regulator chamber; removed debris plastic bags, bottles and wood from diversion chamber
BB-L3B	Preventative tide gate maintenance; removed debris car tire from tide gate chamber
BB-L3C	Preventative tide gate maintenance
BB-L5	Preventative tide gate maintenance; cleared partial blockage in diversion and regulator chambers blacktop
BB-L6	Construction of the Dutch Kills/Review Avenue Bridge
BB-L7	Preventative tide gate maintenance
BB-L8	Preventative tide gate maintenance; removed large debris from tide gate chamber; partial blockage removed rocks and rags from diversion chamber
BB-L9	Preventative tide gate maintenance; removed debris wood and bottles from regulator chamber; removed debris from tide gate; removed debris from tide gate; partial blockage removed bottles and rags regulator and diversion chambers; adjusted tide gate; removed debris bottles from regulator chamber; removed debris from tide gate; removed debris from tide gate
BB-L10	Preventative tide gate maintenance; removed debris from tide gate
BB-L11	Preventative tide gate maintenance; removed debris from tide gate; removed debris rocks and bricks diversion chamber
BB-L12	Preventative tide gate maintenance; removed debris from tide gate; hosed out tide gate chamber
BB-L12A	Preventative tide gate maintenance; partial blockage rags in regulator chamber; removed partial blockage rags diversion chamber; removed debris from tide gate; removed rags and wood diversion chamber; cleared partial blockage rags in regulator chamber; cleared partial blockage diversion chamber
BB-L15	Preventative tide gate maintenance; removed debris from tide gate; removed rocks grit bricks dirt from diversion and regulator chamber
BB-L16	Preventative tide gate maintenance; removed debris from tide gate
BB-L17	Preventative tide gate maintenance; removed debris from tide gate
BB-L18	Preventative tide gate maintenance; reattached pull chain to the tide gate; changed zerk and nipple for grease; removed debris from tide gate
BB-L19	Preventative tide gate maintenance; removed debris from tide gate; removed partial blockage rags in diversion chamber
BB-L20	Preventative tide gate maintenance; removed debris from tide gate; removed debris from diversion chamber; removed partial blockage sticks and rags diversion and regulator chambers
BB-L22A	Preventative tide gate maintenance; removed debris from tide gate; construction debris cannot access

Table 5-2. CSO Maintenance and Inspection Programs in Newtown Creek (2010)

Regulator	Description of Work[1]
	the covers
BB-L23	Preventative tide gate maintenance; cleared partial blockage in diversion and regulator chambers rags; removed debris from tide gate; server down sent crew OK; manual gate alarm sent crew removed partial blockage diversion and regulator chambers wood and rags; manual gate closing alarm sent crew OK; removed partial blockage diversion and regulator chambers wood and rags; removed debris from top of tide gate
BB-L26	Removed partial blockage regulator chamber rags; removed partial blockage diversion and regulator chambers rags
BB-L27	Preventative tide gate maintenance; removed timber from drop pipe; partial blockage diversion and regulator chambers rags; removed debris from tide gate; removed wood from diversion chamber; removed debris from tide gate
BB-L29	Cleared full blockage in sluice gate; removed partial blockage in drop pipe; regulator chamber flooded drop pipe blockage router/flusher truck called Q7
BB-L29A	Preventative tide gate maintenance; removed partial blockage diversion chamber to interceptor blocked rags wood
BB-L31	Preventative tide gate maintenance; tide gate held open by debris removed function ok; removed debris from tide gate; removed partial blockage diversion chamber rages; replaced chain
BB-L32	Preventative tide gate maintenance
BB-L32A	Preventative tide gate maintenance
BB-L33	Preventative tide gate maintenance; removed debris from tide gate; adjusted tide gate
BB-L34	Removed blockages in both drop pipes
BB-L4	Preventative tide gate maintenance; removed debris from tide gate; server down sent crew OK
BB-L21	Preventative tide gate maintenance; removed debris from tide gate; server down sent crew OK; no com sent crew OK; removed debris from middle tide gate
BB-L22	Preventative tide gate maintenance; removed debris from tide gate; removed debris from tide gate wood 2x4; server down sent crew OK; level alarm sent crew OK; no com sent crew OK; no com sent crew OK hosed diversion to free up sensor; removed debris from diversion chamber
BB-L30	Preventative tide gate maintenance; removed debris from tide gate; no com sent crew OK; server down sent crew OK; no com sent crew removed wood from tide gate; removed debris from top of tide gate and diversion chamber
BB-L32B	Cleared partial blockage in the flow
NC-Q1	Newtown Creek lost power several hours checked all holes
NC-Q2	Newtown Creek lost power several hours checked all holes
NC-B1	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes
NC-B2	Preventative tide gate maintenance
NC-B3	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes
NC-B4	Newtown Creek lost power several hours checked all holes
NC-B5	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes; cleaned seals and greased and exercise gates; greased arms and gates. washed down
NC-B5A	Preventative tide gate maintenance; greased and cleaned gate; greased arms and gates. washed down
NC-B6	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes; washed down diversion and tide gate chamber; removed wood and debris from tide gates
NC-B6A	Preventative tide gate maintenance
NC-B7	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes
NC-B8	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes
NC-B9	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes; greased and cleaned gate
NC-B10	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes; cleaned seals and greased hinges; greased arm and gate
NC-B11	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes

Table 5-2. CSO Maintenance and Inspection Programs in Newtown Creek (2010)

Regulator	Description of Work[1]
NC-B12	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes; cleaned seals and greased hinges
NC-B13	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes; flushed line to drop pipe and cleaned diversion chamber greased arms and gate
NC-B14	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes; removed rocks and bricks from diversion chamber
NC-B15	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes; greased and exercised gates
NC-B16	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes
NC-B17	Preventative tide gate maintenance; Newtown Creek lost power several hours checked all holes
(1) As listed in the SPDES Permit for the 14 Wastewater Treatment Plants, CY2009 CSO BMP Annual Report Attachment A, 2011	

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. DEP provides general information describing the status of Citywide SCADA, regulators, tide gates, interceptors, and collection system cleaning in the CSO BMP Annual Report. See Table 5-2 for details on maintenance performed in 2010 at regulators within the Newtown Creek drainage area.

Several interceptors in the Newtown Creek service area were cleaned as part of the NMC 2 requirement. Table 5-3 summarizes interceptor cleaning preformed in 2010.

Table 5-3. Interceptor Cleaning in Newtown Creek (2010)

Description	Size (ft)	Length (ft)	Task completed
Newtown Creek WWTP	Various	Various	Removed 38 cubic yards
Bowery Bay WWTP	Various	Various	Removed 100 cubic yards

5.3.3. Maximize Flow to WWTP

This BMP addresses NMC 4 (Maximizing Flow to the Publicly Owned Treatment Works) and reiterates the WWTP operating targets established by the SPDES permits with regard to the ability of the WWTP to receive and treat minimum flows during wet weather. The collection systems are required to deliver and the WWTPs are required to accept the following flows and provide the following level of treatment with the exception of Newtown Creek that is being upgraded to treat 2.25xDDWF and has no primary treatment. Therefore, a portion of the wet weather flow will bypass aeration and go directly to the final settling tanks and then to disinfection.

- Receipt of flow through the headworks of the WWTP: 2xDDWF;
- Primary treatment capacity: 2xDDWF; and
- Secondary treatment capacity: 1.5xDDWF.

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 DEC approval of the Wet Weather Operating Plan should any physical limitations in flow delivery be detected.

In addition to describing WWTP upgrades and efforts underway to ensure appropriate flows to all 14 WWTPs, the BMP Annual Report provides analysis of the largest 10 storms of the year and WWTP flow results for each of these storms at least during the peak portions of the events.

According to the CY2010 Annual BMP Report, the Bowery Bay WWTP exceeded its reported capacity during 306 hours of 2010. The Newtown Creek WWTP exceeded its reported capacity during 120 hours of 2010. A summary of each plant's performance during the top ten storm events is summarized in Table 5-4 below.

Table 5-4. WWTP 2010 Performance

Plant	Permitted Capacity(1)	Top-Ten Storm Maximum			Top-Ten Storm Average		
		Reported Capacity(2)	Sustained Flow(3)	Peak Flow(4)	Reported Capacity(5)	Sustained Flow(6)	Peak Flow(7)
Bowery Bay	300	220	253	296	200 - 220	234	262
Newtown Creek	620(8)	542	621	653	464 - 542	519	590

(1) **Permitted Capacity** represents the design wet-weather capacity of the WWTP, except as noted. The design wet-weather capacity is typically equal to two times design dry-weather flow (2xDDWF). The design capacity is applicable when all process units are in service. Construction and repair activities can temporarily reduce capacity.

(2) **Maximum Reported Capacity** represents the single largest WWTP capacity reported by the WWTP for any of the top ten storms. Capacities reported by the WWTP are based on the process units in service during each storm and area in accordance with each WWTP's approved wet-weather operating plan. Process units may be taken out of service during construction for upgrades mandated by Consent Orders or for other reasons such as emergency repairs. If all process units are in service during a storm, the reported capacity equals the design capacity.

(3) **Maximum Sustained Flow** is the largest wet-weather "sustained flow" that occurred during any of the top ten storms. Sustained flows represent the average hourly WWTP flow during WWTP throttling periods, or for events with no throttling, the average hourly flow over at least 3 hours including the peak wet-weather flow.

(4) **Maximum Peak Flow** represents the highest hourly flow observed during the top ten storms.

(5) **Average Reported Capacity** represents the average of the capacities reported by the WWTP for all top ten storms. Capacities reported by the WWTP are based on the process units in service during each storm and are in accordance with each WWTP's approved wet-weather operating plan. Process units may be taken out of service during construct for upgrades mandated by Consent Orders or for other reason such as emergency repairs. If all process units are in service during a storm, the reported capacity equals the design capacity.

(6) **Average Sustained Flow** represents the average of the largest, multi-hour flows that occurred during each of the top ten storm periods. Sustained flows represent the average hourly WWTP flow during WWTP-throttling periods or, for events with no throttling, the average hourly flow over at least 3 hours including the peak wet-weather flow.

(7) **Average Peak Flow** represents the average of the highest hourly flows observed during each of the top ten storms.

(8) Newtown Creek's wet-weather flow requirement is 620 MOD as per Second Modified Judgment on Consent, Index No. 196/88 (Newtown Creek) (Sup. Ct Kings County) (Spodek, J.)(2002)

5.3.4. Wet Weather Operating Plan

In order to maximize treatment during wet weather events, WWOPs are required for each WWTP drainage area. Each WWOP should be written in accordance with the DEC 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 biological nutrient removal (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 DEP provides a schedule of plan submittal dates as part of the BMP Annual Report. The submittal dates listed in the CY2010 CSO BMP Annual Report for facilities in Newtown Creek are provided in Table 5-5.

Table 5-5. Wet Weather Operating Plans for WWTPs along the Newtown Creek Waterbody

Facility	Original Submissions to DEC	Revisions Submitted to DEC	DEC Approval Status
Bowery Bay WWTP	July 2003	Sept. 2004, March 2009	March 2009 version Conditionally Approved (May 2009)
Newtown Creek WWTP[(1)]	June 2003	April 2005, March 2009, April 2010	April 2010 version Approved (July 2010)
[(1)] Requirement per Second Modified Judgment on Consent, Index No. 196/88 (Newtown Creek) (Sup. Ct. Kings County) (Spodek, 1.)(2002).			

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 DEC 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 are provided in the CSO 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 WWTP, 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 CSO BMP Annual Report addresses the components of the industrial pretreatment BMP through a description of the Citywide 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, Citywide;
- 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 Citywide 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 CSO BMP Annual Report provides summary information regarding the status of the catch basin and booming, skimming, and netting programs Citywide.

Several catch basin cleaning and hooding activities took place in the Newtown Creek drainage area in 2010 as described in the CY2010 CSO BMP Annual Report. Averages of 906 and 1,725 catch basins were cleaned in Brooklyn and Queens, respectively, each month. In 2010, hoods were replaced in 113 and 109 of the catch basins within the Bowery Bay and Newtown Creek drainage areas, respectively. As part of its floatables plan, the DEP maintains floatables containment booms in East Branch, English Kills, and Maspeth Creek. The DEP has these facilities inspected and serviced after significant rainstorms. Table 5-6 summarizes the quantity of floatables retrieved from the Newtown Creek containment facilities in 2010, as reported in the CY2010 CSO BMP Annual Report.

Table 5-6. Floatable Material Collected in Newtown Creek (2009)

Month of Year	East Branch (CY)	English Kills (CY)	Maspeth Creek (CY)
January	0.0	0.0	0.0
February	0.0	0.0	0.0
March	0.0	0.0	0.0
April	0.0	0.0	9.0
May	0.0	0.0	0.0
June	0.0	0.0	5.0
July	0.0	0.0	0.0
August	0.0	0.0	0.0
September	0.0	10.0	0.0
October	0.0	12.0	6.0
November	1.0	0.0	0.0
December	0.0	1.0	0.0
Total	**1.0**	**23.0**	**20.0**

(1) Formerly known as Newtown Creek CS2
(2) Formerly known as Newtown Creek CS3

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 the New York State Department of Health (NYSDOH) and to be specified within the DEP Master Plan for Sewage and Drainage. Whenever possible, separate sanitary and storm sewers should be used to replace combined sewers. The CSO BMP Annual Report describes the general, Citywide plan and addresses specific projects occurring in the reporting year. No work associated with Newtown Creek was performed in 2010.

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 CSO 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 CY2009 CSO BMP Annual Report, although no combined sewer extension projects were completed in 2010.

5.3.10. Sewer Connection and 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 CSO 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 DEC when necessary.

For the calendar year 2010, no letter of notification was submitted to DEC concerning chronic sewer backups or manhole overflows which would prohibit additional sewer connections or sewer extensions.

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 CSO BMP Annual Report summarizes the three scavenger waste acceptance facilities controlled by DEP, 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 DEP rules and regulations, to be consistent with the DEP Master Plan for Sewers and Drainage, and to be permitted by DEP. This BMP ensures that only allowable flow is discharged into the combined or storm sewer system. The CSO BMP Annual Report refers to the DEP 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 DEP 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 the New York City Department of Health and Mental Hygiene (NYCDHMH) to implement and manage the notification program.

BMP # 13 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). DEP provides the status of the CSO signage program in the CSO BMP Annual Report and lists those former CSO outfalls that no longer require signs. DEP is currently developing improvements to the CSO signs to increase their visibility and to include information relative to wet-weather warnings as required by the EPA CSO Policy. 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 April 2011, the most recent BMP Annual Report submitted was for calendar year 2010.

5.4. CITYWIDE CSO PLAN FOR FLOATABLES ABATEMENT

In the late 1980s, New York City initiated the Citywide Floatables Study, a multi-year investigation of floatables in New York Harbor (HydroQual, 1993, 1995a). In addition to examining floatables characteristics, this study investigated potential sources of floatables, floatables circulation and beach-deposition patterns throughout the Harbor, and potential structural and non-structural alternatives for floatables control. Findings of the study showed that the primary source of floatables (other than natural sources) in the Harbor was urban street litter carried into waterways along with rainfall runoff.

DEP developed a floatables abatement plan (Floatables Plan) for the CSO areas of New York City in June 1997 (HydroQual, 1997). The Floatables Plan was updated in 2005 (HydroQual, 2005b) to reflect the completion of some proposed action elements and the addition of a monitoring program, as well as changes appurtenant to SPDES permits and modifications of regional WB/WS Facility Plans and CSO Facility Plans. The DEC approved the updated Floatables Plan on March 17, 2006.

The objectives of the Floatables Plan are to provide substantial control of floatables discharges from CSOs throughout the City and to provide for compliance with appropriate DEC and IEC requirements pertaining to floatables.

5.4.1. Program Description

The Citywide CSO Floatables Plan consists of the following action elements:

- Monitor Citywide street litter levels and inform the New York City Department of Sanitation (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 Citywide 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 WWTPs;
- 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) booms and nets. As part of this effort, booms are installed in the Newtown Creek tributaries Maspeth Creek, East Branch

and English Kills;

- Continue the Illegal Dumping Notification Program (IDNP) in which DEP 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;
- Provide support to DEC to 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.

Overall, implementation of the Floatables Plan is expected to control approximately 96 percent of the floatable litter generated in New York City (HydroQual, 1997). The 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 component of the Floatables Plan is self-assessment, 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). 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.

5.4.2. Pilot Floatables Monitoring Program

In late 2006, work commenced to develop the Floatables Monitoring Program to track floatables levels in New York Harbor (HydroQual, 2007a). This pilot work which was performed to develop a monitoring procedure and an associated visual floatables rating system based on a five-point scale (very poor, poor, fair, good, very good), involved observations at a number of different sites. At each site, observations were made for up to three categories: on the shoreline, in the water near the shoreline; and in the water away from the shoreline.

5.4.3. Interim Floatable Controls in Newtown Creek

There are booms installed in East Branch, English Kills, and Maspeth Creek. The volume of floatables contained from those locations is provided in Table 5-7 above.

5.4.4. Shoreline Cleanup Pilot Program

As part of the Environmental Benefits Projects (EBP) program established under the Long Island Sound (LIS) Consent Judgment, DEP has implemented a beach clean-up program to clean up shorelines in areas where floatables are known to occur due to CSO overflows and stormwater discharges as well as careless behavior and illegal dumping. This project was undertaken in connection with the settlement of an enforcement action taken by New York State and the DEC for violations of New York State law and DEC regulations. DEP has conducted cleanups at several areas deemed to benefit from these efforts including:

- Coney Island Creek, Brooklyn
- Kaiser Park, Brooklyn
- Sheepshead Bay (Kingsborough Community College), Brooklyn
- Cryders Lane (Little Bay Park), Queens
- Flushing Bay, Queens.
- Owls Head, Brooklyn

These cleanup efforts will consist of two primary methods of cleanup.

- Workboat Assisted Cleanup - Mechanical Cleanup – Where debris is caught up in riprap on the shoreline, a high-pressure pump will be used to spray water onto the shoreline to dislodge and flush debris and floatables from the riprap back into the. A containment boom placed in the water around the site will allow a skimmer vessel to collect the material for proper disposal.
- Workboat Assisted Cleanup – At a few locations where the shoreline is not readily accessible from the land side a small workboat with an operator and crewmembers collects 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 provide the most efficient cleanup method. Debris will then be removed and placed into plastic garbage bags, containers, or dumpsters and then loaded onto a pickup truck for proper disposal.

This pilot program had a four year duration and was completed during the Summer of 2010.

5.5. LONG-TERM CSO CONTROL PLANNING (LTCP) PROJECT

In June 2004, DEP authorized the LTCP Project. This work integrates all Track I and Track II CSO Facility Planning Projects and the Comprehensive Citywide Floatables Abatement Plan, incorporates on-going USA Project work in the remaining waterbodies, and develops WB/WS Facility Plan reports and the LTCP for each waterbody area. The LTCP Project monitors and assures compliance with applicable Administrative Consent Orders. This document is a work product of the LTCP Project.

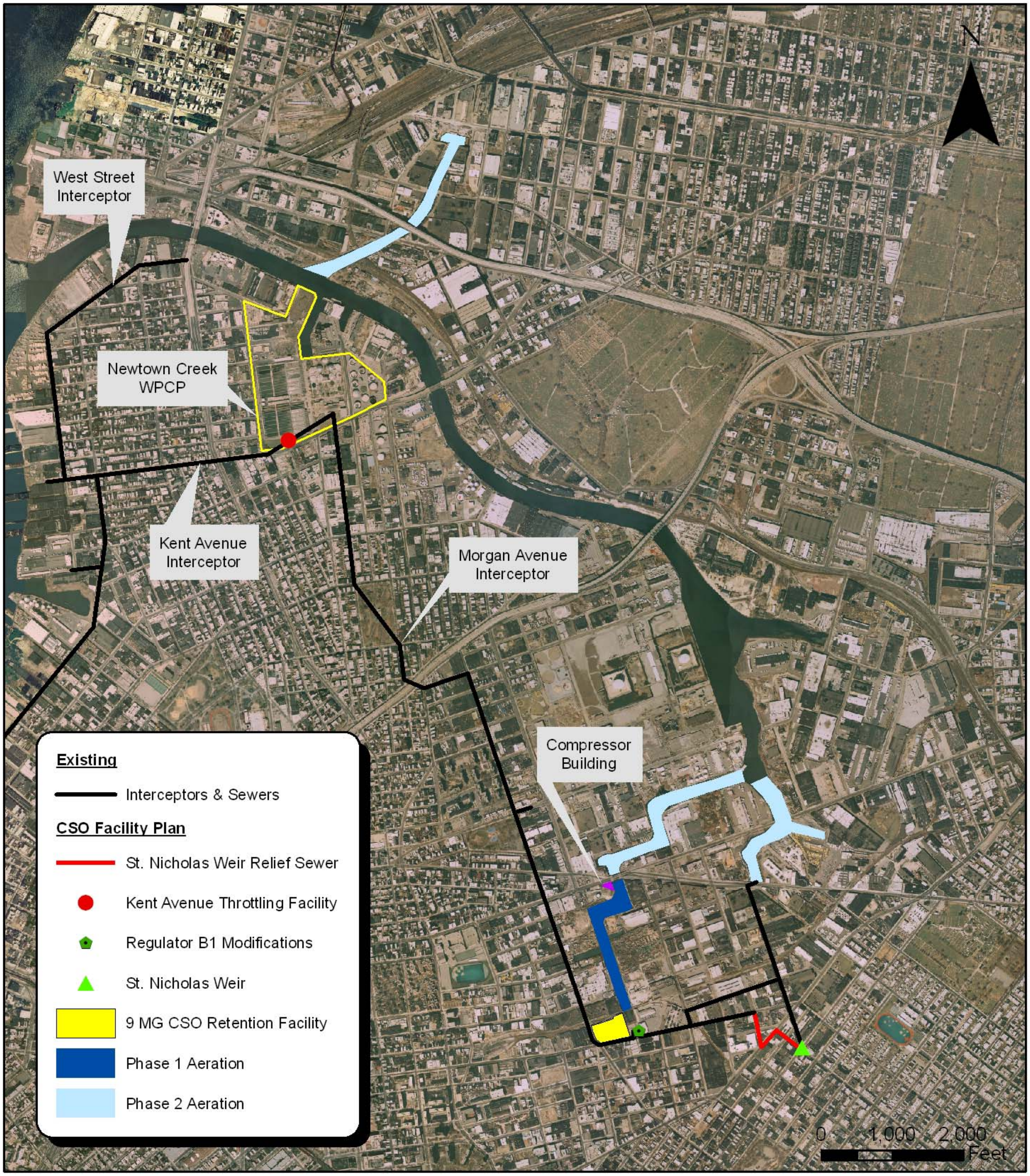
5.6 NEWTOWN CREEK WATER QUALITY FACILITY PLAN

The Newtown Creek Water Quality Facility Planning Project was initiated in July 1990 as one of several tributary area studies that were part of the city-wide CSO abatement program; and concluded in its original scope in January 1993 with the completion of the Draft Facilities Plan. With this planning, the NYCDEP identified and evaluated CSO and non CSO control alternatives with a goal to select the most cost-efficient plan for improvement of water quality in the Newtown Creek and its tributaries to that mandated by their Class SD water quality classification. Initially, all reasonable measures for reducing CSO discharges and thus improving water quality in the waterbody were evaluated under a preliminary screening process. Alternatives that clearly were not applicable in the planning area were initially eliminated. Next, under a secondary screening process, options were evaluated to determine the overall "utility" of the option based on the long- and short-term community impacts, water quality benefits, stand-alone capability, and cost (URS, 1993). Based on conclusions of this initial study, additional work tasks were authorized and additional studies were completed. Project reports submitted to describe these additional studies include:

- Receiving Water Modeling (LMS, 1993)
- Feasibility Study for Non-CSO Abatement Alternatives (URS, 1994)
- Addendum to the Facilities Plan Report (URS, 1995a and 1995b)
- 1996 Aeration Pilot Study Model Report – Draft (LMS, 1997)
- Final Report Aeration Pilot Study (February 1998)
- Addendum to Facilities Plan Report Phase 1 Aeration Facilities – Draft (URS, 1999)
- Subsurface Investigation Report (URS, 2000a)
- Dredging Feasibility Study (URS, 2000b)
- Sewer System Modeling Technical Memorandum (URS, 2001)
- Updated Facility Plan (URS, 2002)
- Final Facility Plan Report (URS, 2003)

During these studies, DEP evaluated the effectiveness of CSO abatement alternatives such as maximizing CSO treatment, inline and offline CSO storage, and other treatment alternatives. Non-CSO abatement alternatives were also evaluated, including re-contouring the waterbody through dredging, in-stream supplemental waterbody aeration, and flushing tunnels. A knee-of-the-curve approach was employed to develop the facility plan, which combines several of those alternatives (URS, 2003).

The 2003 CSO Facility Plan is based on water quality improvement needs, and achievable water quality improvements and as such, it is comprised of projects that focus on the two outfalls that contribute the greatest volume of CSO to the head end of Newtown Creek and on improving water quality in the upstream branch and tributaries where the water quality is most impaired (Figure 5-1). In addition, NYCDEP has taken a phased adaptive management approach to implementing the 2003 CSO Facility Plan, such that the Facility Plan is being implemented in four phases as described in the following subsections.



NYC Environmental Protection

Newtown Creek Water Quality CSO Facility Plan

Newtown Creek Waterbody/Watershed Plan

Figure 5-1

5.6.1 Phase I Aeration Facility

Raising the DO concentration in Newtown Creek above 1.0 mg/L was established as a goal for the aeration system to eliminate hydrogen sulfide production. The Newtown Creek complex was divided into two zones, with aeration facilities to be installed sequentially. The Zone I aeration facility was to be located in the Upper English Kills, and Zone II was to include aeration in Lower English Kills, East Branch, and Dutch Kills. Zone I was expected to serve as a demonstration and evaluation stage prior to constructing Zone II. It was estimated that a mass oxygen transfer of 400 lbs/day for the English Kills and 100 lbs/day for the East Branch and Dutch Kills would be necessary if well-mixed. This translates to aeration requirements of 1500 cfm in the Upper English Kills; 900 cfm in the Lower English Kills; 150 cfm in Dutch Kills; and 600 cfm in East Branch.

The 2005 Consent Order included these aeration facilities as enforceable milestones in Appendix A. Zone I aeration facilities were to be complete by December 2008 and Zone II aeration facilities were to be complete by June 2014. Zone I has been in operation since early 2009 and a preliminary evaluation was submitted in February 2010.

5.6.2 Phase II Kent Avenue Throttling Facility

Throttling of the Kent Avenue Interceptor to limit maximum allowable flow from this interceptor to the Brooklyn Pump Station to 200 MGD was expected to allow more flow through the Morgan Avenue Interceptor, thereby reducing CSO to the English Kills. Although an increase in CSO to the East River would occur, a net overall reduction would be realized. The facility was to include a 9-foot by 10-foot roller gate at a minimum opening of 15 inches on the Kent Avenue Interceptor, 650 feet upstream from the confluence of the Kent Avenue Interceptor with the Morgan Avenue Interceptor. Due to construction sequencing and coordination issues, final design and construction of this gate has been included in the Track 3 Facility Plan upgrades to the Newtown Creek WWTP currently underway.

The 2005 Consent Order requires the Kent Avenue Throttling Facility to be complete by December 2012.

5.6.3 Phase III USA Study/LTCP

Phase III includes upgrading watershed models to more accurately simulate the dynamic hydraulic conditions in the combined sewer systems draining to the Newtown Creek. DEP used these upgraded models to re-evaluate all components of the 2003 CSO Facility Plan and other water quality improvement projects. This WB/WS Facility Plan Report is the result of that re-evaluation, and acknowledges that the 2003 CSO Facility Plan was only one component of the NYCDEP's multi-phase program to address the impacts of CSOs and WPCPs on harbor and tributary waterbodies. Further it acknowledges that the 2005 Consent Order recognizes that there is not a final conceptual design for the facilities proposed for Newtown Creek, and allows the NYCDEP to propose final modifications to the scope of the projects set forth in the 2003 CSO Facility Plan (DEC, 2004b).

5.6.4 Phase IV Sewer System Storage and a CSO Storage Tank

To induce collection system storage, the overflow weir at Regulator B1 was to be raised by 3.67 feet to approximately local Mean High Water (MHW), and the sluice gate was to be enlarged from 24 square feet to 30 square feet by removing the existing gate thimbles and enough of the remaining concrete to match the required 5-foot width and replacing with new flush-mounted gates. In addition, a new 36-inch relief sewer was to be constructed from the Saint Nicholas Weir parallel to the existing sewer to the intersection of Flushing and Gardner Avenues, where the existing sewer increases to 94-inch x 97-inch. Combined, the regulator modification and new sewer would divert additional flow to a new 9 million gallon CSO storage facility expected to be constructed at the intersection of Johnson and Morgan Avenues.

Although the 2003 Facility Plan proposed reevaluating the Phase IV elements upon completion of USA project evaluations, these elements were included as enforceable milestones in Appendix A of the 2005 CSO Consent Order. The sewer system improvements were to be completed by June 2014 and the CSO storage tank was to be completed by December 2022.

5.6.5 Projected Benefits

The modeling supporting the 2003 facility plan used a 4-month projection scenario from June 1990 to September 1990 rather than the 1988 precipitation year, and so the 2003 Facility Plan was reevaluated using the modeling framework described in Sections 3 and 4. Nonetheless, the 2003 facility planning projected a decrease in CSO volume of 79% and a reduction of TSS and BOD5 load of 89% and 85%, respectively for the 9 MG tank with flow-through. Phase III describes facility planning that would not directly result in measurable CSO reductions or water quality improvements.

The proposed aeration and CSO reduction were projected to increase compliance with the existing dissolved oxygen standards. Although the surface waters throughout the Creek are projected to be in full compliance, the bottom waters in the downstream extent of the Creek were projected to be only partially in compliance as a result of the CSO facility plan. Overall, the proposed facility plan was expected to attain nearly all of the improvement in DO concentration standards compliance that are possible through 100% removal of the discharges from the two CSO outfalls targeted by the plan (i.e., NC-015 and NC-083).

For more detailed modeling results of the 2003 Newtown Creek CSO Facility Plan, refer to Section 7.

5.7. NEWTOWN CREEK WWTP ENHANCED TRACK 3 FACILITY PLAN

In 1988, the DEP and the DEC entered into a Judgment on Consent,which directed that the Newtown Creek WWTP be upgraded to secondary treatment. This 1988 Judgment was modified in 1995 to include a revised schedule, provisions for a new Facility Plan, requirements for nutrient removal, Ten States Standards treatment of wet weather flows, and planning for increased treatment capacity. The 1995 Newtown Creek Faciltiy Plan update presented two process alternatives (Track 1 and Track 2) for upgrading the Newtown Creek WWTP to achieve secondary treatment standards for removal of BOD, and suspended solids, and for additional nitrogen removal. The plan was accepted by the DEC; however formal approval was withheld pending DEP's selection of a single alternative. The two track approach detailed in the 1995 Plan included evaluation of the effectiveness of step denitrification (Track 1) as compared to biofilter polishing (Track 2) through a program of demonstration testing to determine the DEP's selection of a single alternative.

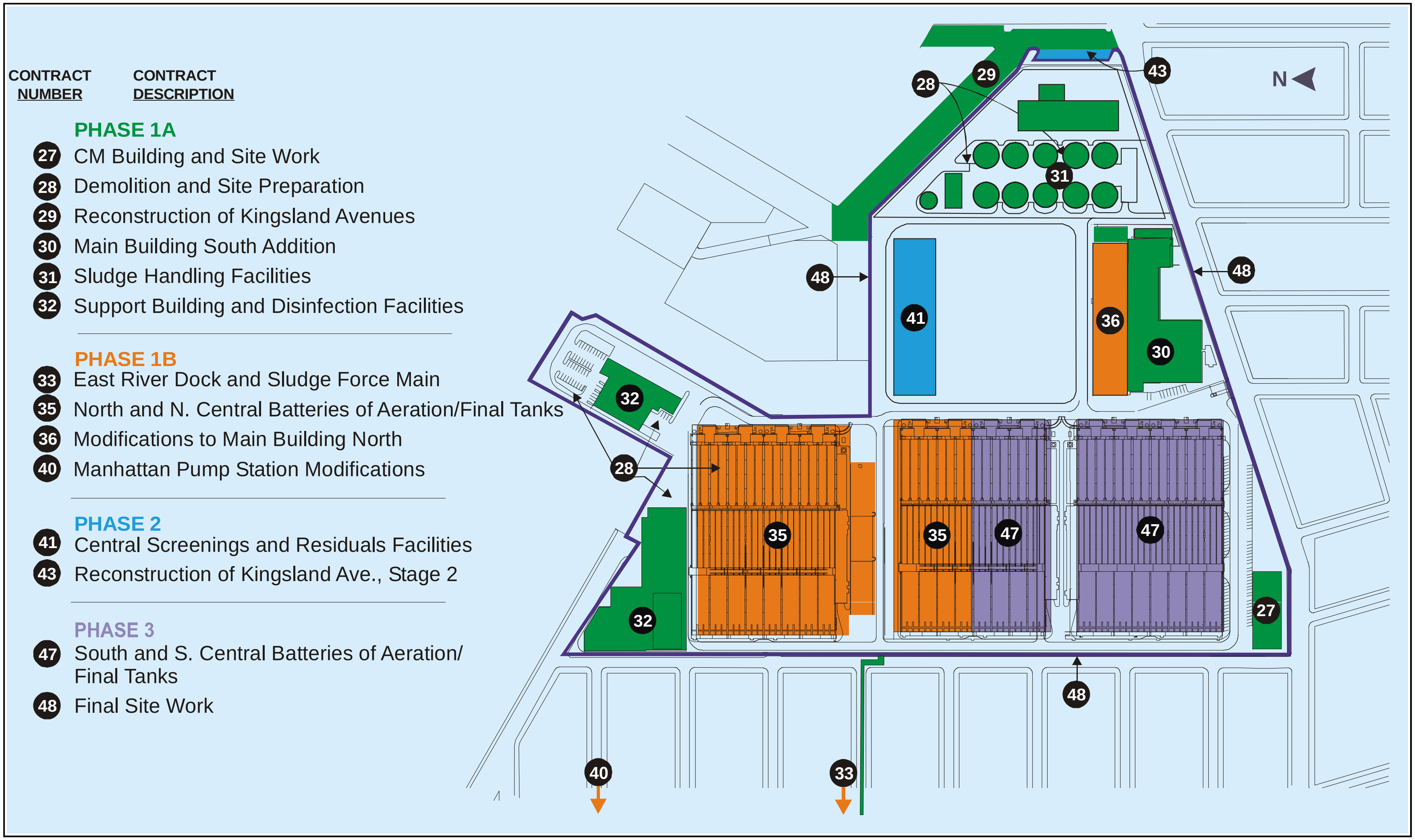
Concurrent with the two-track testing and evaluation, the DEP undertook further testing of treatment enhancement methods that could be implemented over the short-term. During this time the DEP was also conducting an East River water quality facility planning effort to address issues affecting all East River WWTPs. Water quality modeling conducted as part of this effort indicated that the nitrogen removal requirement included in the Consent Order would be less effective in achieving DO improvements in western Long Island Sound than determined by the previous (NC WWTP JV, 1998) modeling efforts.

Based on the results of this demonstration testing, the DEP proposed a "Track 3" alternative in 1998. The Track 3 alternative proposed a design employing modified step-feed that would meet all 1995 Consent Order requirements except nitrogen removal. The Newtown Creek Track 3 Facility Plan noted that the nitrogen removal requirements were included in the 1995 Consent Order to satisfy nitrogen reduction goals adopted by the Long Island Sound Study (LISS). It further noted that based on the updated water quality information, the nitrogen removal facilities included in the 1995 Newtown Creek Facility Plan would not likely meet those goals. The Track 3 Facility Plan recognized that the DEP is still committed to the LISS Phase III Proposal to alleviate hypoxia in western Long Island Sound, and noted that nitrogen control facilities would be best developed in the context of water quality planning initiatives, which were being undertaken on a time frame consistent with the LISS Phase III Proposal.

The Track 3 alternative was subsequently rejected by the DEC in 1999 due to concerns that the proposed upgrade would not consistently and reliably achieve secondary treatment standards and that it did not adequately address the reduction of nitrogen in discharges from the DEP's East River WWTPs. To address these concerns, the DEP subsequently submitted an Enhanced Track 3 Facility Plan, which compiled additional supporting information and included several enhancements to the Track 3 Plan. The Enhanced Track 3 Plan presents new information about the ability of modified step-feed process to provide reliable secondary treatment, includes flexibility for future treatment requirements, provides improved secondary screening, improvements to grit tanks, improved grit handling, additional grit tank capacity, and a number of treatment and operational enhancements (Figure 5-2). A Final Environmental Impact Statement was issued in 1996 and a Supplemental Environmental Impact Statement was issued on June 6, 2003. Formal approval of the Newtown Creek Enhanced Track 3 Facility Plan by the DEC was granted in May 2004.

5.8. 2004 INNER HARBOR CSO FACILITY PLAN

The 2004 Inner Harbor CSO Facility Plan (Hazen and Sawyer, 1993) focused on quantifying and assessing the impacts of CSO discharges to the lower portions of the Hudson and East Rivers, Upper New York Bay, and Gowanus Bay and Canal. The project’s study area included all of the North River, Newtown Creek and Red Hook WWTP service areas, which together comprise over 160 CSOs. Field investigations and mathematical modeling were conducted for receiving waters and their watersheds. Engineering alternatives for abating CSO discharges were evaluated and recommendations were made for improving receiving water quality.



Environmental Protection

Newtown Creek WPCP Secondary Treatment Layout

Water quality and engineering assessments concluded that the flushing and dispersive abilities of the Hudson River, East River and Upper New York Bay minimized the effects of CSOs on water quality for these areas. CSOs were not found to be a major component of water quality impairments. In 1993, the Inner Harbor CSO Facility Plan was finalized and recommended system-wide regulator improvements, maximizing wet weather flow to WWTPs, and inducing in-line storage (Hazen and Sawyer, 1993). The plan was submitted to the DEC and accepted.

The Inner Harbor CSO Facility Plan was subsequently modified by the DEP and detailed in a report submitted to the DEC in April 2003 (DEP, 2003). The revised plan and modified schedule was approved by DEC in May 2003. Additional revisions to themodified CSO facility plan were submitted to DEC in February 2004. No modifications were made to elements of the plan influencing Newtown Creek water quality. The following describes the current 2004 Inner Harbor CSO Facility Plan, and its implementation schedule.

5.8.1. Facility Design and Implementation Schedule

The original Inner Harbor CSO Facility Plan was organized as a three-phase plan for open waters, along with a rehabilitation strategy for Gowanus Canal. The open waters plan, included regulator improvements, new throttling facilities to maximize the wet weather flows to the WWTPs, and in-line storage to increase CSO capture within the Newtown Creek WWTP sewershed. The basic elements of the original plan remained the same; however, details of their components were changed by the 2003 modification.

Phase I of the 2004 Inner Harbor CSO Facility Plan is addressing regulator improvements and a total of 123 regulators are being improved throughout the Inner Harbor planning area. The DEP will automate regulators at 29 locations under the DEP's Citywide SCADA Project and convert 72 other regulators from mechanical to more efficient fixed orifices. The construction contract for the conversion of the 72 mechanical regulators was completed in January 0f 2006. In addition, 22 other regulators have been converted to fixed orifices under the NYSDOT Route 9A Project. These numbers include seven regulators that discharge to Newtown Creek during wet weather, of which two were recommended for no action, four were recommended to be fixed orifice, and one was recommended for automation.

Phase II of the 2004 Inner Harbor CSO Facility Plan is for maximizing wet weather flow to WWTPs by design and construction of throttling facilities. This will maximize the use of available in-line storage, reduce CSOs, and consolidate CSO discharges to fewer locations. Throttling facilities were recommended in the original facility plan at the North River, Newtown Creek, and Red Hook WWTPs, and the Manhattan Pumping Station, which feeds the Newtown Creek WWTP. Throttling facilities, consisting of independent automatic gates located upstream of WWTP forebays, were intended to reduce WWTP operational problems and maximize wet weather flows. By constructing throttling facilities, harmful effects of using existing WWTP inlet gates to control wet weather flows would be eliminated. Operating throttling facilities would enable interceptor storage capacities to be fully utilized and WWTP flows to be maximized by back-flooding the interceptor system. The Red Hook WWTP has a manually operated throttling gate that was installed during construction of the secondary processes. The modified plan includes constructing new throttling facilities at the Manhattan Pump Station and the Newtown Creek WWTP and developing a WWOP for the North River WWTP. The

Manhattan Pump Station throttling facility and the Newtown Creek throttling facilities are being implemented under the Newtown Creek WWTP Enhanced Track 3 Facility Plan discussed above. At the time of the writing of this report, the final design of the Manhattan Pump Station throttling facility was approximately 90 percent complete, and the Newtown Creek WWTP throttling facilities were designed and the contract for its construction was awarded. The throttling facilities will provide up to 3.0 MG of in-system storage in the Manhattan and Brooklyn collections systems.

Phase III of the 2004 Inner Harbor CSO Facility Plan is for inducing in-line storage to increase CSO capture. It was originally planned to be accomplished by either raising weir elevations in diversion chambers or by installing inflatable dams within combined sewers. The original facility plan recommended weir raising due to their lower costs and maintenance. However, the plan was modified from raising weirs to installing inflatable dams due to flooding concerns. Inflatable dams, while more expensive and complicated to construct and maintain, have a built-in system that allows the dams to deflate when water levels rise beyond a pre-set level. The modified facility plan includes installation of two inflatable dams: one for Regulator B-6 in the Newtown Creek WWTP-Brooklyn service area, which will store up to 2.0 MG; and one for Regulator R-20 in the Red Hook WWTP service area that will have the capacity to store up to 2.2 MG. Regulator B-6 is connected to an outfall that discharges to the East River, and therefore the added in-system storage will have little impact on the water quality in Newtown Creek. In accordance with the 2005 Administrative Consent Order, final design of Phase III was completed November, 30 2006. The bid documents are scheduled for advertisement in December 2006.

5.9. ECOSYSTEM RESTORATION

The City is a non-federal local sponsor for the USACE Hudson-Raritan Estuary (HRE) Ecosystem Restoration Project. The HRE project comprises 13 representative sites within the New York and New Jersey Port District, which is delineated as the surrounding greater metropolitan New York City region within an approximate 25-mile radius of the Statue of Liberty in the New York-New Jersey harbor, and which is located in the Hudson-Raritan Estuary. One of these sites is Newtown Creek.

Through this project, the full range of problems and opportunities for ecological restoration in the HRE will be explored and examined, including but not limited to environmental restoration and protection relating to water resources and sediment quality. The study will also recommend initiatives most appropriate for others to lead. A holistic watershed approach will be used to identify overall ecosystem objectives. This will require an intensive effort for agency coordination and public involvement to ensure participation and input from all interested parties. It will also require an intensive effort to inventory and consolidate all available data, studies, and information from all levels of government and private concerns.

Restoration opportunities in Newtown Creek include sediment removal to improve DO levels, enhance benthic habitat, and reduce odors; wetland restoration; shoreline softening; and rounding of sharp angles to increase circulation and reduce sedimentation. Maspeth Creek has been identified as the largest wetland restoration opportunity with potential for shoreline softening at adjacent stream banks along the main channel. Wetland restoration opportunities have also been identified for terminal sections and corners of English Kills and at the East Branch turning basin. Sediment removal has been identified for sections of Maspeth Creek, Dutch Kills, English Kills, and the East Branch. Rounding of sharp angles has been identified for sections of the English Kills and East Branch. Limited shoreline softening, other than that associated with Maspeth Creek, may be identified during the feasibility study (Newtown Creek, 2006).

After completion of the Newtown Creek Dredging Feasibility Study in 2000, the DEP met with USACE staff to discuss the DEP's planned water quality improvement facilities and to share the DEP's ideas for ecosystem restoration in Newtown Creek. The DEP followed up this meeting with a letter that re-affirmed the components of the water quality improvement program, transmitted the Dredging Feasibility Study, and detailed the DEP's ideas for ecosystem restoration. The letter notified USACE that the DEP had no plans to move forward with dredging but requested that it be further evaluated along with the DEP's restoration concepts as part of the overall ecosystem restoration study, and if necessary, implemented through the HRE (Gaffoglio, 2001). The Draft Comprehensive Plan was released in March 2009 and that the USACE has held Public meetings and solicited Public Comments on the Plan since then and is working with other agency partners and environmental stakeholder groups to produce the final Comprehensive Restoration Plan for the Estuary.Irrespective of the future direction of the USACE program, DEP considers environmental dredging a legitimate CSO abatement alternative and a necessary first step to ecological restoration. Dredging is evaluated in Section 7.0.

5.10. NYC GREEN INFRASTRUCTURE PLAN

On September 28, 2010, Mayor Bloomberg and DEP Commissioner Caswell Holloway unveiled the NYC Green Infrastructure Plan which presents a "green strategy" for CSO drainage areas that includes cost-effective grey infrastructure strategies, reduced flows to the WWTP, and 10 percent capture of impervious surfaces with green infrastructure. The green infrastructure component of the plan builds upon and reinforces strong support for green approaches to address water quality concerns. A key goal of the NYC Green Infrastructure Plan is to manage the first inch of runoff from 10 percent of the impervious surfaces in combined sewer watersheds through detention and infiltration source controls over the next 20 years.

The *NYC Green Infrastructure Plan* builds upon and extends the commitments made previously in Mayor Bloomberg's PlaNYC to create a livable and sustainable New York City and, specific to water quality, open up 90 percent of the City's waterways for recreation. PlaNYC included initiatives to promote green infrastructure implementation, including the formation of an Interagency Best Management Practices (BMP) Task Force, development of pilot projects for promising strategies, and providing incentives for green roofs toward these goals.

The Sustainable Stormwater Management Plan (SSMP) released in December 2008 was developed as a result of the Interagency BMP Task Force's efforts to identify promising BMPs for New York City. The SSMP provided a framework for testing, assessing, and implementing pilot installations to control stormwater at its source as well as strategies to promote innovative and cost-effective source controls and secure funding for future implementation. A key conclusion of the SSMP was that green infrastructure is feasible in some areas and could be more cost-effective than certain large infrastructure projects such as CSO storage tunnels.

Based on the evaluations completed for the development of the *NYC Green Infrastructure Plan*, preventing one inch of precipitation from becoming runoff that surges into the sewers over 10 percent of each combined sewer watershed's impervious area will reduce CSOs by approximately 1.5 billion gallons per year. Green infrastructure technologies currently in use and being piloted throughout the City include green roofs, blue roofs, enhanced tree pits, bioinfiltration, vegetated swales, pocket wetlands, and porous and permeable pavements. The monitoring data collected from the pilots will improve our understanding of performance, costs and maintenance requirements under New York City's environmental conditions, and our modeling methods and assumptions will continue to be refined based on this information. Table 5-8 summarizes the opportunities available to achieve the 10 percent goal Citywide.

Table 5-7. Citywide Green Infrastructure Opportunities, Strategies, and Technologies

Land Use	% of Citywide Combined Sewer Watershed Areas	Potential Strategies and Technologies
New development and redevelopment	5.0%	- Stormwater performance standard for new and expanded development - Rooftop detention; green roofs; subsurface detention and infiltration
Streets and sidewalks	26.6%	- Integrate stormwater management into capital program in partnership with DOT, DDC, and DPR - Enlist Business Improvement Districts and other community partners - Create performance standard for sidewalk reconstruction - Swales; street trees; Greenstreets; permeable pavement
Multi-family residential complexes	3.4%	- Integrate stormwater management into capital program in partnership with NYCHA and HPD - Rooftop detention; green roofs; subsurface detention and infiltration; rain barrels or cisterns; rain gardens; swales; street trees; Greenstreets; permeable pavement
Parking lots	0.5%	- Sewer charge for stormwater - DCP zoning amendments - Continue demonstration projects in partnership with MTA and DOT - Swales; permeable pavement; engineered wetlands
Parks	11.6%	- Partner with DPR to integrate green infrastructure into capital program - Continue demonstration projects in partnership with DPR - Swales; permeable pavement; engineered wetlands
Schools	1.9%	- Integrate stormwater management into capital program in partnership with DOE - Rooftop detention; green roofs; subsurface detention and infiltration
Vacant lots	1.9%	- Grant programs - Potential sewer charge for stormwater - Rain gardens; green gardens

Table 5-7. Citywide Green Infrastructure Opportunities, Strategies, and Technologies

Land Use	% of Citywide Combined Sewer Watershed Areas	Potential Strategies and Technologies
Other public properties	1.1%	- Integrate stormwater management into capital programs - Rooftop detention; green roofs; subsurface detention and infiltration; rain barrels; permeable pavement
Other existing development	48.0%	- Green roof tax credit - Sewer charges for stormwater - Continue demonstration projects and data collection - Rooftop detention; green roofs; subsurface detention and infiltration; rain barrels or cisterns; rain gardens; swales; street trees; Greenstreets; permeable pavement

To begin implementation, the City has already created a Green Infrastructure Task Force to design and build stormwater controls into planned roadway reconstructions and other publicly funded projects. In addition, the City recognizes that partnerships with numerous community and civic groups and other stakeholders will be necessary to build and maintain green infrastructure throughout the City. DEP will provide resources and technical support so that communities can propose, build, and maintain green infrastructure projects.

Over the next year, the City will take on a number of other concrete steps to begin early implementation of the *NYC Green Infrastructure Plan* such as demonstrating green infrastructure installations on a variety of land uses (see Table 5-9); launching a comprehensive program to increase optimization of the existing system; piloting sewer charges for stormwater for stand-alone parking lots; refining DEP models by including new impervious cover data and extending predictions to ambient water quality; identifying alternative funding for additional elements of the plan; and replacing all CSO outfall signs to reduce potential exposure.

Table 5-8. DEP Retrofit Demonstration Projects

Green Infrastructure Pilot	Location	Type	Status	Construction Completion
Rain Barrel give-away program	Jamaica Bay	1,000 rain barrels	Completed	2008-2009
5 tree pits/5 swales*	Jamaica Bay	Tree pits and streetside swales in the right-of-way	Completed	Fall 2010
MTA constructed wetland/parking lot*	Jamaica Bay	Biofiltration	In Construction	Spring 2011
Blue roof/green roof comparison*	Jamaica Bay	Blue/green roofs	Completed	August 2010
DEP rooftop detention	Newtown Creek	Various Blue roof technologies	Completed	Winter 2011
High Density residential retrofit	Bronx River	Variety of on-site BMPs at a New York City Housing Authority development	In Construction	Spring 2011

Table 5-8. DEP Retrofit Demonstration Projects

Green Infrastructure Pilot	Location	Type	Status	Construction Completion
DOT parking lots*	Jamaica Bay	Detention/bioinfiltration/porous pavement	Design	Spring 2011
North/South Conduit	Jamaica Bay	Detention/bioinfiltration in roadway median	In construction	Spring 2011
Shoelace Park	Bronx River	Detention/bioinfiltration	Redesign underway	Spring 2011

* This project was undertaken in connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State Law and DEC Regulations.

5.11. DEP ENVIRONMENTAL BENEFIT PROJECTS

In connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State law and DEC regulations, DEP submitted a Nitrogen Consent Judgment Environmental Benefit Project (EBP) Plan to DEC in January 2007 that proposed a stormwater pilot study in the Jamaica Bay drainage area. This project will use Nitrogen Consent Judgment EBP funds to conduct a three year pilot study program to implement and monitor several stormwater treatment technologies and volume reduction stormwater BMPs for potential application within the Jamaica Bay watershed. The goals of Jamaica Bay Watershed Stormwater Pilot Project include documenting the quality of New York City stormwater and refining the specific capture rates and treatment efficiencies that may be expected locally. Once this information has been gathered, effective stormwater strategies would be developed for potential future applications.

The project is expected to cost approximately $1.75 million and will include infiltration swales for street-side and parking lot applications, parking lot curb water capture systems, enhanced tree pits, and a commercial green roof and a blue roof comparison installation (see Table 5-5). The EBP is being conducted through an innovative collaborative effort between DEP and the Gaia Institute. DEP entered into a contract with the Gaia Institute to complete the pilot study. The Gaia Institute is a 501(c)3 not-for-profit corporation, located on City Island in the Bronx, that explores how human activities can be attenuated to increase ecological productivity, biodiversity, environmental quality, and economic well being.

In connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State law and DEC regulations, DEP also submitted a CSO EBP Work Plan DEC in March 2008 (approved by the DEC in April 2008) that is expected to partially mitigate the impacts of stormwater and CSO discharges in the New York Harbor Estuary through stormwater BMP implementation. Practices such as bio-infiltration swales, enlarged street tree pits with underground water storage, constructed wetlands, and others would be evaluated. The CSO EBP Work Plan proposes pilots in the Bronx River, Flushing Bay and Creek, and Gowanus Canal watersheds using the $4 million which has been placed in an EBP Fund.

5.12. NEWTOWN CREEK SEWER BUILDOUT

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 the New York State Department of Health (NYSDOH) and to be specified within the DEP Master Plan for Sewage and Drainage. Whenever possible, separate sanitary and storm sewers should be used to replace combined sewers. This project generally involves the construction of a new storm sewer drainage system serving the area, bulkheading the existing CSO structure, and leaving the existing sewerage to carry sanitary wastewater. DEP completed a hydraulic analysis to determine the feasibility of a drainage plan for separate storm and sanitary sewers in the Newtown Creek drainage area. This area would be approximately 60 acres bounded by Meeker Avenue, Morgan Avenue, Lombardy Street and Scott Avenue. Two new storm outfalls directly discharging to Newtown Creek would be located at Meeker and Scott Avenue. Design is expected to commence in fiscal year 2012 with construction funding scheduled for fiscal year 2013. Final schedules for construction have not yet been established.

5.13 NEWTOWN CREEK SUPERFUND SITE

Newtown Creek and its tributaries were added to Comprehensive Environmental Remediation Certification and Liability Act (CERCLA) National Priorities List, commonly known as Superfund, in September 2010. As a result, the EPA launched a serious of actions to develop a remedy for the Creek and its tributaries. As part of an Administrative Order of Consent with the EPA, New York City and five agreed to conduct a Remedial Investigation and Feasibility Study to identify the appropriate remedy. The anticipated project timeframe for completing the investigation and study is approximately 6-7 years. The preferred remedy is expected to be selected in 2017-2018 and include dredging.

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 guidance states that establishing early communications 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 DEP 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 DEP consisting of city, state, interstate, and federal stakeholders representing regulatory, planning, and public concerns in the New York Harbor watershed.

DEP 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 DEP and to the public via water usage rates) and benefits were discussed before completing engineering evaluations. Comments were sought regarding the selection of a recommended plan. This process has been executed by DEP during the Newtown Creek Facility Planning Project. DEP regularly met with its Advisory Committee on Water Quality to discuss the goals, progress and findings of its ongoing planning projects such as the waterbody/watershed assessment of Newtown Creek. A local stakeholder team was specifically convened by DEP to participate in the waterbody/watershed assessment of Newtown Creek.

The following section describes the formation and activities of DEP’s Harbor-Wide Government Steering Committee, its Citizen’s Advisory Committee on Water Quality, and the Newtown Creek Waterbody/Watershed Stakeholder Team that represented DEP’s public participation and agency interaction components of its waterbody/watershed assessment of Newtown Creek.

6.1. HARBOR-WIDE GOVERNMENT STEERING COMMITTEE

DEP convened a Harbor-Wide Government Steering Committee to ensure 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 DEP water quality improvement programs is represented on the Steering Committee and separately monitors and comments on the progress of CSO projects, among other DEP 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 DEC. The Central Office of the DEC in Albany was represented by its Associate Director of 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 DEC 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 DEP. The Department of City Planning was directed by its Director of Waterfront/Open Space. The New York City Department of Parks and Recreation 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. In 2006 these positions have been changed after a few years' hiatus of the CAC.

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 was responsible for reviewing the methodology and findings of DEP 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, 2001i), and was fully briefed on the on-going 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 water quality restoration actions with USACE, and to coordinate use attainment evaluations with the DEC. Representatives of the DEC reported that its agency was awaiting the results of the DEP waterbody/watershed assessment before completing the 303(d) evaluations.

6.2. NEWTOWN CREEK WATER QUALITY FACILITY PLANNING PROJECT

The Newtown Creek Water Quality Facility Planning (CSO Facility Plan) Project presented to Brooklyn Community Board No. 1 on November 19, 2002. From the slides prepared for that meeting, background information on the study area was presented including the area, the number of CSO outfalls, the waterbody classification, and existing water quality issues. The presentation then turned to the elements of the CSO Facility Plan; aeration, CSO storage tank, relief sewer, and regulator modifications. The presentation included additional detailed discussion of siting the CSO storage tank, including the preferred site and the next steps for site acquisition. The presentation finished with a discussion of potential dredging and ecosystem restoration through being a local sponsor to the Army Corp of Engineers.

Also, efforts have continued for siting the 9 MG CSO Storage Tank, which is planned for construction at the intersection of Johnson and Morgan Avenues. Although the construction of the CSO storage tank has been deferred beyond the current 10-year Capital Plan, the DEP is continuing with efforts pertaining to CEQR and ULURP in order to acquire the preferred site for the tank. As part of this effort, a draft EAS has been completed, reviewed, updated, and is undergoing final review, the goal being to gain a Negative Declaration from the reviewing body. No formal public participation has taken place, but there has been continuing dialog with the local community board. If a Positive Declaration is made by the reviewing body, an EIS would have to be completed and the formal public participation process required for an EIS would be undertaken.

The ULURP process is only just underway. An informal pre-application meeting has been held, but no formal meeting has been scheduled. A formal public review process will not start until the application is certified as complete, which is most likely a year or two away.

6.3. NEWTOWN CREEK WWTP FACILITIES PLANNING AND USA PROJECT

There were extensive public participation activities for the Newtown Creek WWTP Facilities Planning Project from 1995 to 1998, and for the Newtown Creek Use and Standards Attainment (USA) Project from 2003 to 2004.

6.3.1. Newtown Creek WWTP Facilities Planning Public Participation

In the late 1990's a number of activities were underway at the Newtown Creek WWTP that called for public participation and inclusion of the public's concerns in the planning processes. These activities included the Interim Upgrade Projects program; the secondary treatment upgrade; acquisition of property; and preparation of an environmental impact statement. The public participation program for the Newtown Creek Plant Facilities Planning project was carried out under the direction of the DEP Division of Intergovernmental Coordination.

A CAC, composed of major stakeholders, provided an independent appraisal of the project. They dealt with issues involving the Interim Upgrading Program, the Facilities Planning process for the secondary treatment plant upgrade, plant operation, and other issues of interest. To assist the committee in performing its role, the DEP also funded an independent consulting engineer to advise them.

In addition to numerous regularly scheduled meetings and informal meetings held throughout the planning process, a series of 10 formal public meetings, hearings and open houses were scheduled to discuss specific topics. Newspaper advertisements in three different languages, flyers, posters and mailings were used to generate interest in a scheduled event. Handouts, posters and slide presentations were employed to disseminate project-related information. DEP staff members were on-hand at the various meetings to answer questions and to provide individuals with the information needed to understand the issues being discussed.

The Program Manager and the Program Coordinator coordinated activities to ensure that dialogue was maintained between all parties. They promoted opportunities in which the community could have an active voice in the decision-making process. They also scheduled meetings for the DEP engineering staff, plant personnel and citizens to discuss Plant related issues and identify mutually agreeable solutions.

As a result of the DEP's aggressive outreach approach to the community and the community's efforts to work with the DEP, the Interim Upgrade Projects program and the Facilities Planning effort were successful in involving the public in the planning process. As a result, there were no delays to the project, such as those from lawsuits that could have been brought by groups representing members of the affected community. More importantly, the planning process incorporated the public's opinions in the facility design. For instance, the DEP complied with the CAC's request to replace trees removed from the Plant property because of construction by planting trees within the neighborhood around the Plant at locations selected by the Committee. Another example is that the DEP investigated at the community's request, then included in the Plant upgrade, a project whereby a new sludge force main will be constructed so that sludge can be pumped directly from the Plant to waiting sludge boats at the East River Sludge Loading Dock. When the new force main is completed the existing East River Sludge Storage Tank will be demolished. Perhaps the most visible example of the success of the program is inclusion of the River Walk in the Plant upgrade. Responding to the community's request for riverfront access, the DEP included a landscaped River Walk that sweeps around the new Support Building allowing the public access to both Newtown Creek and the Whale Creek Canal.

6.3.2. Use and Standards Attainment (USA) Project Public Participation

DEP's Use and Standards Attainment (USA) Project was conducted for waterbodies throughout New York Harbor to address compliance with water quality standards and designated uses. The goals of the USA Project were to:

- define, through a public process, more specific and comprehensive long-term beneficial use goals for each waterbody, including habitat, recreational, wetlands and riparian goals, in addition to water quality goals, thus maximizing the overall environmental benefit;

- develop technical, economic, public and regulatory support for prioritizing and expediting implementation of projects and actions needed to attain the defined goals; and
- provide the technical, scientific and economic bases to support the regulatory process needed to define water quality standards for the highest reasonably-attainable use and to allow these water quality standards to be attained upon implementation of recommended projects.

To support these goals within the Newtown Creek waterbody/watershed, a stakeholder team specific to the assessment area was assembled, and four meetings were held from September 2003 to May 2004 (DEP, 2003a, 2003b, 2004a, 2004b).

The first meeting included stakeholder introductions. Information was provided to the stakeholders on the State Water Quality Standards and the Newtown Creek's classification, and an introductory review of ongoing and planned projects affecting the Creek was given. The current USA Project activities were reviewed, indicating that the Newtown Creek assessment was underway with the Project Team having reviewed existing water quality data and historic records, and having developed land use and shoreline characterizations. The stakeholders were also informed that additional Newtown Creek water quality sampling had been performed to supplement DEP's ongoing water sampling programs; and that this data was currently being analyzed. It was also explained that the ongoing mathematical watershed and waterbody modeling was being conducted to fill in gaps between sampling stations and sampling periods, as well as to simulate future water quality under a variety of engineering alternatives, and that projecting the long-term water quality benefits of alternatives allows the DEP to identify the option that is most cost-effective and consistent with waterbody uses. The stakeholders were asked to review the land use map and a blank map included in the handout and mark them with information on uses of the creek and activities along the creek, such as: Where are people using the water (e.g. for kayaking or fishing)? Where is there public access to the creek? Where are businesses using the waterbody to support themselves? Where are there problems, such as exposed sediments or illegal dumping? The marked up maps were to be collected at the second meeting and compiled for presentation at the third meeting.

At the second meeting, information was gathered from the stakeholders on the riparian and waterbody uses, and the USA Project's waterbody/watershed assessment objectives, work plan for Newtown Creek, and its schedule were further discussed. Information was disseminated on the field investigations, past and present DEP water quality monitoring, and biological field monitoring conducted by the USA Project. The analysis phase of the assessment was detailed from assembling waterbody-related data, through the construction of predictive mathematical models of Newtown Creek and its watershed, the development of preliminary approaches to attain goals, the evaluation of waterbody/watershed control alternatives, recommendations for waterbody classifications, and the development of a preliminary waterbody/watershed plan. In addition to the discussion of the USA Project, two other presentations were made to the stakeholders. The first was an introductory presentation of the DEP's ongoing \$2.2 billion reconstruction and secondary treatment upgrade of the Newtown Creek WWTP, describing the existing WWTP characteristics and features, the benefits of the upgrade and reconstruction, and the construction schedule. The second was a presentation describing the Newtown Creek CSO

Facility Plan, including the characteristics of the combined sewer system and Newtown Creek water quality, the features and benefits of the CSO Facility Plan, and its implementation schedule.

At the third meeting, updated maps existing land uses in the waterbody/watershed assessment area and of Newtown Creek waterfront resources, including planned and proposed beneficial use projects around the Newtown Creek, were reviewed and input was taken from the stakeholders. A list of recognized water quality and riparian problems/impairments in the assessment area was reviewed. The water quality list included sediment mounds, pathogens/coliforms, odors, oil slicks, floatables, discoloration, dissolved oxygen, and benthic habitat, and the riparian problems/impairments included illegal dumping, minimal public access and brownfields. Stakeholder team members added lack of vegetation and deteriorating bulkheads to the riparian list and identified several areas on the map where illegal dumping, oils slicks, water discoloration, and limited wetland colonization had been observed in and on the waterbody. A list of suggested waterbody use goals for Newtown Creek was also reviewed. The following are comments and discussions recorded.

For recreational boating, it was noted that the East River Apprentice Shop and East River Kayak were launching water craft at the end of Manhattan Avenue and that one team member was using a private launch on Commercial Street.

Tours and environmental education were added as a use goal, along with access to nature and education. It was noted that the Urban Divers were giving tours of the waterbody.

Recreational fishing was noted as occurring at the bus depot on Commercial Street, Manhattan Avenue, the lot 100 pier, the Pulaski Bridge and Gantry Street Park. The use of signs in several languages, posted to identify the potential dangers of fishing was suggested.

Attaining swimmable water was discussed and the Stakeholder Team reached a consensus that the bathing standard would be unreasonable to achieve in the foreseeable future and that primary contact recreation in Newtown Creek represents a potential use conflict with current and potential commercial/industrial maritime uses of the waterbody that would otherwise benefit the local community. Secondary contact recreation was recognized as being more consistent with these maritime uses.

General use goals were identified - improved habitat (both aquatic and terrestrial), improved water quality towards fishable/swimmable, removed odors, remediated sediment, commercial/industrial maritime uses, transportation, secondary contact and “passive”- dangling one's feet in the water - recreation.

Finally, a status report on the waterbody/watershed assessment was provided, describing coordination with the U.S. Army Corps of Engineers, characteristics of the waterbody, watershed and riparian land uses, and ongoing assessment activities including water quality monitoring and data analysis, and computer modeling of the watershed and waterbody.

During the fourth meeting, the Newtown Creek Waterfront Projects and Activities map shown in Figure 6-1 was reviewed, which distinguishes between active and inactive piers and also maps locations of dumping and oil slicks that were identified by stakeholder team members at the third meeting. Stakeholder team members had no further corrections or comments. Also, the list of Newtown Creek Water Use Goals developed previously by the stakeholder team was reviewed as follows:

- Commercial and industrial maritime uses are ongoing and desired to continue;
- Transportation uses such as ferries and excursions are compatible with the waterbody;
- Boating and incidental contact with water is the most appropriate use for the waterbody (secondary contact recreation);
- Swimming is seen as a conflict with commerce, and, because of existing water quality, is unlikely in the short-term, although the goal is to attain fishable/swimmable compliance;
- Improved aquatic habitat is desired, including improvements in the water column (mainly dissolved oxygen) and remediation of sediment. For terrestrial environments, naturalization of shorelines is desired where compatible with upland uses; and
- Abatement of nuisances such as odors and floatables is desired.

The meeting also included a presentation on waterbody/watershed assessment planning describing the Newtown Creek's current designated use and regulatory issues, field investigations, preliminary water quality, biology and toxicity results, watershed and receiving water mathematical models, and a summary of combined sewer overflow discharges to Newtown Creek. The presentation included a description of how the models are used to simulate engineering alternatives and calculate compliance with water quality standards, along with the status of the waterbody/watershed assessment itself. The stakeholders were also informed that USA Project planning for Newtown Creek would be delayed in order to evaluate the effectiveness of in-stream aeration being piloted in Newtown Creek. No further meetings were scheduled.

6.3.3. Use and Standards Attainment (USA) Project Public Opinion Survey

The DEP 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 Citywide issues as well as those for local waterbodies. Primary and secondary waterbody survey results (dependent on residential location within watersheds) were analyzed discretely and summarized to provide additional insight into the public's waterbody uses and goals in addition to those identified via other public participation programs run by the DEP.

Survey interviews were conducted using Computer Assisted Telephone Interviews (CATI) among residents of the five New York City boroughs that were 18 years 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 all 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 at 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 was then 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. A minimum of 300 interviews for each of the 26 watersheds was included 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. Results of the survey for Newtown Creek and summarized below and detailed results are included as Appendix C.

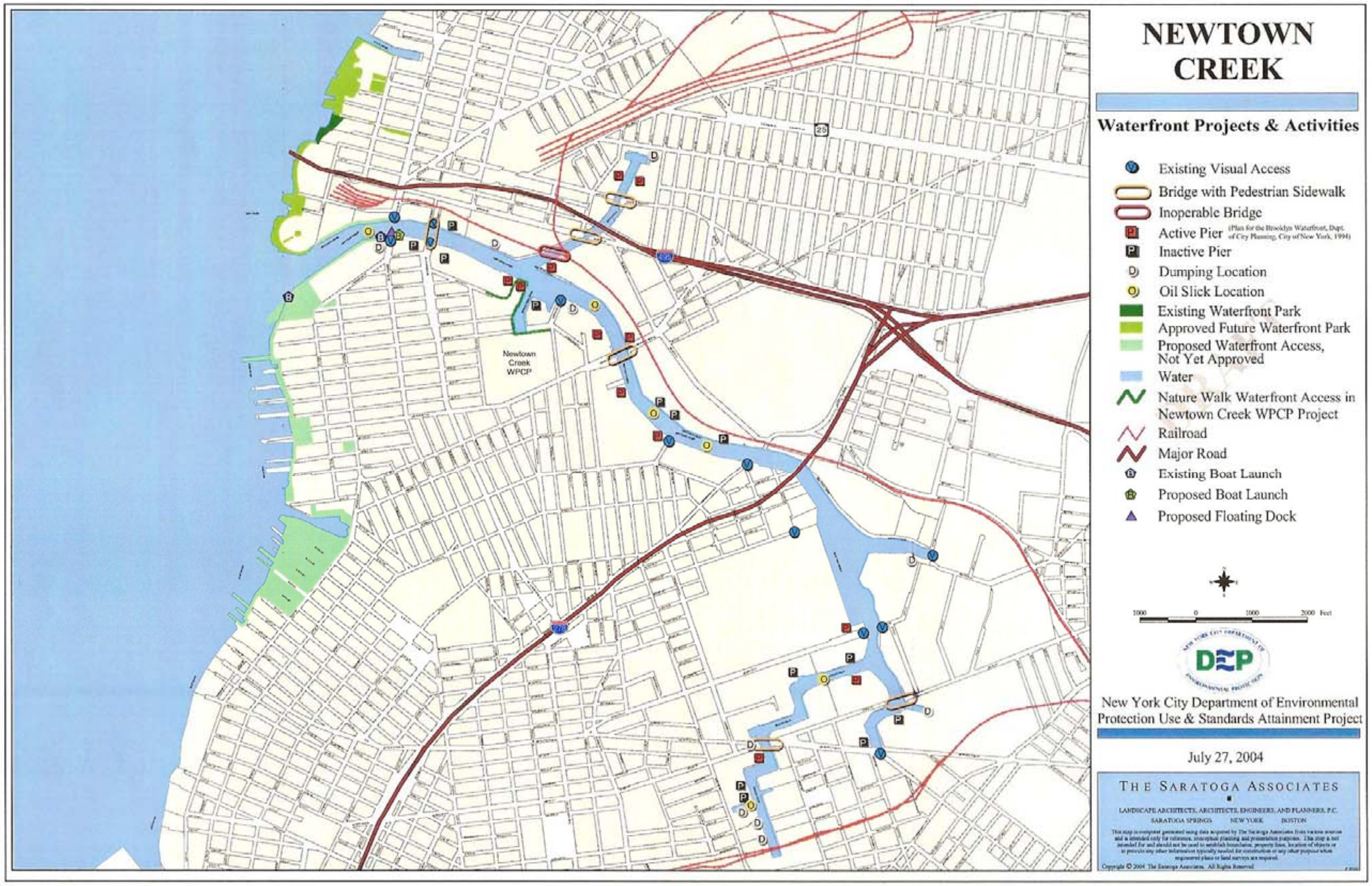
Waterbody Awareness

Approximately 42 percent of the Newtown Creek area residents that participated in the survey were aware of Newtown Creek but only 3 percent could identify Newtown Creek as their primary waterbody without prompting or aid in their response. On an unaided basis, area residents most often mentioned the East River as the waterway closest to their home.

Water and Riparian Uses

Approximately 18 percent of the Newtown Creek area residents that participated in the survey visit waterbodies in their communities or elsewhere in New York City on a regular basis and 42 percent occasionally visit waterbodies. The remaining percentage of area residents rarely visit waterbodies (26 percent) or not at all (14 percent). This is about the same as New York City residents in general. Sixty percent of the Newtown Creek area residents regularly or occasionally visit city waterbodies, while an identical 60 percent of all New York City residents regularly or occasionally visit city waterbodies. Only 4 percent of area residents have visited Newtown Creek at some point and 3 percent have done so in the prior 12 months. Among those area residents who are aware of Newtown Creek but have never visited it, 33 percent responded that there was no particular reason for not doing so, 34 percent cited waterbody conditions and 25 percent cited riparian conditions. When area residents cite negatives about the water as the reason for never having visited Newtown Creek, the specific issues are pollution (13 percent), odors (11 percent), and trash in the water/unclean water (8 percent). When New York City residents cite water negatives as the reason for never having visited the primary waterway in their assessment area, the specific issue most often mentioned is pollution (5 percent).

None of the interviewed Newtown Creek residents have participated in water activities there, but 1 percent has participated in land activities there.



Newtown Creek USA Project Stakeholder Meeting No. 4
Draft Waterfront Projects and Activities Handout

Improvements Noted

Approximately 43 percent of area residents indicated that they have noticed improvements in New York City waterways in general in the past five years, but less than 0.5 percent have noticed improvements specifically at Newtown Creek. Improvements in the water (quality, appearance and color) of New York City waterways were most frequently noted by area residents (22 percent). If funds were available, area residents would most like to see improvements to the water (quality, appearance and odor) at Newtown Creek. Sixty-seven percent of the area residents responding indicated that water quality was extremely important (29 percent) or somewhat important (38 percent).

Approximately 48 percent of the area residents who identified any improvement reported that they would be willing to pay between $10 and $25 a year for that improvement while 16 percent indicated that would not be willing to pay anything for improvements. For those that specifically cited water quality improvements as the most important improvement, 47 percent indicated they would be willing to pay between $10 and $25 a year for that improvement and 18 percent were not willing to pay anything.

When asked which waterway should be improved if funds were available to improve only one New York City waterway, 8 percent of area residents cited Newtown Creek as the waterway to be improved. In comparison, approximately 18 percent of New York City residents cited the waterbody in their own assessment area as the one that should be improved.

6.4. WATERBODY/WATERSHED FACILITY PLAN LOCAL STAKEHOLDER TEAM AND STAKEHOLDER MEETINGS

A stakeholder team for Newtown Creek, consisting of community and environmental leaders from Queens Community Boards 2 and 5, and Brooklyn Community Board 1, was assembled in 2006. The current group is largely made up of the same individuals that were assembled for the USA Project's public participation. Four stakeholder meetings were held from October 2006 to May 2007. Minutes of these meetings are included in Appendix D.

Meeting No. 1

At the first meeting, held October 25, 2006 the DEP introduced the project and indicated that the DEP is currently working to draft individual Waterbody/Watershed plans for CSOs, including one for Newtown Creek and that all plans must be submitted to the DEC by June 2007. Following the introduction, CSOs were defined, locations of Citywide CSOs and the DEP's WWTPs were shown, and a general background and description of the LTCP was given, including the history of CSO policy and previous water quality planning. It was noted that the preparation of the LTCP is a requirement of the 2005 Consent Order with the DEC, which also sets schedules for completion of specific water quality improvement projects, including the elements of the Newtown Creek CSO Facility Plan. It was further noted that each WB/WS plan would be developed with a group of stakeholders like the one assembled, and that their help would be enlisted to identify the existing and desired uses for a waterbody and to help to define waterbody characteristics.

The general introduction was followed by an introduction to the Newtown Creek waterbody and watershed, including the urbanized area, the number of permitted CSO and storm outfalls, the current water quality classification, and the WWTP collection systems serving the area. The significant marine and industrial uses in the area, as well as the limited public access were noted, and previous water quality sampling programs within Newtown Creek were discussed, including sampling locations, frequencies, sample parameters, and sample results. The major water quality issues were identified and preliminary baseline modeling results were shared, showing modeled baseline annual overflow volumes and frequency of discharge to the waterbody from each CSO.

The topic then moved on to planning, detailing the CSO Facility Plan elements that were submitted to the state in 2003: a tank at the head of English Kills, relief sewer from the East Branch, and a throttling gate, among others. It was noted that one element, a full-scale aeration facility, was currently under construction in upper English Kills and that a second phase of aeration was planned for lower English Kills, East Branch, and Dutch Kills. The discussion finished up by outlining some of the elements that might become part of the WB/WS plan, including dredging and flushing tunnels. Several stakeholders asked why separately sewered systems, particularly for new construction, were not included on the list of abatement alternatives, and it was noted that such a system would be costly and would not necessarily lead to improved water quality. A stakeholder expressed concern that low impact development alternatives (LIDs) were not included and it was noted that efforts were currently underway to understand the effects of LIDs on a watershed level and that the timeline required to develop a citywide policy on LIDs, which necessitates interagency evaluations and regulatory actions, will extend beyond the June 2007 milestone for delivery of an approvable WB/WS Facility Plan to DEC. It was further noted that a separate but related effort to create a Citywide policy on LIDs, by the DEP along with the Mayor's Office of Sustainability was underway.

Meeting No. 2

At the second meeting, held on December 13, 2006 a brief review of the waterbody and issues affecting it was given, and an update on the activities of stakeholder teams for other waterbodies was provided. It was noted that four stakeholder teams have completed their tasks of advising DEP on the WB/WS facility plans and that even though all of the completed project areas had significant prior facility planning, some changes have been made to the preexisting plans during the LTCP process.

Next sampling locations and dissolved oxygen data from 1990 and 2003 was presented. Both data sets showed that the Creek often does not attain the current DO standard and that DO levels get worse with distance away from the East River. Modeling results were then presented which also projected that the DO standards cannot be met 100 percent of the time even with complete removal of CSOs. Although there is no pathogen standard related to the waterbody's current SD classification, modeled fecal coliform levels were presented, which showed that fecal coliform levels would be less than 2,000 counts per 100 mL, the next highest water quality standard, if all CSO was removed.

Following the discussion of water quality, previous and ongoing projects and programs were discussed as well as current planning. It was noted that the timetable for the CSO Facility Plan projects is stipulated in the consent order and that the DEP was working to implement these measures and adhere to that schedule, but that other alternatives currently being evaluated under the Waterbody/Watershed Plan would be considered for the final plan if the alternatives are proven to produce equal water quality in a more efficient way or better water quality for a similar investment.

Lastly, current waterbody uses were reviewed based on this stakeholder group's input during the USA Project's public participation. It was noted that during the USA project meetings, some stated current uses included boating and recreational fishing at the bus depot on Commercial Street, Manhattan Avenue, the lot 100 pier, the Pulaski Bridge and Gantry State Park and that use goals included improved habitat, the removal of odors, and secondary contact recreation, such as boating. It was noted that area residents want improved access for boating, as well. During these earlier public participation meetings, this stakeholder group stated that primary contact recreation in Newtown Creek was unreasonable to achieve and that it represents a use conflict with current and potential industrial uses. However during this meeting, some of the current stakeholders said that primary recreation, swimming, should always be considered as the ultimate goal. Stakeholders also advocated for restored wetlands in the tidal inlets and education programs.

On several occasions during the meeting stakeholders asked about LIDs and the inter-agency project on LIDs run by the Mayor's Office of Sustainability. It was noted that the DEP is currently working towards a possible implementation of these alternatives and is carrying out a study to analyze and quantify the effect of LIDs on a watershed scale in the Jamaica Bay Watershed Protection Plan (JBWPP). Further, DEP is also working with the Mayor's Office of Sustainability and Long Term Planning on an interagency effort to implement LIDs, but that both of these projects are on a longer timeframe than the LTCP. The stakeholders were notified that the DEP will work to fold the findings of the JBWPP into the LTCP at a later date. Stakeholders requested that a representative from the Mayor's Office of Sustainability give a presentation at the next meeting, and the DEP team agreed to ask.

Meeting No. 3

A third meeting was held on March 21st, 2007. The meeting began with a recap of the previous meeting, and a brief review of the waterbody and issues affecting it. It was noted that the DEP received a letter from the Newtown Creek Alliance (NCA) regarding their concerns and goals for the waterbody. The NCA is a local community organization whose goal is to improve the environmental and economic conditions in and around Newtown Creek. The NCA requests were discussed at the meeting. The requests and the discussion follow:

- NCA requested that representatives from the Mayor's Office of Sustainability, and the New York City Department of Transportation, Buildings, and City Planning be present at the stakeholder meetings. It was noted that the Mayor's Office of Sustainability was invited to the meeting, but that they could not attend.
- NCA requested that the WB/WS Facility Plan incorporate explicit provisions for integration of alternative stormwater management technologies. It was discussed that the DEP is looking at opportunities for piloting source controls to determine their effectiveness and applicability in New York City, but that this could not occur before the June 2007 deadline for the WB/WS Facility Plans.

- NCA requested that they be able to present opportunities and propositions for alternative stormwater management technologies at the next stakeholder meeting. In response NCA was invited to present and was afforded time at the end of the meeting.
- NCA requested that there be an explicit commitment in the WB/WS Facility Plan to continuing analysis of alternative stormwater management practices and to public participation beyond the June 2007 submission date. It was noted that the DEP is working with the Mayor's Office of Sustainability and other NYC departments to review low impact development alternatives. A commitment will be included in the WB/WS Facility Plan to fold the results of these efforts into the CSO LTCP. Also the DEP is considering bi-annual public participation meetings after June 2007. These meetings would include all stakeholders and would be in addition to meetings required as part of the LTCP process. In response to a stakeholder question, Sue McCormick of the DEC discussed the differences between a WB/WS Facility Plan and a LTCP. The WB/WS Facility Plan is due in June 2007 and will include interim measures to address compliance with existing standards before a LTCP can be drafted and implemented. The LTCP due for Newtown Creek in 2017 will address the gap between the WB/WS Facility Plan and the attainment of CWA standards.
- NCA requested that the water quality designation for Newtown Creek be raised from its current water quality designation to Class I. Sue McCormick (DEC) indicated that marine standards as a whole were up for revision and that the response period is open. She indicated that more information is available online at the DEC's Environmental Notice Bulletin.

The meeting then moved to focus on the alternatives for water quality improvement that have been reviewed as part of the WB/WS Facility Plan. The discussions of each alternative included projected annual CSO volume reduction, projected water quality improvements, and an estimate of the capital cost of instituting the alternative. The alternatives discussed included:

- Dredging;
- In-stream aeration;
- The elements of the 2003 CSO Facility Plan;
- A new interceptor to the Newtown Creek WWTP;
- Flushing tunnels; and
- Multiple CSO storage tunnel layouts and sizes, including one that would capture 100 percent of the CSO in the typical year.

It was noted that removing 100 percent of the typical year CSO would not bring the waterbody into compliance with the existing standards. A review of the modeled dissolved oxygen deficit component analysis showed that the majority of dissolved oxygen deficit is due to sources outside of the Newtown Creek. The next largest contributor to oxygen deficit is Newtown Creek CSOs. Other sources of deficit include stormwater, the Newtown Creek WWTP discharge, and East River load.

Stakeholders expressed interest in wetland construction and questioned whether dredging conflicted with that. It was noted that dredging provides many benefits and that it did not conflict with wetlands. However, the dredging proposed is in close proximity to CSOs, and that wetlands established at these locations would be subject to sediment buildup and scouring.

The meeting wrapped up with a presentation by Kate Zidar (NCA), which provided a background on their efforts and outlined their main goals for the LTCP. These goals included interagency collaboration on stormwater management, pilot projects for source control, habitat restoration, and safe access to the Creek.

Meeting No. 4

The fourth and final Newtown Creek Stakeholder team meeting was held on May 23rd, 2007. The meeting opened with introductions and a review of the previous meeting's notes. Stakeholders asked for a revision that would better reflect the group's aspiration for primary contact recreation standards. The change was made and the finalized notes are included in Appendix D of this report. Stakeholders were also notified that the draft WB/WS Facility Plan being presented at this meeting would be completed and submitted to the DEC for review by the end of June and that the plan would be made available to Stakeholders in electronic form shortly thereafter.

Prior to continuing with the WB/WS Plan presentation, a Stakeholder was granted time to share part of a documentary describing the current water quality in Newtown Creek and uses of the creek, including swimming. The presentation then resumed with a quick review of Newtown Creek's existing conditions, historical sampling data and baseline modeled conditions. Baseline water quality modeling projects that the majority of the DO deficit in Newtown Creek is from sources outside Newtown Creek and as such removing 100% of CSOs from Newtown Creek would not bring the Creek into compliance with the current water quality standards.

Next stakeholder goals were reviewed, including improved habitat, removal of odors, and an upgrade to Water Quality Standard Class I, which allows for secondary contact recreation.

The remainder of the presentation focused on the development of and the elements included in the Waterbody/Watershed Facility Plan. The plan was developed by first analyzing available CSO abatement technologies, a group of which were retained for waterbody specific evaluation which paired down the available technologies even further. The remaining alternatives were then grouped into ten potential waterbody/watershed plans for final qualitative and quantitative comparison and analysis considering constructability, operation and maintenance concerns, cost, CSO volume and event reductions, and water quality. Section 7 of this report explains this process in more detail.

The final element of the WB/WS Plan presentation was to review the specific elements of the Waterbody/Watershed Facility Plan, including the costs and benefits associated with each element. The discussion was basically a summary of the information found in Section 8 of this report.

After the WB/WS Plan presentation, a representative from the DEP's Bureau of Environmental Planning and Assessment (BEPA), presented on the DEP's work with LIDs. The presentation noted that the Mayor signed Local Law 71 in 2005, requiring DEP to develop a plan to address the issue of disappearing wetlands in Jamaica Bay. The ensuing Jamaica Bay Wildlife

Protection Plan stipulates the exploration of different stormwater capture pilots. The data from these projects will be collected for three years after construction and the findings used to inform Citywide projects. The types of pilots already underway were reviewed, including: street side swales; porous pavement; enhanced tree openings, and constructed urban wetlands. Green roofs are also being reviewed for their application in different use districts. It was stressed that the application of many of these methods requires an in-depth understanding of specific site conditions. Other projects discussed included the Mayor's PLANYC, which includes the use of oysters and oyster habitat for water cleansing and the distribution of rain barrels to private property owners. Throughout the presentation representatives of BEPA and the Mayor's Office of Long Term Planning and Sustainability answered stakeholder questions on LIDs/BMPs, including questions on siting issues, incentives, new development, and potential modifications to the Waterfront Access Plan. A representative of the NCA indicated an interest in speaking to the Mayor's Office of Long Term Planning and Sustainability about specific projects in the Newtown Creek watershed. It was noted that an Interagency BMP Taskforce is being formed which will focus on developing a citywide approach to LIDs but more detailed discussions might be warranted.

Following the LIDs presentation, additional footage from the documentary was played and the meeting was adjourned.

6.5. 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 DEC. 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, DEC received in excess of 600 official comments via letter, facsimile, or e-mail during the comment period. All comments received were carefully reviewed and evaluated, then categorized by thematic elements deemed similar in nature by DEC. 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 DEC and DEP 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 DEC to indicate that "NYC citizenry places CSO abatement as a high ongoing priority" (DEC, 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 the plan development.

6.6. SPDES PERMITTING AUTHORITY

Any facilities built as part of this Waterbody/Watershed Facility Plan would be subject to the conditions of the Newtown Creek WWTP SPDES permit. Any action by the DEP that results in changes to their SPDES permits will be available for public comments when these permits are publicly noticed.

6.7. FINALIZATION OF PUBLIC PARTICIPATION

Following DEC review of this Waterbody/Watershed Facility Plan, a public information meeting and a formal public comment period will be held by the DEC to solicit public comment.

7.0. Evaluation of Alternatives

As noted in Section 5 of this report, the DEP has been engaged for many years in water-quality improvement projects and CSO facility planning for the Newtown Creek waterbody and watershed. Indeed, aspects of the Newtown Creek Facility Plan (URS, 2003), the components of which were included in the 2005 Consent Order, are already being implemented. For example, notice to proceed with construction was granted for the Zone 1 Aeration Facility on December 16, 2005 and this project was certified complete as of December 31, 2008. The design of the Kent Avenue Throttling Facility was completed in January 2007 and DEP issued an Order to Commence Work on December 13, 2007; the work is projected to be completed prior to the December 2012 consent order milestone.

Despite DEP's continuing implementation efforts, the Consent Order recognizes that this is not a final conceptual design for Newtown Creek facilities and allows the DEP to propose final modifications to the scope of the projects set forth in the 2003 CSO Facility Plan through the completion of an approvable Waterbody/Watershed Facility Plan for Newtown Creek to be submitted to the DEC by June 2007 (DEC, 2004b). The WB/WS Facility Plan developed herein builds upon these projects, and also examines the extent to which additional or alternative cost effective control measures may result in water quality standards being met. The present document incorporates comments received from the DEC on the June 2007 Newtown Creek WB/WS Facility Plan.

This section presents the evaluation of technologies alternatives for CSO control, including analyses that were performed in accordance with federal CSO LTCP guidance. Section 7.1 summarizes the regulatory framework for the evaluation of alternatives. Section 7.2 identifies and provides an initial screening of a full spectrum of CSO control technologies successfully applied elsewhere. The CSO control technologies that pass through initial screening are then examined in detail in Section 7.3 to create various alternatives that can be evaluated for effectiveness in mitigating CSOs in Newtown Creek. Section 7.4 presents a performance versus cost analysis of the feasible alternatives retained in 7.3, as well as a 100% reduction alternative, based on projected CSO volumes and frequencies and attainment of existing water quality standards. Section 7.5 describes the selected Waterbody/Watershed Facility Plan including the basis of selection and the costs and benefits of this Plan.

7.1 REGULATORY FRAMEWORK FOR EVALUATION OF ALTERNATIVES

The evaluation of alternatives to address CSO discharges and associated water quality impacts involves regulatory considerations in addition to those presented in Section 1. The following subsections present a summary of these considerations.

7.1.1. Water Quality Objectives

As previously described in Sections 1.2.1 and 4.5, Newtown Creek is listed on the Draft 2010 DEC "Section 303(d) List of Impaired Waters" due to DO/Oxygen Demand, and the listed sources of oxygen demand are urban runoff, storm sewers and CSO. The DEC has designated

Newtown Creek and its tributaries a Class SD waterbody subject to a DO concentration of never-less-than 3.0 mg/L. Because Class SD waterbodies do not support contact recreational uses, no bacteria criteria apply in Newtown Creek. The New York State numerical and DEC narrative surface water quality standards for Class SD waters are listed below in Table 7-1.

Table 7-1. New York State Numerical and Narrative Surface Water Quality Standards for Newtown Creek and its Tributaries

Class	**Class SD (Saline)**
Usage	Fishing. Suitable for fish survival. Waters with natural or man-made conditions limiting attainment of higher standards.
DO (mg/L)	≥ 3.0
Total Coliform (#/100mL)	N/A
Fecal Coliform (#/100mL)	N/A
Taste-, color-, and odor producing toxic and other deleterious substances	None in amounts that will adversely affect the taste, color or odor thereof, or impair the waters for their best usages.
Turbidity	No increase that will cause a substantial visible contrast to natural conditions.
Oil and floating substances	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.
Garbage, cinders, ashes, oils, sludge and other refuse	None in any amounts.
Phosphorus and nitrogen	None in any amounts that will result in growth of algae, weeds and slimes that will impair the waters for their best usages.

7.1.2. Range of Alternatives

The federal CSO Policy calls for LTCPs to consider a number of factors when evaluating CSO control alternatives , as described in Sections II.C.4 and II.C.5 of the Policy (40 CFR 122 [FRL-4732-7]). EPA expects the analysis of alternatives to be sufficient to make a reasonable assessment of the expected performance and the cost of the alternatives. With regard to performance, EPA expects the LTCP to "consider a reasonable range of alternatives" in the selection process. The LTCP should consider four or more alternatives, providing a range of control above the existing condition and extending to full elimination of CSOs, as measured in terms of CSO frequency or CSO capture. Such an analysis, based on CSO capture, was undertaken for the Newtown Creek waterbody, and is described in detail later in this section.

7.1.3. "Presumption" and "Demonstration" Approaches

Whether a particular alternative provides sufficient control can be determined in two different manners. In the "Presumption Approach," alternatives that meet any of a number of discharge-based criteria may be "presumed" to provide sufficient CSO control as to meet the water-quality based requirements of the CWA. These discharge-based criteria, which are applicable to an entire combined-sewer system (i.e., a WWTP drainage area) and not necessarily to the drainage area of a particular waterbody include:

i. No more than an average of four overflow events per year, provided that the permitting authority may allow up to two additional overflow events per year. For the purpose of this criterion, an overflow event is one or more overflows from a Combined Sewer System (CSS) as the result of a precipitation event that does not receive a minimum treatment specified below;

ii. The elimination or the capture for treatment of no less than 85 percent by volume of the combined sewage collected in the CSS during precipitation events on a system-wide annual average basis; or

iii. The elimination or removal of no less than the mass of the pollutant [...] for the volumes that would be eliminated or captured for treatment under item ii above.

The Presumption Approach further dictated that combined sewer flows remaining after implementation of the Nine Minimum Controls and within the criteria listed above should receive a minimum of:

- Primary clarification (Removal of floatables and settleable solids may be achieved by any combination of treatment technologies or methods that are shown to be equivalent to primary clarification);
- Solids and floatables disposal; and
- Disinfection of effluent, if necessary, to meet WQS, protect designated uses and protect human health, including removal of harmful disinfection chemical residuals, where necessary.

In the "Demonstration Approach," alternatives providing sufficient CSO control are those that, through modeling and/or other analyses, are expected to provide sufficient CSO control to meet the water-quality based requirements of the CWA. The criteria associated with the Demonstration Approach are:

i. The planned control program is adequate to meet WQS and protect designated uses of the waterbody, unless WQS or uses cannot be met as a result of natural background conditions or pollution sources other than CSOs;

ii. The CSO discharges remaining after implementation of the planned control program will not preclude the attainment of WQS or the receiving water's designated uses or contribute to their impairment. Where WQS and designated uses are not met in part because of natural background conditions or pollution sources other than CSOs, a total maximum daily load, including a waste load allocation and a load allocation, or other means should be used to apportion pollutant loads;

iii. The planned control program will provide the maximum pollution reduction benefits reasonably attainable; and

iv. The planned control program is designed to allow cost effective expansion or cost effective retrofitting if additional controls are subsequently determined to be necessary to meet WQS or designated uses.

7.1.4. Cost/Performance Consideration

EPA expects the permittee to use the costs associated with each of these alternatives to demonstrate the relationships among a comprehensive set of reasonable control alternatives that correspond to the different ranges specified in Section II.C.4 of the federal CSO policy. This should include an analysis to determine where the increment of pollution reduction achieved in the receiving water diminishes compared to the increased costs. This analysis, often known as "knee of the curve," should be among the considerations used to help guide selection of controls for Newtown Creek.

7.1.5. Consideration of Non-CSO Inputs

Load sources other than CSOs were included in the receiving water modeling to assess water-quality conditions. These other inputs consist of stormwater, WWTP discharge, water entering the waterbody via tidal exchange with the East River, and background conditions from the System-Wide Eutrophication Model outside the boundaries of the Newtown Creek Receiving Water Model. The water quality parameter of concern with Non-CSO inputs is oxygen deficit. As shown in Figure 7-1, background conditions in the open waters are the largest contributor to oxygen deficit within Newtown Creek. Oxygen deficit related to CSOs is the next largest, and increases near the head ends of Dutch Kills, Maspeth Creek, East Branch, and English Kills near the four largest outfalls. Other sources of oxygen deficit within the drainage area are considered to be insignificant, and pollutant reduction alternatives focused on CSO.

7.1.6. Consideration of Other Parameters

Other parameters such as existing waterbody uses and stakeholder goals for waterbody use were taken into account when determining the necessary level of CSO control. Other parameters considered as part of the evaluations of alternatives for Newtown Creek include the following:

- Waterbody Use: As discussed in Section 2, the Newtown Creek is within the Coastal Zone Boundary, and all but the downstream reaches have been designated a Significant Maritime and Industrial Area through the Waterfront Revitalization Program, where public investment be targeted to improve transportation access and maritime and industrial operations. This most likely precludes future designation for primary contact recreational uses in the waterbody due to the potential use conflict it would represent.
- Aquatic Life Uses: Aquatic life in the Newtown Creek waterbody was characterized under the USA project and is described in detail in Section 4.
- Sensitive Areas: As discussed in Section 7, DEC, as the permitting authority, has determined that the Newtown Creek waterbody as a whole is a sensitive area. The

sensitive area designation is intended to provide a prioritization for controlling overflows. For such an area, the LTCP should either (a) prohibit new or significantly increased overflows or (b) eliminate or relocate overflows that discharge to sensitive areas if physically possible and economically achievable, unless elimination or relocation creates more environmental impact than continued discharge, with additional treatment as necessary to meet water quality standards. However, the designation does not assist in prioritizing outfalls or evaluating alternatives to addressing CSO discharges within the waterbody itself. Additionally, this waterbody/watershed assessment and planning effort includes alternatives which prohibit new or significantly increased overflows, and eliminates or relocates overflows that discharge to the waterbody in accordance with the requirements of Federal CSO Policy for sensitive areas.

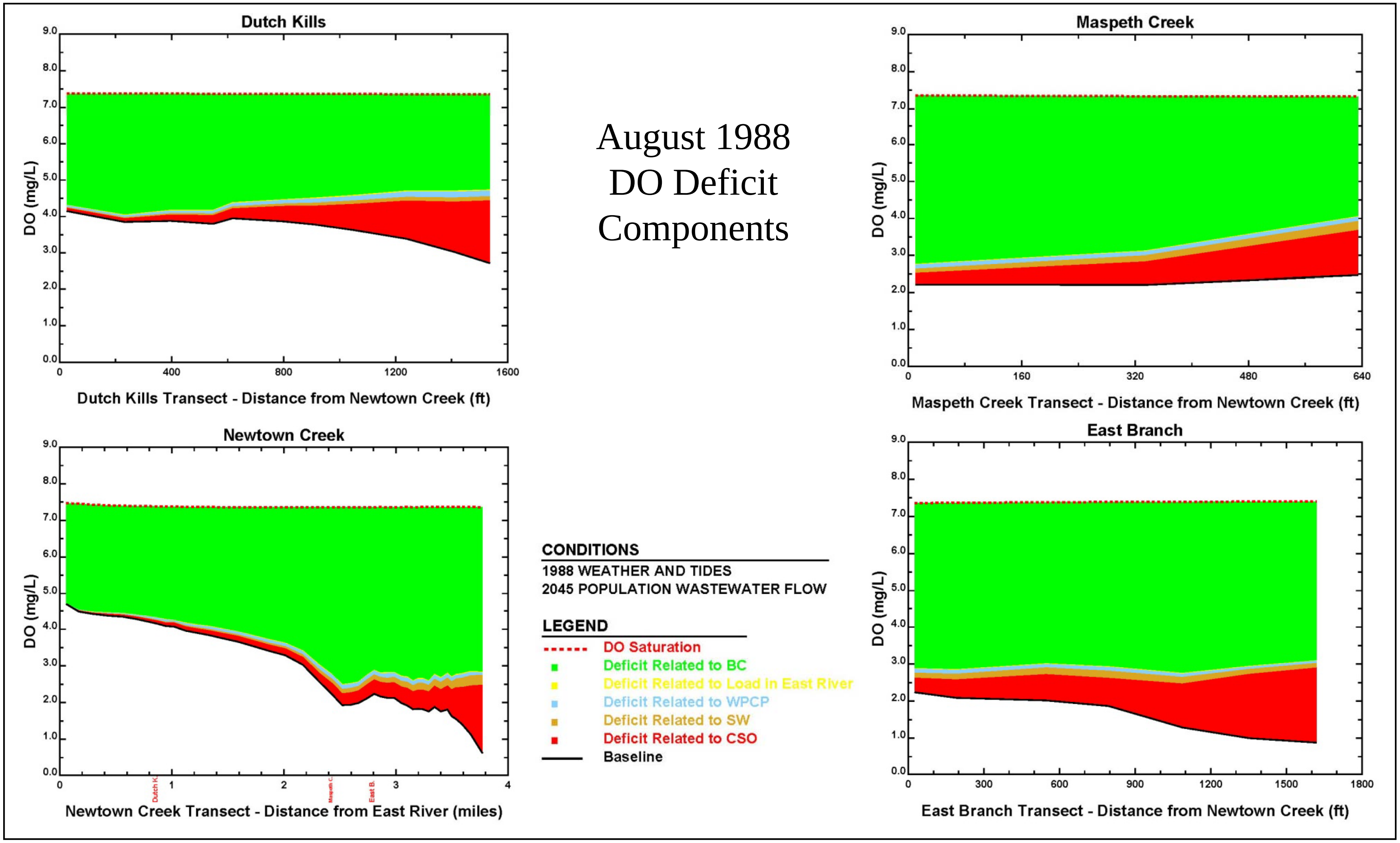
- Stakeholder Goals: Stakeholder goals for the waterbody include fishing, boating, boat access, restored wetlands, education programs, integration of alternative stormwater management technologies, improved habitat (aquatic and terrestrial), odor reduction, "passive" recreation, and upgrading the DEC water quality designation to Class I, and were determined through the public participation effort described in Section 6. As discussed there, some stakeholders also indicated that primary recreation, swimming, should always be considered as the ultimate goal, but previous comments from this stakeholder team during the USA Project acknowledged that primary contact recreation in Newtown Creek was unreasonable because it is a use conflict with current and potential industrial uses of the waterbody.

7.2. SCREENING OF CSO CONTROL TECHNOLOGIES

A wide range of CSO control technologies was considered for application to New York City's CSS. An effort was made to include all technologies that have been successfully applied to CSO control, and no technologies were excluded prior to initial screening. The technologies are grouped into the following general categories:

- Watershed-Wide Non-Structural Controls
- Inflow Control
- Green Infrastructure
- Sewer System Optimization
- Sewer Separation
- Storage
- Treatment
- Receiving Water Improvement
- Solids and Floatables Control

Technologies included in each category are summarized in Table 7-2 below and further described in subsections that follow.



Environmental Protection

Newtown Creek
Dissolved Oxygen Deficit Components

Table 7-2. Preliminary Screening of Technologies

CSO Control Technology	Performance: CSO Volume Reduction	Bacteria Removal	Floatables Control	Suspended Solids Reduction	Implementation and Operational Factors
Watershed-Wide Non-Structural Controls (Section 7.2.1)					
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	Low	Medium	Low	Labor intensive, requires specialized equipment.
Industrial Pretreatment	Low	Low	Low	Low	There is limited industrial activity in this combined sewer area.
Inflow Control (Sections 7.2.2)					
Stormwater 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 Stormwater	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 Infrastructure (see Sections 5.8 and 8.8)					
Sewer System Optimization (Section 7.2.4)					
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 (Section 7.2.5)					
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 stormwater pollutant loads.
Storage (Section 7.2.6)					
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,

CSO Control Technology	Performance				Implementation and Operational Factors
	CSO Volume Reduction	Bacteria Removal	Floatables Control	Suspended Solids Reduction	
					pump station required to lift stored flow out of tunnel.
Treatment (Section 7.2.7)					
Screening/Netting Systems	None	None	High	None	Controls only floatables.
Primary Sedimentation[1]	Low	Medium	High	Medium	Limited space at WWTP, 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 WWTP and other flow controls, increased O&M costs.
High Rate Physical/Chemical Treatment[1]	None	Medium	High	High	Limited space at WWTP, requires construction of extensive new conveyance conduits, high O&M costs.
Disinfection	None	High	None	None	Cost Intensive/Increased O&M.
Expansion of WWTP	High	High	High	High	Limited by space at WWTP, increased O&M.
Receiving Water Improvement (Section 7.2.8)					
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, may require dredging.
Flushing Water	None	None	None	None	Potentially complex and costly delivery system, high O&M, only effective for increasing DO.
Maintenance Dredging	None	None	None	None	Removes deposited solids after build-up occurs.
Solids and Floatables Controls (Section 7.2.9)					
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.
Skimming Vessels	None	None	High	None	Easy to implement but limited to navigable waters.
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.

1. Process includes pretreatment screening and disinfection.

7.2.1. Watershed-Wide Controls or Non-Structural 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 DEP program (DEP, 2005b).

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 sewer systems. 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 two times per week to six times per week reduced floatables by approximately 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, 1995b). 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. DSNY also has an aggressive enforcement program targeting property owners to minimize the amount of litter on their sidewalks. These programs are described in New York City's Citywide Comprehensive CSO Floatables Plan (DEP, 2005a).

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;EPA, 1983). The principal reason for this is that mechanical sweepers, employed at that time, could not 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.

Construction Site Erosion Control

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 operation and maintenance (O&M) costs. For applicable projects, New York City's CEQR requirements addresses potential impacts associated with sediment runoff as well as required measures to be employed to mitigate any potential impacts.

Catch Basin Cleaning

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-to 2 percent of the five day biochemical oxygen demand (BOD_5) produced by a combined sewer watershed (EPA, 1977). As a result catch basins cannot be considered an effective pollution control alternative for BOD_5 removal.

New York City has an aggressive catch basin hooding program to contain floatables within catch basins and remove the material through catch basin cleaning (Citywide Comprehensive CSO Floatables Plan, Modified Facility Planning Report, City of New York, Department of Environmental Protection, July 2005). 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. Results of a pilot scale study showed that floatables capture improves as material accumulates in the catch basin (HydroQual, 2001f). During a rain event, the accumulated floatables can dissipate the hydraulic load entering a catch basin, thereby reducing turbulence in the standing water and reducing the escape of floatables. Thus, while hooding of catch basins will improve floatables capture, the hooding program is not expected to result in a major increase in catch basin cleaning.

Industrial Pretreatment

Industrial pretreatment programs are geared toward reducing potential contaminants in CSO by controlling industrial discharges to the sewer system. DEP has an industrial pretreatment program in place as discussed in Section 3 of this report.

7.2.2. Inflow Control

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

Stormwater Detention

Stormwater detention utilizes a surface storage basin or facility to capture stormwater before it enters the combined sewer system. Typically, a flow restriction device is added to the catch basin to effectively block stormwater from entering the basin. The stormwater is then diverted along natural or man-made drainage routes to a surface storage basin or "pond-like" facility where evaporation and/or natural soil percolation eventually empties the basin. Such systems are applicable for smaller land areas, typically up to 75 acres, and are more suitable for non-urban areas. Stormwater blocked from entering catch basins would be routed along streets to the detention pond which would be built in the urban environment. Extensive public education and testing is required to build support for this control and to address public concerns such as potential unsafe travel conditions, flood damage, damage to roadways. Such a system is not considered viable for a highly congested urban area such as New York City.

Street Storage of Stormwater

Street storage of stormwater utilizes the City's streets to temporarily store stormwater on the road surface. Typically, the catch basin is modified to include a flow restriction device. This device limits the rate at which surface runoff enters the combined sewer system. The excess stormwater is retained on the roadway entering the catch basin at a controlled rate. Street storage can effectively reduce inflow during peak periods and can decrease CSO volume. It also can promote street flooding and must be carefully evaluated and planned to ensure that unsafe travel conditions and damage to roadways does not occur. For these reasons, street storage of stormwater is not considered a viable CSO control technology is New York City.

Water Conservation

Water conservation is geared toward reducing the dry weather flow in the combined sewer system, thereby increasing the system's ability to accommodate more stormwater and reduce CSO discharges. 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 DEP's ongoing efforts to save water that reduce inflows to the combined sewers include installing individual water meters on water service lines to encourage conservation and equipping fire hydrants with special locking devices. Water conservation programs have resulted in the reduction of water consumption Citywide by approximately 230 MGD over a 10-year period or a reduction of 43 gallons per person per day from 1996 to 2006 (DEP, 2007). This change equates to a 17.5 percent reduction in overall daily water consumption, even as the population increased by approximately nine percent. The water consumption on a daily per capita basis decreased by 24.5 percent. Water conservation, as a CSO control technology, is effectively implemented to a satisfactory level, and New York City has achieved significant reductions in wastewater flow through its existing water conservation program.

As described above, reduced flow strategies are expected to require little incremental expenditure as water consumption and wastewater flows have been on the decline in recent years. Furthermore, the combination of automated meter reading, the ability of customers to track water usage, and national water efficient fixture standards is expected to keep flows stable. Additional conservation measures, such as toilet and other fixture rebate programs, are expected to have only nominal costs associated with them, and would be necessary only if the declining trend reverses.

Infiltration/Inflow (I/I) Reduction

Infiltration and inflow is ground water and other undesired water that enters the collection system through leaking pipe joints, cracked pipes, and manholes. Excessive amounts of infiltration and inflow take up the hydraulic capacity of the collection system. In contrast, the inflow of surface drainage is intended to enter the CSS the combined system. Sources of inflow that might be controlled include leaking or missing tide gates and inflow in the separate sanitary system located upstream of the combined sewer system.

DEP conducted an Infiltration/Inflow (I/I) analyses Citywide during the late 1980s and early 1990s, and follow-up Sewer System Evaluation Surveys (SSES) where indicated. These investigations identified areas of excessive I/I by comparing measured nighttime flow rates to estimates of water usage developed from a derived per capita water usage rate and data from available records.

The Bowery Bay SSES identified an average of 40.2 MGD of infiltration, but despite a comprehensive track down program, the sources of less than 4 percent of the I/I anticipated were positively identified in the field. The sewer system was generally found to be in adequate condition, and diver inspections did not locate any obvious sources of infiltration. Because of the lack of success in locating sources during TV programs in other DEP sewer studies, only 15,000 feet of sewers were recommended for inspection, the results of which were identifying only about 2.5 percent of the expected infiltration. The SSES determined that it would be more cost-effective to simply transport and treat the excess I/I flow rather than attempting to reduce it, and therefore recommended no further rehabilitation in the Bowery Bay collection system (URS, 1986, 1990, 1992). It should also be noted that sanitary flows to the WWTPs have been significantly reduced over the last 15 years and the Bowery Bay WWTP is currently well below its design capacity and additional I/I controls is not projected to result in appreciable CSO reductions but will be reevaluated as part of the Drainage Basin Specific LTCP.

The Newtown Creek collection system was evaluated during the 201 Facilities Plan (Greeley and Hansen, 1982). SSES was recommended for several locations in the Manhattan portion of the Newtown Creek WWTP service area, but none in the Brooklyn and Queens portions. Infiltration and inflow have been determined not to be significant problems in the service areas tributary to the Newtown Creek waterbody complex, and were not identified as inducing CSO. Therefore, mitigating I/I is unlikely to result in appreciable reductions in CSO discharges to surrounding waters. Nonetheless, I/I control will be reevaluated during the development of the Drainage Basin Specific LTCP.

7.2.3. Green Infrastructure

See Sections 5.9 and 8.8.

7.2.4. DEP 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, weir modifications, and treatment facilities to determine if improved operating procedures can be developed to provide benefit in terms of CSO control.

Real Time Control (RTC)

RTC is any response – manual or automatic – made in response to changes in the sewer system to improve operating conditions. For example, the depth of flow of sewage within the sewer system and flow data can be monitored in "real time" at key points in the sewer system and transferred to a control device such as a central computer where decisions can be 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 WWTP 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 when 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 WWTP after the storm event when capacity for treatment becomes available. Technologies available for 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 7-2 for a diagram of an example 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. This pilot study involved the use of inflatable dams and RTC at two locations (Metcalf Avenue and Lafayette Avenue) in the Bronx. Testing was completed in early 2007 and the equipment remained idle until August 2009, when decommissioning was completed. From this study, the City found that the technology was feasible for further consideration, and constructed two permanent facilities that were completed in August 2010. 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 to adequately improve water quality, especially in areas where tributary water quality is degraded

Based on the experience gained from both the pilot and permanent installations, DEP has identified significant issues related to the viability of inflatable dams. Acquiring bidders was difficult because there has been only two manufacturers of inflatable dam systems historically: one no longer manufactures the dams and the other has curtailed service in the United States market. Aside from competitive bidding requirements, the limited market results in questionable reliability in the supply of replacement parts. While these challenges may be manageable for a limited number of facilities, wide spread application of dams may lead to ineffective operation, creating considerable operation and maintenance issues, and could lead to flood-inducing malfunctions.

Both optimization of the existing system and real time control will be retained for further consideration when evaluating potential alternatives for CSO control in Newtown Creek.

7.2.5. Sewer Separation

Sewer separation is the conversion of a combined sewer system into a system of separate sanitary 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 stormwater will no longer be captured and treated at the downstream WWTP. In addition, this alternative involves substantial excavation that could exacerbate traffic problems within the City.

Varying degrees of sewer separation could be achieved as described below and illustrated in Figure 7-3:

Rain Leader (Gutters and Downspouts) Disconnection

Rain leaders are disconnected from the combined sewer system with storm runoff diverted elsewhere. Depending on the location, leaders may be run to a dry well, vegetation bed, a lawn, a storm sewer or the street. Unfortunately, this scheme is inconsistent with existing city codes and regulations but these regulations may be modified in the future to support future green initiatives. Rain leader disconnection could contribute to nuisance street flooding and may only briefly delay the water from entering the combined sewer system through catch basins. For this reason, rain leader disconnection will be 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 stormwater system. Partial separation through construction of high level storm sewers (HLSS) is a potentially feasible alternative that is featured in the New York City Mayor's "PlaNYC 2030" initiative. Therefore, the DEP will continue to promote and support opportunities for local partial separation in select locations throughout the City. This technology is retained for further consideration on a site specific basis and is believed to be most cost-effective in areas near the shorelines where there is no need to build large diameter and long storm sewers to convey the separated stormwater to the receiving waterbody.

Complete Separation

In addition to separation of sewers in the streets, stormwater 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, office, and commercial buildings where roof drains are interconnected to the sanitary plumbing inside the building. In urban areas there is a lack of pervious surface areas to disperse the storm runoff into the ground, which could lead to nuisance flooding, and wet foundations and basements. These risks have led to the prohibition of stormwater disconnections from the combined sewers in the City Building Code. In addition, the widespread excavation and lengthy timeframes required to broadly implement separation would lead to unacceptable street disruptions and may not be feasible in areas with dense buried infrastructure. This alternative is not retained for further consideration.

7.2.6. Storage and Conveyance

The objective of retention basins (also referred to as off-line storage) is to reduce overflows by capturing combined sewage in excess of WWTP capacity during wet weather for controlled release into the WWTP after the storm event. Retention basins can provide a relatively constant flow into the treatment plant thereby reducing the hydraulic impact on downstream WWTPs. 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 low, 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 stormwater flows, including those in Richmond, Virginia; Chippewa Falls, Wisconsin; Boston, Massachusetts; Milwaukee, Wisconsin; and Columbus, Ohio.

The following describe 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 of the tank. 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.

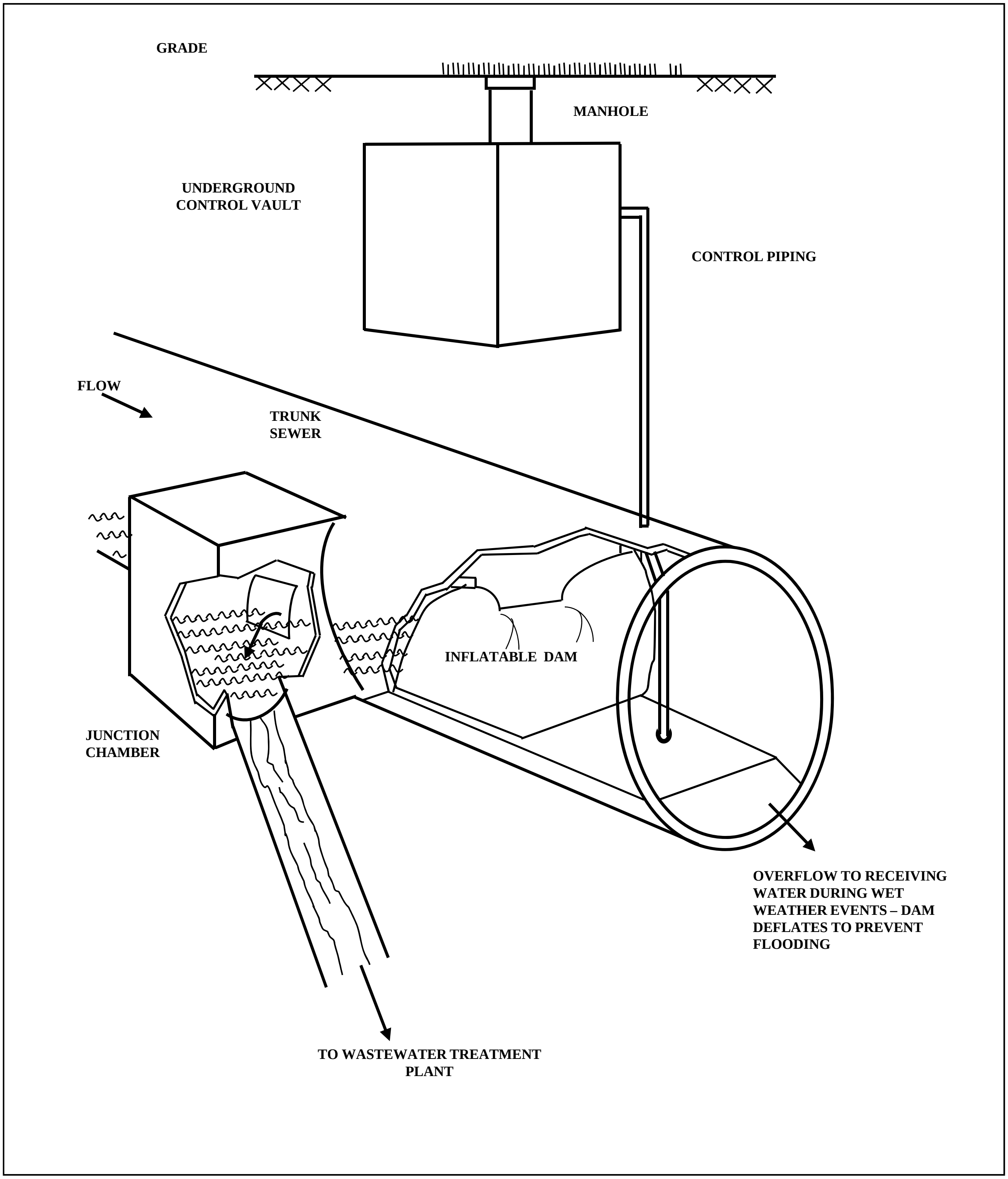
Storage Pipelines/Conduits

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 to downstream WWTPs for ultimate treatment. 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

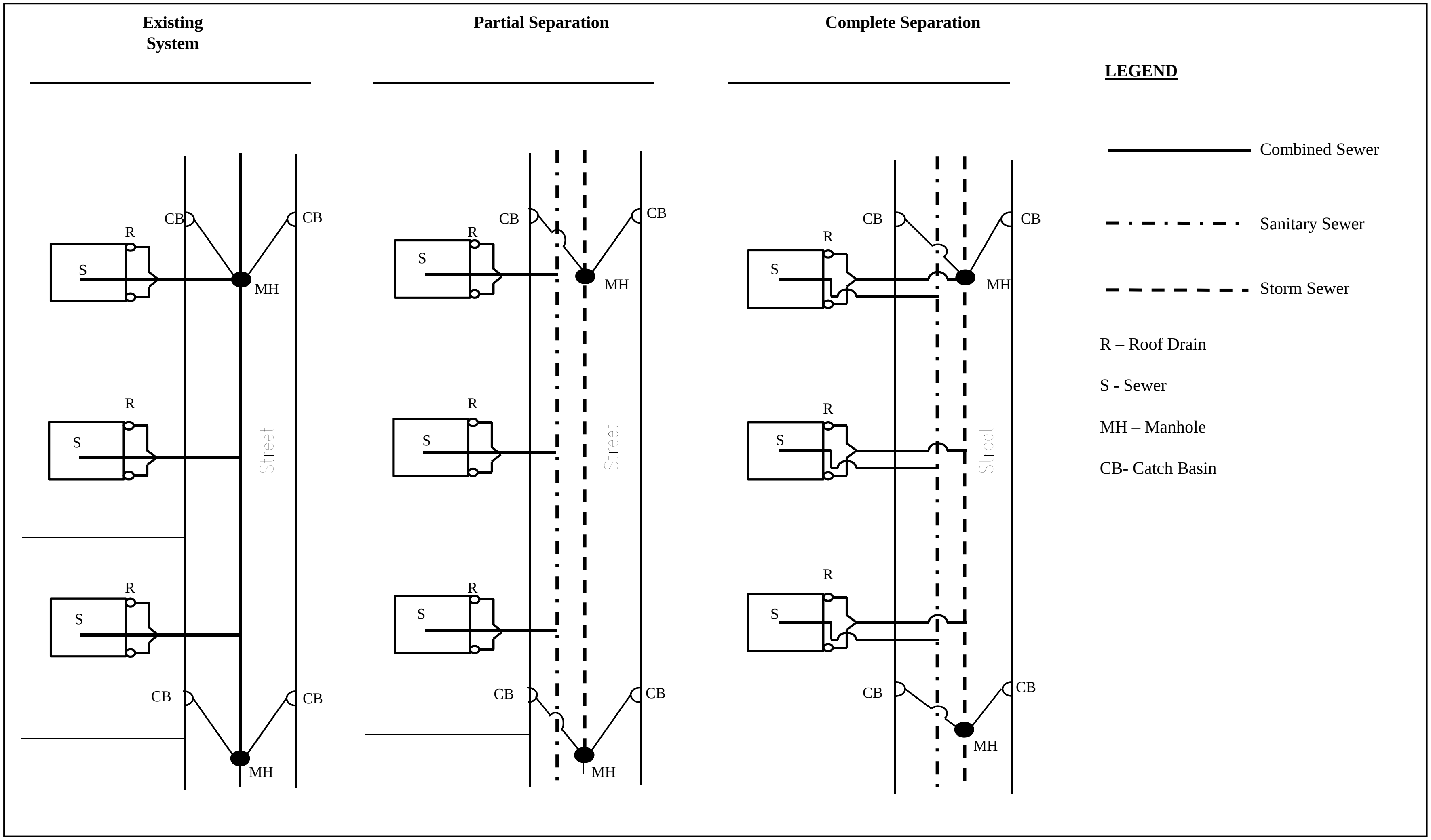
Tunnels are similar to storage pipelines in that they can provide both significant storage volume and conveyance capacity. Tunnels have the advantage of causing minimal surface disruption and of requiring little right-of-way for construction. Excavation to construct the tunnel is carried out deep beneath 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 7-4. 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 WWTP.

The three storage alternatives discussed above – closed concrete tanks, storage pipelines / conduits, and tunnels – will be retained for further consideration.



NYC Environmental Protection

Inflatable Dam System

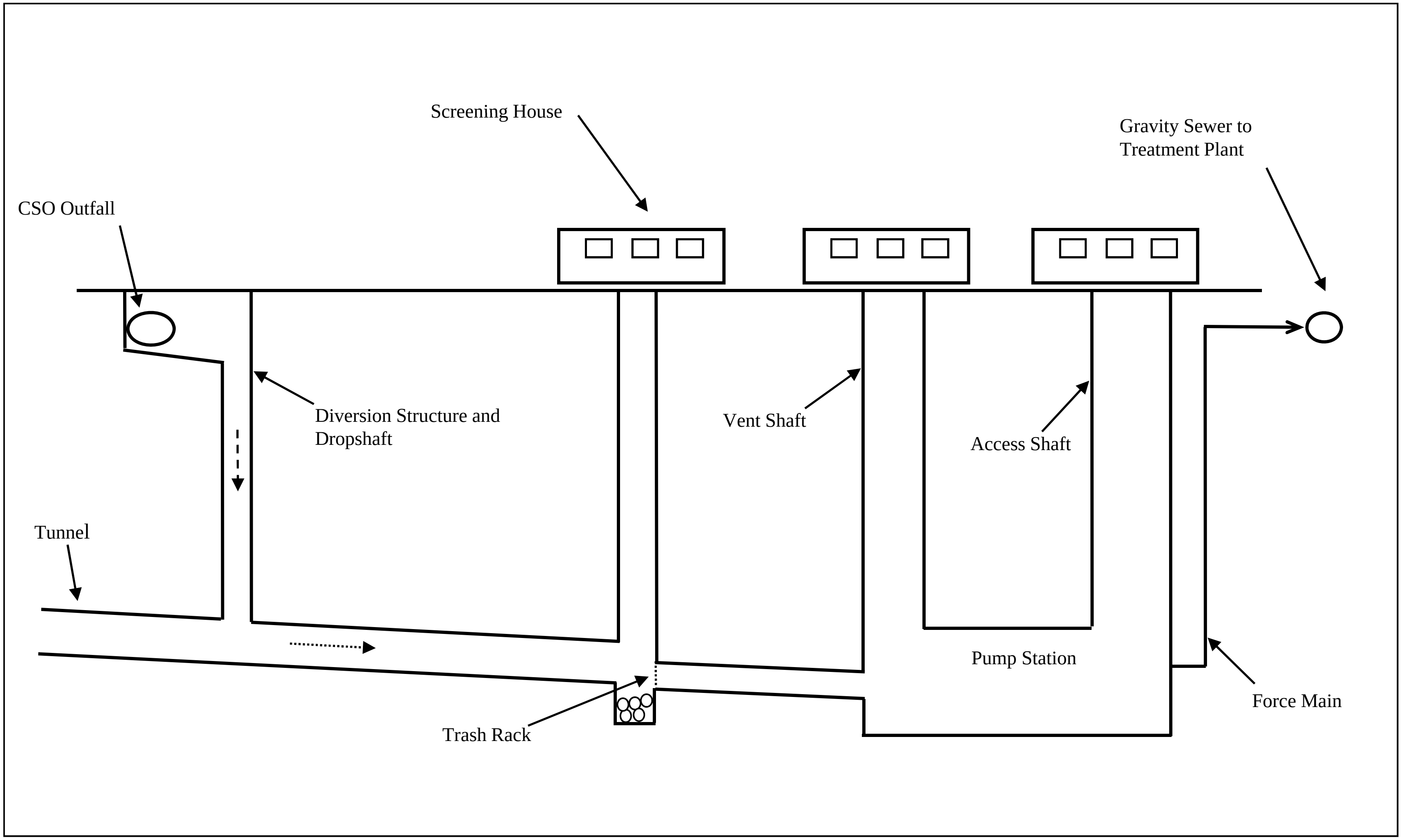


NYC Environmental Protection

Sewer Separation Alternatives

Newtown Creek Waterbody/Watershed Plan

Figure 7-3



Storage Tunnel Schematic

7.2.7. Treatment

CSO Treatment alternatives include technologies intended to separate solids and/or floatables from the combined sewer flow, disinfect for pathogen treatment, or provide secondary treatment for some portion of the combined flow. The following are types of treatment technologies:

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 of between 1.5 to 3.0 inches. Manually cleaned bar racks are similar to trash racks and have clear spacings of between 1.0 to 2.0 inches. Both screens must be manually raked and the screenings must be 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 overflow diversion structure so they can be conveyed to the wastewater treatment plant with the sanitary wastewater thereby minimizing the need for on-site collection of screenings for truck transport.

Due to the widely varying nature of CSO flow rates, even mechanically cleaned screens are subject to blinding under certain conditions. 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. In addition to maintaining the screens, the screening must be housed in a building to address aesthetic concerns and odor facilities may be required as well. Fine screens have had limited application for CSOs in the United States. ROMAG reports that over 250 fine screens have been installed in Europe and several fine screens have been installed in the United States (EPA, 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. The tanks are also very adaptable to chemical additives, such as lime, alum, ferric chloride, and polymers, which can 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 (EPA, 1978). Studies on existing stormwater basins indicate suspended solids removals of 15 to 89 percent; BOD_5 removals of 10 to 52 percent (EPA, 1978, Fair and Geyer, 1965, Ferrara and Witkowski, 1983, Oliver and Gigoropolulos, 1981).

The DEP's WWTPs 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.

Because new primary sedimentation facilities would occupy a significant amount of land, siting these facilities would not be feasible in New York City. Both the Bowery Bay and Newtown Creek WWTPs are already densely developed and cannot accommodate new primary tanks. In the Newtown Creek community, land areas near significant outfalls are also insufficient to site primary sedimentation facilities. Given the land constraints, primary sedimentation will not be further considered.

Vortex Separation

Vortex separation technologies currently marketed include: EPA Swirl Concentrator, Storm King Hydrodynamic Separator of British design, and the FluidSep vortex separator of German design (Figure 7-5). 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 WWTP. 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; and 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 constructed the Corona Avenue Vortex Facility (CAVF) in the late 1990's to evaluate the performance of three swirl/vortex technologies at a full-scale test facility

(133 MGD each). 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 virtually no reductions in total suspended solids and an average floatables removal of approximately 60 percent during the tested events. Based on the results of the testing, DEP concluded that widespread application of the vortex technology is not effective for control of CSOs and is 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. DEP is planning to decommission the CAVF in accordance with all applicable laws and regulations.

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 floatables removal with an average removal efficiency of about 6 percent (Greeley and Hansen, 1995). The suspended solids removal performance of vortex separators is 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 stormwater, the overall TSS removal will be low. Suspended solids removal in the beginning of a storm event 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 moving parts – requires sufficient driving head.

Based on the poor results of the testing at the Corona Vortex Facility Evaluation of Corona Avenue Vortex Facility, City of New York Department of Environmental Protection, September 29, 2003, 2-volumes; Corona Avenue Vortex Facility Underflow Evaluation, City of New York, Department of Environmental Protection, October 2005), and the general lack of available head, vortex separators have been removed from further consideration in New York City in general and from consideration within the Newtown Creek watershed.

High Rate Physical Chemical Treatment (HRPCT)

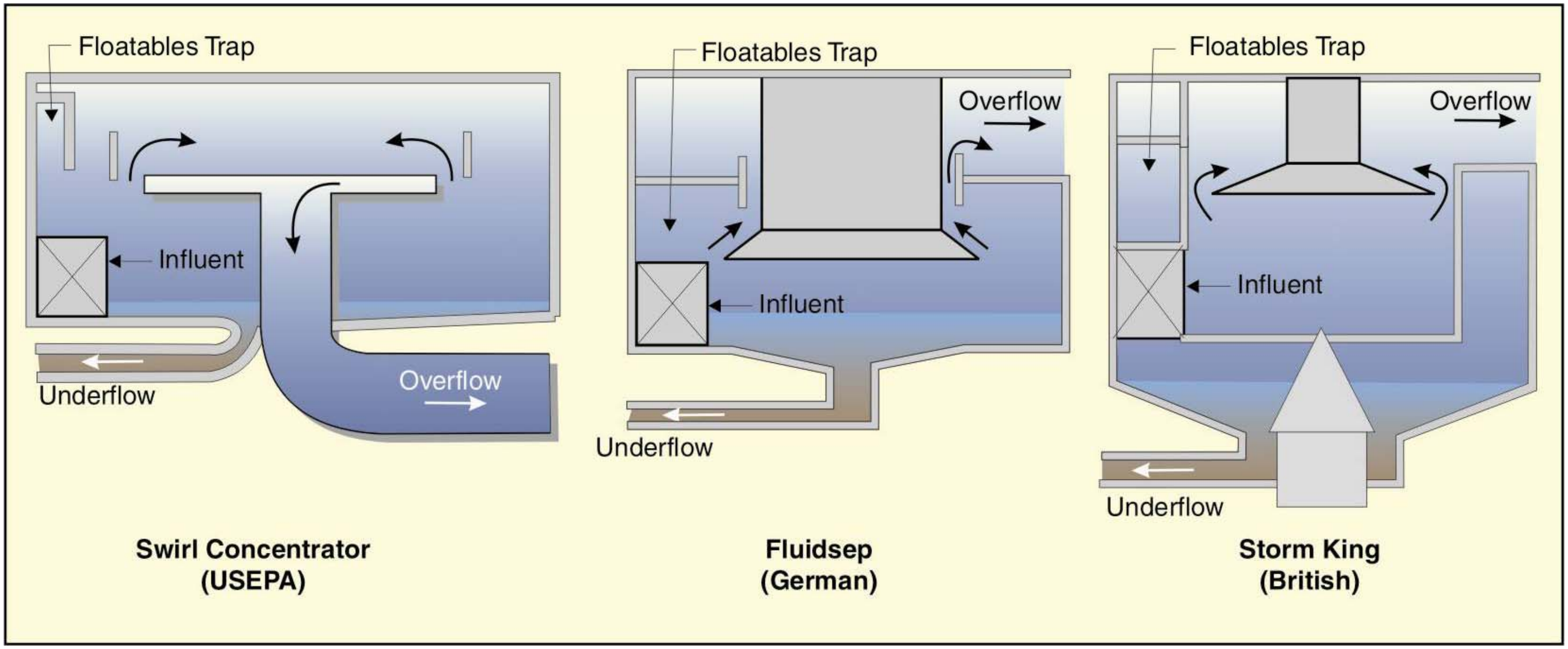
High rate physical/chemical treatment is a traditional gravity settling process enhanced with flocculation and settling aids to increase loading rates and improve performance. The pretreatment requirements for high rate treatment are screening and degritting, identical to that required prior to primary 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 (IDI), which manufacturers the DensaDeg process, and US Filter, which manufactures the Actiflo process.

IDI 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 to 95 percent for TSS and 30 to 60 percent for BOD can be expected. Phosphorous and nitrogen can also be removed 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 requires approximately 30 minutes before optimum removal rates are achieved to allow for the build-up of sludge solids.

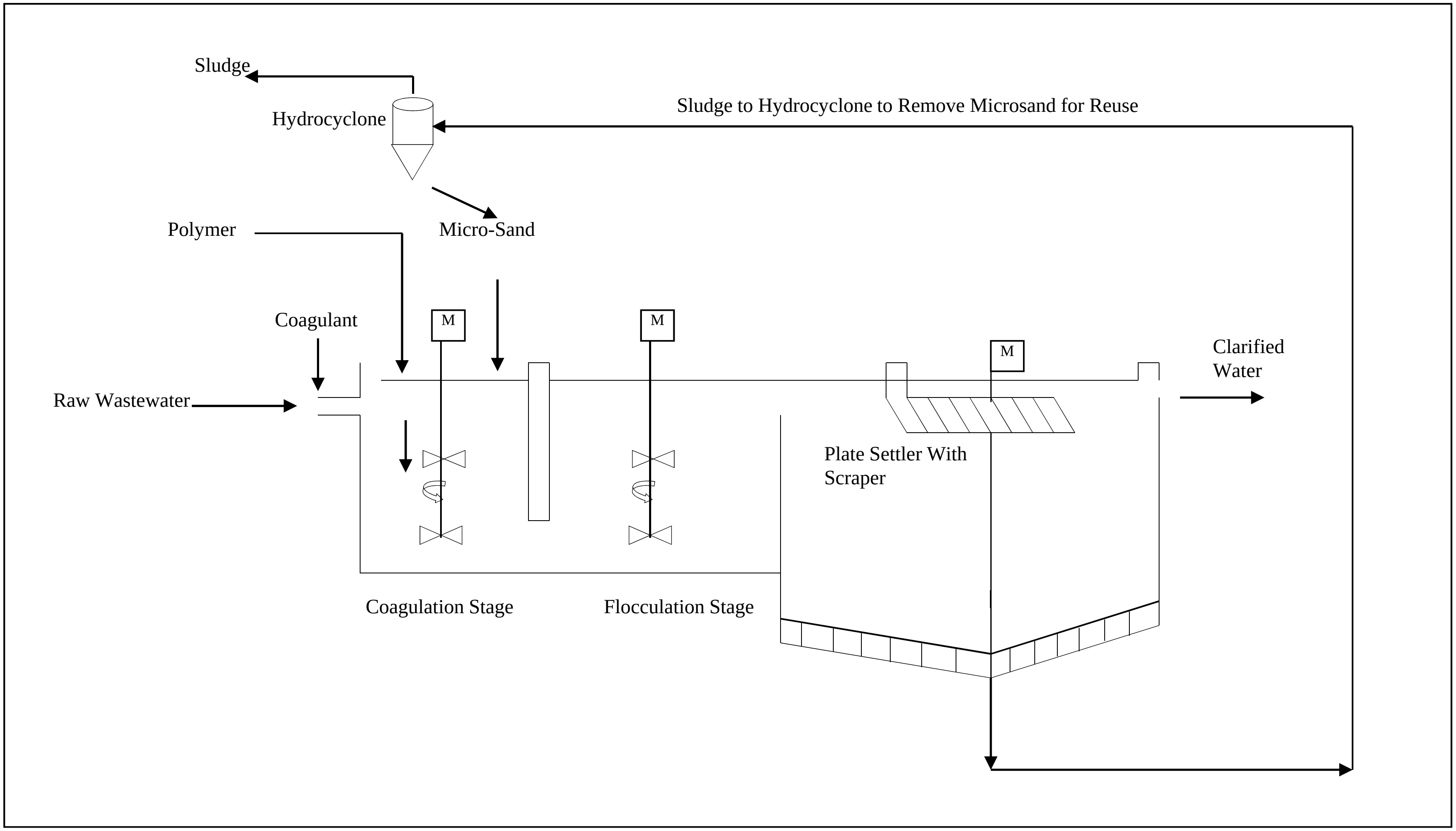
US Filter Actiflo process is different from the DensaDeg process in that fine sand is used to ballast the sludge solids. As a result, the solids settle faster, but specialized equipment must be incorporated in the system to accommodate the handling of sand throughout the system. Figure 7-6 shows the components of a typical US Filter Actiflo system. The 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 to 95 percent for TSS and 30 to 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 and 90 percent, and nitrogen removal is typically between 15 and 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 WWTP 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 Actiflo™ 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. However, operational challenges suggested the need for further testing, which was to be performed in a demonstration-scale facility. Facility planning at that time did not reveal any opportunities to apply HRPCT for CSO abatement in New York City, so the demonstration project was indefinitely postponed. For the purposes of this technology evaluation, it is presumed that the operational challenges would be overcome once testing was re-initiated and, therefore, HRPCT will be retained for further consideration.



Schematic Diagrams of the Three Vortex Technologies Tested at CAVF



Environmental Protection

US Filter Actiflo HRPCT

Disinfection

The major objective of disinfection is to control the discharge of pathogenic microorganisms in receiving waters. As described in Sections 1 and 4, disinfection of CSO is not required for Newtown Creek, a Class SD waterbody.

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, chlorine dioxide, peracetic acid, ozone, ultraviolet radiation, and electron beam irradiation (EPA, 1999c and 1999d). 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 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.

- 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 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 water quality goals.

Disinfection reduces potential public health impacts from CSOs but needs to be used in conjunction with other technologies, as it cannot reduce CSO volume, settleable solids, or floatables. 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, DEP believes that there could be a residual of as much as 1 mg/L from a CSO disinfection facility with a potential to form other harmful disinfection byproducts. Newtown Creek and its tributaries are not designated for either primary or secondary contact uses and therefore have no pathogen standard. For this reason, disinfection is not necessary to obtain water quality standards.

Expansion of WWTP Treatment

DEP developed WWOPs for the Bowery Bay and Newtown Creek WWTPs (see Appendices A and B) per DEC requirements. These WWOPs provided recommendations for maximizing treatment of flow during wet weather events. The reports outlined three primary objectives in maximizing treatment for wet-weather flows: (1) consistently achieve primary treatment and disinfection for wet weather flows up to 2xDDWF; (2) consistently provide secondary treatment for wet weather flows up to 1.5xDDWF before bypassing the secondary treatment system; and, (3) do not appreciably diminish the effluent quality or destabilize treatment upon return to dry weather operations.

7.2.8. 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:

Outfall Relocation

Outfall relocation involves moving a 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. In general, outfall relocation is not considered a feasible alternative in New York City, due in part to extensive construction, disruption to City streets and high construction costs.

However, it may be feasible for a collection system to be modified such that CSO is shifted to a different existing outfall that may have better mixing characteristics or the capability to better handle a CSO discharge. For example, moving a CSO discharge from poorly mixed or narrow channel/tributary to a well-mixed/open waters area would improve water quality in a particular waterbody.

This alternative is not feasible for Newtown Creek where there is no way to reroute outfalls to the East River. Therefore, this alternative will not be retained for further consideration.

In-Stream Aeration

In-stream aeration would improve the DO content of the Creek by adding air directly to the water column via diffusers placed within the waterbody. Air could be added in large enough volumes to bring any waterbody into compliance with 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 required could be extensive and 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. DEP continues to investigate in-stream aeration as a method of meeting DO standards at the recently constructed English Kills in-stream aeration facility. The first of three years of testing was completed in the summer of 2009 and preliminary data analysis was completed in February 2010.

Flushing Water

The addition of flushing water at the head end of dead end waterbodies improves mixing and the dissolved oxygen content of the waterbody by adding water with a higher dissolved oxygen concentration directly to the waterbody. Water with higher concentrations of dissolved oxygen could possibly be added in large enough volumes to increase dissolved oxygen in the waterbody to meet the ambient water quality standards. However, depending on the amount of the water that would be required to be transferred into the water column and the source of that water, the facilities and delivery systems necessary could be extensive and impractical. The Gowanus Canal Flushing Tunnel, which was reactivated in 1999, is an example of this technology.

The routing of potential Newtown Creek Flushing Tunnels along with the locations and sizes of the pumping stations were developed in a previous study (URS, 1994), which are shown on Figure 7-7. Two tunnels would be constructed, each with a water intake located along the East River. One tunnel would go to Dutch Kills and have a 70 cfs pumping station near the terminus at the head end of Dutch Kills. The other tunnel is proposed to go to English Kills and then on to East Branch with 150 cfs pumping stations near the head ends of each tributary. Both tunnels were routed as much as possible under existing rights-of-way to minimize the potential costs associated with easement acquisition. However, due to the number of dead end tributaries to Newtown Creek and their distance from the East River the flushing water option would require around three miles of tunnels, two water intakes, and three pumping stations. In addition, the background conditions in the East River are not substantially better than the target water quality and thus flushing requires larger flushing volumes. Due to these constraints, providing flushing water as the sole means to attain the current water quality standards is prohibitively expensive and does not reduce CSO and this alternative was not retained for further analysis.

Environmental Dredging

The maintenance dredging technology is essentially the dredging of settled CSO solids from the bottom of waterbodies periodically. The settled solids would be dredged from the receiving waterbody as needed to prevent use impairments such as access by recreational boaters, as well as 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 quality between dredging operations would likely not improve and bottom habitat would degrade following each dredging.

This technology allows CSO settleable solids to continue to exit the sewer system and settle in the waterbody generally immediately downstream of the outfall, and without regular or periodic dredging the solids usually accumulate with leaves and other detritus 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 performed 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.

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 techniques. The actual method of dredging selected would depend on the physical characteristics (grain size, viscosity, etc.) of the sediments that require removal, the extent of entrained pollutants (metals, etc), and the local water currents, the depth and width of the waterbody and other conditions such as bridges that could interfere with dredge/barge access. 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 facility licensed to accept such sediments.

7.2.9. 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:

Netting Devices

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. Netting alone will not reduce CSO discharges and, therefore, will only be considered as a supplemental treatment.

Containment Booms

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. An illustration of a containment boom is shown in Figure 7-8.

Containment booms could be used as an interim control until more permanent technologies are constructed. Booms are most useful at larger outfalls where the discharge of floatables is greatest. Booms are already in place in East Branch, English Kills, and Maspeth Creek and can be expected to remain in place while any recommended permanent CSO facilities are built. Because these booms are already in place, no new costs will be factored into the recommended plan.

Skimmer Vessels

Skimmer vessels remove materials floating within a few inches of the water surface and are being used in various cities, including New York City. The vessels range in size from less than 30 feet to more than 100 feet long. They can be equipped with moving screens on a conveyor belt system to separate floatables fromthe water or with nets that can be lowered into the water to collect the materials. Skimmer vessels are typically effective in areas where currents are relatively slow-moving and can also be employed in open-water areas where slicks from floatables form due to tidal and meteorological conditions. New York City currently operates skimmer vessels to service containment boom sites. An example of a skimmer vessel is shown in an overhead view in Figure 7-9.

Bar Screens (Manually Cleaned)

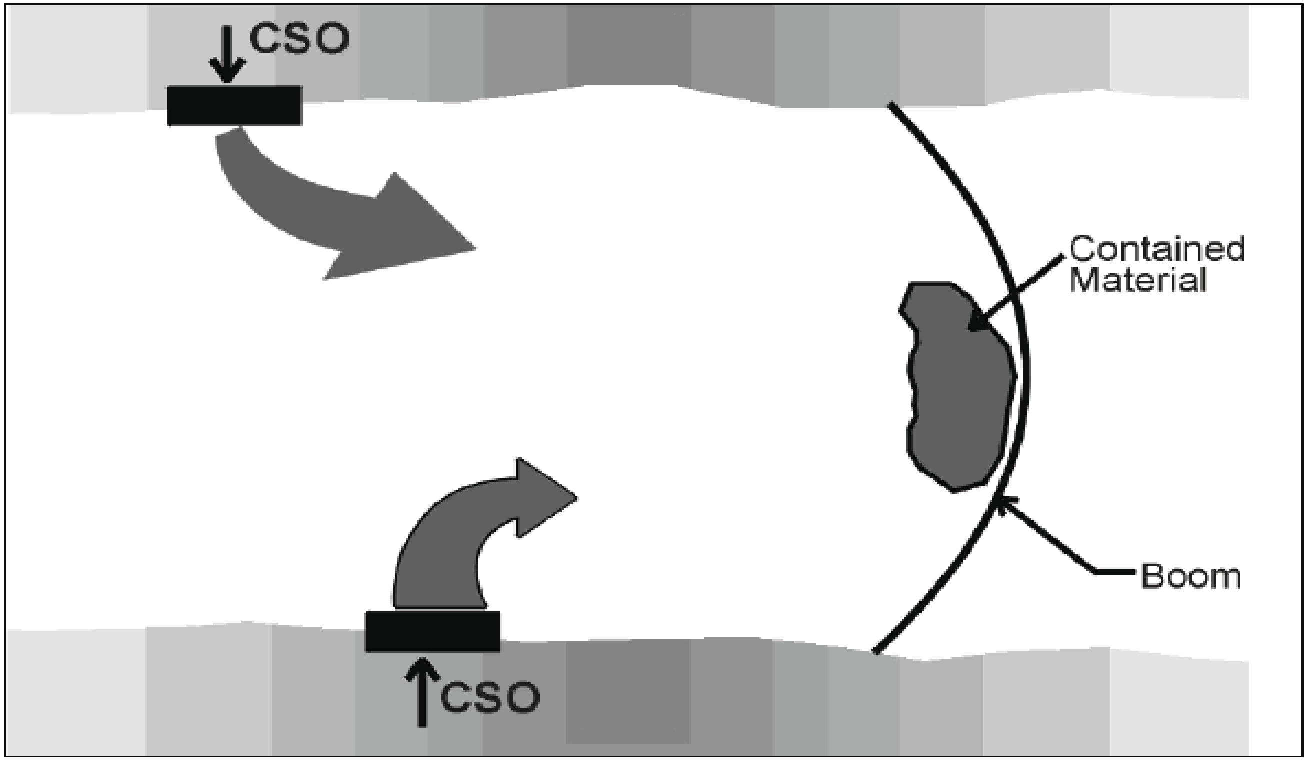
Manually cleaned bar screens can be located within in-line CSO chambers or at the point of outfall to capture floatables. The configuration of the screen would be similar to that found in the influent channels of small wastewater pumping stations or treatment facilities. Retained materials must be manually 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. Thus, manually cleaned bar screens will be eliminated from further consideration.

Weir-Mounted Screens (Mechanically Cleaned)

Weir-mounted mechanically cleaned screens are 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.

Environmental Protection

Proposed Flushing Tunnels to Dutch Kills, English Kills and East Branch



Containment Boom

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NYC Environmental Protection

Skimmer Boat and Boom In Maspeth Creek

Although widely used in Europe, weir-mounted screens are relatively new devices in the United States. As with any type of screening device, they are used for removing floatables and other visible solids. Any removal of suspended solids would be incidental. As such, where water quality evaluations indicate that suspended solids or oxygen demanding materials need to be removed, weir-mounted screens are not effective. Since water quality evaluations for Newtown Creek indicate removal of these materials, other control or treatment processes downstream would be more effective.

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 regulator structures in New York City are not amenable to fixed baffle retrofits. Therefore, fixed underflow baffles will be eliminated from further consideration.
- 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 Grande, 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 this technology has not yet been demonstrated in the United States, there are operating units in Germany.
- Hinged Baffle – The hinged baffle system incorporates two technologies, the hinged baffle (Figure 7-10) and the bending weir (Figure 7-11). 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 stormwater 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 therefore has low O&M costs of a scale similar to tide gates. For the reasons stated above, a bending weir is the preferred technology over a hinged baffle.

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.

Floatables Control 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 7-3 provides a comparison of the floatables control technologies discussed above in terms of the effort to implement the technology, its required maintenance, effectiveness 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 effectiveness rating is indicated as high.

Table 7-3. 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

Table 7-3. Comparison of Solids and Floatable Control Technologies

Technology	Implementation Effort	Required Maintenance	Effectiveness	Relative Capital Cost
End-of-Pipe Netting	Moderate	Moderate	High	Moderate
Containment Booms	Moderate	Moderate	Moderate	Moderate

7.2.10. CSO Control Technology Evaluation Summary

Table 7-4 presents a tabular summary of the results of the preliminary technology screening discussed in this section. Technologies that will advance to the alternatives development screening phase are noted under the column entitled “Retain for Consideration”. These technologies have proven successful in New York City and elsewhere and have the potential for producing some measurable level of CSO control for Newtown Creek. 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, DEP 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 column 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 column indicates those technologies which did not advance through the preliminary screening process.

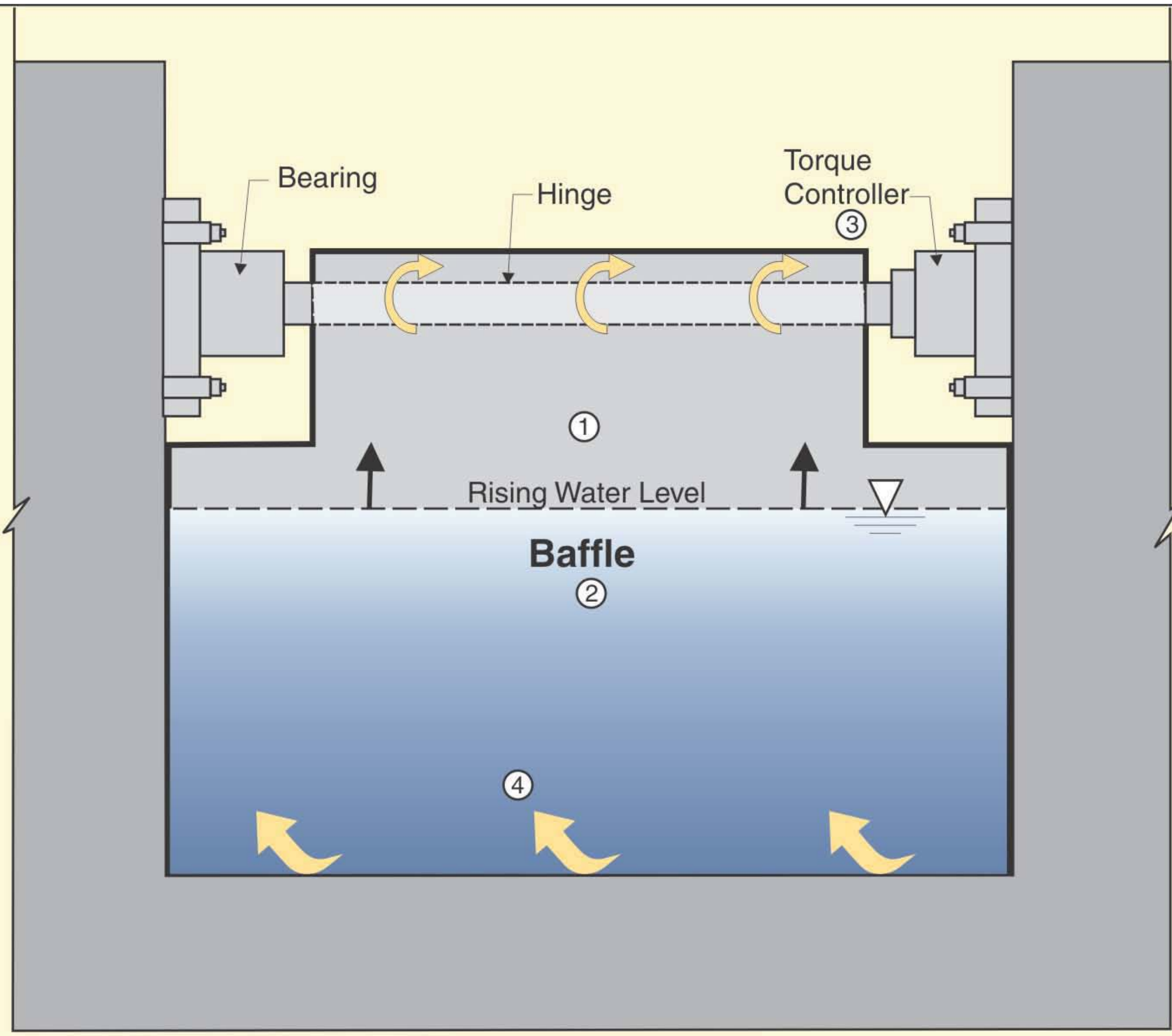
Table 7-4. Screening of CSO Control Technologies

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				
Stormwater Detention				X
Street Storage of Stormwater				X
Water Conservation		X		
Infiltration/Inflow Reduction	X		X	
Green Infrastructure (see Sections 5.10 and 8.8)				

Table 7-4. 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
Sewer System Optimization				
Optimize Existing System	X			
Real Time Control	X			
Sewer Separation				
Complete Separation				X
Partial Separation	X		X	
Rain Leader Disconnection				X
Storage and Conveyance				
Closed Concrete Tanks	X			
Storage Pipelines/Conduits	X			
Tunnels	X			
Treatment				
Screening	X		X	
Primary Sedimentation				X
Vortex Separator				X
High Rate Physical Chemical Treatment	X			
Disinfection				X
Expansion of WWTP		X		
Receiving Water Improvement				
Outfall Relocation				X
In-stream Aeration	X		X	
Flushing Water				X
Environmental Dredging	X			
Solids and Floatable Controls				
Netting Systems	X		X	
Containment Booms		X		
Manual Bar Screens				X
Weir Mounted Screens				X
Fixed baffles				X
Floating Baffles				X
Hinged Baffles (Bending Weir)	X		X	
Catch Basin Modifications		X		

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



Note: As water level rises (1), pressure on the baffle (2) increases exerting increased torque on the controller (3). The controller releases baffle, allowing it to swing open (4) and discharge retained water.

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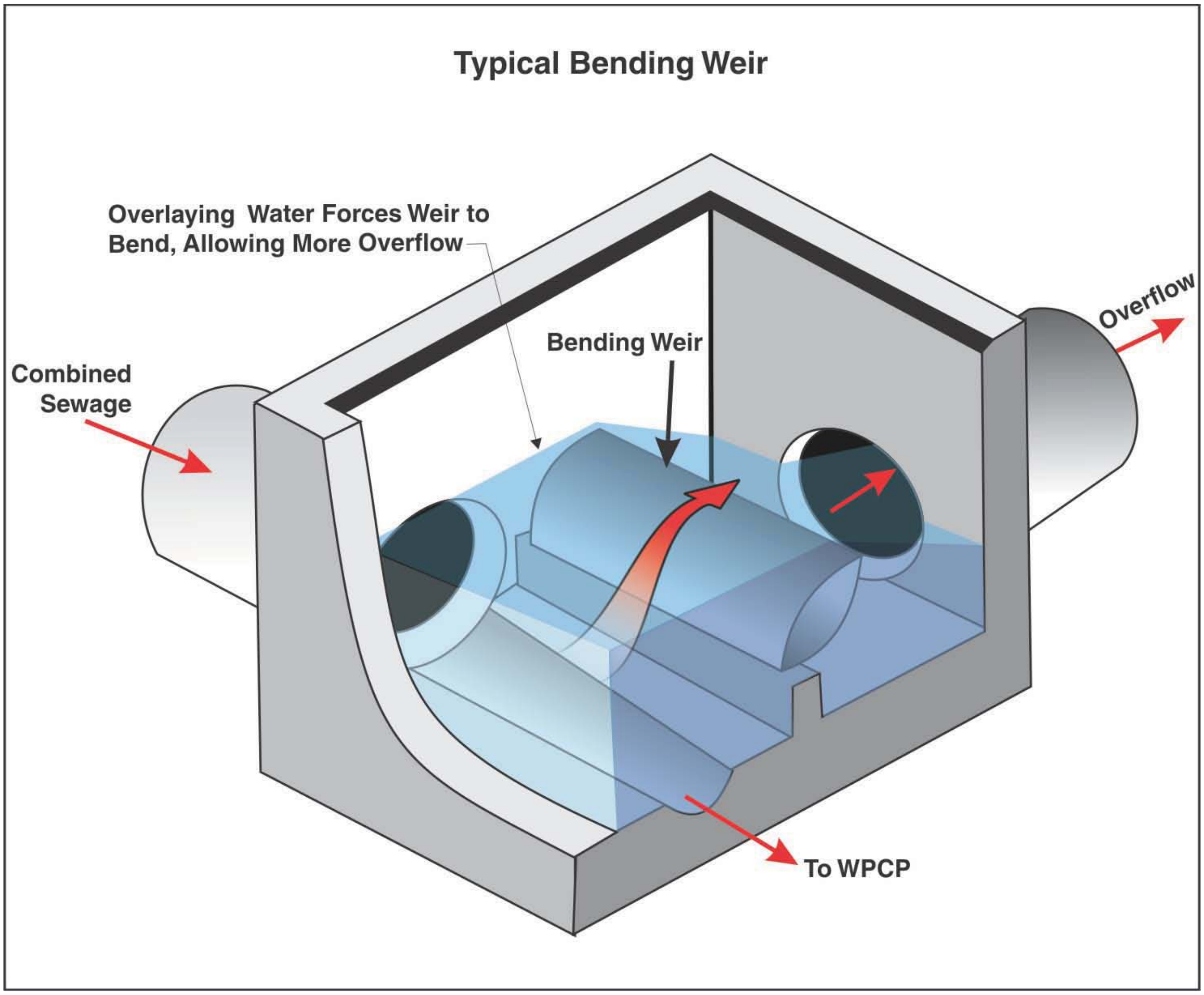
Conceptual Schematic of Hinged Baffle



Environmental Protection

Conceptual Schematic of Bending Weir

7.3. WATER QUALITY IMPROVEMENT ALTERNATIVES

The analysis of feasible alternatives will review the control technologies that were retained from Table 7-4 to "consider a reasonable range of alternatives" as expected by federal CSO policy. Full-year model simulations were performed for each engineering alternative selected, and each of these alternatives was then evaluated in terms of compliance with applicable water quality criteria, designated uses, and overall improvement from the established Baseline condition. Compliance with fish and aquatic-life uses was evaluated by comparing projected DO conditions to the applicable New York State numerical criterion. Compliance with recreational uses was evaluated by comparing projected indicator bacteria levels to New York State numerical criteria for secondary recreation. Aesthetics and riparian uses were evaluated by comparing projected levels of floatables, odors and other aesthetic conditions (based on CSO volume reduction) to narrative water quality standards.

The Baseline Newtown Creek tributary sewer systems characteristics, overflow volumes, and outfall and regulator configurations as described in Section 3 were thoroughly reviewed and evaluated in concert with the existing waterbody characteristics and uses. From this evaluation it was determined that there are a number of conditions that could be addressed through abatement of CSOs and improvements to water quality, which would benefit the Newtown Creek waterbody, and which warranted further consideration. Therefore, the CSO technologies, remaining after the technology screening described above, were reviewed to determine the applicability of each to address the conditions existing in the watershed.

The retained technologies, summarized below, are considered to be feasible insofar as there is no fatal flaw or obvious cost-benefit limitation, and implementation is expected to result in substantial improvements to water quality.

- *Baseline* (Section 7.3.1). The future "no build" case is not a retained technology as such because water quality goals are not currently attained. However, the Baseline serves as a metric for the other alternatives.
- *Treatment* (Sections 7.3.1 and 7.3.9). All of the Newtown Creek alternatives (except for the Baseline Condition) include ongoing Bowery Bay WWTP stabilization construction to the plant headworks (pumps, screens, etc.) and the Newtown Creek WWTP upgrades to provide full secondary treatment to provide for treatment of flows up to the permitted flows on a sustained basis (described in Section 7.3.1). Additionally, HRPCT was determined to be a viable option and is explored in conjunction with other CSO capture tunnel alternatives (Sections 7.3.9).
- *Sewer System Optimization* (Sections 7.3.2 through 7.3.9). The hydraulic capacity of the Morgan Avenue Interceptor limits the amount of flow transported to the Newtown Creek WWTP from areas tributary to Regulator B1. Any alternative implemented to maximize the flow through the Morgan Avenue Interceptor and away from Newtown Creek would require reducing headloss into and through the Morgan Avenue Interceptor, increasing the driving head through the interceptor, and/or adding additional conveyance to the WWTP from Regulator B1. Alternatives that were devised to increase flow to the WWTP

through the Morgan Avenue Interceptor include RTC by way of a Kent Avenue Throttling Facility (Section 7.3.2), modifications to Regulator B1 (Sections 7.3.2 and 7.3.4 through 7.3.8), and St. Nicholas Weir Relief Sewer alternatives (Sections 7.3.2 and 7.3.6 through 7.3.8). Bending weirs, devised as a potential modification to Regulator B1, were also considered at Regulator Q1 to reduce overflows to outfall NCQ-077 (Sections 7.3.4 and 7.3.5). An additional relief sewer alternative, in conjunction with regulator modifications, was devised as a means to reduce overflows to Dutch Kills (Sections 7.3.5, 7.3.7 through 7.3.9). Additionally, ongoing upgrades to the Brooklyn Pumping Station (described in Section 7.3.3), which will maximize the wet weather flow delivered to the WWTP, was included in all alternatives (except for the Baseline and CSO Facility Plan).

- *Storage* (Sections 7.3.2, 7.3.6 through 7.3.9). Inline storage, deep storage tunnel alternatives, and CSO storage tanks were retained to reduce discharges. Storage tanks were considered at outfalls with large annual overflow volumes and available land in the vicinity of the outfalls (Sections 7.3.2 and 7.3.8). Inline storage was considered as an alternative to drive more flow to the WWTP during smaller rainfall events (Sections 7.3.6 through 7.3.8). For very large reduction volumes, deep storage tunnels were determined to be the only feasible approach, and therefore various tunnel alternatives were developed to provide various level of CSO reduction in Newtown Creek and its tributaries (Section 7.3.9).
- *Solids and Floatables Controls* (Sections 7.3.3 through 7.3.6). Floatables control technologies at the four outfalls contributing the largest volume of CSO to Newtown Creek were evaluated.
- *Sewer Separation* (Section 7.3.11). High Level Sewer Separation (HLSS) is an ongoing program in DEP and was evaluated for the Newtown Creek drainage area. *Receiving Water Improvements (Sections 7.3.2 through 7.3.8).* Aeration was included in all alternatives besides the Baseline as a means to improve DO in Newtown Creek. Environmental maintenance dredging (Section 7.3.10) was also considered to reduce odors but has been deferred to the recent superfund listing. Dredging will be re-evaluated as part of the future LTCP when more information regarding the status of the site and the effects of dredging is available via the remedial investigations. This list of feasible alternatives retained from the preliminary screening represents a toolbox from which a suitable technology may be applied to a particular level of CSO abatement. As suggested in USEPA guidance for long-term CSO control plans, water quality modeling was performed for a "reasonable range" of CSO volume reductions, from no reduction up to 100 percent CSO abatement. The technologies employed at each level of this range were selected based on engineering judgment and established principles. For example, any of the storage technologies may be employed to achieve a certain reduction in CSO discharged, but the water quality response would be the same, so the manner of achieving that level of control is a matter of balancing cost-effectiveness and feasibility. In that sense the alternatives discussed below each represents an estimate of the optimal manner of achieving that particular level of control. All costs presented in this section are in June 2011 dollars.

7.3.1. Baseline Conditions

Baseline conditions for the Bowery Bay and Newtown Creek sewer systems were described previously in Sections 3.4 and 3.5, and are repeated below. Table 7-5 presents an overview of the annual average CSO discharge volume and frequency at each outfall.

1. Dry-weather flow rates reflect year 2045 projections. For planning purposes, the 2045-projected dry-weather flow rates at each regulator reflect expected future population and water-use patterns in the study area. The total projected dry-weather flow rates are 109 MGD at Bowery Bay WPCP, and 268 MGD at Newtown Creek WPCP.

2. The Sustained wet-weather treatment capacity of the Bowery Bay WPCP was 236 MGD, and wet-weather treatment capacity of the Newtown Creek WPCP was 585 MGD, based on top-ten-storm analyses for each WPCP as reported to DEC in the 2003 BMP Annual Report. Bowery Bay WWTP has been upgraded to 300 MGD to meet the 2x DDWF requirement, and Newtown Creek WWTP is currently being upgraded to include full secondary treatment of 700 MGD. There are no primary treatment facilities at Newtown Creek WWTP.

3. Documented sediment values were included in the model where known, however, if there was no information available, sedimentation in the sewers was assumed to be removed.

4. The Brooklyn Pump Station (P.S.) capacity is 400 MGD. The Newtown Creek WPCP Enhanced Track 3 Facility Plan and the Newtown Creek CSO Facility Plan dictate a capacity of 300 MGD. However, as noted above, it is intended that the Newtown Creek WPCP be upgraded to accommodate 300 MGD from the Manhattan service area, as well as to accept up to 400 MGD from the Brooklyn Pump Station, for a total of 700 MGD.

Table 7-5. Newtown Creek Discharge Summary for Baseline Conditions (1) (2)

Outfall	Discharge Volume (MG)	Percentage of CSO Volume	Number of Discharges
Combined Sewer			
NCB-083	586.2	39.8%	71
BB-026	186.8	12.7%	47
NCQ-077	261.5	17.8%	49
NCB-015	307.8	20.9%	33
BB-013	39.2	2.7%	44
NCQ-029	18.1	1.2%	48
BB-043	13.9	0.9%	40
BB-009	35.2	2.4%	35
NCB-022	8.4	0.6%	42
BB-014	3.2	0.2%	35
BB-042	2.3	0.2%	29
BB-011	2.8	0.2%	24
BB-040	0.9	0.1%	21
BB-015	3.1	0.2%	39
BB-010	1.6	0.1%	16

Table 7-5. Newtown Creek Discharge Summary for Baseline Conditions (1) (2)

Outfall	Discharge Volume (MG)	Percentage of CSO Volume	Number of Discharges
NCB-023	0.2	0.0%	5
NCB-019	0.4	0.0%	7
BB-012	0.2	0.0%	5
BB-004	0.1	0.0%	4
NCB-024	0.0	0.0%	0
Total	**1471.9**		

(1) Baseline condition reflects design precipitation record (JFK, 1988), treatment plant capacities of 236 MGD for the Bowery Bay WWTP and 585 MGD for the Newtown Creek WWTP, Brooklyn P.S. capacity of 325 MGD, and sanitary flows projected for year 2045.
(2) Totals may not sum precisely due to rounding.
(3) Outfalls BBL-049 and NCB-021 are not incorporated into the model due to lack of as-built data. The adjacent drainage areas are distributed to nearby outfalls. Outfall 002 is the Newtown Creek WWTP high relief that discharges to Whale Creek Canal. This flow is treated before discharge and is built into the water quality model runs.

In recent years, the Bowery Bay and Newtown Creek WWTPs have been able to accept sustained wet weather flows of about 236 MGD and 585 MGD, respectively, as reported in the annual BMP Reports provided to the DEC. DEP is currently modernizing the Bowery Bay WWTP headworks to allow the plant to consistently treat 300 MGD and is upgrading the Newtown Creek WWTP to include full secondary treatment of up to 700 MGD. The Newtown Creek WWTP upgrades will provide for treatment beyond the 2XDDWF normally seen at other plants. These upgrades are included in all of the following alternatives as the work is in progress. However, costs for this upgrade are not included in this WB/WS Facility Plan as they will be accounted for in the Open Water/East River WB/WS Facility Plan.

7.3.2. Alternative 1: CSO Facility Plan

As discussed in Section 5, the DEP has formulated a 2003 CSO Facility Plan which includes several projects to abate the affects of CSOs within the Newtown Creek watershed. These projects are listed below and are shown in Figure 5-1. The probable total project cost of this alternative is $664.9 million and includes:

- English Kills CSO Retention Facility: This 9 MG CSO tank will be located at the intersection of Johnson and Morgan Avenues, to contain CSO volume from outfall NCB-015. DEP does not own the land at the proposed location, therefore condemnation will be necessary. (see Figure 7-12) - $556.3 million
- Zone I & II Aeration Facilities: The Zone I Aeration Facility will aerate Upper English Kills, and the Zone II Aeration Facilities will aerate Lower English Kills, East Branch, and Dutch Kills. (see Figure 7-13) - $78.3 million
- St Nicholas Weir 36-Inch Relief Sewer: A new 36" relief sewer will start at the St Nicholas Weir, and parallel the existing sewer to the intersection of Flushing and Gardner Avenues. (see Figure 7-14) - $16.6 million

- Kent Avenue Throttling Facility: This facility will limit the maximum flow through the Kent Ave Interceptor to the Brooklyn Pumping Station to 200 MGD. This facility will include a 9' x 10' roller gate at a minimum opening of 15" on the Kent Ave Interceptor, 650' upstream of the junction of the Kent Ave Interceptor and the Morgan Ave Interceptor. (see Figure 7-15) - $10.1 million
- Modifications to Regulator B1: In order to increase the hydraulic capacity of this regulator, the overflow weir will be raised from –4.61 ft BSD to 0.94 ft BSD. In addition, the sluice gate opening will be enlarged from 24 ft^2 to 30 ft^2. (see Figure 7-16) - $3.7 million

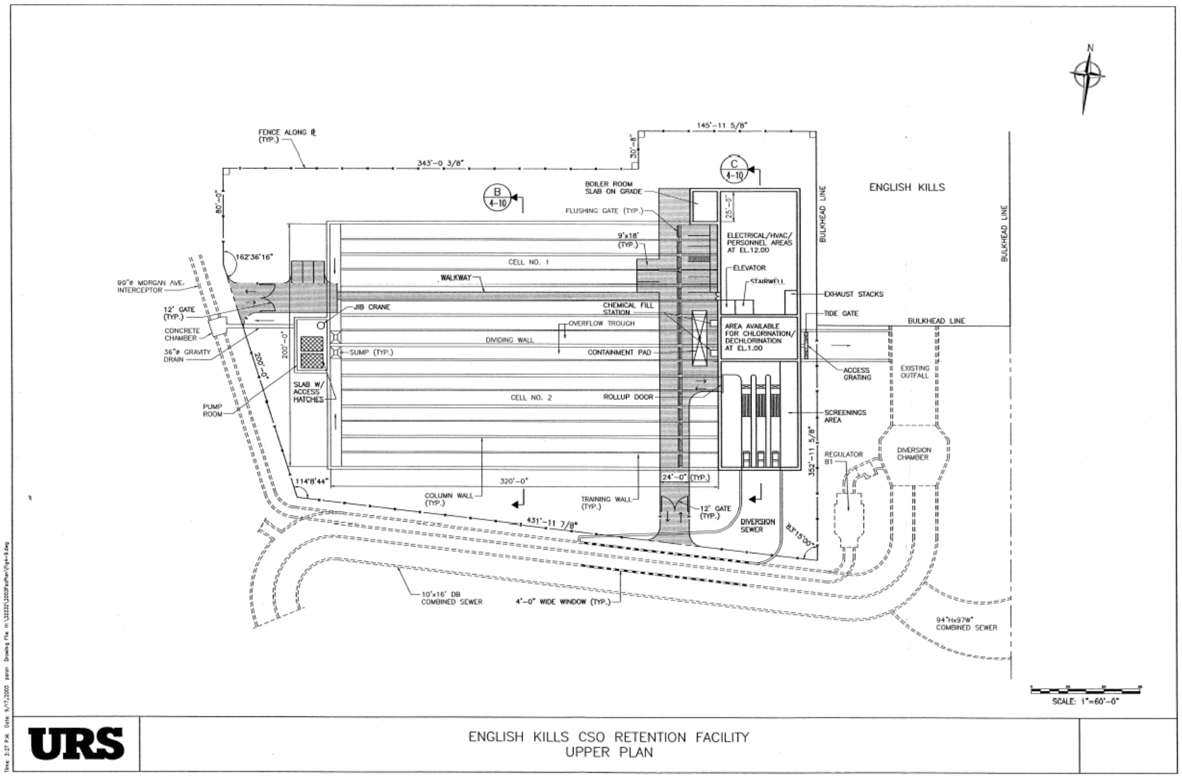
This CSO Facility Plan with the aforementioned elements was simulated in the sewer system and water quality models, and along with the Baseline conditions, is used as a basis to evaluate other CSO abatement alternatives. Sewer system modeling shows that the CSO Facility Plan provides a 27% CSO volume reduction, and a 21% reduction in CSO events, while water quality modeling shows that the CSO Facility Plan would attain the Class SD Standard 3.0 mg/L only for approximately 62% of the year. A summary of Alternative 1 is presented in Table 7-6 below.

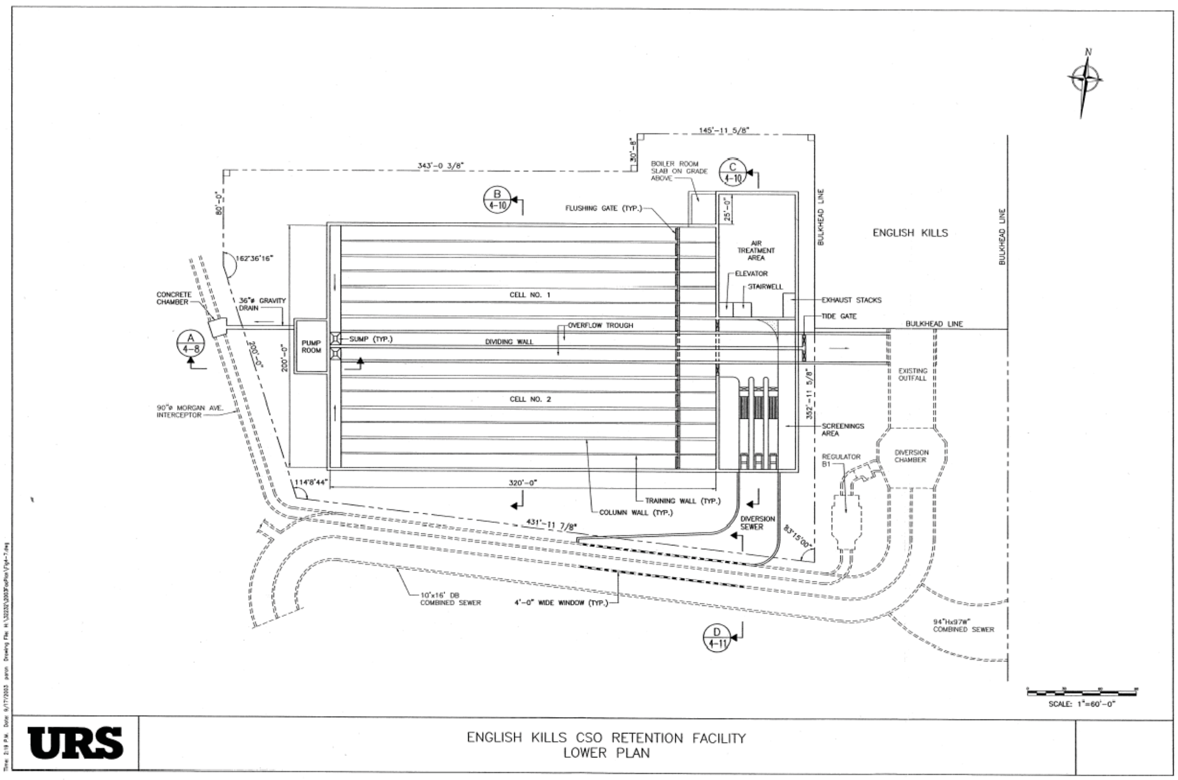
Table 7-6. Summary of Alternative 1

Component	PTPC ($ Million)
English Kills 9 MG CSO Retention Facility	$556.3
Zone I and II Aeration Facilities	$78.3
St. Nicholas Weir 36-Inch Relief Sewer	$16.6
Kent Ave Throttling Facility	$10.1
Modifications to Regulator B1	$3.7
Total	**$664.9**

As discussed in Section 5, the Consent Order acknowledges that Newtown Creek does not have a final conceptual design, and allows for modifications to the 2003 CSO Facility Plan. One step in the Waterbody/Watershed analysis was to review the effectiveness of the CSO Facility Plan elements based on the updated models, to determine if and how much benefit is provided by the individual elements. It was determined as part of these findings some of the elements of the CSO Facility were impractical and/or unnecessary.

The modifications proposed to Regulator B1 and its corresponding tide gate chamber B1A were reviewed using the updated model. Modeling analysis projected that the weir in Tide Gate Chamber B1A could be raised beyond the 0.1 BHD proposed in the 2003 CSO Facility Plan to 1.94 BHD without causing surcharging of the upstream sewers during the typical year, and to divert more wet weather flow to the WWTP and away from English Kills. Subsequently, a drainage plan analysis was performed to determine the corresponding increase in weir length required, such that the higher weir elevation does not increase the design water surface elevation in the upstream sewers. Through this analysis it was determined that raising the weir to the elevation proposed by the 2003 CSO Facility Plan would require over 400 linear feet of weir length, and therefore raising this weir is no longer considered a feasible option.





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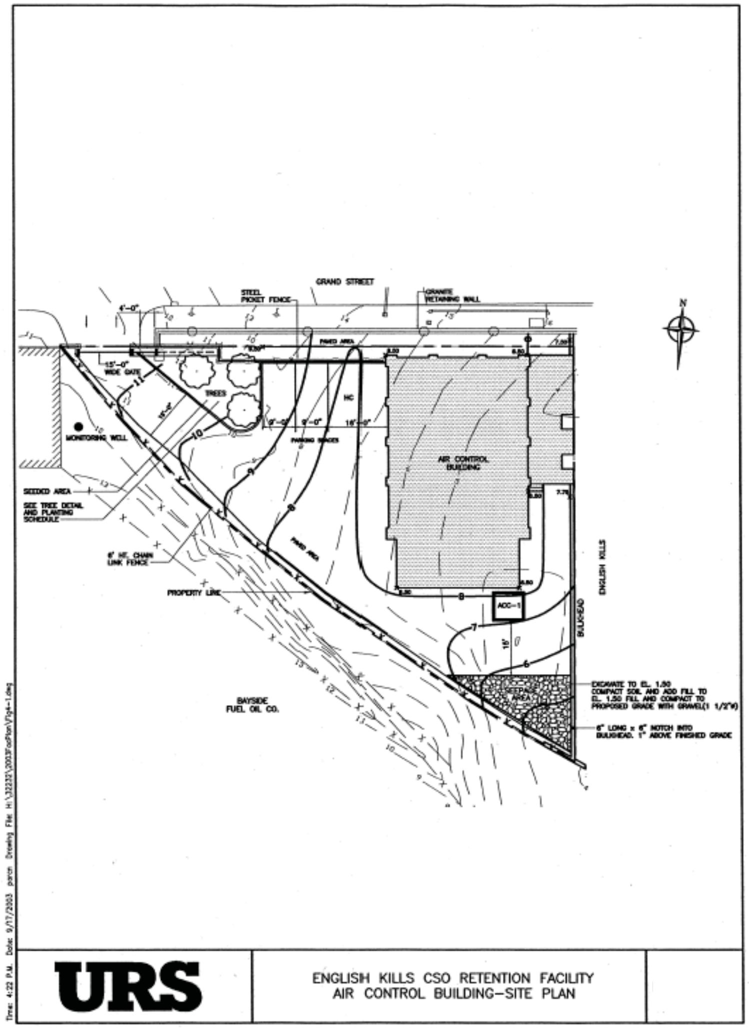
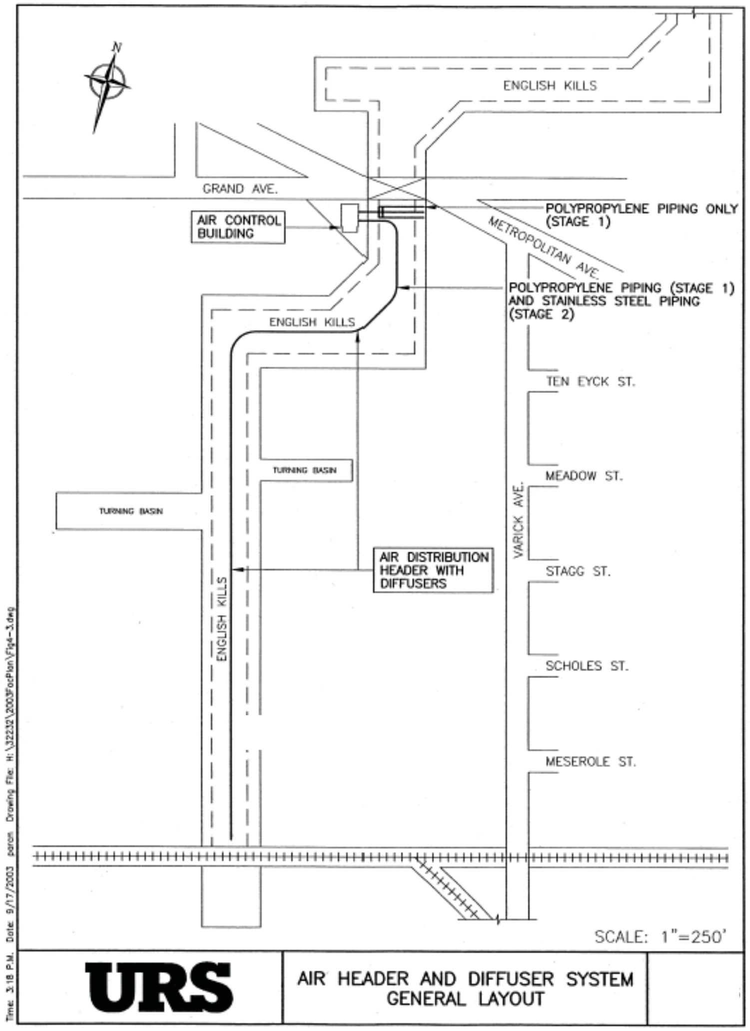
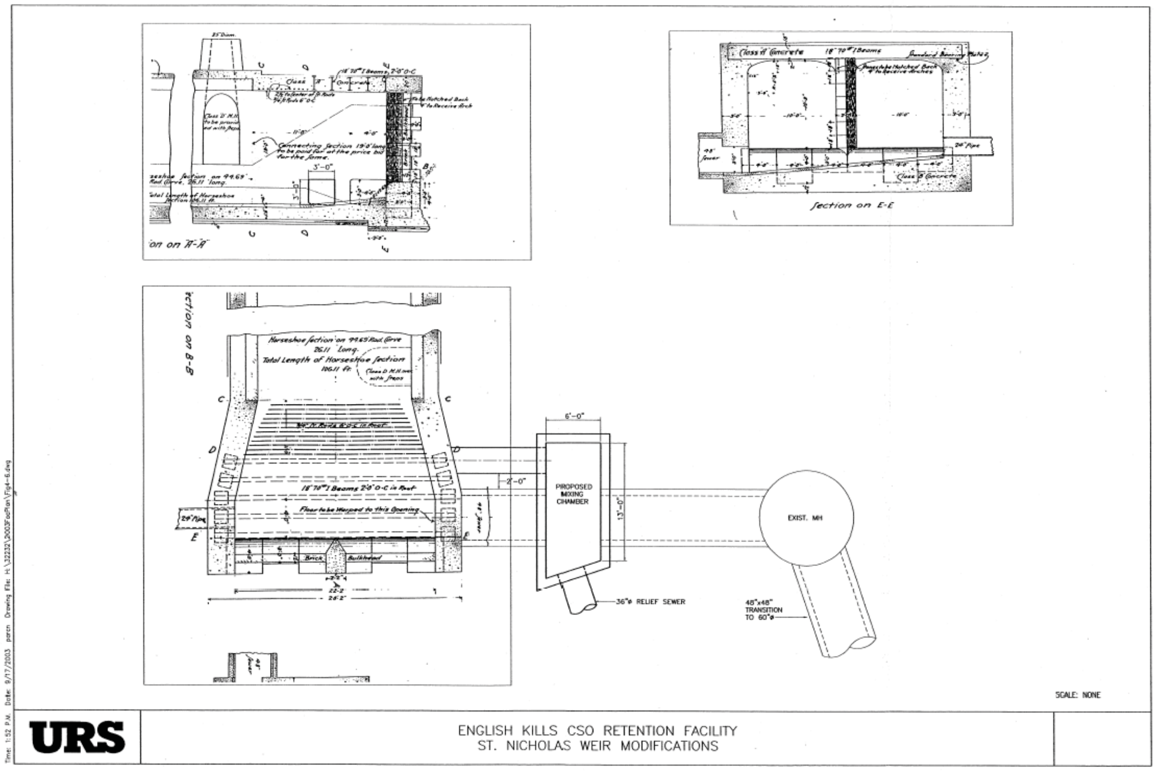
CSO Facility Plan
CSO Storage Tank

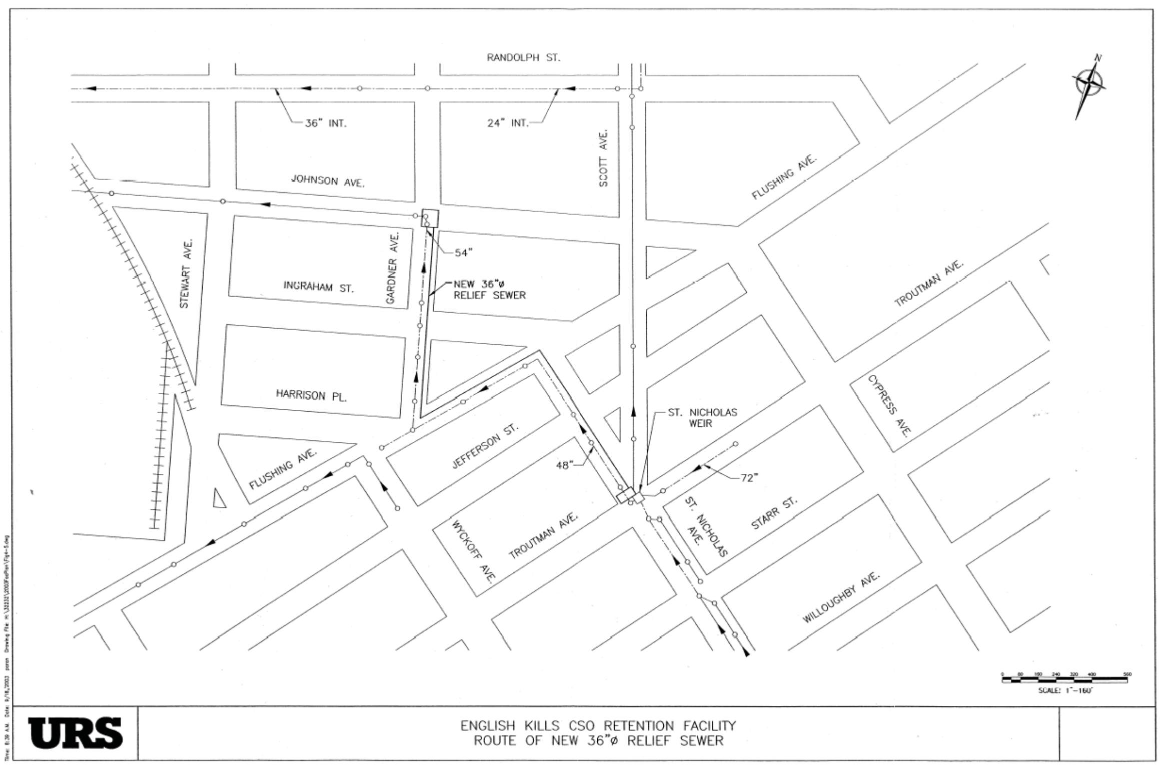




Environmental Protection

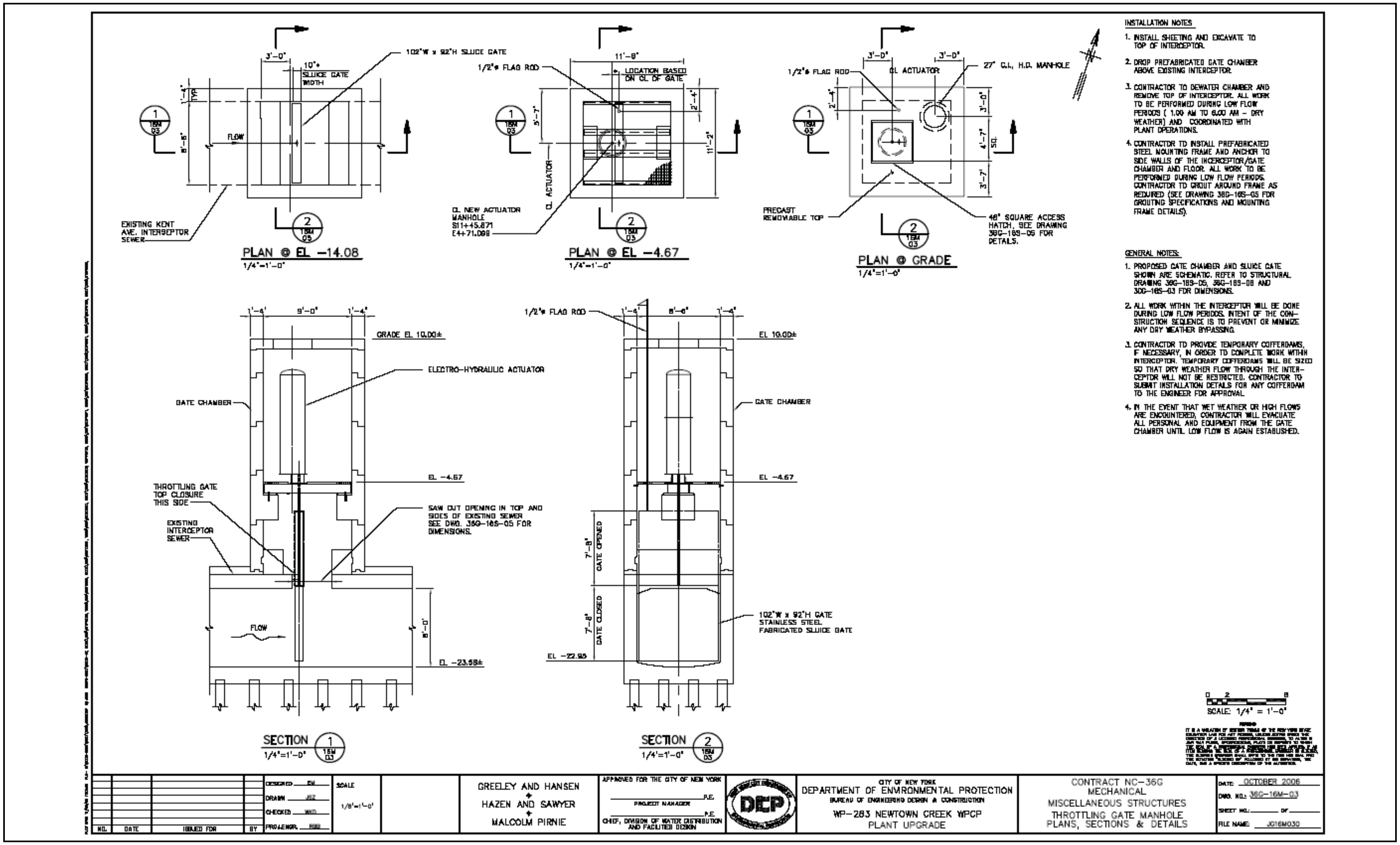
CSO Facility Plan
Zone I Aeration





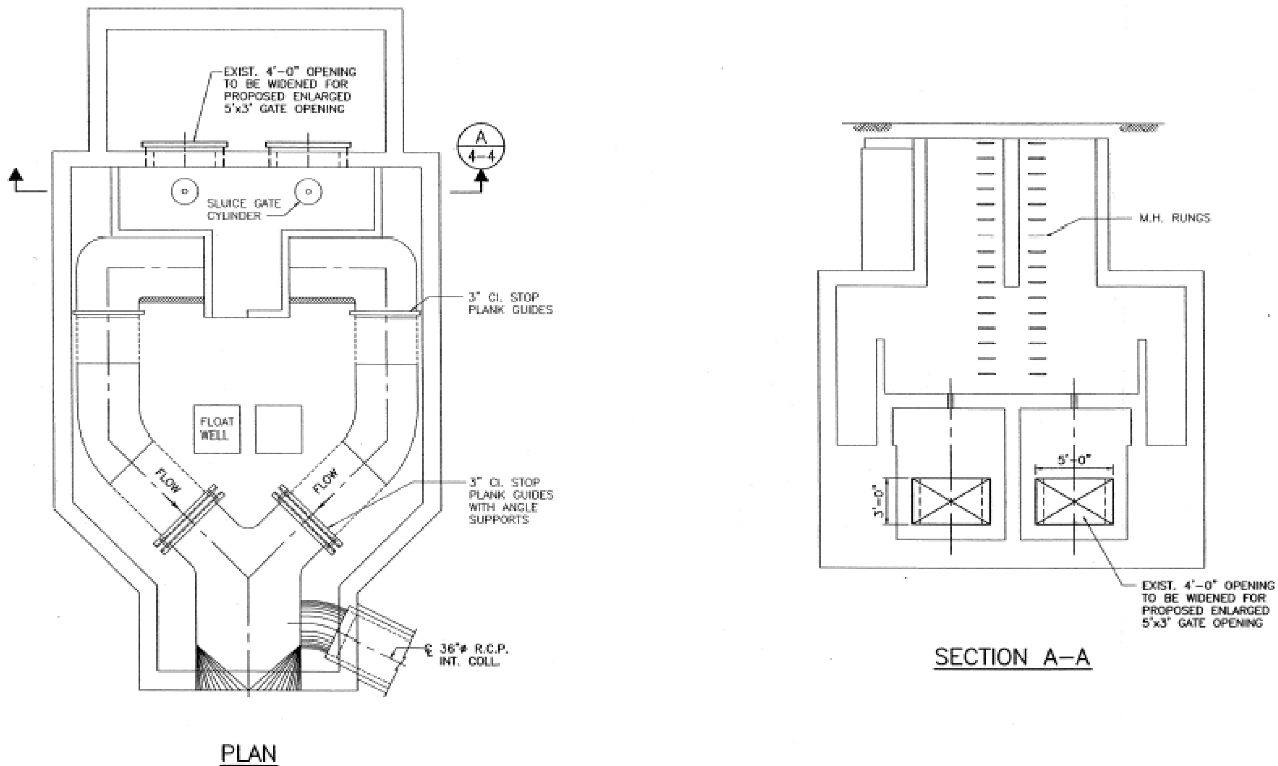
Environmental Protection

CSO Facility Plan
St. Nicholas Weir Relief Sewer

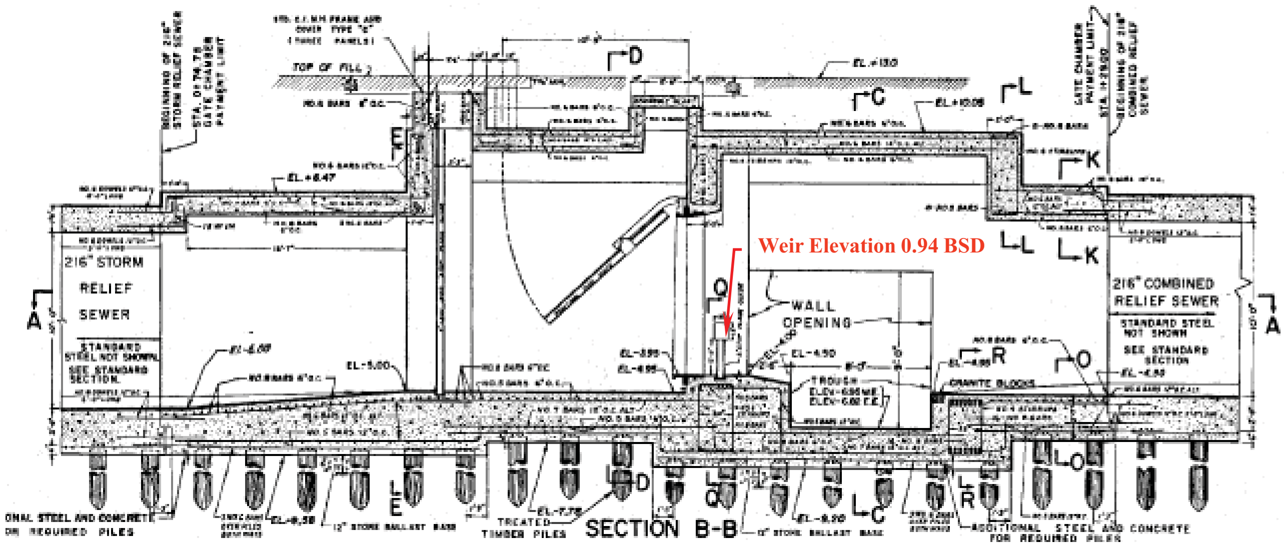


CSO Facility Plan
Kent Avenue Throttling Gate

Figure 7-15



Regulator B1



Tide Gate Chamber B1A

The Kent Avenue Throttling Facility is being constructed as part of the NC WWTP Enhanced Track 3 Upgrade. This Kent Avenue throttling gate facility is being constructed under Newtown Creek Contract 36 and is located west of the Interim Water Meter Building, south of the south battery aeration tank. A second throttling facility is upstream of the Kent Ave and Russell St interceptor combined manhole and is located just south of the Main Building. These facilities are used to throttle the flow during peak flow events to prevent the Brooklyn pump station from flooding. The common throttling gate is used to prevent flooding of the pump station and the Kent Ave throttling gate is use to control how much flow is allowed in from the Kent Ave interceptor as compared to the Russell street interceptor. Upon completion of Track 3, the DEP intends to update is WWOP to include more details on operation of the throttling facilities and new MSP stations intended to maximize wet weather flows to the plant and reduce CSOs into Newtown Creek.

Based on the sewer system model results, alternatives to the other CSO Facility Plan elements were devised to more effectively reduce CSO discharge and improve water quality in Newtown Creek. These alternatives are presented in the following sections.

7.3.3. Alternative 2: Enhanced Aeration and Floatables Control

The updated sewer system modeling results indicated that a modified aeration plan could effectively improve DO in Newtown Creek beyond what is proposed in the 2003 CSO Facility Plan. An enhanced aeration alternative has been devised to improve the water quality in Newtown Creek by increasing the dissolved oxygen concentrations through either directly adding compressed air into the water column through a submerged diffuser grid or potentially using an oxygenation system that would inject supersaturated water back into the creek via submerged nozzles. This enhanced aeration system would target a minimum dissolved oxygen level of 3 mg/L to comply with existing water quality standards as opposed to the aeration system proposed in the 2003 Facility Plan that would have only targeted a dissolved oxygen level of 1 mg/L to keep the water column from going hypoxic. For planning purposes, it was assumed that all aeration systems would be installed in waters that are not less than 6-feet below MLLW. In some areas, this will require injection of slightly more airflow per square meter if those areas are adjacent to shallow area so that the tidal flow can transport the inject air into the shallow areas. The probable total project cost of this enhanced aeration system is $115.3 million.

The enhanced aeration could provide a significant increase in dissolved oxygen levels within the waterbody, but does not address the level of pollutants entering through CSO discharges. Therefore, this alternative also includes elements that control floatables at the four outfalls with the largest baseline annual overflow volumes to address some of the aesthetic impairments related to CSO discharges. These four facilities would remove over 83,000 pounds (EPA, 1999e) of floatables on an average annual basis. The probable total project cost of installing in-line CSO floatables control facilities at outfalls NCB-015, NCB-083, NCQ-077, and BBL-026 is $89.8 million. This cost estimate for the floatable controls is based on in-line netting facilities and do not include rehabilitation of the outfalls.

The Brooklyn and Manhattan Pumping Stations are undergoing upgrades. The upgraded stations will have five pumps with each capable of handling 100 MGD of influent flow. The

2004 Newtown Creek WWTP Enhanced Track 3 Facility Plan and the 2003 CSO Facility Plan each call for the Brooklyn P.S. capacity to be set at 300 MGD (3 online with 2 standby) and the Manhattan P.S. capacity to be set at 400 MGD (4 online with one standby). However, the existing Newtown Creek WWOP (Appendix B) allows up to 400 MGD to be pumped from the Brooklyn P.S. and modeling shows that the collection system can deliver greater than 400 MGD to the Brooklyn pumping station. By continuing to operate during wet weather consistent with the current wet weather operational protocol, the DEP will be able to maximize the proportion of wet weather flow from the Brooklyn and Queens collection system treated at the WWTP. While CSO related to the reduced capacity for Manhattan will be discharged to receiving waters (East River/Open Waters), which has a greater assimilative capacity than the Newtown Creek waterbody. Under this protocol, during smaller events when 300 MGD or less of capacity is required from the Brooklyn side, the Manhattan station can still be utilized to pump up to 400 MGD. The pump station upgrades that would support this rated capacity are already ongoing are included in this and all subsequent alternatives. The probable total project cost for these upgrades is not included in this WB/WS facility plan as they do not increase the total rated pumping capacity to the WWTP from the collection system that drains to Newtown Creek.

A summary of the cost for each component of Alternative 2 is provided in Table 7-7. The estimated Probable Total Project Cost (PTCP) for Alternative 2 is $205.1 million.

Table 7-7. Summary of Alternative 2

Component	PTPC ($ Million)
Floatables Control at NCB-015, NCB-083, NCQ-077, & BBL-026	$89.8
Enhanced Aeration System	$115.3
Total	**$205.1**

7.3.4. Alternative 3: Alternative 2 and Bending Weirs/Regulator Modifications

This alternative includes the elements of Alternative 2 in addition to collection system modifications to reduce CSOs to Newtown Creek. Modeling analysis of the Newtown Creek WWTP service area was employed to identify locations within the collection system that could be modified to further reduce CSO to Newtown Creek by conveyance of additional flow to the WWTP. Two locations for bending weirs were evaluated: Regulator B1, which overflows to outfall NCB-015, and Regulator Q1, which overflows to outfall NCQ-077. These two locations discharge the second and third largest CSO volumes under Baseline Conditions and represent an opportunity for considerable CSO reductions. They also can readily divert wet weather flow into the Morgan Avenue Interceptor and then to the WWTP for treatment.

For the purpose of these modeling evaluations, three different WPCP wet weather flow capacities were considered. The first was a flow capacity of 585 MGD, representing operating conditions present in 2003, prior to adoption of many of the operating improvements associated with the development of the Wet Weather Operating Plans. Next, the WPCP was assumed to operate in wet weather at capacity of 2xDDWF (620 MGD), which is typical of all other NYC DEP WPCPs. Finally, the WPCP wet weather capacity was set at 700 MGD (2.25xDDWF), which represents the ultimate projected capacity after the ongoing reconstruction is completed.

Bending weirs were evaluated in the model by converting the fixed weirs to variable crest weirs and specifying real-time control (RTC) rules for the movement of the weir crest. The RTC rules were based on raising the weir crest when the HGL was below the elevation of the top of the bending weir (in its fully raised position) and lowering it when the HGL was above that elevation. To satisfy the DEP requirement that weir modifications are hydraulically neutral, it was assumed that existing weir heights would be unaffected, and that the bending weir would be installed so that when the bending weir is fully open, the modified weir system would function as the existing static weir. Based on consultation with a vendor specializing in bending weir technology, the maximum height of the bending weir was limited to 5-feet for incremental widths of 7-feet. The benefit of a bending weir was maximized at Regulator B1 by assuming that this 5-foot height could be installed on top of the existing static weir, and that multiple bays would be constructed as necessary to match the total existing weir length. Each bay will have a 10 foot width to accommodate the weir and its counterweight mechanism. The bending weirs will occupy the existing dry weather flow channel in the diversion chamber (aka Regulator B-1A). Relocation of the DWF channel is required. The DWF channel can be constructed in the 16’ x 10’ double barrel combined sewer upstream of the diversion chamber. The relocated DWF channel will be connected to “Manhole A” which is between the diversion chamber and Regulator B-1.

Regulator Q1 was similarly configured in the model, but the weir height was limited to 2-feet because of space constraints. Regulator Q1 receives flow from four large sewers: a 7’-6” x 5’-6” sewer from the west, a 8’-0” x 7’-0” double barrel sewer from the north and a 7’-6” x 7’-0” sewer from the east. All sewers converge at the Regulator. The confluence of the flows will yield extremely turbulent conditions during wet weather which could jeopardize the function of bending weirs. Reconstruction of sewers so as to combine all flows upstream of Regulator Q1 is one proposed approach, in which flow will enter the bending weir facility from one direction that will improve the performance and reliability of the bending weir mechanism. A description of the various runs is presented in Table 7-8 and the results in Table 7-9.

The primary limitation to conveying additional flow through the Morgan Avenue Interceptor is that the HGL cannot rise high enough before relief at regulator B-1 upstream occurs. The interceptor itself can convey well over 200 MGD under surcharged conditions, but because it is shallow, surcharging cannot occur without inducing upstream overflow and flooding. Therefore, any collection system optimization scheme requires addressing this limitation in the Morgan Avenue Interceptor. Modeling indicated that surface and basement flooding at topographic low spots along the 72-inch trunk sewer on Morgan Ave would result from the complete elimination of Regulator B1, rendering the option untenable. Consideration was also given to raising the static weir one foot and installing the bending weirs on top of the elevated weir crest. Runs 2 through 7 employed this approach (“$BW_{(1)}$” in Table 7-8), whereas Runs 8 through 11 reverted to installing the bending weir on the existing weir crest (“$BW_{(2)}$”). Runs 7 and 8 isolate the difference between these two approaches, resulting in only 13 MG of net improvement on an annual basis. Considering that this option would not be approvable without hydraulic neutrality (increasing the length of weir to compensate for a vertical height increase), the limited CSO improvement that may be realized using this alternative approach does not justify the increase in construction cost. Thus, of the two scenarios, Run 8 would be preferred.

Table 7-8. Bending Weir Collection System Configurations Evaluated

Simulation	Newtown Creek WWTP		Outfall NCB-015		Outfall NCQ-077		Kent Ave Throttling
Run	**Capacity**	**Control**	**Regulator B-1 Weir**	**Orifice Dimensions**	**Regulator Q-1 Weir**	**Orifice Dimensions**	
-	585	WB/WS Facility Plan Baseline	Existing	existing	existing	existing	none
1	620	Existing*	El -4.79*	8ft x 3ft*	El +2.83*	2ft x 2ft*	none*
2	620	Existing*	BW(1)	8ft x 3ft*	El +2.83*	2ft x 2ft*	none*
3	620	Existing*	BW(1)	10ft x 3ft	El +2.83*	2ft x 2ft*	none*
4	700	Existing*	BW(1)	10ft x 3ft	El +2.83*	2ft x 2ft*	none*
5	620	Existing*	BW(1)	8ft x 3ft*	El +2.83*	3.5ftx3.5ft	none*
6	620	Existing*	BW(1)	10ft x 3ft	BW(3)	3.5ftx3.5ft	none*
7	700	Existing*	BW(1)	10ft x 3ft	BW(3)	3.5ftx3.5ft	none*
8	700	Existing*	BW(2)	10ft x 3ft	BW(3)	3.5ftx3.5ft	none*
9	700	Optimized(4)	BW(2)	10ft x 3ft	BW(3)	3.5ftx3.5ft	none*
10	700	Optimized(4)	BW(2)	10ft x 3ft	BW(3)	3.5ftx3.5ft	Yes(5)
11	700	Optimized(4)	BW(2)	10ft x 3ft	BW(3)	3.5ftx3.5ft	Yes(5)

Notes:
(1) 5-ft bending weir on top of static weir elevation increased by 1 ft to -3.79 ft;
(2) 5 ft bending weir on top of existing static weir (El -4.79 ft);
(3) 2-ft bending weir on top of existing static weir (El +2.83 ft);
(4) Gate closure at HGL in wet well 5 ft above existing to a minimum of 2.0 ft instead of existing 3.6 ft minimum opening;
(5) Throttle limit 200 MGD;
(6) Throttle limit 100 MGD.
*Existing condition

After eliminating Run 7, the most promising remaining scenarios based on overall CSO reduction from Baseline were Runs 8, 9, and 10. Each run sequentially adds an additional control: Run 8 includes modifications to both regulators, Run 9 adds to this WPCP optimization, and Run 10 adds the Kent Avenue 200 MGD throttling to Run 9. The throttling gate on the Kent Avenue interceptor was expected to limit the contribution of flows from that interceptor and allow more flow from the Morgan Avenue interceptor to reach the WPCP, thus reducing CSOs to Newtown Creek. By comparing Runs 9 and 10, it is evident that it does reduce CSO to Newtown Creek by 29 MG. However, this is offset by a 33 MG increase in CSO to the East River, so that the CSO benefit from the throttling facility is limited to flow transference (i.e., no net reduction is realized). Because of its better assimilative capacity than Newtown Creek, a transfer of CSO to the East River may ultimately yield the greatest water quality benefit, but the scale of the transfer in comparison to the total volume of CSO discharged to each waterbody suggests that little to no measurable effect would occur. Thus, the throttling facility is not justifiable from a water quality perspective even if it has an operational benefit. The last scenario (Run 11) includes throttling to 100 MGD instead of 200 MGD, resulting in a relatively large increase in CSO and suggesting caution when sizing such a facility.

Table 7-9. Bending Weir InfoWorks Modeling Results

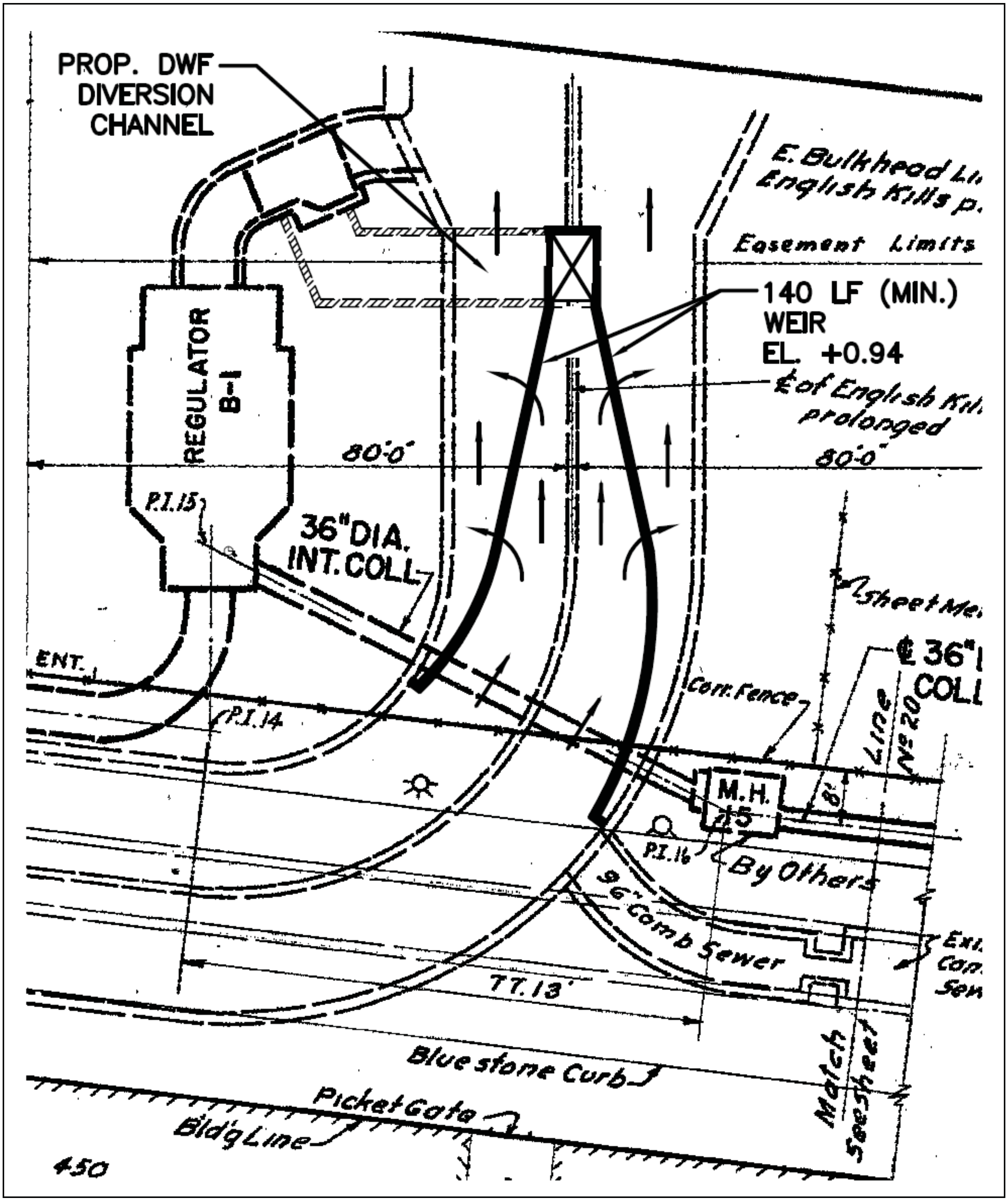
Simulation	CSO Discharges			East River Improvement from WB/WS Plan Baseline	Newtown Creek Improvement From WB/WS Plan Baseline
Run	**Newtown Creek**	**East River**	**Total**	**MG/yr**	**MG/yr**
WB/WS Plan Baseline	1163	589	1752	N.A.	N.A.
1	1,132	545	1,677	44	31
2	1,096	561	1,656	28	67
3	1,085	569	1,654	30	78
4	1,057	527	1,583	62	106
5	1,068	566	1,634	23	95
6	1,028	575	1,603	14	135
7	998	529	1,527	60	165
8	1,013	527	1,540	62	150
9	996	495	1,491	94	167
10	967	528	1,494	61	196
11	956	1,131	2,087	-522	207

Notes: All values in MG for 1988 design year. Numbers may not total exactly due to rounding.

Based on these analyses, Run 9 represents the preferred approach. The modifications at the two regulators can greatly reduce CSO discharge (Run 8), and the addition of operational changes at the headworks of the Newtown Creek WPCP (Run 9) adds to the benefit considerably without incurring additional cost. This configuration provides the greatest net improvement based on CSO reduction and increased conveyance to the WPCP, resulting in a 167 MG/yr reduction in CSOs to Newtown Creek, plus an additional 94 MG/yr reduction in East River CSOs relative to the WB/WS Facility Plan Baseline.

An alternative to the 5 foot tall bending weir at Regulator B-1 is the construction of a 3 foot tall fixed weir equipped with a two foot tall bending weir in the double barrel combined sewer upstream of the diversion chamber as shown in Figure 7-17. The required length of proposed weir system is 140 linear feet. Relocation of the DWF diversion channel and sewer is required for this alternative as well. At the head of the relocated diversion sewer, an 8' x 8' foot opening will be constructed in the double barrel invert to collect DWF. The DWF diversion sewer will be constructed under the existing combined sewer and will discharge to existing manhole "A". An additional diversion barrel downstream of the weir was included at this time so as to pass peak flows without raising the design HGL.

Including the PTPC of the Alternative 2 components ($205.1 million), the estimated PTPC of this alternative is $231.3 million. A summary of the cost for each component of Alternative 3 is provided in Table 7-10.



Proposed Bending Weir Modifications at Regulator B1

Table 7-10. Summary of Alternative 3

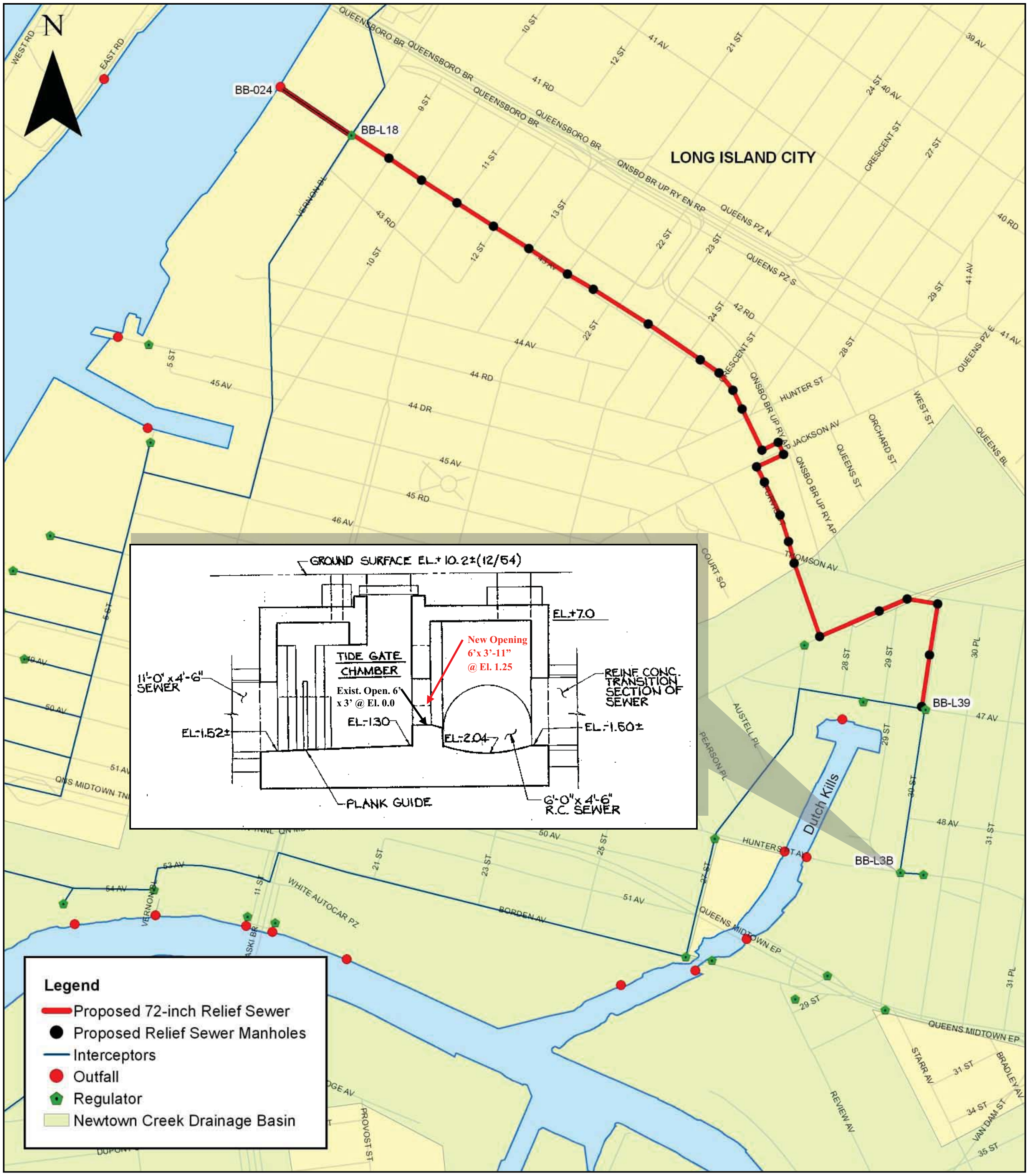
Component	PTPC ($ Million)
Floatables Control at NCB-015, NCB-083, NCQ-077, & BBL-026	$89.8
Enhanced Aeration System	$115.3
Bending Weirs at Regulators B1 and Q1	$26.2
Total	**$231.3**

7.3.5. Alternative 4: Alternative 3 and Dutch Kills Relief Sewer

This alternative combines the elements of Alternative 3 and a Dutch Kills relief sewer and corresponding weir modifications to further reduce CSOs discharging to Newtown Creek. The relief sewer and weir modification elements are intended to reduce CSO discharges to Dutch Kills, which was not addressed under the 2003 CSO Facility Plan, by modifying the collection system upstream of the two outfalls BBL-009 and BBL-026. These outfalls contribute the two largest Baseline CSO discharge volumes to Dutch Kills. The modifications include raising the weir in Regulator BB-L3B that discharges through outfall BBL-009, disconnecting the upstream end of a 39-inch diameter sewer from Regulator BB-L39 that currently discharges to sewers upstream of outfall BBL-026, and constructing a new 72-inch relief sewer in its place to convey flows to Regulator BBL-018. According to modeling results, 72 inches is the minimum diameter required to prevent surcharging of the sewer during the 1988 precipitation year. A drainage plan analysis was performed to determine the corresponding increase in weir length required at Regulator L3B, such that the higher weir elevation does not increase the design water surface elevation in the upstream sewers. Through this analysis it was determined that the tide gates act as an orifice at the design water surface elevation of 5.8 QSD, which is nearly 3 feet above the tide gate openings. Because of this configuration, the lip of the tide gate openings can be shifted upward, and this effectively increases the discharge weir elevation with no corresponding lengthening for all upstream water surface elevations where the tide gates are not submerged. It is proposed to increase the elevation of the tide gate lip from 0.0 QSD to 1.25 QSD, while increasing the height of the tide gates from 3’0” to 3’-11”, so that there will be no change in the design water surface elevation. Figure 7-18 shows the locations of Regulators BB-L3B, L39, and L18, as well as the proposed route of the relief sewer.

Construction of the Dutch Kills Relief Sewer is not without its challenges. Problems exist in crossing the LIRR/Amtrak rail yard, the Jackson Avenue subway, the MTA vent structure and utilities that will be necessary to construct the relief sewer with a positive slope towards the East River. Additionally, geotechnical issues for supporting the sewer will need to be resolved as it may affect adjacent structure and highway foundations. Such issues and challenges have engineering solutions which would be addressed fully during design.

The probable total project cost of these regulator modifications and the relief sewer is $94.7 million. The regulator modifications and the addition of a 72-inch relief sewer reduces the annual average CSO volume to Dutch Kills by 28% without increasing overflows to the East River and thus achieves a nearly 6% reduction in total overflows from the Bowery Bay low level collection system. Including the PTPC of the Alternative 3 components ($231.3 million), the estimated PTPC of this alternative is $326 million. A summary of the cost for each component of Alternative 4 is provided in Table 7-11.



Environmental Protection

Proposed 72-Inch Relief Sewer and Regulator Modifications Adjacent to Dutch Kills

Table 7-11. Summary of Alternative 4

Component	PTPC ($ Million)
Floatables Control at NCB-015, NCB-083, NCQ-077, & BBL-026	$89.8
Enhanced Aeration System	$115.3
Bending Weirs at Regulators B1 and Q1	$26.2
Dutch Kills Relief Sewer	$94.7
Total	**$326.0**

7.3.6. Alternative 5: Alternative 2, St. Nicholas Relief Sewer, and Inflatable Dams

This alternative includes the elements of Alternative 2 in addition to a St. Nicholas Relief Sewer larger than the one proposed in the CSO Facility Plan and inflatable dams installed downstream of Regulator B1. It was determined through modeling that adding additional capacity via a 36-inch relief sewer to redirect flows from outfall NCB-083 to Regulator NC-B1 reduces overflows to the entire Newtown Creek waterbody, and more substantially to East Branch. Increasing the size of the relief sewer to 48-inches further reduces flow to East Branch by 1 million gallons during the largest storm in the typical year and increases the flow to the plant by over 500,000 gallons during that same event. The probable total project cost of installing a 48-inch relief sewer is $17.0 million.

As discussed in Section 7.3.2, through a drainage plan analysis it was determined that raising the weir to the elevation proposed by the 2003 CSO Facility Plan would require over 400 linear feet of weir length, and therefore raising this weir is no longer considered a feasible option. However, there remains benefit in increasing the flow through cross-sectional area of the sluice gates in Regulator B1, which would lower the downstream headloss in the diversion and consequently the water surface upstream of the weir. The probable total project cost of enlarging the sluice gate openings as proposed in the 2003 CSO Facility Plan is $2.7 million.

As noted, the physical configuration required in Regulator B1 to pass the design flows without adversely impacting upstream hydraulic conditions is impractical. Therefore, Alternative 5 includes the installation of two inflatable dams in the double barrel outfall downstream of Regulator B1 as an alternative to raising the weir height. These inflatable dams would close off the outfall during smaller rainfall events, which would back up the system and drive more flow to the Newtown Creek WWTP for treatment. The dams were modeled to deflate when the upstream water surface elevation increased beyond 1.06 BHD, which is less than the current design water surface elevation of 2.74 BHD. After a storm event, the stored volume would drain by gravity to Regulator B-1. The probable total project cost for the inflatable dams is $10.3 million. Including the PTPC of the Alternative 2 components ($205.1 million), the estimated PTPC of this alternative is $235.1 million. A summary of the cost for each component of Alternative 5 is provided in Table 7-12.

Table 7-12. Summary of Alternative 5

Component	PTPC ($ Million)
Floatables Control at NCB-015, NCB-083, NCQ-077, & BBL-026	$89.8
Enhanced Aeration System	$115.3
Regulator B1 Sluice Gate Modification	$2.7
Inline Storage Facility Inflatable Dams at NBC-015	$10.3
St. Nicholas Weir 46-Inch Relief Sewer	$17.0
Total	**$235.1**

7.3.7. Alternative 6: Enhanced Aeration, Inflatable Dams, St. Nicholas Relief Sewer, Dutch Kills Relief Sewer, and Additional 96-Inch Interceptor

This alternative combines Enhanced Aeration (described in 7.3.3), Inflatable Dams at NBC-015 (described in 7.3.3), the St. Nicholas Weir 46-Inch Relief Sewer (described in 7.3.6), the Dutch Kills Relief Sewer (described in 7.3.5), along with an additional 96-Inch Interceptor from the area tributary to Regulator B1. The interceptor is intended to maximize flow to the WWTP from the collection systems tributary to East Branch and English Kills. Modeling shows that the Morgan Avenue Interceptor is already near capacity during larger events. Based on these results, an additional interceptor was proposed to provide more conveyance capacity. Under this scenario, the existing 144-inch sewer in Johnson Avenue would be connected to the 132-inch sewer in Knickerbocker Avenue and a new 96-inch interceptor would be routed from the 144-inch at Johnson Avenue and Humboldt Street to the WWTP. The interceptor would follow Humboldt Street to its intersection with Greenpoint Avenue where it would connect into the Kent Avenue Interceptor downstream of the proposed throttling gate. The interceptor would be deep enough to avoid existing utilities, requiring some micro-tunneling and some open cut, but would still flow by gravity. The probable total project cost for this interceptor alternative is $380.9 million. The total cost of this alternative is $620.8 million and a summary of the cost for each component of Alternative 6 is provided in Table 7-13.

Table 7-13. Summary of Alternative 6

Component	PTPC ($ Million)
Enhanced Aeration System	$115.3
Regulator B1 Sluice Gate Modification	$2.7
Inline Storage Facility Inflatable Dams at NBC-015	$10.3
St. Nicholas Weir 46-Inch Relief Sewer	$17.0
Dutch Kills Relief Sewer	$94.7
96-Inch Additional Interceptor	$380.9
Total	**$620.8**

7.3.8. Alternative 7: Enhanced Aeration, Inflatable Dams, St. Nicholas Relief Sewer, Dutch Kills Relief Sewer, and 9 MG Storage Tank

This alternative combines Enhanced Aeration (described in 7.3.3), Inflatable Dams at NBC-015 (described in 7.3.3), the St. Nicholas Weir 46-Inch Relief Sewer (described in 7.3.6), the Dutch Kills Relief Sewer (described in 7.3.5), in addition to the 9 MG English Kills CSO Retention Facility proposed in the CSO Facility Plan and described in Section 7.3.2. The estimated PTPC of this alternative is $1,177.1 million. A summary of the cost for each component of Alternative 7 is provided in Table 7-14.

Table 7-14. Summary of Alternative 7

Component	PTPC ($ Million)
Enhanced Aeration System	$115.3
Regulator B1 Sluice Gate Modification	$2.7
Inline Storage Facility Inflatable Dams at NBC-015	$10.3
St. Nicholas Weir 46-Inch Relief Sewer	$17.0
Dutch Kills Relief Sewer	$94.7
English Kills 9 MG CSO Retention Facility	$556.3
Total	**$796.2**

7.3.9. Alternatives 8-11 and 100% Reduction Alternative: CSO Capture Tunnels

As noted above, offline capture of CSO can provide a relatively constant flow into the treatment plant and thus reduce the size of treatment facilities required. However, considering the highly congested urban area surrounding Newtown Creek, land requirements, traffic disruptions, and associated costs would prohibit storage pipeline or retention basin alternatives extensive enough to have a large impact on reducing CSO volumes to Newtown Creek. Therefore, CSO capture tunnels are considered the only viable off-line storage alternative that could be implemented on a large enough scale to beneficially impact water quality through abatement of CSO from some of Newtown Creek's 23 CSO outfalls, which are spread throughout the waterbody.

CSO capture tunnels can target specific outfalls throughout the waterbody. Outfalls captured by the tunnel concepts discussed below were selected based on their baseline annual volume, their location within the waterbody, and their proximity to other outfalls. Ten different tunnel concepts, spanning a wide range of both cost and annual percent CSO reduction, were simulated and evaluated. Alternative tunnel layouts were then devised to cost effectively target the most critical outfalls, while providing for the analysis of a range of capture (33%, 55%, 76%, 78%, 95%, 98%, 99%, and 100%) consistent with Federal CSO Policy. These alternatives capture flow from some or all of the outfalls discharging to Newtown Creek, targeting both localized water quality issues and volume reductions. Each tunnel alternative is described below (Dawn, 2006), and the outfalls that are addressed are highlighted in Table 7-15.

1. A 101.5 MG CSO Capture Tunnel – This alternative would capture all of the CSO discharged from the two largest outfalls in the watershed (English Kills outfall NCB-015, East Branch outfall NCB-083), as well as the three largest outfalls discharging to Dutch Kills (outfalls BBL-026, BBL-009, and BBL-042), during the typical year. The proposed tunnel diameter, routing, drop shafts locations, and pumping station site are shown in Figure 7-19. The pumping station shaft would be located in Block 2585, which is currently used as a parking lot for Newtown Creek WWTP employees. The probable total project cost for this tunnel layout is $2,482.7 million. The pumping station shaft and associated odor control facility for this tunnel would be located adjacent to the Newtown Creek WWTP. Dewatering would be initiated 12 hours after an event ends, and the tunnel would be dewatered to the Morgan Avenue Interceptor just upstream of its junction with the Kent Avenue Interceptor within 24 hours based on having available capacity at the WWTP.

2. A 128 MG CSO Capture Tunnel – This alternative would capture all of the CSO discharged from the outfalls picked up under the 101.5 MG tunnel, as well as the all of the typical year discharges from Maspeth Creek outfall NCQ-077, and from outfall NCQ-029 near the mouth of Maspeth Creek. The proposed tunnel diameter, routing, drop shafts locations, and pumping station site are shown in Figure 7-20. The probable total project cost for this tunnel layout is $2,849.0 million. The locations of the tunnel pumping station and shaft, and the dewatering point would be the same as for the 101.5 MG tunnel.
3. A 132.5 MG CSO Capture Tunnel – This alternative would capture all of the CSO discharged from the 10 outfalls with the largest baseline annual overflow volumes. It includes all outfalls picked up under the 128 MG tunnel, as well as the all of the typical year discharges from Newtown Creek Outfalls BBL-013, BBL-043, and NCB-022. The proposed tunnel diameter, routing, drop shafts locations and pumping station site are shown in Figure 7-21. The probable total project cost for this tunnel layout is $2,885.2 million. The locations of the tunnel pumping station and shaft, and the dewatering point would be the same as for the 101.5 MG tunnel.
4. A 145 MG CSO Capture Tunnel and Modifications to Regulator BB-L4 – This alternative would capture all of the CSO discharged from the outfalls picked up under the 128 MG tunnel, except NCQ-029. Additionally, under this alternative the outfall for Regulator BB-L4 would be bulkheaded downstream of the tunnel connection and the regulator modified to lower the overflow elevation and remove the tide gates. This configuration would allow more flow to enter the tunnel at this location, and consequently reduce overflows at other upstream and downstream outfalls that are not captured by the tunnel. The proposed tunnel diameter, routing, drop shafts locations and pumping station site are shown in Figure 7-22. The probable total project cost for this tunnel layout is $2,983.8 million. As with the other alternatives discussed above, the locations of the pumping station and shaft and the dewatering point would be the same as for the 101.5 MG tunnel.
5. A 107 MG CSO Capture Tunnel – This alternative would capture all of the CSO discharged from the 3 outfalls with the largest baseline annual overflow volumes during the typical year; English Kills outfall NCB-015, East Branch outfall NCB-083, and Maspeth Creek outfall NCQ-077. The pumping station would be located at the corner of Johnson and Morgan Avenues, the preferred site of the CSO storage tank proposed under the 2003 CSO Facility Plan and would dewater to the Morgan Avenue Interceptor for conveyance to the Newtown Creek WWTP. This site is Block 2974, Lot 170. It is owned by Berry Bridge Inc. and is currently used by Fedex and other businesses. The proposed tunnel diameter, routing, drop shafts locations and pumping station site are shown in Figure 7-23. The probable total project cost for this tunnel layout is $2,148.2 million.
6. A 72 MG CSO Capture Tunnel and HRPCT Facility – This alternative also provides for 100% capture of the typical year overflow from the three largest outfalls, except that the pumping station will discharge to a high rate physical chemical treatment (HRPCT) facility located on the same site as the pump station, which would then

discharge to the head end of English Kills. Such a configuration would allow dewatering of the tunnel to be independent of the availably capacity at the Newtown Creek WWTP. As such, dewatering could start at the onset of a capture event and run throughout the event until the event is over and the tunnel fully dewatered. This configuration thus reduces the required tunnel volume or the required HRPCT capacity that would otherwise be required by either of these stand-alone technologies.

7. The proposed tunnel diameter, routing, drop shafts locations and pumping station site are shown in Figure 7-24. The probable total project cost for this tunnel layout and 72 MGD HRPCT facility is $2,167.7 million.

8. A 40 MG CSO Capture Tunnel – This alternative would pick up 70% of the baseline annual overflow volume from the 3 outfalls with the largest baseline annual overflow volumes during the typical year. By limiting the total capture volume to 70%, this alternative provides for a more efficient use of the tunnel storage volume while still significantly reducing the overflow volume to the head end of Newtown Creek. As with the 107 MG tunnel, the dewatering pumping station would be sited on the site at the intersection of Morgan and Johnson Avenues, and would discharge to the Morgan Avenue Interceptor for conveyance to the Newtown Creek WWTP. The proposed tunnel diameter, routing, drop shafts locations and pumping station site are shown in Figure 7-25. The probable total project cost for this tunnel layout is $1,470.0 million. Dewatering would still be initiated 12 hours after an event ends, and be completed within 24 hours based on having available capacity at the WWTP.

9. A 24.5 MG CSO Capture Tunnel and HRPCT Facility – This alternative provides the same capture level as the 40 MG tunnel, from the same three outfalls, but it discharges though a HRPCT facility to English Kills. The proposed tunnel diameter, routing, drop shafts locations and pumping station site are shown in Figure 7-26. The probable total project cost for this tunnel layout and 24.5 MGD HRPCT facility is $1,334.1 million.

10. A 19 MG CSO Capture Tunnel – This alternative would pick up approximately 33% of the baseline annual overflow volume from the 3 outfalls with the largest baseline annual overflow volumes during the typical year. However, it is envisioned that this tunnel would be used in conjunction with another CSO abatement alternative such as the additional interceptor, where it would capture nearly 60% of the remaining annual flow to those outfalls. The probable total project cost for this tunnel layout is $1,174.9 million. The routing, drop shafts, pumping station, and the dewatering point would be the same as for the 40 MG tunnel.

11. 100% Capture Tunnel – This alternative is a 134 MG CSO capture tunnel that would capture 100% of the CSO projected to discharge in a typical year. The proposed tunnel diameter, routing, drop shafts locations, and pumping station site are shown in Figure 7-27. The probable total project cost for this tunnel layout is $3,019.5 million. The locations of the tunnel pumping station and shaft, and the dewatering point would be the same as for the 101.5 MG tunnel.

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Proposed 101.5 MG CSO Capture Tunnel Routing, Drop Shafts and Pump Station

NYC Environmental Protection

Proposed 128 MG CSO Capture Tunnel Routing, Drop Shafts and Pump Station

Environmental Protection

Proposed 132.5 MG CSO Capture Tunnel Routing, Drop Shafts and Pump Station

NYC Environmental Protection

Proposed 145 MG CSO Capture Tunnel Routing, Drop Shafts and Pump Station

NYC Environmental Protection

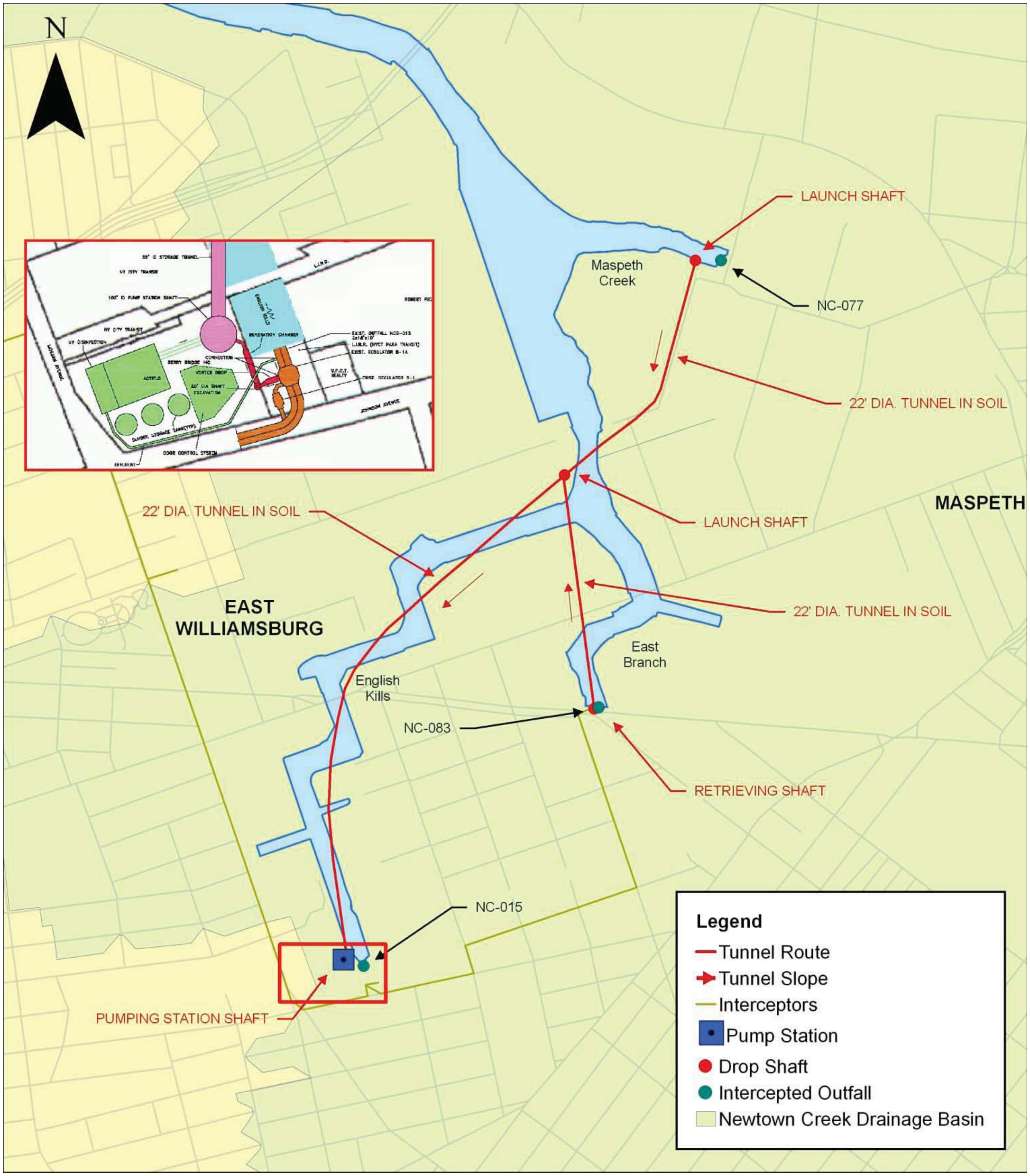
Proposed 107 MG CSO Capture Tunnel Routing, Drop Shafts and Pump Station

Environmental Protection

Proposed 72 MG CSO Capture Tunnel w/HRPCT Routing, Drop Shafts and Pump Station

NYC Environmental Protection

Proposed 40 MG CSO Capture Tunnel Routing, Drop Shafts and Pump Station



NYC Environmental Protection

Proposed 24.5 MG CSO Capture Tunnel w/HRPCT Routing, Drop Shafts and Pump Station

NYC Environmental Protection

Proposed 134 MG CSO Capture Tunnel Routing, Drop Shafts and Pump Station

Figure 7-27

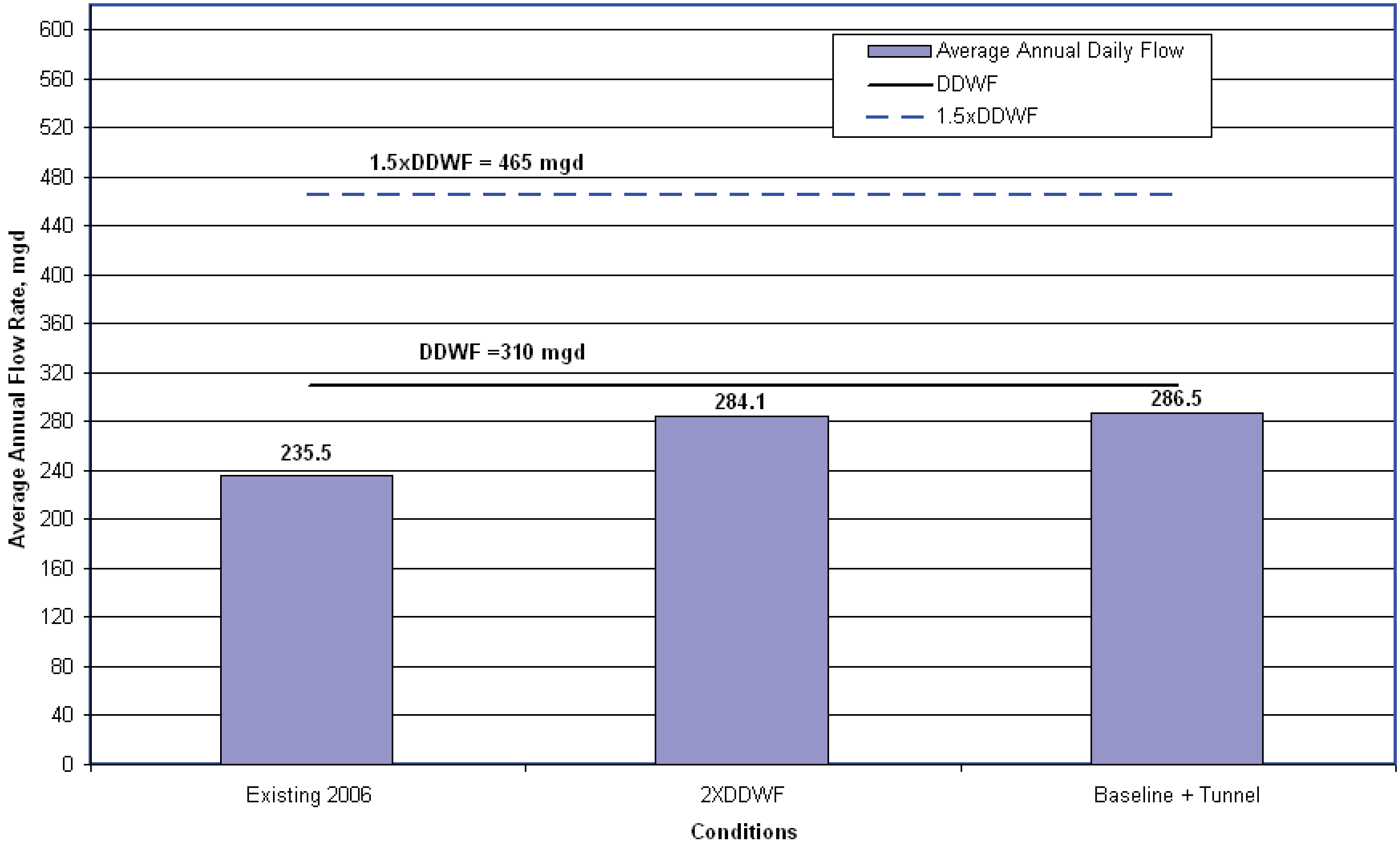
Table 7-15. Outfalls Captured by Tunnel Alternative

Outfalls	Water Body	Annual CSO Volume (MG)	101.5 MG	128 MG	132.5 MG	145 MG	107 MG	72 MG	40 MG	24.5 MG	19 MG	100% Capture 134 MG
NC-083	East Branch	586.2	●	●	●	●	●	●	●	●	●	●
NC-015	English Kills	307.8	●	●	●	●	●	●	●	●	●	●
NC-077	Maspeth Creek	261.5		●	●	●	●	●	●	●	●	●
BB-026	Dutch Kills	186.8	●	●	●	●						●
BB-009	Dutch Kills	35.2	●	●	●	●						●
BB-013	Newtown Creek	39.2			●							●
NC-029	Newtown Creek	18.1		●	●	●						●
BB-043	Newtown Creek	13.9			●							●
NC-022	Newtown Creek	8.4			●							●
BB-042	Dutch Kills	2.3	●	●	●							●
Smaller Outfalls		22.5										●

(1) "Smaller outfalls" are those that discharge less than 5 MG per year under baseline conditions, and are BB-014, BB-015, BB-011, BB-040, BB-010, NC-019, NC-023, BB-012, BB-004, and NC-024

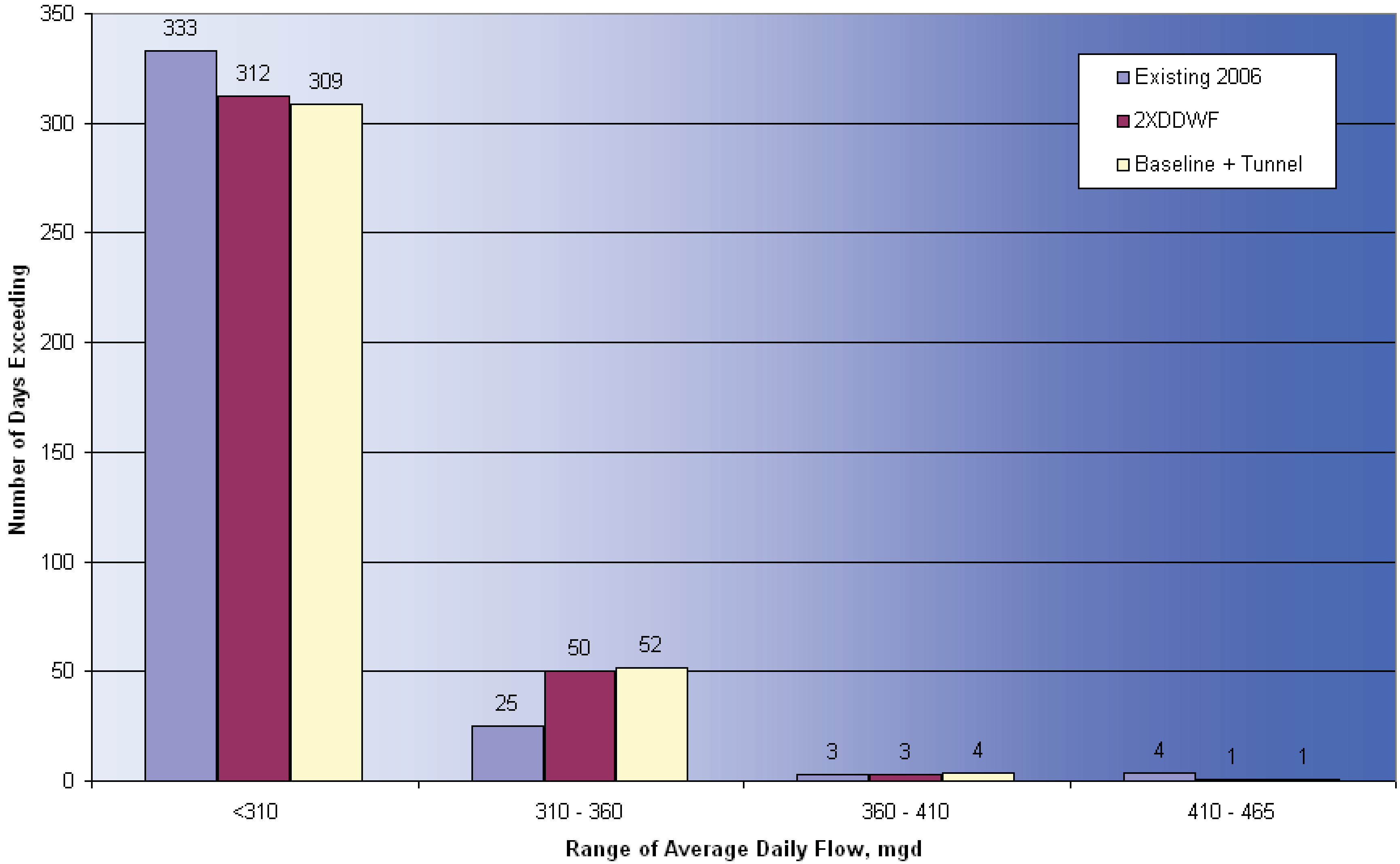
After sizing the different tunnel alternatives, tunnel dewatering was analyzed to determine what if any impacts it would have on operations at the Newtown Creek WWTP. Examples of this analysis based on adding a 40 million gallon tunnel are shown in Figures 7-28 and 7-29. Figure 7-28, shows that dewatering a 40 million gallon tunnel after each capture event is projected to increase average annual plant flow by less than one percent over the flows expected in 2045 after the ongoing plant upgrades are complete. Additionally, the projected average annual flow rate of 286.5 MGD is less than 95 percent of DDWF, and therefore is not expected to require further plant upgrades. Figure 7-29 shows that dewatering of the proposed tunnel would not appreciably increase the number of days that the Newtown Creek WWTP receives high flows. Based on this analysis, construction and operation of a CSO capture tunnel would not impact operations at the Newtown Creek WWTP.

The sewer system hydraulic models for the Bowery Bay Low Level and Newtown Creek Brooklyn/Queens collection systems were used to assess the impacts of the above CSO capture tunnel concepts on CSO discharges to the Newtown Creek waterbody. A summary of the findings for each tunnel concept is presented in Table 7-16.



Environmental Protection

Newtown Creek WPCP Average Annual Daily Flow for Different Collection System Conditions



Environmental Protection

Number of Days that Newtown Creek WPCP Average Daily Flow is Within Stated Range

Table 7-16. Alternative Tunnel Plans Annual Combined Sewer Overflows

CSO Capture Tunnel Concept	Events/Year	Untreated CSO (MG/Year)	% CSO Reduction from Baseline	PTPC ($M)
101.5 MG CSO Capture Tunnel	49	346.7	76%	$2,482.7
128.0 MG CSO Capture Tunnel	44	68.2	95%	$2,849.0
132.5 MG CSO Capture Tunnel	36	14.9	99%	$2,885.2
145.0 MG CSO Capture Tunnel and modifications to Regulator BB-L4	46	26.7	98%	$2,983.8
107.0 MG CSO Capture Tunnel	48	327.4	78%	$2,148.2
72.0 MG and a HRPCT facility to the head end of English Kills	48	327.4	78%	$2,167.7
40 MG CSO Capture Tunnel	48	664.2	55%	$1,470.0
24.5 MG and a HRPCT facility to the head end of English Kills	48	664.2	55%	$1,334.1
19 MG CSO Capture Tunnel	48	985.1	33%	$1,174.9
134.0 MG CSO Capture Tunnel	0	0.0	100%	$3,019.5

(1) Total does not include 141.1 MG that discharges through the tank and receives the equivalent of primary treatment.
(2) Total does not include 35.6 MG that discharges through the tank and receives the equivalent of primary treatment.
(3) A majority of the pollutant load associated with CSO would still be discharged with increased stormwater discharges. This is discussed in more detail later in this section.

As discussed above, the tunnel layouts were devised to target the most critical outfalls and provide for the analysis of a range of capture (33%, 55%, 76%, 78%, 95%, 98%, 99%, and 100%) consistent with Federal CSO Policy. However, the multiple CSO capture tunnel alternatives reviewed were unsuccessful in producing a range of discharge frequencies as low as the example ranges discussed in the Federal CSO Policy (0, 1-3, 4-7, and 8-12 events per year). This is because there are numerous outfalls, particularly from the Bowery Bay low level collection system, which are part of the group of outfalls that make up less than 1% of the total annual average overflow volume, and which discharge between 20 to 30 times per year. Building separate tunnel reaches and drop shafts to collect these relatively small volumes is not considered practical or cost effective.

Two of the tunnel alternatives discussed above include HRPCT as a component. Under this configuration, the tunnel's pumping station would discharge to a HRPCT facility located on the same site as the pump station, which would then discharge directly to the head of English Kills. This application of HRPCT is only considered a cost-effective application for very large tunnels or where WWTP capacity is consistently at 2×DDWF even when wet-weather is over. A HRPCT component was not considered further because of the determination that flow to Newtown Creek WWTP will recede below 2×DDWF after a storm event. Also, siting restrictions would make the addition of a HRPCT facility to the proposed configuration of a Newtown Creek tunnel potentially infeasible. Consequently, HRPCT is not retained for further consideration.

Several of the tunnel concepts were retained and combined with additional elements for detailed alternative analysis. The retained tunnel alternatives are described below:

- **Alternative 8:** Alternative 8 includes the 40 MG CSO capture tunnel, described above, which is designed to capture 70% of the CSO discharged from the 3 outfalls with the largest annual CSO discharge volumes under Baseline conditions (NCB-015, NCB-083, and NCQ-077). Additionally, to address CSO discharges to Dutch Kills, which are not picked up by the 40 MG tunnel, Alternative 8 also includes the Dutch Kills relief sewer (described in Section 7.3.5). Enhanced in-stream aeration and the Brooklyn P.S. upgrade (both described in Section 7.3.3) are also included in Alternative 8 and each subsequent tunnel alternative.

- **Alternative 9:** Alternative 9 includes the 107 MG CSO capture tunnel, described above, which is designed to capture 100% of the CSO discharged from NCB-015, NCB-083, and NCQ-077 during a typical rainfall year. Like Alternative 8, Alternative 9 also includes the Dutch Kills relief sewer, enhanced in-stream aeration, and the Brooklyn P.S. upgrades.

- **Alternative 10:** Alternative 10 includes the 128 MG CSO capture tunnel, described above, which is designed to capture all of the CSO discharged from the two largest outfalls in the watershed (English Kills outfall NCB-015, East Branch outfall NCB-083), the three largest outfalls discharging to Dutch Kills (outfalls BBL-026, BBL-009, and BBL-042), Maspeth Creek outfall NCQ-077, and outfall NCQ-029 near the mouth of Maspeth Creek during the typical year. Enhanced in-stream aeration and the Brooklyn P.S. Upgrade are additional elements of this tunnel alternative.

- **Alternative 11:** Alternative 11 includes the 132.5 MG CSO capture tunnel, described above, which is designed to capture all CSO discharges during the typical rainfall year from the 10 outfalls with the largest baseline annual overflow volumes. Enhanced in-stream aeration and the Brooklyn P.S. Upgrade are additional elements of this tunnel alternative.

- **100% Reduction Alternative:** This alternative includes the 134 MG CSO capture tunnel, described above, that would capture 100% of the CSO projected to discharge in a typical year in addition to enhanced in-stream aeration and the Brooklyn P.S. upgrades.

A summary of the costs for each component of Alternatives 8 through 11 and the 100% Reduction Alternative is provided in Table 7-17.

Table 7-17. Summary of Alternatives 8 - 11 and 100% Reduction Alternative

Component	Alt. 8	Alt. 9	Alt. 10	Alt. 11	100% Alt
Tunnel Volume (MG)	40	107	128	132.5	134
High Level Aeration System (PTPC $ Million)	$115.3	$115.3	$115.3	$115.3	$115.3
Dutch Kills Relief Sewer (PTPC $ Million)	$94.7	$94.7	-	-	-
Tunnel and Dewatering Facility (PTPC $ Million)	$1,470.0	$2,148.2	$2,849.0	$2,885.2	$3,019.5
Total (PTPC $ Million)	**$1,769.8**	**$2,447.9**	**$3,054.1**	**$3,090.3**	**$3,224.6**

7.3.10. Dredging

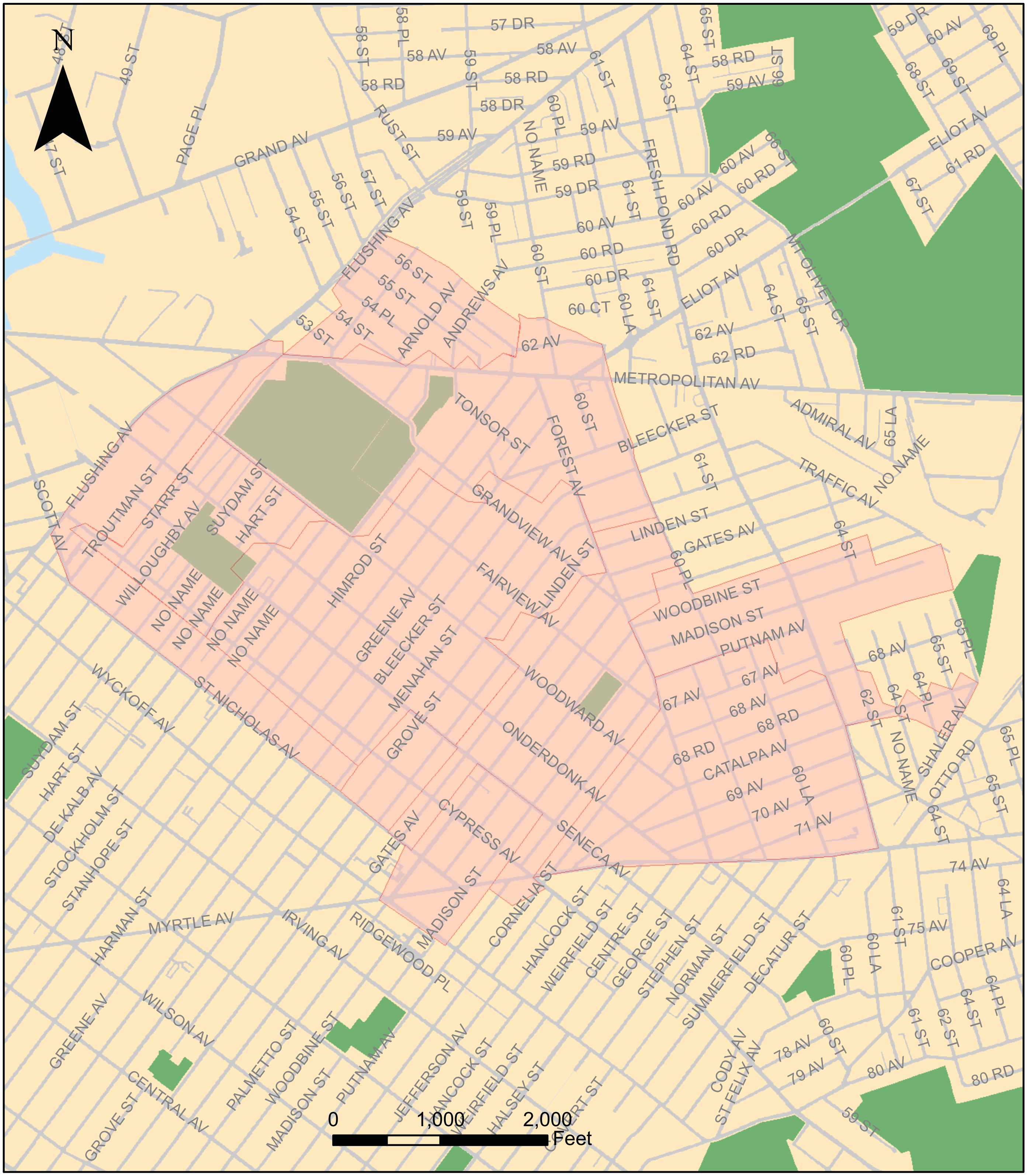
Dredging portions of Newtown Creek has the potential to greatly reduce the hydrogen sulfide (H_2S) flux from creek sediments, and consequently, the odors. Dredging as a standalone alternative would be proposed for areas of Newtown Creek where sediments are less than 3-feet below mean lower low water (MLLW). Alternatively, where in stream aeration is proposed, a greater water column depth would more effectively transfer oxygen and require less air be injected in adjacent areas. In these areas, a final dredge depth of 6-feet below MLLW would be proposed if dredging were initiated in Newtown Creek. The existing sediments have been found to exceed the DEC "No Appreciable Contamination Criteria" (URS, 2000b).

The implementation of dredging, however, is complicated by EPA's designation of Newtown Creek as a Superfund site in September 2010. A dredging alternative cannot be fully developed until the Remedial Investigation/Feasibility Study (RI/FS) is released, and owing to the complexity of the site and the number of potentially responsible parties, this document may not be available for some time. Therefore, dredging is not included as an element of the WB/WS Facility Plan at this time but will be re-evaluated as an element of the LTCP.

7.3.11. High Level Sewer Separation

The City of New York is expecting to continue its program of high level sewer separation to improve the overall level-of-service. Both PlaNYC and the Green Infrastructure Plan submitted by the City consider HLSS as an integral component to cost-effective water quality improvements, and HLSS is therefore retained for further consideration.

To simulate HLSS in detail, GIS data was used to determine the area within each model subcatchment that is composed of property lots as defined by the Department of City Planning, then assuming that the "non-lot areas" would constitute the streets and sidewalks that would no longer contribute runoff to the combined sewers. Both the total subcatchment area and the percent impervious were recomputed and the model was rerun with the adjusted runoff properties. Approximately 657 acres tributary to outfall NCB-083 was targeted in Newtown Creek for HLSS, as shown in Figure 7-30. Model simulations indicate that HLSS in this area would result in a CSO reduction of 184 MG, about 10 percent of all CSO tributary to the Newtown Creek complex. The estimated cost of HLSS for this area is about $180 million.



High Level Sewer Separation (HLSS) Outfall NCB-083 Tributary Area

Newtown Creek Waterbody/Watershed Facility Plan Report

FIGURE 7-30

The anticipated schedule requirements for the Newtown Creek WB/WS Facility Plan do not allow adequate time to fully build out HLSS in the local area. Therefore, HLSS will be deferred to the LTCP phase for this waterbody.

7.4. EVALUATION OF ALTERNATIVES

7.4.1. CSO Reduction

The sewer system hydraulic models for the Bowery Bay Low Level and Newtown Creek Brooklyn/Queens collection systems were used to assess the impacts of the above alternatives on CSO discharges to the Newtown Creek waterbody.

Table 7-18 shows the elements included in each alternative that was developed using the retained technologies from Section 7.2. All of the alternatives, except for Alternative 1, the CSO Facility Plan, include a Brooklyn Pumping Station capacity of 400 MGD (WWTP at 700MGD). As noted above the costs for the upgrades to the Brooklyn and Manhattan Pumping Stations are not included in these analyses as they do not increase total pumping capacity to the Newtown Creek WWTP. The alternatives span a wide range of CSO reduction. Hydraulic model results are summarized in Table 7-19 along with each alternative's cost. Key observations are as follows:

- Enlarging the sluice gate openings in Regulator NC-B1 and raising the weir in tide gate chamber B1A (Section 7.3.2) would reduce overflows to Newtown Creek and increase flow through the Morgan Avenue Interceptor and to the Newtown Creek WWTP, and was retained for further consideration. However, an impractically long weir would be required to avoid increasing the design water surface elevation and to avoid increasing the potential for upstream flooding. As such, raising the weir is not consistent with the drainage plan and modifying the weir elevation is not considered further. As alternatives, inflatable dams (Sections 7.3.6 through 7.3.8) and bending weirs (Sections 7.3.4 and 7.3.5), which would not restrict the diversion at high flows were considered.
- Modeling shows that the collection system can deliver greater than 400 MGD to the Brooklyn pumping station. The Kent Avenue Interceptor contributes 61% of the flow to the pump station, while Morgan Avenue Interceptor accounts for the remaining 39%. By not reducing the capacity of this flow limiting element as planned in the Newtown Creek WWTP and CSO Facility Plans, combined sewer overflows to the Newtown Creek waterbody during higher intensity, longer duration storm events can be minimized. Furthermore, pump station upgrades that would support this rated capacity are already ongoing. This alternative is considered a key element for the final WB/WS Plan (described in Section 7.3.3).
- Adding additional capacity via a 36-inch relief sewer (Section 7.3.2) to redirect flows from outfall NCB-083 to Regulator NC-B1 reduces overflows to the entire Newtown Creek waterbody, and more substantially to East Branch. Increasing the size of the relief sewer to 48-inches further reduces flow to East Branch by 1 million gallons during the largest storm in the typical year and increases the flow to the plant by over

500,000 gallons during that same event. This larger relief sewer was therefore retained for further evaluation (Section 7.3.6 through 7.3.8).

- Regulator modifications and the addition of a 72-inch Dutch Kills Relief Sewer in the Bowery Bay low level collection system reduces annual average overflows to Dutch Kills by 22% without increasing overflows to the East River and thus achieves a nearly 14% reduction in total overflows from the Bowery Bay low level collection system (Sections 7.3.5, 7.3.6 through 7.3.9). The only other alternatives that directly address water quality within Dutch Kills are the more comprehensive flushing and capture tunnel alternatives. The proposed 72-inch Dutch Kills Relief Sewer has several constructability issues which must addressed during final design. The major issues are the crossing of the Sunnyside Railroad yard, the crossing of the Jackson Avenue subway, and a potential interference with the recently constructed MTA vent structure.
- CSO capture tunnels (Section 7.3.9) can target specific outfalls throughout the waterbody. Outfalls captured by the alternatives discussed above were selected based on their baseline annual volume, their location within the waterbody, and their proximity to other outfalls. Alternative tunnel layouts were then devised to cost effectively target the most critical outfalls, while providing for the analysis of a range of capture (33%, 55%, 76%, 78%, 95%, 98%, 99%, and 100%) consistent with Federal CSO Policy. However, the multiple CSO capture tunnel alternatives reviewed were unsuccessful in producing a range of discharge frequencies as low as the example ranges discussed in the Federal CSO Policy (0, 1-3, 4-7, and 8-12 events per year). This is because there are numerous outfalls, particularly from the Bowery Bay low level collection system, which are part of the group of outfalls that make up less than 1% of the total annual average overflow volume, and which discharge between 20 to 30 times per year. Building separate tunnel reaches and drop shafts to collect these relatively small volumes is not considered practical or cost effective.
- Alternative 6 (Section 7.3.7) would discharge 24.5 MG more CSO to Newtown Creek in the typical year than would Alternative 7 (Section 7.3.8). Another 36 MG of CSO would be discharged from the 9 MG tank in Alternative 7 after the equivalent of only preliminary treatment. However, the Alternative 6 would discharge over 100 MG more through the East River CSOs than Alternative 7. As such other considerations such as water quality impacts and operational and maintenance complexities need to be considered and both of these elements were retained for further analysis.
- Floatables control facilities (Sections 7.3.3 through 7.3.6), aimed at removing floatables from overflows, compliment direct water quality improvement alternatives such as full aeration. However, very few of the existing regulators within the Bowery Bay low level and Newtown Creek Brooklyn collection systems have overflow weirs, and as such cannot be easily retrofitted to utilize baffles or screens. Therefore, installation of control facilities that can be installed downstream of these regulators on the outfall pipe will be considered further.
- Newtown Creek, with its numerous CSOs spread throughout the highly urban watershed, lends itself well to storage tunnel alternatives. Additionally, due to lack of

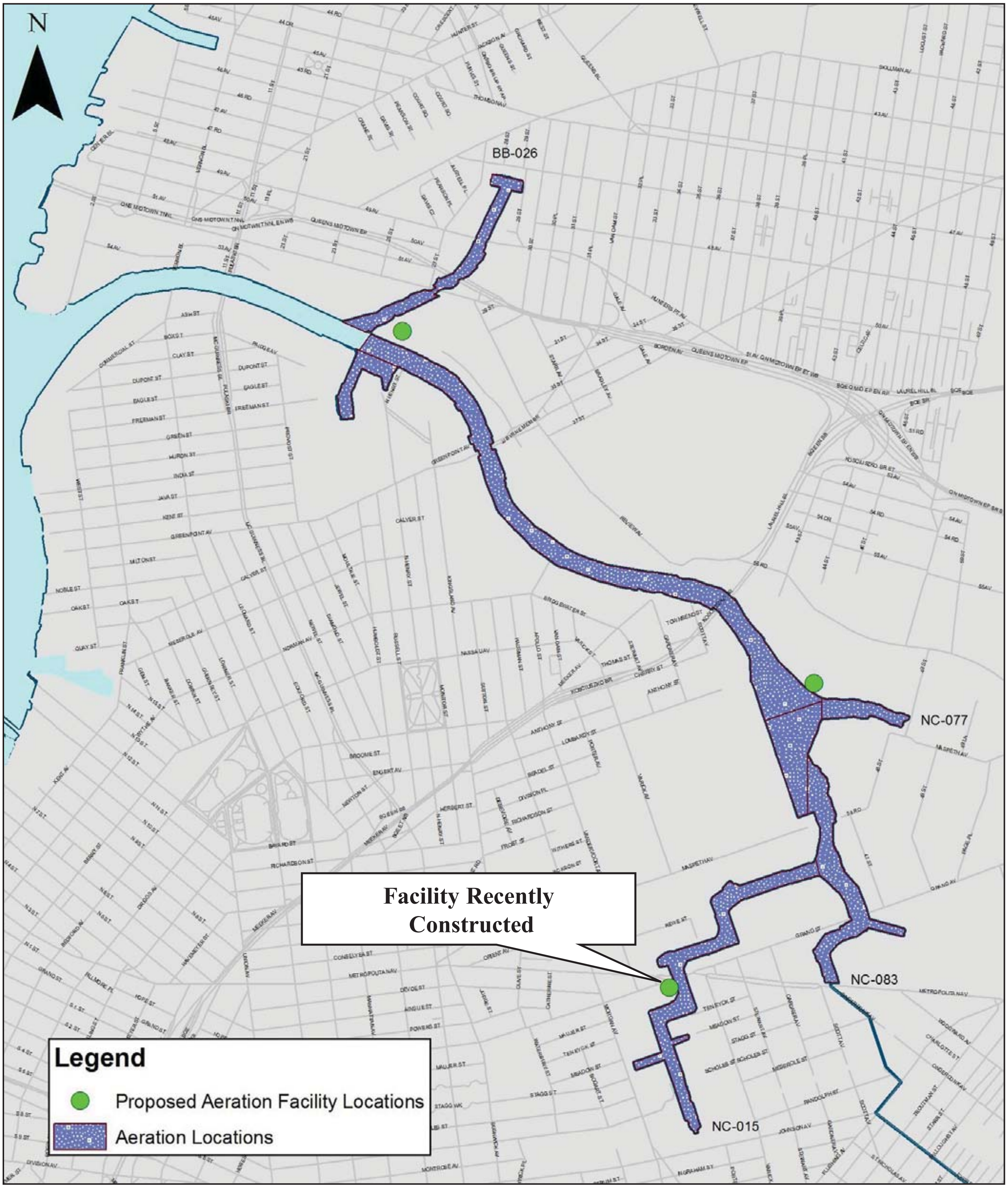
available land for other technologies and their minimal surface disruption, storage tunnels are the only viable option to look at ranges of CSO volume reductions up to 100% capture as suggested by the EPA guidance. Storage tunnels were retained (Section 7.3.9).

In addition, aeration was included as a component of all alternatives to understand the maximum benefit available from this technology at different levels of CSO reduction. As discussed previously, aeration facilities are included in the Consent Order, and one of the proposed sites is already constructed. The DEP has identified this site as a pilot facility to evaluate the effectiveness of aeration. Through this effort the DEP has developed site specific information about transfer efficiency and other related factors that influence the final oxygenation of the waterbody. Based on the results of the pilot study and follow-up water quality modeling, modeling projections show that 19,000 scfm of air would be required to bring the waterbody into compliance with Class SD numerical DO criteria under baseline conditions. Modeling also suggests that to be successful the system would need to be deployed throughout a majority of the waterbody, including the shipping channels, as shown in Figure 7-31. Such an enhanced aeration system will require multiple blower buildings and a vast network of aeration piping.

Table 7-18. Alternative Elements

Alt #	Report Section	CSO Storage Tank	Inter-ceptor	CSO Capture Tunnel	Floatables Control @ 4 Largest Outfalls	Bending Weirs	St. Nicholas Relief Sewer(1)	Dutch Kills Relief Sewer(2)	Inflatable Dams in NCB-015	Aeration(3)	Bklyn P.S. (MGD)
Baseline	7.3.1	-	-	-	-		-	-	-	-	354
1	7.3.2	9 MG	-	-	-		36”	-	YES(4)	LOW	300
2	7.3.3	-	-	-	YES		-	-	-	HIGH	400
3	7.3.4	-	-	-	YES	YES	-	-	-	HIGH	400
4	7.3.5	-	-	-	YES	YES	-	YES	-	HIGH	400
5	7.3.6	-	-	-	YES		48”	-	YES	HIGH	400
6	7.3.7	-	YES	-	-		48”	YES	YES	HIGH	400
7	7.3.8	9 MG	-	-	-		48”	YES	YES	HIGH	400
8	7.3.11	-	-	40 MG	-		-	YES	-	HIGH	400
9	7.3.11	-	-	107 MG	-		-	YES	-	HIGH	400
10	7.3.11	-	-	128 MG	-		-	-	-	HIGH	400
11	7.3.11	-	-	132.5 MG	-		-	-	-	HIGH	400
100% Reduction	7.3.11	-	-	134 MG	-		-	-	-	HIGH	400

(1) Includes larger sluice gate openings in Regulator NC-B1.
(2) Includes modifications to regulators BB-L39, BBL-3B and BB-L18.
(3) High equates to aeration to 3.0 mg/L, low equates to aeration proposed by CSO Facility Plan.
(4) No dams. Raise weir in Tide Gate Chamber B1a to 0.94 BSD.



Proposed Aeration Area and Blower Building Locations

Figure 7-31

Table 7-19. Overflow Reductions for Alternative Plans

Alt #	Description	Events Per Year	Untreated CSO (MG/Year)	CSO Reduction from Baseline (MG/Year)	% CSO Reduction from Baseline	Total Cost W/O Air (Millions)	Total Cost W/Air [(1)] (Millions)
Baseline	Baseline	71	1,471.9	-	-	-	-
1	CSO Facility Plan	56	1,069.5	402.4	27%	$549.6	$664.9
2	High Level Aeration and Floatables Control	71	1,372.9	99.0	7%	$89.8	$205.1
3	Alternative 2 and Bending Weirs	71	1,259.9	212.0	14%	$116.0	$231.3
4	Alternative 3 and Dutch Kills Relief Sewer	55	1,208.9	263.0	18%	$210.7	$326.0
5	Alternative 2, Inflatable Dams, and 48-Inch St. Nicholas Relief Sewer	55	1,218.1	253.8	17%	$119.8	$235.1
6	High Level Aeration, Inflatable Dams, St. Nicholas Relief Sewer, Dutch Kills Relief Sewer, and Additional 96-Inch Interceptor	55	1,037.4	434.5	30%	$505.5	$620.8
7	High Level Aeration, Inflatable Dams, St. Nicholas Relief Sewer, Dutch Kills Relief Sewer, and 9 MG Storage Tank	55	1,012.9	459.0	31%	$680.9	$796.2
8	40 MG CSO Tunnel, Dutch Kills Relief Sewer, and High Level Aeration	55	580.7	891.2	60%	$1,654.5	$1,769.8
9	107 MG Tunnel, Dutch Kills Relief Sewer, and High Level Aeration	48	244.0	1,227.9	83%	$2,332.6	$2,447.9
10	128 MG Tunnel and High Level Aeration	44	68.2	1,403.7	95%	$2,938.8	$3,054.1
11	132.5 MG Tunnel and High Level Aeration	29	14.9	1,457.0	99%	$2,975.0	$3,090.3
100% Reduction	134 MG Tunnel and High Level Aeration	0	0	1471.9	100%	$3,109.3	$3,224.6

[(1)] The CSO Facility Plan includes cost for planned low level aeration. All other alternatives include cost for high level aeration, which is the level of aeration projected to bring the waterbody to full attainment of the Class SD numerical DO standard for the Baseline condition.

Each of these alternatives have an effect on the overall collection system, and as such, overflows to the East River. Some effectively move some of the overflow volume away from Newtown Creek and to the East River, while others reduce overflows to both waterbodies. Table 7-20 shows the net volume and percentage change from baseline of combined sewer overflows to the Newtown Creek and East River as a result of each alternative.

Table 7-20: Change from Baseline CSO volume to the East River

Alternative #	Change from Baseline CSO Volume to the East River (MG)	% Change in East River CSO Volume from Baseline	Element That Reduces/Increases CSO Volume to East River Compared to Alternative 2
1	-72.5	-4.2%	Throttling of Kent Avenue Interceptor to Plant Increases CSOs to East River from Newtown Creek System
2	-219.3	-12.7%	See Notes Below
3	-237.8	-13.8%	Optimization of Influent Pumping Controls at NC WPCP
4	-202.1	-11.7%	72-inch Dutch Kills Relief Sewer
5	-205.3	-11.9%	48-inch St. Nicholas Relief Sewer to Morgan Avenue Interceptor
6	-98.6	-5.7%	48-inch St. Nicholas Relief Sewer to Morgan Avenue Interceptor in NC area, and 72-inch Dutch Kills Relief Sewer in Bowery Bay LLI Area
7	-202.9	-11.8%	48-inch St. Nicholas Relief Sewer to Morgan Avenue Interceptor
8	-128.4	-7.4%	72-inch Dutch Kills Relief Sewer
9	-128.4	-7.4%	72-inch Dutch Kills Relief Sewer
10	-219.3	-12.7%	See Notes Below
11	-219.3	-12.7%	See Notes Below
100% Reduction	-219.3	-12.7%	See Notes Below

Notes:
1. Alternatives were developed to reduce CSO discharges to the Newtown Creek waterbodies, and not necessarily to reduce CSOs to East River
2. Increasing Brooklyn PS from 325 MGD under Baseline to 400 MGD alone resulted in reduction of 70 MG to East River from Newtown Creek System
3. Increasing Bowery Bay Low Level Influent Pumps from 122 MGD under Baseline to 137 MGD alone resulted in reduction of 149 MG to East River from Bowery Bay Low Level System
4. Combined net reduction in CSO to East River from implementing above-noted pump station improvements alone = 219 MG/yr.
5. Maximum reduction of CSO Discharges to the East River occur when the capacities of the Brooklyn Pump Station and Bowery Bay Influent pumps are implemented. Alternatives for CSO reduction to the Newtown Creek waterbodies result in some increased CSO being discharged to the East River compared to the pump station capacities only.

7.4.2. Water Quality Benefits of Alternative Plans

To complete the assessment of alternatives, an evaluation must be made of whether and how cost-effectively each alternative achieves water quality and water use objectives. According to the CSO Policy, a selected alternative must be adequate to meet water quality standards and designated uses unless water quality standards or uses cannot be met through CSO control.

Dissolved Oxygen

Each of the alternatives would increase dissolved oxygen levels through either a reduction in organic loadings to the waterbody or addition of oxygen, or a combination of both. To determine the maximum benefit available from CSO reduction alone, many of the alternatives were modeled with and without aeration. From the modeling results, the percent of the time (hours per year) that the dissolved oxygen concentration was predicted by the water quality model to be at or above 3.0 mg/L was plotted on the transects. Table 7-21 summarizes the typical year minimum percentage attainment value in the transect plots for select alternatives without added aeration, and for comparison, the projected effectiveness of high level aeration alone, with no CSO volume reduction (baseline plus aeration). Although not shown, percent attainment in Newtown Creek and its tributaries when aeration is included with any of the alternatives is equal to or greater than that shown for baseline plus aeration.

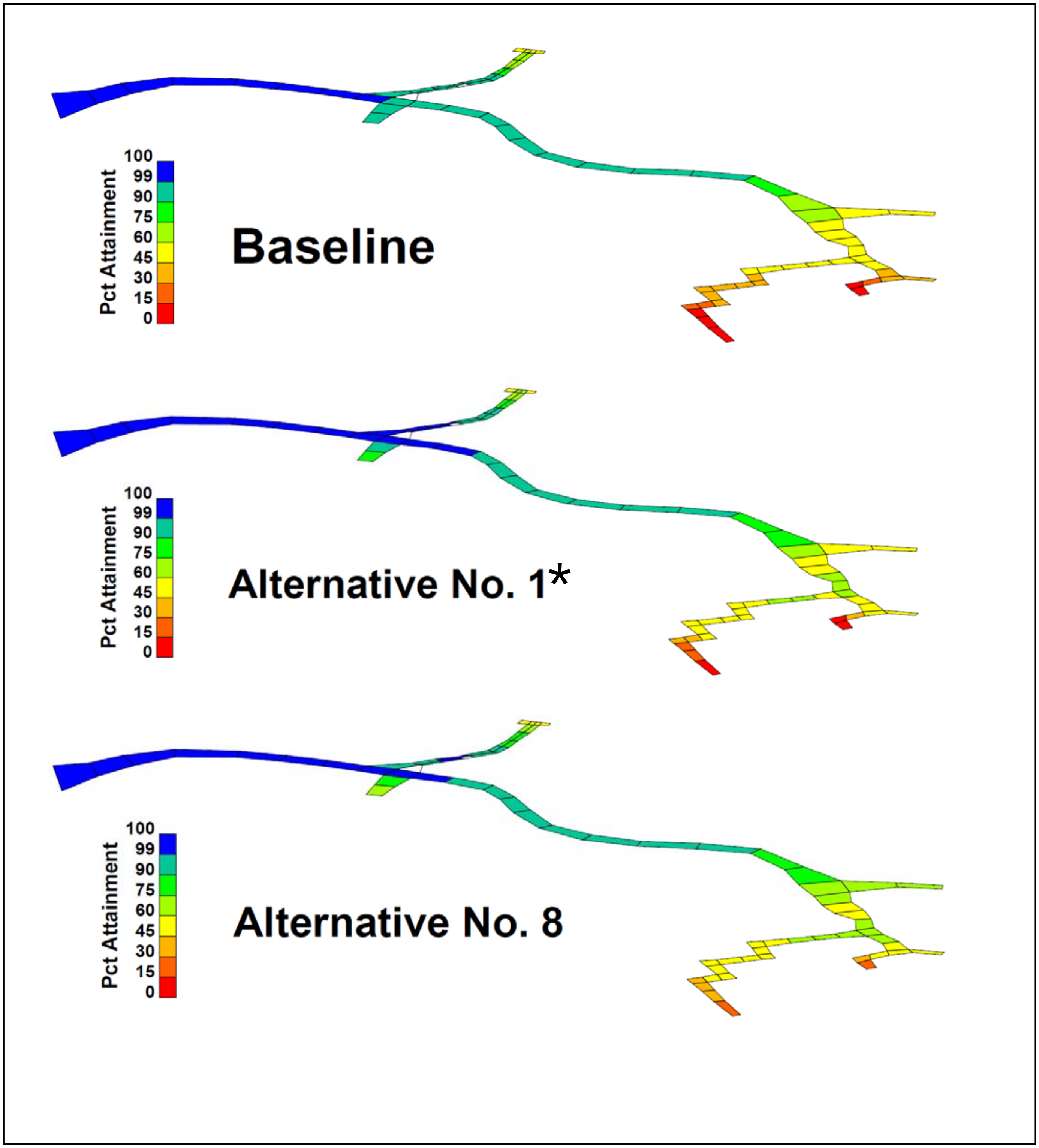
Table 7-21. Minimum Percent of Time That DO Concentrations Exceed 3.0 mg/L(1)

Waterbody	Alternative Plan No.							
	Baseline	**1(2)**	**6**	**7**	**8**	**9**	**100% Removal**	**Baseline + Aeration**
Dutch Kills	85.7%	87.7%	90.5%	90.2%	86.7%	87.9%	99.3%	98.5%
Newtown Creek Main Branch	79.4%	82.9%	81.8%	81.0%	84.2%	85.6%	86.9%	99.6%
Maspeth Creek	80.8%	84.0%	82.1%	82.8%	88.7%	90.2%	90.8%	98.9%
East Branch	55.8%	62.4%	62.9%	62.6%	74.1%	84.5%	86.3%	93%
English Kills	56.1%	66.5%	72.1%	69.9%	74.1%	84.5%	86.3%	90.3%

(1) Aeration is not included in any of the alternatives listed in the table except for Baseline + Aeration.

(2) CSO Facility Plan results include the planned low level of aeration.

To further illustrate the projected effectiveness of aeration, the complete transect plots for several of the alternatives during the summer, the most impaired season in terms of DO, are shown on Figure 7-32. This figure shows that without aeration projected dissolved oxygen levels are largely unaffected by reductions in CSO volume alone, and that aeration with little or no corresponding CSO reduction is projected to attain the 3.0 mg/L threshold a majority of the time.

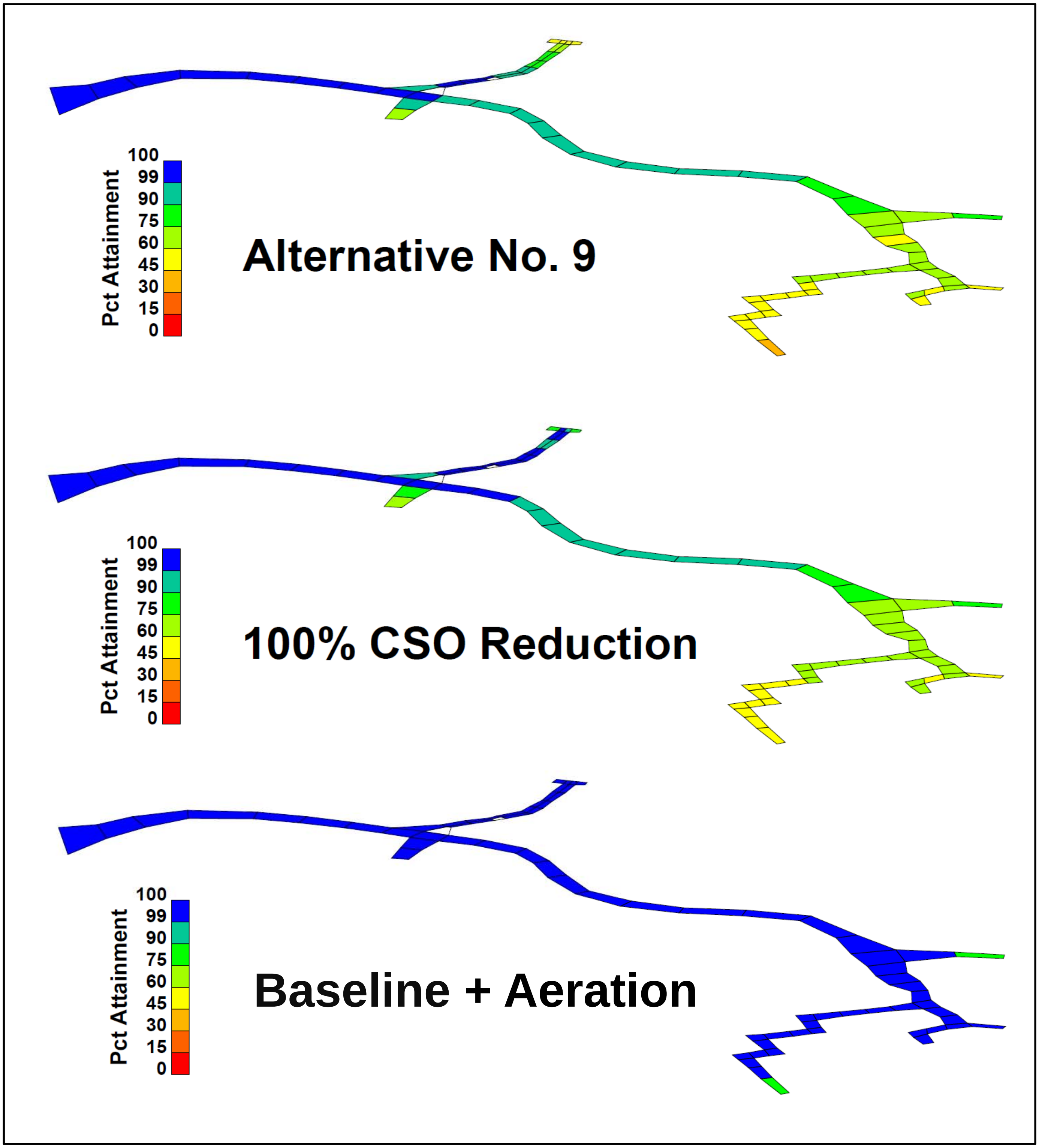


* Includes planned low-level aeration

High-level aeration is not included in any of the alternatives except for Baseline + Aeration

Environmental Protection

Dissolved Oxygen Transect Plots Summer Days Attaining 3.0 mg/L at Bottom



High-level aeration is not included in any of the alternatives except for Baseline + Aeration

Environmental Protection

Dissolved Oxygen Transect Plots
Summer Days Attaining 3.0 mg/L at Bottom

Odor Improvements

Each of the alternatives target odor reductions through CSO volume reductions. By reducing the volume of CSO discharges to Newtown Creek, the amount of organic carbon from CSOs settling in the waterbody is also reduced. These highly reactive organic solids are oxidized rapidly. In the absence of oxygen, carbon is assimilated by bacteria in the sediments using the oxygen bound up in sulfates in the water column, which ultimately results in H_2S gases being produced and released into the atmosphere. Reductions in the annual amount of combined sewage overflowing into Newtown Creek will reduce the carbon discharged into the waterbody and reduce the amount of odor produced from the sediments through the anaerobic decay of this carbon. These annual reductions in CSO discharge are shown in Table 7-19 above.

Floatables Improvements

As discussed in Section 5, the DEP has taken a number of steps to reduce floatables entering Newtown Creek through the implementation of the 14 SPDES required BMPs. The major floatables reductions associated with these programs come through the diversion of additional wet weather flow to the WWTPs for treatment, capture of floatables in catch basins with the installation of catch basin hoods, and the end-of-pipe collection of floatables in the Interim Floatables Containment Program (booms in English Kills, East Branch, and Maspeth Creek). Despite these efforts, floatables are still discharged to Newtown Creek from CSOs. And even though floatables are not as much of a concern in Newtown Creek as they are in some other waterbodies (since the Creek's major use is as a commercial waterway), these discharges may lead to visual impairment of the waterbody.

To address this potential issue, each of the alternatives noted above have elements designed to provide substantial reductions in floatables entering Newtown Creek. Many of the plans would convey additional flow to the WWTP for treatment, and would reduce floatables in proportion to the amount of additional flow treated at the WWTP. For example alternatives including storage, such as a tunnel, would increase flow to the WWTP by retaining CSO and later dewatering it to the WWTP for treatment when capacity is available (Alternatives 1 and 6 through 11, and the 100% Reduction Alternative). Other alternatives, such as those that include the CSO storage tank, or the floatable control facilities, include positive screening of floatables (Alternatives 1 through 5 and 7); therefore the flow discharging from the outfalls with these controls will have a substantial portion of the visible floatables removed before discharge. The annual reductions in floatables for each alternative are shown in Table 7-22 below.

Table 7-22. Floatables Reductions for Alternative Plans

Alternative #	% Floatables Reduction from Baseline
Baseline	-
1	27%
2	92%
3	92%
4	95%
5	92%
6	30%
7	31%
8	61%
9	83%
10	95%
11	99%
100% Reduction	100%

Coliform Improvements

Contact recreation of any level is not a protected use under Newtown Creek's SD classification and therefore no bacteria standards apply and there are no fecal or total coliform numerical criteria to guide selections for CSO control. However, the alternatives are projected to reduce the levels of total and fecal coliform. To illustrate this, transect plots showing annual attainment of Class I (the next higher usage) numerical standards for fecal and total coliform for the baseline condition as well as several alternatives, including 100% CSO removal, have been included as Figures 7-33 and 7-34. These figures show the percentage of months in the typical year that the numerical criteria are projected to be attained.

7.4.3. Cost Analysis

To analyze the alternatives with respect to cost, it is beneficial to look at the point where the incremental change in the cost of the control alternative per change in performance of the control alternative changes most rapidly. This is known as Knee-of-the-curve (KOTC) analysis. It is important to note that the cost utilized for high level aeration is based on three separate facilities sized to provide the air flow rate projected to fully attain the Class SD numerical standards under baseline conditions (approximately $115 million).

Figure 7-35 shows CSO volume and event reductions versus cost for each alternative. Both curves show a small knee around Alternative 5, the alternative including aeration, inflatable dams, and the St. Nicholas Weir relief sewer. However, Alternative 5 has several disadvantages.

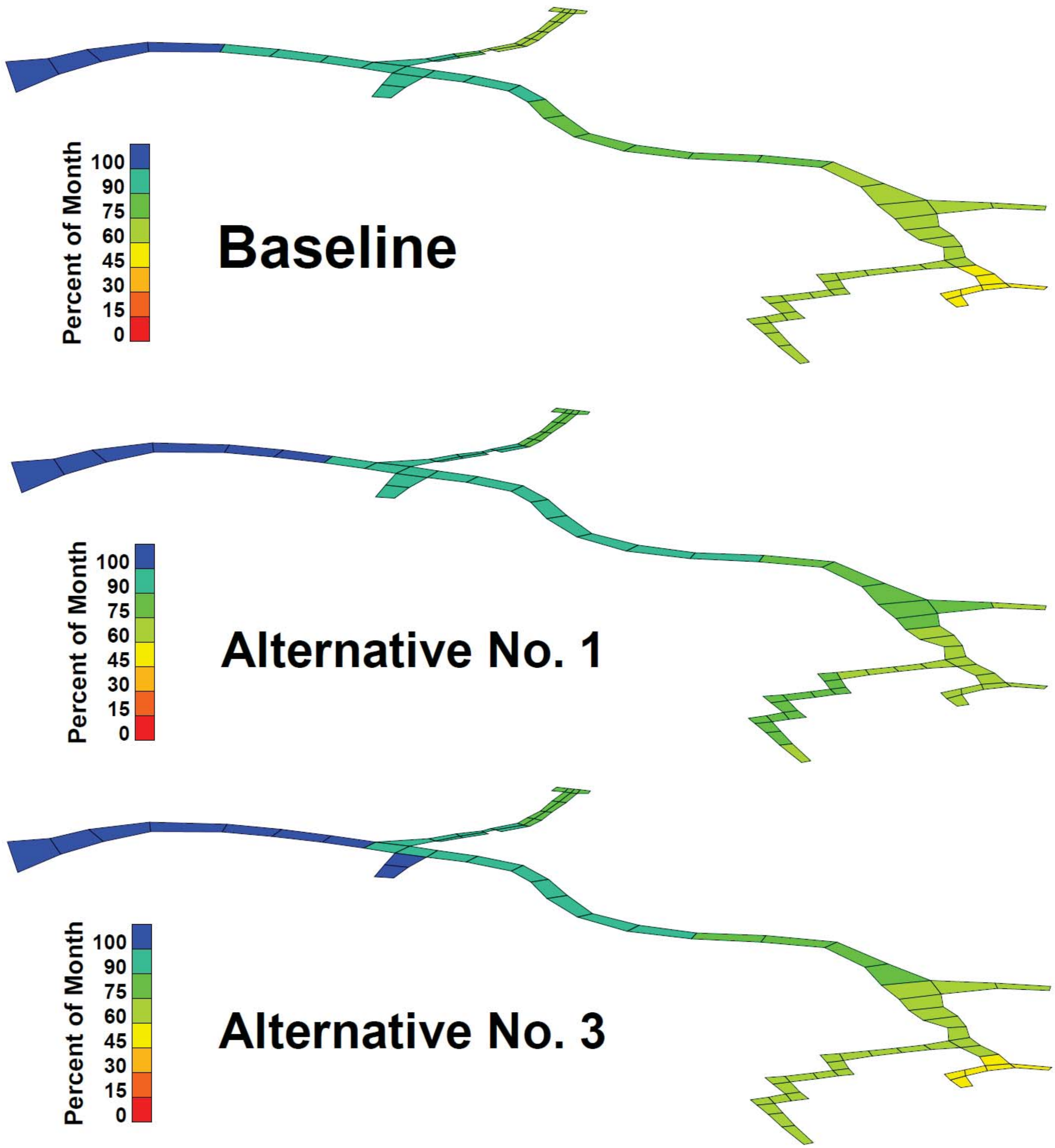
Certain purchase, installation, and operation and maintenance issues must be considered prior to selecting any plan that uses inflatable dams. At other locations in the City where inflatable dam systems were considered, acquiring a bidder was difficult. Competition in the market has diminished with one of the two manufacturers (Bridgestone) no longer producing the dam fabric, and the other (Sumitomo) curtailing direct service in the United States market. A third company, Dyrhoff, has purchased the rights to furnish Sumitomo dam systems in the United States, and has located a fabric supplier in China that can supply fabric similar to Bridgestone's, but they cannot use the Bridgestone clamping arrangement and there has not been a satisfactory demonstration of a hybrid system in New York City. There is thus only one potential distributor with one tested system, creating a problem purchasing the system and ensuring a reliable supply of replacement parts. Furthermore, inflatable dams would cause periodic stagnant water in the outfall sewer for NBC-015 that would lead to sediment accumulation over time. Confined space entry with a front end loader would be required to remove this sediment.

The next closest alternative in terms of CSO reduction is Alternative 4 which achieves a CSO reduction similar to Alternative 5, albeit at a somewhat higher cost. Bending weirs and a relief sewer would be much easier to maintain than the inflatable dam system. However, the Dutch Kills Relief Sewer would present considerable constructability challenges. Additionally the relief sewer only results in 4 percent reduction in annual CSO volume beyond what is achieved by bending weirs alone (Alternative 3) at an added cost of nearly $95 million.

Reviewing alternatives with CSO reductions equal to or greater than the CSO Facility Plan, the volume curve shows steadily increasing benefit with increasing cost and no knee, while the events curve shows that a significant cost must be incurred before the number of events can be reduced significantly from the CSO Plan level. While providing a good graphic representation of the challenges associated with CSO control in Newtown Creek, these curves generally do not assist in identifying a preferred alternative to the CSO Facility Plan.

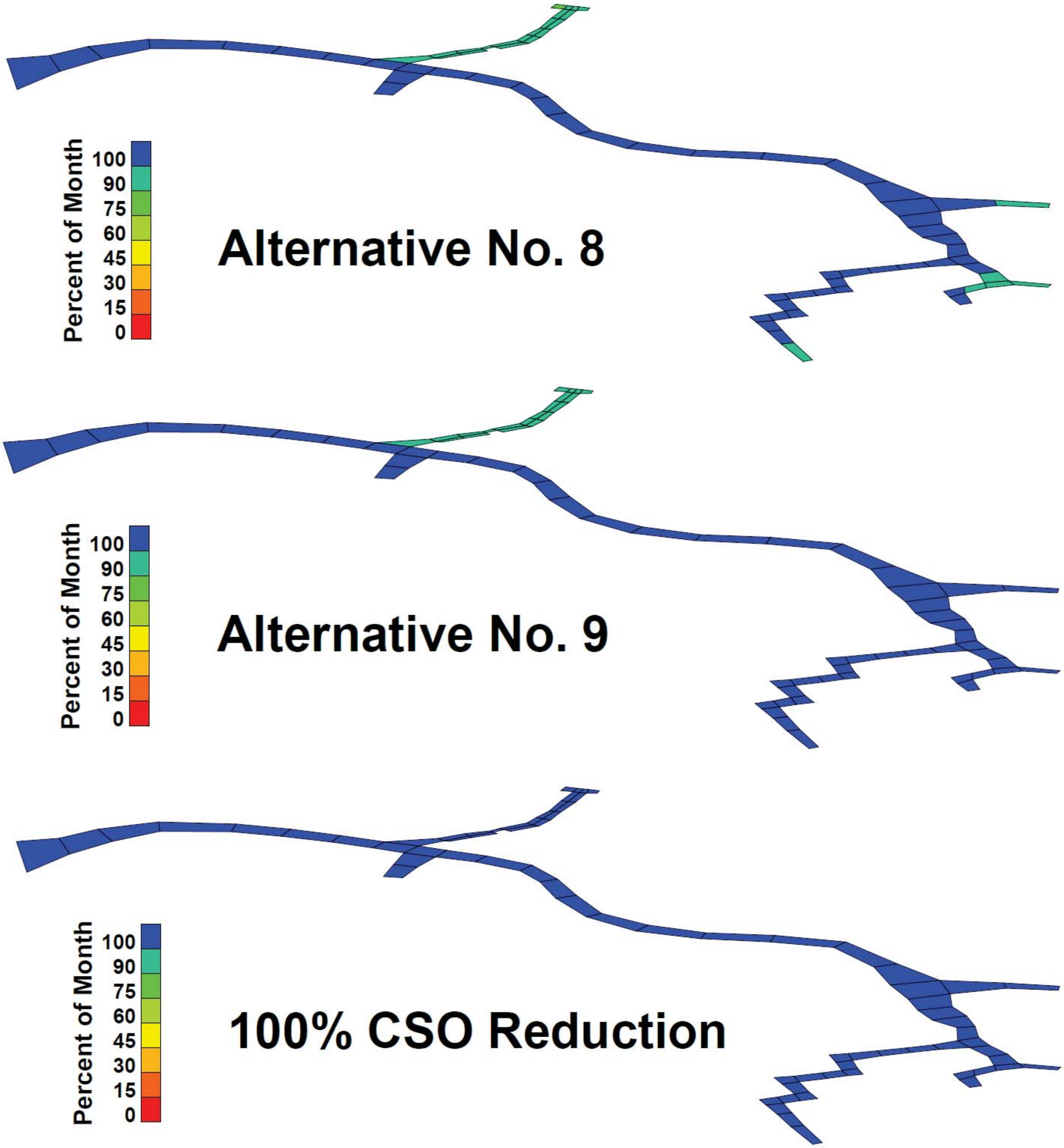
The next consideration is water quality. Figure 7-36 presents water quality cost-benefit curves that depict projected Class SD dissolved oxygen attainment versus cost for each evaluated alternative with and without aeration. Here, water quality benefit is determined as the minimum percentage of hours during the year that any location in the waterbody is projected to attain the applicable DEC Class SD dissolved oxygen criterion (which is equivalent to the IEC Class B-2 criterion as noted in Section 1). Without aeration, there is no pronounced knee, but each alternative is shown to provide equal or better water quality than the CSO Facility Plan, which includes the planned low level of aeration.

With aeration, the curve shows that the CSO Facility Plan with the planned level of aeration does not fully attain the Class SD numerical criteria and does not even fall on the curve. However, the curve shows that the water quality model projects nearly 100% attainment with a higher level of aeration and no corresponding CSO reduction (Alternative 2). This reflects that the level of aeration required to meet the existing SD standard under baseline hydraulic conditions has been projected to be as much as six times higher than the CSO Facility Plan level, and the model shows that aeration would need to be applied to a much larger area of the waterbody than has been planned. Based on these Figure 7-36, the waterbody can attain the existing Class SD numerical standard through aeration, with or without additional CSO reduction.



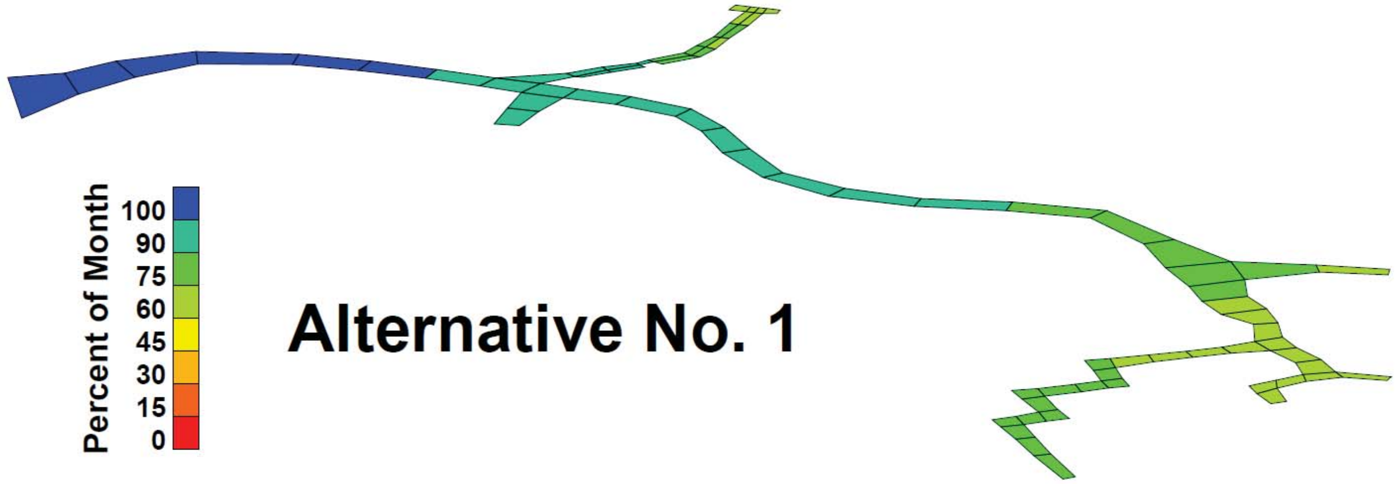
NYC Environmental Protection

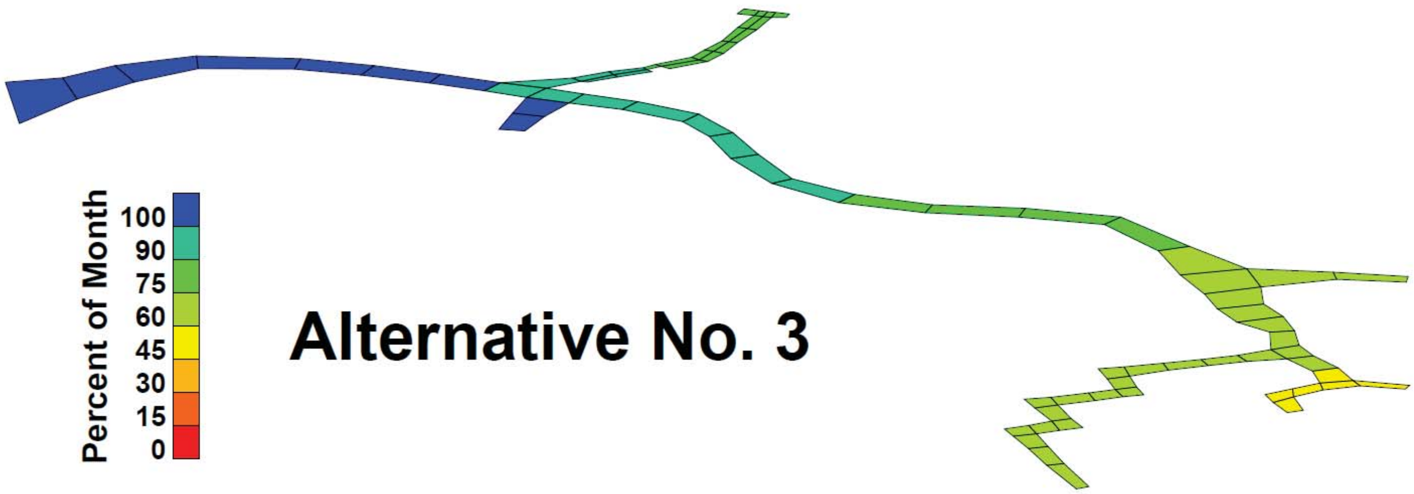
Fecal Coliform Transect Plots
Annual Attainment of Class I Fecal Coliform Standard
Geometric Mean ≤ 2,000 Cts./100 mL



Environmental Protection

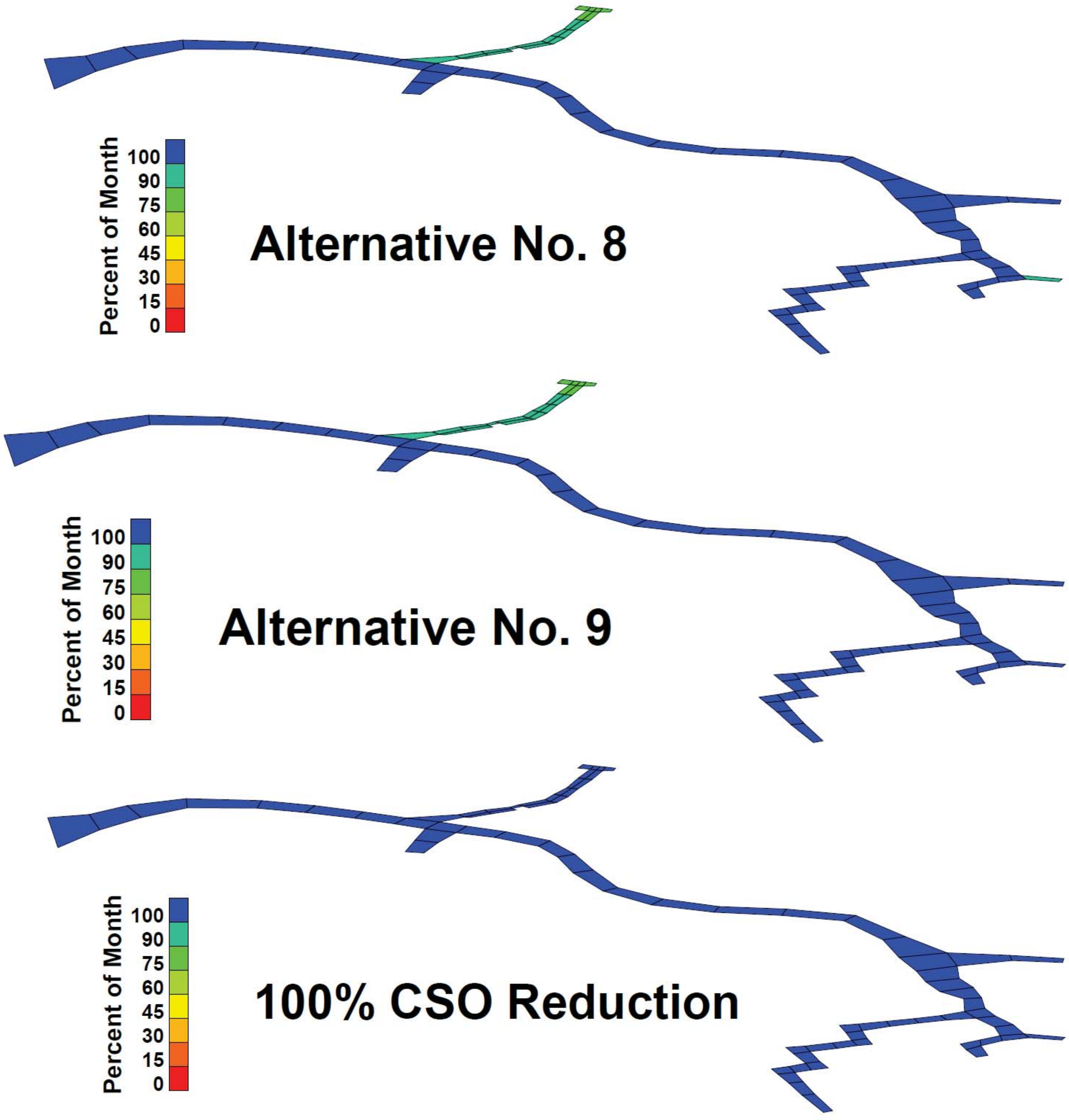
Fecal Coliform Transect Plots
Annual Attainment of Class I Fecal Coliform Standard
Geometric Mean ≤ 2,000 Cts./100 mL





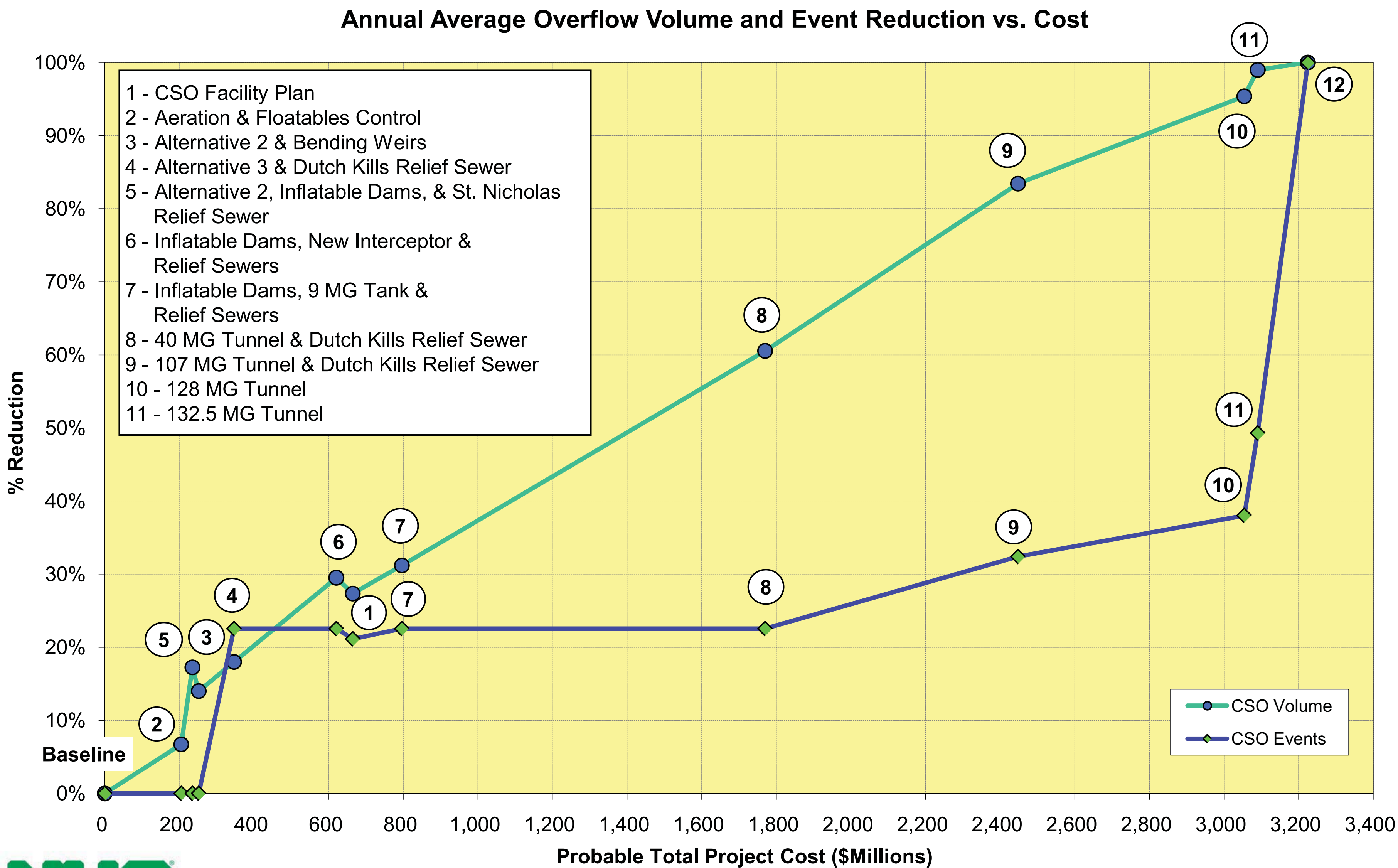
NYC Environmental Protection

Total Coliform Transect Plots
Annual Attainment of Class I Total Coliform Standard
Geometric Mean ≤ 10,000 Cts./100 mL



NYC Environmental Protection

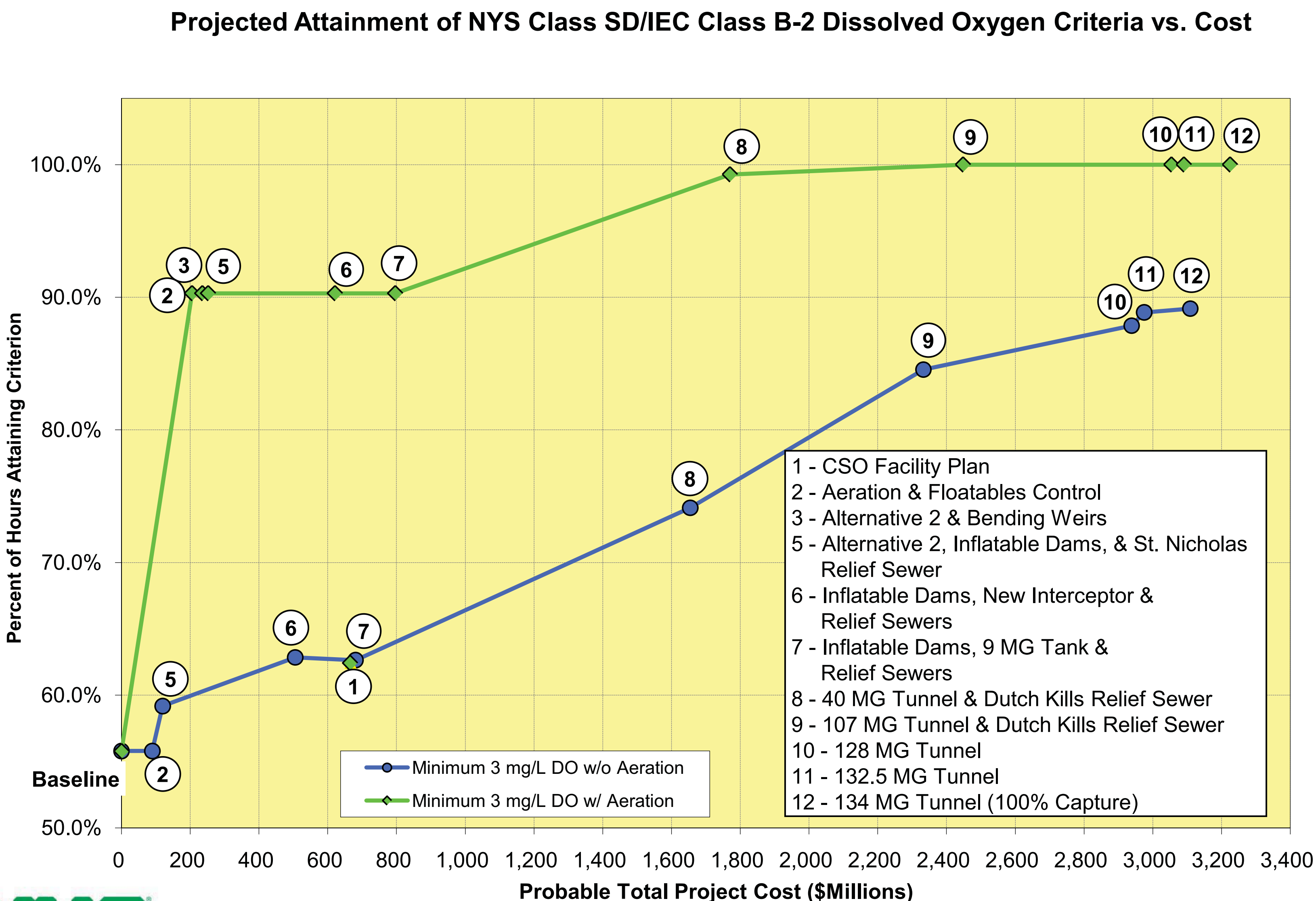
Total Coliform Transect Plots
Annual Attainment of Class I Total Coliform Standard
Geometric Mean ≤ 10,000 Cts./100 mL



Environmental Protection

Knee of the Curve Analysis
CSO Volume and Event Reductions vs. Cost

Figure 7-35



NYC Environmental Protection

Knee of the Curve Analysis
Dissolved Oxygen Criteria Attainment vs. Cost

As discussed previously in this section, the CSO Facility Plan has been thoroughly reviewed using the latest landside hydraulic and water quality models. In addition, collection systems tributary to Newtown Creek have been analyzed for other opportunities to reduce combined sewer overflows and to improve the water quality within Newtown Creek. These analyses indicate that several elements of the CSO Facility Plan are not practical, such as a 400 foot long weir at Regulator B1.As such, alternatives were devised from the available technologies that remained after considerable screening, to modify or replace some or all of the CSO Facility Plan elements.

A thorough analysis of these alternatives has shown that Alternative 2, which includes high level aeration and floatables control at the four outfalls with the largest baseline annual overflow volume would provide the greatest projected attainment of existing water quality standards on a per dollar basis. However, Alternative 2 does not provide significant CSO volume or event reductions. When looking at alternatives that provide cost-effective and highly implementable reductions, and taking into account waterbody use goals, including secondary contact recreation, Alternative 3, which includes high level aeration, floatables control at the four outfalls with the largest baseline annual overflow volume, and bending weirs and regulator modifications at B1 and Q1 provides cost-effective and highly implementable CSO controls. During the LTCP phase alternatives like the Dutch Kills Relief Sewer and HLSS will be reevaluated to provide additional CSO reductions. The proposed Newtown Creek WB/WS Facility Plan includes the following elements:

- Floatables control for the four outfalls with the largest typical year overflow volumes.
- Enhanced aeration to attain the existing Class SD numerical standard.
- Bending Weirs at Regulators B1 and Q1 to reduce CSO discharges
- Continued operation of the Brooklyn Pumping Station at up to 400 MGD during wet weather.

This plan has been selected to attain existing water quality standards, as well as to target higher waterbody use goals, and to provide a greater benefit to the waterbody in terms of CSO reduction and water quality than the CSO Facility Plan. Other more costly alternatives offer little or no water quality improvement beyond that projected for this WB/WS Facility Plan.

To further illustrate how this plan compares to other benchmark levels of CSO control, a comparison of projected attainment of dissolved oxygen criteria is presented in Table 7-23 for the Baseline, CSO Facility Plan, WB/WS Plan, and 100% CSO Reduction alternatives. This table shows the minimum and average values by water quality model transect.

Table 7-23. Attainment[1] of DEC Class SD and IEC Class B-2 Dissolved Oxygen Criteria by Select Alternatives

Dissolved Oxygen Criterion[2]	Baseline	CSO Facility Plan	100% CSO Abatement	WB/WS Plan
Minimum Attainment of Never-less-than 3 mg/L	55.8%	62.4%	86.3%	90.3%
Average Attainment of Never-less-than 3 mg/L	86.4%	89.2%	93.9%	98.2%

(1) Percent of hours that minimum dissolved oxygen criterion is attained for entire length of Creek.
(2) Annual compliance projected for design (typical) precipitation year

In summary, the analysis provided in this section demonstrates that the WB/WS Facility Plan represents the most cost-effective alternative for attainment of the Class SD narrative and numerical standards and will provide for considerable reductions in CSO volume and frequencies. Additionally, higher levels of control are not projected to significantly improve water quality.

Because this phased approach is projected to cost-effectively attain the applicable NYS water quality standards and use criteria most of the time, and targets the next highest use class consistent with stakeholder goals it is herein selected as the “Waterbody/Watershed Facility Plan”.

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8.0 Waterbody/Watershed Facility Plan

The efforts of the DEP to develop an approach to achieve the goals of the CWA have culminated herein with the development of a Waterbody/Watershed Facility Plan that recognizes that achieving water quality objectives may require more than the simple reduction in CSO discharges. The multi-faceted approach incorporates several cost-effective engineering solutions with demonstrable positive impacts on water quality, including increased DO concentrations, decreased coliform concentrations, and reductions in the deleterious aesthetic consequences of CSO discharges such as nuisance odors and floatables. The recommended approach also maximizes utilization of the existing collection system infrastructure and treatment of combined sewage at the Bowery Bay and Newtown Creek WWTPs.

The subsections that follow present the recommended CSO control components required to ensure the full implementation of the Newtown Creek 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 Newtown Creek.

If post-construction monitoring indicates that additional controls are required, protocols established by DEP and the City of New York for capital expenditures require that certain evaluations are completed prior to the construction of the additional CSO controls. 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 this WB/WS Facility Plan.

8.1 PLAN OVERVIEW

The recommended Newtown Creek Waterbody/Watershed Facility Plan proposes elements intended to attain existing Class SD narrative and dissolved oxygen water quality standards. This plan is in addition to the ongoing modernization the Bowery Bay WWTP headworks and the upgrade to full secondary treatment at the Newtown Creek WWTP (which will provide for treatment at the Newtown Creek WWTP beyond the 2XDDWF normally seen at other WWTPs). Costs for the plant upgrades are not included in this WB/WS facility plan as they are accounted for in the Open Water/East River WB/WS Facility Plan.

The recommended Newtown Creek Waterbody/Watershed Plan consists of the following elements:

- Continued operation the Brooklyn Pumping Station at up to 400 MGD during wet weather.
- Construction of bending weirs at B1 and Q1.
- Floatables Control at or around the four largest annual average volume CSOs in Dutch Kills, Maspeth Creek, East Branch, and English Kills.
- Construction of Enhanced Zone II Aeration.
- Continued Implementation of Programmatic Controls.

Locations of the selected elements for the Waterbody/Watershed Facility Plan are shown on Figure 8-1 .

The probable total project cost of the selected WB/WS Plan is $231.3 million. Probable total project costs are defined in Section 11 as being adjusted to June 2011 dollars, and were used in the cost/benefit analyses described in Section 7 to determine the most cost effective Waterbody/Watershed Facility Plan. This section further describes these elements, including their implementation and schedule.

This planning-level cost estimate is in addition to the DEP's current projected costs of $3,778 million to complete the upgrade of the Newtown Creek WWTP to full secondary treatment, which includes the cost of the Brooklyn and Manhattan P.S upgrades, and the $8 million for construction of the full-scale Zone I pilot aeration facility.

8.2 WATERBODY/WATERSHED FACILITY PLAN COMPONENTS

8.2.1 Brooklyn Pumping Station Operational Control

Combined sewer overflows and their associated water quality impacts within the Newtown Creek waterbody will be minimized by maximizing the proportion of flow to the Newtown Creek WWTP from the Brooklyn and Queens collection systems. Under this protocol, the Brooklyn pump station would pump up to 400 MGD of flow during wet weather to the plant for treatment. This protocol is consistent with the April 2010 Newtown Creek WWTP Wet Weather Operating Plan (WWOP) included as Appendix B. The WWOP indicates that the Brooklyn pumps should pump to a maximum capacity of 400 MGD during a wet weather event always leaving one pump out of service as a standby and that the Manhattan pumps provide a minimum of 300 MGD during wet weather always leaving two pumps out of service as standby pumps. The cost of this plan component is not included, as the upgrades to the Brooklyn and Manhattan pumping stations do not increase total rated pumping capacity to the Newtown Creek WWTP.

8.2.2 Bending Weirs

As discussed in Section 7.3.4, two locations for bending weirs were identified to provide considerable CSO reductions. These two locations, Regulator B1 (which overflows to outfall NCB-015) and Regulator Q1 (which overflows to outfall NCQ-077), discharge the second and third largest CSO volumes under Baseline conditions. Bending weirs at these locations also can readily divert wet weather flow into the Morgan Avenue Interceptor and then to the WWTP for treatment. Each regulator will be retrofitted with bending weirs, installed on top of static weirs, and modifications made to the regulator orifices to convey additional flow to the WWTP. The orifices, which control flow into the interceptor, will be enlarged at each regulator so as to further increase flow to the interceptors. Implementation of bending weir systems will require modifications to the sewer system and diversion chambers at each regulator. The estimated cost of the bending weirs and regulator modifications is $26.2 million in June 2011 dollars.

A 3 foot tall 140 foot long fixed weir equipped with a two foot tall bending weir is proposed for Regulator B-1. The weir system will be constructed in the 16' x 10' double barrel combined sewer upstream of the diversion chamber as shown in Figure 7-16. Relocation of the DWF diversion channel and sewer is required. At the head of the relocated diversion sewer, an 8' x 8' foot opening will be constructed in the double barrel invert to collect DWF. The DWF diversion sewer will be constructed under the existing combined sewer and will discharge to existing manhole “A”. An additional diversion barrel downstream of the weir was included at this time so as to pass peak flows without raising the design HGL. The orifices at Regulator B-1 will be expanded from the existing 8-ft by 3-ft to 10-ft by 3-ft.

Regulator Q1 receives flow from four large sewers: a 7’-6” x 5’-6” sewer from the west, a 8’-0” x 7’-0” double barrel sewer from the north and a 7’-6” x 7’-0” sewer from the east. All sewers converge at the Regulator. The confluence of the flows will yield extremely turbulent conditions during wet weather which will jeopardize the function of bending weirs. Reconstruction of sewers so as to combined all flows upstream of Regulator Q1 is proposed. Flow will enter the bending weir facility from one direction which will improve the performance and reliability of the bending weir mechanism. At Regulator Q1, the bending weir will be 2 feet tall and the orifice would be expanded from the existing 2-ft square opening to a 3.5-ft square opening.

8.2.3 Floatables Control

Only minor CSO volume reduction is expected during the Waterbody/Watershed Facility Plan implementation, which focuses on attaining the existing Class SD narrative and numerical water quality standards. Therefore, the DEP will construct floatables control facilities to address floatables at or near the four CSOs with the largest baseline annual overflow volumes (BB-026, NCQ-077, NCB-083, and NCB-015). The feasibility of siting and maintaining such facilities on or around these outfalls will be determined during detailed facility planning performed under the design contract. The estimated capital cost of installing facilities to control floatables from the four outfalls with largest baseline annual overflow volume is $89.8 million in June 2011 dollars.

8.2.4 Enhanced Zone II Aeration

As discussed in Section 7.3.3, the CSO Facility Plan proposed two zones of aeration, sized to increase the minimum dissolved oxygen level in Newtown Creek to 1 mg/L. Construction of Zone I in upper English Kills was completed by the Consent Order milestone of December 2008. Zone II aeration, which is included in the Consent Order with a completion milestone of June 2014, was to include aeration of lower English Kills, East Branch and Dutch Kills. However, the Waterbody/Watershed Facility Plan calls for enhancing Zone II to provide enough oxygen to the water column to attain the existing Class SD numerical DO standard throughout the Creek. The DEP has identified constructed Zone I aeration site as a pilot facility to evaluate the effectiveness of aeration. Through this effort the DEP has developed site specific information about transfer efficiency and other related factors that influence the final aeration of the waterbody. Based on the results of the pilot study and follow-up water quality modeling, modeling projections show that 19,000 scfm of air would be required to bring the waterbody into compliance with Class SD numerical DO criteria under baseline conditions. Modeling also projects that to be successful the system would need to be deployed throughout a majority of the waterbody, including the shipping channels. Such an enhanced aeration system will require multiple blower buildings and a vast network of aeration piping. Information from the pilot study will be used during detailed facility planning and design of Enhanced Zone II Aeration to determine the number of blower facilities, system sizing requirements, and any necessary upgrades to the Zone I facility currently being constructed. Aeration will first be implemented in Lower English Kills, followed by East Branch and portions of Newtown Creek. The final aeration project under the Enhanced Zone II Aeration program will be installed in Dutch Kills and additional portions of Newtown Creek. The estimated cost of Enhanced Zone II Aeration is $115.3 million in June 2011 dollars.

8.2.5 Continued Implementation of Programmatic Controls

As discussed in detail in Section 5.0, DEP currently operates several programs designed to reduce CSO to a minimum and provide treatment levels appropriate to protect waterbody uses. As the effects of the Waterbody/Watershed Facility Plan and subsequent LTCP 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 will continue. 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. A detailed discussion of the existing BMP program is included in Section 5.3.
- The Citywide Comprehensive CSO Floatable Plan (HydroQual, 2005a) will provide substantial reductions in floatables discharges from CSOs throughout the City and will provide for compliance with appropriate DEC and IEC requirements. Like the Waterbody/Watershed Facility Plan, the Floatables Plan is a living program that is expected to change over time based on continual assessment and changes in related programs. This program is discussed in further detail in Section 8.3.2 below.

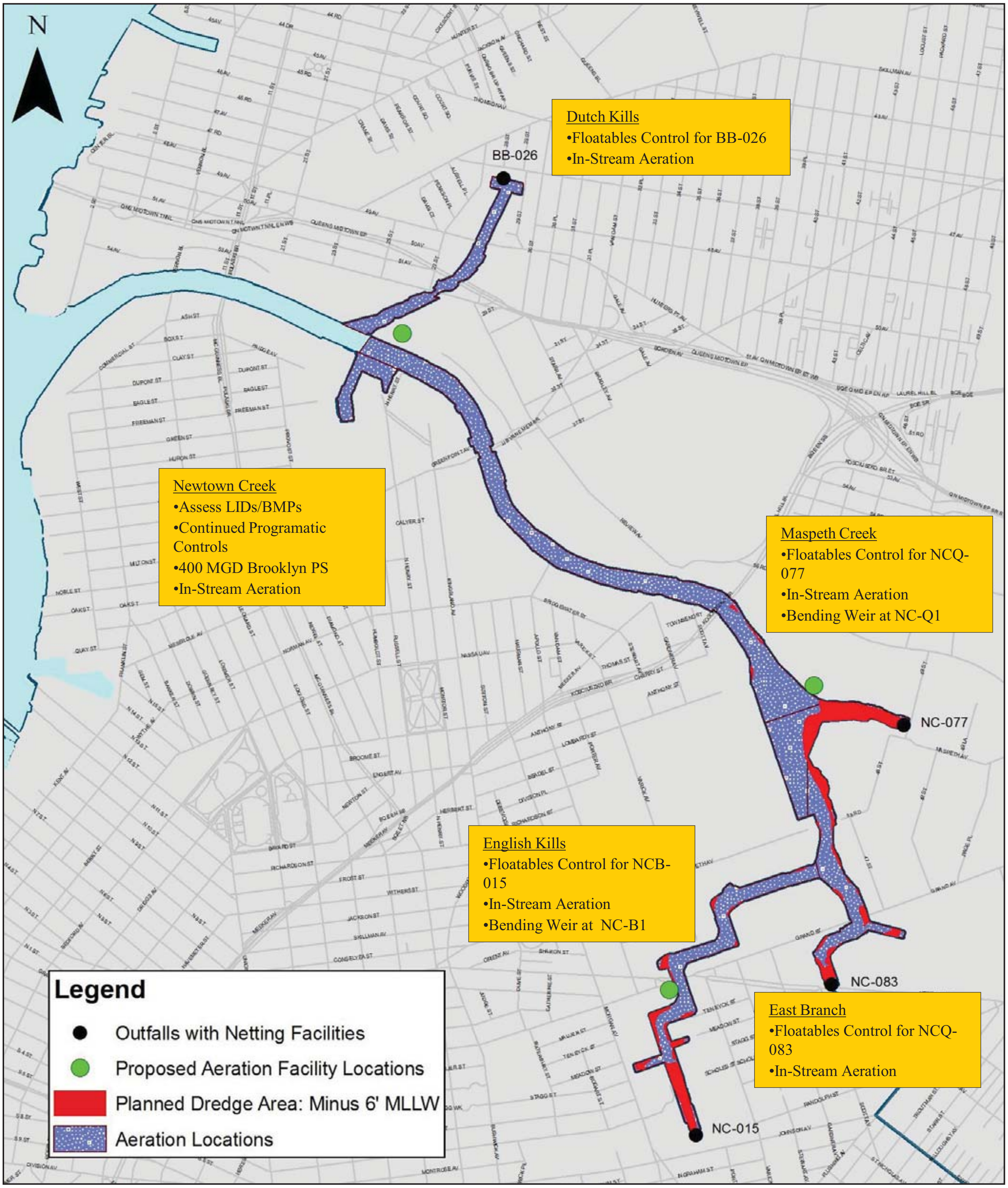
8.2.6 Construction Costs

Costs for the recommended plan are summarized in Table 8-1. Costs are presented as estimated PTPCs adjusted to June 2011 dollars and do not account for escalation over the time period shown in the schedule.

Table 8-1. Recommended Plan PTPC

Elements of the Recommended Plan	PTPC [1] (Million)
Floatables Control at NCB-015, NCB-083, NCQ-077, & BBL-026	$89.8
High Level Aeration System	$115.3
Bending Weirs and Modifications at Regulators B1 and Q1	$26.2
Total	$231.3

(1) Probable Total Project Cost: Includes Hard and Soft Construction Costs - baselined to June 2011



NYC Environmental Protection

Newtown Creek Waterbody/Watershed Facility Plan

8.3 POST-CONSTRUCTION COMPLIANCE MONITORING

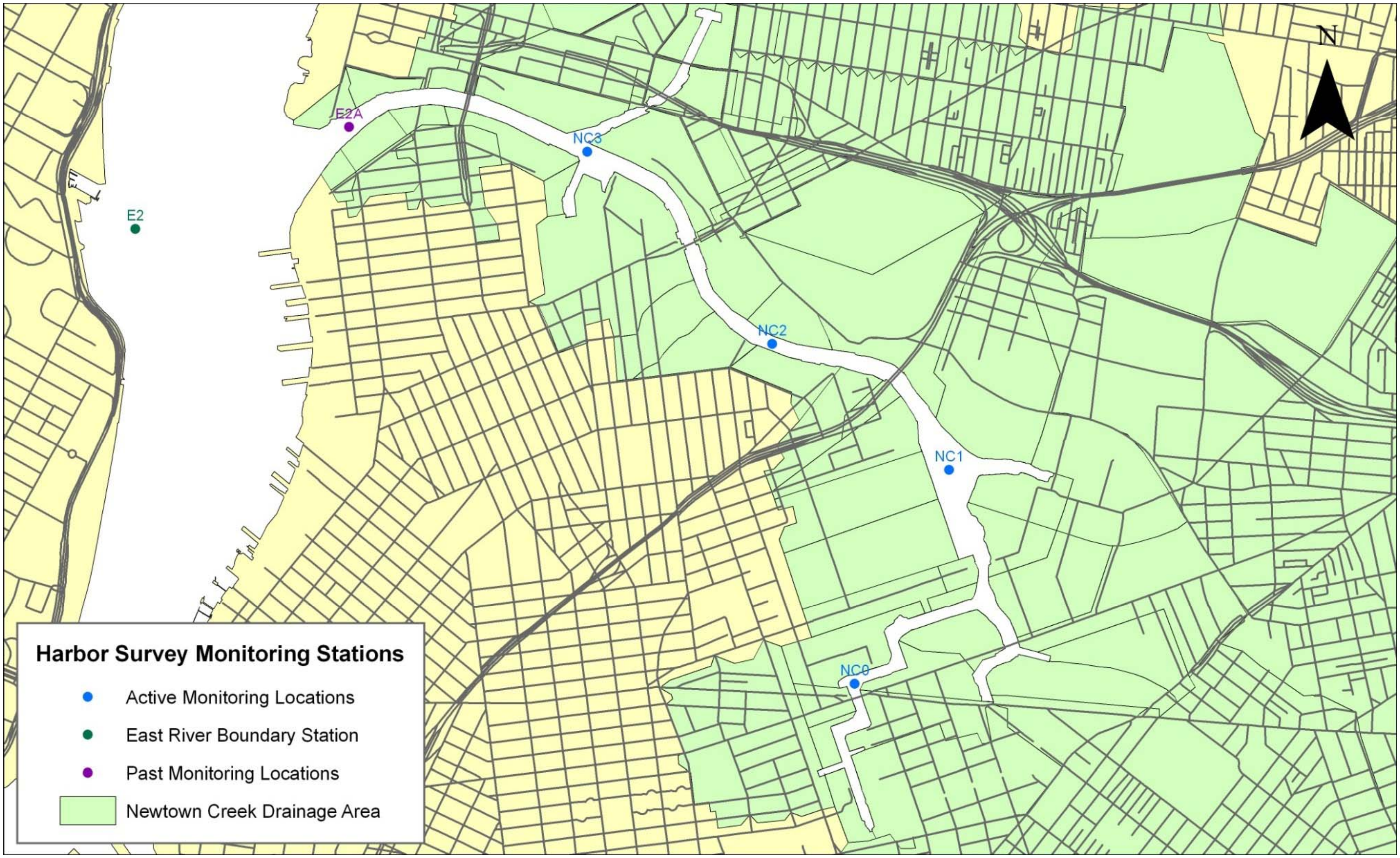
Post-construction compliance monitoring will commence just prior to implementation of CSO controls and will continue for several years in order to quantify the difference between the expected performance (as described in this report) and the actual performance once those controls are fully implemented. 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. The data collection monitoring will contain three basic components:

1. Monitoring and reporting requirements contained in the Bowery Bay WWTP and Newtown Creek WWTP SPDES permits.
2. DEP Harbor Survey program data collection in Newtown Creek; and
3. Modeling of the associated receiving waters to characterize water quality.

8.3.1 Receiving Water Monitoring

The New York City Harbor Survey primarily measures four parameters related to water quality: DO, 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 vertical profiling of conductivity, temperature, and DO parameters are analyzed from samples collected at a depth of three feet below the water surface to reduce influences external to the water column chemistry itself, such as wind and precipitation influences near the surface. DEP samples 33 open water stations routinely, which are 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, including laboratory protocols listed in Table 8-2. As shown in Figure 8-2, Newtown Creek contains four stations that will be monitored regularly. These four stations will serve as the Newtown Creek post-construction monitoring sites. All stations related to the Newtown Creek Post-Construction Compliance Monitoring Program will be sampled a minimum of twice per month from May through September and a minimum of once per month during the remainder of the year.



Environmental Protection

Harbor Survey Monitoring Locations
In and Around Newtown Creek

Table 8-2. Current Harbor Survey Laboratory Protocols

Parameter	Method
Ammonia (as N)	EPA 350.1
Chlorophyll ‘a’	EPA 445.0, modified for the Welschmeyer Method
Dissolved Oxygen	SM 4500-O C, Azide Modification (Winkler Method)
Dissolved Silica	SM 18-19 4500-Si D or USGS I-2700-85
Enterococcus	EPA Method 1600, Membrane Filter
Fecal Coliform	SM 18-20 9222D, Membrane Filter
Nitrate (as N)	EPA 353.2 or SM 18-20 4500-NO3 F
Orthophosphate (as P)	EPA 365.1
pH	SM 4500-H B, Electrometric Method
Total Kjeldahl Nitrogen	EPA 351.2
Total Phosphorus	EPA 365.4
Total Suspended Solids	SM 18-20 2540D
Notes: SM – Standard Methods for the Examination of Water and Wastewater; EPA – EPA’s Sampling and Analysis Methods. Field instrumentation also includes an SBE 911 Sealogger CTD which collects salinity, temperature, and conductivity, among other parameters.	

Data collected during this program will be used primarily to verify the East River Tributaries Model (ERTM) that will be used to demonstrate relative compliance levels in Newtown Creek. 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 numeric WQS (i.e., 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 Citywide LTCP to assure adequate spatial coverage and a technically sound sampling program. The monitoring within each waterbody under DEP’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 DEC approval of the WB/WS Facility Plan.

8.3.2 Floatables Monitoring Program

The Newtown Creek Waterbody/Watershed Facility Plan incorporates by reference the Citywide Comprehensive CSO Floatables Plan Modified Facility Planning Report (DEP, 2005b) 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 is conducted in conjunction with post-construction compliance monitoring with regard to staffing, timing, and location of monitoring sites. The program includes 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 Newtown Creek WB/WS Facility Plan if monitored floatables trends indicate impairment of waters relative to their intended uses. Currently, the results of this ongoing monitoring program are reported in the annual BMP report. Meteorological Conditions

The performance of any CSO control facility 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 facility may be expected to control CSO completely. DEP 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 in Table 8-3, and includes the return period for 1988 conditions.

Table 8-3. 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

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 beach season 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.

Given the uncertainty of the actual performance of the proposed upgrades and the response of Newtown Creek 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 final City-Wide Post-Construction Monitoring Program. On an interim basis, however, the primary source of rainfall data will be from La Guardia Airport and from any DEP gauges that may be available. The use of NEXRAD cloud reflectivity data as proposed in the Waterbody/Watershed Facility Plan will be limited to testing implementation techniques until its utility is fully understood. Any data sets determined to be of limited value in the analysis of compliance may be discontinued.

8.3.3 Analysis

The performance of the Newtown Creek WB/WS Facility Plan will be evaluated on an annual basis using a landside mathematical computer model, as approved by DEC. 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. In addition, DEP 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 DO to be promulgated by DEC 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 of 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.

The InfoWorks collection system model of the Bowery Bay and Newtown Creek WWTP service area was developed under the LTCP project based in part on historical models used in facility planning. InfoWorks is a state-of-the-art modeling package that includes the ability to represent storage tunnel dynamics, hydraulic analyses and other sophisticated aspects of performance within the collection system. Overflow volumes will be quantitatively analyzed on a monthly basis to isolate any periods of 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 quality field data. 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 the Harbor Survey Monitoring Station E2 (see Figure 8-2). 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 attainment level for applicable numerical criteria based on the receiving water model. 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 overload/shutdown, pump repair, etc.) were adequately documented;
- Evaluate specific periods of deviations from modeled performance;

- 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 Newtown Creek Waterbody/Watershed Facility Plan to achieve the desired water quality goals will take place, with appropriate weight given to the various issues New York City identified during the evaluations documented in the annual reports. If it is determined that the desired results are not achieved for dissolved oxygen, DEP will implement additional measures to improve levels of attainment for dissolved oxygen numerical criterion under typical precipitation conditions. Alternatively, the water quality standards revision process may commence with a UAA that would likely rely in part on the findings of the post-construction compliance monitoring program. 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 DEC SPDES permit and CSO Consent Order administrators.

8.3.4 Reporting

Post-construction compliance monitoring will be added to the annual BMP report submitted by DEP in accordance with their SPDES permits. The monitoring report will provide summary statistics on rainfall, the amount of combined sewage, and the proportions directed to the Newtown Creek WWTP and bypassed to the associated CSO outfalls. Verification and refinement of the model framework as necessary will be documented, and modeling results will be presented to assess water quality impacts in lieu of high-resolution sampling. Analyses of precipitation, temperature effects, and other conditions external to the CSO Facility performance will also be included in the Annual BMP Report.

In addition to the information to be provided in the Annual BMP Report, DEP will submit a summary of the monitoring and modeling, including the data, once every five years. DEC has acknowledged that the variability in precipitation dynamics may require more than five successive years of data to statistically validate the models used for evaluating compliance, but have nonetheless stated that this information will be used to identify areas of significant water quality non-compliance and gaps in the water quality modeling, and measure progress with the LTCP goals. They have also stated that they intend to verify the 1988 rainfall data as the "average" year.

8.4 OPERATIONAL PLAN

USEPA guidance specifies that municipalities should be required to develop and document programs for operating and maintaining the components of their combined sewer systems (EPA, 1995a). Prior to new facilities being placed into service, the municipality's operation and maintenance program should be modified to incorporate the facilities and operating strategies associated with selected controls. To this end, DEP has developed and submitted wet weather operating plans (WWOPs) for both the Newtown Creek and Bowery Bay WWTPs. These WWOPs will be appended to the drainage basin specific Long Term Control Plan (LTCP) for Newtown Creek when it is developed.

Because this Waterbody/Watershed Facility Plan requires review and approval by DEC, the operational plan for the remaining components will be developed subsequent to that approval and after all components are designed.

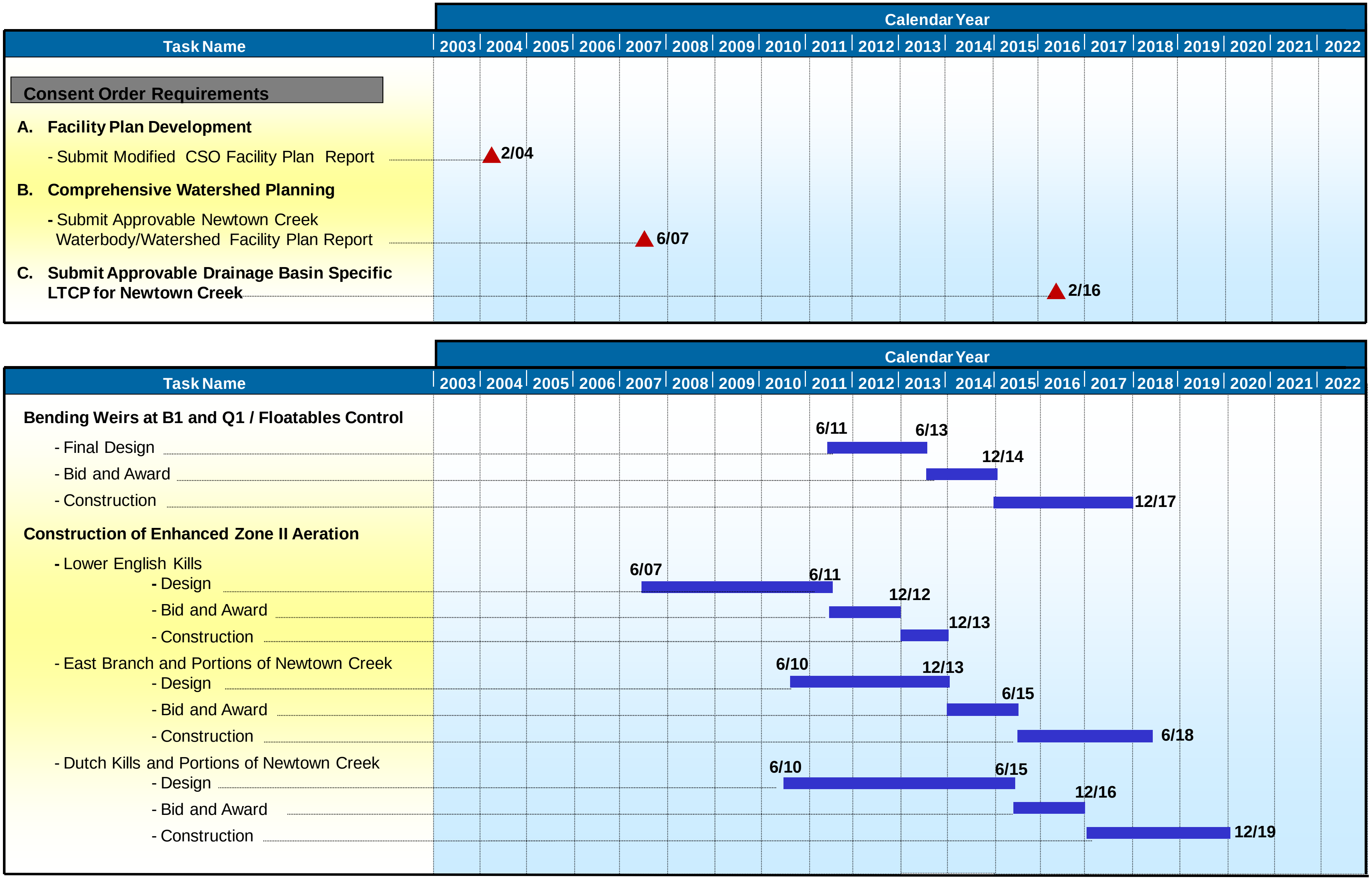
Upon implementation of the Waterbody/Watershed Plan elements, DEP intends to operate the facilities as designed. However, it is both environmentally responsible and fiscally prudent to be responsive to changing and unforeseen limitations and conditions. An adaptive management approach will be employed to accomplish this flexibility. Post-construction compliance monitoring may trigger a sequence of more detailed investigations that, depending on the findings, could culminate in corrective actions. During the first nine post-construction years, the analysis will ultimately determine whether the performance of the CSO controls was adequate. If the performance is unacceptable, the finding will be verified, the causes will be identified, and reasonable corrective actions will be taken. Modifications and retrofits that are implemented and demonstrate improvement will be documented through the issuance of an LTCP update, subject to DEC approval.

8.5 SCHEDULE

The time frames anticipated to develop and implement the elements of the Waterbody/Watershed Facility Plan are presented in Figure 8-3. As shown, all elements of the Plan will be implemented by 2019. It should be noted that elements shown in this schedule address implementation of the recommended Waterbody/Watershed Facility Plan elements only. As noted in the Order on Consent (Section III.C.2) “once the Department approves a Drainage Basin 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 Waterbody/Watershed Facility Plan is further developed and submitted as an LTCP in accordance with dates presented in Appendix A of the Order on Consent. Dredging of Newtown Creek will be considered in the future pending the results of the Remedial Investigation/Feasibility Study. In addition, the DEP will also continue to support and sponsor the USACE in its Hudson-Raritan Estuary Ecosystem Restoration Project, and to support the recommend actions when that study is finalized.

8.6 CONSISTENCY WITH FEDERAL CSO POLICY

The Newtown Creek Waterbody/Watershed Facility Plan was developed so that it satisfies the requirements of the Federal CSO Control Policy. Through extensive water quality and sewer system modeling, data collection, community involvement, and engineering analysis, the DEP has adopted a plan that incorporates the findings of over a decade of inquiry to achieve the highest reasonably attainable use of Newtown Creek. This WB/WS Facility Plan addresses each of the nine minimum elements of long-term CSO control as defined by federal policy and shown in Table 8-2.



Legend:
Completed
Not Completed
Milestones

Waterbody/Watershed Facility Plan
Implementation Schedule
Figure 8-3

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

Element	Report Section	Summary
1. Characterization, Monitoring, and Modeling of the Combined Sewer System	3.0	Addressed during Inner Harbor Facility planning (1993), CSO Facility Plan (1993-2003), USA Project (1999-2004), and WB/WS Plan development (2004-2005).
2. Public Participation	6.0	The WB/WS Plan was developed with active involvement from the affected public and other stakeholders during its development. In addition, four stakeholder meetings were held to develop the plan during the USA Project.
3. Consideration of Sensitive Areas	4.7	The DEC, as the permitting authority, has determined that the Newtown Creek waterbody as a whole is a sensitive area.
4. Evaluation of Alternatives	7.0	Detailed evaluations conducted during facility planning projects and herein clearly establish the combination of alternatives that comprise the WB/WS Facility Plan.
5. Cost/Performance Considerations	7.0	Both facility planning and WB/WS Plan development evaluations of cost suggest that the highest-level controls (100% CSO capture) provide insignificant additional water quality benefits despite inordinate costs. WB/WS Facility Plan CSO facilities were sized according to a "knee-of-the-curve" type cost-benefit analysis.
6. Operational Plan	8.0	DEP will continue to satisfy the operational requirements of the 14 BMPs for CSO control, including the Bowery Bay and Newtown Creek WWTP Wet Weather Operating Plans, as required under the City's SPDES permits. The BMPs satisfy the nine minimum control requirement of federal CSO policy. DEP will also continue implementation of other programmatic controls.
7. Maximizing Treatment at the Existing WWTP	7.0	Maximization of treatment at the Bowery Bay and Newtown Creek WWTPs is included in the WB/WS Plan through satisfaction of the operational requirements of the WWTP WWOPs.
8. Implementation Schedule	8.0	The Newtown Creek Enhanced Track 3 Facility Upgrade was underway at the time of the writing of this report. Construction activity is anticipated to conclude in 2013. Construction of the Zone 1 Aeration Facility was also ongoing is anticipated to conclude in 2008.
9. Post-Construction Compliance Monitoring	8.0	Post-construction monitoring will be performed per CSO Control Policy requirements: receiving water will be monitored per Harbor Survey protocols at the four stations within Newtown Creek and one station in the East River. Monitoring data will be used to assess compliance, to optimize facility performance, and to trigger adaptive management alternatives.

8.7 ANTICIPATED WATERBODY/WATERSHED PLAN BENEFITS

Implementation of the Waterbody/Watershed Facility Plan will provide both sewer-system performance benefits and water-quality benefits. The various components of the Plan will reduce CSO discharges, improve aesthetic conditions, and enhance habitat to levels consistent with regulatory and stakeholder use goals.

Sewer-system performance benefits of the Waterbody/Watershed Facility Plan can be described using the results of the landside modeling projections for the design (typical) precipitation year. Table 8-3 details CSO discharge volume and frequency reductions from each of the outfalls that discharge to the Newtown Creek waterbody as well as total volume reduction to the waterbody.

Table 8-3. Waterbody/Watershed Plan Reductions from Baseline [(1) (2)]

Outfall	Discharge Volume (MG)	% Volume Reduction from Baseline	Number of Discharges	% Reduction in Discharges from Baseline
Combined Sewer [(3)]				
NCB-083	586.2	0.0%	71	0.0%
BB-026	172.8	0.7%	44	6.4%
NCQ-077	190.6	27.0%	35	28.6%
NCB-015	196.4	36.2%	26	21.2%
BB-013	29.8	23.7%	41	6.8%
NCQ-029	18.1	0.0%	48	0.0%
BB-043	12.2	12.2%	37	7.5%
BB-009	34.4	2.3%	34	2.9%
NCB-022	7.0	16.7%	42	0.0%
BB-014	2.2	31.3%	30	14.3%
BB-042	1.9	17.2%	27	6.9%
BB-011	2.8	0.0%	24	0.0%
BB-040	0.7	11.1%	18	14.3%
BB-015	2.1	32.3%	36	7.7%
BB-010	1.6	0.0%	16	0.0%
NCB-023	0.2	0.0%	5	0.0%
NCB-019	0.6	25.0% Increase	12	71.4%Increase
BB-012	0.2	0.0%	5	0.0%
BB-004	0.1	0.0%	4	0.0%
NCB-024	0.0	0.0%	0	0.0%
Total CSO	1259.9	14.4%		
Storm Sewer [(4) (5)]				
NCB-629	62.1	0.0%	71	0.0%
NCB-631	55.9	0.0%	71	0.0%
NCB-632	51.9	0.0%	71	0.0%
NC Non-Permitted	324.1	0.0%	71	0.0%
BB Non-Permitted	82.7	0.0%	71	0.0%
Total Stormwater	576.7	0.0%		
Total	**1,836.6**	**11.5%**		

(1) Baseline condition reflects design precipitation record (JFK, 1998) and sanitary flows projected for year 2045 (Bowery Bay WWTP: 236 MGD, Newtown Creek WWTP: 585 MGD).
(2) Totals may not sum precisely due to rounding.
(3) CSO Outfalls BBL-049 and NCB-021 are not incorporated into the model due to lack of as-built data. The adjacent drainage areas are distributed to nearby outfalls. Outfall 002 is the Newtown Creek WPCP high relief that discharges to Whale Creek Canal. This flow is treated before discharge and is built into the water quality model runs.
(4) The collection system models include a total of 44 non-CSO discharges to Newtown Creek.
(5) SPDES permitted storm outfalls NCB-630 and 633 are not incorporated into the model due to lack of as-built data.

In addition to the projected CSO reductions identified above, this WB/WS Plan is not projected to increase CSO discharges to other waterbodies.

Although the Waterbody/Watershed Facility Plan will provide significant benefits with respect to sewer-system performance and reduction of CSO discharges, the projected improvement to water quality affords a more meaningful measure of the impact of the Plan. Water quality conditions projected with implementation of the Waterbody/Watershed Facility Plan are presented in Figures 8-4 and 8-5. Anticipated water quality improvements to dissolved oxygen, aesthetics, and bacteria are discussed below.

8.7.1 Dissolved Oxygen

Dissolved oxygen is perhaps the most meaningful measure of the impact of the Newtown Creek Waterbody/Watershed Facility Plan because it is due to low levels of dissolved oxygen that Newtown Creek is currently on DEC's 303(d) list of impaired waterbodies. As shown on Figure 8-4, implementation of the Waterbody/Watershed Facility Plan is projected to substantially increase dissolved oxygen levels throughout the Creek. As discussed in Section 7.5 and summarized in Table 7-21, implementation of the first phase of the Newtown Creek Waterbody/Watershed Facility Plan is expected to provide greater average dissolved-oxygen levels, and corresponding aquatic-life uses, than the much more costly 100% CSO reduction. Higher levels of control, including complete elimination of all CSO discharges, do not fully attain the Class SD dissolved oxygen criteria, and do not significantly improve the attainment of higher use levels in the waterbody beyond what is achieved with the Waterbody/Watershed Facility Plan.

8.7.2 Aesthetics

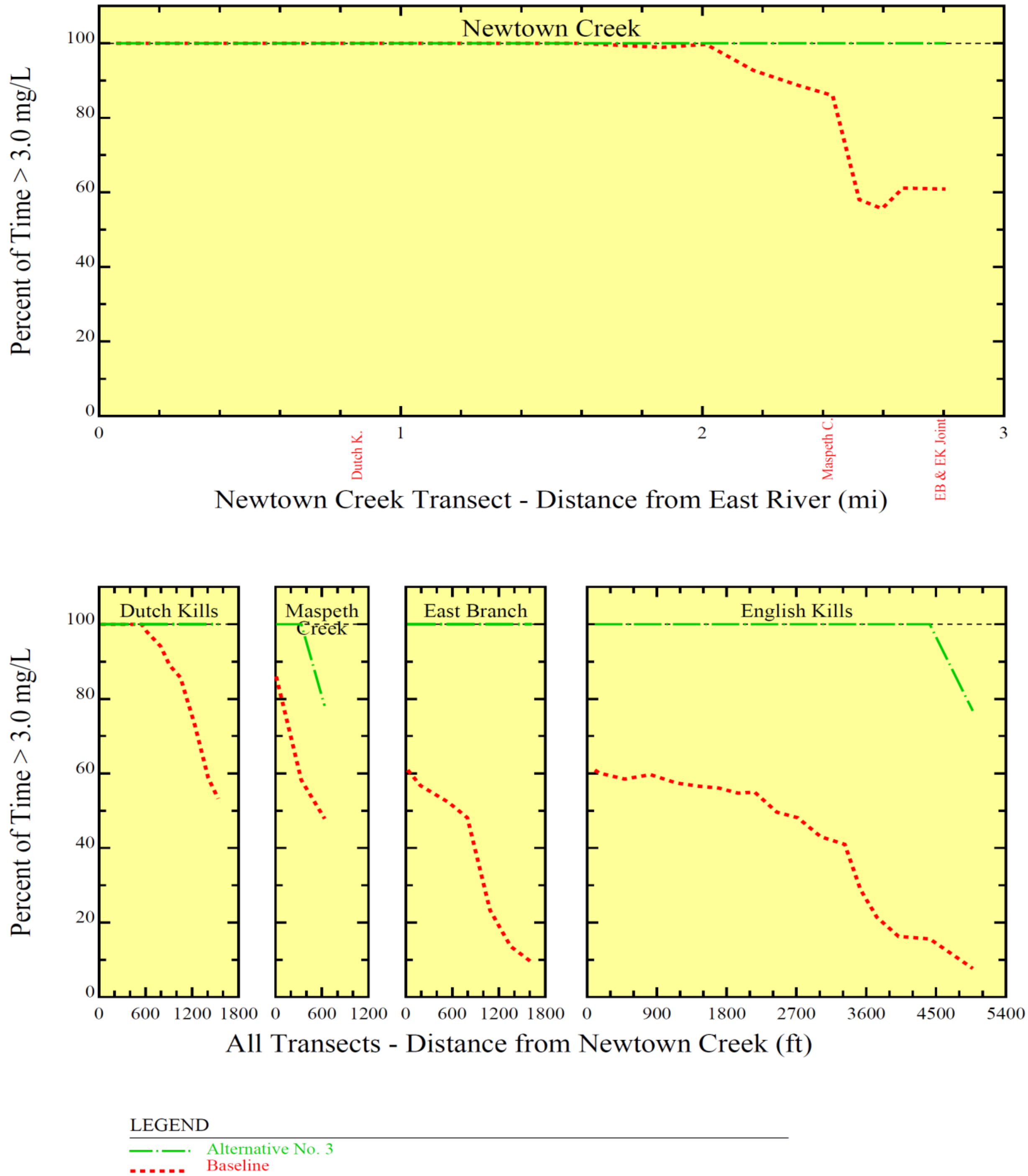
The Waterbody/Watershed Facility Plan is expected to substantially reduce floatables. In addition to the reductions of floatables and solids that will result from the Citywide implementation of the Floatables Plan and the 14 BMPs for CSO control, the Waterbody/Watershed Facility Plan will include projects to directly reduce floatables in the first phase, and is projected to reduce CSO discharges containing these materials by about 61 percent after implementation of all phases. Remaining floatables issues will be addressed with periodic deployment of a skimmer vessel to conduct waterbody floatables removal.

8.7.3 Bacteria

The DEC designates Newtown Creek as a Class SD waterbody. This classification is not suitable for contact recreation and hence is not subject to associated indicator bacteria standards. However, acknowledging stakeholder use goals, levels of indicator bacteria were projected for purposes of comparison between the Baseline and Waterbody/Watershed Facility Plan. Figure 8-5 presents the average and maximum projected levels of total coliform and fecal coliform bacteria in Newtown Creek and its tributaries for the design (typical) precipitation year for the Baseline and Waterbody/Watershed Facility Plan conditions. As shown, the Waterbody/Watershed Facility Plan is projected to reduce average and maximum levels overall and particularly near the head of the Creek within East Branch and English Kills.

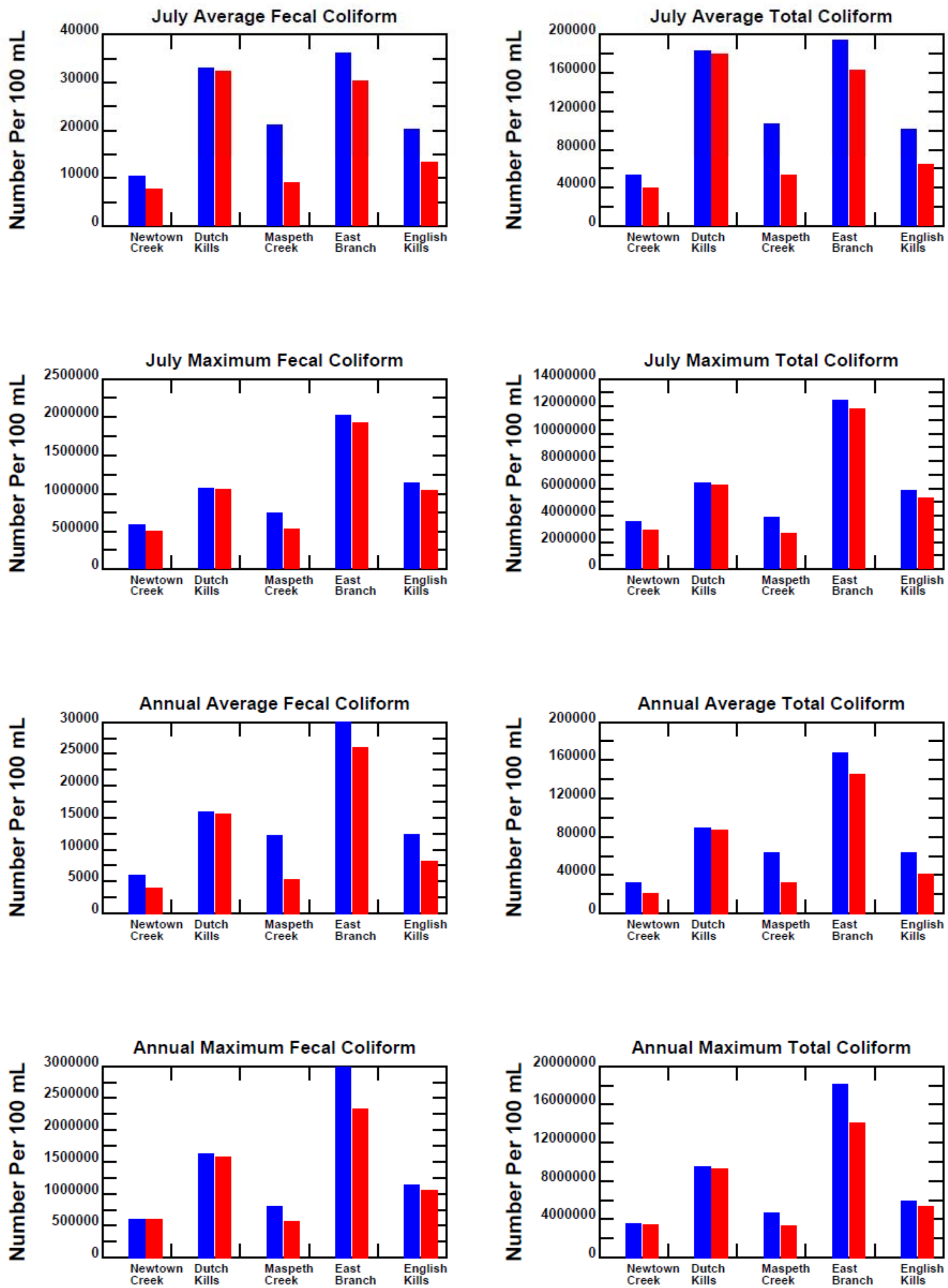
8.8 GREEN STRATEGY ASSESSMENTS AND IMPLEMENTATION

The NYC Green Infrastructure Plan, as described in section 5.8, included five key components: construct cost effective grey infrastructure; optimize the existing wastewater system through interceptor cleaning and other maintenance measures; control runoff from 10 percent of impervious surfaces through green infrastructure; institute an adaptive management approach to better inform decisions moving forward; and engage stakeholders in the development/implementation of these green strategies.



Environmental Protection

Waterbody/Watershed Facility Plan
Projected Seasonal Attainment of Class SD Dissolved Oxygen Standards



Environmental Protection

Waterbody/Watershed Facility Plan
Comparison of Projected Average and Maximum Total and Fecal Coliform Counts

As part of the LTCP process, DEP will evaluate green infrastructure in combination with other LTCP strategies to better understand the extent to which green infrastructure would provide incremental benefits and would be cost-effective. DEP models will be refined by including new data collected from green infrastructure pilots, new impervious cover data and extending predictions to ambient water quality for the development of the LTCP. Based on these evaluations, and in combination with cost effective grey infrastructure, DEP will reassess the green infrastructure strategy.

NO TEXT ON THIS PAGE

9.0. Water Quality Standards Review

The Newtown Creek 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 the 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, 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 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 Newtown Creek 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 USEPA regulations and guidance will provide substantial benefits. However, it does not fully attain the "fishable/swimmable" standard. 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

This section reviews the applicable water quality standards and their attainability in Newtown Creek, as well as waterbody uses and other practical considerations such as partial attainment.

9.1.1. Numeric Water Quality Standards

New York State waterbody classifications and numerical criteria which are or may become applicable to Newtown Creek are shown in Table 9-1.

Newtown Creek is classified as SD with a best usage of fishing. This classification is considered to be suitable for fish survival but not for fish propagation. This classification does not satisfy the "fishable" goal of the CWA. In addition, this classification is not considered suitable for either secondary or primary contact recreation and, therefore, does not have any bacteriological criteria specified. Class SD is not consistent with the "swimmable" goal of the CWA. Satisfaction of the "fishable" goal would require Newtown Creek to be reclassified to Class I, SB or SC, which are considered suitable for fish propagation and survival. It is understood at present that the Class I dissolved oxygen criterion of never less than 4.0 mg/L is considered satisfactory for fish propagation and survival, and therefore consistent with the fishable goal of the CWA. Satisfaction of the "swimmable" goal would require reclassification to Class SB or SC which are considered suitable for primary contact recreation. Reclassification to the fishable/swimmable Class SB/SC requires meeting numerical bacteria standards and also increases the minimum dissolved oxygen requirement to never less than 5.0 mg/L from the never less than 3.0 mg/L under Class SD.

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

Class	Dissolved Oxygen (mg/L)	Bacteria (Pathogens)		
		Total Coliform [1,4] (per 100 mL)	Fecal Coliform [2,4] (per 100 mL)	Enterococci[3] (per 100 mL)
SD	≥ 3.0	N/A	N/A	N/A
I	≥ 4.0	≤ 10,000	≤ 2,000	N/A
SB, SC	≥ 5.0	≤ 2,400 ≤ 5,000	≤ 200	≤ 35

(1) Total coliform criteria are based on monthly geometric means for Class I, and 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), Class I, SB and SC bacteria standards are applicable only when disinfection is practiced.
N/A: not applicable

The Interstate Environmental Commission (IEC) waterbody classifications applicable to waters within the Interstate Environmental District are shown in Table 9-2. Newtown Creek is classified as Class B-2 with best intended uses for passage of anadromous fish and maintenance of fish life.

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

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

Class	Dissolved Oxygen	Best Intended Use
A	$\geq$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	$\geq$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	$\geq$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.

9.1.2. Narrative Water Quality Standards

The New York State narrative water quality standards are applicable to all waterbody classifications and therefore are applicable to Newtown Creek. The narrative standards are shown in Table 1-2 and are restated in Table 9-3. Note that the DEC narrative water quality standards apply a limit of “no” or “none” and that these restrictions are conditioned on the impairment of waters for their best usages for only selected parameters.

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 Newtown Creek 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 7.4 summarizes water quality modeling analyses which were performed to evaluate attainability of water quality standards under Baseline and WB/WS Facility Plan conditions. The results of these analyses are summarized in Tables 9-5 through 9-10. The analyses for Newtown Creek include the various numerical criteria for dissolved oxygen and bacteria under current and fishable/swimmable classifications.

Attainability of Currently Applicable Standards

Table 9-5 summarizes the projected annual percent attainment of dissolved oxygen for current Class SD and IEC Class B-2 criteria under Baseline and WB/WS Facility Plan conditions at the head end, middle and mouth of Newtown Creek and at the head and mouth of its main branches: Dutch Kills, Maspeth Creek, East Branch, and English Kills. As shown in Figure 2-5, the head of Newtown Creek (approximately 2.74 miles from the East River) is located at the junction of the East Branch and English Kills. The head of Newtown Creek is defined as immediately downstream of the mouth of English Kills and the mouth of the East Branch. Maspeth Creek is tributary to Newtown Creek at 2.43 miles from the East River. Dutch Kills is tributary to Newtown Creek at approximately 1 mile from the East River.

The projected Baseline annual attainment of Class SD and IEC Class B-2 dissolved oxygen criteria at the head of Newtown Creek is 83 percent and attainment at the mouth is 100 percent. The WB/WS Facility Plan (Phase I) includes enhanced Zone II Aeration designed to meet Class SD and IEC Class B-2 dissolved oxygen criteria. On an annual basis, the aeration is expected to achieve these criteria throughout the Newtown Creek system as shown in Table 9-5.

Table 9-5. Annual Attainability of Class SD Dissolved Oxygen Criteria for Design Year – Newtown Creek

Location	Class SD and IEC Class B-2 Dissolved Oxygen (≥3.0 mg/L) Percent Attainment	
	Baseline	WB/WS FP
Newtown Creek		
Head	83	99.6
Mid	97	99.4
Mouth	100	100
Dutch Kills		
Head	86	98.5
Mouth	99+	100
Maspeth Creek		
Head	81	98.9
Mouth	86	99.8
East Branch		
Head	56	93.0
Mouth	84	99.1
English Kills		
Head	56	90.3
Mouth	84	99.0

As currently classified SD, Newtown Creek does not support recreational use and no bacteria standards are applicable.

Attainability of Potential Future Standards – Class I

The DEC considers Class SD dissolved oxygen standards supportive of fish survival but not consistent with the "fishable" goal of the CWA. Therefore, a standards reclassification would be necessary for full fishable use attainment in Newtown Creek. Class I dissolved oxygen standards are considered fully supportive of aquatic life uses and consistent with the "fishable" goal of the CWA. An evaluation of the Baseline and WB/WS Facility Plan attainment of the Class I dissolved oxygen criterion, never-less-than 4.0 mg/L, is summarized on Table 9-6. Baseline annual attainment of Class I dissolved oxygen criterion 70 percent at the head of Newtown Creek and essentially 100 percent at the mouth. Annual Baseline compliance at the head of the tributaries ranges from 48 percent (East Branch) to 74 percent (Dutch Kills). Annual dissolved oxygen attainment of the Class I criterion shown in Table 9-6 for the WB/WS Facility Plan is based on the level of aeration planned for Newtown Creek under the WB/WS Facility Plan. As shown, the projected attainment of the Class I criterion improves significantly from Baseline for the WB/WS Facility Plan condition: over 97 attainment in Newtown Creek, and over 95 percent at the head of the various tributaries.

Table 9-6. Annual Attainability of Class I Dissolved Oxygen Criteria for Design Year – Newtown Creek

	Class I and IEC Class B-1 ($\geq$4.0 mg/L) Percent Attainment	
Location	**Baseline**	**WB/WS FP**
Newtown Creek		
Head	70	97.5
Mid	87	99.1
Mouth	99+	100
Dutch Kills		
Head	74	96.5
Mouth	93	100
Maspeth Creek		
Head	68	85.6
Mouth	70	98.8
East Branch		
Head	48	87.1
Mouth	69	97.8
English Kills		
Head	51	76.7
Mouth	69	95.6

Table 9-7 summarizes the annual attainment of potential Class I total coliform and fecal coliform criteria, respectively. Attainability for Baseline and the WB/WS Facility Plan is 67 percent at the head of Newtown Creek and 100 percent at the mouth. Attainability at the head of the Newtown tributaries ranges from 50 percent (East Branch) to 75 percent (Dutch Kills and Maspeth Creek) for both the Baseline and the WB/WS Facility Plan. The mouth of each tributary has the same percent attainability as the Newtown Creek main channel where the tributary channels connect with Newtown Creek. Both the Baseline and the WB/WS Facility Plan achieve 100 percent Class I coliform criteria attainment everywhere in the Newtown Creek system during the summer (June, July and August) for the design year conditions. Secondary contact recreation use is fully supported during the summer months.

Table 9-7. Annual Attainability of Class I Total Coliform Criteria for Design Year

Location	Total Coliform GM ≤10,000/100 mL Percent Attainment		Fecal Coliform GM ≤2,000/100 mL Percent Attainment	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Newtown Creek				
Head	67	67	67	67
Mid	83	92	83	92
Mouth	100	100	100	100
Dutch Kills				
Head	75	83	75	83
Mouth	92	92	92	92
Maspeth Creek				
Head	75	75	75	75
Mouth	75	75	75	75
East Branch				
Head	50	50	50	50
Mouth	67	67	67	67
English Kills				
Head	67	67	67	67
Mouth	75	75	67	75

Attainability of Potential Future Standards – Class SB/SC

The Class I secondary contact use achieved for the WB/WS Facility Plan, however, is not considered consistent with the "swimmable" goal of the CWA. To revise the classification of Newtown Creek to be fully supportive of primary contact use, the "swimmable" goal of the CWA, it would be necessary to attain the Class SB/SC criteria for total and fecal coliform, the enterococci criterion and the enterococci reference level established by USEPA. Tables 9-8 through Table 9-10 summarize projected percentage annual and recreation season attainability of these potential criteria.

Table 9-8 summarizes the annual and recreation season attainability of Class SB/SC primary contract criteria for total coliform. As shown, the total coliform criteria are not expected to be attained on an annual basis under both Baseline and WB/WS Facility Plan conditions although improvement from Baseline conditions would be achieved in some locations. Table 9-8 also shows monthly attainment during the recreation season, the three summer months of June, July, August, which encompasses the official public bathing season at New York City's seven public bathing beaches. The WB/WS Facility Plan is expected to achieve attainment of the total coliform criteria for two of the three summer months during the recreation season at the head of the Newtown Creek system.

Table 9-8. Attainability of SB/SC Total Coliform Criteria for Design Year

Location	Class SB/SC Percent Attainment			
	Annual		Recreation Season	
	Median ≤2,400/100 mL and 80% ≤5,000/100 mL		Median ≤2,400/100 mL and 80% ≤5,000/100 mL	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Newtown Creek				
Head	0	0	0	0
Mid	8	25	33	67
Mouth	33	42	67	67
Dutch Kills				
Head	17	17	33	33
Mouth	17	25	33	67
Maspeth Creek				
Head	17	17	67	67
Mouth	8	8	33	33
East Branch				
Head	0	0	0	0
Mouth	0	0	0	0
English Kills				
Head	17	17	67	67
Mouth	0	0	0	0

Results for fecal coliform, shown in Table 9-9, predict that the WB/WS Facility Plan will achieve attainment during two of the three summer months throughout the Newtown Creek system. It is noted that modeling projects that not even 100 percent elimination of all CSO discharges to Newtown Creek would attain the primary contact fecal coliform criterion on an annual basis due to the presence of stormwater discharges.

Table 9-9. Attainability of SB/SC Fecal Coliform Criteria for Design Year

Location	Annual		Recreation Season	
	Class SB/SC GM ≤200 Percent Attainment		Class SB/SC GM ≤200 Percent Attainment	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Newtown Creek				
Head	25	25	67	67
Mid	25	5	67	67
Mouth	8	25	33	67

Table 9-9. Attainability of
SB/SC Fecal Coliform Criteria for Design Year

Location	Annual		Recreation Season	
	Class SB/SC GM ≤200 Percent Attainment		Class SB/SC GM ≤200 Percent Attainment	
	Baseline	WB/WS FP	Baseline	WB/WS FP
Dutch Kills				
Head	25	25	67	67
Mouth	17	25	67	67
Maspeth Creek				
Head	17	25	67	67
Mouth	25	25	67	67
East Branch				
Head	17	17	67	67
Mouth	25	17	67	67
English Kills				
Head	17	17	67	67
Mouth	25	25	67	67

Table 9-10 summarizes the projected attainability of enterococci criteria which are potentially applicable to the Newtown Creek system for primary contact water use. It is noted that the attainment values shown in Table 9-10 are for the three month period of June, July and August as the enterococci criteria were developed specifically for the bathing season. The table shows that the seasonal geometric mean enterococci criterion is not expected to be attained under the WB/WS Facility Plan conditions at any location in the Newtown Creek system. Similarly, the infrequent use coastal recreation enterococci water reference level (upper 95% confidence limit) is not expected to be attained at any location in the Newtown Creek system.

Table 9-10. Recreation Season Attainability of
Enterococci Bacteria for Design Year – Newtown Creek

	Water Quality Criterion Geometric Mean ≤35		Infrequent Use Reference Level ≤501	
Location	Baseline	WB/WS FP	Baseline	WB/WS FP
Newtown Creek				
Head	0	0	68	68
Mid	0	0	74	76
Mouth	0	0	85	88
Dutch Kills				
Head	0	0	71	71
Mouth	0	0	75	77
Maspeth Creek				
Head	0	0	71	71
Mouth	0	0	70	72

Table 9-10. Recreation Season Attainability of Enterococci Bacteria for Design Year – Newtown Creek

Location	Water Quality Criterion Geometric Mean ≤35		Infrequent Use Reference Level ≤501	
East Branch				
Head	0	0	63	63
Mouth	0	0	68	68
English Kills				
Head	0	0	72	72
Mouth	0	0	68	68

9.1.4. Attainment of Narrative Water Quality Standards

Table 9-3 summarizes DEC narrative water quality standards which are applicable to Newtown Creek and all waters of the State. The existing CSO discharges to the waterbody and materials discharged with stormwater affect some of the listed parameters to some degree; varying amounts of oil and other floating substances and floatable materials (refuse) are discharged.

The WB/WS Facility Plan will not completely eliminate, but will greatly reduce, the discharge of these materials to the Newtown Creek system. The Newtown Creek Brooklyn Pumping Station operational controls, Phase II sewer system improvements, and CSO storage tunnel will reduce the discharge of the parameters of concern from CSOs by at least 66 percent from Baseline conditions based on volumetric capture. Heavy solids that would settle near the CSO outfalls will be virtually eliminated and floatable materials will be substantially reduced. In addition, floatable materials from the four largest CSOs to Newtown Creek will be further controlled by in-line or end-of-pipe netting facilities in Phase I. Odors will be greatly reduced by the environmental dredging program and the enhanced Zone II aeration. Consequently, the adverse impacts of the current CSO discharges will be substantially diminished although not completely eliminated as required by the narrative standards. Additionally, best management practices applied to reduce stormwater volumes to the combined and separate storm systems and to treat stormwater discharges cannot 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 eliminate odors, reduce the deposition of organic solids and floatable materials and restore the aesthetic uses of Newtown Creek to the maximum extent practicable.

9.1.5. Water Uses Restored

Fish and Aquatic Life Protection Use

Table 9-5 presents the dissolved oxygen improvements expected to be attained in Newtown Creek by the WB/WS Facility Plan as compared to Baseline conditions for current DEC and IEC dissolved oxygen criteria. The plan is expected to achieve between 99 to 100 percent attainment for the current Class SD and IEC Class B-2 criteria on an annual basis, a very significant improvement from the near anoxia of the Baseline condition in Maspeth Creek, East Branch and English Kills and near the head of Dutch Kills. This is considered to be a high level of attainment in terms of the survival of fish and aquatic life. The Newtown Creek WB/WS Facility Plan is expected to completely restore the fish survival designated use of the system.

In addition to the protection of the designated fish survival use, the WB/WS Facility Plan is projected to achieve dissolved oxygen conditions supporting fish propagation use criteria. Table 9-6 indicates that the Class I dissolved oxygen criteria of 4.0 mg/L is expected to be attained 99 percent of the time or more on an annual basis after full Facility Plan implementation. Thus conditions supportive of fish larval survival should prevail in the Newtown Creek system throughout the year.

Secondary Contact Recreation Use

As noted, Class SD and IEC Class B-2 do not support primary or secondary contact recreational activities as designated water uses and therefore have no bacteriological criteria. However, Table 9-7 indicates that the Newtown Creek WB/WS Facility Plan is projected to nearly completely attain Class I secondary contact recreational criteria for total and fecal coliform on an annual basis. The one month of non-attainment at various locations is expected to occur during November, when secondary contact recreational use is sharply reduced. The attainment of water quality supporting the secondary contact recreational use is considered an important water use restored to Newtown Creek.

Aesthetic Use

As discussed in Section 9.1.4, the WB/WS Facility Plan will not completely eliminate all regulated parameters in the DEC narrative water quality standards to zero discharge levels, but will significantly reduce the volumetric discharge of such substances. Settleable solids will be substantially reduced by the Brooklyn Pumping Station operational controls, sewer system improvements and the CSO Storage Tunnel. The effect of floatable materials from CSOs will be curtailed by volumetric reduction and the proposed positive floatables controls at the four largest CSO outfalls and the effect of narrative materials from stormwater inputs will be reduced to the maximum extent practicable. Odors will be virtually eliminated by environmental dredging and the enhanced Zone II aeration. Accordingly, the aesthetic conditions in Newtown Creek 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 improvement in the level of attainment of the DEC Class SD and IEC Class B-2 dissolved oxygen criteria, which is expected to result from the WB/WS Facility Plan. As noted, the annual attainment is expected to be virtually complete in the Newtown Creek system thus supporting the fish survival goal of the classifications. Additionally, as discussed, conditions supportive of fish and aquatic life propagation are expected most of the year.

For all but approximately 90 hours of the year, attainment of fish propagation criteria throughout the waterbody is expected. In the limited times where criteria excursions are expected, it should be noted that any adverse impact on fish larval propagation may be limited. Fish larvae spawning in Newtown Creek will be exchanged with, and transported to, East River waters where dissolved oxygen will be greater. The organisms will therefore not be continuously exposed to Newtown Creek dissolved oxygen that may be depressed below the criteria. Consequently, the impact on larval survival will be less than that projected 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 that occurs in Newtown Creek, 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.

Tables 9-8 and 9-9 indicate that during the summer recreation season, water quality in Newtown Creek may be supportive of numerical criteria for the swimmable (primary contact recreation) goal of the CWA during two of the three summer recreation season months. However, swimming should not be considered as a partially attained use in this waterbody due to periodic overflows still projected under the WB/WS Facility Plan, other regional CSO discharges and continuing stormwater discharges. Further, Table 9-10 indicates that the enterococci criteria needed for primary contact would not be achieved at many locations in the Newtown Creek system.

9.2. WATER QUALITY STANDARDS REVISION

This section discusses use and standards attainability based on the information presented above and throughout this Waterbody/Watershed Facility Plan Report.

9.2.1. Overview of Use Attainability and Recommendations

Section 9.1 summarizes the existing and potential water quality standards for Newtown Creek 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 Newtown Creek, organism transport to the East River 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 use of secondary contact recreation in Newtown Creek, although not required under current classifications, is expected to be practically attained under WB/WS Facility Plan conditions. Further, numerical water quality conditions (for the total and fecal coliform bacteriological indicators) suitable to support primary contact may be attained during most of the summer recreation season in Newtown Creek, 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 Newtown Creek after implementation the WB/WS Facility Plan, it is recommended that the current waterbody classification, Class SD, in Newtown Creek be retained at this time. The water use goals for the Class SD classification in Newtown Creek are expected to be achieved, either numerically or for practical purposes, once the WB/WS Facility Plan is constructed and operational except periodically following overflows still expected after implementation of the Newtown Creek WB/WS Facility Plan from heavy rainfall events. However, the attainment of the designated uses, while expected, should be demonstrated 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 in Section 8 of this WB/WS Facility Plan report. The monitoring program will document the actual attainment of uses: whether the current Class SD uses are attained as expected; whether other levels of usage are actually achieved supporting a waterbody reclassification, for example, Class I in Newtown Creek.

As described in this report, complete attainment throughout the Newtown Creek area of the Class SD narrative water quality criteria would require other controls beyond 100 percent abatement of CSO discharges to the waterbody. This water quality based effluent limit (WQBEL) of zero annual overflows is neither cost effective nor consistent with the CSO Control Policy. Therefore, until the long-term post-construction monitoring program is completed to document conditions actually attained in Newtown Creek, it is recommended that a variance to the WQBEL for appropriate effluent variables be applied for, and approved, for the Newtown Creek WB/WS Facility Plan.

9.2.2. DEC Requirements for Variances to Effluent Limitations

The requirements for variances to WQBELs are described in Section 702.17 of DEC's Water Quality Regulations. The following is an abbreviated summary of the variance requirements that are considered applicable to Newtown Creek. 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 DEC to grant a variance to a "water quality based effluent limitation…included in a SPDES permit." It is understood that the Newtown Creek WB/WS Facility Plan, when referenced in the Newtown Creek WWTP 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, DEP, 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 Newtown Creek, a variance would be needed for the following pollutants: effluent constituents covered by narrative water quality standards (suspended, colloidal and settleable solids; oil and floating substances). A variance for dissolved oxygen criteria would not be requested as the Newtown Creek WB/WS Facility Plan is expected to attain Class SD requirements within the constraints of modeling uncertainty.

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. If a UAA is required, it is anticipated that the applicability of at least two of the six factors cited in Subdivision (b): (3) human caused conditions and (4) hydrologic modifications, would provide the basis of the analysis.

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 for suspended, colloidal and settleable solids, and oil and floating substances in the periodic overflows from the Newtown Creek WB/WS Facility Plan. Further, as described above in Section 9.1.4, a 66 percent volumetric reduction is expected from Baseline CSO loadings to Newtown Creek, with additional capture of floatables from the positive controls at the four largest outfalls.

Subdivision (d) of the variance regulations requires that the requestor submit a written application for a variance to DEC that includes all relevant information pertaining to Subdivisions (b) and (c). DEP will submit a variance application for the Newtown Creek WB/WS Facility Plan to DEC six months before the plan is placed in operation. The application will be accompanied by the Newtown Creek WB/WS Facility Plan report, the Newtown Creek Use Attainability Evaluation, if required, 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 DEC and DEP. 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 DEP 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 Newtown Creek (except the Newtown Creek CSO Facility Plan elements not selected as part of the WB/WS Facility Plan), 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 permits authorizing the Newtown Creek 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 Newtown Creek WB/WS Facility Plan would require renewals to allow for sufficient long-term monitoring to assess the degree of water quality standards compliance. 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 SD 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 cost effective technology is available to enhance the WB/WS Facility Plan performance, if needed, whether Newtown Creek should be reclassified, or whether a Use Attainability Analysis should be approved.

In this manner, the approval of a WQBEL variance for Newtown Creek together with an appropriate long-term monitoring program can be considered as a step toward a determination of the following:

- Can Newtown Creek be reclassified in a manner that is wholly or partially compatible with the fishable/swimmable goals of the Clean Water Act, or

- Is a Use Attainability Analysis needed for Newtown Creek and for which water quality criteria?

Although Newtown Creek's current waterbody classification, Class SD, is not wholly compatible with the goals of the Clean Water Act, and would normally 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 Newtown Creek, 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 Newtown Creek, 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 DEC Water Quality Regulations, that being “Urban Tributary”. This 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); and
- 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 or 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 Newtown Creek WB/WS Facility Plan would apply with regard to the narrative water quality criteria previously cited. 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 DEC 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 Newtown Creek, it is not expected to completely attain all applicable water quality criteria. As such, the SPDES Permit for the Newtown Creek WWTP may require a WQBEL variance for the Newtown Creek 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, DEP would request reclassification of portions of Newtown Creek based on a Use Attainability Analysis (UAA). Until the recommended UAAs and required regulatory processes are completed, the current DEC classification of Newtown Creek, Class SD, will be retained.

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10.0.References

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11.0 Glossary and Abbreviations

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.

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.

Brooklyn Sewer Datum (BSD): Coordinate system and origins utilized by surveyors in the Borough of Brooklyn, New York City.

BSD: Brooklyn Sewer Datum

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

DDWF: design dry weather flow

DEC: New York State Department of Environmental Conservation

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).

DEP: New York City Department of Environmental Protection

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 (e.g., 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. 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).

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

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, analyze 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_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: 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 DEP 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). DEP 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.

JABERRT: Jamaica Bay Ecosystem Research and Restoration Team

Jamaica Bay Ecosystem Research and Restoration Team (JABERRT): Team established by the Army Corps of Engineers to conduct a detailed inventory and biogeochemical characterization of Jamaica Bay for the 2000-2001 period and to compile the most detailed literature search established.

Jamaica Eutrophication Model (JEM): Model developed for Jamaica Bay in 1996 as a result of a cost-sharing agreement between the DEP and US Army Corps of Engineers.

JEM: Jamaica Eutrophication Model

Karst Geology: Solution cavities and closely-spaced sinkholes formed as a result of dissolution of carbonate bedrock.

Knee-off-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.

Kurtosis: A measure of the departure of a frequency distribution from a normal distribution, in terms of its relative peakedness or flatness.

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

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.

Mean Lower Low Water (MLLW): A tidal level. The average of all lower 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

MOU: Memorandum of Understanding

MOUSE: Computer model developed by the Danish Hydraulic Institute used to model the combined sewer system.

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.

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 (DEP): 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 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 (DEC): 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

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

NYSDOS: New York State Department of State

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.

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 were 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".

Probable Total Project Cost (PTPC): Represents the realistic total of all hard costs, soft costs, and ancillary costs associated with a particular CSO abatement technology per the definitions provided in memorandum entitled "Comparative Cost Analysis for CSO Abatement Technologies – Costing Factors" (O'Brien & Gere, April 2006). All PTPCs shown in this report are adjusted to July 2005 dollars (ENR CCI = 11667.99).

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 – represents 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: Symbol for Flow (designation when used in equations)

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.

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 unforeseen pipe blockages or breaks, unforeseen 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.

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.

Taxa: The plural of taxon, a general term for any of the hierarchical classification groups for organisms, such as genus or species.

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.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 (DEC) 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

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

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 technology based 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

Zooplankton: Free-floating or drifting animals with movements determined by the motion of the water.

APPENDIX A

NEWTOWN CREEK WASTEWATER TREATMENT PLANT WET WEATHER OPERATING PLAN

Environmental Protection

Bureau of Wastewater Treatment

Capital Project No. WP-283

Newtown Creek WPCP
Wet Weather Operating Plan

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GREELEY AND HANSEN ✦ HAZEN AND SAWYER ✦ MALCOLM PIRNIE
A Joint Venture

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1.0 INTRODUCTION

The Newtown Creek Water Pollution Control Plant (NCWPCP) is currently operating under the Third Modified Judgment on Consent Index No. 196/88 (Judgment) which, in addition to specifying current discharge requirements under the interim SPDES permit (No. 0026204), requires that the facility achieve secondary treatment. Therefore, the NCWPCP is currently undergoing major capital improvements as defined in the Enhanced Track 3 Facility Plan.

This document contains the Wet Weather Operating Plan (WWOP) for the NCWPCP for the interim construction period when only the North and Central Batteries are treating plant influent wastewater flows and plant recycles. In accordance with New York State Department of Environmental Conservation (NYSDEC) guidance, this WWOP presents operating procedures for the existing facility, identifies critical treatment facilities that will be available during the construction period and describes operating strategies that will maximize treatment during wet weather events while not appreciably diminishing effluent quality or destabilizing treatment upon return to dry weather operation. This WWOP assumes the following conditions:

- The improvements to the Brooklyn/Queens and Manhattan Pump Stations (Contracts NC-36 and NC-40, respectively) will commence. Pump station capacities during the upgrade stages are included in this WWOP.
- The South Battery is out of service - Contract NC-47 - underway. This WWOP does not include the operations of the South Battery, South Control Building and associated Air Supply System.
- The Secondary Screening and Residuals Handling Building construction (Contract NC-41) will initiate in the future. Operations of this facility are not included in this WWOP.
- The waste activated sludge will be thickened by the centrifuges, gravity thickeners (GTs), or both.

Section 3 in this document provides more detail on the remaining planned Track 3 upgrades.

1.1 BACKGROUND ON EXISTING SYSTEM

The existing NCWPCP, located on a 53-acre site on Greenpoint Avenue adjacent to Newtown Creek in Brooklyn (Figure 1-1), treats wastewater from a combined sewer service area of 25.4 square miles that includes parts of Brooklyn, Queens and Manhattan. The original facility, constructed in 1967, was designed to provide 60% removal of Biochemical Oxygen Demand (BOD) and 70% removal of Total Suspended Solids (TSS) at a design average annual flow of 310 MGD using a very high rate modified activated sludge process with no primary clarification. Since the original construction, the plant has demolished the original North Battery and constructed new North and Central Batteries. The original South Battery is currently being replaced with a new South Battery. The current interim permit requires that the NCWPCP treat wet weather flows up to 620 MGD (two times the permitted dry weather flow). Flow in excess of the plant flow is discharged through the Combined Sewer Overflows (CSOs) at the regulators in the collections system. The amount of flow discharged through the CSOs is governed by the regulators, plant operations and rainfall characteristics (intensity, duration and location). The NCWPCP currently treats an average daily flow of approximately 240 MGD and has achieved peak wet weather flow rates in excess of 620 MGD. The plant operators control the flow to the plant using the influent pumps at the two main influent pump stations. Influent flow to the pump stations during severe wet weather events is limited by throttling gates at both influent pump stations to maintain acceptable influent wet well levels and protect the pump stations from flooding. Figure 1-2 presents the existing facilities as of April 2009.

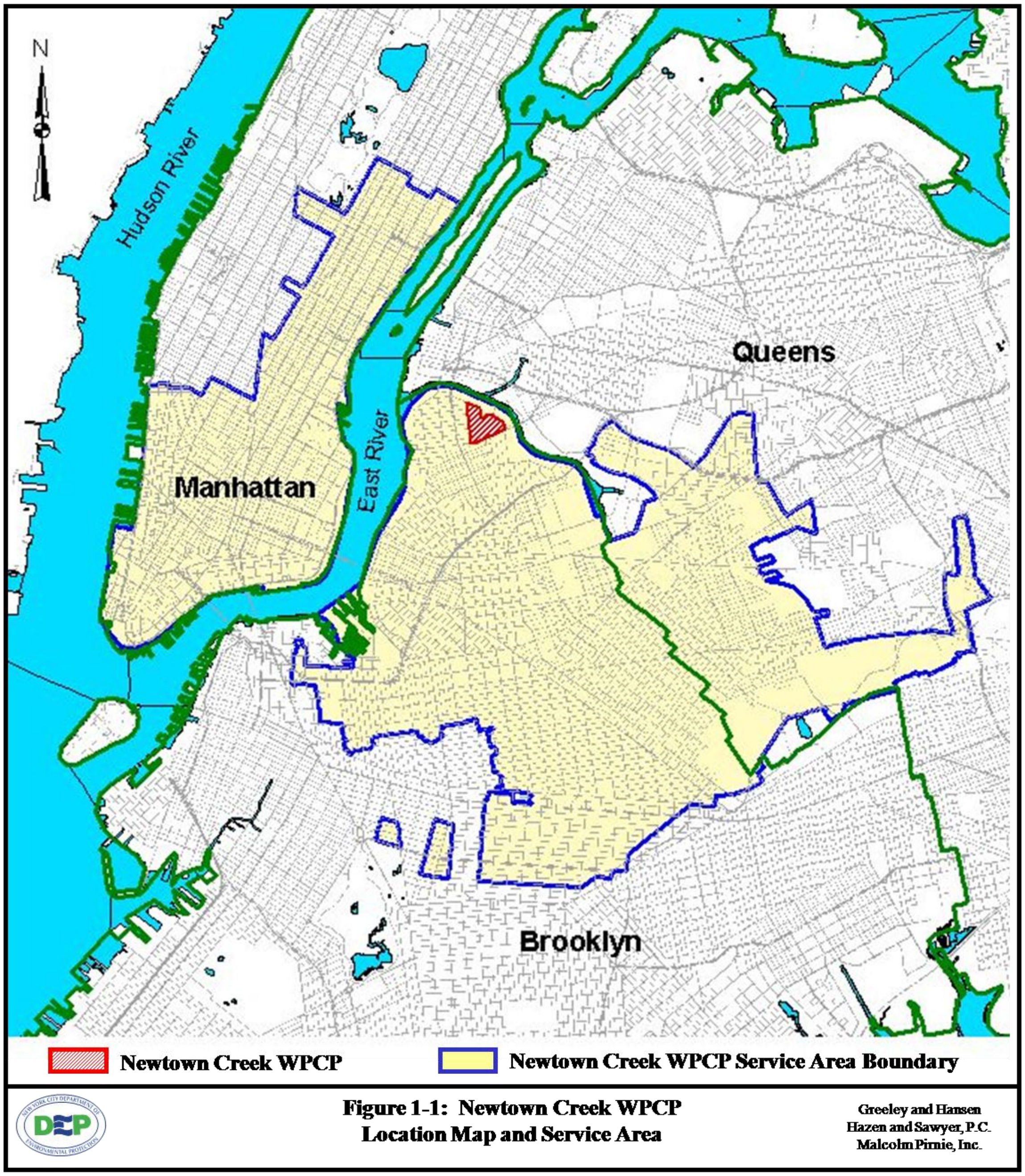

Figure 1-1: Newtown Creek WPCP Location Map and Service Area

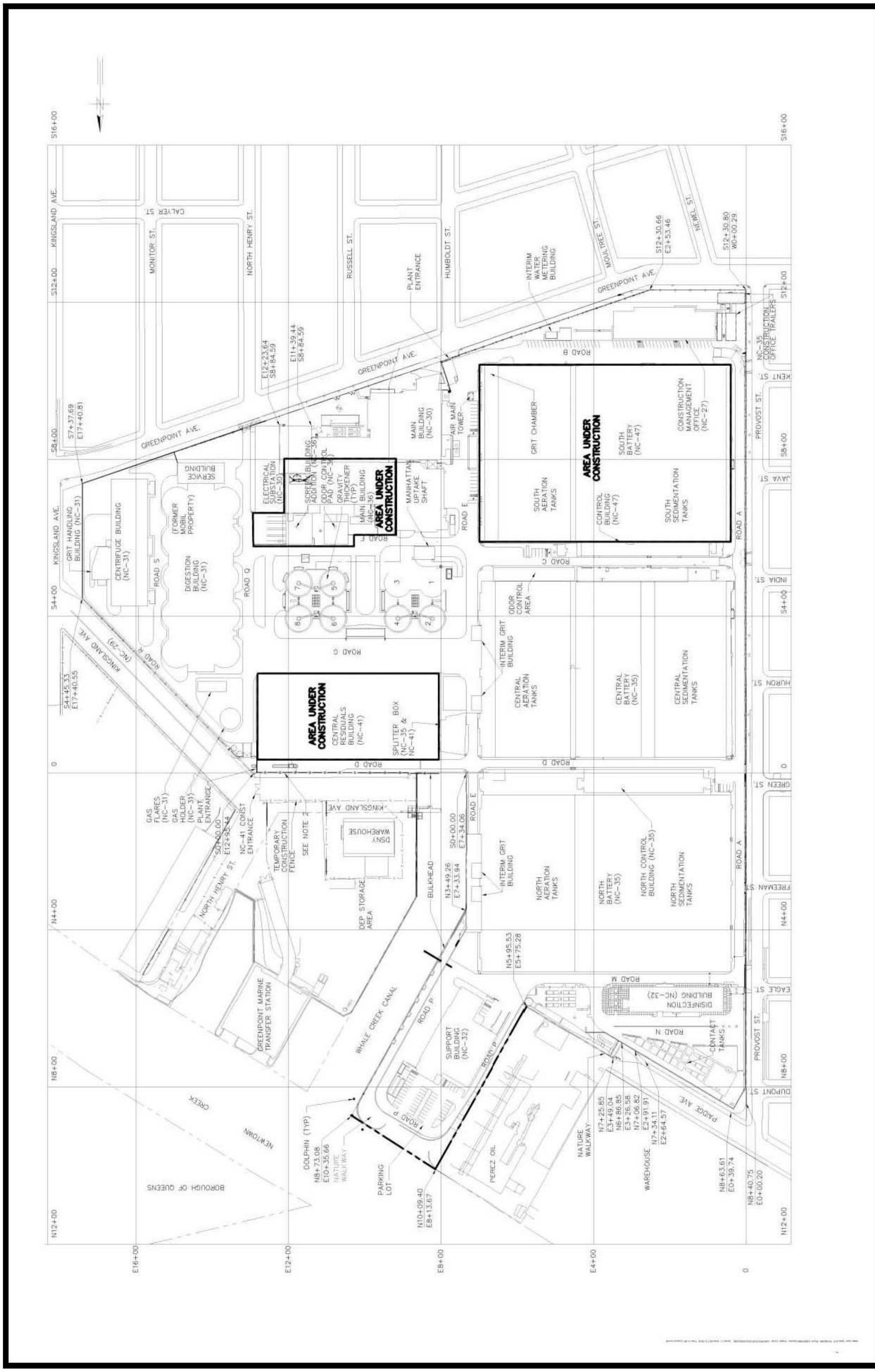

Figure 1-2: Newtown Creek WPCP Existing Facility Site Plan

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The existing wet stream treatment at the NCWPCP includes preliminary screening, detritor grit removal, high rate step feed activated sludge biological treatment, final sedimentation and chlorine disinfection using sodium hypochlorite. A process flow diagram is shown in Figure 1-3.

The plant receives wastewater from two service areas, Brooklyn/Queens and Manhattan. The Brooklyn/Queens flow enters the Brooklyn/Queens (B/Q) pump station located at the plant. The Manhattan flow is pumped from the Manhattan Pump Station (MPS), located at Avenue D between east 12th St. and East 13th St. in Manhattan. The B/Q and MPS influent flow and plant recycle flow are combined in a splitter box and distributed between two existing treatment batteries (North and Central). Each battery includes 8 grit tanks, 4 aeration tanks and 8 final sedimentation tanks.

Wastewater from the splitter box flows by gravity to the grit tanks. Effluent from each grit tank enters a common aeration tank feed channel, which can distribute flow to each aeration tank pass through four individual motorized slide gates (1 per pass). Return activated sludge enters the aeration tanks (ATs) at the head end of the first pass. AT effluent enters a common AT effluent channel which distributes MLSS to the head of the sedimentation tanks. Common feed channels allow for individual tanks to be removed without affecting associated tankage. For example, if an AT needs to be taken out of service, its associated grit tanks can remain in service to accept higher grit loads during storm events. The final sedimentation tank effluent combines in a common effluent channel which flows to the chlorine contact tanks (CCTs) where it is chlorinated and discharged to the East River or during high flow periods caused by wet weather and/or high tide periods from storm tides, both the East River and Whale Creek.

In each battery, Return Activated Sludge (RAS)/ Waste Activated Sludge (WAS) is removed from each final sedimentation tank via a telescoping valve and is routed by gravity to a common RAS/WAS wet well. RAS is then pumped to the RAS splitter box, which distributes the RAS to Pass A of each AT.

WAS is pumped from the RAS/WAS wet well directly to the centrifuge wet wells and/or gravity thickener (GT) distribution box. WAS is thickened by centrifuges and/or GTs, anaerobically digested and then hauled by barge to offsite dewatering facilities. The digested sludge can also be thickened using centrifuges prior to discharge to barge.

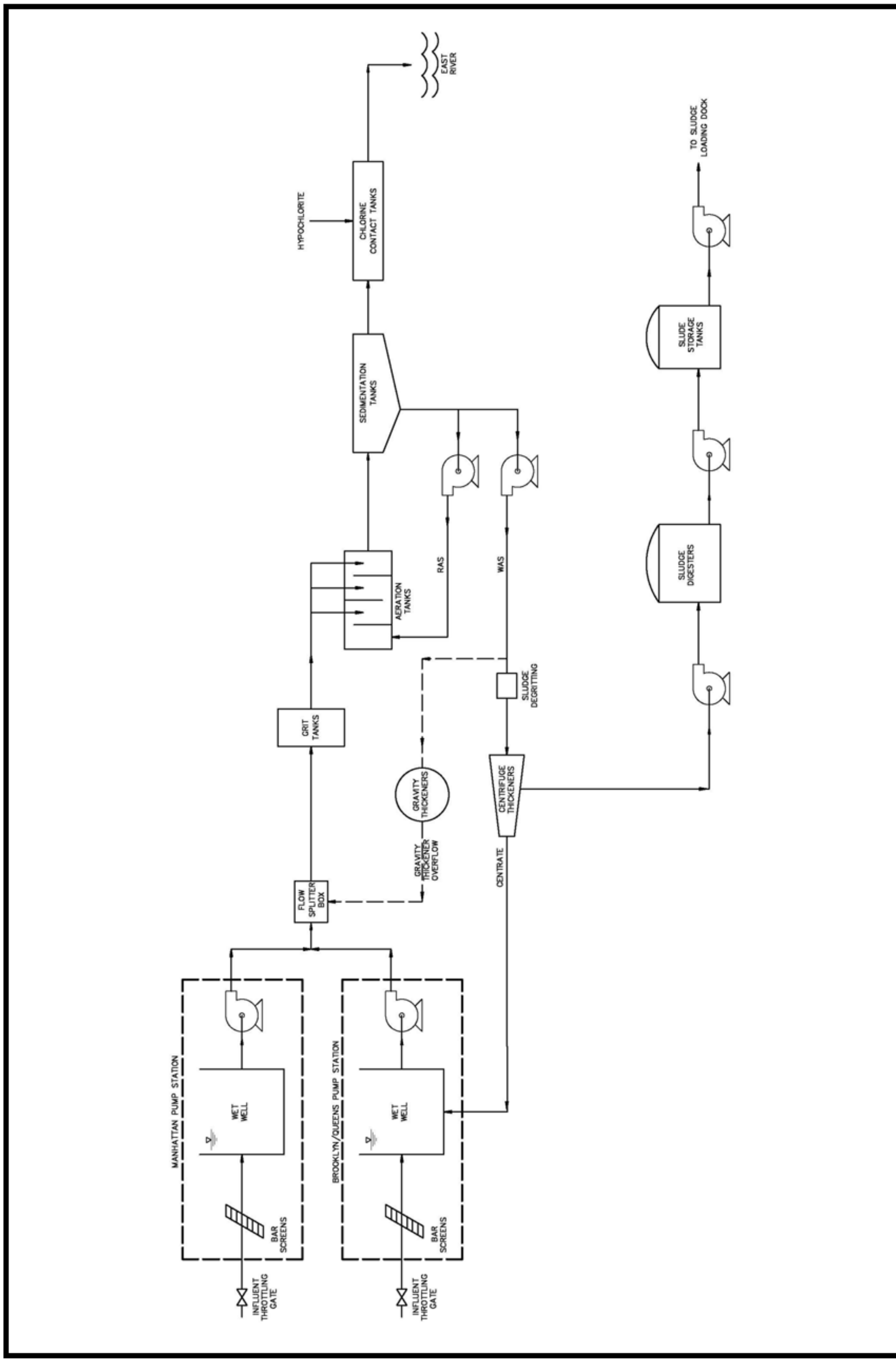

Figure 1-3: Newtown Creek WPCP
Existing Facility Process Flow Diagram

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1.2 EFFLUENT PERMIT LIMITS

The NCWPCP is currently operating under SPDES Permit No. 0026204 and interim effluent limits set forth in the Judgment. The current effluent Flow, $cBOD_5$ and TSS limits and monitoring requirements from Appendix B: Interim Effluent Limits of the Judgment are summarized in Table 1-1 below.

TABLE 1-1: NEWTOWN CREEK WPCP THIRD MODIFIED JUDGEMENT ON CONSENT APPENDIX B: INTERIM EFFLUENT LIMITS		
Parameter	Limit	Monitoring Frequency
Dry Weather Flow	310 MGD	(30 day mean)
Total Flow		Monitor (12 month rolling average)
$cBOD_5$ (1)	45 mg/l	(30 day mean)
	60% removal	(30 day mean) (2)
	68 mg/l	(7 day mean)
TSS (1)	35 mg/l	(30 day Mean)
	75% removal	(30 day mean) (2)
	53 mg/l	(7 day mean)
	60 mg/l	(Daily Maximum) (3)

(1) Sample type 24-Hour Composite
(2) Total Daily Flow greater than 310 MGD excluded from percent removal calculations.
(3) Not applicable within one calendar day of the day in which the instantaneous flow > 620 MGD.

In accordance with the Judgment under which the plant is now operating, the facility must provide secondary treatment for dry weather flows up to 310 MGD. The proposed final effluent Flow, $cBOD_5$ and TSS limits and monitoring requirements for the Newtown Creek WPCP (SPDES No. NY0026024) are summarized in Table 1-2 below.

TABLE 1-2: NEWTOWN CREEK WPCP FINAL TRACK 3 EFFLUENT PERMIT LIMITS		
Parameter	Limit	Monitoring Frequency
Dry Weather Flow	310 MGD	(30 day mean)
Total Flow		Monitor (12 month rolling average)
$cBOD_5$ [1]	25 mg/l	(30 day mean)
	85% removal	(30 day mean) [2]
	40 mg/l	(7 day mean)
TSS [1]	30 mg/l	(30 day Mean)
	85% removal	(30 day mean) [2]
	45 mg/l	(7 day mean)
	50 mg/l	(Daily Maximum) [3]

(1) Sample type 24-Hour Composite

(2) Total Daily Flow greater than 310 MGD excluded from percent removal calculations.

(3) During periods of wet weather, which result in an instantaneous plant influent flow that exceeds twice the permitted flow (620 MGD), the TSS Daily Maximum limit of 50 mg/L shall not apply for the day of the measured flow nor the succeeding day.

The NCWPCP is currently undergoing major capital improvements designed to meet these secondary treatment limits for the design average flow of 310 MGD and provide treatment for instantaneous peak wet weather flows of up to 700 MGD when completed. The improvements will include additional facilities and equipment upgrades, which will provide a greater degree of reliability and flexibility in managing and optimizing wet weather operation and performance.

1.3 PERFORMANCE GOALS FOR WET WEATHER EVENTS

The goals of this WWOP are to establish operating procedures for the NCWPCP facilities while the new South Battery is under construction (2009 to 2012):

- maximize treatment of wet weather flows and thereby minimize pollution of the receiving waters,
- maintain the stability and efficiency of the facility during wet weather events,
- facilitate recovery of dry weather operation and performance following a wet weather event.

1.4 WET WEATHER CAPACITY – EFFECTS OF UNITS IN SERVICE

Based on the physical capacities of equipment and other units at the Newtown Creek WPCP, the actual wet weather hydraulic conveyance capacity will vary depending on the number of available units in service.

1.4.1 Bar Screens

The minimum hydraulic capacities of the bar screens in the Brooklyn/Queens and Manhattan Headworks are shown in Table 1-3.

Table 1-3: Minimum Hydraulic Capacity of Bar Screens in the Brooklyn/Queens and Manhattan Headworks

Location	Number of Bar Screens	Number of Bar Screens in Service	Minimum Total Flow Capacity, MGD
Brooklyn/Queens	4	1	78
		2	155
		3	232
		4	310
Manhattan	4	1	78
		2	155
		3	232
		4	310

1.4.2 Pumping Station

The minimum hydraulic capacity at the North and Central Batteries of the Newtown Creek WPCP is limited during the construction of the South Battery and the upgrades of the Brooklyn-Queens and Manhattan Pump Stations by either the available pumping capacity or the number of units in operation in the North and Central Batteries (See Section 1.4.3).

Table 1-4 below summarizes each stage in the pump station upgrades, the number of pumps installed, the number of existing and new pumps operating, the flows from each pump station, and the minimum total plant flow, which includes internal plant recycle flows.

Table 1-4: Minimum Pumping Capacity During Pump Station Upgrades[1]

Upgrade Stage (Period)	Brooklyn/Queens Pump Station						Manhattan Pump Station						Total Plant Flow (MGD)[3]	Adjusted Raw Influent Flow[4,5,6,7]
	Total No. of B/Q Pumps	No. Existing Pumps Operating / No. Available	Existing Pump Flow (MGD)	No. New Pumps Operating / No. Available	New Pump Flow (MGD)	Total B/Q PS Flow (MGD)	Total No. of Man Pumps	No. Existing Pumps Operating / No. Available	Existing Pump Flow (MGD)	No. New Pumps Operating / No. Available	New Pump Flow (MGD)	Total Man. PS Flow (MGD)		
1	5	5/5	325	0/0	0	325	3	3/3	300	0/0	0	300	625	608
2	5	5/5	325	0/0	0	325	4	3/3	220	1/1	100	320	645	628
3	4	4/4	260	0/0	0	260	4	3/3	220	1/1	100	320	580	563
4	4	4/4	260	0/0	0	260	4	2/2	140	2/2	200	340	600	583
5	4	3/3	195	1/1	80	275	4	2/2	140	2/2	200	340	615	598
6	4	3/3	195	1/1	80	275	4	1/1	40	3/3	300	340	615	598
7	4	2/2	130	2/2	160	290	4	1/1	40	3/3	300	340	630	613
8	4	2/2	130	2/2	160	280[2]	4	0/0	0	4/4	400	400	690[2]	673
9	4	1/1	65	3/3	240	290[2]	4	0/0	0	4/4	400	400	680[2]	663
10	4	1/1	65	3/4	240	280[2]	5	0/0	0	4/5	400	400	680[2]	663
11	4	0/0	0	3/4	280	280[2]	5	0/0	0	4/5	400	400	680[2]	663
12	5	0/0	0	3/5	280	280[2]	6	0/0	0	4/5	400	400	680[2]	663

[1] The pumping capacity for each pump is based on the name plate rated capacity at average wet well level.

[2] Plant flow is temporarily limited by hydraulic capacity rather pumping capacity due to NC-47 construction activities

[3] Total plant flow includes internal plant recycle flows

[4] Adjusted raw influent flow was computed by subtracting the average internal and external recycle flows from the total plant flow

[5] External recycle flows from Feb. 2009 through Sep. 2009 were calculated using the correction factor and recycle flows from Oct. 2009 onwards were measured. The measured values were used to calculate capacity.

[6] External recycle flows from Oct. 2009 through Jan. 2010 averaged of 6.8 ± 3.2 MGD.

[7] Internal recycle flows from Mar. 2009 through Feb. 2010 averaged of 10.1 ± 0.9 MGD.

1.4.3 Batteries (Grit Tanks, Aeration Tanks, Final Sedimentation Tanks)

Table 1-5 below is a matrix of minimum hydraulic capacities in an individual battery (North or Central) dependent upon the number of Grit Tanks, Aeration Tanks, and Final Sedimentation Tanks in operation in that battery. The rows represent the number of aeration tanks in service in the battery and the columns represent the number of grit tanks or final sedimentation tanks in service, whichever is less.

Table 1-5: Minimum Hydraulic Capacity Per Battery (MGD)

	Grit Tanks or Final Sedimentation Tanks in Service[1,]							
Aeration Tanks in Service	1	2	3	4	5	6	7	8
1	39	78	78	78	78	78	78	78
2	39	78	106	155	155	155	155	155
3	39	78	106	155	194	232	232	232
4	39	78	106	155	194	232	271	310

.1- Utilize the fewer number of units between the grit tanks or final clarifiers.

The total minimum hydraulic capacity at any upgrade stage can be determined utilizing both Tables 1-4 and 1-5. Table 1-5 is utilized to determine the North and Central Battery Capacities. When an aeration tank is taken out of service, the flow to the battery will be reduced by closing the gates in the grit tank uptake shaft feeding the two grit tanks near the aeration tank taken out of service. Therefore, the aeration tank and its two corresponding grit tanks would be out of service at the same time. The plant flow will be distributed by way of the splitter box to the remaining units in service in both batteries. However, due to the feed configuration to each battery, the plant may not be able to balance the flow adequately to each remaining aeration tank in service for both batteries. This could significantly increase the loading on the remaining three aeration tanks in the battery, potentially impacting secondary treatment performance and effluent quality in the battery. Therefore, the total minimum hydraulic capacity for the plant when an aeration tank is taken out of service will be determined by using Table 1-5 for the battery with the lower capacity and multiplying by two. When grit tanks or final sedimentation tanks are taken out of service, the same method should be used to determine the total minimum hydraulic capacity. The total minimum hydraulic battery capacity is then compared to the total plant flow in Table 1-4 for the corresponding pump station upgrade stage. The lower of the two flows represents the minimum total plant hydraulic flow.

For example, if an aeration tank is taken out of service from the North Battery, the total minimum hydraulic capacity for both batteries would be 2*232 = 464 MGD according to Table 1-5. Under Pumping Stage 3 conditions, the pumping capacity is 580 MGD. Therefore, the minimum hydraulic plant capacity would be 464 MGD.

1.4.4 Chlorine Contact Tanks

The hydraulic capacities of the chlorine contact tanks (CCTs) at the minimum required detention time for disinfection of 15 minutes are shown in Table 1-6. With all three CCTs in service, the detention time at 700 MGD is 16.7 minutes.

Table 1-6: Chlorine Contact Tank Capacity for a 15-Minute Detention Time

Number of Chlorine Contact Tanks	Number of Chlorine Contact Tanks in Service	Flow Capacity, MGD
3	1	259
3	2	518
3	3	700*

*Maximum plant influent flow.

1.5 PURPOSE OF THIS PLAN

The purpose of this WWOP is to provide guidance to the NCWPCP operating personnel to assist them in making operational decisions, which will best meet the 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. Each storm event produces a unique combination of flow patterns and plant conditions. In spite of the unique nature of individual wet weather events, this plan can serve as a useful reference, which both new and experienced operators can utilize during wet weather events. The plan can be useful in preparing for a coming wet weather event, as a source of ideas for controlling specific processes during a storm and a checklist to avoid missing critical steps in the control of processes during wet weather.

1.6 USING THIS PLAN

Section 2 of this plan is designed to allow for use as a reference tool during wet weather events for the existing NCWPCP. It is broken into subsections that cover major unit processes. Each subsection describes protocols for operation of the subject unit process and includes the following information:

- **Before wet weather:** Describes typical operations, steps to prepare for a wet weather event, as well as staff responsible for these steps.
- **During wet weather:** Describes actions to take during a wet weather event and staff responsible for them.
- **After wet weather:** Discusses action to take subsequent to a wet weather event and staff responsible.
- **Why we do this?:** Discusses why these steps are performed.
- **What triggers the change?:** Identifies conditions or circumstances that trigger the recommended change during wet weather events.
- **What can go wrong?:** Identifies potential problems that operators may encounter in the specific process during a wet weather event.

Section 3 – "Remaining Planned Track 3 Plant Upgrades" identifies the remaining improvements to be implemented at the plant as part of the Track 3 Upgrade. The improvements are presented in the order in which they are scheduled to be completed and available for service.

1.7 REVISIONS TO THIS PLAN

In addition to revisions based on plant operating experience, this plan will also be revised as modifications are made to the NCWPCP that effect the plant's ability to receive and treat wet weather flows. This facility is currently undergoing a complete upgrade to secondary treatment. As required by the Judgment, specific procedures based on actual operating experience for the upgraded facilities will be provided in a revised WWOP, which will be issued following certification by the DEC that the facility is in compliance with secondary treatment limits in accordance with Appendix A-2 of the Judgment.

2.0 EXISTING FACILITY WET WEATHER OPERATION PROCEDURES AND GUIDELINES

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. Also addressed are the bases for the protocols (Why do we do this?), events or observations that trigger the protocols (What triggers the change?), and a discussion of potential problems (What can go wrong?).

2.1 INFLUENT THROTTLING GATES

2.1.1 Equipment

UNIT PROCESS	EQUIPMENT
Brooklyn/Queens Pump Station Influent Throttling Gate	1 – pneumo electro-hydraulic influent throttling gate with both remote and local control
Manhattan Pump Station Influent Throttling Gate	2 – pneumo hydraulic influent throttling gates with remote control

2.1.2 Wet Weather Operating Protocol for the Brooklyn/Queens Headworks

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Monitor local online weather reports. • Influent gate is parked within six inches of normal operating level. • Monitor influent wastewater elevation in the wet well downstream of the bar screens via level indicators. Track the wet well level on control panel readout. • The wet well elevation is continuously monitored and recorded by a circular chart. • The wet well and screenings channel elevation is normally approximately -16 ft.
During Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• During a wet weather event, pump up to the capacity of the pump station before use of the influent throttling gate. Table 1-4 shows the pumping capacity of the

		Brooklyn/Queens Pump Station during various stages of construction. • Supervisor (Watch Engineer) determines the number and speed of the main sewage pumps that must be operated in order to maintain a wet well elevation of approximately -16 feet. • Pump the Brooklyn/Queens influent flow up to the maximum pumping capacity of the Brooklyn/Queens Pump Station or the difference between the maximum plant flow capacity with process units out of service and the Manhattan Pump Station pumping capacity, whichever is lower. Then, continue operation of pumps and begin to close the influent throttling gate while maintaining the maximum flow capacity to the pump station, the difference between the maximum plant flow capacity with process units out of service and the Manhattan Pump Station pumping capacity, whichever is lower. Visually monitor influent flow in the in-service channels.
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• As the wet well wastewater elevation decreases below elevation of -16 feet with the pumps operating, open the throttling gate to normal operation height. • Reduce the number of main sewage pumps while maintaining a wet well elevation of approximately -16 feet.
Why do we do this?		
Prevent flooding of bar screens/channels and screen room, while maximizing flow into the plant for secondary treatment. This is also performed to minimize regulator overflow.		
What triggers the change?		
High flow rates, as determined from monitoring the wet well level. The wet well and screenings channel elevation is normally approximately -16 ft.		
What can go wrong?		
Flooding due to bar screens, pumps, and/or influent throttling gate failure.		

2.1.3 Wet Weather Operating Protocol for the Manhattan Headworks

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Monitor local online weather reports. • Influent gate is parked within six inches of normal water surface elevation. • Monitor influent wastewater elevation in the wet well upstream of the bar screens via level indicators. Track the wet well level on control panel readout. • Track the wet well level on control panel readout. • The wet well elevation is continuously monitored and recorded by a circular chart. • The wet well and screenings channel wastewater elevation is normally approximately -27 feet.
During Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• During a wet weather event, pump up to the capacity of the pump station before use of the influent throttling gates. When the throttling gate is used, maintain the maximum flow capacity of the pump station. Table 1-4 shows the minimum pumping capacity of the Manhattan Pump Station during various stages of construction. • Supervisor (Watch Engineer) determines the number and speed of the main sewage pumps that must be operated in order to maintain a wet well elevation of approximately -27 feet while maintaining the maximum flow capacity of the pump station. • Once the Manhattan influent flow reaches the maximum pumping capacity of the pump station, continue operation of pumps and begin to close the influent throttling gates to maintain a wet well elevation

		of approximately -27 feet. Visually monitor influent flow in the in-service channels.
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• As the wet well wastewater elevation decreases below elevation of approximately -27 feet with the pumps operating, open the throttling gates to normal operation height. • Reduce the number of main sewage pumps while maintaining a wet well elevation of approximately -27 feet.
Why do we do this?		
Prevent flooding of bar screens/channels and screen room, while maximizing flow into the plant for full secondary treatment. This is also performed to minimize regulator overflow.		
What triggers the change?		
High flow rates, as determined from monitoring the influent wet well level. The wet well elevation is normally approximately -27 feet.		
What can go wrong?		
Flooding due to bar screens, pumps, and/or influent throttling gate(s) failure.		

2.2 MAIN WASTEWATER SCREENS

2.2.1 Equipment

UNIT PROCESS	EQUIPMENT
Bar Screens – Brooklyn/Queens Headworks	4 - bar screens 1 – large compacted screenings holding bin
Bar Screens – Manhattan Headworks	4 - bar screens 1 - Screenings conveyor 2 - screenings bins (1 spare for change-out)

2.2.2 Wet Weather Operating Protocol for the Brooklyn/Queens Headworks

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	*Bar screen rakes normally set for automatic timed operation, making approximately 4 cleaning cycles per hour.* *Two of the four bar screens are normally in service, corresponding to the influent channels in use.* *Which of the four channels/screens to use is decided by the supervisor.* *Visually inspect equipment and confirm that cleaning rakes are meshing with bar racks and are operating properly.* *Visually monitor receiving bin level periodically. When full, empty container via forklift into large holding bin.* *Visually check the large screenings holding bin and notify supervisor when 75% full.* *Supervisor (Watch Engineer) calls contractor for bin change-out.*
During Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• All wet weather events require an increase in screenings and channel monitoring from two times per eight hours to continuous monitoring. • Manually switch bar screen rakes to continuous cleaning "hand" operation at the local control panel for each unit (1.5-2 minutes per cycle in continuous cleaning mode). • Monitor discharge receiving bin level. • When receiving bin is full, empty bin

		into large contractor bin using forklift. • Return receiving bin and shovel any screening that discharged to the floor during emptying back into the bin. • Monitor the large contractor bin, notify supervisor when approaching 75% full for bin to be called in to the contractor for change-out. • Visually inspect equipment. Confirm that cleaning rakes are properly meshing with bar screens, and screens have not blinded and are operating properly. • If blinding of bar screen occurs, notify supervisor and close influent gate to the blinded screen until screen is cleared and/or high flows decrease.
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Manually switch bar screen rakes from continuous back to automatic intermittent cleaning, at local control panel. • If the large holding bin is 75% or more full, contact the contractor for change-out. • Shovel screenings that may have overflowed the compactor receiving bins back into the bins.
Why do we do this?		
Protect downstream raw wastewater pumps from damage by large objects.		
What triggers the change?		
High flow rates, as determined from monitoring raw wastewater pumps influent wet well level and rising level of flow in bar screen channels.		
What can go wrong?		
Cleaning rake overtravel/overload, or cleaning rake does not mesh with bar screen and rides over collected screenings, resulting in screen blinding. Screenings overflow receiving bins. Flooding bar screen channels, pump, and/or influent throttling gate failure.		

2.2.3 Wet Weather Operating Protocol for the Manhattan Headworks

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	*Bar screen rakes normally set for automatic timed operation, making approximately 4 cleaning cycles per hour.* *Two of the four bar screens are normally in service, corresponding to the influent channels in use.* *Which of the four channels/screens to use is decided by the supervisor.* *Visually inspect equipment and confirm that cleaning rakes are meshing with bar racks.* *Visually monitor conveyor periodically.* *When full, empty container via forklift into large holding bin.* *Visually check the screenings holding bin and notify supervisor when 75% full.* *Supervisor (Watch Engineer) calls contractor for bin change-out.*
During Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• All wet weather events require an increase in screenings and channel monitoring from two times per eight hours to continuous monitoring. • Manually switch bar screen rakes to continuous cleaning "hand" operation at the local control panel for each unit (1.5-2 minutes per cycle in continuous cleaning mode). • When receiving bin is full, empty bin into large contractor bin using forklift. • Return receiving bin and shovel any screening that discharged to the floor during emptying back into the bin. • Monitor the large contractor bin, notify supervisor when approaching 75% full for bin to be called in to the contractor for change-out. • Visually inspect equipment. Confirm that cleaning rakes are properly meshing with bar screens and screens have not blinded. • If blinding of bar screen occurs, notify supervisor and close influent

		gate to the blinded screen until screen is cleared and/or high flows decrease.
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Manually switch bar screen rakes from continuous back to automatic intermittent cleaning, at local control panel. • If the large holding bin is 75% or more full, contact the contractor for change-out.
Why do we do this?		
Protect downstream raw wastewater pumps from damage by large objects.		
What triggers the change?		
High flow rates, as determined from monitoring raw wastewater pumps intake wet well level and rising level of flow in bar screen channels.		
What can go wrong?		
Cleaning rake overtravel/overload, or cleaning rake does not mesh with bar screen and rides over collected screenings, resulting in screen blinding. Screenings overflow receiving bins. Flooding bar screen channels, pump, and/or influent throttling gate failure.		

2.3 INFLUENT WASTEWATER PUMPING

2.3.1 Equipment

UNIT PROCESS	EQUIPMENT
Influent Pump Station – Brooklyn/Queens (B/Q) Headworks	1 – screened influent wet well 1 – wet well level sensor *4 to 5 - variable speed pumps* (See Section 1.4.2) 1 - venturi flow meter, pump discharge-side with existing pumps in service 1 – new Mag Meter for each new installed pump on discharge side 1 – influent throttling gate
Influent Pump Station – Manhattan Headworks	1 – screened influent wet well 1 – wet well level sensor 4 to 5 – variable speed pumps (See Section 1.4.2) 1 - venturi flow meter, pump discharge-side until the first new pump is installed 2 – influent throttling gates

2.3.2 Wet Weather Operating Protocol for the Brooklyn/Queens Pump Station

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Monitor wet well elevation. • Select and manually adjust in the pump control room the number and speed of pumps in service based on maintaining wet well level within desired operating level (approximately -16 feet) • Monitor pumped flow based on wet well level, pumps in service and speed and via digital read-outs from venturi meters until the first new pump in the Manhattan Pump Station is installed. Then, use only the B/Q Pump Station readout. • B/Q pump station has a read-out of both B/Q and Manhattan pumped flow measured by the existing venturi meters. • Normally, there is no communication

		between B/Q and Manhattan Pump Stations (PSs). Operations pumping decisions are made independently for each PS. The only form of information exchange between pump stations is the Manhattan pumped flow read-out in the B/Q control room for the existing pumps only.
During Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Monitor wet well elevation. • As the wet well level rises, place pumps in service and increase speed of variable speed pumps as necessary to maintain a wet well wastewater elevation of approximately -16 feet. • Pump to maximum capacity of the pumping station or the difference between the maximum plant flow capacity with process units out of service and the Manhattan Pump Station pumping capacity, whichever is lower. • All adjustments are made manually by Operator (STW/SSTW) in the pump control room based on maintaining wet well level within desired operating range. • Restrict flow through influent throttling gate if pumping rate is maximized and wet well level continues to rise (see Section 2.1.2 for influent throttling gate operations).
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Maintain pumping rate as required to keep wet well level at the operating level. • If influent throttling 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. • Reduce pump speeds and number in service to maintain wet well level and

		return to dry weather operation.
Why do we do this?		
Maximize flow to treatment plant, and minimize need for flow storage in collection system and associated storm overflow from collection system into river.		
What triggers the change?		
High flows.		
What can go wrong?		
Pump fails to start. Pump fails while running. Screens blind, necessitating pump speed reduction or shutdown.		

2.3.3 Wet Weather Operating Protocol for the Manhattan Pump Station

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Monitor wet well elevation. • Select and manually adjust in the pump control room the number and speed of pumps in service based on maintaining wet well level within desired operating range (below approximately - 27 feet). • Monitor pumped flow based on wet well level, pumps in service and speed and via digital read-outs from venturi meters until the first new pump in the Manhattan Pump Station is installed. Then calculate/estimate total Manhattan Pump Station flows by subtracting the B/Q flow from the total plant flow or using pump and horsepower draw curves. • Manhattan pump station has a read-out of the Manhattan pumped flow only from discharge venturi meter. • Normally, there is no communication between B/Q and Manhattan Pump Stations. Operations pumping decisions are made independently for each PS. The only form of information exchange between pump stations is the Manhattan pumped flow read-out for existing pumps in the B/Q control room.
During Wet Weather Event		
Shift Supervisor	Operator (STW/SSTW)	• Monitor wet well elevation.

(Watch Engineer)		• As the wet well level rises, place pumps in service and increase speed of variable speed pumps as necessary. • Pump a minimum of 300 MGD during a wet weather event. • All adjustments are made manually by Operator (STW/SSTW) in the pump control room based on maintaining wet well level within desired operating range. • Restrict flow through influent throttling gates if pumping rate is maximized and wet well level continues to rise (see Section 2.1.3 for influent throttling gate operations).
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Maintain pumping rate as required to keep wet well level in operating range. • If influent throttling gates have been throttled, maintain maximum pumping rate until all previously constricted influent throttling gates are returned to fully open position and flow begins to decrease lowering wet well level. • Reduce pump speeds and number in service to maintain wet well level and return to dry weather operation.
Why do we do this?		
Maximize flow to treatment plant, and minimize need for flow storage in collection system and associated storm overflow from collection system into river.		
What triggers the change?		
High flows.		
What can go wrong?		
Pump fails to start. Pump fails while running. Screens blind, necessitating pump speed reduction or shutdown.		

2.4 GRIT REMOVAL

2.4.1 Equipment

UNIT PROCESS	EQUIPMENT
Grit Removal	16 – Grit Tanks (8 per battery) 32– Circular grit collector mechanisms with rotating rake arms (2 per Grit Tank) 32 – Grit pumps (1 operating and 1 standby per Grit Tank). 4 – Grit Houses 16 – Cyclone degritters 4 – grit classifiers 8 – roll-off containers (4 cyclone degritters, 1 grit classifier and 2 roll-off containers per Grit House).

2.4.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• All detritors, associated grit pumps, grit cyclones and classifiers in service are operated continuously. Monitor by visual observation. • Monitor detritor grit collector torque and grit pump discharge pressure.
During Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Monitor the grit roll-off containers. Notify Supervisor (Watch Engineer) when approaching 75% full and request additional containers, as determined by Supervisor. • Operate up to 4 Grit Houses as determined by Supervisor based on plant experience. • Maintain a maximum number of detritors on line in accordance with Section 1.4.3.
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• No action required.
Why do we do this?		

Protect downstream mechanical equipment and pumps from abrasion and accompanying abnormal wear. Prevent accumulation of grit in aeration tanks.
What triggers the change?
No Change.
What can go wrong?
Detritor grit collector torques out or grit pumps fail. Grit cyclone and/or classifier fail. Clogging of grit in the grit collection system.

2.5 AERATION TANKS

2.5.1 Equipment

UNIT PROCESS	EQUIPMENT
Aeration Tanks (ATs)	8 – 4-pass aeration tanks (2 batteries of 4 ATs) 2- Aeration tank influent channels (1 per battery) 32 – Automatic step-feed gates (4 gates per aeration tank)

2.5.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Currently, normal operation involves aeration influent flow split between the four passes as required. Adjustments to influent feed (pass) gates are made by staff, as necessary. • Set the operation of the influent pass gates to automatic. • RAS is sent to pass A.
During Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Flow rates determine aeration tank influent pass gate settings automatically ○ When influent flow exceeds 400 MGD, open the D pass gate to 100% and then close the B pass gate.
After Wet Weather Event		

Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Gate positions reset automatically, based on operator prompt.
		    ○ When the influent flow to the tank drops below 300 MGD, open the B pass step feed gates and wait a minimum of 2 hours.
		    ○ At the end of 2 hours, return Pass D gate to its original pre-Wet Weather event setting.

Why do we do this?		

Gate positions are automatically set to park solids to prevent solids washout in the final tanks.
What triggers the change?
High flows. Increasing speed and/or starting additional raw wastewater pumps to accommodate high wet weather flows.
What can go wrong?
Gate failure. Gates not in automatic mode.

2.6 FINAL SEDIMENTATION TANKS

2.6.1 Equipment

UNIT PROCESS	EQUIPMENT
Final Sedimentation Tanks (FSTs)	16 – sedimentation tanks (8 per battery) 8 – common system RAS pumps (4 per battery) 8 – common system WAS pumps (4 per battery) 96 – chain-and-flight collectors (2 per FST bay) 16 – sludge trough cross-collectors (1 per FST) 16 – common system telescoping sludge flow control valves (1 per FST) 2 – scum pits (1 per battery) 8 – scum pumps (4 per battery) 2 – RAS/WAS wet wells 2 – RAS splitter boxes 3 – Polymer Metering Pumps

2.6.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Currently, normal operation involves all FSTs in-service • Common influent channel allows for all FSTs to be in service even if an aeration tank is out of service. • Scum is removed periodically through scum gates. • Scum discharges to a scum pit, one for each battery of FSTs. • RAS flow rate is manually set (constant) as directed by the process engineer or automatically flow paced according to plant influent flow. Automatic flow pacing should include a maximum RAS flow rate. • WAS flow rate is set as directed by the process engineer. • RAS flow rates are controlled based on pump speed and number in service

		or wet well elevation. • WAS flow rates are controlled based on pump speed and number in service. • Check telescoping valves for clogging with rags and other debris and clean debris as necessary.
During Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• No changes currently made to final sedimentation tank operations schedule during wet weather event. • Check telescoping valve for clogging with rags and other debris and clean debris as necessary. • Disable the automatic scum removal system.
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Modify sludge wasting based on MLSS concentrations if necessary. • Check telescoping valve for clogging with rags and other debris and clean debris as necessary. • Observe effluent quality. • Skim clarifiers as necessary. • Enable the automatic scum removal system.
Why do we do this?		
High flows will substantially increase solids loading to the clarifiers and may result in high effluent TSS. These conditions can lead to loss of biological solids, which may reduce treatment efficiency when the plant returns to dry weather flow conditions.		
What triggers the change?		
High flows -- increasing speed and/or starting additional raw wastewater pumps to accommodate high wet weather flows. .		
What can go wrong?		
Solids washout. Pump failure. Telescopic valve failure. Chain and flight motor failure, or chain and flight link failure.		

2.7 EFFLUENT CHLORINATION

2.7.1 Equipment

UNIT PROCESS	EQUIPMENT
Effluent Chlorination	3 – Chlorine Contact Tanks (CCTs) 6- Hypochlorite metering pumps (3 stand-by) 6- Hypochlorite storage tanks 6- Induction mixers (3 stand-by) 2- Chlorine dosing analyzers 1- Effluent analyzer

2.7.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• All three CCTs are normally in service except for tank cleaning or maintenance • Each CCT normally will have one induction mixer (for the hypo dosing point) and one dual-head metering pump in service for each CCT • The chlorine dosage is normally automatically adjusted to maintain a target residual with a flow paced residual trim control strategy • A target chlorine residual is maintained with the detention time of the three CCTs to achieve adequate fecal coliform kills • The shift supervisor can monitor the residual remotely with the PMCS, but the operator makes any changes locally • Hypochlorite storage capacity should be maintained to insure adequate chemical is available for any sized storm event • Skim the manual scum collection area through the scum weirs as needed.
During Wet Weather Event		
Shift Supervisor	Operator (STW/SSTW)	• All three CCTs are needed to

(Watch Engineer)		maintain a minimum 15 minute detention time during larger storm events. Therefore, all CCT maintenance should be scheduled around storm events, or will need to go back on-line if one is off and a storm event begins. • The pumping range for the metering pumps requires one stroke setting for normal flow and a longer stroke setting for storm events (250 MGD dry weather, 500 MGD wet weather). The operator will make the change as the flow increases. • Increase the residual set point as needed to maintain the effluent chlorine residual in order to achieve adequate disinfection.
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Return stroke rate and residual set point to the normal setting.
Why do we do this?		
To maintain chlorine residual and coliform kills.		
What triggers the change?		
High flows will require higher dosing.		
What can go wrong?		
Chlorine dose/metering pump failure. Automated system failure. Mixer failure.		

2.8 EFFLUENT DISCHARGES TO THE EAST RIVER AND WHALE CREEK

Table 2-1 below shows the effluent flow splits between India Street (East River) and Whale Creek for tidal variances. The flow splitting is based on hydraulics and does not require operator control.

Table 2-1: INDIA STREET/WHALE CREEK CANAL OUTFALL EFFLUENT FLOW SPLIT					
Tide Elevation @ East River, feet	Plant Flow, MGD				Outfall Location
	180	310	465	700	
Mean Low Elevation -4.86	180	310	465	611	India Street
	0	0	0	89	Whale Creek
Mean Average Elevation -2.73	180	310	465	550	India Street
	0	0	0	150	Whale Creek
Mean High Elevation -0.68	180	310	465	485	India Street
	0	0	0	215	Whale Creek
25-year Flood Elevation +4.6	172	196	222	265	India Street
	8	114	243	435	Whale Creek
NOTE: Elevations are based on the Borough of Brooklyn Highway Datum, which is 2.56 feet above mean sea level at Sandy Hook, New Jersey					

2.9 SOLIDS HANDLING: THICKENING

The waste activated sludge may be thickened using the thickening centrifuges, existing GTs or a combination of the two.

2.9.1 Equipment

UNIT PROCESS	EQUIPMENT
Waste Activated Sludge Thickening	20 – Thickening centrifuges 4 – Post-thickening centrifuges 4 – Centrifuge Feed Pumps 12 – Centrifuge Thickened Sludge Pumps 20 – Polymer Metering Pumps 9- Sludge grinders

2.9.2 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• Operate the number of centrifuges required to thicken WAS pumped from the RAS/WAS Wet Well.
During Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• No changes currently made to thickening operations for wet weather event.
After Wet Weather Event		
Shift Supervisor (Watch Engineer)	Operator (STW/SSTW)	• No changes currently made to normal thickening operations.
Why do we do this?		
N/A – no changes currently made for wet weather event.		
What triggers the change?		
N/A – no changes currently made for wet weather event.		
What can go wrong?		
Solids washout. WAS, centrifuge feed, thickened sludge and centrate pump failure. Polymer metering pump failure. Sludge characteristics may change requiring change in centrifuge settings.		

2.9.3 Equipment

UNIT PROCESS	EQUIPMENT
Gravity Thickening (GT)	8 – Gravity Thickeners 16 – Thickened Sludge Pumps 16 – Sludge Grinders

2.9.4 Wet Weather Operating Protocol

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
Shift Supervisor	Operator	• Typically six of the available eight GTs are in service, set up in two batteries with 4 GTs per battery. Each GT battery is paired with an AT/FST battery. • Approximately 2 MGD (not metered, plant operations estimate) of plant water is taken from FST effluent and sent to each battery of GTs, to help maintain high overflow rates and keep the GTs solids fresh. • GTs accept underflow solids wasted from the-RAS/WAS Wet Wells. • Typically, one thickened sludge pump per GT is operated intermittently on a timer with the second pump as a standby. • Timer settings are adjusted if necessary based on solids inventory in the tank.
During Wet Weather Event		
Shift Supervisor	Operator	No changes currently made to GT operations for wet weather event.
After Wet Weather Event		
Shift Supervisor	Operator	No changes currently made to GT operations for wet weather event.
Why do we do this?		
N/A – no changes currently made for wet weather event.		
What triggers the change?		
N/A – no changes currently made for wet weather event.		
What can go wrong?		
Solids washout. GT collector mechanism failure. Thickened sludge pump failure. Plant water pump failure.		

3.0 REMAINING PLANNED TRACK 3 PLANT UPGRADES

The NCWPCP is undergoing major capital improvements as defined in the Track 3 Facility Plan to meet secondary treatment limits and provide a greater degree of flexibility in managing and optimizing wet weather operation and performance. A site plan and process flow diagram for the Track 3 facilities are presented in Figures 3-1 and 3-2 respectively.

At the heart of the Track 3 design is the addition of a new third treatment battery of grit, aeration and sedimentation tanks equal in volume to each of the existing two batteries, increased oxygen transfer capacity, increased RAS and WAS capacity, and solids settleability enhancements including anaerobic selector zones in the aeration tanks and polymer addition to the clarifier influent. The Track 3 design provides a 2-hour HRT at the design average daily flow of 310 MGD and supports operation with a significantly higher average mixed liquor inventory and subsequent higher SRT than the existing system. Numerous additional upgrades are being provided throughout the facility to support the Track 3 process design and provide improved process management and overall system reliability.

This section provides a summary of the remaining major improvements to be implemented as part of the overall plant upgrade.

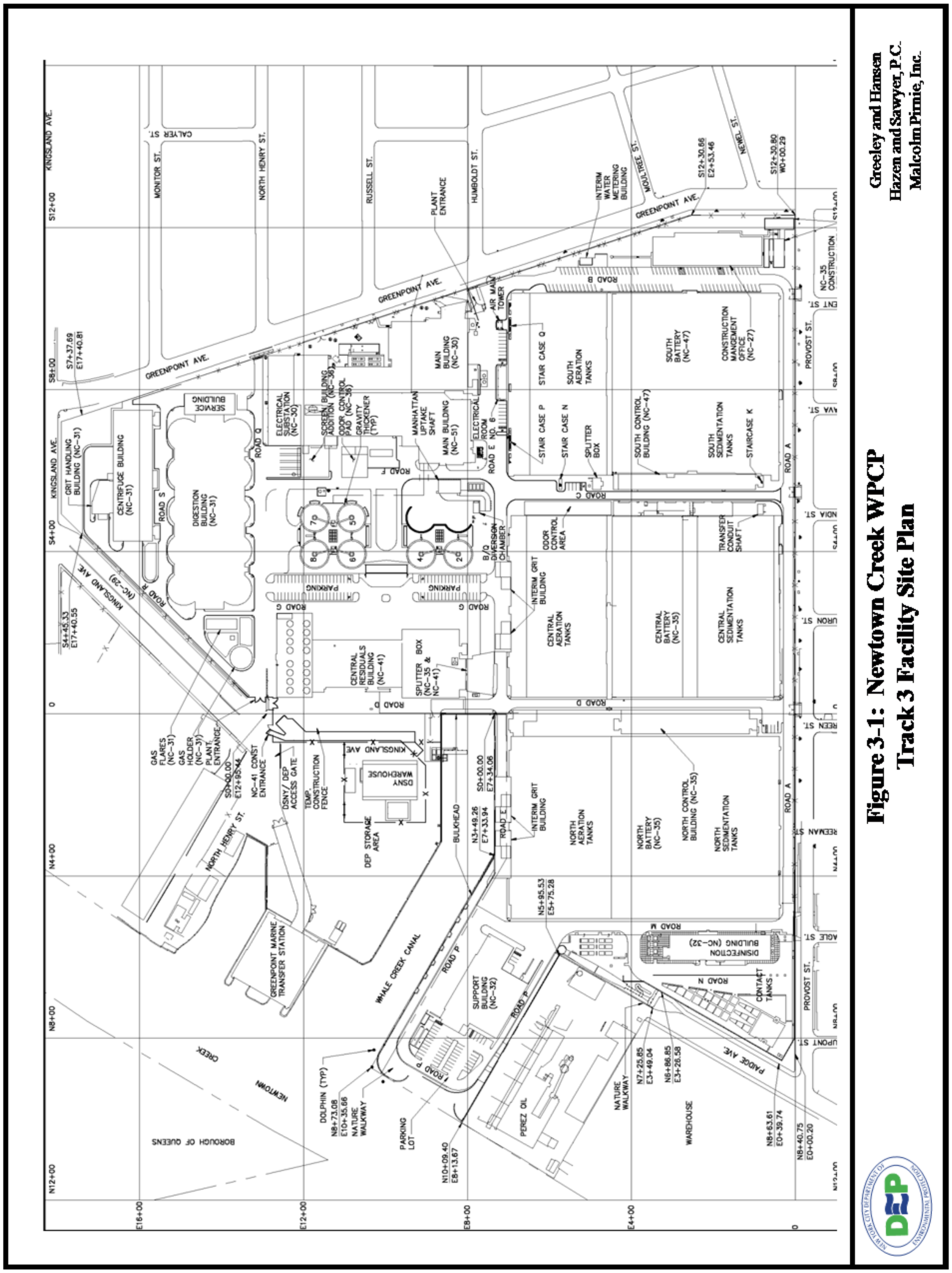

Figure 3-1: Newtown Creek WPCP Track 3 Facility Site Plan

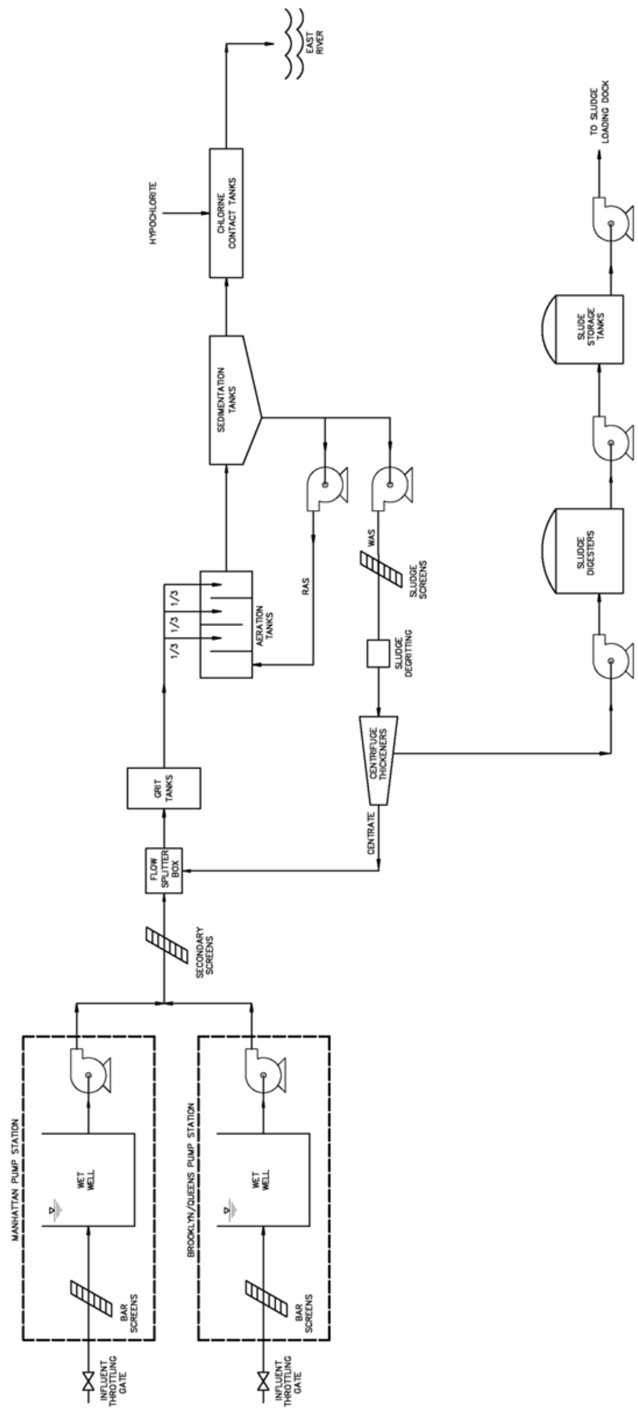

Figure 3-2: Newtown Creek WPCP Track 3 Process Flow Diagram

Greeley and Hansen
Hazen and Sawyer, P.C.
Malcolm Pirnie, Inc.

3.1 NEW AND UPGRADED SECONDARY TREATMENT SYSTEMS

A new South Battery (Grit, Aeration and Sedimentation Tanks), South Control Building, and Air Supply System are to be constructed as part of the remaining Track 3 facility upgrade. The new facilities include the following:

- New South Battery including:
  - Eight detritors for grit removal,
  - Four – four pass step feed, diffused air aeration tanks with anaerobic selector zones and remote operable motorized step feed gates,
  - Eight rectangular final settling tanks with chain and flight sludge collectors, scum skimming, polymer addition and initial flocculation zones.
- New Air Supply System including:
  - Distribution piping and diffuser grids with automated D.O. control systems.
- New South Control Building housing:
  - New RAS and WAS systems including independent sludge wet well and pumps.
  - New odor control system
  - New scum well and scum pumping facility.
  - Complete equipment automation and controls linked to a central process control system in the plant's main control room.

A complete upgrade of the South Battery to match the configuration of the new North and Central Batteries will be completed.

3.2 BROOKLYN/QUEENS PUMP STATION IMPROVEMENTS

The pump station improvements for the new system will provide 300 MGD pumping capacity. The arrangement of all other equipment will be essentially the same as the existing system. Control of all equipment will be linked to the main control room at the plant eliminating the need for local equipment operation during a wet weather event. Local controls will be provided as a backup in the event of a problem with the main control system. The remaining major improvements include:

- Replacement of the 5 existing influent wastewater pumps with new variable speed units. Station firm capacity 300 MGD not including the standby pumps.

- Installation of a new discharge tower downstream of the pump station.

- Replacement of the 4 existing automatically cleaned bar screens with 4 new automatically cleaned units.

- Automation of all equipment based on influent pump wet well level with local and remote (central control room) manual overrides/interface.

The B/Q flow will be routed to the new secondary screens in the new Central Screenings and Residuals Facility.

3.3 MANHATTAN PUMP STATION IMPROVEMENTS

The Manhattan Pump Station improvements for the new system will increase the station pumping capacity from the current 300 MGD to 400 MGD. The arrangement of all other equipment will be essentially the same as the existing system with the exception that the on-site flow meter will be removed and the new meters measuring Manhattan Pump Station flows will be located in the Central Residuals Building. Control of all equipment will be linked to the main control room at the plant eliminating the need for local equipment operation during a wet weather event. Local controls will be provided as a backup in the event of a problem with the main control system. The remaining improvements include:

- Replacement of the 5 existing influent wastewater pumps with new variable speed units with a total firm pumping capacity of 400 MGD not including the standby pump.

- Complete renovation of the facilities above grade.

- Relocation of the main sewage pump meters above the flood plain.

- Automation of equipment based on influent pump wet well level and total station flow with remote (central control room) operating capability and local control with manual override capability.

3.4 SECONDARY SCREENING AND RESIDUALS HANDLING FACILITY

New influent wastewater secondary screening, grit management, scum handling and WAS screening equipment will be provided in a new Central Screening and Residuals Handling Facility. Major equipment to be provided in this facility includes:

- Influent Wastewater Secondary Screening – new secondary screens will be installed to remove rags and other stringy material from the combined plant influent.
    - 12 new 3/8 inch automatic reciprocating rake front cleaned bar screens and channels.
    - 24 motor operated slide gates for bar screen channel isolation.
    - Common influent forebay and effluent afterbay channels.
    - 2 screenings conveyors
    - 8 – 30 cubic yard screenings containers.

- Grit Handling - Grit will be pumped continuously from the grit hopper of each of the new Detritors to the new grit handling system in the Central Screening and Residuals Handling Facility. New grit handling equipment will include:

    - 18 new cyclone grit separators
    - 6 new grit screw classifiers
    - 8 new grit containers

- Waste Activated Sludge Screening – new bar screens will be installed to remove rags and other stringy material from the waste activated sludge. New WAS screening equipment will include:

    - 3 new automatic reciprocating rake front cleaned bar screens and channels.
    - 3 channel influent slide gates and 3 channel effluent weir/slide gates for bar rack channel isolation.
    - Common influent and effluent channels.

- Scum Concentration - Skimmings will be collected from the surface of the sedimentation tanks and sedimentation tank influent channel into a wet well in each battery. The skimmings will be pumped to flotation concentrators in the Central Residuals Handling Facility. Major skimmings handling equipment will include:

    - 3 new concentrating tanks with chain an flight skimming mechanisms
    - 3 skimmings receiving/storage containers

Skimming will be discharged from the concentrators into collection/storage bins to be hauled to offsite disposal. The underflow of the concentrator tanks will discharge by gravity back to the forebay.

3.5 UPGRADE OF SOUTH BATTERY TO TRACK 3 CONFIGURATION

The existing South Battery has been taken out of service entirely for retrofit to Track 3 Configuration. Interim grit and screenings buildings are providing grit and screenings removal until the Residual Handling Facilities comes on line.

APPENDIX B

BOWERY BAY WASTEWATER TREATMENT PLANT WET WEATHER OPERATING PLAN

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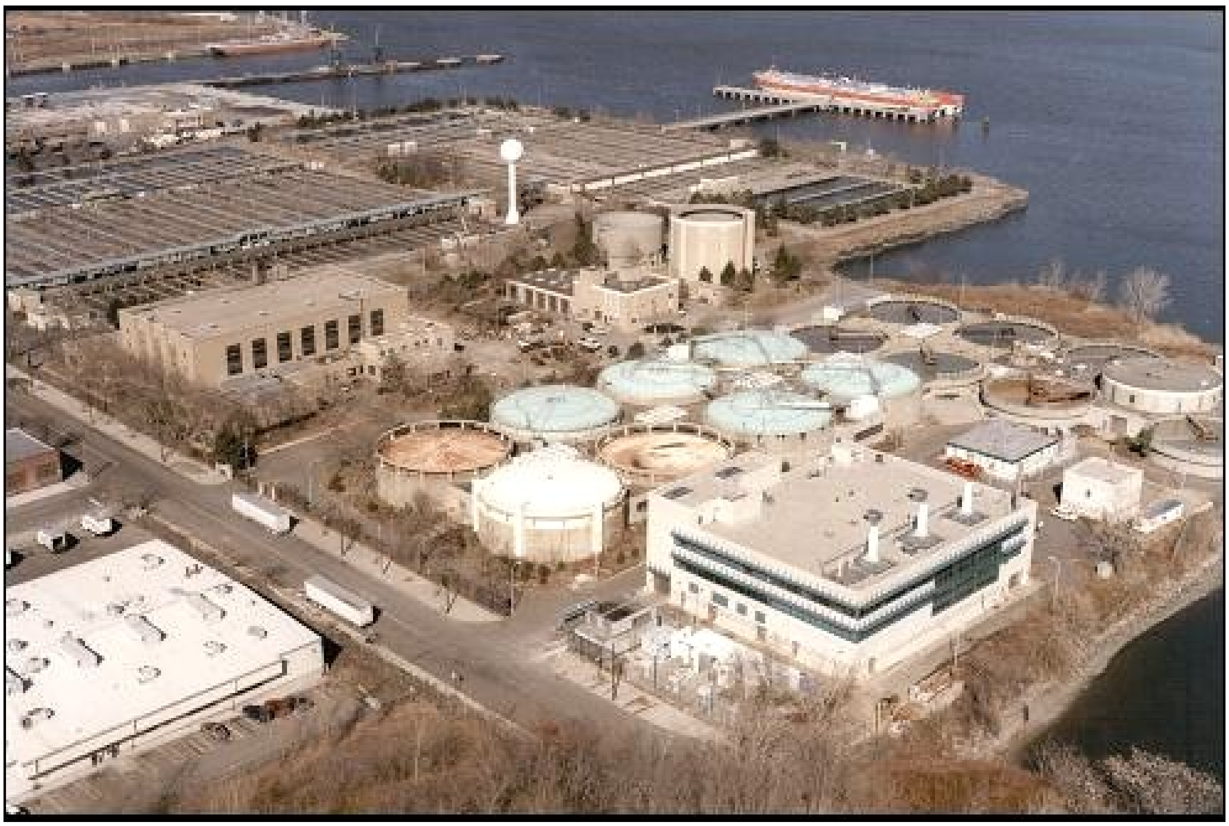
City of New York
Department of Environmental Protection
Bureau of Wastewater Treatment

Bowery Bay
Water Pollution Control Plant
Wet Weather Operating Plan



Prepared by:

The New York City Department of Environmental Protection

Bureau of Wastewater Treatment

March 2009

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1.0 Introduction

The Nitrogen Administrative Order on Consent, DEC Case # CO2-20010131-7 (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 Bowery Bay Water Pollution Control Plant (WPCP) by July 20, 2003. The WWOP shall describe procedures to maximize treatment during wet weather events while the Bowery Bay 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 Bowery Bay 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 Bowery Bay shall be submitted to DEC within 18 months of the completion of the construction of the Facility.

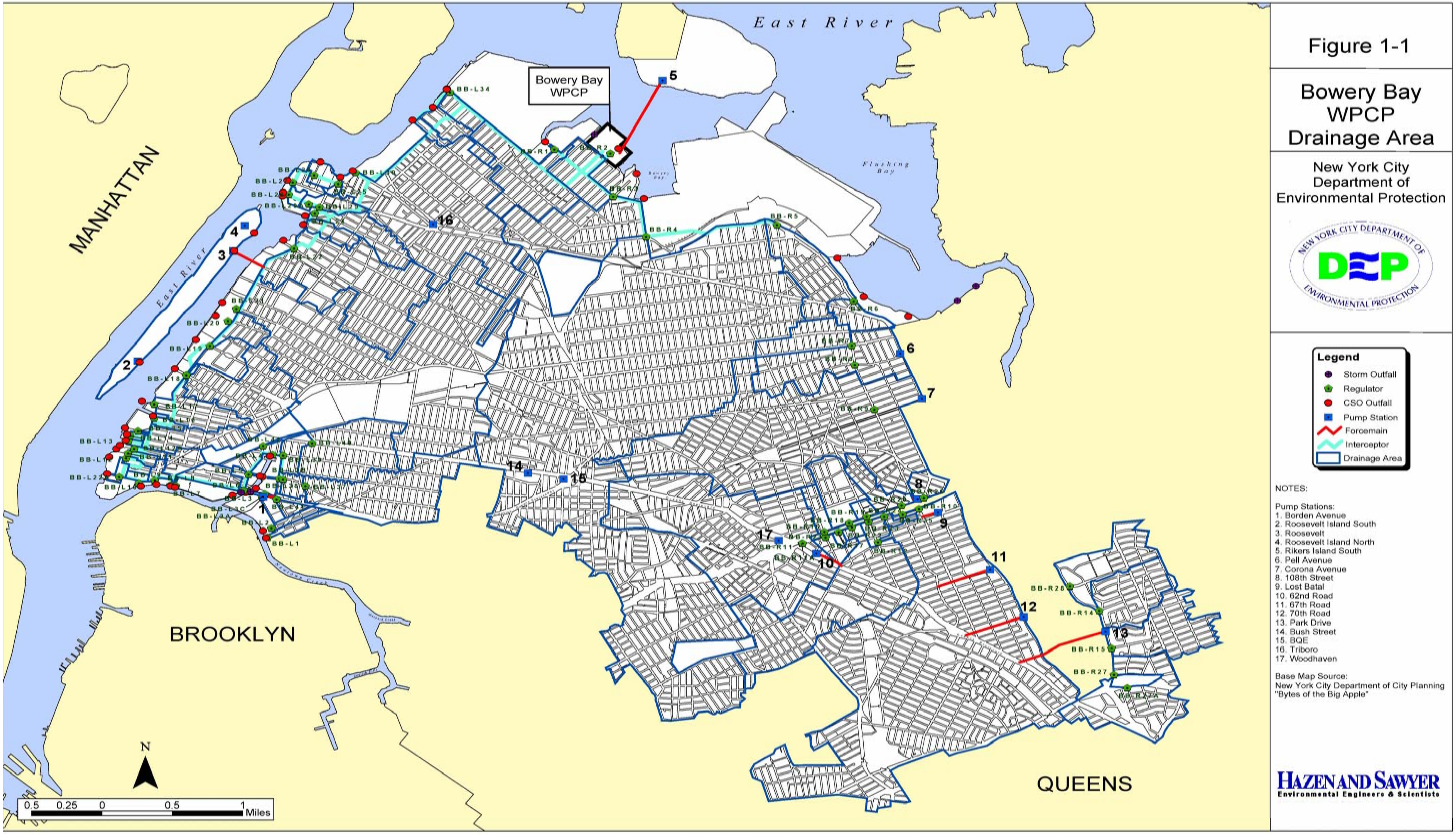
This document contains the WWOP for the Bowery Bay WPCP operation during construction.

1.1 BACKGROUND

The existing Bowery Bay WPCP, located on a 34.6-acre site adjacent to Berrian Boulevard in Astoria, Queens (Figure 1-1) treats wastewater from a 16,105-acre service area in the Borough of Queens of mostly combined sewers that is divided into high level and low level service areas. The high level service area consists of 11,557 acres in the eastern two thirds of the drainage area. The low level service area includes 4,548 acres in the western third of the service area. The flow from the high level and low level service area enters the plant separately.

There are 27 regulators located in the high level service area. Two of these are designed as hydraulic sluice gates. The remaining 25 regulators are weir chambers that will bypass wastewater to a storm sewer whenever the water in the sewer reaches the weir level. The elevations of the weirs were set during the original design to allow a known volume of combined sewage to remain in the interceptors leading to the plant. No control of these regulators is necessary. Three of the weir chambers use tide gates to prevent backflow from the receiving water into the intercepting sewer.

The Corona Avenue Vortex Facility (CAVF) is located in the high level service area near the junction of Corona Avenue and Saultell Avenue, and services a drainage area of approximately 3,730 acres. The facility is located entirely within Corona Avenue and is completely underground and consists of three, 43-ft diameter vortex concentrators that operate in parallel. As a prototype demonstration facility the units were designed to permit one, two or all three units to be operated during wet weather events. The three vortex units represent the following vortex design configurations: the EPA Swirl Concentrator; the Storm King hydrodynamic separator of British design; and the FluidSep vortex separator, of German design. The hydraulic capacity of each vortex unit is approximately 130 million gallons per day (mgd). The peak hydraulic capacity of the overall facility is approximately 400 mgd. The CAVF was not designed to provide end-of-pipe CSO treatment. However, the facility does remove a portion of the floatables and settleable solids that would otherwise be discharged into Flushing Bay through Outfall BB-006. The units remove settleable solids and floatables and discharges these materials through an underflow stream to the 108th Street Pump Station which discharges into the high level interceptor. The overflow from the units is discharged to the BB-006 lower deck sewer which transports it to Flushing Bay through Outfall BB-006. A WWOP for the CAVF facility is attached to this WWOP as Appendix A.


East River
Bowery Bay
WPCP
Flushing Bay
MANHATTAN
East River
BROOKLYN
QUEENS
N
0.5 0.25 0 0.5 1 Miles
Figure 1-1
Bowery Bay
WPCP
Drainage Area
New York City
Department of
Environmental Protection
Legend
Storm Outfall
Regulator
CSO Outfall
Pump Station
Forcemain
Interceptor
Drainage Area
NOTES:
Pump Stations:
1. Borden Avenue
2. Roosevelt Island South
3. Roosevelt
4. Roosevelt Island North
5. Rikers Island South
6. Pell Avenue
7. Corona Avenue
8. 108th Street
9. Lost Batal
10. 62nd Road
11. 67th Road
12. 70th Road
13. Park Drive
14. Bush Street
15. BQE
16. Triboro
17. Woodhaven
Base Map Source:
New York City Department of City Planning
"Bytes of the Big Apple"
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In the low level service area, 44 regulators are used to divert storm water to the East River. These regulators are designed to accept all dry weather flow to the plant, but to limit the flow entering the interceptors and thus reaching the plant during storm conditions. Excess flow from the regulators during storms discharge directly to the East River. The low level regulators consist of three chambers: a diversion chamber, a regulator chamber and a tide gate chamber. A manually or hydraulically operated sluice gate is installed to control the flow between the diversion chamber and the regulator chamber. A tide or flap gate is installed between the division chamber and the tide gate chamber. Under normal dry weather conditions, flow entering the diversion chamber will be diverted to the regulator section and then to the intercepting sewer. During high flows, a surcharge will develop in the diversion chamber, opening the tide gate and allowing the combined waste to be discharged to the East River or its tributaries. The sluice gate controls the volume of flow diverted to the interceptors. The manual sluice gates are set based on determination of the maximum allowable flow. A float located in the regulator section of the sanitary sewer controls the hydraulic sluice gates. The float activates valves on a hydraulic cylinder that raises or lowers the gate. A rising float closes the gate while a falling float opens the gate. City water is used as the hydraulic system fluid. Six diversion and tide gate chambers are provided in the low level service area to bypass flow to the East River should a surcharge develop upon the tide gate. Additionally, five overflow chambers are installed that bypass flow to storm sewers over weirs during high flow conditions. The few sanitary sewers in the collection system do not contain regulators. All pumping stations, regulators, tide gates and overflow chambers for the service area are shown in Table 1-1.

Sewage from the high level service area enters the plant through a 9'-0" x 9'-0" intercepting sewer at invert elevation –6.66. This sewer is provided with an overflow chamber and tide gate opposite the high level screening chamber so that the entire flow from the high level service area can be bypassed into Bowery Bay during an emergency. Sewage from the low level service area, via the Long Island City interceptor, enters the low level screening chamber through a 96-inch intercepting sewer at invert elevation – 36.0. This elevation is below tide water level at the treatment plant. Regulators on the connecting sewers limit the flow to the interceptor to approximately twice design dry weather flow. Excess capacity in the intercepting sewer permits some storage capabilities in the event of power failure.

The CAVF treats CSO through one to three vortex separators. Each unit has a hydraulic capacity of 130 MGD.

Table 1-1. Pumping Stations Regulators, Tide Gates, and Overflow Chambers

No.	Name of Structures	Location
-	Lost Battalion Pumping Station	62nd Avenue & Queens Boulevard
-	108th Street Pumping Station	Long Island Expressway & 108th Street
-	37th Avenue Pumping Station	37th Avenue & 114th Street
-	44th Avenue Pumping Station	44th Avenue & 114th Street
-	70th Road Pumping Station	Grand Central Parkway (West Service Road) & 70th Road
-	Park Drive East Pumping Station	Park Drive East of 75th Avenue
-	67th Road Pumping Station	67th Road & Grand Central Parkway (W. Service Road)
-	Bush Street Storm Water Pumping Station	Queens Boulevard & 63rd Street

-	Cypress Hills Storm Water Pumping Station	Interborough Parkway 800 feet West of Cypress Hill Road
-	Central Avenue Storm Water Pumping Station	Central Avenue & 76th Street
-	Woodhaven Boulevard Storm Water Pumping Station	Queens Boulevard & Woodhaven Boulevard
-	Brooklyn-Queens Expressway Storm Water Pumping Station	Brooklyn-Queens Expressway & 65th Street
1	Tide Gate Chamber	37th Street & 19th Avenue
2	Tide Gate Chamber	45th Street at Plant
3	Regulator Weir	Hazen Street & 19th Avenue
MH Chamber “A”	Regulator Manhole	Ditmars Boulevard – 21st Avenue & 81st Street
MH Chamber “B”	Regulator Manhole	19th Avenue & 80th Street
MH Chamber “C”	Regulator Manhole	19th Avenue & Hazen Street
MH Chamber “D”	Regulator Manhole	19th Avenue & 45th Street
4	Regulator Weir	LaGuardia Airport (82nd Street & Ditmars Boulevard)
Chamber “A”	Regulator Manhole	Ditmars Boulevard & 82nd Street
Chamber “B”	Regulator Manhole	Ditmars Boulevard & 88th Street
Chamber “C”	Regulator Manhole	Ditmars Boulevard & 91st Street
Culvert Chamber “D”	Culvert Regulator Manhole	Ditmars Boulevard & 92nd Street
Chamber “E”	Regulator Manhole	Ditmars Boulevard & 98th Street
Chamber “F”	Regulator Manhole	Ditmars Boulevard & 99th Street
5	Regulator Weir	100th Street (22nd Road) & Ditmars Boulevard
6	Regulator Weir	Ditmars Boulevard & 108th Street
7	Regulator Weir	34th Avenue & 108th Street
8	Regulator Weir	37th Avenue & 108th Street
9	Regulator Weir	43rd Avenue & 108th Street
10	Regulator Weir	Long Island Expressway & 108th Street
11	Regulator Weir	94th Street & Long Island Expressway
12	Regulator Weir	99th Street & 63rd Drive
13	Tide Gate Chamber	111th Street & Corona Avenue
14	Regulator Weir & Sluice Gate	72nd Avenue & Park Drive East
15	Regulator Weir & Sluice Gate	77th Avenue & Park Drive East
16	Regulator Weir	Junction Boulevard & Long Island Expressway, North Side
17	Regulator Weir	97th Street & Long Island Expressway, North Side

Table 1-1. Pumping Stations Regulators, Tide Gates, and Overflow Chambers (Continued)

No.	**Name of Structures**	**Location**
18	Regulator Weir	98th Street & Long Island Expressway, North Side
19	Regulator Weir	99th Street & Long Island Expressway, North Side
20	Regulator Weir	Xenia Street & Long Island Expressway, South Side
21	Regulator Weir	Junction Boulevard & Long Island Expressway, South Side

22	Regulator Weir	98th Street & Long Island Expressway, South Side
23	Regulator Weir	99th Street & Long Island Expressway, South Side
24	Regulator Weir	102nd Street & Long Island Expressway, South Side
25	Regulator Weir	Yellowstone Boulevard & Long Island Expressway, North Side
26	Regulator Weir	Saul tell Avenue & Long Island Expressway, North Side
27	Regulator Weir	Union Turnpike & 135th Street
Low Level Service Area		
-	Roosevelt Island Main Pumping Station	Roosevelt Island (E. Channel Shoreline)
-	Borden Avenue Pumping Station	Borden Avenue & Review Street
-	Triborough Bridge Storm Water Pumping Station	North of Triborough Place, East of 31st Street
-	North Roosevelt Pumping Station	North end of Roosevelt Island
-	South Roosevelt Pumping Station	South end of Roosevelt Island
L-1	Regulator	Greenpoint Avenue & Newtown Creek
L-2	Regulator	35th Street West of Review Avenue
L-3	Regulator	Borden Avenue & Dutch Kills
L-3A	Regulator	Borden Pumping Station Influent
L-3B	Tide Gate & Diversion Chamber	30th Street & Hunters Point Avenue
L-3C	Regulator	Behind Borden Pumping Station
L-4	Regulator	47th Avenue & Dutch Kills
L-5	Regulator	49th Avenue & 27th Street
L-6	Regulator	Borden Avenue & 27th Street
L-7	Tide Gate Chamber	East Side 11th Street & Creek
L-8	Regulator	West Side 11th Street & Creek
L-9	Regulator	Vernon Boulevard & Creek
L-10	Regulator	5th Street & 55th Avenue
L-11	Regulator	2nd Street & 51st Avenue
L-12	Regulator	East of 2nd Street & 50th Avenue
L-12A	Regulator	West of 5th Street & 49th Avenue
L-13	Regulator	48th Avenue & East River
L-14	Regulator	47th Road & East River
L-15	Regulator	West of 5th Street & 47th Avenue
L-16	Regulator	5th Street North of 46th Avenue
L-17	Regulator	44th Drive & East River
L-18	Regulator	43rd Avenue & Vernon Boulevard
L-19	Regulator	41st Avenue & Vernon Boulevard
L-20	Regulator	38th Avenue & Vernon Boulevard

Table 1-1. Pumping Stations Regulators, Tide Gates, and Overflow Chambers (Continued)

No.	Name of Structures	Location
L-21	Regulator	37th Avenue & Vernon Boulevard
L-22	Regulator	Vernon Boulevard & Broadway
L-23	Diversion & Tide Gate Chamber	30th Road & Vernon Boulevard
L-24	Regulator	Wellington Court & Vernon Boulevard

MH-5	Regulator Manhole	30th Street South of L-24
L-25	Regulator	9th Street & 26th Avenue
L-26	Regulator	3rd Street & 26th Avenue
L-27	Regulator	27th Avenue & 1st Street
L-28	Regulator	1st Street & Astoria Boulevard
L-29	Regulator	8th Street & Astoria Boulevard
MH-15K	Regulator Manhole	Astoria Boulevard 400 feet west of L-29
L-30	Regulator	Hoyt Avenue South & Shore Road
L-31	Diversion & Tide Gate Chamber	Ditmars & Shore Road
L-32	Diversion & Tide Gate Chamber	21st Avenue & Shore Boulevard
L-33	Diversion & Tide Gate Chamber	South Side 34th Street & 20th Avenue
L-34	Regulator	North Side 34th Street & 20th Avenue
L-35	Regulator	Rust Street & 56th Drive
L-36	Regulator	56th Road & 43rd Street
L-37	Regulator	Hunters Point Avenue & Van Dam Street
L-38	Overflow Chamber No. 5	Hunters Point Avenue & 30th Place
-	Overflow Chamber No. 2	47th Avenue & 29th Street
-	Regulator	47th Avenue & Van Dam Street
L-39	Overflow Chamber No. 3	47th Avenue & 30th Street
L-40	Overflow Chamber No. 4	47th Avenue & 31st Street
L-41	Regulator	Borden Avenue & 30th Street
L-42	Overflow Chamber No. 1	27th Street & Skillman Avenue

The plant was originally constructed as a 40 MGD primary treatment facility in 1938. The plant was upgraded to an activated sludge facility in 1940. Subsequent expansions in 1949, 1954 and 1975 resulted in the 150 MGD facility in operation today. In 1992, regulations banning sludge dumping at sea resulted in the construction of a dewatering facility. The current plant site layout is shown in Figure 1-2.

The Bowery Bay WPCP is designed for 85 percent removal of suspended solids and Biochemical Oxygen Demand (BOD) utilizing the Step Aeration Activated Sludge Process. The facility is designed to treat 300 MGD (2 times design dry weather flow) through the primary treatment and chlorination facilities and 225 MGD (1.5 times design dry weather flow) through the secondary treatment facilities.

In an effort to achieve the aggregate TN effluent limits specified in the SPDES permits, the NYCDEP developed a Nitrogen Control Action Plan (NCAP). The objective of the NCAP was to implement actions to meet the TN limits, and other permit requirements, as quickly as possible. The NCAP included the retrofit step-feed BNR work; separate centrate treatment in an existing aeration tank and the study of BNR related technologies.

The retrofit step-feed BNR work under the NCAP was intended to be an immediate action for nitrogen removal with a relatively low capital investment while other BNR technologies were evaluated. The facilities included in NYC DEP's basic step-feed BNR retrofit program were Bowery Bay, Hunts Point, Tallman Island, Wards Island (Aeration Tank 13 only), Red Hook, 26th Ward, and Oakwood Beach. The retrofit work included: (1) addition of baffles to existing aeration tanks to create anoxic and oxic zones, (2) installation of mixers in the anoxic zones of the aeration tanks to provide for mixing, and (3) provision for a froth control system for control of *Nocardia* foaming. The retrofit step-feed BNR system provided for some nitrogen removal at Bowery Bay.

The existing Bowery Bay wet stream process includes preliminary screening, raw sewage pumping, secondary screening, primary settling and grit removal, step-feed activated sludge biological treatment, final settling and effluent chlorination. A process flow diagram is shown in Figure 1-3.

Dry weather flows and regulated wet weather flows are conveyed to the Bowery Bay WPCP's high and low level wet wells. Flow from the high and low level Main Sewage pumps is metered through two separate 72" discharge headers before combining in one 102" Main Sewage Header. A temporary 48 inch header was installed with flow measurement for low level Main Sewage pumps 1 and 2 only which combines with the 102 inch Main Sewage Header.

The combined influent flow mixes with the thickener overflow prior to the Division Structure, which splits flow to the North and South Batteries through Parshall flumes followed by the secondary screens. The normal influent flow split is 60% to the South Battery and 40% to the North Battery. Flow from the secondary screens passes into the primary tank influent channels. Grit and grease are removed in the primary settling tanks and flow is distributed to the aeration tanks. Return Activated Sludge is fed into the first pass of the aeration tanks and the primary tank effluent is fed to the remaining three passes. The plant has a total of ten aeration tanks, six South and four North. Normally, all six South aeration tanks and three North aeration tanks are in service to treat the plant influent with the provision of one aeration tank for separate centrate treatment. The aerator effluent from the tanks passes into seventeen final settling tanks, eleven South and six North. Final effluent from the settling tanks combines in a common channel feeding three chlorine contact tanks where the effluent is disinfected with sodium hypochlorite prior to discharge to the East River. Activated sludge is wasted from the RAS discharge line. The Waste Activated Sludge and primary sludge are pumped separately to gravity thickeners. Sludge from the thickeners is anaerobically digested and then dewatered onsite.

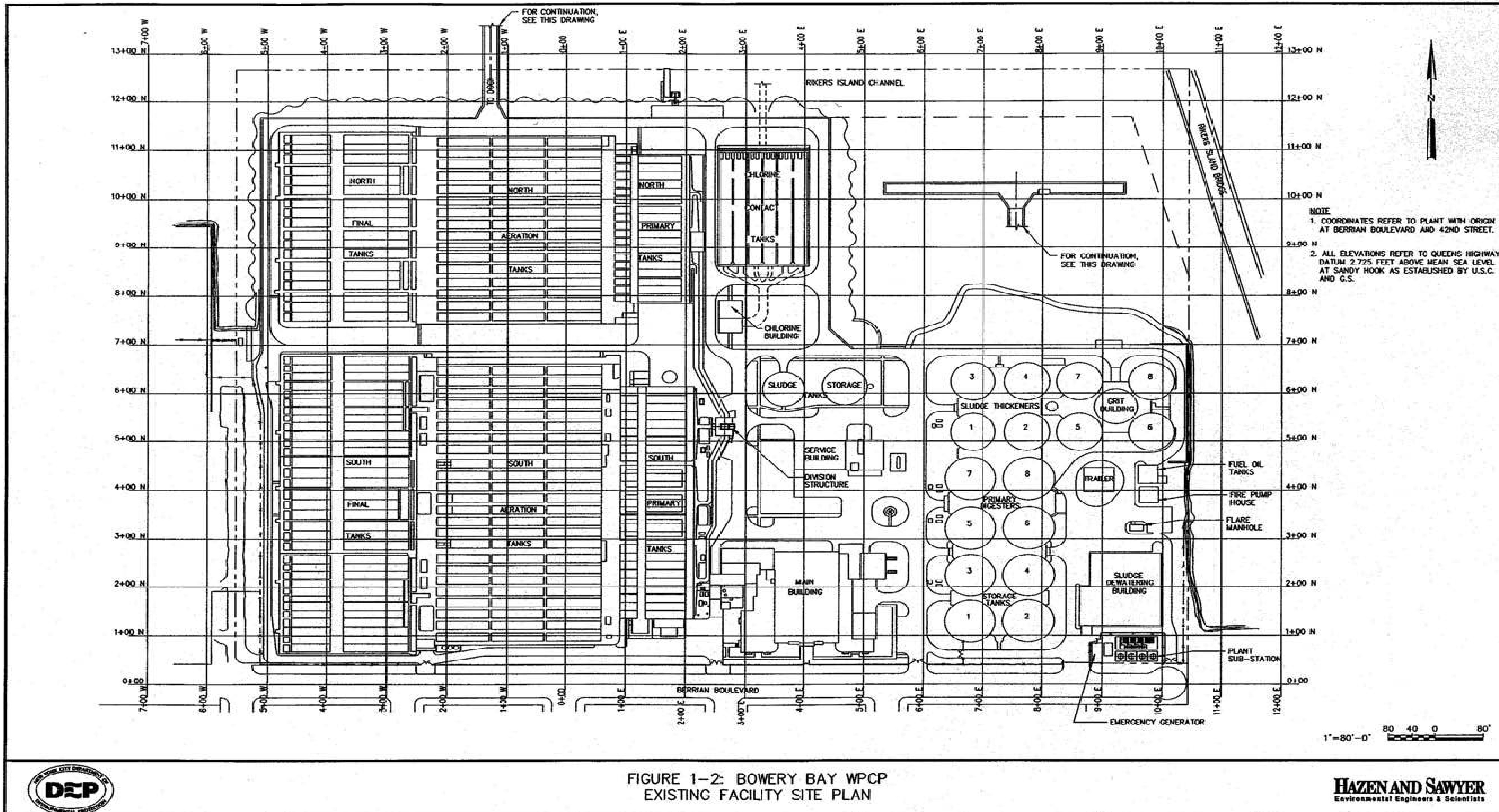

FIGURE 1–2: BOWERY BAY WPCP
EXISTING FACILITY SITE PLAN

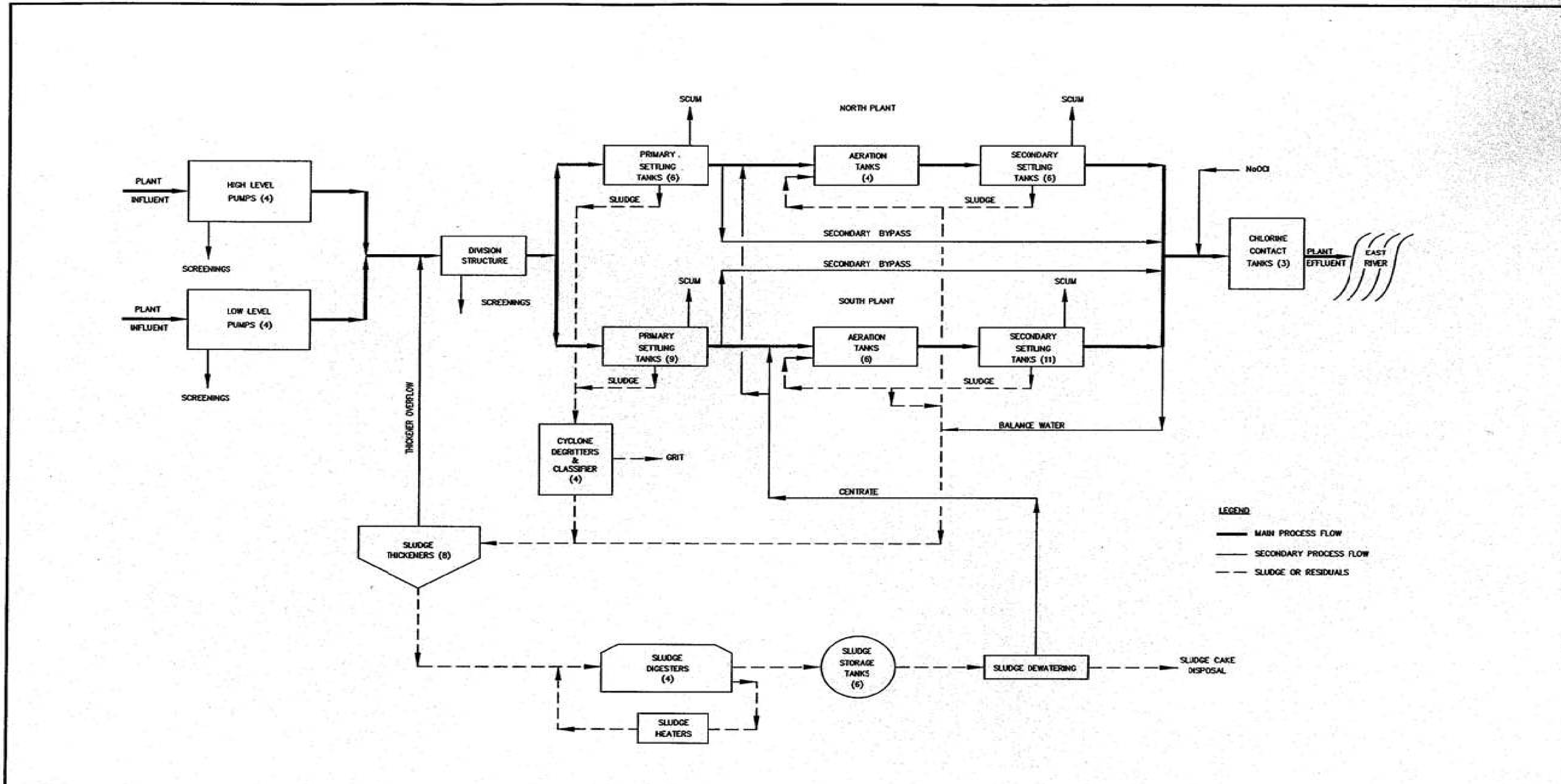

FIGURE 1–3: BOWERY BAY WPCP
EXISTING FACILITY PROCESS FLOW DIAGRAM

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1.2 EFFLUENT PERMIT LIMITS

The Bowery Bay WPCP is currently operating under SPDES permit No. NY0026158. The plant is one of four facilities located on the Upper East River (UER) that are under an aggregate total nitrogen limit. The current permit requires the plant to remove 85% of CBOD and Suspended Solids and all four UER WPCP's to meet a combined effluent total nitrogen limit aggregate.

Based on the LISS Total Maximum Daily Limit (TMDL) the effluent nitrogen goals for the UER aggregate, including offset for the Lower East River (LER) and Non-Point Sources, are 72, 600 lbs/day in 2004; 48,950 lbs/day in 2009 and 32,350 lbs/day in 2014. Utilizing a trading ratio of 2:1 between the UER and the LER, the negotiated Administrative Consent Order limits including LER offset are 73,200 lbs/day in 2010, 64,100 lbs/day in 2012 and 53, 100 lbs/day in August 2014. After 2014, the long-term limit will be determined based on the actual operation of the UER plants.

As a result of the Phase I LISS plan, the four Upper East River facilities (Wards Island, Tallman Island, Hunts Point and Bowery Bay) have effluent nitrogen limits in their current SPDES permits, requiring nitrogen removal. Instead of individual effluent limits, the four facilities are combined under an effluent aggregate.

The Bowery Bay WPCP is undergoing a plant stabilization and a BNR upgrade that is anticipated to be complete in December 2010. Phase 1 construction is currently underway. With the removal of an aeration tank on November 1, 2002 for spray water work at the Hunts Point WPCP, the total nitrogen aggregate for the UER WPCPs increased to a twelve month rolling average of 95,900 lbs/day with a twelve month rolling average goal of 88,600 lbs/day. The BNR upgrade will include additional facilities that will provide the capability of the four UER plants to meet the long-term nitrogen aggregate limits.

1.3 PERFORMANCE GOALS FOR WET WEATHER EVENTS

The goals of this manual are to establish operating procedures for Bowery Bay that will:

- Maximize flows to the plant as early as possible to prevent overflows at the collection system regulators,
- Maintain stable operation and maximize removals during wet weather events,
- Reduce solids losses in the secondary system to allow for a stable recovery back to dry weather operations following a wet weather event.

1.4 PURPOSE OF THIS MANUAL

The purpose of this manual is to provide a set of operating guidelines to assist the Bowery Bay operating staff in making operational decisions that will best meet the performance goals stated in Section 1.3 and the requirements of the SPDES discharge permit.

1.5 USING THIS MANUAL

Section 2 of this manual is designed to be used as a quick reference tool for wet weather events during the Bowery Bay upgrade construction. This manual is divided into sections that cover major unit processes at Bowery Bay. Each section includes the following information:

- A 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 steps are performed
- Identification of the specific conditions or circumstances that trigger the recommended steps
- Identification of potential process problems

Section 3 – Planned Plant Upgrades, identifies the major improvements as part of the plant upgrade. These improvements include a Modified BNR upgrade. These improvements are presented in the order in which they are scheduled to be completed and available for operation. Since the final design of these facilities is not yet complete, detailed operating protocols are not presented.

1.6 REVISIONS TO THIS MANUAL

This manual is a living document. Users of the manual are encouraged to identify new steps, procedures and recommendations to add to the descriptions contained herein. Modifications that improve upon the manual's procedures are also encouraged. With continued input from all users of the manual, it will become an even more useful and effective tool.

In addition to the revisions based on plant operating experience, this manual will be revised as upgrade work is completed that affects the plants ability to treat wet weather flows. The Bowery Bay WPCP is currently undergoing a Step-feed BNR upgrade. As required by the Consent Order, a revised WWOP, including specific procedures based on actual operating experience of the upgraded WPCP will be issued eighteen months after the completion of the construction.

2.0 Existing Facility Wet Weather Operation Procedures and Guidelines

This section presents reduced flow capacities, 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. Also included are the bases for the protocols, events that trigger the protocols and a description of potential problems. Figures 2-1, 2-2 and 2-3 summarize the protocols for before, during and after wet weather events. For a summary of protocols for each major unit operation refer to the following sections.

2.1 REDUCED PLANT FLOWS

During the upgrade construction at the Bowery Bay WPCP, a number of unit processes will be unavailable for service. Unavailability of these unit processes will reduce the influent flow to the plant or the flow through the secondary treatment system. The present plant operation of the high level wet well is to place all screens in service and operate three main sewage pumps. In this operating configuration, the screen channel influent gates are left open because the regulator weir setting prevents the screen channels from overflowing. With less screens and pumps available, it will be necessary to throttle the screen channel influent gates to prevent flooding because the regulator weir may not be sized to bypass the additional flow. On the low level wet well, the screen channels are presently throttled with all screens and three pumps in service. Failure to properly throttle the gates results in flooding of the screen channel floor. With a reduction in operating equipment, it will be necessary to start throttling the screen channel inlet gates earlier to prevent flooding of the screen channels.

When aeration and final tanks are removed for construction, it will not be necessary to increase the secondary system bypass flow unless additional tankage is removed from service for emergency maintenance. The Bowery Bay secondary system has the hydraulic capability to treat 225 mgd with two aeration tanks and four final tanks out of service.. The North Battery secondary bypass is a fixed weir; the South Battery secondary bypass is the combination of fixed weirs and a gate. If a third final tank is out of service in the North Battery, treatment efficiency may be reduced and it is important to monitor the final tank operation during wet weather. If two North Battery aeration tanks are out of service, the channel levels in the North Battery will increase sending flow over the bypass weir earlier. If all North Aeration Tanks are in service and only three final tanks are operating, a reduction in flow to the North Battery may be required to protect the secondary system solids. With eleven final tanks in the South Battery, if a third final tank is removed from service, the clarifier treatment efficiency should not be impacted. If solids washout does occur in the south final tanks, reduction of flow to the South Battery may be required to protect the secondary system solids.

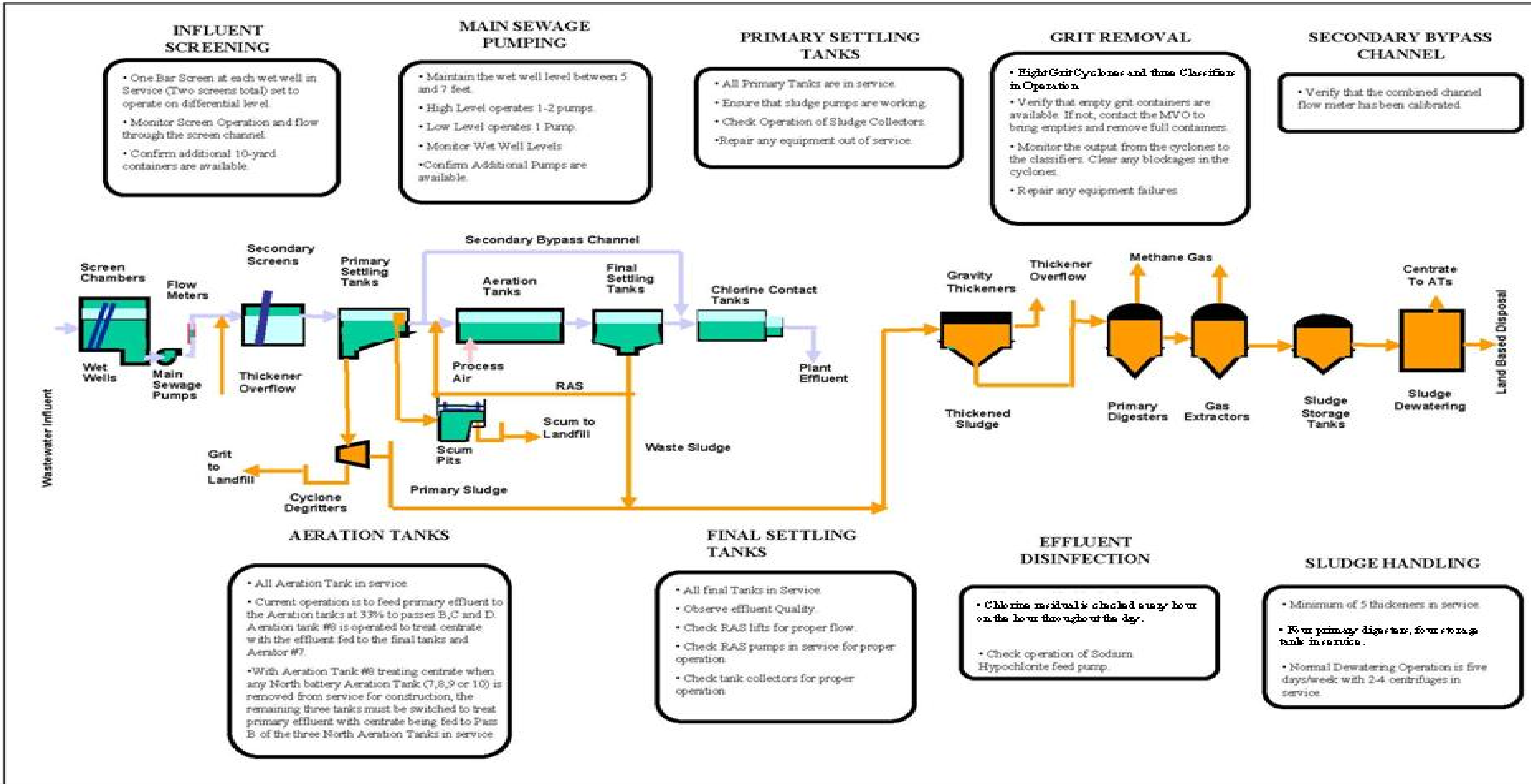

Figure 2-1: Operating Procedures Before Wet Weather Event at the Bowery Bay WPCP

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INFLUENT SCREENING

- All six Bar Screens in Service set to operate on hand.
- Monitor Screen Operation and flow through the Screen channel.
- Close Low Level Channel Influent Gates to prevent screen channel overflow.

MAIN SEWAGE PUMPING

- Maintain the High and Low wet well levels between 7 and 9 feet.
- High Level and Low level Operate 3 Pumps.
- Notify chlorination station operator prior to putting a fifth pump in service.
- Refer to Table 2-1 for maximum hydraulic capacities.

PRIMARY SETTLING TANKS

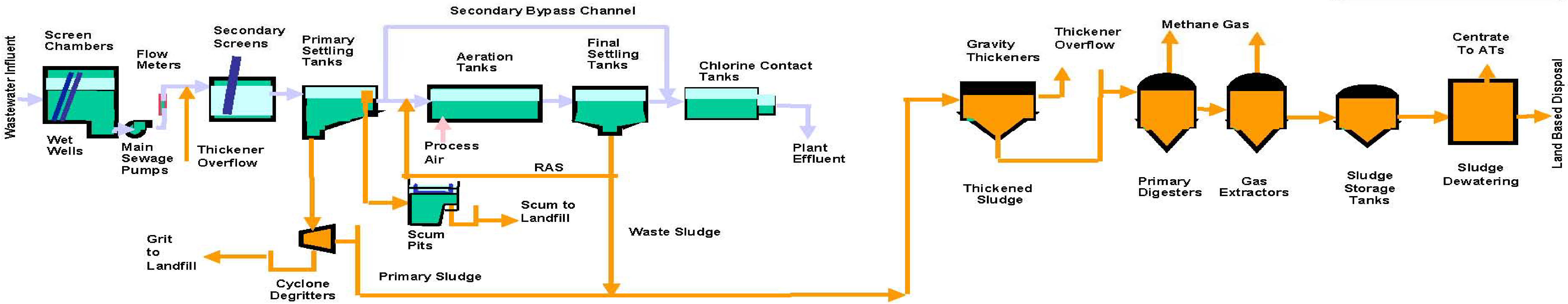
- Check the level of the Primary tank influent channel. Notify the supervisor if the channel is near flooding so the influent flow can be reduced.
- Check the effluent weirs, if flooding is occurring notify supervisor.
- Check sludge pumps for proper operation. Switch pumps in service as necessary.

GRIT REMOVAL

- Eight Grit Cyclones and four Classifiers (All Equipment) in Operation
- Using the tow motor, shift full containers out from under the grit hopper and replace with empties.
- If all containers are full remove the full containers with the tow motor and let the grit fall on the floor.

SECONDARY BYPASS CHANNEL

- Refer to Table 2-1 for maximum hydraulic capacities. Maximum hydraulic and BNR operation Bypass flow may vary.
- When flow reaches the secondary system maximum, (225 mgd with all tanks in service), open the South Bypass Control Gate and verify the correct combined bypass flow.



AERATION TANKS

- Currently no changes are made to the aeration tank operations during a wet weather event. Manual gate operation limits the operator's ability to make rapid adjustments.
- Too high a flow through the secondary system may result in washout of nitrifying bacteria.

FINAL SETTLING TANKS

- Check sludge collectors. If a collector shears a pin, a chain breaks or comes off the sprocket, close the influent gates to isolate the tank.
- Check the effluent quality. Notify the supervisor if solids are washing out over the weirs.
- Check the RAS lifts for clogging.
- Check the RAS pump flow rate.

EFFLUENT DISINFECTION

- Chlorine residual is checked every 30 minutes.
- Adjust chlorine dose as flow increases. When notified by the SEE that a sixth Main Sewage Pump will be started, increase the chlorine dose in anticipation of bypassed flow.

SLUDGE HANDLING

- When influent flow reaches 225 mgd, secure the WAS flow to the thickeners. The primary sludge feed to the thickeners remains on.
- There is no change to the Digester and Sludge Dewatering operations during a wet weather event.

Figure 2-2: Operating Procedures During Wet Weather Event at the Bowery Bay WPCP

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INFLUENT SCREENING

- As the influent flow drops, reduce the number of screens in service.
- When the influent flow drops, return the channel inlet gates to fully open.
- Clean up screenings that have fallen on the floor.

MAIN SEWAGE PUMPING

- Maintain the maximum pumping rate until the wet well level starts to fall.
- As the influent flow drops, reduce the pump operating steps and the number of pumps in service.
- Maintain the wet well level between 5 and 7 feet.

PRIMARY SETTLING TANKS

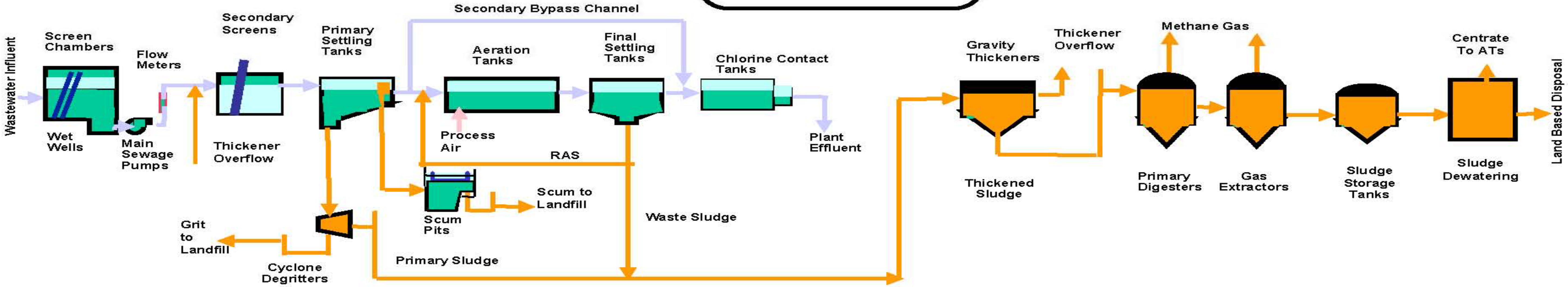
- Check tank collectors for normal operation. Notify supervisor of sheared pins or chain broken or off the sprocket.
- Repair broken equipment.
- Remove scum from Primary Tanks and change full scum containers using the tow motors.
- Contact the MVO to remove full containers and replace with empties.

GRIT REMOVAL

- Replace all full containers with empties.
- Shovel grit that has overflowed onto the floor back into the container.
- Clear clogged cyclones.
- Repair broken equipment.

SECONDARY BYPASS CHANNEL

- When the influent flow drops below the secondary system maximum treatable flow, close the South Bypass Valve.



AERATION TANKS

- Aeration tank primary effluent feed settings remain the same.
- Adjust sludge wasting rates based on the aeration tank inventory loss during the storm.

FINAL SETTLING TANKS

- Repair any broken equipment.
- If the grease load on the tanks is heavy, drop the scum collectors and remove the grease.

EFFLUENT DISINFECTION

- As flow decreases, reduce the chlorine dose.
- Reduce the frequency of checking the chlorine residual.
- Check Sodium Hypochlorite tank storage levels. Notify supervisor of need for delivery.

SLUDGE HANDLING

- When the influent flow drops below 225 mgd, place the WAS flow to the thickeners back on.
- There is no change to the Digester and Sludge Dewatering operations during a wet weather event.

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Figure 2-3: Operating Procedures After Wet Weather Event at the Bowery Bay WPCP

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Table 2-1 below lists the unit process equipment that will be available for service during construction and the corresponding maximum hydraulic capacity associated with the equipment. It should be noted that the maximum flow through the secondary system that will not cause a BNR upset might be lower than the hydraulic maximum of the equipment in service.

Table 2-1. Minimum Hydraulic Capacities for Equipment in Service[1]

Process Equipment	**Total Number of Units in Service**		**Minimum Plant Influent Flow**	**Minimum Secondary Treatment Flow**
Bar Screens	Hi-Level	Low Level		
	3/3	3/3	300 MGD	
	3/3	2/3	250 MGD	
	2/3	3/3	250 MGD	
	2/3	2/3	200 MGD	
	1/3	3/3	200 MGD	
	3/3	1/3	200 MGD	
Main Sewage Pumps	Hi-Level (45)[3]	Low Level (70-L, 40-S)[2]		
	4/4	1/1L, 3/3S	300 MGD	
	4/4	0/1L, 3/3S	300 MGD	
	4/4	1/1L, 2/3S	300 MGD	
	4/4	0/1L, 2/3S	260 MGD	
	4/4	1/1L, 1/3S	290 MGD	
	4/4	0/1L, 1/3S	220 MGD	
	3/4	1/1L, 3/3S	300 MGD	
	3/4	0/1L, 3/3S	255 MGD	
	3/4	1/1L, 2/3S	285 MGD	
	3/4	0/1L, 2/3S	215 MGD	
	3/4	1/1L, 1/3S	245 MGD	
	3/4	0/1L, 1/3S	175 MGD	
	2/4	1/1L, 3/3S	280 MGD	
	2/4	0/1L, 3/3S	210 MGD	
	2/4	1/1L, 2/3S	240 MGD	
	2/4	0/1L, 2/3S	170 MGD	
	2/4	1/1L, 1/3S	200 MGD	
	2/4	0/1L, 1/3S	130 MGD	
	1/4	1/1L, 3/3S	235 MGD	
	1/4	0/1L, 3/3S	165 MGD	
	1/4	1/1L, 2/3S	195 MGD	
	1/4	0/1L, 2/3S	125 MGD	
	1/4	1/1L, 1/3S	155 MGD	
	1/4	0/1L, 1/3S	85 MGD	
When LL MSP is upgraded	Hi-Level (45)[3]	Low Level (70-L, 40-S)[2]		
	4/4	2/2 L, 2/2S	300 MGD	

	4/4	1/2L, 2/2S	300 MGD	
	4/4	0/2L, 2/2S	260 MGD	
	4/4	2/2L, 1/2S	300 MGD	
	4/4	1/2L, 1/2S	290 MGD	
	4/4	0/2L, 1/2S	220 MGD	
	3/4	2/2 L, 2/2S	300 MGD	
	3/4	1/2L, 2/2S	285 MGD	
	3/4	0/2L, 2/2S	215 MGD	
	3/4	2/2L, 1/2S	300 MGD	
	3/4	1/2L, 1/2S	245 MGD	
	3/4	0/2L, 1/2S	175 MGD	
	2/4	2/2 L, 2/2S	300 MGD	
	2/4	1/2L, 2/2S	240 MGD	
	2/4	0/2L, 2/2S	170 MGD	
	2/4	2/2L, 1/2S	280 MGD	
	2/4	1/2L, 1/2S	200 MGD	
	2/4	0/2L, 1/2S	130 MGD	
	1/4	2/2 L, 2/2S	265 MGD	
	1/4	1/2L, 2/2S	195 MGD	
	1/4	0/2L, 2/2S	125 MGD	
	1/4	2/2L, 1/2S	225 MGD	
	1/4	1/2L, 1/2S	155 MGD	
	1/4	0/2L, 1/2S	85 MGD	
Primary Settling Tanks	South	North		
	8/9	6/6	300 MGD	
	7/9	6/6	240 MGD	
	9/9	5/6	300 MGD	
	9/9	4/6	240 MGD	
	9/9	3/6	240 MGD	
	8/9	5/6	260 MGD	
	8/9	4/6	220 MGD	
	8/9	3/6	220 MGD	
	7/9	5/6	240 MGD	
	6/9	6/6	240 MGD	
	9/9	2/6	220 MGD	
	8/9	2/6	200 MGD	
	6/9	5/6	220 MGD	
	5/9	6/6	220 MGD	
	5/9	5/6	200 MGD	
Aeration Tanks	South	North		
	6/6	3/4		225 MGD
	5/6	4/4		225 MGD
	5/6	3/4		225 MGD
	4/6	4/4		225 MGD
	4/6	3/4		190 MGD

	5/6	2/4		190 MGD
	3/6	4/4		190 MGD
	3/6	3/4		190 MGD
Final Settling Tanks	South	North		
	10/11	6/6		225 MGD
	9/11	6/6		225 MGD
	11/11	5/6		225 MGD
	11/11	4/6		225 MGD
	10/11	5/6		225 MGD
	10/11	4/6		225 MGD
	9/11	5/6		225 MGD
	9/11	4/6		225 MGD
	8/11	4/6		200 MGD
	9/11	3/6		200 MGD
	11/11	3/6		225 MGD
	10/11	3/6		200 MGD
	9/11	3/6		200 MGD
	7/11	6/6		225 MGD
	7/11	5/6		200 MGD
	8/11	6/6		200 MGD
	8/11	5/6		200 MGD
Chlorine Contact Tanks	2/3		300 MGD	
	1/3		150 MGD	
[1] Minimum Secondary Treatment Flow may be less than the hydraulic minimum to prevent loss of nitrification from biomass washout.				
[2] Capacity of the large (L) pump is 70 MGD. Capacity of the small (S) pump is 40 MGD. [3] Capacity of the Hi-Level pump is 45 MGD.				

2.2 INFLUENT SCREENING

2.2.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
Hi Level Screens	2 – Chamber Influent Sluice Gates (Auto) 3 – Channel Influent Sluice Gates (Manual) 3 – Channel Outlet Sluice Gates (Manual) 3 – Bar Screens 1 – Belt Conveyors 1 – Bubbler System 3 – 10 Cubic Yard Containers on Dollies
Low Level Screens	3 – Channel Influent Sluice Gates (Auto) 3 – Channel Outlet Sluice Gates (Manual) 3 – Bar Screens 1 – Belt Conveyors 1 – Bubbler System 3 – 10 Cubic Yard Containers on Dollies

2.2.2 Wet Weather Operating Procedures High Level Wet Well

WHO DOES IT?		WHAT DO WE DO
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•During dry weather operation, maintain the wet well level between 5-7 feet. The zero level is the bottom of the wet well. The bubbler levels are not actual elevations from mean sea level. •One bar screen is in service during peak diurnal dry weather flow. •The bar screen mechanism is set for level differential. •Visually inspect the screen to confirm proper operation. •Visually monitor the flow through the screen channel. •Visually inspect the 10-yard container. If the container is full, use the tow motor to switch containers. •Confirm that additional empty 10-yard containers are available.

During Wet Weather Event		
SEE's (with two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•Maintain the wet well level between 7-9 feet. At 9 feet the influent flow will bypass the High Level wet well via the regulator. It is not necessary to throttle the influent channel gates to prevent the wet well from flooding. •Place all three bar screens in service on Hand. •Visually confirm that the screen channels are not approaching the overflow level. •If screen blinding occurs, close the channel influent sluice gate until the screen clears. •If the screening conveyor fails, place wood under the chute and fill wheelbarrows with screenings. •Dump the screenings into the 1.5 cubic yard containers. Use the forklift to empty the 1.5 cubic yard containers into the 10 cubic yard containers. •If there are no containers available let the screenings fall on the floor.
After Wet Weather Event		
SEE	SSTW/STW	•As the flow to the plant decreases, remove the additional screens from service until only one High Level screen remains operating. •Contact the MVO to remove the full containers and replace them with empties. •Clean up any screenings that have fallen on the floor.
Why Do We Do This?		
•To protect the Main Sewage Pumps from damage by large objects. •To allow the plant to pump the maximum flow through the preliminary treatment tanks without flooding the High Level wet well and the High Level screen channels.		
What Triggers The Change?		
• An increase in wet well level due to an increase in flow to the WPCP.		
What Can Go Wrong?		
•Screen failure, screen blinding, screen channel flooding. •Screenings conveyor failure. •Screenings overflowing the containers. •Influent gate failures.		

2.2.3 Wet Weather Operating Procedures Low Level Wet Well

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•During dry weather operation, maintain the wet well level between 5-7 feet. The zero level is the bottom of the wet well. The bubbler levels are not actual elevations from mean sea level. •One bar screen is in service during peak diurnal dry weather flow. •The bar screen mechanism is set for level differential. •Visually inspect the screen to confirm proper operation. •Visually monitor the flow through the screen channel. •Visually inspect the 10-yard container. If the container is full, use the tow motor to switch containers. •Confirm that additional empty 10-yard containers are available.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•Maintain the wet well level between 7-9 feet. At 11 feet the influent screen channel floods onto the floor. •Place all three bar screens in service on Hand. •When three main sewage pumps are in service at the maximum step maintain the screen channel level by adjusting the channel inlet sluice gate. •Visually confirm that the screen channels are not approaching the overflow level. •If screen blinding occurs, lose the channel influent sluice gate until the screen clears. •If the screening conveyor fails, rake the screenings from the stopped conveyor into wheelbarrows. Dump the screenings into the 1.5 cubic yard containers. Use the forklift to empty the 1.5 cubic yard containers into the 10 cubic yard containers. •If the incline conveyor fails, move the conveyor out of the way and place 6-yard containers at the horizontal conveyor belt discharge. •If there are no containers available let the screenings fall on the floor.

After Wet Weather Event		
SEE	SSTW/STW	•As the wet well levels return to normal, the additional screens are removed from service until only one Low Level screen is operating •Return the channel inlet gates to the fully open position. •Contact the MVO to remove the full containers and replace them with empties. •Clean up any screenings that have fallen on the floor.

Why Do We Do This?

- •To protect the Main Sewage Pumps from damage by large objects.
- •To allow the plant to pump the maximum flow through the preliminary treatment tanks without flooding the Low Level wet well or the bar screen channels.

What Triggers The Change?

- •An increase in wet well level due to an increase in flow to the WPCP.
- •Flooding of the bar screen channels.

What Can Go Wrong?

- •Screen failure, screen blinding, screen channel flooding.
- •Screenings conveyor failure. •Screenings overflowing the containers.
- •Influent gate failures.
- •The wet well can flood with sewage overflowing the screening channels.

2.3 INFLUENT WASTEWATER PUMPING

2.3.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
High Level Main Sewage Pumps	4 - Gate Valves (Manual) 4 - Check Valves (Auto) 4 - 53.3 MGD Main Sewage Pumps 1 - 72-inch Discharge Header
Low Level Main Sewage Pumps	4 - Gate Valves (Manual) 4 - Check Valves (Auto) 4 - 46.8 MGD Main Sewage Pumps 1 - 72-inch Discharge Header with Magnetic Flow Meter 1 - 48-inch

2.3.2 Wet Weather Operating Procedures High Level Main Sewage Pumps

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•During dry weather operation, maintain the wet well level between 5-7 feet. The zero level is the bottom of the wet well. The bubbler levels are not actual elevations from mean sea level. •One or two main sewage pumps are in service during normal diurnal dry weather flow. The number of pumps in service and operating step are selected and adjusted manually. •Confirm that additional High •Level Main Sewage Pumps are available for service. •Monitor the wet well level.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•As the wet well levels rise, adjust the operating step of the pumps in service. If the operating pump steps are maximized, place additional High Level pumps in service. •Notify the chlorination station operator prior to placing a fifth main sewage pump in service. •At 300 mgd, there should be three Low Level and three High Level pumps in service. •Adjust the operating step of the Main Sewage Pumps based on wet well levels. •Pump to minimum hydraulic capacity as per Table 2-1. During construction the minimum hydraulic capacity will vary based on equipment availability. Refer to Table 2-1 for minimum hydraulic capacities.

After Wet Weather Event		
SEE	SSTW/STW	•Maintain the maximum pumping rate until the wet well level starts to fall. •Reduce the pump operating steps, as wet well levels fall, to maintain normal wet well level. •When the pumps are lowered to step 2 start taking pumps out of service until one or two High Level pump are operating depending on the time of day.
Why Do We Do This?		
• To allow the plant to pump the maximum flow through the preliminary treatment tanks without flooding the wet well. • To minimize the need for flow storage in the collection system and reduce the storm sewer overflows to the East River.		
What Triggers The Change?		
• An increase in wet well level due to an increase in flow to the WPCP.		
What Can Go Wrong?		
•Main Sewage Pump failure on start-up or while operating. •Screen blinding requiring adjustment of the pump operating step until the screen is cleared.		

2.3.3 Wet Weather Operating Procedures Low Level Main Sewage Pumps

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•During dry weather operation, maintain the wet well level between 5-7 feet. The zero level is the bottom of the wet well. The bubbler levels are not actual elevations from mean sea level. •One or two Main Sewage Pumps are in service during normal diurnal dry weather flow. The number of pumps in service and operating step are selected and adjusted manually. •Confirm that additional Low Level Main Sewage Pumps are available for service. •Monitor the wet well level.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•As the wet well levels rise, adjust the operating step of the pumps in service. If the operating pump steps are maximized, place additional Low Level pumps in service. •Notify the chlorination station operator prior to placing a fifth main sewage pump in service. •At 300 mgd, there should be three Low Level and three High Level pumps in service. •Adjust the operating step of the Main Sewage Pumps based on wet well levels. •Pump to minimum hydraulic capacity as per Table 2-1. During construction the minimum capacity will vary based on equipment availability. Refer to Table 2-1 for minimum hydraulic capacities.
After Wet Weather Event		
SEE	SSTW/STW	•If the channel influent gates have been throttled, maintain the maximum pumping rate until the gates are fully open and the wet well levels start to fall. •Reduce the pump operating steps, as wet well levels fall, to maintain normal wet well level. •When the pumps are lowered to step 2 start taking pumps out of service until only one Low Level pump is operating.
Why Do We Do This?		
•To allow the plant to pump the maximum flow through the preliminary treatment tanks without flooding the Low Level wet well or the bar screen channels. •To minimize the need for flow storage in the collection system and reduce the storm sewer overflows to the East River.		
What Triggers The Change?		
• An increase in wet well level due to an increase in flow to the WPCP.		
What Can Go Wrong?		
•Main Sewage Pump failure on start-up or while operating. •Screen blinding requiring adjustment of the pump operating step until the screen is cleared.		

2.4 SECONDARY SCREENS

2.4.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
Secondary Screens	1 – Division Structure 5 – Parshall Flumes 5 - Influent Sluice Gates 5 – Secondary Screens 4 – Belt Conveyors 5 – 10-yard containers

2.4.2 Wet Weather Operating Procedures

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•Normally all five secondary screens operate continuously. •Four screens have conveyors that dump into the 10-yard containers. The fifth screen dumps into a wheelbarrow that is dumped into the 10-yard containers. •The bar screen mechanisms are set on timer. •Visually inspect the screens to confirm proper operation. •Visually monitor the flow through the screen channels. •Visually inspect the 10-yard containers. If containers are full, use the tow motor to switch containers. •Confirm that additional empty 10-yard containers are available.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•Set the bar screen to hand. •If a conveyor fails, rake the screenings into a wheelbarrow and dump it into the 10-yard containers. •If no containers are available, let the screenings dump onto the floor.
After Wet Weather Event		
SEE	SSTW/STW	•Contact the MVO to remove the full containers and replace them with empties. •Clean up any screenings that have fallen on the floor.
Why Do We Do This?		
•To protect the downstream equipment from damage by large objects. •To allow the plant to pump the maximum flow through the preliminary treatment tanks without flooding the Secondary Screen channels.		
What Triggers The Change?		
•Flooding of the bar screen channels.		
What Can Go Wrong?		
•Screen failure, screen blinding, screen channel flooding. •Screenings conveyor failure. •Screenings overflowing the containers. •Influent gate failures. •Overflow at the Division Structure onto the floor.		

2.5 PRIMARY SETTLING TANKS

2.5.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
South Battery Primary Tanks (1-9)	9 – 124' long x 50' wide x 11.64' deep Primary Settling Tanks 3 – Feed Channels 45 – 15-inch Inlet Sluice Gates (5 per PST) 9 – 18-inch Inlet Sluice Gates (1 per PST) 27 – Chain and Flight Collectors (3 per PST) 9 – Sludge Trough Cross-Collector (1 per PST) 27 – Scum Collectors (3 per PST) 12 – Primary Sludge Vortex Pumps 3 – Primary Sludge Plunger Pumps 2 – Grease Pits 2 – 10-yard containers
North Battery Primary Settling Tanks (10-15)	6 – 124' long x 50' wide x 11.64' deep Primary Settling Tanks 2 – Feed Channels 30 – 15-inch Inlet Sluice Gates (5 per PST) 6 – 24-inch Inlet Sluice Gates (1 per PST) 18 – Chain and Flight Collectors (3 per PST) 6 – Sludge Trough Cross-Collector (1 per PST) 18 – Scum Collectors (3 per PST) 12 – Primary Vortex Sludge Pumps 3 – Primary Sludge Plunger Pumps 2 – Grease Pits 2 – 10-yard containers

2.5.2 Wet Weather Operating Procedures 2.6.2 Wet Weather Operating Procedures

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•All primary tanks are in service during normal operation. •Skim grease from the tank and remove it from the scum pits into the containers as needed. •Ensure that the sludge pumps are working. •Check the operation of the sludge collectors. •Repair any critical/priority equipment out of service. •Confirm additional 10-yard containers are available.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•Check the level of the primary tank influent channel. Notify the supervisor if the channel is near flooding so the influent flow can be reduced. •Check the effluent weirs; if flooding is occurring notify the supervisor. •Check the sludge pumps for proper operation. Switch pumps in service as necessary. If the sludge pump suction line appears clogged shut the pump and back flush through the pump from the discharge of a second pump. •If the sludge discharge line to the grit cyclones clogs, switch the valves to pump through the second line. •If the tank cross collector fails, remove the tank from service.
After Wet Weather Event		
SEE	SSTW/STW	•Check the tank collectors for normal operation. Notify the supervisor of sheared pins or chain broken or off the sprocket. •Begin the process to repair broken equipment. •Remove scum from the Primary Tanks and change full scum containers using the tow motors. •Contact the MVO to remove the full containers and replace them with empties.
Why Do We Do This?		
•To maximize the amount of flow that receives primary treatment. •To protect the downstream processes from abnormal wear due to grit abrasion. •To prevent grit and grease accumulation in the aeration tanks.		
What Triggers The Change?		
•An increase in flow to the primary settling tanks.		
What Can Go Wrong?		
•Broken shear pins, broken or slipped collector chains. •Plugged sludge pump suction and discharge lines. •Grease and grit carryover to the aeration tanks.		

2.6 GRIT REMOVAL

2.6.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
Grit Removal	8 – 20” Sludge Cyclone Degritters 4 – Grit Screw Classifiers 4 – Discharge Chutes 12 – 10 yard containers

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•Six grit cyclones feeding three grit classifiers is the normal operation. •Verify that empty grit containers are available. If not, contact the MVO to bring empties and remove the full containers. •Monitor the output from the cyclones to the classifiers. Clear any blockages in the cyclones. •Repair any critical equipment failures.
During Wet Weather Event		
SEE’s (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•Place all eight cyclones and all four classifiers in service. •Check the cyclones and classifiers for proper operation. •If a cyclone clogs, open the primary sludge crossover line to the other cyclones. •Using the tow motor, shift full containers out from under the grit hopper and replace them with empties. Contact the MVO to bring empties and remove full containers. •If all containers are full remove the full containers with the tow motor and let the grit fall on the floor.
After Wet Weather Event		
SEE	SSTW/STW	•Replace all full containers with empties. •Shovel the grit that has overflowed onto the floor back into the container. •Contact the MVO to bring empty containers and remove full containers. •Clear clogged cyclones. •Begin the process to repair broken equipment.
Why Do We Do This?		
•To protect the downstream equipment from abnormal wear and to prevent accumulation of grit in the aeration tanks.		
What Triggers The Change?		
•Increased grit load in the preliminary settling tanks due to increased flows and first flush of the collection system.		
What Can Go Wrong?		
•Grit cyclones can clog. •Grit classifier failure. •Grit container overflows onto the floor. •No empty containers requiring grit to be piled on the floor.		

2.7 SECONDARY SYSTEM BYPASS

2.7.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
South Secondary System Bypass	1 – Automated Control Gate (Manually Control) 1 – Combined Channel Flow meter
North Secondary System Bypass	1 – Overflow weir

2.7.2 Wet Weather Operating Procedures

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	Instrumentation Technician	•Verify that the combined channel flow meter has been calibrated.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•See Table 2-1, page 13, for minimum hydraulic capacities. The actual flow that can be passed through the secondary system may be lower than the hydraulic capacity in order to protect the nitrogen treatment biomass. The actual bypass flow will be determined by the loss of nitrification at various flows. •When flow reaches the secondary system minimum as per Table 2-1, open the South Bypass Control Gate accordingly, and verify the correct combined bypass flow. •If the channel flow meter fails, use the temporary measurement ruler installed on the wall and convert the inches of water into MGD based on the chart provided.
After Wet Weather Event		
SEE	SSTW/STW	•When flow drops below the secondary system minimum as per Table 2-1, close the South Bypass Gate. •Repair any failed equipment.
Why Do We Do This?		
•To maximize the flow that receives secondary treatment without causing nitrification failure or violations and 85% removal. •To maximize the flow that receives secondary treatment without causing hydraulic failure. •To maximize the flow that receives preliminary treatment and chlorination.		
What Triggers The Change?		
•Influent flows are higher than the hydraulic or BNR maximum that can be treated through the secondary system.		
What Can Go Wrong?		
•The South Bypass gate is not opened soon enough resulting in too much flow through the secondary system. •The South Bypass gate fails closed causing hydraulic overload of the secondary system. •The South Bypass gate fails open resulting in too much flow being bypassed. •The North Bypass weir is blocked causing hydraulic overload of the secondary system. •The channel flow meter fails resulting in estimation of bypass flow.		

•The channel flow meter is not calibrated causing incorrect bypass flow.

2.8 AERATION TANKS

2.8.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
South Aeration Tanks (1-6)	6 – 4 pass aeration tanks Influent channels 24 – Manual Step Feed Gates Diffusers 4 – Blowers (Old); 3 – (New) temporary blowers as of 4/09 or 5/09. 3 – Submersible Waste Sludge pumps 6 – Submersible Return sludge pumps (both waste sludge pumps and return sludge pumps were temporary installed under Contract 57).
North Aeration Tanks (7-10)	4 – 4 pass aeration tanks Influent channels 16 – Manual Step Feed Gates Diffusers 4 – Blowers (Old); 3 – (New) temporary blowers 1 – Waste Sludge pumps 2 – Hydraulic Balance Pumps (2 temporary waste sludge pumps and 4 temporary return sludge pumps will be installed under Contract 59 for phase III upgrade).

2.8.2 Wet Weather Operating Procedures

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•Current normal operation is to feed primary effluent to the Aeration tanks at 33% to passes B, C and D.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•Typically, wasting rates are adjusted or shut off. •The froth control hoods are normally shut off.
After Wet Weather Event		
SEE	SSTW/STW	• Adjust the sludge wasting rates based on the aeration tank inventory loss during the storm.
Why Do We Do This?		
•To maintain a desired solids inventory in the aerators. •Spray hoods are not effective during wet weather events.		
What Triggers The Change?		
N/A		
What Can Go Wrong?		
•Loss of nitrification due to loss of biomass from too much flow through the secondary system. Blower failure resulting in loss of treatment performance from lack of aeration. •Waste sludge pump failure. •Clogged or broken diffusers.		

2.9 FINAL SETTLING TANKS

2.9.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
South Final Settling Tanks (1-11)	11 – Final Settling Tanks 6 – temporary RAS pumps (1 per aerator) 41 – Chain and Flight Collectors (4 per FST 1-4 and 8-11, 3 per FST 5-7) 11 – Sludge Trough Cross-Collectors (1 per FST) 41 – Inlet Sluice Gates (4 per FST 1-4 and 8-11, 3 per FST 5-7) 41 – Rotating Scum Collectors 11 – Common RAS Telescoping Valves
North Final Settling Tanks (12-17)	6 – Final Settling Tanks 4 – temporary (Will be installed in contract 59) RAS pumps (1 per aerator) 18 – Chain and Flight Collectors (3 per FST) 6 – Sludge Trough Cross-Collectors (1 per FST) 18 – Inlet Sluice Gates (3 per FST) 18 – Rotating Scum Collectors 6 – Common RAS Telescoping Valves

2.9.2 Wet Weather Operating Procedures

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•Normal operation is for all tanks in service. •Observe the effluent quality. •Check the RAS bell weirs for proper flow. •Check the RAS pumps in service for proper operation. •Check the tank collectors for proper operation. •Skim grease by dropping the scum collectors.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•Check the sludge collectors. If a collector shears a pin, a chain breaks or comes off the sprocket, close the influent gates to isolate the tank. •Check the effluent quality. Notify the supervisor if solids are washing out over the weirs. •Check the RAS bell weirs for clogging. •Check the RAS pump flow rate.
After Wet Weather Event		
SEE	SSTW/STW	•Begin the process to repair any critical equipment failures •If the grease load on the tanks is heavy, drop the scum collectors and remove the grease.
Why Do We Do This? •To prevent solids build-up and washout in the clarifiers.		
What Triggers The Change?		
•Solids build-up in the clarifiers from a clogged RAS bell weir. •Solids washout over the clarifier effluent weirs.		
What Can Go Wrong?		
•Clogged RAS lifts. RAS pump failure. •Solids washout at the final effluent weirs. •Broken chains and flights. •Chains off the sprocket. •Sheared collector pins.		

2.10 PLANT EFFLUENT CHLORINATION

2.10.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
Plant Effluent Chlorination	3 – 232’ long x 50’ 3’’ wide x 12’ 6” deep Chlorine Contact Tanks 12 – Influent Slide Gates 2 – Sodium Hypochlorite Pumps 4 – 9,000 gallon Sodium Hypochlorite Storage Tanks 1 – Elevated Effluent Water Storage Tank 12 – 12-inch diameter relief lines

2.10.2 Wet Weather Operating Procedures

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•Monitor the Sodium Hypochlorite Storage Tank levels. •Normal monitoring for chlorine residual is every two hours. •Check the operation of the Sodium Hypochlorite feed pump.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•Adjust the chlorine dose as flow increases. When notified by the SEE that a sixth Main Sewage Pump will be started, increase the chlorine dose in anticipation of bypassed flow. It will be necessary to put a second hypochlorite pump in service to maintain the chlorine residual due to the high demand from the secondary bypass. •Check the chlorine residual every hour •Check the Sodium Hypochlorite Storage tank level. If low, isolate the tank and place a different tank on-line.
After Wet Weather Event		
SEE	SSTW/STW	•As flow decreases, reduce the chlorine dose. •As flow decreases, return to the normal monitoring frequency for the chlorine residual (See "Before Wet Weather Event"). •Check the Sodium Hypochlorite tank storage levels. Notify the supervisor of the need for a delivery.
Why Do We Do This?		
•To meet the elevated chlorine residual demand from additional flow and from bypassed flow that has only received Preliminary Treatment.		
What Triggers The Change?		
•Increased chlorine demand caused by an increase in flow and secondary bypassing of flow.		
What Can Go Wrong?		
•The chlorine dose is not high enough to anticipate the increased demand resulting in a low residual. •Secondary bypassing can occur without the chlorination operator being forewarned. •Failure of a hypochlorite feed pump. •Chlorine residual is too high after the storm event.		

2.11 SOLIDS HANDLING: THICKENING

2.11.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
Gravity Thickeners	1 – Inlet Distribution Box 8 – 70' Diameter Gravity Thickening Tanks 8 – Inlet Slide Gates 14 – Thickened Sludge Pumps (before construction) 8 – Thickener Collector Mechanisms

2.11.2 Wet Weather Operating Procedures

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•Normal operation is with a minimum of six out of eight thickeners in service. •Thickeners receive primary sludge and WAS via separate lines that meet at the influent distribution box.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	•No changes are currently made to thickening operations during wet weather events. •The primary sludge flow to the thickeners remains in service.
After Wet Weather Event		
SEE	SSTW/STW	•No changes are currently made to thickening operations during wet weather events.
Why Do We Do This?		
•To prevent flooding of the thickener overflow weirs.		
What Triggers The Change?		
•Increased flow to the division structure, which requires additional head for the Gravity Thickener Overflow to drain properly.		
What Can Go Wrong?		
•The gravity thickeners will flood and start to short circuit solids. •Collector mechanism failure. •Thickened Sludge Pump failure. •Waste sludge pump failure. •Thickened sludge is over pumped when no WAS is sent to the thickeners and water enters the digester.		

2.12 SOLIDS HANDLING: DIGESTION

2.12.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
Sludge Digestion	4 – Primary Digesters 2 – Secondary Digesters 4 – Sludge Storage Tanks 4 – Sludge Heaters 6 – Sludge Recirculation Pumps 2 – Sludge Transfer Pumps

2.12.2 Wet Weather Operating Procedures

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•All equipment is in service. Four digesters are operated as primary digesters with heating and recirculation. •Four tanks are operated as sludge storage tanks. Storage tanks 3 and 4 are the only tanks that feed dewatering.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	• No changes are currently made to the Sludge Digestion Operation during wet weather.
After Wet Weather Event		
SEE	SSTW/STW	• No changes are currently made to the Sludge Digestion Operation during wet weather.
Why Do We Do This?		
N/A		
What Triggers The Change?		
N/A		
What Can Go Wrong?		
•Hot loop pump failure. •Sludge recirculation pump failure. •Plugged sludge heaters. •Gas recirculator failure. •Over pressurization of the digesters resulting in gas venting. •Lifting of the digester cover.		

2.13 SOLIDS HANDLING: DEWATERING

2.13.1 Unit Processes and Equipment List

UNIT PROCESS	EQUIPMENT
Sludge Dewatering	4 – Centrifuges 5 – Sludge Pumps 1 – Sludge Feed Wet Well 2 – Polymer Storage Tanks 4 – Polymer Mixing Tanks 5 – Polymer Feed Pumps 2 – Conveyor Systems 2 – Truck Loading Hoppers 1 – Centrate Wet Well 3 – Centrate Wet Well Pumps 1 – Ferric Chloride Storage Tank 1 – Ferric Chloride Feed Pump

2.13.2 Wet Weather Operating Procedures

WHO DOES IT?		WHAT DO WE DO?
SUPERVISORY	IMPLEMENTATION	
Before Wet Weather Event		
SEE	SSTW/STW	•The number of centrifuges in service will vary from 2-4 depending on the sludge demand. •The centrifuge building normally operates five days per week but it will operate longer during periods of high sludge production.
During Wet Weather Event		
SEE's (With two separate influent wet wells in operation, a second SEE is assigned to the shift during wet weather events.)	SSTW/STW	• No changes are currently made to the Sludge Digestion Operation during wet weather.
After Wet Weather Event		
SEE	SSTW/STW	• No changes are currently made to the Sludge Digestion Operation during wet weather.
Why Do We Do This?		
N/A		
What Triggers The Change?		
N/A		
What Can Go Wrong?		
•Struvite blocking the centrate return line. •Polymer pump failure. •Sludge feed pump failure. •Centrifuge failure.		

3.0 Planned Plant Upgrades

The Bowery Bay WPCP is undergoing a plant stabilization and a BNR upgrade. A site plan and process flow diagram for the upgraded facilities are presented in Figures 3-1 and 3-2, respectively.

The plant upgrade will result in no increase to the current 300 mgd maximum capacity. This section summarizes the major improvements to be implemented as part of the overall plant upgrade.

3.1 INFLUENT SCREENING AND MAIN SEWAGE PUMPING

The present capacity of the main sewage pumps at Bowery Bay is 46.8 mgd for pumps 2-4 and 53.3 mgd for pumps 5-8. Main sewage pump No. 1 was installed under contract 57 with a capacity of 75mgd. LL MSP No. 2 will be upgraded to 75mgd under the same contract. A diversion sewer was installed that allows flow to be rerouted from before the high level wet well to the low level wet well. This will allow for a short-term shutdown of the high level wet well.

3.2 PRIMARY SETTLING TANKS

The number of primary settling tanks will remain at 15.

3.3 AERATION TANKS

The number of Aeration Tanks at Bowery Bay will remain at ten. The tanks will have anoxic/oxic switch zones constructed to allow the flexibility of changing the aerobic volume for nitrification. The tanks will also undergo an aeration system upgrade with new blowers, air piping, airflow measurement and control, new diffusers to allow the influent and centrate nitrogen load to be completely nitrified in the aeration tanks. Automated gates will also be installed to allow automatic control of excess storm flow to pass D. This is done to protect the biomass to prevent washout of the nitrifiers. Step Feed BNR Operation may require that secondary bypassing occur at flows lower than 225 mgd. If necessary, this will be performed based on the loss of nitrification following storm conditions and the secondary system bypass flow will be determined from actual operating experience.

3.4 FINAL SETTLING TANKS

The existing seventeen final settling tanks were upgraded with new chains, flights and effluent weirs, and will undergo an upgrade consisting of scum removal and increased RAS withdrawal capacity.

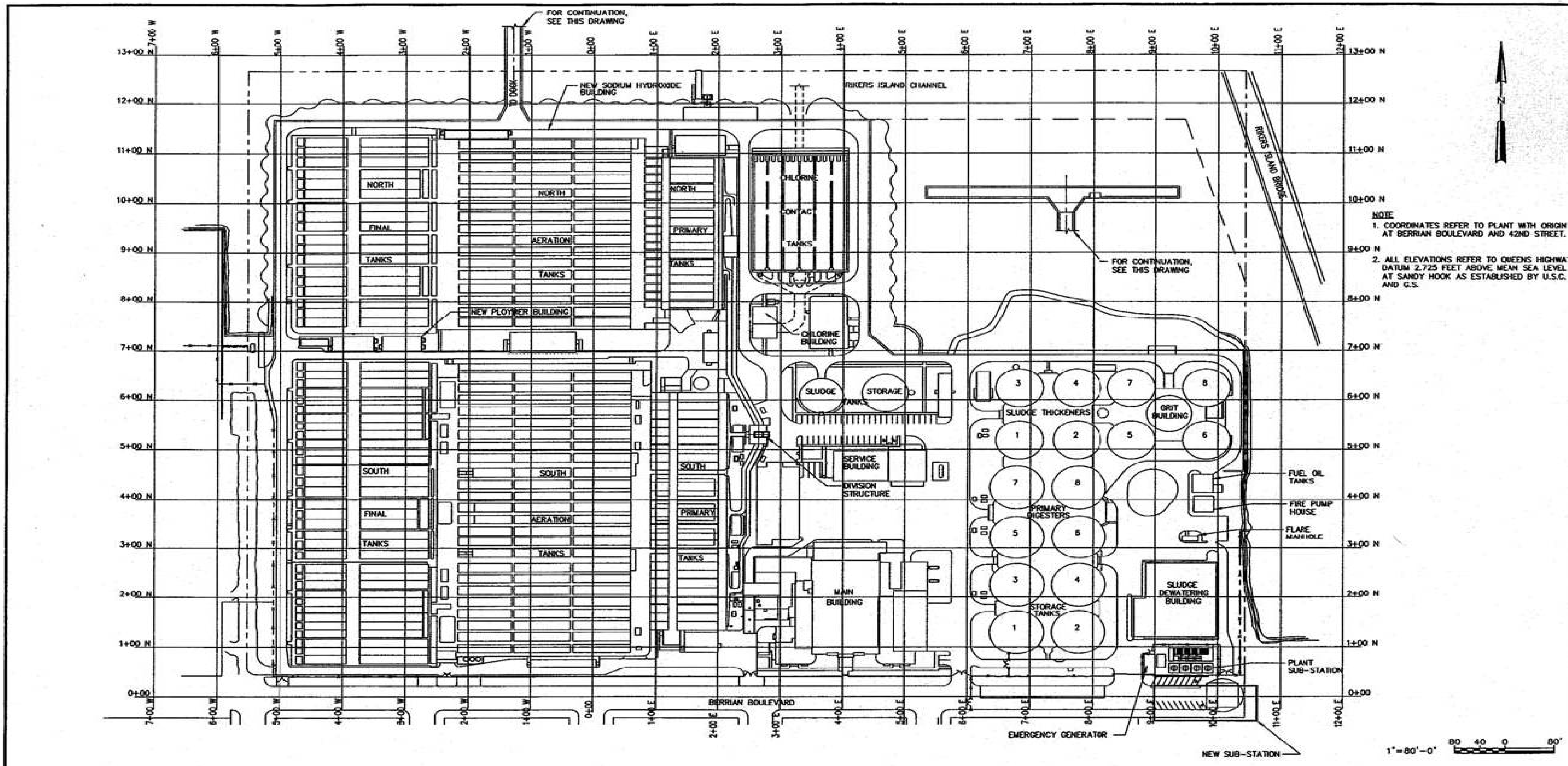

FIGURE 3-1: BOWERY BAY WPCP
UPGRADED FACILITY SITE PLAN

HAZEN AND SAWYER
Environmental Engineers & Scientists

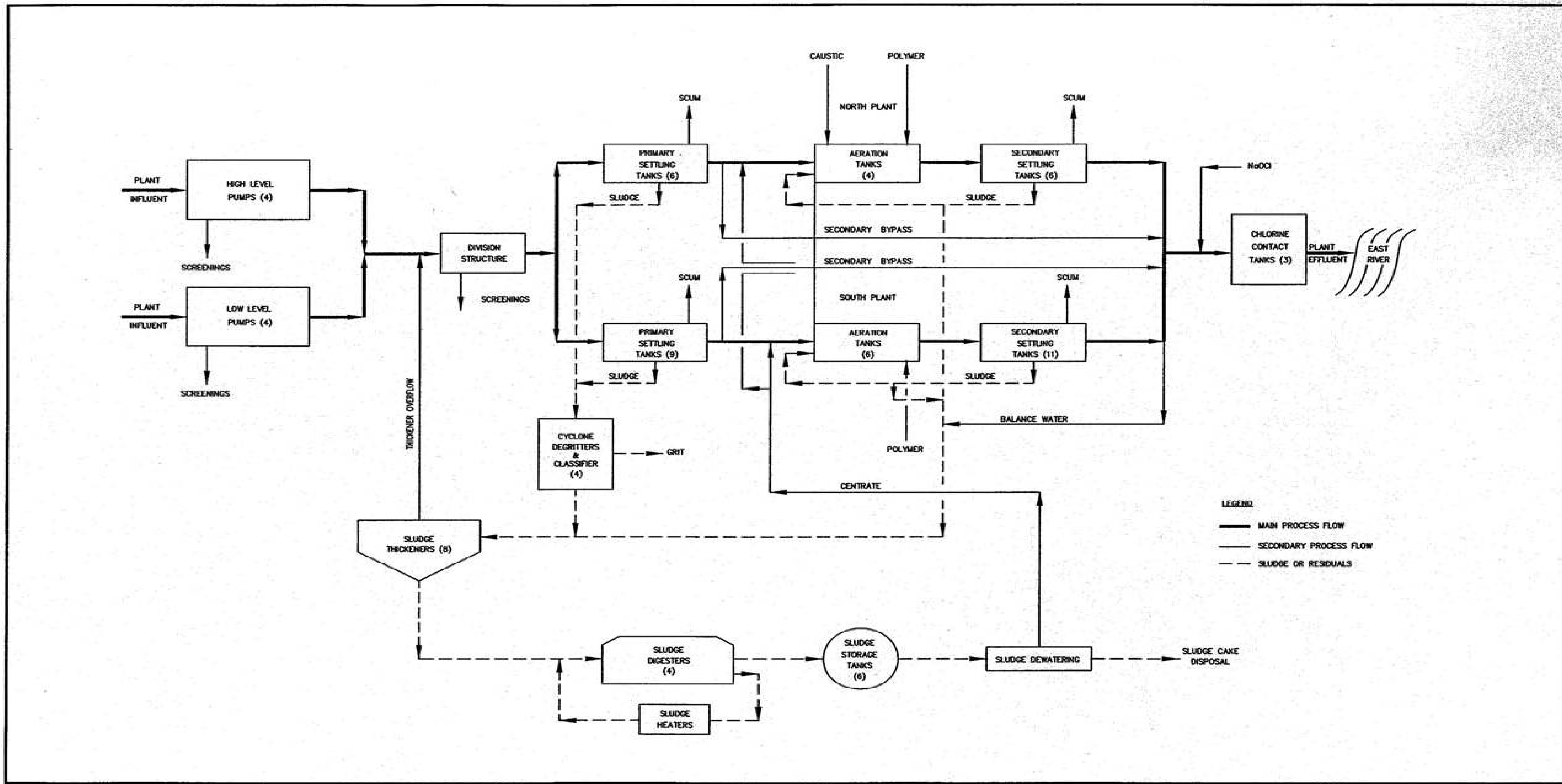

FIGURE 3–2: BOWERY BAY WPCP
UPGRADED FACILITY PROCESS FLOW DIAGRAM

3.5 PLANT EFFLUENT CHLORINATION

The existing chlorine contact tanks were upgraded and improved to reduce short-circuiting, increase mixing efficiency and increase the flow measurement accuracy. The Sodium Hypochlorite storage and feed system will be rehabilitated and upgraded.

3.6 CHEMICAL ADDITION SYSTEMS

A new Froth Control Building will be constructed between the North and South Final Settling Tanks and will supply sodium hypochlorite to the new froth control hoods located in Pass A and B of each aeration tank as well as the two RAS distribution boxes.

A new chemical building will be constructed to house the sodium hydroxide and the polymer systems. Sodium hydroxide will be the alkalinity source to the separate centrate treatment aeration tank.

3.7 RAS AND WAS SYSTEMS

A new RAS pump station will be constructed with the capacity to return a maximum of 150-mgd, which is the recommended capacity from the Comprehensive Nitrogen Management Plan Plant Upgrading Guidance Technical Memorandum.

A new WAS system will be constructed with flow meters and controls to maintain a constant SRT in the aeration tanks possibly in the future upgrades.

3.8 GRAVITY THICKENERS

The gravity thickeners are undergoing a complete rehabilitation with new mechanisms, overflow piping and thickened sludge pumps. A new gravity thickener overflow return line will be constructed that feeds directly into the Division Structure.

3.9 SLUDGE DIGESTION AND STORAGE

The four existing anaerobic sludge digesters heat exchangers are to be replaced. Storage tanks 1 through 4 will be upgraded with new pumps in order to pump to the sludge boats. Open roof storage tanks 1, 4, 9 and 10 will be covered and an odor control system provided.

The digester gas system will be overhauled and two new digester gas flares will be constructed.

APPENDIX A

CORONA AVENUE VORTEX FACILITY WWOP

Corona Avenue Vortex Facility
Corona, New York

Wet Weather Operating Plan
Corona Avenue Vortex Facility
Addendum to Bowery Bay WWOP

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LIST OF FIGURES

1. INTRODUCTION

The purpose of a wet weather operating plan (WWOP) is to provide a set of operating guidelines to assist operating personnel in making operational decisions that will best meet the wet weather operating performance goals. This WWOP is also a SPDES requirement for the Corona Avenue Vortex Facility (CAVF) as well as for the Bowery Bay Water Pollution Control Plant (WPCP).

During wet weather events, numerous operational decisions must be made to effectively manage and optimize treatment of wet weather flows and combined sewer overflows (CSOs). However, each wet weather event produces a unique combination of flow patterns and facility conditions. Therefore, no plan or manual can provide specific, step-by-step procedures for every possible wet weather scenario. However, a WWOP can provide a consistent method of operation for various situations. The WWOP is intended to provide a basis for consistent wet weather operating practices, and that will maximize the utility of the CAVF during wet weather conditions.

This WWOP for the CAVF provides for operation during dry and wet weather flow periods.

The CAVF was designed as a prototype, demonstration facility for the study of floatables removal from CSOs from the lower deck sewer of Outfall CS-3 (SPDES No. BB-006) in the Bowery Bay WPCP drainage area. The combined collection system drainage area of CSO Outfall BB-006 consists of approximately 3,730 acres serving the southeastern portion of the Bowery Bay WPCP service area.

The CAVF was not designed to provide end-of-pipe CSO treatment. However, the facility does remove a portion of the floatables and settleable solids that would otherwise be discharged into Flushing Bay through Outfall BB-006.

The CAVF is located in the Borough of Queens, New York City on Corona Avenue near the junction of Corona Avenue and Saultell Avenue, and within the service area of the Bowery Bay WPCP. Figure 1-1 presents an aerial view of the facility location. The facility is located entirely within Corona Avenue and is completely underground. A schematic of the facility is presented in

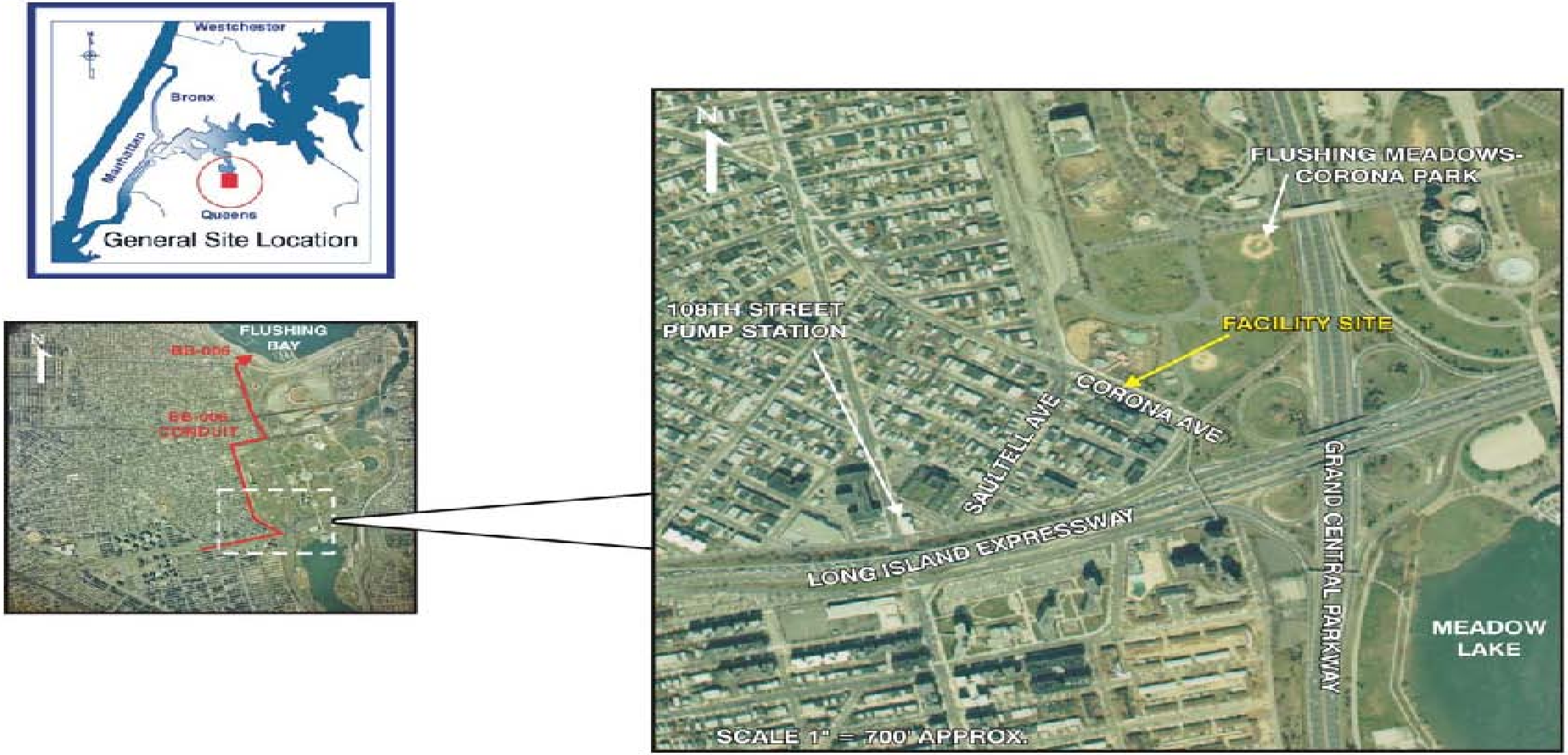
Figure 1-2. It consists of three, 43-ft diameter vortex concentrators that operate in parallel. As a testing facility the units were designed to permit one, two or all three units to be operated during wet weather events. The three vortex units represent the following vortex design configurations: the EPA Swirl Concentrator; the Storm King hydrodynamic separator of British design; and the FluidSep vortex separator, of German design. The hydraulic capacity of each vortex unit is approximately 130 million gallons per day (mgd). The peak hydraulic capacity of the overall facility is approximately 400 mgd.

The original WWOP was conceptual in nature. The procedures presented in this WWOP reflect operating experience with the prototype facility. These procedures will continue to be revised as additional operating experience is gained.

1.1 Background

In the early 1990s the New York City Department of Environmental Protection (NYCDEP) selected vortex technology for potential use in developing its city-wide combined sewer overflow treatment strategy. The three vortex design configurations selected for evaluation were the EPA Swirl Concentrator; the Storm King hydrodynamic separator of British design; and the FluidSep vortex separator, of German design. The three types of vortex units were constructed as part of the CAVF, and parallel operation of the units began in 1998. The primary objective of the CAVF was to evaluate the effectiveness of each of the vortex technologies to determine if they are appropriate for use in New York City to remove floatables from CSO discharges.

The CAVF is designed to treat flows up to about 400 mgd, and serves the lower deck of Outfall CS3 (SPDES No. BB-006) in the Bowery Bay WPCP drainage area. The hydraulic capacity of each vortex unit is approximately 130 mgd. Outfall BB-006 is a combined sewer outfall that discharges overflow to Flushing Bay from the Bowery Bay High Level Interceptor System. An upper deck sewer originating from Regulator BB-R10 and a lower deck sewer from Regulator BB-R11 combine to form the 10'-6"x 9'-0" four barrel outfall. Outfall BB-006 is tidally affected, and the capacity of the outfall is restricted at high tide. The CAVF was designed to operate passively, withstand flooding from extreme conditions, and is provided with water submersible



FACILITY SITE LOCATION

DEP	CORONA AVENUE VORTEX FACILITY WET WEATHER OPERATING PLAN	Figure 1-1 URS

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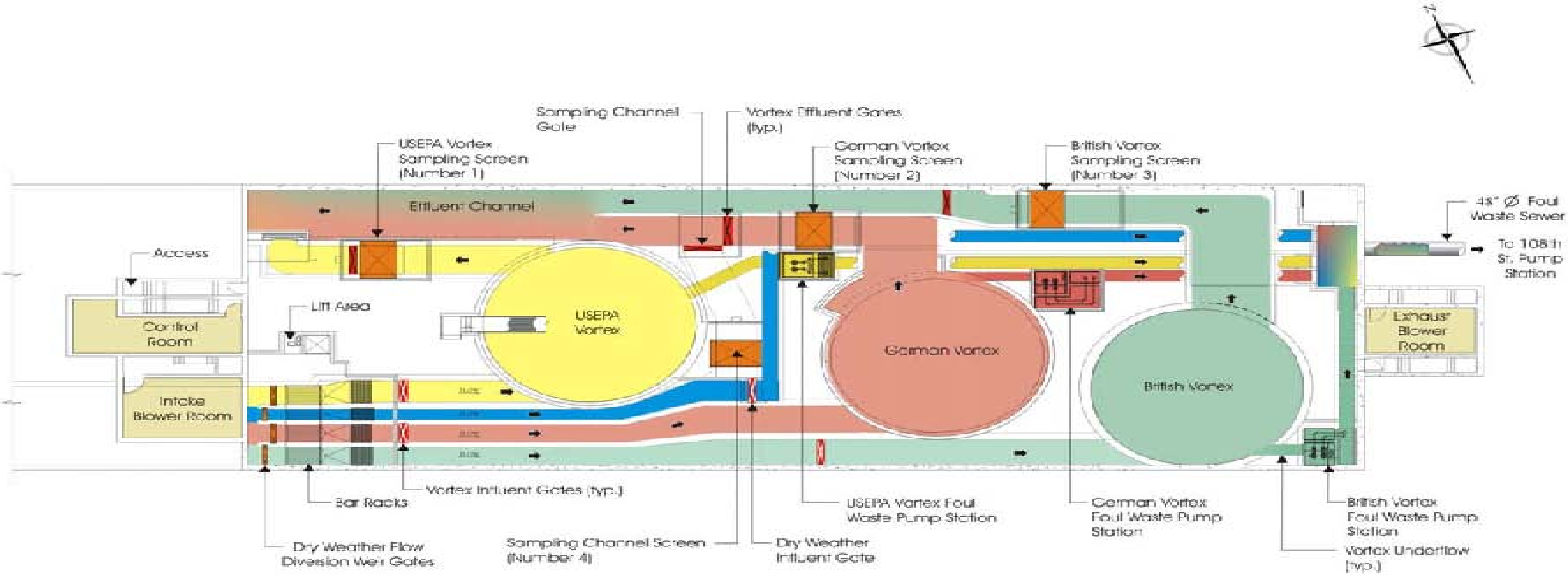
equipment, elevated local switches and panels, and electrical components located in a separate, isolated control room.

Vortex separation technology uses the inherent energy within the flow-stream and induced by the specific geometry of the device to remove floatables and settleable solids from influent CSO. The vortex units have no moving parts, and rely on the inertial forces induced by the flow-path to remove a concentrated stream of pollutants from the CSO stream. During CSO events, flows into the CAVF are routed tangentially into each vortex unit. The vortex devices differ from sedimentation tanks in that they are designed to use the differences in inertia between the particles and the liquid as well as gravitational forces to effect solid-liquid separation at high flow rates.

Flows enter the vortex units through large inlet pipes, and exit each vortex device via a route at the base of the unit, and a route at the surface of the unit. Solids, including settleable solids, tend to concentrate inward towards the center, exiting at the base of the units as an underflow stream. The CAVF was designed to transfer the underflow from the CAVF to a gravity sewer, the Foul Waste Sewer, which discharges to the wet well of the 108th Street Pumping Station. The underflow is transported to the Foul Waste Pit through a combination of gravity flow and pumping. Gravity can deliver the underflow to the Foul Waste Sewer when the vortex units are running. When flow to the vortex units subsides after a rain event the units will partially drain by gravity after which foul waste pumps are activated to fully drain the units.

From the foul waste effluent chamber, the combined underflow of the three vortex units flows by gravity to the 108th Street Pumping Station. From the 108th Street Pumping Station, the underflow is pumped to the collection system of the Bowery Bay WPCP, and is conveyed to the WPCP for final treatment. As the underflow mixes with the combined sewage in the interceptor a portion of it is released in CSO’s through inline regulators. The operators can also choose to retain the underflow in the CAVF units and not discharge it to the Foul Waste Sewer. Because of the potential loss of underflow through CSO’s the operators currently retain the underflow in the units and discharge it to the Foul Waste Sewer after wet weather flows and the hydraulic gradeline in the interceptor subside.



CORONA AVENUE VORTEX FACILITY SCHEMATIC PLAN

DEP	**CORONA AVENUE VORTEX FACILITY** **WET WEATHER OPERATING PLAN**	**FIGURE 1-2** URS

As a demonstration facility, the CAVF was constructed with features and equipment to facilitate the collection of data for the evaluation of floatables and pollutant capture efficiencies. A sampling and monitoring program of the CAVF was performed from December 6, 1999 to October 3, 2002. The results of the program are presented in a September 29, 2003 report entitled Evaluation of Corona Avenue Vortex Facility.

1.1.1 Drainage Area and Collection System

The combined collection system drainage area of Outfall BB-006 consists of approximately 3,730 acres serving the southeastern portion of the Bowery Bay WPCP service area. Outfall BB-006 receives flow from two subsystems: the upper deck drainage area which originates at Regulator BBR10, and the lower deck drainage area which originates from Regulator BB-R11.

The discharges from both decks combine at a transition chamber downstream of the CAVF, and discharge to Flushing Bay through a four-barrel 10'-6" W x 9' -0" H (inner dimensions) sewer. The lower deck drainage area is 1,528 acres, and contributes approximately 67 percent of the combined sewage that overflows to Flushing Bay through Outfall BB-006.

Prior to the construction of the CAVF, the collection system of the BB-006 drainage area was regulated by 15 regulators as follows:

Upper Deck - Regulator BB-R10 (Upper Deck)

Lower Deck -Regulators BB-R11, BB-R12, BB-R16, BB-R17, BB-R18, BB-R19, BB-R20, BB-R21, BB-R22, BB-R23E, BB-R22W, BB-R24, BB-R25, and BB-R26

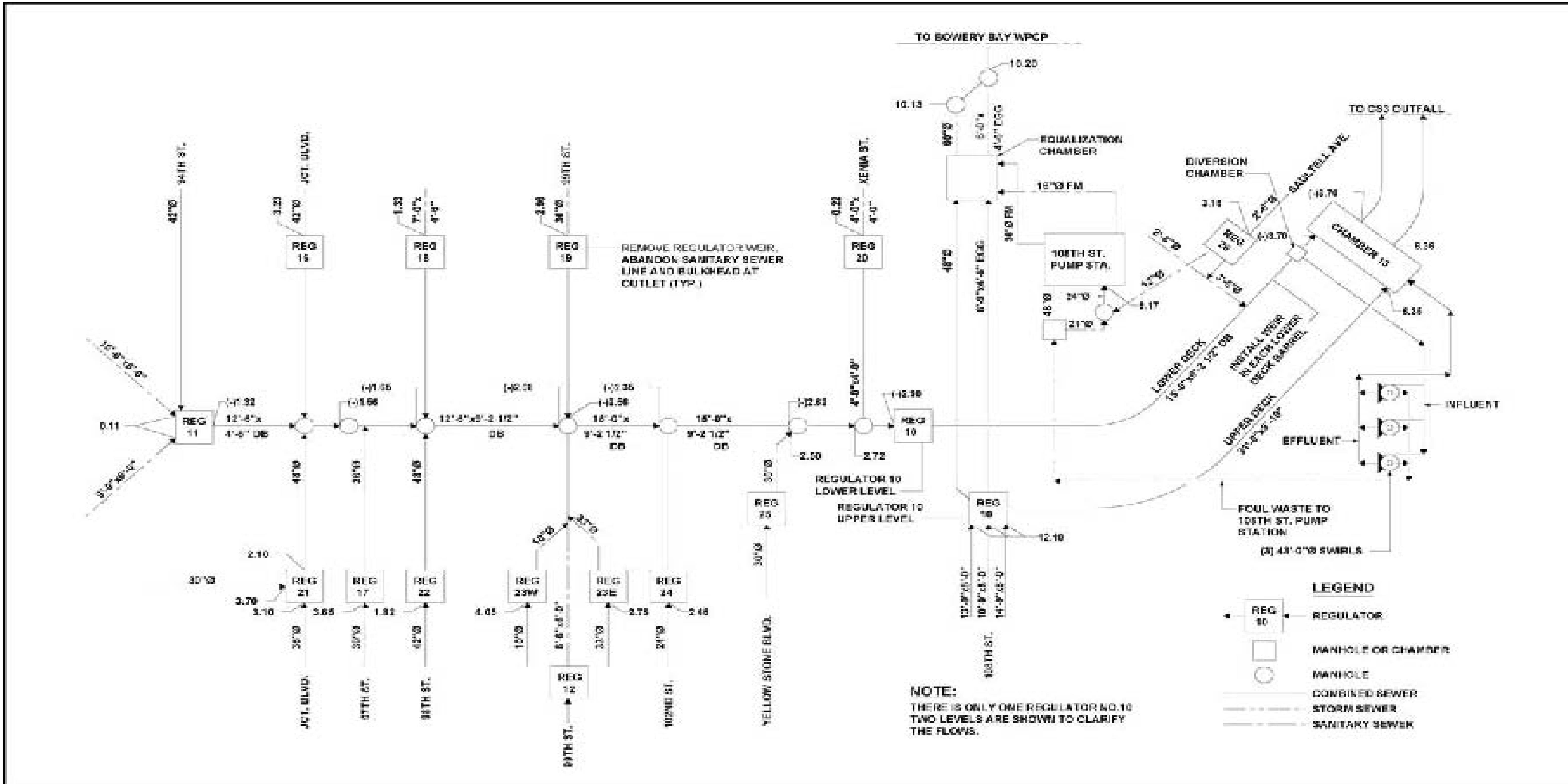
The construction of the CAVF changed the collection system such that the CAVF serves as the CSO regulator for the lower deck sewers. Modifications of the collection system have been made such that dry weather as well as combined flows only from the regulator BBHL-11 is coming to 108 ST. pump station and the thirteen lower deck regulators are now directed to the existing lower deck overflow sewer to the existing lower deck overflow sewer. The diversion weirs in these thirteen regulators have been removed, and the dry weather outlets have been permanently bulkheaded. A schematic diagram of the collection system of the BB-006 drainage area after the construction of the CAVF, the existing CSO system, is shown in Figure 1-3. Figure 1-4 shows the drainage area of the CAVF overlaid on an aerial photograph; the location of the Outfall BB-006 is also shown.

1.1.2 Facility Capacity

A wet weather bypass weir is located within the CAVF Diversion Structure and limits the maximum CSO flow to the CAVF to approximately 400 mgd. Flows that exceed this capacity pass through a baffle, spill over the wet weather bypass weir, and discharge to Flushing Bay through Outfall BB-006. The maximum hydraulic capacity of the BB-006 lower deck combined sewer outfall conduit is approximately 650 mgd.

During wet weather flows within the capacity of the CAVF enter the facility through the influent channel, and as the water surface elevation rises, the one, two or all three vortex units begin operating automatically, each one coming on line at preset water surface elevations. The diverted flow passes through the vortex units, and floatables and settleable solids are captured. Overflows from the vortex units are returned to the BB-006 lower deck sewer, downstream of the wet weather bypass weir, for discharge into Flushing Bay through Outfall BB-006. The underflow, which contains floatables and settleables from each vortex unit, is pumped to the Foul Waste Effluent Chamber, after the event (during dry weather) where it then flows by gravity to the 108th Street Pumping Station. This additional wet weather flow being conveyed to the 108th Street Pumping Station is within the overall capacity of the station.

Presently, dry weather flow, up to an average of about 10 mgd, also enters the CAVF. This flow bypasses the vortex units and is discharged to the Foul Waste Chamber then to the 108th Street Pumping Station.



DEP	CORONA AVENUE VORTEX FACILITY - SCHEMATIC OF EXISTING CSO SYSTEM	FIGURE 1-3
	CORONA AVENUE VORTEX FACILITY WET WEATHER OPERATING PLAN	URS

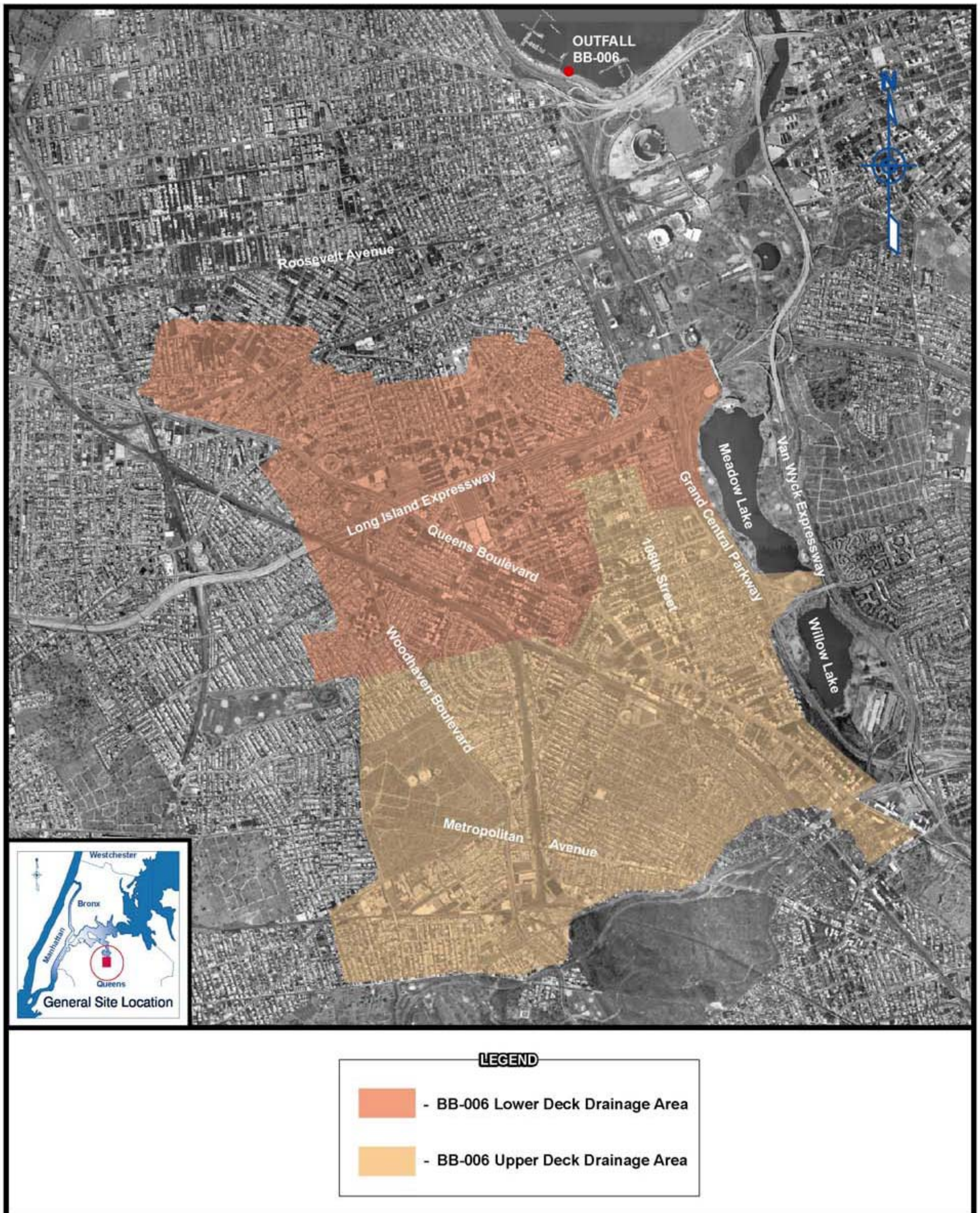


FIGURE 1-4
Wet Weather Operating Plan

OUTFALL BB-006 DRAINAGE AREA

1.1.3 CSO Outfall Characteristics

Prior to construction of the CAVF, CSO from the lower deck system of the BB-006 sewers upstream of the CAVF was discharged into Flushing Bay through Outfall BB-006. Outfall BB-006 is equipped with timber tide gates.

Construction of the CAVF has not significantly altered the way in which combined sewage overflows to Flushing Bay through Outfall BB-006. However, there are two notable differences, as follows:

Prior to discharging to Flushing Bay through Outfall BB-006, combined sewage, up to approximately 400 mgd, is routed through the CAVF, where floatables and settleable solids removal takes place.

During storms in which the vortex units overflow, a portion of settleable solids and floatables are removed and retained in the units. The effluent is discharged to Outfall BB-006. . The foul waste pumps pump the underflow from each vortex unit to the Foul Waste Effluent Chamber after the storm event. The underflow then flows by gravity from the Foul Waste Effluent Chamber through the 48-inch Foul Waste Sewer to the 108th Street Pumping Station.

1.1.4 Floatables and Settleable Solids Removal

In a typical vortex facility design, the foul waste line discharges by gravity to a sewer. The underflow, or foul waste, is equal to up to 10 percent of the vortex influent flow, and includes solids and floatables removed in the vortex unit. However, since the invert elevations of the CAVF vortex units are approximately 10 to 20 feet lower than the invert of the elevation of the 48-inch diameter line that discharges to the 108th Street Pumping Station, the vortex units cannot be completely drained by gravity.

Each vortex unit is equipped with its own foul waste chamber that collects the underflow. Each of the foul waste chambers is furnished with two foul waste pumps (1 main, 1 standby) to pump the underflow to a common foul waste effluent chamber that is part of the CAVF.

The foul waste pumps are rated at 10 hp submersible pumps and have vertical, semi-open chopper impellers and cutter bars, and bottom inlet and side discharges. Their rated capacities are:

USEPA Vortex - 575 gpm @ 28 ft TDH
Storm King Vortex (British) - 500 gpm @ 30.8 ft TDH
FluiSep Vortex (German) - 475 gpm @ 31.5 TDH

The foul waste pumps are activated manually after a wet weather event. The pumps discharge the underflow to the Foul Waste Chambers which transports the underflow to the 108th Street Pumping Station. In order to prevent solids from settling out in the foul waste chambers, the chambers are equipped with liquid mixing eductors that utilize City water as the operating liquid. Flow to the eductors is controlled by solenoid valves that are activated when the foul waste pumps are activated.

1.1.5 Combined Sewage Diversion to the CAVF

The CAVF Diversion Structure is located in the intersection of Saultell Avenue and Corona Avenue. It consists of the diversion chamber, located within the previously existing 15'-0" x 9'-22" Double Barrel Lower Deck CSO line to Outfall BB-006, and the influent and effluent channels to the vortex facility. The Diversion Structure diverts dry weather flow in the CS3 Lower Deck combined sewer to the CAVF. During wet weather, the Diversion Structure also diverts combined sewage to the vortex units. The maximum hydraulic capacity of the CS3 Lower Deck combined sewer and the CSO outfall line is approximately 650 mgd. The diversion structure is designed to limit the maximum flow rate to the CAVF to approximately 400 mgd.

Combined sewage is diverted to the CAVF by a 6'-2½" high wet weather bypass weir located within the lower deck of the BB-006 sewer, at the influent chamber (Diversion Structure) to the CAVF.

This weir directs CSO into the CAVF, up to a capacity of approximately 400 mgd. Flows in excess of this capacity pass through a baffle, overflow the weir, and discharge to Flushing Bay through Outfall BB-006.

1.1.6 Wet Weather Flow Control

The CAVF is provided with four manually operated dry weather flow diversion slide gates (SG-9, SG-10, SG-11, SG-12). These slide gates are installed in the influent channels, upstream of manually cleaned bar racks. Their purpose is to direct the dry weather flow to the dry weather flow/sampling channel, thereby preventing it from entering any of the vortex units. Under normal conditions, when it is desired to direct dry weather flow to a vortex unit, then the corresponding slide gate may be raised and the direct dry weather flow/sample channel slide gate (SG-12) lowered.

The CAVF is equipped with twelve sluice gates, nine motor operated and three manually operated. A total of six gates (SG-1 through SG-6) are provided in the influent and effluent channels of the vortex units. These gates are used to control or isolate the flow of combined sewage to each vortex unit. Two gates (SG-7, SG-8) are provided in the sampling channel: one for effluent, and one for the dry weather flow bypass. Three gates (SG-13 through SG-15), one for each vortex unit foul waste pump chamber, are provided. One gate (SG-16) is provided for the emergency floor drain to the 48inch diameter foul waste sewer. An additional gate (SG-17) is provided at the 108th Street Pumping Station for the 48-inch diameter foul waste sewer influent to the pumping station. Under typical operating conditions, the sluice gates are in the open position. In its current configuration, the CAVF cannot be isolated from flow. However, the CAVF was designed to operate passively, withstand flooding from extreme conditions, and is provided with water submersible equipment, elevated local switches and panels, and electrical components located in a separate, isolated control room.

1.2 Performance Goals for Wet-Weather Events

The CAVF is intended primarily as a floatables removal demonstration facility, and as a CSO regulator. However, the facility will also remove a portion of the floatables and settleable solids that would otherwise be discharged into Flushing Bay through Outfall BB-006.

Settleable solids are defined as those heavier solids associated with street runoff and having a specific gravity of 2.65 at a particle size of 0.4 to 1.0 mm. Particles that have lower specific gravity but are proportionately larger in size will also be removed. During overflow events, the performance of the units as a solid separator is expected to decrease as storms progress. This occurs because solids separation operations are more efficient at high solids concentrations, and solids concentrations during overflow events are likely to be relatively low after the initial period of a rainstorm.

1.3 Purpose of this Manual

The purpose of this manual is to provide a set of operating guidelines to assist NYCDEP staff in making operational decisions which will best meet the performance goals stated in Section 1.2 and the requirements of the New York SPDES discharge permit.

1.4 Using the Manual

This manual is designed to allow use as a general reference during wet weather events, and is meant to supplement the facility operation and maintenance manual with which operating personnel should be familiar. This manual is broken down into sections that cover operation of the CAVF. The following information is included:

- Steps to take before, during and after a wet weather event;
- Discussion of why the recommended control steps are performed;
- Identification of specific circumstances that trigger the recommended changes; and
- Identification of things that can go wrong with the equipment.

This WWOP is a living document, and is subject to modification. Users of the WWOP are encouraged to identify new steps, procedures, and recommendations to further improve the wet-weather operating efficiency of the CAVF. Modifications, which improve upon the manual=s procedures, are encouraged. With continued input from experienced operations staff, this WWOP will become a more useful and effective tool.

2. FACILITY OPERATION

This section presents wet weather operating procedures followed for the CAVF. This section is divided into operation of the facility during dry weather, operation during rising level event (onset of wet weather), and during falling level event (end of wet weather with receding water levels). The operating procedures address the basis for the protocol, events or observations that trigger the protocol, and a discussion of what can go wrong.

2.1 Operation of the CAVF During Dry Weather Conditions

During dry weather conditions (no storm flow) the flow in the BB-006 sewer is diverted from the BB-006 sewer through the Diversion Structure by the 6'-22" high wet weather bypass weir located within the lower deck of the BB-006 sewer, at the influent chamber to the CAVF. This weir directs CSO into the CAVF, up to a capacity of approximately 400 mgd during wet weather. Flows in excess of this capacity pass through a baffle, overflow the weir, and discharge to Flushing Bay through Outfall BB-006.

Why Do We Do This?

To direct dry-weather flow to the 108th Street Pumping Station rather than the CAVF.

What Triggers the Change?

During dry weather conditions, level in the Dry Weather Diversion Chamber is less than El. (-) 1.50, therefore level transmitters do not send signal to trigger the computer control system.

What Can Go Wrong?

- The dry weather diversion weir has been designed to passively control flow to the vortex facility. Therefore, operational problems are not anticipated.

- During dry weather conditions, make sure that the dry weather diversion slide gates are closed. Sluice gate 7 should be shut; sluice gate 8 should be open.

- During dry weather conditions, make sure that the sluice gate at the 108th Street Pumping Station is in the open position.

2.2 Operation of the CAVF During Wet Weather Events

Routing of flow through the facility is managed by sewage elevations. Tanks in service will fill and convey flow as sewage levels rise.

Why Do We Do This?
To allow the tanks to receive flow and remove some floatables and solids from the CSO stream.

What Triggers The Change?
Rising water surface levels in the Dry Weather Diversion Chamber and in the CAVF trigger the change.

What Can Go Wrong?
Excessive flows and high tides will result in flooding of the facility, which takes personnel and time to clean and can create odors.

2.3 Operation of the CAVF After Wet Weather Event

After a wet weather event, Collection Facilities crew use the underflow pumps to pump out the tanks and remove captured solids and floatables. This flow goes to the 108 St. pumping station for transfer to Bowery Bay for treatment.

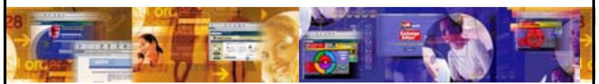
Why Do We Do This?
To remove solids and floatables captured during the wet weather event and prevent odors.

What Triggers The Change?

The end of the wet weather event and the available capacity in the interceptor to Bowey Bay.

What Can Go Wrong?

If sewage is left in Vortex tanks for an extended period of time, odors can be encountered.



New York City Waterways Study

Newtown Creek

Fall 2003

RoperASW The power of intelligence in action — NOP World

Purpose and Objectives

Newtown Creek Assessment Area

The overall purpose of the study was to measure New York City residents' use of and attitudes toward the water resources in their community and elsewhere. The research covered many different areas relevant to this overall purpose. Among the key topics included were:

- **New Yorkers' awareness of the major New York City waterways;**
- **Their use of the water and the land areas alongside the water for recreational use for various waterways;**
- **The recreational activities they have participated in and how enjoyable they found these activities;**
- **If they have not used the various waterways for recreational purposes, the reasons why not;**
- **Their attitudes toward New York City waterways on a variety of aspects;**
- **The improvements they have seen in New York City waterways and their desired future improvements.**

Method

Newtown Creek Assessment Area

Interviews were conducted via CATI (Computer Assisted Telephone Interviews) among 18+ year old residents of the five boroughs of New York City.

The sample design for the study was as follows:

- **HydroQual selected 26 New York City "primary waterways" to be studied. The specific waterways respondents were asked about were determined by their zip code.**
- **The sample size for each waterway was to be 300.**
- **However, because some zip codes are proximate to more than one primary waterway, respondents in those zip codes were asked about two and sometimes three primary waterways. As a result, the number of responses for some individual waterways is greater than 300. In turn, a total of 7,424 interviews were conducted which yielded a total of 8,031 responses to questions about primary waterways.**

Method (cont'd)

Newtown Creek Assessment Area

- **Of the total of 7,424 interviews, 5,488 interviews (74%) were conducted using a RDD (random digit dial) sample of the five boroughs.**
- **The balance of 1,936 interviews was conducted using listed sample specific to the zip codes for those waterways with remaining sample assignments, (i.e., for those assessment areas where an RDD method would have been dispro-portionately expensive due to the relatively low incidence of people living in the areas.)**
- **Within each household, whether from the RDD or the listed sample, the specific individual interviewed was selected at random from all 18+ year old residents at home.**

A list of the 26 primary waterways studied is provided in Appendix A.

Method (cont'd)

Newtown Creek Assessment Area

As a first step in the questionnaire development process a series of 5 focus groups was conducted among residents of the five boroughs (one in each borough) to ensure that the questionnaire for the telephone survey covered all the relevant issues, and did so in a way that would be clear to respondents.

The questionnaire was then designed in close consultation with HydroQual and NYC DEP senior personnel. A copy is appended at the end of this report.

The interviews, which averaged about 18 minutes in length, were conducted as follows:

- **Written instructions regarding the correct administration of the questionnaire were provided and all field supervisors and interviewers were briefed on the study prior to conducting any interviews.**
- **A pre-test was conducted prior to the full field to ensure that the questionnaire would be clearly understood by respondents.**
- **The full fieldwork was conducted from late June until early September. Interviewing hours throughout the period were weekday evenings and during both the day and evening on the weekend.**

Method (cont'd)

Newtown Creek Assessment Area

The data were edited and cleaned prior to tabulation. In addition, "other specify" responses to all pre-coded answer list questions were examined and where a sufficient number of responses clustered around a general theme (at least 2% of responses), a code for those responses was added to the pre-coded list in tabulating the data

The final data were weighted as follows:

- **Weights were applied to correct for:**
  - **The unequal probability of household selection due to households with more than one voice telephone number; and**
  - **The unequal probability of selection of the individual selected for the interview due to different numbers of individuals being available to be interviewed in different households.**

Method (cont'd)

Newtown Creek Assessment Area

- In addition, post-stratification weighting was applied separately for each of the 26 primary waterways to balance the sample data to 2000 U.S. Census Data for:
  - The composition of the household -- Single adult (18+) households vs. 2+ adult with children households vs. 2+ adult without children households;
  - Age within gender; and
  - Race/ethnicity.
- Data for each waterbody area were projected to actual population counts from the 2000 Census, so that the areas could be easily combined to yield an appropriately weighted sample of all adults 18+ in the five boroughs of New York City.

Organization of the Report

Newtown Creek Assessment Area

A separate report is provided for each of the 26 primary waterways included in the study. In each report, the results for the subject primary waterway is compared to the average for all 26 waterways. (A separate report of the findings on a city-wide basis has also been prepared.)

The findings for each individual waterway are organized as follows:

- Awareness of primary waterways
- Visiting primary waterways
- Participation in recreational activities and attitudes toward primary waterways
- Improvements to primary waterways -- past and desired in the future
- Demographic and other profile information.

Glossary and Other Reading Notes

Newtown Creek Assessment Area

- **Area residents** -- live in one of the zip codes that define the subject primary waterway
- **Total NYC residents** -- all respondents
- **Primary waterway** – one of the 26 New York City waterways for which respondents were asked their use of and attitudes toward
- **Other NYC waterways** – other New York City waterways respondents volunteered in response to various questions
- **Unaided awareness** -- a mention of a NYC waterway without prompting or aiding the respondent
- **Total awareness** -- a combination of unaided awareness and aided awareness. i.e., the respondent is given the name and asked if they have ever heard of that waterway
- **Visiting a waterway** -- spending recreational or leisure time in or on the waterway or the land alongside those waters
- **On water activities –** boating/speed boating, canoeing, cruising/tour boat, ferryboat ride (for leisure), kayaking, sailing.
- **In water activities –** jet skiing, surfing, swimming, wading.

Glossary and Other Reading Notes (cont'd)

Newtown Creek Assessment Area

All base sizes shown are the actual number of people who were asked the question, prior to projecting them to the population of New York City.

As mentioned earlier, two base sizes are shown for the total for New York City residents depending on the question:

- A base of 8,031 for all questions that are specific to a primary waterway; and
- A base of 7,424 for all questions that are not specific to a primary waterway.

Glossary and Other Reading Notes (cont'd)

Newtown Creek Assessment Area

Comparisons of the findings for the subject waterway are made to all New York City residents in two ways:

- An average of the values for all 26 primary waterways; and
- A median value for the 26 waterways -- the value at the mid-point of the values for the 26 waterways, that is, there are an equal number of values above and below the median value.

The median value is shown whenever extremely high values for a few waterways tend to distort the average. In these cases, the median value is more helpful than the average in placing where the subject waterway stands relative to all the other waterways.

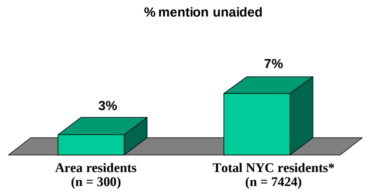
Awareness of Primary Waterway

Newtown Creek

Total Unaided Awareness of Primary Waterway

Newtown Creek Assessment Area

- 3% of area residents mention the Newtown Creek on an unaided basis.
  - The average for unaided awareness for all the primary waterways is 13%.
  - The median value for unaided awareness for all the primary waterways is 7%. (See page 11.)

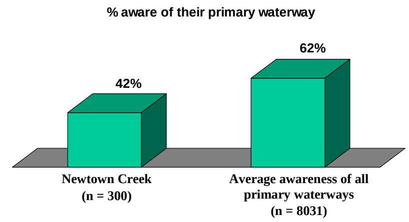


* Median

Total Awareness of Primary Waterway

Newtown Creek Assessment Area

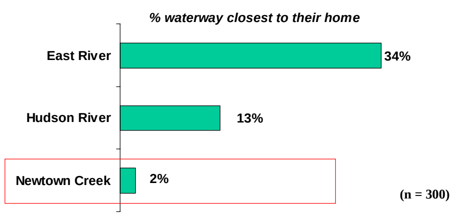
- In total, 42% of Newtown Creek area residents are aware of Newtown Creek on a combined unaided and aided basis.
  - Average total awareness of all primary waterways among NYC residents is 62%.



Waterway Closest to Home (Unaided)

Newtown Creek Assessment Area

- On an unaided basis, area residents most often mention the East River as the waterway closest to their home.
  - 2% of area residents mention the Newtown Creek unaided as the waterway closest to their home.
  - On average, 10% of NYC residents mention unaided the primary waterway in their assessment area as the waterway closest to their home. The median value for all primary waterways being regarded as the waterway closest to home is 3%. (See page 11.)



Awareness Summary

Newtown Creek Assessment Area

	Area Residents %	NYC Residents %
Total unaided awareness of primary waterway	3	13*
Total awareness of primary waterway	42	62
Primary waterway is waterway closest to home	2	10**

* Median is 7% ** Median is 3%

Visiting Primary Waterway

Newtown Creek

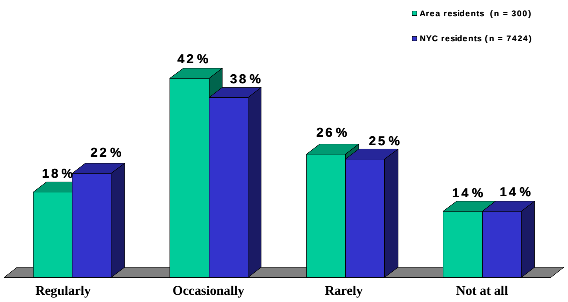
How Often Visit NYC Waterways Generally

Newtown Creek Assessment Area

- 18% of area residents say they visit the waterways in their community or elsewhere in the city on a regular basis. 42% say they visit them occasionally.
  - 22% of all NYC residents say they visit the city's waterways regularly while 38% say they visit them occasionally.

How Often Visit NYC Waterways Generally

Newtown Creek Assessment Area



Ever Visited Primary Waterway and Visited Prior 12 Months

Newtown Creek Assessment Area

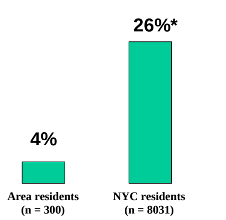
- **4% of area residents have visited the Newtown Creek at some point.**
  - **On average, 26% of NYC residents have visited the primary waterway in their assessment area. The median value is 22%.**
- **3% of area residents report visiting the Newtown Creek in the prior 12 months.**
  - **On average, 19% of NYC residents visited the primary waterway in their assessment area in the prior 12 months. The median value is 14%.**

Note: Due to the small base sizes, no data regarding activities are shown for this waterway

Ever Visited Primary Waterway and Visited Prior 12 Months

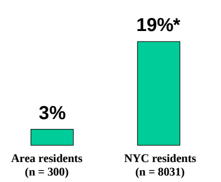
Newtown Creek Assessment Area

Ever Visited



*Median value = 22%

Visited in the Prior 12 Months



*Median value = 14%

Reasons for Never Visiting Primary Waterway

Newtown Creek Assessment Area

Among those aware of primary waterway but never visited (38% of area residents)

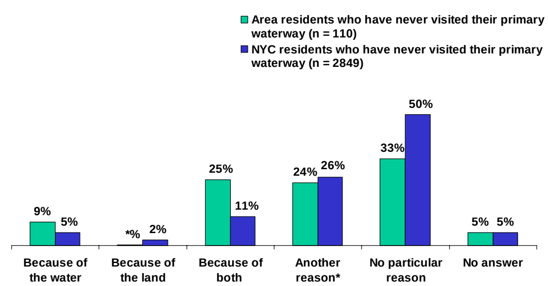
- **33% of area residents who have never visited the Newtown Creek, but who are aware of it, say there is no particular reason for not visiting. 34% say they have never visited because of the water, and 25% say it is because of the land.**
  - **50% of all NYC residents who have never visited their primary waterway, though aware, say there is no particular reason for not visiting. 16% say they have never visited because of the water and 13% say they have never visited because of the land.***

* These percentages include those who said only water or only land as well as those who said both water and land reasons.

Reasons for Never Visiting Primary Waterway

Newtown Creek Assessment Area

Among those aware of primary waterway but never visited (38% of area residents)



* Further details not available

Water Reasons for Never Visiting Primary Waterway

Newtown Creek Assessment Area

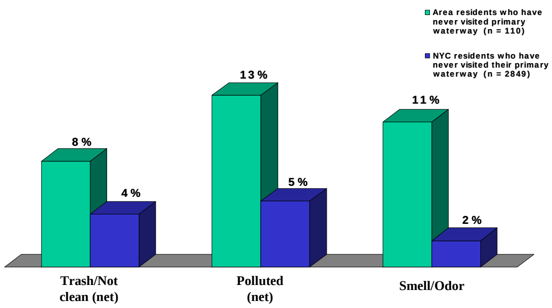
Among those aware of primary waterway but never visited (38% of area residents)

- **When area residents cite negatives about the water as the reason for never having visited Newtown Creek, the specific issues are:**
  - **Pollution (13%),**
  - **Smell and/or odor (11%),**
  - **Trash in the water/the water not being clean (8%).**
- **When NYC residents cite water negatives as the reason for never having visited the primary waterway in their assessment area, the specific issue most often mentioned is pollution (5%).**

Water Reasons for Never Visiting Primary Waterway

Newtown Creek Assessment Area

Among those aware of primary waterway but never visited (38% of area residents)



Land Reasons for Never Visiting Primary Waterway

Newtown Creek Assessment Area

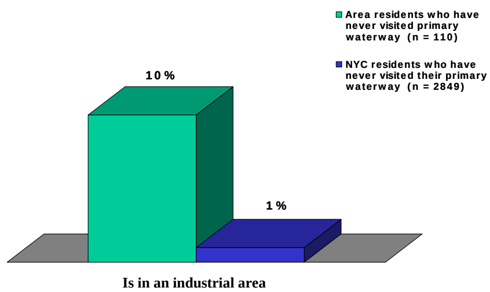
Among those aware of primary waterway but never visited (38% of area residents)

- **When area residents cite negatives about the land as a reason for never having visited Newtown Creek, the specific issue most often mentioned is:**
  - **It is an industrial area (10%).**
- **When NYC residents cite land negatives as a reason for never having visited the primary waterway in their assessment area, no specific issue was mentioned by at least 5% of the area residents.**

Land Reasons for Never Visiting Primary Waterway

Newtown Creek Assessment Area

Among those aware of primary waterway but never visited (38% of area residents)



Visiting Summary

Newtown Creek Assessment Area

	Area Residents %	NYC Residents %
Visit NYC waterways regularly/occasionally	60	60
Ever visited primary waterway	4	26*
Visited prior 12 months	3	19**
Haven't visited because of water (among aware never visitors)(Net)	34	16
Pollution	13	2
Smell/odor	11	2
Trash in water	8	5
Haven't visited because of land (among aware never visitors)(Net)	25	13
It is an industrial area	10	--

* Median is 22%
** Median is 14%

Participation in Recreational Activities at and Attitudes Toward Primary Waterway

Newtown Creek

Participation in Water Activities at Primary Waterway

Newtown Creek Assessment Area

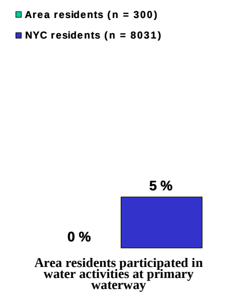
- **None of the Newtown Creek residents have participated in water activities there.* (4% of area residents have visited Newtown Creek at some point.)**
  - **5% of NYC residents have participated in water activities at the primary waterway in their assessment area.**

*** Accordingly, no data are shown for this waterway area regarding what water activities were participated in at this waterway, how enjoyable water activities were, what made water activities enjoyable/not enjoyable or why never participated in water activities.**

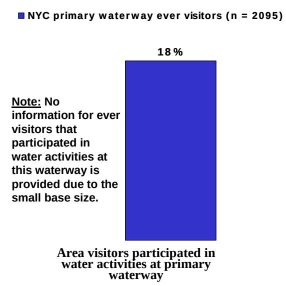
Participation in Water Activities at Primary Waterway

Newtown Creek Assessment Area

Among area residents



Among ever visitors (4% of area residents)



Participation in Land Activities at Primary Waterway

Newtown Creek Assessment Area

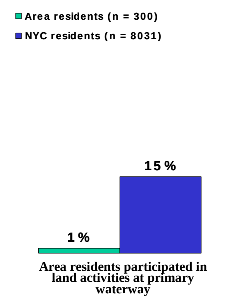
- **1% of area residents have participated in land activities there. (4% of area residents have visited Newtown Creek at some point.)**
  - **15% of NYC residents have participated in land activities at the primary waterway in their assessment area.**

Note: Due to the small base sizes, no data are shown for this waterway area regarding what land activities were participated in at this waterway, how enjoyable land activities were, what made land activities enjoyable/not enjoyable or why never participated in land activities.

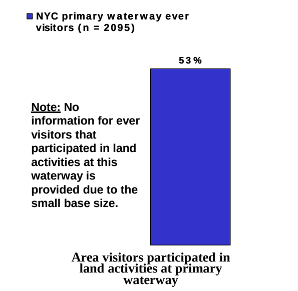
Participation in Land Activities at Primary Waterway

Newtown Creek Assessment Area

Among area residents



Among ever visitors (4% of area residents)



Water/Land Activities Participation Summary

Newtown Creek Assessment Area

	Area Residents %	NYC Residents %
Participated in water activities at primary waterway (among area residents)	0	5
Participated in land activities at primary waterway (among area residents)	1	15

Improvements to Primary Waterways

Newtown Creek

Improvements Noticed in Past Five Years in NYC Waterways

Newtown Creek Assessment Area

- **43% of area residents say they have noticed improvements in NYC waterways in general in the past five years. Less than 0.5% have noticed improvements specifically at the Newtown Creek.**
  - **48% of NYC residents say that they have noticed improvements in NYC waterways in general in the past five years. On average, 6% of NYC residents have noticed improvements at the primary waterway in their assessment area. The median value for those who have noticed improvements at the primary waterway in their assessment area is 3%. (See page 11.)**
- **Improvements in the water (quality, appearance, color) are the most frequently mentioned improvement in NYC waterways in general noticed by area residents in the past five years (22%).**
  - **Improvements in the water are the most frequently mentioned improvement noticed in NYC waterways in general among all NYC residents (21%).**

Improvements Noticed in Past Five Years in NYC Waterways

Newtown Creek Assessment Area

	Area Residents (n = 300) %	NYC Residents (n = 7424) %
Have noticed improvements at NYC waterways (net)	43	48
Water mentions (quality, appearance, odor)	22	21
Cleaner/better (net)*	11	13
Haven't seen improvements	32	31
Don't know	26	22

* Cleanliness/sanitation/better maintenance

Improvement Would Most Like in Primary Waterway if Funds Available

Newtown Creek Assessment Area

Among those aware of their primary waterway (42% of area residents)

- **If funds were available, improvements in the water (quality, appearance, odor) are the aspect that area residents would most like to see improved at the Newtown Creek (39% of those aware of the Newtown Creek).**
  - **If funds were available, improvements in the water at their primary waterway are the most frequently cited desired improvement among all NYC residents (38% of those aware of the primary waterway in their assessment area).**

Improvement Would Most Like in Primary Waterway if Funds Available

Newtown Creek Assessment Area

Among those aware of their primary waterway (42% of area residents)

	Area Residents (n = 128) %	NYC Residents (n = 4944) %
Water mentions (quality, appearance, odor)	39	38
Cleaner/better (net)*	9	11
Access to shoreline	7	3
Don't know	27	24

* Cleanliness/sanitation/better maintenance

Importance of Most Desired Improvement at Primary Waterway

Newtown Creek Assessment Area

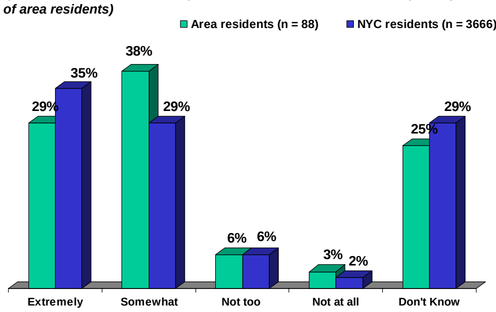
Among those who identified the improvement would most like at their primary waterway (29% of area residents)

- **29% of area residents who identified the improvement they would most like to see in Newtown Creek, if funds were available, say that that improvement is "extremely important" and another 38% say it is "somewhat important."**
  - **35% of NYC residents who identified the improvement they would most like to see in the primary waterway in their assessment area say that, if funds were available, that improvement is "extremely important" and an additional 29% say it is "somewhat important."**

Importance of Most Desired Improvement at Primary Waterway

Newtown Creek Assessment Area

Among those who identified the improvement would most like at their primary waterway (29% of area residents)



Importance of Water Improvements at Primary Waterway

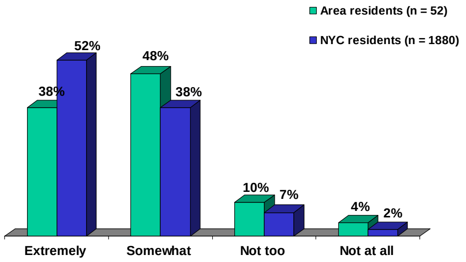
Newtown Creek Assessment Area

Among those for whom it is the most important improvement at their primary waterway (16% of area residents)

- **Specifically among those area residents who identified improving the water quality, appearance and/or odor as the improvement they would most like to be made to the Newtown Creek, 38% consider it "extremely important."**
  - **52% of NYC residents who identified improvements in water quality, appearance and/or odor in the primary waterway in their assessment area as the improvement they would most like to see in the primary waterway in their assessment area say this improvement is "extremely important."**

Importance of Water Quality Improvements at Primary Waterway
Newtown Creek Assessment Area

Among those for whom it is the most important improvement at their primary waterway (16% of area residents)



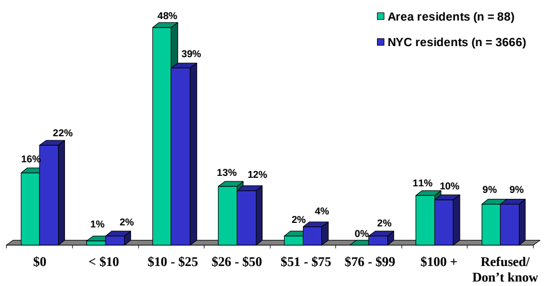
Amount Say Willing to Pay Per Year for Most Desired Improvement at Primary Waterway
Newtown Creek Assessment Area

Among those who identified the improvement would most like at their primary waterway (29% of area residents)

- **48% of area residents who identified the improvement they would most like to see in the Newtown Creek say they would be willing to pay between $10 and $25 a year for that improvement.**
- **16% say they would not be willing to pay anything.**
  - **39% of NYC residents who identified the improvement they would most like to see in the primary waterway in their assessment area say they would be willing to pay between $10 and $25 a year for that improvement.**
  - **22% say they would not be willing to pay anything.**

Amount Say Willing to Pay Per Year for Most Desired Improvement at Primary Waterway
Newtown Creek Assessment Area

Among those who identified an improvement would most like at their primary waterway (29% of area residents)



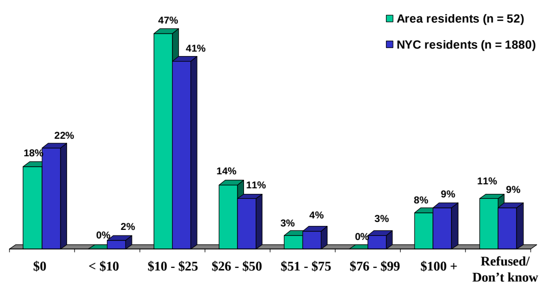
Amount Say Willing to Pay Per Year for Water Quality Improvements at Primary Waterway
Newtown Creek Assessment Area

Among those for whom it is the most desired improvement at their primary waterway (16% of area residents)

- **Specifically among those area residents who identified water quality improvements as the improvement they most like made to the Newtown Creek, 47% say they would be willing to pay between $10 and $25 per year for that improvement.**
- **18% are not willing to pay anything for water quality improvements to the Newtown Creek.**
  - **41% of NYC residents who identified water quality improvements as the improvement they most like made to the primary waterway in their assessment area say they would be willing to pay between $10 and $25 each year for that improvement.**
  - **22% are not willing to pay anything for water quality improvements to the primary waterway in their assessment area.**

Amount Say Willing to Pay Per Year for Water Quality Improvements at Primary Waterway
Newtown Creek Assessment Area

Among those for whom it is the most desired improvement at their primary waterway (16% of area residents)



Waterway Most Want Improved if Funds Available for Only One
Newtown Creek Assessment Area

- **If funds were available to improve only one NYC waterway, 8% of area residents would like it to be the Newtown Creek.**
  - **On average, 18% of NYC residents would like the primary waterway in their assessment area to be the one to be improved.**

Waterway Most Want Improved if Funds Available for Only One

Newtown Creek Assessment Area

	Area Residents (n = 300) %	NYC Residents (n = 7424) %
Newtown Creek	8	1
The East River	27	18
The Hudson River	20	22
Rockaway Beach*	7	3
Jamaica Bay	1	3
Don't know	20	17

* Not one of the 26 primary waterways studied.

Improvements Summary

Newtown Creek Assessment Area

	Area Residents %	NYC Residents %
Noticed improvements in NYC waterways in past 5 years	43	48
Noticed improvements in primary waterway in past 5 years	*	6**
Improvements in water improvement most frequently noticed (at NYC waterways)	22	21
Improvements in water most desired improvement at primary waterway (among those aware of primary waterway)	39	38

* Less than 0.5%
**Median is 3%.

Improvements Summary (cont'd)

Newtown Creek Assessment Area

	Area Residents %	NYC Residents %
Percent rating most desired improvement "extremely/ somewhat important" (among those who identified improvement would most like at primary waterway)	67	64
Percent rating water improvements "extremely/ somewhat important" (among those for whom it is the most desired improvement at primary waterway)	86	90
Would pay $10-$25 annually for most desired improvement (among those who identified improvement would most like at primary waterway)	48	39
Would pay $10-$25 annually for water improvements (among those for whom it is the most desired improvement at primary waterway)	47	41
Primary waterway is one most want improved	8	18

Demographics

Newtown Creek

Demographics

Newtown Creek Assessment Area

	Newtown Creek	Total NYC Residents
Gender	%	%
Male	48	46
Female	52	54
Age		
18-34	37	36
18-24	12	14
25-34	25	21
35-54	37	37
35-44	20	22
45-54	17	15
55+	25	26
55-64	15	13
65+	9	13

Demographics

Newtown Creek Assessment Area

	Newtown Creek	Total NYC Residents
Children Under 18 in HH	%	%
Yes	42	37
1	18	17
2	15	11
3	7	5
4	2	2
5	*	1
6+	--	1
No	56	62
Ethnicity/Race		
African-American	11	21
Asian	11	10
Hispanic	30	22
White	37	35
Other	11	12

Demographics

Newtown Creek Assessment Area

	Newtown Creek	Total NYC Residents
Education	%	%
H.S. or less	42	33
Grammar school or less	4	3
Some high school	7	6
High school graduate	31	24
Some College or More	55	65
Some college/ technical school	22	24
College graduate	26	28
Some/completed postgraduate	8	14

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Demographics

Newtown Creek Assessment Area

	Newtown Creek	Total NYC Residents
Income	%	%
<$35,000	33	27
$35,000 to <$50,000	14	16
$50,000 to <$75,000	17	17
$75,000 to <$100,000	14	12
$100,000+	7	13
Refused	15	15
Own or Rent		
Rent	64	62
Own	35	36

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Other Characteristics

Newtown Creek Assessment Area

	Newtown Creek	Total NYC Residents
Ever volunteer to clean NYC parks/waters	%	%
Yes	13	13
No	86	86
Member of NYC boating/ canoeing/kayaking club		
Yes	4	2
No	94	97

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Other Characteristics

Newtown Creek Assessment Area

	Newtown Creek	Total NYC Residents
Water activities enjoy *	%	%
Boating/speed boating	20	22
Canoeing	6	5
Fishing	22	17
Kayaking	5	4
Sailing	3	5
Swimming	63	58
Water/jet skiing	7	7
None	9	18

* Not added until after field had begun so not everyone was asked this question.

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Appendix

Newtown Creek

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NYC Primary Waterways Included in Study

Newtown Creek Assessment Area

Alley Creek	Jamaica Bay
Arthur Kill	Kill Van Kull
Bergen Basin	Lower New York Bay
Bronx River	Mill Basin
Coney Island Creek	Newtown Creek
East River	Paedergat Basin
Flushing Bay	Raritan Bay
Fresh Creek	Sheepshead Bay
Gowanus Canal	Shellbank Basin
Harlem River	Spring Creek
Hendrix Creek	Thurston Basin
Hudson River	Upper New York Bay
Hutchinson River	Westchester Creek

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Questionnaire

NOTE: Final copies of each report will contain a copy of the questionnaire.

APPENDIX D

NEWTOWN CREEK STAKEHOLDER TEAM MEETING MINUTES

NO TEXT ON THIS PAGE

APPENDIX D.1

STAKEHOLDER TEAM MEETING NO. 1

OCTOBER 25TH, 2006

NO TEXT ON THIS PAGE

Long Term Control Plan
Newtown Creek Stakeholder Team
Meeting No. 1 October 25th, 2006

The first Newtown Creek Stakeholder team meeting of the Long Term Control Plan (LTCP) for Combined Sewer Overflows (CSO) of the NYC Department of Environmental Protection (DEP) was held on October 25, 2006, at 6:30 p.m. at the Newtown Creek Water Pollution Control Plant, 329 Greenpoint Avenue in Greenpoint, Brooklyn. Mark Klein, Project Director for the LTCP, opened the meeting and introduced John Leonforte, Director of Capital Project Outreach (DEP). Mark said that DEP is currently working to draft individual Waterbody/Watershed plans (WB/WS) for CSOs, including one for Newtown Creek. All of the plans must be submitted by June 2007. The subsequent detailed review of the WB/WS plans by the State, along with any refinement by DEP, will lead to the NYSDEC's regulatory approval of the LTCP document.

Stephen Whitehouse, Starr Whitehouse, defined CSOs. They occur when the flow from a storm event exceeds the capacity of the treatment plant or conveyance system, in which case combined sewage—a mixture of sanitary and storm water—is discharged into adjacent waterbodies. He said that most of the city is served by combined sewers, including Most of the Newtown Creek area. A stakeholder asked whether CSO caused basement flooding. John replied that, as the collection sewers are deep, it is unlikely. He asked the stakeholder to describe the problem and suggested replacing the caps. Stephen showed the locations of the city-wide CSOs and the Water Pollution Control Plants (WPCP).

Stephen Whitehouse presented a general background of the LTCP. He described the history of CSO policy and previous water quality planning, including the Use and Standards Attainment (USA) project. The preparation of the LTCP is a requirement of the January 2005 consent order on CSO's with the NY State Department of Environmental Conservation, which also sets schedules for completion of specific water quality improvement projects, including the construction of a Newtown Creek CSO retention tank and aeration projects on the creek. Stephen said that the City's first CSO abatement projects prioritized the most impacted waterbodies, including Flushing Bay and Creek, Paerdegat Basin, and Newtown Creek. A stakeholder asked for further information about the holding tank operations. Stephen explained that the basic concept of the tank is to retain wet weather flow and then, during dry weather, pump the contents of the tank to the WPCP for treatment. A stakeholder asked for a document outlining the multiple consent orders with regards to conditions and projects in Newtown Creek, so as to better understanding the current regulatory framework of CSO related projects; the project team agreed to pull together a summary. Another stakeholder asked what other city-wide waterbodies had stakeholder groups. Stephen said that there were ten stakeholder groups: Paerdegat Basin; Gowanus Canal; Coney Island Creek; Newtown Creek; Alley Creek and Little Neck Bay; Flushing Bay and Creek; the waterbodies around Jamaica Bay; the

Bronx River; the Westchester Creek and Hutchinson River; and the Open Waters or the Harlem River, East River, and Harbor. He added that stakeholders were invited to join the Open Water group.

Stephen said that each WB/WS plan would be developed with a group of stakeholders like the one assembled. The stakeholders are instrumental for identifying the existing and desired uses for a waterbody. They also help to define waterbody characteristics. He said that stakeholders would share in the review and analysis of the WB/WS plan. He defined stakeholder as any person or representative of an entity with a demonstrated interest in the project area. The stakeholder group for Newtown Creek is composed of stakeholders from the USA Project and was refined through recent conversations with Queens Community Boards 2 and 5 and Brooklyn Community Board 1. Stephen emphasized that the scope of this project is limited to CSOs, only one of the many water quality issues in Newtown Creek.

Curtis Courter, Hazen and Sawyer, presented an introduction to the waterbody. He said that Newtown Creek was an urbanized water body, largely bulkheaded and channelized. He said that there are 23 CSO outfalls and 5 permitted storm sewer outfalls in the creek and that the creek is served by both the Newtown Creek and Bowery Bay WPCP collection systems. The water quality standard for the creek is class SD, with designated uses of fishing and fish survival. A stakeholder asked whether the East River would meet swimming standards. Curtis said that the East River water quality is meeting federal primary contact standards but that these are not the same as the Department of Health standards, and that other issues, such as strong currents, preclude swimming. Curtis described the significant marine and industrial uses in the area. He said that there was limited public access, although the NYC Economic Development Corporation is completing a park at the end of Manhattan Street and DEP is building a waterfront promenade in the new Newtown Creek WPCP. Next, Curtis described the sampling efforts that have taken place in Newtown Creek. He showed the different sampling points, shared some sampling results, and discussed the history of various sampling efforts.

A stakeholder asked what the highest pathogen levels were and where they were located. Curtis said that that information would be shared at the next meeting. Another stakeholder said that he hoped that the data would not be displayed in averages, as the different sampling points have radically different water quality issues. Curtis said that the data would be displayed along a transept which shows that the water quality is worse at the head end of the creek. A stakeholder asked if the sampling data was correlated with wet and dry weather. Curtis said that it was. Another stakeholder expressed trepidation that data from the 1990s was used in the powerpoint presentation. She asked that, at the next meeting, more recent data would be shown. Curtis said that it would.

Curtis reviewed the major water quality issues in Newtown Creek, which include sediment deposits and low dissolved oxygen, in part due to sediment oxygen demand. He said that there was ongoing groundwater remediation pursuant to a consent order concerning an underground oil spill. A stakeholder said that the remediation did not improve groundwater quality; its only goal was to remove the oil. A stakeholder asked what funds were available for the remediation of the Phelps Dodge superfund site. Another stakeholder said that she would look into it. Curtis said that he had tried, but was unable, to get that information.

Curtis shared the baseline modeling results. He reviewed some of the WB/WS elements that were included in the CSO facility plan that was submitted to the state in 2003: a tank at the head of English Kills, relief sewer from the East Branch, and a throttling gate. He said that there was an initial small scale pilot of instream aeration Upper English Kills and that a full-scale facility for aeration is currently under construction for the same zone. A second phase of aeration is planned for lower English Kills, East Branch, and Dutch Kills. Data on aeration will be presented at the next meeting.

A stakeholder expressed a concern that, if the 2003 Consent order was modifiable, the water quality standard could be decreased through a use attainability analysis (UAA). Curtis said that the SD water standard for Newtown Creek was the lowest possible standard and could not be lowered. He said that the fact that the 2003 CSO facility plan can be modified does not provide a back door, but to the contrary, creates opportunities for additional improvements. John added that NYSDEC was unlikely to remove facility plan elements. Stephen said that the WB/WS plan that will be submitted to the NYSDEC is a draft and would be subject to public comment prior to an approval from NYSDEC. He added that, while the City could not anticipate all potential issues the State may raise in its technical review, it was the DEP's goal that the draft WB/WS plan developed with the current stakeholder meetings will be largely the same as the plan that will be brought back to the public for comment after NYSDEC review. Another stakeholder asked about modeling efforts. Curtis said that modeling is carried out by HydroQual, one of the project consultants. More information will be presented about modeling at the next meeting.

Curtis reviewed elements that may become part of the WB/WS plan, including dredging and flushing tunnels. Several stakeholders asked why separately sewered systems, particularly for new construction, were not included on the list of abatement alternatives. Curtis said that such a system would be costly. Additionally, since they would be located within a combined sewer area, the volume from the separate sewers would be merged and would have a minimal impact. A stakeholder expressed concern that low impact development alternatives (LIDs) were not included. Stephen said that efforts were currently underway within DEP to understand the effects of LIDs on a watershed level. He added that, while DEP supports LIDs and constructs them into their own facilities, the timeline required to develop a citywide policy on LIDs, which necessitates interagency evaluations and regulatory actions, will extend beyond the June 2007 milestone for delivery of an approvable WB/WS Facility Plan to NYSDEC. A separate but related effort to create a city-wide policy on LIDs, with the Mayor's Office of Sustainability and Long Term Planning, is currently underway.

A stakeholder asked whether the forecasted improvements took into account the area's projected growth. Curtis said that the baseline for the model assumed 2045 population projections and no significant changes, with the exception of the ongoing upgrades to the Newtown Creek WPCP. The stakeholders said that they would like to see the current existing conditions used as a baseline. Curtis said that the assumptions made in modeling tended towards overestimation, as that will ensure that there is ample capacity. He added that, given that the rule of thumb for the ratio of stormwater to sanitary waste in CSOs is 80-90% against 10-20%, the population growth expected in the area will not have a significant effect in total volume. The main factor that overwhelms the sewer infrastructure is the increment from the storm. He said that, in future work, the alternatives would be measured against the volume of CSOs eliminated and the reduction in CSO events per year.

One of the stakeholders said that, considering that USA project on CSOs suddenly disappeared, she mistrusts the current process. John shared his belief that DEP should have continued to keep the USA stakeholders up to date. A stakeholder said that she would like to see more participation from neighborhoods close to, but not abutting, the creek, such as Bushwick. A community board member suggested that the participants present were those that were most affected and most interested. She thought that increased outreach efforts may not have significant results.

Curtis reviewed the next steps. He said that the team would submit a WB/WS facility plan in June 2007. The group picked a tentative next meeting date of December 13th. Meeting notes will be available several weeks before the meeting.

APPENDIX D.2

STAKEHOLDER TEAM MEETING NO. 2

DECEMBER 13TH, 2006

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Long Term Control Plan
Newtown Creek Stakeholder Team
Meeting No. 2 December 13th, 2006

The second Newtown Creek Stakeholder team meeting of the Long Term Control Plan (LTCP) for Combined Sewer Overflows (CSO) of the NYC Department of Environmental Protection (DEP) was held on December 13th, 2006 at 6:30 p.m. at the Newtown Creek Water Pollution Control Plant, 329 Greenpoint Avenue in Greenpoint, Brooklyn. Stephen Whitehouse, Starr Whitehouse, began the meeting. He reviewed the meeting notes from the previous meetings. The notes will be finalized. In response to a request from the first meeting, Stakeholders were provided a brief summary of different consent orders that apply to Newtown Creek.

Stephen went over the activities of other stakeholder teams for the LTCP. He said that four stakeholder teams have completed their tasks of advising DEP on the Waterbody/Watershed (WB/WS) plans and that all of these project areas had significant facility planning prior to the onset of the LTCP project. Some changes have been made to the preexisting plans during the LTCP process, including a change based on stakeholder recommendations in Alley Creek. These plans will now be submitted to the New York State Department of Environmental Conservation (NYSDEC) for review.

Curtis Courter, Hazen and Sawyer, spoke about the designated uses and regulatory issues facing Newtown Creek. He said that the existing designated use is Class SD, which provides for fish survival. Curtis reviewed a map of the CSOs on Newtown Creek and its tributaries; the seven largest CSO's are mainly at the head ends of each of the creek's branches. He said that the drainage area for Newtown Creek has a population of approximately 330,000 residents. A stakeholder asked Curtis to show the five DEP storm outfalls on the map at the next meeting. Curtis reviewed the key water quality issues in Newtown Creek, including sediment deposits at the head end, sediment oxygen demand, and low dissolved oxygen (DO) in the creek's tributaries. Curtis listed ongoing problems unrelated to CSOs, including the oil spill at the Exxon Mobil site, currently undergoing remediation; the Phelps Dodge Superfund site; and other industrial discharges.

Curtis reviewed the sampling locations in Newtown Creek and showed 1990 and 2003 data of the DO levels in the creek. Both data sets showed a direct progression of decreasing water quality toward the head end of the creek. Next, Curtis compared data from 1990 with a water quality modeling forecasting 100% CSO removal. The modeling data indicated that, even with 100% CSO removal, DO could still occasionally fall below the standard, to lower than 3 mg/L, in some parts of the creek in the summer months. A stakeholder asked whether the implementation of Low Impact Developments (LIDs) would help to improve water quality. Curtis said that DEP is currently working towards a possible implementation of these alternatives. DEP is carrying out a study to analyze and quantify the effect of LIDs on a watershed scale in the Jamaica Bay Watershed Protection

Plan (JBWPP) and it is also working with the Mayor's Office of Sustainability and Long Term Planning on an interagency effort to implement LIDs. Both of these projects are on a longer timeframe than the LTCP and DEP will work to fold the findings of the JBWPP into the LTCP at a later date. A stakeholder asked whether DEP could incorporate findings from other cities in order to better facilitate the inclusion of LIDs into New York City's LTCP. Stephen said that there were no other LTCPs on a comparable scale and with comparable weather patterns that would enable them to be applied directly to the conditions in New York City.

Then, Curtis reviewed the aeration pilot studies, as requested at the first meeting. Curtis said that the boundary conditions had a direct effect on the ability to raise DO in the pilot area through aeration. He also said that the aeration induced a DO level of 1mg/L in English Kills. While this is still below the standard, raising the DO in the head end of the creek helps to bring other areas of the creek to standard. Estimated oxygen requirements were increased based on the study. Although there is no pathogen standard related to the waterbody's current SD classification, Curtis compared the existing fecal coliform levels with the predicted levels in a scenario of 100% CSO capture, derived from the water quality model. This preliminary modeling shows that under the 100% CSO removal scenario, fecal coliform would be less than 2,000 counts per 100 mL, the next highest water quality standard, 100% of the time.

Next, Curtis showed a map of the sediment mounds. Curtis said that the main issue with the sediment mounds is that, when exposed, they emit an odor. To prevent this, the mounds would have to be dredged to three feet below mean lower low tide level (MLLW). A stakeholder inquired about sediment disposal. Curtis said that disposal will be offsite and Stephen added that any dredging would be accompanied by environmental permitting, which requires an extensive regulatory process wherein such issues are discussed. Another stakeholder asked about the feasibility of constructing wetlands in the creek. Curtis said that the continuous deposition of sediments would be noxious to the wellbeing of wetland plants.

Curtis reviewed previous projects and programs on Newtown Creek, including a comprehensive floatables abatement plan, part of the city's trash removal program, which includes the installation and regular maintenance of hooded catch basins and sediment booms. He also mentioned the Newtown Creek CSO Facility Planning; the Use and Standards Attainment (USA) Project, which identified many of the gaps in CSO planning now being addressed in the LTCP; Newtown Creek Water Pollution Control Plant (WPCP) Facility Plan; and the Inner Harbor CSO Facility Plan. Then Curtis went over current projects and programs, including the Newtown Creek WPCP upgrade to secondary treatment. He went over the elements in the CSO facility plan, including a 9MG CSO storage basin; Zone 1 and 2 Aeration facility of which Zone 1 is under construction and the design of Zone 2 has been put out to bid; the Kent Avenue Interceptor throttling facility, currently in design; the design of St. Nicholas Weir Relief Sewer which is out to bid; and Regulator B1/B1A Modifications. Curtis said the timetable for the CSO Facility Plan projects is stipulated in the consent order and that the

DEP is working to implement these measures and adhere to that schedule. Curtis added NYSDEC will only consider an alternative to these measures if the alternatives are proven to produce equal water quality in a more efficient way or better water quality for a similar investment. Curtis said that the CSO facility plan generally targets the head end, where CSO problems are aggravated. A stakeholder inquired about the size of the 9MG CSO storage tank. Curtis said that the tank is approximately the size of a city block. Another stakeholder asked how aeration works. Curtis described it as similar to a fish tank, where air is pumped through in order to provide oxygen across a body of water. A stakeholder asked about the purpose of the relief sewer. Curtis explained that the relief sewer provides additional conveyance capacity of the sewage infrastructure during storms and thus minimizes overflow. In the CSO Facility Plan, the relief sewer is provided to move more flow to the CSO tank, which can store these flows until the WPCP has capacity to treat the captured flow.

Curtis reviewed other alternatives being evaluated for the Waterbody/Watershed Plan, which will become the LTCP. Alternatives under evaluation include different combinations of dredging, flushing tunnels, aeration, relief sewers, floatables control, CSO storage tunnels, and high rate physical/chemical treatment (HRPCT) in different areas on the creek. Fred Edmond, of the DEP, asked Curtis whether the CSO retention tank will be manned. Curtis confirmed that it would be. Curtis said that at the next meeting, the plan will be discussed in greater detail including an analysis of the costs and benefits. One stakeholder asked about the inter-agency project on LIDs run by the Mayor’s Office of Sustainability. Curtis said that it was unlikely that there would be geographically quantified data by the next meeting and that there would be little to report relevant to Newtown Creek. Stakeholders requested that a representative from the Mayor’s Office of Sustainability give a presentation at the next meeting. The DEP team agreed to ask.

Stephen and Curtis reviewed the current waterbody uses. Stephen noted that in the USA project meetings, some stated uses included boating and recreational fishing at the bus depot on Commercial Street, Manhattan Avenue, the lot 100 pier, the Pulaski Bridge and Gantry State Park. Stephen also reviewed use goals compiled at the last USA meeting including improved habitat, the removal of odors, and secondary contact recreation, such as boating. At that time, the stakeholder group stated that primary contact recreation in Newtown Creek was difficult to achieve and possibly represents a conflict with current and potential industrial uses. However, many current stakeholders clarified that primary recreation, swimming, should always be considered as the ultimate goal. Stephen noted that area constituents want improved access for boating. Stakeholders also advocated for restored wetlands in the tidal inlets and education programs. A stakeholder asked that a representative from New York State DOT be invited to the next meeting.

Next Stephen reviewed the progress of Newtown Creek Plan in the LTCP process. He said that the DEP is putting together a plan to submit to the NYSDEC for review. When the plan has been reviewed, it will be brought back to the public. The group picked a next meeting date of March 21st. Meeting notes will be available prior to the meeting.

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APPENDIX D.3

STAKEHOLDER TEAM MEETING NO. 3

MARCH 21ST, 2007

NO TEXT ON THIS PAGE

Long Term Control Plan
Newtown Creek Stakeholder Team
Meeting No. 3 March 21th, 2007

The third Newtown Creek Stakeholder team meeting of the Long Term Control Plan (LTCP) for Combined Sewer Overflows (CSO) of the NYC Department of Environmental Protection (DEP) was held on March 21th, 2007 at 6:30 p.m. at the Newtown Creek Water Pollution Control Plant, 329 Greenpoint Avenue in Greenpoint, Brooklyn. Stephen Whitehouse, Starr Whitehouse, began the meeting. He reviewed the meeting notes from the previous meetings. Stakeholders asked for a revision to the notes that would better reflect the groups' aspirations for higher use standards. The change has been incorporated and the notes were finalized.

Stakeholders asked about the project timeline. Sue McCormick, New York State Department of Environment Conservation (NYSDEC), spoke about the differences between Waterbody/Watershed Facility plans and the LTCP. The WB/WS plans, due June 2007, are immediate, interim measures to address compliance with existing standards before the LTCP can be drafted and implemented. The LTCP will address the gap between the WB/WS plan and the attainment of fishable/swimmable water quality called for in the Clean Water Act. Sue said that the LTCP for Newtown Creek will be submitted in February 2016, but that projects from the WB/WS facility plan will be implemented sooner than that.

Stakeholders inquired as to how the water quality standards could be upgraded in Newtown Creek. The upgrade of water quality standards in Newtown Creek will be addressed in the LTCP, current water quality standards will be addressed in the WB/WS plan. Additionally, Sue mentioned that the DEC is in the process of modifying their marine water standards for DO and that the public comment period was currently open. She told stakeholders that more information is available online on NYSDEC's Environmental Notice Bulletin.

Stephen said that DEP has received the Newtown Creek Alliance's letter and is working on a response. He noted that Bureau of Environmental Planning and Assessment (BEPA), which is the bureau at DEP currently working on source controls, was unable to attend the meeting. The stakeholders asked whether the Mayor's Office of Sustainability was invited to the meeting as requested. Stephen said that they were but could not attend. He said that they are currently preparing an update on plaNYC 2030 which will be released in April. A stakeholder stated that she believes that the Mayor's Office of Sustainability should attend every LTCP meeting and that she was concerned about the local sensitivity of the plan that will be presented in April. Stephen spoke about public participation efforts beyond the June 2007 submission of the WB/WS plans. DEP is considering a bi-annual meeting of all stakeholders in addition to the meetings stipulated by the Long Term Control Plan process. Stakeholders requested that the DEP notify the Newtown

Creek Monitoring Committee on all items concerning public notification, such as the February 28th Offline Meeting on that topic.

Curtis Courter, Hazen and Sawyer said that, after review of past materials, his presentation would focus on abatement alternatives, anticipated benefits, and preliminary costs. He showed a map of the drainage area and CSO and storm outflows. A stakeholder asked about the monitoring of privately controlled outflows. Sue responded that all discharges are permitted by the State. Curtis reviewed the designated uses, regulatory issues, and stakeholder goals in Newtown Creek. Curtis spoke about the use goals outlined in the Newtown Creek Alliance's letter to Commissioner Emily Lloyd, including upgrading the water quality standard to Class I. Curt reviewed the baseline modeling results and showed the five largest outfalls. He reviewed the elements of the 2003 CSO facility plan included in the 2004 consent order. He said that these elements were called out in the plan but that they could be altered in the process of drafting a WB/WS plan.

Next, Stephen spoke about DEP's source control efforts. Stephen said that DEP feels that the unique environment of New York City --with high density, specific rain patterns, extensive subterranean infrastructure, and other characteristics-- merits pilots. Such projects will help DEP to adapt source control methods to New York City's specific context. Pilot projects are being initiated through the Jamaica Bay Watershed Protection Plan and data collected from these efforts will be transferable to other parts of the city. Findings will be finalized after the June 2007 submission date for the WB/WB Facility Plans. As data is gathered, it will be folded into the DEP's CSO LTCP. A stakeholder expressed the need for a legally binding placeholder for source control in the LTCP. Sue confirmed that there is such a placeholder in effect.

Then, Curt reviewed alternatives under consideration for inclusion in the WB/WS plan. He stressed that the project team is still evaluating these alternatives and looking to ways that they can be grouped into a plan. He spoke about dredging of sediment mounds to below three feet below low tide. A stakeholder asked how this would improve water quality. Dredging would remove exposed sediment mounds, which would improve the aesthetics of the waterbody and eliminate odors, caused by exposed sediment. Curtis reviewed a Weir Modification and relief sewer at Dutch Kills that is under consideration. Raising the weir would improve conveyance to the plant and allow the plant to treat more flow. This alternative is projected to reduce CSO by 23% in Dutch Kills. Next, Curtis discussed the possibility of aeration which would directly add oxygen to the water. Aeration projects would require dredging to six feet below mean low tide to provide enough water depth for the oxygen to transfer to the water. He showed several proposed sites but stressed that the project was not near site selection. Aeration as a stand alone alternative would result in a projected 3% CSO reduction due to ongoing plant upgrades, but appears to be more effective when paired with other alternatives.

Curtis also reviewed elements of the 2003 CSO Facility Plan, including a 9 MG CSO storage tank where initial preparation for the ULURP process has begun, Kent Avenue Interceptor throttling, regulator B1/B1A modifications, Zone 1 and 2 Aeration, and a St.

Nicolas weir relief sewer. The plan is projected to result in an overall reduction of 24% but would not attain Class SD standards. Curtis noted that current studies show that throttling the Kent Avenue Interceptor does not appear have the intended impact.

Curtis reviewed a proposed new interceptor which could run roughly parallel to the existing Morgan Avenue Interceptor. This is projected to result in 22% CSO reduction but would not attain Class SD standards unless it was paired with aeration projects. Curtis indicated that this alternative would include inflatable dams at the upstream regulator to increase the water surface during lower flows to drive flow through the interceptor.

Next Curtis described a series of CSO storage tunnels, which also satisfy regulatory requirements to look at ranges of CSO reduction. The storage tunnels range from 38.5 million gallons (mg) to 134 mg. The latter would capture 100% of CSO volume in a typical year for rain. Even the largest of the tunnels is not projected to bring Newtown Creek to class SD standards without complementary aeration. Curtis also spoke about the possibility of constructing a flushing tunnel, such as the one that feeds the Gowanus Canal. He showed possible locations. He stressed that the tunnels were expensive and did not provide significantly more improvement to water quality than other, less expensive solutions. Stakeholders stated that they were concerned about the community impact and stressed that street repair should be coordinated with other agencies. Specifically, stakeholders brought up the upcoming reconstruction of Nassau Avenue and asked whether a flushing tunnel could be built in conjunction with that project to minimize the impact of construction in the neighborhood. The NYCDEP does coordinate with other agencies where available, however such coordination comes later in the process as designs begin to be finalized.

A stakeholder asked about the possibility of filling in Maspeth Creek. Sue said that NYSDEC would not consider this as an option as it would harm wetlands.

Curtis reviewed the DO deficit component analysis which shows that Newtown Creek is failing to meet dissolved oxygen standards. Modeling indicates that the main reason for the Creek's DO problems comes from sources outside of Newtown Creek. The second largest cause of DO deficiency is from CSO discharges to the Creek. Curtis reviewed a table showing how different plans incorporate different combinations of the alternatives that he presented.

Stakeholders expressed great interest in wetland construction. A stakeholder asked whether dredging would harm wetlands. Sue and Curtis said that there were numerous benefits to dredging and that dredging and wetlands did not conflict. Stephen mentioned that siting wetlands directly at CSO outflows would expose them to sediment build-up and scouring, which could be detrimental to establishing wetlands.

Next, Kate Zidar gave a presentation for the Newtown Creek Alliance, a community organization that works to improve the environmental and economic situation of Newtown Creek. She described the broad base of membership, ranging from elected officials to local residents. Kate categorized the Newtown Creek watershed as an area that carries a heavy environmental burden. She said that the area's open space ratio was low and the there are high concentrations of brownfields and severely polluted sites. She described the Alliance's recent work, such as the Vernon Street End Park project and application for State Brownfield Opportunity Area funds.

Kate outlined the Alliance's main goals for the LTCP: interagency collaboration on stormwater management, pilot projects for source control methods on Newtown Creek; habitat restoration including wetlands restoration; and safe access to the creek. Kate also emphasized the need for stormwater guidelines for new development and a legally binding placeholder for source control in the LTCP. Stephen noted that public notification, one of the concerns for safe access, will be addressed in the LTCP after a discussion in an offline meeting that Kate took part in. Kate expressed concern that public notification efforts would focus on waterbodies that are currently more actively used. She argued that public notification efforts in Newtown Creek should be greater, as associated risks are greater. Additionally, stakeholders expressed interest in improving water quality standards to allow for primary contact recreation.

Stakeholders asked that the project team request a special meeting between the Newtown Creek Alliance and the Mayor's Office of Sustainability. The project team set the next meeting date for May 23rd. Notes will be available prior to the meeting.

APPENDIX D.1

STAKEHOLDER TEAM MEETING NO. 1

MAY 23RD, 2007

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Long Term Control Plan
Newtown Creek Stakeholder Team
Meeting No. 4 May 23rd, 2007

The fourth and final Newtown Creek Stakeholder team meeting of the Long Term Control Plan (LTCP) for Combined Sewer Overflows (CSO) of the NYC Department of Environmental Protection (DEP) was held on May 23rd, 2007 at 6:30 p.m. at the Newtown Creek Water Pollution Control Plant, 329 Greenpoint Avenue. Keith Mahoney, DEP, opened the meeting. Stephen Whitehouse, Starr Whitehouse, made introductions, including Ariella Rosenburg, from the Mayor's Office of Long Term Planning and Sustainability. He reviewed the previous meeting's notes. Stakeholders asked for a revision that would better reflect the group's aspiration for primary contact recreation standards. The change was made and the notes were finalized.

Stephen explained the next steps. He said that the draft Waterbody/Watershed facility (WB/WS) plan, presented tonight, would be finalized by June and submitted to the New York State Department of Environmental Conservation (DEC) for review. Shortly after the plan submission, the plan will be made available to Stakeholders in electronic form, on either the DEP website or the project data-sharing site. This WB/WSplan will be prepared into a LTCP to be submitted to DEC for approval by February 2016.

Next, a stakeholder shared part of a documentary describing the current water quality in Newtown Creek and uses of the creek, including swimming.

Curtis Courter, Hazen and Sawyer, reviewed Newtown Creek's existing conditions. Newtown Creek is currently classed as SD, which supports fish survival but not recreational use. The main metric for SD classification is dissolved oxygen (DO). Curtis said that the SD standard does not have a metric for pathogens, as pathogens are used to measure suitability for human recreation. Next, Curtis reviewed the baseline modeling results, which are the baseline conditions presuming projected population to 2045 and no water quality improvement initiatives. Analysis of the baseline conditions allows the project team to compare alternatives. He showed the annual CSO volume and identified the five largest outfalls. Curtis showed a map of the DO levels in different areas in Newtown Creek, derived from DO sampling efforts from 1984 to 2003. Curtis characterized Newtown Creek as having low DO throughout, with particularly high deficiency at the head end of the creek where there is little tidal mixing. Next, Curtis reviewed the different sources of DO deficiency, the largest source of which is related to boundary conditions in the East River. A stakeholder expressed concern that the analysis does not take into account the largest source of water quality problems because it does not treat boundary conditions. Curtis explained that understanding the boundary conditions allows the project team to focus on CSO loading. The mandate of the plan is to improve water quality problems that are caused by CSOs. CSOs are the second largest source of DO deficiency. A stakeholder asked if the outfall at India Street, one of the

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largest, affects the water quality of the East River. Curtis affirmed that the effects of this outfall were included in the East River sources component. He also noted that the high level overflow from the Newtown Creek WPCP into the Whale Creek Canal is included in the models. Curtis summarized that a plan that removed 100% of CSOs would not solve all of the water quality issues on the creek, as other factors contribute to low DO.

Curtis reviewed stakeholder goals: improved habitat, removal of odors, and an upgrade to Water Quality Standard Class I, which allows for secondary contact recreation.

Curtis said that the project team examined a number of technologies and retained a group of alternatives for additional evaluation, including: environmental dredging; system optimization which maximizes the use of the existing sewer infrastructure; sewer separation; in-stream aeration to improve DO; floatables control; flushing tunnels; CSO storage tanks and tunnels; and low impact development (LIDs). He said that the team grouped alternatives into ten plans and modeled their impact. The project team used cost benefit analysis to select a plan. Cost benefit analysis weighs the projected benefit against probable total project cost. Curtis explained that many plans are very expensive and, after a certain point, provide decreasing increment of benefit per dollar in expenditure. The project team targeted the plan that achieves the maximum benefit per dollar, or the knee of the curve. Curtis shared a number of cost benefit graphs, plotting project costs against percent reduction and percent of hours attaining Class SD standards. A stakeholder asked how the cost data was derived. Curtis explained that a team of cost estimators calculated the data. It was also noted that two independent reviews of the WB/WS Facility Plan were planned, a Value Engineering session with the Office of Management and Budget is scheduled in July, and a Cost and Constructibility Evaluation that was not yet scheduled. The stakeholder asked to see their cost estimations and meet with the team.

Next, Curtis showed a cost benefit graph plotting different plans against Class I standards for total and fecal coliform. One set of solutions exhibited a clear knee of the curve. This plan would bring Newtown Creek into compliance with Class I standards over 90% of the months of the year. Curtis said that this figure reflects the compliance of the worst sample in the creek and it is possible that most of the creek would be in compliance with Class I standards all of the time. A stakeholder asked whether fish would die if Newtown Creek was only in compliance for eight months out of the year. Curtis explained the graph showed Class I standards, which are have higher use goals than fish survival. He reiterated that, during the other four months, only the worst spots in Newtown Creek would not be in compliance with Class I pathogen standards.

Curtis presented the proposed WB/WS Facility Plan. The first phase of the plan will include: enhanced aeration; environmental dredging; floatables control; and assessment of LIDs. Curtis said that the project team found that aeration was necessary in order to increase the DO levels. A pilot aeration facility in English Kills is currently under construction to be completed in December 2008. Curtis said that, while the modeling results are encouraging, the project team would like to use the opportunity to monitor the effectiveness of aeration after construction to better understand the impact of aeration and

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help to design additional facilities required in the plan. Curtis said that aeration, which works similarly to air bubbles in a fish tank, would be used to attain Class SD standards and that the first target of the plan is to attain existing standards. The plan includes environmental dredging, which will improve DO (in the short term) and remove odors. The plan stipulates dredging to a final elevation of six feet below mean lower low water. This depth can accommodate aeration. A stakeholder asked whether dredging was sited in wetlands. Curtis said that it was not as the sediment targeted for removal is caused by CSOs. Stephen added that DEC process to permit dredging will be public and will examine issues such as schedule and sediment disposal. The third prong of Phase I of the plan is floatables control, which removes trash including sanitary wastes. The plan favors the use of in-line netting, which are cleaned after every storm, but in some cases, where nets are not feasible, booms will continue to be used. Several stakeholders stated that the removal of booms would improve boating conditions. The fourth prong in Phase I is assessment of LIDs.

Next, Curtis described the second phase of the WB/WS facility plan, which includes: the implementation of LIDs assessed in Phase I; a raised weir in regulator BB-L3B near Dutch Kills, which would retain more volume in the sewers during storm events; the addition of a 72 inch sewer from BB-L39 to BB-L18; and a CSO storage tunnel which would be sized to achieve Class I standards. The project team hopes to downsize the CSO storage tunnel, decreasing total project costs, with the success of LID implementation. Curtis showed a map of the tunnel's current alignment, planned to capture a portion of the flow from the three largest outfalls. He showed the approximate location and several possible sites for the pump station and odor control facility at outfall NCB-015, where the CSO from the tunnel would be pumped to the Water Pollution Control Plant. Curtis showed the location and potential sites of the drop shafts which would capture outflow from NCB-083 and NCQ-077. Further facility planning will refine the design of these facilities and site selection will include a ULURP and associated public review. Next, Curtis showed maps comparing the proposed WB/WS plans projected attainment of Class I standards, --including DO, total coliform, and fecal coliform-- and the baseline conditions, the previous CSO facility plan, and a 100% CSO removal scenario. He said that the total plan would cost $1.3B in today's dollars. The floor was opened for questions:

- A stakeholder asked if the project team considered natural methods. Curtis confirmed that she was referring to LIDs, which will be implemented in the plan.
- A stakeholder asked about timeframe. Curtis said that the phased approach is lengthy but that many plan components will be started before the 2016 ratification of the LTCP. The LTCP will include enforceable dates for the completion of various components. Draft dates will be included in the WB/WS report.
- A stakeholder asked about the likelihood of funding the plan. Curtis said that, if the plan is approved by DEC, DEP will be legally bound to fund the projects.
- A stakeholder asked whether the plan could be funded by private sector polluters. Another stakeholder responded that, as DEP is responsible for CSO-related pollution, only DEP can be held accountable in this instance.

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- A stakeholder expressed concern that the plan would force a raise in water rates. Stephen acknowledged that much of the recommended plan is not presently in DEP's 10-year $19.6B Capital Plan, and that this increased commitment to CSO control would likely require additional revenues or a future reallocation of capital priorities.

Next, John McLaughlin, from the DEP's Bureau of Environmental Planning and Assessment, spoke about DEP's work with LIDs. He said that in 2005, the Mayor signed Local Law 71, requiring DEP to develop a plan to address the issue of disappearing wetlands in Jamaica Bay. The ensuing Jamaica Bay Wildlife Protection Plan stipulated the exploration of different stormwater capture pilots, which DEP is elaborating with the help of the Gaia Institute. The data from these projects will be collected for three years, after construction, and the findings will be used to inform city-wide projects. John reviewed the types of pilots underway: street side swales; porous pavement; enhanced tree openings, which can be equipped with additional water storage; and constructed urban wetlands adapting vacant parcels for storm water retention. The DEP team is also looking at green roofs and their application in different use districts. Larger, flat roofs provide the best opportunities for green roofs. John stressed that the application of many of these methods requires an in-depth understanding of specific site conditions. Other projects are included in the Mayor's PLANYC, including the use of oysters and oyster habitat for water cleansing and the distribution of rain barrels to private property owners.

- A stakeholder asked if New York City schools can participate in these projects. John said that, in GIS-driven site selection, the team favors sites that within close proximity to schools so as to create opportunities for education.
- A stakeholder asked whether there would be incentives for property owners for certain projects. Ariella Rosenburg said that the Mayor's Office has drafted a package of incentives that is currently under review by the State Legislature.
- A stakeholder asked whether sewers could be separated in large, new developments. Ariella confirmed that this is under consideration for projects, such as Hudson Yards and Queens West. Ariella added that an Interagency BMP Taskforce is being formed. Their mandate will to develop a systematic plan to implement LIDs.
- A member of the Newtown Creek Alliance (NCA) asked whether Ariella could speak with NCA about opportunities for LIDs on Newtown Creek. Ariella stressed that her group is focusing on developping a citywide approach to LIDs but that she would be interested to speak with them.
- Another stakeholder asked whether the Waterfront Access Plan for the Greenpoint area could be updated, given current research. Ariella said that the Interagency Task Force will be looking at how to incorporate these findings into the zoning. The stakeholder said that, considering the pace of local development, this work would be immediately useful to the neighborhood.
- A stakeholder asked whether the water bill could be used to encourage private property owners to implement LIDs. Stephen said DEP is looking into it.

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Additional footage from the documentary was played. The meeting closed at 9:30. Stakeholders will be informed when the plan is available.

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