Environmental Protection

Capital Project No. WP-169
Long Term Control Plan II

Combined Sewer Overflow Long Term Control Plan for Newtown Creek

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Department of Environmental Protection
Bureau of Engineering Design & Construction

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EXECUTIVE SUMMARY

This Executive Summary is organized as follows:

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- Evaluations and Conclusions — A list of assessments that are consistent with the Federal Combined Sewer Overflow (CSO) Control Policy and the Clean Water Act (CWA).

1. BACKGROUND

The New York City Department of Environmental Protection (DEP) prepared this Long Term Control Plan (LTCP) for Newtown Creek pursuant to a New York State Department of Environmental Conservation (DEC) CSO Order on Consent (DEC Case No. CO2-20000107-8) (2005 CSO Order), modified by a 2012 CSO Order on Consent (DEC Case No CO2-20110512-25) (2012 CSO Order) and subsequent minor modifications (collectively referred to herein as the "CSO Order"). Pursuant to the CSO Order, DEP is required to submit 10 waterbody-specific LTCPs and one citywide LTCP to DEC for review and approval. The Newtown Creek LTCP is the ninth of these LTCPs.

As described in the LTCP Goal Statement in the 2012 CSO Order, the goal of each LTCP is to identify, with public input, appropriate CSO controls necessary to achieve waterbody-specific water quality standards (WQS) consistent with the Federal CSO Control Policy and related guidance. In addition, the Goal Statement advises: *"Where existing water quality standards do not meet the Section 101(a)(2) goals of the Clean Water Act, or where the proposed alternative set forth in the LTCP will not achieve existing water quality standards or the Section 101(a)(2) goals, the LTCP will include a Use Attainability Analysis examining whether applicable waterbody classifications, criteria, or standards should be adjusted by the State."* DEP conducted water quality assessments where the data is represented by percent attainment with pathogen targets and associated recovery times. Consistent with guidance from DEC, 95 percent attainment of applicable water quality criteria constitutes compliance with the existing WQS or the Section 101(a)(2) goals conditioned on verification through post-construction compliance monitoring (PCM).

Regulatory Requirements

The waters of New York City (NYC) are subject to Federal and New York State (NYS) laws and regulations. Particularly relevant to this LTCP is the U.S. Environmental Protection Agency's (EPA) CSO Control Policy, which provides guidance on the development and implementation of LTCPs, and the promulgation of WQS. In NYS, CWA regulatory and permitting authority has been delegated to DEC.

DEC has designated Newtown Creek as a Class SD waterbody. The best usage of Class SD waters is fishing. These waters "shall be suitable for fish, shellfish, and wildlife survival and the water quality" and, under recent revisions to NYS regulations, the water quality "shall be suitable for primary and secondary contact recreation, although other factors may limit the use for this purpose" (6 NYCRR 701.14). Figure ES-1 shows the Newtown Creek watershed.

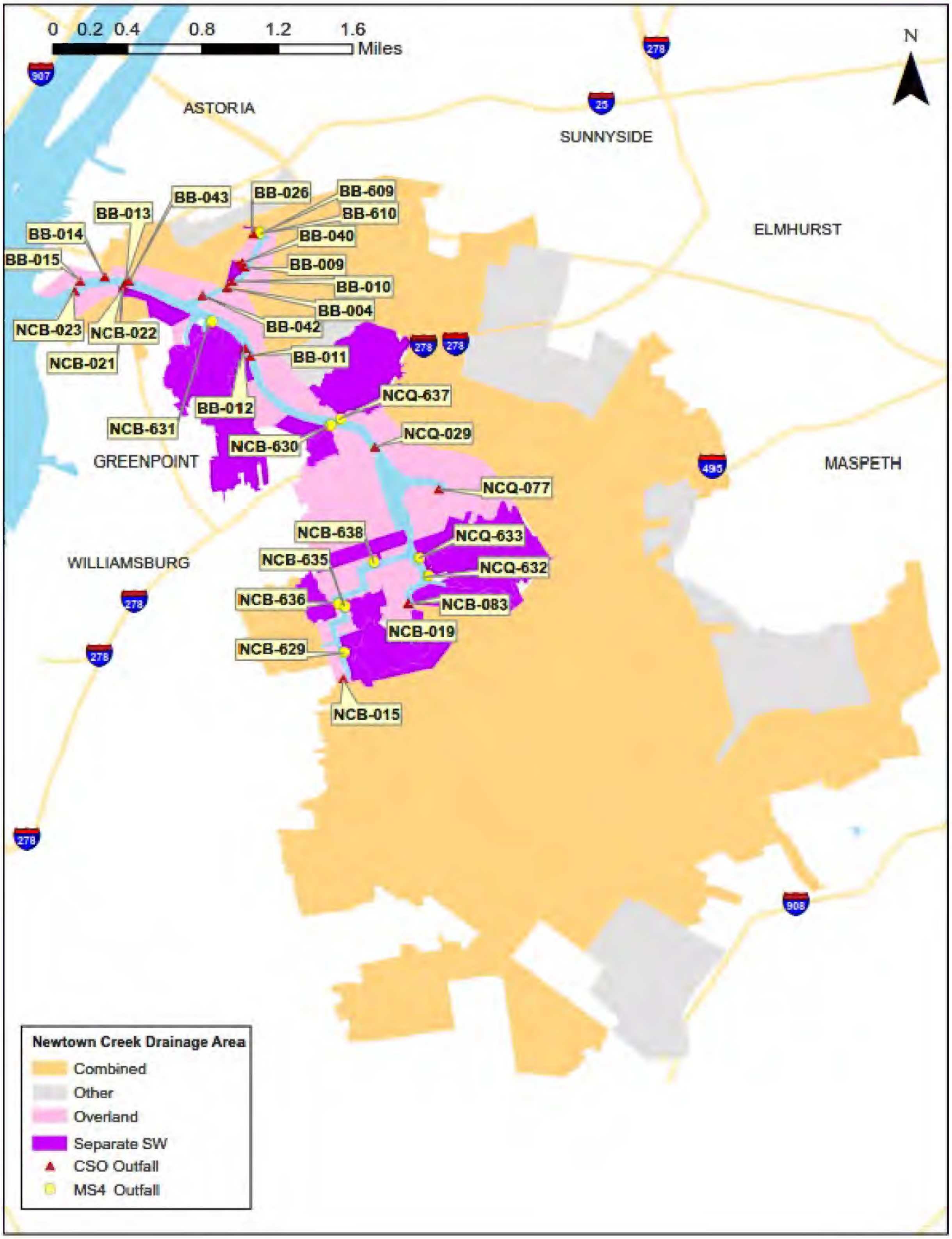

Figure ES-1. Newtown Creek Watershed Characteristics

The criteria assessed in this Newtown Creek LTCP include the Existing WQ Criteria (Class SD) and Dissolved Oxygen (DO) Class SC criteria. *Enterococci* criteria do not apply to tributaries such as Newtown Creek under the Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000 because Newtown Creek is not a coastal recreational water as defined by the BEACH Act and is not designated by DEC for recreational use. However, DEP has also assessed the 2012 EPA Recreational Water Quality Criteria (RWQC) for enterococci to evaluate attainment with the standards that would apply if DEC designated Newtown Creek as a primary contact use waterbody and adopted the 2012 RWQC for Newtown Creek. This LTCP includes attainment analyses for both current WQ Criteria and for the recommended 2012 EPA RWQC (referred to hereinafter as the "Potential Future Primary Contact WQ Criteria"). These criteria include a 30-day rolling geometric mean (GM) for *Enterococci* of 30 cfu/100mL with a not-to-exceed 90^{th} percentile statistical threshold value (STV) of 110 cfu/100mL.

Table ES-1 summarizes the Existing WQ Criteria, Bacteria Primary Contact WQ Criteria/DO Class SC Criteria and Potential Future Primary Contact WQ Criteria analyzed in this LTCP.

Table ES-1. Classifications and Standards Applied

Analysis	Numerical Criteria Applied	
Existing WQ Criteria	Class SD	Fecal Monthly GM ≤ 200; DO never <3.0 mg/L
Bacteria Primary Contact WQ Criteria / DO Class SC(1)	Class SC	Fecal Monthly GM ≤ 200; DO between > 3.0 & ≤4.8 mg/L(1, 3); DO never < 3.0 mg/L(1)
Potential Future Primary Contact WQ Criteria(2)	Entero: rolling 30-d GM – 30 cfu/100mL Entero: STV – 110 cfu/100mL	

Notes:
GM = Geometric Mean; STV = 90% Statistical Threshold Value
(1) This water quality classification is not currently assigned to Newtown Creek, which is a Class SD waterbody.
(2) DEC has not adopted the Potential Future Primary Contact WQ Criteria, which are EPA's recommended water quality criteria for coastal recreational waters designated for primary contact recreational use.
(3) This is an excursion based limit that allows for the average daily DO concentrations to fall between 3.0 and 4.8 mg/L for a limited number of days as described in more detail in Section 2.

EPA is evaluating the presence of hazardous substances in Newtown Creek under the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA" or "Superfund"). EPA's Superfund process addresses listed hazardous substances, such as polycyclic aromatic hydrocarbons, polychlorinated biphenyls, volatile organic compounds, semi-volatile organic compounds, and metals. EPA listed Newtown Creek on the Superfund National Priorities List in September 2010.

In July 2011, EPA issued an administrative order on consent (AOC) to six potentially responsible parties (PRPs), including the City of New York. The AOC required a Remedial Investigation (RI) and Feasibility Study (FS) at Newtown Creek under EPA's oversight. The RI was performed by the non-City PRPs, and included surveys of physical and ecological characteristics of Newtown Creek; sampling of surface water, surface sediments, subsurface sediments and air; delineation of surface sediments, subsurface sediments and surface water; and investigation of non-aqueous phase liquid and groundwater. Data collected from the RI was reported and analyzed in a Draft RI Report, which the non-City parties submitted to EPA in November 2016.

On March 20, 2017, the City submitted extensive comments to EPA on the Draft RI Report. The City concurs with comments from DEC, dated March 16, 2017, and from EPA, dated May 9, 2017, in which each stated that "[b]iological data from reference areas with CSO point source discharges indicate risk from CERCLA [chemicals of potential concern (COPCs)] as evaluated from these data could be significantly decreased to background (reference area) levels even with continuing CSO discharge during storm events." (EPA Comments at ES-3, Specific Comment 9; DEC Comments at 4, Specific Comment 1.g).

The data show that CSO discharges are not a significant source of hazardous substances in Newtown Creek. Nevertheless, the City expects the CSO control alternative selected in this LTCP (see Section 8) would be sufficient to address any CSO discharge controls that EPA may require under Superfund. The FS, which is being conducted by the non-City PRPs, will evaluate potential remedies for Newtown Creek based on both data collected during the RI and on additional sampling and studies. EPA expects to issue a Record of Decision (ROD) in 2020, which will set forth EPA's selected remedy for Newtown Creek.

Newtown Creek Watershed

Newtown Creek's watershed characteristics, including the Creek's CSO and stormwater outfalls, are shown in Figure ES-1. Newtown Creek is a saline waterbody between the Boroughs of Brooklyn and Queens in NYC. Newtown Creek is tributary to the Lower East River, and the East River is tributary to the Upper New York Bay. Water quality levels for bacteria and dissolved oxygen in Newtown Creek are influenced by CSO, stormwater discharges and dry-weather sources. The Newtown Creek watershed comprises approximately 6,815 acres and the majority of the land use within a quarter-mile radius of the Creek is industrial and commercial. The urbanization of NYC and the Newtown Creek watershed has led to the creation of a large combined sewer system and smaller pockets served by separate sanitary and storm sewer systems, including its companion stormwater outfalls that discharge directly to the Creek. The Newtown Creek watershed is served by both the Bowery Bay Wastewater Treatment Plant (WWTP) and Newtown Creek WWTP. Dry-weather flow is conveyed to the WWTPs for treatment. During wet-weather, the combined sewage flow that exceeds the capacity of the WWTP may discharge through any one or more of the 20 State Pollution Discharge Elimination System (SPDES)-permitted CSO Outfalls to Newtown Creek. Table ES-2 summarizes the model-projected annual volume and frequency of overflow for each SPDES-permitted CSO Outfall under the CSO LTCP selected baseline conditions described below. A total of 11 DEP-owned Municipal Separate Storm Sewer System (MS4) outfalls that are subject to a SPDES permit for the MS4 system also discharge to Newtown Creek. Figure ES-2 illustrates the location of the DEP CSO outfalls, NYC MS4 outfalls as well as Department of Transportation (DOT) outfalls and other privately-owned discharge points to Newtown Creek.

Table ES-2. CSO Discharges Tributary to Newtown Creek (2008 Typical Year)

Combined Sewer Outfalls	Receiving Waters	Discharge Volume (MGY)	No. of Discharges	Percentage of Total CSO Discharge to Newtown Creek
BB-026	Dutch Kills	120	37	10.3%
NC-077	Maspeth Creek	300	41	25.8%
NC-083	East Branch	314	42	27.0%
NC-015	English Kills	321	31	27.7%
Subtotal - Four Largest Outfalls	**Newtown Creek and Tributaries**	**1,055**	**42 (max.)(1)**	**90.9%**
BB-004	Dutch Kills	0	1	
BB-009	Dutch Kills	43	34	3.7%
BB-040	Dutch Kills	1	16	<1.0%
BB-010	Newtown Creek	1	7	<1.0%
BB-011	Newtown Creek	2	14	<1.0%
BB-012	Newtown Creek	0	1	<1.0%
BB-013	Newtown Creek	16	31	1.4%
BB-014	Newtown Creek	2	18	<1.0%
BB-015	Newtown Creek	1	13	<1.0%
BB-042	Newtown Creek	2	22	<1.0%
BB-043	Newtown Creek	9	32	<1.0%
BB-049	Newtown Creek	0	0	0.0%
NCB-019	Newtown Creek	3	21	<1.0%
NCB-021	Newtown Creek	0	0	0.0%
NCB-022	Newtown Creek	7	29	<1.0%
NCB-023	Newtown Creek	0	8	<1.0%
NCQ-029	Newtown Creek	19	40	1.6%
Subtotal – Other Outfalls	**Newtown Creek and Dutch Kills**	**106**	**40 (max.) (1)**	**9.1%**
Total CSO	**Newtown Creek and Tributaries**	**1,161**	**42 (max.) (1)**	**100%**

Notes: (1) Max. = Activation frequency of most active outfall

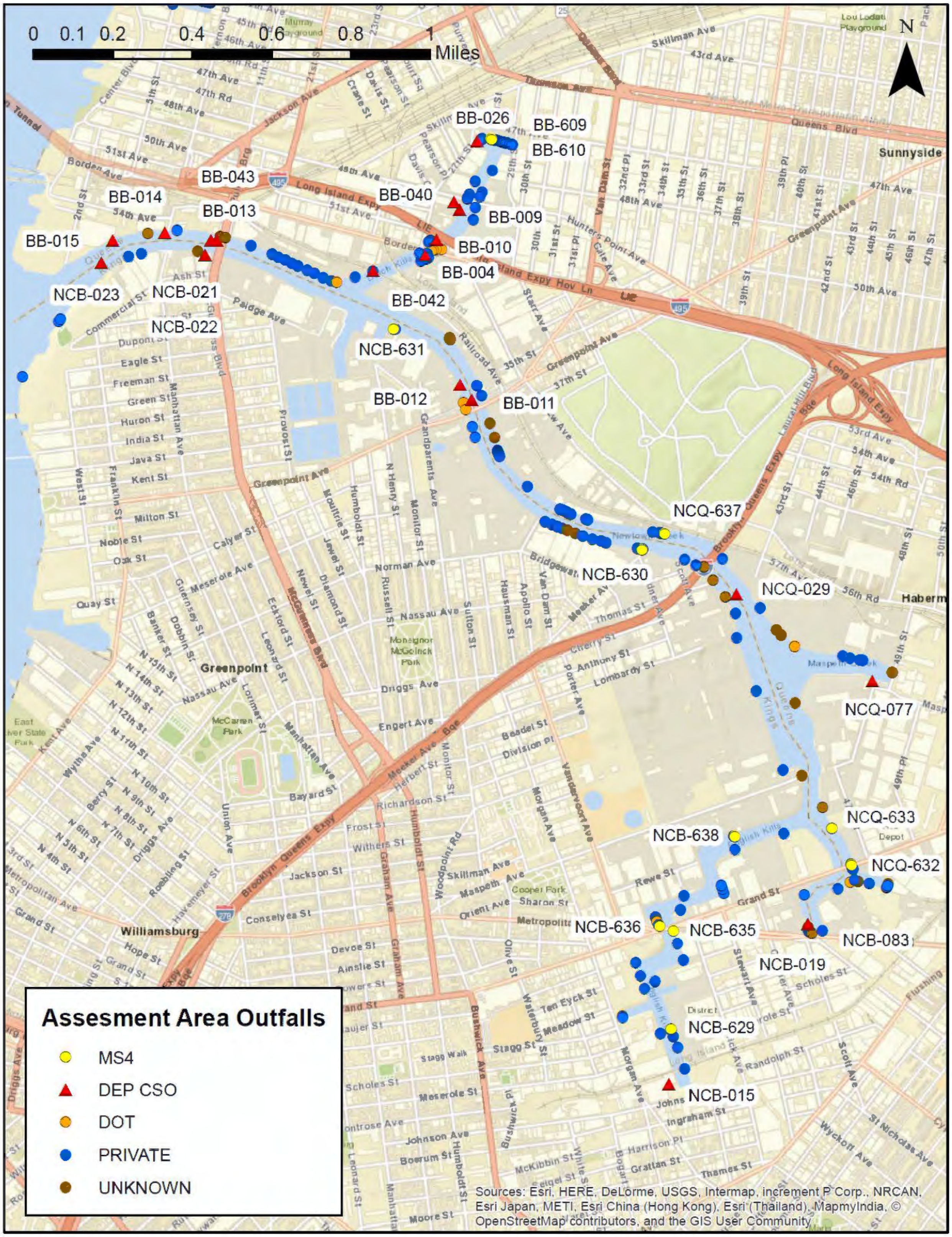

Figure ES-2. Newtown Creek Outfalls

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Green Infrastructure

Newtown Creek is a priority watershed for DEP's Green Infrastructure (GI) Program, which seeks to saturate priority watersheds with GI based on the specific opportunities each watershed presents. DEP has installed, or plans to install, nearly 1,300 GI assets, including right-of-way (ROW) practices, public property retrofits, and GI implementation on private properties. These assets will result in an annual CSO volume reduction of approximately 83 million gallons per year (MGY), based on the 2008 baseline rainfall condition.

As LTCPs are developed, model-based baseline GI penetration rates for each watershed may be adjusted based on the adaptive management approach described in Section 5.2, and as additional information on field conditions, feasibility, and costs becomes available. Figure ES-3 shows the current contracts in progress in Newtown Creek. DEP will continue to pursue additional GI opportunities beyond the baseline assumptions and will make necessary adjustments as needed.

2. FINDINGS

Current Water Quality Conditions

Data collected in and around Newtown Creek are available from sampling conducted by DEP's Harbor Survey Monitoring Program (HSM) between 2013 and 2016, and from sampling conducted from July 2016 through November 2016 during the implementation of the LTCP sampling program. The sampling locations of both programs are depicted in Figure ES-4. Figures ES-5 and ES-6 show the GM along with data ranges (minimum to maximum and 25th percentile to 75th percentile) for fecal coliform and *Enterococci*, respectively, for the LTCP sampling program. Figures ES-7 and ES-8 show similar data for the HSM sampling program over the concurrent sampling period. For reference purposes, Figures ES-5 and ES-7 also show the monthly GM water quality numerical criterion for fecal coliform (200 cfu/100mL).

Overall, the fecal coliform levels measured throughout the LTCP sampling program result in GMs indicative of the impacts of both dry- and wet-weather pollution sources on Newtown Creek. As shown in Figure ES-5, the wet-weather geometric means along the extension of Newtown Creek and its tributaries at Stations NC-3 to NC-14 are all above 200 cfu/100mL. Similarly, the dry-weather geometric means at Stations NC-4 to NC-14 are also all above 200 cfu/100mL. The LTCP *Enterococci* data generally follow a similar trend as the fecal coliform data for wet-weather pollution sources, with wet-weather geometric means along the extension of Newtown Creek and its tributaries from Stations NC-4 to NC-14 all above 30 cfu/100mL. As shown in Figure ES-6, wet-weather geometric means are all higher than dry-weather geometric means at each station, with dry-weather geometric means exceeding 30 cfu/100mL only at the station within the Creek tributaries of Dutch Kills (Station NC-6), East Branch (Station NC-12) and English Kills (Stations NC-13 and NC-14).

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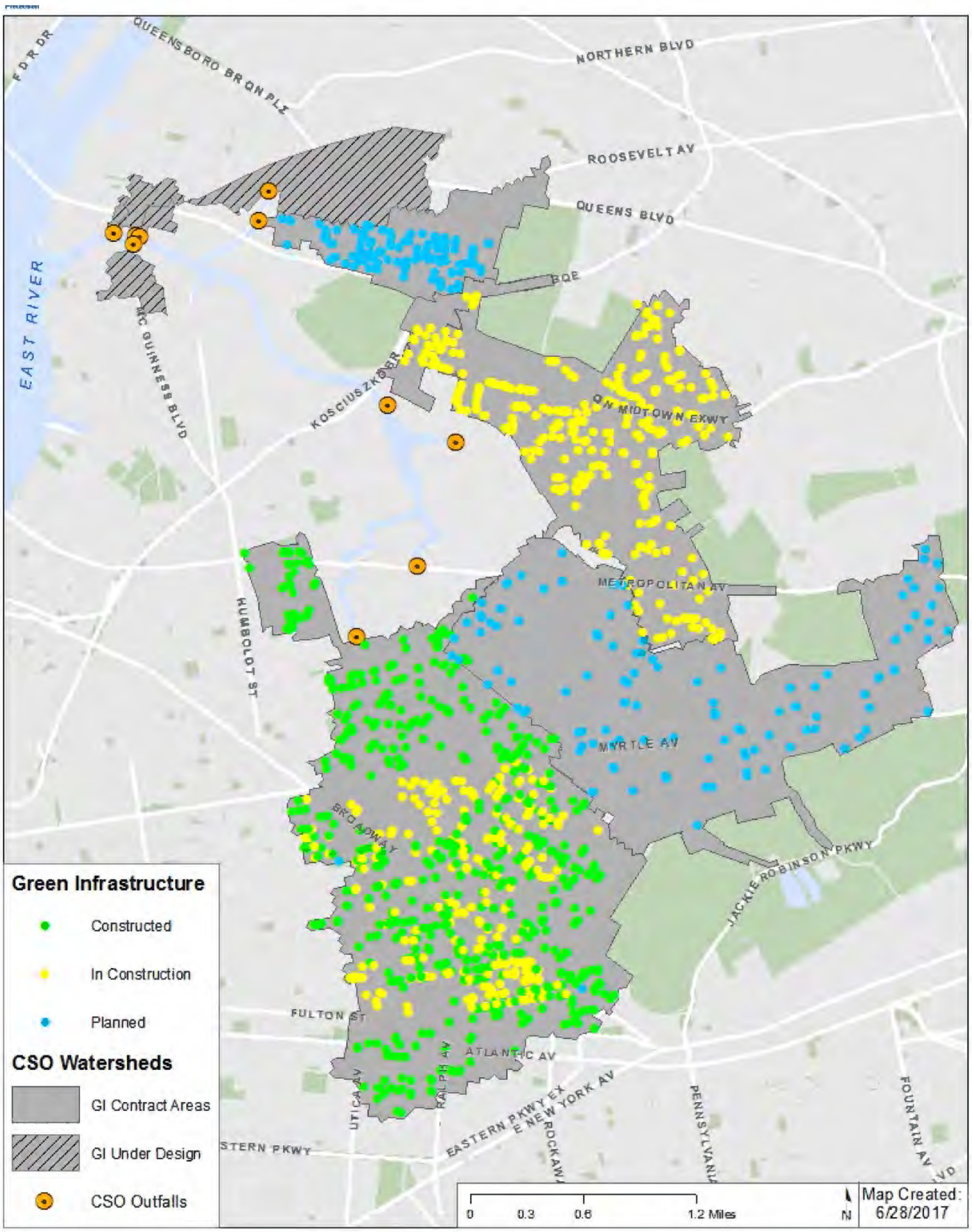

Figure ES-3. Green Infrastructure Projects in Newtown Creek

The “wet-weather” samples for the LTCP sampling program were taken over a period of three days following a wet-weather event. The “dry-weather” samples were taken on the fourth day following a wet-weather event. When the data from each sampling day are plotted, the elevated dry-weather bacteria concentrations observed in Newtown Creek under the LTCP sampling program appear to be related to a slow time to recovery following a wet-weather event, as opposed to being caused by a dry-weather source of bacteria to the Creek.

The HSM fecal coliform data presented in Figure ES-7 are also consistent with the LTCP data. The wet-weather geometric means along the extension of the Creek and tributary English Kills from Stations NC-3 to NC-0 are all above 200 cfu/100mL for 2013 through 2016, except for Station NC-3 in 2014. The HSM dry-weather fecal coliform data differed from the LTCP2 data trend with the overall dry-weather geometric means along the Creek from Stations NC-3 to NC-1 below 200 cfu/100mL. However, dry-weather geometric means at Station NC-1 in 2016 and Station NC-0 in the tributary English Kills in 2013, 2014 and 2016 were above 200cfu/100mL. HSM *Enterococci* data (Figure ES-8) showed generally a similar pattern to the HSM fecal coliform data.

Riverkeeper and the Newtown Creek Alliance collected water quality data; this dataset consists of *Enterococci* bacteria concentrations for four sampling stations in Newtown Creek as shown in Figure 2-23. See Riverkeeper’s website http://www.riverkeeper.org/. Consistent with the LTCP and HSM data, the Riverkeeper data showed a relationship between wet-weather conditions and higher *Enterococci* concentrations throughout the years 2014, 2015 and 2016.

Figure ES-9 depicts the average DO values derived from the LTCP dataset measured from July to November 2016. The data shows average DO above 4.0 mg/L at all stations. However, DO measurements below 3.0 mg/L were recorded consistently through the lower portion of Newtown Creek (Stations NC-9, NC-10 and NC-11) and in the tributaries Dutch Kills (Station NC-6), East Branch (NC-12), and English Kills (Stations NC-13 and NC-14).

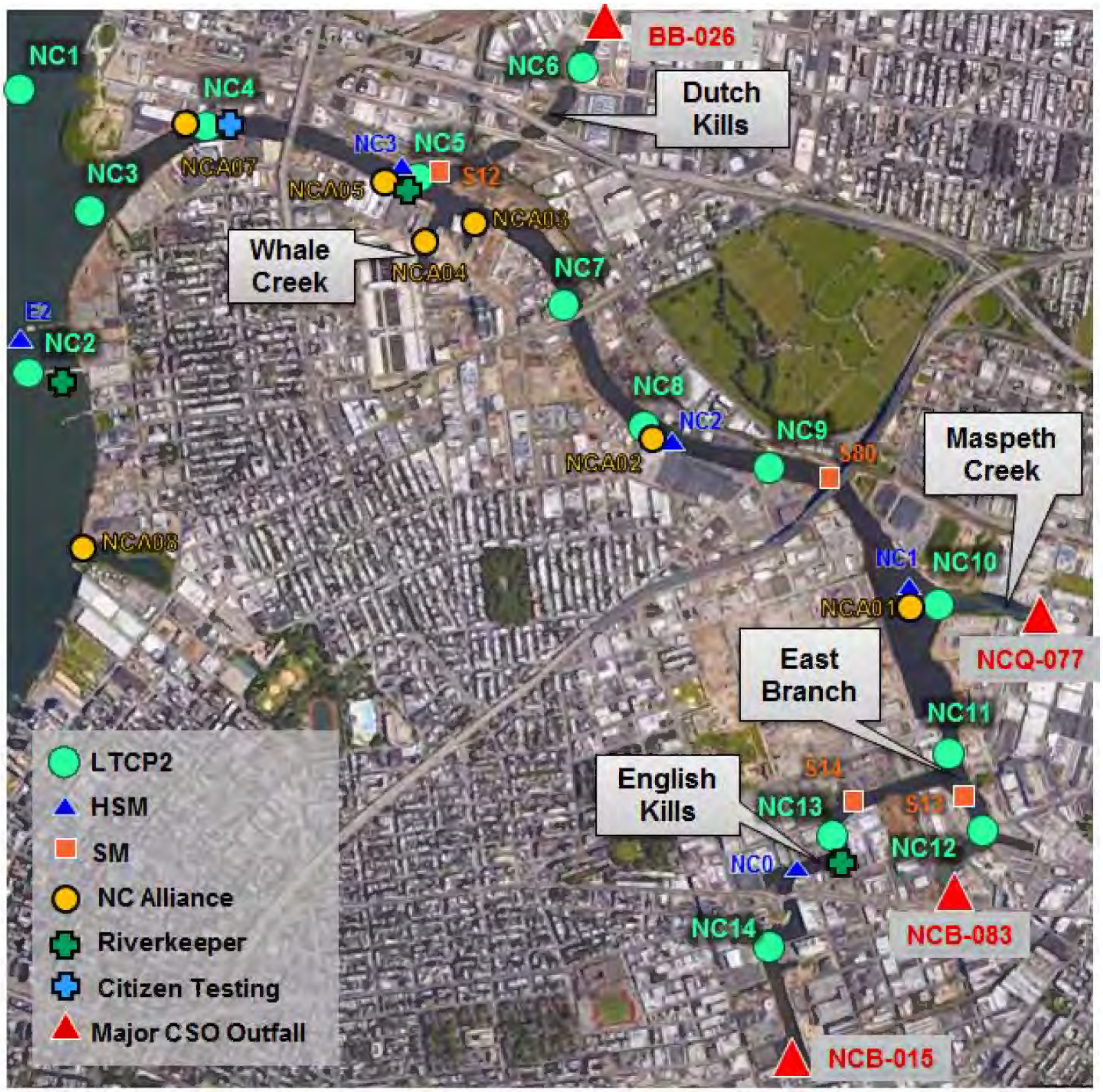

Figure ES-4. Newtown Creek LTCP Field Sampling Analysis Program and Harbor Survey Monitoring Program Sampling Locations

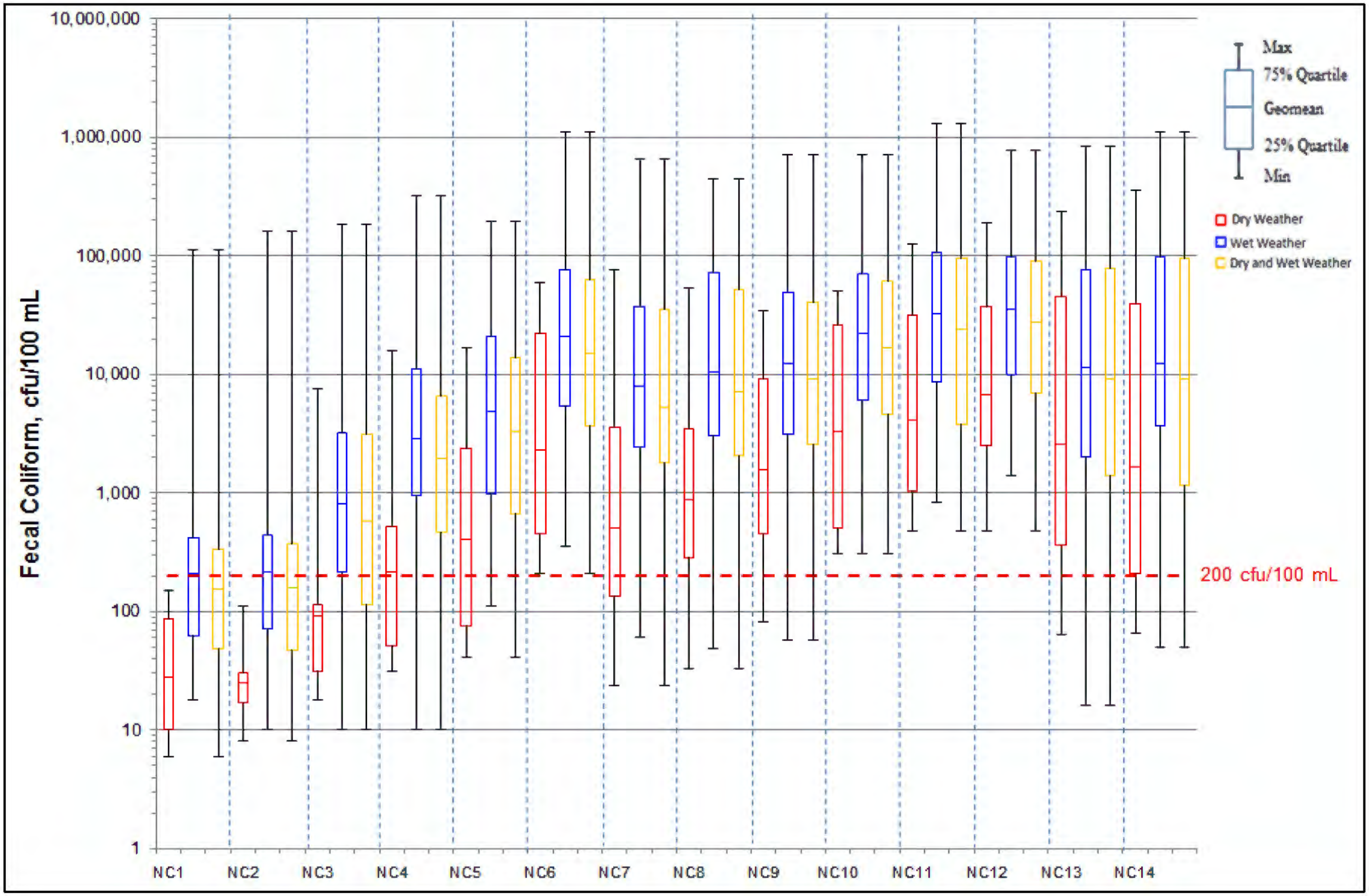

Figure ES-5. Fecal Coliform Concentrations at Newtown Creek LTCP Monitoring Stations

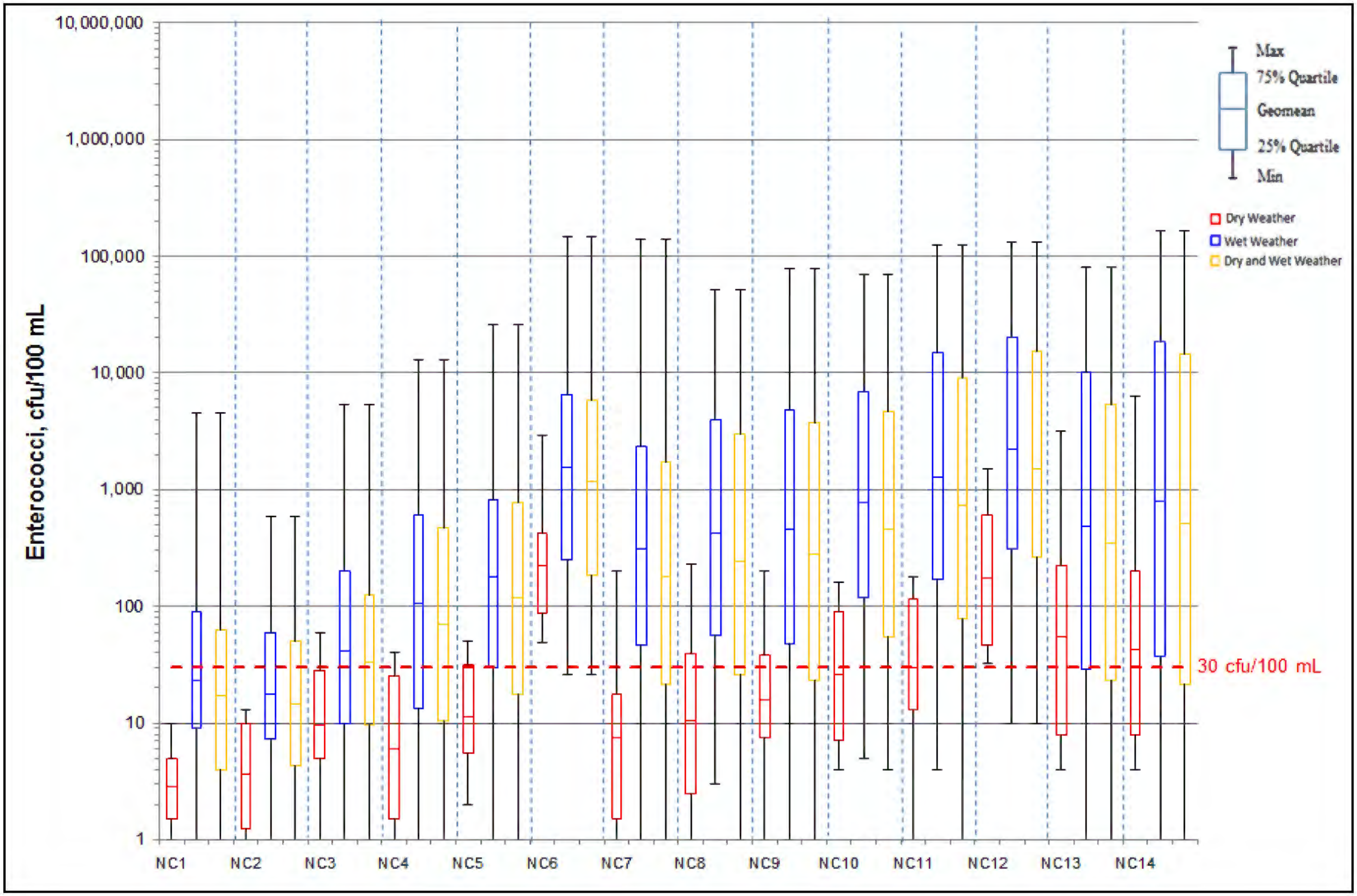

Figure ES-6. *Enterococci* Concentrations at Newtown Creek LTCP Monitoring Stations

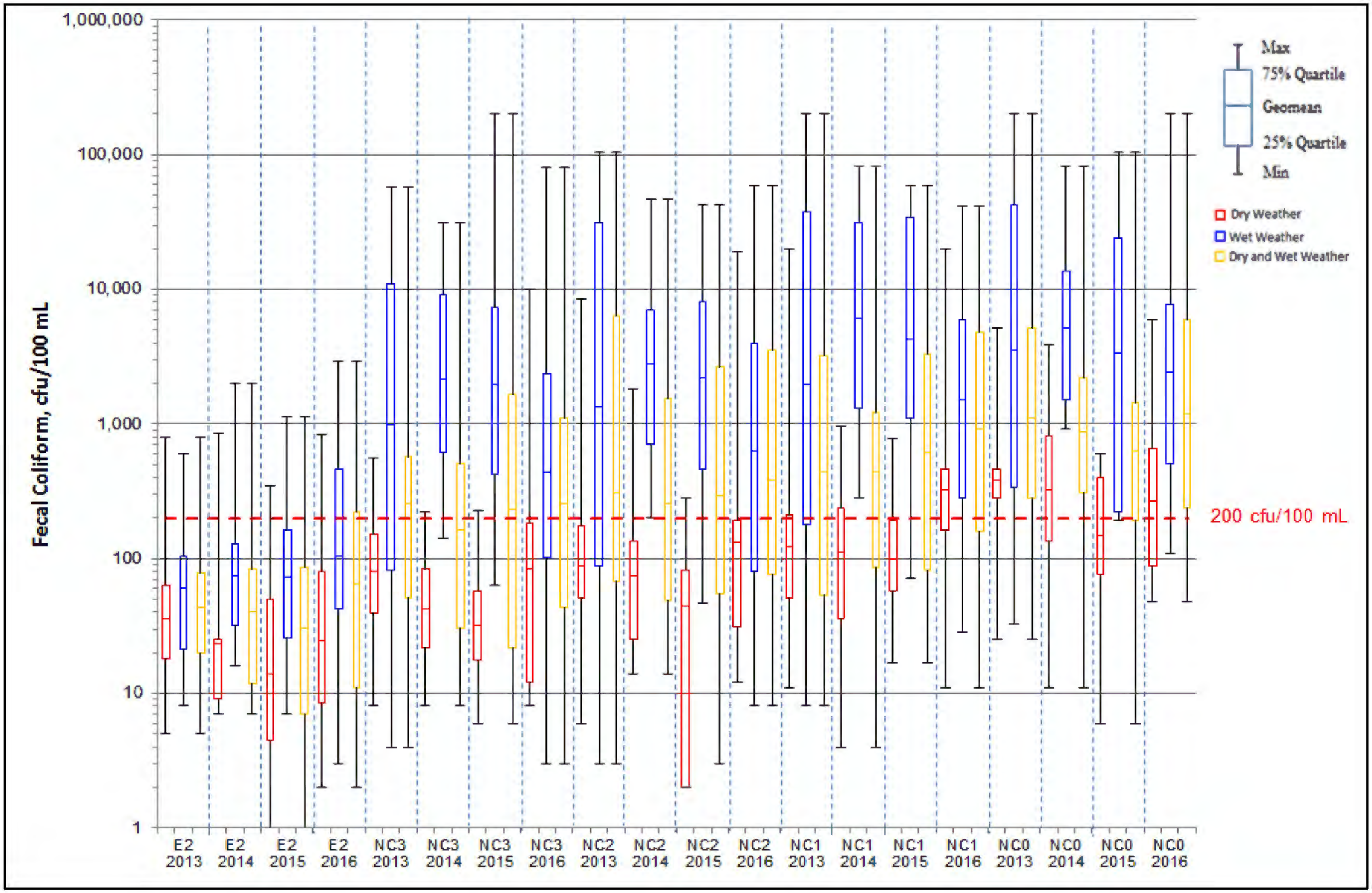

Figure ES-7. Fecal Coliform Concentrations at Newtown Creek Harbor Survey Monitoring Stations

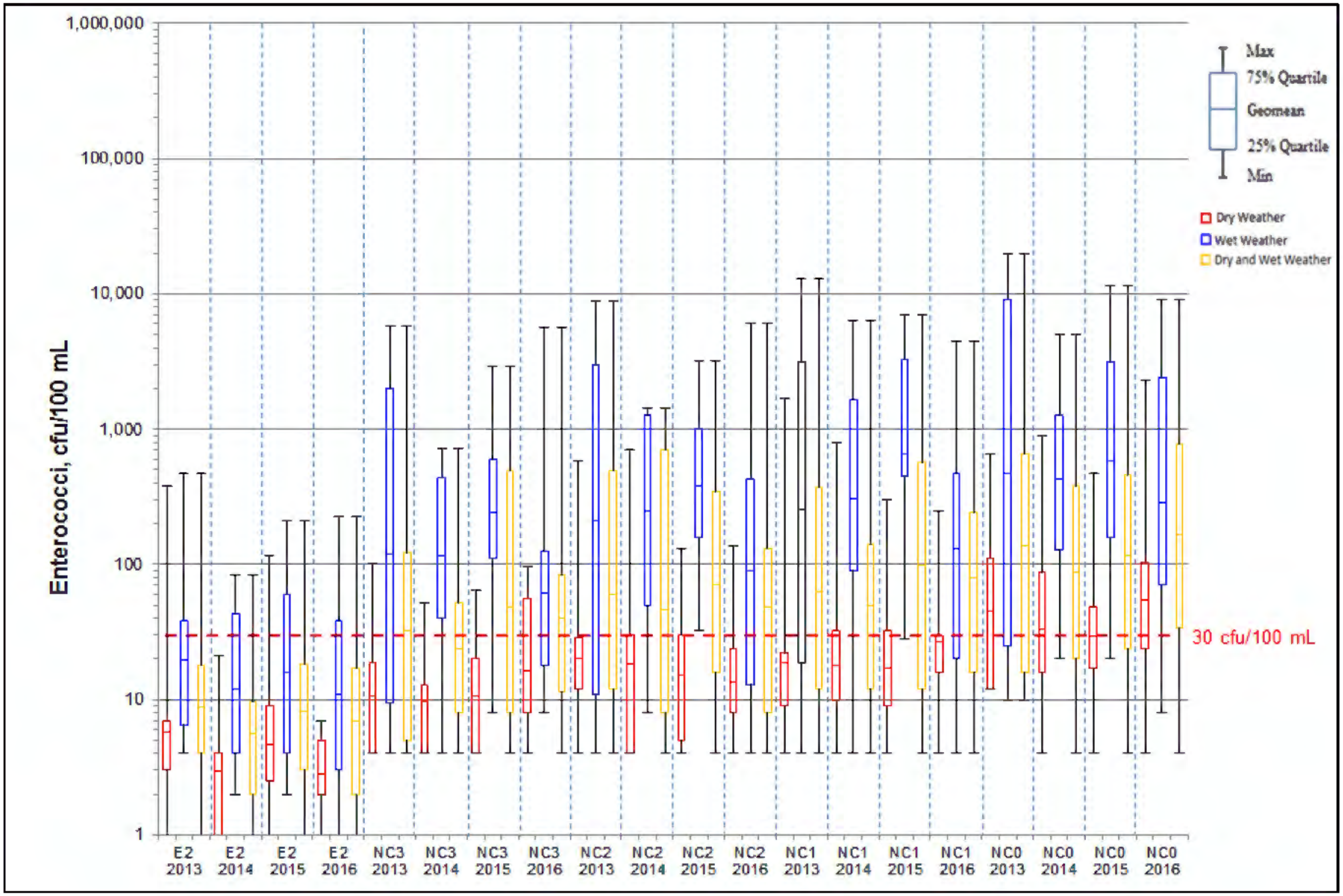

Figure ES-8. ***Enterococci*** **Concentrations at Newtown Creek Harbor Survey Monitoring Stations**

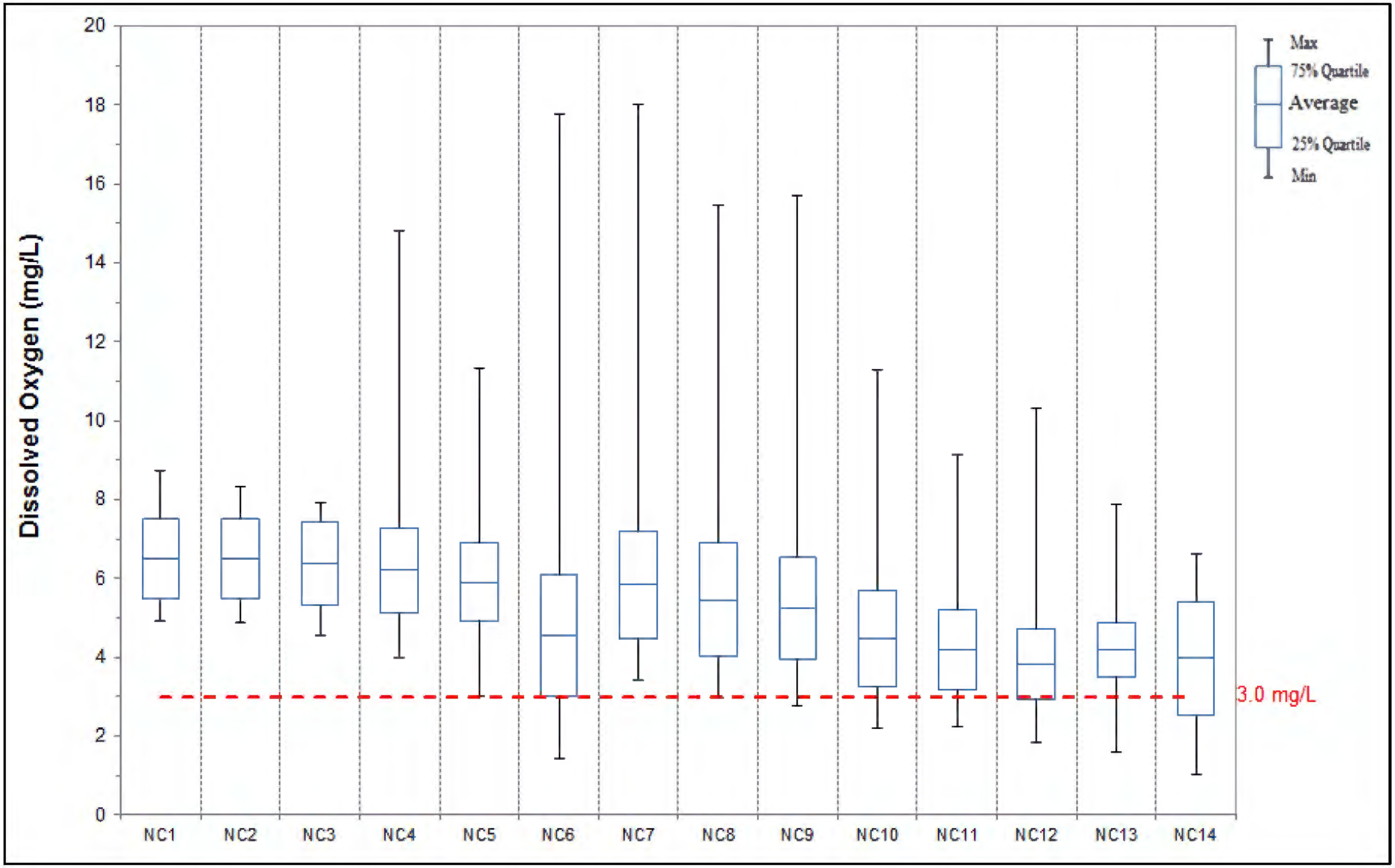

Figure ES-9. DO Concentration at Newtown Creek LTCP WQ Stations (July 2016 – November 2016)

Baseline Conditions, 100 Percent CSO Control and Performance Gap

Computer models were used to assess attainment with Existing WQ Criteria (Class SD), Class SC DO Criteria and Potential Future Primary Contact WQ Criteria. The analyses focused on two primary objectives:

1. Determine the levels of compliance with water quality criteria for bacteria and dissolved oxygen under future baseline conditions, defined as conditions with sanitary flows based on 2040 population projections, with all other sources being discharged at existing levels to the waterbody. The primary sources would be dominated by CSO but also include stormwater, direct drainage, and treated effluent from the Newtown Creek WWTP. This analysis is presented for Existing WQ Criteria (Class SD), Class SC DO Criteria and Potential Future Primary Contact WQ Criteria.
2. Determine potential attainment levels with WQS for bacteria and dissolved oxygen without discharge of CSO to the waterbody (100 percent control), keeping the remaining non-CSO sources. This analysis is based on the criteria shown in Table ES-1.

An InfoWorks CS™ (IW) sewer system model was used to develop stormwater flows, conveyance system flows, and CSO volumes for the baseline conditions for the Newtown Creek sewershed. For the Newtown Creek LTCP, the baseline conditions were initially developed in a manner consistent with the earlier Waterbody/Watershed Facility Plans (WWFPs) for other waterbodies. However, based on more recent data and public comments received on the preceding WWFPs, it was recognized that some of the baseline condition model input data required updating to better reflect more recent meteorological conditions, as well as the current operating characteristics of various collection and conveyance system components. Furthermore, the mathematical models were updated from their configurations and levels of calibration developed and documented prior to this LTCP. IW model modifications for this LTCP reflect a better understanding of dry- and wet-weather pollutant sources, catchment areas, and new or upgraded physical components of the system.

The new IW models were used to calculate CSO volumes for the baseline conditions and were used as a tool to evaluate the impact on CSOs of potential alternative operating strategies and other possible physical changes to the collection system. Using these overflow volumes, CSO loadings were generated using measured *Enterococci*, fecal coliform, nutrient, organic carbon and biochemical oxygen demands (BOD) concentrations. These loadings provided input to bacteria and DO receiving water quality models of Newtown Creek.

Baseline conditions were established in accordance with the guidance provided by DEC to represent future conditions. Baseline conditions included the following assumptions: the design year for projected future dry-weather flows was established as 2040; Bowery Bay WWTP would receive peak flows of 300 MGD (two times design dry-weather flow [2xDDWF]) and Newtown Creek WWTP would receive peak flows at 700 MGD (greater than 2xDDWF); cost-effective grey infrastructure CSO controls included in the CSO Order would be fully implemented; and waterbody-specific GI application rates would be based on the best available information. In the case of the Newtown Creek project area, constructed or planned GI projects are estimated to result in an 83 MGY reduction in annual CSO volume in the watershed.

Improvements to the water quality models, including expanded and more refined model grid segmentation, were also made as part of this LTCP. The water quality assessments were conducted using continuous water quality simulations. A one-year (2008 rainfall) simulation for bacteria and DO assessment was used to support an alternatives evaluation. A 10-year rainfall bacteria simulation (2002 to 2011) for attainment analysis was used for the preferred alternative. The gaps between calculated baseline concentrations of bacteria, as well as DO, were then compared to the applicable bacteria and DO criteria to quantify the level of attainment.

Table ES-3 presents a summary of the baseline annual and recreational season (May 1st through October 31st) attainment of Bacteria Existing WQ Criteria for the 2008 rainfall year, along with the maximum monthly fecal coliform GM. As shown, the highest GMs were found to occur in the head end of Newtown Creek or near the largest CSO outfalls, with 100 percent attainment achieved only at stations in the East River or near the mouth of the Creek during the recreational season (May 1st through October 31st). 100 percent attainment was not met on an annual basis at any station.

Levels of attainment for the Bacteria Primary Contact WQ Criteria on an annual or recreational season (May 1st through October 31st) basis are the same as those shown for the Bacteria Existing WQ Criteria in Table ES-3, given that both standards share the same fecal coliform numerical threshold of 200 cfu/100mL.

Table ES-3. Model Calculated 2008 Baseline Fecal Coliform Maximum Monthly GM and Attainment of Existing WQ Criteria

	Station	Maximum Monthly Geometric Means (cfu/100mL)		% Attainment (GM <200 cfu/100mL)	
		Annual	Recreational Season(1)	Annual	Recreational Season(1)
East River	NC1	242	67	83	100
	NC2	239	69	83	100
	NC3	260	85	83	100
Main Channel	NC4	483	168	75	100
	NC5	618	188	75	100
Dutch Kills	NC6	1,103	294	50	83
Main Channel	NC7	729	203	75	100
	NC8	859	226	50	83
	NC9	1,004	250	50	83
Maspeth Creek	NC10	1,711	369	42	67
English Kills	NC11	1,567	441	42	67
East Branch	NC12	2,056	552	42	67
English Kills	NC13	1,597	544	42	67
	NC14	1,840	975	42	67

Note:
(1) The recreational season is May 1st to October 31st.

The average annual attainment of DO criteria under baseline conditions that includes seasonal operation of the aeration systems in English Kills and East Branch is presented in Table ES-4 for the 2008 rainfall. The average annual attainment is calculated by averaging the calculated attainment in each of the ten modeled depth layers that comprise the entire water column. When assessing the water column in its entirety, attainment of the DO criterion is high. Most of the station locations that were assessed have a water column annual attainment of 95 percent or greater for year 2008 conditions with only three stations (NC12, NC13, NC14) below 95 percent.

Table ES-4. Model Calculated Baseline DO Attainment – Existing WQ Criteria (2008)

Station		Annual Attainment (%) Entire Water Column >=3.0 mg/L
East River	NC1	100
	NC2	100
	NC3	100
Main Channel	NC4	100
	NC5	99.9
Dutch Kills	NC6	98.1
Main Channel	NC7	99.8
	NC8	99.5
	NC9	99.2
Maspeth Creek	NC10	96.3
English Kills	NC11	95.4
East Branch	NC12	94.5
English Kills	NC13	94.0
	NC14	89.8

Table ES-5 presents a comparison of the maximum monthly GM and the annual percent attainment for baseline conditions and 100 percent CSO control. The data in Table ES-5 show that the CSOs have the largest impact on DO in the vicinity of the head of the Creek at Stations NC11 through NC14, where the removal of the CSO loadings results in a modeled reduction of the maximum monthly fecal coliform GM concentration by at least 1,300 cfu/100mL at each station, therefore improving the attainment of the corresponding applicable numerical DEC standard. Modeled improvements in the monthly fecal coliform GM due to 100 percent CSO control are less significant in the East River and near the mouth of Newtown Creek. Model calculated annual attainment of the fecal coliform monthly geomean criteria improves with the removal of the CSOs resulting in lower geomean concentrations at each of the monitoring locations. 100 percent CSO control would result in 100 percent attainment of fecal coliform water quality standard during the recreational season (May 1st through October 31st) but will not fully attain the bacterial standards on an annual basis.

Table ES-5. Comparison of the Model Calculated 2008 Baseline and 100 Percent Newtown Creek CSO Control Fecal Coliform Maximum Monthly GM and Attainment of Existing WQS for Fecal Coliform Bacteria

Station		Maximum Monthly Geometric Means (Annual)		% Attainment (Annual)		% Attainment (Recreational Season)(1)	
		Baseline	100% CSO Control	Baseline	100% CSO Control	Baseline	100% CSO Control
East River	NC1	242	241	83	83	100	100
	NC2	239	237	83	83	100	100
	NC3	260	236	83	83	100	100
Main Channel	NC4	483	204	75	100	100	100
	NC5	618	193	75	100	100	100
Dutch Kills	NC6	1,103	143	50	100	83	100
Main Channel	NC7	729	173	75	100	100	100
	NC8	859	162	50	100	83	100
	NC9	1,004	157	50	100	83	100
Maspeth Creek	NC10	1,711	143	42	100	67	100
English Kills	NC11	1,567	183	42	100	67	100
East Branch	NC12	2,056	230	42	92	67	100
English Kills	NC13	1,597	184	42	100	67	100
	NC14	1,840	227	42	83	67	100

Note:
(1) The recreational season is from May 1st through October 31st.

The average annual attainment of DO criteria for baseline conditions and 100 percent CSO control is presented in Table ES-6 for year 2008 conditions. As indicated in Table ES-6, calculated in-Creek attainment with 100 percent CSO control with aeration (i.e. seasonal operation of the English Kills and East Branch aeration systems) is 100 percent at all stations in Newtown Creek. Without operations of the English Kills and East Branch aeration systems, attainment would drop below 95 percent at NC14 even with 100% CSO control.

Table ES-6. Model Calculated Baseline and 100 Percent CSO Control DO Attainment – Existing WQ Criteria (2008)

Station	Annual Attainment Percent Attainment (Average DO ≥ 3 mg/L)		
	Baseline with Aeration(1)	100% Newtown Creek CSO Control, with Aeration(1)	100% Newtown Creek CSO Control, Without Aeration(2)
NC1	100	100	100
NC2	100	100	100
NC3	100	100	100
NC4	99.98	100	100
NC5	99.92	100	100
NC6	98.1	100	100
NC7	99.8	100	100
NC8	99.5	100	100
NC9	99.2	100	100
NC10	96.3	100	99.2
NC11	95.4	100	98.0
NC12	94.5	100	97.3
NC13	94.0	100	97.0
NC14	89.8	100	91.0

Notes:
(1) Assumes seasonal operation of East Branch and English Kills aeration systems.
(2) Assumes no operation of East Branch and English Kills aeration systems.

The attainment of the DO Class SC criteria for the entire water column is presented in Table ES-7 for baseline and 100 percent CSO control conditions. Determination of projected attainment with Class SC DO criteria can be complex as the chronic standard allows for excursions from the daily average limit of 4.8 mg/L for a limited number of consecutive calendar days. Based on model results, most of the stations achieve at least 95 percent attainment of the acute criterion (never less than 3.0 mg/L) under baseline conditions based on the entire water column except for three stations near the head of the Creek (Stations NC12, NC13, and NC14). For the chronic criterion, calculated in-Creek baseline attainment ranges between 70 and 100 percent. Calculated in-Creek attainment with 100 percent CSO control with aeration (i.e. seasonal operation of the English Kills and East Branch aeration systems) is 100 percent at all stations for the acute criterion, and exceeds 95 percent at all stations except NC14 for the chronic criterion. For 100 percent CSO control without aeration, the acute criterion is projected to be attained at all stations except NC14, but calculated attainment of the chronic criterion would fall below 95 percent at 11 out of 14 locations, negating the benefits of 100 percent CSO controls for chronic attainment.

Table ES-7. Model Calculated 2008 Baseline and 100 Percent CSO Control DO Attainment of Class SC WQ Criteria

Station		Annual Attainment Percent Attainment (Water Column)					
		Baseline with Aeration(1)		100% Newtown Creek CSO Control with Aeration(1)		100% Newtown Creek CSO Control, Without Aeration(2)	
		Chronic(3)	Acute(4)	Chronic(3)	Acute(4)	Chronic(3)	Acute(4)
East River	NC1	100	100	100	100	100	100
	NC2	100	100	100	100	100	100
	NC3	100	100	100	100	100	100
Main Channel	NC4	90.8	99.98	98.9	100	92.3	100
	NC5	90.6	99.92	99.0	100	90.0	100
Dutch Kills	NC6	82.9	98.1	100	100	92.3	100
Main Channel	NC7	88.1	99.8	100	100	89.5	100
	NC8	87.3	99.5	100	100	88.3	100
	NC9	87.0	99.2	100	100	87.8	100
Maspeth Creek	NC10	80.4	96.3	100	100	85.6	99.2
English Kills	NC11	80.4	95.4	100	100	75.7	98.0
East Branch	NC12	78.7	94.5	100	100	73.9	97.3
English Kills	NC13	77.5	94.0	97.8	100	72.5	97.0
	NC14	70.4	89.8	89.1	100	61.2	91.0

Notes:
(1) Assumes seasonal operation of East Branch and English Kills aeration system.
(2) Assumes no operation of East Branch and English Kills aeration system.
(3) Chronic Criteria: 24-hr average DO ≥ 4.8 mg/L with allowable excursions to ≥ 3.0 mg/L for certain periods of time.
(4) Acute Criteria: DO ≥ 3.0 mg/L.

The Potential Future Primary Contact WQ Criteria attainment for baseline conditions, 2008 recreational season (May 1st through October 31st), is shown below in Table ES-8. Under 2008 baseline conditions, greater than 95 percent attainment of the rolling 30-day GM *Enterococci* criteria of 30 cfu/100mL is projected to be achieved at eight out of 14 sampling locations in the East River and the main stem of Newtown Creek during the recreational season (May 1st through October 31st). Calculated attainment is lower at the six sampling locations in the tributaries and Turning Basin, ranging from 50 percent to 90 percent. Calculated attainment of the 90th percentile STV criterion of 110 cfu/100mL is 10 percent or less throughout the main channel and upstream reaches of Newtown Creek.

As shown in Table ES-9, 100 percent CSO control is projected to result in greater than 95 percent attainment of the 30-day rolling GM *Enterococci* criterion. The calculated attainment of the 90th percentile STV *Enterococci* criterion ranges from 4 to 86 percent. The projected high degree of attainment with the GM *Enterococci* criterion based on 100 percent CSO control indicates that the GM *Enterococci* concentrations are predominantly generated by CSOs and therefore can be altered with CSO controls.

Table ES-8. Model Calculated 2008 Baseline *Enterococci* Maximum 30-day GM and Attainment of Potential Future Primary Contact WQ Criteria

Station		Maximum Recreational Season(1) 30-day *Enterococci* (cfu/100mL)		% Attainment	
		GM	90th Percentile STV	GM	90th Percentile STV
East River	NC1	19	310	100	76
	NC2	18	316	100	76
	NC3	20	417	100	62
Main Channel	NC4	32	1,611	99	10
	NC5	36	1,527	98	10
Dutch Kills	NC6	69	20,549	90	8
Main Channel	NC7	37	1,630	98	8
	NC8	40	2,287	98	10
	NC9	44	2,754	97	8
Maspeth Creek	NC10	77	14,117	90	5
English Kills	NC11	90	11,131	72	5
East Branch	NC12	128	27,907	53	3
English Kills	NC13	93	8,428	73	5
	NC14	162	34,902	50	4

Note:
(1) The recreational season is from May 1st through October 31st.

Table ES-9. Model Calculated 2008 100 Percent CSO Control *Enterococci* Maximum 30-day GM and Attainment of Potential Contact WQ Criteria

Station		Maximum Recreational Season(1) 30-day *Enterococci* (cfu/100mL)		% Attainment	
		GM	90th Percentile STV	GM	90th Percentile STV
East River	NC1	19	304	100	76
	NC2	18	308	100	77
	NC3	18	310	100	76
Main Channel	NC4	17	281	100	45
	NC5	18	318	100	24
Dutch Kills	NC6	10	141	100	86
Main Channel	NC7	16	303	100	39
	NC8	15	250	100	42
	NC9	15	223	100	35

Table ES-9. Model Calculated 2008 100 Percent CSO Control *Enterococci* Maximum 30-day GM and Attainment of Potential Contact WQ Criteria

Station		Maximum Recreational Season(1) 30-day *Enterococci* (cfu/100mL)		% Attainment	
		GM	90th Percentile STV	GM	90th Percentile STV
Maspeth Creek	NC10	11	183	100	74
English Kills	NC11	21	725	100	11
East Branch	NC12	29	1,491	100	4
English Kills	NC13	22	441	100	14
	NC14	32	1,241	97	5

Note:
(1) The recreational season is from May 1st through October 31st.

Public Outreach

DEP's comprehensive public participation plan provides the opportunity for interested stakeholders to be involved in the LTCP process. Stakeholders include local residents and citywide and regional groups, a number of whom offered comments at three public meetings held for this LTCP.

On November 15, 2016, DEP hosted a Public Kickoff Meeting to initiate the water quality planning process for the Newtown Creek LTCP. Approximately 60 stakeholders from 25 different non-profit, community planning, environmental, economic development, governmental organizations, and the broader public attended the event, as did three media representatives. The two-hour event, held at the Newtown Creek WWTP Visitor Center, in Greenpoint, Brooklyn, provided stakeholders with information about DEP's LTCP Program, Newtown Creek watershed characteristics, and the status of waterbody improvement projects. DEP also solicited information from the public about their recreational use of Newtown Creek, and described additional opportunities for public input and outreach. The presentation is available on DEP's LTCP Program website: http://www.nyc.gov/dep/ltcp/.

DEP hosted a Public Data Review Meeting to present the water quality data collected, and to get the public's feedback on issues to be addressed in Newtown Creek. Approximately 30 stakeholders from different non-profit, community planning, environmental, economic development, governmental organizations, and the broader public, attended the event, as did three media representatives. The two-hour event, held at Newtown Creek WWTP Visitor Center, in Greenpoint, Brooklyn, provided information about DEP's LTCP development for Newtown Creek. The data-sharing meeting was the first of its kind and was held in response to the request made at the close of the kickoff meeting held on November 15, 2016. The presentation is available on DEP's LTCP Program website: http://www.nyc.gov/dep/ltcp.

DEP hosted a third Public Meeting on April 26, 2017 to continue the public planning process. Approximately 45 stakeholders from several different non-profit, community planning, environmental, economic development, and governmental organizations, as well as the general public, attended the event. The purpose of the almost three-and-half-hour event, held at the Newtown Creek WWTP Visitor

Center, in Greenpoint, Brooklyn, was to describe the alternatives identification and selection processes, and solicit public comment and feedback. This presentation is available on DEP's LTCP Program website: http://www.nyc.gov/dep/ltcp/.

DEP has received several stakeholder emails and comment letters. These documents and additional information on the public outreach activities performed are available on DEP's website and are also included in Appendix B, Public Participation Materials.

Evaluation of Alternatives

DEP used a multi-step process to evaluate CSO control measures and CSO control alternatives. As described in Section 8, CSO control alternatives for Newtown Creek focused on the four largest CSOs, Outfalls BB-026, NC-015, NC-083 and NC-077, which accounted for over 90 percent of the annual CSO volume to Newtown Creek. Outfall BB-026 is located much closer to the Newtown Creek WWTP than the other three major CSO outfalls, and the Borden Avenue Pumping Station (BAPS), located near BB-026. DEP has planned a state-of-good-repair (SOGR) upgrade for BAPS. Given these conditions, it made sense to develop a preferred alternative for Outfall BB-026 that could compliment the alternatives for the other three major outfalls.

Alternatives were developed that included diverting overflow from Outfall BB-026 to the BAPS, and providing additional wet-weather pumping capacity to convey flow from the BAPS to a location just upstream of the Newtown Creek WWTP. Modeling evaluations indicated that for pumping levels associated with 25, 50 and 75 percent control of Outfall BB-026, the pumped flow would be treated at the Newtown Creek WWTP. However, the flow would displace flow coming from upstream regulators associated with East River outfalls, resulting in an increase in CSO volume to the East River. Water quality modeling indicated that the 50 percent control alternative for Outfall BB-026 would be sufficient to achieve recreational season (May 1st through October 31st) attainment of the Bacteria Primary Contact WQ Criteria based on 2008 rainfall. However, cost/performance evaluations indicated that the knee-of-the-curve for cost versus volumetric CSO control fell on the 75 percent control alternative. The 75 percent control alternative is projected to further reduce the activation frequency of Outfall BB-026. Because of the projected improved performance that could be achieved with a relatively nominal increase in incremental cost, the 75 percent BAPS expansion alternative (26 MGD capacity) was selected as the preferred alternative for Outfall BB-026. In addition, since the baseline water quality modeling indicated that Dutch Kills would be in annual compliance with the Existing Class SD DO criterion, the previously-proposed Dutch Kills in-stream aeration system is not needed to comply with DO water quality standards.

For Outfalls NC-015, NC-083 and NC-077, the retained alternatives were either individual storage tanks or various tunnel storage options. Storage tank alternatives were sized to provide 25 and 50 percent control of each of the three remaining major outfalls. No unoccupied parcels of sufficient size were identified for these storage tank alternatives, but the alternatives were carried forward as a means to provide comparison to the storage tunnel alternatives. Figures and descriptions of the conceptual layouts were evaluated for the tunnel alternatives with siting of the dewatering pumping stations at potential sites near the Newtown Creek WWTP and a DEP-owned site near Outfall NC-077. These conceptual layouts and sites were developed for the purposes of developing costs and evaluating the feasibility of the various CSO Storage Tunnel alternatives. The final siting of the dewatering pumping station, the tunnel alignment and other associated details of the tunnel alternatives presented herein will be further evaluated and finalized during subsequent planning and design stages. The evaluation process considered: environmental benefits; community and societal impacts; and issues related to implementation and operation and maintenance (O&M). Following the comments generated by detailed technical workshops, the retained alternatives were subjected to cost-performance and cost-attainment evaluations, where economic factors were introduced. Table ES-10 presents the retained alternatives that resulted from the evaluation process.

Table ES-10. Basin-Wide Alternatives

Alternative	Remarks
1. 26 MGD BAPS Expansion and Individual Storage Tanks for 25% Control of Three Largest Outfalls	Volumes of Individual storage tanks: • NC-077 – 2.4 MG • NC-083 – 3.0 MG • NC-015 – 4.3 MG
2. 26 MGD BAPS Expansion and Deep Tunnel for 25% Control of Three Largest Outfalls	16 foot interior diameter deep tunnel with lengths ranging from 7,570 to 9,980 feet
3. 26 MGD BAPS Expansion and Individual Storage Tanks for 50% Control of Three Largest Outfalls	Volumes of Individual storage tanks: • NC-077 – 6.9 MG • NC-083 – 8.5 MG • NC-015 – 12.3 MG
4. 26 MGD BAPS Expansion and Deep Tunnel for 50% Control of Three Largest Outfalls	16 to 26 foot interior diameter deep tunnels with lengths ranging from 7,570 to 18,800 feet
5. 26 MGD BAPS Expansion and Deep Tunnel for 62.5% Control of Three Largest Outfalls	19 to 30 foot interior diameter deep tunnels with lengths ranging from 7,570 to 18,800 feet
6. 26 MGD BAPS Expansion and Deep Tunnel for 75% Control of Three Largest Outfalls	23 to 26 foot interior diameter deep tunnel with lengths ranging from 7,570 to 18,800 feet; 20 MGD retention treatment basin (RTB) for dewatering flows
7. Deep Tunnel for 100% Control of Four Largest Outfalls	36 to 42 foot interior diameter deep tunnel with lengths ranging from 13,700 to 18,800 feet ; 100 MGD RTB for dewatering flows

Table ES-11 summarizes the projected performance of the retained Newtown Creek basin-wide alternatives in terms of CSO volume, fecal coliform and *Enterococci* load reduction. Because the retained alternatives for Newtown Creek provide volume reduction and not treatment, the predicted bacteria loading reductions of the alternatives are very closely aligned with their projected CSO volume reductions. The bacteria loading reductions shown in Table ES-11 were computed based on the 2008 typical year. Based on the Newtown Creek Receiving Water Quality Model (NCRWQM) runs for the 2008 typical year, historic and recent water quality monitoring, along with baseline condition modeling, none of the stations within the waterbody are projected to be in annual attainment with the Existing WQS for

Table ES-11. Newtown Creek Retained Alternatives Performance Summary (2008 Rainfall)

Alternative	CSO Volume (MGY) (3)	Frequency of Overflow(4)	CSO Volume Reduction(3) (%)	Fecal Coliform Reduction(1)(3) (%)	*Enterococci* Reduction(1)(3) (%)
Baseline Conditions(2)	1,055	42	-	-	-
1. 26 MGD BAPS Expansion and Deep Tunnel for 25% Control of Three Largest Outfalls	696	29	34	29	37
2. 26 MGD BAPS Expansion and Individual Storage Tanks for 25% Control of Three Largest Outfalls	696	29	34	29	37
3. 26 MGD BAPS Expansion and Deep Tunnel for 50% Control of Three Largest Outfalls	475	29	55	53	58
4. 26 MGD BAPS Expansion and Individual Storage Tanks for 50% Control of Three Largest Outfalls	475	19	55	52	57
5. 26 MGD BAPS Expansion and Individual Storage Tanks for 62.5% Control of Three Largest Outfalls	364	19	65	63	68
6. 26 MGD BAPS Expansion and Deep Tunnel for 75% Control of Three Largest Outfalls	286	18	73	70	75
7. Deep Tunnel for 100% Control of Four Largest Outfalls	0	0	100	100	100

Notes:
(1) Bacteria reduction is computed on an annual basis.
(2) Values presented based upon 2008 Typical Year.
(3) Values reported for four largest outfalls (BB-026, NC-077, NC-083 and NC-015).
(4) Maximum values for the three upstream outfalls (NC-077, NC-083 and NC-015); annual frequency for BB-026 is 25.

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bacteria under baseline conditions. A review of the Potential Future Primary Contact WQ Criteria for *Enterococci* indicates that under baseline conditions, Newtown Creek is also not projected to be in full attainment of the rolling 30-day geomean criterion of 30 cfu/100mL or the 90th percentile statistical threshold value (STV) criterion of 110 cfu/100mL. Upon implementation of at least 62.5 percent CSO control at Outfalls BB-026, NC-077, NC-083 and NC-015, DEP projects that recreational season (May 1st through October 31st) attainment of the fecal coliform criterion would be achieved at all sampling locations based on the 2008 typical year.

Estimated Costs of Retained Alternatives and Selection of the Preferred Alternative

The alternatives were reviewed for cost effectiveness, ability to meet water quality criteria, public comments and operations. The construction costs were developed as Probable Bid Costs (PBC), and the total Net Present Worth (NPW) costs were determined by adding the estimated PBC to the NPW of the projected annual O&M costs at an assumed interest rate of 3 percent over a 20-year life cycle. However, for tunnel alternatives that provide longer service, a longer 100-year lifecycle was used for computing NPW. Design, construction management and land acquisition costs are not included in the cost estimates. All costs are in February 2017 dollars and are considered Level 5 cost estimates by Association for the Advancement of Cost Engineering (AACE) International with an accuracy of -50 to +100 percent. The costs of the retained alternatives are shown in Table ES-12.

The selection of the preferred alternative is based on multiple considerations including public input, environmental and water quality benefits, and costs. A traditional knee-of-the-curve (KOTC) analysis is presented in Section 8.5 of the LTCP. As described above, based on that analysis, a 24 MGD expansion to the BAPS was identified as the most cost-effective alternative for reducing the frequency and volume of CSOs from Outfall BB-026 to Dutch Kills. For Outfalls NC-015, NC-083, and NC-077, the evaluations indicated that a storage tunnel would be more cost-effective and would have less siting impacts on established businesses than individual storage tanks. However, the final tunnel route depends on whether DEP is successful in obtaining a site near the Newtown Creek WWTP and/or resolving the potential competing uses for the DEP-owned site near Outfall NC-077. Based on the cost/performance curves presented in Section 8, a tunnel sized for 62.5 percent control fell on the KOTC for cost versus CSO volume and bacteria load controlled. A tunnel sized for 62.5 percent control is projected to achieve recreational season (May 1st through October 31st) attainment of the Existing WQ Criteria for bacteria at all sampling locations in Newtown Creek for the 2008 typical year. Assessment of compliance using a 10-year continuous model run indicated that recreational season compliance would be in the 83 to 93 percent range for the 62.5 percent control tunnel. Most of the main trunk of Newtown Creek and Dutch Kills is projected to be at 93 percent attainment, while the upstream reaches would be in the 83 to 90 percent range.

Table ES-12. Cost of Retained Alternatives

Alternative	February 2017 PBC ($ Million)	Annual O&M Cost ($ Million)	Total Net Present Worth ($ Million)
1. 26 MGD BAPS Expansion and Individual Storage Tanks for 25 % Control of Three Largest Outfalls	563	4.3	627
2a. 26 MGD BAPS Expansion and Deep Tunnel for 25% Control of Three Largest Outfalls- Creek Alignment(1)(2)	408	3.9	508
2b. 26 MGD BAPS Expansion and Deep Tunnel for 25% Control of Three Largest Outfalls (Row Alignment)(1)	427	3.9	527
3. 26 MGD BAPS Expansion and Individual Storage Tanks for 50% Control of Three Largest Outfalls (1)	826	5	901
4a. 26 MGD BAPS Expansion and Deep Tunnel for 50% Control of Three Largest Outfalls (Creek Alignment)(1)(2)	526 to 528	4.5	645 to 647
4b. 26 MGD BAPS Expansion and Deep Tunnel for 50% Control of Three Largest Outfalls (ROW Alignment)(1)	523 to 528	4.5	642 to 647
5a. 26 MGD BAPS Expansion and Deep Tunnel for 62.5% Control of Three Largest Outfalls (Creek Alignment)(1)(3)	584 to 589	5.0	717 to 722
5b. 26 MGD BAPS Expansion and Deep Tunnel for 62.5% Control of Three Largest Outfalls (ROW Alignment)(1)	570 to 597	5.0	703 to 730
6a. 26 MGD BAPS Expansion and Deep Tunnel for 75% Control of Three Largest Outfalls (Creek Alignment)(1)(4)	795 to 837	7.4	1,013 to 1,054
6b. 26 MGD BAPS Expansion and Deep Tunnel for 75% Control of Three Largest Outfalls (ROW Alignment)(1)	840 to 845	7.4	1,057 to 1,063
7a. Deep Tunnel for 100% Control of Four Largest Outfalls (Creek Alignment)(1)(2)	1,371	8.8	1,649
7b. Deep Tunnel for 100% Control of Four Largest Outfalls (ROW Alignment)(1)	1,373	8.8	1,650

Notes:

(1) Both the WWTP and DEP sites were used for the purposes of developing conceptual layouts for evaluation of 25, 50, 75 and 100% CSO control tunnel alternatives. The final siting of the Tunnel Dewatering Pumping Station (TDPS), the tunnel alignment and other associated details of the tunnel alternatives presented herein will be further evaluated and finalized during subsequent planning and design stages.

(2) Tunnel alternative shown in subsequent cost-performance and cost-attainment plots.

(3) Tunnel alternative with higher NPW of $722M shown in subsequent cost-performance and cost-attainment plots.

(4) Tunnel alternative with higher NPW of 1,054M shown in subsequent cost-performance and cost-attainment plots.

In comparison, a tunnel sized for 75 percent control fell beyond the KOTC for cost versus CSO volume and bacteria load controlled, meaning that the additional control achieved required a proportionally larger incremental cost compared to the 62.5 percent control tunnel. In terms of attainment, the 75 percent control tunnel would provide no improvement for the 2008 recreational season, as the 62.5 percent tunnel would already provide 100 percent attainment. For the 10-year continuous simulation, the recreational season attainment for the 75 percent tunnel would range from 90 to 95 percent, with only station NC4 achieving the 95 percent level. All other stations in the Creek would range from 90 to 93 percent. The 75 percent tunnel would therefore not achieve full attainment in the recreational season, and would provide only marginal improvement in attainment as compared to the 62.5 percent tunnel. As described further in Section 8, the Newtown Creek WWTP is a high-rate, step-feed plant with no primary settling tanks. As such, a 40-MGD tunnel dewatering rate was determined to be an appropriate dewatering rate limit for the WWTP. This limitation would not constrain the dewatering rate for the 62.5 percent tunnel, but would require additional treatment capacity in the form of a retention treatment basin (RTB) to allow dewatering of the 75-percent tunnel within 24 hours. This requirement would complicate the implementation of a 75-percent tunnel due to the potential need for additional property acquisition, siting, construction, and long-term O&M requirements. This requirement also adds to the implementation cost for the 75-percent tunnel alternative.

In summary, the 62.5 percent tunnel provides the following:

- 100 percent attainment of the Existing WQ Criteria for bacteria during the 2008 recreational season
- The most cost-effective alternative, based on the KOTC analysis approach, consistent with EPA's CSO Control Policy
- Is projected to have a time to recovery of less than 24 hours for 90% of the wet weather events.
- Tunnel dewatering in 24 hours without the cost, siting, O&M, and other implementation issues associated with providing additional treatment for dewatering flows that would otherwise exceed the established limit for the Newtown Creek WWTP

Although the 62.5 percent tunnel would not achieve recreational season compliance with the Existing WQ Criteria for bacteria based on the 10-year continuous simulation, the 75-percent tunnel would provide only an incremental improvement, and still would not achieve full compliance. Nevertheless, the final siting of the dewatering pumping station, the tunnel alignment and other associated details of the tunnel alternative, will be evaluated further based upon a number of factors including additional modeling and will be finalized during subsequent planning and design stages. That additional planning will provide an opportunity to optimize the sizing of the tunnel. However, the ability of the Newtown Creek WWTP to handle the dewatering flows would remain a limiting factor for the sizing of the tunnel. Based on these considerations, the 62.5-percent tunnel has been selected as the preferred alternative for controlling CSO to Newtown Creek from outfalls NC-015, NC-083 and NC-077. Conceptual layouts for the tunnel alternatives are provided in Section 8.

This preferred alternative is projected to achieve recreational season (May 1st through October 31st) attainment of the Existing WQ Criteria for bacteria in Newtown Creek at all sampling locations in Newtown Creek for the 2008 typical year. The preferred alternative will also provide significant reduction in CSO volume and frequency of overflow. The implementation of the preferred alternative, which would include the storage tunnel for Outfalls NC-015, NC-083 and NC-077, plus the expansion of the BAPS to 26 MGD, has an estimated NPW ranging from $703M to $730M. This estimate reflects $5.0M of annual O&M over the course of 20 years, and an unescalated PBC ranging from $570M to $597M, depending on the final route to be determined in subsequent planning and design stages. Costs escalated to the assumed midpoint of construction would range from $1,275M to $1,335M. Note that these costs do not include costs for land acquisition, design and construction management.

Affordability and Financial Capability

DEP is in the midst of an unprecedented period of investment to improve water quality in New York Harbor. Since 2002, projects worth almost $10.0B have been completed or are under way, including projects for nutrient removal, CSO abatement, marshland restoration, and hundreds of other projects. DEP has committed a total of nearly $4.2B from the WWFP ($2.7B) and the GI Program ($1.5B), slightly more than half of which has been incurred to-date. Table ES-13 provides a summary of CSO improvement projects that have been completed or are underway.

Table ES-13. Completed and Underway CSO Improvement Projects Prior to LTCPs

1995 – 2016 (Completed): • Newtown Creek WWTP MSP (620 MGD to 700 MGD) • Four CSO Storage Tanks (118 MG) • Pumping Station Expansions (Gowanus Canal and Avenue V Pumping Station) • Floatables Control (Bronx and Gowanus) • NYC Green Infrastructure Program Initiated • Wet Weather Maximization (Tallman Island) • Dredging (Paerdegat Basin and Hendrix Creek) • Gowanus Canal Flushing Tunnel Expansion
2017 – 2030 (Underway): • Dredging (Flushing Bay) • Aeration (Newtown Creek) • Regulator Modifications Flushing Bay High Level Interceptor • Regulator Modifications and Floatables Control (Westchester Creek, Newtown Creek, Jamaica Tributaries) • Sewer Work (Pugsley Creek, Fresh Creek High Level Storm Sewers (HLSS), Belt Pkwy Crossing, and Flushing Bay Low Lying Sewers) • 26th Ward Plant Wet Weather Stabilization • NYC Green Infrastructure Program
Total Costs (Completed and Ongoing)(1): • Grey Infrastructure: $2.7 Billion • Green Infrastructure: $1.5 Billion

Note:

(1) Total LTCP costs are not currently known. Waterbody costs for the approved LTCP plans are shown in Section 9. For conceptual purposes, up to $5.7B in LTCP spending through 2042 is assumed. Actual costs will be determined as part of the LTCP planning process.

A preliminary Financial Capability Assessment has been conducted to assess the impact of current and future expenditures, including costs associated with the LTCP, on the financial capability of NYC and on the financial burden to the rate payers. This assessment is included in Section 9.6 of this LTCP. According to EPA 1997 Guidance, a high economic impact occurs when expenditures per household exceed 2.0 percent of the Median Household Income (MHI) of the ratepayer base. The current figure for NYC is 0.91 percent for the average household, which translates to a low financial impact. When combined with the score based on six additional criteria for NYC's financial capacity, the EPA method indicates that the overall impact of the current wastewater expenditures fall into the "low burden" category. However, the standard MHI metric used by EPA to define a high economic impact to ratepayers (i.e., affordability) is poorly applicable to NYC because of NYC's skewed distribution of household income and other factors, including the very high cost of living for housing, food, transportation, and utilities relative to the nation as a whole.

EPA issued new guidance in 2014 that clarifies that permittees are encouraged to supplement the standard metrics with information that provides a more detailed and localized characterization of that permittee's financial capability and the economic status of the residential ratepayer base. The type of information that could be presented includes, but is not limited to:

- presentation of household income by quintiles;
- poverty rates and trends;
- cost of living;
- total utility expenditures including expenditures to meet Safe Drinking Water Act (SDWA) mandates;
- historical increases in rates or other dedicated revenue streams; and
- information on the percent of households who own versus rent.

The supplemental information considered for this assessment indicates that when taking into account estimates for future spending, 55 percent of households are estimated to pay more than 2.0 percent of MHI by 2042 on annual wastewater costs alone, suggesting a "high" financial impact on residential users based on EPA guidance. When accounting for both water and wastewater bills, the percentage of households spending at least 4.5 percent of their income could reach 43 percent by 2042. Applying cost of living adjustment factors to discount the value of household incomes and make them comparable to the U.S. average increases this percentage dramatically, considering the Cost of Living Index value for NYC 67 percent higher than the U.S. average.

NYC has a poverty rate of approximately 20 percent, far higher than the national average of 14.7 percent. Thus, a large percentage of households would be adversely impacted by sustained rate increases. Additionally, recent data show stagnant to decreasing household incomes in the lower economic brackets. Accordingly, the snapshot picture of household income may underestimate the impacts of future rate increases.

Ultimately, the environmental, social, and financial benefits of all water-related obligations should be considered when priorities for spending are developed and implementation of mandates is scheduled, so that resources can be focused where the community will receive the greatest possible environmental benefit.

3. EVALUATIONS AND CONCLUSIONS

DEP will implement the elements of the preferred alternative after approval of the LTCP by DEC. This LTCP also recommends the continued implementation of WWFP recommendations.

The analyses for the Newtown Creek LTCP recommended plan are summarized below for the following three areas:

1. Summary of Recommended Plan.
2. Water Quality Modeling Results.
3. Use Attainability Analysis (UAA), Water Quality Compliance and Time to Recovery.

Summary of Recommend Plan

Water quality for bacteria and dissolved oxygen in Newtown Creek is projected to be improved through the implementation of the following: (1) currently planned improvements including those recommended in the 2011 WWFP; (2) planned GI projects: and (3) the implementation of this recommended Newtown Creek LTCP alternative which calls for the design, construction, and operation of an expansion of the BAPS to 26 MGD to provide 75 percent control of the annual CSO volume at Outfall BB-026, and a CSO Storage Tunnel that will be sized to provide 62.5 percent control of Outfalls NC-015, NC-083 and NC-077. The final dimensions and route for the storage tunnel will be further evaluated and finalized during subsequent planning and design stages. The Dutch Kills aeration system could also be eliminated based on the baseline attainment of the Class SD DO criterion. These identified actions have been balanced with input from the public and awareness of the cost to rate payers.

Water Quality Modeling Results

The water quality modeling results associated with the recommended plan for Newtown Creek are shown in Tables ES-14 through ES-17. These results provide the calculated annual and recreational attainment of the fecal coliform bacteria concentrations and the recreational season (May 1st through October 31st) attainment for *Enterococci*, for a 10-year continuous model simulation. The results show, for the different calculated levels of attainment, when concentrations would be at or lower than the Existing WQ Criteria and Potential Future Primary Contact WQ Criteria under the 10-year simulation. Annual average attainment of Class SD and SC DO criteria are also shown based on the 2008 water quality simulation.

The Existing WQ Criteria for fecal coliform attainment levels (monthly GM<200 cfu/100mL) as determined using the 10-year simulation are shown below in Table ES-14. As noted in Section 8, the values presented in Table ES-14 for the preferred alternative were interpolated from the 50 percent and 75 percent control runs. As indicated in Table ES-14, recreational season (May 1st through October 31st) compliance for the preferred alternative would be in the 83 to 93 percent range. Most of the main trunk of Newtown Creek and Dutch Kills would be at 93 percent attainment, while the upstream reaches would be in the 83 to 90 percent range. Annual compliance is predicted to be slightly lower than recreational season compliance. To put the 10-year simulation performance into perspective, the 10-year period includes a total of 60 months that fall within the recreational season (May 1st to October 31st). 93 percent attainment in the recreational season over 10 years means that in 56 out of the 60 recreational season months, the monthly GM did not exceed 200 cfu/100mL.

Table ES-14. Model Calculated Preferred Alternative Fecal Coliform Percent Attainment of Existing WQ Criteria and Bacteria Primary Contact WQ Criteria

Station		75% Control at BB-026, 62.5% Control at NC-015, 083, 077			
		2008 % Attainment		10 Year % Attainment(1)	
		Annual Monthly GM <200 cfu/100mL	**Recreational Season**(1)(2) Monthly GM <200 cfu/100mL	**Annual** Monthly GM <200 cfu/100mL	**Recreational Season**(1)(2) Monthly GM <200 cfu/100mL
Main Channel	NC4	83	100	90	93
	NC5	83	100	90	93
Dutch Kills	NC6	83	100	88	93
Main Channel	NC7	83	100	90	93
	NC8	83	100	90	93
	NC9	83	100	90	93
Maspeth Creek	NC10	83	100	89	92
English Kills	NC11	83	100	89	92
East Branch	NC12	83	100	83	88
English Kills	NC13	83	100	89	92
	NC14	83	100	83	83

Notes:
(1) Values interpolated from 10-year simulations of 50% and 75% control tunnel (with 75% control at BB-026) runs.
(2) The recreational season is from May 1st through October 31st.

The Potential Future Primary Contact WQ Criteria attainment levels for *Enterococci* are shown in Table ES-15 for the 10-year simulation. Values presented for the preferred alternative were interpolated from the 50 percent and 75 percent control runs. As indicated in Table ES-15, attainment of the 30-day rolling GM for *Enterococci* is projected to range from 72 to 91 percent. Attainment of the 90th percentile STV criterion is projected to range from 6 to 26 percent.

The annual average DO attainment for Existing WQ Criteria for Class SD based on the 2008 typical year is presented in Table ES-16, and the DO attainment for Class SC is presented in Table ES-17. The LTCP framework does not evaluate DO attainment under a 10-year simulation. As indicated in Table ES-16, the Existing DO Criterion for Class SD is predicted to be attained on an average annual basis. As indicated in Table ES-17, the Class SC DO acute criteria are predicted to be attained on an average annual basis, but attainment of the chronic criteria would range from 84 to 96 percent for the preferred alternative.

Table ES-15. Model Calculated Preferred Alternative
***Enterococci* Percent Attainment of**
Potential Future Primary Contact WQ Criteria

Station		75% Control at BB-026, 62.5% Control at NC-015, 083, 077			
		2008 Recreational Season% Attainment(1)		10 Year Recreational Season % Attainment(1)(2)	
		30-day Rolling GM <30 cfu/100mL	90th Percentile STV <110 cfu/100mL	30-day Rolling GM <30 cfu/100mL	90th Percentile STV <110 cfu/100mL
Main Channel	NC4	100	19	91	26
	NC5	100	11	90	19
Dutch Kills	NC6	99	18	90	25
Main Channel	NC7	100	10	90	20
	NC8	100	11	90	22
	NC9	100	10	90	20
Maspeth Creek	NC10	100	19	90	25
English Kills	NC11	98	5	83	11
East Branch	NC12	88	4	72	6
English Kills	NC13	98	5	83	12
	NC14	88	4	72	6

Notes:
(1) The recreational season is from May 1st through October 31st.
(2) Values interpolated from 10-year simulations of 50% and 75% control tunnel (with 75% control at BB-026) runs.

Table ES-14. Model Calculated (2008) Preferred Alternative DO Attainment – Existing WQ Criteria

Station		DO Annual Attainment (%)[1] Class SD ≥ 3.0 mg/L 75% Control at BB-026, 62.5% Control at NC-015, NC-083, NC-077
Main Channel	NC4	100
	NC5	100
Dutch Kills	NC6	99.0
Main Channel	NC7	100
	NC8	100
	NC9	100
Maspeth Creek	NC10	99.7
English Kills	NC11	100
East Branch	NC12	100
English Kills	NC13	99.8
	NC14	97.2

Note:
(1) Values interpolated from 2008 simulations of 50% and 75% control tunnel (with 75% control at BB-026) runs.

Table ES-15. Model Calculated (2008) Preferred Alternative DO Attainment of Class SC WQ Criteria

Station		DO Annual Attainment (%)	
		75% Control at BB-026, 62.5% Control at NC-015, 083, 077	
		Class SC Chronic$^{(1)}$	Class SC Acute$^{(2)}$
Main Channel	NC4	94	100
	NC5	95	100
Dutch Kills	NC6	88	100
Main Channel	NC7	96	100
	NC8	94	100
	NC9	93	100
Maspeth Creek	NC10	91	99
English Kills	NC11	90	99
East Branch	NC12	88	99
English Kills	NC13	87	99
	NC14	84	97

Notes:

(1) Chronic Criteria: 24-hr average DO≥ 4.8 mg/L with allowable excursions to ≥ 3.0 mg/L for certain periods of time.

(2) Acute Criteria: DO≥ 3.0 mg/L.

The LTCP assessment shows that the preferred alternative would achieve recreational season (May 1st through October 31st) attainment of the Existing WQ Criteria for fecal coliform bacteria at all sampling locations in Newtown Creek, based on the 2008 typical year. Annual compliance with Existing WQ Criteria for fecal coliform bacteria would not be met at any of the sampling locations in Newtown Creek with the preferred alternative.

Assessment of compliance using a 10-year continuous model run indicated that recreational season (May 1st through October 31st) compliance would be in the range of 83 to 93 percent. The difference between the 2008 and 10-year attainment is likely due to certain months during the 10-year period having more rainfall than the months in 2008. In addition, the documented low circulation and flushing in the upstream reaches of Newtown Creek contribute to more extended impacts of the bacteria loads from larger storms. The preferred alternative will also provide significant reduction in CSO volume and frequency of overflow. Table ES-18 presents an overview of the attainment status.

Table ES-18. Recommended Plan for Compliance with Bacteria Water Quality Criteria

Compliance with Existing WQ Criteria and Primary Contact WQ Criteria (Class SD)				Compliance with Potential Future Primary Contact WQ Criteria	
(2008)(1)		(10-yr)(2)		Rec. Season(3)	
Annual	Rec. Season(3)	Annual	Rec. Season(3)	30-day Rolling GM	90% STV
83%	100%	83-90%	83-93%	88-100% (2008)(1) 72-91% (10-yr)(2)	4-19% (2008)(1) 6-26% (10-yr)(2)

Notes:

(1) Compliance based on 2008 typical year.
(2) Compliance based on 10-year simulation.
(3) Recreational season is May 1st to October 31st.

UAA, Water Quality Compliance and Time to Recovery

The 2012 CSO Order Goal Statement stipulates that, in situations where the proposed alternatives presented in the LTCP will not achieve existing WQS or the CWA Section 101(a)(2) goals, the LTCP will include a UAA. Because the analyses developed indicate that Newtown Creek is not projected to fully attain Existing WQ Criteria for fecal coliform bacteria, a UAA is included in this LTCP.

DEP has performed an analysis to determine the amount of time following the end of rainfall periods required for Newtown Creek to recover and return to fecal coliform concentrations of less than 1,000 cfu/100mL. The analyses consisted of examining the water quality model-calculated bacteria concentrations in Newtown Creek for recreational periods (May 1st through October 31st) abstracted from 10 years of model simulations. The time to return (or “time to recovery”) to a fecal coliform concentration of 1,000 cfu/100mL for each water quality station within the waterbody was then calculated for each storm with the various size categories. The median time after the end of rainfall was then calculated for each rainfall category. The results of these analyses for Newtown Creek are summarized in Table ES-19. As described in Section 8, results presented for the preferred alternative (62.5 percent control tunnel and BAPS improvements for 75 percent control at BB-026) for the 10-year model simulations were interpolated from available results for the alternatives that included the 50 and 75 percent control tunnels. As indicated in Table ES-19, the median duration of time within which pathogen concentrations are expected to be higher than the New York City Department of Health and Mental Hygiene (DOHMH) considers safe for primary contact varies by storm size and location within Newtown Creek. For the preferred alternative, the median times to recovery are below 24 hours at all of the sampling locations for the storm sizes up to 1.5 inches except for location NC6 in Dutch Kills, where the median for storms in the 0.8 to 1.5 inch range is 38 hours. For storms greater than 1.5 inches, the median times to recovery are well above 24 hours at all locations.

Table ES-16. Time to Recovery to 1,000 cfu/100mL Fecal Coliform – 62.5% Control Tunnel with 75% Control at BB-026

Station		Average Time to Recovery to 1,000 cfu/100mL Fecal Coliform (Hrs)(1)					
		Storm Size Bins (inches of rainfall)					
		<0.1	0.1 – 0.4	0.4-0.8	0.8-1.0	1.0-1.5	>1.5
Main Channel	NC4	1	1	1	6	6	43
	NC5	1	1	1	3	1	54
Dutch Kills	NC6	1	1	1	38	38	73
Main Channel	NC7	1	1	1	1	1	63
	NC8	1	1	1	1	1	70
	NC9	1	1	1	1	1	72
Maspeth Creek	NC10	1	1	3	9	10	67
English Kills	NC11	1	1	1	1	1	57
East Branch	NC12	1	1	1	5	8	79
English Kills	NC13	1	1	1	1	1	50
	NC14	1	1	1	2	7	80

Note:
(1) Values interpolated from 10-year simulations of 50% and 75% control tunnel (with 75% control at BB-026) runs.

1.0 INTRODUCTION

The New York City Department of Environmental Protection (DEP) prepared this Long Term Control Plan (LTCP) for Newtown Creek pursuant to a New York State Department of Environmental Conservation (DEC) CSO Order on Consent (DEC Case No. CO2-20000107-8) (2005 CSO Order), modified by a 2012 CSO Order on Consent (DEC Case No CO2-20110512-25) (2012 CSO Order) and subsequent minor modifications (collectively referred to herein as the "CSO Order"). Pursuant to the CSO Order, DEP is required to submit 10 waterbody-specific LTCPs and one citywide LTCP to DEC for review and approval. The Newtown Creek LTCP is the ninth of these LTCPs.

1.1 Goal Statement

The following is the LTCP Introductory Goal Statement, which appears as Appendix C to the 2012 CSO Order. It is generic in nature, so that waterbody-specific LTCPs will take into account, as appropriate, the fact that certain waterbodies or waterbody segments may be affected by, among other factors, NYC's concentrated urban environment, human intervention, and current waterbody uses. DEP will identify appropriate water quality outcomes based on site-specific evaluations in the drainage-basin-specific LTCP, consistent with the requirements of Federal CSO Control Policy and the CWA.

> *"The New York City Department of Environmental Protection submits this Long Term Control Plan (LTCP) in furtherance of the water quality goals of the Federal Clean Water Act and the State Environmental Conservation Law. We recognize the importance of working with our local, State, and Federal partners to improve water quality within all citywide drainage basins and remain committed to this goal.*
>
> *After undertaking a robust public process, the enclosed LTCP contains water quality improvement projects, consisting of both grey and green infrastructure, which will build upon the implementation of the U.S. Environmental Protection Agency's (EPA) Nine Minimum Controls and the existing Waterbody/Watershed Facility Plan projects. As per EPA's CSO Control Policy, communities with combined sewer systems are expected to develop and implement LTCPs that provide for attainment of water quality standards and compliance with other Clean Water Act requirements. The goal of this LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with EPA's 1994 CSO Policy and subsequent guidance. Where existing water quality standards do not meet the Section 101(a)(2) goals of the Clean Water Act, or where the proposed alternative set forth in the LTCP will not achieve existing water quality standards or the Section 101(a)(2) goals, the LTCP will include a Use Attainability Analysis, examining whether applicable waterbody classifications, criteria, or standards should be adjusted by the State. The Use Attainability Analysis will assess the waterbody's highest attainable use, which the State will consider in adjusting water quality standards, classifications, or criteria and developing waterbody-specific criteria. Any alternative selected by a LTCP will be developed with public input to meet the goals listed above.*
>
> *On January 14, 2005, the NYC Department of Environmental Protection and the NYS Department of Environmental Conservation entered into a Memorandum of Understanding (MOU), which is a companion document to the 2005 CSO Order also executed by the parties and the City of New*

York. The MOU outlines a framework for coordinating CSO long-term planning with water quality standards reviews. We remain committed to this process outlined in the MOU, and understand that approval of this LTCP is contingent upon our State and Federal partners' satisfaction with the progress made in achieving water quality standards, reducing CSO impacts, and meeting our obligations under the CSO Orders on Consent."

This Goal Statement has guided the development of the Newtown Creek LTCP.

1.2 Regulatory Requirements (Federal, State, Local)

The waters of NYC are subject to Federal and State regulations. The following sections provide an overview of the regulatory framework relevant to long term CSO planning.

1.2.a Federal Regulatory Requirements – Clean Water Act

The CWA established the regulatory framework to control surface water pollution, and gave the EPA the authority to implement pollution control programs. The CWA established the National Pollutant Discharge Elimination System (NPDES) permit program. The NPDES permit program regulates point sources discharging pollutants into waters of the United States. CSO and MS4 outfalls are also subject to regulatory control under the NPDES permit program. In NYS, the NPDES permit program is administered by DEC, and is thus a SPDES program. NYS has had an approved SPDES program since 1975. Section 303(d) of the CWA and 40 CFR §130.7 (2001) require states to identify waterbodies that do not meet WQS and are not supporting their designated uses. These waters are placed on the Section 303(d) List of Water Quality Limited Segments (also known as the list of impaired waterbodies or "303(d) List"). The 303(d) List, which is updated every two years, identifies the stressor causing impairment, and establishes a schedule for developing a control plan to address the impairment. Placement on the list can lead to the development of a Total Maximum Daily Load (TMDL) for any waterbody and associated pollutant/stressor on the list. Pollution controls based on the TMDL serve as the means to attain and to maintain WQS for the impaired waterbody.

In 2012, DEC proposed to delist Newtown Creek as a Category 4b waterbody for which required control measures set forth in the 2008 CSO Consent Order (i.e., an approved LTCP) other than a TMDL were expected to result in attainment of WQS within a reasonable period of time. Table 1-1 shows the status of Newtown Creek as of DEC's September 2014 Section 303(d) list that is currently in effect.

Table 1-1. 2014 DEC 303(d) Impaired Waters Listed and Delisted (With Source of Impairment)

Waterbody	DO/Oxygen Demand	Floatables
Newtown Creek	Delisted Category 4b CSOs, Urban/Storm	Delisted Category 4b CSOs, Urban/Storm

In the proposed Final 2016 Section 303(d) list of impaired waters, DEC has retained Newtown Creek as a waterbody for which TMDLs were *deferred* pending development, implementation, evaluation of other restoration measures, in this case, the submittal, and approval of the LTCP.

1.2.b Federal CSO Policy

The 1994 EPA CSO Control Policy provides guidance to permittees and to NPDES permitting authorities on the development and implementation of a LTCP in accordance with the provisions of the CWA. EPA first established the CSO policy in 1994, and it was codified as Section 402(q) of the CWA in 2000.

1.2.c New York State Regulations and Policies

New York State has established WQS for all navigable waters within its jurisdiction. Newtown Creek is classified as a Class SD waterbody. The best usage of Class SD waterbodies is fishing. These waters "shall be suitable for fish, shellfish, and wildlife survival" and, under recent revisions to NYS regulations, the water quality "shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes." The corresponding total and fecal coliform standards for primary contact recreation are set forth in 6 NYCRR Part 703. This LTCP reflects the water quality criteria protective of primary contact recreation, i.e., Primary Contact WQ Criteria.

The States of New York, New Jersey and Connecticut are signatories to the Tri-State Compact, which designated the Interstate Environmental District and created the Interstate Environmental Commission (IEC). The Interstate Environmental District includes all saline waters of greater NYC, including Newtown Creek. The IEC was recently incorporated into and is now part of the New England Interstate Water Pollution Control Commission, a similar multi-State compact of which NYS is a member. Newtown Creek is classified as Type B-2 under the IEC system. Details of the IEC Classifications are presented in Section 2.2.

1.2.d Administrative Consent Order

NYC and DEC entered into the 2005 CSO Order to address CSOs in NYC. Among other requirements, the 2005 CSO Order, as modified, requires DEP to evaluate and implement CSO abatement strategies on an enforceable timetable for 18 waterbodies and, ultimately, for citywide long-term CSO control. Consistent with the 1994 EPA CSO Control Policy, the CSO Order also requires that DEP meet construction milestones and incorporate GI into the LTCP process, as proposed under the *NYC Green Infrastructure Plan*. In a separate MOU, DEP and DEC established a framework for coordinating LTCP development with WQS reviews in accordance with the 1994 CSO Control Policy.

1.2.e Other Regulatory Requirements – Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

EPA is evaluating the presence of hazardous substances in Newtown Creek under the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA" or "Superfund"). EPA's Superfund process addresses listed hazardous substances, such as polycyclic aromatic hydrocarbons, polychlorinated biphenyls, volatile organic compounds, semi-volatile organic compounds, and metals. EPA listed Newtown Creek on the Superfund National Priorities List in September 2010.

In July 2011, EPA issued an administrative order on consent (AOC) to six potentially responsible parties (PRPs), including the City of New York. The AOC required a Remedial Investigation (RI) and Feasibility Study (FS) at Newtown Creek under EPA's oversight. The RI was performed by the non-City PRPs, and included surveys of physical and ecological characteristics of Newtown Creek; sampling of surface water, surface sediments, subsurface sediments and air; delineation of surface sediments, subsurface sediments and surface water; and investigation of non-aqueous phase liquid and groundwater. Data collected from the RI was reported and analyzed in a Draft RI Report, which the parties submitted to EPA in November 2016.

On March 20, 2017, the City submitted extensive comments to EPA on the Draft RI Report. The City concurs with comments from DEC, dated March 16, 2017, and from EPA, dated May 9, 2017, in which each stated that "[biological data from reference areas with CSO point source discharges indicate risk from CERCLA [chemicals of potential concern (COPCs)] as evaluated from these data could be significantly decreased to background (reference area) levels even with continuing CSO discharge during storm events." (EPA Comments at ES-3, Specific Comment 9; DEC Comments at 4, Specific Comment 1.g).

The data show that CSO discharges are not a significant source of hazardous substances in Newtown Creek. Nevertheless, the City expects the CSO control alternative selected in this LTCP (see Section 8) to address any CSO discharge controls that EPA may require under Superfund. The FS, which is being conducted by the non-City PRPs, will evaluate potential remedies for Newtown Creek based on both data collected during the RI and on additional sampling and studies. EPA expects to issue a Record of Decision (ROD) in 2020, which will set forth EPA's selected remedy for Newtown Creek.

1.3 LTCP Planning Approach

LTCP planning includes several phases. The first is the characterization phase – an assessment of current waterbody and watershed characteristics, system operation and management practices, green and grey infrastructure projects, and system performance. DEP is gathering the majority of this information from field observations, historical records, analyses of studies and reports, and the collection of new data. The next phase identifies and analyzes alternatives to reduce the amount and frequency of wet-weather discharges and to improve water quality. Alternatives may include a combination of green and grey infrastructure elements that are evaluated using both the collection system and receiving water models. After analyzing alternatives, DEP develops a recommended plan with an implementation schedule and strategy. If the proposed alternative does not achieve existing WQS or the Section 101(a)(2) goals of the CWA, an LTCP also includes a UAA or variance, as appropriate, examining whether applicable waterbody classifications, criteria, or standards should be adjusted by DEC.

1.3.a Integrate Current CSO Controls from Waterbody/Watershed Facility Plans (Facility Plans)

This LTCP integrates and builds upon DEP's prior efforts to control CSOs by capturing the findings and recommendations from previous facility planning documents for this watershed, including the WWFP.

In June 2011, DEP issued the Newtown Creek WWFP. The WWFP, which was prepared pursuant to the 2005 CSO Order, includes an analysis and presentation of operational and structural modifications targeting the reduction of CSOs and improvement of the overall performance of the collection and treatment system within the watershed. DEC approved the Newtown Creek WWFP on June 21, 2012. The projects approved in the WWFP were incorporated into the CSO Order as modified and are in various stages of construction or are complete.

1.3.b Coordination with DEC

As part of the LTCP process, DEP works closely with DEC to share ideas, track progress, and develop strategies and solutions to address wet-weather challenges for the Newtown Creek LTCP.

DEP shared the Newtown Creek alternatives with DEC and discussed the formulation of various control measures, and has coordinated public meetings and other stakeholder presentations with DEC. On a quarterly basis, DEC, DEP, and outside technical consultants also convene for larger progress meetings that typically include technical staff and representatives from DEP and DEC's Legal Departments and Department Chiefs who oversee the execution of the CSO program.

1.3.c Watershed Planning

DEP prepared its CSO WWFPs before the emergence of GI as an established method for reducing stormwater runoff. Consequently, the WWFPs did not include a full analysis of GI alternatives for controlling CSOs. In comments on DEP's CSO WWFPs, community and environmental groups voiced widespread support for GI, urging DEP to rely more heavily upon that sustainable strategy. In September 2010, DEP published the *NYC Green Infrastructure Plan* (GI Plan). Consistent with the GI Plan, the 2012 CSO Order requires DEP to analyze the use of GI in LTCP development. As discussed in Section 5.0, this sustainable approach includes the management of stormwater at its sources through the creation of vegetated areas, bluebelts, greenstreets, green parking lots, green roofs, and other green technologies.

1.3.d Public Participation Efforts

DEP made a concerted effort during the Newtown Creek LTCP planning process to involve relevant and interested stakeholders, and to keep interested parties informed about the project. DEP developed and implemented a public outreach participation plan throughout the process. That plan is posted and regularly updated on DEP's LTCP program website, www.nyc.gov/dep/ltcp. Specific objectives of this initiative include the following:

- Develop and implement an approach that would reach interested stakeholders;
- Integrate the public outreach efforts with other aspects of the planning process; and
- Take advantage of other ongoing public efforts being conducted by DEP and other NYC agencies as part of related programs.

The public participation efforts for the Newtown Creek LTCP are summarized in Section 7.0.

2.0 WATERSHED/WATERBODY CHARACTERISTICS

This section summarizes the major characteristics of the Newtown Creek watershed and waterbody, building upon earlier documents that characterize the area including, most recently, the WWFP for Newtown Creek (DEP, 2011). Section 2.1 addresses watershed characteristics and Section 2.2 addresses waterbody characteristics.

2.1 Watershed Characteristics

The Newtown Creek watershed is highly urbanized, comprised primarily of industrial, manufacturing, commercial, and transportation areas with some residential and open space areas within the Boroughs of Brooklyn and Queens.

This subsection contains a summary of the watershed characteristics as they relate to the land use, zoning, permitted discharges and their characteristics, sewer system configuration, performance, and impacts to the adjacent waterbodies, as well as the modeled representation of the collection system used to analyze system performance and CSO control alternatives.

2.1.a Description of Watershed

The highly urbanized Newtown Creek watershed is comprised of approximately 6,815 acres, and the majority of the land use within a quarter-mile radius of the Creek is industrial and commercial. As described in this section, the area is served by a complex collection system of: combined, separate sanitary, and storm sewers; interceptor sewers; pumping stations; and 20 combined, 1 inactive combined, 1 wet-weather treated effluent and 11 stormwater outfalls under DEP's jurisdiction. The majority of the watershed (5,920 acres) is served by the Newtown Creek WWTP. A smaller watershed (895 acres) on the northern shore of the Creek is served by the Bowery Bay WWTP.

The Newtown Creek WWTP serves a total area of 15,033 acres with a population of over 1 million people in the boroughs of Manhattan, Brooklyn, and Queens. Of the entire Newtown Creek WWTP sewershed, only certain portions of Brooklyn and Queens influence the CSO discharges to Newtown Creek. The flows from the Manhattan portion of the Newtown Creek WWTP sewershed reach the plant via the Manhattan Pumping Station (PS), while flows from the Brooklyn/Queens system enter the plant via the Brooklyn/Queens PS. The Wet Weather Operating Plan (WWOP) for the Newtown Creek WWTP provides that under peak wet-weather flow conditions, the Brooklyn/Queens PS will be operated up to its full capacity (400 million gallons per day [MGD]) and, if necessary, flow from Manhattan PS may be limited to a maximum of 300 MGD to maximize treatment of wet-weather flow, which is established in the SPDES permit for the Newtown WWTP as 700 MGD. This approach to maximizing treatment of wet-weather flow prioritizes flows from the Brooklyn/Queens system, which is directly associated with CSO discharges to Newtown Creek. Because flows from the Manhattan PS do not have a direct impact on the hydraulic performance of the Brooklyn/Queens system, this section of the LTCP is focused on the Brooklyn/Queens portion of the Newtown Creek WWTP sewershed. The Newtown Creek watershed served by the Newtown Creek WWTP can be seen in Figure 2-1.

Similarly, combined sewage reaches the Bowery Bay WWTP through two interceptors. The Low Level Interceptor flows east toward the Bowery Bay WWTP and the High Level Interceptor flows west toward the Bowery Bay WWTP. The elevation differential between the High Level and Low Level Interceptors at the Bowery Bay WWTP is 29 feet. The High Level Interceptor serves approximately 8,392 acres in the central and eastern part of the Bowery Bay WWTP sewershed, carrying flows from individual drainage basins extending from Steinway Creek, Bowery Bay, and Flushing Bay. The High Level Interceptor is not hydraulically influenced by the Newtown Creek watershed and will therefore not be discussed in this LTCP. The Low Level Interceptor serves approximately 3,502 acres in the western side of the Bowery Bay WWTP sewershed, carrying flow from individual drainage basins along the East River extending to Newtown Creek. The portion of the Newtown Creek watershed served by the Bowery Bay WWTP is shown in Figure 2-1.

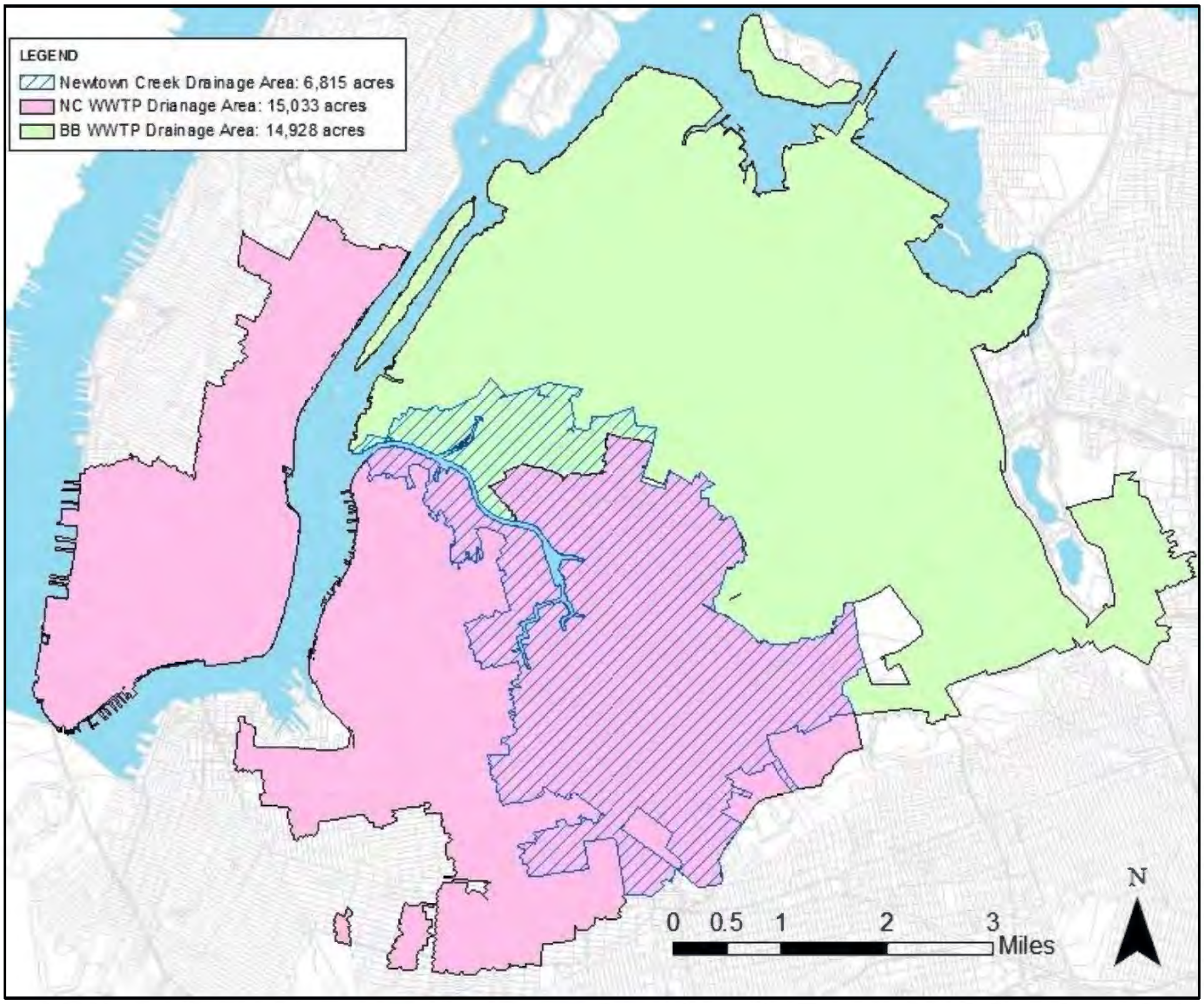

Figure 2-1. Newtown Creek and Bowery Bay WWTPs Drainage Areas

As the watershed was developed, the condition of the waterbody and its shoreline was influenced by engineered sewer systems, filled-in wetlands and waterways, and an overall "hardening" of the shorelines with bulkheads. The urbanization of NYC and the Newtown Creek watershed has led to the creation of a large combined sewer system, as well as areas served by a separate storm and sanitary sewer system. Eleven NYC storm outfalls that are permitted under NYC's MS4 SPDES-permit discharge to Newtown Creek. During dry-weather the combined and sanitary sewer systems convey sewage to the Newtown Creek and Bowery Bay WWTPs for treatment. The SPDES permit for the Bowery Bay WWTP requires that the WWTP have the capacity to receive and treat 300 MGD (2xDDWF) during wet-weather. The SPDES permit for the Newtown Creek WWTP requires that during wet-weather the WWTP have the capacity to receive and treat 700 MGD, which is more than the WWTP's 2xDDWF of 620 MGD. During wet-weather, combined sewage flow that exceeds the capacity of the WWTP and the combined sewer system may discharge to Newtown Creek and its tributaries through one or more of the 20 SPDES-permitted CSO outfalls. Approximately 90 percent of the average annual CSO volume to Newtown Creek is attributable to four CSO outfalls: three CSO outfalls providing wet-weather relief to the combined sewer system tributary to the Newtown Creek WWTP (NCB-015, NCQ-077 and NCB-083); and one CSO outfall providing wet-weather relief to the combined sewer system tributary to the Bowery Bay WWTP (BB-026). As shown in Figure 2-2, the Newtown Creek watershed is located between the eastern end of the Newtown Creek WWTP sewershed and the southern end of the Bowery Bay WWTP sewershed.

Neighborhoods that border Newtown Creek include the Brooklyn neighborhoods of Greenpoint and East Williamsburg and the Queens neighborhoods of Hunters Point, Long Island City, Blissville, Laurel Hill, Maspeth, and Ridgewood. Additional neighborhoods in the watershed include Bushwick and Glendale.

Newtown Creek has several large and notable transportation corridors such as the Brooklyn-Queens Expressway, the NYC Metropolitan Transportation Authority (MTA) transit system, and parts of the Long Island Rail Road, that cross the watershed to provide access between industrial, commercial and residential areas (Figure 2-3). These transportation corridors limit access to some portions of the waterbody and were considered when developing CSO control alternatives.

2.1.a.1 Existing and Future Land Use and Zoning

Of the total watershed area of 6,815 acres, approximately 35 percent consists of commercial, industrial, institutional, or transportation-related uses, including Sunnyside Railyards. Approximately 24 percent consists of open space, cemeteries, or vacant land, while the remaining 41 percent is residential and mixed use. Within the riparian areas immediately surrounding Newtown Creek (including all blocks which are wholly or partially within a quarter-mile of the Creek), the uses are dominated by industrial and manufacturing uses. Riparian areas are characterized as 72 percent industrial, transportation and utility, and the remaining 28 percent is a mix of various uses including public facilities and institutions, residential, commercial, and transportation-related use. The breakdown of the existing land uses within the Newtown Creek watershed is shown in Figure 2-4, and Table 2-1 summarizes the land use characteristics of the overall Newtown Creek watershed area, as well as the riparian area within a quarter-mile radius of the Creek.

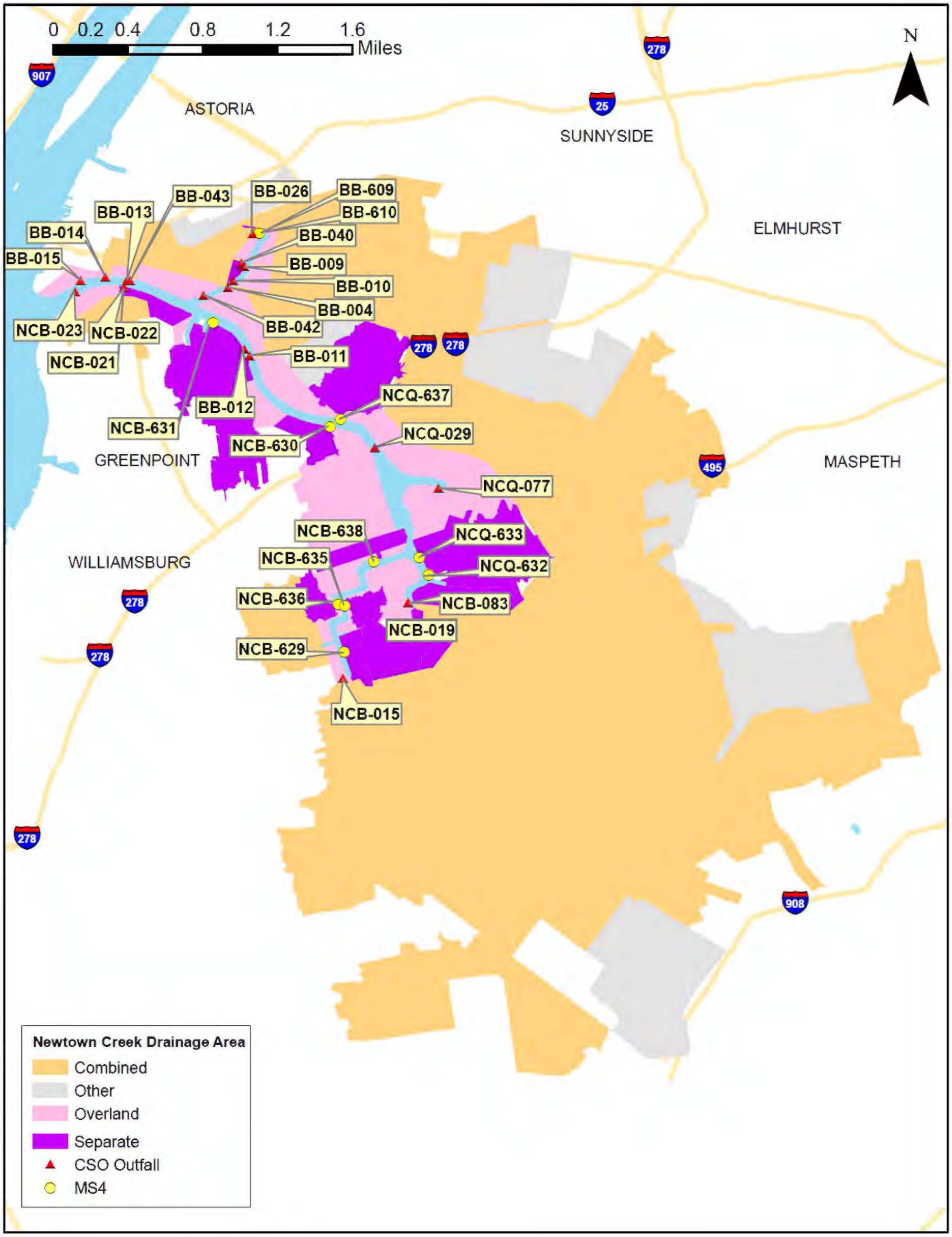

Figure 2-2. Newtown Creek Watershed and Associated WWTP Sewershed

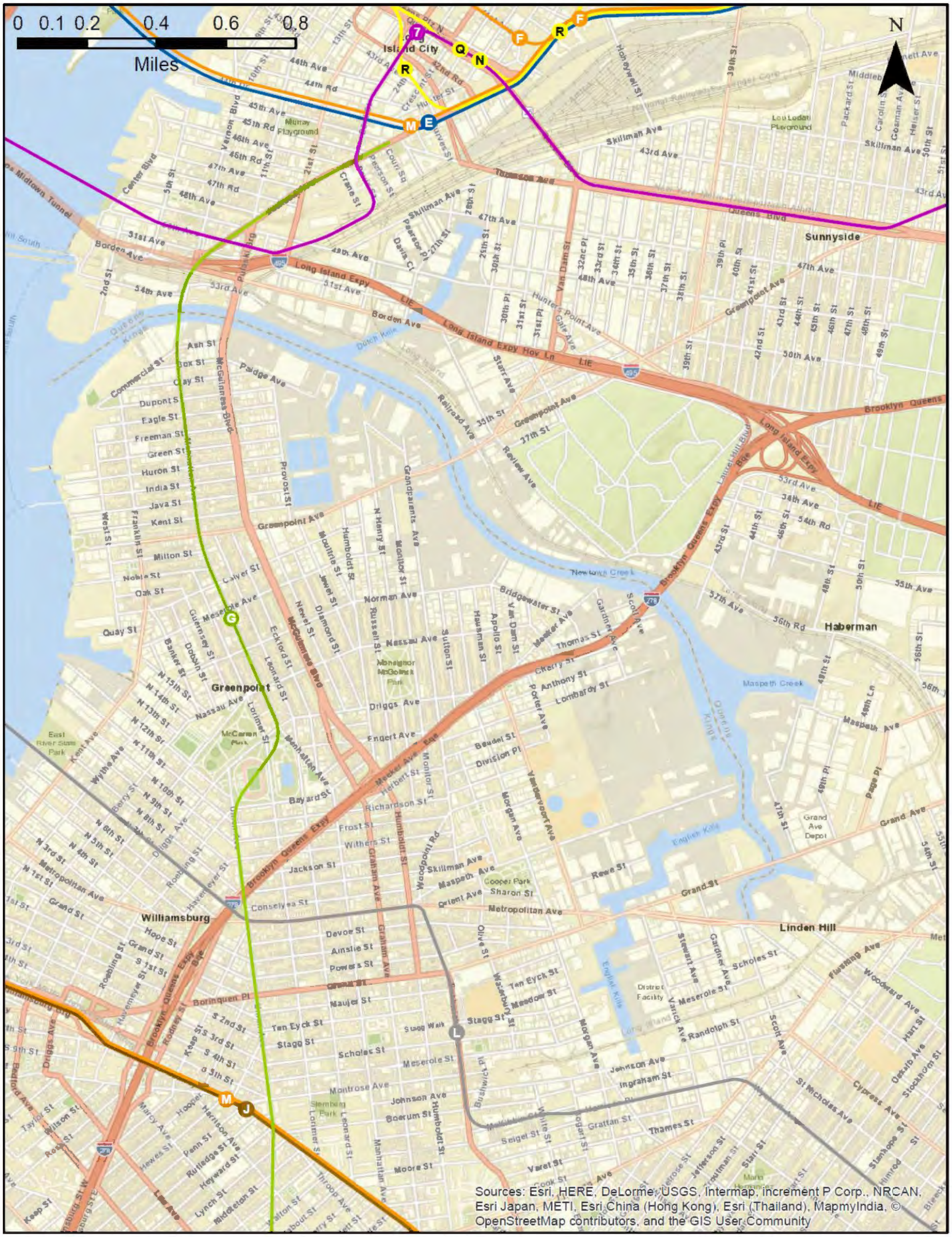

Figure 2-3. Major Transportation Features of Newtown Creek Watershed

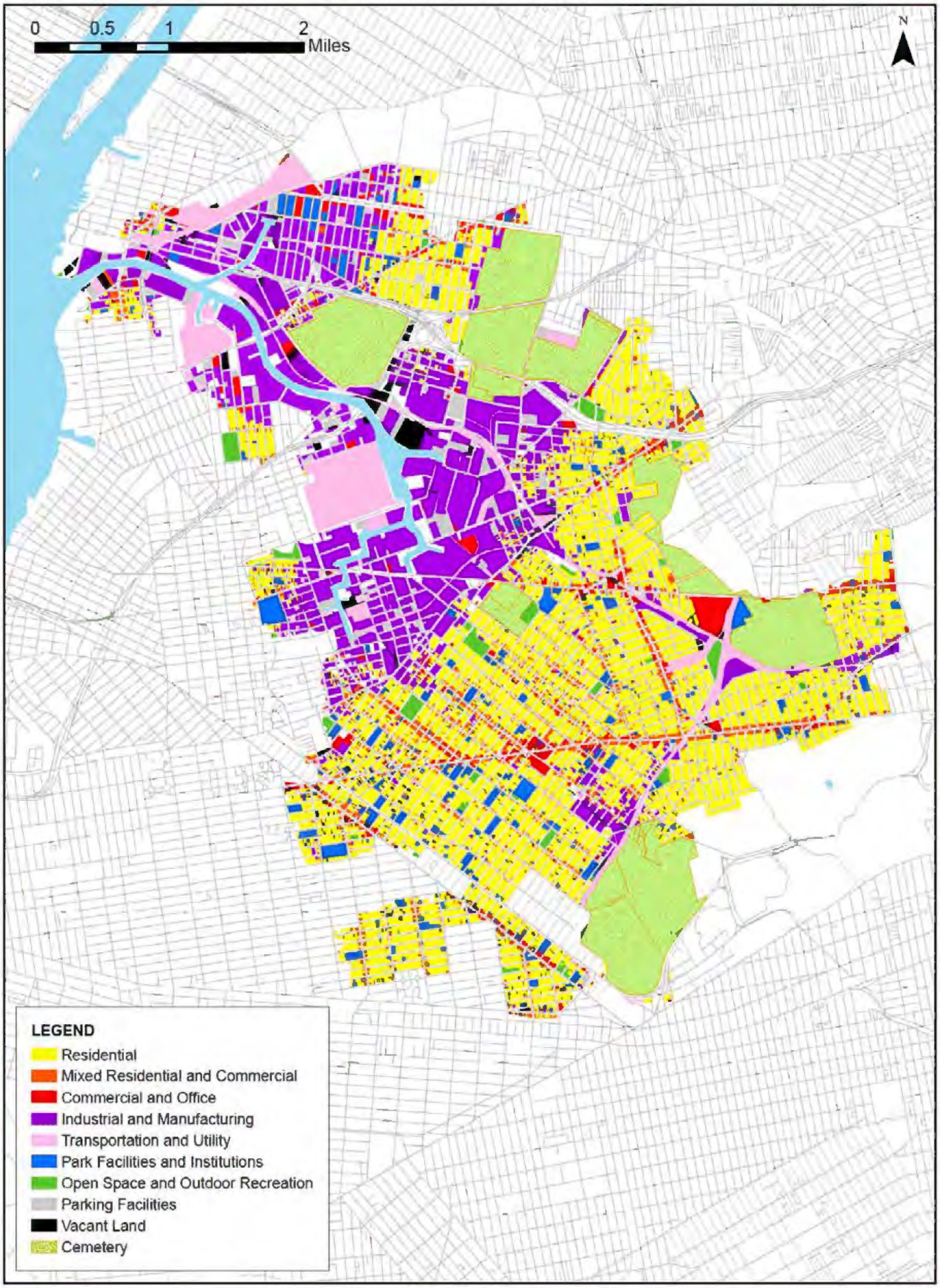

Figure 2-4. Land Use in Newtown Creek Watershed

Table 2-1. Existing Land Use within the Newtown Creek Drainage Area

Land Use Category	Percent of Area	
	Riparian Area (1/4-mile radius) (%)	Drainage Area (%)
Commercial	2.2	3.1
Industrial	54.3	21.7
Open Space, Cemeteries, and Outdoor Recreation	10.9	22.1
Mixed Use and Other	0.7	4.0
Public Facilities and Institutions	1.6	4.1
Residential	1.6	33.1
Transportation and Utility	17.3	6.0
Parking Facilities	6.9	3.8
Vacant Land	4.5	2.1

Figure 2-5 presents a map of the established zoning within the riparian areas surrounding Newtown Creek. Nearly a fifth of the riparian land area surrounding Newtown Creek is classified as having transportation or utility uses, several of which are located directly along the shoreline of Newton Creek.

One major utility use is the Newtown Creek WWTP located along the southern shoreline in the Brooklyn neighborhood of Greenpoint. Newtown Creek WWTP is the largest of NYC's 14 WWTPs. The Newtown Creek WWTP has undergone multiple expansions and redesigns that included the development of the publicly accessible quarter-mile Newtown Creek Waterfront Nature Walk located along the Whale Creek tributary. Another significant waterfront utility is National Grid, whose expansive facilities are located along the southern shoreline of Newtown Creek near the mouth of the English Kills and East Branch tributaries. In addition, the Sunnyside Railyards is an active railyard jointly owned by Amtrak, NYC MTA, NJ Transit, and General Motors, that covers 180 acres and lines the northwestern boundary of the Newtown Creek watershed.

Industrial, commercial and municipal uses are predominantly found along the Newtown Creek waterfront, and generally extend from the waterfront to the first few upland blocks from the Creek. Common industrial uses throughout the reach include various manufacturing operations, distribution/trucking centers, warehouses, waste management facilities, and bulk fuel/petroleum storage facilities. Waterfront activity is used primarily to support ship and barge navigation with approximately 5,000 feet of berthing space and nine active piers (public and private). Key industrial operations in the waterbody include: Alloco Recycling, which processes construction debris from Brooklyn, Queens, and Manhattan and ships it via barge and scow; and Metro Terminals, a bulk oil terminal and storage facility that loads and discharges petroleum using tug and barge.

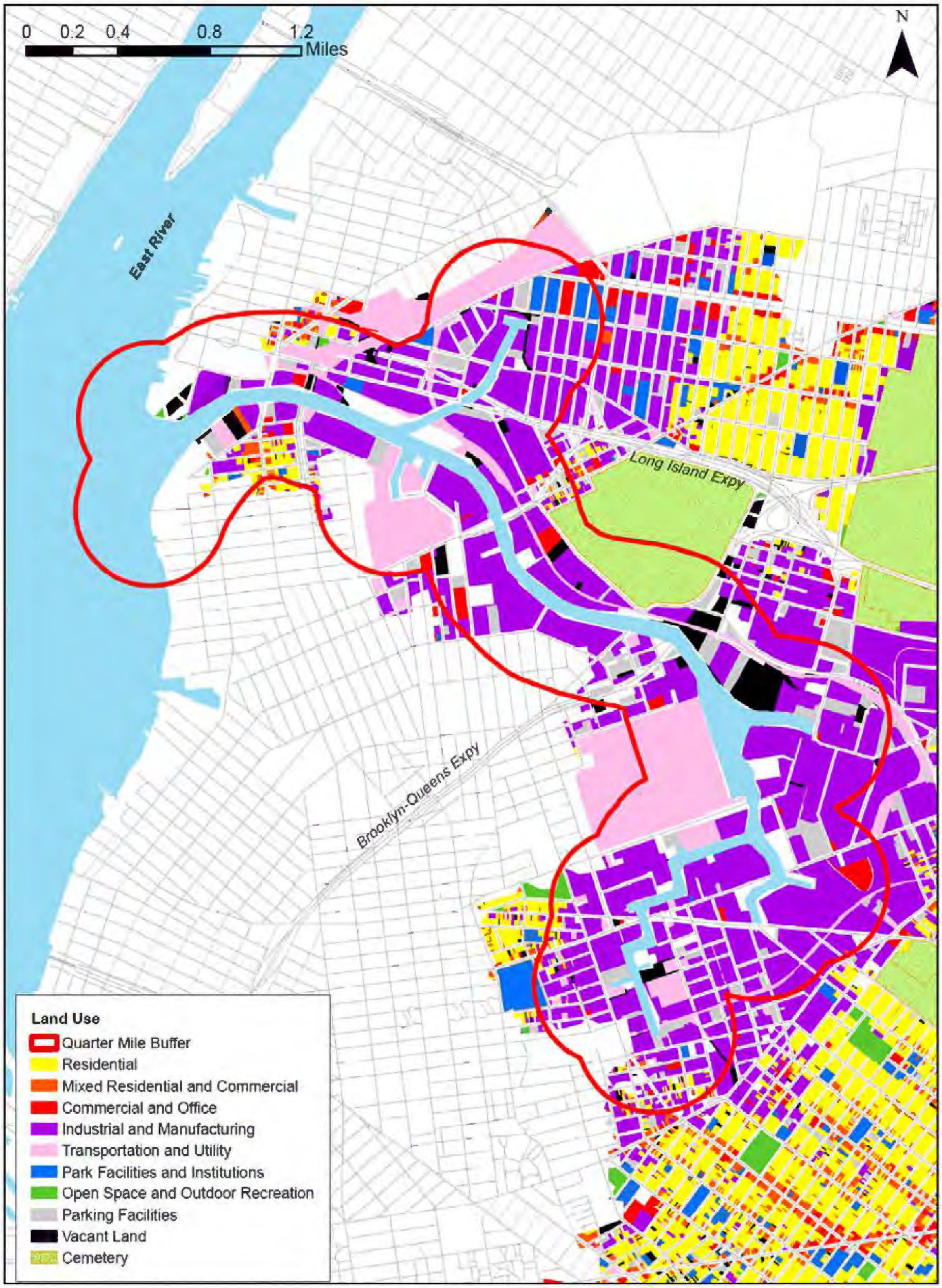

Figure 2-5. Quarter-Mile Riparian Zoning in the Newtown Creek Vicinity

Although the riparian area is dominated by industrial zoning classifications, the Newtown Creek watershed as a whole is 33 percent residential and is increasing along certain areas of the waterfront. A 12-acre development site in Maspeth, with more than 1 million square feet of buildable space along Newtown Creek was sold in May 2016. The site housed manufacturing facilities until the 1980s and is located in a manufacturing zone that allows for heavy industrial use, light manufacturing, distribution, storage, and other commercial uses. While navigational requirements within the waterbody are expected to stay in place, there are growing residential uses in the neighborhoods around Newtown Creek that have the potential to increase demand for recreational use of the waterbody.

Cemeteries account for 15 percent of the total watershed. The Calvary and New Calvary Cemeteries, covering 365 acres spread across the neighborhoods of Maspeth and Woodside, are among the oldest cemeteries in the United States. Additional cemeteries in the Queens portions of the watershed include Mount Zion Cemetery, Mount Olivet Cemetery, and Lutheran Cemetery. Public and community facilities in the vicinity include the NYC Fire Department Engine Company 259, Ladder 128 facility (at Greenpoint Avenue), Saint Aloysius's Roman Catholic Church (along Onderdonk Street), Holy Cross Roman Catholic Church in Maspeth, Queens, and the Wyckoff Heights Medical Center in Brooklyn.

New York City Department of City Planning (DCP) has designated the entire Newtown Creek watershed as within the Coastal Zone Boundary. In addition, all but the downstream reaches of Newtown Creek are designated as within the Newtown Creek Significant Maritime and Industrial Areas. Any proposed land uses for the Newtown Creek project area, including those associated with the LTCP, must demonstrate consistency with the Waterfront Revitalization Program.

Plans for significant development and redevelopment within the Newtown Creek watershed are noted below.

Pertinent long term planning information available during the preparation of this LTCP included the Vision 2020 – New York City Waterfront Plan. The Vision 2020 plan identified six target areas for potential improvements along Newtown Creek. These six target areas are part of "Reach 13" for the Newtown Creek watershed, as shown in Figure 2-6. The Vision 2020 plan targets opportunities to:

- Improve existing public waterfront areas, including boat launching and residential/commercial development;
- Support public access/recreation;
- Promote the waterway for goods transport; and
- Support the remediation and habitat enhancement of the Creek.

Figure 2-6. NYC Vision 2020 – Reach 13 Comprehensive Waterfront Plan

The DCP is undertaking the North Brooklyn Industry and Innovation Plan, the general boundary of which is that of the North Brooklyn Industrial Business Zone, which spans from the top of Newtown Creek to Flushing Avenue. The plan will introduce a land use framework for the area, with the goals of supporting and strengthening existing industrial businesses in a Core Industrial Area along Newtown Creek, while encouraging growth of diverse business sectors in areas close to transit in an Innovation District. No residential development would be introduced as part of this planning effort.

The Park Tower Group's Greenpoint Landing project depicted in Figure 2-7 will consist of a 10-building complex covering approximately 22 acres with two high-rise rental properties planned along the East River at the mouth of Newtown Creek in Brooklyn. The project calls for up to 5,550 residential units with 1,400 units (25.45%) planned for affordable housing. To provide quality-of-life amenities for residents and visitors, the project also provides four acres of dedicated open space that will include a waterfront esplanade, public parks, a Great Lawn, and a reconstructed public pier. Two of the three affordable housing buildings were completed in 2016. Construction on an additional two towers and a public waterfront open space began in 2016.

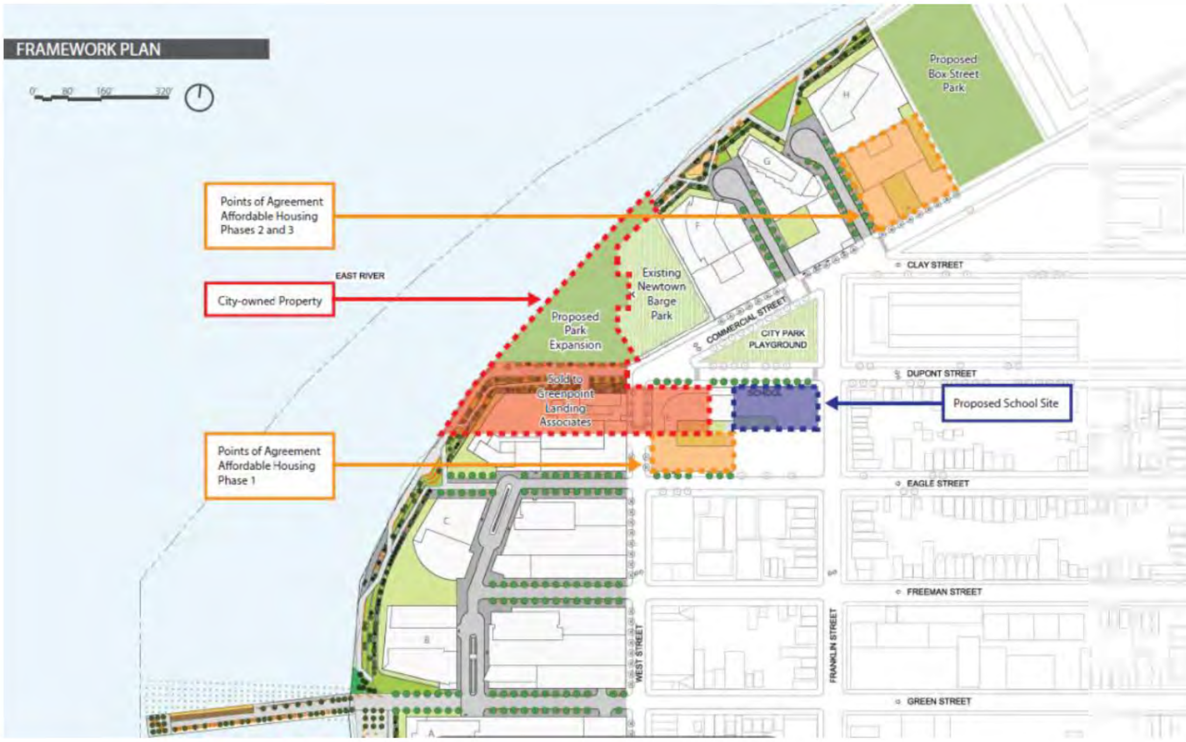

Figure 2-7. Proposed Greenpoint Landing High-Rise Residential Towers

The proposed Hunter's Point South Housing Development includes the construction of a mixed use, affordable housing development covering approximately 30 acres in Long Island City, Queens, at the mouth of Newtown Creek. The project calls for up to 5,000 housing units with 60 percent of the units planned as affordable housing. Dedicated open space will also be provided and will include a 10-acre waterfront park. The project is being implemented in phases. The completed phase 1 housing for Parcels A and B include two mixed-use buildings with more than 900 housing units, roughly 0.5 acres of new retail space, five acres of new waterfront parkland, a new school, and parking. All of the housing in this first phase will be for low, moderate, and middle-income families. Parcel C will include 1,400 residential units, including senior housing, and a school. Parcels F and G will have over 1,100 units of housing and another school. These final parcels are within the riparian area of Newtown Creek.

2.1.a.2 Permitted Discharges

New York City holds an MS4 SPDES permit for 11 stormwater outfalls and the Newtown WWTP SPDES permit includes 20 permitted CSO outfalls that are located along Newtown Creek and its tributaries. These discharge locations, as well as discharges from other entities that hold industrial SPDES permits in the Newtown Creek watershed, are discussed in more detail in Section 2.1.c. No permitted dry-weather discharges are associated with this waterbody. Based on data available on-line at the time of this LTCP submittal, it was determined that a total of nine State-significant industrial SPDES permit holders are operating facilities located in the watershed.

Table 2-2 lists these permits, their owners and location.

Table 2-2. Industrial SPDES Permits within the Newtown Creek Watershed [(1)]

Permit Number	Owner	Location
NY0201138	Consolidated Edison Co. of New York	Ash Avenue & McGuiness Boulevard
NY0006131	Motiva Enterprises LLC	25 Paidge Avenue
NY0005789	Ditmas Terminal	364 Maspeth Avenue
NY0007676	Metro Terminal Corporation	498 Kingsland Avenue
NY0004596	BP Products North America Terminal - Amoco Oil Company	125 Apollo Street
NY0036609	BCF Oil Refining, Inc.	360 Maspeth Avenue
NY0267724	Exxon Mobil Oil Corp [(2)]	400 Kingsland Avenue
NY0200841	NYC Dept. of Sanitation	48-01 58th Road
NY0007641	Bayside Fuel Oil Corp	1100 Grand Street

Notes:
(1) U.S. Environmental Protection Agency PCS-ICIS database (accessed in April 2017).
(2) Permit for the Greenpoint Remediation Project.

2.1.a.3 Superfund Sites

As noted in Section [1.2], EPA listed Newtown Creek on the National Priorities List ("NPL") in 2010, and is currently evaluating the presence of hazardous substances in Newtown Creek under the Comprehensive Environmental Response, Compensation and Liability Act (“CERCLA” or “Superfund"). EPA is overseeing the performance of a Remedial Investigation (RI) and Feasibility Study (FS) at Newtown Creek which includes the investigation of surface sediments, subsurface sediments and surface water, and groundwater. EPA expects to issue a Record of Decision (ROD), which will set forth EPA’s selected remedy for Newtown Creek, in 2020.

In 2014, EPA listed the Former Wolff Alport Chemical Company ("Wolff Alport") site in Ridgewood, Queens to the NPL. The Wolff Alport site is located within the Newtown Creek sewershed. EPA is evaluating the presence of hazardous substances at the Wolff Alport site, including radionuclides, through an RI and FS, which is expected to be completed in 2017. It is further expected that EPA will issue a ROD for the Wolff Alport site in 2017.

2.1.a.4 Impervious Cover Analysis

Impervious surfaces within a watershed are those characterized by an artificial surface that prevents rainfall infiltration, such as concrete, asphalt, rock, or rooftop. Some of the rainfall that lands on an impervious surface will remain on the surface via ponding, and will evaporate. The remaining rainfall volume becomes overland runoff that may flow directly into the combined sewer system or into a separate stormwater system, may flow to a pervious area and soak into the ground, or may flow directly to a waterbody. The percentage of impervious surface that is connected directly to the combined sewer system is an important parameter in the characterization of a watershed and in the development of hydraulic models used to simulate combined sewer system performance.

A representation of the impervious cover was made in the 2007 version of the models for the 13 NYC WWTPs that serve combined watersheds, to support the several WWFPs that were submitted to DEC in the period 2009-2011. Efforts to update the models and the impervious surface representation concluded in 2012.

As DEP began to focus on the use of GI to manage stormwater runoff by either slowing it down prior to its entering the combined sewer network, or preventing it from entering the network entirely, it became clear that a more detailed evaluation of the impervious cover would be beneficial. In addition, DEP determined that the distinction between impervious surfaces that introduce storm runoff directly to the sewer system (Directly Connected Impervious Areas [DCIA]) and impervious surfaces that may not contribute runoff directly to the sewers was important. For example, a rooftop with drains directly connected to the combined sewers (as required by the NYC Plumbing Code) would be an impervious surface that is directly connected. However, a sidewalk or impervious surface adjacent to parkland might not contribute runoff to the combined sewer system and, as such, would not be considered directly connected.

In 2009 and 2010, DEP invested in the development of high quality satellite measurements of impervious surfaces to support analyses that improved the differentiation between pervious and impervious surfaces, and further differentiated the types of impervious surfaces. Flow meter data were then used to estimate the DCIA. The data and the approach used are described in detail in the InfoWorks CS^{TM} (IW) Citywide Model Recalibration Report (DEP, 2012a). This effort resulted in an updated model representation of the areas that contribute runoff to the combined sewer system. This improved set of data aided in model recalibration, and better informed the deployment of GI projects to reduce runoff from impervious surfaces that contribute flow to the combined sewer system.

2.1.a.5 Population Growth and Projected Flows

DEP routinely develops water consumption and dry-weather wastewater flow projections for planning purposes. In 2012, DEP projected an average per capita water demand of 75 gallons per day that was representative of future uses. The year 2040 was established as the planning horizon, and populations for that time were developed by DCP and the New York Metropolitan Transportation Council.

The 2040 population projection figures were then used with the dry-weather per capita sewage flows to establish the dry-weather sewage flows in the IW models for the Bowery Bay WWTP and Newtown Creek WWTP sewersheds. This was accomplished by using Geographical Information System (GIS) tools to proportion the 2040 populations locally from the 2010 census information for each landside subcatchment tributary to each CSO regulator. Per capita dry-weather sanitary sewage flows for these landside model subcatchments were established as the ratio of two factors: the per capita dry-weather sanitary sewage flow for each year; and the 2040 estimated population for the landside model subcatchments within the Newtown Creek and Bowery Bay WWTP sewersheds.

2.1.a.6 Updated Landside Modeling

The majority of the Newtown Creek watershed is included within the overall Newtown Creek WWTP system IW model. A smaller portion of the watershed, at the northern end, is served by the Bowery Bay WWTP and is represented within the Bowery Bay WWTP system IW model. Several modifications to both collection systems have occurred since the models were calibrated in 2007. Given that both models have been used for analyses associated with the annual reporting requirements of the SPDES permit, Best Management Practices (BMPs) and Post-Construction Monitoring (PCM) program, many of these changes already have been incorporated into the models. Other updates to the modeled representation of the collection systems since the 2007 update include:

Bowery Bay IW Model – Low Level (BBL)

- The representation of several open spaces within the BBL watershed was updated based on new information with new subcatchments added.
- Stormwater areas for the Queens West Development Project were revised. Stormwater Outfalls BB-019, BB-020, and BB-044 no longer exist and were removed.
- The Bowery Bay High Level (BBH) and BBL models were combined to better simulate the effects of linking the high- and low-level wet wells.

Newtown Creek IW Model

- A new subcatchment representing the Lutheran Cemetery was added.
- Regulator Q-1 was revised based on recent as-built drawings.

In addition to changes made to the modeled representations of the collection system configuration, other changes include:

- ***Runoff Generation Methodology***. The identification of pervious and impervious surfaces was updated. As described in Section 2.1.a.3 above, the impervious surfaces were also categorized into DCIA and impervious runoff surfaces that do not contribute runoff to the collection system.
- ***GIS Aligned Model Networks.*** Historical IW models were constructed using record drawings, maps, plans, and studies. Over the last decade, DEP has been developing a GIS system that will provide the most up-to-date information available on the existing sewers, regulators, outfalls, and pump stations. Part of the update and model recalibration utilized data from the GIS repository for interceptor sewers.
- ***Interceptor Sediment Cleaning Data.*** Between April 2009 and May 2011, DEP undertook a citywide interceptor sediment inspection and cleaning program. Over approximately 136 miles of NYC's interceptor sewers were inspected. Data on the average and maximum sediment depth in the inspected interceptors were available for use in the model as part of the update and recalibration process. Multiple sediment depths available from sonar inspections were spatially averaged to represent depths for individual interceptor segments included in the model that had not yet been cleaned.
- ***Evapotranspiration Data.*** Evapotranspiration (ET) is a meteorological input to the hydrology module of the IW model that represents the rate at which depression storage (surface ponding) is depleted and available for use for additional surface ponding during subsequent rainfall events. In previous versions of the model, an average rate of 0.1 inches/hour (in/hr) was used for the model calibration, while no evaporation rate was used as a conservative measure during alternatives analyses. During the update of the model, hourly ET estimates obtained from four National Oceanic and Atmospheric Administration (NOAA) climate stations (John F. Kennedy [JFK], Newark [EWR], Central Park [CPK], and LaGuardia [LGA]) for an 11-year period were reviewed. These data were used to calculate monthly average ETs, which were then used in the

updated model. The monthly variations enabled the model simulation to account for seasonal variations in ET rates, which are typically higher in the summer months.

- ***Tidal Boundary Conditions at CSO Outfalls.*** Tidal stage can affect CSO discharges when tidal backwater in a CSO outfall reduces the ability of that outfall to relieve excess flow. Model updates took into account this variable boundary condition at CSO outfalls that were influenced by tides. Water elevation, based on the tides, was developed using a customized interpolation tool that assisted in the computation of meteorologically-adjusted astronomical tides at each CSO outfall in the New York Harbor complex.

- ***Dry-Weather Sanitary Sewage Flows.*** Dry-weather sewage flows were developed as discussed in Section 2.1.a.4 above. Hourly dry-weather flow (DWF) data for 2011 were used to develop the hourly diurnal variation patterns at each plant. For the calibration period, the DWF generation rates were developed by dividing 2011 plant flows by the population from the 2010 census. The DWF generation rate was then applied to each catchment in the model based on population. The resulting DWF was then adjusted, if necessary, to match the calibration meters. The projected 2040 DWF were used in the LTCP Baseline Conditions model that was the basis for evaluating alternatives.

- ***Precipitation.*** The annual rainfall series that was to be used to represent a typical year of rainfall for annual model simulations was re-evaluated as part of this exercise. This re-evaluation is discussed in Section 2.1.b below.

In addition to the updates and enhancements listed above, 13 of DEP's IW landside models underwent recalibration in 2012. The recalibration process and results are included in the IW Citywide Recalibration Report (DEP, 2012a) required by the 2012 CSO Order. Following this report, DEP submitted to DEC a Hydraulic Analysis report in December 2012 (DEP, 2012b). The general approach followed was to recalibrate the model in a stepwise fashion beginning with the hydrology module (runoff). The following summarizes the overall approach to model update and recalibration:

- ***Site Scale Calibration (Hydrology)*** – The first step was to focus on the hydrologic components of the model, which had not been modified since 2007. Flow monitoring data were collected in upland areas of the collection systems, remote from (and thus largely unaffected by) tidal influences and in-system flow regulation, for use in understanding the runoff characteristics of the impervious surfaces. Data were collected in two phases – Phase 1 in the Fall of 2009, and Phase 2 in the Fall of 2010. The upland areas ranged from 15 to 400 acres in size. A range of areas with different land use mixes was selected to support the development of standardized sets of coefficients which could be applied to other unmonitored areas of NYC. The primary purpose of this element of the recalibration was to adjust pervious and impervious area runoff coefficients to provide the best fit of the runoff observed at the upland flow monitors.

- ***Area-wide Recalibration (Hydrology and Hydraulics)*** – The next step in the process was to focus on larger areas of the modeled systems where historical flow metering data were available, and which were neither impacted by tidal backwater conditions nor subject to flow regulation. Where necessary, runoff coefficients were adjusted further to provide reasonable simulation of flow measurements made at the downstream end of these larger areas. The calibration process then moved downstream further into the collection system, where flow data were available in portions of the conveyance system where tidal backwater conditions could exist, as well as

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potential backwater conditions from throttling at the WWTPs. Regulation at in-system control points (regulator, internal reliefs, etc.) impacts the flow measured in these downstream locations. During this step in the recalibration, minimal changes were made to runoff coefficients.

This effort resulted in models that better represented the collection systems and their tributary areas. These updated models are used for the alternatives analysis in Section 8 as part of this LTCP. A comprehensive discussion of the recalibration efforts can be found in the previously noted IW Citywide Recalibration Report (DEP, 2012a) and the Hydraulic Analysis Report (DEP, 2012b). Additional model updates were made in support of this LTCP and were described above.

2.1.b Review and Confirm Adequacy of Design Rainfall Year

In previous planning work for the WWFPs, DEP applied the 1988 annual precipitation characteristics to the landside IW models to develop loads from combined and separately sewered watersheds. The year 1988 was considered representative of long term average conditions. Therefore, that year was used to analyze facilities where "typical" (rather than extreme conditions) served as the basis of design, in accordance with the EPA CSO Control Policy's framework for using an "average annual basis" for analyses. However, in light of increasing concerns over climate change and the potential for more extreme and possibly more frequent storm events, the selection of 1988 as the average condition was re-considered. DEP evaluated a comprehensive range of historical rainfall data from 1969 to 2010 at four rainfall gauges (CPK, LGA, JFK, EWR). The 2008 JFK rainfall was determined to be the most representative of average annual rainfall across all four gauges. Figure 2-8 shows the annual rainfall at JFK for 1969 through 2014.

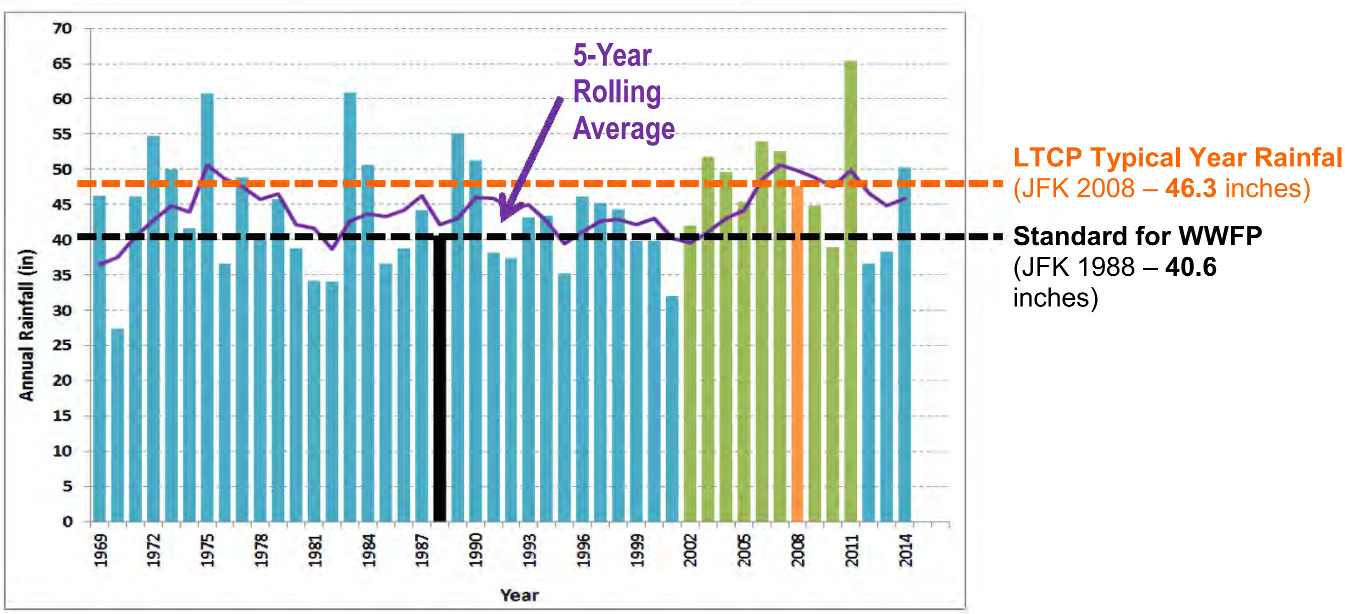

Figure 2-8. Annual Rainfall Data and Selection of the Typical Year

As indicated in Figure 2-8, the JFK 2008 rainfall currently used for the LTCP typical year includes almost six inches more rainfall than the JFK 1988 rainfall used for the WWFP evaluations, and is more consistent with recent rainfall trends. As a result, recent landside modeling analyses as part of the LTCP process have used the 2008 precipitation as the typical rainfall year in NYC, together with the 2008 tide observations. Based on an analysis of 30 years of rainfall data at four rain gauges (JFK, LGA, EWR, CPK), the rainfall recorded at the JFK gauge in 2008 was also determined to be closest to the 30-year average of all four gauges combined. The 2008 JFK data had a higher total rainfall volume than the JFK 1988 data, and was considered more reflective of current climate conditions. The 10-year period of 2002 to 2011 is also used to assess long term performance of the LTCP recommended plans (see Section 8).

2.1.c Description of Sewer System

As noted previously, the Newtown Creek watershed/sewershed is located within the Boroughs of Brooklyn and Queens, and the watershed is served by the Bowery Bay and Newtown Creek WWTPs and associated collection systems. The CSO and stormwater outfalls associated with Newtown Creek and its tributaries are shown in Figure 2-9. As shown, numerous outfalls are located along the perimeter of Newtown Creek. In total, 201 discharge points have been documented to exist along the shoreline of Newtown Creek by DEP's Shoreline Survey Unit, as shown in Table 2-3.

Table 2-3. Outfalls Discharging to Newtown Creek and Tributaries

Identified Ownership of Outfalls	Number of Outfalls
NYCDEP	DEP MS4 Permitted = 11
	DEP CSO Permitted = 20 DEP Inactive CSO = 1 DEP Wet-Weather Treated Effluent = 1
NYS Department of Transportation	10
Private	131
Unknown	27
Total	201

The following sections describe the major features of the Bowery Bay and Newtown Creek WWTP sewersheds within the Newtown Creek watershed. Table 2-4 presents a breakdown of the size of the areas served by the various drainage system categories.

Table 2-4. Bowery Bay WWTP and Newtown Creek WWTP Sewersheds Tributary to Newtown Creek: Acreage Per Sewer Category

Sewer Area Description	Area (acres)
Combined	**4,642**
Separate MS4	**665**
Direct Drainage	**585**
Other	**923**
Total	**6,815**

It should be noted that the combined sewer watersheds have been delineated over many years and during numerous planning studies. As such, they fairly accurately represent the combined sewer area draining to Newtown Creek. However, this is not the case for the Separate and Direct Drainage categories listed in Table 2-4. Generally, the areas between the CSO drainage boundary and the shoreline of the waterbody have been delineated and loosely assigned as separate if they appeared to be serviced by municipal storm sewers, and as direct drainage if they drained directly into Newtown Creek, were from commercial/industrial/manufacturing sites, or were parkland/open space located immediately adjacent to the shoreline. The allocation of areas to these categories should be considered a rough estimate for the purposes of establishing total stormwater and direct drainage loads.

Figure 2-9. Newtown Creek Outfalls

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2.1.c.1 Overview of Drainage Area and Sewer System

Bowery Bay WWTP Drainage Area and Sewer System

The northern portion of the Newtown Creek watershed is served by the Bowery Bay WWTP. The Bowery Bay WWTP is located at 43-01 Berrian Blvd. in the Astoria section of Queens, on a 34.6 acre site adjacent to the Rikers Island Channel. The Bowery Bay WWTP serves an area 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, Jackson Heights, Maspeth, Woodside, Sunnyside Gardens, Sunnyside, Hunters Point, Long Island City, Astoria, Astoria Heights, Steinway, Ravenswood, and Roosevelt Island. Additional details on the Bowery Bay WWTP are presented in Section 2.1.c.6, below.

The Bowery Bay collection system associated with Newtown Creek includes:

- One pumping station (Borden Avenue PS);
- 19 combined sewer flow regulator structures; and
- 12 active and 1 inactive CSO discharge outfalls.

The Borden Avenue PS operates within the Bowery Bay WWTP portion of the Newtown Creek sewershed with a total capacity of 3.9 MGD.

Wastewater flows to the Bowery Bay WWTP through two interceptors. The High Level Interceptor serves the central and eastern part of the Bowery Bay WWTP sewershed, and is not hydraulically influenced by the Newtown Creek watershed. The Low Level Interceptor serves approximately 3,502 acres in the western side of the Bowery Bay WWTP sewershed, carrying flow from individual drainage basins along the East River extending to Newtown Creek. The Long Island City Interceptor ties into the upstream end of the Low Level Interceptor. All of the CSO regulators from the Bowery Bay WWTP sewershed that discharge to outfalls on Newtown Creek are tied into this interceptor. Figure 2-10 shows the Bowery Bay WWTP collection system for the Low Level Interceptor portion of the sewershed.

Table 2-5 shows the acreage by outfall/regulator/relief structure for the Bowery Bay WWTP sewershed within the Newtown Creek watershed.

Table 2-5. Bowery Bay WWTP Service Area Within Newtown Creek Watershed: Acreage by Outfall/Regulator/Relief Structure

Outfall	Outfall Drainage Area (acres)	Regulator(s)	Regulator Drainage Area (acres)	Regulated Drainage Area Type	Receiving Water
BB-004	12	BB-L3	12	Combined	Dutch Kills
		BB-L41			
BB-009	302	BB-L3B	3	Combined	Dutch Kills
		BB-L3A	0		
		BB-L37	279		
		BB-L38	20		
BB-010	22	BB-L3C	22	Combined	Dutch Kills
BB-011	15	BB-L1	15	Combined	Newtown Creek
BB-012	13	BB-L2	13	Combined	Newtown Creek
BB-013	32	BB-L8	32	Combined	Newtown Creek
BB-014	10	BB-L9	10	Combined	Newtown Creek
BB-015	6	BB-L10	6	Combined	Newtown Creek
BB-026	240	BB-L4	0	Combined	Dutch Kills
		BB-L39	30		
		BB-L40	182		
		BB-L42	27		
BB-040	8	BB-L5	8	Combined	Dutch Kills
BB-042	1	BB-L6	1	Combined	Dutch Kills
BB-043	35	BB-L7	35	Combined	Newtown Creek
BB-049(1)	0	N/A	0	Combined	Newtown Creek

Note:

(1) Outfall BB-049 is listed in the 2016 SPDES Permit. However, field investigation carried on by DEP revealed it is an inactive CSO.

Bowery Bay Non-Sewered Areas

Some areas within the Bowery Bay WWTP sewershed are considered direct watersheds, where stormwater drains directly to receiving waters without entering the combined sewer system or a separate drainage pipe network. These areas are generally located along the shoreline.

Bowery Bay MS4 Outfalls

Two MS4 SPDES-permitted storm outfalls (BB-609 and BB-610) are associated with the Bowery Bay WWTP sewershed served by the Low Level Interceptor. These MS4 outfalls, shown in Figure 2-9 (above), drain stormwater runoff from the separate sanitary sewer areas adjacent to Dutch Kills, and then discharge to Dutch Kills. While runoff from these areas does not enter the combined system, the stormwater discharging to Dutch Kills can affect water quality in the tributary and Newtown Creek.

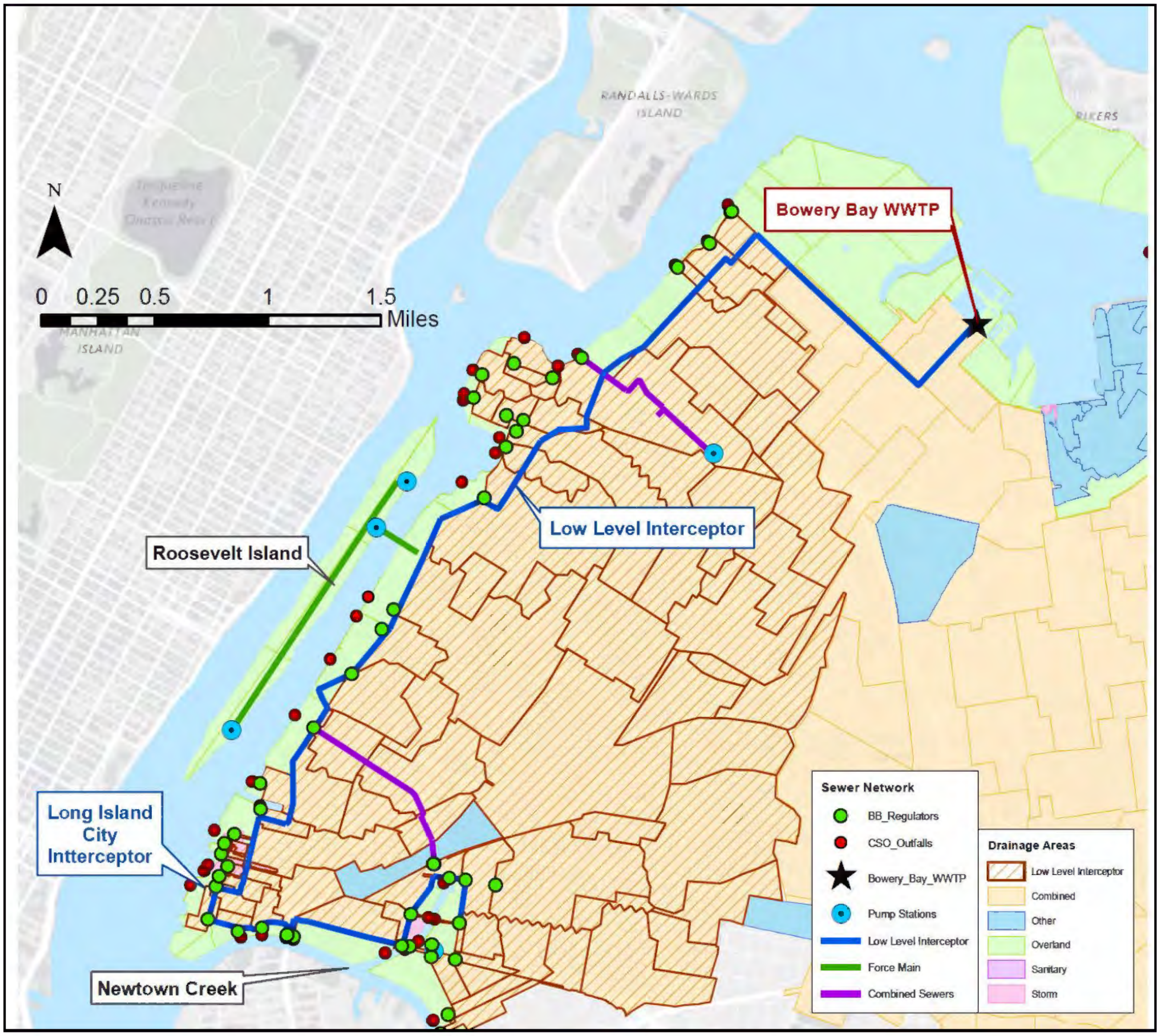

Figure 2-10. Bowery Bay WWTP Collection System - Low Level Interceptor

Bowery Bay CSOs

A total of 12 active Bowery Bay WWTP SPDES-permitted CSO outfalls discharge to Newtown Creek. Of these, six discharge directly to the main stem of Newtown Creek (BB-011, BB-012, BB-013, BB-014, BB-015, and BB-043) and six discharge to Dutch Kills (BB-004, BB-009, BB-010, BB-026, BB-040, and BB-042). As previously noted, although Outfall BB-049 is listed in the 2015 WWTP SPDES Permit, DEP has determined that it is an inactive CSO. The locations of the Bowery Bay SPDES CSO outfalls tributary to Newton Creek are shown in Figures 2-2 and 2-9.

Newtown Creek WWTP Drainage Area and Sewer System

The portion of the Newtown Creek watershed served by the Newtown Creek WWTP surrounds the southern and eastern shores of Newtown Creek in Brooklyn, and the northwestern shores of the Creek in Queens. The Newtown Creek WWTP is located at 327 Greenpoint Avenue, in the Greenpoint neighborhood of Brooklyn, on a 53-acre site. The Newtown Creek WWTP serves the sewered area in 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. A total of 593 miles of sanitary, combined, and interceptor sewers feed into the Newtown Creek WWTP. Additional details on the Newtown Creek WWTP are presented in Section 2.1.c.6, below.

Of the entire Newtown Creek WWTP sewershed, only certain portions of Brooklyn and Queens influence the CSO discharges to Newtown Creek. The Manhattan portion of the Newtown Creek WWTP sewershed does not impact the CSOs within Newtown Creek, and will therefore not be discussed in this LTCP. A total of 5,920 acres of the Newtown Creek watershed area are served by the Newtown Creek WWTP. The Newtown Creek sewershed includes sanitary and combined sewers. The Newtown Creek sewershed includes:

- Three pumping stations;
- One wet-weather treated effluent and eight active CSO discharge outfalls; and
- Nine permitted SPDES MS4 outfalls.

Figure 2-11 shows the Newtown Creek collection system for the Brooklyn and Queens portions of the sewershed. Table 2-6 shows the acreage by outfall/regulator/relief structure for the Newtown Creek WWTP sewershed within the Newtown Creek watershed.

The 49th Street and Glendale PSs operate within the Newtown Creek portion of the Newtown Creek WWTP sewershed. The 49th Street PS, located at 49th Street and 57th Avenue, is a sanitary station with a total capacity of 7.9 MGD. The station discharges via the secondary interceptor from Queens to the combined Morgan Avenue Interceptor. The Glendale PS, located at Cooper Avenue, is a stormwater station with a total capacity of 1.2 MGD that discharges to the downstream combined sewer system. The Brooklyn/Queens PS is located at the Newtown Creek WWTP and was built in 1967 with a rated capacity of 300 MGD. This pumping station was recently upgraded to a capacity of 400 MGD. The Kent and Morgan Avenue Interceptors convey wastewater from Brooklyn and Queens, joining together just upstream of the Brooklyn/Queens PS.

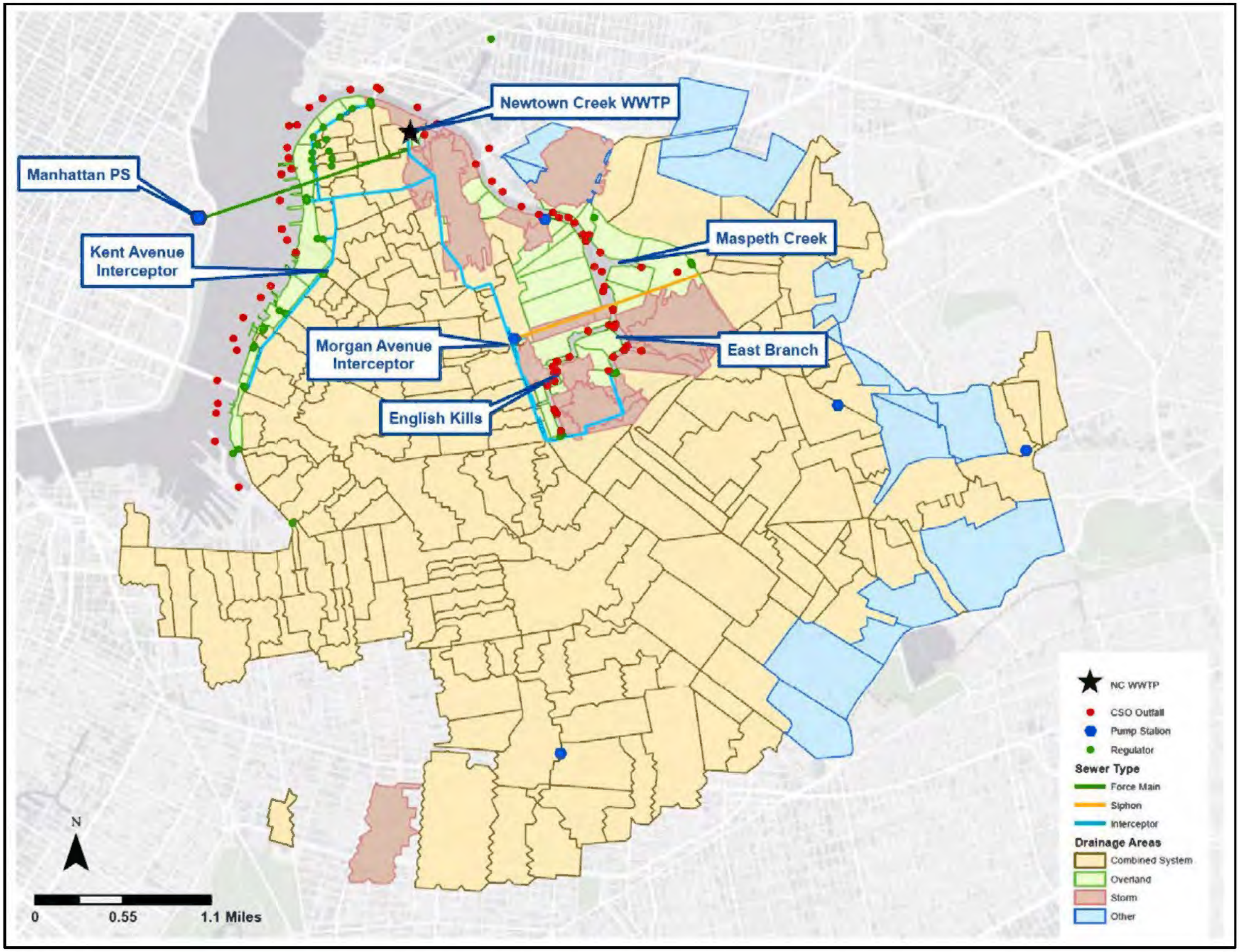

Figure 2-11. Newtown Creek WWTP Collection System – Brooklyn/Queens

Table 2-6. Newtown Creek WWTP Service Area Within Newtown Creek Watershed: Acreage by Outfall/Regulator/Relief Structure

Outfall	Outfall Drainage Area (acres)	Regulator(s)	Regulator Drainage Area (acres)	Regulated Drainage Area Type	Receiving Water
NCB-015	1,728	NC-B01, B01A	1,728	Combined	English Kills
NCB-019	29	NC-B02	29	Combined	East Branch
NCB-021	15	High Relief	15	Combined	Newtown Creek
NCB-022	22	NC-B17	22	Combined	Newtown Creek
NCB-023	15	NC-B16	15	Combined	Newtown Creek
NCQ-029	76	NC-Q02	76	Combined	Newtown Creek
NCQ-077	1,248	NC-Q01	1,248	Combined	Maspeth Creek
NCB-083	1,998	NC-St. Nicholas Weir	1,998	Combined	East Branch
NCB-002	N/A	Newtown Creek WWTP Overflow	N/A	Combined	Whale Creek

Note:
(1) Outfall NCB-002 is the Newtown Creek WWTP high relief that discharges to Whale Creek Canal. This flow is treated before discharge.

Newtown Creek Non-Sewered Areas

Some areas within the Newtown Creek WWTP sewershed are considered direct watersheds, where stormwater drains directly to receiving waters without entering the combined sewer system or a separate drainage pipe network. These areas are generally located along the shoreline.

Newtown Creek MS4 Outfalls

According to NYC's MS4 SPDES permit, nine storm sewer outfalls (NCB-629, NCB-630, NCB-631, NCB-635, NCB-636, NCB-638, NCQ-632, NCQ-633, and NCQ-637) are located along the shore of Newtown Creek and its tributaries associated with the Newtown Creek WWTP sewershed. These outfalls are shown in Figure 2-9, above. In addition, as identified by the DEP Shoreline Survey, over 150 non-CSO, non-MS4 pipes are located along the banks of Newtown Creek. Some of these pipes likely direct stormwater from highways and commercial/industrial sites into the Creek.

Newtown Creek CSOs

A total of eight Newtown Creek SPDES-permitted CSO outfalls discharge to Newtown Creek and its tributaries including NCQ-029, NCQ-077, NCB-015, NCB-019, NCB-023, NCB-021, NCB-022, and NCB-083. Outfall NCB-015 contributes the most annual CSO volume to the waterbody from the Newtown Creek combined sewer system. Outfall NCB-002 is the Newtown Creek WWTP high relief that discharges treated wet-weather flow to Whale Creek Canal. The locations of the Newtown Creek SPDES CSO outfalls tributary to Newtown Creek are shown in Figure 2-2 and Figure 2-9, above.

2.1.c.2 Stormwater and Wastewater Characteristics

The concentrations found in wastewater, combined sewage, and stormwater can vary based on a number of factors, including flow rate, runoff contribution, and the mix of the waste discharged to the system from domestic and non-domestic customers. Because the mix of these waste streams can vary, it can be challenging to identify a single concentration to use for analyzing the impact of discharges from these systems to receiving waters.

Data collected from sampling events were used to estimate concentrations for carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids, fecal coliform bacteria, and enterococci bacteria to use in calculating loadings from various sources.

Table 2-7 shows the bacteria and $CBOD_5$ concentrations for CSO, stormwater, direct drainage, and Calvary Cemetery runoff assigned to the service areas of the collection systems that discharge to Newtown Creek. Previously collected citywide sampling data from the Inner Harbor Facility Planning Study (DEP, 1994) was combined with data from the EPA Harbor Estuary Program (HydroQual, 2005a) to develop the direct drainage concentrations. The Calvary Cemetery runoff was assumed to be similar to the direct drainage runoff. CSO and stormwater bacteria concentrations were assigned using a Monte Carlo approach based on the data collected from the LTCP sampling program in Newtown Creek. The IW sewer system model was used to generate the flows from NYC CSO and storm sewer outfalls.

Table 2-7. Newtown Creek Source Loadings Characteristics

Source	Enterococci (cfu/100mL)	Fecal Coliform (cfu/100mL)	BOD_5 (mg/L)(2)
Stormwater(1)	Monte Carlo 20,061 to 289.071	Monte Carlo 7,025 to 60,829	17.4
CSOs(2)	Monte Carlo 82,081 to 2,092,322	Monte Carlo 33,951 to 4,478,329	42.2
Direct Drainage(3)	6,000	4,000	17.4
STP Treated Effluent to Whale Creek(4)	1	Monte Carlo 1 to 1,407	Monthly Averages 8.0 to 11.7

(1) Stormwater bacteria concentrations based on 2016 Newtown Creek LTCP measurements. Stormwater BOD_5 based on 2012-2016 Newtown Creek Superfund and LTCP measurements.
(2) CSO bacteria concentrations based on 2016 Newtown Creek LTCP measurements. CSO BOD_5 based on 2012-2016 Newtown Creek Superfund and LTCP measurements.
(3) Direct drainage bacteria concentrations based on NYS Stormwater Manual, Charles River LTCP, and National Stormwater Data Base for commercial and industrial land uses. Direct drainage BOD_5 concentrations specified as stormwater. Cavalry Cemetery BOD_5 concentration specified slightly higher at 22.7 mg/L based on Superfund measurements specific to the Cemetery catchment area.
(4) STP effluent bacteria concentrations based on 2016 DMR measurements: Monte Carlo selection of daily averages for fecal coliform and median of several months for *Enterococci*. BOD concentrations based on monthly averages of 2012-2016 DMR measurements

A flow monitoring and sampling program targeting CSO tributary to Newtown Creek, as more specifically described below, was implemented as part of this LTCP. Data were collected to supplement existing information on the flows/volumes and concentrations of various sources to the waterbody.

CSO concentrations were measured in 2016 to provide site-specific information for Outfalls BB-026, NCB-083, and NCQ-077. The CSO bacteria concentrations were characterized by direct measurements of three CSO events during various storms occurring during the months of July 2016 through November 2016. These cumulative frequency distribution concentrations are shown in Figures 2-12 through 2-14.

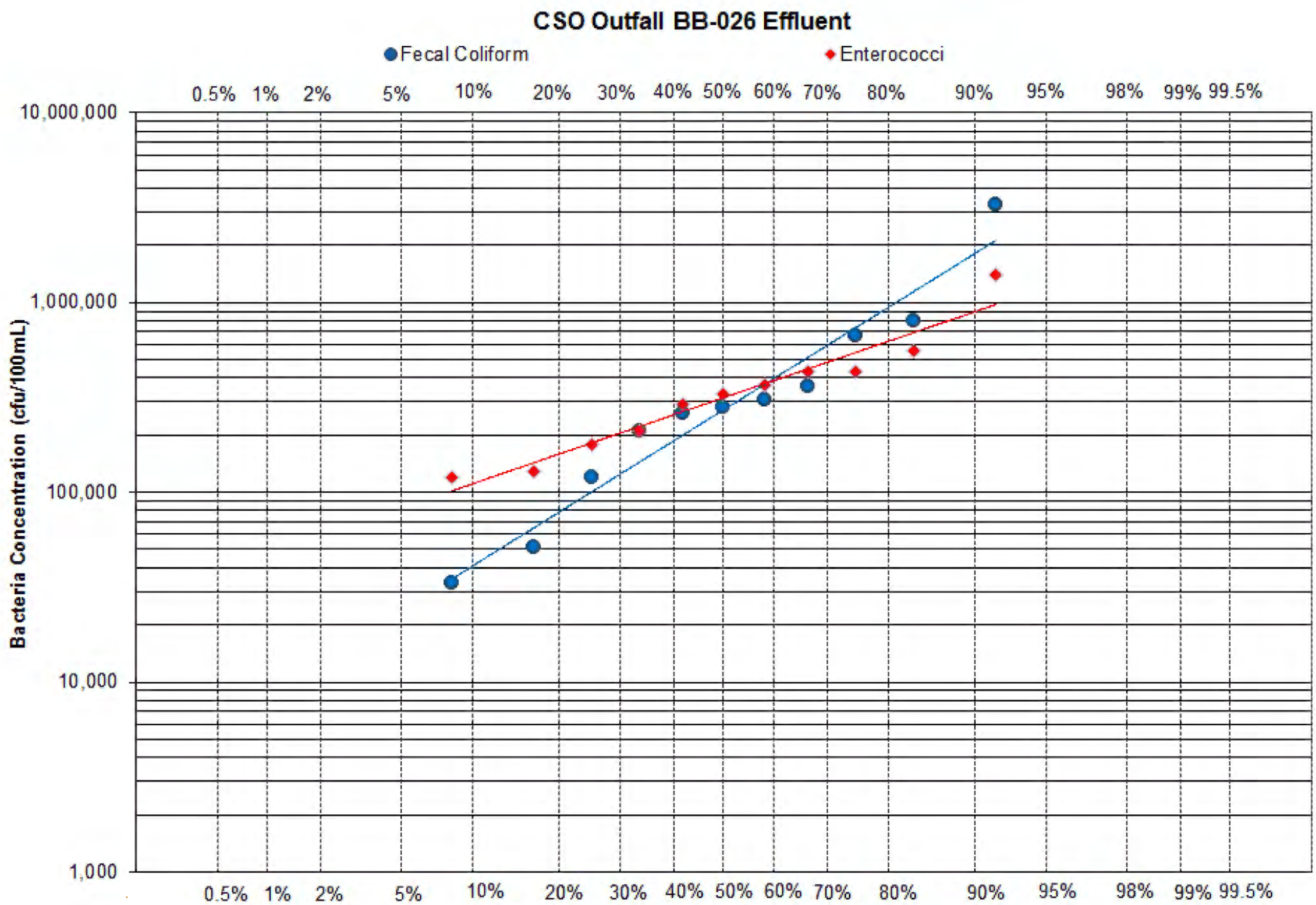

Figure 2-12. Outfall BB-026 Measured CSO Bacteria Concentrations

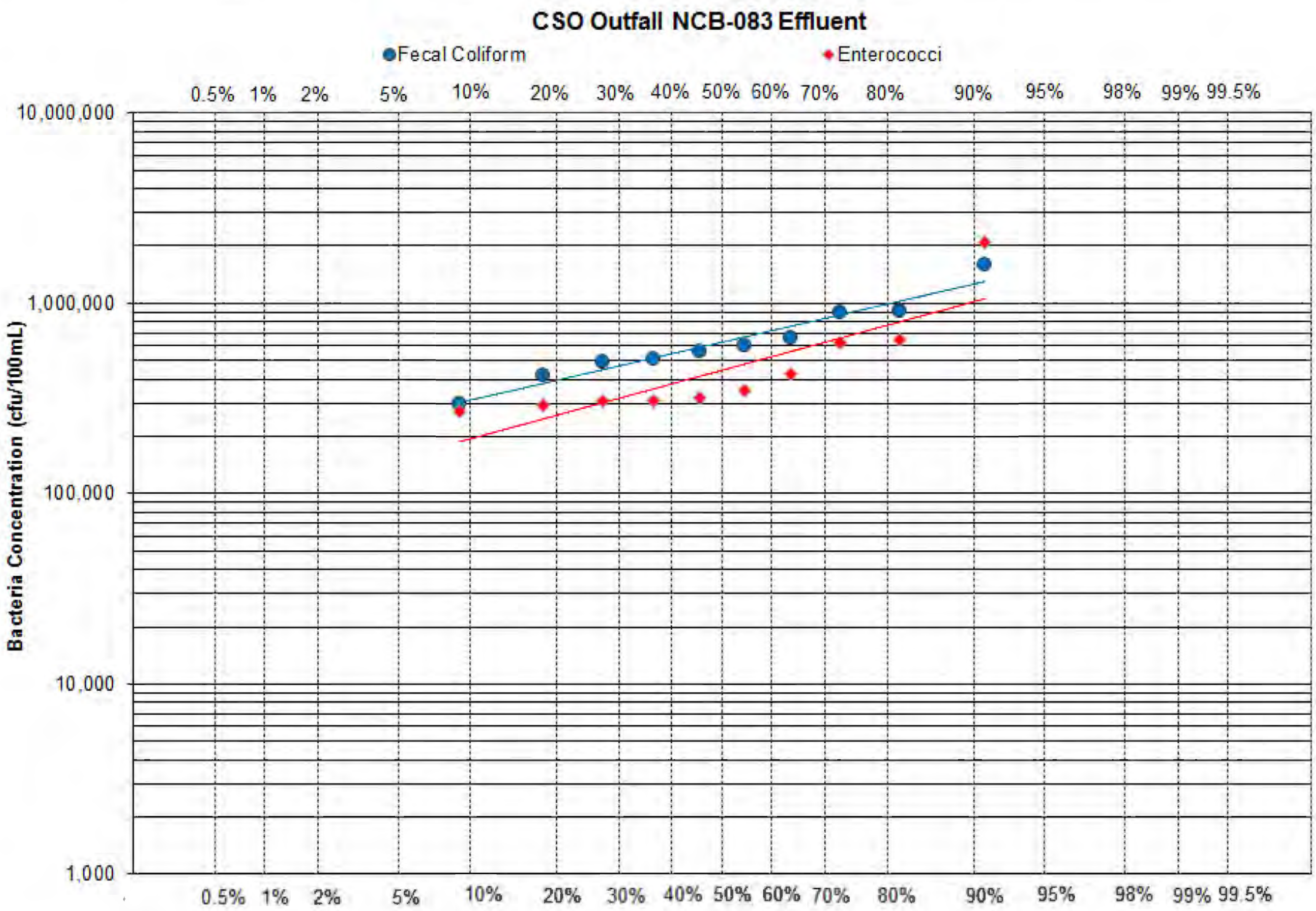

Figure 2-13. Outfall NCB-083 Measured CSO Bacteria Concentrations

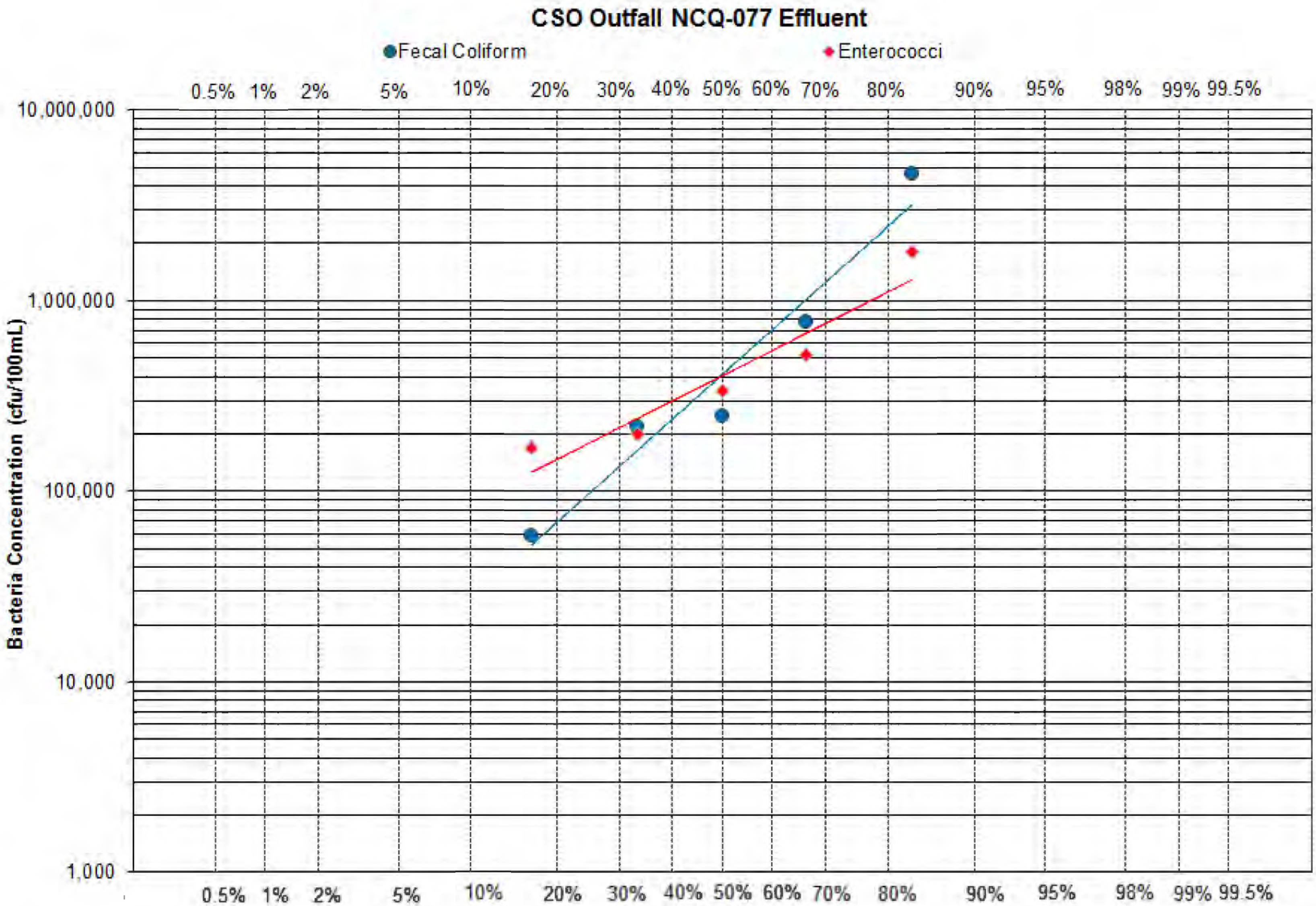

Figure 2-14. Outfall NCQ-077 Measured CSO Bacteria Concentrations

Individual sample points are shown, as well as the trend line that best fits the data distribution, in Figures 2-12 through 2-14. For all three CSO outfalls sampled, the measured fecal coliform and enterococci concentrations were log-normally distributed. Table 2-8 below provides the ranges of the measured CSO fecal coliform concentrations and enterococci concentration for each outfall.

Table 2-8. Newtown Creek Measured CSO Bacteria Concentrations

Outfall	Fecal Coliform (cfu/100mL)	Enterococci (cfu/100mL)
BB-026	33,000 – 3,300,00	210,000 – 1,400,000
NCB-083	300,000 – 1,600,000	270,000 – 650,000
NCQ-077	59,000 – 4,600,000	170,000 – 1,800,000

Flow monitoring data were collected for CSO Outfalls BB-026, NCB-015, NCB-083, NCQ-029, and NCQ-077 to support the development of the Newtown Creek LTCP. A description of the IW model update and calibration processes based on the flow monitoring data gathered for Outfalls BB-026, NCB-015, NCB-083, NCQ-029, and NCQ-077 was provided earlier in Section 2.1.a.5.

Sampling, data analyses, and water quality modeling calibration resulted in the assignment of flows and loadings to these sources for inclusion in the calibration/validation of the water quality model.

2.1.c.3 Hydraulic Analysis of Sewer System

A citywide hydraulic analysis was completed in December 2012 (an excerpt of which is included in this subsection), to provide further insight into the hydraulic capacities of key system components and system responses to various wet-weather conditions. The hydraulic analyses can be divided into the following major components:

- Annual simulations to estimate the number of annual hours that the WWTPs are predicted to receive and treat up to 2xDDWF for the rainfall year 2008 with projected 2040 DWFs; and
- Estimation of peak conduit/pipe flow rates that would result from a significant single-event with projected 2040 DWFs.

Detailed presentations of the data were contained in the December 2012 Hydraulic Analysis Report (DEP, 2012b) submitted to DEC. The objective of each evaluation and the specific approach undertaken are briefly described in the following paragraphs.

Annual Hours at 2xDDWF for 2008 with Projected 2040 DWF

Model simulations were conducted to estimate the annual number of hours that the Bowery Bay and Newtown Creek WWTPs would be expected to treat 2xDDWF for the 2008 precipitation year. These simulations were conducted using projected 2040 DWF for two model input conditions – the recalibrated model conditions as described in the December 2012 IW Citywide Recalibration Report (DEP, 2012a), and the Cost Effective Grey (CEG) alternative defined for the service area. The CEG elements represent the CSO controls that became part of the 2012 CSO Order. For these simulations, the primary input conditions applied were as follows:

- Projected 2040 DWF conditions.

- 2008 tides and precipitation data.
- Bowery Bay WWTP at 2xDDWF capacity of 300 MGD and Newtown Creek WWTP at capacity of 700 MGD (above the WWTP's 2xDDWF of 620 MGD).
- No sediment in the combined sewers (i.e., clean conditions).
- Sediment in interceptors representing the sediment conditions after the inspection and cleaning program completed in 2011 and 2012.
- No green infrastructure in combined areas.

Key observations/findings are summarized below:

- Simulation of the 2008 annual rainfall year resulted in a prediction that the Bowery Bay WWTP would operate at its 2xDDWF capacity for 58 hours under the no-CEG condition. When the CEG conditions were applied in the model, the annual number of hours at 2xDDWF was higher, at 74 hours.
- Simulation of the 2008 annual rainfall year resulted in a prediction that the Newtown Creek WWTP would operate at its 700 MGD capacity for 24 hours under the non-CEG condition. When the CEG conditions were applied in the model, the annual number of hours at 700 MGD increased to 53 hours.
- The total volume (dry- and wet-weather combined) treated annually at the Bowery Bay WWTP for the 2008 non-CEG condition was predicted to be 47,289 MG, while the 2008 with CEG condition resulted in a prediction that 47,471 MG would be treated at the plant – an increase of 182 MG.
- The total volume (dry- and wet-weather combined) treated annually at the Newtown Creek WWTP for the 2008 non-CEG condition was predicted to be 92,845 MG, while the 2008 with CEG condition resulted in a prediction that 92,981 MG would be treated at the plant – an increase of 136 MG.
- The total annual CSO volume predicted for the outfalls in the Bowery Bay WWTP sewershed were as follows:
  - 2008 non-CEG: 4,720 MG
  - 2008 with CEG: 4,333 MG
- The total annual CSO volume predicted for the outfalls in the Newtown Creek WWTP sewershed were as follows:
  - 2008 non-CEG: 3,362 MG
  - 2008 with CEG: 3,224 MG

The above results indicate an increase in the number of hours at the 2xDDWF operating capacity for Bowery Bay and Newtown Creek WWTPs, an increased annual volume being delivered to the WWTPs, and a decrease in CSO volume from the outfalls in the service areas as a result of the CEG projects.

Estimation of Peak Conduit/Pipe Flow Rates

Model output tables containing information on several pipe characteristics were prepared, coupled with calculation of the theoretical, non-surcharged, full-pipe flow capacity of each sewer included in the models. To test the conveyance system response under what would be considered a large storm event condition, a single-event storm that was estimated to approximate a five-year return period (in terms of peak hourly intensity as well as total depth) was selected from the historical record.

The selected single-event was simulated for two conditions, the first being prior to implementation of WWFP CEG conditions, and the second with the WWFP CEG conditions implemented. The maximum flow rates and maximum depths predicted by the model for each modeled sewer segment were retrieved and aligned with the other pipe characteristics. Columns in the tabulations were added to indicate whether the maximum flow predicted for each conduit exceeded the non-surcharged, full-pipe flow, along with a calculation of the maximum depth in the sewer as a percentage of the pipe full height. It was suspected that potentially, several of the sewer segments could be flowing full, even though the maximum flow may not have reached the theoretical maximum full-pipe flow rate for reasons such as: downstream tidal backwater, interceptor surcharge, or other capacity-limiting reasons. The resulting data were then scanned to identify the likelihood of such capacity-limiting conditions, and to provide insight into potential areas of available capacity, even under large storm event conditions. Key observations/findings of this analysis are described below.

- Capacity exceedances for each sewer segment were evaluated in two ways for both interceptors and combined sewers:
  - Full flow exceedances, where the maximum predicted flow rate exceeded the full-pipe non-surcharged flow rate. This could be indicative of a conveyance limitation.
  - Full depth exceedances, where the maximum depth was greater than the height of the sewer segment. This could be indicative of either a conveyance limitation or a backwater condition.
- For the single storm event simulated, the model predicted that between 91 and 96 percent (by length) of the Bowery Bay Low Level Interceptor sewer segments would exceed full-pipe capacity flow for both the non-CEG and CEG scenarios. About 32 to 34 percent (by length) of the upstream combined sewers would exceed their full-pipe flow under the same scenarios.
- For the single storm event simulated, the model predicted that 78 percent (by length) of the interceptor sewer segments in the Newtown Creek service areas for Brooklyn would exceed full-pipe capacity flow, while about 45 percent (by length) of the upstream combined sewers would exceed their full-pipe flow.
- For both the non-CEG and CEG scenarios, the full lengths of all of the interceptors in the Bowery Bay WWTP sewershed (High Level Interceptor [HLI] and Low Level Interceptor [LLI]) were predicted to flow at full depth or higher. About 32 percent (by length) of the combined sewers in the LLI system service areas were also predicted to flow at full depth.
- 100 percent (by length) of the interceptors in the Newtown Creek WWTP sewershed in Brooklyn were predicted to flow at full depth or higher. About 56 percent (by length) of the combined sewers in the Brooklyn service area were also predicted to flow at full depth, indicating that many of these sewers experienced backwater conditions from the downstream sewer (and interceptor) system as a result of either pipe or plant capacity limitations.
- The length of sewers that did not reach full depth under the CEG simulations (about 30 percent) in the Bowery Bay service area indicates that there is little potential for in-line storage in the Bowery Bay system.

- The length of sewers that did not reach full depth under the CEG simulations (about 45 to 55 percent) in the Newtown Creek Brooklyn service area indicates that there is some potential for in-line storage capability in the Newtown Creek Brooklyn system.
- The results for the Bowery Bay Low Level Interceptor system service area showed modest improvements when CEG improvements were included.
- The results for the system condition without CEG improvements were nearly the same as the system condition that included CEG improvements in the Newtown Creek WWTP sewershed.

2.1.c.4 Identification of Sewer System Bottlenecks, Areas Prone to Flooding and History of Sewer Back-ups

DEP maintains and operates the collection systems throughout the five boroughs. To do so, DEP employs a combination of reactive and proactive maintenance techniques. NYC's "Call 311" system routes complaints of sewer issues to DEP for response and resolution. Though not every call reporting flooding or sewer back-ups corresponds to an actual issue with the municipal sewer system, each call to 311 is responded to. Sewer functionality impediments identified during a DEP response effort are corrected as necessary.

2.1.c.5 Findings from Interceptor Inspections

DEP has several programs with staff devoted to sewer maintenance, inspection and analysis, and regularly inspects and cleans its sewers, as reported in the SPDES BMP Annual reports. In the last decade, DEP has implemented advanced technologies and procedures to enhance its proactive sewer maintenance practices. GIS and Computerized Maintenance and Management Systems provide DEP with expanded data tracking and mapping capabilities, through which it can identify and respond to trends to better serve its customers. Both reactive and proactive system inspections result in maintenance, including cleaning and repair as necessary. Figures 2-15 and 2-16 illustrate the intercepting sewers that were inspected in the Boroughs of Queens and Brooklyn, encompassing the entire Newtown Creek watershed. Throughout 2016, 724 cubic yards of sediment was removed from 28,351 lf of intercepting sewers within the Bowery Bay WWTP collection system, and 1,413 feet of Newtown Creek WWTP intercepting sewers were inspected with no subsequent sediment removal required. Citywide, the inspection of 166,344 feet of intercepting sewers resulted in the removal of 3,574 cubic yards of sediment.

DEP recently conducted a sediment accumulation analysis to quantify levels of sediments in the combined sewer system. For this analysis, a statistical approach was used to randomly select a sample subset of combined collection sewers representative of the modeled systems as a whole, with a confidence level commensurate to that of the IW landside models. Field crews investigated each location, and estimated sediment depth using a rod and measuring tape. Field crews also verified sewer pipe sizes shown on maps, and noted physical conditions of the sewers. The data were then used to estimate the sediment levels as a percentage of overall sewer cross-sectional area. The aggregate mean sediment level for the entire NYC was approximately 1.25 percent of the cross-sectional area, with a standard deviation of 2.02 percent.

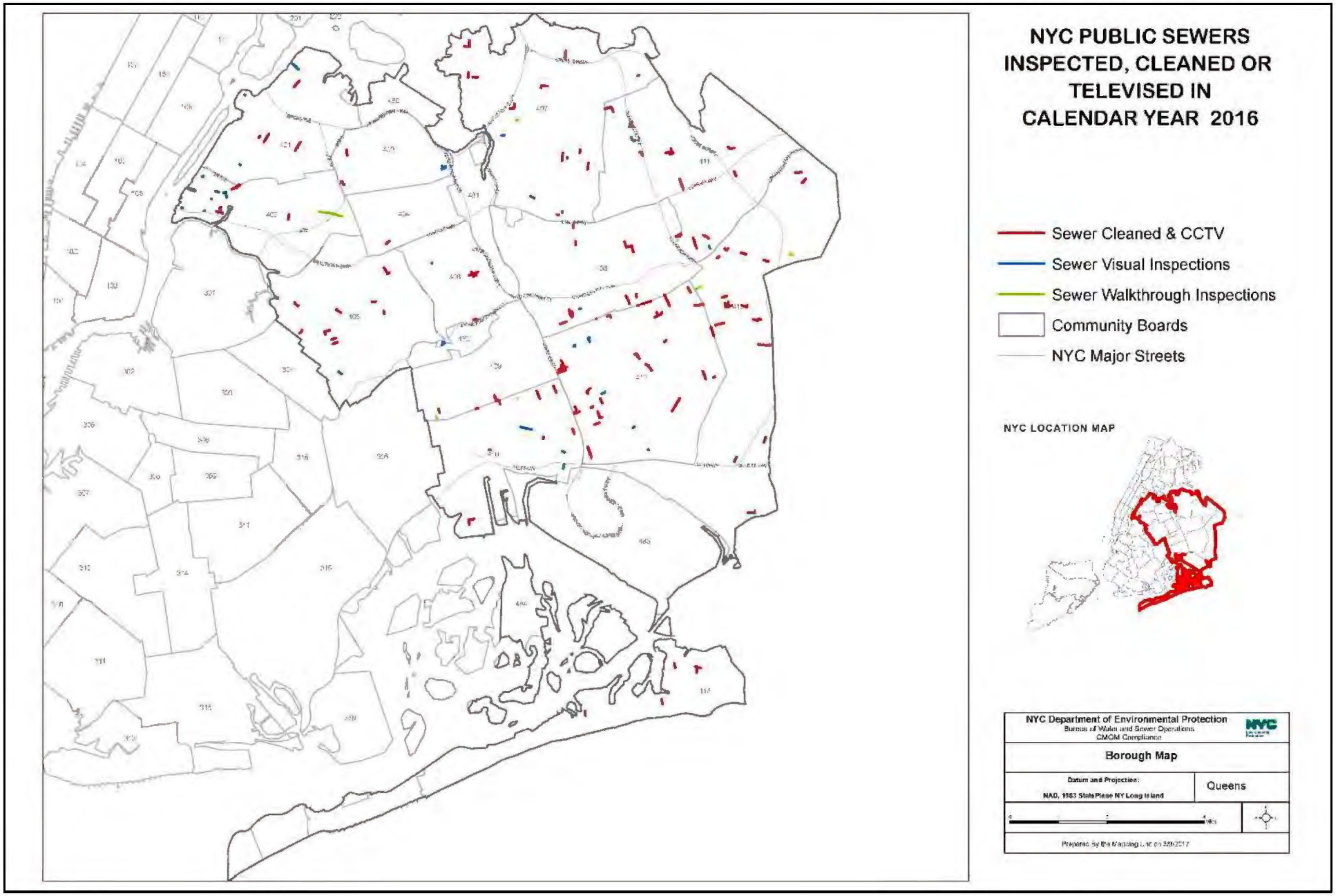

Figure 2-15. Sewers Inspected and Cleaned in Queens Throughout 2016

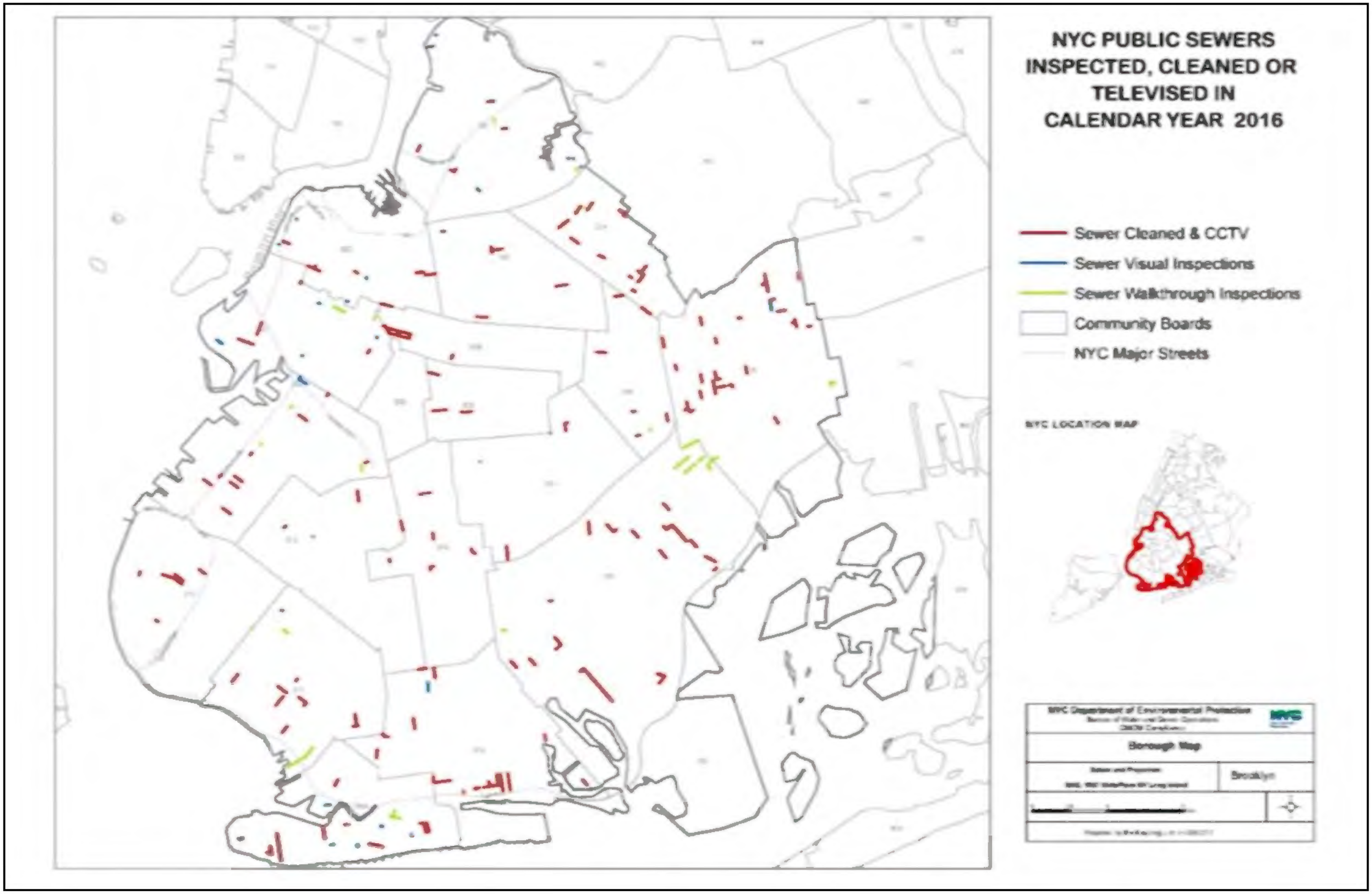

Figure 2-16. Sewers Inspected and Cleaned in Brooklyn Throughout 2016

2.1.c.6 Status of Receiving Wastewater Treatment Plants

As previously noted, the Newtown Creek watershed is served by the Bowery Bay WWTP sewershed and the Newtown Creek WWTP sewershed.

The Bowery Bay WWTP was constructed in 1939. The plant has undergone a series of upgrades and expansions and has been providing secondary treatment for a design dry flow of 150 MGD since 1978. Current treatment includes preliminary treatment, secondary treatment (activated sludge, aeration tanks), disinfection (sodium hypochlorite) and Biological Nutrient Removal (BNR). Sludge is treated by gravity thickening and anaerobic digestion prior to off-site transportation to a landfill for disposal. The plant serves an area of 15,203 acres and a population of 848,300 in the northwest section of Queens. The Bowery Bay WWTP has a design dry-weather flow capacity of 150 MGD, and is designed to receive a maximum wet-weather flow of 300 MGD (2xDDWF), with 225 MGD (one and one-half times design dry-weather flow [1.5xDDWF]) receiving secondary treatment. Flows over 225 MGD receive primary treatment and disinfection.

The Newtown Creek WWTP started operating in 1967. The treatment system, upgraded and completed in 2014, provides secondary treatment for a design dry flow of 310 MGD. Current treatment includes preliminary treatment, secondary treatment (activated sludge, step-feed aeration), and disinfection. Sludge is treated by thickening using centrifuges and anaerobic digestion prior to off-site transportation to a landfill for disposal. It serves an area of 15,656 acres and a population of 1.1 million spread throughout portions of south and eastern midtown Manhattan, northeast Brooklyn, and western Queens. The Newtown Creek WWTP is designed to receive a maximum wet-weather flow of 700 MGD (more than 2xDDWF of 620 MGD), all of which receive secondary treatment and disinfection.

2.2 Waterbody Characteristics

This section of the report describes the features and attributes of Newtown Creek. Characterizing the features of the waterbody is important for assessing the impact of wet-weather inputs and creating approaches and solutions that mitigate the impact from wet-weather discharges.

2.2.a Description of Waterbody

Newtown Creek is a saline waterbody located between Brooklyn and Queens, New York. Newtown Creek is tributary to the Lower East River, and the East River is tributary to the Upper New York Bay. Water quality in Newtown Creek is influenced by CSO, stormwater discharges and dry-weather sources. The following section describes the present-day physical and water quality characteristics of Newtown Creek, along with its existing uses.

2.2.a.1 Current Waterbody Classification(s) and Water Quality Standards

New York State Policies and Regulations

In accordance with the provisions of the CWA, the State of New York has established WQS for all navigable waters within its jurisdiction. The State has developed a system of waterbody classifications based on designated uses that include five classifications for saline waters. DEC considers the Class SA and Class SB classifications to fulfill the CWA goals. Classes SC, I, and SD support aquatic life and recreation, but the primary and secondary recreational uses of the waterbody are limited due to other factors. Class I best uses are aquatic life protection, as well as secondary contact recreation. Class SD waters best uses are fish, shellfish, and wildlife survival. DEC has classified Newtown Creek as a Class SD waterbody.

Numerical standards corresponding to these waterbody classifications are shown in Table 2-9. The water quality criteria for DO are the numerical standards that DEC uses to establish whether a waterbody supports aquatic life uses. The water quality criteria for total and fecal coliform bacteria concentrations are the numerical criteria that DEC uses to establish whether a waterbody supports recreational uses. In addition to numerical standards, NYS has narrative criteria to protect aesthetics in all waters within its jurisdiction, regardless of classification (see Section 1.2.c.). As indicated in Table 2-9, these narrative criteria apply to all five classes of saline waters. Narrative water quality criteria are presented in Table 2-10.

Although not yet promulgated by DEC, DEC considers the enterococci criterion of 35 cfu/100mL listed in Table 2-9 as an enforceable standard for coastal recreational waters that have designated recreational uses in NYS, because EPA established recommended Recreational Water Quality Criteria in 2012 (2012 RWQC) for all coastal recreational waters with designated recreational uses. According to DEC's interpretation of the Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000, the 2012 RWQC would apply on a 30-day moving geometric mean (GM) basis during the recreational season (May 1st through October 31st). Newtown Creek waters are not considered coastal recreational waters; therefore, the 2012 RWQC enterococci criterion does not apply under current water quality classifications.

Currently, DEC is conducting its federally mandated "triennial review" of the NYS WQS, which States are required to perform every three years. DEC is in the pre-public proposal phase of this rule, and DEC staff is considering a wide range of revisions/additions to WQS regulations. DEC has indicated that it intends to establish the 2012 RWQC enterococci criterion as a promulgated standard through formal rulemaking.

Table 2-9. New York State Numerical Surface WQS (Saline)

Class	Usage	Dissolved Oxygen (mg/L)	Total Coliform (cfu/100mL)	Fecal Coliform (cfu/100mL)	Enterococci (cfu/100mL)(7)
SA	Shellfishing for market purposes, primary and secondary contact recreation, fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥ 4.8(1) ≥3.0(2)	≤ 70(3)	N/A	
SB	Primary and secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥4.8(1) ≥3.0(2)	≤ 2,400(4) ≤ 5,000(5)	≤ 200(6)	≤ 35(8)
SC	Limited primary and secondary contact recreation, fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥4.8(1) ≥3.0(2)	≤ 2,400(4) ≤ 5,000(5)	≤ 200(6)	N/A
I	Secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥ 4.0	≤ 2,400(4) ≤ 5,000(5)	≤ 200(6)	N/A
SD	Fishing. Suitable for fish, shellfish and wildlife survival. Waters with natural or man-made conditions limiting attainment of higher standards.	≥ 3.0	≤ 2,400(4) ≤ 5,000(5)	≤ 200(6)	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 the formula:

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

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.,

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

(2) Acute standard (never less than 3.0 mg/L).
(3) Colony forming unit per 100mL 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.
(7) DEC considers this criterion, although not promulgated by DEC, to be an enforceable standard in New York State for all coastal recreational waters with designated recreational uses.
(8) 30-day moving geometric mean promulgated by the EPA BEACH Act of 2000 that is only applicable to coastal recreational waters with designated recreational uses.

Table 2-10. New York State Narrative WQS

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 waste 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 waste 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.

Interstate Environmental Commission (IEC)

The States of New York, New Jersey, and Connecticut are signatories to the Tri-State Compact that designated the Interstate Environmental District and created the IEC. The IEC includes all saline waters of greater NYC. Newtown Creek is an interstate water and is regulated by IEC as Class B-2 waterbody. Numerical standards for IEC-regulated waterbodies are shown in Table 2-11, while narrative standards are shown in Table 2-12.

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. IEC effluent quality regulations do not apply to CSOs if the combined sewer system is being operated with reasonable care, maintenance, and efficiency. Although IEC regulations are intended to be consistent with State WQS, the three-tiered IEC system and the five NYS saline classifications in New York Harbor do not spatially overlap exactly.

Table 2-11. IEC Numeric WQS

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 River, east of the Whitestone Bridge; Hudson River north of confluence with the Harlem River; Raritan River east of the Victory Bridge 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 River, south of confluence with Harlem River; upper New York Harbor; East River from the Battery to the Whitestone Bridge; Harlem River; 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; Newtown Creek

Table 2-12. IEC 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.

EPA Policies and Regulations

New York City Department of Health and Mental Hygiene (DOHMH) regulates the operation of bathing beaches in New York City. Newtown Creek has no areas designated by DOHMH as bathing areas.

For non-designated beach areas of primary contact recreation that are used only infrequently for primary contact, the EPA has established an enterococci reference level of 501 cfu/100mL as indicative of pollution events.

According to EPA documents, these reference levels are not binding regulatory criteria; rather, they are to be used by the State agencies in making decisions related to recreational uses and pollution control needs. For bathing beaches, these reference levels are to be used for announcing beach advisories or beach closings in response to pollution events. No areas of the Newtown Creek shoreline are authorized by the DOHMH for bathing.

In December 2012, the EPA released RWQC recommendations that are designed to protect human health in coastal and non-coastal waters designated for primary recreational use. These recommendations were based on a comprehensive review of research and science that evaluated the link between illness and fecal contamination in recreational waters. The recommendations are intended as guidance to States, territories, and authorized tribes in developing or updating WQS to protect swimmers from exposure to pathogens found in water with fecal contamination.

The 2012 RWQC recommends two sets of numeric concentration thresholds, as listed in Table 2-13, and includes limits for both the GM (30-day) and a statistical threshold value (STV) based on exceeding a 90th percentile value associated with the geometric mean. The STV is a new limit, and is intended to be a value that should not be exceeded by more than 10 percent of the samples taken.

Table 2-13. 2012 RWQC Recommendations

Criteria Elements	Recommendation 1 (Estimated Illness Rate 36/1,000)		Recommendation 2 (Estimated Illness Rate 32/1,000)	
Indicator	**GM (cfu/100mL)**	**STV (cfu/100mL)**	**GM (cfu/100mL)**	**STV (cfu/100mL)**
Enterococci (Marine and Fresh)	35	130	30	110
E. coli (Fresh)	126	410	100	320

Based upon its understanding that DEC intends to promulgate EPA's RWQC Recommendation 2, DEP has included the enterococci numerical criteria associated with that Recommendation in its LTCP evaluations for Newtown Creek.

2.2.a.2 Physical Waterbody Characteristics

Newtown Creek is located between northern Brooklyn and southern Queens, NY. It is a saline tributary that runs northwestward and opens into the Lower East River, which opens to the Upper New York Bay. Newtown Creek consists of a main stem and multiple tributaries (Dutch Kills, Whale Creek Canal, and Maspeth Creek) and branches (English Kills and East Branch).

The shoreline is nearly entirely bulkheaded with wood, steel, cement, or stone with some rip-rap protected areas. The land use immediately surrounding the waterbody is primarily industrial.

Newtown Creek is located within the Coastal Zone Boundary as designated by DCP.

Shoreline Physical Characterization

The shorelines of Newtown Creek are composed of a mix of rip-rap, piers and bulkhead, as shown in Figure 2-17. Figures 2-18 and 2-19 show examples of the predominant shoreline characteristics along the Creek.

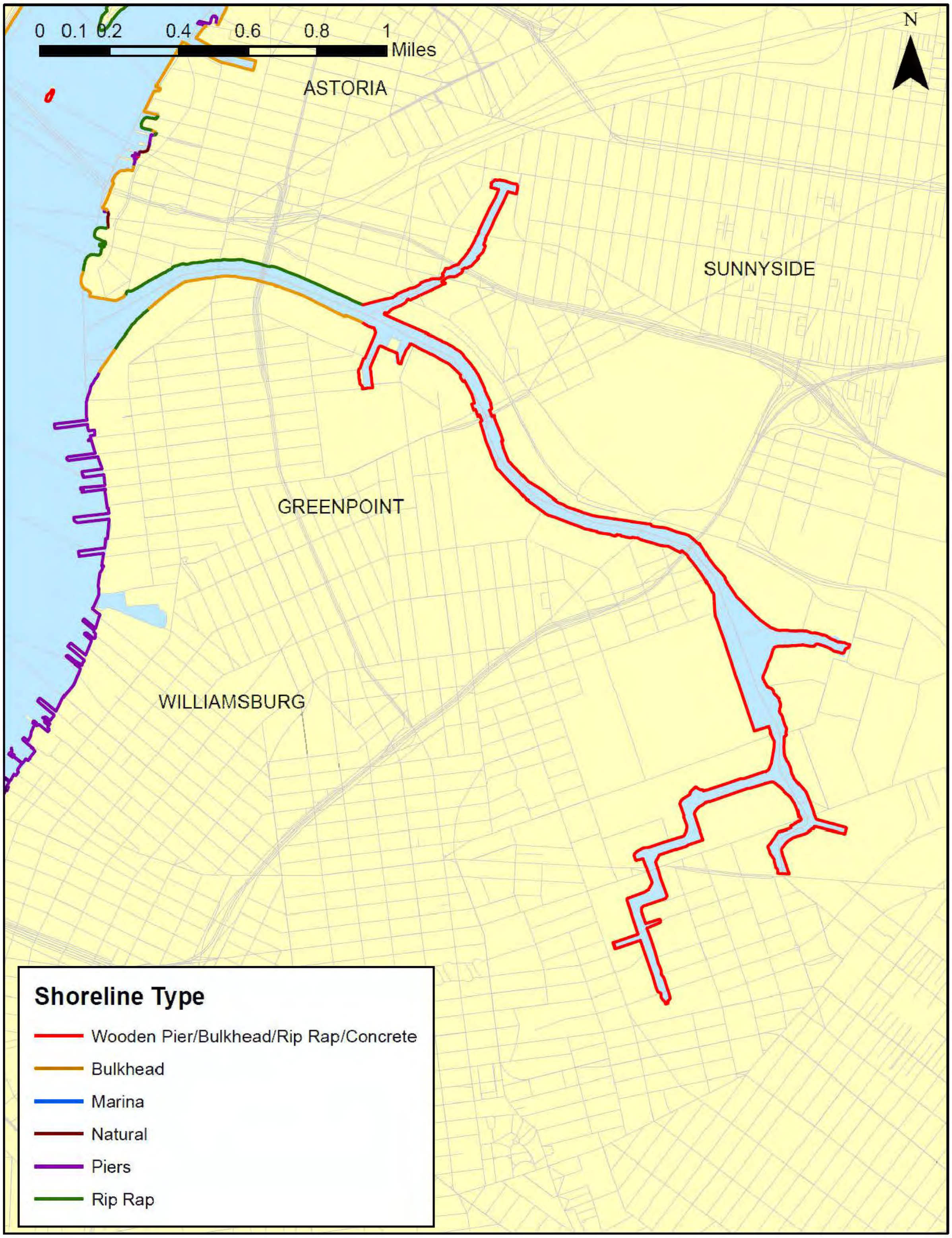

Figure 2-17. Newtown Creek Shoreline Characteristics

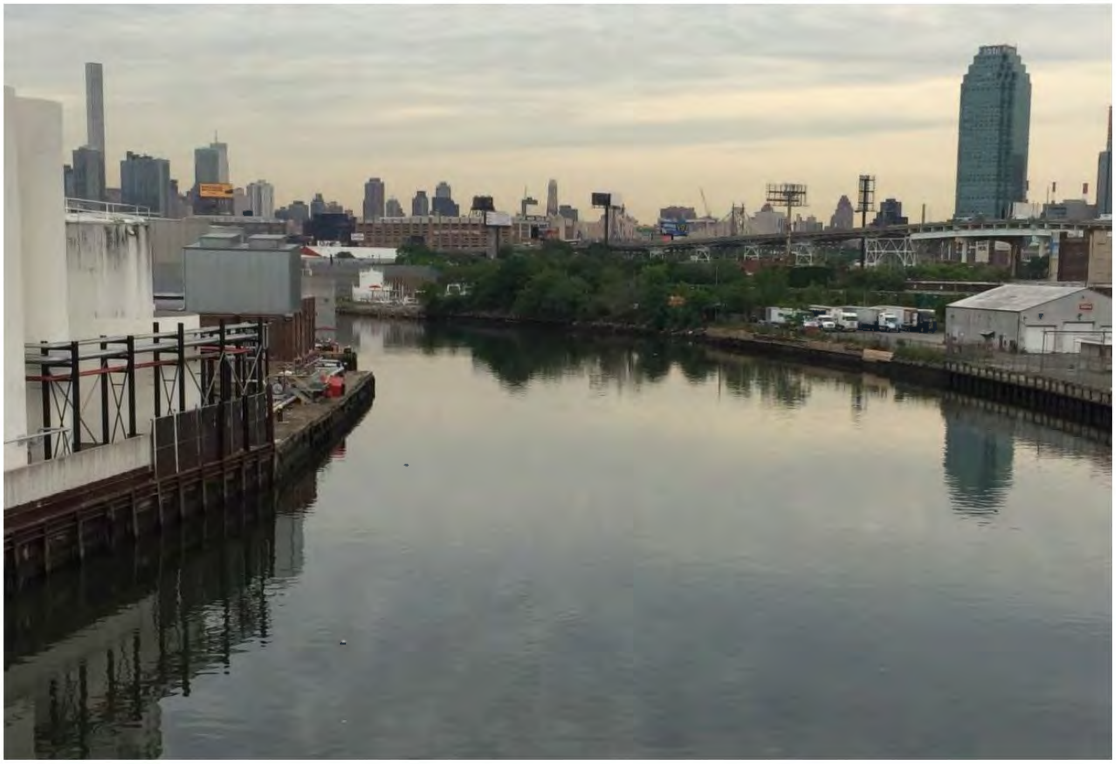

Figure 2-18. Shoreline View of Newtown Creek (Looking Northwest)

Figure 2-19. Bulkheaded Shoreline of Newtown Creek (Looking North)

Shoreline Slope

Shoreline slope has been qualitatively characterized along shoreline banks where applicable, and where the banks are not channelized or otherwise developed with regard to physical condition. "Steep" is defined as greater than 20 degrees, or an 80-foot vertical rise for each 200-foot horizontal distance perpendicular to the shoreline. "Intermediate" is defined as 5 to 20 degrees. "Gentle" is defined as less than 5 degrees, or an 18-foot vertical rise for each 200-foot horizontal distance. The Newtown Creek shoreline is bulkheaded or rip-rap protected throughout most of its extension. There are no significant natural slopes along the Newtown Creek shoreline.

Waterbody Sediment Surficial Geology/Substrata

The grain-size distribution of surface (0-15 cm) sediment in Newtown Creek presents a heterogeneous mixture of clay/silt (<63 μm), sand (63 μm–2 mm), and a few patches with small fractions (up to 10% by mass) of gravel (2 mm–64 mm). Tidal currents in Newtown Creek are very weak and do not have the capacity to transport sand or gravel, so the natural condition of the Creek is a sediment bed dominated by silt and clay. Sand is introduced into the Creek via point-source discharges (CSO, stormwater, and direct drainage) and possibly by the collapse and washout of exposed shoreline. This sand settles to the bed near the source and may dominate the sediment mass distribution locally. Another localized sand source to Newtown Creek appears to be spillage from shoreline industries that store and/or transport sand. These industries are likely also the source of gravel. Because the largest point-source discharges are aggregated near the heads of East Branch and English Kills, surface sediments in these areas tend to have a higher percentage of sand, as much as 80 percent by mass local to the point-source discharges, decreasing to background levels closer to 20 percent farther from the source. Since tidal currents are too weak to appreciably transport sand into Newtown Creek from the East River, the main channel of the Creek from the mouth through the Turning Basin (CM 0–2.7) is dominated (≥ 80% by mass) by silt/clay. However, as already noted, localized sand patches can also occur within this region. The above description is based strictly on available measurements and does not consider insights that may be gained through modeling and/or any further measurement collection, especially in the vicinity of the mouth of Newtown Creek.

Waterbody Type

Newtown Creek is classified as a saline tributary. Wet-weather discharges from CSO and stormwater are the predominant source of freshwater inflows.

Tidal/Estuarine Systems Biological Systems

No tidal/estuarine wetlands reported by the U.S. Fish and Wildlife Service National Wetlands Inventory maps are located in the Newtown Creek study area. The Creek itself has been designated as estuarine, subtidal with an unconsolidated bottom (E1BUL), and the tributaries (English Kills, East Branch, Maspeth Creek and Dutch Kills) have been identified as estuarine, subtidal with an unconsolidated bottom excavated by human activities (EI1BULx).

Freshwater Systems Biological Systems

No NYS regulated freshwater wetlands (i.e., freshwater wetlands greater than 12.4 contiguous acres) are located in the watershed of Newtown Creek.

2.2.a.3 Current Public Access and Uses

Primary contact recreation use (swimming) is not an existing designated use in Newtown Creek. Secondary contact recreation opportunities are also limited, due primarily to access restrictions imposed by the physical characteristics of the shoreline and surrounding land uses. However, four identified access points are located along Newtown Creek as shown in Figure 2-20.

Two of the access points are located at street end parks with the first at Manhattan Avenue on the Brooklyn side (Figure 2-21), and the second at Plank Road on the Queens side of the Creek (Figure 2-22). The boat/kayak launch at the Manhattan Avenue Park is used for recreational activities by different public groups, including the Newtown Creek Alliance (NCA). The North Brooklyn Boat Club accesses the Creek for recreational activities at their boat/kayak launch point on Ash Street and McGuinness Boulevard. Public access is also available from the Newtown Creek WWTP Nature Walk in Brooklyn (Figure 2-23). The Nature Walk consists of a quarter-mile public walkway along the Creek at the tributary Whale Creek.

2.2.a.4 Identification of Sensitive Areas

EPA's CSO Control Policy requires that the LTCP give the highest priority to controlling overflows to sensitive areas. 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;
- Water with primary contact recreation;
- Waters with threatened or endangered species and their habitat; and
- Additional areas determined by the Permitting Authority (i.e., DEC).

General Assessment of Sensitive Areas

The results of the analysis of Newtown Creek for sensitive areas are summarized in Table 2-14. Newtown Creek was targeted for a regional watershed management plan by DEC in 2005. This 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 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; and waterbodies targeted for regional watershed management plans (Newtown Creek and Gowanus Canal). Designation of Newtown Creek as a whole does not assist in prioritizing outfalls or evaluating alternatives to address CSO discharges within the waterbody itself. Therefore, prioritization of outfalls within the waterbody and the selection and implementation of CSO control alternatives can be driven by those alternatives that most reasonably attain maximum benefit to water quality.

Table 2-14. Sensitive Areas Assessment

CSO Discharge Receiving Water Segments	Current Uses Classification of Waters Receiving CSO Discharges Compared to Sensitive Areas Classifications or Designations[1]							
	Outstanding National Resource Water (ONRW)	National Marine Sanctuaries[2]	Threatened or Endangered Species and their Habitat[3]	Best Use - Primary Contact Recreation	Public Water Supply Intake	Public Water Supply Protected Area	Shellfish Bed	Additional Area Determined by Permitting Authority
Newtown Creek	None	None	No	No[4]	None[5]	None[5]	None	Yes[6]

Notes:
(1) Classifications or Designations per EPA CSO Control Policy.
(2) NOAA.
(3) Department of State - Significant Coastal Fish and Wildlife Habitats.
(4) The best usage of Class SD waters is fishing. These waters "shall be suitable for fish, shellfish, and wildlife survival. In addition, the water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for this purpose." (6 NYCRR 701.14)
(5) These waterbodies contain salt water.
(6) Targeted for regional watershed management plan by DEC (2005).

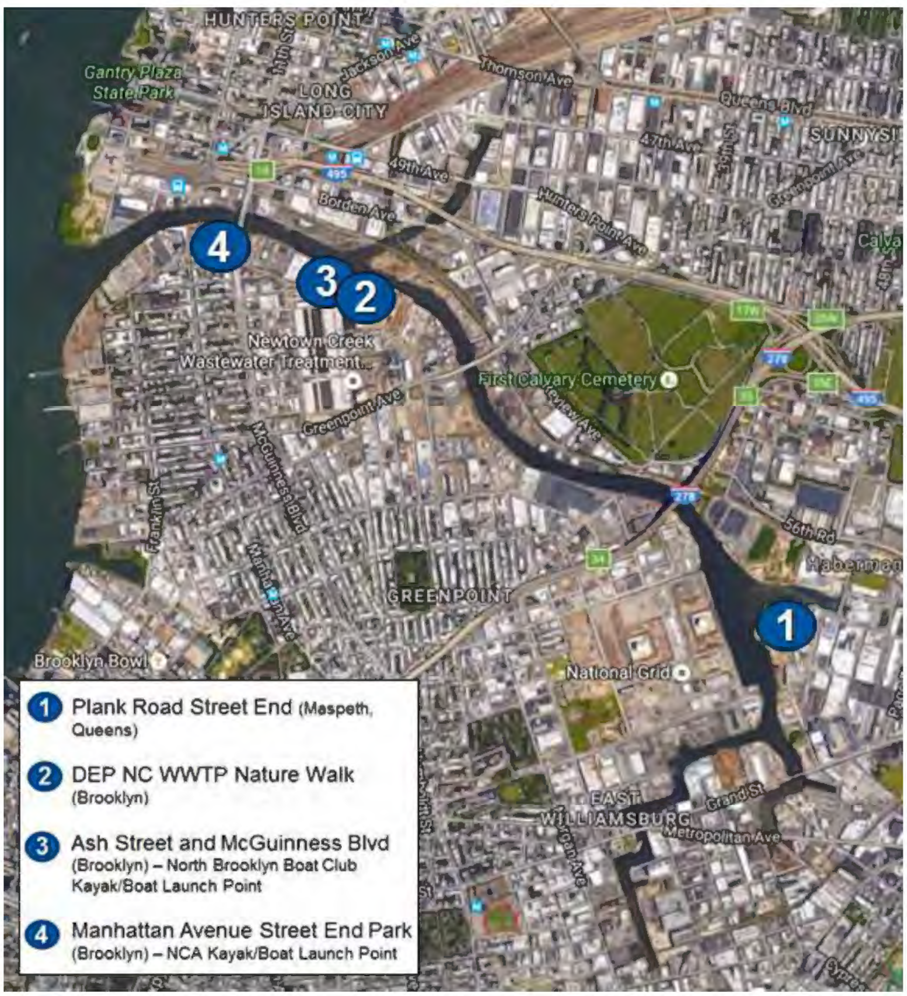

Figure 2-20. Access Points to Newtown Creek

Figure 2-21. Manhattan Avenue Park (NCA Kayak/Boat Launch Point) in Brooklyn

Figure 2-22. Plank Road Street End in Maspeth, Queens

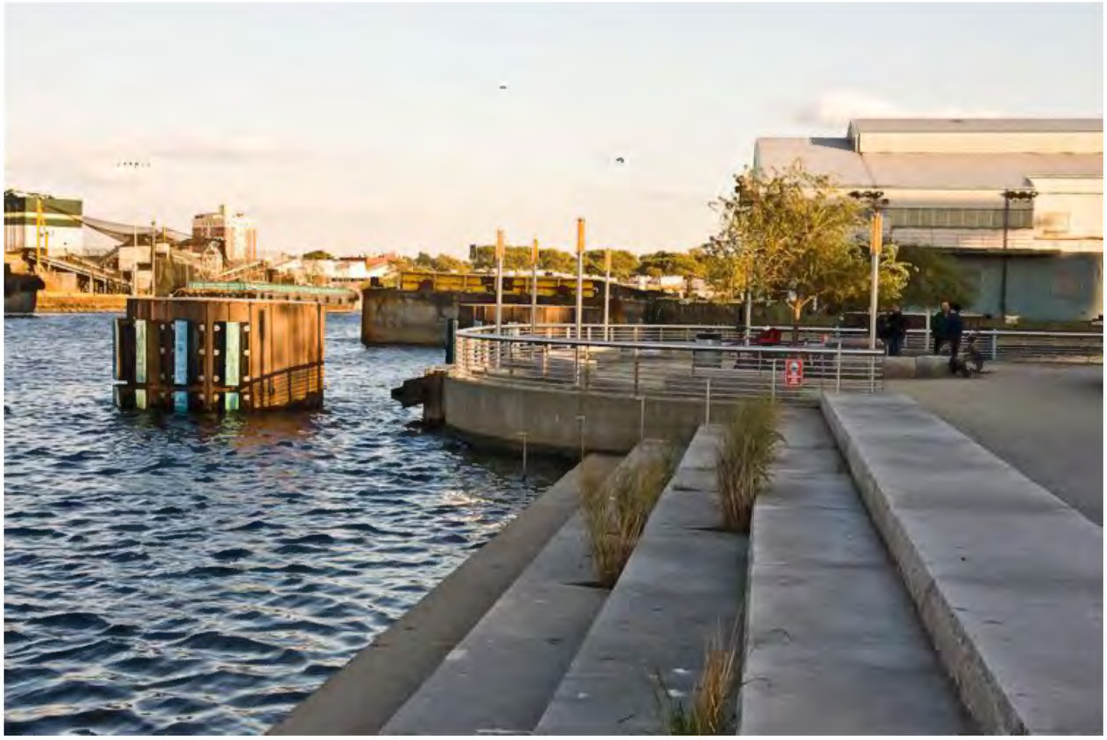

Figure 2-23. Newtown Creek WWTP Nature Walk

2.2.a.5 Tidal Flow and Background Harbor Conditions and Water Quality

DEP has been collecting New York Harbor water quality data since 1909. These data are utilized by regulators, scientists, educators, and citizens to assess impacts, trends, and improvements in the water quality of New York Harbor. The Harbor Survey Monitoring (HSM) Program has been the responsibility of DEP's Marine Sciences Section for the past 27 years. These initial surveys were performed in response to public complaints about quality-of-life near polluted waterways. The initial effort has grown into a survey that consists of 72 stations distributed throughout the open waters of the Harbor and smaller tributaries within NYC. The number of water quality parameters measured has also increased from 5 in 1909, to over 20 today.

Harbor water quality has improved dramatically since the initial surveys. Infrastructure improvements and the capture and treatment of virtually all dry-weather sewage are the primary reasons for this improvement. The LTCP process has begun to focus on those areas that could be improved still further.

The HSM program focuses on the water quality parameters of fecal coliform and enterococci bacteria, DO, chlorophyll 'a', and Secchi disk transparency. HSM data are presented in four sections, each delineating a geographic region within the Harbor. Newtown Creek is located within the Upper New York Bay (HR-Upper New York Bay) section. This area contains 12 open-water monitoring stations and 8 tributary sites. Figure 2-24 shows the location of five HSM tributary stations along or in the vicinity of Newtown Creek: E2, NC0, NC1, NC2, and NC3.

Figure 2-24. Harbor Survey HR-Upper New York Region

Fecal coliform and enterococci are indicators of human waste and pathogenic bacteria. According to the HSM program data (2013 through 2016), fecal coliform geometric means representative of wet- and dry-weather conditions for the period range from 30 cfu/100mL at Station E2 to 1,193 cfu/100mL at Station NC0. The computed enterococci GMs range from 6 cfu/100mL at Station E2 to 167 cfu/100mL at Station NC0.

DO is the oxygen in a waterbody available for aquatic life forms. Hypoxia is a water quality condition associated with low DO, and occurs when DO levels fall below 3.0 mg/L. Throughout recent years, average DO levels have been measured above the compliance requirement of 3.0 mg/L most of the time. However, HSM data does show multiple DO measurements below 3.0 mg/L recorded throughout the extension of Newtown Creek (Stations NC3 to NC1) to the tributary English Kills (Station NC0).

Chlorophyll 'a' is the green pigment in algae and plankton. The amount of chlorophyll 'a' is a gage of primary productivity, which is used to measure ecosystem quality. A concentration of 20 μg/L or above is considered eutrophic. In a state of eutrophication, phytoplankton reproduction rates greatly increase, causing a depletion of DO. Recent chlorophyll 'a' HSM data is not available for Newtown Creek. However, based on LTCP sampling data collected from July 2016 to November 2016, the chlorophyll 'a' concentration in the Creek and its tributaries ranged between 5 μg/L (near the mouth of the Creek) and 12 μg/L (in the tributary Dutch Kills) with an average of 6.7 μg/L. The average chlorophyll 'a' concentration at the mouth of the Creek leading out to the East River was 2 μg/L.

Secchi transparency is a measure of the clarity of surface waters. Clarity is measured as a depth when the Secchi disk blends in with the water. Clarity is most affected by the concentrations of suspended solids and plankton. Lack of clarity limits sunlight, which inhibits the nutrient cycle. The average summer Secchi depth from 2013 throughout 2016 was 3.5 feet for E2, 2.8 feet for NC0, 2.5 feet for NC1, 2.6 feet for NC2, and 2.5 feet for NC3. All stations in Newtown Creek reported a significant number of low transparency values (under 3.0 feet).

DEP has been proactive in identifying and abating illicit connections in the watersheds of NYC. The Sentinel Monitoring program did not identify evidence of illicit connections in Newtown Creek. However, a 2016 flow meter inspection revealed an illicit connection in the Newtown Creek watershed tributary to NCQ-077. As a result of DEP's enforcement actions and issuance of Commissioner's Orders for its removal, the connection was fully abated in December 2016. The owner of the property reconnected the sanitary line to a private manhole that discharges to the sanitary sewer system.

2.2.a.6 Compilation and Analysis of Existing Water Quality Data

Data collected within Newtown Creek from sampling conducted by DEP's HSM program are available from 2013 to 2016, and from extensive sampling conducted from July 2016 through November 2016 to support the Newtown Creek LTCP. The sampling locations of both programs are shown in Figure 2-25.

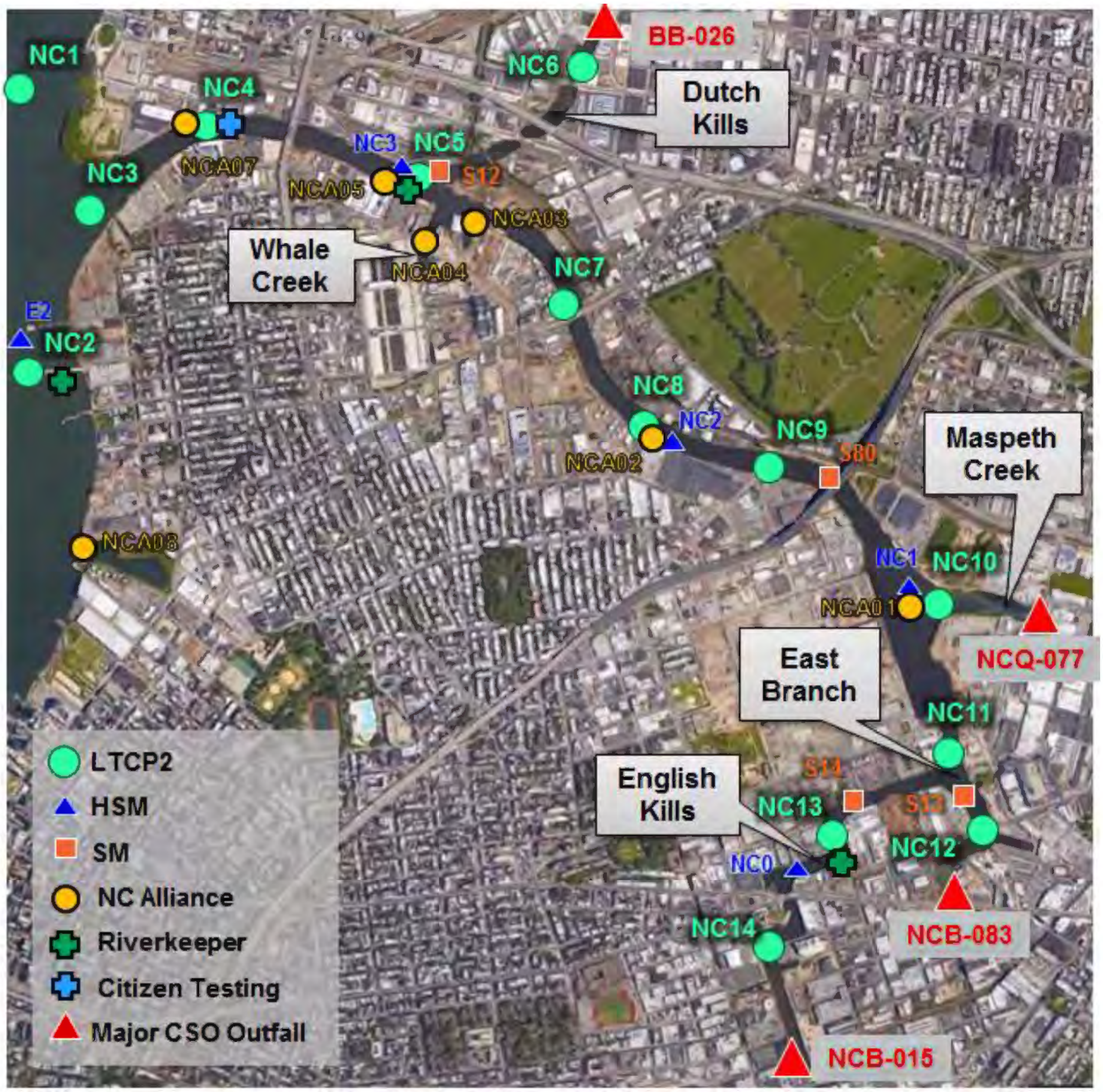

Figure 2-25. LTCP Field Sampling Analysis Program and Harbor Survey Monitoring Program Sampling Locations

Figures 2-26 through 2-30 show the GM of both datasets over the concurrent sampling period along with data ranges (minimum to maximum and 25^{th} percentile to 75^{th} percentile) for fecal coliform and enterococci, respectively. For reference purposes, each figure also shows the monthly GM water quality numerical criterion for the respective pathogen.

Overall, the fecal coliform levels measured throughout the LTCP sampling program result in geometric means indicative of the impacts of both dry- and wet-weather pollution sources on Newtown Creek. As shown in Figure 2-26, the wet-weather geometric means along the extension of Newtown Creek and its tributaries at Stations NC-3 to NC-14 are all above 200 cfu/100mL. Similarly, the dry-weather geometric means at Stations NC-4 to NC-14 are also all above 200 cfu/100mL. The LTCP enterococci data generally follow a similar trend as the fecal coliform data for wet-weather pollution sources, with wet-weather geometric means along the extension of Newtown Creek and its tributaries from Stations NC-4 to NC-14 all above 30 cfu/100mL. As shown in Figure 2-27, wet-weather geometric means are all higher than dry-weather geometric means at each station, with dry-weather geometric means exceeding 30 cfu/100mL only at the station within the Creek tributaries of Dutch Kills (Station NC-6), East Branch (Station NC-12) and English Kills (Stations NC-13 and NC-14).

Please note that the “wet-weather” samples for the LTCP sampling program were taken over a period of three days following a wet-weather event, with the “dry-weather” samples taken on the fourth day following a wet-weather event. When the data from each sampling day are plotted, the elevated dry-weather bacteria concentrations observed in Newtown Creek under the LTCP sampling program appear to be related to a longer than three day time to recover following a wet-weather event, as opposed to being caused by an actual dry-weather source of bacteria.

The HSM wet-weather fecal coliform data presented in Figure 2-28 are also consistent with the LTCP data. The wet-weather geometric means along the extension of the Creek and tributary English Kills from Stations NC-3 to NC-0 are all above 200 cfu/100mL for 2013 through 2016, except for Station NC-3 in 2014. The HSM dry-weather fecal coliform data differed from the LTCP2 data trend with the overall dry-weather geometric means along the Creek from Stations NC-3 to NC-1 below 200 cfu/100mL. However, dry-weather geometric means at Station NC-1 in 2016 and Station NC-0 in the tributary English Kills in 2013, 2014 and 2016 were above 200 cfu/100mL. HSM enterococci data (Figure 2-29) generally showed a similar pattern to the HSM fecal coliform data.

Data collected by the Citizens Testing Group is also made available to the public by the Riverkeeper Group. This dataset is limited to enterococci bacteria concentrations for four sampling stations in Newtown Creek as shown in Figure 2-25. These data are available at the Riverkeeper Group’s website http://www.riverkeeper.org/ and, consistent with the LTCP and HSM data, showed a relationship between wet-weather conditions and higher enterococci concentrations throughout the years 2014, 2015 and 2016.

Figure 2-30 depicts the DO averages derived from the LTCP dataset measured from July to November 2016. The data shows average DO above 4.0 mg/L at all stations. However, DO measurements below 3.0 mg/L were recorded consistently through the lower portion of Newtown Creek (Stations NC-9, NC-10 and NC-11) and in the tributaries Dutch Kills (Station NC-6), East Branch (NC-12), and English Kills (Stations NC-13 and NC-14).

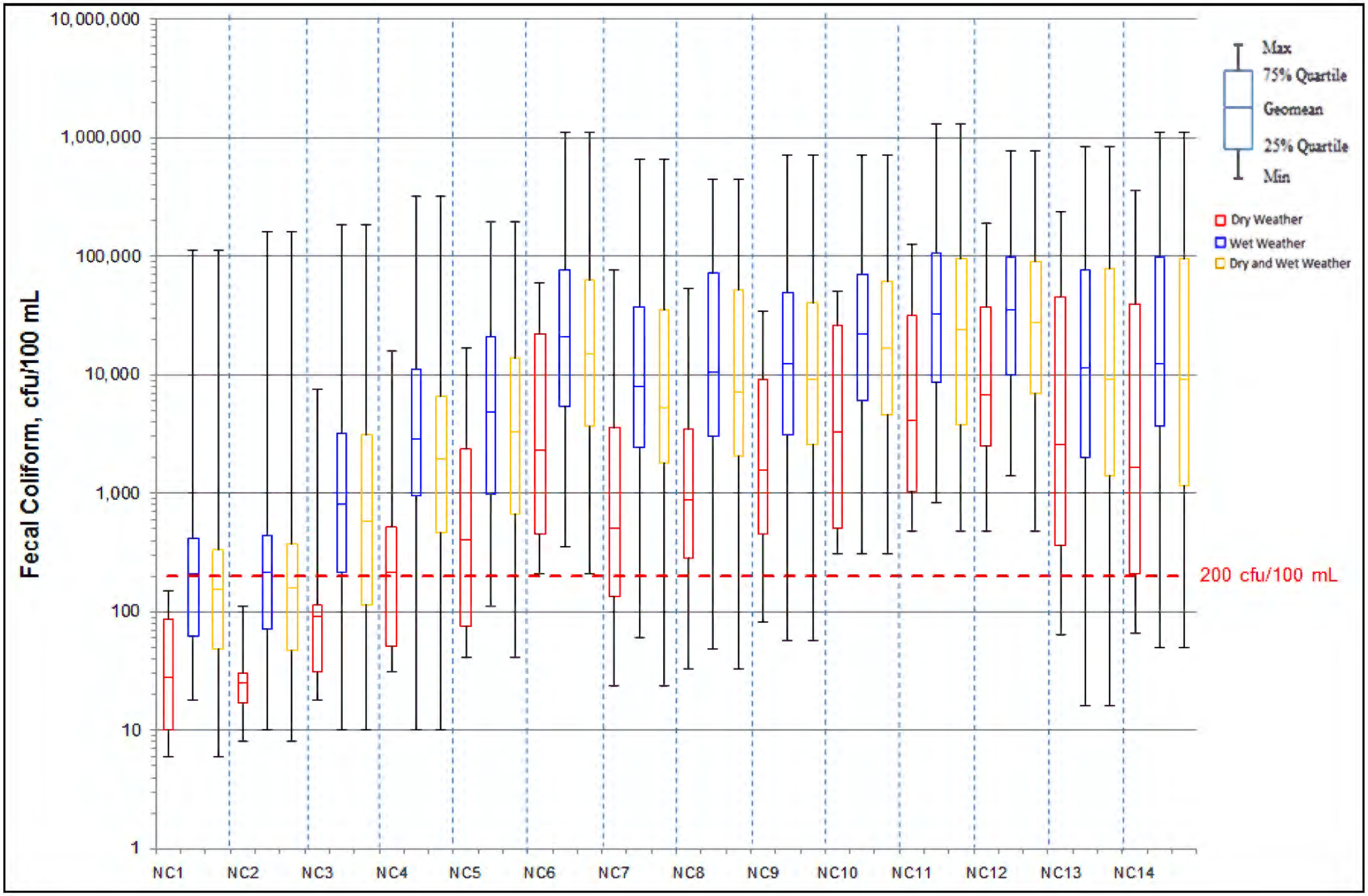

Figure 2-26. Fecal Coliform Concentrations at Newtown Creek LTCP Monitoring Station

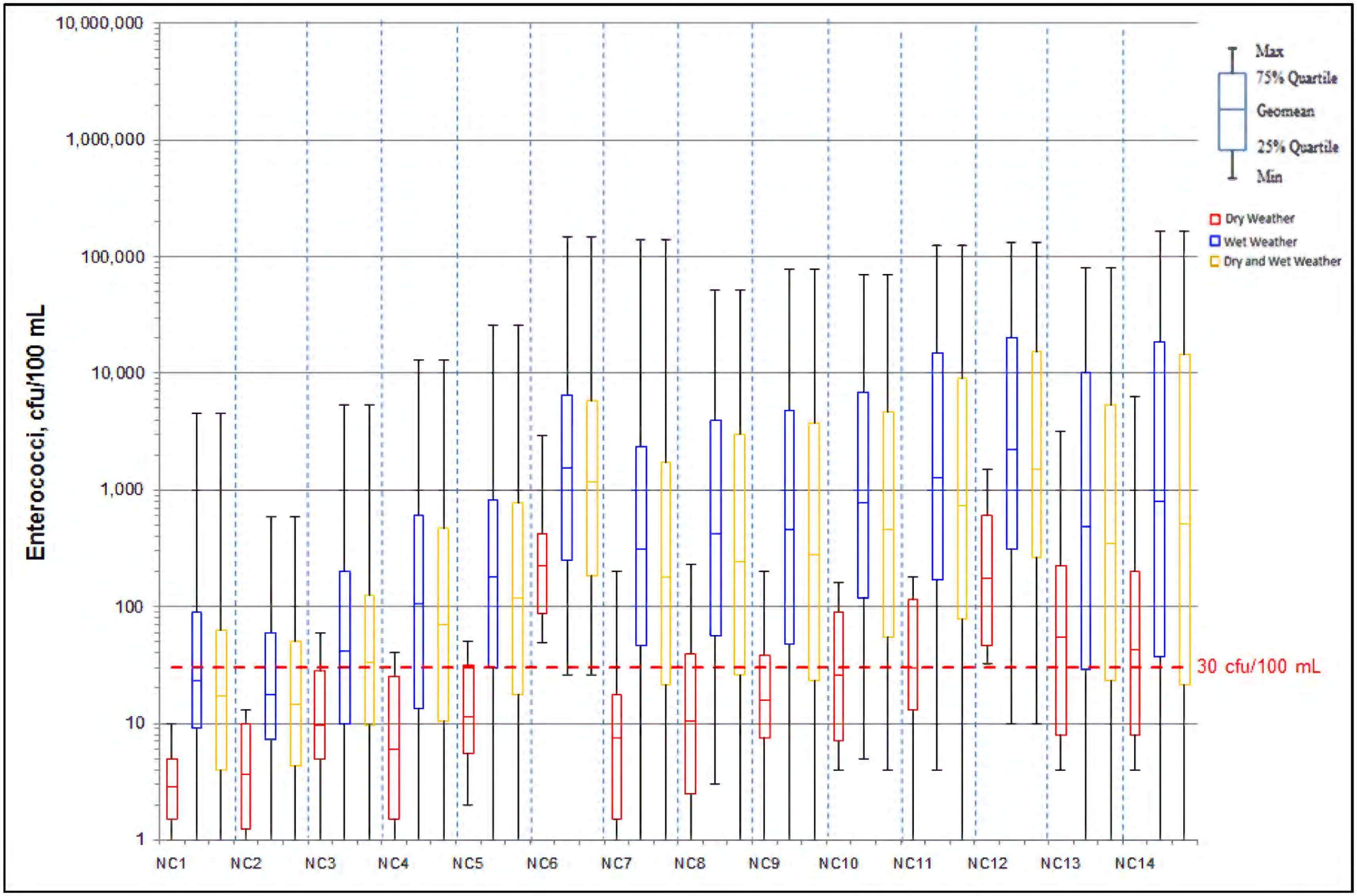

Figure 2-27. Enterococci Concentrations at Newtown Creek LTCP Monitoring Stations

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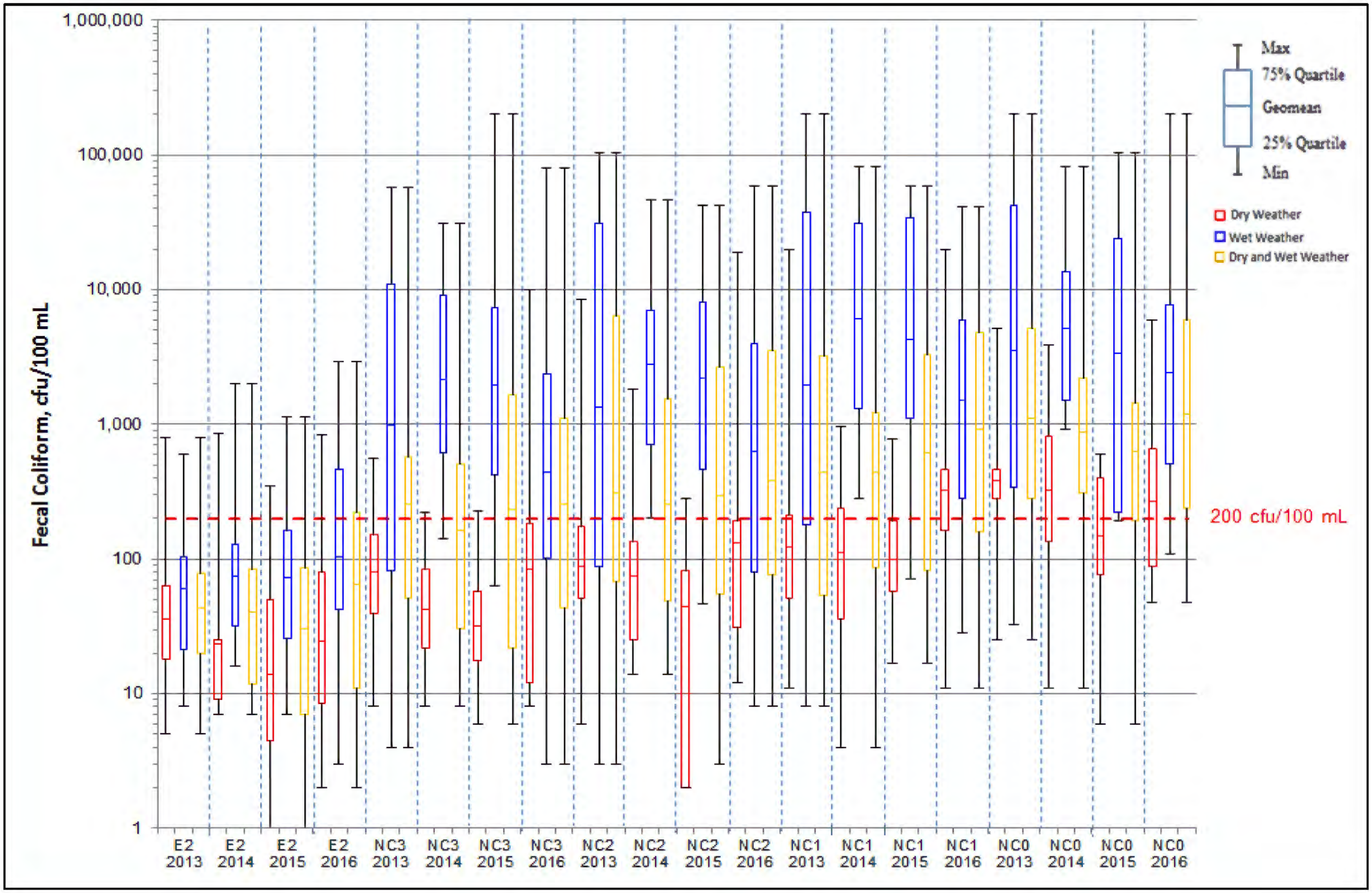

Figure 2-28. Fecal Coliform Concentrations at Newtown Creek Harbor Survey Monitoring Stations

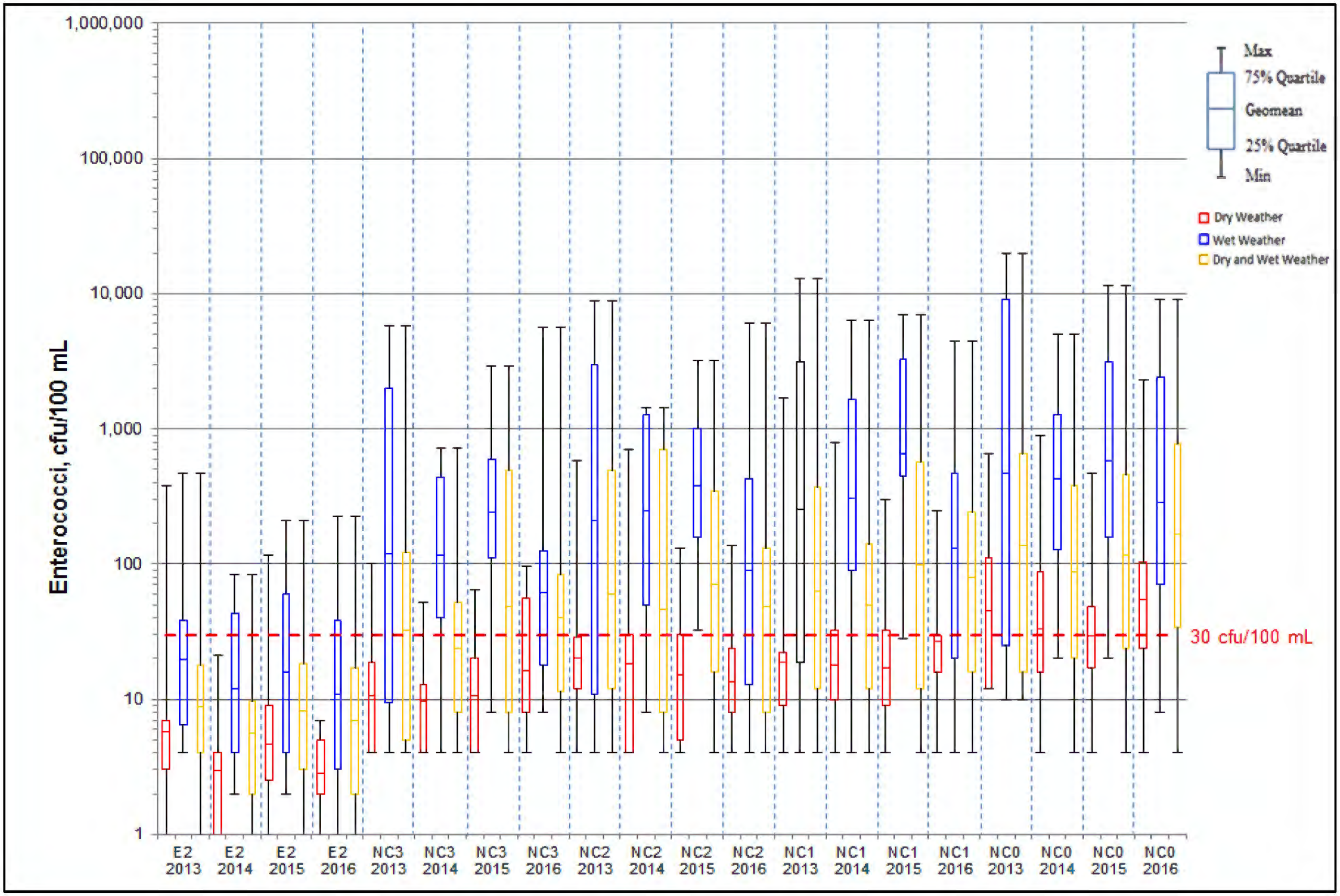

Figure 2-29. Enterococci Concentrations at Newtown Creek Harbor Survey Monitoring Stations

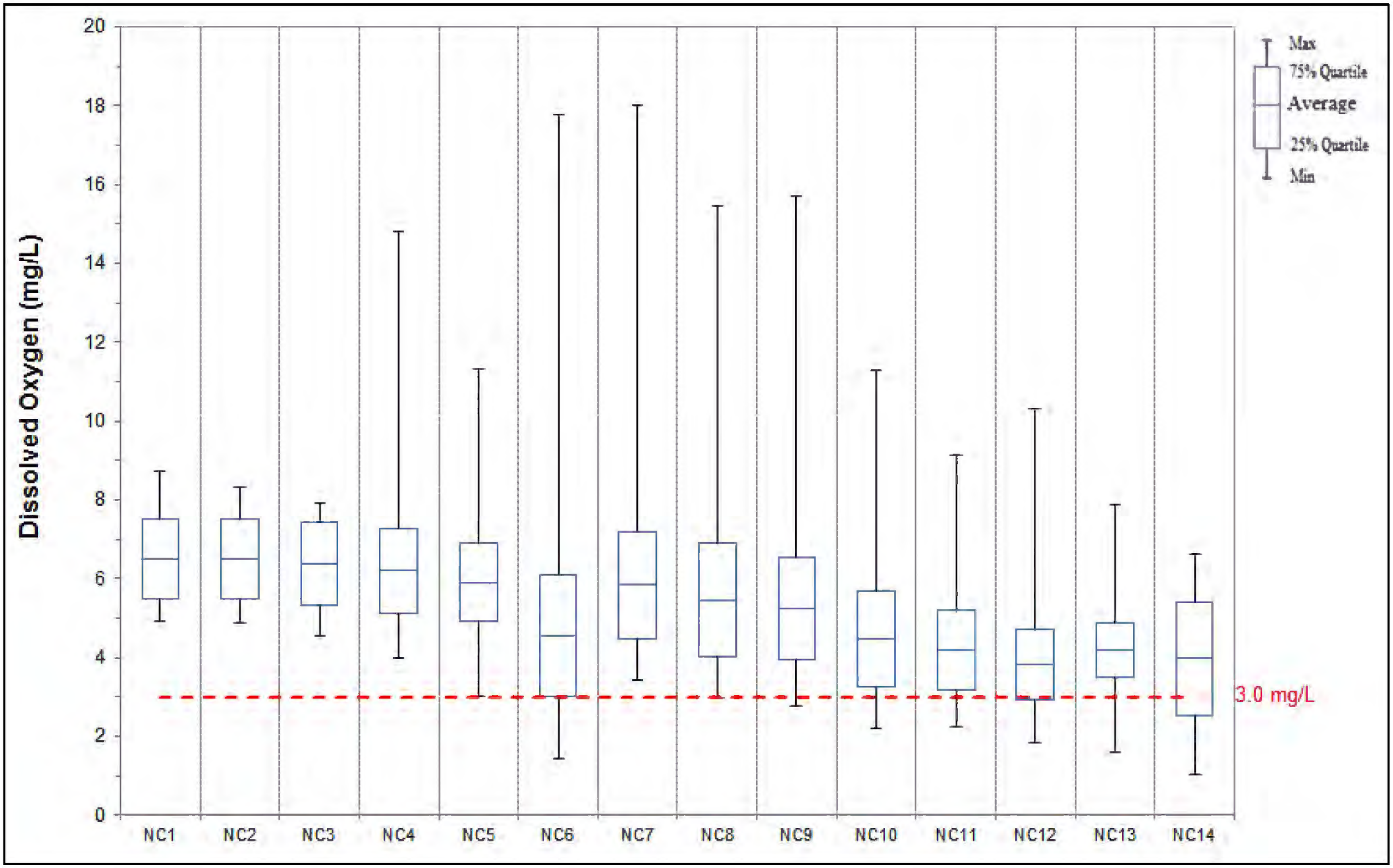

Figure 2-30. DO Concentration at Newtown Creek LTCP WQ Stations (July 2016 – November 2016)

2.2.a.7 Water Quality Modeling

In addition to the collection, compilation, and analysis of measurements described in Section 2.2.a.6, water quality modeling was also used to characterize and assess Newtown Creek water quality. A model computational grid as part of the East River Tributaries Model (ERTM) was used in the LTCP analysis to represent Newtown Creek. The model computational grid, shown in Figure 2-31, was used for LTCP hydrodynamic, pathogens, and dissolved oxygen modeling. The validation of these water quality models using measurements collected during 2014 and 2015 is described in the Newtown Creek LTCP Sewer System and Water Quality Modeling Report (DEP, 2017). The measurements used for model calibration and validation include LTCP, DEP Harbor Survey and Sentinel Monitoring, with wet-weather volumetric loading information from validated IW models. Once calibrated and validated, the water quality models were used to aid in the assessment of water quality benefits associated with LTCP CSO control alternatives, as will be presented in Sections 6 and 8.

Figure 2-31. Computational Grid for Newtown Creek Water Quality Modeling

3.0 CSO BEST MANAGEMENT PRACTICES

As a general matter, CSO BMPs address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO and to reduce contaminants in the combined sewer system, thereby reducing water quality impacts. The SPDES permits for all 14 WWTPs in NYC require DEP to report annually on its progress in implementing the following 13 CSO BMPs:

1. CSO Maintenance and Inspection Program
2. Maximum Use of Collection Systems for Storage
3. Maximize Flow to Publicly Owned Treatment Works (POTW)
4. Wet Weather Operating Plan (WWOP)
5. Prohibition of Dry Weather Flow (DWF)
6. Industrial Pretreatment
7. Control of Floatable and Settleable Solids
8. Combined Sewer Replacement
9. Combined Sewer Extension
10. Sewer Connection and Extension Prohibitions
11. Septage and Hauled Waste
12. Control of Runoff
13. Public Notification

These 13 BMPs are equivalent to the Nine Minimum Controls (NMCs) required under the EPA CSO Control Policy, and were developed by the EPA to represent BMPs that would serve as technology-based CSO controls. The BMPs 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 permittees could implement within two years. EPA developed two guidance manuals that embodied the underlying intent of the NMCs for permit writers and municipalities, offering suggested language for SPDES permits and programmatic controls that could accomplish the goals of the NMCs (EPA, 1995a, 1995b). A comparison of the EPA's NMCs to the 13 SPDES BMPs is shown in Table 3-1.

Table 3-1. Comparison of EPA NMCs with SPDES Permit BMPs

EPA Nine Minimum Controls	SPDES Permit Best Management Practices
NMC 1: Proper Operations and Regular Maintenance Programs for the Sewer System and the CSOs	BMP 1: CSO Maintenance and Inspection Program BMP 4: Wet Weather Operating Plan BMP 8: Combined Sewer Replacement BMP 9: Combined Sewer Extension BMP 10: Sewer Connection and Extension Prohibitions BMP 11: Septage and Hauled Waste
NMC 2: Maximum Use of the Collection System for Storage	BMP 2: Maximum Use of Collection Systems for Storage

Table 3-1. Comparison of EPA NMCs with SPDES Permit BMPs

EPA Nine Minimum Controls	SPDES Permit Best Management Practices
NMC 3: Review and Modification of Pretreatment Requirements to Assure CSO Impacts are Minimized	BMP 6: Industrial Pretreatment
NMC 4: Maximization of Flow to the Publicly Owned Treatment Works for Treatment	BMP 3: Maximize Wet Flow to POTW BMP 4: Wet Weather Operating Plan
NMC 5: Prohibition of CSOs During Dry Weather	BMP 5: Prohibition of Dry Weather Overflow
NMC 6: Control of Solid and Floatable Material in CSOs	BMP 7: Control of Floatables and Settleable Solids
NMC 7: Pollution Prevention	BMP 6: Industrial Pretreatment BMP 7: Control of Floatables and Settleable Solids BMP 12: Control of Runoff
NMC 8: Public Notification to Ensure that the Public Receives Adequate Notification of CSO Occurrences and CSO Impacts	BMP 13: Public Notification
NMC 9: Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls	BMP 1: CSO Maintenance and Inspection Program BMP 5: Prohibition of Dry Weather Overflow BMP 6: Industrial Pretreatment BMP 7: Control of Floatables and Settleable Solids

On May 8, 2014 DEP and DEC entered into the 2014 CSO BMP Order on Consent[1] (2014 CSO BMP Order). The 2014 CSO BMP Order identified certain deliverables and procedures in Appendices A and B that were added to DEP's SPDES permit in October 2015 as "Additional CSO BMP Special Conditions." The SPDES Additional CSO BMP Special Conditions are in addition to the 13 CSO BMPs referenced above and consist of the following:

Additional CSO BMP Special Conditions – Appendix A

- Interceptor Cleaning;
- Management of Interceptor Sewer Physical Assets;
- Interceptor Re-inspection and Cleaning; and
- Data Submission.

Additional CSO BMP Special Conditions – Appendix B

- Maximizing Flow to WWTP;
- Maximizing Flow at WWTP;
- CSO Monitoring and Equipment;
- Wet Weather Operating Plan;
- Event Reporting and Corrective Actions; and
- Hydraulic Modeling Verification.

[1] 2014 CSO BMP Order on Consent, DEC File No. R2-20140203-112.

The City's BMP Annual Report, beginning with calendar year 2016, includes a section on the Additional CSO BMP Special Conditions including Appendix B, Item 5.b., "Key Regulator(s) Monitoring Reporting." That provision requires DEP to submit monthly reports of all known or suspected CSO discharges from key regulators outside the period of a critical wet-weather event, and to submit for DEC approval an engineering analysis of the cause(s) for each discharge and an analysis of options to reduce or eliminate similar future events. These analyses were required to be submitted on a quarterly basis for the first year pursuant to the 2014 CSO BMP Order and annually thereafter with the SPDES Annual BMP Report

This section of the LTCP presents a brief summary of each BMP and its respective relationship to the federal NMCs. A more detailed discussion of CSO BMPs can be found in DEP's Annual BMP Report.

3.1 Collection System Maintenance and Inspection Program

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and the CSOs) and NMC 9 (Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls). Through regularly scheduled inspections of the CSO regulator structures and the performance of required repair, cleaning, and maintenance work, dry-weather overflows and leakage can be prevented and flow to the WWTP can be maximized. 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 events that cause discharge at outfalls during dry-weather; and
- DEC review of inspection program reports.

Details of recent preventative and corrective maintenance reports can be found in the appendices of the BMP Annual Reports.

3.2 Maximizing Use of Collection System for Storage

This BMP addresses NMC 2 (Maximum Use of the Collection System for Storage) and requires cleaning and flushing to remove and prevent solids deposition within the collection system, and an evaluation of hydraulic capacity. These practices enable regulators and weirs to be adjusted to maximize the use of system capacity for CSO storage, which reduces the amount of overflow. In its 2016 BMP Annual Report, DEP describes the status of citywide Supervisory Control and Data Acquisition, regulators, tide gates, interceptors, in-line storage projects, and collection system inspections and cleaning.

Additional data gathered in accordance with the requirements set forth in the Additional CSO BMP Special Conditions, such as CSO monitoring, will be used to verify and/or further calibrate the hydraulic model developed for the CSO LTCPs.

3.3 Maximizing Wet Weather Flow to WWTPs

This BMP addresses NMC 4 (Maximization of Flow to the Publicly Owned Treatment Works for Treatment), and reiterates the operating targets established by the SPDES permits for each WWTP's ability to receive and treat minimum flows during wet-weather. The WWTP must be physically capable of receiving a minimum of 2xDDWF through the plant headworks; a minimum of 2xDDWF through the primary treatment works (and disinfection works, if applicable); and a minimum of 1.5xDDWF through the secondary treatment works during wet-weather. The actual process control set points may be established by the WWOP required in BMP 4.

NYC's WWTPs are physically capable of receiving a minimum of twice their permit-rated design flow through primary treatment and disinfection in accordance with their DEC-approved WWOPs. However, the maximum flow that can reach a particular WWTP is controlled by a number of factors, including: hydraulic capacities of the upstream flow regulators; storm intensities within different areas of the collection system; and plant operators, who can restrict flow using "throttling" gates located at the WWTP entrance to protect the WWTP from flooding and process upsets. DEP's operations staff is trained in how to maximize pumped flows without impacting the treatment process, critical infrastructure, or public safety. For guidance, DEP's operations staff follow their plant's DEC-approved WWOP, which specifies the actual process control set points, including average flow, in accordance with Sections VIII (3) and (4) of the SPDES permits. Analyses presented in the 2016 BMP Annual Report indicate that DEP's WWTPs generally complied with this BMP during 2015.

The Additional CSO BMP Special Conditions have a number of requirements related to maximizing wet-weather flows to WWTPs including, but not limited to:

- An enforceable compliance schedule to ensure that DEP maximizes flow to and through the WWTP during wet-weather events;
- Incorporating throttling protocol and guidance at the WWTPs;
- Updating the critical equipment lists for WWTPs, which includes screening facilities at pump stations that deliver flow directly to the WWTP and at WWTP headworks; and
- Reporting bypasses to DEC.

3.4 Wet Weather Operating Plan

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and the CSOs) and NMC 4 (Maximization of Flow to the Publicly Owned Treatment Works for Treatment). To maximize treatment during wet-weather events, WWOPs were developed for each WWTP sewershed in accordance with the DEC publication entitled *Wet Weather Operating Practices for POTWs with Combined Sewers*. Components of the WWOPs include:

- 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 biochemical nutrient removal (BNR) processes, if required.

DEP has submitted to DEC all WWOPs required by the Additional CSO BMP Special Conditions.

3.5 Prohibition of Dry Weather Overflows

This BMP addresses NMC 5 (Prohibition of CSOs During Dry Weather) and NMC 9 (Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls), and requires that any dry-weather overflow event be promptly abated and reported to DEC within 24 hours. A written report must follow within 14 days and contain the information required by the corresponding SPDES permit. 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 BMP Annual Reports.

Dry-weather overflows from the combined sewer system are prohibited, and DEP's goal is to reduce and/or eliminate dry-weather bypasses.

Specific to Newtown Creek, the 2016 data for regulators and pump stations revealed two dry-weather overflows to Newtown Creek. The first event took place on May 23, 2016 at the NCQ-01 regulator due to a blockage in the opening of the regulator, resulting in a raw sewage bypass of 3,400 gallons. The second event took place on October 8, 2016 where a tipping of Regulator BB-LL-03B occurred due to a contractor's error. Typically, sewage flows from BB-LL-03B to BB-LL-04; however, Regulator BB-LL-04 is under construction. The bulkhead installed by the contractor was not suitable for actual sewer system conditions, and caused the regulator to surcharge and backup in the bypass at Outfall BB-009. This event resulted in a raw sewage bypass of 1,400 gallons.

In addition, as noted in Section 2.0, a 2016 flow meter inspection revealed an illicit connection to Outfall NCQ-077 in the MS4 drainage area tributary. DEP commenced enforcement proceedings, and issued Commissioner's Orders for its removal. As a result, the illicit connection was terminated and properly reconnected to a sanitary sewer on December 16, 2016.

3.6 Industrial Pretreatment Program

This BMP addresses three NMCs: NMC 3 (Review and Modification of Pretreatment Requirements to Assure CSO Impacts are Minimized); NMC 7 (Pollution Prevention); and NMC 9 (Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls). By regulating the discharges of toxic pollutants from unregulated, relocated, or new Significant Industrial Users[2] tributary to CSO outfalls, 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;

[2] Significant Industrial Users are defined by EPA under federal law.

- 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 WWTP over residential/commercial sewersheds.

3.7 Control of Floatables and Settleable Solids

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

- Catch Basin Repair and Maintenance: This practice includes inspection and maintenance as needed to ensure the proper operation of basins.

- Catch Basin Retrofitting: This program is intended to increase the control of floatables and settleable solids citywide, by upgrading obsolete basin designs with contemporary designs that capture street-litter.

- Booming, Skimming and Netting: This practice implements floatables containment systems within the receiving waterbody associated with applicable CSO outfalls. Requirements for system inspection, service, and maintenance are also established.

- Institutional, Regulatory, and Public Education: The report also must include recommendations for alternative NYC programs and an implementation schedule to reduce the water quality impacts of street and toilet litter.

3.8 Combined Sewer Replacement

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer Systems and the CSOs), requiring all combined sewer replacements to be approved by the DOHMH and to be specified within DEP's Master Plan for Sewage and Drainage. Whenever possible, separate sanitary and storm sewers should be used to replace combined sewers. Each BMP Annual Report describes the citywide plan, and addresses specific projects occurring in the reporting year.

No projects are reported for the Bowery Bay WWTP and Newtown Creek WWTP sewersheds in the 2016 BMP Annual Report.

3.9 Combined Sewer Extension

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and the CSOs). To minimize stormwater 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, analyses must be performed to demonstrate 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. As reported in the 2016 BMP Annual Report, DEP constructed two private sewer extensions in 2016.

3.10 Sewer Connection & Extension Prohibitions

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and the CSOs). If there are documented recurrent instances of either sewer back-ups or manhole overflows. DEP must, upon letter notification from DEC, prohibit sewer connections and extensions that would exacerbate any surcharging or backup issues. Wastewater connections to the combined sewer system downstream of the last regulator or diversion chamber are also prohibited. Each BMP Annual Report includes a status report for this BMP and provides details pertaining to any recurrent sewer back-ups and manhole overflow notifications submitted to DEC. For the calendar year 2016, conditions did not require DEP to prohibit additional sewer connections or sewer extensions.

3.11 Septage and Hauled Waste

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and the CSOs). The discharge or release of septage or hauled waste upstream of a CSO outfall (e.g., scavenger waste) is prohibited under this BMP. Scavenger wastes may only be discharged at designated manholes that never drain into a CSO outfall, and only with a valid permit. The 2008 BMP Annual Report summarizes the three scavenger waste acceptance facilities controlled by DEP, and the regulations governing discharge of such material at the facilities. The facilities are located in the Hunts Point, Oakwood Beach, and 26th Ward WWTP sewersheds. The program remained unchanged through the 2016 BMP Annual Report.

3.12 Control of Runoff

This BMP addresses NMC 7 (Pollution Prevention) 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.

A rule to “reduce the release rate of storm flow from new developments to 10 percent of the drainage plan allowable or 0.25 cfs per impervious acre, whichever is higher (for cases when the allowable storm flow is more than 0.25 cfs per impervious acre),” was promulgated on January 4, 2012, and became effective on July 4, 2012.

3.13 Public Notification

BMP 13 addresses NMC 8 (Public Notification to Ensure that the Public Receives Adequate Notification of CSO Occurrences and CSO Impacts), as well as NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and the CSO outfalls) and NMC 9 (Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls).

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 allows the DOHMH to implement and manage the notification program. Accordingly, the Wet Weather Advisories, Pollution Advisories and Closures are tabulated for all NYC public and private beaches. There are no bathing beaches in or near Newtown Creek.

3.14 Characterization and Monitoring

Previous studies have characterized and described the Bowery Bay WWTP collection system, the Newtown Creek WWTP collection system, and the water quality for Newtown Creek (see Chapters 3 and 4 of the Newtown Creek WWFP, 2011). Additional data were collected and are analyzed in this LTCP (see Section 2.2). Continued monitoring occurs under a variety of DEP initiatives, such as floatables monitoring programs and the DEP Harbor Monitoring Survey, and is reported in the BMP Annual Reports under SPDES BMPs 1, 5, 6 and 7, as described above.

The Additional CSO BMP Special Conditions, described above, require future monitoring to include the installation of CSO monitoring equipment (Doppler sensors in the telemetry system and inclinometers where feasible) at key regulators for the purpose of detecting CSO discharges, which DEP completed in accordance with the 2014 CSO BMP Consent Order. Following installation of the CSO monitoring equipment, and as described at the beginning of this section, monthly reports of all known or suspected CSO discharges from key regulators outside the period of a critical wet-weather event, have been submitted to DEC in accordance with the 2014 CSO BMP Consent Order, as have been required quarterly reports and, beginning in 2016, an annual report summarizing one year of known or suspected CSO discharges, describing the cause of each, and providing options to reduce or eliminate similar future events, together with an implementation schedule. See Appendix B to the 2014 CSO BMP Consent Order, Items 3(a) and (b); 5(b).

In addition, on February 1, 2016, DEP complied with its Regulator(s) with CSO Monitoring Equipment Identification Program Reporting requirement. See Additional CSO BMP Special Conditions, Appendix B Item 5(c). That report identified three Category A early tipping regulators (BBL-04, NCB-01, and NCQ-01) in Newtown Creek with known or suspected discharges outside the period of a critical wet-weather event. Regulators BBL-04 and NCB-01 were noted as key regulators, meaning that they are within close proximity to bathing beaches. All three Category A regulators have planned bending weir and underflow baffles installations expected to be completed by December 2017 (see Section 4.0 for further details). The evaluation of CSO control alternatives and selection of the LTCP Recommendation will both consider and seek to address these “early tipping” discharges from those three regulators.

3.15 CSO BMP Report Summaries

In accordance with the SPDES permit requirements, annual reports summarizing the citywide implementation of the 13 BMPs and Additional CSO BMP Special Conditions described above are submitted to DEC. To-date, DEP has submitted 14 annual reports, covering calendar years 2003 through 2016. The 2016 BMP Annual Report is divided into 15 sections, one for each of the BMPs in the SPDES permits, one section for Characterization and Monitoring, and one section for the SPDES Permit Additional CSO BMP Special Conditions. Each section of the Annual BMP Report describes ongoing DEP programs, provides statistics for initiatives occurring during the preceding calendar year, and discusses overall environmental improvements.

4.0 GREY INFRASTRUCTURE

4.1 Status of Grey Infrastructure Projects Recommended in Facility Plans

CSO planning for Newtown Creek began via the Newtown Creek Water Quality Facility Planning Project, initiated in 1990. This planning focused on quantifying and assessing the impacts of CSO discharges to Newtown Creek and its tributaries. Based on conclusions of this initial study, additional studies and work tasks were recommended, including an aeration pilot model study, a dredging feasibility study, and a subsurface investigation. Numerous project reports were submitted to describe these additional studies with a Final Facility Plan Report submitted to DEC in 2003. A Newtown Creek Waterbody/Watershed Facility Plan Report was subsequently submitted to DEC in June 2011 with the following recommended CSO construction projects:

1. Continued operation of the Brooklyn/Queens PS at up to 400 MGD during wet-weather;
2. Construction of bending weirs at B1 and Q1;
3. Floatables control at or around the four largest CSO outfalls by volume for Newtown Creek; and
4. Construction of Enhanced Zone II Aeration.

4.1.a Completed Projects

Zone I aeration facilities (Contract EK-11) in Newtown Creek were completed in December 2008 and were placed in operation in 2009. The Lower English Kills aeration as part of Zone II (Contract CSO-NC-2) was also completed in January 2014 and placed into operation annually from May 15th – September 30th.

4.1.b Ongoing Projects

All four projects recommended in the Newtown Creek WWFP Report have moved forward and are ongoing. It should be noted that the recommendation for the construction of bending weirs at B1 and Q1, and the recommendation for floatables control at or around the four largest outfalls, were combined and modified during the design phase of these projects following the WWFP Report. The new recommendation following the design phase includes the construction of bending weirs and underflow baffles for floatables control at all four outfall locations: B1, Q1, B2, and L4. Below is a brief summary of each project: B-01 (NCB-015), NCQ-01 (NCQ-077), NCB-2 (NCB-083), and BB-L4 (BB-026).

1. Brooklyn/Queens PS at Newtown Creek WWTP

   - *Project Summary*: The project aims to minimize CSOs and their associated water quality impacts in Newtown Creek by maximizing the proportion of flow to the Newtown Creek WWTP from the Brooklyn and Queens collection systems. Consistent with the May 2011 Newtown Creek WWTP WWOP, the Brooklyn/Queens PS continues to pump up to 400 MGD of flow to the plant during wet-weather events. The Brooklyn/Queens PS upgrade in 2013 included five new Main Sewage Pumps (MSPs), a headworks upgrade and odor control. See Figure 4-1 for further information.

Status: A substantial part of the project was completed in 2013. The MSPs had a manufacturing defect that limited full pump capacity. The manufacturer developed an acceptable repair method to correct the issue and will have all pumps restored by December 2017.

Figure 4-1. Brooklyn/Queens Pumping Station at Newtown Creek WWTP

2. Bending Weir and Underflow Baffles Installations

- *Project Summary*: Initially split into two projects, the bending weir and underflow baffle installations will provide an annual volume reduction of 62 million gallons and floatables control within Newtown Creek. The regulator sites are tied to the four largest CSO outfalls by volume for Newtown Creek: B-01 (NCB-015), NCQ-01 (NCQ-077), NCB-2 (NCB-083), and BB-L4 (BB-026). See Figure 4-2 for further information.

  Status: Construction is scheduled to be completed by December 2017.

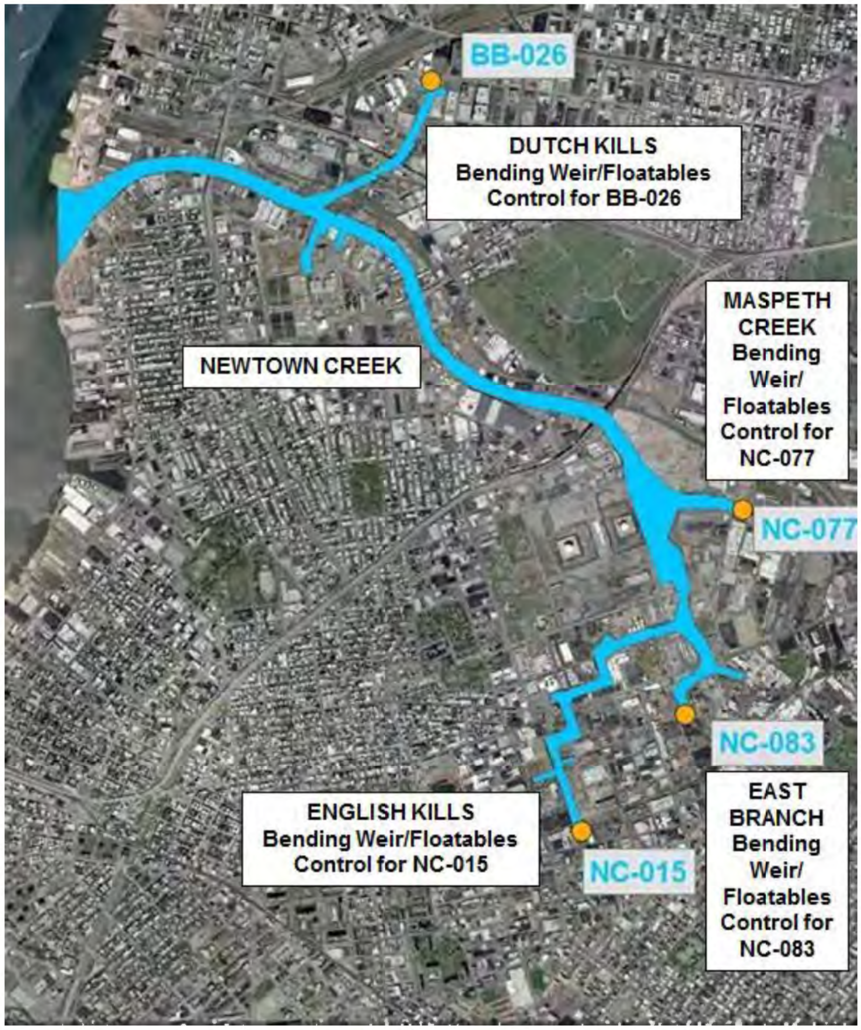

Figure 4-2. Newtown Creek Bending Weir and Underflow Baffles Improvements

3. In-Stream Aeration Projects

- *Project Summary*: This project involved installation of coarse bubble diffusers along the bottom of Newtown Creek, with the intent of improving the DO concentration within the Creek. The goal for the aeration system was to raise the DO concentration in Newtown Creek above 1.0 mg/L and control hydrogen sulfide production. Newtown Creek was divided into two zones for the planned aeration facilities installations: Zone I includes an aeration facility in the Upper English Kills; and Zone II includes aeration in Lower English Kills, East Branch, and Dutch Kills. The planned in-stream aeration projects are depicted in Figure 4–3.

  Status: Zone I aeration facilities in Upper English Kills (Contract EK-11) were completed in December 2008 and were placed in operation in 2009. The Lower English Kills aeration as part of Zone II (Contract CSO-NC-2) was completed in January 2014 and is operated Online annually from May 15th – September 30th. The East Branch aeration as

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part of Zone II (Contract CSO-NC-3) is scheduled for completion in June 2018. The need for the Dutch Kills aeration project (Contract CSO-NC-4) is being re-evaluated as part of this LTCP.

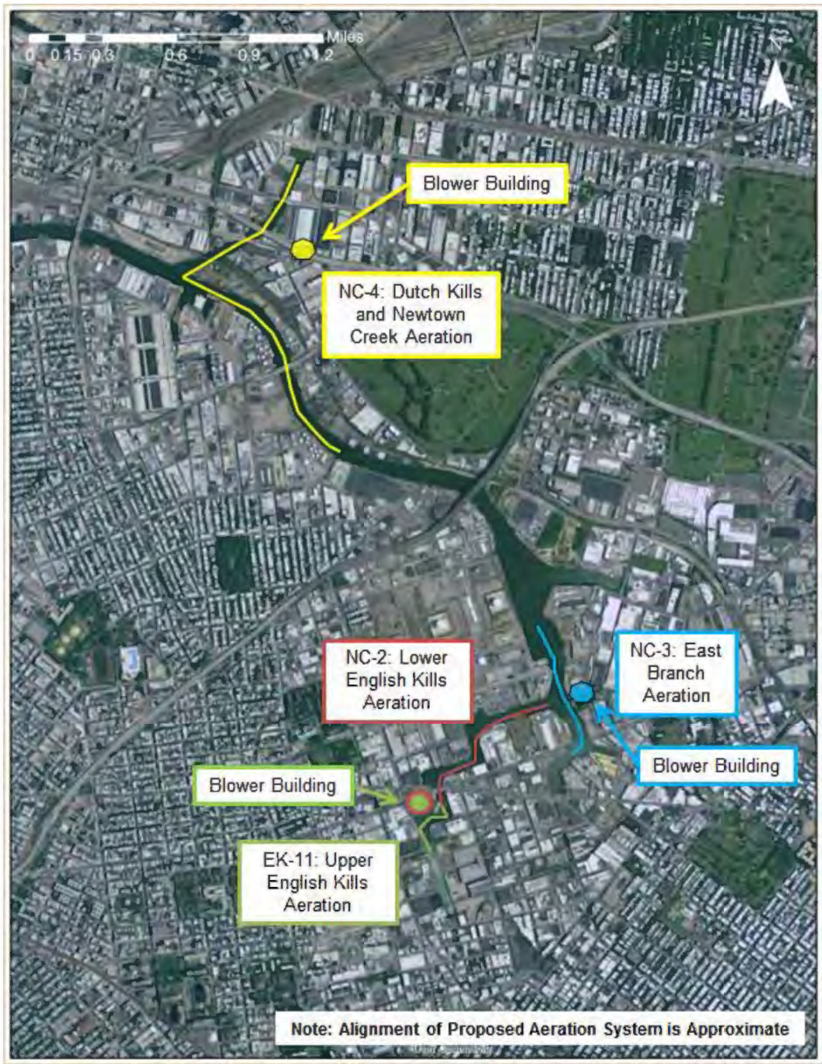

Figure 4-3. In-Stream Aeration in Newtown Creek

4.1.c Planned Projects

DEP proposed a variety of resiliency improvements for the Bowery Bay and Newtown Creek WWTPs and pumping stations within the Newtown Creek sewershed, consistent with the October 2013 NYC Wastewater Resiliency Plan. However, no other CSO-related grey infrastructure projects that target reduction of frequency or amount of CSO are planned beyond those recommended in the June 2011 WWFP. Impacts on the frequency and/or amount of CSO overflows from the proposed WWTP and pumping station improvements will be determined when the specific projects are fully implemented and certified..

4.2 Other Water Quality Improvement Measures Recommended in Facility Plans (Dredging, Floatables, Aeration)

No additional water quality improvement measures were recommended for Newtown Creek. Dredging may reduce the odor and aesthetic issues in portions of Newtown Creek. However, because EPA is currently evaluating dredging alternatives under the Superfund process, DEP did not consider dredging under this LTCP.

4.3 Post-Construction Monitoring

The PCM program is integral to the optimization of the Newtown Creek LTCP, providing data for model validation and feedback on system performance. Each year's data set will be compiled and evaluated to refine the understanding of the impacts of the interaction between Newtown Creek and the actions identified in this LTCP. The ultimate goal is to fully attain compliance with current WQS, or supporting a UAA or variance, if appropriate, if standards cannot be attained. The PCM program contains two basic components:

1. Receiving water data collection in Newtown Creek at the stations of DEP's HSM and Sentinel Monitoring programs; and

2. Modeling the collection system and receiving waters to characterize water quality using the existing InfoWorks CS™ (IW) and ERTM, respectively.

The details provided herein are limited to the Newtown Creek PCM and may be modified as DEP's CSO planning advances through the completion of other LTCPs, including the Citywide LTCP.

PCM in Newtown Creek commenced just prior to the implementation of WWFP elements, and precedes any additional CSO control measures proposed under this LTCP becoming operational. Build-out of GI would be factored into the final scheduling. Monitoring will continue for several years after the controls are in place in order to quantify the difference between the expected and actual performance. Gaps identified by the monitoring program can then be addressed through operations adjustments, retrofitting additional controls, or through the implementation of additional technically feasible and cost-effective alternatives. If it becomes clear that CSO control will not result in full attainment of applicable WQS, DEP will pursue the necessary regulatory mechanism for a UAA or variance, as appropriate.

4.3.a Collection and Monitoring of Water Quality in the Receiving Waters

PCM sampling in the Newtown Creek Stations HSM-NC3, HSM-NC2, HSM-NC1, and HSM-NC0 commenced in 2011. Figure 4-4 shows the locations of LTCP2 PCM Stations. Sampling at all stations related to the Newtown Creek PCM program is typically scheduled monthly in the non-recreational season (November 1st through April 31st) and weekly in the recreational season (May 1st through October 31st). Additional ambient water quality data was also collected in Newtown Creek by the LTCP2 team to calibrate and validate the landside and water quality models. It is anticipated that additional CSO controls identified for implementation as part of this LTCP would require a subsequent PCM program in Newtown Creek.

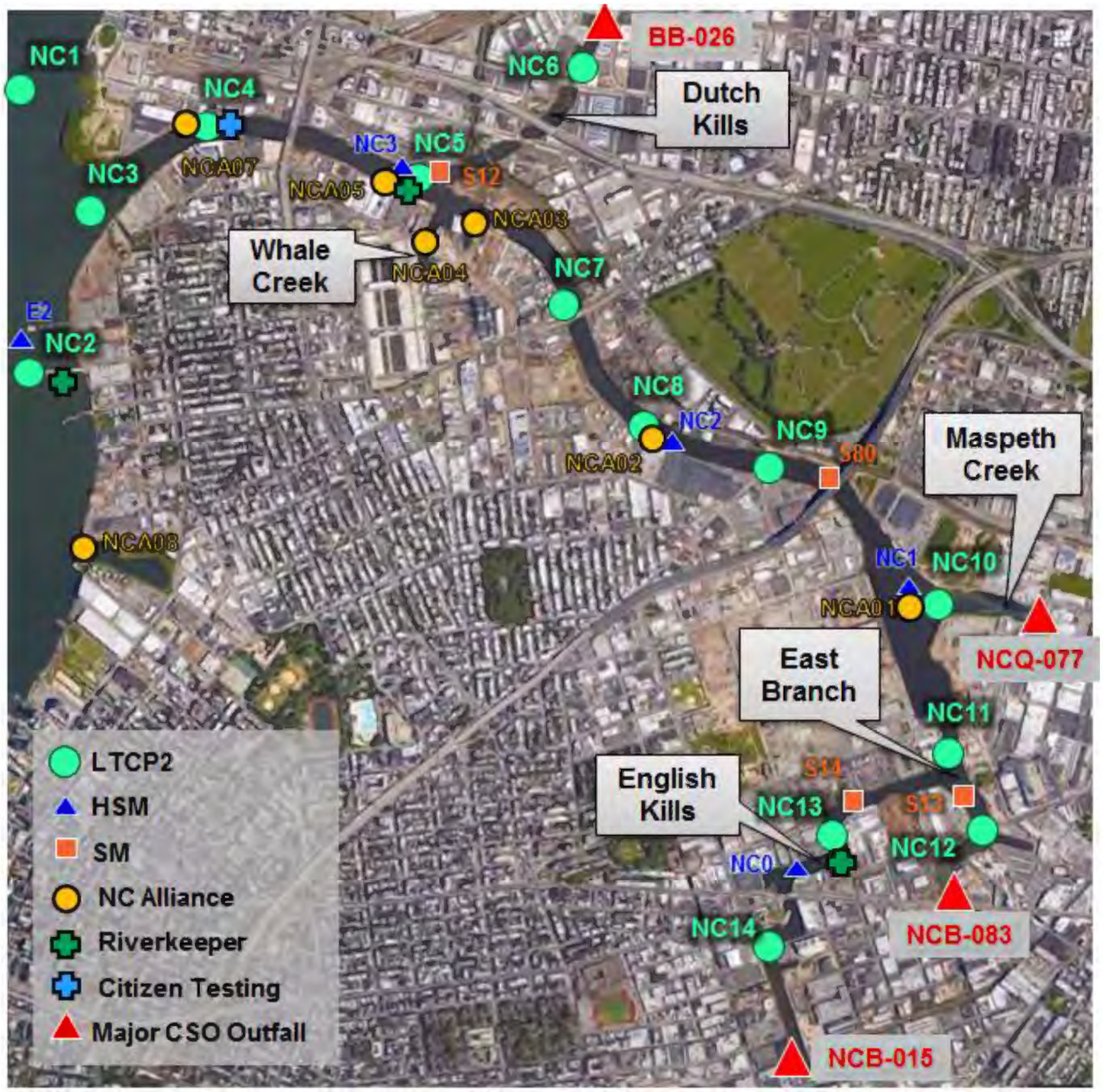

Figure 4-4. LTCP2 and PCM Sampling Locations in Newtown Creek

Measured parameters relating to receiving water quality include: DO, fecal coliform, enterococci, chlorophyll 'a', and Secchi depth. With the exception of enterococci, NYC has used these parameters for decades to identify historical and spatial trends in water quality throughout New York Harbor.

The PCM program measures DO and chlorophyll 'a' at surface and bottom depths; the remaining parameters are measured at the surface only.

4.3.b CSO Facilities Operations – Flow Monitoring and Effluent Quality

A flow and effluent quality monitoring program would be dependent on the types and sizes of proposed CSO controls recommended under this LTCP. Effluent quality data is not expected to be collected routinely at an unstaffed facility, nor is routine CSO flow and effluent quality data anticipated to be collected on outfalls for which no controls have been provided. If the implemented control is permitted under SPDES, the effluent monitoring conditions of that permit would be followed.

4.3.c Assessment of Performance Criteria

CSO controls implemented under this LTCP will be designed to achieve a specific set of water quality and/or CSO reduction goals as established in this LTCP, and as directed in the subsequent Basis of Design Report that informs the design process. If no additional CSO controls are proposed, then affirmation of water quality projections would be necessary. In both cases, the PCM data, coupled with the modeling framework used for annual reporting, will be used to assess the performance of the CSO controls implemented in comparison to the water quality goals.

Differences between actual overflows and model-predicted overflows are often attributable to the fact that the model results are based on the rainfall measured at a single NOAA rain gauge to represent the rainfall over the entire watershed. In reality, storms move through the area and are variable, and the rainfall varies over time and space. Because rainfall patterns tend to even out across the area over time, the practice of using the rainfall measurement from one nearby location typically provides good agreement with long term performance for the collection system as a whole; however, model results for any particular storm may vary somewhat from observations.

Given the uncertainty associated with potentially widely varying precipitation conditions, rainfall analysis is an essential component of the PCM. For Newtown Creek, the most representative long term rainfall data record is available from the National Weather Service's John F. Kennedy International Airport (JFK) gauge. Rain data for each calendar year of the PCM program will be compared to the 10-year model period (2002-2011) and to the JFK 2008 rain data used for alternative evaluations. Statistics, including number of storms, duration, total annual and monthly depths, and relative and peak intensities, will be used to classify the particular reporting year as wet or dry relative to the time series on which the concept was based. Uncertainty in the analysis may be supplemented with radar rainfall data where there is evidence of large spatial variations.

The reporting year will be modeled utilizing the existing IW/CICWQM framework using the reporting year tides and precipitation. The resulting CSO discharges and water quality attainment will then be compared with available PCM data for the year as a means of validating model output. The level of attainment will be calculated from the modeling results and coupled with the precipitation analysis to determine relative improvement and the existence of any gap. Three successive years of evaluation will be necessary before capital improvements are considered, but operational adjustments will be considered throughout operation and reporting.

5.0 GREEN INFRASTRUCTURE

The New York City Green Infrastructure (GI) Program was initiated to manage stormwater to reduce CSOs in NYC and to provide resiliency and other co-benefits to local communities. More details on the overall program elements are described below. DEP publishes the *Green Infrastructure Annual Report* every April 30th to provide details on GI implementation and related efforts. These reports can be found at www.nyc.gov/dep/greeninfrastructure.

5.1 NYC Green Infrastructure Plan (GI Plan)

In January 2011, DEP launched the GI Program and committed $1.5B in funding through 2030 to implement green infrastructure on public property, including $5M in Environmental Benefit Project (EBP) funds.[1] DEP's green infrastructure staff focuses on a wide variety tasks to accomplish GI Program goals including: planning; design; construction; extensive peer-reviewed scientific research on and maintenance of the assets to improve knowledge on how they function and perform assessments; and modeling. In addition to its primary objective to improve water quality, the Program will yield climate change resiliency resulting in co-benefits including: improved air quality; urban heat island mitigation; carbon sequestration: and biodiversity co-benefits, including increased urban habitat for pollinators and wildlife.

5.2 Citywide Coordination and Implementation

DEP works directly with its partner agencies on retrofit projects within rights of way at public schools, public housing, parkland, and other NYC-owned property within the target areas. DEP coordinates on a regular basis with partner agencies to review designs for new projects and to gather current capital plan information to identify opportunities to integrate GI into planned public projects.

DEP manages several of its own design and construction contracts for ROW and on-site GI practices. The New York City Economic Development Corporation, the NYC Department of Parks and Recreation, and the Department of Design and Construction manage the design and construction of several of these area-wide contracts in conjunction with DEP. For GI Program status, please refer to the Green Infrastructure Annual Reports on DEP's website (www.nyc.gov/dep/greeninfrastructure). DEP has developed design standards for ROW GI Practices and is developing additional GI standards to address various certain field conditions and restrictions. The Program is also developing on-site GI standards to retrofit City-owned properties. These standards include porous pavement, rain gardens, retention systems, and synthetic turf.

5.2.a Community Engagement

Stakeholder participation is critical to the success of decentralized GI projects. To this end, DEP engages and educates local neighborhoods, community groups, and other environmental and urban planning stakeholders about their role in the management of stormwater. DEP's outreach efforts involve

[1] The City undertakes EBP projects as part of the settlement of a New York State and DEC enforcement action against the City.

presentations and coordination with elected officials, community boards, stormwater advocacy organizations, green job non-profits, environmental justice organizations, schools and universities, Citizens Advisory Committees, civic organizations, and other NYC agencies.

DEP recently launched its new searchable on-line map to view the status of GI assets (Final Design, In Construction, or Constructed) in the context of area-wide contracts. This addition now allows users to easily access information on the GI Program, including Reports and Standard Designs for ROW GI practices at www.nyc.gov/dep/greeninfrastructure.

DEP also created an educational video about the GI Program. The video gives a brief explanation of the environmental challenges posed by CSOs, and features GI technologies such as retention/detention systems, green/blue roofs, rain gardens, porous paving and permeable pavers. The video is available at DEP's YouTube© page (https://www.youtube.com/user/nycwater).

The site selection and construction processes for ROW are described in an informational brochure that also includes frequently asked questions and answers, and explains the co-benefits of GI.

DEP notifies abutting property owners in advance of ROW GI construction projects. In each contract area, DEP and its partner agencies provide construction liaison staff to be present during construction. Contact information for the construction liaison is affixed to door hangers should property owners wish to contact DEP with concerns during construction.

As part of its ongoing outreach efforts, DEP continues its presentations to elected officials and their staffs, community boards, and other civic and environmental organizations about the GI Program, upcoming construction schedules, and final GI locations.

5.3 Completed Green Infrastructure to Reduce CSOs (Citywide and Watershed)

DEP's Green Infrastructure Annual Reports contain updated information on completed projects and can be found on DEP's website. In addition, Quarterly Progress Reports are posted on the DEP LTCP webpage: http://www.nyc.gov/html/dep/html/cso_long_term_control_plan/index.shtml.

5.3.a Green Infrastructure Demonstration and Pilot Projects

The GI Program applies an adaptive management approach to demonstration and pilot projects, based on information collected and evaluated from lessons learned in the field and performance monitoring results.

Pilot Site Monitoring Program

DEP initiated site selection and design for its Pilot Monitoring Program in 2009. This program provided DEP with opportunities to test different designs and monitoring techniques, and to determine the most cost-effective, adaptable, and efficient GI strategies. Specifically, the pilot monitoring aimed to assess the effectiveness of each of the evaluated source controls at reducing the volume and/or rate of stormwater runoff from a drainage area by measuring quantitative aspects (e.g., source control inflow and outflow rates), as well as qualitative issues (e.g., maintenance requirements, appearance and community perception). Starting in 2010, more than 30 individual pilot GI practices were constructed and monitored as part of the citywide Pilot Program. These practices include: ROW GI, such as bioswale rain gardens;

rooftop practices, such as blue roofs and green roofs; subsurface detention/retention systems with open bottoms for infiltration; porous pavement; and bioretention facilities. Data collection began in 2010, as construction of each pilot being monitored was completed. Pilot Monitoring Program results assisted greatly in validating modeling methods and parameters.

Additional performance monitoring work is planned over the next five years as a part of the GI Research and Development Program and will provide field-collected data for further documenting GI performance and improving modeling representation. This significant undertaking will create inputs for evaluating GI life cycle costs, volumetric stormwater runoff and CSO reduction performance and co-benefits. This work will be used to compare GI to traditional grey infrastructure options, incorporating the real cost of maintenance into financial consideration.

Neighborhood Demonstration Area Projects

The 2012 CSO Order included design, construction, and monitoring milestones for three Neighborhood Demonstration Area Projects (Demonstration Projects). DEP completed construction of GI practices within a total of 66 acres of tributary area in the Hutchinson River, Newtown Creek and Jamaica Bay CSO watersheds. DEP monitored these GI practices to study the benefits of GI application on a neighborhood scale and from a variety of techniques. DEP submitted a PCM Report to DEC in August 2014 and, after responding to DEC comments, submitted an updated PCM Report in January 2015.

While DEP's Pilot Monitoring Program provides performance data for individual GI installations, the Demonstration Projects provided standardized methods and information for calculating, tracking, and reporting derived stormwater volume reductions, impervious area managed, and other benefits associated with multiple installations within identified sub-TDAs. The data collected from each of the three Demonstration Areas enhanced DEP's understanding of the benefits of GI relative to runoff control and resulting CSO reduction and were used in the development of the 2016 Performance Metrics Report.

5.3.b Public Projects

In coordination with NYC agency and non-profit partners, DEP continues to identify, design and construct public property GI retrofit projects. Detailed information on project status, the site selection and design processes for public property retrofit projects can be found in the Green Infrastructure Annual Reports on DEP's website (www.nyc.gov/dep/greeninfrastructure).

5.3.c Other Private Projects (Grant Program)

Green Infrastructure Grant Program

Since its introduction in 2011, the Grant Program has strengthened public-private partnerships and public engagement in the design, construction and maintenance of GI.

The 2012 CSO Order requires the Grant Program to commit $3M of EBP funds[2] to projects by 2015. DEP met this commitment in 2014. To date, the Grant Program has committed more than $15M to 34 private property owners to build GI projects.

In September 2016, DEP released a Request for Information (RFI) for management of a GI private property incentive program. The goal of the RFI, and any potential subsequent program development, is to build upon and to scale up considerably DEP's experience administering the Grant Program. Ultimately, DEP would like to provide an easier application process and engage additional property owners in retrofitting their properties with GI.

Green Roof Property Tax Abatement

Since 2008, the NYC Green Roof Tax Abatement (GRTA) has provided a fiscal incentive to install green roofs on private property. DEP has worked with the Mayor's Office of Sustainability, the Department of Buildings, the Department of Finance (DOF) and the Office of Management and Budget, as well as with environmental advocates and green roof designers, to modify and extend the GRTA through 2018. DEP has met with stakeholders and incorporated much of their feedback into the next version to help increase the number of green roofs in NYC. Additionally, DEP funded an outreach position to educate applicants and to assist them through the tax abatement process.

The value of the tax abatement was increased, from $4.50 to $5.23 per square foot, to continue offsetting construction costs by roughly the same value as the original tax abatement. Also, given that rooftop farms tend to be larger than typical green roofs (approximately one acre in size), the abatement value cap was also increased, from $100,000 to $200,000, allowing rooftop farm applicants to receive the full value of the abatement. Finally, based on the amount allocated for this abatement, the total annual amount available for applicants (i.e., in the aggregate) is $750,000 in the first year, and $1,000,000 in each subsequent year through March 15, 2018. The aggregate amount of abatements will be allocated by DOF on a pro rata basis. More information on the GRTA can be found in the Green Infrastructure Annual Reports.

5.3.d Projected vs. Monitoring Results

For projected and monitored results, see the 2016 Green Infrastructure Performance Metrics Report and Appendices which are available on DEP's website (www.nyc.gov/dep/greeninfrastructure).

5.4 Future Green Infrastructure in the Watershed

5.4.a Relationship Between Stormwater Capture and CSO Reduction

The DEP's 2016 Performance Metrics Report describes CSO reductions based on the 1.5 percent GI implementation rate and a modeled CSO volume reduction based on the 10 percent implementation rate. The 1.5 percent equivalency rate incorporates data on the existing and planned GI implemented through the program to date, which has primarily included retention-based ROW bioswale rain gardens using site-

[2] The City undertakes EBP projects as part of the settlement of a New York State and DEC enforcement action against the City.

specific information to model individual, distributed assets. By contrast, the 10 percent equivalency rate incorporates a lumped approach to estimate future projects where GI asset specifics such as location, technology type and design details are currently unknown.

To summarize the relationship between stormwater capture and CSO reduction, DEP has included two equivalency rates based on the 1.5 percent GI implementation rate that are defined as: (a) "Stormwater capture to CSO reduction ratio;" and (b) "Million Gallons of CSO eliminated on an annual basis per acre (Ac) of impervious area managed by GI."

For the Newtown Creek LTCP, the baseline model incorporated an 83 million gallons per year (MGY) reduction from GI implementation constructed or planned in the watershed, primarily through retention practices, including an assumption of GI controlling runoff from 3 percent of the combined sewer impervious area tributary to Newtown Creek through detention-based systems on private property.

5.4.b Opportunities for Cost-Effective CSO Reduction Analysis

As described above, the 83 MGY reduction represents built or planned GI assets in the Newtown Creek watershed, the vast majority of which are ROW GI projects, as well as a limited number of public property retrofits within the watershed.

Additional GI projects planned for the watershed will include public property retrofits (or "strategic" projects), adding GI to ongoing capital projects initiated by the owner agencies (or "opportunistic" projects), and private property projects implemented through DEP's incentive programs both in combined and separate sewer areas as part of an integrated watershed approach. Benefits from these additional projects would exceed the baseline target rate as described above. The GI Program will be implemented through 2030 and the final implementation rate will be reassessed as part of the adaptive management approach.

Additional opportunities for cost-effective stormwater volume capture and CSO reduction will be achieved through enhanced or enlarged grey alternatives that will make up any shortfalls in GI implementation due to physical constraints, available land, and other factors that are outside of DEP's control. The stormwater volume capture and related CSO reduction would be applied toward the Citywide CSO Baseline Reduction Credit and included in future GI contingency plans.

5.4.c Watershed Planning to Determine 20 Year Implementation Rate for Inclusion in Baseline Performance

Waterbody-specific implementation rates for GI are estimated based on the best available information from known subsurface conditions, zoning and land use data, availability of publicly owned properties as well as modeling efforts, WWFPs, and CSO outfall tier data (current as of the LTCP report date).

The following criteria were applied to prioritize CSO tributary areas to determine waterbody-specific GI implementation rates:

- WQS;
- Cost-effective grey investments; and
- Additional considerations:
  - Background water quality conditions

- Public concerns and demand for recreational uses
- Site-specific limitations (i.e., groundwater, bedrock, soil types, etc.)
- Additional planned CSO controls not captured in WWFPs or 2012 CSO Order (i.e., high level storm sewers [HLSS]).

The overall goal for this prioritization is to saturate GI implementation rates within the priority watersheds to cost-effectively maximize benefits based on the specific opportunities and field conditions in the Newtown Creek watershed.

Green Infrastructure Baseline Implementation Rate – Newtown Creek

Newtown Creek is a priority watershed for DEP's GI Program, which seeks to saturate priority watersheds with GI based on the specific opportunities each watershed presents. DEP has installed or plans to install over 1,300 GI assets, including ROW practices, public property retrofits, and GI implementation on private properties resulting in a CSO volume reduction of approximately 83 MGY, based on the 2008 baseline rainfall condition.

Figure 5-1 shows the current contracts in progress in the Newtown Creek CSO tributary areas. As more information on field conditions, feasibility, and costs becomes known, and as GI projects progress, DEP will continue to model the GI implementation rates.

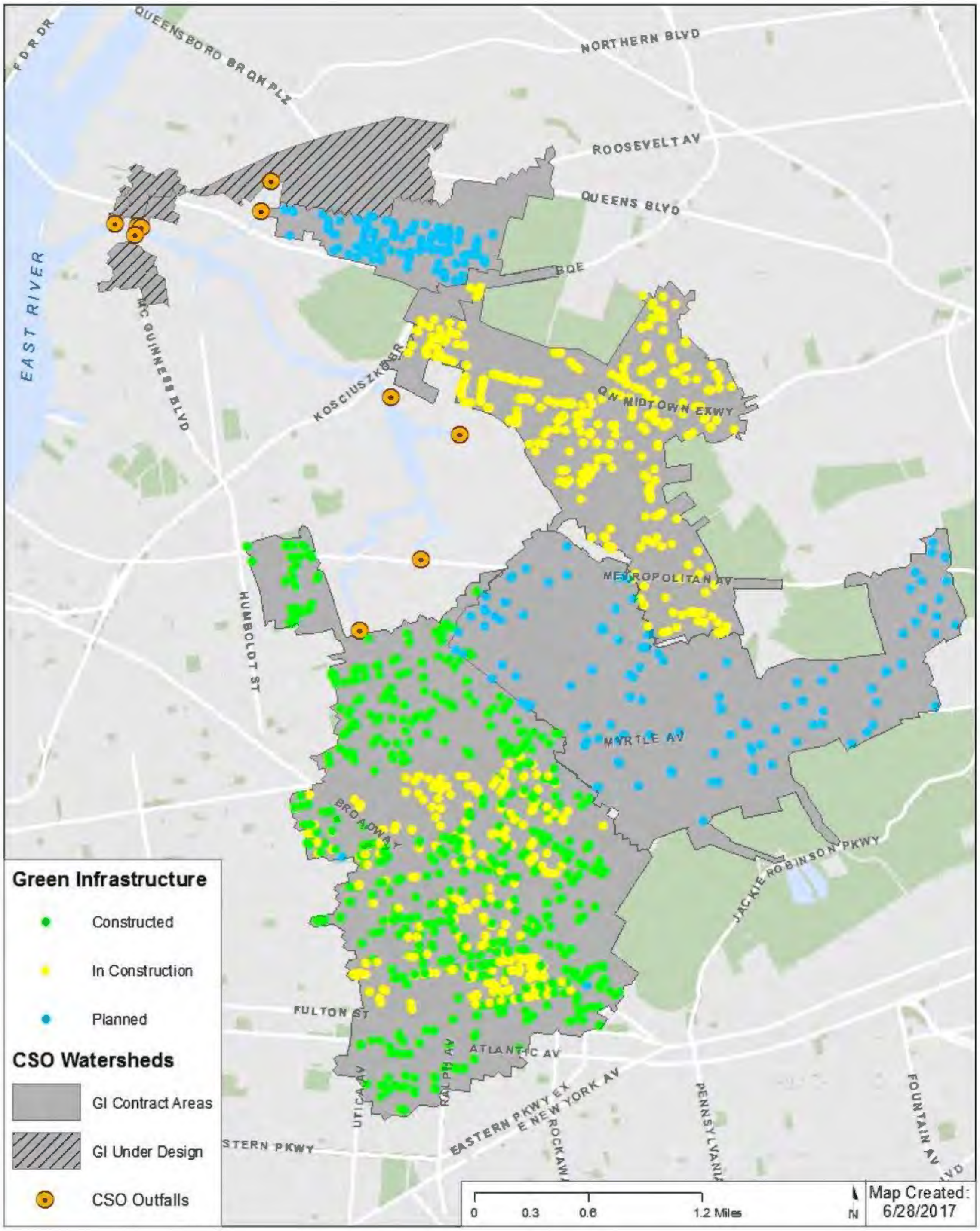

Figure 5-1. Green Infrastructure Projects in Newtown Creek

6.0 BASELINE CONDITIONS AND PERFORMANCE GAP

A key element in the development of the Newtown Creek LTCP was the assessment of water quality relative to attainment of applicable WQS within the waterway. Water quality was assessed using hydrodynamic, bacteria and DO water quality models developed specifically for Newtown Creek. The water quality models were verified with both Harbor Survey Monitoring Program and synoptic water quality data collected in 2016 as part of the LTCP development. The hydrodynamic and DO models were also calibrated with measurements collected by the Harbor Survey Monitoring Program, as well as information derived from EPA and DEP Superfund efforts in 2012-2015. The models were used to simulate ambient bacteria and DO concentrations within Newtown Creek for a set of baseline conditions as described in this section. The IW sewer system model was used to provide loading volumes from intermittent wet-weather sources as input to the hydrodynamic, bacteria and DO water quality models.

The water quality assessment described herein started with simulations of baseline conditions to determine future bacteria and DO levels without additional CSO controls beyond those already required under the CSO Order. Simulations were then performed to determine bacteria and DO levels under the assumption of 100 percent CSO control. Baseline simulation results were compared to 100 percent CSO control simulation results, and the gap between the two scenarios was then assessed to determine whether bacteria and DO criteria could be attained through application of CSO controls. Continuous water quality simulations were performed to evaluate the gap between the calculated baseline bacteria and DO levels and Existing WQ Criteria. For bacteria, the gap was also assessed for the Potential Future Primary Contact WQ Criteria, while for DO, the gap was also assessed for Class SC criteria. As detailed below, one-year simulations using 2008 JFK Airport rainfall were performed for bacteria and DO. These simulations served as the basis for an evaluation of the control alternatives in Section 8.0.

This section of the LTCP describes the baseline conditions, the loading volumes calculated by the IW model, the loading concentrations of bacteria and BOD developed from measurements, loadings calculated for water quality modeling, and the resulting receiving water bacteria and DO concentrations calculated by the Newtown Creek bacteria and DO water quality models. It further describes the gap between calculated baseline bacteria and DO concentrations and existing and potential future WQS. This section also assesses whether the gap can be closed through CSO reductions alone (100 percent CSO control).

It should be noted that the Existing WQ Criteria (Class SD) do not include *Enterococci.* Therefore, Newtown Creek water quality assessments for existing criteria considered the fecal coliform criterion only. However, Potential Future Primary Contact WQ Criteria assessments took into account *Enterococci* criteria for primary contact recreation.

6.1 Define Baseline Conditions

Establishing baseline conditions was an important step in the LTCP process. Baseline conditions were used to compare and contrast the effectiveness of CSO controls, and to predict whether water quality goals would be attained after implementation of the preferred LTCP alternative. Baseline conditions for this LTCP were established in accordance with guidance set forth by DEC to represent future conditions. Specifically, these conditions included the following assumptions:

- Dry-weather flow and loads to the Bowery Bay and Newtown Creek WWTPs were based on CY2040 projections. The 2040 projected dry-weather flow rate for the Bowery Bay WWTP was 113.5 MGD and was 112 MGD for the Brooklyn/Queens portion of Newtown Creek WWTP.

- The Bowery Bay WWTP could accept and treat peak flows up to 300 MGD, equal to two times design dry-weather flow (2xDDWF). The Newtown Creek WWTP could accept peak flows up to 700 MGD, which is greater than 2xDDWF (design dry-weather flow at Newtown Creek WWTP is 310 MGD).

- Constructed or planned GI projects resulting in an 83 MGY reduction in baseline annual CSO volume in the watershed were included. Most of the CSO volume reduction takes place at Outfall NC-014 (64 MG).

- Cost-effective Grey Infrastructure CSO controls included in the CSO Order were fully implemented. For Newtown Creek, these projects included environmental dredging, diversion of low-lying sewers, and modifications to regulators along the Bowery Bay High Level Interceptor system High Level Interceptor.

- Precipitation was based on data taken in 2008 at the JFK rainfall gauge, which has been selected as the typical year for rainfall. Modeled tide elevations were also based on 2008 data.

- The IW model was developed to represent the sewer system on a macro scale, including all conveyance elements greater than 48-inches in equivalent diameter, along with all regulator structures and CSO outfall pipes. Sediment levels after interceptor cleaning were also included in the IW model, to better reflect actual conveyance capacities to the WWTPs.

The IW model was used to develop stormwater flows, conveyance system flows, and CSO volumes for the baseline conditions for the Newtown Creek sewershed. For the Newtown Creek LTCP, the baseline conditions were initially developed in a manner consistent with the earlier WWFPs for other waterbodies. However, based on more recent data and public comments received on the preceding WWFPs, it was recognized that some of the baseline condition model input data required updating to better reflect more recent meteorological conditions, as well as the current operating characteristics of various collection and conveyance system components. Furthermore, the mathematical models were updated from their configurations and levels of calibration developed and documented prior to this LTCP. IW model modifications for this LTCP reflected a better understanding of dry- and wet-weather pollutant sources, catchment areas, and new or upgraded physical components of the system. In addition, a model recalibration report was issued in 2012 (*InfoWorks Citywide Recalibration Report, June 2012*) that used improved impervious surface satellite data.

Improvements to the water quality models were also made as part of this LTCP. The improvements to the water quality models included expanding the model domain to include the East and Harlem Rivers; increasing the lateral and longitudinal resolution of the model computational grid within Newtown Creek; calibrating and validating the models for measurements collected between January 2012 and September 2016; adding preliminary sediment transport capabilities to the dissolved oxygen model; and completing an extensive peer review. Peer review was conducted during six full day meetings scheduled throughout various phases of the modeling work in 2016 and 2017. Changes to, and recalibration of, the IW and water quality models are discussed in *Newtown Creek LTCP – Sewer System and Water Quality Modeling – July 2017.* The new IW models were used to calculate CSO volumes for the baseline conditions and were used as a tool to evaluate the impact on CSOs of potential alternative operating strategies and other possible physical changes to the collection system. The improved water quality models were applied to evaluate the conditions in Newtown Creek associated with CSO volume results from the IW models for baseline and various potential alternative changes to the collection system.

Additional details on specific aspects of the baseline conditions are described in the subsections below.

6.1.a Hydrological Conditions

For this LTCP, the precipitation characteristics for 2008, based on JFK Airport precipitation data, were used for the baseline condition, as well as for alternatives evaluations, and were considered to be representative of a typical rainfall year. In addition to the 2008 precipitation pattern, the observed tide conditions in 2008 were also applied in the model.

6.1.b Flow Conservation

Consistent with previous studies, the dry-weather sanitary sewage flows used in the baseline modeling were escalated to reflect anticipated population growth in NYC. In 2014, DEP completed detailed analysis of water demand and wastewater flow projections. A detailed GIS analysis was also performed to apportion total population among the 14 WWTP sewersheds throughout NYC. For this analysis, Transportation Analysis Zones were overlaid with WWTP sewersheds. Population projections for 2010-2040 were derived from population projections developed by DCP and the New York Metropolitan Transportation Council. These analyses used the 2010 census data to reassign population values to the watersheds in the model and project sanitary flows to 2040. These projections also reflect water conservation measures implemented by DEP that have reduced flows to the WWTPs and thus free up capacity in the conveyance system.

6.1.c Best Management Practices Findings and Optimization

A list of BMPs pertaining to Newtown Creek CSOs, along with a brief summary of each and their respective relationship to the EPA NMCs, appears in Section 3.0. The BMPs primarily address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO.

The following provides an overview of the specific elements of various DEP, SPDES, and BMP activities as they relate to the development of the baseline conditions for Newtown Creek.

- Sentinel Monitoring: In accordance with BMPs #1 and #5, DEP collects quarterly samples at four locations in Newtown Creek (Stations S12, S13, S14 and S80, as shown in Figure 2-25) in dry-weather to assess whether dry-weather sewage overflows occur, or whether illicit connections to storm sewers exist. No evidence of illicit sanitary sewer connections was observed based on these data and no illicit sources were included in the baseline conditions. Based on the 2016 BMP report, two short duration/low volume dry-weather overflows occurred within the Newtown Creek watershed. Within the Newtown Creek WWTP sewershed, 0.0034 MG were discharged at Regulator NCQ-01 over a single 20 minute event and 0.0014 MG were discharged at Regulator BBL-03B, within the Bowery Bay WWTP sewershed, over a one hour and 35 minute single event.

- Interceptor Sediments: Sewer sediment levels were determined during post-cleaning inspections and are included in the IW model.

- Combined Sewer Sediments: The IW models assume no sediment in upstream combined trunk sewers in accordance with BMP #2.

- WWTP Flow Maximization: In accordance with BMP #3 and the Additional CSO BMP Special Conditions, the Bowery Bay and Newtown Creek WWTPs treat wet-weather flows that are conveyed to these WWTPs, up to 2xDDWF. Newtown Creek has the capacity to treat wet-weather flows up to 700 MGD, which is greater than the WWTP's 2xDDWF of 620 MGD. DEP's Interceptor inspection and cleaning efforts have increased the ability of the sewer system to convey 2xDDWF to the WWTPs.

- Wet Weather Operating Plan (WWOP): The Bowery Bay and Newtown Creek WWOPs (BMP #4) establish procedures to facilitate treatment of 2xDDWF and 700 MGD (over 2xDDWF), respectively.

6.1.d Elements of Facility Plan and GI Plan

The Newtown Creek LTCP also considered the bending weirs at four regulators that are currently under construction as recommended in the Newtown Creek 2011 WWFP. This capital project is required under the CSO Order and has a Construction Completion milestone of December 2017. In addition, although not a formal recommendation from the 2011 WWFP, a throttling gate was installed on the Kent Avenue Interceptor and was incorporated into the model. Additional details on the bending weirs and Kent Avenue gate, as well as the findings from field inspections of other regulators in the Newtown Creek system, are provided below.

<u>Bending Weirs</u>

The static weirs at the four largest overflow locations tributary to Newtown Creek are currently being replaced with bending weirs. The four modified locations are:

- BB-026;
- NCB-015;
- NCB-083; and
- NCQ-077.

The bending weir modifications resulted in two main updates to the baseline model (from the Final Design drawings from O'Brien and Gere, dated June 30, 2013):

1. Incorporation of the physical geometry associated with the bending weir design, including weir length, weir height, and elevation adjustments to inverts based on the O'Brien and Gere drawings.
2. Addition of real time control (RTC) to characterize the functionality of the bending weirs. The RTC allows the bending weirs to lower when the water level reaches the top of the weir.

Kent Avenue

As part of the improvements to the NC WWTP, a gate was installed on the Kent Avenue Interceptor to throttle flows to the Newtown Creek WWTP, allowing flow to be prioritized from the Morgan Avenue Interceptor. This gate was added to the model with RTCs set as per the procedure outlined in the December 2014 Newtown Creek WWTP WWOP.

Other Updates

Several regulators were inspected as part of an effort to resolve discrepancies between the model and the latest SPDES permitting lists. The following locations were investigated:

- BB-031 – Regulator L-24 and L-29A;
- BB-038 – Regulator L-34;
- BB-046 – Regulator L-26;
- BB-047 – Regulator L-28;
- NCM-050 - Regulator M-19; and
- NCM-079 – Regulator M-8.

BB-031

Regulator L-24 was inspected and it was determined that the overflow has been bulkheaded. The overflow was removed from the model.

Regulator L-29A is designated to BB-032 in the Regulator Improvement Project drawings and SPDES 2016 Permit. The model previously showed Regulator L-29A tributary to BB-031; the model was updated to connect Regulator L-29A to BB-032.

BB-038

During field investigations of Regulator L-34, it was determined that the structure does not have an overflow pipe, and the structure can only overflow by backflowing through Regulator L-33. Therefore, the overflow pipe was removed from the model.

BB-046

During field investigations of Regulator L-26, the regulator was determined to be in service. Therefore, no modifications were made to the model for this regulator.

BB-047

During field investigations of Regulator L-28, the regulator was determined to be in service. Therefore, no modifications were made to the model for this regulator.

NCM-050

During field investigations of Regulator M-19, the regulator was determined to be in service. Therefore, no modifications were made to the model for this regulator.

NCM-079

Regulator M-08 was inspected and it was determined that the outfall pipe downstream of the regulator is still in place with no tide gate. The outfall was not found during the Shoreline Survey in 2013. There is still some question as to whether this outfall is still in service.

Green Infrastructure (GI)

As discussed in Section 5.0, DEP has targeted the Newtown Creek watershed for GI projects. The list of GI projects presented in Section 5 is assumed to be fully implemented in the baseline model.

6.1.e Non-CSO Discharges

Over the past 30 years, DEP has invested heavily in mapping and delineating combined sewer drainage areas and piping systems as part of CSO facility planning and waterbody watershed facility planning efforts. However, non-CSO drainage areas have not received the same level of effort. Non-CSO drainage areas were first identified during WWFP activities as land areas that were not contained within the CSO drainage areas. They were labeled as direct drainage and MS4 drainage areas, but that distinction was inconsequential since both areas were assigned the same runoff characteristics. As part of DEP's LTCP work, DEP has distinguished between these areas to better understand the impact of these areas. Direct drainage areas (parks, cemeteries, large unoccupied open areas, etc.) are now assigned lower pathogen runoff concentrations than more urbanized non-CSO drainage areas (residential and commercial areas with a separate storm sewer system). In general, highway runoff has been established as a standalone category, but in many cases, highway runoff is lumped together with other stormwater discharges.

In several sections of the Bowery Bay and Newtown Creek WWTP sewersheds, runoff drains directly to receiving waters via overland flow, open channels, or privately owned pipes, without entering the combined sewer system or separate storm sewer system. These areas were depicted as "Direct Drainage" in Figure 6-1 and were estimated based on topography and the direction of stormwater runoff flow in those areas. In general, shoreline areas adjacent to waterways comprise the direct drainage category, as they consist of parks, marinas, industrial properties, and sections of the highways adjacent to Newtown Creek. In total, these areas comprise approximately 585 acres of the 6,815 acres of drainage area tributary to Newtown Creek (8.5 percent).

MS4 areas in the IW model were updated based on desktop analyses conducted by DEP. Non-MS4 stormwater areas and direct drainage areas are meant to represent the remaining parts of the drainage areas not covered by the MS4 delineations. The modeled discharge locations of the non-MS4 and direct drainage areas may not tie to actual locations of individual outfalls, but the loads to the receiving water are appropriately accounted for. Figure 6-1 presents the IW subcatchments within the drainage area of Newtown Creek.

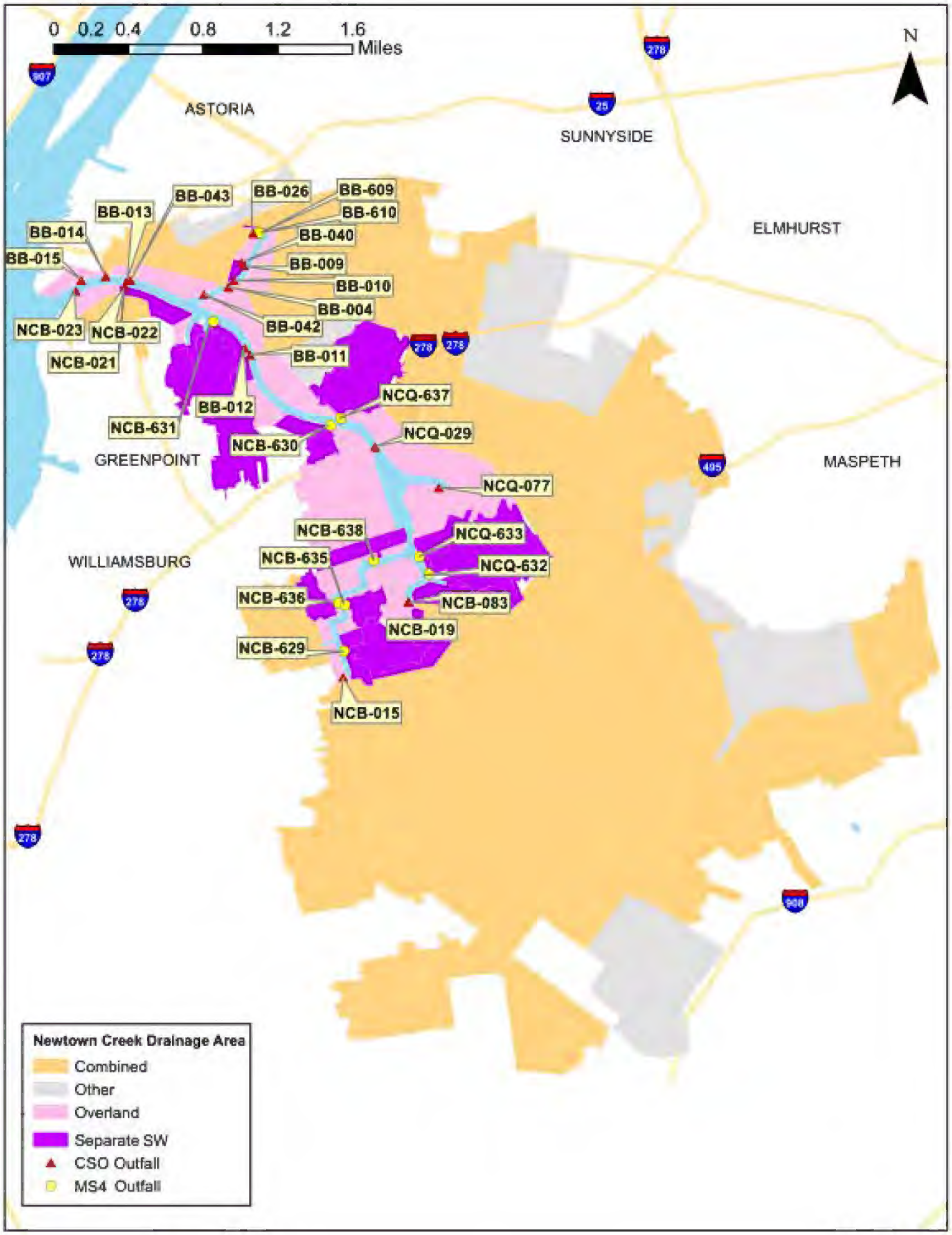

Figure 6-1. InfoWorks CSO and MS4 Subcatchments within Newtown Creek

6.2 Baseline Conditions – Projected CSO Volumes and Loadings after the Facility Plan and GI Plan

As previously noted, the IW model was used to develop CSO volumes for baseline conditions. The IW model incorporated the implementation of planned GI and grey infrastructure associated with the bending weir installations and Brooklyn/Queens Pumping Station upgrade. Using these overflow volumes, CSO loadings were generated using measured *Enterococci*, fecal coliform, nutrient, organic carbon, and BOD concentrations. These loadings provided input to bacteria and DO receiving water quality models of Newtown Creek.

For bacteria modeling, fecal coliform and *Enterococci* loadings were developed using 2016 monitoring data collected during development of the Newtown Creek LTCP. Fecal coliform and *Enterococci* CSO loadings were developed by employing an hourly Monte Carlo randomization of the measured range of CSO concentrations assigned to the hourly overflows simulated by IW for the outfalls contributing CSO to Newtown Creek. For DO modeling, BOD-related CSO loadings were developed based on median concentrations from EPA and DEP Superfund monitoring data from 2012-2015, as well as 2016 monitoring data collected during development of the Newtown Creek LTCP.

In addition to CSO loadings, storm sewer discharges and direct drainage calculated by IW impact the water quality in Newtown Creek. The concentrations assigned to the various discharge sources to Newtown Creek are summarized in Table 6-1. Further details of the development of loadings and the development and validation of the bacteria and DO receiving water quality models are provided in the technical memorandum *"Newtown Creek LTCP Sewer System and Water Quality Modeling, July 2017."*

Table 6-1. Source Concentrations

Source	*Enterococci* (cfu/100mL)	Fecal Coliform (cfu/100mL)	BOD_5 (mg/L)
Stormwater[(1)]	Monte Carlo 20,061 to 289,071	Monte Carlo 7,025 to 60,829	17.4
CSOs[(2)]	Monte Carlo 82,081 to 2,092,322	Monte Carlo 33,951 to 4,478,329	42.2
Direct Drainage[(3)]	6,000	4,000	17.4
STP Treated Effluent to Whale Creek[(4)]	1	Monte Carlo 1 to 1,407	Monthly Averages 8.0 to 11.7

Notes:

(1) Stormwater bacteria concentrations based on 2016 Newtown Creek LTCP sampling results. Stormwater BOD_5 based on 2012-2016 Newtown Creek Superfund and LTCP measurements.

(2) CSO bacteria concentrations based on 2016 Newtown Creek LTCP measurements. CSO BOD_5 based on 2012-2016 Newtown Creek Superfund and LTCP measurements.

(3) Direct drainage bacteria concentrations based on NYS Stormwater Manual, Charles River LTCP, and National Stormwater Data Base for commercial and industrial land uses. Direct drainage BOD_5 concentrations specified as stormwater. Cavalry Cemetery BOD_5 concentration specified slightly higher at 22.7 mg/L based on Superfund measurements specific to the Cemetery catchment area.

(4) STP effluent bacteria concentrations based on 2016 DMR measurements: Monte Carlo selection of daily averages for fecal coliform and median of several months for *Enterococci*. BOD concentrations based on monthly averages of 2012-2016 DMR measurements

Baseline volumes of CSO to Newtown Creek for each outfall for the 2008 typical year are summarized in Table 6-2, and the total baseline volumes of CSO, stormwater, and direct drainage to Newtown Creek along with the associated fecal coliform, *Enterococci*, and BOD annual loadings are summarized in Table 6-3. The specific SPDES permitted outfalls associated with these sources are shown in Figure 6-1. Additional tables that summarize annual volumes and loadings can be found in Appendix A.

Table 6-2. 2008 CSO Volume and Overflows per Year

CSO	Volume[(1)]	Annual Overflow Events
	Total Discharge (MG/yr)	Total (No./yr)
BB-004	0	1
BB-009	43	34
BB-010	1	7
BB-011	2	14
BB-012	0	1
BB-013	16	31
BB-014	2	18
BB-015	1	13
BB-026[(2)]	120	37
BB-040	1	16

Table 6-2. 2008 CSO Volume and Overflows per Year

CSO	Volume[1] Total Discharge (MG/yr)	Annual Overflow Events Total (No./yr)
BB-042	2	22
BB-043	9	32
BB-049	0	0
NCB-015[2]	321	31
NCB-019	3	21
NCB-021	0	0
NCB-022	7	29
NCB-023	0	8
NCQ-029	19	40
NCQ-077[2]	300	41
NCB-083[2]	315	42
NCB-002[3]	N/A	N/A
Total	1,161	-

Notes:
(1) Volumes are rounded to the nearest MG.
(2) NCB-015 + NCB-083 + NCQ-077 + BB-026 = 91% of Total Annual Volume.
(3) NCB-002 is the Newtown Creek WWTP high relief outfall that discharges to Whale Creek Canal. This flow is treated before discharge.

Table 6-3. 2008 Baseline Loading Summary

Totals by Source by Waterbody		Volume	*Enterococci*	Fecal Coliform	BOD
Waterbody	**Source**	**Total Discharge (MG/yr)**	**Total Organisms (10^12/yr)**	**Total Organisms (10^12/yr)**	**Total (lbs/yr)**
Newtown Creek	CSO	1,162	19,773	28,655	409,344
	MS4 Stormwater	404	1,312	430	58,604
	Direct Drainage	527	120	80	77,204
	Treated Effluent from NC WWTP discharge at Whale Creek	1,650	0.06	8	137,294
Total		**3,743**	**21,205**	**29,173**	**682,445**

As indicated in Table 6-2, over 90 percent of the total CSO discharge volume originates from Outfalls NCB-015, NCB-083, NCQ-077, and BB-026, with 321 MG, 315 MG, 300 MG, and 120 MG of CSO volume, respectively, under 2008 conditions. The CSO outfalls from both the Bowery Bay and Newtown Creek WWTP sewersheds discharge an average of two to four times per month.

6.3 Performance Gap

Bacteria and DO concentrations in Newtown Creek are controlled by a number of factors, including the volumes of all sources, the concentrations of pollutants within those volumes, and the exchange of tidal flow with the East River. Because most of the bacteria load discharged into this waterway is the result of runoff from rainfall events, the frequency, duration, and amounts of rainfall strongly influence Newtown Creek's water quality.

Newtown Creek water quality models were used to simulate bacteria and DO concentrations for the baseline conditions using 2008 rainfall and tidal data. Hourly model calculations were saved for post-processing and comparison with the Existing WQ Criteria and Potential Future Primary Contact Recreation WQ Criteria for bacteria, as well as designated and higher use classifications criteria for DO, as discussed in Section 6.3.c. The performance gap was then developed as the difference between the model-calculated baseline waterway DO and bacteria concentrations, and the applicable numerical WQS. The analysis is developed to address the following three sets of criteria:

- Existing WQ Criteria (Class SD);
- DO WQ Criteria for a higher use classification (Class SC); and
- Bacteria Potential Future Primary Contact Recreation WQ Criteria (2012 EPA RWQC).

The following sections include analyses that reflect the differences in attainment, both spatially and temporally. The temporal assessment focuses on compliance with the applicable fecal coliform water quality criteria over the entire year, as well as the recreational season of May 1st through October 31st. For *Enterococci*, the temporal assessment focuses on compliance during the recreational season.

A summary of the criteria that were applied is shown in Table 6-4. Analyses in this LTCP were performed using the 30-day rolling GM of 30 cfu/100mL and the STV of 110 cfu/100mL for *Enterococci*.

Table 6-4. Classifications and Standards Applied

Analysis	Numerical Criteria Applied	
Existing WQ Criteria	(Class SD)	Fecal Monthly GM ≤ 200; DO never < 3.0 mg/L
Bacteria Primary Contact WQ Criteria / DO Class SC(1)	(Class SC)	Fecal Monthly GM ≤ 200 DO between > 3.0 & ≤4.8 mg/L(1, 3); DO never < 3.0 mg/L(1)
Potential Future Primary Contact WQ Criteria(2)	*Enterococci*: Rolling 30-day GM – 30 cfu/100mL STV – 110 cfu/100mL	

Notes:
GM = Geometric Mean; STV = 90 Percent Statistical Threshold Value
(1) This water quality classification is not currently assigned to Newtown Creek.
(2) DEC has not yet adopted the Potential Future Primary Contact WQ Criteria.
(3) This is an excursion based limit that allows for the average daily DO concentrations to fall between 3.0 and 4.8 mg/L for a limited number of days as described in more detail on Table 2-9 in Section 2.

6.3.a CSO Volumes and Loadings Needed to Attain Current Water Quality Standards

To assess the performance gap, Newtown Creek fecal coliform concentrations were calculated under baseline conditions and DEP analyzed whether the gap could be closed through reductions to, or control of, CSOs. The assessment was completed to determine if Newtown Creek water quality would comply with Existing WQ Criteria. The water quality monitoring stations are shown in Figure 6-2.

2008 Annual Rainfall Simulation – Bacteria

A one-year simulation of bacteria water quality was performed for the 2008 baseline loading conditions. The results of this simulation are summarized in Table 6-5. In addition, the results shown in Table 6-5 summarize the highest calculated monthly GM on an annual basis and during the recreational season (May 1st through October 31st). The maximum monthly GM is presented for each sampling location is shown on Figure 6-2.

Table 6-5 also presents the annual attainment (percent) of the fecal coliform GM criterion of 200 cfu/100mL. The highest GMs were found to occur in the head end of Newtown Creek or near the CSO outfalls, with 100 percent attainment only achieved at stations in the East River or near the mouth of the Creek during the recreational season (May 1st through October 31st). 100 percent attainment was not met on an annual basis at any station.

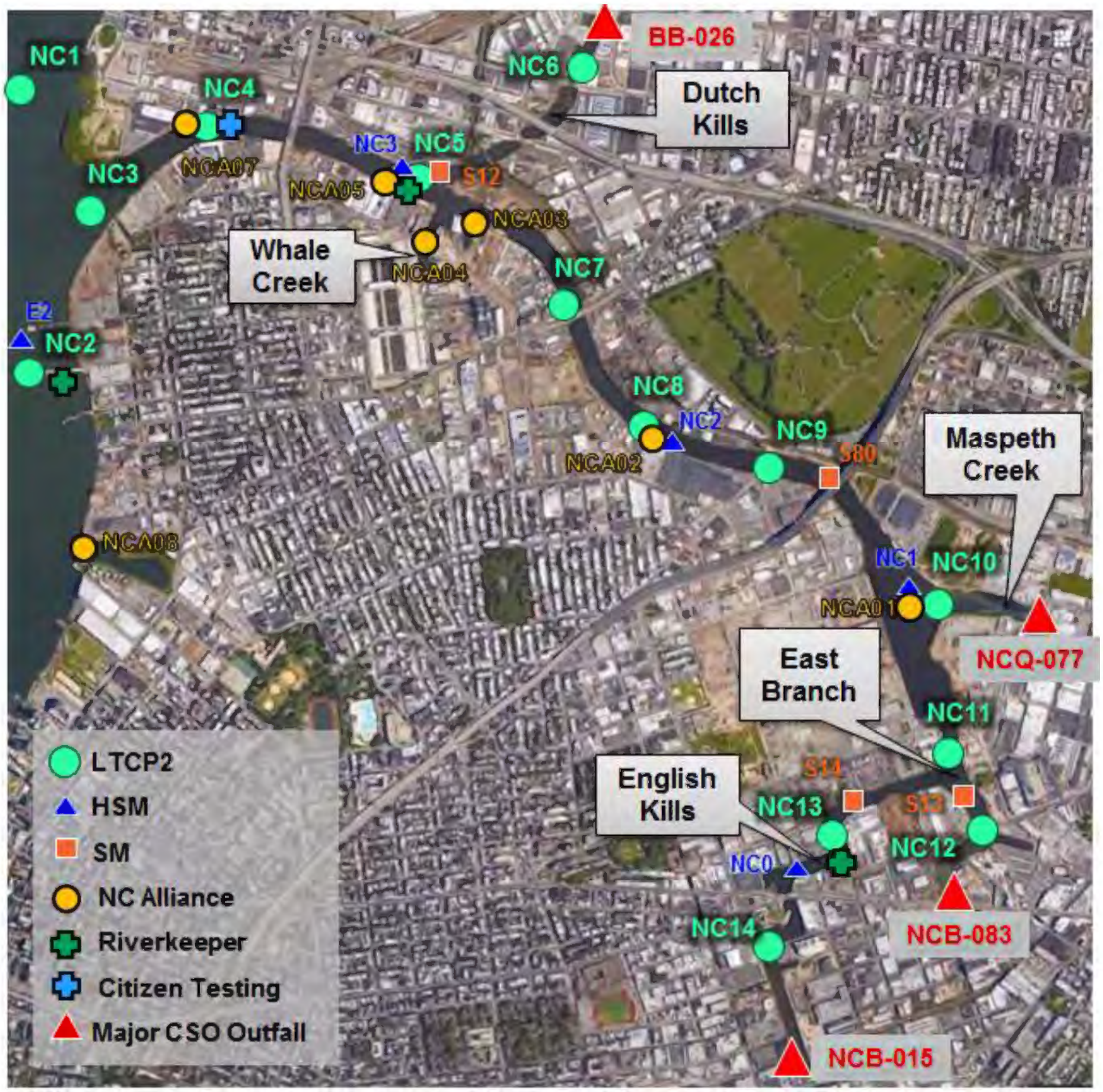

Figure 6-2. LTCP2 Water Quality Monitoring Stations in Newtown Creek

Table 6-5. Model Calculated 2008 Baseline Fecal Coliform Maximum Monthly GM and Attainment of Existing WQ Criteria

Station	Maximum Monthly Geometric Means (cfu/100 mL)		% Attainment (GM<200 cfu/100mL	
	Annual	Recreational Season(1)	Annual	Recreational Season(1)
NC1	231	63	83	100
NC2	229	65	83	100
NC3	247	80	83	100
NC4	447	165	75	100
NC5	582	183	75	100
NC6	1,183	283	50	83
NC7	718	197	75	100
NC8	852	220	50	83
NC9	976	243	50	83
NC10	1,590	356	42	67
NC11	1,627	422	42	67
NC12	2,241	520	42	67
NC13	1,525	523	42	67
NC14	1,691	919	42	67

Note:
(1) The recreational season is May 1st through October 31st.

The 2008 baseline condition scenario was rerun with the Newtown Creek CSO loadings removed. This projection represents the maximum possible reduction of CSO loads to Newtown Creek and is referred to as the 100 percent CSO control scenario. It should be noted, however, that numerous other CSO outfalls that discharge to the East River/Upper East River remain at baseline conditions for this CSO control scenario. All other conditions from the baseline projection remain unchanged in the 100 percent CSO control scenario. Table 6-6 presents the maximum monthly fecal coliform GM concentration and the annual and recreation season (May 1st through October 31st) attainment of the existing WQS (primary contact criterion for fecal coliform) for baseline conditions and the 100 percent CSO control scenario.

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Table 6-6. Comparison of the Model Calculated 2008 Baseline and 100 Percent Newtown Creek CSO Control Fecal Coliform Maximum Monthly GM and Attainment of Existing WQS for Fecal Coliform Bacteria

Station	Maximum Monthly Geometric Means (Annual)		% Attainment (Annual)		% Attainment (Recreation Season)	
	Baseline	100% CSO Control	Baseline	100% CSO Control	Baseline	100% CSO Control
NC1	231	231	83	83	100	100
NC2	229	227	83	83	100	100
NC3	247	225	83	83	100	100
NC4	447	194	75	100	100	100
NC5	582	183	75	100	100	100
NC6	1,183	136	50	100	83	100
NC7	718	164	75	100	100	100
NC8	852	154	50	100	83	100
NC9	976	149	50	100	83	100
NC10	1,590	148	42	100	67	100
NC11	1,627	187	42	100	67	100
NC12	2,241	236	42	92	67	100
NC13	1,525	190	42	100	67	100
NC14	1,691	225	42	83	67	100

Table 6-6 shows that the CSOs have the largest impact in the vicinity of the head of the Creek at Stations NC11 through NC14, where the removal of the CSO loadings results in a modeled reduction of the maximum monthly fecal coliform GM concentration by at least 1,300 cfu/100mL at each station, therefore improving attainment of the corresponding applicable WQ criteria. Modeled improvements in the monthly fecal coliform GM due to 100 percent CSO control are less significant in the East River and near the mouth of Newtown Creek. Model calculated annual attainment of the fecal coliform monthly geomean criteria improves with the 100 percent removal of the CSOs resulting in lower geomean concentrations at each of the monitoring locations. 100 percent CSO control would result in 100 percent attainment of the fecal coliform water quality standard during the recreation season (May 1st through October 31st).

2008 Annual Rainfall Simulation – Dissolved Oxygen

The average annual attainment of DO criteria based on the water quality model simulation is presented in Table 6-7 for year 2008 conditions. The average annual attainment is calculated by averaging the calculated attainment in each of ten modeled depth layers, comprising the entire water column. When assessing the water column in its entirety, attainment of the DO criterion is high. Most of the station locations that were assessed have a water column annual attainment of 95 percent or greater for year 2008 conditions with only three stations (NC12, NC13, NC14) below 95 percent.

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Table 6-7. Model Calculated Baseline DO Attainment – Existing WQ Criteria (2008)

Station	Annual Attainment (%)
	Entire Water Column
	>3.0 mg/L
NC1	100
NC2	100
NC3	100
NC4	99.98
NC5	99.92
NC6	98.1
NC7	99.8
NC8	99.5
NC9	99.2
NC10	96.3
NC11	95.4
NC12	94.5
NC13	94.0
NC14	89.8

Table 6-8 presents a comparison of the modeled Class SD DO criterion attainment under baseline conditions, which assumes seasonal operation of the East Branch and English Kills in-stream aeration systems ("with aeration"), and 100 percent CSO control conditions both with and without aeration. The "without aeration" scenario assumes no operation of the East Branch and English Kills in-stream aeration systems. As noted above, under baseline conditions, only three of the upstream stations had annual attainment less than 95 percent. For 100 percent CSO control with aeration, all stations had 100 percent annual average attainment. Under 100 percent CSO control conditions without aeration, model calculated DO attainment is at least 97 percent at all stations other than NC14.

Table 6-8. Model Calculated Baseline and 100 Percent CSO Control DO Attainment – Existing WQ Criteria (2008)

Station	Annual Attainment Percent Attainment (Average DO ≥ 3 mg/L)		
	Baseline with Aeration(1)	100% Newtown Creek CSO Control, with Aeration(1)	100% Newtown Creek CSO Control, Without Aeration(2)
NC1	100	100	100
NC2	100	100	100
NC3	100	100	100
NC4	99.98	100	100
NC5	99.92	100	100
NC6	98.1	100	100
NC7	99.8	100	100
NC8	99.5	100	100
NC9	99.2	100	100
NC10	96.3	100	99.2
NC11	95.4	100	98.0
NC12	94.5	100	97.3
NC13	94.0	100	97.0
NC14	89.8	100	91.0

Notes:
(1) Assumes seasonal operation of East Branch and English Kills aeration systems.
(2) Assumes no operation of East Branch and English Kills aeration systems.

6.3.b CSO Volumes and Loadings That Would be Needed to Support the Next Highest Use or Swimmable/Fishable Uses

Bacteria

DEC has promulgated new regulations that require Class SD and I waterbodies to meet the primary contact (Class SC) bacteria criteria. The primary contact fecal coliform criterion is a monthly GM less than or equal to 200 cfu/100mL. Since the Class SC bacteria criteria are now the same as the Class SD criteria, the performance gap to attain Class SC bacteria criteria would be the same as presented in Table 6-6 above.

Dissolved Oxygen

The average annual attainment of the DO Class SC criteria is presented in Table 6-9, for the baseline (with aeration) and 100 percent CSO control conditions (both with and without aeration). As noted above, the average annual attainment is calculated by averaging calculated attainment in each of ten modeled depth layers, comprising the entire water column. Determination of attainment with Class SC DO criteria can be complex, as the chronic standard allows for excursions from the daily average limit of 4.8 mg/L for a limited number of consecutive calendar days. Based on model results, 11 out of the 14 stations achieve at least 95 percent attainment of the acute criterion (never less than 3.0 mg/L) under baseline conditions based on the entire water column. The three stations that do not achieve attainment are located near the head of the Creek (Stations NC12, NC13, and NC14). For the chronic criterion, calculated in-Creek baseline attainment ranges between 70 and 100 percent. Calculated in-Creek attainment with 100 percent CSO control with aeration is 100 percent at all stations for the acute criterion, and exceeds 95 percent at all stations, except NC14 for the chronic criterion. For 100 percent CSO control without aeration, the acute criterion would be attained at all stations except NC14, but attainment of the chronic criterion would fall below 95 percent at 11 out of 14 locations, negating the benefits of 100 percent CSO control for chronic attainment.

Table 6-9. Model Calculated 2008 Baseline and 100 Percent CSO Control DO Attainment of Class SC WQ Criteria

Station	Annual Attainment Percent Attainment (Water Column)					
	Baseline with Aeration(1)		100% Newtown Creek CSO Control, With Aeration(1)		100% Newtown Creek CSO Control, Without Aeration(2)	
	Chronic(3)	Acute(4)	Chronic(3)	Acute(4)	Chronic(3)	Acute(4)
NC1	100	100	100	100	100	100
NC2	100	100	100	100	100	100
NC3	100	100	100	100	100	100
NC4	90.8	99.98	98.9	100	92.3	100
NC5	90.6	99.92	99.0	100	90.0	100
NC6	82.9	98.1	100	100	92.3	100
NC7	88.1	99.8	100	100	89.5	100
NC8	87.3	99.5	100	100	88.3	100
NC9	87.0	99.2	100	100	87.8	100
NC10	80.4	96.3	100	100	85.6	99.2
NC11	80.4	95.4	100	100	75.7	98.0
NC12	78.7	94.5	100	100	73.9	97.3
NC13	77.5	94.0	97.8	100	72.5	97.0
NC14	70.4	89.8	89.1	100	61.2	91.0

Notes:
(1) Assumes seasonal operation of East Branch and English Kills aeration system.
(2) Assumes no operation of East Branch and English Kills aeration system.
(3) Chronic Criteria: 24-hr average DO ≥ 4.8 mg/L with allowable excursions to ≥ 3.0 mg/L for certain periods of time.
(4) Acute Criteria: DO ≥ 3.0 mg/L.

6.3.c Potential Future Primary Contact WQ Criteria

As noted in Section 2.0, EPA released its RWQC recommendations in December 2012. That document included recommendations for RWQC for protecting human health in all coastal waters designated for primary contact recreation use, based on *Enterococci*. The standards would include a rolling 30-day GM of either 30 cfu/100mL or 35 cfu/100mL and a 90th percentile STV during the rolling 30-day period of either 110 cfu/100mL or 130 cfu/100mL. An analysis using the 2008 baseline and 100 percent CSO control condition model simulation results for *Enterococci* was conducted using both the 30 cfu/100mL GM and 110 cfu/100mL 90th percentile STV criteria, to assess attainment with the potential future RWQC.

6.3.d Load Reductions Needed to Attain the Potential Future Primary Contact WQ Criteria

Additional water quality modeling analyses were performed to assess the extent to which CSO and non-CSO sources impact *Enterococci* concentrations at key locations in Newtown Creek. That analysis consisted of first assessing the baseline conditions for *Enterococci* in Newtown Creek and then determining whether 100 percent CSO control could close the gap between the baseline conditions and the potential future recreational water quality criterion of a 30-day rolling GM *Enterococci* concentration of 30 cfu/100mL and 90th percentile STV of 110 cfu/100mL. The results of the baseline analyses are presented in Table 6-10 for the maximum 30-day GM and 90th percentile STV concentrations and for attainment of the rolling 30-day GM and 90th percentile STV criteria. All results are for the attainment of the Potential Future Primary Contact WQ Criteria during the May 1st through October 31st recreational season, as defined by DEC.

Table 6-10. Model Calculated 2008 Baseline *Enterococci* Maximum 30-day GM and Attainment of Potential Future Primary Contact WQ Criteria

Station	Maximum Recreational Season[1] 30-day *Enterococci* (cfu/100mL)		% Attainment	
	GM	90th Percentile STV	GM	90th Percentile STV
NC1	19	310	100	76
NC2	18	316	100	76
NC3	20	417	100	62
NC4	32	1,611	99	10
NC5	36	1,527	98	10
NC6	69	20,549	90	8
NC7	37	1,630	98	8
NC8	40	2,287	98	10
NC9	44	2,754	97	8
NC10	77	14,117	90	5
NC11	90	11,131	72	5
NC12	128	27,907	53	3
NC13	93	8,428	73	5
NC14	162	34,902	50	4

Note:
(1) The recreational season is May 1st through October 31st.

Under 2008 baseline conditions, greater than 95 percent attainment of the rolling 30-day GM *Enterococci* criteria of 30 cfu/100mL is achieved at 8 out of 14 sampling locations in the East River and the main stem of Newtown Creek during the recreational season (May 1st through October 31st). Attainment is lower at the six sampling locations in the tributaries and Turning Basin, ranging from 50 percent to 90 percent. Attainment of the 90th percentile STV criterion of 110 cfu/100mL is less than 10 percent throughout Newtown Creek.

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Water quality modeling analyses conducted to assess attainment of the *Enterococci* criteria with complete removal of the CSO *Enterococci* loadings in Newtown Creek, as provided in Table 6-11, show that 100 percent CSO control would result in greater than 97 percent attainment of the 30-day rolling GM *Enterococci* criterion. Attainment of the 90th percentile STV *Enterococci* criterion ranges from 4 to 86 percent. The high degree of attainment with 100 percent CSO control indicates that the GM *Enterococci* concentrations can be reduced with CSO controls. This is further supported by the loadings shown in Table 6-3 above.

Table 6-11. Model Calculated 2008 100 Percent CSO Control *Enterococci* Maximum 30-day GM and Attainment of Potential Future Primary Contact WQ Criteria

Station	Maximum Recreational Season(1) 30-day *Enterococci* (cfu/100mL)		% Attainment	
	GM	90th Percentile STV	GM	90th Percentile STV
NC1	19	304	100	76
NC2	18	308	100	77
NC3	18	310	100	76
NC4	17	281	100	45
NC5	18	318	100	24
NC6	10	141	100	86
NC7	16	303	100	39
NC8	15	250	100	42
NC9	15	223	100	35
NC10	11	183	100	74
NC11	21	725	100	11
NC12	29	1,491	100	4
NC13	22	441	100	14
NC14	32	1,241	97	5

Note:
(1) The recreational season is May 1st through October 31st.

A load source component analysis was conducted for the 2008 baseline condition using JFK Airport rainfall data, to provide a better understanding of how each source type contributes to bacteria concentrations in Newtown Creek. The source types include CSOs, stormwater, direct drainage, STP discharge to Whale Creek, point sources discharging to the East River and the East and Harlem Rivers open boundaries. Stormwater contribution to bacteria loads is relatively small when compared to CSOs, thus, the MS4 and non-MS4 loads were combined together as one source with direct drainage for analysis purposes. The analysis included the calculation of fecal coliform and *Enterococci* bacteria GMs in total and from each component. For fecal coliform, a maximum winter month (December) was analyzed because the decay rate is lower in winter, resulting in generally higher fecal coliform concentrations, as well as a worst month during the recreation season (September). *Enterococci* were evaluated on a maximum recreational season (May 1st through October 31st) 30-day GM basis. The 30-day period chosen for the *Enterococci* component analysis included both the maximum 30-day period and the 30-day period where the maximum contribution of CSOs to the geometric mean was observed.

Table 6-12 summarizes the fecal coliform component analysis for the maximum winter month and for the maximum recreation season month during 2008. The fecal coliform criterion (monthly GM less than or equal to 200 cfu/100mL) is exceeded during this maximum winter month (December) at all sampling locations within Newtown Creek and at most locations away from the East River and the mouth of Newtown Creek during the maximum recreation season month (September). CSOs are the largest contributor to the monthly GM fecal coliform concentration at Stations NC4 to NC14. Monthly GM fecal coliform concentrations at Stations NC1 to NC3 are more heavily influenced by the East and Harlem Rivers open boundaries.

Table 6-12 also summarizes the *Enterococci* component analysis. Similar to the fecal coliform component results, CSO is the largest contributor to the 30-day *Enterococci* GM at Stations NC4 to NC14. The East and Harlem Rivers open boundaries are the largest influence on Stations NC1 through NC3. For the worst 30-day period during the recreation season, Stations NC4 to NC14 had a 30-day *Enterococci* GM greater than the potential future criterion of 30 cfu/100mL.

Table 6-12 indicates that CSO impacts attainment of bacteria WQS in Newtown Creek. The alternatives analysis described in Section 8.0 focuses on reduction of the CSO discharges to Newtown Creek.

Table 6-12. Fecal and *Enterococci* GM Source Components

Source	Station	Fecal Coliform Contribution (#/100mL)		*Enterococci* Contribution (#/100mL)
		Monthly GM for Annual Worst Month-December	Monthly GM for Recreation Season Worst Month-September	Maximum 30-day Rolling GM During the Recreation Season(1)
East R. and Harlem R. Boundaries	NC1	222	53	15
East R. Point Sources	NC1	8	9	4
Whale Creek	NC1	0	0	0
Newtown Creek SW and DD	NC1	1	0	0
Newtown Creek CSO	NC1	0	1	0
Total	**NC1**	231	63	19
East R. and Harlem R. Boundaries	NC2	217	52	14
East R. Point Sources	NC2	10	11	4
Whale Creek	NC2	0	0	0
Newtown Creek SW and DD	NC2	0	0	0
Newtown Creek CSO	NC2	2	2	0
Total	**NC2**	229	65	18
East R. and Harlem R. Boundaries	NC3	214	52	13

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Table 6-12. Fecal and *Enterococci* GM Source Components

Source	Station	Fecal Coliform Contribution (#/100mL)		*Enterococci* Contribution (#/100mL)
		Monthly GM for Annual Worst Month-December	Monthly GM for Recreation Season Worst Month-September	Maximum 30-day Rolling GM During the Recreation Season(1)
East R. Point Sources	NC3	9	10	4
Whale Creek	NC3	0	0	0
Newtown Creek SW and DD	NC3	2	0	1
Newtown Creek CSO	NC3	22	18	2
Total	**NC3**	247	80	20
East R. and Harlem R. Boundaries	NC4	159	36	7
East R. Point Sources	NC4	4	5	2
Whale Creek	NC4	1	1	0
Newtown Creek SW and DD	NC4	31	7	6
Newtown Creek CSO	NC4	252	116	16
Total	**NC4**	447	165	31
East R. and Harlem R. Boundaries	NC5	134	30	6
East R. Point Sources	NC5	3	3	1
Whale Creek	NC5	2	2	0
Newtown Creek SW and DD	NC5	48	9	9
Newtown Creek CSO	NC5	378	139	20
Total	**NC5**	565	183	36
East R. and Harlem R. Boundaries	NC6	88	16	3
East R. Point Sources	NC6	2	1	1
Whale Creek	NC6	1	0	0
Newtown Creek SW and DD	NC6	47	7	6
Newtown Creek CSO	NC6	724	259	60
Total	**NC6**	862	283	70
East R. and Harlem R. Boundaries	NC7	109	24	4
East R. Point Sources	NC7	2	1	1
Whale Creek	NC7	3	1	0
Newtown Creek SW and DD	NC7	56	10	9
Newtown Creek CSO	NC7	493	161	24
Total	**NC7**	663	197	38
East R. and Harlem R. Boundaries	NC8	92	19	3

Table 6-12. Fecal and *Enterococci* GM Source Components

Source	Station	Fecal Coliform Contribution (#/100mL)		*Enterococci* Contribution (#/100mL)
		Monthly GM for Annual Worst Month-December	Monthly GM for Recreation Season Worst Month-September	Maximum 30-day Rolling GM During the Recreation Season(1)
East R. Point Sources	NC8	2	1	0
Whale Creek	NC8	2	1	0
Newtown Creek SW and DD	NC8	64	11	9
Newtown Creek CSO	NC8	617	188	27
Total	**NC8**	777	220	39
East R. and Harlem R. Boundaries	NC9	80	17	3
East R. Point Sources	NC9	1	1	0
Whale Creek	NC9	2	0	0
Newtown Creek SW and DD	NC9	73	12	9
Newtown Creek CSO	NC9	748	213	32
Total	**NC9**	904	243	44
East R. and Harlem R. Boundaries	NC10	42	8	2
East R. Point Sources	NC10	1	1	0
Whale Creek	NC10	1	0	0
Newtown Creek SW and DD	NC10	97	13	10
Newtown Creek CSO	NC10	1,378	334	65
Total	**NC10**	1,519	356	77
East R. and Harlem R. Boundaries	NC11	40	7	2
East R. Point Sources	NC11	0	0	0
Whale Creek	NC11	1	0	0
Newtown Creek SW and DD	NC11	128	17	17
Newtown Creek CSO	NC11	1,230	398	71
Total	**NC11**	1,399	422	90
East R. and Harlem R. Boundaries	NC12	33	5	1
East R. Point Sources	NC12	1	0	0
Whale Creek	NC12	0	0	0
Newtown Creek SW and DD	NC12	159	19	21
Newtown Creek CSO	NC12	1,452	496	105
Total	**NC12**	1,645	520	127
East R. and Harlem R. Boundaries	NC13	34	5	1

Table 6-12. Fecal and *Enterococci* GM Source Components

Source	Station	Fecal Coliform Contribution (#/100mL)		*Enterococci* Contribution (#/100mL)
		Monthly GM for Annual Worst Month-December	Monthly GM for Recreation Season Worst Month-September	Maximum 30-day Rolling GM During the Recreation Season(1)
East R. Point Sources	NC13	1	0	0
Whale Creek	NC13	0	0	0
Newtown Creek SW and DD	NC13	141	20	19
Newtown Creek CSO	NC13	1,251	498	72
Total	**NC13**	1,427	523	92
East R. and Harlem R. Boundaries	NC14	26	3	1
East R. Point Sources	NC14	1	0	0
Whale Creek	NC14	0	0	0
Newtown Creek SW and DD	NC14	186	29	28
Newtown Creek CSO	NC14	1,426	887	133
Total	**NC14**	1,639	919	162

Notes:
(1) 30-day period selected based on results at Station NC14.
SW – Stormwater; DD – Direct Drainage

6.3.d Time to Recovery

The analyses provided above examine the long-term impacts of wet-weather sources of bacteria, as is required by Existing and Potential Future Primary Contact WQ Criteria (monthly GM and 30-day GM). Shorter-term impacts are not evaluated using these regulatory criteria. Therefore, to gain insight into the shorter-term impacts of wet-weather sources of bacteria, DEP has reviewed the NYSDOH guidelines relative to single sample maximum bacteria concentrations that NYSDOH believes "constitute a potential hazard to health if used for bathing." The presumption is that if the bacteria concentrations are lower than these levels, then the waterways do not pose potential hazards if used for primary contact activities.

> **From NYS DOH**
>
> **https://www.health.ny.gov/regulations/nycrr/title_10/part_6/subpart_6-2.htm**
>
> **Operation and Supervision**
>
> 6-2.15 Water quality monitoring
> (a) No bathing beach shall be maintained … to constitute a potential hazard to health if used for bathing. To determine if the water quality constitutes a potential hazard … shall consider one or a combination of any of the following items: results of a sanitary survey; historical water quality model for rainfall and other factors; verified spill or discharge of contaminants affecting the bathing area; and water quality indicator levels specified in this section.
>
> (1) Based on a single sample, the upper value for the density of bacteria shall be: (i) 1,000 fecal coliform bacteria per 100 ml; or …(iii) 104 *Enterococci* per 100 ml for marine water; ….

NYSDOH considers fecal coliform concentrations that exceed 1,000 cfu/100mL to be potential hazards to bathing. Water quality modeling analyses were conducted to assess the amount of time following the end of rainfall required for Newtown Creek to recover and return to concentrations of less than 1,000 cfu/100mL.

LGA rainfall data were first analyzed for the period of 2002-2011. The Synoptic Surface Plotting (SYNOP) models were used to identify each individual storm and calculate the storm volume, duration, and start and end times. Rainfall periods separated by four hours or more were considered separate storms. Statistical analysis of the individual rainfall events for the recreational seasons (May 1st through October 31st) of the 10-year period resulted in a 90th percentile rainfall event of 1.09 inches. Based on this information, a storm approximating the 90th percentile storm was chosen from the 2008 recreational season (May 1st through October 31st) as a design storm. This design storm was the August 15, 2008 JFK rainfall event, which resulted in 1.02 inches of precipitation. A principal feature of this storm, aside from its volume, was the time until the next rainfall event, which allows concentrations to reach the fecal coliform target concentration. The period of dry-weather following this event allows for sufficient time to assess a wide range of recovery times that may occur depending on the characteristics of the CSO discharges and the receiving waterways.

Table 6-13 presents the time to recovery for the baseline condition and the Newtown Creek 100 percent CSO control scenario, evaluated with the August 15, 2008 JFK storm discussed above. Approximately 90 percent of the storms in the typical year generate less runoff volume. DEC has indicated that it seeks to have a time to recovery of less than 24 hours. Under the baseline conditions, 12 stations have time to recovery of well over 24 hours, ranging from 29 to 129 hours. Under baseline conditions, only two stations in the East River by the mouth of Newtown Creek have time to recovery below 24 hours, ranging between 9 and 10 hours.

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Removal of CSOs from Newtown Creek (100 percent CSO control) results in a significant reduction in the time to recovery compared to baseline conditions. For nine of the stations within Newtown Creek, the time to recovery would be reduced to zero, which means that the concentration at those stations does not exceed 1,000 cfu/100mL for the August 15, 2008 storm. Time to recovery at the other five stations would be decreased to a range of two to ten hours.

Table 6-13. Time to Recovery

Station	Time to Recovery (hours) Fecal Threshold (1,000 cfu/100mL)	
	Baseline	100% CSO Control
NC1	10	10
NC2	9	9
NC3	29	2
NC4	67	0
NC5	68	0
NC6	71	0
NC7	69	0
NC8	79	0
NC9	80	0
NC10	93	0
NC11	105	0
NC12	107	6
NC13	117	0
NC14	129	9

In summary, the time to recovery for baseline conditions does not attain DEC's desired target of 24 hours. However, 100 percent removal of CSO loadings would result in a significant decrease in the time to recovery and attainment of DEC's desired target.

7.0 PUBLIC PARTICIPATION AND AGENCY COORDINATION

DEP is committed to a proactive and robust program to inform the public about the development of watershed-specific and citywide LTCPs. Public outreach and public participation are important aspects of the plans, which are designed to reduce CSO-related impacts to achieve waterbody-specific WQS, consistent with the Federal CSO Control Policy and the CWA, and in accordance with EPA and DEC mandates.

DEP's Public Participation Plan was released to the public on June 26, 2012, and describes the tools and activities DEP uses to inform, involve and engage a diverse group of stakeholders and the broader public throughout the LTCP process. The purpose of the Plan is to create a framework for communicating with and soliciting input from interested stakeholders and the broader public concerning water quality and the challenges and opportunities for CSO controls. As described in the Public Participation Plan, DEP will strategically and systematically implement activities that meet the public's information needs and meet critical milestones in the overall LTCP schedule outlined in the 2012 CSO Order.

As part of the CSO Quarterly Reports, DEP reports to DEC on the public participation activities outlined in the Public Participation Plan, and summarizes public participation activities.

7.1 Local Stakeholder Team

DEP began the public participation process for the Newtown Creek LTCP by reaching out to the Newtown Creek Community Boards to identify the stakeholders who would be instrumental to the development of this LTCP. Identified stakeholders included both citywide and regional groups such as: environmental organizations (Stormwater Infrastructure Matters [S.W.I.M.] Coalition, Riverkeeper, Newtown Creek Alliance, North Brooklyn Boat Club, Harbor Lab); community planning organizations (Community Boards 2 and 7); academic and research organizations (LaGuardia CUNY); and City governmental agencies (NYC Department of Parks and Recreation, NYC Department of City Planning, New England Interstate Water Pollution Control Commission).

7.2 Summaries of Stakeholder Meetings

DEP held three public meetings and several stakeholder meetings to aid in the development and execution of the LTCP. The objective of the public meetings and a summary of the discussions are presented below.

Public Meetings

- Public Meeting #1: Newtown Creek LTCP Kickoff Meeting (November 15, 2016)

  Objectives: Provide overview of LTCP process, public participation schedule, watershed characteristics and sampling program.

  DEP hosted a Public Kickoff Meeting to initiate the water quality planning process for the Newtown Creek LTCP. Approximately 60 stakeholders from 25 different non-profit, community, planning, environmental, economic development, governmental organizations, and the broader public, attended the event, as did three media representatives. The two-hour event, held at Newtown Creek Wastewater Treatment Plant, Brooklyn, provided stakeholders with information about DEP's LTCP Program, Newtown Creek's watershed characteristics, green infrastructure implementation, and the status of waterbody improvement projects. The presentation is available on DEP's LTCP Program website: http://www.nyc.gov/dep/ltcp.

The Newtown Creek LTCP Kickoff Public Meeting was the first opportunity for public participation in the development of this LTCP. As part of the development of the LTCP, and in response to stakeholder comments, DEP provided detailed information about each of the following:

- Newtown Creek water quality standard classification;
- Newtown Creek ongoing and new developments;
- Newtown Creek current uses;
- Newtown Creek watershed and land uses;
- Newtown Creek sampling program;
- Newtown Creek water quality improvement projects;
- Newtown Creek Pre-WWFP and LTCP Baseline modeled CSO volumes; and
- Newtown Creek CSO mitigation options.

Stakeholder questions and DEP's responses provided during the meeting are posted to DEP's LTCP Program website and are included in Appendix B, Public Participation Materials.

- <u>Public Meeting #2: Newtown Creek LTCP Public Data Review Meeting (February 21, 2017)</u>

Objectives: Present water quality data collected in Newtown Creek and collect thoughts on issues to be addressed in the waterbody.

DEP hosted a Public Data Review Meeting to present the water quality data collected, and to get the public's thoughts on issues to be addressed in Newtown Creek. Approximately 30 stakeholders from different non-profit, community, planning, environmental, economic development, governmental organizations, and the broader public, attended the event, as did three media representatives. The two-hour event, held at Newtown Creek Visitor Center, Queens, provided information about DEP's LTCP development for Newtown Creek. The data-sharing meeting was the first of its kind being held in response to the request made at the close of the kickoff meeting held on November 15, 2016. The presentation is available on DEP's LTCP Program website: http://www.nyc.gov/dep/ltcp.

Key findings from the data collected in the Newtown Creek LTCP Sampling Program indicated elevated bacteria levels, excursions below the WQS criteria for DO and a slow time to recovery for the waterbody. DEP provided detailed information about each of the following:

- Newtown Creek DEP sampling programs and sampling locations;
- Newtown Creek CSO and MS4 landside sampling results and analysis;
- Newtown Creek flow monitoring results and analysis;

- Newtown Creek receiving water bacteria sampling results and analysis;
- Newtown Creek dissolved oxygen sampling results and analysis;
- Newtown Creek landside and water quality model calibration processes;
- Newtown Creek data from other (non-DEP) sampling programs;
- Newtown Creek baseline model inputs and assumptions; and
- Newtown Creek model results for baseline CSO volumes.

Stakeholder questions and DEP's responses provided during the meeting are posted to DEP's LTCP Program website and are included in Appendix B, Public Participation Materials.

- Public Meeting #3: Newtown Creek LTCP Alternatives Review Meeting (April 26, 2017)

Objectives: Review proposed alternatives, related waterbody uses and water quality conditions.

DEP hosted a third Public Meeting to continue discussion of the water quality planning process. Approximately 45 stakeholders from several different non-profit, community planning, environmental, economic development, and governmental organizations, as well as the general public, attended the event. The purpose of the three-and-half-hour event, held at the Newtown Creek WWTP, Brooklyn, was to describe the alternatives identification and selection processes, and solicit public comment and feedback. The presentation is available on DEP's LTCP Program website: http://www.nyc.gov/dep/ltcp.

As part of the development of the LTCP, and in response to stakeholder comments, DEP provided detailed information about each of the following:

- Review of Newtown Creek public comments received;
- Review of water quality standards and goals for Newtown Creek;
- Newtown Creek field sampling program results;
- Modeling results and performance gap analysis for Newtown Creek;
- Fecal, entero and dissolved oxygen projected attainment for Newtown Creek;
- CSO reduction alternatives evaluation for Newtown Creek;
- Potential sites and alternatives under further review for Newtown Creek; and
- 2017 and Escalated Cost Estimates for Potential Alternatives for Newtown Creek.

Stakeholder questions and DEP's responses provided during the meeting are posted on DEP's website, and are included in Appendix B, Public Participation Materials.

- Public Meeting #4: LTCP Review Meeting (not yet scheduled)

Objectives: Present LTCP after it has been submitted to DEC.

This meeting will present the final Recommended Plan to the public after DEC review. Outcomes of the discussion and a copy of presentation materials will be posted to DEP's website.

Stakeholder Meetings

- North Brooklyn Boat Club (July 20, 2016)

  Representatives from DEP's Bureaus of Wastewater Treatment and Public Affairs joined the North Brooklyn Boat Club and Newtown Creek Alliance for a canoe trip on Newtown Creek. During the trip members of the Newtown Creek Alliance shared information about how they use the waterway and highlighted their water quality concerns.

- Newtown Creek Alliance and Riverkeeper (April 5, 2017)

  DEP attended a meeting with the Newtown Creek Alliance, Riverkeeper, and DEC. During the meeting the environmental organizations shared their opposition to and concerns with the current aeration system. Representatives from DEP's Bureaus of Wastewater Treatment and Public Affairs participated in the meeting and answered questions regarding operations and maintenance of the aeration system.

- Plank Road Site Visit (April 21, 2017)

  DEP met with members of the Newtown Creek Alliance at Plank Road near Newtown Creek. The Newtown Creek Alliance has installed plantings and signage at Plank Road to turn the street end into a community amenity. DEP has underground infrastructure under Plank Road and the community was concerned about protecting their plantings and preserving community space. Representatives from DEP's Bureaus of Water and Sewer Operations and Public Affairs and Communications listened to the concerns and worked with Newtown Creek Alliance to create solutions. Ongoing follow-up will be needed as DEP repairs infrastructure in the area.

- Newtown Creek Alliance and Riverkeeper – Newtown Creek Vision Report (March 24, 2017 and June 3, 2017)

  In March 2017, DEP hosted a meeting with the Newtown Creek Alliance and Riverkeeper. Riverkeeper is producing a Newtown Creek Vision Report in consultation with local community members. DEP shared information about ongoing ecological restoration projects in the Creek and provided contacts for other City agencies with Newtown Creek related projects and programs. In June, Riverkeeper and Newtown Creek Alliance hosted a Vision Report workshop at Kingsland Wildfires in Brooklyn. DEP tabled the event and had maps, posters, and materials to give away. Several participants stopped by the DEP table to ask questions about the LTCP, green infrastructure, and MS4 programs.

- Wait… Pilot Program

  In Spring 2016, DEP initiated a pilot program called Wait… Launched in the Newtown Creek watershed, the purpose of the pilot was to educate residents about combined sewer overflows and encourage them to wait to use water in their homes until heavy rain events end. Over the course of several weeks, DEP tabled events, conducted street canvasing, flyered restaurants and stores in the pilot area, and went door to door to sign people up for the program. Registered participants received real-time text messages at the beginning of a heavy rain event, reminding them to wait before engaging in water-intensive activities in their homes, such as dish washing, laundry, showering and toilet flushing. When the heavy rain event ended, a second automated text message was sent to all participants, thanking them for waiting. DEP's comprehensive metering system enabled staff to analyze daily water consumption readings at the building level during the pilot program. DEP began monitoring participants' consumption in June 2016 for a six-month period and results indicate that water consumption among the 379 participants decreased approximately 5 percent from baseline conditions during the heavy rain events. DEP held four meetings during the sign-up phase:

  - April 22, 2016: Partner meeting at New York City Housing Authority (NYCHA) Williamsburg Houses Community Center
  - April 29, 2016: Councilman Reynoso staff briefing and pilot area tour
  - May 25, 2016: presentation and sign-up event at Jennings Hall Senior Citizen Housing (St. Nicks Alliance)
  - May 27, 2016: presentation and sign-up event at Monsignor Vetro Hall (St. Nicks Alliance)

- Elected Official and Community Board Meetings

  DEP maintains positive working relationships with elected officials, community boards, and neighborhood associations. The meetings and briefings listed below allowed DEP to provide information about the Newtown Creek Long Term Control Plan, updates on projects under the Newtown Creek Waterbody Watershed Facility Plan, and the green infrastructure implementation in the Newtown Creek watershed.

  - Briefing for Brooklyn Borough President and Borough Service Cabinet (November 9, 2016)
  - Briefing for Queens Borough President and Borough Service Cabinet (November 15, 2016)

Public Comments Received

DEP received the following comments:

- Newtown Creek Group. Newtown Creek CSO Long Term Control Plan. May 31, 2016.
- Newtown Creek Alliance and S.W.I.M. Coalition Steering Committee. Newtown Creek CSO Long Term Control Plan Alternatives Meeting. June 1, 2017.

These comments are posted to DEP's website and are included in Appendix B, Public Participation Materials.

7.3 Coordination with Highest Attainable Use

Newtown Creek is a Class SD water, with the best usages defined by DEC as: "fishing. These waters shall be suitable for fish, shellfish, and wildlife survival. In addition, the water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for this purpose." Newtown Creek currently cannot fully support existing uses, kayaking and wildlife survival, and the waterbody is not in full attainment existing Class SD water quality criteria for bacteria and DO. Even 100 percent CSO reduction would not bring the waterbody into compliance with WQS. The analyses also show that the enteroccoi Potential Future Primary Contact WQ Criteria is projected to not be attained throughout the recreational season (May 1st through October 31st). There are no permitted swimming locations or sanctioned infrastructure or equipment supporting secondary contact recreation along Newtown Creek; thus, the non-attainment of the swimmable standard during and after rainfall or during the non-recreational season (November 1st through April 30th) would not impact such uses.

This LTCP further investigated the spatial and temporal attainment with Potential Future Primary Contact WQ Criteria consistent with the 2012 EPA RWQC. Based on 10-year model simulations with the Recommended Plan conducted as part of this LTCP, Newtown Creek is not currently predicted to be in full attainment (95 percent) with the Potential Future Primary Contact WQ 30-day geometric mean enterococcus criterion of 30 cfu/100mL during the recreational season (May 1st through October 31st). The STV value of 110 cfu/100mL is also not projected to be attained. Analyses presented herein clearly show that attainment of the STV value of 110 cfu/100mL is not possible through CSO control alone.

DEP is committed to improving water quality in Newtown Creek, and the Recommended Plan for Newtown Creek presented herein will significantly reduce the wet-weather pollutant loads to the Creek. Water quality evaluations conducted as part of the LTCP have demonstrated that short-term impacts to water quality will continue to occur during wet-weather events. As a result, wet-weather advisories based on time to recovery analysis are recommended for consideration for this waterbody.

7.4 Internet Accessible Information Outreach and Inquiries

Both traditional and electronic outreach tools are important elements of DEP's overall communication effort. DEP will ensure that outreach tools are accurate, informative, up-to-date and consistent, and are widely distributed and easily accessible. Table 7-1 presents a summary of Newtown Creek LTCP public participation activities.

Table 7-1. Summary of Newtown Creek LTCP Public Participation Activities Performed

Category	Mechanisms Utilized	Dates (if applicable) and Comments
Regional LTCP Participation	Citywide LTCP Kickoff Meeting and Open House	• June 26, 2012
	Annual Citywide LTCP Meeting – Modeling Meeting	• February 28, 2013
	Annual Citywide LTCP Meeting #3	• December 11, 2014
	Annual Citywide LTCP Meeting #4	• January 12, 2016

AECOM with Hazen

Table 7-1. Summary of Newtown Creek LTCP Public Participation Activities Performed

Category	Mechanisms Utilized	Dates (if applicable) and Comments
Waterbody-specific Community Outreach	Public meetings and open houses	• Kickoff Meeting: November 15, 2016 • Meeting #2: February 21, 2017 • Meeting #3: April 26, 2017 • Meeting #4: TBD
Waterbody-specific Community Outreach	Stakeholder meetings and forums	• Newtown Creek Alliance and Riverkeeper (April 5, 2017) • Plank Road Site Visit (April 21, 2017) • Newtown Creek Alliance and Riverkeeper – Newtown Creek Vision Report (March 24, 2017 and June 3, 2017) • Wait…Public Meetings • April 22, 2016 • April 29, 2016 • May 25, 2016 • May 27, 2016
Waterbody-specific Community Outreach	Elected officials briefings	• Brooklyn Borough President and Borough Service Cabinet (November 9, 2016) • Queens Borough President and Borough Service Cabinet (November 15, 2016)
Data Collection and Planning	Establish online comment area and process for responding to comments	• Comment area added to website on October 1, 2012 • Online comments receive response within two weeks of receipt
Data Collection and Planning	Update mailing list database	• DEP updates master stakeholder database (1,100+ stakeholders) before each meeting
Communication Tools	Program Website or Dedicated Page	• LTCP Program website launched June 26, 2012 and frequently updated • Newtown Creek LTCP web page launched October 2015
Communication Tools	Social Media	• Facebook and Twitter announcements of meetings
Communication Tools	FAQs	• LTCP FAQs developed and disseminated beginning June 2014 via website, meetings and email

Table 7-1. Summary of Newtown Creek LTCP Public Participation Activities Performed

Category	Mechanisms Utilized	Dates (if applicable) and Comments
Communication Tools	Print Materials	• LTCP FAQs: June 11, 2014 • LTCP Goal Statement: June 26, 2012 • LTCP Public Participation Plan: June 26, 2012 • LTCP Program Brochure: February 12, 2015 • Glossary of Modeling Terms: February 28, 2013 • Meeting advertisements, agendas and presentations • PDFs of poster board displays from meetings • Meeting summaries and responses to comments • Quarterly Reports • WWFPs
	Translated Materials	• Advertisements for the Alternatives Meeting were distributed in English, Korean, and Spanish • Translators were available for the Alternatives Meeting
	Portable Informational Displays	• Poster board displays at meetings
Student Education	Participate in ongoing education events	• DEP has robust and ongoing education programs in local schools
	Provide specific green and grey infrastructure educational modules	• DEP has robust and ongoing education programs in local schools

DEP launched its LTCP Program website on June 26, 2012. The website provides links to documents related to the LTCP Program, including the CSO Order and any modifications, approved WWFPs, CSO Quarterly Reports, links to related programs, such as the GI Plan and Annual Report, and handouts and poster boards distributed and displayed at public meetings and open houses. A LTCP feedback email account was also created to receive LTCP-related feedback, and stakeholders can sign-up to receive LTCP Program announcements via email. In general, DEP's LTCP Program Website:

- Describes the LTCP process, CSO-related information and citywide water quality improvement programs to-date;
- Describes waterbody-specific information including historical and existing conditions;
- Provides the public and stakeholders with timely updates and relevant information during the LTCP process, including meeting announcements;
- Broadens DEP's outreach campaign to further engage and educate the public on the LTCP process and related issues; and
- Provides an online portal for submission of comments, letters, suggestions, and other feedback.

A dedicated Newtown Creek LTCP webpage was created on October 1, 2015 and includes the following information:

- Newtown Creek public participation and education materials
  - Newtown Creek Summary Paper
  - LTCP Public Participation Plan
- Newtown Creek LTCP Meeting Announcements
- Newtown Creek Meeting #1 Meeting Documents – November 15, 2016
  - Advertisement
  - Meeting Presentation
  - Meeting Summary
- Newtown Creek Meeting #2 Meeting Documents – February 21, 2017
  - Meeting Advertisement
  - Meeting Presentation
  - Meeting Summary
- Newtown Creek Meeting #3 Meeting Documents – April 26, 2017
  - Meeting Advertisement
  - Meeting Presentation
  - Meeting Summary

8.0 EVALUATION OF ALTERNATIVES

This section describes the development and evaluation of CSO control measures and watershed-wide alternatives. A CSO control measure is defined as a technology (e.g., treatment or storage), practice (e.g., NMC or BMP), or other method (e.g., source control or GI) of abating CSO discharges or the effects of such discharges on the environment. Alternatives evaluated are comprised of a single CSO control measure or a group of control measures that will collectively address the water quality objectives for Newtown Creek.

This section contains the following information:

- Process for developing and evaluating CSO control alternatives that reduce CSO discharges and improves water quality (Section 8.1).
- CSO control alternatives and their evaluation (Section 8.2).
- CSO reductions and water quality benefits achieved by the higher-ranked alternatives, as well as their estimated costs (Sections 8.3 and 8.4).
- Cost-performance and water quality attainment assessment for the higher-ranked alternatives for the selection process of the preferred alternative (Section 8.5).

As presented in Section 6.2, Table 6-4, three sets of WQS, including fecal coliform and *Enterococci* bacteria WQ criteria and DO criteria, were used to evaluate CSO control alternatives and their corresponding levels of attainment. These evaluations include both existing and possible future WQ criteria.

It should be noted that while this LTCP focuses on attaining WQS in accordance with the CWA and New York State Environmental Conservation Law, EPA is also evaluating the presence of hazardous substances in Newtown Creek in accordance with CERCLA. A draft Remedial Investigation Report was submitted to EPA on November 15, 2016 by the non-City PRPs and is under EPA review. EPA is currently overseeing the performance of a Feasibility Study, also by the non-City PRPs, to evaluate potential remedies for Newtown Creek based on data collected during the Remedial Investigation, as well as on additional sampling and studies. EPA expects to issue a ROD for Newtown Creek, which will set forth EPA's selected remedy for Newtown Creek, in 2020, and it is possible that the ROD may include a CSO mitigation component.

8.1 Considerations for LTCP Alternatives under the Federal CSO Policy

This LTCP addresses the water quality objectives of the CWA and the New York State Environmental Conservation Law. This LTCP also builds upon the conclusions presented in DEP's June 2011 Newtown Creek WWFP. As required by the 2012 CSO Order, when the proposed alternative set forth in the LTCP will not achieve Existing WQ Criteria or the Section 101(a)(2) goals, a Use Attainability Analysis (UAA) must be prepared. A UAA is the mechanism to examine whether applicable waterbody classifications, criteria, or standards should be adjusted by the State. If deemed necessary, the UAA would assess compliance with the next higher classification that the State would consider in adjusting WQS and developing waterbody-specific criteria. The remainder of Section 8.1 discusses the development and evaluation of CSO control measures and watershed-wide alternatives to comply with the CWA in general, and with the CSO Control Policy in particular. This section describes the evaluation factors considered for each alternative and a description of the process for evaluating the alternatives.

8.1.a Performance

A summary of the IW model output data for volume and frequency of discharge of the CSO outfalls to Newtown Creek and its tributaries is provided in Table 8-1. The locations of these outfalls are shown in Figure 8-1.

Table 8-1. CSO Discharges Tributary to Newtown Creek (2008 Typical Year)

Combined Sewer Outfalls	Receiving Waters	Discharge Volume (MGY)	No. of Discharges	Percentage of Total CSO Discharge to Newtown Creek
BB-026	Dutch Kills	120	37	10.3%
NC-077	Maspeth Creek	300	41	25.8%
NC-083	East Branch	314	42	27.0%
NC-015	English Kills	321	31	27.7%
Subtotal - Four Largest Outfalls	**Newtown Creek and Tributaries**	**1,055**	**42 (max.)**	**90.9%**
BB-004	Dutch Kills	0	1	
BB-009	Dutch Kills	43	34	3.7%
BB-040	Dutch Kills	1	16	<1.0%
BB-010	Newtown Creek	1	7	<1.0%
BB-011	Newtown Creek	2	14	<1.0%
BB-012	Newtown Creek	0	1	<1.0%
BB-013	Newtown Creek	16	31	1.4%
BB-014	Newtown Creek	2	18	<1.0%
BB-015	Newtown Creek	1	13	<1.0%
BB-042	Newtown Creek	2	22	<1.0%
BB-043	Newtown Creek	9	32	<1.0%
BB-049	Newtown Creek	0	0	0.0%
NCB-019	Newtown Creek	3	21	<1.0%
NCB-021	Newtown Creek	0	0	0.0%
NCB-022	Newtown Creek	7	29	<1.0%
NCB-023	Newtown Creek	0	8	<1.0%
NCQ-029	Newtown Creek	19	40	1.6%
Subtotal – Other Outfalls	**Newtown Creek and Dutch Kills**	**106**	**40 (max.)**	**9.1%**
Total CSO	**Newtown Creek and Tributaries**	**1,161**	**42 (max.)**	**100%**

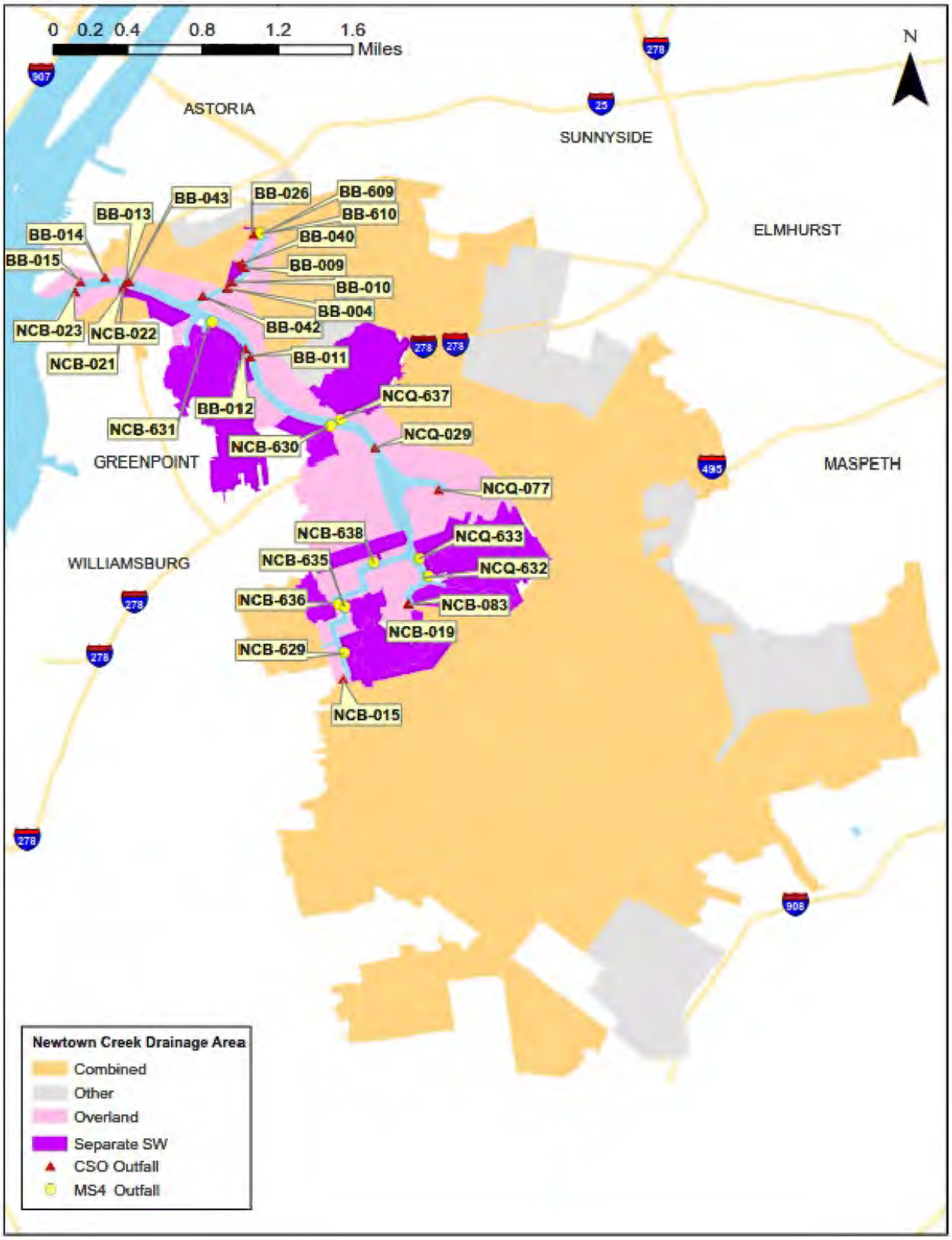

Figure 8-1. CSO Discharges to Newtown Creek

As indicated in Table 8-1, four CSO outfalls - BB-026, NCQ-077, NCB-083 and NCB-015 - generate 91 percent of the total annual CSO discharge volume. None of the other outfalls contributes more than four percent of the total, and most contribute less than one percent of the total. The four outfalls that generate the largest volumes are located at the head ends of four Newtown Creek tributaries: Dutch Kills, Maspeth Creek, East Branch and English Kills, respectively. Because of their headwater locations, the water quality impacts of the loadings from the four largest outfalls are generally measurable throughout the Creek.

To determine the influence of CSO control on the attainment of existing and future WQ criteria, a Performance Gap Analysis was performed. The results of the analysis are summarized in Section 6.3. The evaluations concluded that a performance gap exists because both the Primary Contact WQ Criteria for fecal coliform bacteria and the Class SD DO criterion will not be attained under baseline conditions. As a result, the evaluation of performance for the Newtown Creek alternatives related to bacteria focused on improving the attainment of Primary Contact Bacteria WQ criteria and the designated Class SD DO criterion (>3.0 mg/L). The alternatives evaluations also considered the level of control necessary to achieve the DEC goal for a time to recovery of less than 24 hours after a wet-weather event. Additionally, improvements to the attainment of Potential Future WQ Criteria (RWQC) and the Class SC DO criterion that would be realized by the selected CSO mitigation alternatives have been evaluated and reported.

The analyses in Section 6 showed that under baseline conditions, annual attainment with Existing WQ Criteria for bacteria ranged from 42 to 83 percent, with lower attainment projected towards the head end. While 100 percent CSO control would improve overall annual attainment with Existing WQ Criteria for bacteria, modeling still projected non-attainment in English Kills and East Branch, with an annual attainment of 83 percent. Under baseline conditions during the recreational season (May 1st through October 31st), attainment with Existing WQ Criteria for bacteria ranged from 67 to 100 percent, with lower attainment projected towards the head end. With 100 percent CSO control, projected recreational season (May 1st through October 31st) attainment with Existing WQ Criteria for bacteria was projected to be 100 percent. Overall, the dissolved oxygen had a projected annual attainment with the Existing Class SD WQ Criterion for DO between 90 and 100 percent under baseline conditions that includes seasonal aeration in English Kills and East Branch. Dutch Kills without aeration was projecting an annual attainment with the Existing WQ Criterion for DO between 98 and 99.9 percent.

The primary goals for the development and evaluation of control alternatives are the ability to achieve bacteria load reduction and to attain applicable water quality criteria. The control of floatables is also an important goal and is a consideration for all alternatives. The evaluation of control alternatives typically follows a two-step process. First, based upon IW watershed model runs for the typical year rainfall (2008), the level of CSO control of each alternative is established, including the reduction of CSO volume, fecal coliform and *Enterococci* loading. The second step uses the estimated levels of CSO control to project levels of attainment in the receiving waters. This latter step uses the Newtown Creek Receiving Water Quality Model (NCRWQM). LTCPs are typically developed with alternatives that span a range of CSO volumetric (and loadings) reductions. Accordingly, this LTCP includes alternatives that consider a wide range of reductions in CSO loadings - up to 100 percent CSO control - including investments in green and grey infrastructure. Intermediate levels of CSO volume control, approximately 25, 50 and 75 percent, are typically also evaluated. Table 8-2 provides a summary of the required storage volume and associated peak flow rates that would have to be diverted from the outfalls for each of these levels of CSO control for the four largest CSO outfalls.

Table 8-2. Summary of Storage and Peak Flow Rates Required for Each Level of CSO Control for the Four Largest Outfalls

Required Capacity	25% CSO Control	50% CSO Control	75% CSO Control	100% CSO Control
Storage Capacity (MG)	11	30	59	138
Diverted Peak Flow (MGD)(1)	67	165	343	1,833

Note:
(1) Peak flow that would have to be conveyed to storage or treatment to provide the targeted level of CSO control.

Figures 8-2 and 8-3 show plots of the required volumes and flow rates for these four large outfalls.

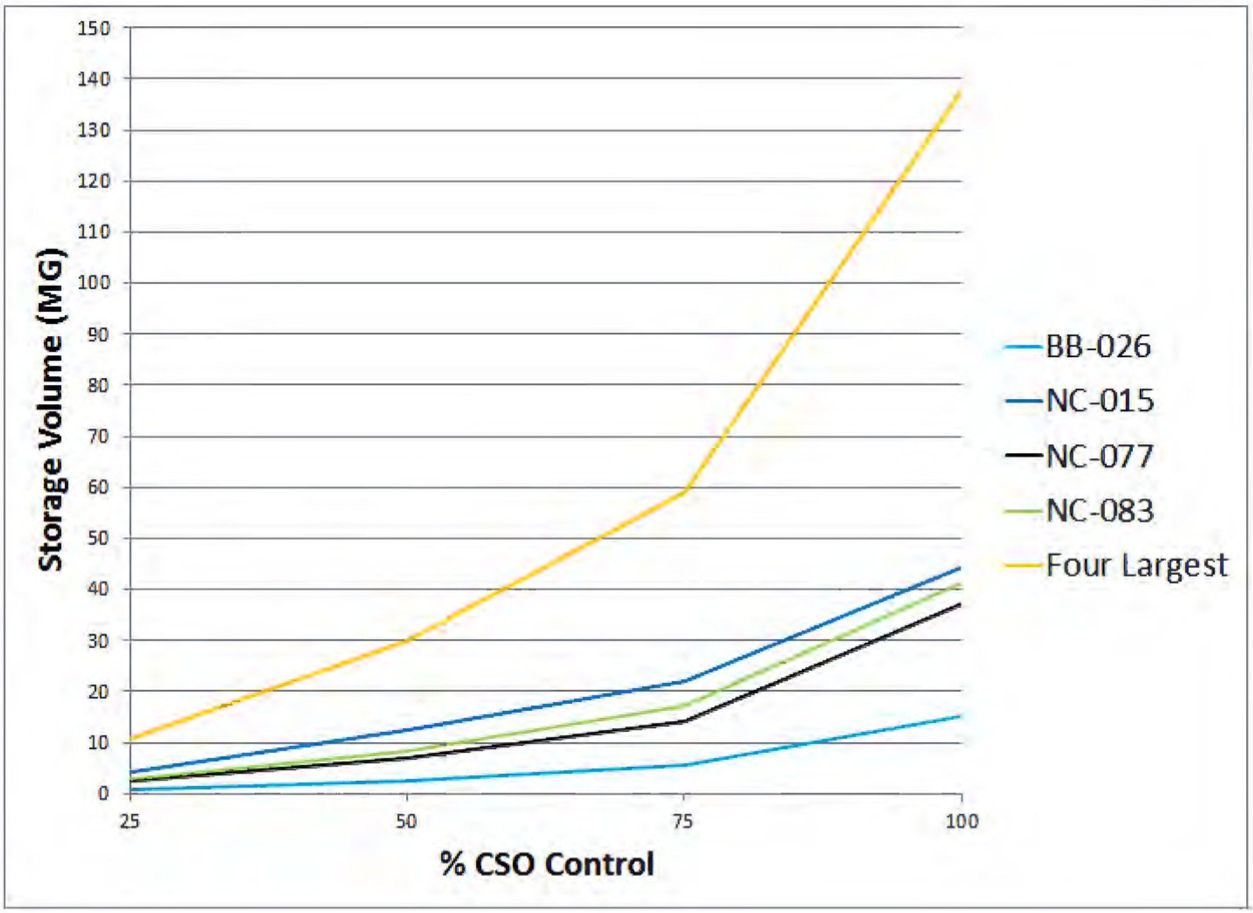

Figure 8-2. Required Storage Volume for Various Levels of CSO Control for Four Largest Outfalls

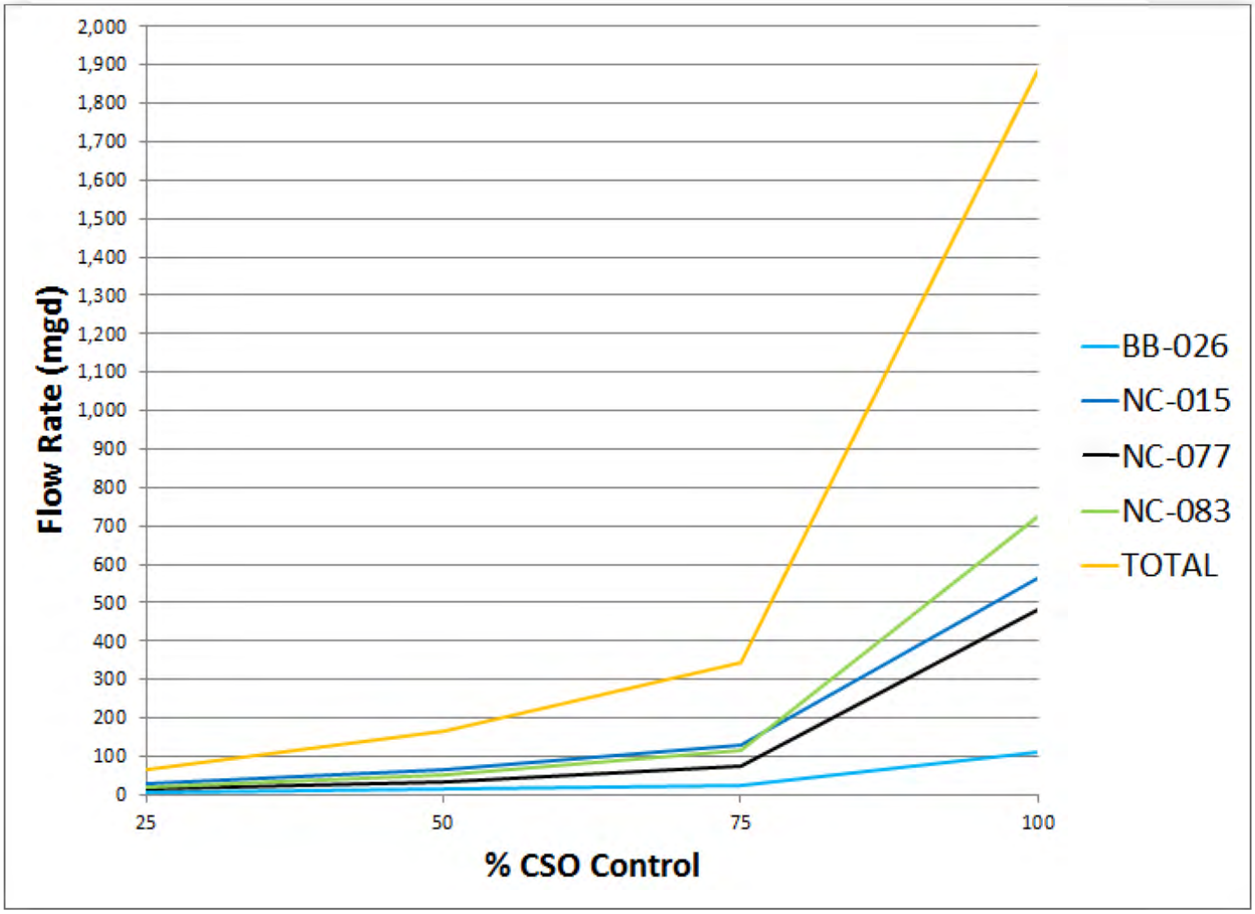

Figure 8-3. Required Diverted Peak Flow for Various Levels of CSO Control for the Four Largest Outfalls

8.1.b Impact on Sensitive Areas

In developing LTCP alternatives, special effort is made to minimize the impact of construction, to protect existing sensitive areas, and to enhance water quality in sensitive areas. As described in Section 2.0, no sensitive areas were identified within the Newtown Creek watershed. As such, only construction impacts were considered, as appropriate.

8.1.c Cost

Cost estimates for the alternatives were computed using a costing tool based on parametric costing data. This approach provides an AACE Class 5 estimate (accuracy range of minus 20 to 50 percent to plus 30 to 100 percent), which is typical and appropriate for this type of planning evaluation. For the purpose of this LTCP, all costs are in February 2017 dollars.

For the LTCP alternatives, Probable Bid Cost (PBC) was used as the estimate of the construction cost. Annual operation and maintenance costs were then used to calculate the total or net present worth (NPW) over the projected useful life of the project. In general, a lifecycle of 20 years and an interest rate of 3.0 percent were assumed resulting in a Present Worth Factor of 14.877. However, for tunnel alternatives, which provide longer service, a 100-year lifecycle was considered and a corresponding Present Worth Factor of 31.599 was used.

To quantify costs and benefits, alternatives were compared based on reductions of both CSO discharge volume and bacteria loading against the total cost of the alternative. These costs were then used to plot the performance and attainment curves. A pronounced inflection point appearing in the resulting graphs, the so-called knee-of-the-curve point, suggests a potential cost-effective alternative for further consideration. In theory, this would reflect the alternative that achieves the greatest appreciable water quality improvements per unit of cost. However, cost/performance or cost/attainment curves do not always identify a distinct "knee," and if an alternative does fall on a distinct "knee," it may not necessarily be the preferred alternative. The final, or preferred, alternative must be capable of improving water quality in a fiscally responsible and affordable manner to ensure that resources are properly allocated across the overall citywide LTCP program. These monetary considerations also must be balanced with non-monetary factors, such as construction impacts, environmental benefits, technical feasibility, and operability, which are discussed below.

8.1.d Technical Feasibility

Several factors were considered when evaluating technical feasibility, including:

- Effectiveness for controlling CSO
- Reliability
- Implementability

The effectiveness of CSO control measures was assessed based on their ability to reduce CSO frequency, volume and load. Reliability is an important operational consideration, and can have an impact on overall effectiveness of a control measure. Therefore, reliability and proven history were used to assess the technical feasibility of a CSO control measure.

Several site-specific factors were considered to evaluate an alternative's implementability, including available space, neighborhood assimilation, impact on parks and green space, and overall practicability of installing - and later maintaining - CSO controls. In addition, the method of construction was factored into the final selection. Some technologies require specialized construction methods that typically incur additional impacts as well as costs.

8.1.e Cost-Effective Expansion

All alternatives evaluated were sized to handle the CSO volumes based on the 2008 typical year rainfall and 2040 design year dry-weather flows, with the understanding that the predicted and actual flows may differ. To help mitigate the difference between predicted and actual flows, adaptive management was considered for those CSO technologies that can be expanded in the future to capture or treat additional CSO flows or volumes, should it be needed. In some cases, this may have affected where the facility would be constructed, or gave preference to a facility that could be expanded at a later date with minimal cost and disruption of operation.

Breaking construction into segments allows adjustment of the design of future phases based on the performance of already-constructed phases. Lessons learned during operation of current facilities can be incorporated into the design of future facilities. However, phased construction also exposes the local community to a longer construction period. Where applicable, for those alternatives that can be expanded, the LTCP takes into account the ease of expansion, what additional infrastructure may be required, and if additional land acquisition would be needed.

As regulatory requirements change, other water quality improvements may be required. The ability of a CSO control technology to be retrofitted to address additional pollutant parameters or more stringent discharge limits strengthens the case for application of that technology.

8.1.f Long Term Phased Implementation

Recommended LTCP implementation steps associated with the preferred alternative are typically structured in a way that makes them adaptable to change by expansion and modification resulting from possible new regulatory and/or local drivers. If applicable, the project(s) would be implemented over a multi-year schedule. Because of this, permitting and approval requirements must be identified prior to selection of the alternative. With the exception of GI, which is assumed to occur on both private and public property, most of the CSO grey technologies target municipally owned property and right-of-way-acquisitions. DEP will work closely with other NYC agencies and, as necessary, with NYS, to ensure proper coordination with other government entities.

8.1.g Other Environmental Considerations

DEP has considered minimizing impacts on the environment and surrounding neighborhood during construction. These impacts could potentially include traffic, site access issues, park and wetland disruption, noise pollution, air quality, and odor emissions. To minimize environmental impacts, they will be identified with the selection of the preferred plan and communicated to the public. The specific details on mitigation of the identified concerns and/or impacts, such as erosion control measures and the rerouting of traffic, are addressed later as part of a pre-construction environmental assessment.

8.1.h Community Acceptance

As described in Section 7, DEP is committed to involving the public, regulators, and other stakeholders throughout the planning process. Community acceptance of the recommended plan is essential to its success. As such, DEP uses the LTCP public participation process to present the scope of the LTCP, background, newly collected data, WQS and the development and evaluation of alternatives to the public and to solicit its support and feedback. The Newtown Creek LTCP is intended to improve water quality, and public health and safety are its priorities. The goal of raising awareness of and access to waterbodies was also considered throughout the alternative analysis. Several CSO control measures, such as GI, have been shown to enhance communities while increasing local property values. As such, the benefits of GI were considered in the formation of the baseline and the final recommended plan.

8.1.i Methodology for Ranking Alternatives

The multi-step evaluation process DEP used to develop the Newtown Creek LTCP accomplished the following:

1. Evaluated benchmarking scenarios, including baseline and 100 percent CSO control, to establish a range of controls within the Newtown Creek watershed for consideration. The results of this step were described in Section 6.
2. Used baseline conditions to prioritize the CSO outfalls for possible controls.

3. Developed a list of promising control measures for further evaluation based in part on the prioritized CSO list.
4. Established levels of intermediate CSO control that provide a range between baseline and 100 percent CSO control for the receiving water quality simulations that were conducted.
5. Held a Challenge Team Workshop on March 31, 2016, to brainstorm ideas ahead of the formal alternatives development process.
6. Toured the Narragansett Bay Commission (Providence, RI) CSO tunnel (as part of the Flushing Bay LTCP development) on October 19, 2016, to solicit feedback and lessons learned.
7. Conducted an initial "brainstorming" meeting with DEP staff on January 12, 2017, to review the most promising control measures and to solicit additional options to explore.
8. Held a meeting with DEP Bureau Executives on January 30, 2017, to develop presentation materials for joint DEC/EPA meeting.
9. Held a meeting with DEC and EPA staff on February 16, 2017, to present water quality sampling results, baseline modeling, WQS attainment and preliminary CSO control alternatives, and to review the progress to-date on the alternatives development.
10. Held a second "brainstorming" meeting with DEP staff on March 22, 2017, to further review additional details on the most promising control measures and to solicit additional options to further explore.
11. Conducted meetings with DEP staff on March 30 and April 4, 2017, to prepare for Inter-Bureau Alternatives Workshop.
12. Conducted a follow-up workshop with operations staff on April 10 2017, to review the progress to-date on the alternatives development and to solicit input and concerns on operability, and to select a shortlist of retained alternatives.
13. Toured the Monroe County (Rochester, NY) CSO tunnel on May 10, 2017, to solicit feedback and lessons learned.
14. Presented findings of retained alternatives to DEC on June 13, 2017.

The focal points of this process were the meetings and workshops listed above. Prior to the first meeting, the control measures that were evaluated in the 2011 WWFP were revisited from the perspective of the LTCP goal statement and in light of the implemented WWFP controls. Additional control measures were also identified and assessed. The resultant control measures were introduced at the first meeting. Based on discussions at that meeting, further additional control measures were identified. A preliminary evaluation of these control measures was then conducted including an initial estimation of costs and water quality CWA impacts. During the second meeting, promising alternatives were reviewed in more detail. The LTCP workshops, attended by a broader array of DEP operational and engineering staff, included updated alternative assessments.

Categories of control measures considered included, Source Control, System Optimization, CSO Relocation, Water Quality/Ecological Enhancement, Treatment and Storage. Specific control measures considered under each category were as follows:

Source Control

- Additional and Existing Green Infrastructure
- Sewer Separation

System Optimization

- Fixed Weirs
- Parallel Interceptor/Sewer
- Inflatable Dams, Bending Weirs or Control Gates
- Pumping Station Expansion/Optimization

CSO Relocation

- Gravity Flow Tipping to Other Watersheds
- Pumping Station Modification
- Flow Tipping with Conduit/Tunnel and pumping

Water Quality/Ecological Enhancement

- Floatables Control
- Environmental Restoration
- In-Stream Aeration
- Flushing Tunnel

Treatment

- Outfall Disinfection
- Retention Treatment Basin
- High Rate Clarification
- WWTP Expansion

Storage

- In-System/Outfall
- Shaft
- Tank
- Tunnel

Figure 8-4 presents these control measures according to their relative cost and level of complexity. The control measures in the upper left corner are generally the least costly and least complex to construct and/or operate, while those towards the lower right are the most costly and most complex to construct and/or operate. The level of loading removal performance of each measure typically corresponds with the level of cost and complexity.

Following the initial screening meeting, control measures were advanced to a second level of evaluation with the exception of the following (either marked with an "X" or highlighted as an ongoing project in Figure 8-4):

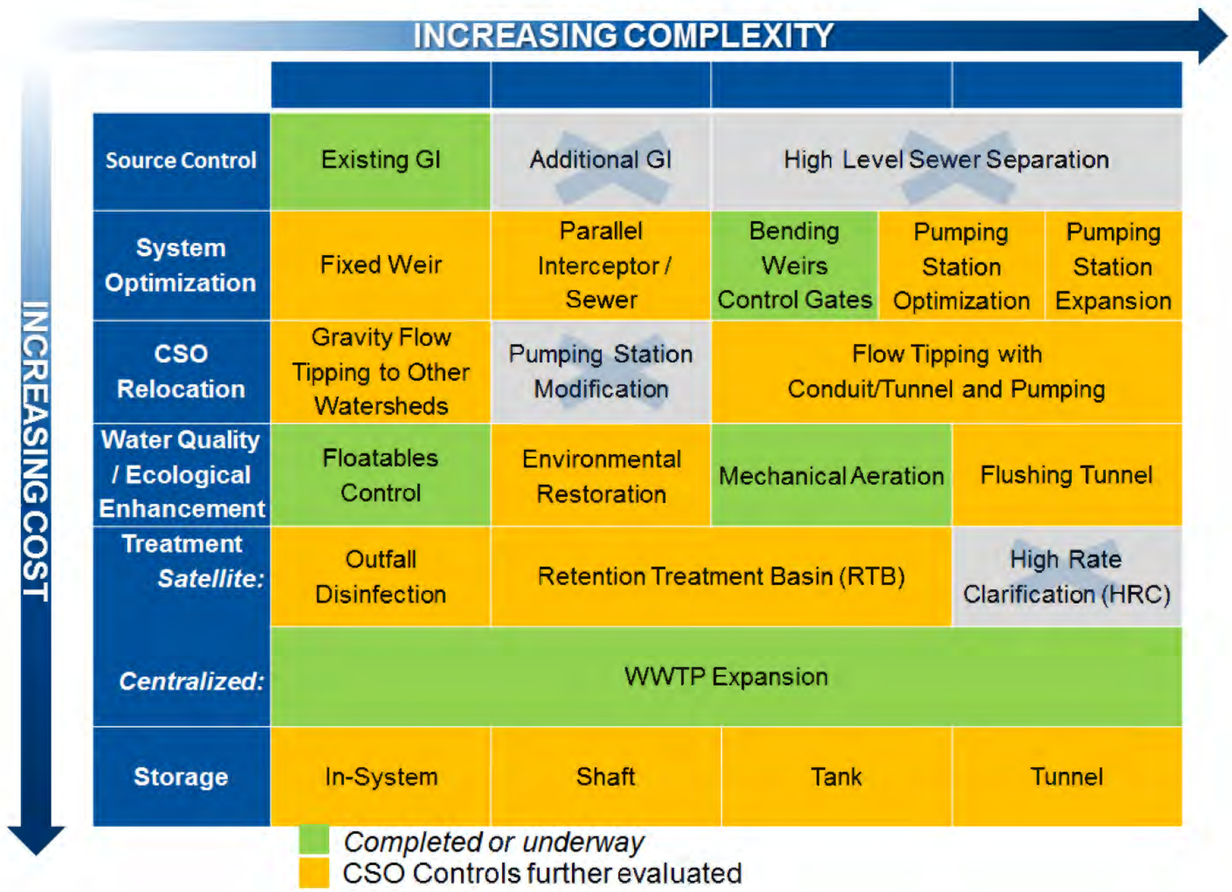

Figure 8-4. Matrix of CSO Control Measures for Newtown Creek

- Additional and Existing Green Infrastructure (GI): Newtown Creek is a priority target area for DEP's Green Infrastructure Program. DEP has installed or plans to install over 1,300 GI assets consisting of right-of-way (ROW) practices, public property retrofits, and GI implementation on private properties. Figure 8-5 illustrates the location of the built or planned GI projects. While GI will be encouraged in areas proposed for redevelopment, site characteristics in publicly owned rights-of-way throughout the sewershed limit the ability to implement additional GI. As noted in Section 5, the GI in the Newtown Creek watershed is projected to result in a CSO volume reduction of approximately 83 MGY, based on the 2008 baseline rainfall condition. Because the application of additional GI would rely on commitments from private property owners, it is not feasible to identify and commit definitively to such private GI projects within the timeframe for development of this LTCP. As a result, application of additional GI will not be evaluated as part of this LTCP. Nevertheless, DEP will continue to develop programs to incentivize the application of GI by private property owners for the purposes of managing stormwater runoff.

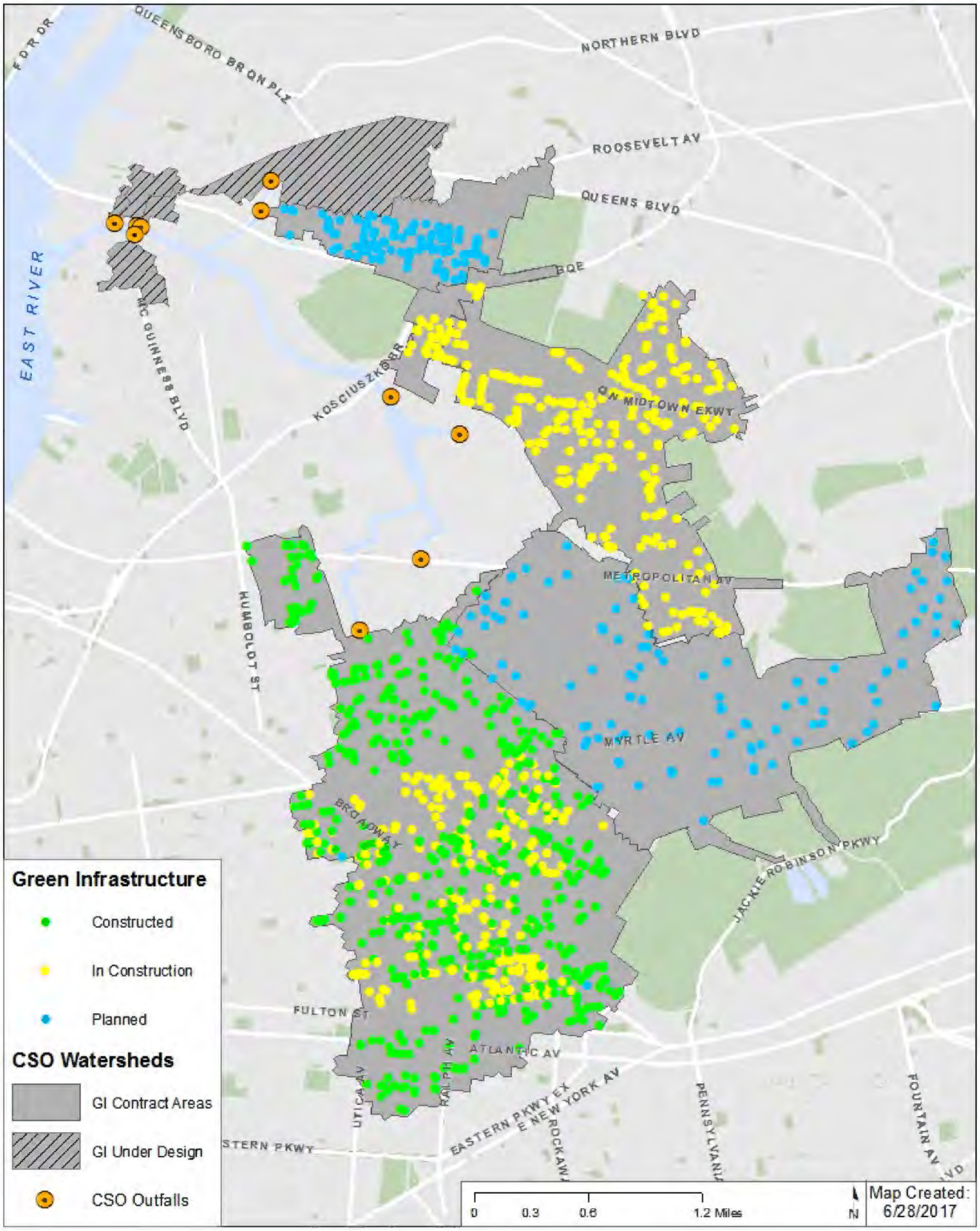

Figure 8-5. Built and Planned Green Infrastructure Projects

- *Sewer Separation:* The drainage areas tributary to the four largest CSO outfalls - BB-026, NC-077, NC-083 and NC-015 - are expansive and generate large volumes of annual discharge. The cost and disruption to the neighborhoods to separate sewers would be significant while only providing limited water quality benefits due to the resultant stormwater discharges. DEP has typically employed so-called high level storm sewer separation (HLSS) – i.e., the removal of public rights-of-way runoff from streets and sidewalks – only where localized flooding problems have occurred, rather than as a CSO control measure. Because flooding has not been identified as an issue in this watershed, HLSS was not considered for Newtown Creek.

  As a partial separation alternative, DEP considered redirecting the stormwater runoff generated on the large area of cemeteries along the northeastern edge of the Newtown Creek watershed. IW modeling indicated that about a 12 percent basin-wide CSO volume reduction could possibly be achieved by rerouting that stormwater directly to Newtown Creek. However, after further evaluation, it was determined that, as with HLSS, extensive new conveyance piping would be needed to redirect the cemetery-generated runoff to the Creek. As a result, both HLSS and this focused cemetery-generated stormwater redirection were eliminated from further consideration.

- *Inflatable Dams, Bending Weirs, Control Gates:* Mechanical methods of regulating CSO were evaluated under the 2011 WWFP. As described above, of these measures, bending weirs were deemed the most applicable control for the four largest outfalls due to the concern of adverse upstream hydraulic grade line impacts. Because the bending weirs already are being implemented, and nothing has changed regarding the potential hydraulic grade line impacts of the other technologies, these control measures were eliminated from further consideration.

- *Pumping Station Modification:* The majority of the combined sewage in the Newtown Creek watershed is pumped to the Newtown Creek WWTP through the Brooklyn/Queens Pumping Station (BQPS). Per the Newtown Creek WWTP WWOP, the BQPS pumps a maximum of 400 MGD to the plant. The pumping station and the system of gates that control the inflow to the wet well were upgraded recently. The Newtown Creek WWTP also receives flow from the Manhattan portion of the sewershed via the Manhattan Pumping Station. Theoretically, flow from the Manhattan Pumping Station could be throttled during wet-weather, and the capacity of the BQPS expanded to keep the total peak flow to Newtown Creek WWTP at its peak design capacity of 700 MGD. However, hydraulic evaluations and the IW model have indicated that increasing the capacity of the BQPS would not significantly reduce CSO volumes to Newtown Creek, due to conveyance limitations along the Morgan Avenue interceptor (i.e., the additional peak flow could not get to the pumping station). As a result, further modification of the BQPS was not considered.

- *Floatables Control*: Underflow baffles are being installed currently at the four largest outfalls as part of the Regulator Improvement Project, and a floatables control boom is located at the mouth of Maspeth Creek. Further, the control measures described below that include storage or treatment would inherently also capture floatables. As such, additional measures that specifically target floatables control were not considered.

- *Environmental Dredging*: DEP conducted maintenance dredging of portions of Newtown Creek in April/May 2014. The dredging area encompassed the lower portion of the Creek, approximately between the mouth and Whale Creek, to improve navigability up to the new sludge loading dock near the Newtown Creek WWTP. Because EPA is currently evaluating dredging alternatives under the Superfund process, DEP did not consider that measure under this LTCP.

- *In-stream Aeration*: In-stream aeration has already been installed in English Kills, and is currently being installed in East Branch. WQ modeling evaluations indicated that without those aeration systems, the Class SD DO criterion would not be achieved in the upstream reaches of Newtown Creek even with 75 percent CSO control. With 100 percent CSO control, the criterion still would not be met at Station NC-014 in English Kills. Therefore, it is recommended that the East Branch and English Kills aeration systems remain in operation. However, the WQ assessments indicated that the Class SD DO criterion is currently being met in Dutch Kills and the main trunk of Newtown Creek under baseline conditions. Therefore, the previously-proposed Dutch Kills aeration system is recommended to be eliminated.
- *High Rate Clarification*: High rate clarification is typically employed for CSO discharges when high levels of suspended solids and BOD reductions are targeted for control in addition to bacteria and floatables. Because high rates of removal of these parameters were not identified as concerns for the Newtown Creek watershed, this control measure was eliminated from further consideration.
- *WWTP Expansion*: As noted above, the benefit of expanding the WWTP capacity would be limited by the capacity of the collection system to convey additional wet-weather flow to the plant. In addition, because space constraints limit the ability to expand existing plant processes, storage or remote treatment was considered in lieu of WWTP expansion.
- *Storage Shafts*: Shaft storage involves constructing a deep circular shaft to provide storage, with pump-out facilities to dewater the shaft after the storm event. Shaft storage construction techniques would be similar to those used to construct deep tunnel drop or access shafts. The benefit of shaft storage is that it allows for relatively large storage volumes with relatively small facility footprints. Disadvantages of shaft storage include limits to the depth of shafts, complex dewatering pumping operations, and difficult maintenance. Another disadvantage is that very few operating shaft storage systems exist from which to gain insight on operational issues and experience. Finally, the largest shaft currently in operation is 7.5 MG. Using that size as a maximum, multiple units would be required at the largest Newtown Creek outfalls. Because the range of levels of CSO control could be provided by more conventional tunnels or, in some cases, tanks, storage shafts do not offer advantages sufficient to outweigh their disadvantages. For these reasons, shaft storage was eliminated from further evaluation.

The evaluation of the retained control measures is described in Section 8.2.

8.2 Matrix of Potential CSO Reduction Alternatives to Close Performance Gap from Baseline

Each control measure was initially evaluated on three of the key considerations described in Section 8.1: (1) benefits, as expressed by level of CSO control and attainment; (2) costs; and (3) challenges, such as siting and operations. Using this methodology, the retained control measures listed in Section 8.1 were evaluated on a cost-performance basis and used to develop the basin-wide alternatives.

Following the LTCP outline, these control measures are described under the following categories: Other Future Grey Infrastructure, Other Future Green Infrastructure and subsets thereof.

8.2.a Other Future Grey Infrastructure

For the purpose of this LTCP, "Other Future Grey Infrastructure" refers to potential grey infrastructure beyond existing control measures implemented based on previous planning documents. "Grey infrastructure" refers to systems used to control, reduce, or eliminate discharges from CSOs. These are the technologies that DEP and other wastewater utilities typically have used in their CSO planning and implementation programs. They include retention tanks, tunnels and treatment facilities, including satellite facilities, and other similar capital-intensive facilities.

Grey infrastructure projects implemented under previous CSO control programs and facility plans, such as the 2011 WWFP, are described in Section 4. To summarize, those projects include:

1. Upgrade of Brooklyn/Queens Pumping Station to 400 MGD capacity.
2. The Regulator Improvement Project to install underflow baffles and bending weirs at regulators associated with the four largest CSO outfalls, specifically BBL-4, NCQ-01, NCB-01 and the NC-St. Nicholas Weir regulator. Figure 8-6 shows the longitudinal profile at one of the regulators, NCQ-01.
3. In-stream aeration at English Kills and East Branch (Figure 8-7).

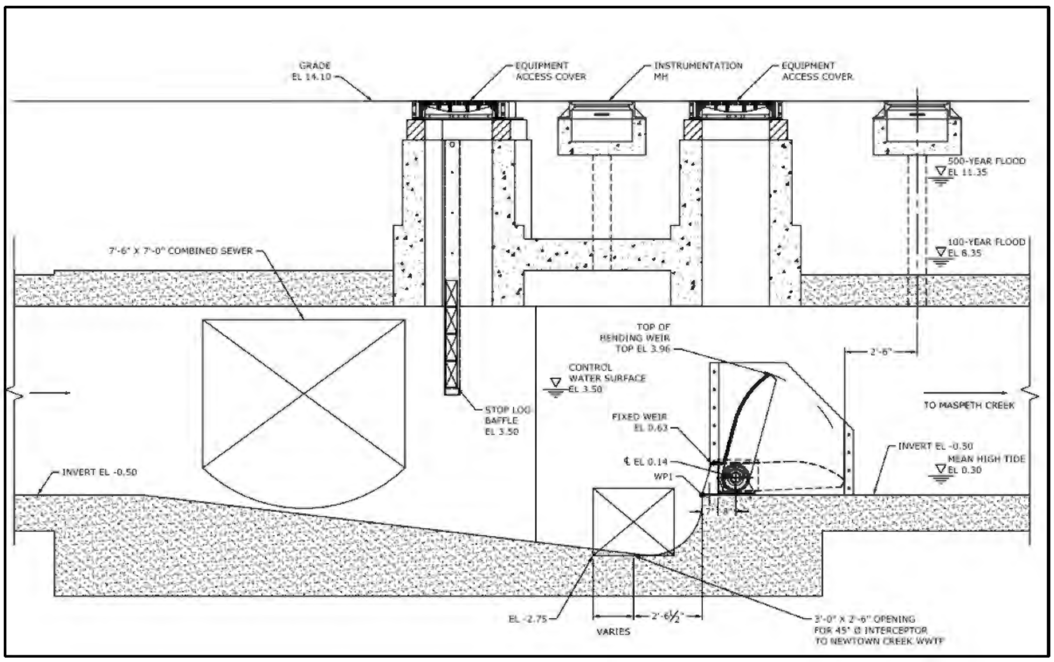

Figure 8-6. Bending Weir and Underflow Baffle at Regulator NCQ-01

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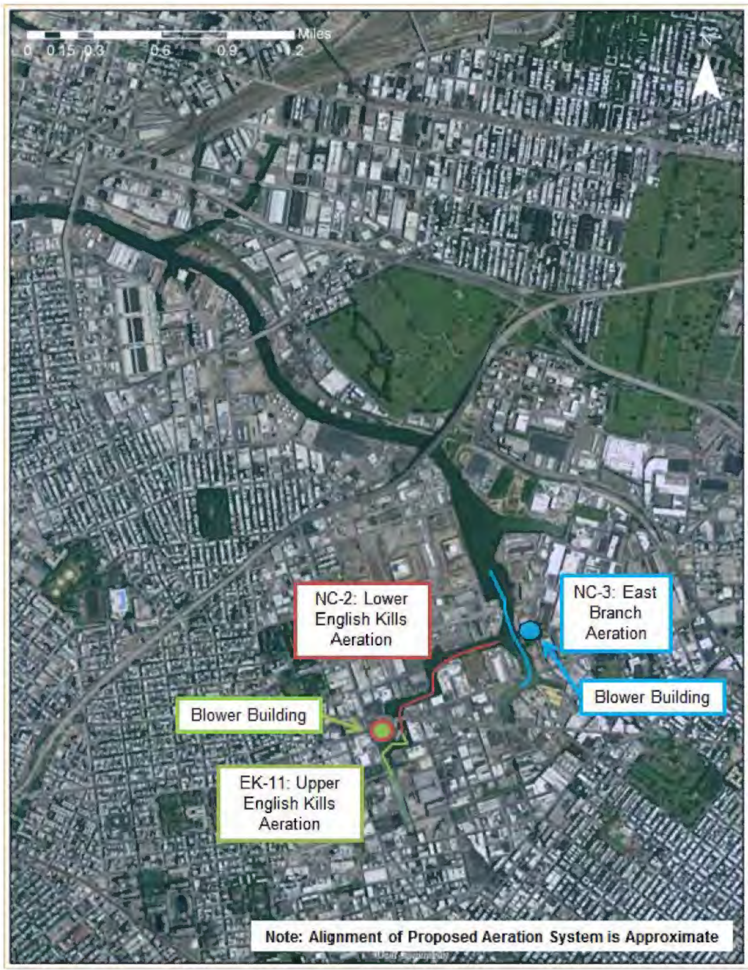

Figure 8-7. In-Stream Aeration at English Kills and East Branch

Additional grey infrastructure alternatives that were considered in the development of this LTCP are described here.

8.2.a.1 System Optimization - Sewer Enhancements

Sewer enhancements typically include measures to optimize the performance of the sewer system by taking advantage of in-system storage capacity to reduce CSO through automated controls or modifications to the existing collection system infrastructure. Examples include: regulator or weir modifications including fixed and bending weirs; control gate modifications; real time control; and increasing the capacity of select conveyance system components, such as gravity lines, pumping stations and/or force mains. Force main relocation or interceptor flow regulation would also fall under this category. These control measures generally retain more of the combined sewage within the collection system during storm events. The benefits of retaining this additional volume must be balanced against the potential for sewer back-ups and flooding, or the relocation of the CSO discharge elsewhere in the watershed or in an adjacent watershed. Viability of these control measures is system-specific, depending on existing physical parameters such as pipeline diameter, length, slope and elevation.

As part of the control measure review process described in Section 8.1, two system optimization measures passed the initial screening process and were subsequently developed and evaluated for Newtown Creek, while other system optimization measures were not carried forward, as described below.

Fixed Weirs: Regulator improvements were recommended under the 2011 WWFP and resulted in the Regulator Improvement Project. The project evaluated opportunities to improve wet-weather capture and conveyance for treatment at the Newtown Creek WWTP, along with floatables control. To neutralize adverse impacts on the upstream hydraulic grade line, bending weirs were deemed preferable to fixed weirs and are now being installed at the key regulator structures associated with Outfalls BB-026, NC-077, NC-083 and NC-015. As a result of this ongoing work at the four largest CSO outfalls, this control measure was eliminated from further consideration as a stand-alone CSO reduction alternative for this LTCP. However, DEP evaluated relocating overflow between two large outfalls by replacing the existing bending weirs with lower fixed weirs at either Outfall NC-015 or NC-083. These evaluations targeted the potential elimination of a diversion structure, conveyance, and in some cases, a drop shaft, that would no longer be necessary under other CSO reduction alternatives (e.g., tunnel), if the overflows from one of these outfalls could be significantly relocated to the other outfall. These evaluations revealed that little CSO would be relocated from one outfall to the other due to capacity limitations in the existing conveyance piping. For this reason, this concept was not developed further in this LTCP.

Parallel Interceptor/Sewer: Construction of a major near-surface relief pipe parallel to the existing interceptors would have significant constructability and construction impact issues due to the size of the streets, level traffic and density of existing utilities, particularly along the existing Morgan Avenue Interceptor or the Long Island City Interceptor. Trenchless construction would not fully mitigate these challenges. For these reasons, parallel interceptors were not advanced as alternatives. However, other control measures targeting the conveyance of additional combined sewage from the upper end of Newtown Creek watershed to the Newtown Creek WWTP were evaluated. Specifically, a consolidation conduit was evaluated that would run along the northern portion of the watershed, capturing CSO discharges at Outfalls NC-015, NC-083 and NC-077, immediately downstream of the regulators. Because this conduit would convey CSO to a retention/treatment basin (RTB), it is described below as part of Alternative RTB-1, a treatment-based CSO control alternative.

Pumping Station Optimization: In addition to pumping station upgrade or expansion (see below), the operation of a station could also be evaluated to ensure that it is optimized with respect to its ability to maximize the amount of wet-weather flow that is controlled (treated or stored). For example, as noted above, two pumping stations feed flow to the Newtown Creek WWTP, and the adjustment of the rate of pumped flow from one (e.g., Manhattan Pumping Station) would affect the flow amount of flow that could be pumped from the other (e.g., BQPS). However, as also noted under the "Pumping Station Modification" alternative above, interceptor capacity would limit the CSO reduction benefit from increasing the BQPS capacity. As a result, the LTCP evaluations focused on optimizing the Kent Avenue interceptor gate controls, seeking to maximize the flow from the Morgan Avenue interceptor that enters the BQPS wet well. Because the conveyance capacity of the Morgan Avenue interceptor, through which the regulated flow from Outfalls NC-077, NC-083 and NC-015 is conveyed, is limited to approximately 211 MGD, further throttling of the Kent Avenue Gate would not allow more flow from the Morgan Avenue interceptor to reach the pumping station wet well. Consistent with the analyses conducted in the WWFP, the LTCP evaluations concluded that pumping station optimization alone, without significant conveyance relief works along the Morgan Avenue interceptor system, would not result in CSO reduction at Outfalls NC-015, NC-083 and NC-077. Therefore, this CSO measure was not considered further in this LTCP.

Pumping Station Upgrade/Expansion: The 3-MGD Borden Avenue Pumping Station (BAPS) is located adjacent to Dutch Kills on the north side of Newtown Creek. The pumping station serves a relatively small tributary area, and discharges flow to the Long Island City Interceptor (LICI) for conveyance to the Bowery Bay WWTP. The BAPS is currently a candidate for a state of good repair (SOGR) intervention, and the design of the SOGR upgrade was already underway during development of this LTCP. Independently, an alternative was identified whereby the overflow from Outfall BB-026 would be diverted to a wet-weather pumping station, and the discharge routed to a location across Newtown Creek to a point just upstream of the Kent Avenue Gate. Because the location of the wet-weather pumping station would be in the same general vicinity as the BAPS, expanding the BAPS to include additional wet-weather flow capacity presented an opportunity for synergy between the SOGR needs and CSO control. This specific pumping station upgrade/expansion is considered further in this LTCP and is evaluated as Alternative SO-1, described below.

Alternative SO-1: Borden Avenue Pumping Station Upgrade/Expansion

This alternative would involve the following elements (Figure 8-8):

- A new diversion chamber with tide gate constructed on the existing BB-026 outfall downstream of the existing regulator.
- Approximately 2,500 linear feet (LF) of gravity conveyance piping from the new diversion structure to the BAPS.
- Expansion of the BAPS to include additional wet-weather flow capacity.
- Approximately 4,350 LF of new force main from the BAPS to a location just upstream of the Kent Avenue Gate Structure, adjacent to the Newtown Creek WWTP. Two potential alternative routes for the force main are shown in Figure 8-8.

Under this alternative, dry-weather flow would continue to be pumped to the LICI similar to current operation. Under wet-weather conditions, when overflow is diverted from the BB-026 outfall, all flow from the BAPS would be discharged to the new force main. The flow that is discharged just upstream of the Kent Avenue Gate would partially displace flow from regulators associated with outfalls that discharge to the East River from the Newtown Creek WWTP system, resulting in an increase in CSO discharge to the East River. Modeled tracer studies and analysis of flow direction in the pipes indicates that none of the flow pumped from the BAPS would discharge to the East River.

For the 75 percent CSO control alternative, CSO volume will be reduced by about 110 MGY in Dutch Kills, but the additional flow at the Newtown Creek WWTP will displace approximately 80 MGY of CSO into the East River. The overall increase into the East River represents a nine percent increase above the current baseline projection of 848 MGY. Figure 8-9 shows the locations of the East River CSOs where the overflow volume would increase. As indicated in Figure 8-9, a number of GI projects are planned for the general vicinity of Outfall NC-014, where the greatest increase in volume would occur. Other potential options to mitigate the impact of the increased overflow volumes at those outfalls will be investigated under the City-wide/Open Waters LTCP.

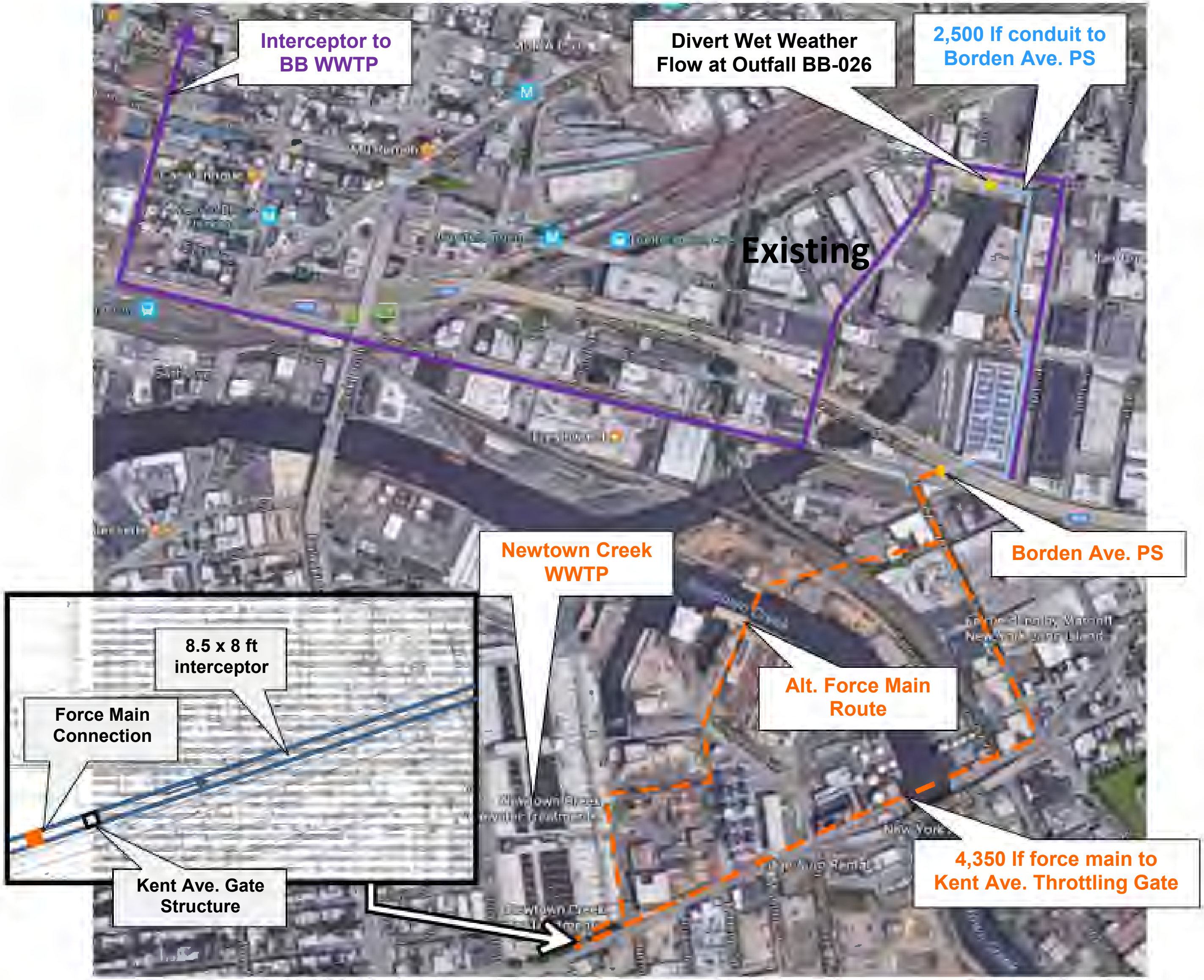

Figure 8-8. Borden Avenue Pump Station Upgrade/Expansion Layout

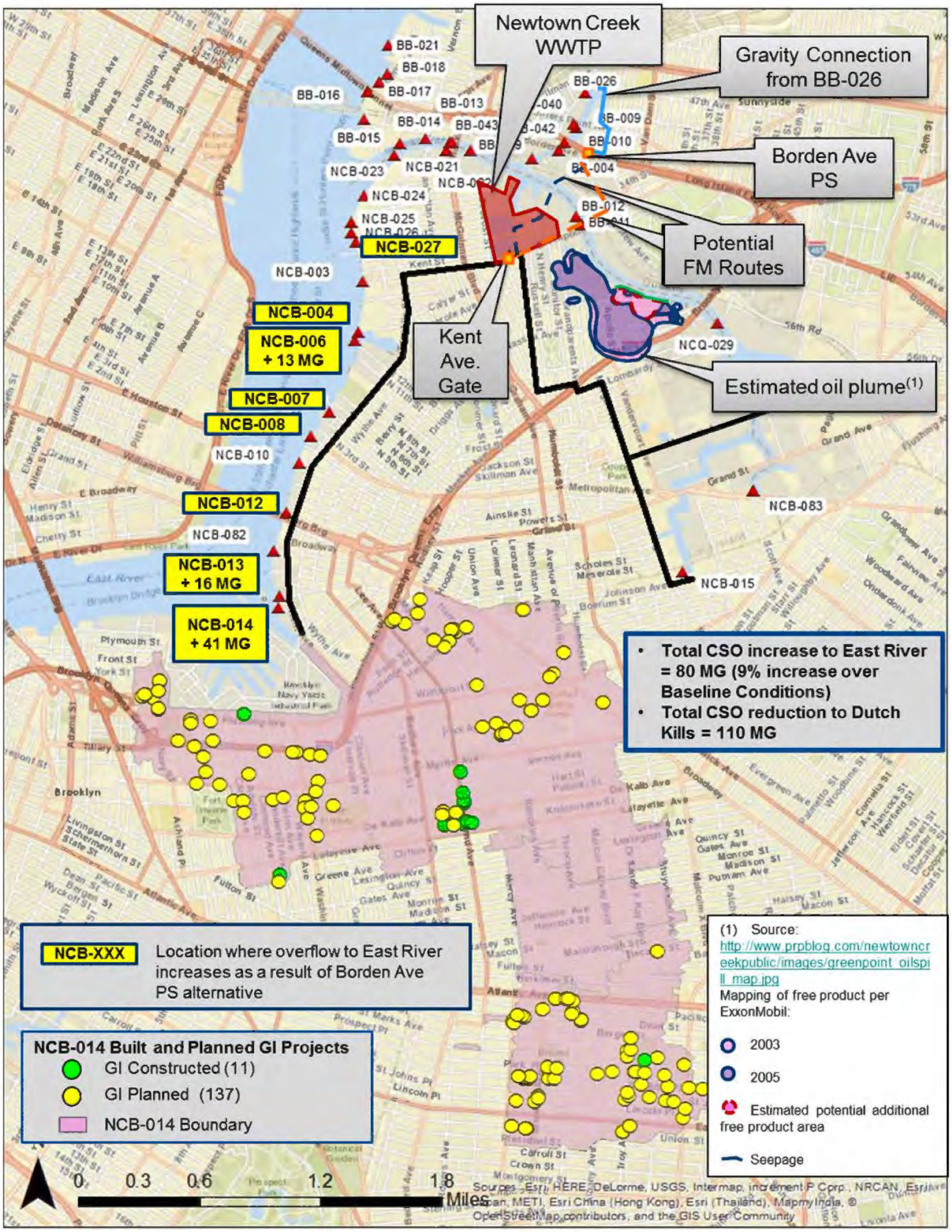

Figure 8-9. Locations of Increase in East River CSO Volume with 75 Percent CSO Control BAPS Expansion Alternative

Diverting wet-weather flow from Outfall BB-026 also results in a reduction in overflow at other CSO outfalls in the Bowery Bay low level system. Most of the additional reduction occurs at Outfall BB-009, in Dutch Kills, while more nominal reductions occur at other Bowery Bay outfalls along Newtown Creek and the East River. Total flow to the Newtown Creek WWTP is increased with this alternative, and total flow to the Bowery Bay WWTP is slightly decreased with this alternative.

The BAPS wet-weather expansion alternative was evaluated for 25, 50, and 75 percent control of the annual discharge from Outfall BB-026. The pumping capacity for 100 percent control would have been over 100 MGD, which would have required a new stand-alone pumping station, significantly increased the volume of overflow to the East River, and potentially have had adverse impacts on the hydraulic grade line in the Kent Avenue system. For these reasons, the 100 percent CSO control option for the BAPS wet-weather expansion was not pursued further.

Table 8-3 summarizes the additional wet-weather flow pumping capacity, force main diameter, and gravity influent sewer diameter associated with the 25, 50 and 75 percent CSO control alternatives for the BAPS expansion.

Table 8-3. Summary for Alternative SO-1

Parameter	Targeted BB-026 Level of Control		
	25%	50%	75%
Additional Wet Weather Flow Pumping Capacity (MGD)	6	13	24
Force Main Diameter (ft)	1.5	2	3
Gravity Conduit Diameter (ft)	2	3	3.5
Net Present Worth ($M)	51	59	71

An individual CSO storage alternative such as a retention tank would require property acquisition through either negotiated acquisition or eminent domain acquisition of developed parcels to provide equivalent levels of control. The maximum annual CSO control that could be implemented with a retention tank without negotiated acquisition or eminent domain land acquisition would be approximately 20 percent. As such, expansion of the BAPS is the only control measure considered throughout the LTCP for developing alternatives up to 75 percent level of control at Outfall BB-026. For 100 percent control, reduction of the discharges from BB-026 would be realized by conveying the flows to a basin-wide solution (i.e., a CSO storage tunnel) that would also capture CSO from the three large upstream Outfalls NC-077, NC-083 and NC-015.

The benefits, costs and challenges associated with the BAPS wet-weather expansion are as follows:

Benefits

Without further site acquisition, this control measure provides up to 75 percent annual CSO control at Outfall BB-026 at a relatively low cost and provides synergies with a SOGR intervention.

Cost

The estimated NPW for this control measure varies by level of control as follows:

- 25 percent CSO control: $51M
- 50 percent CSO control: $59M
- 75 percent CSO control: $71M

Details of the estimate for 75 percent CSO control are presented in Section 8.4.

Challenges

The challenges associated with this alternative would include:

- Increased CSO volume to the East River.
- Potential construction site constraints due to the location of the Borden Avenue Pumping Station under the highway bridge.
- The force main to the Kent Avenue Gate Structure will need to pass under Newtown Creek, through bulkheads along the shore of Newtown Creek, and under the Long Island Rail Road (LIRR) tracks. Dense utilities will be encountered along Greenpoint Avenue in the vicinity of the Kent Avenue gate.
- The need to maintain the function of the Borden Avenue Pumping Station during construction.
- The potential for interferences with Superfund remedy work related to dredging and/or bulkhead reconstruction.
- The construction of the diversion conduit and force main would require approval of construction within road rights-of-way to be coordinated with the Department of Transportation (DOT).

8.2.a.2 CSO Relocation

Gravity Flow Tipping to Other Watersheds: This concept would involve conveying overflows by gravity from one receiving water to another receiving water, where the second receiving water would either be less sensitive or provide greater dilution/assimilation than the one from which the CSO is being diverted. A number of potential gravity flow tipping alternatives were identified and initially evaluated, but none were determined to provide significant opportunity to warrant pursuing this solution further. Options evaluated included the following:

Diversion from NCB-015 to NCB-014. Gravity diversion of flows was evaluated across the boundary between the subcatchments of outfalls NCB-015 and NCB-014, which discharge to Newtown Creek and the East River, respectively. A subsequent analysis of the conveyance network and the subcatchment boundaries revealed that the concept would relocate only flows generated by a very limited portion of the NC-015 drainage area, with limited benefit in terms of CSO reduction. As a result, this alternative was eliminated from further consideration.

Diversion from BB-026. Multiple gravity conveyance relief solutions were evaluated for CSO mitigation at Outfall BB-026. These alternatives primarily considered improving conveyance of combined sewage upstream and downstream of Regulator BLL-4 (Outfall BB-026). Multiple discharge locations along the Bowery Bay low level interceptor as well as the headworks of the Bowery Bay WWTP were evaluated. Consistent with the analyses conducted in the June 2011 WWFP, these concepts proved either hydraulically infeasible or extremely challenging to implement due to constructability restraints imposed by the dense transportation network along the potential routes, most notably the LIRR tracks and yard and Metropolitan Transportation Authority subway lines. As a result, these concepts were also eliminated from further consideration.

Morgan Avenue Prioritization. For the direct Newtown Creek WWTP sewershed, assessments were conducted to evaluate potential options to prioritize flow from the Morgan Avenue Interceptor to the plant. The performance gains from the various evaluated concepts were limited by the conveyance capacity of the Morgan Avenue Interceptor. As a result, these CSO relocation concepts for the Newtown Creek WWTP sewershed were also eliminated from further consideration.

Flow Tipping with Conduit/Tunnel and Pumping: This control measure would be similar to gravity flow tipping, but the conveyance of flow to another receiving water would require pumping. This concept was evaluated for Outfall NC-077 as described below.

Alternative CR-1: Alternative SO-1 + New Pumping Station at Outfall NC-077.

A 2.8-acre DEP owned parcel is located adjacent to the alignment of the existing NC-077 outfall and Regulator NCQ-01, providing the potential opportunity to utilize the site for a CSO control facility. One option would be to divert overflow from Outfall NC-077 to a new wet-weather pumping station on that site. The pumping station would discharge the flow through a long force main (9,800 LF) to a location upstream of the Kent Avenue Gate Structure, similar to the concept described above for Outfall BB-026. The required pumping rates for the various levels of control are shown in Table 8-4. Figure 8-10 shows the conceptual layout of Alternative CR-1.

Table 8-4. Summary of Parameters for Alternative CR-1

NC-077 CSO Control	25%	50%	75%
PS Cap.(MGD)	14	35	75
Force Main Diameter (ft)	2.5	3.5	5

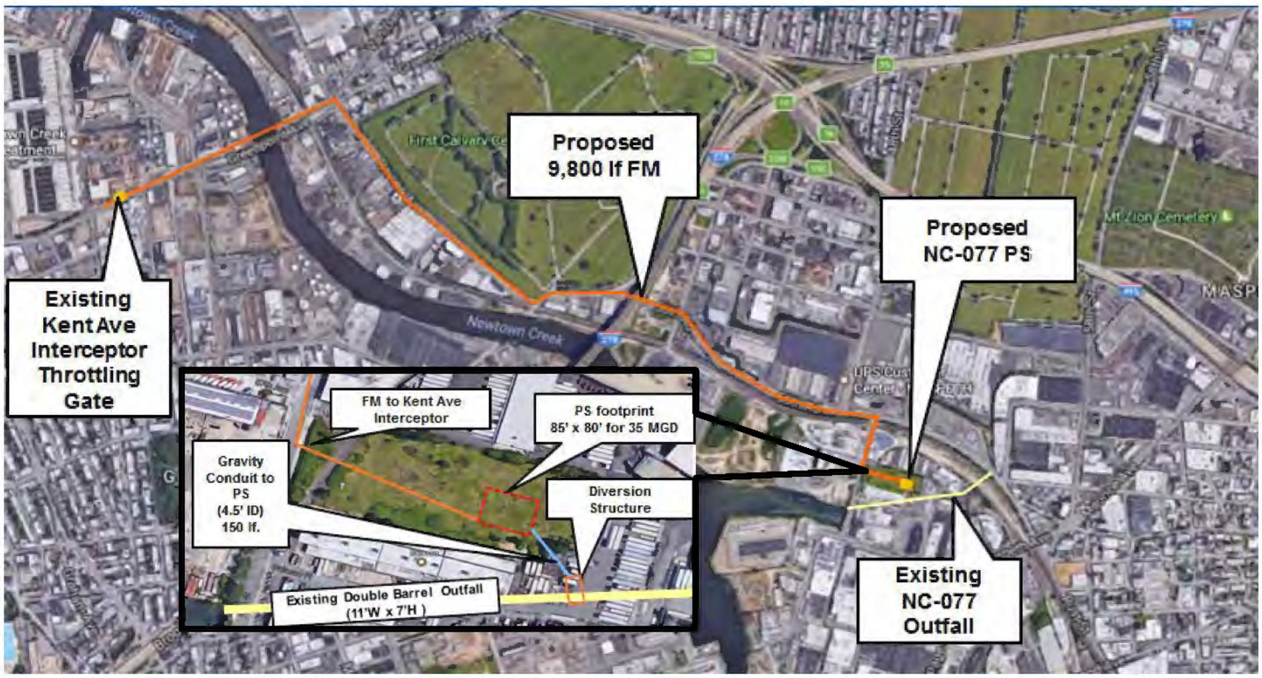

Figure 8-10. Layout of New Pumping Station at Outfall NC-077 part of Alternative CR-1

As with the BAPS alternative for Outfall BB-026, the pumping rate required to achieve 100 percent CSO control at Outfall NC-077 was excessive (482 MGD), so the 100 percent control option for this alternative was not evaluated further. Because of the large force main diameter required for the 75 percent level of control, and the cumulative impacts of this alternative with the BAPS alternative (SO-1) on the Kent Avenue interceptor performance, only the 50 percent CSO control option was evaluated further. Even at the 50 percent control level, the volume of additional overflow at the East River outfalls upstream of the Kent Avenue gate would further increase over the values presented for Alternative SO-1. The total increase in overflow volume to the East River for this alternative would be 187 MG, with a 100-MG increase at Outfall NC-014 alone.

Benefits

CSO discharges would be reduced from Maspeth Creek, a tributary with poor tidal exchange.

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Cost

The preliminary estimated NPW for this control measure is $114M for 50 percent CSO control.

Challenges

The challenges associated with this control measure include:

- Although DEP owns the site of the proposed pumping station, other competing needs within DEP may affect the availability of the site for a wet-weather pumping station.
- The measure does not appear to be cost-effective when compared to broader solutions that could also target capture of the two other large CSO outfalls (NC-083 and NC-015) in the headwaters of the Creek and would result in increased CSO discharges at other outfalls.
- The long force main route would require multiple micro-tunneling launching stations with associated siting risks and disruption to the heavy industrial traffic in the neighborhood.
- The significant increase in additional volume discharged at the East River outfalls would likely require mitigation.

8.2.a.3 Water Quality/Ecological Enhancements

The control measures under the category of Water Quality/Ecological Enhancements are not CSO reduction measures but, rather, focus on enhancing the water quality through other approaches. As noted above, floatables control is currently being implemented at the four largest outfalls to Newtown Creek, and mechanical aeration systems have been or are being installed in English Kills and East Branch. Dredging was not considered under this LTCP because EPA is evaluating dredging alternatives for Newtown Creek under the Superfund process. At public meetings conducted during the development of the Newtown Creek LTCP, comments were received that expressed an interest in ecological enhancements/wetlands restoration along the banks of Dutch Kills. Given the existing volumes and peak flows from Outfall BB-026, a wetlands treatment system for Dutch Kills did not appear to be practical. However, wetlands plantings along the banks of Dutch Kills, similar to the pilot installation installed at the head of Dutch Kills, would likely be more feasible. However, the timing of wetlands restoration along the banks of Dutch Kills would depend on the scope and timing of any dredging and/or shoreline work that may be included in the Superfund ROD. For this reason, wetlands restoration along the Dutch Kills shoreline is not included as recommendation in this LTCP.

Flushing tunnels were ruled out for Maspeth Creek, East Branch and English Kills due to the length and cost of a tunnel to convey East River water to those upstream locations. An initial concept for a flushing tunnel was developed for Dutch Kills. This alternative included a 50-MGD pumping station located along Newtown Creek near the mouth of Dutch Kills, and a force main from the pumping station to the head end of Dutch Kills. The cost of this alternative would have been approximately the same as the BAPS wet-weather pumping alternative (SO-1) described above. However, because the flushing tunnel alternative would not have reduced the CSO volume to Dutch Kills, whereas the BAPS alternative would remove up to 75 percent of the annual volume, the flushing tunnel alternative was not pursued further.

The gap analysis presented in Section 6 indicated that for the receiving water stations in and upstream of Dutch Kills (Stations NC-5 to NC-9), the Class SD DO criterion was met more than 95 percent of the time on an average annual basis under baseline conditions. As a result, in-stream mechanical aeration is not recommended for Dutch Kills and the reach of Newtown Creek between Dutch Kills and Station NC-9. However, aeration was deemed to still be needed in English Kills and East Branch.

8.2.a.4 Retention/Treatment Alternatives

A number of the control measures considered for Newtown Creek fall under the dual category of treatment and retention. For purposes of this LTCP, the term "storage" is used in lieu of "retention." These control measures include in-line or in-system storage, off-line tanks and deep tunnel storage. Treatment refers to disinfection in either CSO outfalls or at RTBs. A discussion of the retention/treatment alternatives evaluated follows.

Evaluation of Retrofitting and Re-purposing of Existing Infrastructure for Retention/Treatment

Initial evaluations focused on maximizing the performance of existing infrastructure to capture and/or treat CSO discharges. Alternative OTF-1 and OTF-2 evaluated opportunities to modify Outfalls NC-077 and NC-083 for outfall storage or disinfection. The lengths of Outfalls NC-015 and BB-026 downstream of the respective regulators were too short to consider for outfall storage or disinfection.

Alternative OTF-1: In-line Storage at Outfalls NC-077 and NC-083

Outfall NC-077 is a 720-foot-long, twin-barrel, 11-ft W x 7-ft H conduit, and Outfall NC-083 is a 1,250-foot-long, 17-ft W x 13-ft H single-barrel conduit. Both outfalls run at a relatively flat slope, and were of sufficient length and size to be considered for outfall storage. Figure 8-11 shows the longitudinal profile for the NC-083 outfall barrel. To modify the outfalls for in-line storage, a weir structure would be required at the downstream end, with a small dewatering pumping station. In small storms, the outfall would fill up to the elevation of the weir, and the stored flow would be pumped back to the interceptor system at the end of the storm. In larger storms, higher flows would overflow the weir and continue to discharge, but at the end of the storm, the flow remaining behind the weir would still be pumped back to the interceptor.

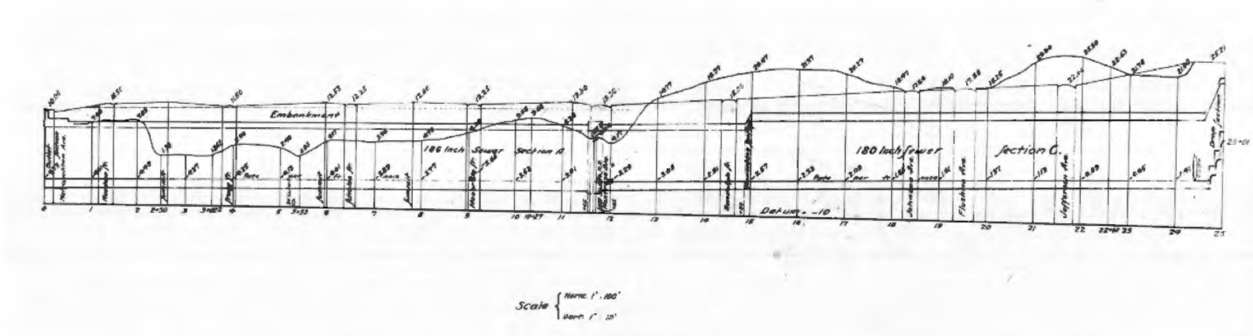

Figure 8-11. Longitudinal Profile of NC-083 Outfall Barrel.

An analysis was conducted to determine the maximum potential CSO reduction that could be achieved through outfall storage at each of these two longer outfall barrels. Table 8-5 summarizes the key characteristics of each outfall and the approximate maximum potential CSO level of control that could be achieved for Outfalls NC-077 and NC-083.

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Table 8-5. Key Outfall Characteristics (NC-077 and NC-083)

Parameter	NC-077	NC-083
Length (lf)	720	1,250
Cross-section (W x H)	11 ft x 7 ft	17 ft x 13 ft
Number of Barrels	2	1
Percent Reduction in Annual Volume with Storage Only	2%	2%

As shown in Table 8-5, neither outfall would provide an appreciable amount of in-line storage. To achieve even the levels of storage stated, a number of separate storm drains that connect to the outfalls downstream of the CSO regulator would have to be re-routed. Given the potential costs of this alternative and the limited CSO reduction benefit, this alternative was eliminated from further consideration.

Alternative OTF-1: Disinfection at Outfalls NC-077 and NC-083

Building upon the maximum potential in-line storage volume that could be provided by Alternative OTF-1 at both the NC-077 and NC-083 outfalls, an analysis was also performed of the outfall disinfection opportunities associated with these two long outfalls. The concept for this alternative would be to dose sodium hypochlorite just downstream of the regulator, and use the volume in the outfall for disinfection contact time. Using a 15-minute chlorination contact time, it was determined that the maximum seasonal level of CSO control would not exceed 22 percent for NC-077 and 24 percent for NC-083. Given the limited benefit, together with the cost and complexity of outfall disinfection, this alternative was eliminated from further consideration.

Retention/Treatment Facilities

A review of existing parcels in the vicinity of Outfalls BB-026, NC-077, NC-083 and NC-015 was performed to identify potential sites for retention/treatment facilities. The siting review looked at parcels within a half-mile radius of the CSO regulators associated with each outfall. The initial siting assessment looked for unoccupied sites that did not have existing buildings, while cemeteries, schoolyards and rail yards were excluded as potential sites. The sizes of the unoccupied sites were then compared against the space needed for either a storage tank or RTB to provide 25, 50, 75, or 100 percent CSO control. Smaller sites were also identified for potential locations of tunnel drop shafts. The results of this analysis were as follows:

- Outfall BB-026: one site identified that could provide 25 percent control for a storage tank, or 50 percent control for an RTB
- Outfall NC-077: one site identified that could provide 50 percent control for a storage tank, or 75 percent control for an RTB
- Outfalls NC-083 and NC-015: no sites identified that could provide at least 25 percent control for a storage tank or RTB

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Based on the limited number of unoccupied sites identified, the siting assessment was expanded to look at all parcels within a half-mile radius of the CSO regulator, regardless of whether the parcel was occupied by an existing building. Cemeteries, schoolyards and rail yards remained excluded as potential sites. While this approach identified more potential parcels of sizes sufficient to accommodate storage tanks or RTBs at higher levels of CSO control, the challenges of obtaining these sites for CSO storage tanks or RTBs were clearly recognized. Acquisition of these sites would likely be through either a negotiated acquisition or the eminent domain process. Although this process of land acquisition would be highly undesirable and time-consuming, it was necessary to consider this option to develop traditional individual off-line storage tank options for comparison to other consolidated CSO control alternatives (i.e., storage tunnels).

For Outfall BB-026 in Dutch Kills, the BAPS wet-weather expansion alternative described in Section 8.2.a.1 above could provide up to 75 percent control through expansion of the pumping station on the existing pumping station site. Given the high level of control achievable for that alternative, together with its minimal siting impacts and lower relative cost, storage tanks and RTBs were not evaluated further for BB-026.

For Outfalls NC-077, NC-083 and NC-015, the areas required to provide 25, 50, 75 or 100 percent control with storage tanks are presented in Table 8-6. Conceptual alternatives were developed for storage tanks to provide 50 percent CSO control at each of these three outfalls. As described further below, the 50 percent storage tanks would have sufficient volume to provide disinfection for flows up to the 100 percent control level. Based on this finding, no further individual storage or RTB alternatives were evaluated. Specific sites for the conceptual 50 percent storage tank alternatives were not identified, as these alternatives were considered place-holders for comparison to the alternatives that addressed all three outfalls as a consolidated project. The consolidated alternatives include storage tunnels, and consolidation of the outfalls with conveyance to an RTB located adjacent to the Newtown Creek WWTP.

Table 8-6. Outfalls NC-015, NC-083 and NC-077

Level of Control	Area Required for Storage Tank (acres)		
	NC-077	NC-083	NC-015
25%	1.5	1.5	1.9
50%	2.4	2.6	3.6
62.5%	3.1	3.4	4.5
75%	3.7	4.1	5.3
100%	6.8	7.9	9.3

Each of the Retention/Treatment Alternatives described below requires dewatering of stored CSO volumes after wet-weather events occur. Table 8-7 provides a summary of the total storage volume and the associated dewatering rate assuming a 24-hour dewatering period for storage facilities providing 25, 50, 75 and 100 percent levels of CSO control for Outfalls NC-077, NC-083 and NC-015. The 100 percent control level also assumes inclusion of Outfall BB-026.

Table 8-7. Storage and Dewatering System Capacity for Storage Alternatives for Outfalls NC-015, NC-083 and NC-077

Level of Control	Storage Volume (MG)	Dewatering PS Capacity(1) (MGD)
25%	10	10
50%	28	28
62.5%	39	39
75%	54	54
100%	138(2)	138(2)

Notes:

(1) Assumes pump-back of stored CSO within a 24 hour period.

(2) 100% control including BB-026.

The available dry-weather treatment capacity at the Newtown Creek WWTP limits the maximum dewatering rates at which storage facilities can be drained after each storm. The average dry-weather flow at the Newtown Creek WWTP under baseline conditions is 227 MGD, and the dry-weather flow capacity is 310 MGD, which leaves an average of 83 MGD available for dewatering during dry-weather. However, the Newtown Creek WWTP is a high-rate, step-feed plant with no primary settling tanks. As such, due to concerns related to solids loading on the WWTP, a 40-MGD tunnel dewatering rate was determined to be an appropriate dewatering rate limit for the WWTP. . Thus, for the 75 and 100 percent storage alternatives, additional treatment capacity would be needed to maintain a 24-hour dewatering time.

The following concepts were evaluated for control of CSO from Outfalls NC-077, NC-083 and NC-015: consolidation conduit with an RTB; individual off-line storage tanks; and storage tunnels. Additionally, a 100 percent control storage tunnel that also captures CSO from Outfall BB-026 was also evaluated. Discussion relating to these alternatives follows.

Alternative RTB-1: 152 MGD RTB and Consolidation Conduit for Outfalls NC-015, NC-083 and NC-077.

This concept would include a consolidation conduit and a single RTB to provide treatment and disinfection of CSO discharges to Newtown Creek from Outfalls NC-015, NC-083 and NC-077. The facility would be located in the vicinity of the Newtown Creek WWTP. Using a 4,000 gal/day/sf surface overflow rate, an RTB facility with a design flow of 152 MGD could be accommodated on a 3.5-acre site. That design flow rate would provide 50 percent control of bacteria during the recreational season (May 1st through October 31st), and 39 percent control of the annual bacteria load to Newtown Creek. The annual percent control assumes disinfection is applied during the recreational season (May 1st through October 31st), and the tank is operated as a storage facility without disinfection during the non-recreational season (November 1st through April 30th). The layout of Alternative RTB-1 is shown in Figure 8-12.

Flows entering the facility would be screened of large solids and floatable material. Following a wet-weather event, the tank would be dewatered and cleaned. Flushing gates or tipping buckets would be provided to facilitate cleaning of the tank bottom. Flushed grit and solids would be conveyed in a channel to a wet well containing dewatering pumps for pump down of the facilities to the Newtown Creek WWTP.

Disinfection would be accomplished by dosing sodium hypochlorite just upstream of the tank and dechlorination at the outfall, prior to release to the receiving waters. The operation of the chlorination/dechlorination process would be informed by the recent Spring Creek Facility chlorination study, seeking to maximize the efficiency of the bacteria reduction while minimizing the residual chlorination compounds released to the environment in the form of TRC.

A headworks building would be constructed to house screening facilities, pumps, odor control and equipment and piping for chemical delivery, storage, and feed. Ancillary electrical, instrumentation controls and heating, ventilation and air conditioning (HVAC) systems would also be included. With this concept, the facility would be made integral to the RTB tank.

Diversion structures would be required at each of the three outfalls being captured. It is assumed that the consolidation conduit would be constructed by microtunneling, to reduce impacts during construction.

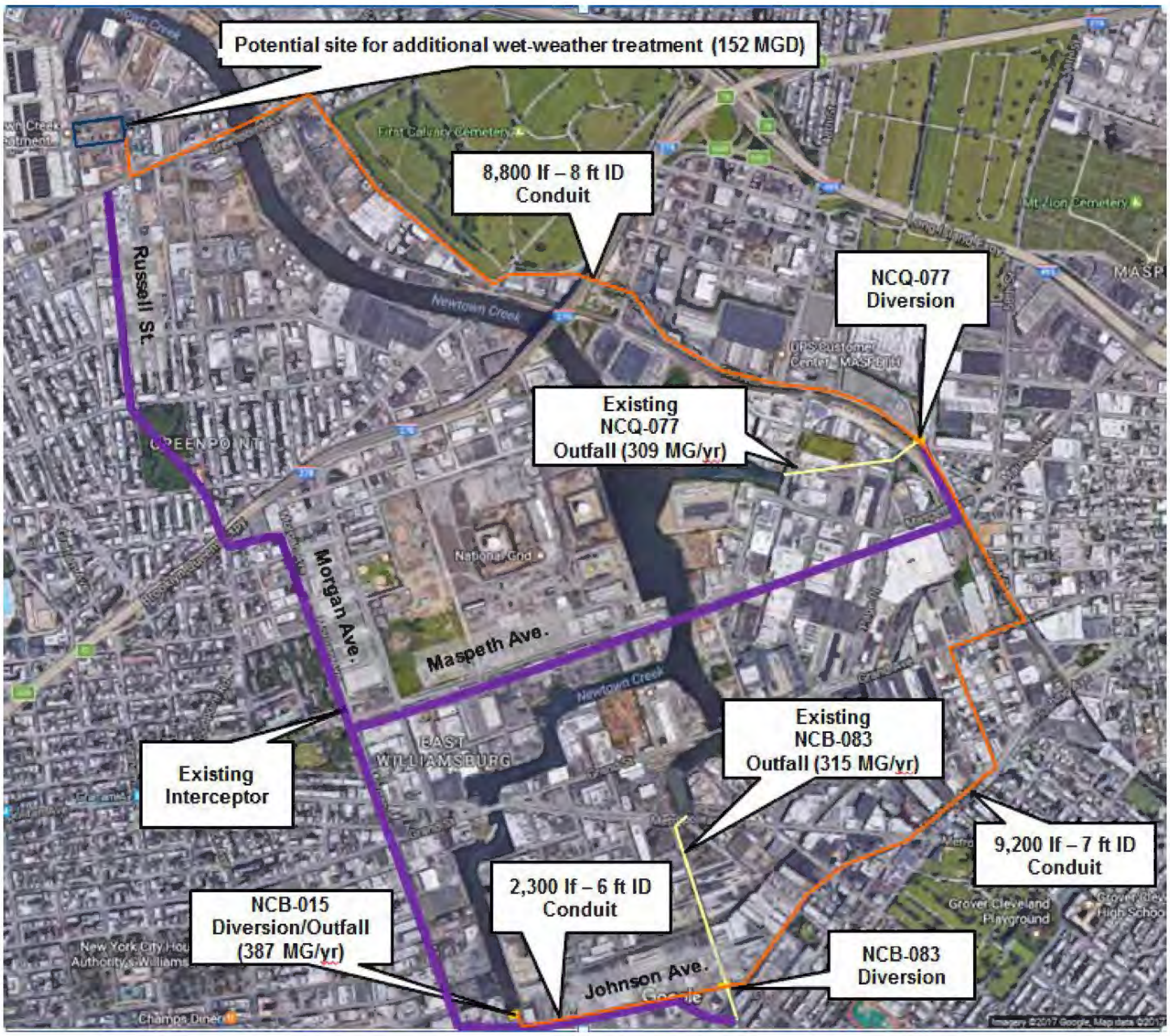

Figure 8-12. Layout of Alternative RTB-1 – Retention Treatment Basin with Consolidation Conduit for Outfalls NC-015, NC-083 and NC-077

The benefits, costs and challenges associated with construction and operation of the RTB are as follows:

Benefits

This alternative would provide 50 percent control of the CSO loads at Outfalls NC-015, NC-083 and NC-077 in the upstream reaches of Newtown Creek during the recreational season (May 1st through October 31st), and provide additional volume reduction and floatables control during the non-recreational season (November 1st through April 30th). Locating the RTB adjacent to the Newtown Creek WWTP would facilitate access for O&M of the facility, and allow for direct discharge of the dewatered solids load to the WWTP.

Cost

The estimated NPW for this control measure is $595M. Details of the estimate are presented in Section 8.4.

Challenges

The challenges associated with this alternative include:

- Permitting and approvals would be necessary for construction of a new outfall for the treated effluent to Newtown Creek. The construction of the outfall diversions and consolidation conduit would require approval of construction within road rights-of-way to be coordinated with the Department of Transportation (DOT).
- Although the 9,800 LF consolidation conduit would be constructed by microtunneling, traffic impacts and utility conflicts would still be anticipated at the multiple microtunneling shafts that would be required along the route.
- While the RTB could theoretically be upgraded in the future to provide chemically-enhanced primary treatment for higher levels of solids reduction, the flexibility to provide higher levels of CSO control would be limited by the contact time available in the tank and the conveyance capacity of the consolidation conduit.
- The discharge from the RTB, while treated, would still be in the downstream reach of Newtown Creek, where recreational use of the waterway is more likely to occur.

Although construction of Alternative RTB-1 would provide 50 percent recreational season (May 1st through October 31st) control of the three major upstream CSOs, this alternative has limited opportunity for future expansion for additional levels of control, carries the potential for significant construction impacts along the near-surface consolidation conduit route, and does not offer significant cost savings over other alternatives that would provide a similar level of control. For these reasons, this alternative was not carried forward to the next level of evaluation for inclusion in the retained alternatives.

Alternative IT-1: Individual Off-line Storage Tanks

As noted earlier, in consideration of siting constraints, a review of developed properties that could be acquired through the eminent domain process was conducted. Although this process of land acquisition is highly undesirable, it was necessary to consider this option to develop traditional individual off-line storage tank options for comparison to other broader CSO control alternatives. The developed parcels within a half-mile radius of the regulators associated with Outfalls NC-015, NC-083 and NC-077 were identified and, based on their size, categorized according to the level of CSO control that could be implemented within their property limits. Cemeteries, schoolyards, parks and parcels associated with transportation uses were excluded from the analysis. As an example, Figure 8-13 summarizes the analyses for Outfall NC-083. The area in acres is shown for each highlighted parcel. Parcels highlighted in blue, green and orange would be large enough to accommodate 25, 50 or 75 percent CSO control storage tanks, respectively. It should be stressed that none of the highlighted sites are specifically being considered for a storage tank facility. The intent is to demonstrate the lack of suitable sites and the difficulties in site acquisition that would be encountered if this alternative were to be further pursued. Similar analyses were conducted for Outfalls NC-077 and NC-015. It is noted that no single developed parcel that could accommodate 100 percent CSO control storage tanks were identified within the search radius for Outfalls NC-083 and NC-015.

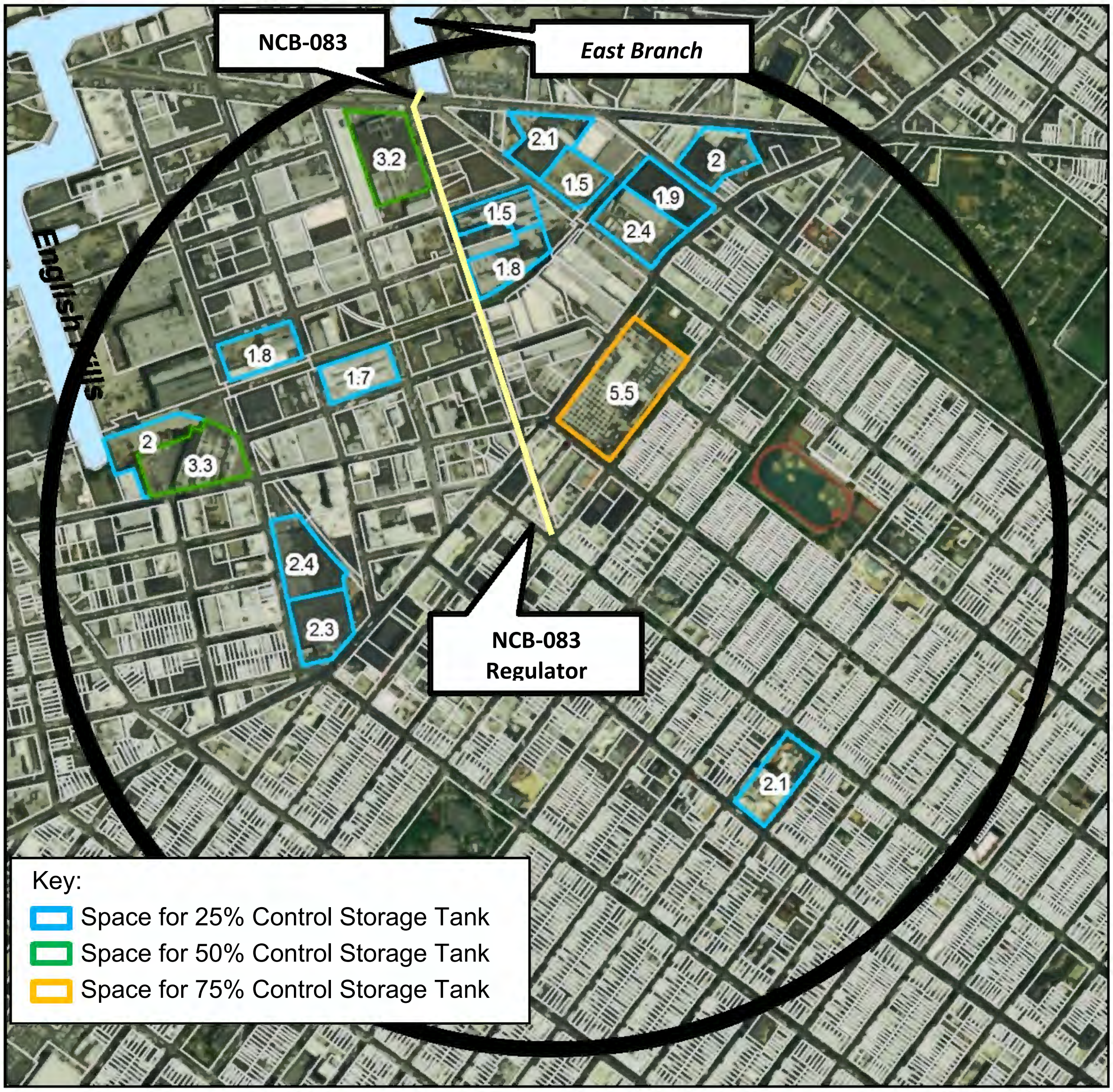

Figure 8-13. Developed Parcels Larger than 1.5 Acres Identified within Half-mile Radius from the Nicholas Weir/Regulator (Outfall NC-083)

Table 8-8 summarizes the individual storage tank dimensions and characteristics associated with the various levels of CSO control. Due to the multiple developed parcels that could accommodate a given tank size, approximate lengths of the corresponding conveyance elements had to be assumed for most tanks for cost estimation purposes.

For each facility, a diversion chamber would need to be constructed along each outfall to divert overflows to the storage tanks. The diameters of each collection conduit and dewatering force main are shown in Table 8-8.

Table 8-8. Characteristics of CSO Retention Tanks for Outfalls NC-077, NC-083 and NC-015

Outfall	Level of Control	Tank Volume (MG)	Inside Length (ft)	Inside Width (ft)	Dewatering PS Capacity (MGD)	Collection Conduit Diameter (ft)	Dewatering Force Main Diameter (ft)
NC-077	25%	2.4	146	73	2.4	3.0	1.0
	50%	6.8	248	124	6.9	4.5	2.0
	75%	14.2	356	178	14.2	5.5	2.0
	100%	37	574	287	37	2 X 8	4.0
NC-083	25%	3	164	82	3	3.5	1.0
	50%	8.5	275	138	8.5	5	2.0
	75%	17.2	392	196	17.2	7.5	3.0
	100%	41.1	605	303	41.1	2 x 8	4.0
NC-015	25%	4.3	196	98	4.3	4.0	2.0
	50%	12.3	332	166	12.3	5.5	2.0
	75%	22	443	221	22	7.0	3.0
	100%	44.3	628	315	44.3	2 x 8	4.0

Flows entering the facilities would be screened of large solids and floatable material. Following the event, the tank would be dewatered and cleaned and made ready for the next event. Flushing gates or tipping buckets would be provided to facilitate cleaning of the tank bottom. Flushed grit and solids would be conveyed in a channel to a wet well containing dewatering pumps for pump down of the facilities to the Newtown Creek WWTP. Ventilation of the tanks with activated carbon odor control facilities would be provided.

Given the large tank volumes shown in Table 8-8 an evaluation was conducted to determine the maximum flow rate for disinfection that could be achieved with those volumes assuming a 15 minute contact time, and the associated level of seasonal bacteria load control. The results indicated that, for Outfalls NC-077, NC-083 and NC-015, the chlorination rates that could be implemented for the 50 percent annual control tanks would exceed the rates required to provide 100 percent recreational season (May 1st through October 31st) bacteria load control. This analysis is summarized in Table 8-9 below.

Table 8-9. Potential Peak Disinfection Capacity for 50 Percent Control Storage Volume

Outfall	Tank Volume (MG)	Peak Disinfection Capacity (MGD)	Maximum Peak Flow During Recreational Season(1) (MGD)
NC-077	6.8	653	481
NC-083	8.5	816	725
NC-015	12.4	1190	564

Note:
(1) Recreational Season is from May 1st through October 31st.

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Providing 75 or 100 percent recreational season control would be more cost-effectively achieved through adding disinfection to the 50 percent annual control tanks than by building larger tanks, and would avoid the additional site acquisition issues associated with the greater area requirements of the larger tanks. For these reasons, the 75 and 100 percent control storage tanks were not retained for further consideration.

The benefits, costs and challenges associated with construction and operation of the individual CSO storage tanks are as follows:

Benefits

The primary benefit of a storage tank is its predicted high degree of volumetric CSO and annual bacterial capture. The operations are simple in comparison to treatment facilities and DEP operations staff is familiar with the maintenance requirements of the equipment used in this type of facility. In addition, the surface of the tanks could be designed to provide secondary uses, such as a parking lot, ball fields, a gathering area, a park or other recreational amenities.

Cost

The estimated NPW for this control measure at Outfalls NC-015, NC-083 and NC-077 ranges from $627M to $901M for 25 percent annual control and 50 percent annual control, respectively. Details of these estimates are presented in Section 8.4.

Challenges

The challenges associated with this alternative include:

- Acquisition of the sites would likely require either a negotiated acquisition process or eminent domain. In addition, most of the area covered by the siting assessment for Outfalls NC-077, NC-083 and NC-015 are designated by the City as NYC Industrial Business Zones (IBZ). These areas were established to protect existing manufacturing districts and encourage industrial growth citywide, and include tax credits for industrial and manufacturing firms choosing to relocate to these zones. Displacing active industrial or manufacturing uses in this area would run counter to the concept of the IBZ.
- During construction, plans for maintenance and protection of traffic will be required, along with coordination of construction methods and schedules with DOT. These issues will need to be addressed not only for the tank site, but for the alignments of the dewatering force main and the outfall sewer diversion and conveyance to the tanks. As a result, the immediate and long-term neighborhood impacts are expected to be widespread and will impact a large area of the community.
- Past operational experience of off-line CSO storage tanks in other parts of NYC indicates that grit and solids in the pump-back following a wet-weather event have a tendency to drop out of suspension in the interceptor. The deposition of sediment reduces interceptor capacity and increases the risk of flooding and sewer back-ups. More frequent cleaning of the interceptors would be necessary to manage this issue.
- Control of the three CSO outfalls would require operation and maintenance of three separate facilities remote from the Newtown Creek WWTP.

Alternatives DT-1 through DT-4 – Tunnel Storage for Outfalls NC-015, NC-083 and NC-077

As a result of the general limited availability of suitable sites for traditional storage and treatment technologies within the Newtown Creek watershed, tunnel alternatives were developed further. Unlike traditional tanks, tunnels:

1) Can provide for both conveyance and storage of CSO;

2) Require less permanent above-ground property per equivalent unit of storage volume;

3) Minimize surface construction impacts;

4) Reduce construction related groundwater pumping and treatment costs; and

5) Reduce the volume of near-surface spoil material to be treated, handled and transported for disposal during construction. For the Newtown Creek watershed, the likelihood of encountering contaminated near-surface soils is high.

These benefits make tunnel storage more practical for highly developed watersheds such as Newtown Creek. Tunnel alternatives are described below.

Tunnel construction would involve the boring of a linear storage conduit underground using a tunnel boring machine (TBM). Shafts would be installed during construction for the connection of CSO diversion pipes and O&M access. A tunnel dewatering pumping station (TDPS) would also be included at the downstream end of the tunnel with pumped discharges being conveyed to the Newtown Creek WWTP for treatment after wet-weather events. A mechanical ventilation system would be provided with an activated carbon odor control system. Additional passive odor control systems and/or backdraft dampers would be provided at the drop shafts.

Potential sites for the mining shaft/TDPS were identified. Figure 8-14 shows one potential site within the boundaries of the WWTP. Figure 8-15 shows a potential site currently owned by the DEP adjacent to Outfall NC-077. The site within the Newtown Creek WWTP was not considered advantageous due to considerations for reserving that site for potential future upgrades of the Newtown Creek WWTP, but other sites in the vicinity of the Newtown Creek WWTP could be considered as part of more detailed siting investigations. The deep tunnel alignments evaluated for the Newtown Creek watershed would either begin at a site near the Newtown Creek WWTP (longer tunnel) or at the DEP owned parcel near Outfall NC-077 (shorter tunnel). These parcels will be abbreviated herewith as “WWTP” and “DEP” parcels, respectively. The tunnels would terminate at the LIRR owned parcel near Outfall NC-015. For both mining shaft site options, the alignments would run either under Newtown Creek, to the extent possible, or under the public ROW, to the extent possible. As such, four potential tunnel alignments were identified and are shown in Figures 8-16 and 8-17, for the shorter and longer tunnel options, respectively. A longer tunnel option for 25 percent CSO control was not evaluated because the diameter associated with 25 percent control for the long tunnel would have been too small to be practical for a deep tunnel. Therefore, for this level of control, only the shorter tunnel with TDPS at the DEP parcel was evaluated further. Additionally, a shorter tunnel for the 100 percent level of control was not considered further as it resulted in a large diameter that was at the limit of current TBM technology.

Figure 8-14. Potential Mining Shaft Site near the Newtown Creek WWTP

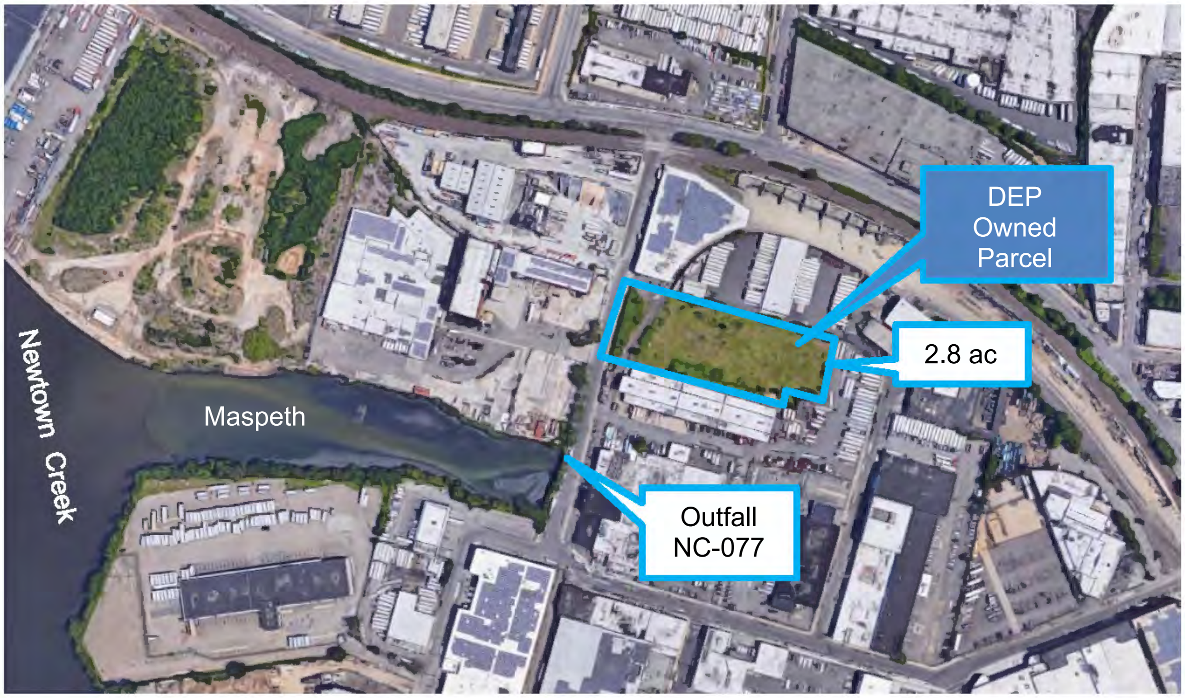


Figure 8-15. Potential Shaft Site at DEP Owned Parcel

Several conceptual layouts were evaluated for the tunnel alternatives. These conceptual layouts and sites were developed for the purposes of developing costs and evaluating the feasibility of the various CSO storage tunnel alternatives. The final siting of the dewatering pumping station, the tunnel alignment and other associated details of the tunnel alternatives presented herein will be further evaluated and finalized during subsequent planning and design stages.

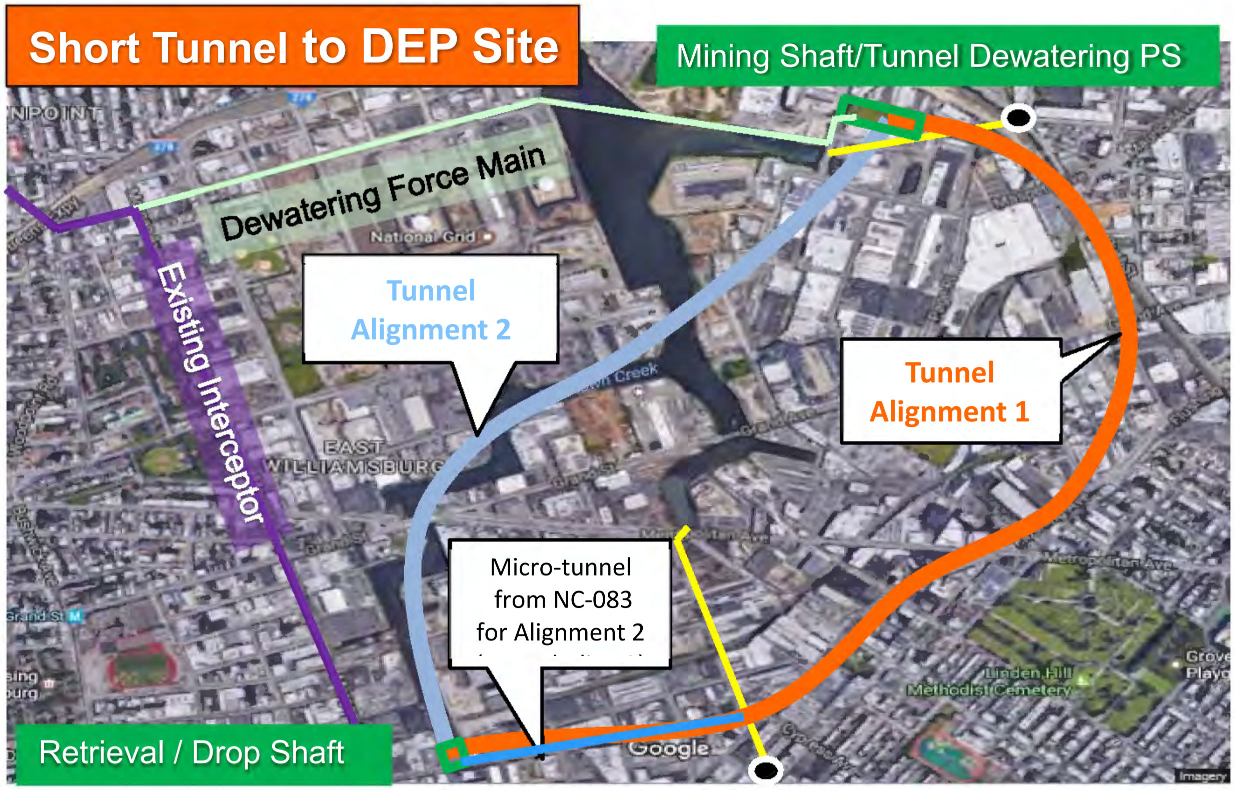


Figure 8-16. Conceptual Layout of Tunnel Storage with TDPS at DEP Parcel –Tunnel Alignments 1 and 2 for 25, 50, 62.5 and 75 Percent CSO Control of Outfalls NC-015, NC-083 and NC-077

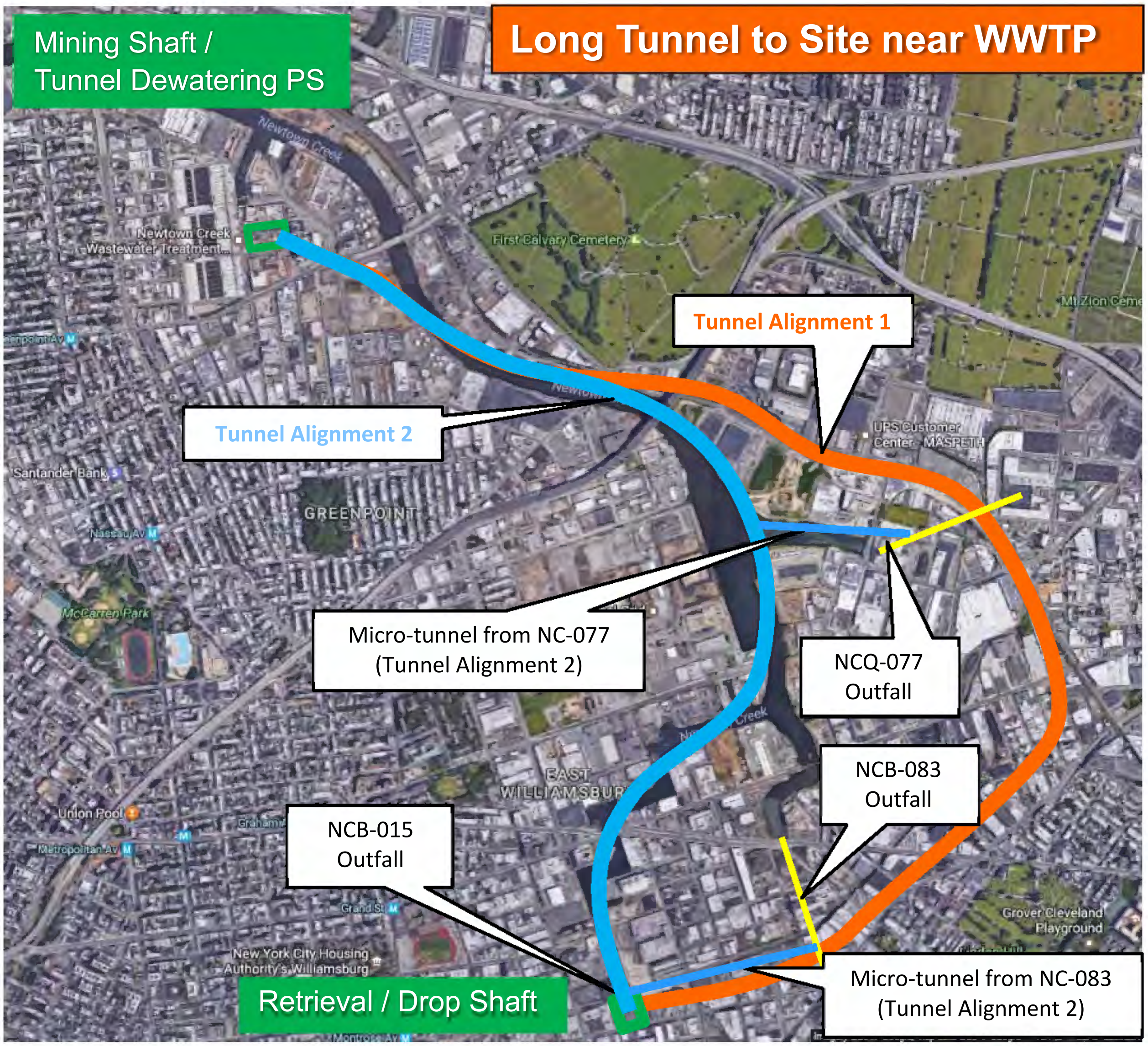


Figure 8-17. Conceptual Layout of Tunnel Storage with TDPS near WWTP for 50, 62.5 and 75 Percent CSO Control of Outfalls NC-015, NC-083 and NC-077 and 100 Percent CSO Control of Outfalls BB-026, NC-015, NC-083 and NC-077

Using the IW model, an evaluation was performed that included several iterations to assess the tunnel sizes necessary to provide the storage volume required for 25, 50, 62.5 and 75 percent control for the three largest outfalls, and 100 percent control for all four of the largest outfalls. The storage volumes and dewatering rates provided in Table 8-7 were used as a basis for sizing the tunnels. Required tunnel diameters were rounded up to the nearest foot, and it was assumed that the diameter would be constant for the entire length of the tunnel.

Based on available geotechnical information, which included United States Geological Survey rock contours and boring information from DEP water tunnels that run through the area, the depth to bedrock in the project area varies from approximately 60 feet in the vicinity of the proposed mining shaft at the WWTP site to approximately 230 feet in the vicinity of the proposed retrieval shaft at Outfall NC-015. As risk significantly increases with variable ground conditions, it is generally desirable to maintain a tunnel profile either completely within soft ground or completely in hard rock. Given the lengths of the tunnel routes and the density of development in the Newtown Creek area, passing under multiple private property parcels was unavoidable for the tunnel routes. This would necessitate acquisition of either the parcel or an easement on the parcel through either negotiated acquisition eminent domain. Although a rock tunnel would have deeper shafts than a soft ground tunnel, the unit costs of tunneling in rock are typically lower than the unit cost for similarly sized soft ground tunneling. Based upon these considerations, a vertical tunnel alignment in rock was considered to have lower risks and costs than a soft ground/mixed face tunnel vertical alignment for the storage tunnels being considered for this LTCP, and the alignments presented herein are based on a rock alignment.

Two DEP water tunnels run through the Newtown Creek project area. However, these tunnels are in the range of 500-to-600-feet deep, and would be well below the vertical alignment of the CSO storage tunnel. The water tunnels are not anticipated to be affected by the CSO storage tunnel, but the presence of the water tunnels would be taken into account during design.

Each of the tunnel alternatives requires a dewatering pumping station to convey the retained CSO volumes to the treatment plant following a wet-weather event. The capacities of the dewatering pumping stations for each of the tunnel alignment/level of control alternatives are shown in Table 8-10. The dewatering pumping station capacities shown are based on a 24 hour dewatering period. Analyses of the conveyance capacity of the interceptor system near the TDPSs revealed that for the short tunnel options, with the TDPS at the DEP parcel, the local Maspeth Avenue Interceptor did not have sufficient capacity for the dewatering flows from the 25 percent control tunnel or larger. The closest location with sufficient capacity would be downstream of the junction between the Maspeth Avenue and Morgan Avenue interceptors, about 5,800 ft away and across Newtown Creek from the TDPS site. A dewatering force main to that location has been included for those alternatives. For the 75 and 100 percent CSO control alternatives, the capacities indicated in Table 8-10 for 24-hour dewatering would exceed the level that would be considered prudent from a loading perspective and to maintain treatment levels at the Newtown Creek WWTP. Thus to consider a 75 or 100 percent CSO control alternative would require construction of an additional treatment facility. As noted above, the maximum dewatering rate based on the considerations of loading impacts to the WWTP would be 40 MGD.

Table 8-10. Tunnel Characteristics and Dewatering Pumping Station Capacity of Based on 24-hour Dewatering

Alternative/Level of CSO Control	Required Storage Volume (MG)	Tunnel Length (ft)	Selected Tunnel Diameter (ft)	Storage Volume Provided (MG)	PS Capacity (MGD)
DT-1a/25% (DEP/In-Creek)	10	7,570	16	11	11
DT-1b/25% (DEP/ROW)	10	9,980	16(1)	15	15
DT-2a/50% (WWTP/In-Creek)	28	13,700	19	28	28
DT-2b/50% (WWTP/ROW)	28	18,800	16	28	28
DT-2c/50% (DEP/In-Creek)	28	7,570	26	29	29
DT-2d/50% (DEP/ROW)	28	9,980	23	30	30
DT-3a/62.5% (WWTP/In-Creek)	39	13,700	22	39	39
DT-3b/62.5% (WWTP/ROW)	39	18,800	19	39	39
DT-3c/62.5% (DEP/In-Creek)	39	7,570	30	39	39
DT-3d/62.5% (DEP/ROW)	39	9,980	26	39	39
DT-4a/75% (WWTP/In-Creek)	54	13,700	26	55	55(3)
DT-4b/75% (WWTP/ROW)	54	18,800	23	58	58(3)
DT-4c/75% (DEP/In-Creek)	54	7,570	36	56	56(3)
DT-4d/75% (DEP/ROW)	54	9,980	32	59	59(3)
DT-5a/100% (WWTP/In-Creek)(2)	138	13,700	42	137(3)	137(3)
DT-5b/100% (WWTP/ROW)(2)	138	18,800	36	143(3)	143(3)

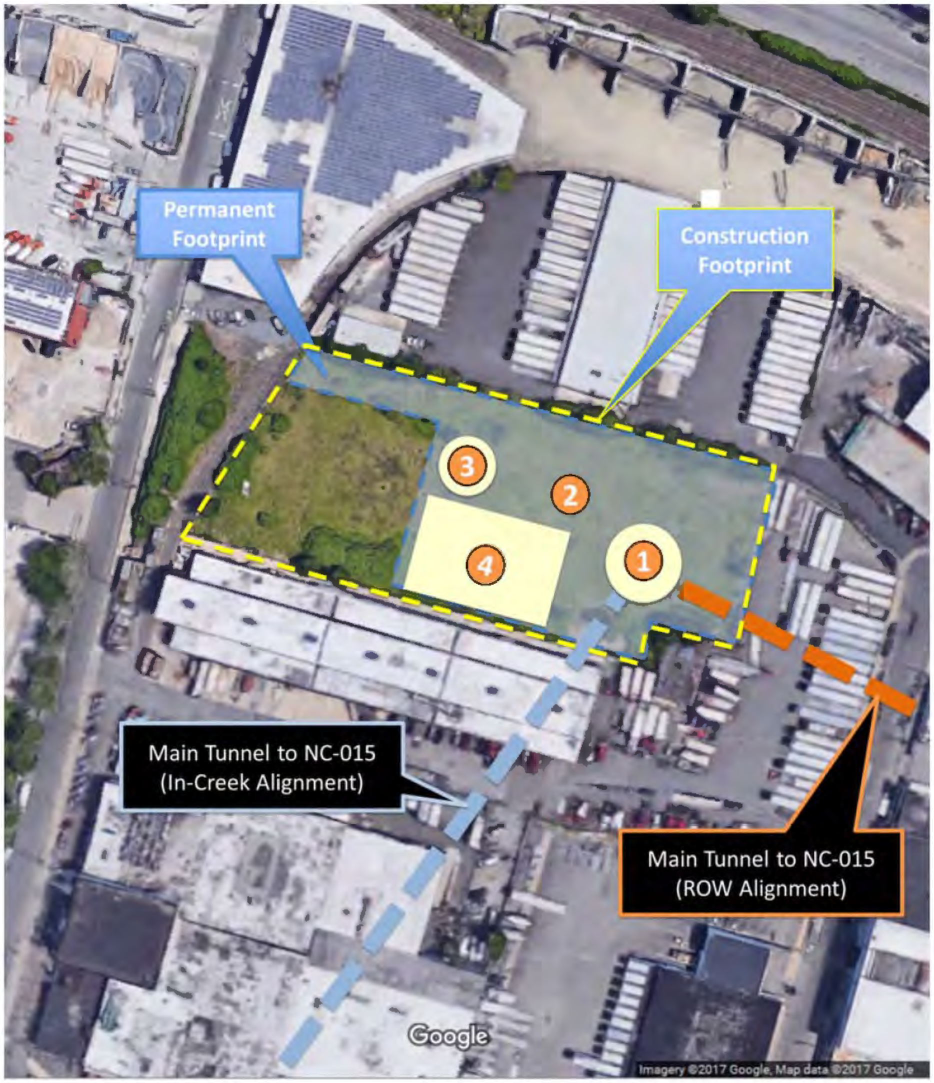
Notes:
(1) Assumed minimum cost-effective diameter for TBM technology.
(2) 100% control of Outfalls BB-026, NC-077, NC-083 and NC-015.
(3) Maximum capacity based on loadings to the Newtown Creek WWTP would be 40 MGD.

Alternative DT-1 – 25 Percent CSO Control Tunnel Options for Outfalls NC-015, NC-083 and NC-077, Mine from DEP Site

The tunnels designated as Alternatives DT-1a and DT-1b in Table 8-11 would provide 25 percent CSO control with the tunnel launching shaft and dewatering pumping station located at the DEP parcel near Outfall NC-077. From this mining shaft/TDPS site, the tunnel alignments would either follow the Creek alignment or the ROW alignment as shown in Figure 8-15. In both cases, the tunnel internal diameter would be 16 ft. A smaller diameter would provide 25 percent CSO control for the shorter ROW alignment (Alternative DT-1b). However, a rock tunnel at less than 16 ft diameter would be less efficient to construct due to space constraints, and would not likely provide cost savings compared to a 16-ft diameter tunnel. Upon completion of the tunnel, the associated TDPS would be constructed. The TDPS could either be a cavern pumping station constructed in rock, or a circular design for which a dedicated shaft would be provided. To minimize the extent of surface features, a cavern pumping station was assumed for the LTCP. The TDPS capacities would be 11 MGD and 15 MGD for Alternatives DT-1a and DT-1b, respectively. The layout of the pumping station and appurtenant features assuming a cavern configuration is shown on Figure 8-18.

Upon completion of the tunnel mining operations, the mining shaft would be converted to a screenings and grit removal shaft. A grit sump would be constructed in the bottom of the shaft, coarse bar screen would be provided on the downstream side of the grit sump, and an overhead bridge crane would be provided with clamshell bucket and bar screen rake attachments for removal of grit, screenings, or other large objects captured in the sump. Two access shafts would be provided for the pumping station: one main access shaft, and one equipment access shaft. An above-ground building housing HVAC and electrical support equipment for the pumping station would be provided adjacent to the access shafts.

Both the ROW and the Creek tunnel alignments would include diversion structures with weirs and tide gates on the existing NC-015, NC-083 and NC-077 outfalls, and both alignments would require drop shafts at Outfalls NC-015 and NC-077. For the Creek alignment, a micro-tunneled connection would be provided from the NC-083 diversion structure to the drop shaft at NC-015. For the ROW alignment, a drop shaft for NC-083 flows would be located adjacent to that outfall, in proximity to where the tunnel alignment crosses under the outfall. The drop shafts would include influent trash racks/grit sumps and passive odor control if determined to be necessary during design. Figure 8-19 shows the proposed configurations in the vicinity of Outfalls NC-015 and NC-083, and Figure 8-20 shows the configurations in the vicinity of Outfall NC-077. Table 8-10 above summarizes the key capacities and dimensions of Alternatives DT-1a and DT-1b.



1	Mining Shaft/Screen & Grit Removal Shaft
2	PS Equipment Access Shaft
3	PS Main Access Shaft
4	Pump Station Building

Figure 8-18. Conceptual Layout of Mining Shaft/TDPS at DEP Owned Parcel – Shorter Tunnel

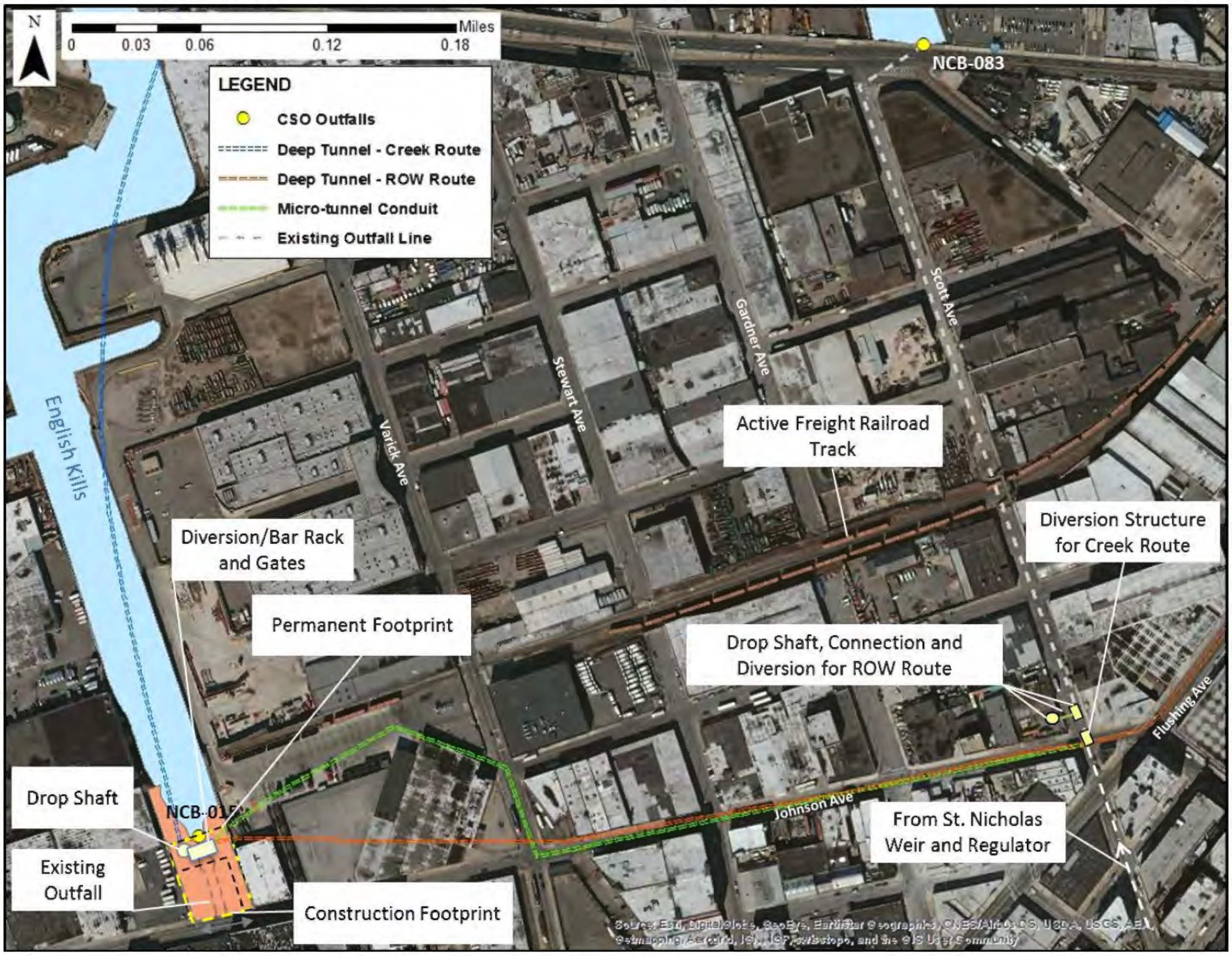


Figure 8-19 Details of Diversion Structures/Drop Shafts for Outfalls NC-083 and NC-015

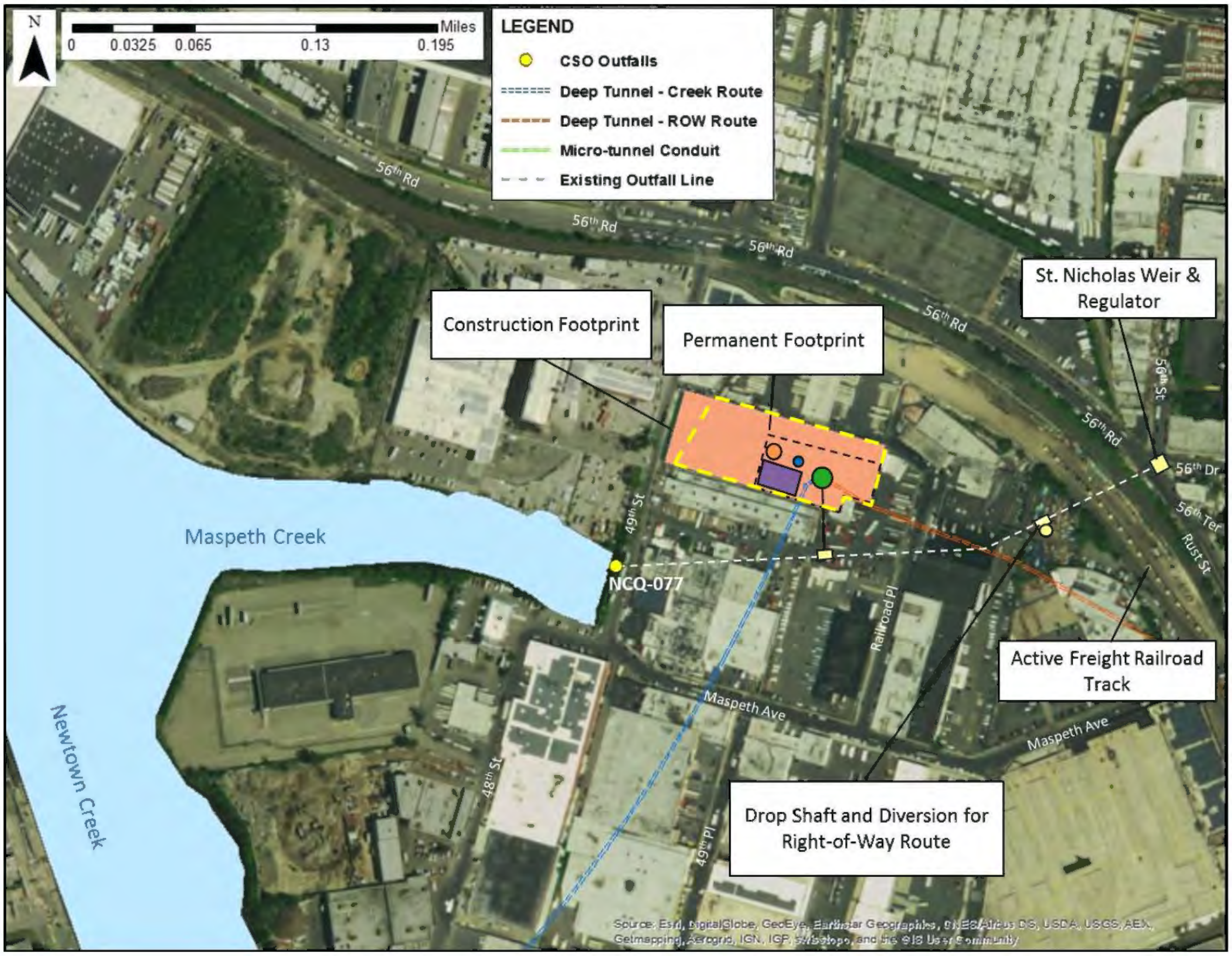


Figure 8-20 Details of Diversion Structures/Drop Shafts for Outfalls NC-077 (Shorter Tunnel)

The benefits, costs and challenges associated with this tunnel storage alternative are as follows:

Benefits

The primary benefit of tunnel storage is the high level of CSO volume reduction with minimal permanent above-ground land requirements and disruption during construction. The single tunnel facility addresses three of the largest CSO discharge locations to Newtown Creek.

Cost

The estimated NPW for this control measure is $437M for Alternative DT-1a (DEP site/creek route) and $456M for Alternative DT-1b (DEP site/ROW route). Details of the estimates are presented in Section 8.4.

Challenges

The challenges associated with this alternative include:

- Uncertainty related to the availability of the DEP site due to competing needs for existing maintenance needs and future treatment requirements for use as a tunnel mining location and long-term location for the TDPS.
- Construction of the long tunnel dewatering force main across Newtown Creek.
- Construction of the micro-tunneled connection from NC-083 to the drop shaft at NC-015 for the Creek route.
- Potential impacts of the dewatered flow on sediment deposition in the Morgan Avenue interceptor downstream of the dewatering force main tie-in location.
- More difficult/complex O&M associated with the deep dewatering force main and deep grit/screenings shaft.
- The potential for sediment deposition in the tunnel.
- The potential for hydraulic surge conditions in the tunnel.
- The potential for encountering unforeseen geotechnical conditions during construction of the tunnel, shafts, or cavern TDPS.
- Maintaining outfall functionality during construction of the diversion structures.
- Limited space for construction of the drop shaft at NC-015.
- Property acquisition through either negotiated acquisition or eminent domain process.

Both Alternatives DT-1a and DT-1b were carried forward to the next level of evaluation for inclusion in the basin-wide alternatives.

Alternative DT-2 – 50 Percent CSO Control Tunnel for Outfalls NC-015, NC-083 and NC-077

The tunnels designated as Alternatives DT-2a, DT-2b, DT-2c and DT-2d would provide 50 percent CSO control with the tunnel launching shaft and dewatering pumping station to be located at either the DEP parcel near Outfall NC-077 for the shorter tunnel option, or at a site in the vicinity of the Newtown Creek WWTP for the longer tunnel option. For each mining shaft/TDPS site, the tunnel alignments would either follow the Creek alignment or the ROW alignment shown in Figures 8-16 and 8-17 above. The tunnel internal diameters would range from 19 ft to 26 ft, depending on the route. As described for Alternative DT-1, the TDPS was assumed to be a cavern pumping station. The TDPS capacity would range from 28 MGD to 30 MGD, depending on the tunnel route. The layout of the pumping station configuration for the DEP owned parcel, assuming a cavern configuration, is shown above on Figure 8-18. The layout for a site in the vicinity of the Newtown Creek WWTP for the longer tunnel option would be similar. The configurations of the diversion structures and drop shafts for Outfalls NC-015 and NC-083 would be similar to the arrangements shown in Figure 8-19 above for all the potential alignments of this alternative. For the short tunnel from the DEP site, the arrangement at Outfall NC-077 would be similar to the arrangement shown in Figure 8-20. For the long tunnel alignment to the vicinity of the Newtown Creek WWTP, the arrangement of diversion structures/drop shafts is presented in Figure 8-21. As with Alternative DT-1, the drop shafts would include influent trash racks/grit sumps and passive odor control if

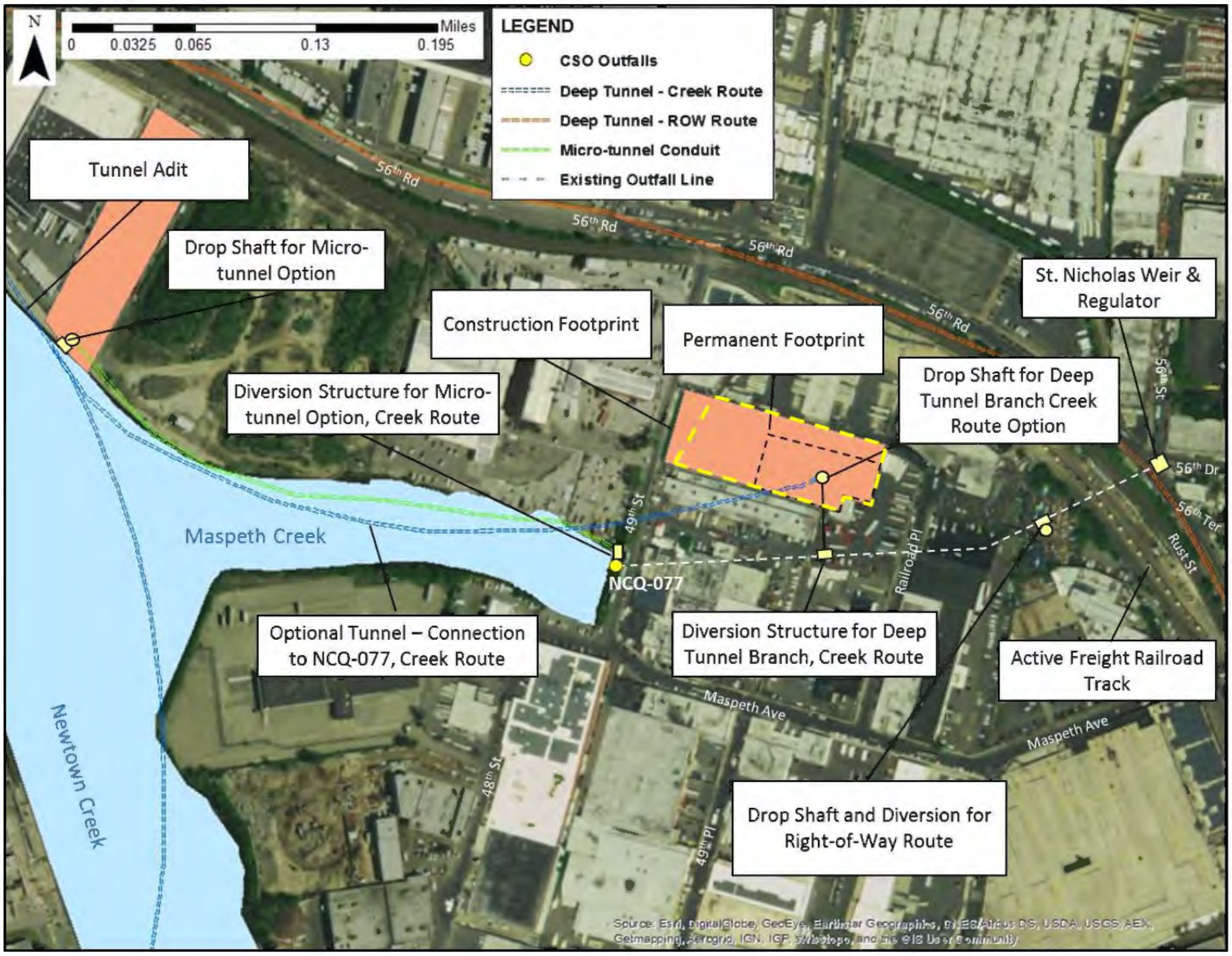


Figure 8-21 Details of Diversion Structures/Drop Shafts for Outfalls NC-077 (Longer Tunnel)

determined to be necessary during design. Table 8-10 above summarizes the features of Alternatives DT-2a, DT-2b, DT-2c and DT-2d.

The benefits, costs and challenges associated with this tunnel storage alternative are as follows:

Benefits

The primary benefit of tunnel storage is the high level of CSO volume reduction with minimal permanent above-ground land requirements and disruption during construction. The single tunnel facility addresses three of the largest CSO discharge locations to Newtown Creek.

Benefits of the long tunnel with TDPS in the vicinity of the Newtown Creek WWTP over the short tunnel with TDPS at the DEP site include that the long dewatering force main from the DEP site would be eliminated, along with the risks of sediment deposition in the Morgan Avenue interceptor from the dewatering flow. This site would also be much closer to the Newtown Creek WWTP, making access to the TDPS easier from the Newtown Creek WWTP.

Cost

The estimated NPW for this control measure is $576M for Alternative DT-2a (WWTP site/Creek route), $571M for Alternative DT-2b (WWTP site/ROW route), $574M for Alternative DT-2c (DEP site/Creek route) and $576M for Alternative DT-2d (DEP site/ROW route). Details of the estimates are presented in Section 8.4.

Challenges

The challenges associated with this alternative would be similar to those identified for Alternative DT-1, with the following differences:

- For the long tunnel route, uncertainty related to the availability of sites in the vicinity of the Newtown Creek WWTP for use as a tunnel mining location and long-term location for the TDPS and any necessary property acquisition through negotiated acquisition or eminent domain.
- Specific challenges associated with dewatering from the DEP site would not apply to a site near the Newtown Creek WWTP. The dewatering force main would be much shorter, and would tie in directly to the Newtown Creek WWTP.

Alternatives DT-2a, DT-2b, DT-2c and DT-2d were carried forward to the next level of evaluation for inclusion in the basin-wide alternatives.

Alternative DT-3 – 62.5 Percent CSO Control Tunnel for Outfalls NC-015, NC-083 and NC-077

The tunnels designated as Alternatives DT-3a, DT-3b, DT-3c and DT-3d would provide 62.5 percent CSO control with the tunnel launching shaft and dewatering pumping station to be located at either the DEP parcel near Outfall NC-077 for the shorter tunnel option, or a site in the vicinity of the Newtown Creek WWTP for the longer tunnel option. For each mining shaft/TDPS site, the tunnel alignments would either follow the Creek alignment or the ROW as shown in Figures 8-16 and 8-17 above. The tunnel internal diameters would range from 19 ft to 30 ft depending on the alignment. Upon completion of the tunnel, a TDPS would be constructed. As described for Alternatives DT-1 and DT-2, the TDPS was assumed to be a cavern pumping station. The dewatering pumping station capacity would have a capacity of 39 MGD for the four tunnel alignment options. The layout of the pumping station configuration for the DEP owned parcel, assuming a cavern configuration, is shown above on Figure 8-18. The layout for a site in the vicinity of the Newtown Creek WWTP for the longer tunnel option would be similar. The configurations of the diversion structures and drop shafts for Outfalls NC-015 and NC-083 would be similar to the arrangements shown in Figure 8-19 above for all the potential alignments of this alternative. For the short tunnel from the DEP site, the arrangement at Outfall NC-077 would be similar to the arrangement shown in Figure 8-20. For the long tunnel alignment to the vicinity of the Newtown Creek WWTP, the arrangement of diversion structures/drop shafts would be as shown in Figure 8-21. As with Alternatives DT-1 and DT-2, the drop shafts would include influent trash racks/grit sumps and passive odor control if determined to be necessary during design. Table 8-10 above summarizes the features of Alternatives DT-a, DT-3b, DT-3c and DT-3d.

The benefits, costs and challenges associated with this tunnel storage alternative are as follows:

Benefits

The primary benefit of tunnel storage is the high level of CSO volume reduction with minimal permanent above-ground land requirements and disruption during construction. The single tunnel facility addresses three of the largest CSO discharge locations to Newtown Creek.

Benefits of the long tunnel with TDPS in the vicinity of the Newtown Creek WWTP over the short tunnel with TDPS at the DEP site include that the long dewatering force main from the DEP site would be eliminated, along with the risks of sediment deposition in the Morgan Avenue interceptor from the dewatering flow. This site would also be much closer to the Newtown Creek WWTP, making access to the TDPS easier from the Newtown Creek WWTP.

Cost

The estimated NPW for this control measure is $646M for Alternative DT-3a (WWTP site/Creek route), $659M for Alternative DT-3b (WWTP site/ROW route), $651M for Alternative DT-3c (DEP site/Creek route) and $632M for Alternative DT-3d (DEP site/ROW route). Details of the estimates are presented in Section 8.4.

Challenges

The challenges associated with these tunnel alternatives would be similar to the challenges identified for the DT-2 alternatives for 50 percent control.

Alternatives DT-3a, DT-3b, DT-3c and DT-3d were carried forward to the next level of evaluation for inclusion in the basin-wide alternatives.

Alternative DT-4 – 75 Percent CSO Control Tunnel for Outfalls NC-015, NC-083 and NC-077

The tunnels designated as Alternatives DT-4a, DT-4b, DT-4c and DT-4d would provide 75 percent CSO control with the tunnel launching shaft and dewatering pumping station to be located at either the DEP parcel near Outfall NC-077 for the shorter tunnel option, or a site in the vicinity of the Newtown Creek WWTP for the longer tunnel option. For each mining shaft/TDPS site, the tunnel alignments would either follow the Creek alignment or the ROW as shown in Figures 8-16 and 8-17 above. The tunnel internal diameters would range from 23 ft to 36 ft depending on the alignment. Upon completion of the tunnel, a TDPS would be constructed. As described for Alternatives DT-1 and DT-2, the TDPS was assumed to be a cavern pumping station. The dewatering pumping station capacity for 24-hour dewatering would range from 55 MGD to 59 MGD, depending on the route. However, based on considerations of loadings to the Newtown Creek WWTP, the maximum dewatering rate would be 40 MGD. To achieve a 24-hour dewatering time, an approximately 20 MGD RTB would be required for treatment of the additional dewatering flow. The 20 MGD RTB would require an approximately 1.0-acre site. The layout of the pumping station configuration for the DEP owned parcel, assuming a cavern configuration, is shown above on Figure 8-18. The layout for a site in the vicinity of the Newtown Creek WWTP for the longer tunnel option would be similar. The configurations of the diversion structures and drop shafts for Outfalls NC-015 and NC-083 would be similar to the arrangements shown in Figure 8-19 above for all the potential alignments of this alternative. For the short tunnel from the DEP site, the arrangement at Outfall NC-077 would be similar to the arrangement shown in Figure 8-20. For the long tunnel alignment to the vicinity of the Newtown Creek WWTP, the arrangement of diversion structures/drop shafts would be as shown in Figure 8-21. As with Alternatives DT-1, DT-2and DT-3, the drop shafts would include influent trash racks/grit sumps and passive odor control if determined to be necessary during design. Table 8-10 above summarizes the features of Alternatives DT-4a, DT-4b, DT-4c and DT-4d.

The benefits, costs and challenges associated with this tunnel storage alternative are as follows:

Benefits

The primary benefit of tunnel storage is the high level of CSO volume reduction with minimal permanent above-ground land requirements and disruption during construction. The single tunnel facility addresses three of the largest CSO discharge locations to Newtown Creek.

Benefits of the long tunnel with TDPS in the vicinity of the Newtown Creek WWTP over the short tunnel with TDPS at the DEP site include that the long dewatering force main from the DEP site would be eliminated, along with the risks of sediment deposition in the Morgan Avenue interceptor from the dewatering flow. This site would also be much closer to the Newtown Creek WWTP, making access to the TDPS easier from the Newtown Creek WWTP.

Cost

The estimated NPW for this control measure is $942M for Alternative DT-3a (WWTP site/Creek route), $992M for Alternative DT-3b (WWTP site/ROW route), $983M for Alternative DT-3c (DEP site/Creek route) and $986M for Alternative DT-3d (DEP site/ROW route). Details of the estimates are presented in Section 8.4.

Challenges

The challenges associated with these tunnel alternatives would be similar to the challenges identified for the DT-2 alternatives for 50 percent control and DT-3 for 62.5 percent control, with the additional challenge of siting and operating an RTB to allow 24-hour dewatering of the tunnel.

Alternatives DT-4a, DT-4b, DT-4c and DT-4d were carried forward to the next level of evaluation for inclusion in the basin-wide alternatives.

Alternative DT-5 – 100 Percent CSO Control Tunnel for Outfalls BB-026, NC-015, NC-083 and NC-077

The tunnels designated as Alternatives DT-5a and DT-5b would provide 100 percent CSO control for Outfall BB-026 in addition to Outfalls NC-015, NC-083 and NC-077. The tunnel launching shaft and dewatering pumping station would be located in the vicinity of the Newtown Creek WWTP. The tunnel alignments would either follow the Creek alignment or the ROW alignment, as shown in Figure 8-17 above. The tunnel internal diameters would range from 36 ft to 42 ft, depending on the route. Upon completion of the tunnel, a dewatering pumping station would be constructed. As described for Alternatives DT-1, DT-2, DT-3 and DT-4, the TDPS was assumed to be a cavern pumping station. The dewatering pumping station capacity required to dewater the tunnel in 24 hours would be 137 MGD to 142 MGD depending on the tunnel route. However, as noted above, based on considerations of loadings to the Newtown Creek WWTP, the maximum dewatering rate would be 40 MGD. To dewater within 24 hours would require 97 to 103 MGD of additional treatment for the dewatered flow. The 100 MGD RTB would require an approximately 2.5-acre site. The layout of the dewatering pumping station configuration assuming a cavern configuration would be similar to the layout shown in Figure 8-18. The configurations of the diversion structures and drop shafts for Outfalls NC-015 and NC-083 would be similar to the arrangements shown in Figure 8-19 above for all the potential alignments of this alternative. The arrangement of diversion structures/drop shafts for Outfall NC-077 would be as shown in Figure 8-21. For Outfall BB-026, a consolidation conduit would be routed from a diversion structure at the outfall to a drop shaft adjacent to the mining shaft in the vicinity of the Newtown Creek WWTP. It may be possible to incorporate the drop shaft for the BB-026 flows into the mining shaft structure. As with Alternatives DT-1, DT-2, DT-3 and DT-4, the drop shafts would include influent trash racks/grit sumps and passive odor control if determined to be necessary during design. Table 8-10 above summarizes the features of Alternatives DT-5a and DT-5b.

The benefits, costs and challenges associated with this tunnel storage alternative are as follows:

<u>Benefits</u>

The benefits would be similar to those identified for the DT-3, 75 percent control alternatives, but the volume controlled would be greater.

<u>Cost</u>

The estimated NPW for this control measure is $1.6B for both Alternative DT-5a (WWTP site/creek route) and Alternative DT-5b (WWTP site/ROW route). Details of the estimates are presented in Section 8.4.

<u>Challenges</u>

The challenges associated with these tunnel alternatives would be similar to the challenges identified for the DT-2, DT-3 and DT-4 alternatives for 50, 62.5 and 75 percent control, with the additional challenge of installing the micro-tunneled connection from Outfall BB-026, and providing a much larger RTB (100 MGD) for the dewatering flows.

Alternatives DT-5a and DT-5b were carried forward to the next level of evaluation for inclusion in the basin-wide alternatives.

8.2.b Future Scalability of Tunnel Alternatives

The scalability opportunities for the tunnel alternatives depend on whether the mining shaft/TDPS is located in the vicinity of the Newtown Creek WWTP or the DEP site. If the shaft is located at the DEP site, and a site in the vicinity of the Newtown Creek WWTP remained available, then a future phase could potentially extend the tunnel from the DEP site to the vicinity of the Newtown Creek WWTP, providing additional storage capacity and higher levels of CSO control. However, an RTB would be required for treatment of the higher tunnel dewatering flows. If the shaft is located in the vicinity of the Newtown Creek WWTP, then a future scalability scenario would require the addition of an RTB facility to provide treatment of flows in excess of the tunnel capacity. These scenarios would likely require land acquisition either through a negotiated acquisition or eminent domain. These alternatives would also include providing additional pumping capacity to the RTB. Siting of the RTB would be a challenge.

8.2.c Other Future Green Infrastructure (Various Levels of Penetration)

As discussed in Section 5, DEP projects that GI should result in a CSO volume reduction to Newtown Creek of approximately 83 MGY, based on the 2008 baseline rainfall condition. This projected GI has been included as part of the baseline model projections, and is thus not categorized as an LTCP alternative.

For the purpose of this LTCP, "Other Future Green Infrastructure" is defined as GI alternatives that are in addition to those implemented under previous facility plans and those included in the baseline conditions. Because DEP is working on the implementation of GI area-wide contracts in the Newtown Creek watershed, additional GI beyond the baseline is not being considered for this LTCP at this time. DEP's goal is to saturate priority watersheds, such as Newtown Creek, with GI to maximize benefits and cost-effectiveness based on the specific opportunities, as discussed in Section 5.

8.2.d Hybrid Green/Grey Alternatives

Hybrid green/grey alternatives are those that combine traditional grey control measures with GI control measures, to achieve the benefits of both. However, as discussed above, development of the baseline GI projects for this watershed is already underway and further GI is not planned at this time. Therefore, no controls in this category are proposed for the Newtown Creek LTCP.

8.2.e Retained Alternatives

The goal of the previous evaluations was the development of a list of retained control measures for Outfalls BB-026, NC-077, NC-083 and NC-015 to Newtown Creek. These control measures, whether individually or in combination, will form the basis of basin-wide alternatives that will be assessed using the more rigorous cost-performance and cost-attainment analyses. That list is presented in Table 8-11. The reasons for excluding the non-retained control measures from further consideration are also noted in the table.

Table 8-11. Summary of Next Level of Control Measure Screening

Control Measure	Category	Retained for Further Analysis?	Remarks
Additional GI Build-out	Source Control	NO	Planned GI build-out in the watershed (included in the baseline) is in development; unlikely that additional sites will be identified due to site constraints in publicly owned properties.
High Level Sewer Separation	Source Control	NO	Concern with resulting stormwater related pollution and construction impacts.
Fixed Weirs	System Optimization	NO	No CSO reduction benefit.
Parallel Interceptor Sewer	System Optimization	NO	Significant constructability challenges.
Pumping Station Optimization	System Optimization	NO	Limited benefit due to capacity limitation in Morgan Avenue interceptor.

Table 8-11. Summary of Next Level of Control Measure Screening

Control Measure	Category	Retained for Further Analysis?	Remarks
Pumping Station Expansion	System Optimization	YES	Borden Avenue PS (BAPS) expansion reduces CSO discharges to Dutch Kills and provides synergies with a SOGR intervention.
Gravity Flow Tipping to Other Watersheds	CSO Relocation	NO	No alternatives evaluated were determined to provide significant opportunity to warrant pursuing this solution further.
Flow Tipping with Conduit and Pumping	CSO Relocation	YES	BAPS expansion also falls into this category.
Floatables Control	Floatables Control	NO	Not evaluated as a separate CSO control measure. Baseline conditions include floatables control at four largest outfalls.
Environmental Restoration	Water Quality/ Ecological Enhancement	NO	EPA is evaluating dredging alternatives under Superfund; wetlands restoration could be required after dredging.”
In-Stream Aeration	Water Quality/ Ecological Enhancement	NO	Gap analysis indicated Dutch Kills aeration system not required for average annual attainment of DO criterion.
Flushing Tunnel	Water Quality/ Ecological Enhancement	NO	Not practical for upstream reaches, not cost-effective compared to BAPS expansion for Dutch Kills.
Outfall Disinfection	Treatment: Satellite	NO	Very limited CSO control benefit.
Retention/Treatment Basins	Treatment: Satellite	NO	Alternative RTB-1 evaluated a 152 MGD RTB in conjunction with a consolidation conduit. High risk associated with long near-surface construction.
In-System Storage (Outfalls)	Storage	NO	Very limited levels of CSO control.
Off-line Storage (Shafts)	Storage	NO	Limited capacity would require multiple shafts; limited number of existing facilities from which to judge performance/ operational issues.
Off-line Storage (Tanks)	Storage	YES	To provide perspective on tunnel costs for equivalent levels of control.
Off-line Storage (Tunnels)	Storage	YES	Tunnels were evaluated under Alternatives DT-1, DT-2, DT-3 and DT-4.

As shown, the retained control measures include the BAPS expansion, storage tanks and deep tunnel storage. Measures for additional and/or improved floatables control are addressed within the retained alternatives.

8.3 CSO Reductions and Water Quality Impact of Retained Alternatives

To evaluate effects on the loadings and water quality CWA impacts, the retained alternatives listed in Table 8-12 were analyzed using both the Newtown Creek watershed (IW) and receiving water quality (NCRWQM) models. Evaluations of levels of CSO control for each alternative are presented below. In all cases, the predicted reductions shown are relative to the baseline conditions using 2008 JFK rainfall as described in Section 6. The baseline assumptions were described in detail in Section 6 and assume that the grey infrastructure projects from the WWFP have been implemented, along with the GI projected implementation identified in Section 5.

As noted earlier, a SOGR upgrade of the BAPS targeting an additional wet-weather pumping capacity of up to 24 MGD (75 percent CSO control at Outfall BB-026) was selected as the most favorable solution to mitigate the impacts of CSO discharges to Dutch Kills. Because the existing BAPS serves another small drainage area associated with Regulator BBL3a, whose flow contribution would also be pumped to the Newtown Creek WWTP during wet-weather, the total installed capacity at the BAPS would need to be 26 MGD to provide the targeted 75 percent CSO control at Outfall BB-026, 14 MGD to provide 50 percent CSO control and 7 MGD to provide 25 percent CSO control. Table 8-12 presents the annual and recreational season (May 1st through October 31st) activation frequencies at BB-026, the percent attainment of the Primary Contact WQ bacteria criteria based on 2008 rainfall, the PBC and NPW for the range of levels of control considered for the BAPS alternative. As shown in Table 8-12, implementation of at least 50 percent CSO control at Outfall BB-026 would bring Dutch Kills to seasonal attainment of the Primary Contact WQ fecal coliform criterion at WQ Station NC-6, which is the station closest to the Outfall. The locations of Outfall BB-026 and WQ Station NC-6 are shown in Figure 6-2. This assessment was conducted assuming equivalent levels of CSO control at Outfalls NC-077, NC-083 and NC-015. Table 8-12 also shows that implementing a 75 percent level of CSO control at Outfall BB-026, leads to elimination of four additional CSO activations in the recreational season (May 1st through October 31$^{st)}$. The NPW shown are described with more detail in Section 8-4.

Table 8-12. Summary of Performance for BAPS Alternatives

Outfall BB-026	Annual Activation Frequency	Seasonal Activation Frequency	2008 Seasonal Fecal Coliform Attainment (%)	PBC ($M)	NPW ($M)
Baseline	37	20	83	-	-
25% Control	35	15	>95	39	51
50% Control	29	9	>95	44	59
75% Control	25	5	>95	50	71

As mentioned in Section 8.2, 100 percent CSO control at Outfall BB-026 would be more effectively accomplished by conveying the typical year CSO discharges to a storage tunnel that would also target the capture of the discharges from Outfalls NC-077, NC-083 and NC-015. Through analysis of various tunneling options, it was possible to assign an additional PBC of $130M to the tunnel expansion scope required to retain and dewater the additional volume from Outfall BB-026. Neglecting the nominal increase in O&M cost associated with capturing the BB-026 volume, Figure 8-22 shows a clear knee-of-the-curve (KOTC) at the 75 percent level of control, based on PBCs. Expanding the BAPS up to 26 MGD to achieve 75 percent CSO control at Outfall BB-026 is the most cost-effective alternative for this outfall.

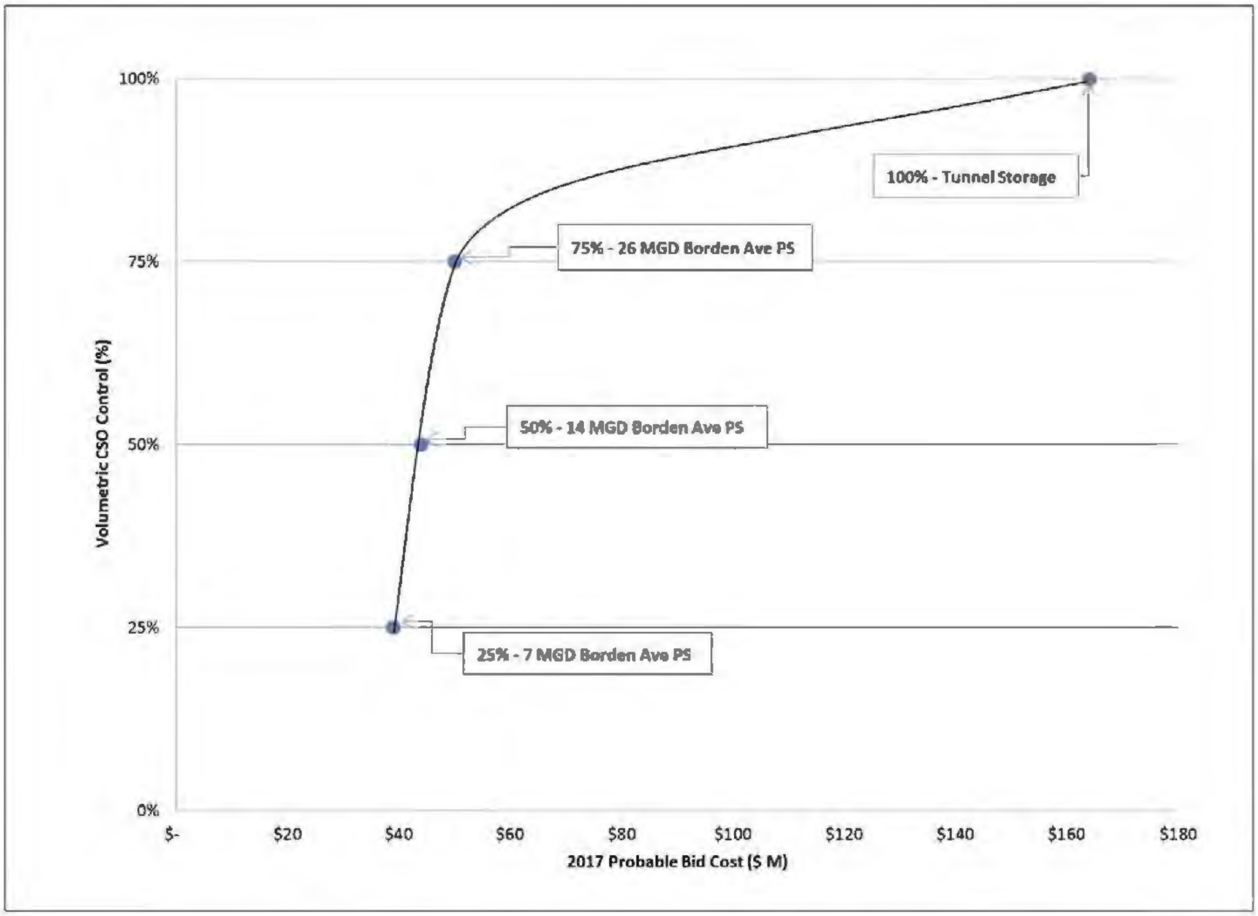


Figure 8-22. Probable Bid Cost vs Volumetric CSO Level of Control at Outfall BB-026

Basin-wide alternatives were developed based on the combination of a 26 MGD expansion of the BAPS and CSO control tunnels or individual storage tanks for Outfalls NC-077, NC-083 and NC-015. Table 8-13 presents the resulting alternatives along with their new sequential numbering system. As shown, six basin-wide alternatives were included that target the largest, most active outfalls, BB-026, NC-077, NC-083 and NC-015.

Table 8-13. Basin-Wide Alternatives with New Sequential Numbering

Alternative	Remarks
1. 26 MGD BAPS Expansion and Deep Tunnel for 25% Control of Three Largest Outfalls	16 foot interior diameter deep Tunnel with lengths ranging from 7,570 to 9,980 feet
2. 26 MGD BAPS Expansion and Individual Storage Tanks for 25% Control of Three Largest Outfalls	Volumes of Individual storage tanks: • NC-077 – 2.4 MG • NC-083 – 3.0 MG • NC-015 – 4.3 MG
3. 26 MGD BAPS Expansion and Deep Tunnel for 50% Control of Three Largest Outfalls	16 to 26 foot interior diameter Deep Tunnels with lengths ranging from 7,570 to 18,800 feet
4. 26 MGD BAPS Expansion and Individual Storage Tanks for 50% Control of Three Largest Outfalls	Volumes of Individual storage tanks: • NC-077 – 6.9 MG • NC-083 – 8.5 MG • NC-015 – 12.3 MG
5. 26 MGD BAPS Expansion and Deep Tunnel for 62.5% Control of Three Largest Outfalls	19 to 30 foot interior diameter Deep Tunnels with lengths ranging from 7,570 to 18,800 feet
6. 26 MGD BAPS Expansion and Deep Tunnel for 75% Control of Three Largest Outfalls	23 to 26 foot interior diameter Deep Tunnel with lengths ranging from 7,570 to 18,800 feet; 20 MGD RTB for dewatering flows
7. Deep Tunnel for 100% Control of Four Largest Outfalls	36 to 42 foot interior diameter Deep Tunnel with lengths ranging from 13,700 to 18,800 feet; 100 MGD RTB for dewatering flows

These seven Newtown Creek basin-wide retained alternatives were then analyzed on the basis of their cost-effectiveness in reducing loads and improving water quality. These more advanced analyses are described in Sections 8.3, 8.4 and 8.5.

8.3.a CSO Volume and Bacteria Loading Reductions of Basin-Wide Retained Alternatives

Table 8-14 summarizes the projected performance of the retained Newtown Creek basin-wide alternatives in terms of CSO volume, fecal coliform and *Enterococci* load reduction. These data are plotted on Figure 8-23. The bacteria loading reductions shown in Table 8-14 were computed on an annual basis.

Table 8-14. Newtown Creek Retained Alternatives Performance Summary (2008 Rainfall)

Alternative	CSO Volume (MGY) (3)	Frequency of Overflow(4)	CSO Volume Reduction(3) (%)	Fecal Coliform Reduction(1)(3) (%)	*Enterococci* Reduction(1)(3) (%)
Baseline Conditions(2)	1,055	42	-	-	-
1. 26 MGD BAPS Expansion and Deep Tunnel for 25% Control of Three Largest Outfalls	696	29	34	29	37
2. 26 MGD BAPS Expansion and Individual Storage Tanks for 25% Control of Three Largest Outfalls	696	29	34	29	37
3. 26 MGD BAPS Expansion and Deep Tunnel for 50% Control of Three Largest Outfalls	475	29	55	53	58
4. 26 MGD BAPS Expansion and Individual Storage Tanks for 50% Control of Three Largest Outfalls	475	19	55	52	57
5. 26 MGD BAPS Expansion and Deep Tunnel for 62.5% Control of Three Largest Outfalls	364	19	65	63	68
6. 26 MGD BAPS Expansion and Deep Tunnel for 75% Control of Three Largest Outfalls	286	18	73	70	75
7. Deep Tunnel for 100% Control of Four Largest Outfalls	0	0	100	100	100

Notes:

(1) Bacteria reduction is computed on an annual basis.
(2) Based upon 2008 Typical Year.
(3) Maximum values reported for four largest outfalls (BB-026, NC-077, NC-083 and NC-015).
(4) Maximum values for the three upstream outfalls (NC-077, NC-083 and NC-015); annual frequency for BB-026 is 25.

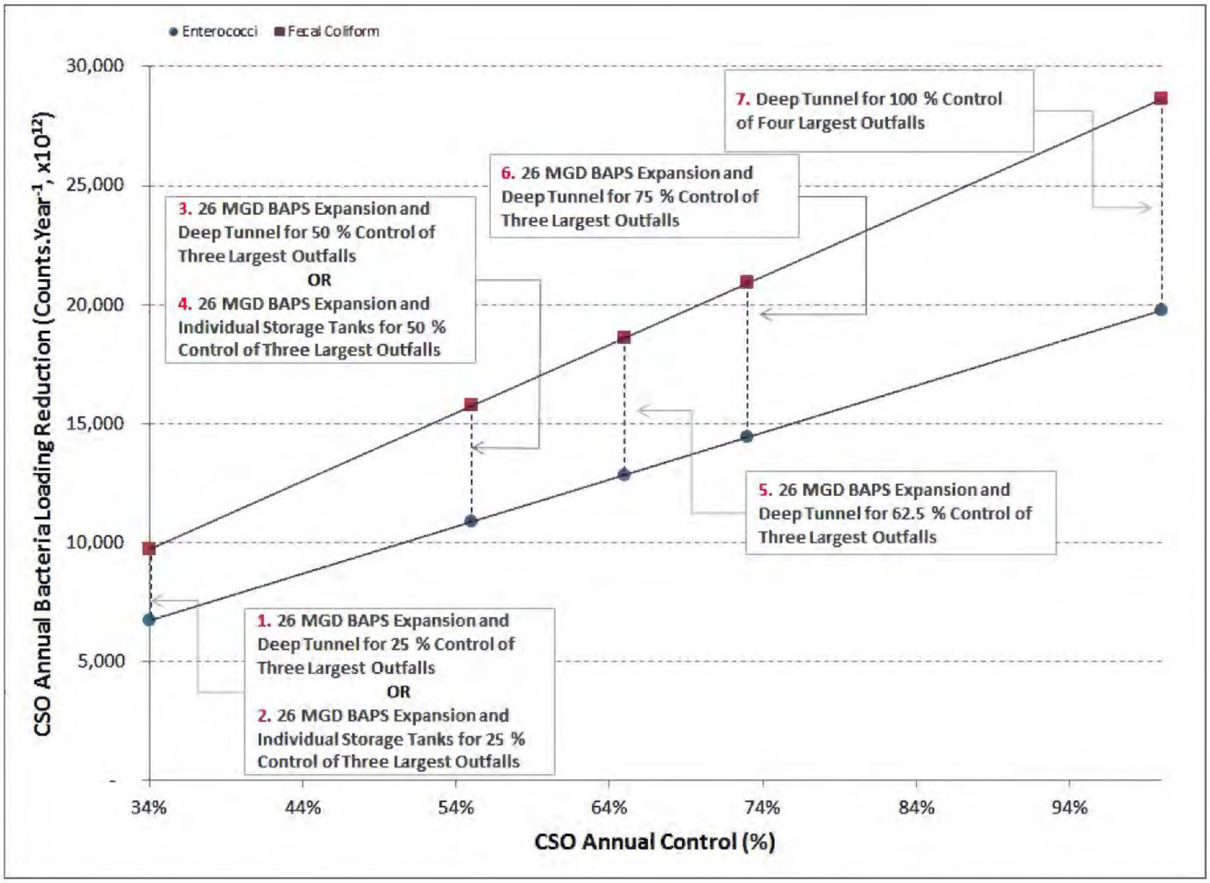


Figure 8-23. Untreated CSO Volume Reductions (as Percent CSO Annual Control) vs. Annual CSO Bacteria Loading Reduction (2008 Rainfall)

Because the retained alternatives for Newtown Creek provide volume reduction and not treatment, the predicted bacteria loading reductions of the alternatives are very closely aligned with their projected CSO volume reductions.

8.3.b Water Quality Impacts Within Newtown Creek

Due to the geographic location of Dutch Kills relative to the other tributary branches, the analysis of water quality impacts to the waterbody was segmented accordingly below:

CSO reduction at Outfall BB-026 and WQ improvements at WQ Station NC-6

The evaluation of the improvements to the WQ in Dutch Kills upon implementation of various levels of CSO control focused on WQ Station NC-6 and CSO Outfall BB-026, both close to the head end of the tributary branch. This assessment was conducted assuming equivalent levels of CSO control at Outfalls NC-077, NC-083 and NC-015. As discussed in Section 8.2 and above in this section, the preferred solution is to provide 75 percent CSO control at Outfall BB-026 by an expansion of the BAPS to 26 MGD. The cost for 100 percent control is based on the incremental cost to connect Outfall BB-026 to a tunnel storage alternative. Figure 8-24 presents the NPW of the various alternatives for BB-026 versus annual and recreational season (May 1st through October 31st) attainment of the Existing Primary Contact WQ Criteria, as well as attainment of the Potential Future Primary Contact WQ Criteria. The attainment in

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these plots is based on the 2008 typical year. These plots further support selection of the 75 percent level of control alternative as the preferred alternative for BB-026.

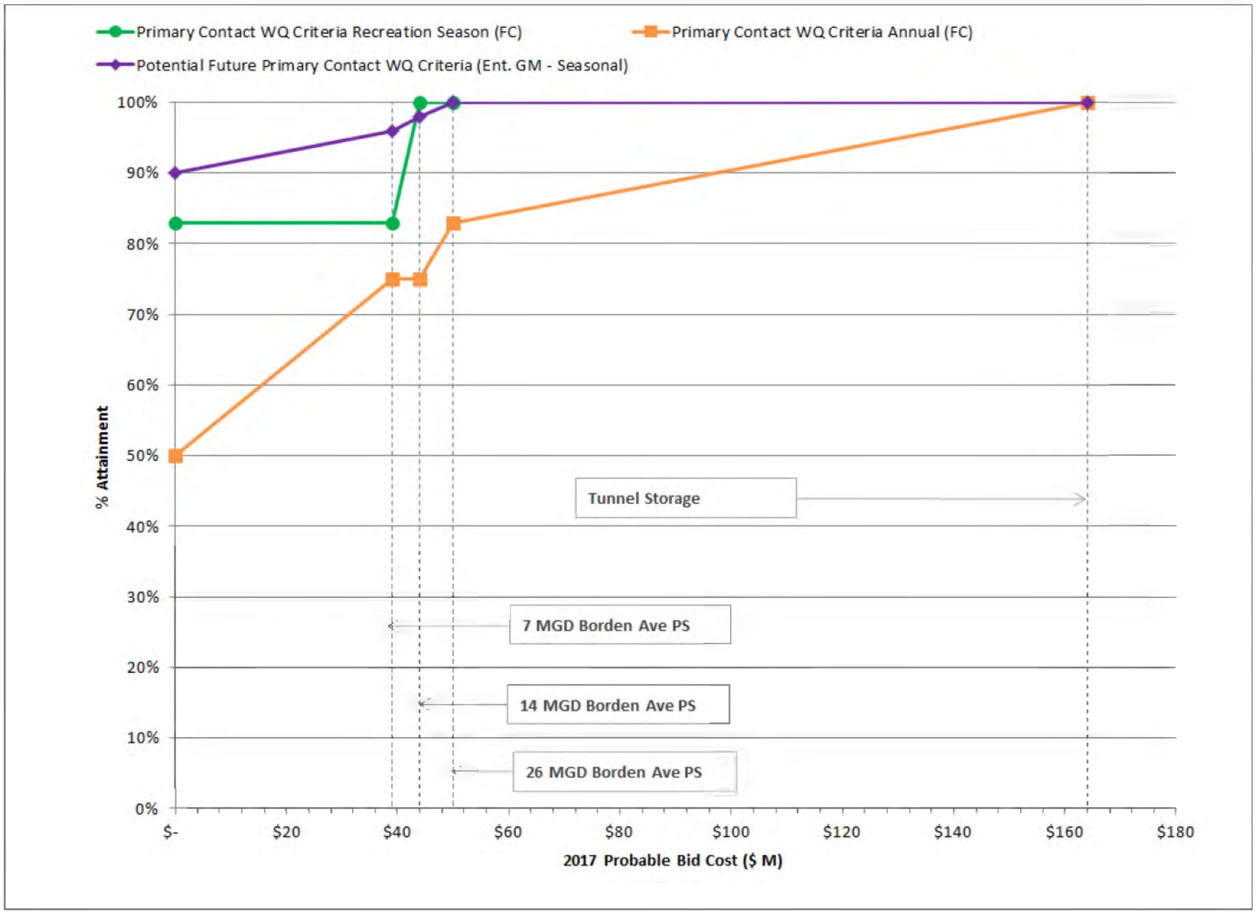

Figure 8-24. Probable Bid Cost vs Attainment at Outfall BB-026

Basin-wide Alternatives 1 through 7 and WQ Improvements to Newtown Creek and Tributary Branches

This section describes the levels of attainment with applicable current and potential future bacteria criteria within Newtown Creek that would be achieved through implementation of the basin-wide retained CSO control alternatives listed in Table 8-13.

Newtown Creek is a Class SD waterbody. Based on the analysis presented in Section 6.0, and supported by the NCRWQM runs for 2008 typical year, historic and recent water quality monitoring, along with baseline condition modeling, none of the stations within the waterbody are in attainment with the Primary Contact WQ Criteria for fecal coliform under baseline conditions. A review of the Potential Future Primary Contact Water Quality Criteria for *Enterococci* indicates that under baseline conditions, Newtown Creek would also not be in attainment of the rolling 30-day geomean criterion of 30 cfu/100mL and the 90th

percentile standard threshold value criterion of 110 cfu/100mL. Upon implementation of at least 50 percent CSO control at Outfalls BB-026, NC-077, NC-083 and NC-015, recreational season (May 1st through October 31st) attainment of the fecal coliform criterion would be achieved at all sampling locations except NC12 and NC14 for the 2008 typical year. NC12 and NC14 are located in the upstream reaches of East Branch and English Kills, respectively. Providing 62.5 percent CSO control would bring locations NC12 and NC14 into recreational season compliance based on the 2008 typical year. General aspects of the relationship between levels of CSO control through implementation of the retained alternatives and predicted levels of WQS attainment are discussed in greater detail in Section 8.5.

8.4 Cost Estimates for Retained Alternatives

Evaluation of the retained alternatives requires cost estimation. The methodology for developing these costs is dependent upon the type of technology and its O&M requirements. The construction costs were developed as PBC and the total NPW costs were determined by adding the estimated PBC to the NPW of the projected annual O&M costs at an assumed interest rate of 3 percent over a 20-year life cycle. However, for tunnel alternatives which provide longer service, a longer 100 year lifecycle was used for computing NPW. Design, construction management and land acquisition costs are not included in the cost estimates. All costs are in February 2017 dollars and are considered Level 5 cost estimates by AACE International with an accuracy of -50 percent to +100 percent.

8.4.a Alternative 1 – 26 MGD BAPS Expansion and 25 Percent Control Individual Tanks for Outfalls NC-015, NC-083 and NC-077

Costs for Alternative 1 include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the upgraded station. The costs also include construction of three storage tanks for Outfalls NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 1 is $627M as shown in Table 8-15.

Table 8-15. Costs for Basin-Wide Alternative 1

Item	February 2017 Cost ($ Million)		
	BAPS Expansion	Individual Storage Tanks	Total
Probable Bid Cost	50	513	563
Annual O&M Cost	1.4	2.9	4.3
Net Present Worth	71	556	627

8.4.b Alternative 2a – 26 MGD BAPS Expansion and 25 Percent Control Deep Tunnel for Outfalls NC-015, NC-083 and NC-077 (Creek Alignment/Shorter Tunnel)

Costs for Alternative 2a include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the station. The costs also include construction of a deep tunnel for Outfalls NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 2a is $508M as shown in Table 8-16.

Table 8-16. Costs for Basin-Wide Alternative 2a

Item	February 2017 Cost ($ Million)		
	BAPS Expansion	Storage Tunnel	Total
Probable Bid Cost	50	358	408
Annual O&M Cost	1.4	2.5	3.9
Net Present Worth	71	437	508

8.4.c Alternative 2b – 26 MGD BAPS Expansion and 25 Percent Control Deep Tunnel for Outfalls NC-015, NC-083 and NC-077 (ROW Alignment/Shorter Tunnel)

Costs for Alternative 2b include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the station. The costs also include construction of a deep tunnel for Outfalls NC-077, NC-083 and NC-015 and reflect the description provided in detail in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 2b is $527M as shown in Table 8-17.

Table 8-17. Costs for Basin-Wide Alternative 2b

Item	February 2017 Cost ($ Million)		
	BAPS Expansion	Storage Tunnel	Total
Probable Bid Cost	50	377	427
Annual O&M Cost	1.4	2.5	3.9
Net Present Worth	71	456	527

8.4.d Alternative 3 – 26 MGD BAPS Expansion and 50 Percent Control Individual Storage Tanks for Outfalls NC-015, NC-083 and NC-077

Costs for Alternative 3 include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the station. The costs also include construction of three storage tanks for Outfalls NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 3 is $901M as shown in Table 8-18.

Table 8-18. Costs for Basin-Wide Alternative 3

Item	February 2017 Cost ($ Million)		
	BAPS Expansion	Individual Storage Tanks	Total
Probable Bid Cost	50	776	826
Annual O&M Cost	1.4	3.6	5
Net Present Worth	71	830	901

8.4.e Alternative 4a - 26 MGD BAPS Expansion and 50 Percent Control Deep Tunnel for Outfalls NC-015, NC-083 and NC-077 (Creek Alignment)

Costs for Alternative 4a include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the station. The costs also include construction of a deep tunnel collecting overflows from Outfalls NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 4a ranges from $645M to $647M, as shown in Table 8-19.

Table 8-19. Costs for Basin-Wide Alternative 4a

Item	February 2017 Cost ($ Million)				
	BAPS Expansion	Shorter (DEP)		Longer (WWTP)	
		Tunnel	Total	Tunnel	Total
Probable Bid Cost	50	476	526	478	528
Annual O&M Cost	1.4	3.1	4.5	3.1	4.5
Net Present Worth	71	574	645	576	647

8.4.f Alternative 4b - 26 MGD BAPS Expansion and 50 Percent Control Deep Tunnel for Outfalls NC-015, NC-083 and NC-077 (ROW Alignment)

Costs for Alternative 4b include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the station. The costs also include construction of a deep tunnel for Outfalls NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 4b ranges from $642M to $647M as shown in Table 8-20.

Table 8-20. Costs for Basin-Wide Alternative 4b

Item	February 2017 Cost ($ Million)				
	BAPS Expansion	Shorter (DEP)		Longer (WWTP)	
		Storage Tunnel	Total	Storage Tunnel	Total
Probable Bid Cost	50	478	528	473	523
Annual O&M Cost	1.4	3.1	4.5	3.1	4.5
Net Present Worth	71	576	647	571	642

8.4.g Alternative 5a - 26 MGD BAPS Expansion and 62.5 Percent Control Deep Tunnel for Outfalls NC-015, NC-083 and NC-077 (Creek Alignment)

Costs for Alternative 5a include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the station. The costs also include construction of a deep tunnel collecting overflows from Outfalls NC-077, NC-083 and

NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 5a ranges from $717M to $722M, as shown in Table 8-21.

Table 8-21. Costs for Basin-Wide Alternative 5a

Item	February 2017 Cost ($ Million)				
	BAPS Expansion	Shorter (DEP)		Longer (WWTP)	
		Tunnel	Total	Tunnel	Total
Probable Bid Cost	50	539	589	534	584
Annual O&M Cost	1.4	3.6	5.0	3.6	5.0
Net Present Worth	71	651	722	646	717

8.4.h Alternative 5b - 26 MGD BAPS Expansion and 62.5 Percent Control Deep Tunnel for Outfalls NC-015, NC-083 and NC-077 (ROW Alignment)

Costs for Alternative 5b include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the station. The costs also include construction of a deep tunnel for Outfalls NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 5b ranges from $703M to $730M as shown in Table 8-22.

Table 8-22. Costs for Basin-Wide Alternative 5b

Item	February 2017 Cost ($ Million)				
	BAPS Expansion	Shorter (DEP)		Longer (WWTP)	
		Storage Tunnel	Total	Storage Tunnel	Total
Probable Bid Cost	50	520	570	547	597
Annual O&M Cost	1.4	3.6	5.0	3.6	5.0
Net Present Worth	71	632	703	659	730

8.4.i Alternative 6a – 26 MGD BAPS Expansion and 75 Percent Control Deep Tunnel for Outfalls NC-015, NC-083 and NC-077 (Creek Alignment)

Costs for Alternative 6a include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the station. The costs also include construction of a deep tunnel for Outfalls NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 6a ranges from $1.01B to $1.05B as shown in Table 8-23.

Table 8-23. Costs for Basin-Wide Alternative 6a

Item	February 2017 Cost ($ Million)				
	BAPS Expansion	Shorter (DEP)		Longer (WWTP)	
		Storage Tunnel	Total	Storage Tunnel	Total
Probable Bid Cost	50	787	837	745	795
Annual O&M Cost	1.4	6.0	7.4	6.0	7.4
Net Present Worth	71	983	1,054	942	1,013

8.4.j Alternative 6b – 26 MGD BAPS Expansion and 75 Percent Control Deep Tunnel for Outfalls NC-015, NC-083 and NC-077 (ROW Alignment)

Costs for Alternative 6b include planning-level estimates of the costs to expand the BAPS to provide 26 MGD pumping capacity and the construction of conveyance elements to and from the station. The costs also include construction of a deep tunnel for Outfalls NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 5b is approximately $1.06B as shown in Table 8-24.

Table 8-24. Costs for Basin-Wide Alternative 6b

Item	February 2017 Cost ($ Million)				
	BAPS Expansion	Shorter (DEP)		Longer (WWTP)	
		Storage Tunnel	Total	Storage Tunnel	Total
Probable Bid Cost	50	790	840	795	845
Annual O&M Cost	1.4	6.0	7.4	6.0	7.4
Net Present Worth	71	986	1,057	992	1,063

8.4.k Alternatives 7a - 100 Percent Control Deep Tunnel for Outfalls BB-026, NC-015, NC-083 and NC-077 (Creek Alignment)

The costs for Alternative 7a include planning-level estimates for the construction of a deep tunnel for Outfalls BB-026, NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 7a is $1.65B, as shown in Table 8-25.

Table 8-25. Costs for Basin-Wide Alternative 7a

Item	February 2017 Cost ($ Million)
Probable Bid Cost	1,371
Annual O&M Cost	8.8
Net Present Worth	1,649

8.4.l Alternatives 7b – 100 Percent Control Deep Tunnel for Outfalls BB-026, NC-015, NC-083 and NC-077 (ROW Alignment)

Costs for Alternative 7b include planning-level estimates of the costs construction of a deep tunnel collecting overflows from Outfalls BB-026, NC-077, NC-083 and NC-015 and reflect the description provided in Section 8.2. Site acquisition costs are not included. The total cost, expressed as NPW, for Alternative 6b is $1.65B, as shown in Table 8-26.

Table 8-26. Costs for Basin-Wide Alternative 7b

Item	February 2017 Cost ($ Million)
Probable Bid Cost	1,373
Annual O&M Cost	8.8
Total Net Present Worth	1,650

The cost estimates of these retained alternatives are summarized below in Table 8-27 and are then used in the development of the cost-performance and cost- attainment plots presented in Section 8.5. For the purposes of the cost-performance and cost-attainment curves development, costs for the tunnel options whose alignment follows the Creek to the extent possible were used. These costs do not differ significantly from those estimated for the ROW alignments.

Table 8-27. Cost of Retained Alternatives

Alternative	February 2017 PBC ($ Million)	Annual O&M Cost ($ Million)	Total Net Present Worth ($ Million)
1. 26 MGD BAPS Expansion and Individual Storage Tanks for 25 % Control of Three Largest Outfalls	563	4.3	627
2a. 26 MGD BAPS Expansion and Deep Tunnel for 25% Control of Three Largest Outfalls- Creek Alignment(1)(2)	408	3.9	508
2b. 26 MGD BAPS Expansion and Deep Tunnel for 25% Control of Three Largest Outfalls (Row Alignment)(1)	427	3.9	527
3. 26 MGD BAPS Expansion and Individual Storage Tanks for 50% Control of Three Largest Outfalls (1)	826	5	901
4a. 26 MGD BAPS Expansion and Deep Tunnel for 50% Control of Three Largest Outfalls (Creek Alignment)(1)(2)	526 to 528	4.5	645 to 647
4b. 26 MGD BAPS Expansion and Deep Tunnel for 50% Control of Three Largest Outfalls (ROW Alignment)(1)	523 to 528	4.5	642 to 647
5a. 26 MGD BAPS Expansion and Deep Tunnel for 62.5% Control of Three Largest Outfalls (Creek Alignment)(1)(3)	584 to 589	5.0	717 to 722
5b. 26 MGD BAPS Expansion and Deep Tunnel for 62.5% Control of Three Largest Outfalls (ROW Alignment)(1)	570 to 597	5.0	703 to 730
6a. 26 MGD BAPS Expansion and Deep	795 to 837	7.4	1,013 to 1,054

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Table 8-27. Cost of Retained Alternatives

Alternative	February 2017 PBC ($ Million)	Annual O&M Cost ($ Million)	Total Net Present Worth ($ Million)
Tunnel for 75% Control of Three Largest Outfalls (Creek Alignment)(1)(4)			
6b. 26 MGD BAPS Expansion and Deep Tunnel for 75% Control of Three Largest Outfalls (ROW Alignment)(1)	840 to 845	7.4	1,057 to 1,063
7a. Deep Tunnel for 100% Control of Four Largest Outfalls (Creek Alignment)(1)(2)	1,371	8.8	1,649
7b. Deep Tunnel for 100% Control of Four Largest Outfalls (ROW Alignment)(1)	1,373	8.8	1,650

Notes:

(1) Both the WWTP and DEP sites were used for the purposes of developing conceptual layouts for evaluation of 25, 50, 75 and 100% CSO control tunnel alternatives. The final siting of the TDPS, the tunnel alignment and other associated details of the tunnel alternatives presented herein will be further evaluated and finalized during subsequent planning and design stages.

(2) Tunnel alternative shown in subsequent cost-performance and cost-attainment plots.

(3) Tunnel alternative with higher NPW of $722M shown in subsequent cost-performance and cost-attainment plots.

(4) Tunnel alternative with higher NPW of $1,054M shown in subsequent cost-performance and cost-attainment plots.

8.5 Cost-Attainment Curves for Retained Alternatives

The final step of the analysis is to evaluate the cost-effectiveness of the basin-wide retained alternatives based on their NPW and projected impact on CSO loadings and attainment of applicable WQS. Those retained alternatives that did not show incremental gains in performance (shown in red in the figures) were not included in the development of the best-fit curve.

8.5.a Cost-Performance Curves

Cost-performance curves were developed by plotting the costs of the retained alternatives against their predicted level of CSO control. For the purposes of this section, CSO control is defined as the degree or rate of bacteria reduction through volumetric capture. Both the cost-performance and subsequent cost-attainment analyses focus on bacteria loadings and bacteria WQ criteria.

A best-fit cost curve was developed based on those alternatives judged most cost-effective for a defined level of CSO control as estimated by IW modeling for the typical year rainfall (2008).

DEP also evaluated the level of bacteria loadings reductions to the receiving waters. Figure 8-25 shows the percent reductions on a volumetric basis achieved by each alternative whereas Figure 8-26 illustrates the CSO events remaining upon implementation of each alternative. Bacteria load reduction plots are presented in Figures 8-27 (*Enterococci*) and 8-28 (fecal coliform). These curves plot the cost of the alternatives against their associated projected annual CSO *Enterococci* and fecal coliform loading reductions, respectively. The primary vertical axis shows percent CSO bacteria loading reductions. The secondary vertical axis shows the corresponding total bacteria loading reductions, as a percentage, when loadings from other non-CSO sources of bacteria are included. Figures 8-25, 8-27 and 8-28 show a KOTC at the alternative with the 62.5 percent control tunnel.

The evaluation of the retained alternatives focused on cost-effective reduction of the frequency of CSO discharge in addition to CSO volume and pathogen load reductions to address current impacts to waterbody uses and issues raised by the public.

8.5.b Cost-Attainment Curves

This section evaluates the relationship of the costs of the retained alternatives versus their expected level of attainment of bacteria Primary Contact WQ Criteria and Potential Future Primary Contact WQ Criteria as modeled using NCRWQM with 2008 rainfall. The cost-performance plots shown in Figures 8-25 through 8-28 indicate that most of the retained alternatives represent incremental gains in marginal performance. Those retained alternatives that did not show incremental gains in marginal performance on the cost-performance curves are not included in the cost-attainment curves as they were deemed not to be cost-effective relative to other alternatives.

In addition to the bacteria Primary Contact WQ Criteria, the cost-attainment analysis considered Potential Future Primary Contact WQ Criteria. As was noted in Section 2.0, under the BEACH Act of 2000, *Enterococci* criteria do not apply to tributaries such as Newtown Creek, which is not a coastal recreation water and does not have primary contact recreation as a designated use. The bacteria standards evaluations thus only considered the fecal coliform criterion, specifically the monthly GM of 200 cfu/100mL both on an annual and recreational season (May 1st through October 31st) basis. The resultant curves for the current and potential future standards and relevant criteria are presented as Figures 8-29 through 8-40 for eleven locations (Stations OW-4 through OW-14) within Newtown Creek.

Based on the 2008 typical year WQ simulations for Newtown Creek, annual or seasonal attainment of the Existing WQ (Class SD) or Primary Contact WQ Criteria for fecal coliform under baseline conditions are not satisfied 100 percent of the time.

Upon implementation of at least 50 percent CSO control at Outfalls BB-026, NC-077, NC-083 and NC-015, recreational season (May 1st through October 31st) attainment of the fecal coliform criterion would be achieved at all sampling locations except NC12 and NC14 for the 2008 typical year. NC12 and NC14 are located in the upstream reaches of East Branch and English Kills, respectively. Providing 62.5 percent CSO control would bring locations NC12 and NC14 into recreational season compliance based on the 2008 typical year.

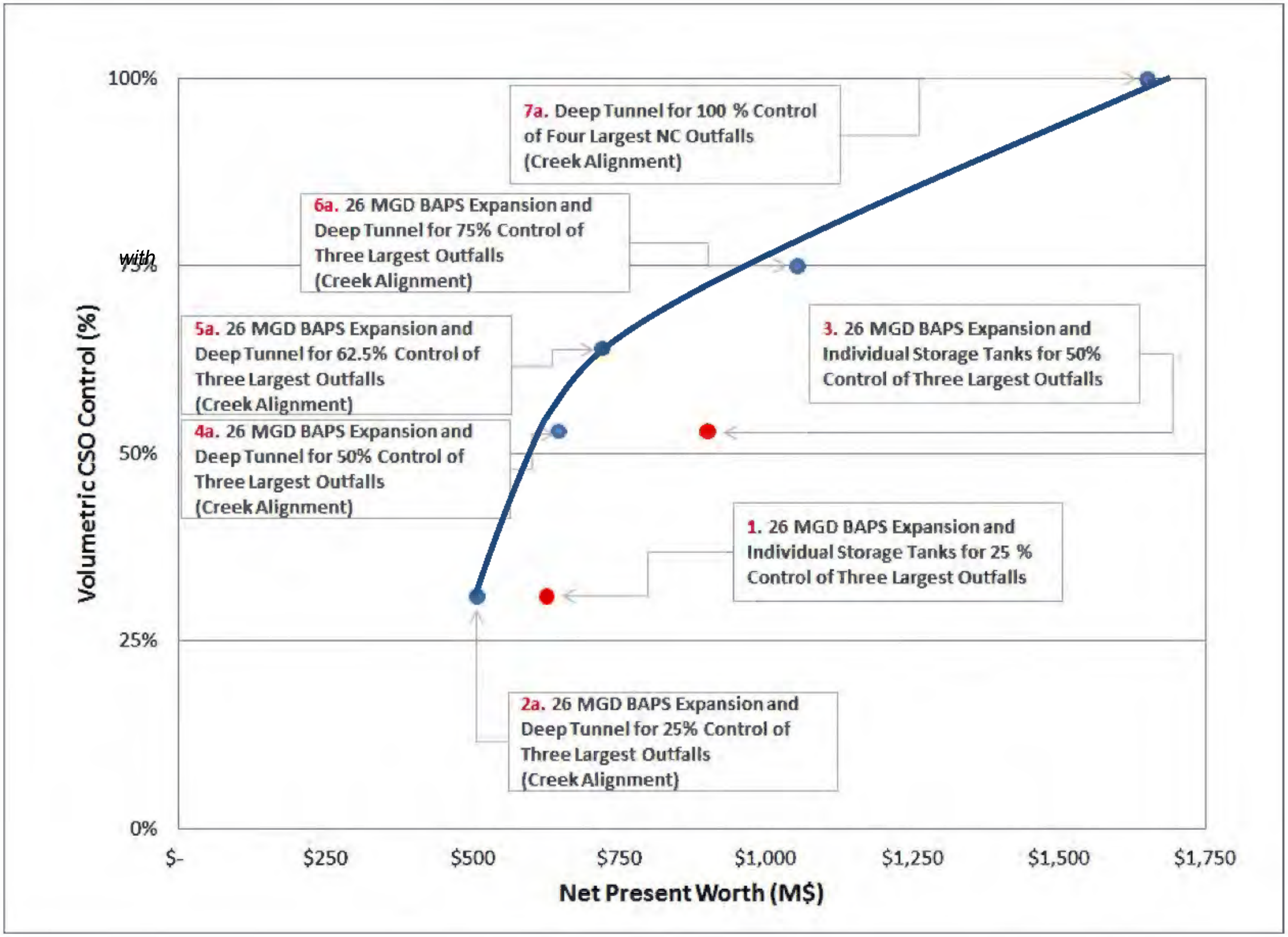

Figure 8-25. Cost vs. CSO Control (2008 Rainfall)

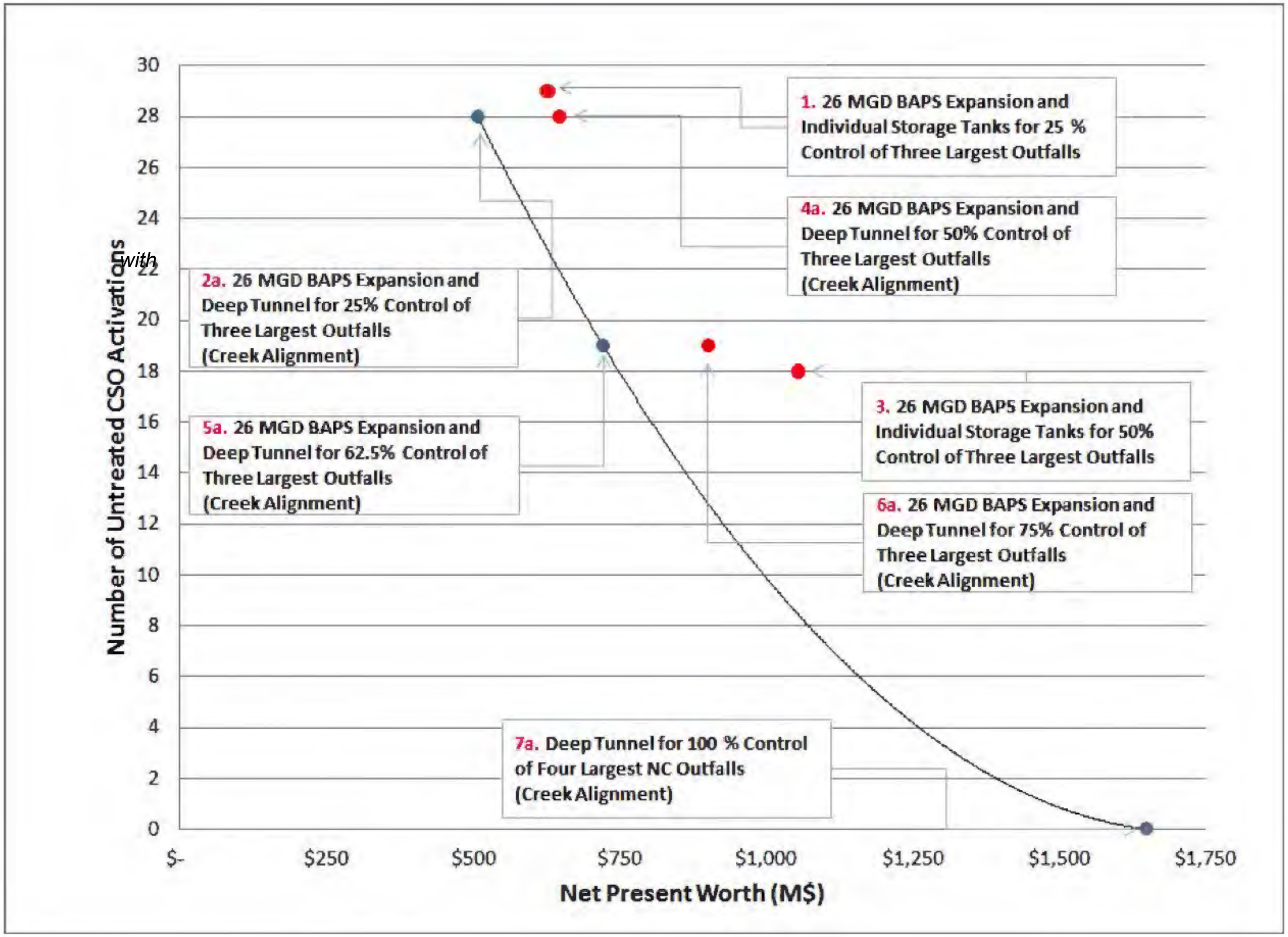

Figure 8-26. Cost vs. Remaining CSO Events (2008 Rainfall)

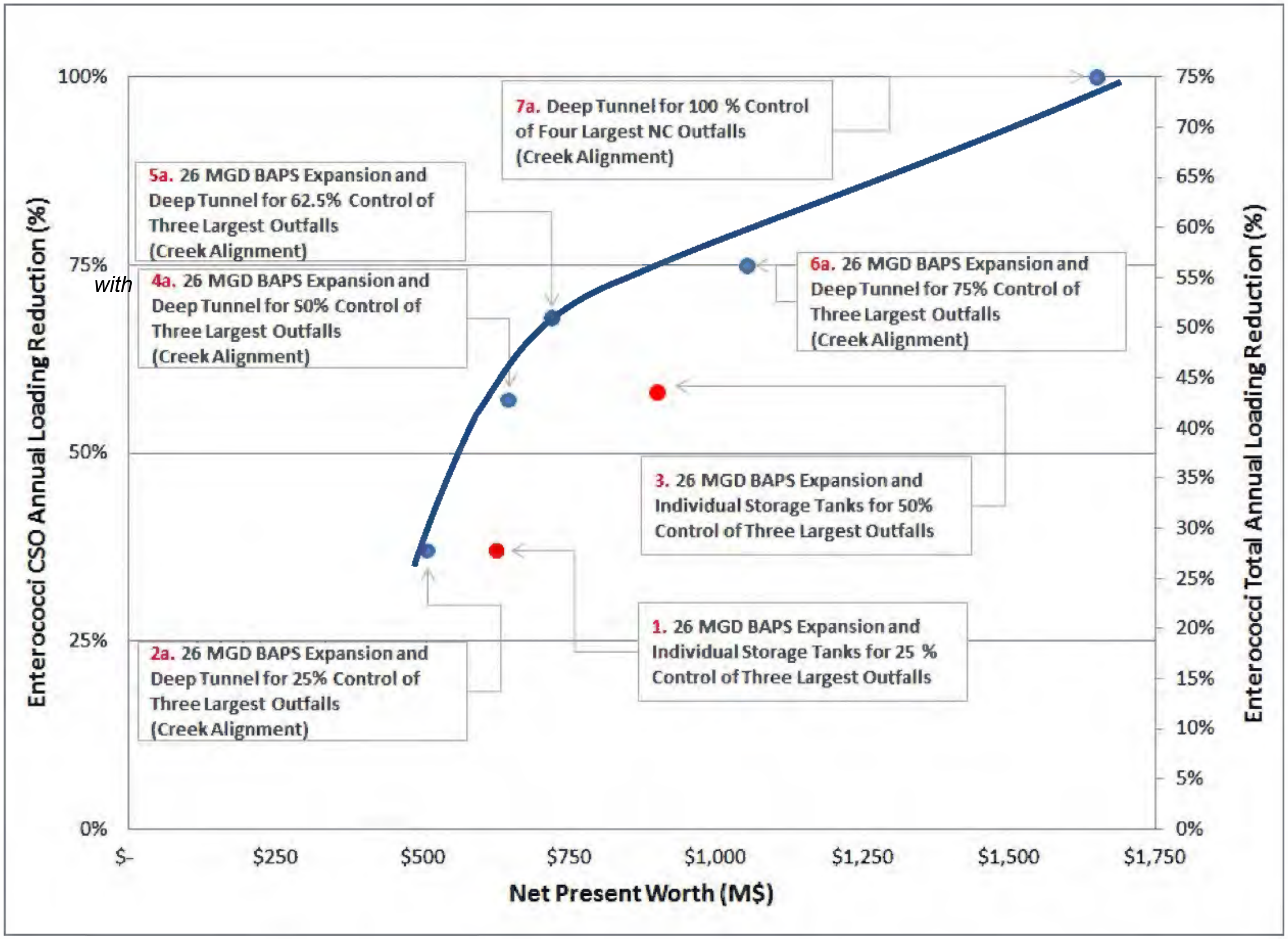

Figure 8-27. Cost vs. *Enterococci* Loading Reduction (2008 Rainfall)

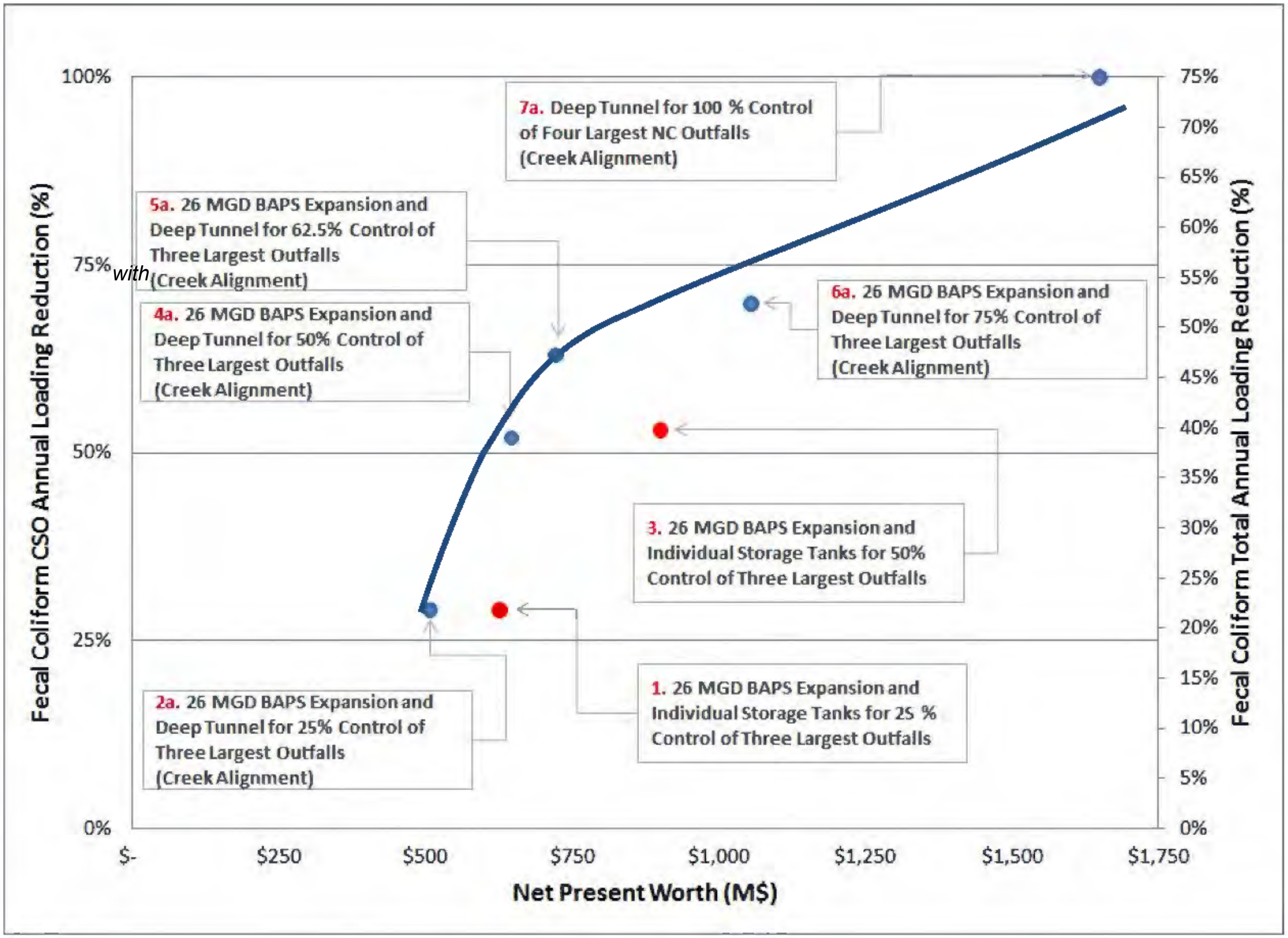

Figure 8-28. Cost vs. Fecal Coliform Loading Reduction (2008 Rainfall)

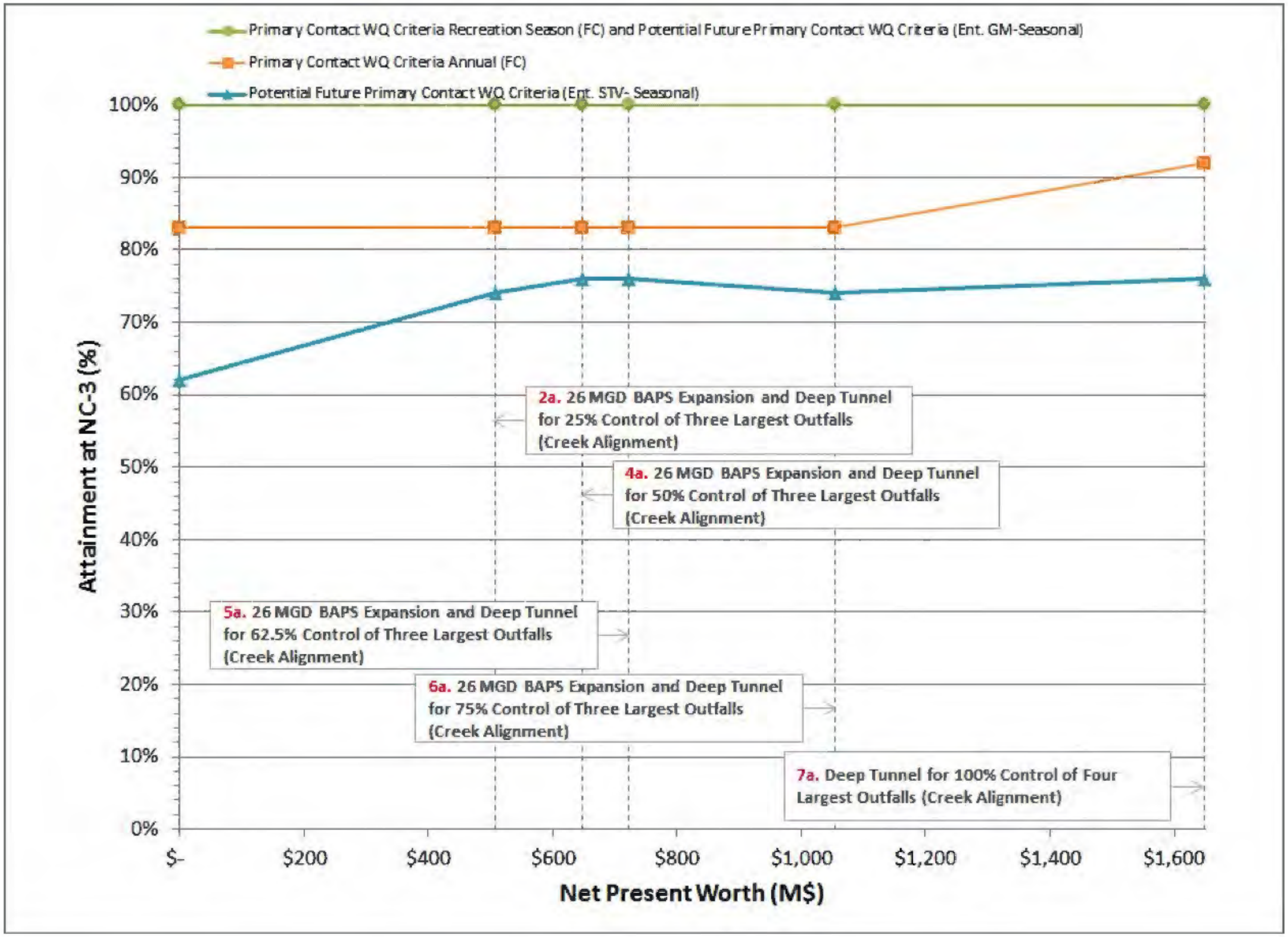

Figure 8-29. Cost vs. Bacteria Attainment at Station NC3 (2008 Rainfall)

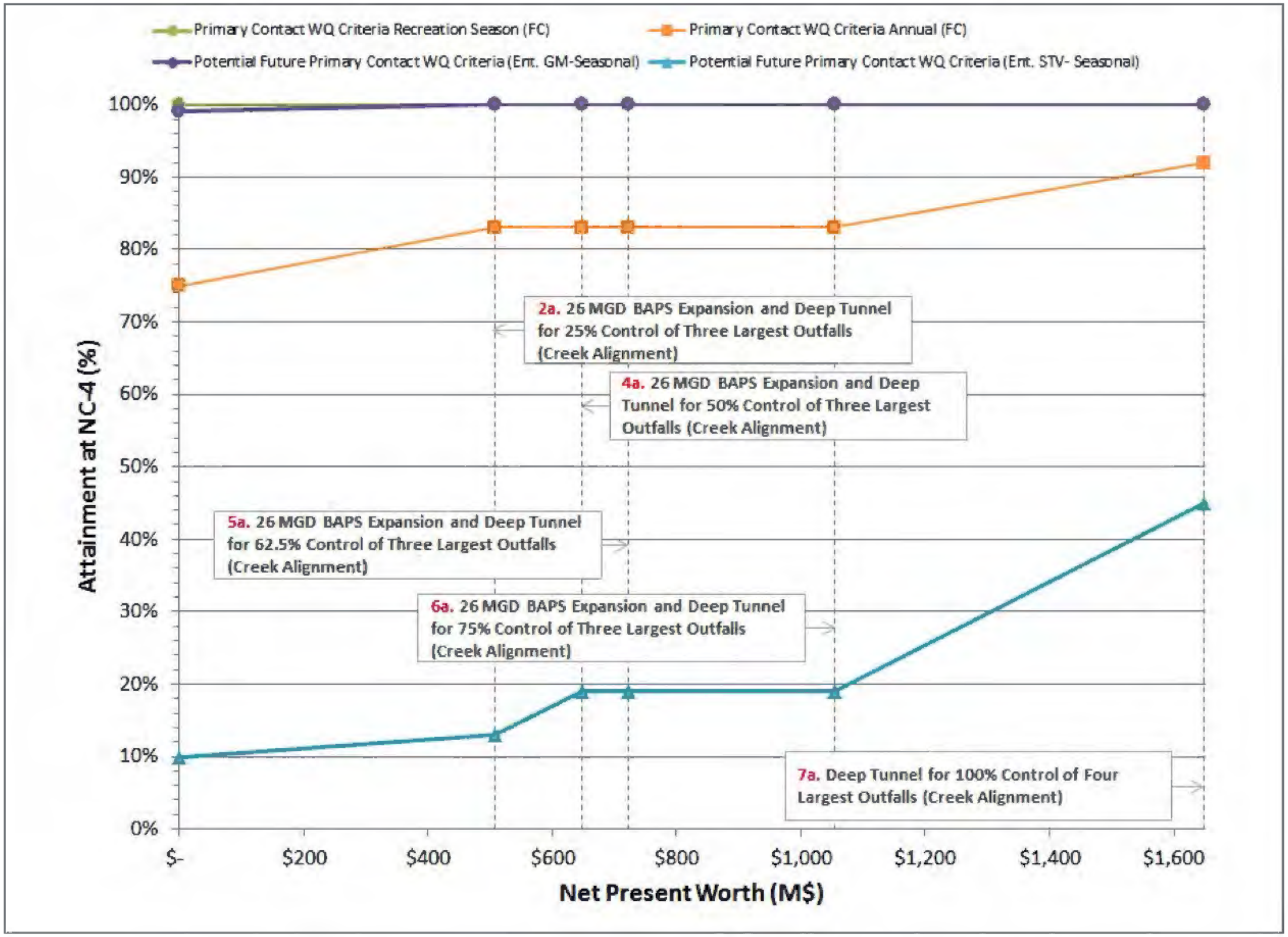

Figure 8-30. Cost vs. Bacteria Attainment at Station NC4 (2008 Rainfall)

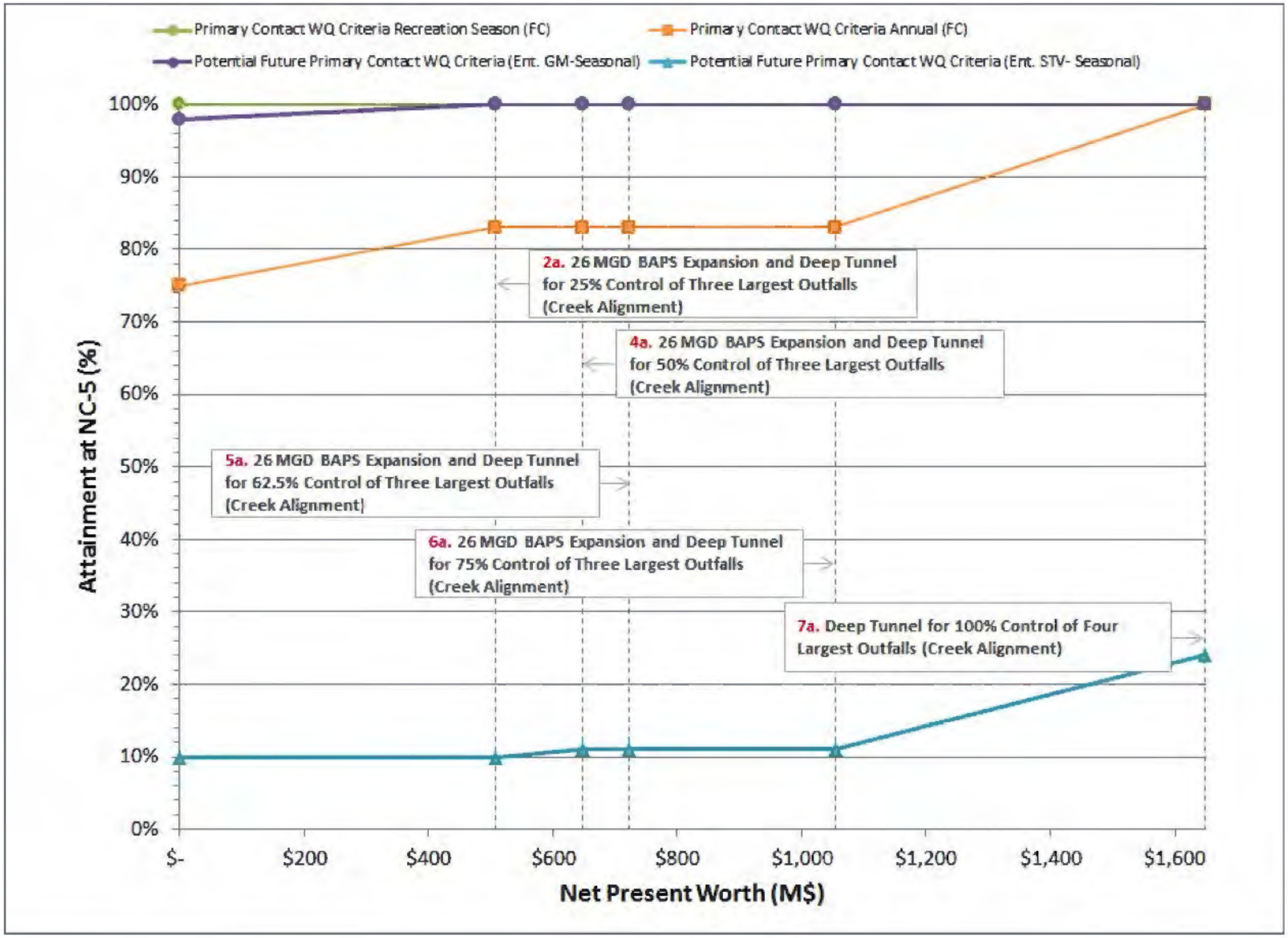

Figure 8-31. Cost vs. Bacteria Attainment at Station NC5 (2008 Rainfall)

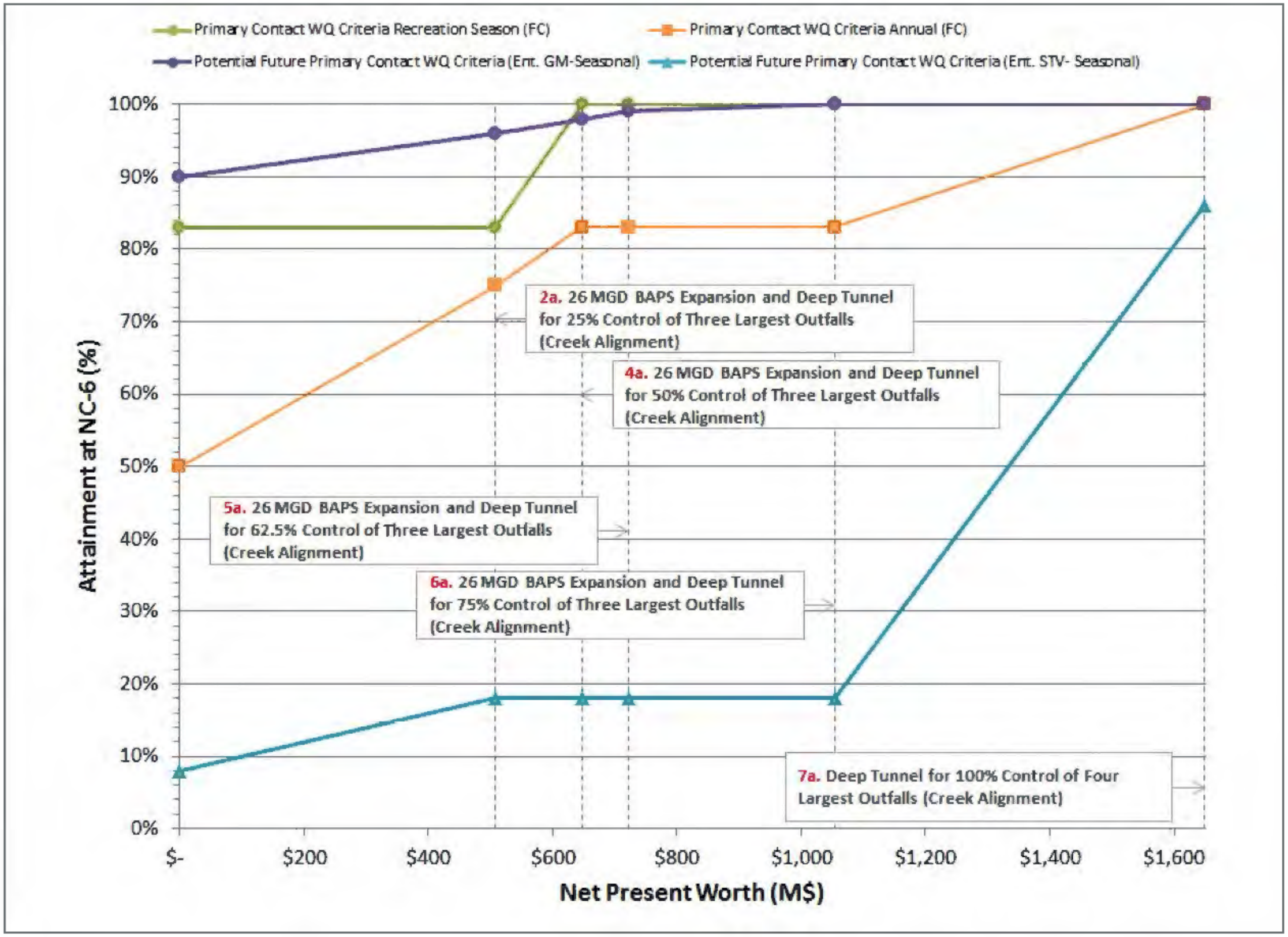

Figure 8-32. Cost vs. Bacteria Attainment at Station NC6 (2008 Rainfall)

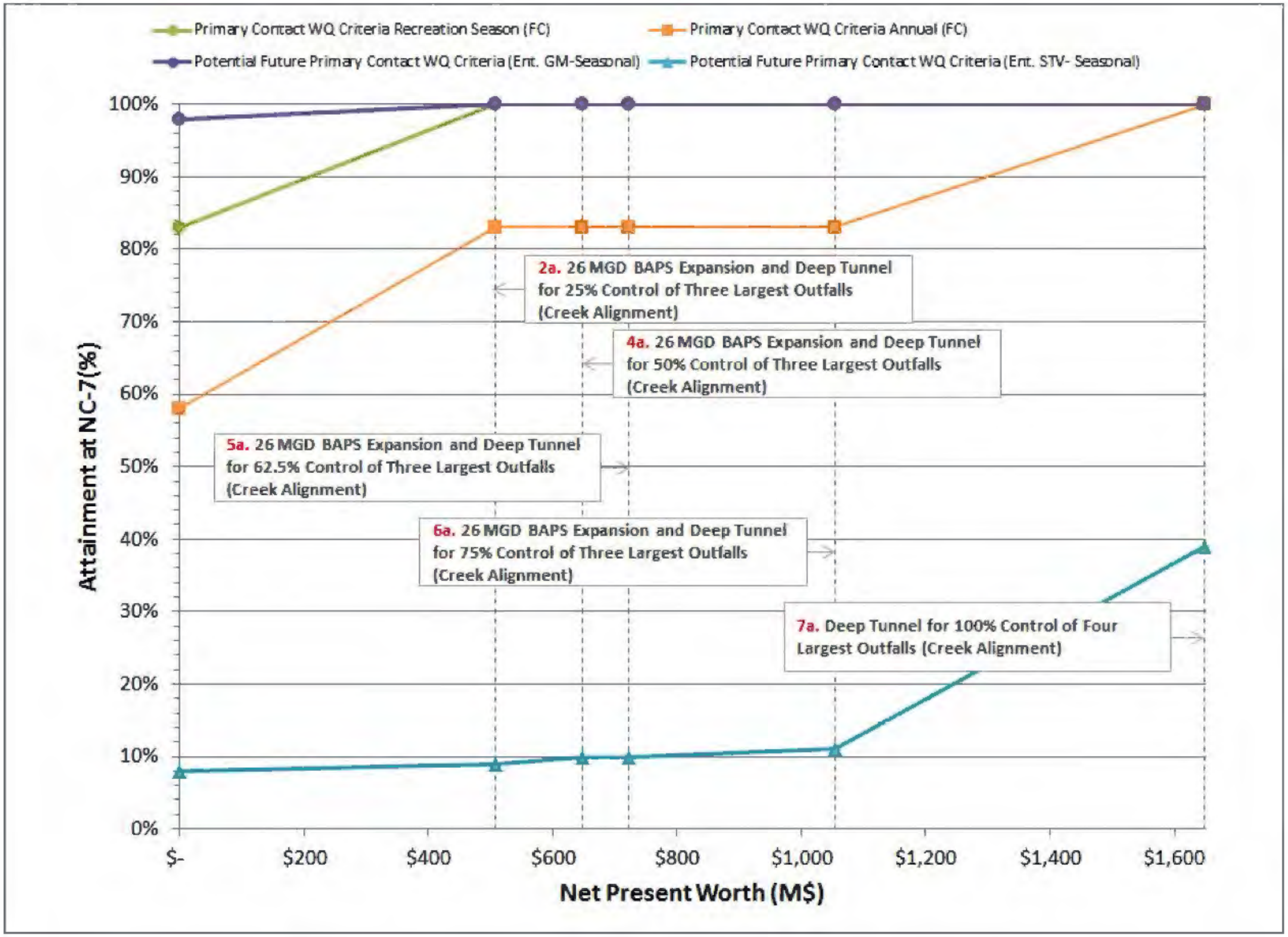

Figure 8-33. Cost vs. Bacteria Attainment at Station NC7 (2008 Rainfall)

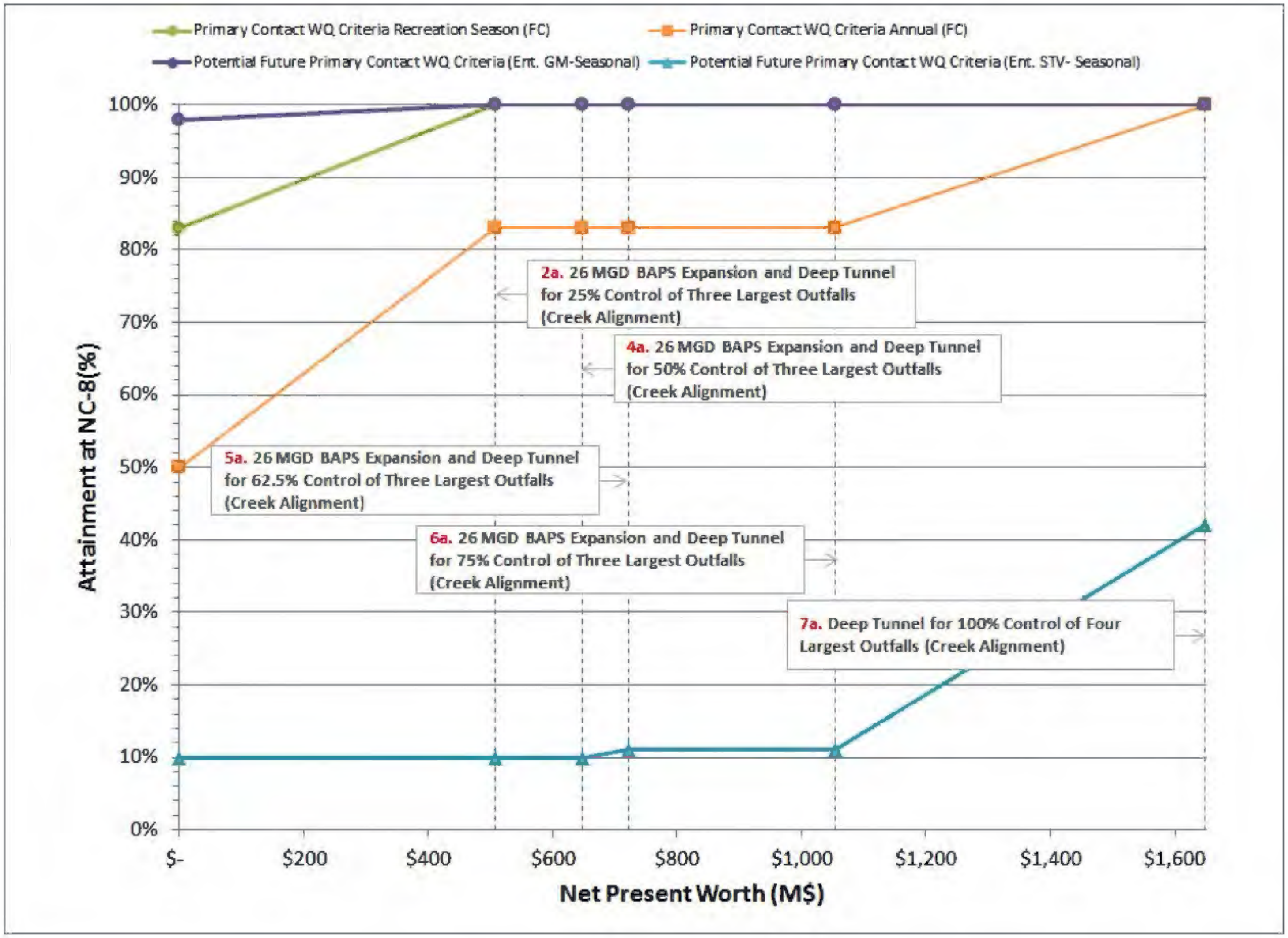

Figure 8-34. Cost vs. Bacteria Attainment at Station NC8 (2008 Rainfall)

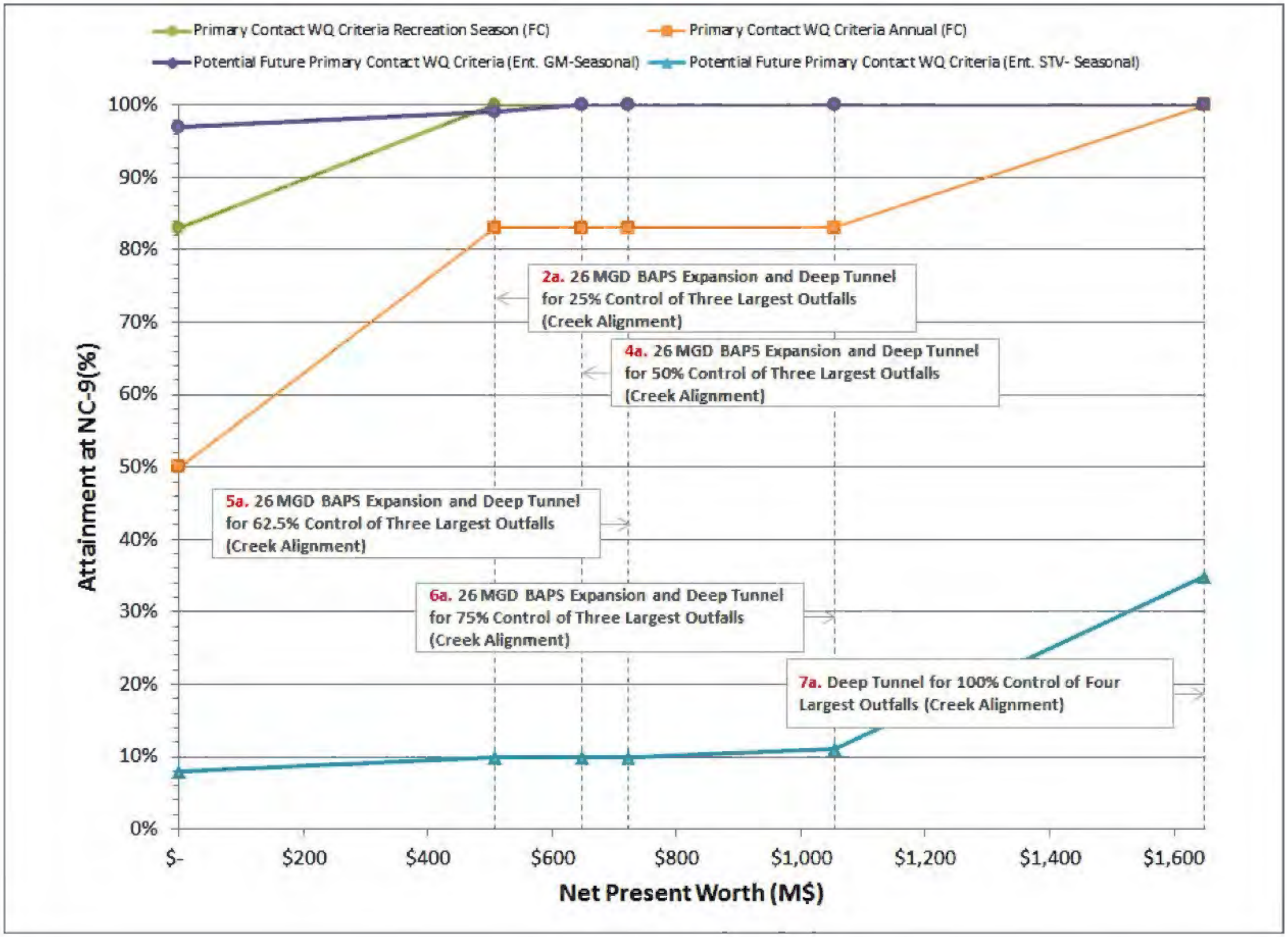

Figure 8-35. Cost vs. Bacteria Attainment at Station NC9 (2008 Rainfall)

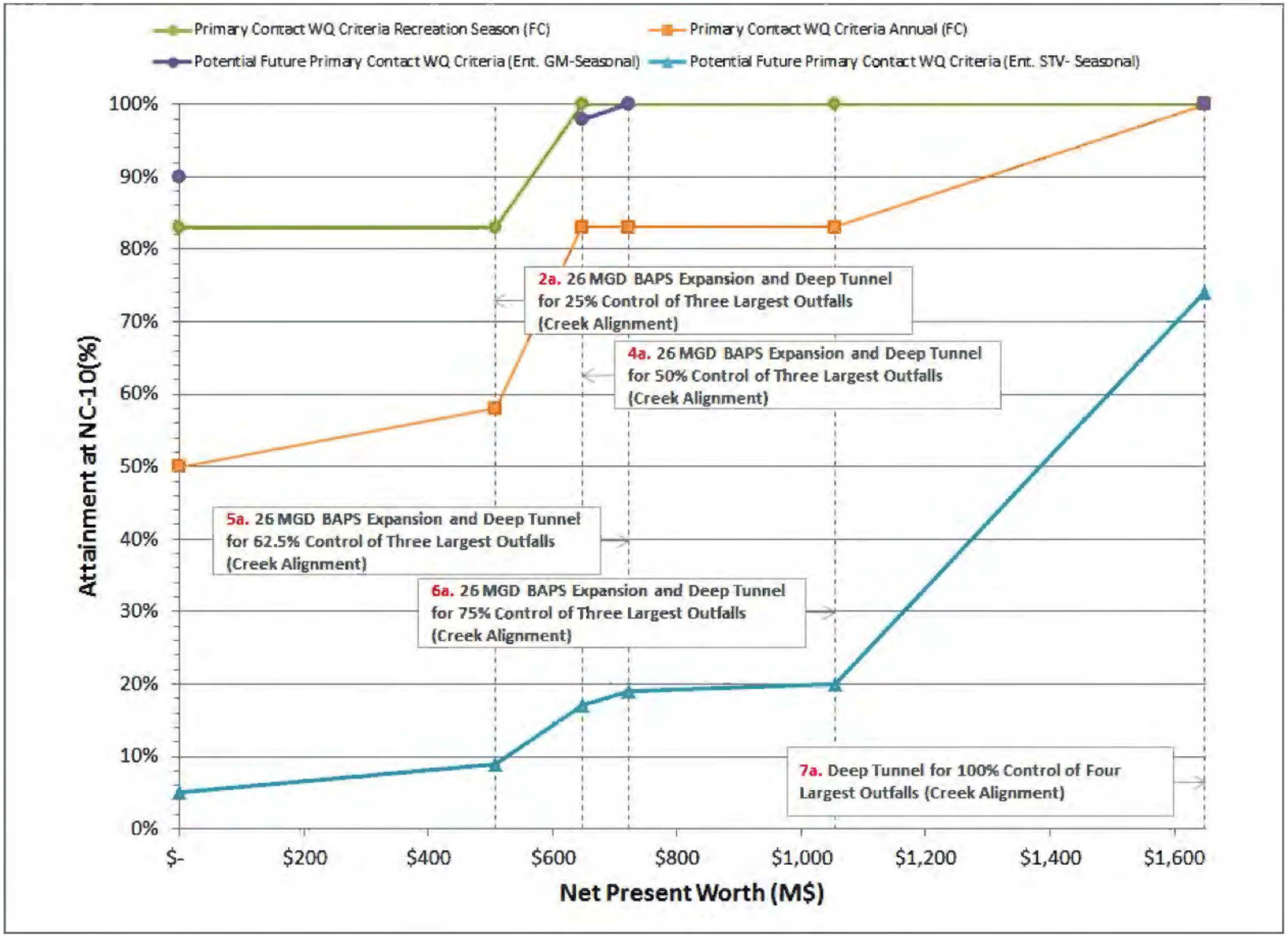

Figure 8-36. Cost vs. Bacteria Attainment at Station NC10 (2008 Rainfall)

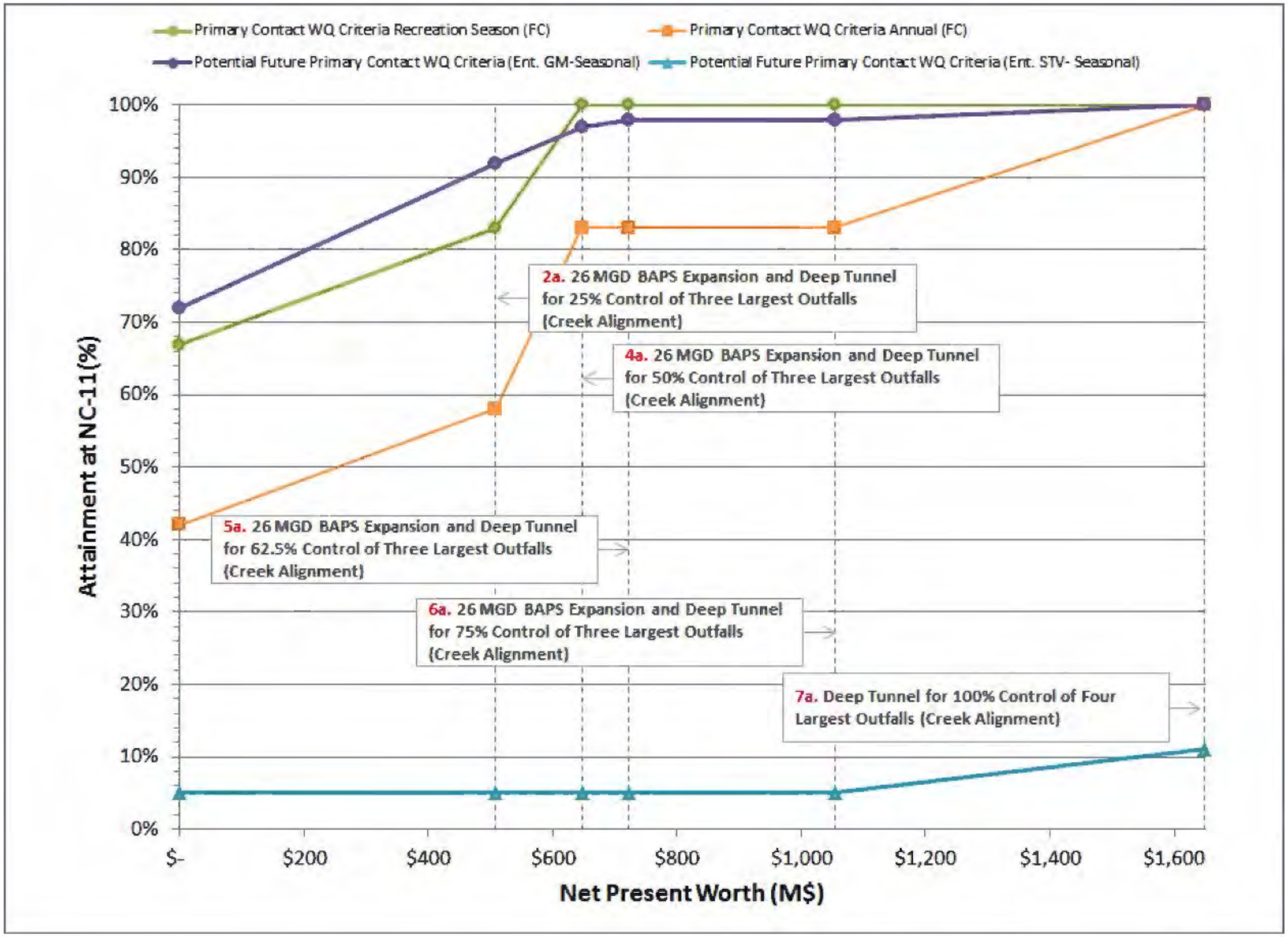

Figure 8-37. Cost vs. Bacteria Attainment at Station NC11 (2008 Rainfall)

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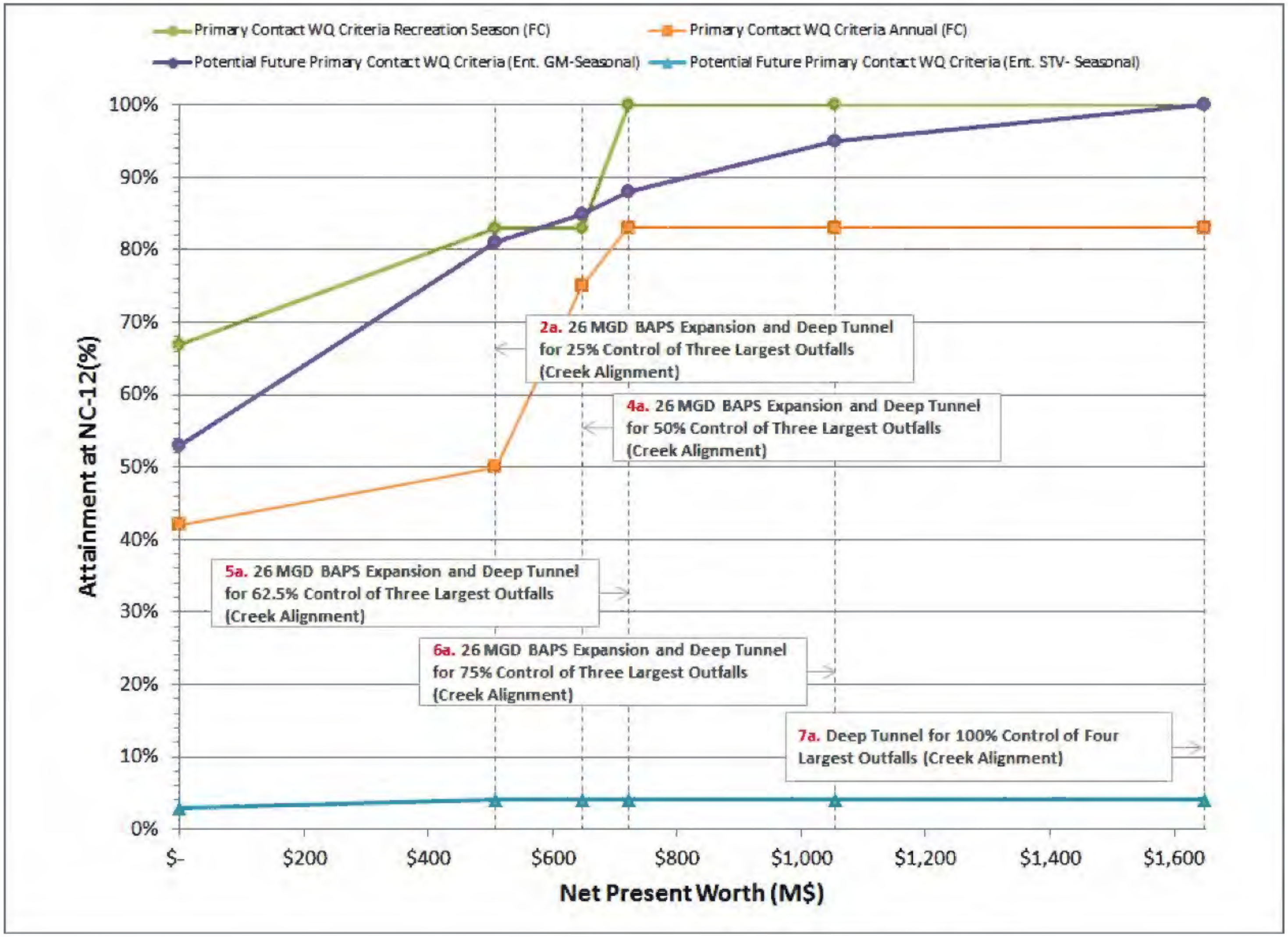

Figure 8-38. Cost vs. Bacteria Attainment at Station NC12 (2008 Rainfall)

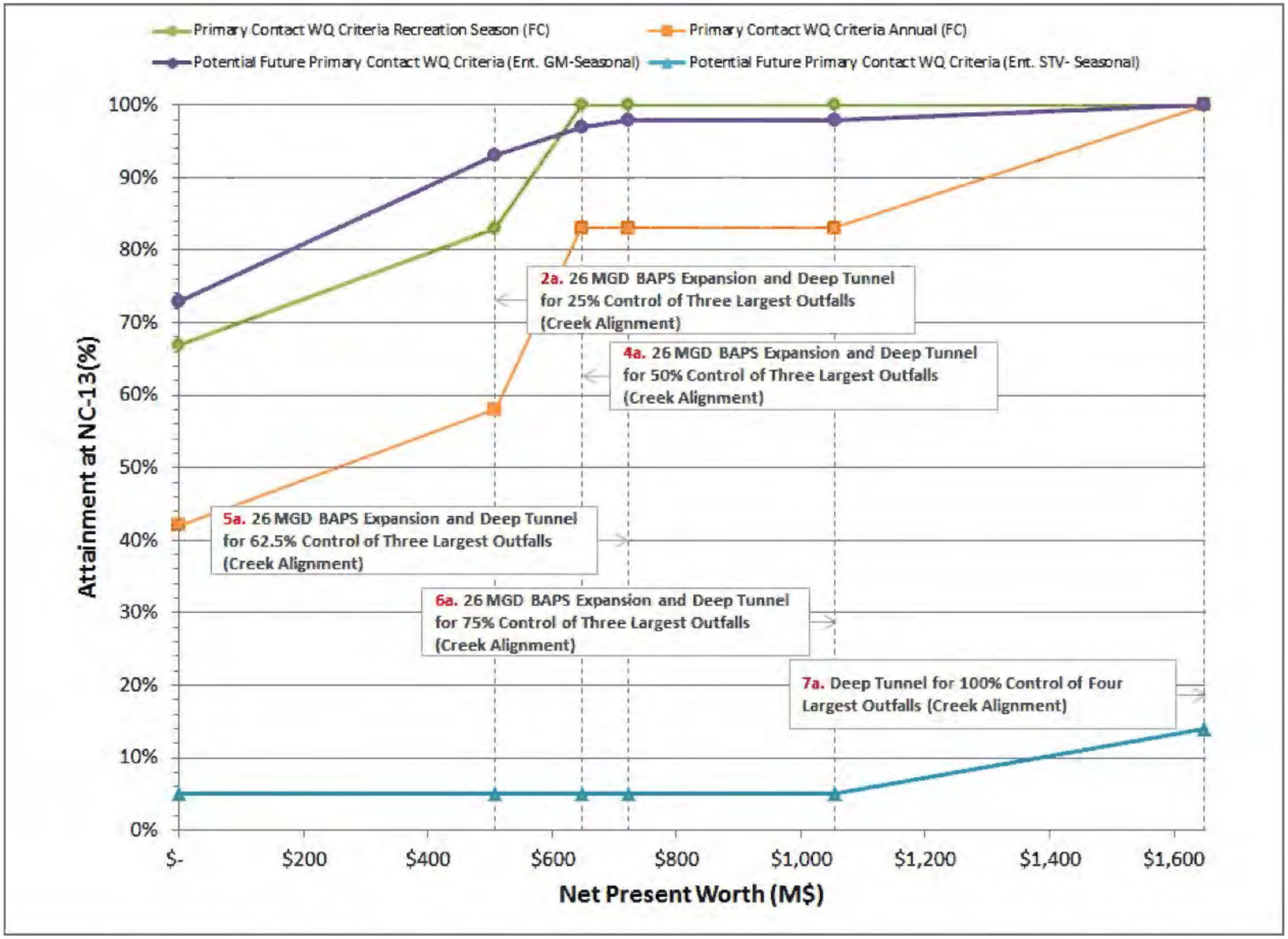

Figure 8-39. Cost vs. Bacteria Attainment at Station NC13 (2008 Rainfall)

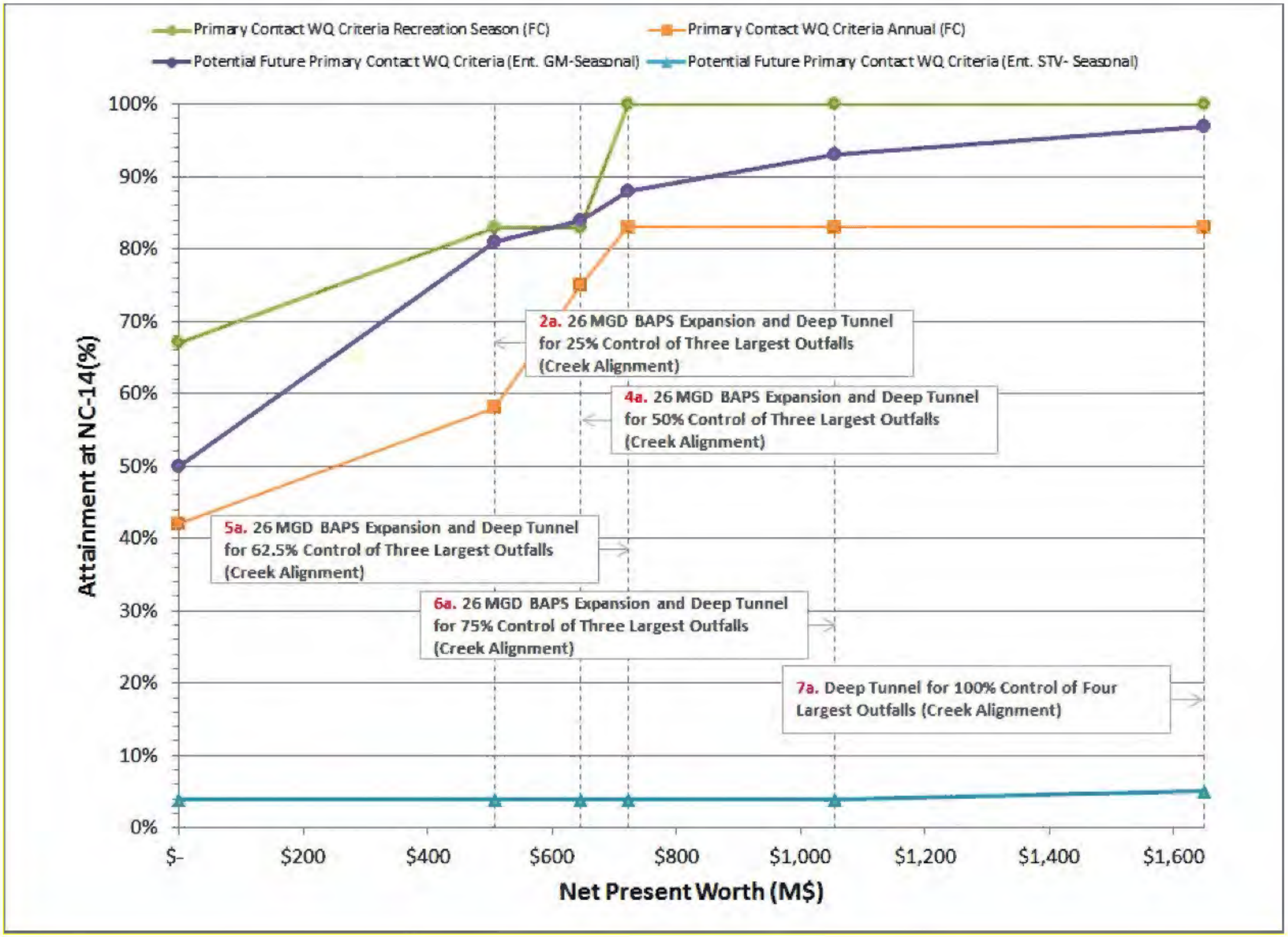

Figure 8-40. Cost vs. Bacteria Attainment at Station NC14 (2008 Rainfall)

8.5.c Conclusion on Preferred Alternative

The alternatives were reviewed for cost effectiveness, ability to meet water quality criteria, public comments and operations. The construction costs were developed as Probable Bid Costs (PBC), and the total Net Present Worth (NPW) costs were determined by adding the estimated PBC to the NPW of the projected annual O&M costs at an assumed interest rate of 3 percent over a 20-year life cycle. However, for tunnel alternatives that provide longer service, a longer 100-year lifecycle was used for computing NPW. Design, construction management and land acquisition costs are not included in the cost estimates. All costs are in February 2017 dollars and are considered Level 5 cost estimates by Association for the Advancement of Cost Engineering (AACE) International with an accuracy of -50 to +100 percent.

The selection of the preferred alternative is based on multiple considerations including public input, environmental and water quality benefits, and costs. A traditional KOTC analysis is presented above. As described above, based on that analysis, a 26 MGD expansion to the BAPS was identified as the most cost-effective alternative for reducing the frequency and volume of CSOs from Outfall BB-026 to Dutch Kills. For Outfalls NC-015, NC-083, and NC-077, the evaluations indicated that a storage tunnel would be more cost-effective and would have less siting impacts on established businesses than individual storage tanks. However, the final tunnel route depends on whether DEP is successful in obtaining a site near the Newtown Creek WWTP and/or resolving the potential competing uses for the DEP-owned site near Outfall NC-077. Based on the cost/performance curves presented above, a tunnel sized for 62.5 percent control fell on the KOTC for cost versus CSO volume and bacteria load controlled. A tunnel sized for 62.5 percent control is projected to achieve recreational season (May 1st through October 31st) attainment of the Existing WQ Criteria for bacteria at all sampling locations in Newtown Creek for the 2008 typical year. Assessment of compliance using a 10-year continuous model run indicated that recreational season compliance would be in the 83 to 93 percent range for the 62.5 percent control tunnel. Most of the main trunk of Newtown Creek and Dutch Kills is projected to be at 93 percent attainment, while the upstream reaches would be in the 83 to 90 percent range.

In comparison, a tunnel sized for 75 percent control fell beyond the KOTC for cost versus CSO volume and bacteria load controlled, meaning that the additional control achieved required a proportionally larger incremental cost compared to the 62.5 percent control tunnel. In terms of attainment, the 75 percent control tunnel would provide no improvement for the 2008 recreational season, as the 62.5 percent tunnel would already provide 100 percent attainment. For the 10-year continuous simulation, the recreational season attainment for the 75 percent tunnel would range from 90 to 95 percent, with only station NC4 achieving the 95 percent level. All other stations in the Creek would range from 90 to 93 percent. The 75 percent tunnel would therefore not achieve full attainment in the recreational season, and would provide only marginal improvement in attainment as compared to the 62.5 percent tunnel. As described above, the Newtown Creek WWTP is a high-rate, step-feed plant with no primary settling tanks. As such, a 40-MGD tunnel dewatering rate was determined to be an appropriate dewatering rate limit for the WWTP. This limitation would not constrain the dewatering rate for the 62.5 percent tunnel, but would require additional treatment capacity in the form of a retention treatment basin (RTB) to allow dewatering of the 75-percent tunnel within 24 hours. This requirement would complicate the implementation of a 75-percent tunnel due to the potential need for additional property acquisition, siting, construction, and long-term O&M requirements. This requirement also adds to the implementation cost for the 75-percent tunnel alternative.

In summary, the 62.5 percent tunnel provides the following:

1. 100 percent attainment of the Existing WQ Criteria for bacteria during the 2008 recreational season

2. The most cost-effective alternative, based on the KOTC analysis approach, consistent with EPA's CSO Control Policy

3. Is projected to have a time to recovery of less than 24 hours for 90% of the wet weather events.

4. Tunnel dewatering in 24 hours without the cost, siting, O&M, and other implementation issues associated with providing additional treatment for dewatering flows that would otherwise exceed the established limit for the Newtown Creek WWTP

Although the 62.5 percent tunnel would not achieve recreational season compliance with the Existing WQ Criteria for bacteria based on the 10-year continuous simulation, the 75-percent tunnel would provide only an incremental improvement, and still would not achieve full compliance. Nevertheless, the final siting of the dewatering pumping station, the tunnel alignment and other associated details of the tunnel alternative, will be evaluated further based upon a number of factors including additional modeling and will be finalized during subsequent planning and design stages. That additional planning will provide an opportunity to optimize the sizing of the tunnel. However, the ability of the Newtown Creek WWTP to handle the dewatering flows would remain a limiting factor for the sizing of the tunnel. Based on these considerations, the 62.5-percent tunnel has been selected as the preferred alternative for controlling CSO to Newtown Creek from outfalls NC-015, NC-083 and NC-077. Conceptual layouts for the tunnel alternatives are provided in Section 8.

This preferred alternative is projected to achieve recreational season (May 1st through October 31st) attainment of the Existing WQ Criteria for bacteria in Newtown Creek at all sampling locations in Newtown Creek for the 2008 typical year. The preferred alternative will also provide significant reduction in CSO volume and frequency of overflow. The implementation of the preferred alternative, which would include the storage tunnel for Outfalls NC-015, NC-083 and NC-077, plus the expansion of the BAPS to 26 MGD, has an estimated NPW ranging from $703M to $730M. This estimate reflects $5.0M of annual O&M over the course of 20 years, and an unescalated PBC ranging from $570M to $597M, depending on the final route to be determined in subsequent planning and design stages. Costs escalated to the assumed midpoint of construction would range from $1,275M to $1,335M. Note that these costs do not include costs for land acquisition, design and construction management.

The Existing WQ Criteria for fecal coliform attainment levels (monthly GM<200 cfu/100mL) as determined using the 10-year simulation are shown below in Table 8-28. As noted above, the values presented in Table 8-28 for the preferred alternative were interpolated from the 50 percent and 75 percent control runs. As indicated in Table 8-28, recreational season (May 1st through October 31st) compliance for the preferred alternative would be in the 83 to 93 percent range. Most of the main trunk of Newtown Creek and Dutch Kills would be at 93 percent attainment, while the upstream reaches would be in the 83 to 92 percent range. Annual compliance is predicted to be slightly lower than recreational season compliance. To put the 10-year simulation performance into perspective, the 10-year period includes a total of 60 months that fall within the recreational season. 93 percent attainment in the recreational season over 10 years means that in 56 out of the 60 recreational season months, the monthly GM did not exceed 200 cfu/100mL.

Table 8-28. Model Calculated Preferred Alternative Fecal Coliform Percent Attainment of Existing WQ Criteria and Bacteria Primary Contact WQ Criteria

Station		75% Control at BB-026, 62.5% Control at NC-015, 083, 077			
		2008 % Attainment		10 Year % Attainment[1]	
		Annual Monthly GM <200 cfu/100mL	**Recreational Season[2]** Monthly GM <200 cfu/100mL	**Annual** Monthly GM <200 cfu/100mL	**Recreational Season[2]** Monthly GM <200 cfu/100mL
Main Channel	NC4	83	100	90	93
	NC5	83	100	90	93
Dutch Kills	NC6	83	100	88	93
Main Channel	NC7	83	100	90	93
	NC8	83	100	90	93
	NC9	83	100	90	93
Maspeth Creek	NC10	83	100	89	92
English Kills	NC11	83	100	89	92
East Branch	NC12	83	100	83	88
English Kills	NC13	83	100	89	92
	NC14	83	100	83	83

Notes:
(1) Values interpolated from 10-year simulations of 50% and 75% control tunnel (with 75% control at BB-026) runs.
(2) The recreational season is from May 1st through October 31st.

The average annual attainment of the Existing WQ Criterion for DO (Class SD) for the entire water column is presented for the preferred alternative in Table 8-29. As indicated in Table 8-29, the Existing WQ Criterion for DO (Class SD) are predicted to be attained at all stations for the preferred alternative. The average annual attainment of the Class SC criteria for the entire water column is presented for the preferred alternative in Table 8-30. As discussed in Section 6, analysis of attainment of Class SC DO criteria are complex because the standard allows for excursions from the daily average limit of 4.8 mg/L for a limited number of consecutive calendar days. To simplify the analysis, attainment was based solely upon attainment of the daily average without the allowed excursions. The results indicate full attainment (at least 95 percent) of the acute criterion (never less than 3.0 mg/L) for the preferred alternative. Attainment of the chronic criterion (greater than or equal to 4.8 mg/L) ranges from 84 to 96 percent for the preferred alternative. As discussed in Section 6, the gap analysis indicates that with 100 percent CSO

Table 8-28. Model Calculated (2008) Preferred Alternative DO Attainment – Existing WQ Criterion – Aeration System Operational

Station		DO Annual Attainment (%)
		Class SD ≥ 3.0 mg/L
		75% Control at BB-026, 62.5% Control at NC-015, NC-083, NC-077
Main Channel	NC4	100
	NC5	100
Dutch Kills	NC6	99.0
Main Channel	NC7	100
	NC8	100
	NC9	100
Maspeth Creek	NC10	99.7
English Kills	NC11	100
East Branch	NC12	100
English Kills	NC13	99.8
	NC14	96.2

Table 8-29. Model Calculated (2008) Preferred Alternative DO Attainment of Class SC WQ Criteria – Aeration System Operational

Station		DO Annual Attainment (%) 75% Control at BB-026, 62.5% Control at NC-015, 083, 077	
		Class SC Chronic(1)	Class SC Acute(2)
Main Channel	NC4	94	100
	NC5	95	100
Dutch Kills	NC6	88	100
Main Channel	NC7	96	100
	NC8	94	100
	NC9	93	100
Maspeth Creek	NC10	91	99
English Kills	NC11	90	99
East Branch	NC12	88	99
English Kills	NC13	87	99
	NC14	84	97

Notes:
(1) Chronic Criteria: 24-hr average DO≥ 4.8 mg/L with allowable excursions to ≥ 3.0 mg/L for certain periods of time.
(2) Acute Criteria: DO≥ 3.0 mg/L.

control, the Class SC Chronic criterion would still not be met at Station NC14, although it would be met at all other Newtown Creek stations.

Table 8-31 summarizes the projected levels of attainment for the Potential Future Primary Contact WQ Criteria. Values presented for the preferred alternative were interpolated from the 50 percent and 75 percent control runs. As indicated in Table 8-31, attainment of the 30-day rolling GM for *Enterococci* is projected to range from 72 to 91 percent. Attainment of the 90th Percentile STV criterion is projected to range from 6 to 26 percent.

Table 8-31. Model Calculated 10-Year Preferred Alternative Enterococci Percent Attainment of Potential Future Primary Contact WQ Criteria

Station		75% Control at BB-026, 62.5% Control at NC-015, 083, 077			
		2008 Recreational Season% Attainment(1)		10 Year Recreational Season % Attainment(1)(2)	
		30-day Rolling GM <30 cfu/100mL	90th Percentile STV <110 cfu/100mL	30-day Rolling GM <30 cfu/100mL	90th Percentile STV <110 cfu/100mL
Main Channel	NC4	100	19	91	26
	NC5	100	11	90	19
Dutch Kills	NC6	99	18	90	25
Main Channel	NC7	100	10	90	20
	NC8	100	11	90	22
	NC9	100	10	90	20
Maspeth Creek	NC10	100	19	90	25
English Kills	NC11	98	5	83	11
East Branch	NC12	88	4	72	6
English Kills	NC13	98	5	83	12
	NC14	88	4	72	6

Notes:
(1) The recreational season is from May 1st through October 31st.
(2) Values interpolated from 10-year simulations of 50% and 75% control tunnel (with 75% control at BB-026) runs.

The preferred alternative is based on multiple considerations, including public input and environmental and water quality benefits and costs. The LTCP assessment shows that the preferred alternative would achieve recreational season (May 1st through October 31st) attainment of the Existing WQ Criteria for fecal coliform bacteria at all sampling locations in Newtown Creek, based on the 2008 typical year. Annual compliance with Existing WQ Criteria for fecal coliform bacteria would not be met at any of the sampling locations in Newtown Creek with the preferred alternative.

Assessment of compliance using a 10-year continuous model run indicated that recreational season (May 1st through October 31st) compliance would be in the range of 83 to 93 percent. The difference between the 2008 and 10-year attainment is likely due to certain months during the 10-year period having more rainfall than the months in 2008. In addition, the documented low circulation and flushing in the upstream reaches of Newtown Creek contribute to more extended impacts of the bacteria loads from larger storms. The preferred alternative will also provide significant reduction in CSO volume and frequency of overflow. The preferred alternative is projected to reduce CSO discharges to Newtown Creek by approximately 65 percent, and CSO events are projected to be reduced by 55 percent.

The key components of the preferred alternative include:

- Expansion of the Borden Avenue Pumping Station to 26 MGD capacity, with a new diversion structure and gravity pipe from Outfall BB-026, and a new force main to the Kent Avenue Gate Structure;
- A storage tunnel that will capture 62.5 percent of the annual CSO volume from Outfalls NC-015, NC-083 and NC-077, with the final route to be determined during subsequent planning and design activities;
- A dewatering pumping station; and
- Appurtenant near-surface connecting conduits and structures.

The implementation of these elements has a NPW ranging from $703M to $730M, reflecting $5.0M of annual O&M over the course of 20 years for the BAPS and 100 years for the CSO Deep Storage Tunnel.

The proposed schedule for the implementation of the recommended plan is presented in Section 9.2.

8.5.d Newtown Creek Wastewater Treatment Plant Performance During CSO Pump-back

The following presents an analysis of the impacts to the Newtown Creek WWTP of a 60-MG CSO Storage Tunnel in terms of infrastructure and equipment capacity and total nitrogen loadings. During wet-weather events, CSO will be prevented from overflowing at Outfalls NC-015, NC-083 and NC-077 by diverting it into a CSO storage tunnel for subsequent treatment after the rain event subsides. In evaluating plant impacts from the captured CSO, a 24-hour pump-back was considered, which would contribute an additional hydraulic and mass loading to the Newtown Creek WWTP.

First, an analysis of historical data from 2012-2016 was performed to estimate the potential process impacts and limitations. Next, a calibrated BioWin model was used to estimate impacts to plant equipment/infrastructure. Additionally, impacts to the total nitrogen effluent discharges from the plant were quantified during CSO pump-back conditions. A conservative "worst-case" analysis provided an upper limit on the potential CSO storage volume, but recognizing that the impacts would be of limited duration.

Historical Data Analysis

The Newtown Creek WWTP has a DDWF capacity of 310 MGD and a peak wet-weather capacity of 700 MGD. The historical plant influent concentrations for key pollutant parameters are shown below in Table 8-32.

Table 8-30. Newtown Creek WWTP Historical Data Analysis 2012-2016- Plant Influent

Parameter	Historical Average (Total)	Wet Weather Average
TSS, mg/L	157	188
CBOD, mg/L	178	152
TKN, mg/L	29	23

BioWin and State Point Analysis Modeling

A calibrated BioWin model for the Newtown Creek WWTP was used to analyze process impacts and ensure sufficient infrastructure and equipment capacity exists during CSO pump-back. From a loading perspective, CSO storage will increase the process loadings to Newtown Creek during CSO pump-back. The model was used to determine: (1) the aeration tank solids inventory requirement to maintain a solids retention time (SRT) of 1.25 days to ensure sufficient bio-flocculation; (2) the impact of increased solids on final clarifier solids loading in conjunction with a clarifier State Point Analysis (SPA); (3) aeration requirements related to the increased loads; and (4) solids handling equipment capacity.

Using plant data, the increase in process loadings during CSO pump-back is shown in Table 8-33.

Table 8-31. Secondary Process Loadings During CSO Pump-back of 60 MG in 24-hours

Parameter	Avg Raw Influent[1]	CSO Component[2]	Total Secondary Loading	% Increase
TSS, lbs/d	347,100	84,300	431,300	24%
ISS, lbs/d	49,000	39,500	88,400	81%
CBOD, lbs/d	350,600	52,700	403,300	15%
TKN, lbs/d	57,300	6,400	63,600	11%

1. Forecasted 2040 average flows using influent concentrations from 2012-2016
2. Calculated using recorded influent concentrations during wet weather 2012-2016

Process modeling confirmed that the increase in secondary solids and loadings to the final settling tanks (FSTs) will not exceed the capacity of the FSTs. As shown in Table 8-34, Newtown Creek has sufficient aeration, thickening, and anaerobic digestion capacity.

Table 8-32. 60 MG CSO Storage Tunnel at Newtown Creek and Impact on Equipment Capacity

Equipment	Parameter	Total Capacity	Model Prediction	Capacity Available (Y/N)
Aeration	Flow Rate	180,000 scfm (5 of 7 total Units)	139,000 SCFM	Y
Thickening Centrifuges	Feed Concentration	2,000 to 10,000 mg/L	4,300 mg/L	Y
	Feed Flow	23.3 MGD (18 of 24 total Units)	14 MGD	Y
Digester	Target HRT	20+ Days (6 of 8 Units)	21.8 days[1]	Y

1. HRT calculated assuming pump-back frequency consistent with 2008 representative storm conditions. Conservatively assumed full pump-back was needed with each storm.

Nitrogen

Newtown Creek is not a BNR facility and does not have the infrastructure and equipment to remove nitrogen. Thus, the nitrogen contained within the stored CSO volume, which otherwise would have been discharged directly into the NYC waterways, would now be discharged from the plant. Because the increase in nitrogen load from the WWTP is offset by the corresponding reduction in loads at the CSO outfalls, there is no net increase in overall nitrogen discharged as a result of CSO storage and pump-back.

A historical data analysis using 2008 as a representative year for storm frequencies and intensities was used to evaluate the impact of CSO pump-back on effluent nitrogen loading. A "worst case" effluent TN concentration during wet weather (16.5 mgN/L) was selected based on historical data analysis of wet-weather events at Newtown Creek to estimate effluent TN loads during CSO pump-back. Based on a total of 41 CSO pump-back events, with volumes ranging from less than 1 MG to 69 MG, the projected TN effluent discharges from the Newtown Creek WWTP will increase approximately 224 lbs/d on an annual average basis. Only one quarter, or 56 lbN/d, of this increase will impact Combined East River TN TMDL, as shown in Table 8-35. This impact is minimal and is not expected to compromise permit compliance, assuming current operations are maintained at the Upper East River BNR plants contributing to the TMDL, and no changes in effluent permits are implemented.

Table 8-33. Total Nitrogen Discharges for the UER and LER Treatment Plants with 60 MG CSO Storage Tunnel to Newtown Creek WWTP

Condition	Total Nitrogen Discharges
Combined East River TN TMDL Limit (Jan.2017)	44,325 lbs/d
Actual East River TN as of Jan 2017	41,175 lbs/d
Modeled UER TN Compliance with final stepdown[1]	41,000 lbs/d
Net increase from CSO pump-back	~56 lbs/d total nitrogen increase

1. Modeling East River Nitrogen Bulge – Update, July 24, 2015

Potential Implications of Increased Nitrogen Discharges from Newtown Creek

Process considerations related to the additional CSO loads due to increased effluent nitrogen loadings from Newtown Creek and their impact to the overall East River Nitrogen TMDL must be recognized. One quarter of Newtown Creek effluent Total Nitrogen (TN) is applied to the Combined East River Nitrogen TMDL. Pump-back of the stored CSO increases the total influent nitrogen load, and subsequent effluent load, from the Newtown Creek WWTP. The increased nitrogen load to the WWTP thereby reduces the margin of safety in meeting the final Combined East River Nitrogen TMDL limit.

A net increase in effluent TN from Newtown Creek may need to be mitigated by increased TN removal at the Upper East River (UER) BNR facilities. Any process limitations at the UER BNR facilities during periods of pump-back at Newtown Creek, such as tanks out of service or poor DO levels, can increase the risk to the BNR treatment process. These impacts could be further exacerbated during critical conditions such as colder weather that could effectively limit the ability for the plant to completely nitrify.

Additionally, effluent TN limits likely will be stricter in the coming decades, and discussions of numerical limits are currently underway. If future numerical limits substantially reduce the acceptable effluent TN from the City's BNR facilities, or if stricter TN limits specific to Newtown Creek WWTP are implemented, any increases in net TN loads due to CSO pump-back could compromise permit compliance.

For these reasons, a conservative approach is taken in determining the maximum CSO storage volume to both mitigate TN discharges and manage the risks of maintaining permit compliance. While this analysis showed that the Newtown Creek WWTP potentially could handle up to 60 MGD of dewatering flow, consideration is given to the fact that the Newtown Creek WWTP is a high-rate, step-feed plant with no primary settling tanks. As such, a 40-MGD tunnel dewatering rate was deemed to be an appropriate dewatering rate limit for the WWTP.

Grit Accumulation

With an increase in ISS loading from CSO pump-back, it is also appropriate to consider possible impacts to the frequency of aeration tank cleaning. In an October 1998 correspondence titled "NYCDEP Response to NYSDEC Preliminary Technical Comments on Track 3 Facility Plan", DEP responded to DEC concerns regarding the Grit Chamber Effectiveness, citing an improvement in grit removal as a result of new grit tanks, for which a more than seven-year cleaning frequency was deemed appropriate. The increase in ISS anticipated from CSO pump-back was calculated to be 1,350 lb/d over the course of a year, an increase in ISS of less than 5% over the influent without CSO pump-back in place. Accordingly, this minimal increase in grit is not expected to require more frequent aeration-tank cleaning.

8.6 Use Attainability Analysis

The CSO Order requires that a UAA be included in an LTCP "where existing WQS do not meet the Section 101(a)(2) goals of the CWA, or where the proposed alternative set forth in the LTCP will not achieve existing WQS or the Section 101(a)(2) goals." The UAA shall "examine whether applicable waterbody classifications, criteria, or standards should be adjusted by the State." The UAA process specifies that States can remove a designated use that is not an existing use if the scientific assessment can demonstrate that attaining the designated use is not feasible for at least one of six reasons:

1. Naturally occurring loading concentrations prevent the attainment of the use; or
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, 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 the attainment of the use; or
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 water quality, preclude attainment of aquatic life protection uses; or
6. Controls more stringent than those required by Sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

As part of the LTCP, elements of a UAA, including the six conditions presented above, will be used to determine if changes to the designated use are warranted, considering a potential adjustment to the designated use classification as appropriate.

As noted in previous sections, with the implementation of the preferred alternative, Newtown Creek is predicted to meet the Existing WQ fecal coliform bacteria criterion of 200 cfu/100mL during the recreational season (May 1st through October 31st) (based on 2008 rainfall) for the preferred alternative. However, the Existing WQ fecal coliform bacteria criterion of 200 cfu/100mL is not predicted to be fully attained on an annual basis based on 2008 rainfall. The 10-year continuous simulation showed that the preferred alternative would not fully attain the existing fecal coliform bacteria criterion of 200 cfu/100mL during the recreational season (May 1st through October 31st). As discussed above, the DO criterion is predicted to be achieved for the existing WQS under the preferred alternative.

8.6.a Use Attainability Analysis Elements

The objectives of the CWA include providing for the protection and propagation of fish, shellfish, wildlife and recreation in and on the water. Cost-effectively maximizing the water quality benefits associated with CSO reduction is a cornerstone of this LTCP.

To simplify this process, DEP and DEC have developed a framework that outlines the steps taken under the LTCP in two possible scenarios:

1. Waterbody meets WQ requirements. This may either be the existing WQS (where primary contact is already designated) or for an upgrade to the Primary Contact WQ Criteria (where the existing standard is not a Primary Contact WQ Criteria). In either case, a high-level assessment of the factors that define a given designated use is performed, and if the level of control required to meet this goal can be reasonably implemented, a change in designation may be pursued following implementation of CSO controls and Post-Construction Compliance Monitoring.

2. Waterbody does not meet WQ requirements. In this case, if a higher level of control is not feasible, the UAA must justify the shortcoming using at least one of the six criteria (see Section 8.6 above). It is assumed that if 100 percent elimination of CSO sources does not result in attainment, the UAA would include factor number 3 at a minimum as justification (human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied, or would cause more environmental damage to correct than to leave in place).

As indicated in Tables 8-29 and 8-30, the modeled attainment of fecal coliform criterion of the Class SD waters upon implementation of the LTCP recommended plan is not achieved on an annual basis. Implementation of the plan will lead to Class SD DO criterion being fully attained throughout the waterbody. Future revisions of the Newtown Creek WQ classification should await completion of construction of the preferred alternative and the results of the Post-Construction Compliance Monitoring.

8.6.b Fishable/Swimmable Waters

The goal of this LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific WQS, consistent with EPA's CSO Control Policy and subsequent guidance. DEC considers that compliance with Class SD WQS, the current classification for Newtown Creek, as fulfillment of the CWA's fishable/swimmable goal.

The preferred alternative summarized in Section 8.5 results in the levels of attainment with fishable/swimmable criteria as follows:

- Based on the 2008 typical year simulations, as presented in Figures 8-29 to 8-40, the preferred alternative would result in attainment of the Existing WQ Criteria (Class SD) for bacteria during the recreational season (May 1st through October 31st), but would not achieve full attainment on an annual basis. As indicated in Table 8-29, the Class SD DO criterion would be met on an annual average basis.

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- For the 10-year continuous simulation, summarized in Table 8-28, attainment of the Existing WQ Criteria (Class SD) criterion for bacteria is not predicted to be met on an annual basis or for the recreational season (May 1st through October 31st).

8.6.c Assessment of Highest Attainable Use

The 2012 CSO Order Goal Statement stipulates that, in situations where the proposed alternatives presented on the LTCP will not achieve the CWA Section 101(a)(2) goals, the LTCP will include a UAA. Because the analyses developed herein indicate that Newtown Creek is not projected to fully attain the Class SD fecal coliform criterion on an annual basis, a UAA is required under the 2012 CSO Order. Table 8-32 summarizes the compliance for the identified plan.

Table 8-34. Recommended Plan for Compliance with Bacteria Water Quality Criteria

Compliance with Existing WQ Criteria and Primary Contact WQ Criteria (Class SD)				Compliance with Potential Future Primary Contact WQ Criteria	
(2008)(1)		(10-yr)(2)		Rec. Season(3)	
Annual	Rec. Season(3)	Annual	Rec. Season(3)	30-day Rolling GM	90% STV
83%	100%	83-90%	83-93%	88-100% (2008)(1) 72-91% (10-yr)(2)	4-19% (2008)(1) 6-26% (10-yr)(2)

Notes:
(1) Compliance based on 2008 typical year.
(2) Compliance based on interpolation of10-year simulation.
(3) Recreational season is May 1st to October 31st.

8.7 Water Quality Goals

Based on the analyses of Newtown Creek and the WQS associated with the designated uses, the following conclusions can be drawn:

8.7.a Existing Water Quality

Newtown Creek is a navigable urban channel that primarily supports shipping traffic associated with the commercial, industrial and municipal land uses of the adjacent taxable lots. Public access to the shoreline is extremely limited, and includes two small parks/nature walks and two kayak/boat launch locations. The shoreline is highly bulkheaded, further limiting access onto or off the water. No DOHMH certified bathing beaches are located in Newtown Creek. Under baseline conditions, the waterbody is not in attainment with its current classifications for bacteria or DO criteria.

8.7.b Primary Contact Water Quality Criteria

As presented in Section 8.5, this LTCP incorporates assessments for attainment with primary contact WQS criteria, as the Existing WQ Criteria for bacteria are the same as the primary contact criteria. Attainment was assessed, both spatially and temporally, using the 2008 rainfall year, and a 10-year simulation for bacteria. Projected bacteria levels for the preferred alternative comply with Primary Contact WQ Criteria during the recreational season (May 1st through October 31st) for the 2008 rainfall, but not on an annual basis for 2008, or for the 10-year simulation. DO levels were assessed against the Existing WQ Criterion (Class SD) for the 2008 typical year. With the preferred alternative, attainment with the Class SD criterion is predicted at all stations in Newtown Creek.

8.7.c Potential Future Water Quality Criteria

DEP is committed to improving water quality in Newtown Creek. Toward that end, DEP has identified instruments for Newtown Creek that will allow DEP to continue to improve water quality in the system over time. Wet-weather advisories based on time to recovery analysis are recommended for consideration while advancing towards the numerical criteria established, or others under consideration by DEC, including Potential Future Primary Contact WQ Criteria consistent with the 2012 EPA RWQC.

8.7.d Time to Recovery

Although Newtown Creek could be protective of primary contact use during the recreational season (May 1st through October 31st), it will not be capable of supporting primary contact 100 percent of the time. Even with anticipated reductions in CSO overflows resulting from grey and green infrastructure, the waterbody cannot support primary contact during and following rainfall events. Toward the goal of maximizing the amount of time that Newtown Creek can achieve water quality levels to support primary contact, DEP has performed an analysis to assess the amount of time following the end of a rainfall event required for Newtown Creek to recover and return to fecal coliform concentrations less than 1,000 cfu/100mL.

The analyses consisted of examining the WQ model-calculated bacteria concentrations in Newtown Creek for recreational periods (May 1st through October 31st) abstracted from 10 years of model simulations. The time to return (or “time to recovery”) to a fecal coliform concentration of 1,000 cfu/100mL for each water quality station within the waterbody was then calculated for each storm with the various size categories and the median time after the end of rainfall was then calculated for each rainfall category. The results of these analyses for Newtown Creek are summarized in Table 8-33. As described above, results presented for the preferred alternative for the 10-year model simulations were interpolated from available results for the 50 and 75 percent control alternatives. As indicated in Table 8-33, the median duration of time within which pathogen concentrations are expected to be higher than the DOHMH considers safe for primary contact varies by storm size and location within Newtown Creek. For the preferred alternative, the median times to recovery are below 24 hours at all of the sampling locations for the storm sizes up to 1.5 inches except for location NC6 in Dutch Kills, where the median for storms in the 0.8 to 1.5 inch range is 38 hours. For storms greater than 1.5 inches, the median times to recovery are well above 24 hours at all locations.

Table 8-35. Time to Recovery to 1,000 cfu/100mL Fecal Coliform – Preferred Alternative 62.5 Percent Control Tunnel with 75 Percent Control at BB-026

Station		Average Time to Recovery to 1,000 cfu/100mL Fecal Coliform (Hrs)(1)					
		Storm Size Bins (inches of rainfall)					
		<0.1	0.1 – 0.4	0.4-0.8	0.8-1.0	1.0-1.5	>1.5
Main Channel	NC4	1	1	1	6	6	43
	NC5	1	1	1	3	1	54
Dutch Kills	NC6	1	1	1	38	38	73
Main Channel	NC7	1	1	1	1	1	63
	NC8	1	1	1	1	1	70
	NC9	1	1	1	1	1	72
Maspeth Creek	NC10	1	1	3	9	10	67
English Kills	NC11	1	1	1	1	1	57
East Branch	NC12	1	1	1	5	8	79
English Kills	NC13	1	1	1	1	1	50
	NC14	1	1	1	2	7	80

Notes:
(1) Values interpolated from 10-year simulations of 50% and 75% control tunnel (with 75% control at BB-026) runs.

8.8 Recommended LTCP Elements to Meet Water Quality Goals

Water quality in Newtown Creek will be improved with the preferred alternative and other actions identified herein.

The actions identified in this LTCP include:

- Expansion of the Borden Avenue Pumping Station to 26 MGD capacity, with a new diversion structure and gravity pipe from Outfall BB-026, and a new force main to the Kent Avenue Gate Structure;
- A storage tunnel that will capture 62.5 percent of the annual CSO volume from Outfalls NC-015, NC-083 and NC-077, with the final route to be determined during subsequent planning and design activities;
- A dewatering pumping station;
- Appurtenant near-surface connecting conduits and structures.
- Elimination of the in-stream mechanical aeration for Dutch Kills as contained in the 2012 CSO Order.
- Ranges of costs (in February 2017 dollars) for the recommended alternative are: NPW $703M to $730M, PBC of $570M to $597M, and annual O&M of $5.0M.
- Compliance with Primary Contact WQ Criteria during the recreational season (May 1st through October 31st) based on 2008 rainfall, but not achieving compliance annually based on 2008 rainfall, or during the recreational season based on a 10-year continuous simulation. As a result, a UAA is included as part of this LTCP.
- DEP will establish with the DOHMH through public notification a wet-weather advisory during the recreational season (May 1st through October 31st) during which recreational activities would not be recommended in Newtown Creek. The LTCP includes a recovery time analysis that can be used to establish the duration of the wet-weather advisory for public notification.

DEP is committed to improving water quality in this waterbody, which will be advanced by the improvements and actions identified in this LTCP. These identified actions have been balanced with input from the public and awareness of the cost to the citizens of NYC.

9.0 LONG-TERM CSO CONTROL PLAN IMPLEMENTATION

The evaluations performed for this LTCP concluded that under baseline conditions, Newtown Creek does not attain existing water quality standards (Class SD) for bacteria and DO. Even with 100 percent CSO control, Newtown Creek is not projected to fully attain water quality standards for bacteria in the head end portions of the Creek. As detailed in section 8.5, the selection of the preferred alternative is based on multiple considerations including public input, environmental benefits, water quality improvements, and cost effectiveness. A traditional KOTC analysis was performed to identify the most cost-effective alternative for reducing the frequency and volume of CSOs to Newtown Creek while achieving the highest attainable use.

The preferred LTCP alternative for Newtown Creek includes expanding the Borden Avenue Pumping Station (BAPS) to provide 75 percent control of the annual CSO volume from Outfall BB-026 to Dutch Kills, and providing a storage tunnel for Outfalls NC-015, NC-083, and NC-077 sized to provide for 62.5 percent level of CSO control. The final dimensions and routes for the tunnel are to be further evaluated and finalized during subsequent planning and design stages. The analyses developed herein indicate that the recommended plan will attain existing water quality criteria for DO and will provide significant improvements in water quality attainment but will not fully attain existing bacteria standards on an annual basis.

9.1 Adaptive Management (Phased Implementation)

Adaptive management, as defined by the EPA, is the process by which new information about the characteristics of a watershed is incorporated into a watershed management plan on a continuing basis. The process relies on establishing a monitoring program, evaluating monitoring data and trends and making adjustments or changes to the plan. DEP will continue to apply the principles of adaptive management to this LTCP based on its annual evaluation of monitoring data, which will be collected to sustain the operation and effectiveness of the currently operational CSO controls.

NYC is developing a program to further address stormwater discharges as part of its MS4 permit. This program, along with the actions identified in this LTCP, may further improve water quality in Newtown Creek.

DEP will also continue to monitor the water quality of Newtown Creek through its ongoing HSM Program, as discussed in Section 2.0. For example, if evidence of dry-weather sources of pollution is found, DEP will initiate investigations to identify the source. Such activities will continue to be reported to DEC on a quarterly basis, as is currently required under the Bowery Bay and Newtown Creek WWTP SPDES permits.

CSO discharges are not a significant source of CERCLA hazardous substances to Newtown Creek. Nevertheless, the City expects the CSO control alternative selected in this LTCP (see Section 8) would be sufficient to address any CSO discharge controls that EPA may require as a result of the Superfund process.

9.2 Implementation Schedule

The implementation schedules to construct the facilities associated with the upgraded BAPS and a long tunnel to a site in the vicinity of the Newtown Creek WWTP are presented in Figures 9-1 and 9-2.

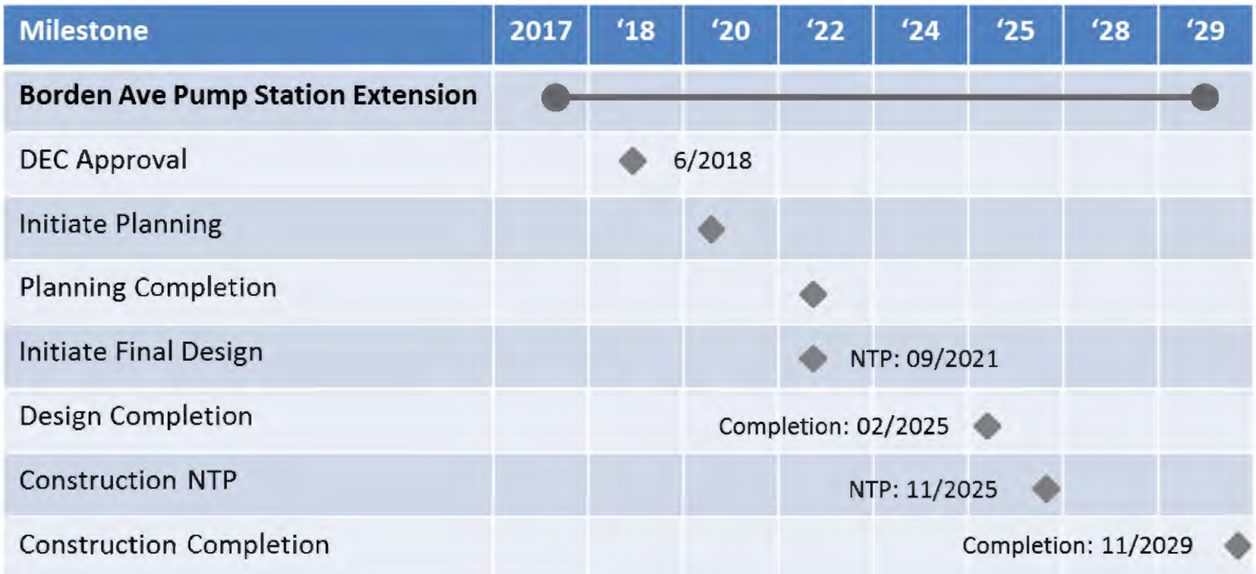


Figure 9-1. Borden Avenue Pumping Station Implementation Schedule

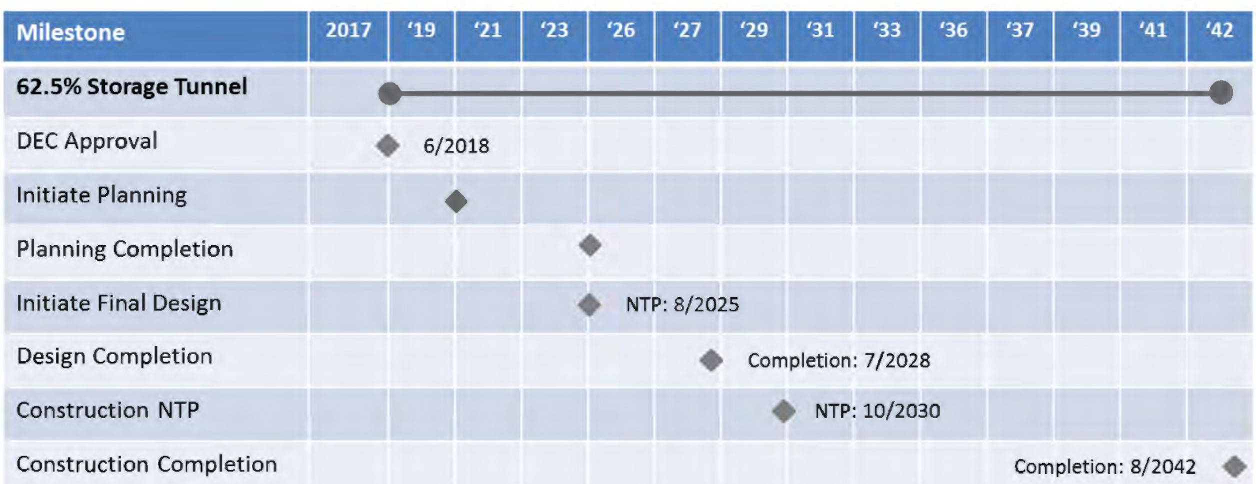


Figure 9-2. Newtown Creek LTCP Tunnel Implementation Schedule

The schedules represent our best estimate at this conceptual level given the size, complexity, and multiple site acquisitions and coordination access needed to support the projects. The schedule includes the estimated duration of time needed to perform the engineering design, advertise and bid the construction contracts, and complete construction. This schedule will be further refined as the tunnel design progresses and more detailed information becomes available. During the design process, DEP will use its best efforts to identify opportunities to expedite the schedule.

9.3 Operational Plan/O&M

DEP is committed to effectively incorporating Newtown Creek LTCP components into the Bowery Bay and Newtown Creek collection and transport systems as they are built-out during the implementation period. O&M of the near-surface components of the Newtown Creek Preferred Alternative (diversion structures, connecting conduits) will be consistent with similar existing sewers and CSO regulator structures within DEP's sewer system. Site-specific O&M plans will be developed for the CSO storage tunnel and the tunnel dewatering pumping station.

9.4 Projected Water Quality Improvements

As described in Section 8.3, the expansion to the BAPS and 62.5 percent CSO control tunnel will result in significantly improved water quality for bacteria and dissolved oxygen in Newtown Creek including reduction of the human or CSO-derived bacteria, as well as other CSO-related loadings both annually and during the recreational season (May 1st through October 31st). Improvements in water quality will also be realized as GI projects are built-out and when bending weir projects are completed later this year.

9.5 Post-Construction Monitoring Plan and Program Reassessment

Ongoing DEP monitoring programs such as the HSM and Sentinel Monitoring Programs will provide water quality data. DEP will conduct PCM after the recommended plan is placed into operation to assess effectiveness in terms of water quality improvements and CSO reductions.

9.6 Consistency with Federal CSO Policy

The Newtown Creek LTCP was developed to comply with the requirements of the EPA CSO Control Policy and associated guidance documents, and the CWA.

The selection of the preferred alternative is based on multiple considerations including public input, environmental and water quality benefits, and cost effectiveness. A traditional KOTC analysis is presented in Section 8.5 of the LTCP. Based on that analysis, a 26 MGD expansion to the BAPS was identified as the most cost-effective alternative for reducing the frequency and volume of CSOs from Outfall BB-026 to Dutch Kills. For Outfalls NC-015, NC-083, and NC-077, the evaluations indicated that a storage tunnel providing 62.5 percent control would be more cost-effective and would have less siting impacts on established businesses than individual storage tanks.

The projected attainment of Existing Class SD Criteria under baseline conditions with 2008 rainfall and for the recommended plan is presented in Table 9-1. As indicated in Table 9-1, the 2008 Typical Year modeling of baseline conditions shows that Newtown Creek exhibits a low level of attainment of the Existing Class SD Criteria for fecal coliform on an annual basis and for the recreational season (May 1st to October 31st). Attainment with the Existing Class SD Criteria for fecal coliform ranges from 42 percent to 75 percent on an annual basis, and from 67 percent to 100 percent for the recreational season. The DO attainment for the Existing Class SD criterion under baseline conditions ranges from 90 percent to 100 percent. For the recommended alternative using the same 2008 JFK rainfall, Newtown Creek is projected to attain the Existing Class SD Criteria for bacteria on a recreational season basis and will also attain the Existing Class SD DO criterion. However, it will not fully attain the Existing Class SD Criteria for bacteria on an annual basis and even 100 percent CSO control is not projected to attain Existing Class SD Criteria for bacteria on an annual basis.

Table 9-1. Projected Attainment of Class SD Criteria, for 2008 Rainfall, Baseline and Recommended Plan

Station	Baseline Conditions			Recommended Plan		
	Fecal Coliform % Attainment		DO % Attainment	Fecal Coliform % Attainment		DO % Attainment
	Annual Monthly GM <200 cfu/100mL	**Recreational Season(1)** Monthly GM <200 cfu/100mL	**Annual > 3.0 mg/L**	**Annual** Monthly GM <200 cfu/100mL	**Recreational Season(1)** Monthly GM <200 cfu/100mL	**Annual > 3.0 mg/L**
NC4	75	100	99.98	83	100	100
NC5	75	100	99.92	83	100	100
NC6	50	83	98.1	83	100	99.0
NC7	75	100	99.8	83	100	100
NC8	50	83	99.5	83	100	100
NC9	50	83	99.2	83	100	100
NC10	42	67	96.3	83	100	99.7
NC11	42	67	95.4	83	100	100
NC12	42	67	94.5	83	100	100
NC13	42	67	94.0	83	100	99.8
NC14	42	67	89.8	83	100	96.2

Note:
(1) The recreational season is from May 1st through October 31st.

Attainment with the Potential Future Primary Contact WQ Criteria under baseline conditions for stations in Newtown Creek ranges between 50 percent and 99 percent for the 30 day rolling geometric mean and ranges from 3 to 10 percent for the 90th percentile STV. Attainment with the Potential Future Primary Contact WQ Criteria for the recommended plan ranges between 88 and 100 percent for the 30 day rolling geometric mean and ranges from 4 to 19 percent for the 90th percentile STV.

The attainment with the Class SC chronic DO criterion under baseline conditions for 2008 rainfall ranges from 70 percent to 91 percent, while attainment with the Class SC acute DO criterion ranges from 90 to 100 percent. With the recommended plan, attainment with the Class SC chronic DO criterion for 2008 rainfall ranges from 84 percent to 96 percent, while the Class SC acute DO criterion attainment is greater than 95 percent.

Projected attainment with bacteria criteria for the recommended alternative using 10 years of rainfall data (CY2002-CY2011), and annual attainment for Class SC DO criteria is presented in Table 9-2. As indicated in Table 9-2, annual attainment of the Existing Class SD Criteria for bacteria ranges from 83 percent to 90 percent and recreational season attainment ranges from 83 percent to 93 percent. Attainment with the Potential Future Primary Contact WQ Criteria ranges between 72 percent and 91 percent for the 30 day rolling geometric mean and ranges from 6 to 26 percent for the 90th percentile STV. The attainment with the Existing Class SD DO criterion and the Class SC acute DO criterion ranges from

97 percent to 100 percent. The attainment with the Class SC chronic DO criterion ranges from 84 percent to 96 percent.

Table 9-2. Projected Attainment for the Recommended Plan

Station	Fecal Coliform (1)		Enterococcus (1)		Dissolved Oxygen (2)	
	Annual Monthly GM <200 cfu/100mL	Recreational Season(3) Monthly GM <200 cfu/100mL	30-day Rolling GM <30 cfu/100mL	90th Percentile STV <110 cfu/100mL	Class SC Chronic(4)	Class SC Acute(5)
NC4	90	93	91	26	94	100
NC5	90	93	90	19	95	100
NC6	88	93	90	25	88	99.0
NC7	90	93	90	20	96	100
NC8	90	93	90	22	94	100
NC9	90	93	90	20	93	100
NC10	89	92	90	25	91	99.7
NC11	89	92	83	11	90	100
NC12	83	88	72	6	88	100
NC13	89	92	83	12	87	99.8
NC14	83	83	72	6	84	96.2

Notes:
(1) Based on 2002-2011 simulation period.
(2) Based on 2008 typical year.
(3) The recreational season is from May 1st through October 31st.
(4) Chronic Criteria: 24-hr average DO≥ 4.8 mg/L with allowable excursions to ≥ 3.0 mg/L for certain periods of time.
(5) Acute Criteria: DO≥ 3.0 mg/L.

9.6.a Affordability and Financial Capability Introduction

EPA has recognized the importance of taking a community's financial status into consideration, and in 1997, issued "Combined Sewer Overflows: Guidance for Financial Capability Assessment and Schedule Development." EPA's financial capability guidance contains a two-phased assessment approach. Phase I examines affordability in terms of impacts to residential households. This analysis applies the residential indicator (RI), which examines the average cost of household water pollution costs (wastewater and stormwater) relative to a benchmark of two percent of service area-wide Median Household Income (MHI). The results of this preliminary screening analysis are assessed by placing the community in one of three categories:

- Low economic impact: average wastewater annual costs are less than one percent of MHI;
- Mid-range economic impact: average wastewater annual costs are between one percent and two percent of MHI; and
- High economic impact: average wastewater annual costs are greater than two percent of MHI.

The second phase develops the Permittee Financial Capability Indicators, which examine several metrics related to the financial health and capabilities of the impacted community. The indicators are compared to national benchmarks and are used to generate a score that is the average of six economic indicators: bond rating; net debt; MHI; local unemployment; property tax burden; and property tax collection rate within a service area. Lower Financial Capability Indicators (FCI) scores imply weaker economic conditions, and thus the increased likelihood that additional controls would cause substantial economic impact.

The results of the RI and the FCI are then combined in a Financial Capability Matrix to give an overall assessment of the permittee's financial capability. The result of this combined assessment can be used to establish an appropriate CSO control implementation schedule.

Significantly, EPA recognizes that the procedures set out in its guidance are not the only appropriate analyses to evaluate a community's ability to comply with CWA requirements. EPA's 2001 "Guidance: Coordinating CSO Long-term Planning with Water Quality Standards Reviews" emphasizes this by stating:

> *The 1997 Guidance "identifies the analyses States may use to support this determination [substantial and widespread impact] for water pollution control projects, including CSO LTCPs. States may also use alternative analyses and criteria to support this determination, provided they explain the basis for these alternative analyses and/or criteria* (U.S. EPA, 2001, p. 31)".

Likewise, EPA has recognized that its RI and FCI metrics are not the sole socioeconomic basis for considering an appropriate CSO compliance schedule. EPA's 1997 guidance recognizes that there may be other important factors in determining an appropriate compliance schedule for a community, and contains the following statement that authorizes communities to submit information beyond that which is contained in the guidance:

> *It must be emphasized that the financial indicators found in this guidance might not present the most complete picture of a permittee's financial capability to fund the CSO controls. … Since flexibility is an important aspect of the CSO Policy, permittees are encouraged to submit any additional documentation that would create a more accurate and complete picture of their financial capability* (U.S. EPA, 1997, p. 7).

Furthermore, in 2012, EPA released its "Integrated Municipal Stormwater and Wastewater Planning Approach Framework," which is supportive of a flexible approach to prioritizing projects with the greatest water quality benefits and the use of innovative approaches like GI (U.S. EPA, 2012). In November of 2014, EPA released its "Financial Capability Assessment Framework" clarifying the flexibility within their CSO guidance. Although EPA did not modify the metrics established in the 1997 guidance, the 2014 Framework reiterates that permittees are encouraged to supplement the core metrics with additional information that would "create a more accurate and complete picture of their financial capability" that may "affect the conclusion" of the analysis.

For example, EPA will consider:

- All CWA costs presented in the analysis described in the 1997 Guidance; and
- Safe Drinking Water Act obligations as additional information about a permittee's financial capability.

EPA will also consider alternative disaggregation of household income (e.g., quintiles), as well as economic indicators including, but not limited to:

- Actual poverty rates;
- Rate of home ownership;
- Absolute unemployment rates; and
- Projected, current, and historical wastewater (sewer and stormwater costs) as a percentage of household income, quintile, geography, or other breakdown.

The purpose of presenting these data is to demonstrate that the local conditions facing the municipality deviate from the national average to the extent that the metrics established in the 1997 guidance are inadequate for accurately assessing the municipality's financial capacity for constructing, operating, and implementing its LTCP Program in compliance with its regulatory mandates.

This section begins to explore affordability and financial capability concerns as outlined in the 1997 and 2001 guidance documents and the 2014 Framework, and analyzes the financial capability of NYC to make additional investments in CSO control measures, in light of the relevant financial indicators, the overall socioeconomic conditions in NYC, and the need to continue spending on other water and sewer projects. The analysis is presented both in terms of the EPA's Financial Capability Guidance Framework and by applying several additional factors that are relevant to NYC's unique socioeconomic. This affordability and financial capability section will be refined in each LTCP as project costs are further developed, and to reflect the latest available socioeconomic metrics.

9.6.b Residential Indicator (RI)

As discussed above, the first economic test from EPA's 1997 CSO guidance is the RI, which compares the average annual household water pollution control cost (wastewater and stormwater related charges) to the MHI of the service area. Average household wastewater cost can be estimated by approximating the residential share of wastewater treatment and dividing it by total number of households. In NYC, the wastewater bill is a function of water consumption. Therefore, average household costs and the RI are estimated based on application of Fiscal Year (FY) 2016 rates, to consumption rates by household type, as shown in Table 9-3.

Table 9-3. Residential Water and Wastewater Costs Compared to Median Household Income (MHI)

	Average Annual Wastewater Cost ($/year)	Wastewater RI (Wastewater Cost/MHI[(1)]) (%)	Total Water and Wastewater Cost ($/Year)	Water and Wastewater RI (Water and Wastewater Cost/MHI) (%)
Single-family[(2)]	648	**1.11**	1,055	**1.81**
Multi-family[(3)]	421	**0.72**	686	**1.18**
Average Household Consumption[(4)]	531	**0.91**	864	**1.48**
MCP[(5)]	617	**1.06**	1,005	**1.72**

Notes:

(1) Latest MHI data is $55,752 based on 2015 ACS data, estimated MHI adjusted to 2017 is $58,306.
(2) Based on 80,000 gallons/year consumption and Fiscal Year (FY) 2016 Rates.
(3) Based on 52,000 gallons/year consumption and FY2016 Rates.
(4) Based on average consumption across all metered residential units of 65,534 gallons/year and FY2016 Rates.
(5) Multi-family Conservation Plan (MCP) is a flat fee per unit for customers who will implement certain conservation measures.

As shown in Table 9-3, the RI for wastewater costs varies between 0.72 percent of MHI to 1.11 percent of MHI, depending on household type. Because DEP is a water and wastewater utility and ratepayers receive one bill for both charges, it is also appropriate to look at the total water and wastewater costs in considering the RI, which varies from 1.18 percent to 1.81 percent of MHI.

Based on this initial screen, current wastewater costs pose a low to mid-range economic impact according to the EPA's 1997 guidance. Several factors, however, limit use of MHI as a financial indicator for a city like New York. NYC has a large population and more than three million households. Even if a relatively small percentage of households were facing unaffordable water and wastewater bills, there would still be a significant number of households experiencing this hardship. For example, more than 668,000 households in NYC (about 21 percent of NYC's total households) earn less than $20,000 per year and have estimated wastewater costs well above 2 percent of their household income. Therefore, there are several other socioeconomic indicators to consider in assessing residential affordability, as described later in this section.

9.6.c Financial Capability Indicators (FCI)

The second phase of the 1997 CSO guidance develops the Permittee FCI, which examine several metrics related to the financial health and capabilities of the impacted community. The indicators are compared to national benchmarks and are used to generate a score that is the average of six economic indicators: bond rating, net debt, MHI, local unemployment, property tax burden, and property tax collection rate within a service area. Lower FCI scores imply weaker economic conditions and thus an increased likelihood that additional controls would cause substantial economic impact.

Table 9-4 summarizes the FCI scoring as presented in the 1997 CSO guidance. NYC's FCI score based on this test is presented in Table 9-5 and is further described below.

Table 9-4. Financial Capability Indicator Scoring

Financial Capability Metric	Strong (Score = 3)	Mid-range (Score = 2)	Weak (Score = 1)
Debt Indicator			
Bond rating (G.O. bonds, revenue bonds)	AAA-A (S&P) Aaa-A (Moody's)	BBB (S&P) Baa (Moody's)	BB-D (S&P) Ba-C (Moody's)
Overall net debt as percentage of full market value	Below 2%	2–5%	Above 5%
Socioeconomic Indicator			
Unemployment rate	More than 1 percentage point below the national average	+/- 1 percentage point of national average	More than 1 percentage point above the national average
MHI	More than 25% above adjusted national MHI	+/- 25% of adjusted national MHI	More than 25% below adjusted national MHI
Financial Management Indicator			
Property tax revenues as percentage of Full Market Property Value (FMPV)	Below 2%	2–4%	Above 4%
Property tax revenue collection rate	Above 98%	94–98%	Below 94%

Table 9-5. NYC Financial Capability Indicator Score

Financial Capability Metric	Actual Value	Score
Debt Indicators		
Bond rating (G.O. bonds)	AA (S&P) AA (Fitch) Aa2 (Moody's)	Strong/3
Bond rating (Revenue bonds)	AAA (S&P) AA+ (Fitch) Aa1 (Moody's)	
Overall net debt as percentage of FMPV	3.6%	Mid-range/2
G.O. Debt	$38.1B	
Market value	$1,064.2B	
Socioeconomic Indicators		
Unemployment rate (2016 annual average)	0.3% above the national average	Mid-range/2
NYC unemployment rate	5.7%	
United States unemployment rate	4.9%	
MHI as percentage of national average	100.0%	Mid-range/2
Financial Management Indicators		
Property tax revenues as percentage of FMPV	2.4%	Mid-range/2
Property tax revenue collection rate	98.6%	Strong/3
Permittee Indicators Score		2.3

Notes:
Debt and Market Value Information as of October 31, 2016.
G.O. Debt and market value from 2016 CAFR.

9.6.c.1 Bond Rating

The first financial benchmark is NYC's bond rating for both general obligation (G.O.) and revenue bonds. A bond rating performs the isolated function of credit risk evaluation. While many factors go into the investment decision-making process, bond ratings can significantly affect the interest that the issuer is required to pay, and thus the cost of capital projects financed with bonds. According to EPA's criteria – based on the ratings NYC has received from all three rating agencies [Moody's, Standard & Poor's (S&P), and Fitch Ratings] – NYC's financing capability is considered "strong" for this category.

NYC's G.O. rating and Municipal Water Finance Authority's (MWFA) revenue bond ratings are high due to prudent fiscal management, the legal structure of the system, and the Water Board's historic ability to raise water and wastewater rates. However, mandates over the last decade have significantly increased the leverage of the system, and future bond ratings could be impacted by further increases to debt beyond what is currently forecasted.

9.6.c.2 Net Debt as a Percentage of Full Market Property Value (FMPV)

The second financial benchmark measures NYC's outstanding debt as a percentage of FMPV. At the end of FY2016, NYC had more than $38.1B in outstanding G.O. debt, and the FMPV within NYC was $1,064.2B. This results in a ratio of outstanding debt to FMPV of 3.6 percent and a "mid-range" rating for this indicator. If $24.2B of MWFA revenue bonds that support the system are included, net debt as a percentage of FMPV increases to 5.8 percent, which results in a "weak" rating for this indicator. Furthermore, if NYC's $44.0B of additional debt that is related to other services and infrastructure is also included, the ratio further increases to 10.0 percent.

9.6.c.3 Unemployment Rate

For the unemployment benchmark, the 2016 annual average unemployment rate for NYC was compared to that for the U.S. NYC's 2016 unemployment rate of 5.2 percent is 0.3 percentage points higher than the national average of 4.9 percent (U.S. Bureau of Labor Statistics). Based on EPA guidance, NYC's unemployment benchmark would be classified as "mid-range." It is important to note that over the past two decades, NYC's unemployment rate has generally been significantly higher than the national average. Additionally, the unemployment rate measure identified in the 1997 financial guidance is a relative comparison based on a specific snapshot in time. It is difficult to predict whether the unemployment gap between the United States and NYC will widen, and it may be more relevant to look at longer term historical trends of the service area.

9.6.c.4 Median Household Income (MHI)

The MHI benchmark compares the community's MHI to the national average. Using American Community Survey (ACS) 2015 single-year estimates, NYC's MHI is $55,752 and the nation's MHI is $55,775. Thus, NYC's MHI is nearly 100 percent of the national MHI, resulting in a "mid-range" rating for this indicator. However, as discussed above, MHI does not provide an adequate measure of affordability or financial capability. MHI is a poor indicator of economic distress and bears little relationship to poverty, or other measures of economic need. In addition, reliance on MHI alone can be a misleading indicator of the affordability impacts in large and diverse cities like NYC.

9.6.c.5 Tax Revenues as a Percentage of Full Market Property Value (FMPV)

This indicator, which EPA also refers to as the "property tax burden," attempts to measure "the funding capacity available to support debt based on the wealth of the community," as well as "the effectiveness of management in providing community services." According to the NYC Property Tax Annual Report issued for FY2017, NYC had billed $25.8B in real property taxes against a $1,064.2B FMPV, which amounts to 2.4 percent of FMPV. For this benchmark, NYC received a "mid-range" score. This figure does not include water and wastewater revenues. Including FY2016 system revenues ($3.9B) would increase the ratio to 2.8 percent of FMPV.

This indicator, whether including or excluding water and wastewater revenues, is misleading because NYC obtains about 44 percent of its tax revenues from property taxes, meaning that taxes other than property taxes (e.g., income taxes, sales taxes) accounted for nearly 56 percent of the locally-borne NYC tax burden.

9.6.c.6 Property Tax Collection Rate

The property tax collection rate is a measure of "the efficiency of the tax collection system and the acceptability of tax levels to residents." The FY2017 NYC Property Tax Annual Report indicates NYC's total property tax levy was $25.8B, of which 98.6 percent was collected, resulting in a "strong" rating for this indicator.

DEP notes, however, that the processes used to collect water and wastewater charges and the enforcement tools available to water and wastewater agencies differ from those used to collect and enforce real property taxes. The NYC Department of Finance (DOF), for example, can sell real property tax liens on all types of non-exempt properties to third parties, who can then take action against the delinquent property owners. DEP, in contrast, can sell liens on multi-family residential and commercial buildings whose owners have been delinquent on water bills for more than one year, but it cannot sell liens on single-family homes. Thus, the real property tax collection rate does not accurately reflect DEP's ability to collect the revenues used to support water supply and wastewater capital spending.

9.6.d Summary of the Phase 1 and Phase 2 Indicators

The results of the Phase 1 (Residential Indicator) and the Phase 2 (Permittee Financial Capability Indicators) evaluations are combined in the Financial Capability Matrix (see Table 9-6), to evaluate the level of financial burden the current CWA program costs may impose on NYC. Based on a RI score of 0.90 percent (using average household consumption), and a FCI score of 2.3, NYC's Financial Capability Matrix score is "Low Burden." The score falls in the "Medium Burden" category when considering the higher RI scores of 1.09 percent and 1.04 percent for single-family and multi-family conservation plan households, respectively.

Table 9-6. Financial Capability Matrix

Permittee Financial Capability Indicators Score (Socioeconomic, Debt, and Financial Indicators)	Residential Indicator (Cost Per Household as a % of MHI)		
	Low Impact (Below 1.0%)	**Mid-Range (Between 1.0 and 2.0%)**	**High Impact (Above 2.0%)**
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	**Low Burden**	Medium Burden	High Burden
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

9.6.e Socioeconomic Considerations in the New York City Context

As encouraged by EPA's financial capability assessment guidance, several additional factors of particular relevance to NYC's unique socioeconomic character are provided in this section to aid in the evaluation of affordability implications of the costs associated with anticipated CWA compliance on households in NYC.

9.6.e.1 Income Levels

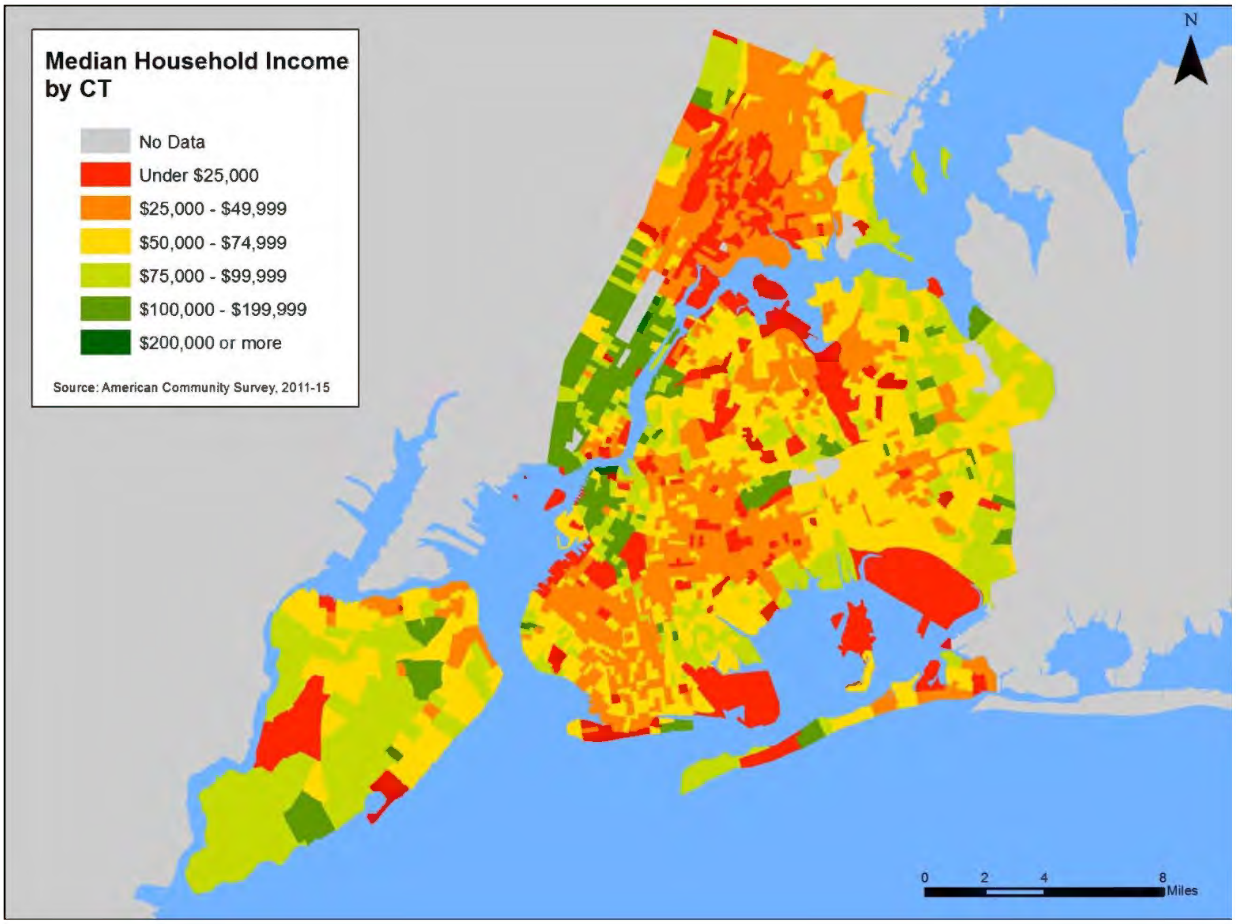
In 2015, the latest year for which Census data is available, the MHI in NYC was $55,752. As shown in Table 9-7, across the NYC boroughs, MHI ranged from $35,176 in the Bronx to $75,575 in Manhattan. Figure 9-2 shows that income levels also vary considerably across NYC neighborhoods, and there are several areas in NYC with high concentrations of low-income households.

Table 9-7. Median Household Income

Location	2015 (MHI)
United States	$55,775
New York City	$55,752
Bronx	$35,176
Brooklyn	$51,141
Manhattan	$75,575
Queens	$60,422
Staten Island	$71,622

Source: U.S. Census Bureau 2015 ACS 1-Year Estimates.

As shown in Figure 9-3, after 2008, MHI in NYC actually decreased for two years, and it took several years to recover to the 2008 level. In addition, the cost of living continued to increase during this period. When adjusting for inflation (2017 dollars) using the Bureau of Labor Statistics Consumer Price Index, MHI in NYC declined by 2 percent from 2006 through 2015 (see Figure 9-3).

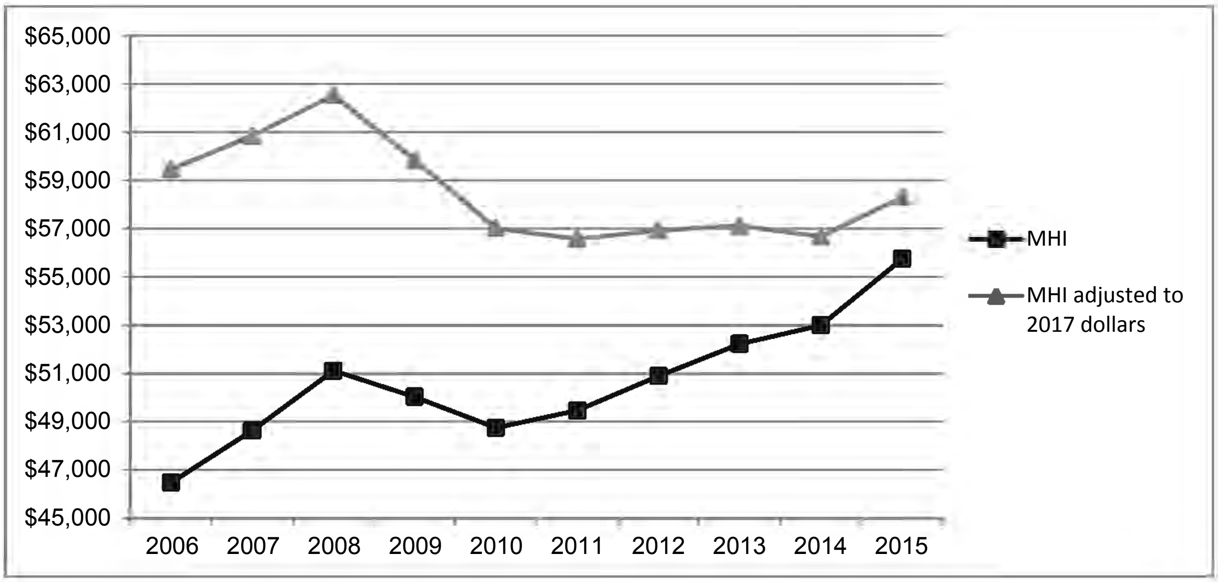


Source: U.S. Census Bureau 2011-2015 ACS 5-Year Estimates.

Figure 9-2. Median Household Income by Census Tract

9.6.e.2 Income Distribution

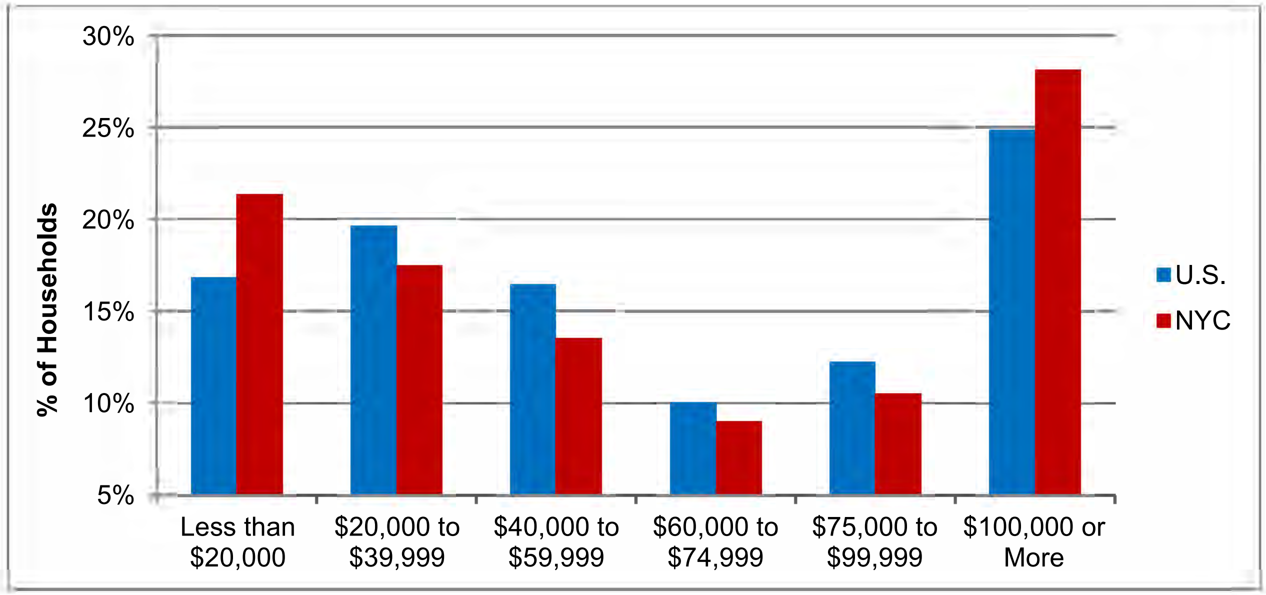
NYC currently ranks as one of the most unequal cities in the United States (U.S.) in terms of income distribution. NYC's income distribution highlights the need to focus on metrics other than citywide MHI to capture the disproportionate impact on households in the lowest income brackets. It is clear that MHI does not represent "the typical household" in NYC. As shown in Figure 9-4, incomes in NYC are not clustered around the median. Rather, a greater percentage of NYC households exist at either end of the economic spectrum. Also, the percentage of the population with middle-class incomes between $20,000 and $100,000 is 7.8 percent less in NYC than in the United States.



Source: U.S. Census Bureau 2006 through 2015 ACS 1-Year Estimates, Bureau of Labor Statistics Consumer Price Index.

Figure 9-3. NYC Median Household Income Over Time

As shown in Table 9-8, the income level that defines the upper end of the Lowest Quintile (i.e., the lowest 20 percent of income earners) in NYC is $18,681, compared to $22,824 nationally. This further demonstrates that NYC has a particularly vulnerable, and sizable, lower income population. Table 9-9 compares the average household consumption wastewater RI and wastewater plus water RI for the Lowest Quintile, Second Quintile (i.e., the lowest 40 percent of income earners), and MHI for NYC using FY2016 rates. As shown in this table, households in the Lowest Quintile have a wastewater RI of at least 2.8 percent, which easily exceeds EPA's "High Financial Impact" threshold of 2.0 percent, and the combined water and wastewater RI is over 4.5 percent.



Source: U.S. Census Bureau 2015 ACS 1-Year Estimates.

Figure 9-4. Income Distribution for NYC and U.S.

Table 9-8. Household Income Quintile Upper Limits in New York City and the United States (2015 Dollars)

Quintile	New York City	United States
Lowest 20 Percent	$18,681	$22,824
Lowest 40 Percent	$41,260	$43,576
Lowest 60 Percent	$72,007	$70,323
Lowest 80 Percent	$124,848	$112,145
Lower Limit of Top 5 Percent	$250,000	$210,737

Source: U.S. Census Bureau 2015 ACS 1-Year Estimates.

Table 9-9. Average Household Consumption Residential Indicator for Different Income Levels using FY2017 Rates

Income Level	Wastewater RI(1)	Water and Wastewater RI(1)
Lowest 20 Percent Upper Limit	2.78%	4.53%
Lowest 40 Percent Upper Limit	1.26%	2.05%
MHI	0.91%	1.48%

Note:
(1) RI calculated by dividing average household consumption annual wastewater bill ($531 using FY2017 rates) and wastewater and water bill ($864 using FY2017 rates) by income level values adjusted to 2017 dollars.

9.6.e.3 Poverty Rates

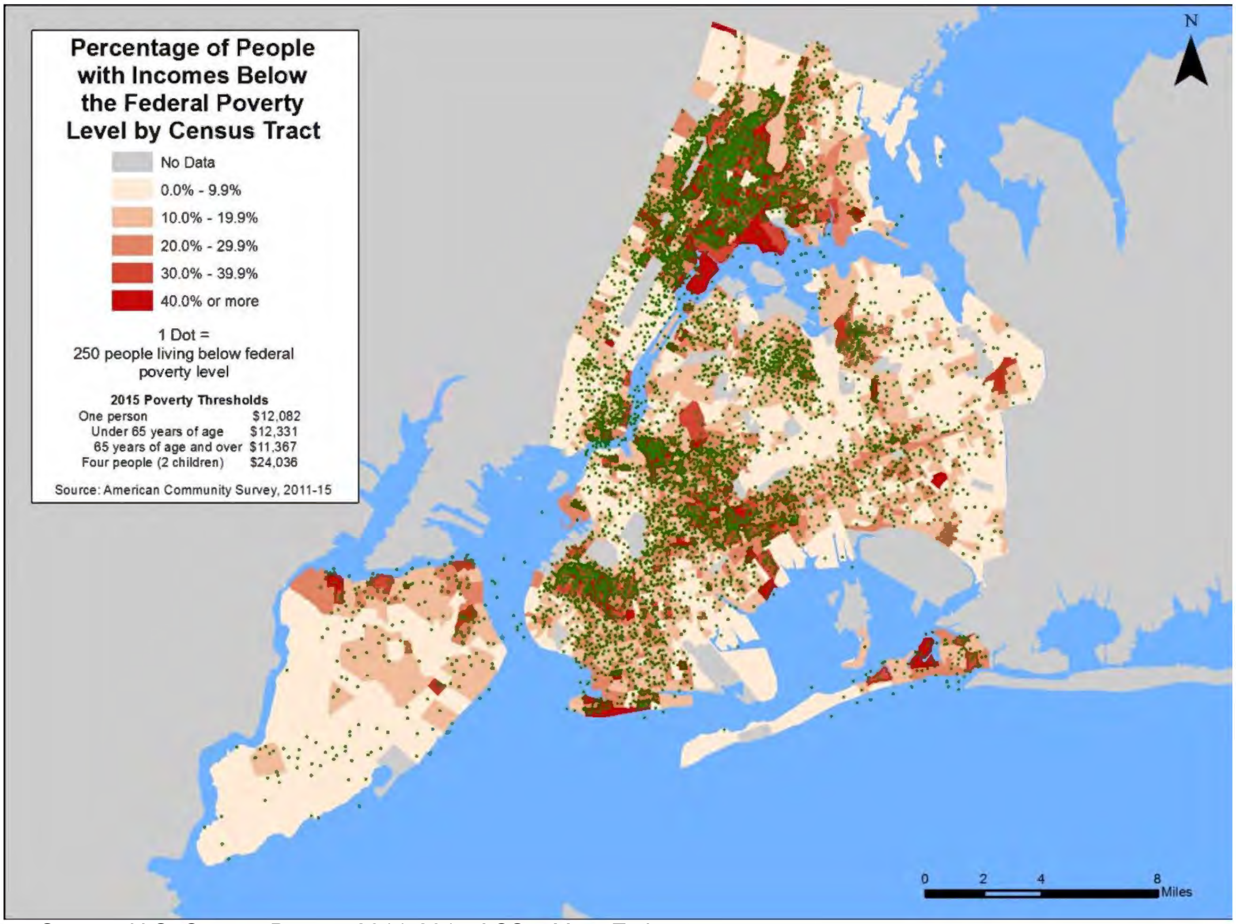
Based on the latest available Census data, 20 percent of NYC residents are living below the federal poverty level (almost 1.7 million people, which, for reference, is greater than the entire population of Philadelphia). This is significantly higher than the national poverty rate of 14.7 percent, despite similar MHI levels for NYC and the U.S. as a whole. As shown in Table 9-10, across the NYC boroughs, poverty rates vary from 14.4 percent in Staten Island to 30.4 percent in the Bronx.

Table 9-10. NYC Poverty Rates

Location	Percentage of Residents Living Below the Federal Poverty Level
United States	14.7
New York City	20.0
Bronx	30.4
Brooklyn	22.3
Manhattan	17.6
Queens	13.8
Staten Island	14.4

Source: U.S. Census Bureau 2015 ACS 1-Year Estimates.

Figure 9-6 shows that poverty rates also vary across neighborhoods, with several areas in NYC having a relatively high concentration of people living below the federal poverty level. Each green dot represents 250 people living in poverty. While poverty levels are highly concentrated in some areas, smaller pockets of poverty exist throughout NYC. Because an RI that relies on MHI alone fails to capture these other indicators of economic distress, two cities with similar MHI could have disparate levels of poverty.



Source: U.S. Census Bureau 2011-2015 ACS 5-Year Estimates

Figure 9-5. Poverty Clusters and Rates in NYC

9.6.e.4 Cost of Living and Housing Burden

NYC residents face relatively high costs for nondiscretionary items (e.g., housing, utilities) compared to individuals living almost anywhere else in the nation, as shown in Figure 9-7. While water costs are slightly less than the average for other major United States cities, the housing burden is significantly higher.

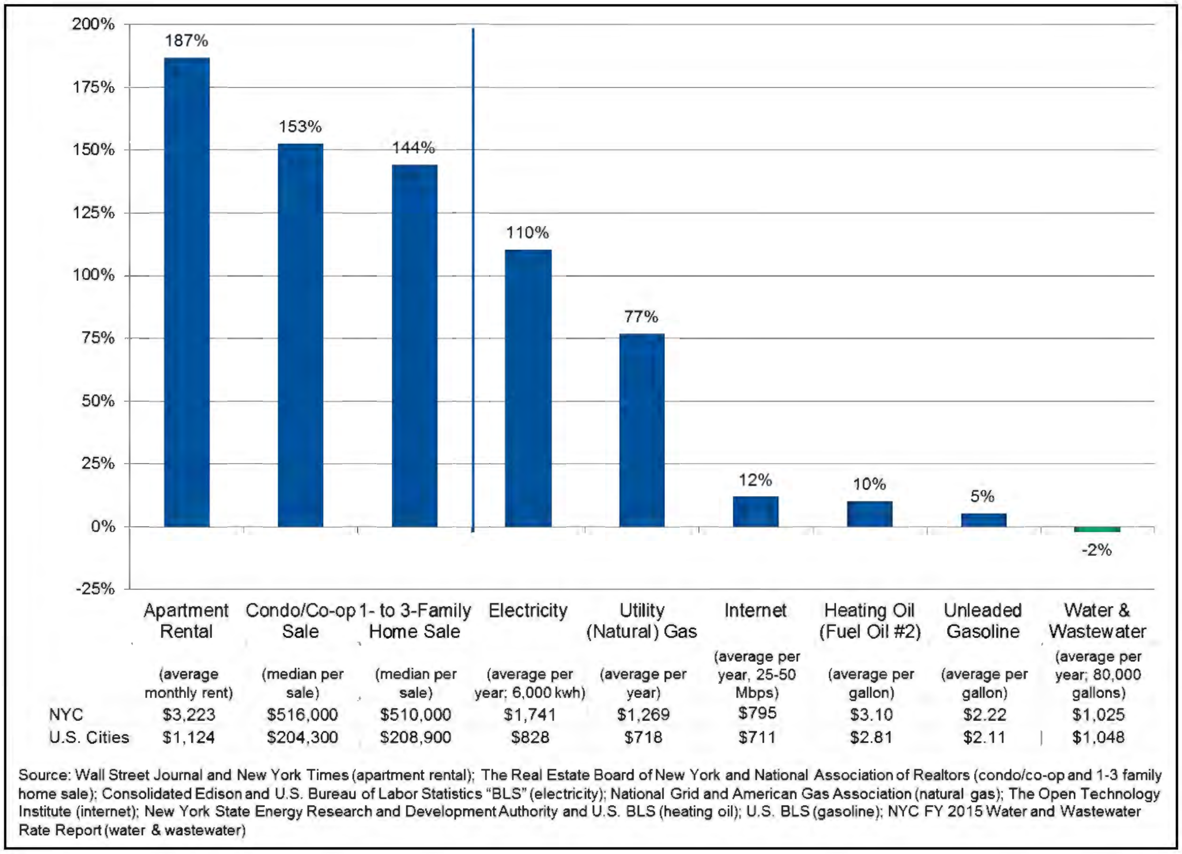


Figure 9-6. Comparison of Costs between NYC and other U.S. Cities

As noted above, the cost of living in NYC is high compared to the average cost of living of other cities in the U.S. In 2016, NYC's Cost of Living Index (COLI)[1] was 167, or 67 percent higher than the average cost of living of other cities. When adjusted for cost of living, the purchasing power of a MHI of $58,306 is reduced to $34,914 in NYC (2017 dollars). Adjusting MHI for cost of living increases the RI ranking from a low impact to a mid-range impact, resulting in an elevated Financial Capability Score from a Low Burden to a Medium Burden. For average household consumption, the RI increases from 0.91 to 1.52 for wastewater and 1.48 to 2.47 for water and wastewater. Table 9-11 displays the RI adjusted for 2017 dollars and cost of living in NYC.

[1] The Council for Community and Economic Research (C2ER)'s Cost of Living Index (COLI) measures how urban areas compare in the cost of maintaining a standard of living appropriate for moderately affluent professional and managerial households. The COLI measures relative price levels for consumer goods and services in over 300 participating areas.

Table 9-11. Residential Water and Wastewater Costs compared to Median Household Income (MHI) and MHI with Cost of Living Adjustment (COLA)

	Wastewater RI (Wastewater Bill/MHI[(1)]) (%)		Water and Wastewater RI (Water and Wastewater Bill/MHI[(1)]) (%)	
	MHI	**MHI COLA**	**MHI**	**MHI COLA**
Single-family[(2)]	1.11	1.86	1.81	3.02
Multi-family[(3)]	0.72	1.21	1.18	1.96
Average Household Consumption[(4)]	0.91	1.52	1.48	2.47
MCP[(5)]	1.06	1.77	1.72	2.88

Notes:
(1) Latest MHI data is $55,752 Based on 2015 ACS data, estimated MHI adjusted to 2017 is $58,306, adjusting 2017 MHI for cost of living, MHI is $34,914.
(2) Based on 80,000 gallons/year consumption and FY2016 Rates.
(3) Based on 52,000 gallons/year consumption and FY2016 Rates.
(4) Based on average consumption across all metered residential units of 65,534 gallons/year and FY2016 Rates.
(5) Multi-family Conservation Plan is a flat fee per unit for customers who will implement certain conservation measures.

Approximately 68 percent of all households in NYC are renter-occupied, compared to about 37 percent of households nationally. In recent years, affordability concerns have been compounded by the fact that gross median rents in NYC have increased, while median renter income has declined. Although renter households may not directly receive water and wastewater bills, these costs are often indirectly passed onto them in the form of rent increases. Increases in water and sewer costs that are borne by landlords and property owners could also indirectly impact tenants, as it may limit the ability to perform necessary maintenance. Although it can be difficult to discern precisely how much the water and sewer rates impact every household, particularly those in multi-family buildings and affordable housing units, EPA's 1997 Guidance requires that all households in the service area be identified and used to establish an average cost per household for use in financial capability and affordability analyses. This LTCP financial capability assessment applies a lower average annual wastewater cost for households in multi-family buildings, due to a lower annual consumption value as compared to single-family households, and also examines average consumption across the board.

Most government agencies consider housing costs of between 30 percent and 50 percent of household income to be a moderate burden in terms of affordability; costs greater than 50 percent of household income are considered a severe burden. A review of 2015 ACS Census data shows approximately 18 percent of NYC households (over 176,000 households) spent between 30 percent and 50 percent of their income on housing, while about 19 percent (almost 184,000 households) spent more than 50 percent. This compares to 14 percent of households nationally that spent between 30 percent and 50 percent of their income on housing and 10 percent of households nationally that spent more than 50 percent. This means that 37 percent of households in NYC versus 24 percent of households nationally spent more than 30 percent of their income on housing costs.

New York City Housing Authority (NYCHA) is responsible for 177,634 affordable housing units, which accounts for 9 percent of the total renter households in NYC. NYCHA paid approximately $188M for water and wastewater in FY2016. This total represents approximately 5.6 percent of its $3.38B operating budget. More than 90 percent of NYCHA billings are calculated under the Multi-family Conservation Program (MCP) rate. Even a small increase in rates could potentially impact the agency's ability to provide affordable housing and/or other programs and, in recent years, NYCHA has experienced funding cuts and operational shortfalls, further exacerbating its operating budget.

In sum, the financial capability assessment for NYC must look beyond the EPA 1997 Guidance, and must additionally consider the socioeconomic conditions discussed in this section including NYC's income distribution, water and wastewater rate impacts on households with income below the median level, poverty rates, housing costs, total tax burden, and long-term debt. Because many utilities provide both drinking and wastewater services and households often pay one consolidated bill, financial capability and affordability must consider total water and wastewater spending. Scheduling and priorities for future spending should consider the data presented here and below with respect to historical and future commitments.

9.6.f Background on Historical DEP Spending

As the largest combined water and wastewater utility in the nation, DEP provides over 1 billion gallons of drinking water daily to more than eight million NYC residents, visitors and commuters, as well as to one million upstate customers. DEP maintains over 2,000 square miles of watershed comprised of 19 reservoirs, three controlled lakes, several aqueducts, and 6,600 miles of water mains and distribution pipes. DEP also collects and treats wastewater. Averaged across the year, the system treats approximately 1.3 billion gallons of wastewater per day collected through 7,500 miles of sewers, 95 pumping stations and 14 in-city WWTPs. During wet-weather conditions, the system can treat up to 3.5 billion gallons per day of combined storm and sanitary flow. In addition to its WWTPs, DEP also has four CSO storage facilities. In 2010, DEP launched a 20-year, $2.4B GI program, of which $1.5B will be funded by DEP, with the remainder funded through private partnerships.

9.6.f.1 Historical Capital and Operations and Maintenance Spending

As shown in Figure 9-8, from FY2007 through FY2016, 51 percent of DEP's capital spending was for wastewater and water mandates. Figure 9-9 identifies associated historical wastewater and water operating expenses from FY2007 through FY2016, which have generally increased over time, reflecting the additional operational costs associated with NYC's investments. Many projects have been important investments that safeguard our water supply and improve the water quality of our receiving waters in the Harbor and its estuaries. These mandates and associated programs are described below.

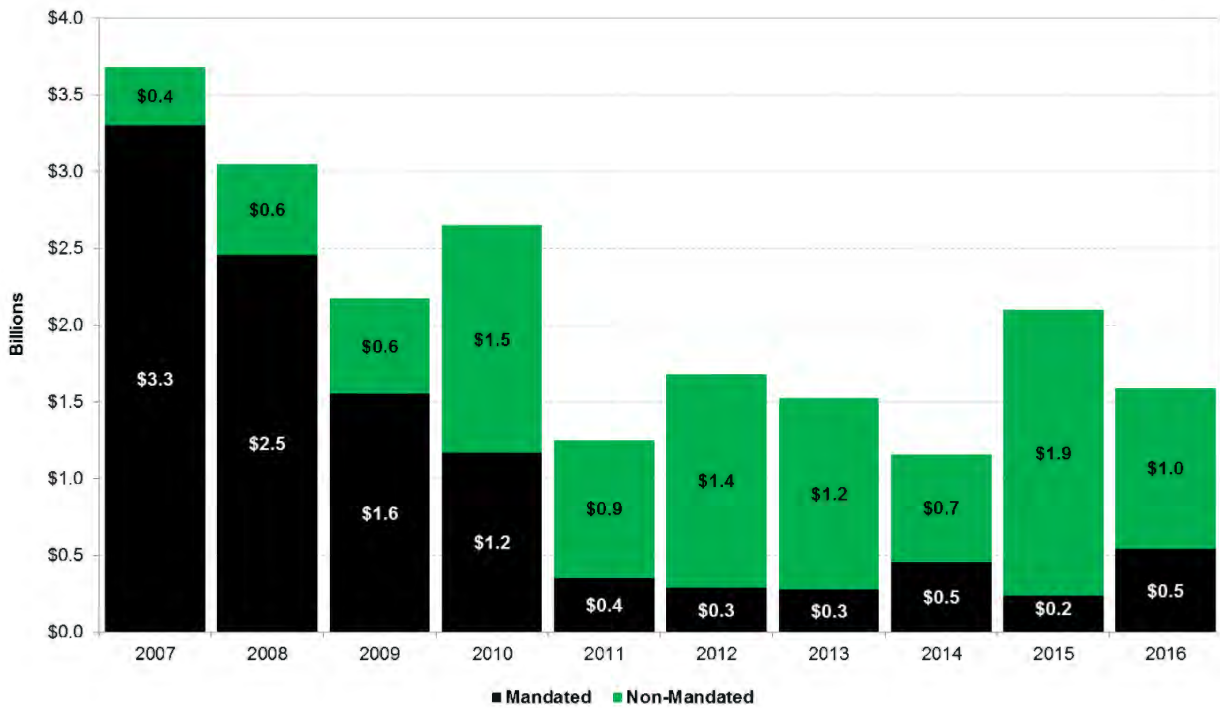


Figure 9-7. Historical Capital Commitments

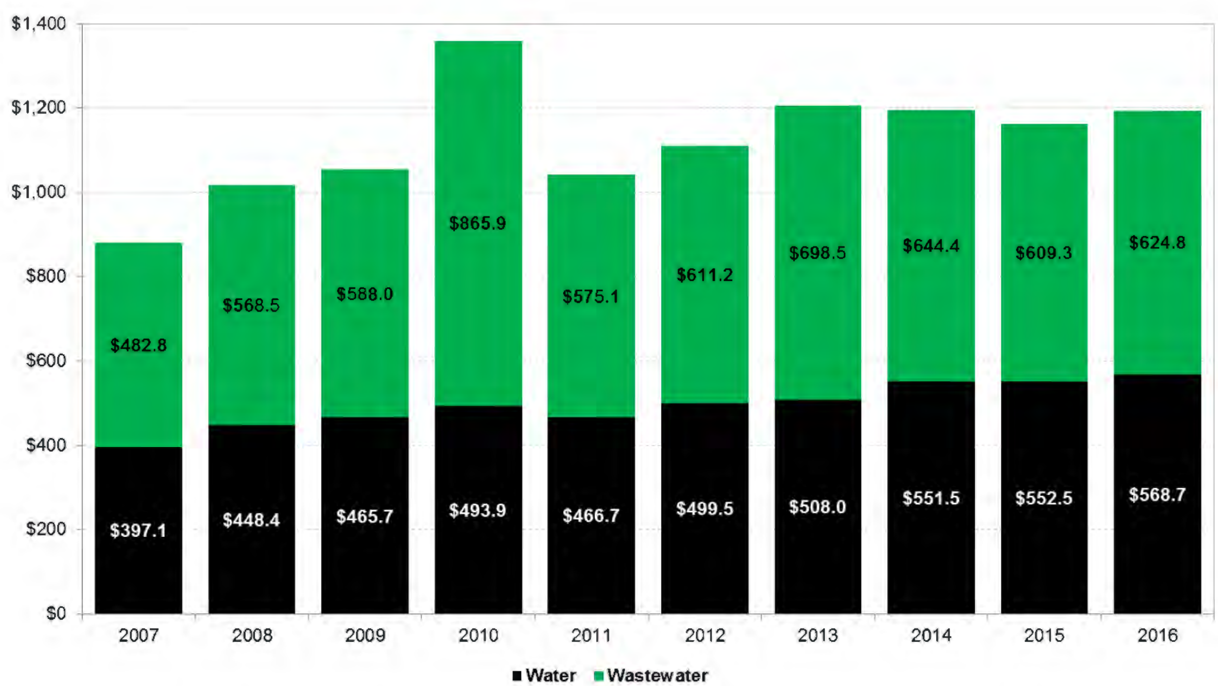


Figure 9-8. Historical Operating Expenses

9.6.f.2 Wastewater Mandated Programs

DEP is subjected to multiple mandates to comply with federal and state laws and permits. The following wastewater programs and projects represent a few of the more significant projects that have been initiated, but does not represent an exhaustive list of all currently mandated projects:

- CSO Abatement and Stormwater Management Programs

  DEP has initiated a number of projects to reduce CSOs, including construction of CSO abatement facilities, optimization of the wastewater system to reduce the volume of CSO discharge, controls to prevent floatables and debris that enters the combined wastewater system from being discharged, dredging of CSO sediments that contribute to low DO and poor aesthetic conditions, and other water quality-based enhancements to enable attainment of the WQS. These initiatives impact both the capital investments that DEP must make, and the agency's O&M expenses. Historical commitments and those currently in DEP's ten-year capital plan for CSOs are estimated to cost $4.5B (and an additional $1.5B for the GI program). DEP expects that additional investments in stormwater controls will be required, as they will be for other NYC agencies, pursuant to MS4 requirements.

- Biological Nitrogen Removal

  In 2006, NYC entered into a Consent Judgment with DEC, which required DEP to upgrade five WWTPs to reduce nitrogen discharges and comply with draft SPDES nitrogen limits. Pursuant to a modification and amendment to the Consent Judgment in 2011, DEP agreed to upgrade three additional WWTPs and to install additional nitrogen controls at one of the WWTPs included in the original Consent Judgment. As in the case of CSOs and stormwater, these initiatives include capital investments made by DEP (over $1.2B to-date and an additional $127M in the 10-year capital plan), as well as O&M expenses. (Chemicals alone in FY2017 are estimated to be about $16M per year.)

- Wastewater Treatment Plant Upgrades

  The Newtown Creek WWTP has been upgraded to secondary treatment pursuant to the terms of a Consent Judgment with DEC. The total cost of the upgrade is estimated to be $5B. In 2011, DEP certified that the Newtown Creek WWTP met the effluent discharge requirements of the CWA, bringing all 14 WWTPs into compliance with the secondary treatment requirements.

9.6.f.3 Drinking Water Mandated Programs

Under the federal Safe Drinking Water Act and the New York State Sanitary Code, water suppliers are required to either filter their surface water supplies or obtain and comply with a determination from EPA that allows them to avoid filtration. In addition, EPA promulgated a rule known as Long Term 2 (LT2) that required that unfiltered water supplies receive a second level of pathogen treatment (e.g., ultraviolet [UV] treatment in addition to chlorination) by April 2012. LT2 also requires water suppliers to cover or treat water from storage water reservoirs. The following DEP projects have been undertaken in response to these mandates:

- Croton Watershed - Croton Water Treatment Plant

  Historically, NYC's water has not been filtered because of its good quality and long retention times in reservoirs. However, more stringent federal standards relating to surface water treatment resulted in a federal court consent decree, which mandated the construction of a full-scale water treatment facility to filter water from NYC's Croton watershed. Construction on the Croton Water Treatment Plant began in late 2004, and the facility began operating in 2015. To-date, DEP has spent roughly $3.3B in capital costs. Since commencement of operations, DEP is also now incurring annual expenses for labor, power, chemicals, and other costs associated with plant O&M. For FY2015, O&M costs are estimated to be about $12M.

- Catskill/Delaware Watershed - Filtration Avoidance Determination

  Since 1993, DEP has been operating under a series of Filtration Avoidance Determinations (FADs), which allow NYC to avoid filtering surface water from the Catskill and Delaware systems. In 2007, EPA issued a new FAD (2007 FAD), which requires NYC to take certain actions over a ten-year period to protect the Catskill and Delaware water supplies. In 2014, the NYSDOH issued mid-term revisions to the 2007 FAD. Additional funding was added to the Capital Improvement Plan (CIP) to support these mid-term FAD revisions. DEP has committed about $1.7B to-date and anticipates that expenditures for the next FAD will amount to $900M.

- UV Disinfection Facility

  In January 2007, DEP entered into an Administrative Consent Order (UV Order) with EPA pursuant to EPA's authority under LT2 requiring DEP to construct a UV facility by 2012. Since late 2012, water from the Catskill and Delaware watersheds has been treated at DEP's new UV disinfection facility in order to achieve Cryptosporidium inactivation. To-date, capital costs committed to the project amount to $1.6B. DEP is also incurring related annual expenses for property taxes, labor, power, and other costs related to plant O&M. FY2016 O&M costs were $23M, including taxes.

9.6.f.4 Other: State of Good Repair Projects

In addition to mandated water and wastewater programs, DEP has invested in critical projects related to maintenance and repair of its assets and infrastructure.

9.6.f.5 Initiatives to Reduce Operational Expenditures

To mitigate rate increases, DEP has diligently managed operating expenses and has undertaken an agency-wide program to review and reduce costs and to improve the efficiency of the agency's operations. DEP has already implemented changes through this program that will result in a financial benefit of approximately $98.2M in FY2016.

9.6.g History of DEP Water and Sewer Rates

9.6.g.1 Background on DEP Rates

The NYC Water Board is responsible for setting water and wastewater rates sufficient to cover the costs of operating NYC's water supply and wastewater systems (the System). Water supply costs include those associated with water treatment, transmission, distribution, and maintaining a state of good repair. Wastewater service costs include those associated with wastewater conveyance and treatment, stormwater service, and maintaining a state of good repair. The NYC MWFA issues revenue bonds to finance NYC's water and wastewater capital programs, and the costs associated with debt service consume a significant portion of the system revenues. As shown in Figure 9-10, increases in capital expenditures have resulted in increased debt. While confirmed expenditures may decline over the next few years, debt service continues to be on the rise in future years, and will continue to do so with future spending commitments. In FY2016, debt service represented a large percentage (approximately 44 percent) of the System's operating budget.

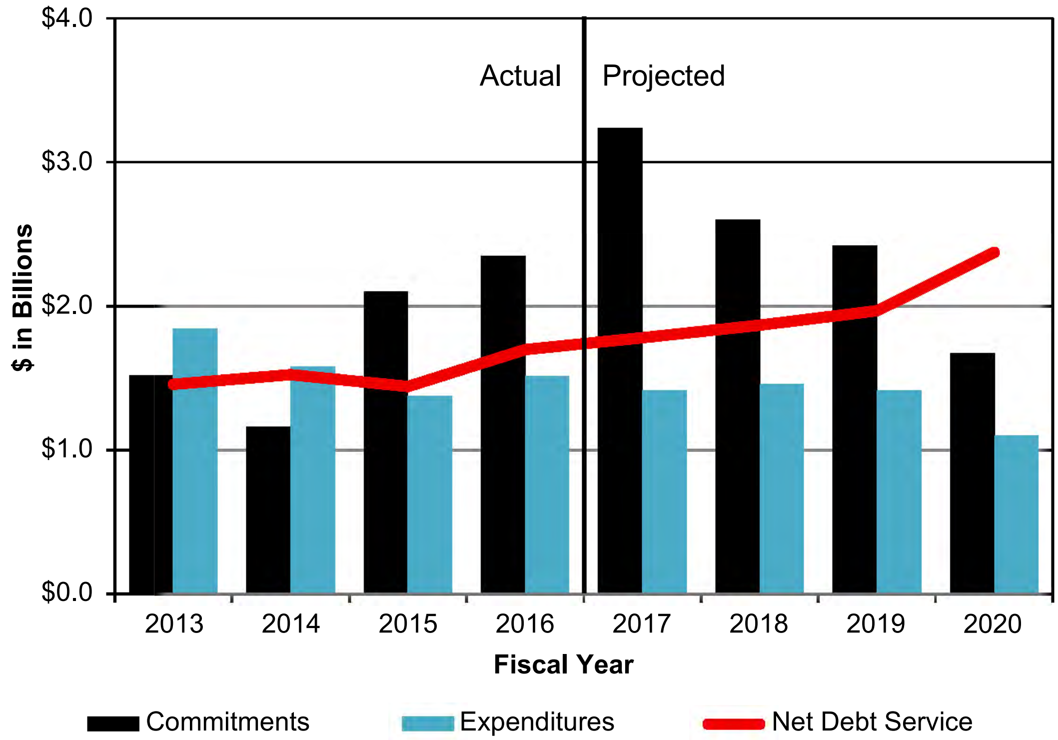


Figure 9-9. Past Costs and Debt Service

For FY2017, most customers will be charged a proposed uniform water rate of $0.51 per 100 gallons of water. Wastewater charges are levied at 159 percent of water charges ($0.81 per 100 gallons). These are the same as FY2016 rates. A small percentage of properties are billed a fixed rate. Under the MCP, some properties are billed at a fixed per-unit rate if they comply with certain conservation measures. Some non-profit institutions are also granted exemptions from water and wastewater charges on the condition that their consumption is metered and falls within specified consumption threshold levels. Select properties are also granted exemptions from wastewater charges (i.e., pay only for water services) if they can prove that they do not burden the wastewater system (e.g., they recycle wastewater for subsequent use on-site).

9.6.g.2 Historical Rate Increases to meet Cost of Service

Figure 9-11 shows how water and sewer rates have increased over time and how that compares with system demand and population. Despite a rise in population, water consumption rates have been falling since the 1990s due to metering and increases in water efficiency measures. The increase in population has not kept pace with the increase in the cost of service associated with DEP's capital commitments over the same time period. Furthermore, the total cost of service is spread across a smaller demand number due to the decline in consumption rates. As a result, DEP has had to increase its rates to meet the cost of service. DEP operations are funded almost entirely through rates paid by our customers. From FY2000 to FY2016, water and sewer rates have risen 193 percent, almost tripling. This is despite the fact that DEP has diligently reduced operating costs and improved the efficiency of the agency's operations. The water and sewer rates have remained constant since FY2016.

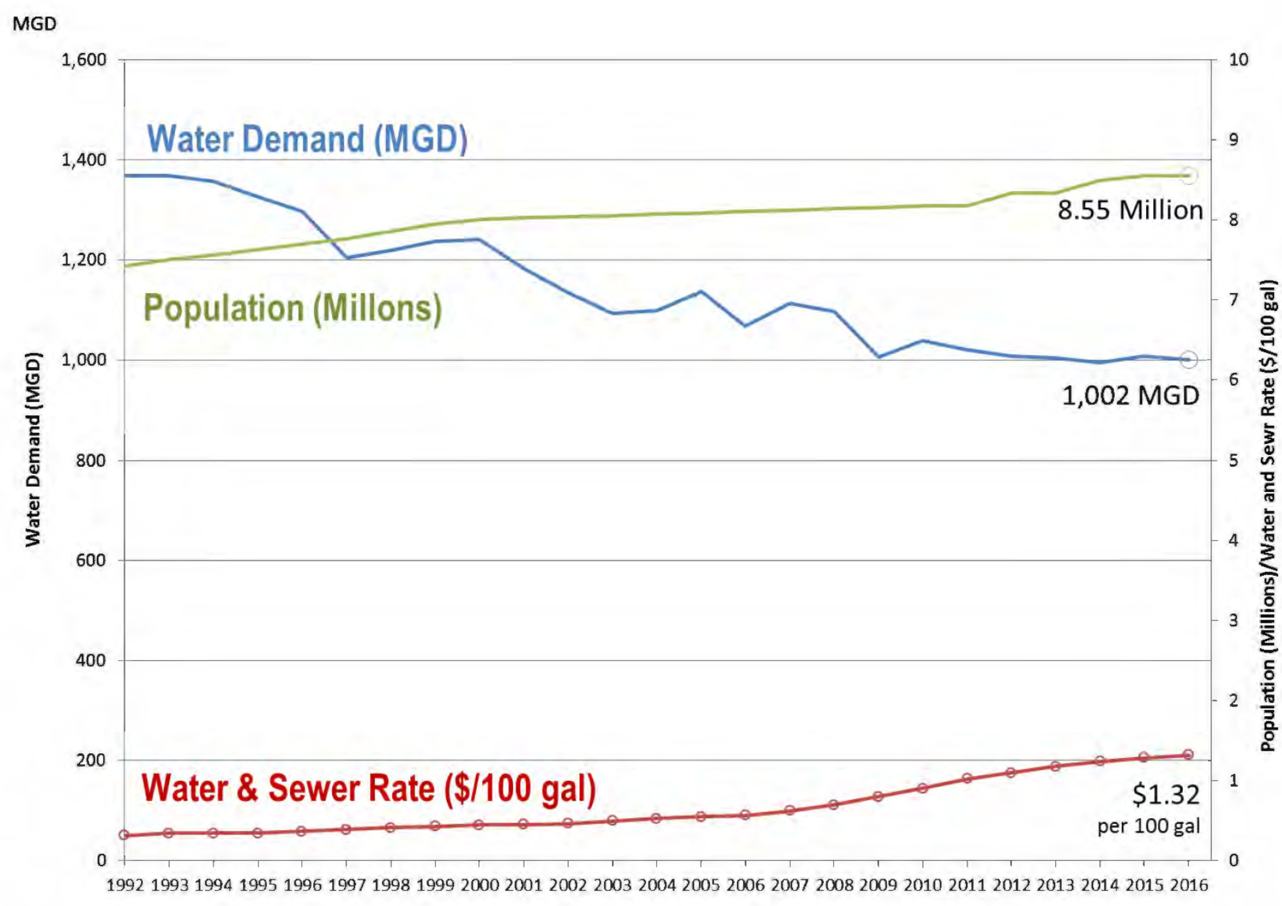


Figure 9-10. Population, Consumption Demand, and Water and Sewer Rates over Time

9.6.g.3 Customer Assistance Programs

Several programs provide support and assistance for customers in financial distress, and DEP continues to expand these programs. The Safety Net Referral Program uses an existing network of NYC agency and not-for-profit programs to help customers with financial counseling, low-cost loans, and legal services. The Water Debt Assistance Program provides temporary water debt relief for qualified property owners who are at risk of mortgage foreclosure. While water and wastewater charges are a lien on the property served, and NYC has the authority to sell these liens to a third party (lienholder) in a process called a lien sale, DEP offers payment plans for customers who may have difficulty paying their entire bill at one time. DEP and the Water Board also recently created a Home Water Assistance Program to assist low-income homeowners. For this program, DEP partnered with the NYC Human Resources Administration, which administers the Federal Home Energy Assistance Program (HEAP), and DOF, which provides tax exemptions to senior and disabled homeowners, to identify low-income homeowners who receive HEAP assistance and/or tax exemptions and, thus, are automatically eligible to receive a credit on their DEP bill.

There is also a new Multi-family Water Assistance Program for Affordable Housing, where a $250 credit per housing unit would be issued for qualified projects identified by the NYC Housing Preservation and Development. The credit reflects 25 percent of the MCP rate, on which many of the eligible properties are billed. Up to 40,000 housing units will receive this credit, providing $10M of assistance.

9.6.g.4 Future System Investment

Over the next decade, the percentage of mandated project costs already identified in the CIP is anticipated to decrease, but DEP will be funding critical state of good repair projects and other projects needed to maintain NYC's infrastructure to deliver clean water and treat wastewater. Accordingly, as of April 2017, DEP's capital budget for FY2017 through FY2027 is $21.3B. This budget includes projected capital commitments averaging $1.9B per year through FY2027, which is similar to the average spending from FY2007 through FY2016 shown in Figure 9-8 above. In addition, DEP anticipates that there will be additional mandated investments as a result of MS4 compliance, proposed modifications to DEP's in-city WWTP SPDES permits, Superfund remediation, and the 2014 CSO BMP Order. It is also possible that DEP will be required to construct a cover for Hillview Reservoir, as well as other additional wastewater and drinking water mandates. The inclusion of this additional spending is supported by the EPA financial capability assessment guidance in order to create a more accurate and complete picture of NYC's financial capability. Additional details for anticipated future mandated and non-mandated programs are provided below.

9.6.g.5 Potential or Unbudgeted Wastewater Regulations

- Municipal Separate Storm Sewer System (MS4) Permit Compliance

  DEC issued a citywide MS4 permit to NYC for all City agencies, effective August 1, 2015, that covers NYC's municipal separate stormwater system.

  DEP is required to coordinate efforts with other NYC agencies and to develop a stormwater management program plan for NYC to facilitate compliance with the permit. This plan will include the necessary legal authority to implement and enforce the stormwater management program, and will develop enforcement and tracking measures and provide adequate resources to comply with the MS4 permit. Some of the stormwater control measures identified through this plan may result in increased costs to DEP, and those costs will be more clearly defined upon completion of the plan. The permit also requires NYC to conduct fiscal analysis of the capital and O&M expenditures necessary to meet the requirements of this permit, including any required development, implementation and enforcement activities, within three years of the effective permit date.

The full MS4 permit compliance costs are yet to be estimated. DEP's annual historic stormwater capital and O&M costs have averaged $131.6M. However, given the more stringent requirements in the MS4 permit, future MS4 compliance costs are anticipated to be significantly higher than DEP's current stormwater program costs. The future compliance costs will also be shared by other NYC agencies that are responsible for managing stormwater. The projected cost for stormwater and CSO programs in other major urban areas such as Philadelphia and Washington, D.C. are $2.4B and $2.6B, respectively. According to preliminary estimates completed by Washington District Department of Environment, the MS4 cost could be $7B (green build-out scenario) or as high as $10B (traditional infrastructure) to meet the TMDLs. In FY2016, Philadelphia's FY16 Stormwater Management Program budget was $99.5M (MS4 Permit Annual Report, 2016). Washington D.C. reported total MS4 expenditures of $11.7M in 2016 and a budget of $26.7M for FY17 (MS4 Permit Annual Report, 2017).

Existing data for estimating future NYC MS4 compliance costs is limited. Based on estimates from other cities, stormwater retrofit costs are estimated between $25,000 and $35,000 per impervious acre on the low end, to between $100,000 and $150,000 on the high end. Costs would vary based on the type and level of control selected. For the purposes of this analysis, a stormwater retrofit cost of $35,000 per impervious acre was assumed, which results in estimated MS4 compliance costs of about $2B for NYC.

- SPDES Permit Compliance

On November 1, 2015, newly modified SPDES permits for DEP's 14 WWTPs went into effect. These modifications to the SPDES permits may have significant monetary impacts to DEP and include the following requirements:

- New effluent ammonia limits at many WWTPs, which may require upgrades at the North River, 26th Ward, and Jamaica WWTPs.
- Monthly sampling for free cyanide with results submitted in report form to DEC. After review, DEC may reopen the permits to add a limit or action level for free cyanide.
- Beginning three years from the effective date of the Permit (11/01/2018), maintain and implement an Asset Management Plan (AMP) covering DEP's WWTPs, pumping stations, and CSO control facilities to prioritize the rehabilitation and replacement of capital assets that comprise the AMP Treatment System.
- Develop, implement, and maintain a Mercury Minimization Program (MMP). The MMP is required because the 50 nanograms/liter (ng/L) permit limit exceeds the statewide water quality-based effluent limit (WQBEL) of 0.70 ng/L for Total Mercury. The goal of the MMP will be to reduce mercury effluent levels in pursuit of the WQBEL.

- DEC has also advised DEP that it intends to adopt through formal rulemaking EPA's 2012 Recommended Water Quality Criteria for *Enterococci*, which would be bacteria water quality criteria protective of primary contact recreation. This change could result in additional compliance costs.

- The BMPs for CSOs section of the permit has been revised as follows:

  - Additional requirements related to DEP's CSOs to maximize flow were added to the permit as a new Additional CSO BMP Special Condition section, as required pursuant to the 2014 CSO BMP Order. The SPDES Additional CSO Special Conditions include monitoring of any CSOs from specified regulators, reporting requirements for bypasses, and providing notification of equipment out-of-service at the WWTPs during rain events. DEP to assess compliance with requirements to "Maximize Flow to the WWTP" using CSO data from key regulators and to identify options for reducing or eliminating CSOs that occur prior to the WWTP achieving twice design flow. A schedule for reasonable and cost-effective options that can be completed within two years must be submitted to DEC for review and approval. Other projects that cannot be completed within two years shall be considered as part of the LTCP process. The costs for compliance for this new permit requirement have not yet been determined, but DEP expects this program will require the expenditure of additional capital and expense dollars.

- Total Residual Chlorine (TRC) Consent Order

  As part of the TRC Consent Order effective October 8, 2015, DEP is required to construct alternate disinfection at six WWTPs. In addition, following completion of ambient water quality monitoring for TRC, DEP may also need to develop TRC Facility Plans for the WWTPs that may require further upgrades to disinfection to comply with the TRC WQ based effluent limit.

- Superfund Remediation

  Two major Superfund sites in NYC may affect DEP's Long Term Control Plans, and are at different stages of investigation. The Gowanus Canal Remedial Investigation/Feasibility Study (RI/FS) is complete, and remedial design work will take place in the next three to five years. Completion of the Newtown Creek RI/FS is anticipated by the end of 2018 with issuance of a ROD projected by the end of 2020.

  DEP's ongoing costs for these projects are estimated to total approximately $50-60M for the next ten years, excluding design or construction costs. EPA's selected remedy for the Gowanus Canal requires that NYC build two combined sewage overflow retention tanks. Potential Superfund costs for the two Gowanus Canal retention tanks total approximately $825M. For Newtown Creek, the City does not believe that CSO discharges are a significant source of hazardous substances to Newtown Creek. However, the CSO control alternative selected in this LTCP would address any CSO discharge controls that EPA may require as a result of the Superfund process for Newtown Creek.

9.6.g.6 Potential, Unbudgeted Drinking Water Regulation

- Hillview Reservoir Cover

  LT2 also mandates that water from uncovered storage facilities, including DEP's Hillview Reservoir, be treated or that the reservoir be covered. DEP has entered into an Administrative Order with the NYSDOH and an Administrative Order with EPA, both of which mandate NYC to begin work on a reservoir cover by the end of January 2017. In August 2011, EPA announced that it would review LT2 and its requirement to cover uncovered finished storage reservoirs such as Hillview. DEP has spent significant funds analyzing water quality, engineering options, and other matters relating to the Hillview Reservoir. Potential costs affiliated with construction are estimated to be $1.6B. DEP submitted a request to EPA in April 2013 for suspension of the January 2017 milestone. This request was made to avoid use of limited resources for a contract that may be rescheduled or eliminated pending the outcome of the LT2 review. On January 11, 2017, USEPA issued its determination that it was not going to include the LT2 as one of the regulations for revision, and that the requirement to cover uncovered finished storage reservoirs would remain. DEP and EPA are in discussions concerning next steps.

9.6.g.7 Other: State of Good Repair Projects and Sustainability/Resiliency Initiatives

Wastewater Projects

- Climate Resiliency

  In October 2013, on the first anniversary of Superstorm Sandy, DEP released the NYC Wastewater Resiliency Plan, the nation's most detailed and comprehensive assessment of the risks that climate change poses to a wastewater collection and treatment system. The groundbreaking study, initiated in 2011 and expanded after Superstorm Sandy, was based on an asset-by-asset analysis of the risks from storm surge under new flood maps at all 14 WWTPs and 58 of NYC's pumping stations, representing more than $1B in infrastructure.

  DEP estimates that it will need to spend $407M in cost-effective flood mitigation strategies at these facilities to protect valuable equipment and to minimize disruptions to critical services during future storms. Investing in these protective measures today will help protect this infrastructure from over $2B in repeated flooding losses over the next 50 years. DEP is currently pursuing funding through the EPA State Revolving Fund Storm Mitigation Loan Program to implement these strategies.

  DEP is coordinating this work with the broader coastal protection initiatives, such as engineered barriers and wetlands, described in OneNYC and continues to implement the energy, drinking water, and drainage strategies identified in the report to mitigate the impacts of future extreme events and climate change. This includes ongoing efforts to reduce CSOs with GI as part of LTCPs and build-out of high level storm sewers that reduce both flooding and CSOs. It also includes build-out of storm sewers and GI in areas of Queens with limited drainage and continued investments and build-out of the Bluebelt system.

- Energy projects at WWTPs

  In April 2015, NYC launched One New York: The Plan for a Strong and Just City (OneNYC), which calls for reducing NYC's greenhouse gas (GHG) emissions by 80 percent below 2005 levels by 2050. In order to meet this and other OneNYC goals, DEP has implemented: Demand-Side Solutions, including on-site energy conservation and efficiency, on-site equipment and operational improvements, and citywide water demand management; Supply-Side Solutions, including on-site clean energy generation using anaerobic digester gas ("biogas"); Traditional Renewable Energy Solutions, including non-biogas renewable energies such as hydropower, solar photovoltaic systems, geothermal, and more; and Energy and Carbon Offsets, including off-site beneficial use of biosolids and biogas, as well as carbon sequestration by GI, restored wetlands, and DEP-acquired forested lands. To-date, this four-pronged approach has resulted in a 21 percent reduction in GHG emissions at DEP from 2006 to 2016. DEP has approximately $732M allocated in its CIP to make additional system repairs to flares, digester domes, and digester gas piping, in order to maximize capture of fugitive emissions for beneficial use or flaring. A 12 megawatt cogeneration and electrification system estimated at $271M is currently in design for the North River WWTP and is estimated to be in operation in winter 2020. DEP has completed energy audits that identified close to 150 energy conservation measures at the in-city WWTPs having the potential to reduce GHG emissions by over 160,000 metric tons of carbon dioxide equivalent at an approximate cost of $140M. DEP is in the process of developing an agency-wide Energy Plan to determine the most economically, operationally, and technologically feasible and innovative pathways forward to achieve the OneNYC goals.

Water Projects

- Water for the Future

  In 2011, DEP unveiled Water for the Future, a comprehensive program to permanently repair the leaks in the Delaware Aqueduct, which supplies half of New York's drinking water. Based on a 10-year investigation and more than $200M of preparatory construction work, DEP is designing a bypass for a section of the Delaware Aqueduct in Roseton and internal repairs for a tunnel section in Wawarsing. Since DEP must shut down the Aqueduct when it is ready to connect the bypass tunnel, DEP is also working on projects that will supplement NYC's drinking water supply during the shutdown, such as implementing demand reduction initiatives, including offering a toilet replacement program, replacing municipal fixtures, and providing demand management assistance to the wholesale customers located north of NYC. Construction of the shafts for the bypass tunnel is underway, and the project will culminate with the connection of the bypass tunnel in 2022. The cost for this project is estimated to be approximately $1.5B.

- Gilboa Dam

  DEP is currently investing in a major rehabilitation project of the Gilboa Dam at Schoharie Reservoir. Reconstruction of the dam is the largest public works project in Schoharie County, and one of the largest in the entire Catskills. The rehabilitation of Gilboa Dam is part of an approximately $451M program to build and improve other facilities near the dam.

- Kensico Eastview Connection 2

  To ensure the resilience and provide critical redundancy of infrastructure in NYC's water supply system, DEP will be constructing a new tunnel between the Kensico Reservoir and the Ultraviolet Disinfection Facility. The cost for this project is estimated at approximately $1.24B.

- Activation of City Tunnel No. 3 Brooklyn/Queens

  The Brooklyn/Queens leg of City Tunnel No. 3 is a 5.5-mile section in Brooklyn that connects to a 5-mile section in Queens. The project is scheduled for completion in the 2020s. When activated, the Brooklyn/Queens leg will deliver water to Staten Island, Brooklyn, and Queens and provide critical redundancy in the system. This project is estimated at $710M.

9.6.h Potential Impacts of CSO LTCPs to Future Household Costs

As previously discussed, DEP is facing significant future wastewater spending commitments associated with several regulatory compliance programs. This section presents the anticipated CSO LTCP implementation costs for NYC and describes the potential resulting impacts to future household costs for wastewater service, when coupled with DEP's current and future investments. As described below, estimating the future rate and income increases through 2042 based on the cumulative impacts of this investment and DEP's other future spending, up to 52 percent of households could pay two percent or more of their income for wastewater services. The information in this section will be refined in future LTCP waterbody submittals.

9.6.h.1 Estimated Costs for Waterbody CSO Preferred Alternative

As discussed in Section 8.8, the LTCP preferred alternative for Newtown Creek is an expansion of the Borden Avenue Pumping Station to 26 MGD capacity including a new diversion structure and gravity pipe from Outfall BB-026, and a new force main to the Kent Avenue Gate Structure; and a storage tunnel that will capture 62.5 percent of the annual CSO volume from Outfalls NC-015, NC-083 and NC-077, a dewatering pumping station, and appurtenant near-surface connecting conduits and structures. The ranges of costs (in February 2017 dollars) for the recommended alternative are: NPW $703M to $730M, PBC of $570M to $597M, and annual O&M of $5.0M. The escalated design and construction costs for the LTCP Recommended Plan are estimated to range from $1,275 M to $1,335 M.

9.6.h.2 Overall Estimated Citywide CSO Program Costs

DEP's LTCP planning process was initiated in 2012 and will advance pursuant to the 2012 CSO Order schedule and any subsequent amendments. Overall anticipated CSO program costs for NYC will be unknown until each LTCP is developed and approved. Capital costs for the LTCP preferred alternatives that have been identified to-date are presented in Table 9-12. Additionally, GI is a major component of the 2012 CSO Order. The overall GI program cost is estimated at $2.4B, of which $1.5B will be spent by DEP. The GI program costs are in addition to the grey CSO program costs and are therefore presented as a separate line item.

As illustrated in Table 9-12, from FY2002-FY2016, DEP has incurred about $2.7B for CSO control projects, and approximately $2.5B has been committed towards CSO investments from FY2017-FY2027, which could be some combination of grey, green, and treatment options. Estimated LTCP costs are provided in Table 9-12 for waterbodies where a LTCP has been completed. Costs for waterbodies where a LTCP has not yet been prepared will be identified in future LTCP waterbody submittals. The LTCP preferred alternatives for these waterbodies could be a mix of treatment and storage options. Some of the LTCP costs will be incurred between FY2017 and FY2027 and the remainder will be committed beyond FY2027.

Table 9-12. Committed Costs and Range of Future CSO Program Costs and Water Quality Improvements(1)

Waterbody / Watershed	Historical and Current CIP Commitments	Incurred Cost FY2002-FY2016	Committed Cost FY2017-FY2027(4)	LTCP Costs(5)	CSO Reductions from LTCP	
					CSO Volume Reduced (Million Gallons)	CSO Volume Treated (Million Gallons)
Alley Creek and Little Neck Bay	CSO Abatement Facilities and East River CSO	$139,131,521	$15,374,000	$8,100,000	0	131
Westchester Creek	Hunts Point WWTP Headworks, Regulator Modification, Pugsley Creek Parallel Sewer	$25,988,886	$98,251,000	$0	0	0
Hutchinson River	Hunts Point WWTP Headworks	$3,000,000	$112,000,000	$95,900,000	0	584
Flushing Creek	Flushing Bay Corona Avenue Vortex Facility, Flushing Bay CSO Retention	$396,967,368	$46,781,000	$11,400,000	0	82
Bronx River	Installation of Floatable Control Facilities, Hunts Point WWTP Headworks	$45,617,986	$146,200,000	$117,400,000	170	0
Gowanus Canal	Gowanus Flushing Tunnel Reactivation and Pump Station, Gowanus CSO Tanks	$269,948,081	$738,207,000	$825,000,000 (6)	90	0
Coney Island Creek	Avenue V Pumping Station, Force Main Upgrade	$196,885,560	$0	$0	0	0
Jamaica Bay	Improvements of Flow Capacity to 26th Ward Drainage Area, Hendrix Creek Canal Dredging, Shellbank Destratification, Spring Creek AWCP Upgrade, 26 Ward Wet Weather Improvements	$170,394,949	$180,493,000			
Flushing Bay(2)	High Level Regulator Mods, Low Level Diversion Sewer (See Flushing Creek for Costs), Flushing Bay CSO Storage Tunnel	$0	$0	$691,800,000	746	0
Newtown Creek	English Kills Aeration, Newtown Creek Headworks, Bending Weirs and Floatables Control, 75% BAPS and 62.5% CSO Storage Tunnel	$225,582,936	$27,922,000	$570,000,000-$597,000,000 (7)	690	0
East River and Open Waters	Bowery Bay Headworks, Inner Harbor In-Line Storage, Port Richmond Throttling Facility, Tallman Island Conveyance Improvements, Outer Harbor CSO Regulator Improvements	$153,145,476	($69,000)			
Bergen and Thurston Basins(3)	Warnerville Pumping Station and Force Main, Bending Weirs	$41,876,325	$188,000			
Paerdegat Basin	Retention Tanks, Paerdegat Basin Water Quality Facility	$394,414,503	($2,408,000)			
Green Infrastructure Program	Miscellaneous Projects Associated with Citywide Green Infrastructure Program	$350,171,090	$1,074,279,000			
Other CSO Controls		$247,683,084	$35,888,000			
Total Grey		$2,310,636,675	$1,398,827,000			
Total Grey + Green		$2,660,807,765	$2,473,106,000			

Notes:
(1) All costs reported in this table reflect estimated capital costs only (i.e., probable bid cost). Projected O&M costs are not included. Capital costs are based on estimates from June 2017.
(2) Committed costs for Flushing Bay are captured in the committed costs reported for Flushing Creek.
(3) Bergen and Thurston Basins and Paerdegat Basin are not part of the current LTCP effort; thus, no LTCP detail is provided for them.
(4) Negative values reflect de-registration of committed funds. Costs in this column include some LTCP commitments.
(5) LTCP probable bid costs are escalated to 2017 dollars and have been updated to reflect the projects included in the DEC Approval letters.
(6) Superfund costs for the Gowanus Canal commitments started in FY16.
(7) Additional Superfund mandated CSO controls at Newtown Creek may be required.

9.6.h.3 Potential Impacts to Future Household Costs

The potential future rate impacts of the possible future CSO control capital costs were determined by: considering capital investments in the current CIP (FY2017-2027); estimated future DEP investments from 2028 to 2042 of $2.0B per year, which are based on DEP's current CIP average of $2.0B per year, inflated by 3 percent per year beginning in 2027; and a conceptual $5.7B in LTCP spending through 2042, a portion of which is included in the current CIP. This potential $5.7B in LTCP spending is in addition to the $4.2B in existing commitments associated with the WWFP grey CSO control projects and the citywide GI program, resulting in a potential total CSO program financial commitment of $9.9B (see Table 9-13). The cost estimates presented will evolve over the next year as the LTCPs are completed for the remaining waterbodies and will be updated as the LTCPs are completed.

Table 9-13. Financial Commitment to CSO Reduction

New York City's CSO Program	Financial Commitment ($B)
Waterbody/Watershed Facility Plan and other CSO Projects	$2.7
Green Infrastructure Program	$1.5
LTCP	$5.7(1)
Total	**$9.9**

Note:
(1) Total LTCP costs are not currently known. Waterbody costs for the approved LTCP plans is shown in Table 9-12. For conceptual purposes, up to $5.7B in LTCP spending through 2042 is assumed. Actual costs will be determined as part of the LTCP planning process.

A 4.75 percent interest rate was used to determine the estimated annual interest cost associated with the capital costs, and the annual debt service was divided by the FY2017 Revenue Plan value to determine the resulting percent rate increase. This also assumes bonds are structured for a level debt service amortization over 32 years. Note that interest rates on debt could be significantly higher in the future. For illustration purposes, future annual O&M increases and other incremental costs were estimated based on historical data.

As Table 9-14 shows, implementation of the current CIP (FY2017-2027) would result in an 80 percent rate increase by 2027. Additional potential mandates and CIP investments from 2028 to 2042 (using an average of $2.0B per year, inflated by 3 percent per year), as well as the up to $5.7B in total LTCP spending, could add an additional 163 percent. Cumulatively, the rates could increase on the order of 243 percent higher than 2017 values.

Table 9-14. Potential Future Spending Incremental Additional Household Cost Impact

Analysis Year	Percent Incremental Rate Increase from FY2016 Rates	Additional Annual Household Cost		
		Single-family Home	Multi-family Unit	Average Cost
2027[(1)]	80%	$843	$548	$691
2042[(2)]	163%	$1,724	$1,121	$1,412
Cumulative Total	**243%**	**$2,567**	**$1,669**	**$2,103**

Notes:

(1) Includes costs for the current $21.3B 2017-2027 CIP, which includes approximately $1.8B in LTCP spending.

(2) Includes an estimated $2.0B per year in capital commitments based on DEP's current CIP, inflated by 3.0 percent per year for 2028-2042. Total LTCP costs are not currently known. For conceptual purposes, up to $5.7B in LTCP spending from 2017 through 2042 is assumed.

Table 9-15 shows the potential range of future spending and its impact on household cost compared to MHI for the analysis years of 2017 (current conditions), 2027 (end of current CIP), and 2042 (accounts for anticipated additional spending and an assumed commitment of the total $5.7B in CSO Order and associated spending). The projected MHI for the analysis years of 2027 and 2042 was estimated by applying an annual inflation rate of 1.24 percent. This rate is based on the average annual inflation rate from 2011 to 2016 according to Consumer Price Index data for the New York Metro Area, as obtained from the Bureau of Labor Statistics. While these estimates are preliminary, it should be noted (as discussed in detail earlier in this section), that comparing household cost to MHI alone does not tell the full story since a large percentage of households below the median could be paying a larger percentage of their income on these costs.

Table 9-16 summarizes this range of future spending and impact on household cost accounting for the high cost of living in NYC using an Adjusted MHI based on the COLI value of 167, as discussed in Section 9.6.e.4. Based on this adjustment, total wastewater costs per average household account is projected to be almost 4 percent of MHI in 2042.

Figure 9-12 shows the average estimated household cost for wastewater services compared to household income, versus the percentage of households in various income brackets for 2017 (using FY2016 rates) and projected future rates for 2027 and 2042 (based on detail included in Table 9-15 and Table 9-16). As shown, roughly 26 percent of households are estimated to pay two percent or more of their income on wastewater service alone in 2017. Estimating the future rate and income increases to 2027 and 2042 (based on the projected costs in Table 9-15 and historic Consumer Price Index data), up to 55 percent of households could be paying more than 2 percent of their income on wastewater services when all future spending scenarios would be in place – the average wastewater annual cost is estimated to be about 2.3 percent of MHI in 2042). This is summarized in Table 9-17. As noted above, applying a cost of living adjustment to future incomes results in an even greater number of households paying more than 2 percent of their income.

Table 9-15. Total Estimated Cumulative Future Household Costs / Median Household Income

Year	Total Projected Annual Household Cost[1]			Projected MHI[2]	Total Water and Wastewater HH Cost / MHI			Total Wastewater HH Cost / MHI		
	Single-family Home	Multi-family Unit	Average HH Cost		Single-family Home	Multi-family Unit	Average HH Cost	Single-family Home	Multi-family Unit	Average HH Cost
2017	$1,055	$686	$864	$58,306	1.81%	1.18%	1.48%	1.11%	0.72%	0.91%
2027	$1,898	$1,234	$1,555	$64,596	2.94%	1.91%	2.41%	1.80%	1.17%	1.48%
2042	$3,662	$2,355	$2,967	$77,648	4.67%	3.03%	3.82%	2.86%	1.86%	2.35%

Notes:
(1) Projected household costs are estimated from rate increases presented in Table 9-12.
(2) Costs were compared to assumed MHI projection which was estimated using Census and Consumer Price Index data.
HH = Household

Table 9-16. Total Estimated Cumulative Future Household Costs/Median Household Income Adjusted for Cost of Living

Year	Total Projected Annual Household Cost[1]			Projected MHI[2]	Total Water and Wastewater HH Cost / MHI			Total Wastewater HH Cost / MHI		
	Single-family Home	Multi-family Unit	Average HH Cost		Single-family Home	Multi-family Unit	Average HH Cost	Single-family Home	Multi-family Unit	Average HH Cost
2017	$1,055	$686	$864	$34,914	3.02%	1.96%	2.48%	1.86%	1.21%	1.52%
2027	$1,898	$1,234	$1,555	$38,680	4.91%	3.19%	4.02%	3.01%	1.96%	2.47%
2042	$3,662	$2,355	$2,967	$46,496	7.79%	5.06%	6.38%	4.78%	3.11%	3.92%

Notes:
(1) Projected household costs are estimated from rate increases presented in Table 9-12.
(2) Costs were compared to assumed projected MHI, which was estimated using Census and Consumer Price Index data and calculated based on Cost of Living Index value of 167 for NYC in Q4 of 2016 (Source: C2ER).
HH = Household

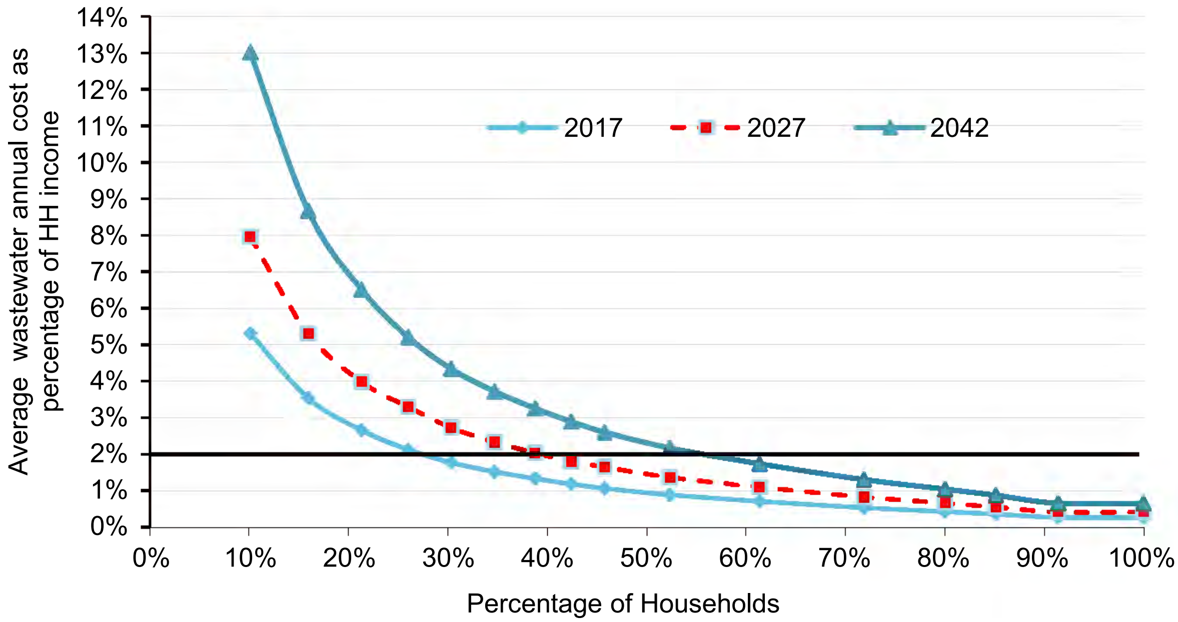


Figure 9-11. Estimated Average Wastewater Household Cost Compared to Household Income (2017, 2027, and 2042)

Table 9-17. Average Wastewater Annual Costs / Income Snapshot over Time

Year	RI using Average Wastewater Cost/MHI	RI using Average Wastewater Cost/Upper Limit of Lowest 20 Percent	RI using Average Wastewater Cost/Upper Limit of Lowest 40 Percent	Percent of HH estimated to be paying more than 2% of HH income on Wastewater Services
2017	0.9%	2.7%	1.2%	26%
2027	1.5%	4.4%	2.0%	39%
2042	2.3%	7.0%	3.2%	55%

DEP, like many utilities in the nation, provides both water and wastewater service, and its rate payers receive one bill. Currently, the average combined water and sewer annual is around 1.5 percent of MHI, but approximately 19 percent of households are estimated to be paying more than 4.5 percent of their income, and that could increase to about 43 percent of households by 2042, as shown in Figure 9-13.

AECOM with Hazen

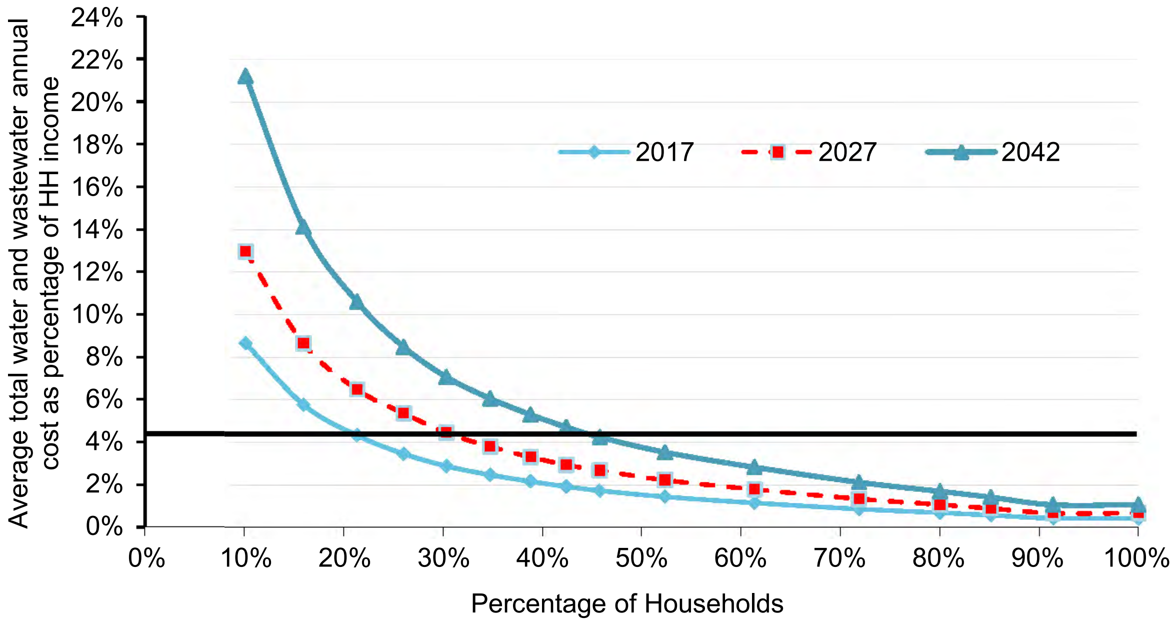


Figure 9-12. Estimated Average Total Water and Wastewater Household Cost Compared to Household Income (2017, 2027, and 2042)

9.6.i Benefits of Program Investments

DEP has been in the midst of an unprecedented period of investment to improve water quality in New York Harbor. Projects worth almost $10B have been completed or are underway since 2002 alone, including projects for nutrient removal, CSO abatement, marshland restoration in Jamaica Bay, and hundreds of other projects. In-city investments are improving water quality in the Harbor and restoring a world-class estuary while creating new public recreational opportunities and inviting people to return to NYC's 578 miles of waterfront. A description of citywide water quality benefits resulting from previous and ongoing programs is provided below, followed by the anticipated benefits of water quality improvements to Newtown Creek resulting from implementation of the baseline projects.

9.6.i.1 Citywide Water Quality Benefits from Previous and Ongoing Programs and Anticipated Newtown Creek Water Quality Benefits

Water quality benefits have been documented in the Harbor and its tributaries resulting from the almost $10B investment that NYC has already made in grey and GI since 2002. Approximately 95 percent of the Harbor is available for boating and kayaking, and 14 of NYC's beaches provide access to swimmable waters in the Bronx, Brooklyn, Queens and Staten Island.

Figure 9-14 shows the historical timeline of DEP's investments in wastewater infrastructure since the CWA of 1972. Of the $10B invested since 2002, almost 20 percent has been dedicated to controlling CSOs and stormwater. That investment has resulted in NYC capturing and treating over 70 percent of the combined stormwater and wastewater that otherwise would be directly discharged to our waterways during periods of heavy rain or runoff. Projects that have already been completed include: GI projects in

26th Ward, Hutchinson River, and Newtown Creek watersheds; area-wide GI contracts; Avenue V Pumping Station and Force Main; and the Bronx River Floatables Control. Several other major projects are in active construction or design. The water quality improvements already achieved have allowed greater access of the waterways and shorelines for recreation, as well as enhanced environmental habitat and aesthetic conditions in many of NYC's neighborhoods.

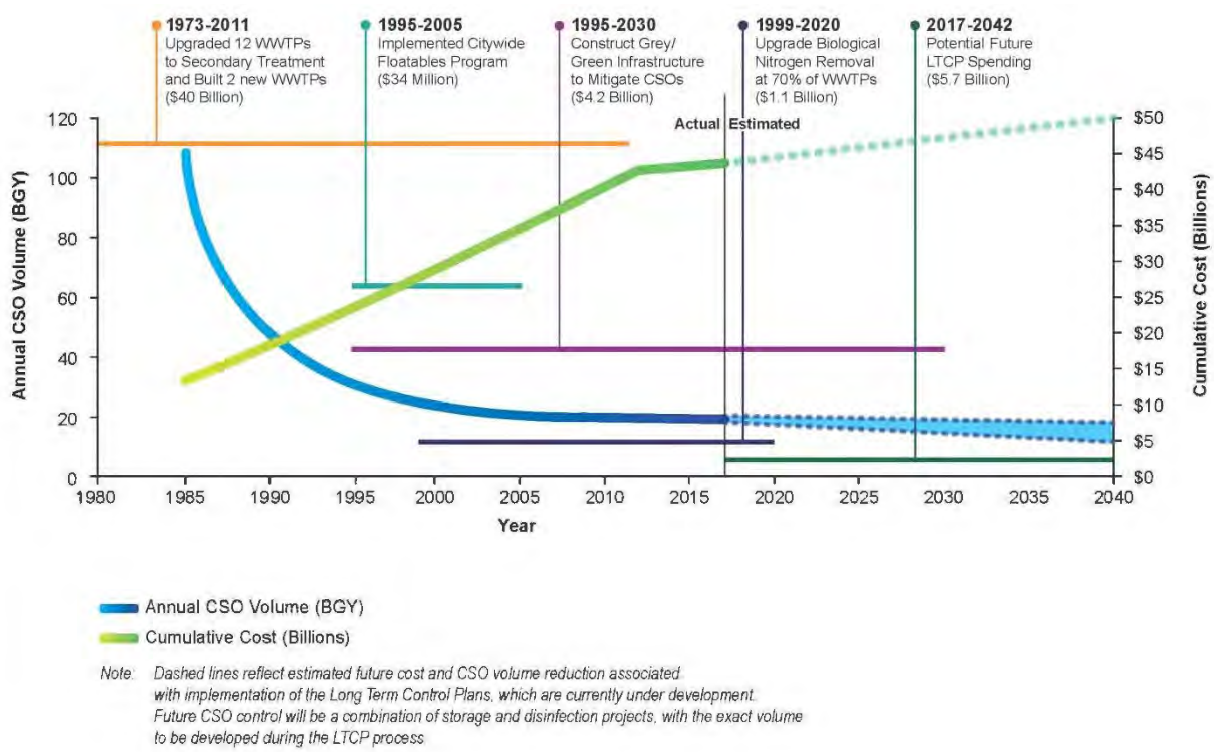


Figure 9-13. Historical Timeline for Wastewater Infrastructure Investments and CSO Reduction over Time

Although significant investments have been made for water quality improvements Harbor-wide, more work is needed. DEP has committed to working with DEC to further reduce CSOs and make other infrastructure improvements to gain additional water quality improvements. The 2012 CSO Order between DEP and DEC outlines a combined grey and green approach to reduce CSOs. This LTCP for Newtown Creek is just one of the detailed plans that DEP is preparing to evaluate and identify additional control measures for reducing CSOs and improving water quality in the Harbor. DEP is also committed to extensive water quality monitoring throughout the Harbor which will allow better assessment of the effectiveness of the controls implemented.

As noted above, a major component of the 2012 CSO Order that DEP and DEC developed is GI stormwater control measures. DEP is targeting implementing GI in priority combined sewer areas citywide. GI will take multiple forms, including green or blue roofs, bioinfiltration systems, right-of-way bioswales, rain barrels, and porous pavement. These measures provide benefits beyond their associated water quality improvements. Depending on the measure installed, they can recharge groundwater, provide localized flood attenuation, provide sources of water for non-potable use (such as watering lawns or gardens), reduce heat island effect, improve air quality, enhance aesthetic quality, and provide recreational opportunities. These benefits contribute to the overall quality of life for residents of NYC.

A detailed discussion of anticipated water quality improvements to Newtown Creek is included in Section 8.0.

9.6.j Conclusions

As part of the LTCP process, DEP will continue to develop and refine the affordability and financial capability assessments for each individual waterbody as it works toward an expanded analysis for the citywide LTCP. In addition to what is outlined in the Federal CSO guidance on financial capability, DEP has presented in this section a number of additional socioeconomic factors for consideration in the context of affordability and assessing potential impacts to our ratepayers. Furthermore, it is important to include a fuller range of future spending obligations and DEP has presented an initial picture of that in this section. Ultimately, the environmental, social, and financial benefits of all water-related obligations should be considered when priorities for spending are developed and implementation of mandates are scheduled, so that resources can be focused where the community will get the most environmental benefit.

9.7 Compliance with Water Quality Goals

Newtown Creek is a Class SD waterbody whose water quality can be improved through the 2011 WWFP recommendations, planned GI projects, and implementation of this LTCP. Under baseline conditions, the waterbody does not achieve attainment with its current classifications for bacteria or DO. Upon implementation of this LTCP, Newtown Creek is projected to comply with the Existing WQ criterion for DO and significantly improve attainment with Existing WQ Criteria for bacteria on a recreational season and on an annual basis. For the 2008 rainfall, the preferred alternative is predicted to result in attainment of the Existing WQ Criteria for bacteria during the recreational season. Annual attainment of the Existing WQ Criteria for bacteria, however, will not be met. In terms of compliance with primary contact standards, the Class SC Criteria for fecal coliform bacteria are identical to the Class SD criteria, and therefore the attainment is the same. The Class SC DO acute criterion is projected to be met, with attainment ranging from 97 to 100 percent. The Class SC DO chronic criterion attainment is projected to range from 84 to 96 percent.

The 2012 CSO Order Goal Statement stipulates that, in situations where the proposed alternatives presented in the LTCP will not achieve the CWA Section 101(a)(2) goals, the LTCP is to include a UAA. Because the analyses developed indicate that Newtown Creek is not projected to fully attain Existing WQ Criteria for fecal coliform bacteria on an annual basis, a UAA is included in this LTCP.

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11.0 GLOSSARY

1.5xDDWF:	One and One-half Times Design Dry Weather Flow
2xDDWF:	Two Times Design Dry Weather Flow
AACE:	Association for the Advancement of Cost Engineering
AAOV:	Annual Average Overflow Volumes
AMP:	Asset Management Plan
AWPCP:	Auxiliary Water Pollution Control Plant
BAPS:	Borden Avenue Pumping Station
BB:	Bowery Bay
BBH:	Bowery Bay High Level
BBL:	Bowery Bay Low Level
BEACH:	Beaches Environmental Assessment and Coastal Health
BMP:	Best Management Practice
BNR:	Biological Nutrient Removal
BOD:	Biochemical Oxygen Demand
BQPS:	Brooklyn/Queens Pumping Station
$CBOD_5$:	Carbonaceous Biochemical Oxygen Demand
CEG:	Cost Effective Grey
CERCLA:	Comprehensive Environmental Response, Compensation, and Liability Act
CFS:	Cubic Feet Per Second
CIP:	Capital Improvement Plan
COLI:	Cost of Living Index
CPK:	Central Park
CSO:	Combined Sewer Overflow
CSS:	Combined Sewer System

CWA:	Clean Water Act
DCIA:	Directly Connected Impervious Areas
DCP:	New York City Department of City Planning
DDWF:	Design Dry Weather Flow
DEC:	New York State Department of Environmental Conservation
DEP:	New York City Department of Environmental Protection
DO:	Dissolved Oxygen
DOF:	New York City Department of Finance
DOHMH:	New York City Department of Health and Mental Hygiene
DOT:	New York City Department of Transportation
DWF:	Dry Weather Flow
EBP:	Environmental Benefit Project
EDC:	New York City Economic Development Corporation
EPA:	United States Environmental Protection Agency
ERTM:	East River Tributaries Model
ET:	Evapotranspiration
EWR:	Newark Liberty International Airport
FAD:	Filtration Avoidance Determination
FCI:	Financial Capability Indicators
FMPV:	Full Market Property Value
FS:	Feasibility Study
FT:	Abbreviation for “Feet”
FY:	Fiscal Year
GHG:	Greenhouse Gases
GI:	Green Infrastructure
GIS:	Geographical Information System

GM:	Geometric Mean
G.O.:	General Obligation
GRTA:	NYC Green Roof Tax Abatement
HEAP:	Home Energy Assistance Program
HH:	Household
HLI:	High Level Interceptor
HLSS:	High Level Storm Sewers
HLSS:	High Level Sewer Separation
HSM:	Harbor Survey Monitoring Program
HVAC:	Heating, Ventilation and Air Conditioning
IBZ:	Industrial Business Zone
IEC:	Interstate Environmental Commission
in.:	Abbreviation for “Inches”.
in/hr:	Inches per hour
IW:	InfoWorks CS™
JFK:	John F. Kennedy International Airport
KOTC:	Knee-of-the-Curve
lbs/day:	pounds per day
LF:	linear feet
LGA:	LaGuardia Airport
LICI:	Long Island City Interceptor
LIRR:	Long Island Rail Road
LLI:	Low Level Interceptor
LT2:	Long Term 2
LTCP:	Long Term Control Plan
MCP:	Multifamily Conservation Program

mg/L:	milligrams per liter
MG:	Million Gallons
MGD:	Million Gallons Per Day
MGY:	Million Gallons Per Year
MHI:	Median Household Income
MMP:	Mercury Minimization Program
MOU:	Memorandum of Understanding
MS4:	Municipal separate storm sewer systems
MSP:	Main Sewage Pump
MTA:	Metropolitan Transportation Authority
MWFA:	New York City Municipal Water Finance Authority
NC:	Newtown Creek
NCA:	Newtown Creek Alliance
NCRWQM:	Newtown Creek Receiving Water Quality Model
ng/L:	Nanograms per Liter
NMC:	Nine Minimum Control
NOAA:	National Oceanic and Atmospheric Administration
NPDES:	National Pollutant Discharge Elimination System
NPW:	Net Present Worth
NYC:	New York City
NYCHA:	New York City Housing Authority
NYCRR:	New York State Code of Rules and Regulations
NYMTC:	New York Metropolitan Transportation Council
NYS:	New York State
NYSDOH:	New York State Department of Health
O&M:	Operation and Maintenance

ONRW:	Outstanding National Resource Waters
PBC:	Probable Bid Cost
PCM:	Post-Construction Compliance Monitoring
POTW:	Publicly Owned Treatment Works
PRP:	Potentially Responsible Parties
PS:	Pump Station or Pumping Station
Q:	Symbol for Flow (designation when used in equations)
RFI:	Request for Information
RI:	Remedial Investigation
ROD:	Record of Decision
ROW:	Right-of-Way
RTB:	Retention Treatment Basin
RTC:	Real Time Control
RWQC:	Recreational Water Quality Criteria
S&P:	Standard and Poor
SDWA:	Safe Drinking Water Act
SOD:	Sediment Oxygen Demand
SOGR:	State of Good Repair
SPDES:	State Pollutant Discharge Elimination System
STV:	Statistical Threshold Value
S.W.I.M.:	Stormwater Infrastructure Matters Coalition
TBD:	To Be Determined
TBM:	Tunnel Boring Machine
TDPS:	Tunnel Dewatering Pumping Station
TMDL:	Total Maximum Daily Load
TN:	Total Nitrogen

TRC:	Total Residual Chlorine
UAA:	Use Attainability Analysis
UER:	Upper East River
ug/L:	Micrograms Per Liter
U.S.:	United States
UV:	Ultraviolet Light
WDAP:	Water Debt Assistance Program
WQ:	Water Quality
WQBEL:	Water Quality Based Effluent Limitations
WQS:	Water Quality Standards
WWFP:	Waterbody/Watershed Facility Plan
WWOP:	Wet Weather Operating Plan
WWTP:	Wastewater Treatment Plant

Appendix A: Supplemental Tables

Annual CSO, Non-CSO,
Local Source Baseline Volumes (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Newtown Creek	BB-011	L1	1.6
Newtown Creek	BB-015	L10	0.7
Newtown Creek	BB-012	L2	0.1
Dutch Kills	BB-004	L3	0.1
Dutch Kills	BB-009	L3B	43.1
Dutch Kills	BB-010	L3C	0.5
Dutch Kills	BB-040	L5	1.2
Dutch Kills	BB-042	L6	1.6
Newtown Creek	BB-043	L7	9.4
Newtown Creek	BB-013	L8	16.3
Newtown Creek	BB-014	L9	1.8
Dutch Kills	BB-026	L4	119.7
English Kills	NC-015	B1	321.0
East Branch	NC-019	B2	3.0
Newtown Creek	NC-021	NA	0.0
Newtown Creek	NC-022	B17	7.7
Newtown Creek	NC-023	B16	0.5
Newtown Creek	NC-024	B15	0.0
Newtown Creek	NC-029	Q2	18.7
Maspeth Creek	NC-077	Q1	300.7
East Branch	NC-083	St.Nicholas Ave. Weir	314.5
		Total CSO	**1,162.3**

InfoWorks Non-CSO Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Newtown Creek	BB-LKD	NA	34.9
Dutch Kills	BB-604	NA	3.6
Dutch Kills	BB-609	NA	0.4
Newtown Creek	NC-624	NA	4.2
English Kills	NC-625	NA	17.0
English Kills	NC-629	NA	72.1
Newtown Creek	NC-631	NA	126.1
East Branch	NC-632	NA	93.0
English Kills	NC-635	NA	14.1
English Kills	NC-636	NA	16.2
Newtown Creek	NC-637	NA	21.9
Newtown Creek	BB--73	NA	5.4
Newtown Creek	BB--74	NA	6.2
Newtown Creek	BB--75	NA	3.1
Newtown Creek	BB--76	NA	21.6
Dutch Kills	BB--77	NA	9.4
Newtown Creek	BB--78	NA	26.6
Newtown Creek	BB--79	NA	17.7
Newtown Creek	BB--80	NA	9.4
Dutch Kills	BB-510	NA	3.1
Dutch Kills	BB-512	NA	7.3
English Kills	NC--26	NA	1.1
Newtown Creek	NC--29	NA	10.0
Newtown Creek	NC--30	NA	8.9
Newtown Creek	NC--65	NA	6.1
Newtown Creek	NC--66	NA	7.8
Newtown Creek	NC--67	NA	4.8
English Kills	NC--68	NA	10.8
Whale Creek	NC--69	NA	3.3
Newtown Creek	NC--70	NA	22.4
Newtown Creek	NC--71	NA	13.4
Newtown Creek	NC--72	NA	29.2
Newtown Creek	NC--73	NA	38.9
English Kills	NC--74	NA	18.0
English Kills	NC--75	NA	3.7
English Kills	NC--76	NA	6.8
English Kills	NC--77	NA	12.6

InfoWorks Non-CSO Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
English Kills	NC--78	NA	13.9
East Branch	NC--83	NA	2.8
Newtown Creek	NC--84	NA	5.3
Newtown Creek	NC-506	NA	13.9
Newtown Creek	NC-513	NA	10.9
Newtown Creek	NC--27	NA	15.5
Newtown Creek	NC--28	NA	6.8
Newtown Creek	NC--31	NA	45.2
Newtown Creek	NC--79	NA	25.0
Newtown Creek	NC--81	NA	14.2
Maspeth Creek	NC--82	NA	16.6
East Branch	NC-510	NA	25.8
East Branch	NC-511	NA	7.1
Newtown Creek	NC-514	NA	16.5
		Total	**930.5**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Whale Creek	Newtown Creek WPCP	NA	1,650.1
		Total	**1650.1**

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Discharge (MG/Yr)**
Newtown Creek & Tributaries	CSO	31.0	1,162.3
	Non-CSO	24.9	930.5
	Local Sources	44.1	1650.1
		Total	**3742.8**

Annual CSO, Non-CSO,
Local Sources Enterococci Loads (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{12}**
Newtown Creek	BB-011	L1	28.9
Newtown Creek	BB-015	L10	16.2
Newtown Creek	BB-012	L2	2.7
Dutch Kills	BB-004	L3	0.7
Dutch Kills	BB-009	L3B	770.8
Dutch Kills	BB-010	L3C	11.4
Dutch Kills	BB-040	L5	21.1
Dutch Kills	BB-042	L6	31.9
Newtown Creek	BB-043	L7	180.9
Newtown Creek	BB-013	L8	269.1
Newtown Creek	BB-014	L9	41.5
Dutch Kills	BB-026	L4	2,486.8
English Kills	NC-015	B1	5,830.2
East Branch	NC-019	B2	139.6
Newtown Creek	NC-021	NA	0.0
Newtown Creek	NC-022	B17	151.3
Newtown Creek	NC-023	B16	8.0
Newtown Creek	NC-024	B15	0.1
Newtown Creek	NC-029	Q2	354.1
Maspeth Creek	NC-077	Q1	5,009.6
East Branch	NC-083	St.Nicholas Ave. Weir	4,975.4
		Total CSO	**20,330.2**

InfoWorks Non-CSO Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{12}**
Newtown Creek	BB-LKD	NA	112.4
Dutch Kills	BB-604	NA	12.2
Dutch Kills	BB-609	NA	1.3
Newtown Creek	NC-624	NA	14.0
English Kills	NC-625	NA	55.9
English Kills	NC-629	NA	224.3
Newtown Creek	NC-631	NA	417.1
East Branch	NC-632	NA	302.9
English Kills	NC-635	NA	46.8
English Kills	NC-636	NA	52.7
Newtown Creek	NC-637	NA	72.4
Newtown Creek	BB--73	NA	1.2
Newtown Creek	BB--74	NA	1.4
Newtown Creek	BB--75	NA	0.7
Newtown Creek	BB--76	NA	4.9
Dutch Kills	BB--77	NA	2.1
Newtown Creek	BB--78	NA	6.0
Newtown Creek	BB--79	NA	4.0
Newtown Creek	BB--80	NA	2.1
Dutch Kills	BB-510	NA	0.7
Dutch Kills	BB-512	NA	1.7
English Kills	NC--26	NA	0.3
Newtown Creek	NC--29	NA	2.3
Newtown Creek	NC--30	NA	2.0
Newtown Creek	NC--65	NA	1.4
Newtown Creek	NC--66	NA	1.8
Newtown Creek	NC--67	NA	1.1
English Kills	NC--68	NA	2.4
Whale Creek	NC--69	NA	0.8
Newtown Creek	NC--70	NA	5.1
Newtown Creek	NC--71	NA	3.0
Newtown Creek	NC--72	NA	6.6
Newtown Creek	NC--73	NA	8.8
English Kills	NC--74	NA	4.1
English Kills	NC--75	NA	0.8
English Kills	NC--76	NA	1.6
English Kills	NC--77	NA	2.9

InfoWorks Non-CSO Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{12}**
English Kills	NC--78	NA	3.1
East Branch	NC--83	NA	0.6
Newtown Creek	NC--84	NA	1.2
Newtown Creek	NC-506	NA	3.2
Newtown Creek	NC-513	NA	2.5
Newtown Creek	NC--27	NA	3.5
Newtown Creek	NC--28	NA	1.5
Newtown Creek	NC--31	NA	10.3
Newtown Creek	NC--79	NA	5.7
Newtown Creek	NC--81	NA	3.2
Maspeth Creek	NC--82	NA	3.8
East Branch	NC-510	NA	5.9
East Branch	NC-511	NA	1.6
Newtown Creek	NC-514	NA	3.7
		Total	**1,431.6**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{12}**
Whale Creek	NC WPCP	NA	0.06
		Total	**0.06**

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Org.x10^{12}**
Newtown Creek & Tributaries	CSO	93	20,330.2
	Non-CSO	7	1,431.6
	Local Sources	0	0.1
		Total	**21,761.9**

Annual CSO, Non-CSO,
Local Sources Fecal Coliform Loads (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{12}**
Newtown Creek	BB-011	L1	36.0
Newtown Creek	BB-015	L10	15.5
Newtown Creek	BB-012	L2	1.3
Dutch Kills	BB-004	L3	1.1
Dutch Kills	BB-009	L3B	880.4
Dutch Kills	BB-010	L3C	11.1
Dutch Kills	BB-040	L5	28.6
Dutch Kills	BB-042	L6	40.5
Newtown Creek	BB-043	L7	259.4
Newtown Creek	BB-013	L8	346.2
Newtown Creek	BB-014	L9	49.1
Dutch Kills	BB-026	L4	2,933.9
English Kills	NC-015	B1	7,188.9
East Branch	NC-019	B2	71.6
Newtown Creek	NC-021	NA	0.0
Newtown Creek	NC-022	B17	226.0
Newtown Creek	NC-023	B16	9.3
Newtown Creek	NC-024	B15	0.1
Newtown Creek	NC-029	Q2	460.9
Maspeth Creek	NC-077	Q1	7,541.9
East Branch	NC-083	St.Nicholas Ave. Weir	8,553.2
		Total CSO	**28,655**

InfoWorks Non-CSO Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{12}**
Newtown Creek	BB-LKD	NA	36.1
Dutch Kills	BB-604	NA	3.8
Dutch Kills	BB-609	NA	0.4
Newtown Creek	NC-624	NA	4.5
English Kills	NC-625	NA	18.5
English Kills	NC-629	NA	77.3
Newtown Creek	NC-631	NA	134.2
East Branch	NC-632	NA	99.4
English Kills	NC-635	NA	15.1
English Kills	NC-636	NA	18.2
Newtown Creek	NC-637	NA	22.9
Newtown Creek	BB--73	NA	0.8
Newtown Creek	BB--74	NA	0.9
Newtown Creek	BB--75	NA	0.5
Newtown Creek	BB--76	NA	3.3
Dutch Kills	BB--77	NA	1.4
Newtown Creek	BB--78	NA	4.0
Newtown Creek	BB--79	NA	2.7
Newtown Creek	BB--80	NA	1.4
Dutch Kills	BB-510	NA	0.5
Dutch Kills	BB-512	NA	1.1
English Kills	NC--26	NA	0.2
Newtown Creek	NC--29	NA	1.5
Newtown Creek	NC--30	NA	1.3
Newtown Creek	NC--65	NA	0.9
Newtown Creek	NC--66	NA	1.2
Newtown Creek	NC--67	NA	0.7
English Kills	NC--68	NA	1.6
Whale Creek	NC--69	NA	0.5
Newtown Creek	NC--70	NA	3.4
Newtown Creek	NC--71	NA	2.0
Newtown Creek	NC--72	NA	4.4
Newtown Creek	NC--73	NA	5.9
English Kills	NC--74	NA	2.7
English Kills	NC--75	NA	0.6
English Kills	NC--76	NA	1.0
English Kills	NC--77	NA	1.9

InfoWorks Non-CSO Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{12}**
English Kills	NC--78	NA	2.1
East Branch	NC--83	NA	0.4
Newtown Creek	NC--84	NA	0.8
Newtown Creek	NC-506	NA	2.1
Newtown Creek	NC-513	NA	1.7
Newtown Creek	NC--27	NA	2.3
Newtown Creek	NC--28	NA	1.0
Newtown Creek	NC--31	NA	6.8
Newtown Creek	NC--79	NA	3.8
Newtown Creek	NC--81	NA	2.2
Maspeth Creek	NC--82	NA	2.5
East Branch	NC-510	NA	3.9
East Branch	NC-511	NA	1.1
Newtown Creek	NC-514	NA	2.5
		Total	**510.1**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{12}**
Whale Creek	NC WPCP	NA	8.0
		Total	**8.0**

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Org.x10^{12}**
Newtown Creek & Tributaries	CSO	98	28,654.8
	Non-CSO	2	510.1
	Local Sources	0	8.0
		Total	**29,172.9**

Annual CSO, Non-CSO,
Local Sources BOD_5 Loads (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Newtown Creek	BB-011	L1	556.6
Newtown Creek	BB-015	L10	247.5
Newtown Creek	BB-012	L2	34.8
Dutch Kills	BB-004	L3	18.0
Dutch Kills	BB-009	L3B	15,168.6
Dutch Kills	BB-010	L3C	187.9
Dutch Kills	BB-040	L5	413.6
Dutch Kills	BB-042	L6	565.5
Newtown Creek	BB-043	L7	3,327.2
Newtown Creek	BB-013	L8	5,727.0
Newtown Creek	BB-014	L9	638.2
Dutch Kills	BB-026	L4	42,167.3
English Kills	NC-015	B1	113,051.1
East Branch	NC-019	B2	1,073.4
Newtown Creek	NC-021	NA	0.0
Newtown Creek	NC-022	B17	2,726.9
Newtown Creek	NC-023	B16	177.3
Newtown Creek	NC-024	B15	1.5
Newtown Creek	NC-029	Q2	6,582.9
Maspeth Creek	NC-077	Q1	105,899.7
East Branch	NC-083	St.Nicholas Ave. Weir	110,779.1
		Total CSO	**409,344**

InfoWorks Non-CSO Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Newtown Creek	BB-LKD	NA	5070.7
Dutch Kills	BB-604	NA	519.4
Dutch Kills	BB-609	NA	56.6
Newtown Creek	NC-624	NA	605.4
English Kills	NC-625	NA	2470.7
English Kills	NC-629	NA	10468.9
Newtown Creek	NC-631	NA	18310.2
East Branch	NC-632	NA	13510.9
English Kills	NC-635	NA	2052.1
English Kills	NC-636	NA	2358.6
Newtown Creek	NC-637	NA	3180.3
Newtown Creek	BB--73	NA	779.6
Newtown Creek	BB--74	NA	897.9
Newtown Creek	BB--75	NA	456.9
Newtown Creek	BB--76	NA	3141.4
Dutch Kills	BB--77	NA	1365.5
Newtown Creek	BB--78	NA	3859.6
Newtown Creek	BB--79	NA	2577.5
Newtown Creek	BB--80	NA	1370.9
Dutch Kills	BB-510	NA	455.9
Dutch Kills	BB-512	NA	1064.3
English Kills	NC--26	NA	162.0
Newtown Creek	NC--29	NA	1454.3
Newtown Creek	NC--30	NA	1292.8
Newtown Creek	NC--65	NA	881.0
Newtown Creek	NC--66	NA	1130.9
Newtown Creek	NC--67	NA	695.2
English Kills	NC--68	NA	1562.9
Whale Creek	NC--69	NA	485.5
Newtown Creek	NC--70	NA	3257.5
Newtown Creek	NC--71	NA	1939.3
Newtown Creek	NC--72	NA	4238.0
Newtown Creek	NC--73	NA	5643.6
English Kills	NC--74	NA	2615.0
English Kills	NC--75	NA	537.7
English Kills	NC--76	NA	992.8
English Kills	NC--77	NA	1822.6

InfoWorks Non-CSO Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
English Kills	NC--78	NA	2012.6
East Branch	NC--83	NA	403.9
Newtown Creek	NC--84	NA	764.7
Newtown Creek	NC-506	NA	2023.2
Newtown Creek	NC-513	NA	1584.1
Newtown Creek	NC--27	NA	2933.8
Newtown Creek	NC--28	NA	984.2
Newtown Creek	NC--31	NA	6568.8
Newtown Creek	NC--79	NA	3626.2
Newtown Creek	NC--81	NA	2062.3
Maspeth Creek	NC--82	NA	2403.4
East Branch	NC-510	NA	3741.3
East Branch	NC-511	NA	1024.5
Newtown Creek	NC-514	NA	2389.8
		Total	**135,807**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Whale Creek	NC WPCP	NA	137,293.9
		Total	**137,294**

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Lbs**
Newtown Creek & Tributaries	CSO	60	409,344.1
	Non-CSO	20	135,807.3
	Local Sources	20	137,293.9
		Total	**682,445**

Appendix B: Long Term Control Plan (LTCP) Newtown Creek Public Meeting #1 – Public Kickoff Meeting

Summary of Meeting and Public Comments

On November 15, 2016 the New York City Department of Environmental Protection (DEP) hosted a public kickoff meeting to initiate the water quality planning process for the Newtown Creek Combined Sewer Overflows (CSO) Long Term Control Plan (LTCP). The two-hour event, held at the Newtown Creek Wastewater Treatment Plant (WWTP) Visitor Center in Greenpoint, Brooklyn, provided stakeholders with information about DEP's LTCP Program, Newtown Creek's watershed characteristics, and the status of waterbody improvement projects. DEP also solicited information from the public about their recreational use of Newtown Creek, and described additional opportunities for public input and outreach.

Approximately 60 stakeholders from 25 different non-profit, community, planning, environmental, economic development, and governmental organizations and the broader public attended the event, as did representatives from DEP and the New York State Department of Environmental Conservation (DEC). Information presented included:

- Newtown Creek water quality standard classification;
- Newtown Creek ongoing and new developments;
- Newtown Creek current uses;
- Newtown Creek watershed and land uses;
- Newtown Creek sampling program;
- Newtown Creek water quality improvement projects;
- Newtown Creek Pre-Waterbody Watershed Facilities Plan (WWFP) and LTCP Baseline modeled CSO volumes; and
- Newtown Creek CSO mitigation options.

The Newtown Creek LTCP Kickoff Public Meeting was the first opportunity for public participation in the development of this LTCP. The following summarizes the questions and comments from attendees as well as responses given. The presentation can be found at http://www.nyc.gov/dep/ltcp.

Q1: Is there any (mosaic) map that extends into the East River to show the bacteria levels as a comparison tool to the levels seen in Newtown Creek during wet-weather?

> A1: DEP responded that there are multiple models in which the boundaries can be pushed out to include the bacteria levels in East River as requested.

Q2: What information is the time to recovery graphs presenting? How should they be read?

> A2: DEP responded that the data collected is used to calibrate the water quality models, which will be used to update the DEP water quality advisories. Because every storm is different, water quality models are run to help determine a time to recovery after each event. Reading the data as presented now is difficult because of the number of factors included, such as tide influence. However, when the models are complete, they will allow DEP to project a time to recovery for each event that will inform DEP's advisories. The current time to recovery graphs serve as a check for DEP to ensure the data being collected makes sense, and to identify any anomalies.

Q3: Do you have continuous DO data in this presentation? If not, could you map it out over time with rain events for the next meeting?

A3: DEP responded that they have not yet seen the data, but that it has been collected for the model calibration. The continuous DO data can be provided at the next public meeting.

Q4: Do you have literature on the New Private Incentive Program? Have you received any responses on the Request for Information (RFI) and what is the cutoff date?

A4: DEP responded that yes, the RFI is on the DEP website. DEP added that it has not yet received responses on the RFI, but had had a lot of questions and discussions with different non-profit organizations, community-based organizations, and private-sector entities, so is hopeful for a good turnout. The cutoff date is November 18th.

Q5: Have you worked with the NYC Economic Development Corporation (EDC) with respect to the Request for Proposals for the properties surrounding the mouth of the Creek? In particular, have you asked them to build these opportunities in and encouraged them to respond to your RFI?

A5: DEP responded that yes, it has been exchanging information with EDC. For new properties, developers must undergo a site connection DEP permit process through which it approves or disapproves the site or house connections.

Q6: When new sewers were put in the properties north and south of the Creek, were combined sewers installed?

A6: DEP responded that partially separated sewers exist in the Hunter's Point location south of the Creek and that, typically for new construction separated sewers are permitted. This should also be the case for construction from 10 to 20 years ago, but the existence of any permit from that time would need to be confirmed.

Q7: For the bioswales and the rain gardens, are you getting feedback from the local area about the concern of these items being put in without giving the homeowners the option to opt out?

A7: DEP responded it is considering the extent to which it can accommodate such requests and is working closely with City Hall to come up with a city-wide policy. However, opting out can delay green infrastructure (GI) installations by years.

Q8: How are the City agencies working together to ensure that green infrastructure is getting in at the very beginning of street redesign?

A8: DEP responded that a cultural shift in the City and that the GI program was bringing together City agencies, including Parks and New York City Department of Transportation, on a common mission and vision.

Q9: Given that significant portions of Newtown Creek are brownfield reclamation sites, is there consideration going into the industrial chemicals that are in the ground when replacing permeable pavement? Is the flow of the water through the pavement a concern for allowing the fumes and chemicals in the ground to migrate around?

A9: DEP responded that there are no large permeable pavement projects planned for Newtown Creek and that other GI practices, such as rain gardens, are typically implemented as a first option. Permeable pavements are more typically considered in high bedrock areas, for example, in the upper watersheds, including the Bronx.

Q10: Has there been any study on the idea of capturing rainwater off of rooftops where you are not picking up street contaminants as a source of freshwater to be put into Newtown Creek?

A10: DEP responded that it has not performed a study to determine the impacts of catching rainwater on rooftops to input directly to the Creek, but that DEP could look into performing such a study. DEP stated that, typically, house connection downspouts go into the regular plumbing of the house but that it is something that DEP could evaluate to determine whether enough freshwater flow is generated to make a difference.

Q11: There are numerous large, industrial factory buildings next to Newtown Creek that are not eligible for the GI grant program, but are perfect candidates for green roofs. Will they become eligible?

A11: DEP responded the new RFI expanded beyond just the CSO areas to the separated sewer/MS4 areas to take a watershed approach to the program and to encourage the third party administration to look at it as a watershed. The hope is for the new program to have a larger coverage, but the levels of responses and sign-up are still to be determined.

Q12: For individuals who want to encourage and engage private property owners in GI projects, is there a way to get more support from DEP to show these owners the effectiveness of these projects?

A12: DEP responded that it hopes the new RFI will encourage community-based organizations to take a role in the new GI program, and that there be more partnering between community-based organizations, engineering companies and non-profit organizations to structure the program.

Q13: For the 37 projects listed in the Public Property Retrofits for Newtown Creek, what is the time frame for completing all 37 projects and what is the total water gallon capture?

A13: DEP responded that each project is different. Designs are not standard, but customized, so that the rollout of each is unique. All 37 projects will be completed within 10 years, and each project will be listed on the NYC Green Infrastructure Map. The map shows many project details, including gallons of water captured, and each year DEP releases its Green Infrastructure Annual Report with program statistics.

Q14: What is the data on illegal dumping? There have been instances of cement dumping directly into catch basins causing them to get plugged up until DEP comes to clean them out.

A14: DEP responded that it does not have enforcement authority over illegal dumping, but has a complaint response group that responds to complaints, performs inspections, and maintains a facility history. DEP explained that stormwater runoff from industrial/commercial properties are generally regulated under the Clean Water Act through the multi-sector general permit issued and administered by the DEC.

Q15: Does outfall disinfection imply chlorine? Are you still looking at dechlorination?

A15: DEP responded that yes, it is considering a range of alternatives, including disinfection, but that disinfection does not necessarily require chlorine. Chlorine tends to be easier to implement and less expensive, but disinfection can take many forms. If chlorination is carried through as a potential alternative, then dechlorination would also be considered.

Q16: Does outfall disinfection mean disinfection at the CSO outfall site?

A16: DEP responded that every scenario is different. Typically, there would be a tank at the outfall for a combination of detention time and chlorination.

Q17: Would this be similar to what the Newtown Creek WWTP does with its treated effluent that is released out in the East River? As in, the chlorine would be combined with the outgoing effluent and fed to a deep point away from the shore?

> A17: DEP responded that yes, that is what the plant does, and yes, the majority is sent to the East River.

Q18: Why is aeration being considered? It does not reduce the volume of CSOs and it makes the Creek look creepy for a person that may want to fish or swim in it.

> A18: DEP responded that aeration was required under the Waterbody Watershed Facility Plan for Newtown Creek to meet the dissolved oxygen (DO) criterion of not less than 3 mg/L, and as a means to reduce odors and improve DO overall. Aeration is not used for bacterial reduction. Under the current LTCP process, aeration is just one of many alternatives being evaluated.

Q19: In English Kills, what effect has aeration had on wildlife in the water?

> A19: DEP responded that some studies have been done in which improvement was shown, but that they were limited and undertaken during a three-year pilot study.

Q20: The sediment mounds in the Creek can cause navigation vessels to shallow out especially in low tide and in the tributaries. What are you doing to remove the tons of material, besides the most overt of floatables that are being carried out of the pipes and deposited into the Creek?

> A20: DEP responded that these items, including solids, will be evaluated in the next phase of the LTCP process, when alternatives are reviewed. "Everything in the toolbox" will be evaluated, but not necessarily recommended.

Q21: On the topic of aeration, is DEP going to commit through the LTCP process to reevaluate the aeration projects that are already in place or planned to go forward? Is there a chance for feedback to reevaluate and see if there is a way to save the money that is planned for Dutch Kills and the main stem?

> A21: DEP responded that yes, Dutch Kills aeration is being deferred because it is being reevaluated for size. DEP is open to discussions with the community and DEC to determine whether to revisit the projects.

Q22: To reinforce the previous question, it sounds like the aeration in Newtown Creek was really a bridge approach to a final fishable, swimmable waterway that would not rely on aeration. Can we at some point explicitly declare aeration as a bridge and evaluate it fiscally in those terms to determine if it is worth the cost?

> A22: DEP responded that yes, the aeration was thought of as a phase one bridge to a larger, long-term solution, and not the final investment. The purpose of the LTCP is to evaluate alternatives with water quality models, so that fully informed decisions can be made.

Q23: If a storage tunnel is used where CSO discharges would be diverted from going into the tributaries, would you consider evaluating shutting down the aeration that is already in place?

> A23: DEP responded that is not known at this point. Other entities, such as DEC, would have to be involved in that decision, but DEP will take feedback from this meeting to discuss with others.

Q24: How would the dredging through the LTCP fit in with the Superfund dredging program?

A24: DEP responded that it will share data and coordinate with the U.S. Environmental Protection Agency (EPA) on any dredging activity relating to or impacting Superfund activities. Final dredge depth would likely be dictated by the Superfund process.

Q25: Independent of the Superfund process, if you decide that dredging out CSO sediments is a good idea, is the EPA on board in allowing you to come in and do that or would you have to wait until the end of the Record of Decision to move forward?

A25: DEP responded that while dredging is in the CSO toolbox for the LTCP, it is unlikely that it would be selected for Newtown Creek. Any Superfund dredging would likely be more extensive and would supersede any dredging that would normally be considered for a CSO program. There are many logistics involved, which is why an integrated technical coordination process will be followed.

Q26: The fishable goal requires clean sediment or a clean bottom in the Creek, so the swimmable goal will come a lot sooner, correct?

A26: DEP responded that fishable means recreational fishing, not edible fishing. Swimmable and fishable are water quality goals, but that does not mean DEP endorses or recommends swimming in or eating the fish from the Creek. Specific information for edible fishing is available and can be provided.

Q27: Regarding the Wait… Pilot Program, is there any conception of an incentive program so that in the future people can be rewarded for showing their discipline?

A27: DEP responded that the Wait… Pilot Program was highly successful. An incentive program is planned for discussion and evaluation for future pilot areas.

Q28: What is the time frame in general from the first alert to the all-clear for the Wait… Pilot Program?

A28: DEP responded typically six hours.

Q29: Based on the presentation, there was not a lot of data presented to be able to interpret and discuss the problems and potential solutions. Can DEP give more data information?

A29: DEP acknowledged that a lot of data was collected as part of the LTCP program and was evaluating how best to present the data to the public for further discussion. DEP also noted it is still coordinating with EPA and the Newtown Creek Group on Superfund.

Q30: Normally after this meeting you come back with an alternative where you have crossed out several alternatives and have a plan. Would you be open to having another meeting where we come together again to dive into the material as a community since there is a lot of expertise in the room?

A30: DEP responded it would consider how best to go forward with the process around the data sharing.

Long Term Control Plan (LTCP) Newtown Creek Public Meeting #2 – Public Data Review Meeting

Summary of Meeting and Public Comments

On February 21, 2017 the New York City Department of Environmental Protection (DEP) hosted a public meeting to present the data collected as part of the Newtown Creek Combined Sewer Overflows (CSO) Long Term Control Plan (LTCP). The two-hour event, held at the Newtown Creek Wastewater Treatment Plant (WWTP) Visitor Center in Greenpoint, Brooklyn, provided information about DEP's LTCP development for Newtown Creek. The data-sharing meeting was the first of its kind and was held in response to the request made at the close of the kickoff meeting held on November 15, 2016.

Approximately 30 people from the public attended the event, as well as representatives from DEP and the New York State Department of Environmental Conservation (DEC). Information presented included:

- DEP sampling programs and sampling locations;
- CSO and MS4 landside sampling results and analysis;
- Flow monitoring results and analysis;
- The landside model calibration process;
- Receiving water bacteria sampling results and analysis;
- Dissolved oxygen sampling results and analysis;
- Impact of Aeration on DO Levels;
- The water quality model calibration process;
- Data from other (non-DEP) sampling programs;
- Newtown Creek built and planned GI projects;
- Baseline model inputs and assumptions; and
- Model results for baseline CSO volumes.

Key findings from the data collected in the Newtown Creek LTCP Sampling Program indicated elevated bacteria levels, excursions below the water quality standards (WQS) criteria for DO and a slow time to recovery for the waterbody. The following summarizes the questions and comments from attendees as well as responses given. The presentation can be found at http://www.nyc.gov/dep/ltcp.

Q1: Why doesn't fecal coliform and *Enterococci* concentration track consistently with each other in the CSO data?

> A1: DEP responded that it does not have a clear explanation or reason, but that the data seem to be consistent with data from other waterbodies where fecal coliform is generally higher than *Enterococci*.

Q2: Why are bacteria concentrations elevated in MS4 outfalls?

> A2: DEP responded that they are evaluating the issue. . DEP noted that it is unclear why the MS4 *Enterococci* results are much higher than the fecal coliform concentrations, but that it is presenting the data collected.

Q3: Why are there no overflow results for CSO Outfall NC-015?

> A3: DEP responded there was not an overflow with the rain intensities experienced during the LTCP Sampling Program that ran from July 1st to November 3rd 2016.

Q4: Can you explain where the samples are taken?

A4: DEP responded that the results shown on slide 13 are for CSO outfall samples taken from the regulator, upstream of the waterbody.

Q5: In monitoring bacteria levels in water you mentioned, samples were collected at high and low tide. I imagine that for DO, the DO levels would vary with time and tide? Were samples taken at times when minimum DO is expected?

A5: DEP responded that slides later in the presentation show DO results including continuous DO data collection using data sondes.

Q6: What about sampling for heavy metals?

A6: DEP responded that heavy metals are not a parameter analyzed under the Clean Water Act CSO sampling programs but that other programs, such as Superfund, that collect data on heavy metals.

Q7: The fecal coliform and *Enterococci* values for MS4 seem really high. Do you have a sense of what typical values are, and if high, can you check for illicit connections?

A7: DEP responded that illicit connections are not a problem in the Newtown Creek area. This is a wet-weather program so the sampling events target CSO-triggering events. DEP can provide typical MS4 values and the concentrations being used in the model.

FOLLOW-UP RESPONSE: Typical stormwater concentrations from a previous city-wide stormwater sampling program are:

- Fecal coliform:
  - 120,000 #/100mL (high level urban)
  - 35,000 #/100mL (low level urban)
- Enterococci:
  - 50,000 #/100mL (high level urban)
  - 15,000 #/100mL (low level urban)

The water quality model for Newtown Creek is using stormwater concentrations based on the sampling data from Newtown Creek, so the model will reflect the range and relative frequency of the measured concentrations.

Q8: If a wetter year had been used for model calibration, would the results have shown more variability compared to the calibration standards?

A8: 2014-2015 was representative in terms of rainfall, with both large and small storm events, plus there was an entire year of data upon which to evaluate the calibration.

Q9: What does top and bottom mean for samples?

A9: DEP responded that along with high/low tide, samples are collected near the water surface and near the bottom of the Creek if sufficient depth exists for both.

Q10: Do you see a difference in time of recovery from top and bottom samples?

A10: DEP responded that yes, the top sample typically has a higher bacteria concentration than bottom samples. Because CSOs are non-saline water, which is less dense than salt water, the CSO tends initially to be concentrated in the top layers. Bacteria that is attached to sediment can also be re-suspended.

Q11: Was this data collected during the day?

A11: DEP responded that yes, waterbody samples were collected during the day following the storm/CSO event.

Q12: So even in the area with aeration there are depressed DO levels below the WQS? Do you think it would be worse without aeration?

A12: DEP responded that the data sondes continuously recorded data throughout the day and night (low DO hours). DEP noted that there are some issues with the sonde data collected. And yes, the DO levels would be worse without aeration. Slide 17 shows historical DO data in the area of the installed aeration.

Q13: Where were the data sondes installed, on top of the aeration system?

A13: DEP responded that grab samples were taken from the centerline of the Creek and DEP needs to confirm the location of the data sonde installations.

FOLLOW-UP ITEM: All sondes were on low profile mounts close to the bed of the Creek but they were not installed on or directly adjacent to the aeration system equipment. It is possible the sondes were being covered and uncovered by sediment with changes in the tide and the low DO readings are an artifact of being covered with sediment.

Q14: Was Sediment Oxygen Demand (SOD) collected using light and dark chambers?

A14: DEP responded that yes, it believes the light and dark chambers were used.

FOLLOW-UP ITEM: The SOD analysis protocol called for incubating the sediment core tubes in the dark.

Q15: Have you looked at variable die-off rates for other factors such as solar reduction?

A15: DEP responded that yes, it has considered other die-off factors such as solar radiation, and may revisit those factors.

Q16: Have you done any vertical profiles for DO?

A16: DEP responded no; only top and bottom are collected.

Q17: Why did you do comparison of Newtown Creek Alliance data but not Riverkeeper?

A17: DEP responded that the Riverkeeper comparison is shown on slide 45.

Q18: How many gallons of CSO does aeration prevent?

A18: DEP respond zero; aeration addresses only dissolved oxygen.

Q19: Regarding the use of natural versus artificial turf in green infrastructure installations, have you done sampling/testing to determine which is better?

A19: DEP responded yes, testing is part of the DEP research and development program. DEP noted that in some cases, artificial turf was better for programmable uses of the green space.

Q20: Do you have any GI projects in the Community Board 2 area, north of Newtown Creek?

A20: DEP responded that information can be sent regarding that area.

FOLLOW-UP ITEM: Visit www.nyc.gov/greeninfrastructure to view the online map of planned, designed, and constructed green infrastructure installations. Click "content" to include community board shapes.

Q21: All GI is upland and small sites. Seems like Newtown Creek is an opportunity to restore/make an entire area as marshland to be used as for treatment. Has there been thought to transforming Dutch Kills into a marshland?

A21: DEP responded yes, those concepts are part of the LTCP analysis. There is a balance between green and grey infrastructure to achieve the desired water quality. DEP seeks the public's input on where to install GI. DEP also noted that a wetland pilot project has been installed in Dutch Kills and that a second one will be installed this year.

Q22: Are the volumes for all outfalls in the model? And available to the public?

A22: DEP responded that yes, the 21 outfalls are in the model and yes, we can provide the volumes for all 21.

FOLLOW-UP ITEM: Updated LTCP Baseline volumes for all CSO outfalls to Newtown Creek for the 2008 typical year are presented in Table 1.

Table 1. LTCP Baseline Volumes to Newtown Creek (2008 Typical Year)

Combined Sewer Outfalls	Receiving Waters	Discharge Volume (MGY)	No. of Discharges
BB-026	Dutch Kills	120	37
NC-077	Maspeth Creek	300	41
NC-083	East Branch	314	42
NC-015	English Kills	321	31
Subtotal - Four Largest Outfalls	**Newtown Creek and Tributaries**	**1,055**	**42 (max.)**
BB-004	Dutch Kills	0	1
BB-009	Dutch Kills	43	34
BB-040	Dutch Kills	1	16
BB-010	Newtown Creek	1	7
BB-011	Newtown Creek	2	14
BB-012	Newtown Creek	0	1
BB-013	Newtown Creek	16	31
BB-014	Newtown Creek	2	18
BB-015	Newtown Creek	1	13
BB-042	Newtown Creek	2	22
BB-043	Newtown Creek	9	32
BB-049	Newtown Creek	0	0
NCB-019	Newtown Creek	3	21
NCB-021	Newtown Creek	0	0
NCB-022	Newtown Creek	7	29
NCB-023	Newtown Creek	0	8
NCQ-029	Newtown Creek	19	40
Subtotal – Other Outfalls	**Newtown Creek and Dutch Kills**	**106**	**40 (max.)**
Total CSO	**Newtown Creek and Tributaries**	**1,161**	**42 (max.)**

Q23: Why such changes in modeled volumes from previous models? NC-083 has been the biggest outfall in the past.

A23: DEP responded that Outfall NC-083 has stormwater connections downstream of the regulator. In addition, DEP has active bending weir projects that move flows around. Further details can be provided in the model calibration report. In the case of Outfall NC-015, some areas now go to the East River.

Q24: Does DEP have updated sewershed maps reflecting the changes?

A24: DEP responded yes, that slide 54 shows the outfall drainage areas, and revised maps will be included in the LTCP. DEP can also provide that information separately beforehand.

Q25: At what point will aeration be addressed since it has been delayed several times? Would like to address it now and make an argument that previous analysis is based on aged data before other improvements were in place and is an old order requirement. Aeration is poor investment of money and the installed system is not functioning properly and is not an effective system. Why not just run the aeration system right after storm events, when DO conditions are worse?

A25: DEP responded that aeration and the other LTCP alternatives will be discussed at the April Alternatives Meeting when DEP will have model results and more/updated analyses.

Q26: Request a meeting with DEP to discuss and finalize the aeration decision?

A26: DEP responded that it is open to meeting with the community to further discuss aeration.

FOLLOW-UP ITEM: DEP and DEC met with representatives from Riverkeeper and the Newtown Creek Alliance to discuss aeration. That meeting took place at DEC Region 2's headquarters in Long Island City on April 5, 2017.

Long Term Control Plan (LTCP) Newtown Creek Public Meeting #3 – Review of Alternatives Meeting

Summary of Meeting and Public Comments

On April 26, 2017 the New York City Department of Environmental Protection (DEP) hosted a third public meeting for the water quality planning process for the Long Term Control Plan (LTCP) of combined sewer overflows (CSOs) in Newtown Creek. The three-hour event, held at the Newtown Creek Wastewater Treatment Plant Educational Center in Brooklyn, provided overview information about DEP's LTCP Program, presented information on Newtown Creek's water quality, baseline conditions and performance gaps. The bulk of the presentation focused on DEP's alternatives evaluation. At the end of the presentation, attendees asked questions and gave input on the proposed alternatives.

Approximately 45 people from the public attended the event, as well as representatives from DEP and the New York State Department of Environmental Conservation (DEC). Information presented included:

- Concurrent Newtown Creek Programs;
- Water Quality Standards & LTCP Goals;
- Recap of LTCP Process;
- Water Quality, Baseline Conditions and Performance Gap;
- CSO Control Evaluation Process;
- Newtown Creek Alternatives Toolbox and Overview of Newtown Creek Alternatives;
- CSO Storage Volume, Peak Flow, and Activation vs. Percent Capture;
- BB-026: Borden Avenue Pumping Station Expansion;
- Potential Sites at Dutch Kills;
- NC-077: New Wet Weather PS+ FM to Kent Ave Interceptor;
- NCB-015, NCB-083 and NCQ-077: Parallel Wastewater Interceptor;
- Ecological Restorations;
- Dutch Kills Flushing System Concept;
- Storage Tanks at Each Outfall;
- Retention/Treatment Basins at Each Outfall;
- Tunnel Alternatives A and B;
- Alternatives Summary – 2017 Costs;
- Alternatives Summary – Escalated Costs;
- Affordability Analysis; and
- LTCP Delivery Schedule.

At the end of the meeting, attendees were given note cards on which to write any questions, after which the questions were collected and read aloud by DEP staff. The following summarizes the questions and comments from attendees, as well as responses given. The presentation can be found at http://www.nyc.gov/dep/ltcp.

Q1: An attendee asked why Dutch Kills was excluded from the 50 percent CSO Control Modeling.

A1: DEP stated that the results shown are preliminary and DEP will examine 25, 50, and 75 percent CSO Control at Dutch Kills.

Q2. An attendee asked about siting storage tanks, eminent domain, and tunnels.

A2. DEP stated that the first phase of site selection is looking at vacant parcels, then parcels where buildings are already in place. Tanks are usually sited on large-scale existing parcels but for the Newtown Creek watershed, this option is impossible due to the number of properties within the area. Tunnels are typically placed in the right-of-way to avoid conflict with properties. The right-of-way tunnel alignment would be preferred due to lower risks to property foundations and soil contamination.

Q3. An attendee asked about Water Tunnel Number 3 and utility lines.

A3. DEP stated that different tunnel routes are being considered. If selected, a tunnel would be placed according to a three-tunnel-depth assumption and contingent on bedrock conditions. A tunnel within NCB-015 and NCB-083 would be approximately 250-ft deep. DEP stated that the preferred route would not be in close proximity to the Water Tunnel.

Q4. An attendee asked why BB-009 is not addressed even though it discharges 47 MG to Dutch Kills.

A4. DEP stated that the LTCP is focusing on the largest CSO outfalls. These outfalls have the biggest impact on water quality due to the volume and frequency of CSO events. However, if more information is needed, BB-009 will be evaluated.

Q5. An attendee asked why more green infrastructure projects are not considered in the vicinity of Newtown Creek.

A5. DEP stated, a lot of green infrastructure is planned, in-construction, or has already been constructed for the Newtown Creek watershed. DEP is working to meet its current Consent Order goals, and will continue to build out and work with other partner agencies to identify feasible projects.

Q6. An attendee asked why High Rate Treatment Clarification was removed from the alternatives.

A6. DEP stated that High Rate Treatment and Retention Treatment Basins (RTB) are similar, but that the High Rate Treatment requires additional chemicals. Therefore, RTB was one of the retained alternatives.

Q7. An attendee asked what causes the Algae Blooms if not CSOs.

A7. DEP stated that the WWTPs provide the largest nutrient loads. Nitrogen is the limiting nutrient for algae growth in saline water; phosphorus is the limiting factor in fresh waters. DEP has invested $1.1B for nitrogen removal, which has led to lower amounts of nitrogen within the NYC waterbodies.

Q8. An attendee asked what outfall disinfection method DEP examined.

A8. DEP stated that it is currently looking into chlorination. Disinfection using ultraviolet light (UV) is not preferable due to solids removal that is needed prior to UV treatment. DEP looked at peracetic acid as well.

Q9. An attendee asked about the status of the Borden Avenue Pumping Station and if the expansion can be maintained.

A9. DEP stated that the current pump system needs replacement. DEP is currently looking into potential option for Borden Avenue Pumping Station upgrade.

Q10. An attendee asked if the results of GI on CSO have been quantified.

A10. DEP stated that a Performance Metrics Report was developed and is available on the DEP website. DEP looked at CSO reductions based on the current GI implementation rate and ran a model to calculate CSO volume reduction based on a 10 percent implementation rate.

Q11. An attendee asked if GI analyses are available.

A11. DEP stated that GI Performance Metrics and Annual Reports are available online.

Q12. An attendees suggested areas for additional GI projects, for example: street end of Vernon Blvd. and South of 83rd St.

A12. DEP stated that is it open to suggestions.

Q13. An attendee asked why there are no rain gardens and other GI projects in lower Manhattan since it feeds to Newtown Creek.

A13. DEP stated that wastewater from lower Manhattan goes to the Newtown Creek WWTP but only GI within the Newtown Creek watershed would have an impact on CSO reduction in Newtown Creek.

Q14. An attendee asked how CSO is measured.

A14. DEP stated that flow meters were installed at five CSO regulators and flow data was collected for one year.

Q15. An attendee asked why Bowery Bay WWTP is ideal for flow tipping.

A15. DEP stated that it is currently looking into expansion of Borden Avenue Pumping Station, directing the flow from BB-026 into the pumping station and bringing it to Newtown Creek WWTP. The evaluation is underway.

Q16. An attendee asked why focusing on increasing treatment of current CSO contaminants instead of increasing maximum flow threshold for the system.

A16. DEP stated that capacity of Newtown Creek WWTP was already expanded and, as of now, it is not feasible to direct more flow into the plant.

Q17. An attendee asked why the studies for LTCP projects are under the Superfund timeline.

A17. DEP stated that it is working on the two programs simultaneously.

Q18. An attendee asked if it is feasible to increase the capacity in existing interceptors rather than building a new tunnel.

A18. DEP stated that the City always looks at optimizing the existing capacity first. For example, the ongoing bending weirs construction project allows system optimization. The CSO volumes shown during the presentation took system optimization into account.

Q19. An attendee asked if there are cost savings to new construction with separated grey and black water disposition.

A19. DEP stated that there can be cost savings for some projects.

Q20. An attendee asked if DEP considered roof runoff as contribution to the Creek.

A20. DEP stated it does not look at roof runoff as a freshwater contribution to the Creek.

Q21. An attendee asked if more flow will be going into Flushing Bay and Flushing Creek since it will be pumped away from Bowery Bay WWTP.

A21. DEP stated that there will be no flow going to Bowery Bay WWTP. The flow coming from BB-026 will be directed to Newtown Creek WWTP.

Q22. An attendee asked why the Federal standards for *Enterococci* are not applied in NYC. Are DEP and DEC agreeing on LTCP plans to pre-empt the implementation of the Federal *Enterococci* Standard?

A22. DEP stated that the LTCPs are prepared in accordance with the current water quality standards. The *Enterococci* results are run for evaluation and analyses purposes.

Q23. An attendee asked why only 3.2 percent GI and not 10 percent GI is applied in Newtown Creek watershed.

A23. DEP stated that a 3.2 percent GI rate was very ambitious and it will consider more GI when feasible and when it does not conflict with grey projects.

Q24. An attendee stated that the presented models and plots point towards 50 percent CSO control. Why not mix grey and green infrastructure to get 100 percent CSO control?

A24. DEP stated that it is not an easy task to get to 100 percent CSO control given the size of the waterway. DEP's alternatives analysis will make recommendations on the right course of actions.

Q25. An attendee asked how much money DEP is spending in Gowanus Canal.

A25. DEP stated that currently they are spending $800M for 12 MG storage tanks to capture 74 percent of the CSO.

Q26. An attendee stated that there may be many toxics coming out of the CSO.

A26. DEP stated that the analyses that have been made on the CSO did not show any toxic substances. There are wash-off substances from the street that will contribute to the water quality; however, the concentration is not anticipated to exceed the remedial levels set by EPA.

Q27. An attendee asked if there is opportunity for GI as a constructed wetland or treatment wetland.

A27. DEP stated that it has built wetlands in Dutch Kills as a pilot project and that more wetlands will be constructed in the summer of 2017.

Q28. An attendee asked how many of the presented ideas are closed due to Superfund.

A28. DEP stated that this is difficult to determine because the remedial goals have not yet been determined for the Superfund program.

Q29. An attendee asked why LaGuardia College parking lot was dismissed from land acquisition.

A29. DEP stated that LaGuardia College parking lot is difficult for site acquisition because it is owned by the State Dormitory Authority and is already in use. DEP is targeting sites that are owned by DEP or other City entities.

Q30. An attendee asked what the prioritization is in getting a property.

A30. DEP stated that first the Department is looking into DEP-owned properties, next City-owned properties and, finally, privately-owned properties.

Q31. An attendee asked how the baseline projection of compliance compares to existing conditions.

A31. DEP stated that DEP has made significant improvements, particularly since the Newtown Creek WWTP expansion.

Q32. An attendee asked how long it will take until the construction will start.

A32. DEP stated that they do not know and will look closely into the alternatives. The LTCP will include projected timelines for the final selected alternative.

Q33. An attendee asked what the tunnel life span is and will it eventually have to be taken off-line for maintenance.

A33. DEP stated that a tunnel's typical life span is 100 years. DEP is also reviewing the scalability of the options. Maintenance is usually done once a decade, typically during winter season.

Q34. An attendee asked how the aeration system built in East Branch will be evaluated in the next years.

A34. DEP stated that it continues to evaluate aeration operations and work depends on the seasonal variation of DO.

NCA
NEWTOWN CREEK ALLIANCE

February 11, 2015

Angela Licata
Deputy Commissioner for Sustainability
NYC Department of Environmental Protection

Gary E. Kline, P.E.
NYC Municipal Compliance Section Chief
NYS Department of Environmental Conservation

Dear Ms. Licata and Mr. Kline,

I am writing in regards to the aeration project within Newtown Creek, especially phase NC-4 that expands the project into the lower stretches of the main channel and the Dutch Kills tributary. Much of our previous conversation has focused on the failure to collect on-site data that demonstrate the safety of inorganic particulates aerosolized by the aeration; an omission of particular concern, given on-site data that demonstrates benthic microbes are aerosolized. We now wish to shift focus to other vital concerns regarding the expansion of the project. For reasons stated below we request a delay of the NC-4 expansion.

Dissolved Oxygen Levels in the Main Channel

The proposed expansion of the aeration project includes the greater part of the main channel of Newtown Creek (extending 4500 feet eastward from the mouth of Dutch Kills and about one mile north from the Maspeth blower building). While we fully appreciate efforts to raise dissolved oxygen levels above the 3 mg/L standard that is driving the consent order, we would like to point out that the main channel of Newtown Creek regularly meets this standard from May through September (when DO levels are typically lower and the system would be in operation). From last year's Harbor Survey conducted during this period by the New York City Department of Environmental Protection (NYCDEP), we find that a large majority of the samples from three main channel sites proposed for inclusion in the aeration project - NC3, NC2 and NC1 measured above the 3 mg/L DO standard; respectively 97%, 84% and 87%. To offer comparison to other waterways with conditions similar to Newtown Creek (poor circulation and heavy CSO discharge), we examined NYCDEP data from the Harbor Survey for sites CIC2, WC2, HC1 and BR3. In contrast to the NC sites, records for BR3 and HC1 show that a minority of samples measured above 3 mg/L DO: respectively, 41% and 48%. For sites WC2 and CIC2, the standard was exceeded in only 65% and 73%, respectively, of recorded samples.[1] In sum, the NYCDEP's own data reveal that conditions are measurably worse at sites where no aeration system is currently proposed. Given these data, the community of Newtown Creek is owed an explanation for the speed with which the aeration project is being implemented, especially in light of the community's growing concerns.

[1] See NYCDEP Harbor Survey data referenced here: http://www.newtowncreekalliance.org/wp-content/uploads/2015/02/DO_ncversus.jpg

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To this point, at a recent meeting with the Environmental Committee of Queens Community Board 2, DEP officials clearly stated that the system would “only run during times when DO concentrations are below the 3 mg/L threshold”. If this is indeed to be the case then the some 2 miles of piping within the main channel would only need to run 11% of the time during summer months (using the average of the three test sites given above). Given that water quality conditions continue to improve throughout NY Harbor (in large part due to significant investments from both your agencies to reduce CSO volume) one would only expect these numbers to improve, as they have already done so from 1992 when this consent order was originally initiated.

Alternative ‘Green’ Strategies for Dutch Kills

There are numerous advantages to implementing a natural system (*i.e*. wetland habitat) for water quality remediation over an engineered aeration strategy. These advantages include:

- no energy footprint
- no greenhouse gas emissions
- no health risk
- long-term self-sustaining environmental services in addition to increasing DO levels
- habitat creation for wildlife
- social benefit to local businesses and residents

No area of Newtown Creek would be better suited for such a strategy as the Dutch Kills tributary. There has been documented interest, effort and progress in the reintroduction of marsh habitat here, given the proximity of the tributary to LaGuardia Community College and community support for funding wetland remediation through the NYS Environmental Benefits Fund. Pilot habitat modules, installed and monitored with the help of LaGuardia students, have now demonstrated the viability of cordgrass and ribbed mussel along the bulkhead of the upper tributary. A local business, American Storage, is soon to remove an abandoned barge and associated structures from the adjacent shore, thereby rendering this shoreline available for habitat remediation. A salt marsh constructed here could be designed so as to serve the function of a treatment wetland, given the proximity of a Tier 3 CSO. Unlike the main channel and English Kills, this tributary is totally void of commercial maritime traffic and many areas have already become too shallow for navigation, presenting great potential conditions for wetland restoration as identified in the Newtown Creek BOA report (2011) as well as DEP Ecological Services.

Additionally, aeration within Dutch Kills will have a more pronounced impact on local communities than areas like English Kills and East Branch. The waterway has become a focused area of study for environmental science students at LaGuardia, is a frequent destination for environmental education canoe trips led by the North Brooklyn Boat Club and is only a few hundred feet from several high schools and community gardens. Additionally, plans for a Dutch Kills Basin Park at the tributary’s edge are still being actively pursued (via City Parks Foundation). As with other parts of the waterway, a number of businesses border the Creek, many here with the tributary as their personal backyard. The installation of a loud and disruptive aeration system will directly impact current uses as well as the calm nature of the water that makes for safer boating and better observations of wildlife. In regards to local interest in restoring natural systems, the community has twice supported wetland development in Newtown Creek by voting to pursue such efforts with NYS Environmental Benefit Funds. While we appreciate that consent orders are issued to effect compliance with environmental legislation on behalf of the public good; we urge your agencies to allow public feedback to guide how consent orders are addressed. We see an amazing opportunity in Dutch Kills to implement a project that can provide significant long lasting improvements, and urge the Departments of Environmental Conservation and Protection to consider employing green alternatives to the planned gray infrastructure project.

Long Term Control Plan (LTCP) and Water Quality Standards and Classifications
As a LTCP for Newtown Creek will be submitted (2017) well before construction of NC-4 is completed (December 2019) and would ostensibly drive all future initiatives to improve water quality conditions, we find it prudent to delay the aeration expansion until the LTCP is put in place. As no timeline has been given for how long the aeration project would remain installed and operating within the Creek, it seems that an LTCP would be the appropriate time to plan and identify such a timeline, incorporating goals beyond a 3mg/L threshold. For instance, we are hopeful that the LTCP will take significant steps to address CSO discharge into the Creek, which again will improve and stabilize DO levels.

And there is yet another argument to temper the pursuit of gray infrastructure construction, given that the DEC is considering a revision this year of Water Quality Classifications (the basis of the consent order). The present consent order is to bring conditions within the Creek up to current SD standards to accommodate fish survival with DO levels greater than 3mg/L. In the new standards, SD waters are to be suitable for primary and secondary contact and would be measured by bacteria standards, as well as DO levels. While it is unclear if the consent order will be updated to reflect new classifications it is reasonable to re-evaluate the approach to improving water quality in the Creek so that both DO and bacteria levels will meet the new standard. In other words, if the new standards are adopted aeration alone will not fulfill the original consent order, which is to meet SD classification.

In closing, we fully appreciate the thousands of hours that DEP, DEC and numerous contractors have spent to date on the aeration project, as well as the tremendous budget for the project, including some $20 million to be spent on NC-4. However, we feel that the improving conditions on the Creek and upcoming planning opportunities have changed the very nature of the consent order and that the NC-4 expansion should not advance without a serious re-evaluation of alternatives that can offer long term solutions to improving water quality. We look forward to a continued dialog that engages both agencies and respects all members of the Newtown Creek community.

Sincerely,
Willis Elkins
Newtown Creek Alliance

CC:
Venetia Lannon, DEC
Emily Lloyd, DEP
Eileen Mahoney, DEP
Carolyn Kwan, EPA
Peter Washburn, NY State Attorney General's Office
Mike Schade, Superfund Community Advisory Group
Sean Dixon, Riverkeeper
Dr. Sarah Durand, LaGuardia Community College
Dr. Eli Dueker, Queens College
Dr. Greg O'Mullen, Queens College
Council Member Antonio Reynoso
Council Member Stephen Levin
Council Member Jimmy Van Bramer
Council Member Elizabeth Crowley
Assemblywoman Catherine Nolan
Assemblyman Joseph Lentol
Joseph Conley, Queens Community Board 2 Chair
Dorothy Moorehead, Queens Community Board 2 Environmental Chair
Vincent Arcuri, Jr., Queens Community Board 5 Chair
Walter Sanchez, Queens Community Board 5 Land Use Chair
Dealice Fuller, Brooklyn Community Board 1 Chair
Ryan Kuonen, Brooklyn Community Board 1 Environmental Chair
Dewey Thompson, North Brooklyn Boat Club
Noah Kauffman, LIC Roots

S.W.I.M. Coalition
Stormwater Infrastructure Matters: utilizing stormwater as a resource, not a waste!

NCA
NEWTOWN CREEK ALLIANCE

December 19, 2016

Vincent Sapienza, P.E.
Acting Commissioner
NYC Department of Environmental Protection
59-17 Junction Boulevard
Flushing, NY 11373

Sent via email ltcp@dep.nyc.gov

Re: Newtown Creek CSO LTCP Kick-off meeting

Dear Commissioner Sapienza,

The Stormwater Infrastructure Matters (SWIM) Coalition and Newtown Creek Alliance submit this letter in response to the New York City Department of Environmental Protection (DEP) invitation for public comments concerning the development of the Newtown Creek CSO Long Term Control Plan (LTCP).

The SWIM Coalition represents over 70 organizations dedicated to ensuring swimmable and fishable waters around New York City through natural, sustainable stormwater management practices. Our members are a diverse group of community-based, citywide, regional and national organizations, water recreation user groups, institutions of higher education, and businesses.

The Newtown Creek Alliance (NCA) is a community-based organization dedicated to restoring, revealing and revitalizing Newtown Creek. NCA represents the interests of community residents and local businesses who are dedicated to restoring community health, water quality, habitat, access, and vibrant water-dependent commerce along Newtown Creek. Since 2002, the Alliance has served as a catalyst and channel for effective community action and our efforts have made a positive and enduring impact on the health and quality of life of Creek-side communities.

On behalf of the SWIM Coalition Steering Committee and the Board of Directors for the Newtown Creek Alliance, please accept these comments regarding the Newtown Creek LTCP.

CSO Data

First and foremost, we are concerned about the lack of detailed information provided at the kick off meeting. As one example, inconsistent with other LTCP presentations by the DEP, no details were provided on outfall-specific CSO volumes. This data has been provided for the Westchester Creek, Flushing Creek, Gowanus Canal, Bronx River, Flushing Bay, and Coney Island Creek LTCP kick-off presentations. Citywide, SWIM, Newtown Creek Alliance, our partners, and the public rely on such data for everything from outreach and education to providing detailed comments on LTCP proposals.

The last time the Newtown Creek community was presented with specific CSO discharge volumes was in the 2011 Waterbody Watershed Facility Plan. We request that this information be made publicly available on the Newtown Creek LTCP webpage as soon as possible. We also reiterate a request made at the public meeting, and below, that there be a new, data-focused, detail-driven meeting with the community before the planned "Alternatives" meeting.

Green Infrastructure

The Community also needs more details for planned and completed green infrastructure (GI) projects. What are the 24 preliminary projects being considered? What projects were considered but ultimately not considered? What is the total square footage and potential gallons managed from these potential and constructed projects? These details should be made available on the Newtown Creek LTCP webpage as soon as possible. This information is vital for the community; it aligns ongoing private property work with public projects and DEP initiatives, shows the public what regional approaches are underway for reducing stormwater before it enters the CSO system, and it gives community boards and neighborhood associations a clear picture of upcoming or planned projects in their action areas.

Specific GI information also informs interested stakeholders, such as our groups, as to where gaps are in green infrastructure proposals and where we can focus our efforts for outreach and engagement. In short, it appears that the City is walking back investments in green infrastructure for this region - we request, therefore, that the DEP generate a more robust presentation on its plans and progress for GI in this sewershed.

Members of the public mentioned that industrial buildings near the Creek have the potential for and capacity to install and maintain green roofs but do not qualify for the current

DEP GI Grant Program because they are in an MS4 area. We recommend that the Grant Program be extended to the MS4 areas of the city so that GI on private property can assist in capturing stormwater runoff.

Aeration

In regards to the LTCP and CSO "control", we seek to fully address the numerous issues surrounding the currently operational aeration system and planned expansion. We have raised a multitude of concerns over the years and have not received straight answers from DEP or DEC addressing these concerns. To have meaningful engagement on this topic, and most importantly, find solutions that satisfy all vested interests, we request a meeting with DEC and DEP to specifically discuss aeration in person. Given the lack of dialog regarding the long - term plan for utilizing aeration as well as the actual necessity for aerating different areas of Newtown Creek, and the fact that the system only addresses one symptom of Clean Water Act standards, we ask that growing community concerns and unanswered questions not only be acknowledged but addressed in determining a revised plan going forward. The DEP, the State DEC, and the EPA (in its role overseeing the Creek's contamination remediation) cannot continue to ignore the public on this fundamental issue.

Illegal Dumping/Discharges in the Creek

It is important to note that several community members at the kick off meeting raised concerns about the illegal dumping into the Creek and nearby catch basins. While we recognize that DEP will address this matter through the forthcoming MS4 plans and their enforcement program, we recommend that DEP consider stronger enforcement measures against chronic violators and not just impose fines but rather require that these violators pay for the costs to clean up the waterway and catch basins that they damage when they dump cement and other toxins into the Creek and the City's sewer system.

Public Involvement in Alternatives Selection

Finally, as noted during the meeting, the current process of meeting for the kick-off and then for the proposed alternatives does not allow sufficient opportunity for the public to weigh in on the alternatives. This community is well informed on CSO and water quality issues, due in part to Newtown Creek Alliance outreach and education efforts, as well as involvement from the Newtown Creek Superfund CAG.

The knowledge of the community should be leveraged through this process. As such, we ask DEP to hold a separate collaborative session to explore and discuss alternatives for the LTCP before the agency makes its initial knee-of-the-curve decisions.

Thank you for the opportunity to submit these comments for the Newtown Creek CSO LTCP. We would welcome the opportunity to meet with you to discuss these matters further.

Sincerely,

Willis Elkins, Project Manager
Newtown Creek Alliance

Julie A. Welch, Program Manager
On Behalf of the SWIM Coalition Steering Committee

Sean Dixon, Riverkeeper
Andrea Leshak, NY/NJ Baykeeper
Larry Levine, Natural Resources Defense Council
Michelle Luebke, Bronx River Alliance
Paul Mankiewicz, The Gaia Institute
Tatiana Morin, New York City Soil & Water Institute
Jaime Stein, Pratt Institute
Shino Tanikawa, New York City Soil & Water Conservation District

CC: Pamela Elardo, NYC DEP
Angela Licata, NYC DEP
James Tierney, NYS DEC
Joseph DiMura, NYS DEC
Gary Kline, NYS DEC

May 31st, 2017

Vincent Sapienza, P.E.
Commissioner
NYC Department of Environmental Protection
59-17 Junction Boulevard
Flushing, NY 11373
Sent via email ltcp@dep.nyc.gov

Newtown Creek LTCP Comments

Dear Commissioner Sapienza,
As the New York City Department of Environmental Protection (NYCDEP) prepares a Long Term Control Plan (LTCP) for addressing Combined Sewer Overflow (CSO) and Clean Water Act standards in Newtown Creek, we offer the following comments. CSO is one of the most significant threats to the health of Newtown Creek. The estimated 1.2 billion gallons of untreated combined sewage per year brings excessive nutrients, pathogens, chemicals and plastic debris into the waterway posing harm to local wildlife and community members who seek to use the Creek for recreational and educational opportunities. We believe the following solutions are necessary steps forward in creating a healthier and more vibrant waterway for generations to come.

100% Capture for Largest 3 CSOs
We believe that large-scale capture of CSO is the most viable solution to improving water quality in Newtown Creek. We are in support of a storage tunnel that will capture 100% of CSO volume from the largest 3 outfalls on the Creek: NCQ-077 (Maspeth Creek), NCB-083 (East Branch) and NBC-015 (English Kills)[1]. We feel strongly that complete capture is the only viable path forward to ensure compliance and protection of both the ecosystem and human health for generations to come. A partial reduction of CSO volume from these big three outfalls will ensure that ongoing water quality hazards present in these most stagnant areas of the Creek will persist. Allowing half a million gallons of CSO to continue to enter Newtown Creek is simply unacceptable. If a significant investment of time and resources are required to bring a storage tunnel online; we urge NYCDEP to ensure that the resulting benefits to the ecosystem and surrounding communities reflect such an investment. We look forward to learning more details about storage tunnel specifications.

Storage Tank in Dutch Kills
As with the other 3 largest CSOs, we believe that capture at the largest CSO in Dutch Kills (BB-026) is a necessity. As stated in NYCDEP's Alternative Presentation, a 2.3 acre site is

[1] We recognize that abnormally large storms may render 100% capture impossible in reality, but support a tunnel with capacity over 130 millions gallons, as outlined in NYCDEP's Alternative Presentation from April 26, 2017.

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required to achieve 75% capture at this outfall. The NYS Dormitory Authority parking lot, which lies in direct proximity to the outfall tide gate, covers 2.1 acres - essentially allowing for more than 70% capture. We urge NYCDEP to engage with LaGuardia Community College in an evaluation of feasibilities at this location. While we fully appreciate the value of parking space for an institution of this size in a crowded urban environment; we believe that solutions exist that can retain parking, allow for DEP infrastructure and possibly add extra benefits (such as a green roof on top of a parking garage). Given that a growing number of LaGuardia faculty and students are some of the most engaged and committed stakeholders in creating a cleaner and more accessible Dutch Kills, we feel there is great potential for a partnered project between a city agency and city college.

We are also in favor of CSO capture in Dutch Kills so as to not overburden adjacent waterways. The idea of increasing the volume of wet weather flow from BB-026 to the Newtown Creek Water Pollution Control Plant (WPCP) is of concern for us, given the likelihood of increasing CSO discharge to the East River. Although less stagnant, the East River is connected to Newtown Creek both via tidal flushing and by the communities that border both. Simply put, we seek solutions that prevent pollution - not redirect it.

Increase Green Infrastructure (GI) in Dutch Kills

In addition to the 25% to 30% of annual CSO volume that a 2.1 acre storage tank could not capture from outfall BB-026 (30 to 36 Million Gallons per Year (MGY)), there are additional CSOs that discharge into Dutch Kills, primarily from outfall BB-009, which discharges an estimated 43 MGY. To address this estimated 79 million gallons, we urge NYCDEP to expand Green Infrastructure in the Dutch Kills area, primarily the BB-026 and BB-009 sewersheds. We understand that scoping for GI in Dutch Kills is underway but feel that current commitments are inadequate and need to be increased. There are a number of GI opportunities in these areas, including large industrial rooftops, residential, commercial and industrial streets as well as runoff from the Long Island Expressway which currently drains directly to catch basins in CSO drainage areas. An expansive and innovative GI program in Dutch Kills could help capture CSO which will continue to create environmental and public health risk.

Opposed to Expansion of Aeration and Use of Chlorination

We are encouraged to know that NYCDEP is not considering expansion of aeration within Dutch Kills and the main channel of Newtown Creek (from Whale Creek to the Turning Basin), as originally planned in the 2011 Waterbody Watershed Facility Plan. NCA has challenged the effectiveness and necessity of aeration since 2012 and we are encouraged that recent evaluation and discussion of current data and community concerns will spare large sections of Newtown Creek from this narrowly focussed water quality improvement. We continue to urge NYCDEP and NYSDEC to implement improved protocols for operating existing aeration sections, based on real time dissolved oxygen levels, as well as explore alternative systems that don't pose disruption to surface waters and create potential hazards for human health.

As with aeration, we oppose the potential use of Chlorination as a CSO improvement measure - given that such a method only treats one symptom of a much larger issue and introduces additional impacts to the waterway and surrounding communities. We are discouraged to see this method being pursued at other waterbodies in New York City, given the potential negative impacts and strong opposition from our partner community and environmental organizations.

Wetlands and Ecological Services

Just ten years ago Newtown Creek was totally void of any native salt marsh grasses and populations of native filter feeder bivalves, like ribbed mussels and oysters, had not yet been identified or acknowledged[2]. Thanks to community interest and investments from agencies like NYCDEP, we have made great strides in advancing the possibility for increased ecological services in Newtown Creek. Salt marshes can produce oxygen, uptake excess nutrients, sequester carbon, breakdown bacteria and even help mitigate impacts of coastal flooding. We believe that wetlands and softer shoreline edges, where physically feasible, should be considered part of a long term strategy in Newtown Creek in conjunction with reduction of CSO volume. The greater the reduction of CSO, the more potential for natural systems to survive and thrive.

Timeframes

We ask that the LTCP submitted to NYSDEC specifically outlines design and construction timelines with justification for any significant delays in beginning the process. While we appreciate the amount of time necessary to fulfill these desired solutions, we ask that NYCDEP proceed with urgency in completing these vital projects. Additionally, we ask that solutions are able to proceed independently of other clean-up and regulatory projects underway, namely the USEPA Superfund Record of Decision (ROD). As with the ROD at Gowanus Canal, we believe the USEPA will identify CSO as an ongoing source of chemical contamination. An LTCP that outlines a 100% reduction of CSOs will achieve benefits for both Superfund contaminants as well as meet the Clean Water Act. Limited reductions to CSO volume under the LTCP may create great complications, delays and additional costs as we await a final ROD in the years to come. We therefore urge NYCDEP to select thorough solutions to CSO now; in the interest of avoiding complications, advancing environmental improvements and benefiting the surrounding communities.

Solutions Beyond Standards

Lastly, we are deeply concerned that solutions being considered as part of the Long Term Control Plan are too narrowly focused on meeting individual standards through the use of predictive modeling. As earlier mentioned, CSO contribute numerous types of pollutants that directly impact the health of Newtown Creek; including pathogens, nutrient pollution, petrochemicals, plastics, pharmaceuticals and a number of emerging chemical compounds.

[2] A recent survey conducted by Newtown Creek Alliance counted over 200,000 ribbed mussels; present throughout Newtown Creek and it's many tributaries.

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Many of these pollutants are not currently addressed under Clean Water Act standards, but pose significant risk to ecological and human health. Seeking a solution which only address a few symptoms of this larger problem, such as fecal coliform and dissolved oxygen levels (during select months no less) is nearsighted and inadequate. We urge the NYCDEP to address water quality in a comprehensive fashion and invest directly in the reduction of CSO itself. By doing so, solutions outlined this year will not just address current Clean Water Act standards but help create a clean water body for decades to come - a true Long Term Control Plan.

Additionally, we are concerned about the use of modeling to prescribe a necessary level of reduction to CSO. Many of the alternatives presented at the April 26th meeting predict compliance to current standards with a 50% reduction from the largest CSO outfalls in Newtown Creek. A 50% capture of CSO, still leaves 600,000,000 gallons of untreated sewage flowing into our waterbody every year. Such a high volume is unacceptable in the long term (for numerous impacts listed above) and we question the validity of a model predicting attainment of water quality standards with over half a billion gallons of CSO discharging into Newtown Creek every year.

Continued Dialog
We thank NYCDEP for strong consideration of these comments and welcome ongoing dialog concerning potential solutions. We fully appreciate the complications in improving an impaired urban waterbody like Newtown Creek and hope that NYCDEP take necessary actions that repair ecological harm and provide justice for surrounding communities.

Sincerely,

Willis Elkins
Program Manager
Newtown Creek Alliance

Sean Dixon
Staff Attorney
Riverkeeper

Julie A. Welch
Program Manager
on behalf of the SWIM Coalition Steering Committee

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May 31, 2017

Via Electronic Mail

New York City Department of Environmental Protection
96-05 Horace Harding Expressway
Corona, New York 11368.

Re: Comments on the Newtown Creek LTCP Alternatives Review

Dear Sir or Madam:

The Newtown Creek Group ("NCG"), appreciates the opportunity to submit these comments on the April 26, 2017 Review of Alternatives ("Alternatives Review") pursuant to the Newtown Creek Long Term Control Plan ("LTCP") process. The NCG, which is comprised of Phelps Dodge Refining Corporation, Texaco, Inc., BP Products North America Inc., The Brooklyn Union Gas Company d/b/a National Grid NY, and ExxonMobil Oil Corporation, is conducting the Remedial Investigation & Feasibility Study ("RI/FS") at the Newtown Creek NPL Site pursuant to an Administrative Order on Consent ("AOC") with the United States Environmental Protection Agency ("EPA"), to which the City of New York is also a named party. The site boundary for the Newtown Creek NPL site and the waterbody of interest under the Newtown Creek LTCP process are one and the same waterbody. For that reason, the NCG has a direct interest in the LTCP process and evaluation of sources, and the steps that the New York Department of Environmental Protection ("NYCDEP") ultimately takes pursuant to the LTCP to address the impacts on Newtown Creek of NYCDEP's ongoing discharges from its Combined Sewer Outfall ("CSO") and Municipal Separate Storm Sewer ("MS4") discharges into Newtown Creek.

The NCG shares with the New York State Department of Environmental Conservation ("NYSDEC") and the New York City Department of Environmental Protection ("NYCDEP") the broad goal of improving water quality in Newtown Creek. The NCG is committed to identifying and quantifying the risks that Newtown Creek may pose to human health and the environment and identifying scientifically sound solutions that will address those risks. The NCG believes that remedial alternatives should be developed and selected in a manner that is protective of human health and the environment, while thoughtfully balancing the environmental, economic and social effects of remediation on the Creek and community. Although the RI/FS process is ongoing, the extensive work to date reveals that the CSOs and MS4s are significant contributors to those risks, so any proposed remedial response must take account of those contributions and what reductions (treatment, system upgrades, or control), if any, will result from the implementation of the Newtown Creek LTCP. Moreover, recognizing the risks posed by CSOs and MS4s, Newtown Creek community stakeholders have been extremely vocal in their desire to have these risks addressed in order to improve water quality. Any LTCP that fails to do so will be unacceptable to the community.

The NCG's direct interest in the LTCP process will come as no surprise to NYCDEP, NYSDEC or EPA, as they are all direct participants in the Newtown Creek RI/FS process. Moreover, EPA itself has explained that "the CWA and CERCLA domains are intersecting with increased frequency on contaminated sediment sites, offering the opportunity for improved integration, including increasing collaboration between EPA, and state CWA program managers, CWA permittees, and responsible parties under CERCLA."[1] What is unstated in the EPA Guidance is that in the absence of such coordination, both programs are destined to fail to meet their objectives. These comments represent the NCG's attempt to jumpstart the necessary dialogue between the two programs.

I. Introduction

Newtown Creek is one of the most complex environmental remediation sites in the United States, owing to the concurrent efforts under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") and the Clean Water Act ("CWA"). NYCDEP, NYSDEC, EPA, and NCG understand that actions taken under one statutory and regulatory regime must take into account actions taken under the other. As the comments below highlight, in many instances, there are direct conflicts between potential CWA remedies and potential CERCLA remedies. In other instances, even if no direct conflict exists, actions taken pursuant to the CWA may have direct and negative ramifications for the scope, timing, and effectiveness of any potential remedy under CERCLA. Again, EPA has recognized those facts, as it has explained that "the CWA and CERCLA are inherently linked when sediment sites are considered, because surface water discharges can be sources of contamination to sediment, and contaminated sediment can be an ongoing source of contamination to surface water."[2] Moreover, because of differences in regulatory approach, "the effectiveness of Superfund remedies at urban sites may depend on successful coordination between regional CWA and CERCLA programs,

[1] EPA Guidance (December 2013): "A Primer for Remedial Project Managers on Water Quality Standards and the Regulation of Combined Sewer Overflows under the Clean Water Act"

[2] *Id.*

throughout the entire RI/FS and remedy selection and implementation process."[3] In the context of Newtown Creek, the core issue with respect to the relation between the CWA and CERCLA is that the effectiveness of any remedy will be affected by the manner and extent to which NYCDEP controls its ongoing discharges from CSOs and MS4s into Newtown Creek.

II. Newtown Creek Background

The Newtown Creek area has a history of extensive urban and industrial development. Modifications to the physical layout of the creek shoreline and configuration of freshwater discharges have resulted in a system that is largely engineered for industrial, municipal, navigational, and sewage management purposes. Historically, freshwater flow to the creek largely consisted of tributary flow and groundwater flow. Decades of urban development has led to the elimination of tributary flows and to the creation of freshwater point source discharges (e.g., CSOs and MS4s).

The land use around Newtown Creek from the 1800s through the present has been, and continues to be, predominately industrial. This industrial use has occurred in parallel with municipal use of Newtown Creek as a receiving waterbody for both untreated stormwater and wastewater discharges. Dating back to the 1800s and the early 1900s, untreated stormwater, industrial wastewater, and domestic sewage were typically discharged directly to Newtown Creek. This municipal use of Newtown Creek has evolved over time, especially with the initial construction of a wastewater treatment plant ("WWTP") in the late 1960s.

Significant changes have occurred in the use of Newtown Creek and the surrounding uplands since the early 1800s. Industrial activities in the surrounding uplands and use of the creek for shipping and navigational purposes increased steadily after the Civil War. In 1912, The New York Times reported that Newtown Creek "has commerce greater than that of the Mississippi River or any of its tributaries." Historical industrial operations located around Newtown Creek generally included adhesives factories; animal rendering, glue factories, and fertilizer plants; asphalt mining, mixing, and storage operations; automobile manufacture, repair, and service; canneries; coal processing, handling, and storage; copper wiring plants; creosote production and treatment; distilleries; electronics and electroplating industries; hide-tanning plants; incinerators; MGPs; metal production, smelting, metal works, and fabricating; metal scrap and storage; municipal wastewater treatment; paints and pigments industry; paper products industry; pencil manufacturing; petroleum refining and bulk storage; plastics industry; printing;

[3] *Id.*

railyards; sawmills and lumberyards; shipbuilding; solid waste disposal/landfilling by the City of New York; sugar refining; utilities; and waste oil refining operations. Following World War II, marine cargo on Newtown Creek decreased significantly and there was a shift away from manufacturing facilities to materials handling facilities. Today, the predominant land use around Newtown Creek and the tributaries remains industrial, with pockets of mixed use, commercial, and, at further distance from the Creek, residential developments. Industrial activities near the creek currently include the following: warehouse and distribution facilities; vehicle storage and maintenance; electrical distribution; plastics and foil manufacturing; waste transfer yards and recycling facilities; road service support facilities; construction materials storage; facilities that store electrical equipment; scrap metal processing facilities; lumberyards; ready-mix concrete plants; bulk fuel distribution terminals; railroads (e.g., tracks, yards); utilities; and municipal wastewater treatment.

III. CSO and MS4 Discharges are the Dominant Sources of Surface Water to the Creek

The Newtown Creek drainage area comprises approximately 7,300 acres in Brooklyn and Queens. Approximately 66% of this area is served by combined municipal sewer infrastructure. The remaining area is primarily served by municipal separate sewage and stormwater systems. In portions of the Newtown Creek drainage area served by municipal combined sewer systems, stormwater and sewer discharges enter the same pipe. In other areas near the creek, stormwater is discharged to the creek via privately owned infrastructure.

CSOs and MS4s are the dominant source of freshwater flow (i.e., surface water inflow primarily comprised of municipal sewage, runoff, and stormwater) into Newtown Creek. Freshwater from point sources and overland flow discharges into the Study Area both continuously (e.g., treated effluent from groundwater dewatering and remediation systems) and during episodic rain events (i.e., CSO, WWTP effluent overflow, or stormwater). CSOs account for the largest fraction of total freshwater flow among the point sources. The four largest CSO outfalls (i.e., English Kills [NCB-015], East Branch [NCB-083], Maspeth Creek [NCQ-077], and Dutch Kills [BB-026]), which discharge to Newtown Creek during episodic rain events, have the following range of discharge characteristics:

- Annual discharge ranging between 100 and 600 million gallons ("MG") per year
- 40 to 80 CSO events per year (i.e., discharges during rain events)
- Discharge duration of 2 to 6 hours per event

  - Peak flow rates ranging between 370 and 1,500 gallons per second

A diagnostic analysis to evaluate the precipitation amounts needed to trigger CSO events for two of the large CSOs (English Kills and East Branch) indicates that approximately 0.1 inch (East Branch) to between 0.1 and 0.2 inch (English Kills) of precipitation is needed for discharge from these two CSO outfalls to occur.

- According to data the NCG has collected and analyzed during the CERCLA RI/FS process, the following ongoing sources contribute solids, Total Polycyclic Aromatic Hydrocarbon ("TPAH"), total polychlorinated biphenyls ("TPCB"), copper ("Cu"), pharmaceuticals, personal care products, and pathogens ("3Ps") to surface sediment in Newtown Creek. Point sources (primarily CSOs and MS4s) and the East River are the dominant current sources of solids to CM 2+.

- Point sources (primarily CSOs and MS4s) are dominant current sources of solids to the surface sediment and surface water in the tributaries.

- For all three chemicals (TPAH, TPCB, Cu), CSOs and MS4s contribute significantly to the total loads to surface sediment. It should be noted, however, that the majority of the point source TPAH load enters the Study Area in CM 0 – 1 from the Con Edison – 11th Street Conduit discharge. This discharge, which contains dewatered groundwater effluent, alone contributes approximately 65% of the total point source discharge of TPAH to Newtown Creek.

IV. <u>The CSO and MS4 Discharges Pose Ongoing Risks to Human Health and the Environment</u>

The Baseline Ecological Risk Assessment ("BERA") the NCG conducted during the RI/FS process identified potential risks from exposure to CSO and MS4 discharges for benthic macroinvertebrates and benthic fish in Creek Mile ("CM") 2+, the tributaries, and English Kills. These potential risks in CM 2+ are associated with the following receptors and exposure pathways:

- Surface sediment toxicity to benthic organisms in CM 2+ and the tributaries is significantly greater than toxicity in sediments in the four Phase 2 reference areas. These four different reference areas were selected to encompass a wide range of potential impacts from both industrial and CSO-related point sources. This indicates that CSO-related impacts in the tributaries of Newtown Creek are greater than those in otherwise similar water bodies with lower amounts of CSO flows.

- Toxicity results at sample locations close to CSOs and MS4s cannot be explained solely, or in many cases, at all, by either PAHs or certain metals in porewater. At these locations, the toxicity results appear to be linked to the presence of other constituents (e.g., a complex mixture of organic compounds or other pollutants or contaminants, including pharmaceuticals, personal care products, and/or pathogens), that were observed in proximity to CSOs, MS4s, and other stormwater discharges.

- In addition to the potential risks quantified as part of the baseline risk assessments, potential risk to human health and the environment also arise from other confounding factors or pollutants and contaminants (e.g., pathogens, pharmaceuticals, and personal care products from CSO/MS4 discharges), resulting in an underestimation of potential risk as evaluated in the BERA. Moreover, ongoing anthropogenic contributions from CSO/MS4 discharges to Newtown Creek impact the ecological environment because of high organic carbon loadings which lower dissolved oxygen (DO).

As documented by NYCDEP, subtidal surface sediment with total organic carbon ("TOC") greater than 3% is likely contributing to impairment of the benthic macroinvertebrate community in Newtown Creek.[4] This is in large part because bacterial decomposition of organic matter results in a decrease in DO and an increase of toxic byproducts such as ammonia and sulfide. DO below 2 milligrams per liter (mg/L) results in hypoxic conditions that adversely affect the respiration of benthic macroinvertebrates and can result in local extinction except for the microbial community. This condition is exacerbated during the summer months when water temperatures are elevated and the bacterial degradation of organic matter is accelerated. During the summer RI/FS Phase 1 field surveys conducted by the NCG in 2012, surface water DO at depth fell below the New York State Class SD threshold of 3 mg/L, particularly in the tributaries; the benthic macroinvertebrate community was impaired even further, with no macroinvertebrates found at tributary sampling stations.

The RI/FS field data reveal the ongoing risks to the ecological communities at many locations in the tributaries. These risks are due in large part to massive ongoing discharges from

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[4] Hyland et al. (Hyland, J., I. Karakassis, P. Magni, A. Petrov, and J. Shine), 2000. Ad hoc Benthic Indicator Group – Results of Initial Planning Meeting. Intergovernmental Oceanographic Commission (IOC) Technical Series No. 57. SC-2000/WS/60. United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France as cited in Newtown Creek Waterbody/Watershed Facility Plan Report (June 2011).

CSOs and MS4s. While those ongoing discharges are regulated by the CWA, the discharges also include CERCLA hazardous substances and other pollutants and contaminants that contribute to those risks and must be considered in the evaluation of remedial alternatives under the CERCLA process in those portions of Newtown Creek.

In addition to the BERA, the NCG also collected sediment and water data to evaluate the potential for ecological[5] and human health[6] risks from pharmaceuticals, personal care products, and pathogens. These chemical and biological constituents enter Newtown Creek from CSO and/or MS4-related sources, and they have significant adverse impacts on Newtown Creek. The key findings from the NCG studies include:

- Eight pharmaceuticals and personal care products (PPCPs) exceeded ecological screening criteria. Of these eight, four PPCPs (beta-estradiol, bisphenol A, estrone, and nonylphenol) contributed the most to unacceptable ecological risks from exposure in both surface water and sediments.

- Area-wide ecological risks were identified from exposure to PPCPs in surface water under both dry and wet conditions, with ethinyl estradiol representing the greatest contribution to the risk. Area-wide and location-specific ecological risks also were identified for benthic macroinvertebrate and fish receptor groups exposed to PPCPs in surface sediment pore water. The spatial extent of surface sediment pore water ecological risks were similar to that of surface water, with the highest risks primarily located in the vicinity of major CSOs and a mix of both acceptable and unacceptable risk present within the main channel of Newtown Creek.

- Dose-response relationships for bisphenol A, nonylphenol, and 4-tert-octylphenol (as both bulk sediment concentrations and estimated pore water toxic units) suggest that these PPCPs are contributing to the overall toxicity observed in organisms exposed to Newtown Creek sediments.

[5] NewFields and GEI. 2016. Baseline Ecological Risk Assessment, Pharmaceuticals and Personal Care Products. Newtown Creek Superfund Site. Prepared for the Newtown Creek Group, July, 2016.

[6] GEI and NewFields. 2016. Human Health Risk Assessment for Pathogens, Pharmaceuticals, and Personal Care Products, Newtown Creek Superfund Site. Prepared for the Newtown Creek Group, July, 2016.

- The human health risk investigation revealed that potentially significant human health risk is likely to occur from recreational exposure to pathogens in surface waters, particularly near CSO discharge points under wet weather conditions.

Finally, the NCG has observed that CSO discharges to Newtown Creek introduce significant levels of sheen to the water surface, and thus represent an additional source of NAPL which can adversely impact water quality and create ecological and human health risks. During the CERCLA remedial investigation, the NCG documented sheens during wet and dry weather near and emanating from CSOs and MS4s. The Newtown Creek Alliance (NCA) has also documented sheens emanating from CSO discharges during wet weather events.[7]

V. NYCDEP Has Considerable Additional Work to Do in its Limited Analysis of Proposed Alternatives

NYCDEP has undertaken some infrastructure projects to address CWA requirements on Newtown Creek, including the installation of enhanced aeration, bending weirs, floatables control, and green infrastructure. In the Alternatives Review, NYCDEP identified a number of other projects that might help it fulfill its obligations under the CWA. Before any alternatives are selected, however, NYCDEP must consider the following:

1. Possible conflict between aeration and CERCLA remedy

In an effort to meet water quality standards for DO, NYCDEP installed an enhanced aeration system in lower English Kills, completed in March 2014. That aeration system will interfere with the successful implementation of a CERCLA remedy in the area. The aeration system consists of sections of air header piping that are connected to a series of diffusers that distribute oxygen into the water column. The infrastructure for the diffusers and piping is typically less than 1 to 2 feet tall and rests on the bottom of the creek. The aeration system only operates during certain months of the year when DO levels fall below regulatory requirements of 3 mg/L specified by the CWA.

As part of the permit approval process for the system, NYCDEP will be required to remove the infrastructure associated with the aeration system in the creek for any of the following reasons: (1) Maintenance dredging required by the USACE; (2) Obstruction of vessel traffic or interference with navigation or adjacent facilities; and (3) USEPA-required remedial activities within the Creek under CERCLA (e.g., dredging, cap construction, etc.). Future

[7] NCA (Newtown Creek Alliance), 2017. Combined Sewer Overflow: Newtown Creek. Video, 2:20 minutes. Available from: https://www.facebook.com/newtowncreek/videos/1248501821852107/. March 2017.

expansions of the aeration system are planned to cover East Branch and upper Newtown Creek by June 2018 and Dutch Kills and lower Newtown Creek by December 2020. Not only does the physical structure create a conflict with implementation of a CERCLA remedy, but removal of the system during any in-creek work will result in a substantial drop in DO, which will in turn cause ecological stresses, die off of microinvertebrates, and degradation of surface water quality, threatening the effectiveness of any remedy.

Furthermore, NYCDEP's alternatives analysis is flawed in that it does not address the possible impacts of any sediment remedy (e.g., dredging and capping) that would increase water column depth and could therefore impact the effectiveness of the aeration system. NYCDEP has not evaluated this, and must take it into account when assessing each alternative.

2. NYCDEP Examined an Overly Narrow Range of Pollutants

In its Alternatives Review (as in previous presentations), NYCDEP focused only on pathogens and DO. That narrow focus ignores the fact there is ample evidence that a number of other pollutants coming from the CSOs (and MS4s), including but not limited to TPAH, TPCB, non-aqueous phase liquid ("NAPL"), Cu, oil and grease, pharmaceuticals, and personal care products. All of these constituents will adversely impact the suitability of Newtown Creek for fish, shellfish and wildlife survival, and its suitability for primary and secondary recreation. The ongoing discharges of those other pollutants and contaminants must be analyzed and controlled if the LTCP is to effectively address the ongoing impact of the CSOs on Newtown Creek.[8]

3. NYCDEP Cannot Rewrite the DO and Pathogen Water Quality Standards During the LTCP Process

In direct conflict with statutory and regulatory procedures, NYCDEP appears to be attempting to dramatically re-define the water quality standards for Newtown Creek, which will result in its failure to provide adequate protection to ensure Newtown Creek is suitable for fish, shellfish, and wildlife survival, and suitable for primary and secondary contact recreation. It is doing this by removing the temporal components of the criteria. For DO, NYCDEP appears to be seeking to change the criterion "acute, never less than" 3.0 mg/L to an annual average of greater than 3 mg/L. This would be a dramatic change directly conflicting with regulatory practice and procedures for changing or complying with water quality standards. For example, DO

[8] Moreover, MS4 sources are not discussed in any detail whatsoever. The modeling and CSO controls alternatives analyses are mute regarding MS4 control. As discussed above, while the LTCP process does focus on CSO controls, the lack of planning to control MS4 discharges represents a large gap in NYCDEP's Newtown Creek point source control program. Without addressing stormwater sources, including MS4s, it is difficult to envision compliance with the water quality standards in Newtown Creek.

measurements in the East Branch tributary collected during July and August 2016 were continuously less than 3 mg/L for 60 consecutive days (i.e., never in compliance for two months), but the average annual DO concentration at the same location was above 3 mg/L (*see* Alternatives Review presentation slides 36 and 38). Thus, the East Branch tributary might achieve the NYCDEP redefined LTCP goal, while failing to meet the actual water quality criterion for extended time periods. This change in the DO criterion does not appear to have a credible technical or legal basis and would not be protective of aquatic life or designated uses (e.g., fishable).

For pathogens, NYCDEP appears to be seeking to change the criterion from monthly geometric mean to seasonal bacteria compliance. NYCDEP also seeks to establish a 24-hour "time of recovery" following CSO events when bacteria concentrations would be allowed to exceed the criterion.

These DO and bacteria compliance goals and targets are an attempt by NYCDEP to lower the bar of regulatory compliance standards, rather than directly address the impact of CSO discharges on Newtown Creek. If NYCDEP is permitted to do so, not only will water quality suffer, but the reduction will negatively impact the effectiveness of any CERCLA remedy. In evaluating the alternatives and finalizing the draft LTCP for submission to NYSDEC, NYCDEP should not be permitted to demonstrate compliance through lowering the bar on what counts as compliance with the water quality standards.

4. NYCDEP Needs to Make its Data Readily Available.

Slide 14 of the Alternatives Review presents a map of pathogen sampling locations and provides a brief summary of the data. One bullet on the slide states; "Data is available online," but these data do not appear to be currently available. A previous presentation, the Newtown Creek LTCP Kickoff meeting (Nov. 15, 2016), NYCDEP provided an online link to Newtown Creek data (slide 16). However, only data for 4 Newtown Creek harbor wide sampling locations (with prefix NC) were available at the online address provided. The NCG requests that NYCDEP make these data fully available online to NCG and the public, as NYCDEP has previously committed to do. Further, on a number of slides, data are not presented in a manner consistent with applicable water quality standards:

- For example, in slides 22 – 24 of the Alternatives Review, the bacteria geometric mean[9] ("geomean") concentrations for the period of January to November 2016 appear to be presented as a single geomean, when the appropriate metric would be monthly geomeans throughout that time period. Similarly, in slides 25 – 27, the bacteria geomean concentrations for May – October 2016 (the recreational season) appear to be presented as a single geomean rather than monthly geomeans throughout that time period. By taking geomeans over a longer period of time, larger exceedances of the water quality criterion for bacteria may have been effectively masked.

- In another case (slides 34-38), DO concentration results are presented in a manner that is very different from the water quality criterion (DO never less than 3 mg/L). Annual average DO concentration data are presented; as described above, annual average and "never less than" are at opposite ends of the temporal spectrum. Annual averaging effectively masks long periods of water quality violations. Furthermore, on slide 35, the 5th percentile values are presented. The 5th percentile value represents the lowest 5th percent in the distribution of DO data at each sampling location. However, because an annual average (rather than the "never less than" metric) is used, the 5th percentile values of an annual average is misleading because it is less conservative than using the appropriate regulatory metric, i.e., "Shall not be less than 3.0 mg/L at any time."

As discussed above (and echoed by comments by other stakeholders), NCG requests that all data supporting or involved in the LTCP process be made available in detail, and in a format matching the applicable water quality standards (e.g., monthly geomeans rather than annual averages, individual DO measurements rather than annual averages, etc.).

5. NYCDEP has not Considered Several Effective Alternatives

Slide 30 of the Alternatives Review provides a table of CSO control alternatives organized by type and by increasing complexity and increasing cost. The table shows that 11 CSO control types have been removed from further consideration. Specifically, high rate

[9] A geometric mean is calculated similar to an average. However, instead of adding the numbers together and dividing by the number of values (a simple average), to calculate a geometric mean, the different calculations are multiplied together and then the root of the number of calculations is taken of the total. In the case of fecal coliforms, the water quality standards for Newtown Creek require that a minimum of five samples are taken over the course of a month to calculate the monthly geometric mean.

clarification, in-system storage, and shaft storage, among others, were removed. These are among the potentially most effective alternatives, and many have been implemented across the country even at great cost. In fact, New York City has implemented some of these remedies at other sites. Examples of costs for significant CSO controls in other cities including Kansas City ($2.5 billion), Cleveland ($3 billion), Washington DC ($3 billion), and Atlanta ($1.5 billion).[10] NYCDEP should thus fully evaluate all potentially effective alternatives, or at a minimum, substantively explain why these alternatives were removed from further consideration.

6. Too Many Alternatives Are Presented in Insufficient Detail

In the Alternatives Review, NYCDEP presented 184 Newtown Creek CSO control alternatives that were described as under further evaluation.[11] It is not feasible for stakeholders to assess this many alternatives. In contrast, for example, the Coney Island LTCP alternatives meeting (April 20, 2016) featured four alternatives under further evaluation. The NCG requests (and believes that other stakeholders would agree) that NYCDEP conduct a second alternatives meeting focusing on a near-final set of alternatives so that stakeholders can better evaluate possible CSO controls and provide an additional comment before NYCDEP submits the draft LTCP.

Conclusion

The NCG looks forward to continuing to work with EPA, NYSDEC, and NYCDEP in identifying effective solutions on Newtown Creek. To that end, we would welcome the opportunity to discuss these comments further with NYCDEP, NYSDEC, and EPA.

Respectfully submitted,

W. David Bridgers
Common Counsel, the Newtown Creek Group

[10] CSO cost data are from publicly available consent decrees (e.g., https://www.epa.gov/enforcement/st-louis-clean-water-act-settlement)

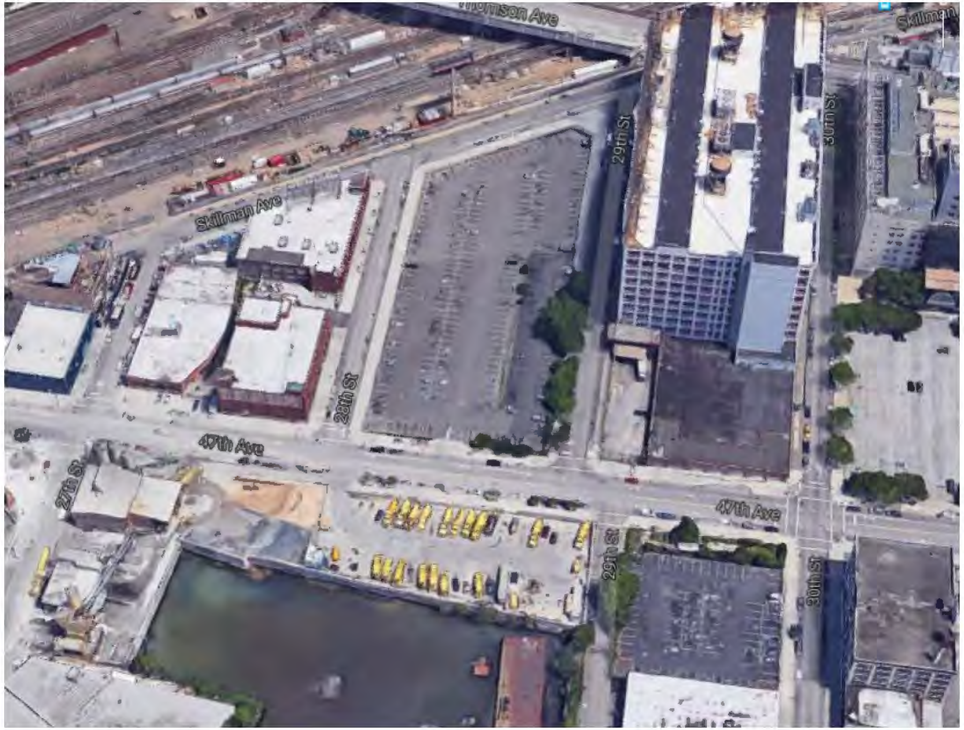
[11] The 184 total alternatives were estimated as follows: There were 16 alternatives listed in the alternatives summary (slides 44 and 45). Of the 16 alternatives, six included four outfalls, six included three outfalls, and four included one outfall. Each alternative included four sub-alternatives; 25%, 50%, 75%, and 100% control. Six alternatives x four outfalls x four levels of control = 96 total alternatives, 6 x 3 x 4 = 72, and 4 x 1 x 4 = 16. Summing 96, 72, and 16 yields a total of 184 alternatives presented.

CSO Storage Options for Newtown Creek

4 outfalls release 90% of total CSO volume into Newtown Creek

BB-026 = 141 million gallons per year
NCQ-077 = 327 million gallons per year
NCB-083 = 314 million gallons per year
NCB-015 = 356 million gallons per year

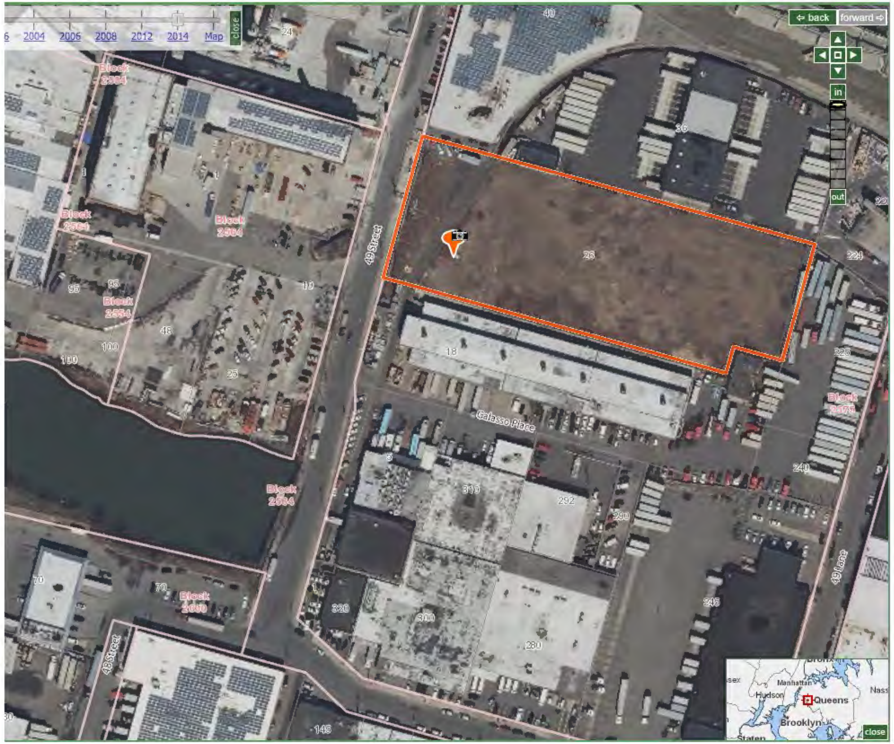
NCA
NEWTOWN CREEK ALLIANCE

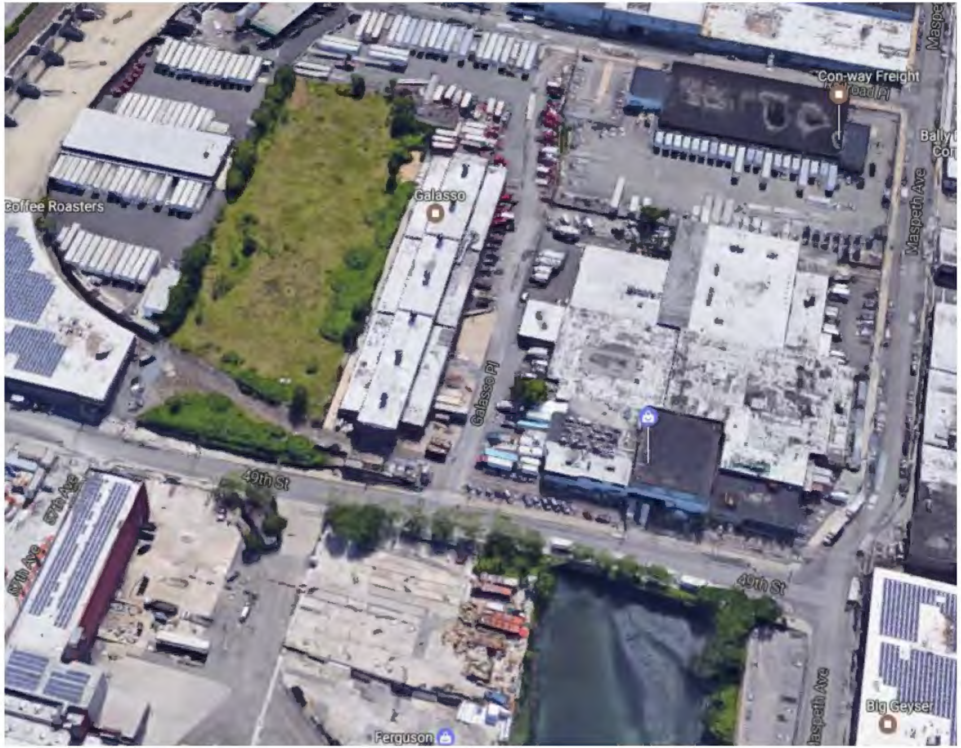


Head of Dutch Kills

Possible CSO Storage Tank for BB-026

Address: 28-02 Skillman Ave, Queens NY 11101
Block: 272 **Lot:** 1
Owner: The Dormitory Authority (NYS)
Size: 2.1 acres
Current Use: Parking lot for LaGuardia Community College

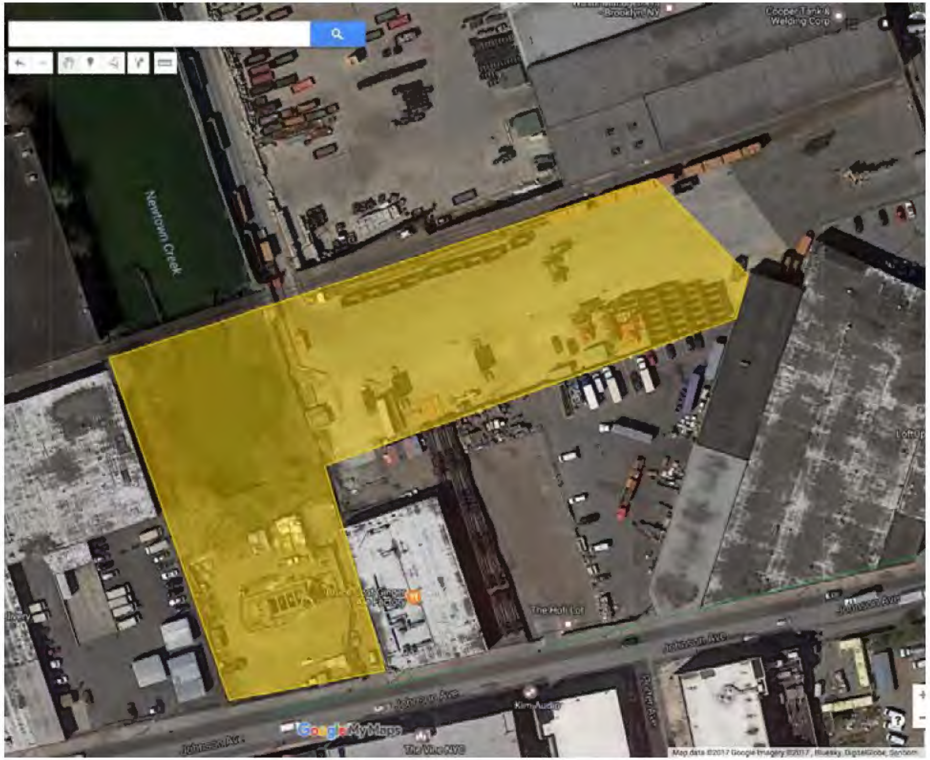


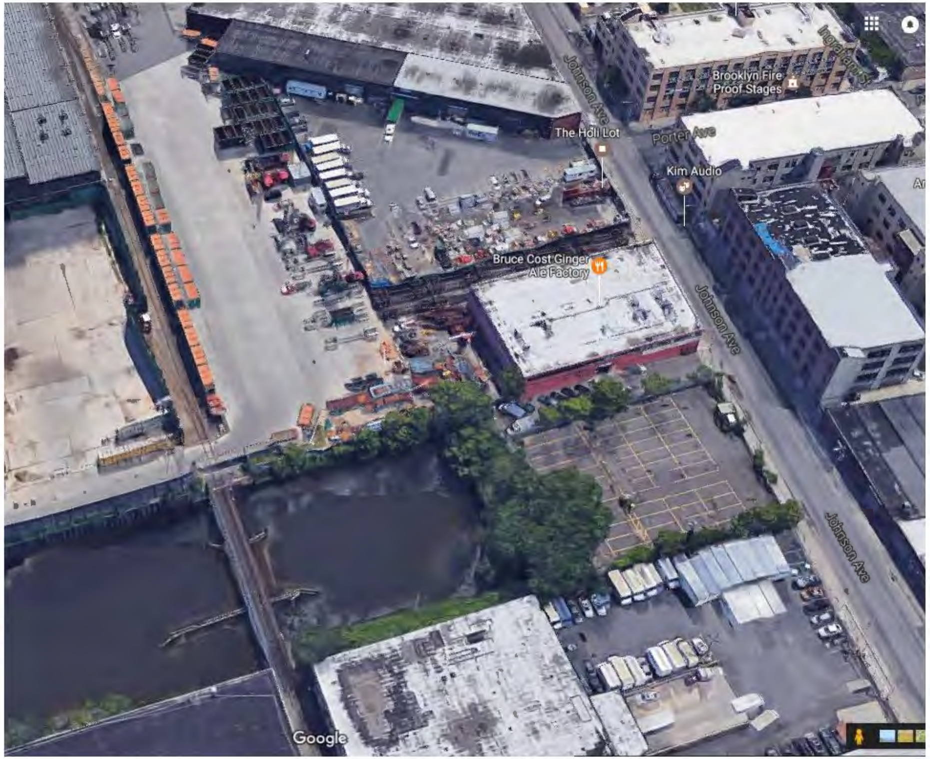


Head of Maspeth Creek

Possible CSO Storage Tank for NCQ-077

Address: 49th Street, Queens, NY 11378
Block: 2575 **Lot:** 26
Owner: NYC DEP
Size: 2.8 acres
Current Use: Vacant. More info and background here.





Head of English Kills

Possible CSO Storage Tank for NCB-015 + NCB-083

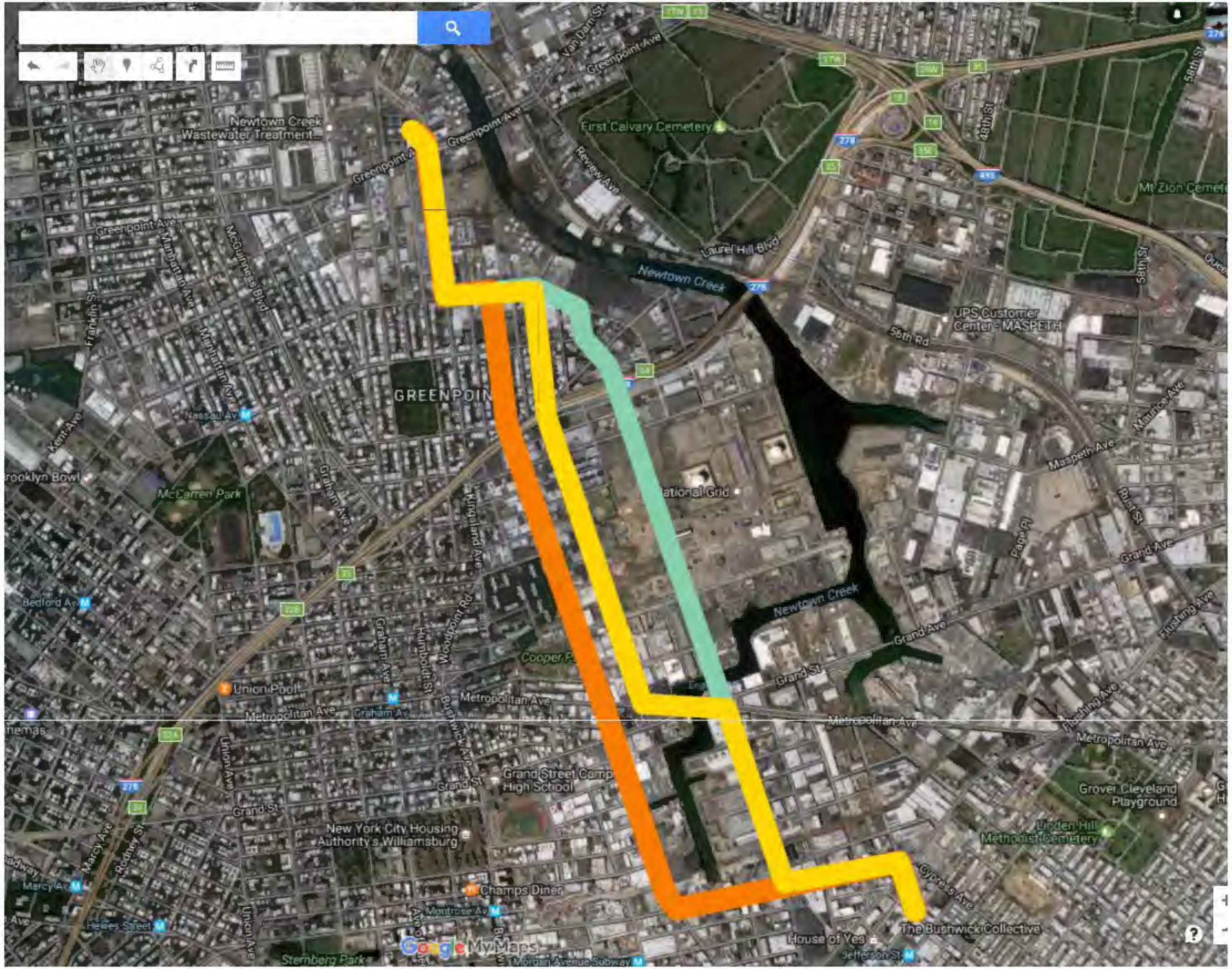
Address: 469 and 451 Johnson Ave
Block: 2974 **Lot:** 112 + 162
Owners: Unknown + MTA
Size: 3 acres
Current Use: Parking lot + open industrial + non-navigable head of English Kills

Head of Creek to WWTP

Possible CSO Storage Tunnel for NCB-083 and NCB-015

Route: Running from St. Nicholas Ave (NCB-083) to Johnson Ave (NCB-015). Main route via Morgan Ave, Vandervoort Ave or Varick Ave then to Norman Ave, Kingsland Ave and to Newtown Creek WWTP.

Length: 2.5 miles approximately



Appendix C: Newtown Creek Use Attainability Analysis

EXECUTIVE SUMMARY

The New York City Department of Environmental Protection (DEP) has performed a Use Attainability Analysis (UAA) for Newtown Creek in accordance with the 2012 CSO Order. Newtown Creek is a tidal waterbody in the Boroughs of Brooklyn and Queens and exchanges waters with the East River (Figure 1). The Newtown Creek watershed is located throughout north Brooklyn and south Queens and is served by the Newtown Creek and Bowery Bay Wastewater Treatment Plants (WWTPs). The waters of Newtown Creek are saline and receive freshwater input from groundwater, stormwater, direct drainage, and CSO discharges.

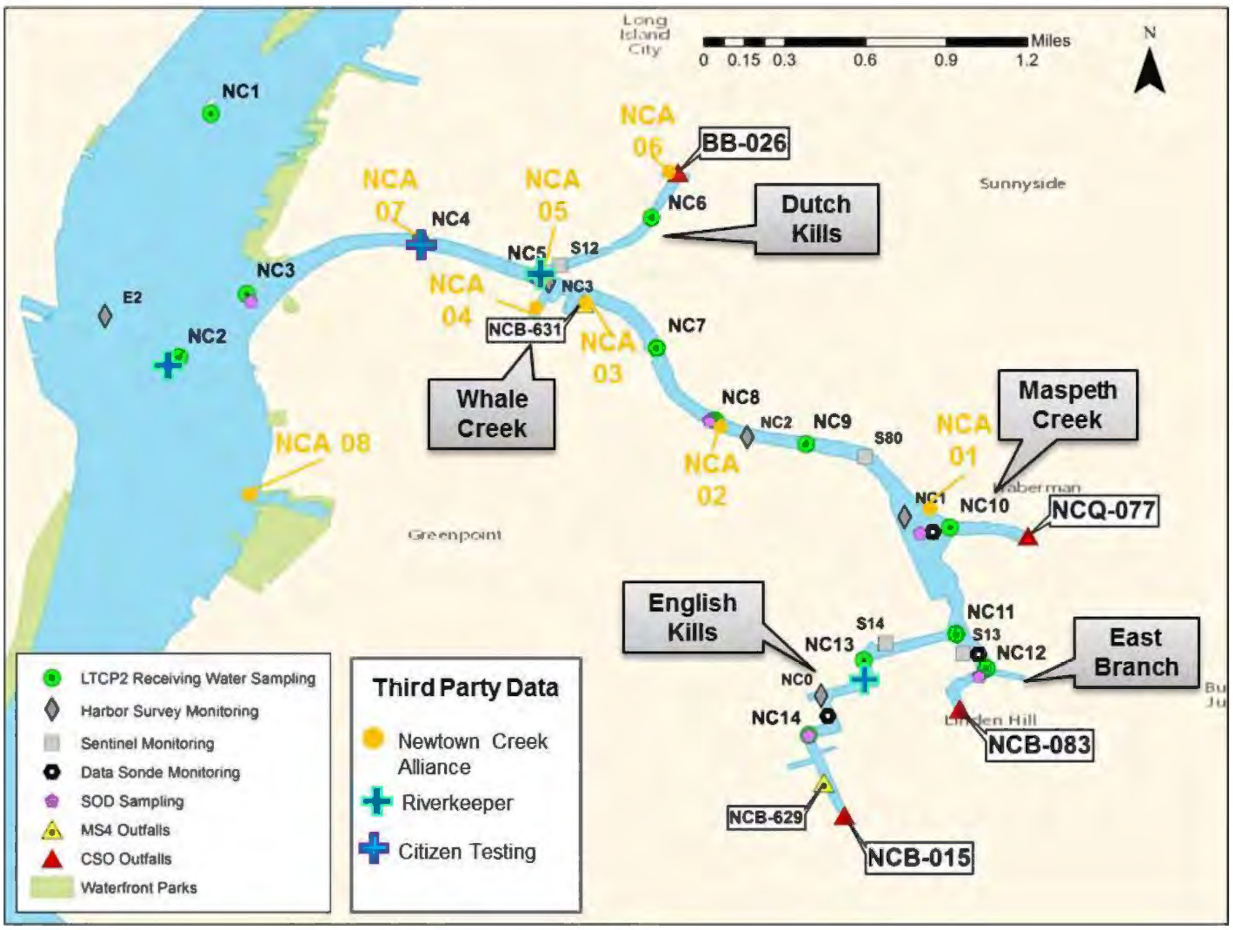


Figure 1. Overview of Water Quality Stations and Permitted Outfalls in Newtown Creek

The gap analyses performed as part of the Newtown Creek LTCP concluded that under baseline conditions, the Existing WQ Criteria for fecal coliform in this waterbody would not be attained at any of the monitored WQ stations on an annual basis, and would not be met at most stations during the recreational season (May 1st through October 31st). The gap analyses also indicated that the Existing WQ Criteria for fecal coliform would not be attained at all stations on an annual basis even with the implementation of

100 percent CSO control. This finding is not unexpected, as bacteria levels in Newtown Creek are also affected by stormwater loads and poor tidal flushing, largely due to manmade conditions.

The gap analyses also demonstrated that Class SD dissolved oxygen (DO) criteria is attained under baseline conditions at least 95 percent of the time on an annual average basis at all but three upstream stations (NC12, NC13, and NC14), assuming seasonal operation of the English Kills and East Branch in-stream aeration systems.

The preferred alternative includes 75 percent control of Outfall BB-026 through expansion of the Borden Avenue Pumping Station and a storage tunnel to provide 62.5 percent control at outfalls NC-15, NC-083, and NC-077. The LTCP assessment shows that the preferred alternative would achieve recreational season (May 1st through October 31st) attainment of the Existing WQ Criteria for fecal coliform bacteria at all sampling locations in Newtown Creek for the 2008 typical year. However, annual attainment of the Existing WQ Criteria for fecal coliform is predicted to be 83 percent based on the 2008 typical year. Assessment of compliance using a 10-year continuous model run indicated that recreational season (May 1st through October 31st) compliance would be in the range of 83 to 93 percent, and annual compliance would be slightly lower.

With the preferred alternative, the existing Class SD DO criteria is predicted to be met at least 95 percent of the time at all stations on an annual average basis, assuming seasonal operation of the English Kills and East Branch in-stream aeration systems.

Enterococci criteria do not currently apply to this waterbody. Each applicable criterion is discussed below:

Fecal Coliform

> WQ modeling analyses performed during the Newtown Creek LTCP concluded that under baseline conditions and 2008 rainfall, attainment of the Existing WQ Criteria for bacteria during the recreational season (May 1st through October 31st) ranges from 67 percent in the upstream reaches to 100 percent in the downstream main stem of the Creek. Annual attainment ranges from 42 percent in the upstream reaches to 83 percent in the downstream main stem. The preferred alternative would achieve recreational season (May 1st through October 31st) attainment of the Existing WQ Criteria for fecal coliform bacteria at all sampling locations in Newtown Creek for the 2008 typical year. However, annual attainment of the Existing WQ Criteria for fecal coliform is predicted to be 83 percent based on the 2008 typical year.

Newtown Creek is a navigable urban channel that primarily supports shipping traffic associated with the commercial, industrial, and municipal land uses of the adjacent taxable lots, as shown in Figure 1. Public access to the shoreline is extremely limited, but includes two small parks/nature walks and two kayak/boat launch locations (see Figure 2). The shoreline is highly bulkheaded, further limiting access onto or off of the water. No Department of Health and Mental Hygiene (DOHMH) certified bathing beaches are located in Newtown Creek.

.**Figure 2. Newtown Creek Watershed Land Use and Waterfront Public Areas**

Based on the analyses summarized above, projected fecal coliform levels do not meet the Existing WQ Criteria on an annual basis. Non-attainment appears to be primarily related to CSO sources in Newtown Creek, although the gap analysis indicated that even 100 percent CSO control would not achieve annual

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compliance at all of the stations. It is recommended that the current designated uses of the waterbody and SD classification be maintained after implementation of the LTCP recommended plan. After implementation, future data collection efforts will provide data that could be used to re-assess the attainment of Class SD and Class I WQS and the best use of the Creek could be revised accordingly. DEP will continue to issue wet-weather advisories informed by the time to recovery analyses presented in the Newtown Creek LTCP. However, it should be noted that although the water quality is projected to be protective of primary contact during the recreational season (May 1st through October 31st) based on the 2008 typical year, other factors, such as adjacent land use, limited access, current marine industrial uses, and safety must be taken into account in considering appropriate uses of the waterbody.

INTRODUCTION

Regulatory Considerations

The New York State Department of Environmental Conservation (DEC) has designated Newtown Creek as a Class SD waterbody. The best usage of Class SD waters is fishing. "*These waters shall be suitable for fish, shellfish and wildlife survival. In addition, the water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes. This classification may be given to those waters that, because of natural or man-made conditions, cannot meet the requirements for fish propagation"* (6 NYCRR 701.14).

Federal policy recognizes that the uses designated for a waterbody may not be attainable, and the UAA has been established as the mechanism to modify the WQS in such a case. Newtown Creek does not meet the existing Class SD water quality criteria for bacteria on an annual basis, but is projected to attain the bacteria primary contact WQ criteria at all stations at least 95 percent of the time during the recreational season (May1st through October 31st), based on 2008 rainfall with the implementation of the LTCP recommended plan that includes seasonal operation of the aeration system for the upper tributaries (English Kills and East Branch).

This UAA identifies the attainable and existing uses of Newtown Creek and compares them to those designated by DEC in order to provide data to establish appropriate WQ goals for this waterway. An examination of several factors related to the physical condition of the waterbody and the actual and possible uses suggests that annual attainment of bacteria criteria associated with existing Class SD standards is not projected to occur, and even 100 percent CSO reduction would not bring the waterbody into compliance on an annual basis. Under Federal regulations (40 CFR 131.10), six factors may be considered in conducting a UAA:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the waterbody to its original conditions or to operate such modification in a way that would result in the attainment of the use; or
5. Physical conditions related to the natural features of the waterbody, such as the lack of proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
6. Controls more stringent than those required by Sections 301(b) and 306 of the Clean Water Act would result in substantial and widespread economic and social impact.

The UAA shall "examine whether applicable waterbody classifications, criteria, or standards should be adjusted by the State." The UAA process specifies that States can remove a designated use which is not an existing use if the scientific assessment can demonstrate that attaining the designated use is not feasible for at least one of six factors listed above.

Identification of Existing Uses

The waterfront area surrounding Newtown Creek is predominantly altered on both its banks throughout its length. Due to limited access, altered shorelines (bulkheads and rip-rap), low bridges, and industrial maritime uses, the bulk of the waterbody is not conducive to primary contact or secondary contact recreation. However, a boat launch ramp, maintained by the North Brooklyn Boat Club, is located at the Manhattan Avenue Street End Park and facilitates community-led water quality research efforts. Secondary contact recreation has also been reported. No DOHMH certified bathing beaches exist anywhere within the waterbody. Figures 3a and 3b show examples of the Newtown Creek typical shoreline.

Figure 3a. Newtown Creek Shoreline (Rip-Rap - View from the Brooklyn Queens Expressway Looking Upstream)

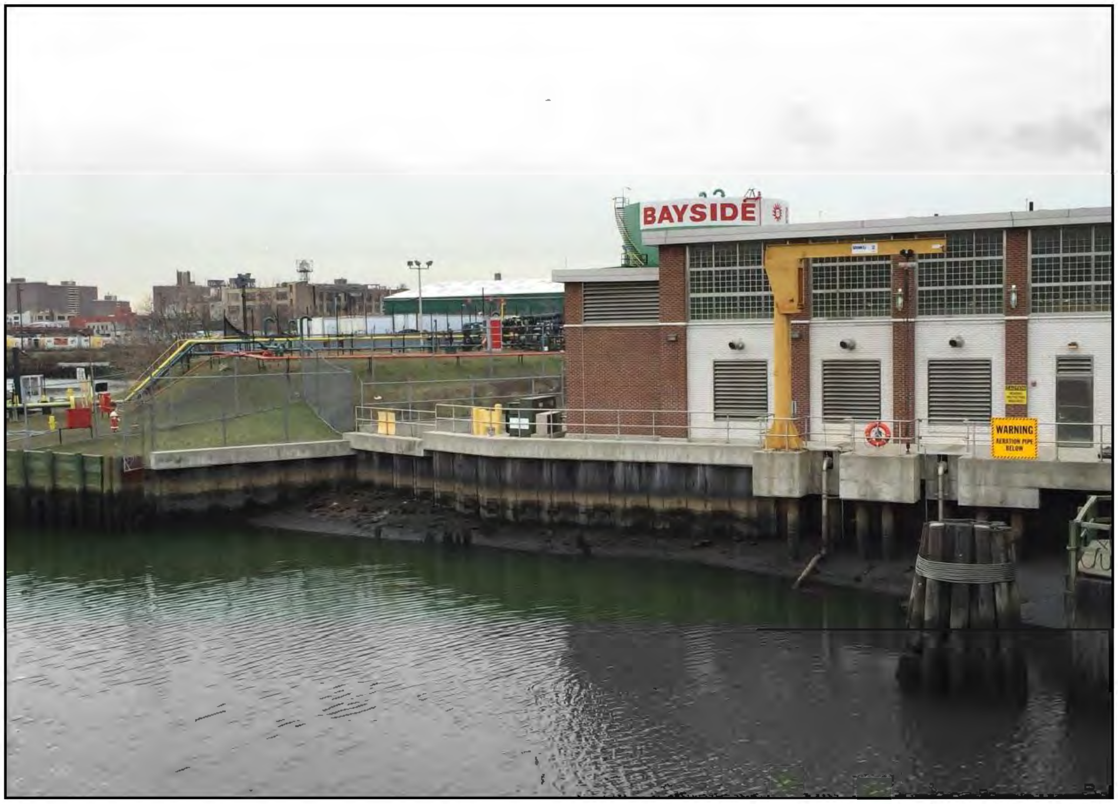

Figure 3b. Newtown Creek Shoreline (Bulkhead near Grand Street Bridge)

ATTAINMENT OF DESIGNATED USES

Newtown Creek is a Class SD waterbody, suitable for fish, shellfish, and wildlife survival. As noted previously, physical features of Newtown Creek make it unsuitable for primary contact, and create obstacles to secondary contact recreation. As part of this LTCP, an analysis was performed to assess the level of attainment of the primary contact fecal coliform criterion associated with Class SD waters, although other factors may preclude the attainment of the use.

WQ modeling analyses performed during the Newtown Creek LTCP concluded that under baseline conditions and 2008 rainfall, attainment of the Existing WQ Criteria for bacteria during the recreational season (May 1^{st} through October 31^{st}) ranges from 67 percent in the upstream reaches to 100 percent in the downstream main stem of the Creek. Annual attainment ranges from 42 percent in the upstream reaches to 83 percent in the downstream main stem. The non-attainment is due to CSO, and direct drainage and stormwater discharges accruing due to poor tidal flushing conditions, largely due to manmade conditions.

The preferred alternative would achieve recreational season (May 1^{st} through October 31^{st}) attainment of the Existing WQ Criteria for fecal coliform bacteria at all sampling locations in Newtown Creek for the 2008 typical year. However, annual attainment of the Existing WQ Criteria for fecal coliform is predicted to be 83 percent based on the 2008 typical year. Assessment of compliance using a 10-year continuous model run indicated that recreational season (May 1^{st} through October 31^{st}) compliance would be in the range of 83 to 93 percent, and annual compliance would be slightly lower.

The Existing WQ Criteria for fecal coliform attainment levels (monthly GM<200 cfu/100mL) as determined using the 10-year simulation and 2008 rainfall are shown below in Table 1. As described in Section 8 of the LTCP, the values presented in Table 1 for the 10-year simulation were interpolated from the runs that included the 50 percent and 75 percent control tunnels for outfalls NC-015, 083 and 077.

Table 1. Model Calculated Preferred Alternative Attainment of Existing WQ Criteria (Primary Contact)

Station		75% Control at BB-026, 62.5% Control at NC-015, 083, 077			
		10-Year Simulation(1)		2008 Typical Year	
		Annual Monthly GM <200 cfu/100mL	Recreational Season(2) Monthly GM <200 cfu/100mL	Annual Monthly GM <200 cfu/100mL	Recreational Season(2) Monthly GM <200 cfu/100mL
Main Channel	NC4	90	93	83	100
	NC5	90	93	83	100
Dutch Kills	NC6	88	93	83	100
Main Channel	NC7	90	93	83	100
	NC8	90	93	83	100
	NC9	90	93	83	100
Maspeth Creek	NC10	89	92	83	100
English Kills	NC11	89	92	83	100
East Branch	NC12	83	88	83	100
English Kills	NC13	89	92	83	100
	NC14	83	83	83	100

Notes:
(1) Values interpolated from 10-year simulations of 50% and 75% control tunnel (with 75% control at BB-026) runs.
(2) The recreational season is from May 1st through October 31st.

Although not currently applicable to Newtown Creek, projected levels of attainment for the Potential Future Primary WQ Criteria were also assessed using a 10-year continuous simulation. Values for the preferred alternative were interpolated from runs that included the 50 percent and 75 percent control tunnels for outfalls NC-015, 083 and 077. Based on those runs, attainment of the 30-day rolling GM for Enterococci is projected to range from 72 to 91 percent for the stations in Newtown Creek. Attainment of the 90th Percentile STV criterion is projected to range from 6 to 26 percent.

The waterbody is projected to attain the existing Class SD DO criteria at least 95 percent of the time for the whole waterbody on an annual basis, with the implementation of the LTCP recommended plan that includes seasonal operation of the aeration system for the upper tributaries (English Kills and East Branch). If the aeration system were not to be in operation, even 100 percent control would not bring the upper reaches of the waterbody into compliance with the Class SD DO criterion (never less than 3.0mg/L).

An analysis was also conducted to predict the recovery time in Newtown Creek following a rain event. As primary contact uses are projected to be attained in Newtown Creek during the recreational season (May 1st through October 31st), DEP used the primary contact fecal coliform recreation warning level of 1,000 cfu/100mL from the DOHMH guidelines in this analysis. The analyses consisted of examining the WQ model-calculated bacteria concentrations in Newtown Creek for recreational periods (May 1st through October 31st) abstracted from 10 years of model simulations. The time to return (or "time to recovery") to a fecal coliform concentration of 1,000 cfu/100mL for each water quality station within the waterbody was then calculated for each storm with the various size categories and the median time after the end of rainfall was then calculated for each rainfall category. The results of the analysis are summarized in Sections 6 and 8 of the Newtown Creek LTCP, and are presented in Table 2. For the preferred alternative, the median times to recovery are below 24 hours at all of the sampling locations for the storm sizes up to 1.5 inches except for location NC6 in Dutch Kills, where the median for storms in the 0.8 to 1.5 inch range is 38 hours. For storms greater than 1.5 inches, the median times to recovery are well above 24 hours at all locations.

Table 2. Time to Recovery to 1,000 cfu/100mL Fecal Coliform – Preferred Alternative 62.5 Percent Control Tunnel with 75 Percent Control at BB-026

Station		Average Time to Recovery to 1,000 cfu/100mL Fecal Coliform (Hrs)(1)					
		Storm Size Bins (inches of rainfall)					
		<0.1	0.1 – 0.4	0.4-0.8	0.8-1.0	1.0-1.5	>1.5
Main Channel	NC4	1	1	1	6	6	43
	NC5	1	1	1	3	1	54
Dutch Kills	NC6	1	1	1	38	38	73
Main Channel	NC7	1	1	1	1	1	63
	NC8	1	1	1	1	1	70
	NC9	1	1	1	1	1	72
Maspeth Creek	NC10	1	1	3	9	10	67
English Kills	NC11	1	1	1	1	1	57
East Branch	NC12	1	1	1	5	8	79
English Kills	NC13	1	1	1	1	1	50
	NC14	1	1	1	2	7	80

Note:

(1) Values interpolated from 10-year simulations of 50% and 75% control tunnel (with 75% control at BB-026) runs.

DEP has been using model projections in various waterbodies and near beaches to assist with advisories that are typically issued twice a day. The recovery time is essentially the timeline throughout which the waterbody will not support primary contact and is intended to advise the water users of the potential health risks associated with this use during this time period.

CONCLUSIONS

Newtown Creek does not attain the existing Class SD WQS for bacteria under baseline conditions. The Creek cannot fully achieve the Primary Contact Bacteria WQ Criteria based on fecal coliform on an annual basis, even with 100 percent CSO control. However, the analyses show that with the preferred alternative, Primary Contact Bacteria WQ Criteria is projected to be attained throughout the recreational season (May 1st through October 31st) based on 2008 rainfall. Assessment of compliance using a 10-year continuous model run indicated that recreational season (May 1st through October 31st) compliance would be in the range of 83 to 93 percent, and annual compliance would be slightly lower. Regardless of the timeframe used to assess compliance, bacteria levels will be elevated during and after rain events. No permitted swimming locations exist along Newtown Creek. Thus, the non-attainment of swimmable standards during and after rainfall or during the non-recreational season (November 1st through April 30th) would not impact such uses. Secondary contact recreation has been reported in the Creek, although physical features of the Creek limit the extent of those activities. Non-attainment of the fecal coliform primary contact criterion is attributable to the following UAA factors:

Fecal Coliform:

- Human caused conditions (direct drainage and urban runoff) create high bacteria levels that prevent the attainment of the use and that cannot be fully remedied for large storms (UAA factor #3).

It should be emphasized that the Newtown Creek watershed, although surrounded by commercial and industrial uses in most areas, does provide a few limited shoreline access points for on-shore recreation, which allow the public to take advantage of the recreational uses of the waterway. These uses should be protected in recreational periods, with the exception of during rain events when advisories will be in place.

RECOMMENDATIONS

Newtown Creek is not projected to attain the current bacteria Class SD criterion for fecal coliform on an annual basis with the preferred alternative, but will attain the criterion on a seasonal basis (based on 2008 rainfall). Assessment of compliance using a 10-year continuous model run indicated that recreational season (May 1st through October 31st) compliance would be in the range of 83 to 93 percent, and annual compliance would be slightly lower. However, as noted above, no DOHMH sanctioned locations for primary contact recreation exist along the Creek, and physical features limit the extent of secondary contact recreation. The current uses are primarily associated with on-shore activities at specific access locations, as well as boating/kayaking facilitated by the North Brooklyn Boat Club boat launching location. The general public indicated that Newtown Creek should be made safe for fishing and boating/kayaking in the future. This awareness was demonstrated in the attendance and input received through the public participation process, where the aspiration for continued improvement in water quality was conveyed and brought into the LTCP framework. The LTCP assessments demonstrated that the LTCP recommended plan will bring the waterbody into seasonal compliance of the Existing WQ Criteria for fecal coliform bacteria based on 2008 rainfall, and, to protect other non-designated uses, DEP would implement wet-weather advisories during the recreational season (May 1st through October 31st). This would make Newtown Creek protective of the secondary contact use, should it occur, as long as it did not occur during or following rainfall events. DO WQS are met for the designated Class SD standard. The LTCP analyses demonstrated that 100 percent CSO control would not bring annual fecal coliform bacteria levels into compliance with the Class SD standard.

The above conclusions support that Newtown Creek should remain a designated Class SD waterbody after the implementation of the LTCP recommended plan. Future Post-Construction Compliance Monitoring data collection efforts may later support a revision of the best uses and designated WQ classification for Newtown Creek.