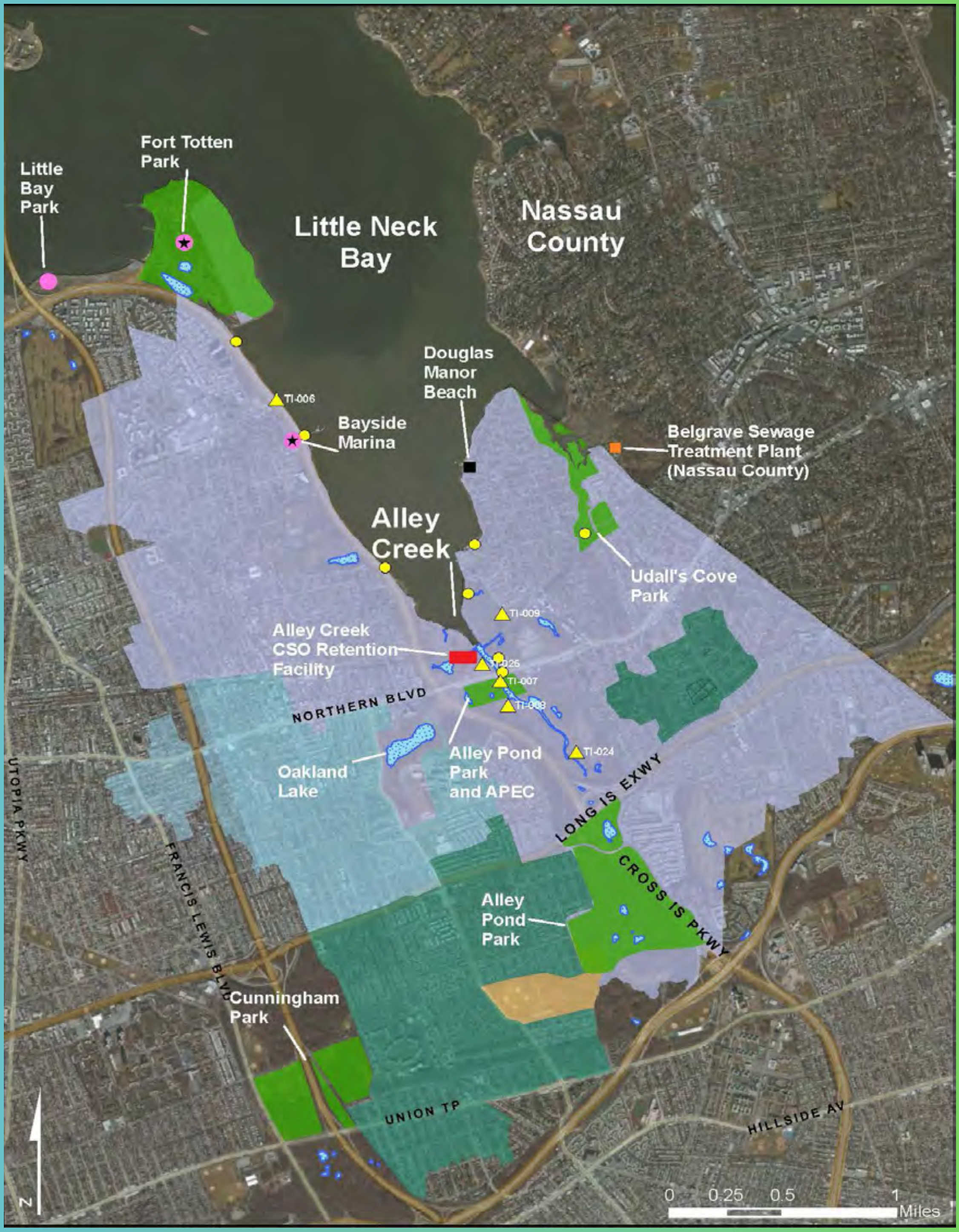
New York City Department of
Environmental Protection

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

Combined Sewer Overflow Long Term Control Plan for Alley Creek and Little Neck Bay



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

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EXECUTIVE SUMMARY

This Executive Summary is organized as follows:

- Background — An overview of the regulations, approach and existing waterbody information.
- Findings — A summary of the key findings of the water quality data analyses, the water quality modeling simulations and the alternatives analysis.
- Recommendations — A listing of recommendations for improvements that are consistent with the Federal CSO Control Policy and the Clean Water Act (CWA). In addition, recommendations regarding suggested site-specific targets for the Alley Creek and Little Neck Bay waterbodies are provided. The site-specific targets are expected to advance the waterbody toward the Primary Contact WQ Criteria.

BACKGROUND

This Long Term Control Plan (LTCP) for Alley Creek and Little Neck Bay was prepared pursuant to the Combined Sewer Overflow (CSO) Order on Consent (DEC Case No. CO2-20110512-25), dated March 8, 2012 (2012 Order on Consent). The 2012 Order on Consent is a modification of the 2005 CSO Order on Consent (DEC Case No. CO2-20000107-8). Under the 2012 Order on Consent, the New York City Department of Environmental Protection (DEP) is required to submit 11 waterbody-specific LTCPs to the New York State Department of Environmental Conservation (DEC) by December 2017. The Alley Creek and Little Neck Bay LTCP is the first of the LTCPs under the 2012 Order on Consent to be completed. Previous versions of this LTCP were submitted to DEC on July 2 and November 12, 2013[(1)].

The goal of each LTCP, as described in the LTCP Goal Statement in the 2012 Order on Consent, is to identify, with public input, appropriate CSO controls necessary to achieve waterbody-specific water quality standards (WQS) consistent with the CSO Control Policy and related guidance. In addition, the Goal Statement provides: *"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 bacteria targets and associated recovery times. For this LTCP, in accordance with guidance from DEC, DEP considers that 95 percent attainment of applicable water quality criteria constitutes compliance with the existing WQS or the Section 101(a) (2) goals[2] conditioned on verification

[1] DEC indicated that the July submittal was not approvable as submitted. DEP re-submitted the LTCP with revisions in November 2013; DEC disapproved that submittal. DEP challenged the disapproval of the November submittal and believes that the LTCP was an approvable plan per the 2012 Order on Consent. However, DEP has made further revisions to the LTCP in response to DEC comments received in review letters dated September 12 and December 12, 2013, as well as in subsequent technical meetings held between DEC and DEP.

[2] This LTCP is designed to meet the existing WQS that have been promulgated by DEC. To the extent that this LTCP provides, analyzes, or selects alternatives that may lead to achievement of targets beyond what are required under existing WQS, DEP provides these analyses and/or commitments in order to improve water quality beyond the requirements of the CSO Control Policy and other applicable law. DEP reserves all rights with respect to any administrative and/or rulemaking process that DEC may engage in to revise WQS.

through rigorous post construction monitoring (PCM). The PCM will be reviewed for the Citywide LTCP and the percent attainment targets will be reviewed and possibly modified.

Regulatory Requirements

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

Currently, existing State WQS for navigable waters designate Little Neck Bay as a Class SB waterbody, which is defined as "suitable for fish, shellfish and wildlife propagation and survival." The best usages of Class SB waters are "primary and secondary contact recreation and fishing" (6 NYCRR 701.11). Class SB waterbodies include bacteria indicator criteria that are currently in the DEC WQS in addition to recreational bathing pathogen indicator criteria in the Beaches Environmental Assessment and Coastal Health Act of 2000 (BEACH Act of 2000). DEC has designated Alley Creek as a Class I water body, defined as "suitable for fish, shellfish and wildlife propagation and survival." The best usages of Class I waters are "secondary contact recreation and fishing" (6 NYCRR 701.13).

Under the BEACH Act of 2000, states with coastal recreation waters were to adopt new bacteria criteria for primary contact waters. For marine waters, like those in NYC, EPA proposed using enterococci as the new indicator organism with a requirement that the geometric mean (GM) concentration of enterococci not exceed 35 cfu/100mL. When this rule was promulgated, the EPA guidance document provided flexibility in the interpretation of the calculation of the GM. States were given the discretion by EPA to apply this new criterion as a seasonal GM, a monthly GM, or a rolling 30-day GM. Per DEC's interpretation of the BEACH Act of 2000 and instruction to DEP, DEP has assessed the enterococci attainment calculations in this LTCP by applying a recreational season 30-day rolling GM to calculate enterococci attainment. The recreation season, as defined by DEC, is the period from May 1st to October 31st. When using a recreational season 30-day rolling GM, the more frequent and constant sources become less important in terms of attainment of the criterion and short-term sources become more important. In addition, DEC has recently advised DEP that it plans to adopt the 30-day rolling GM for enterococci of 30 cfu/100mL, with a not to exceed the 90th percentile statistical threshold value (STV) of 110 cfu/100mL, which is the EPA Recommended Recreational Water Quality Criteria "2012 EPA RWQC". The analyses in this LTCP were performed prior to this recent communication, and thus used the 30-day rolling GM for enterococci of 35 cfu/100mL with a corresponding STV of 130 cfu/100mL. Sufficient time was not available to update all of the LTCP. The recommendations are not impacted.

This LTCP used the bacteria criteria shown in Table ES-1 to evaluate the proposed alternatives.

Table ES-1. Classifications and Standards Applied

Analysis	Numerical Criteria Applied		
	Alley Creek	**Little Neck Bay**	**DMA Beach**
Existing WQ Criteria	I (Fecal Monthly GM – 2,000 cfu/100 mL)	SB (Fecal Monthly GM – 200 cfu/100 mL) SB (Entero rolling 30-d recreational season GM - 35 cfu/100 mL)	SB (Fecal Monthly GM - 200 cfu/100 mL) SB (Entero rolling 30-d bathing season GM- 35 cfu/100 mL)
Primary Contact WQ Criteria(3)	SC (Fecal Monthly GM – 200 cfu/100mL	----	----
Future Primary Contact WQ Criteria(4)	(Entero rolling 30-d recreational season GM – 35 cfu/100 mL + STV – 130 cfu/100 mL)	(Entero rolling recreational season 30-d GM – 35 cfu/100 mL+ STV – 130 cfu/100 mL)	SB (Entero rolling bathing season 30-d GM – 35 cfu/100 mL + STV – 130 cfu/100 mL)

Note: GM = Geometric Mean; STV = 90th Percentile Statistical Threshold Value; NYC DOHMH Bathing Season = Memorial Day to Labor Day; Recreational Season = May 1st to October 31st.

3 *This water quality standard is not currently assigned to Alley Creek.*

4 *This Future Standard has not yet been proposed by DEC. For such standard to take effect, DEC must first adopt the standard in accordance with rulemaking and environmental review requirements. In addition, DEC must follow the required regulatory procedures to reclassify Alley Creek from I to SC.*

The criteria assessed in this LTCP include the applicable existing WQS (Class I – secondary contact recreation for Alley Creek). Also assessed in this LTCP is what attainment would be if DEC were to re-classify Alley Creek to a Class SC - limited primary contact recreation. Regarding Little Neck Bay, this LTCP assesses existing WQS (Class SB – primary contact recreation). The bacteria criteria for Class SC are the same as for Class SB. The best usage of Class SC waters is fishing. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use of the waterbody for these purposes. It should be also noted that enterococci criteria do not apply to the tributaries such as Alley Creek under the BEACH Act of 2000, therefore, Alley Creek water quality assessments for Class SC considered the fecal coliform criteria only (Table ES-1). As described above, the 2012 EPA RWQC recommended certain changes to the bacterial water quality criteria for primary contact. DEC has indicated that NYS will seek to adopt those more stringent standards for both primary and secondary contact waterbodies. As such, this LTCP includes attainment analysis both for existing WQS and for the proposed 2012 EPA RWQC that is referred to as "future primary contact criteria." A complete summary of existing and Future Primary Contact WQ Criteria is included in Table ES-1.

The attainment values with standards applied under Table ES-1 varied spatially and temporally at Alley Creek and Little Neck Bay locations. While the attainment with primary recreation fecal standard of 200 cfu/100 ml was high at all locations including Alley Creek (AC1) during the recreational season, when the standard is applied annually the resulting attainment value dropped to ≤95% at the AC1 location. Attainment results with the primary recreation enterococci standard showed spatial variability among locations: while the attainment with GM of 35 cfu/100 ml enterococci was higher at LNB locations (≥95%) during the recreational season, it was significantly lower (64%) at the Alley Creek tributary location (AC1).

When STV values are taken into account, the attainment values dropped significantly at all locations, ranging from 85% at the outer Bay (E11) to 10% at the Alley Creek location (AC1).

Alley Creek Watershed

Alley Creek watershed characteristics are as shown in Figure ES-1 and the CSO and stormwater outfalls are shown in Figure ES-2.

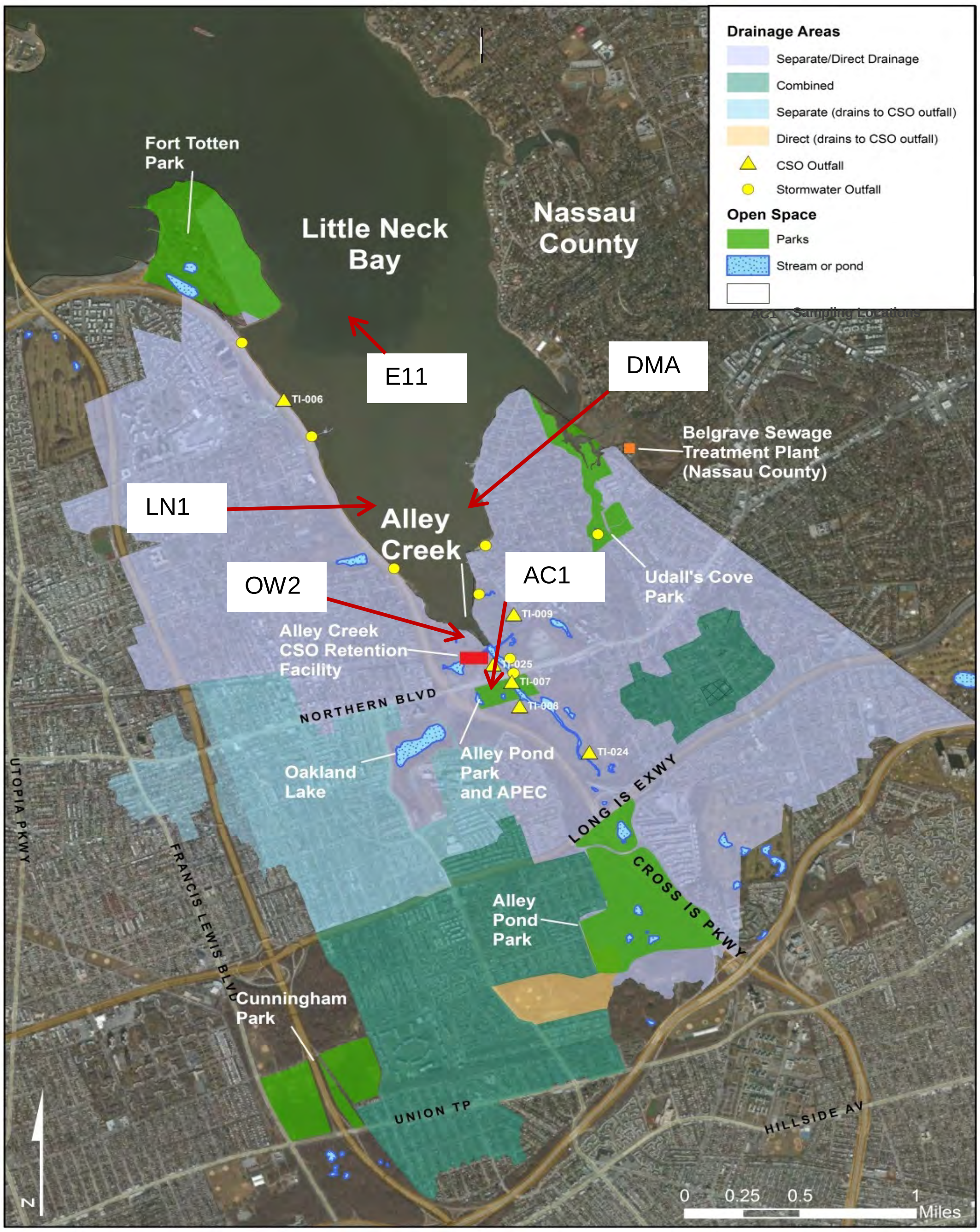
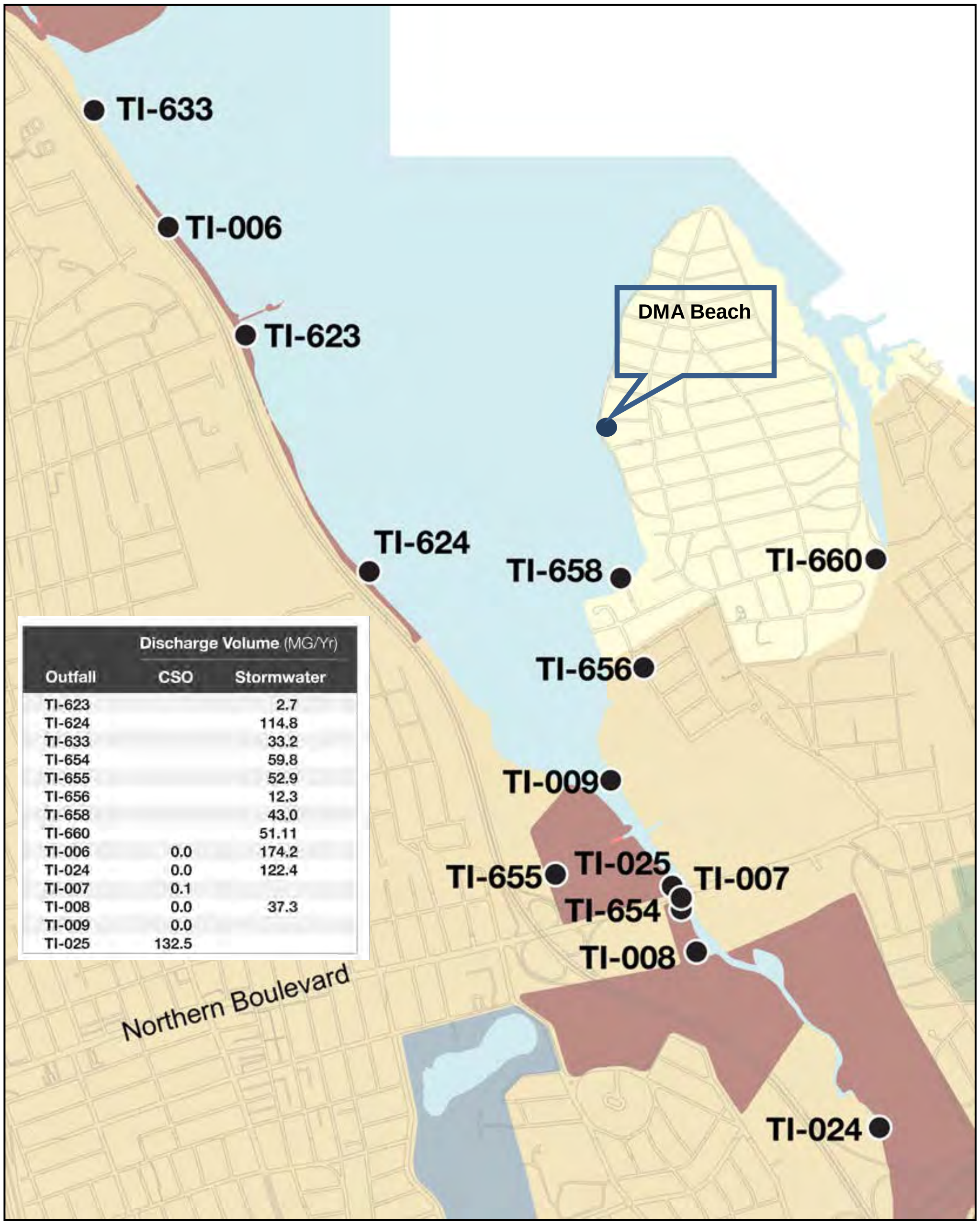


Figure ES-1. Watershed Characteristics and Sampling Locations



Outfall	Discharge Volume (MG/Yr) CSO	Stormwater
TI-623		2.7
TI-624		114.8
TI-633		33.2
TI-654		59.8
TI-655		52.9
TI-656		12.3
TI-658		43.0
TI-660		51.11
TI-006	0.0	174.2
TI-024	0.0	122.4
TI-007	0.1	
TI-008	0.0	37.3
TI-009	0.0	
TI-025	132.5	

Figure ES-2. New York City Alley Creek and Little Neck Bay SPDES Permitted Outfalls

The area on the eastern shore of Little Neck Bay, known as Douglas Manor, is a private residential community. The neighborhood is predominantly composed of single-family residences served by on-site septic systems. Approximately 58 acres of drainage area generate runoff upstream of Shore Road, a waterfront roadway that follows the alignment of the eastern shore of Little Neck Bay. The Douglas Manor Association (DMA) manages a permitted private community beach known as DMA Beach, along Shore Road. DMA Beach is located approximately 0.7 miles north of the mouth of Alley Creek, and approximately one mile downstream from the principal CSO outfall on Alley Creek, TI-025.

For designated bathing beach areas, the BEACH Act of 2000 recommends a seasonal GM of 35 MPN/100mL and includes a single sample maximum enterococci value of 104 per 100mL to be used by agencies for announcing bathing advisories or beach closings. The DMA Beach is permitted to operate by the NYC Department of Health and Mental Hygiene (DOHMH). DOHMH has adopted a seasonal 30-day GM of 35 enterococci per 100mL that is used to trigger a beach closing. DOHMH also adopted the single sample maximum of 104 enterococci per 100mL that is used to issue beach advisories. Although these are the existing DOHMH rules for bathing beaches, the operating criteria will likely change in the future as a result of recommendations provided in the 2012 EPA RWQC.

Green Infrastructure

The Alley Creek and Little Neck Bay watershed has one of the smallest total combined sewer impervious areas among the NYC managed watersheds, totaling 1,490 acres. DEP has already made significant investments in the watershed and has been successful in significantly controlling CSOs through the construction of CSO facilities and sewer enhancements. Therefore, as part of this LTCP, DEP assumes no public investment in green infrastructure (GI) implementation in the right-of-way or onsite public properties. However, DEP projects that approximately 45 acres will be managed through onsite private GI implementation in the Alley Creek and Little Neck Bay watershed by 2030. This acreage would represent three percent of the total combined sewer impervious area in the watershed, and assumes new development or redevelopment, based on a detailed review of NYC Department of Buildings (DOB) building permit data from 2000 to 2011.

Findings

Analysis of water quality in Alley Creek and Little Neck Bay was based on data collected by the DEP Harbor Survey Program between January 2009 and March 2014 and from sampling performed in late 2012, 2013 and 2014 during the development of the Alley Creek and Little Neck Bay LTCP. The data indicate that bacteria concentrations within Alley Creek are elevated, with GMs for enterococci at approximately 500 MPN/100mL and fecal coliform bacteria near 2,000 MPN/100mL. These elevated bacteria values are partially attributed to illicit connections to the storm sewers that discharge out of TI-024 during dry weather. A portion of these illicit connections have been corrected and track-down efforts are still underway to ensure that all illicit connections are addressed. Accordingly, the loadings attributed to the illicit connections are not included in the LTCP baseline conditions.

Bacteria levels within Little Neck Bay are significantly lower, with GM concentrations of less than 10 MPN/100mL for enterococci and GMs between 10 and 100 MPN/100mL for fecal coliform bacteria during the sampling/survey period. Locally at DMA Beach, enterococci concentrations, as measured by the DOHMH, have a GM that is very close to the moving 30-day GM criterion of 35 MPN/100mL. Between 2009 and March 2014, the water quality at DMA Beach was in attainment with the bathing season (Memorial Day – Labor Day) rolling 30-day GM for enterococci, from a low of 5 percent of the time in 2011, to a high of 67 percent of the time in 2012.

The results of this sampling program revealed the highest levels of bacteria concentrations in Alley Creek and in the southern area of inner Little Neck Bay near the mouth of Alley Creek. Localized contamination was also evident from the sampling at the DMA Beach. The high concentrations drop significantly, moving from the mouth of Alley Creek to the open waters of the Bay. This is also the case for the samples collected at DMA Beach.

As discussed above, the high bacteria concentrations in Alley Creek were associated with illicit discharges detected in TI-024, which serves as a separate stormwater outfall. Those illicit discharges found in 2012 were promptly corrected as outlined in a letter to DEC, dated November 7, 2012. This letter described the tracking and corrective actions taken as a result of this ongoing program. Follow-up investigations conducted in 2013 and 2014, prompted by high bacteria levels found in the Creek at location AC1 (Northern Boulevard), suggest that other illicit connections still exist. DEP is in the process of investigating and correcting these connections. Further, DEP will continue to conduct water quality sampling and connection dye studies and work with relevant authorities to ensure that all illicit connections are tracked down and corrected. This is a high priority for DEP and DEP will continue to sample and conduct water quality and pollution characterization investigations of the TI-024 outfall tributary area.

In addition to Alley Creek and lower Little Neck Bay, elevated bacteria concentrations were also found at the DMA Beach and have been a known chronic problem. These are believed to be caused by a highly localized source of contamination associated with septic systems in the drainage area. It should be noted that while these septic systems are not within DEP's jurisdiction, the matter has been brought to the attention of agencies which may have such jurisdiction including DEC, DOB and DOHMH.

Slightly elevated enterococci and fecal coliform values were also observed during dry weather conditions at the outlets of Oakland Lake and from a small highway drainage pond south of the Long Island Expressway (LIE) known as the LIE Pond. Additional sampling was conducted for these areas during 2014 and bacteria concentrations were found to be representative of urban waters, likely the result of wildlife and not representative of waters with illicit connections.

Baseline Conditions, 100 Percent CSO Control and Performance Gap

Analyses utilizing computer models to evaluate the ability to bring Alley Creek and Little Neck Bay into compliance with the existing WQ criteria, as well as the Future Primary Contact WQ Criteria with 2012 EPA RWQC bacteria modifications were conducted as part of this LTCP. These analyses also evaluated the ability of Alley Creek to comply with the Primary Contact WQ Criteria (Class SC). The analyses focused on two primary objectives:

1. Determine the future baseline levels of compliance with water quality criteria with all sources being discharged at existing levels (exclusive of illicit discharges) to the waterbody. These sources would primarily be stormwater and CSO. This analysis is presented for existing WQ criteria, Primary Contact WQ Criteria for Alley Creek (Class SC) and future Primary Contact WQ Criteria with 2012 EPA RWQC for both waterbodies.

2. Determine attainment levels with 100 percent of CSO controlled or no discharge of CSO to the waterbody, keeping the remaining stormwater sources. This analysis is presented for the standards and bacteria criteria shown in Table ES-1.

DEP assessed water quality using the East River Tributary Model (ERTM), a water quality model that was created and calibrated during the development of the WWFP in 2009. The model was modified as part of this LTCP development to significantly increase the grid resolution in Little Neck Bay, and was recalibrated using DEP water quality monitoring data, DOHMH DMA Beach monitoring data, and the synoptic water quality sampling data collected in 2012. Model outputs for fecal and enterococci bacteria as well as DO were compared with various monitored datasets during calibration in order to improve the accuracy and robustness of the models to adopt them for LTCP evaluations. The water quality model was then used to calculate ambient bacteria concentrations within the waterbodies for a set of baseline conditions.

Baseline conditions were established in accordance with the guidance provided by DEC to represent future conditions. These included the following assumptions: the design year was established as 2040; Tallman Island Wastewater Treatment Plant (WWTP) would receive peak flows at 2xDDWF; grey infrastructure would include those elements recommended in the 2009 WWFP; and waterbody-specific GI application rates would be based on the best available information. In the case of Alley Creek and Little Neck Bay, GI was assumed to have three percent coverage. In addition, the LTCP assumed baseline conditions with inflows from Oakland Lake and the LIE Pond as monitored in 2014.

The water quality assessments were conducted using continuous water quality simulations – a one-year (2008 rainfall) simulation for bacteria and dissolved oxygen (DO) assessment to support alternatives evaluation, and a 10-year (2002 to 2011 rainfall) simulation for bacteria for attainment analysis for developed alternatives. The gaps between calculated baseline bacteria as well as DO were then compared to the applicable bacteria and DO criteria to quantify the level of non-attainment. Because DO in Little Neck Bay and Alley Creek is highly influenced by the Upper East River and Long Island Sound, impacts from CSO overflows are minimal. Thus, the majority of the analyses focused on bacteria.

A summary of the baseline attainment results is presented in Table ES-2. Table ES-3 follows and presents projected level of attainment following 100 percent control of the CSO discharges.

Table ES-2. Baseline Compliance with Bacteria Criteria

<table>
<tr><th colspan="2" rowspan="2">Location</th><th colspan="2">Existing WQ Criteria[1]</th><th colspan="2">Alley Creek Primary Contact WQ Criteria (Class SC)</th><th>Future Primary Contact WQ Criteria</th></tr>
<tr><th>Fecal Coliform[2] (%)</th><th>Entero[3] (%)</th><th>Fecal Coliform[2] (%)</th><th>Entero[3] (%)</th><th>Entero[3] (%)</th></tr>
<tr><td>Alley Creek</td><td>AC1</td><td>YES</td><td>NA</td><td>87</td><td>N/A</td><td>53</td></tr>
<tr><td rowspan="3">Little Neck Bay</td><td>OW2</td><td>YES</td><td>91</td><td colspan="2" rowspan="4">N/A</td><td>91</td></tr>
<tr><td>LN1</td><td>YES</td><td>YES</td><td>YES</td></tr>
<tr><td>E11</td><td>YES</td><td>YES</td><td>YES</td></tr>
<tr><td>Bathing Area</td><td>DMA</td><td>YES</td><td>YES</td><td>YES</td></tr>
</table>

Notes: YES indicates ≥ 95 percent attainment

1. Alley Creek – Class I, Little Neck Bay – Class SB.
2. Fecal attainment assessed on an annual basis.
3. Little Neck Bay including Bathing Area – Attainment shown for 35 MPN/100mL applicable to a 30-day rolling GM during recreational season.

Table ES-2 shows that the waterbodies achieve a high level of attainment with the existing WQ criteria. Levels of attainment are less for the Primary Contact WQ Criteria in Alley Creek and modification based on the 2012 EPA RWQC in both waterbodies.

Table ES-3. Compliance with Bacteria Criterion with 100 Percent CSO Loading Removal

Location		Existing WQ Criteria[1]		Alley Creek Primary Contact WQ Criteria (Class SC)		Future Primary Contact WQ Criteria
		Fecal Coliform[2] (%)	Entero[3] (%)	Fecal Coliform[2] (%)	Entero[3] (%)	Entero[3] (%)
Alley Creek	AC1	YES	NA	94	N/A	64
Little Neck Bay	OW2	YES	YES	N/A		YES
	LN1	YES	YES			YES
	E11	YES	YES			YES
Bathing Area	DMA	YES	YES			YES

Notes: YES indicates ≥ 95 percent attainment

1. Alley Creek – Class I, Little Neck Bay – Class SB.
2. Fecal attainment assessed on an annual basis.
3. Little Neck Bay including Bathing Area – Attainment shown for 35 MPN/100mL applicable to a 30-day rolling GM during recreational season.

Further, as indicated in Table ES-3, even with 100 percent control of all CSOs, through additional control of the existing Alley Creek CSO Retention Facility effluent, the projected attainment with the recreational season enterococci criteria only increases marginally for the same 10-year period. Although not presented in Tables ES-2 and ES-3, even less attainment occurs when the 2012 EPA RWQC modification enterococci STV value 90th upper percentile limits are applied. The reason that full compliance is not attained is due mainly to two primary factors, use of GM averaging for compliance determination and stormwater contributions that occur during virtually each rain event.

GM averaging, as required for DEC compliance analyses, minimizes the importance of low frequency-high numbers, thus the effects of the infrequent Alley Creek CSO Retention Facility discharges, approximately once per month, are de-emphasized. Stormwater contributions are more frequent, at essentially one discharge for every rain event per outfall, averaging ten events per month, and thus become important in the calculation of the GM. Water quality is thus highly influenced by frequency of stormwater discharges while removal of CSOs has a smaller effect.

In summary, the baseline modeling showed that Alley Creek and Little Neck Bay exhibit a high level of attainment with the existing WQ criteria. The attainment levels with the Primary Contact WQ Criteria (Class SC for Alley Creek) and the Future Primary Contact WQ Criteria are lower.

Public Outreach

DEP followed a comprehensive public participation plan in ensuring engagement of interested stakeholders in the LTCP process. Stakeholders included both citywide and regional groups, a number of who offered comments at public meetings held for this LTCP. DEP will continue to gather public feedback on waterbody uses and will provide the public UAA-related information at the third Alley Creek and Little Neck Bay Public Meeting. The third meeting will present the final recommended plan to the public after DEC review of the LTCP.

At the second of two public meetings conducted to date, there was a high degree of public support for DEP's findings that additional grey infrastructure based-CSO controls were not warranted, due to the water quality improvements achieved from implementation of the 2009 WWFP recommendations, as well as from the related additional enhancements to the area wetlands and habitat. The recent $130M public investment in construction of the Alley Creek CSO Retention Facility, related collection system improvements and ecological restoration was well-received. No support was expressed for additional CSO controls or a higher standard for Alley Creek during the public participation meetings.

Evaluation of Alternatives

A three-step evaluation process was used to evaluate control measures and CSO control alternatives. The process was based on an evaluation process that considered factors related to environmental benefits; community and societal impacts; and implementation and O&M considerations. Following the initial or fatal flaw step and a more rigorous numerical evaluation second step, the most promising or retained alternatives were subjected to cost performance and cost attainment evaluations where economic factors were introduced. Table ES-4 contains the ten retained alternatives.

Table ES-4. Alley Creek and Little Neck Bay Alternatives Summary

Alternative	CSO Volume (MGY)	CSO Volume Reduction[1] Percent	Fecal Coliform Reduction[2] Percent	Enterococci Reduction[2] Percent	May 2013 Present Worth ($M)[3]
Baseline Conditions	132	0	0	0	$0
1. HLSS (High Level Sewer Separation)	65	51	5.4	-5.2	$658
2A. 3.0 MG Additional Downstream Retention	98	25	12.1	10.1	$93
2B. 6.5 MG Additional Downstream Retention	65	50	24.3	20.4	$156
2C. 12 MG Additional Downstream Retention	33	75	36.5	30.7	$310
2D. 29.5 MG Additional Downstream Retention	0	100	48.5	40.8	$569
3A. 2.4 MG Additional Upstream Retention	98	25	18.5	14.5	$113
3B. 6.7 MG Additional Upstream Retention	65	50	35.0	27.5	$173
4. Recreational Season Disinfection Operation in Existing Alley Creek CSO Retention Facility	132	0	23.3	19.6	$11.3
5A. 10 percent Green Infrastructure	112	15	5.9	5.2	$63
6. Hybrid – HLSS plus 3.0 MG Retention	38	71	11.0	0.1	$751

[1] CSO annualvolume reduction from baseline conditions.
[2] Includes both CSO and stormwater; reduction from baseline conditions.
[3] Based on Probable Bid Cost plus O&M cost for 20-year life, assuming three percent interest.

Alternative 4, Recreational Season Disinfection Operation in Existing Alley Creek CSO Retention Facility, will need to address potential effluent toxicity from total residual chlorine (TRC). Therefore, DEP sought a balance to reduce a high level of human or CSO-derived bacteria while protecting the waterbodies from TRC. A potential operational strategy was developed and incorporated into Alternative 4. The disinfection facilities would be operated during the recreational season to achieve a targeted 2-log bacteria kill (99 percent) while seeking to produce a minimum discharge of TRC to the extent possible. Consistent with the majority of the surveyed operating CSO disinfection facilities around the country, the effluent TRC in the Alley Creek CSO Retention Facility is expected to have a maximum concentration of 0.1 mg/L. This potential operational strategy is reflected in the results in Table ES-4, above, and the cost estimates. The DEPs approach for disinfection includes an interim facility and a permanent facility at the existing Alley Creek CSO Retention Facility. Section 8 and 9 provide an explanation and schedule for the disinfection facilities.

CSO Reductions, WQ Impact with the Selected Alternative

A summary of the results of the final step of the evaluation process for enterococci and fecal coliform are illustrated by Figure ES-3 and ES-4, which is a cost-performance curve for the various alternatives regarding enterococci and fecal coliform loading reductions at CSO outfall TI-025. The best-fit curve in the figure does not clearly show a knee-of-the-curve (KOTC). If the best-fit curve had encompassed the seasonal disinfection point rather than the annual equivalent disinfection point, a KOTC would stand out. the latter was used in the best-fit curve in order to present a uniform, consistent comparison between the various alternatives evaluated.

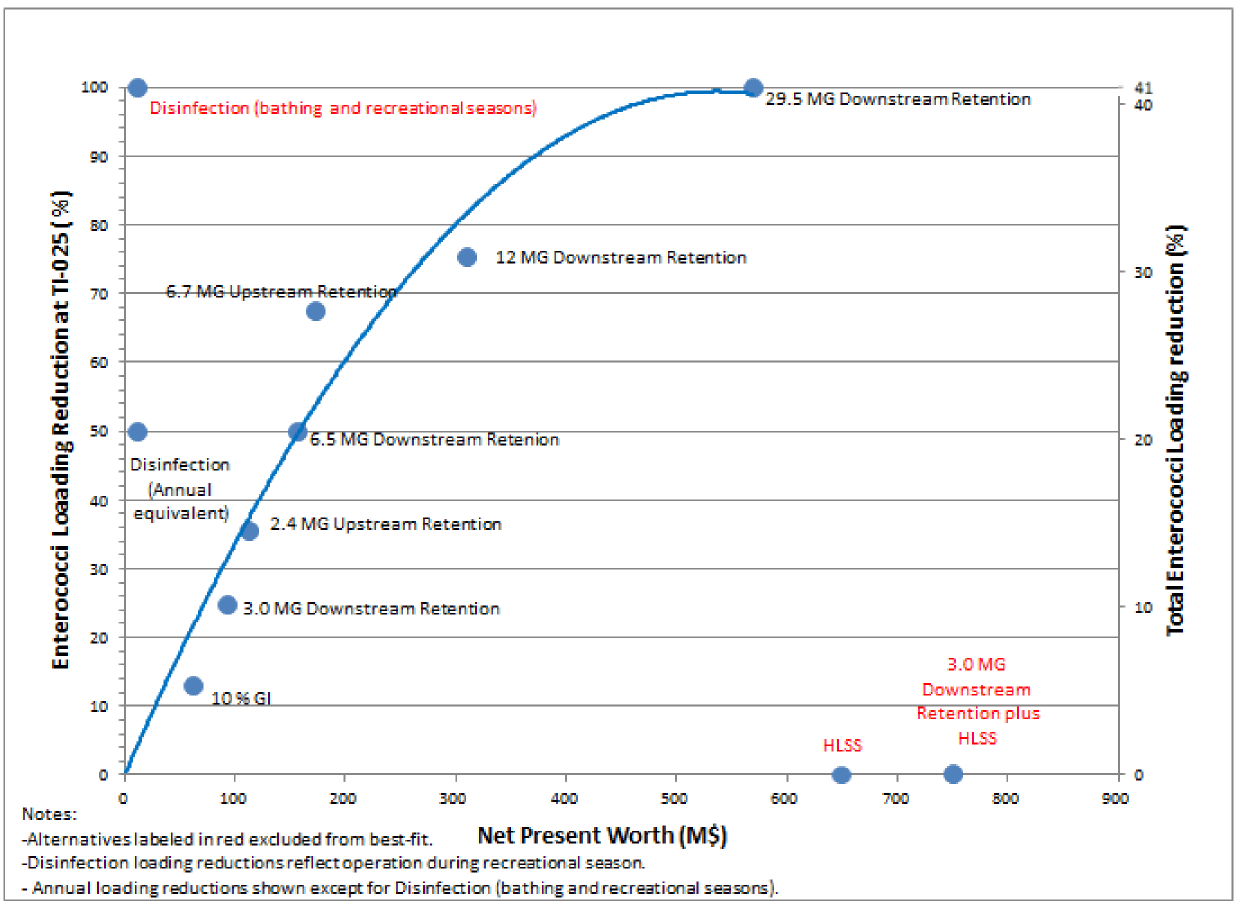


Figure ES-3. Cost vs. Total Enterococci Loading Reduction

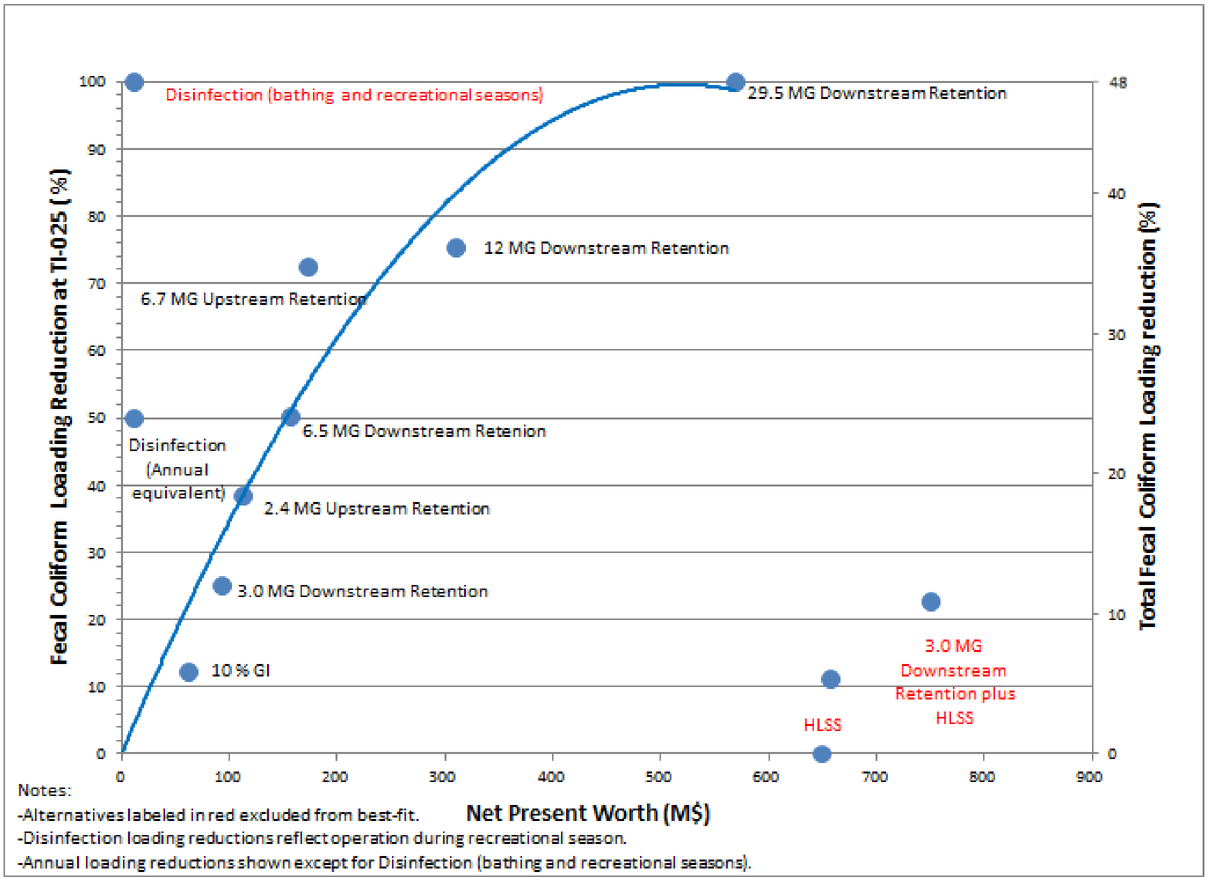


Figure ES-4. Cost vs. Fecal Coliform Loading Reduction – 2008 Rainfall

The cost-attainment curves that are presented in Section 8.5 did not show meaningful improvement in WQS attainment for any of the alternatives, including 100 percent CSO control. The least costly alternative is disinfection at the existing Alley Creek CSO Retention Facility. The analyses established that CSO discharges are not the primary factor in non-attainment of the Primary Contact WQ Criteria for Alley Creek (Class SC) or the Future Primary Contact WQ Criteria. However, due to findings from the cost-performance curves when focusing strictly on CSO discharges, Alternative 4 (see Table ES-4) stands out as a cost-effective means of controlling the remaining source of human bacteria, the CSOs. It is thus recommended as the selected alternative for the Alley Creek and Little Neck Bay LTCP.

This LTCP recommendation follows the findings and adaptive nature of DEP's long established CSO planning and abatement efforts. The Alley Creek CSO Retention Facility was first proposed in the 2003 Facilities Plan, followed by a re-statement in the 2009 Waterbody/Watershed Facilities Plan. The $130M investment in the Alley Creek CSO Retention Facility, related collection system improvements and ecological restoration were effective in reducing the volume of annual CSO overflows. This latest improvement resulting from this LTCP will further build upon these earlier efforts and will now specifically address the human or CSO-source bacteria in the periodic discharges from the facility.

The recommended disinfection will require improvements to the Alley Creek CSO Retention Facility that include: a new building, interim chlorination facilities, chlorination, possibly sodium bisulfite, pumps and mechanical equipment. Environmental reviews, permits, land acquisition or lease and multiple additional items will be needed to build the disinfection facility. The estimated probable bid cost is $7.6M in 2013 dollars, and operations costs are estimated at $0.25M annually, for a present worth cost of $11.3M. A more complete description of the disinfection approach is described in Section 8.0.

The public expressed their satisfaction with the current uses of Alley Creek and Little Neck Bay, made possible by DEP's $130M investments in grey infrastructure and related wetland restoration work. As such, the public was not in favor of additional construction in the watershed that could impact the restored area. Potential delays may impact the disinfection project, including the approval process, public comment, permitting issues, land use and easement acquisition, impact on Parkland, environmental review of the creek biota and design/construction/operation requirements.

RECOMMENDATIONS

Long Term CSO Control Plan Implementation, UAA and Summary of Recommendations

DEP will implement the plan elements identified in this section after approval of the LTCP by DEC. This Long Term Control Plan recommends the continued operation of the Alley Creek CSO Retention Facility with the addition of seasonal disinfection to control human bacteria, and has identified potential site-specific water quality targets for the water body beyond the currently applicable water quality standards, based on the predicted performance of the selected CSO controls. The targets are goals to move towards and are not enforceable. Post construction monitoring data will be collected to assess and compared to the targets.

The potential site-specific water quality targets are based on a review of ten years of water quality model simulations and should be met the majority of time. Achieving the targets will require that DEP continue to track down and eliminate remaining illicit connections.

The LTCP analyses and recommendations for the Alley Creek and Little Neck Bay LTCP are summarized below for the following items:

1. Water Quality Modeling Results
2. Identified UAA Site-Specific Targets
3. Summary of Recommendations

Water Quality Modeling Results

The water quality modeling results for Alley Creek and Little Neck Bay are shown in Tables ES-5 and ES-6 for the recommended alternative. These results provide the calculated annual attainment of the fecal coliform and enterococci bacteria concentrations for the plan with a new disinfection facility at the Alley Creek CSO Retention Facility operating during the recreational season (May 1st – October 31st). The results show, for the different calculated levels of attainment, when concentrations would be at or lower than the Existing WQ Criteria, Primary Contact WQ Criteria for Alley Creek (Class SC) and Future Primary Contact WQ Criteria with 2012 EPA RWQC bacteria criteria modifications.

The recommended plan achieves annual attainment of the existing fecal coliform criteria as well as attainment of the existing recreational season 30-day rolling GM enterococci criterion, with bacteria concentrations lower than the requirements throughout Little Neck Bay and with a very high level of attainment at the DMA bathing area. In Alley Creek, a high but not full level of attainment with the fecal coliform criterion for Class SC is projected to occur. With the recommended alternative, compliance with the 2012 EPA RWQC bacteria modifications remains low in Alley Creek, but increases in Little Neck Bay except for the inner (southern) portions of the bay (OW2).

Table ES-5. Compliance with Bacteria Criterion for the Recommended Alternative

Location		Existing WQ Criteria[1]		Primary Contact WQ Criteria (Class SC for Alley Creek)		Future Primary Contact WQ Criteria
		Fecal Coliform[2] (%)	Entero[3] (%)	Fecal Coliform[2] (%)	Entero[3] (%)	Entero[3] (%)
Alley Creek	AC1	YES	N/A	90	N/A	64
Little Neck Bay	OW2	YES	YES	N/A		YES
	LN1	YES	YES			YES
	E11	YES	YES			YES
Bathing Area	DMA	YES	YES			YES

Notes: YES indicates ≥ 95 percent attainment

1. Alley Creek – Class I, Little Neck Bay – Class SB.
2. Fecal attainment assessed on an annual basis.
3. Little Neck Bay including Bathing Area – Attainment shown for 35 MPN/100mL applicable to a 30-day rolling GM during recreational season.

Attainment of the STV criterion of the Future Primary Contact WQ Criteria is difficult if not impossible to achieve, as shown in Table 8-18 of the LTCP report. As noted previously, the analyses performed for this LTCP are based on 35 cfu/100mL and 130 cfu/100 mL for the GM and STV criteria, respectively.

Potential UAA Site-Specific Targets

Since the recommended LTCP projects will not result in full compliance in Alley Creek with Primary Contact WQ Criteria (Class SC), DEP has prepared a UAA for Alley Creek that identifies potential site-specific targets with advisories based on the predicted performance of the selected CSO controls. Application of these targets will reduce the bacteria loads to Alley Creek, and will improve attainment with existing Class SB of Little Neck Bay. The site-specific target is a goal to work toward during the period within which DEP's MS4 stormwater permit will come into effect and additional bacteria loading reductions will be expected.

These site-specific targets are based on water quality model simulations that account for CSO and stormwater sources, assume that seasonal disinfection is practiced, assume illicit discharges to storm sewers have been corrected and suspected DMA septic issues are corrected. Under these conditions, the pathogen water quality indicators should be less than the identified targets the majority of the time.

The recommended recreational season water quality targets are summarized in Table ES-6 in comparison to the existing and proposed bacteria WQ criteria. This table also provides a summary of the calculated bacteria criteria attainment. As noted in this table, the plan results in a high level of attainment with these proposed numerical targets.

Table ES-6. Proposed Site-Specific Bacteria Targets for Alley Creek and Little Neck Bay

Location	Existing WQ Criteria	Primary Contact WQ Criteria	Site-Specific Targets with Disinfection (cfu/100mL)	Attainment with Site-Specific Targets (%)
Little Neck Bay	Fecal Coliform ≤ 200 Enterococci ≤ 35[2]	Fecal Coliform No change Enterococci ≤ 35[2]	Fecal Coliform ≤ 200	100
			Enterococci ≤ 35	95[3] 100[4]
Alley Creek	Fecal Coliform ≤ 2000	Fecal Coliform ≤ 200	Fecal Coliform ≤ 200	98
			Enterococci ≤ 130	100
DMA Beach	Fecal Coliform ≤ 200 Enterococci ≤ 35[1]	Fecal Coliform No change Enterococci ≤ 35[2]	Fecal Coliform ≤ 200	100
			Enterococci ≤ 35	99

Notes: (1) Bathing season (Memorial Day – Labor Day)
(2) Recreational season (May 1st – October 31st)
(3) Inner Little Neck Bay
(4) Outer Little Neck Bay

Water quality modeling analyses were conducted herein to assess the amount time following the end of rainfall required for Alley Creek and Little Neck Bay to recover and return to concentrations less than 1,000 cfu/100mL fecal coliform and 130 cfu/100mL enterococci for the recreation periods (May 1st to October 31st) abstracted from 10-years of model simulations. The time to return (or “time to recover”) to 1,000 or 130 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 are summarized in Table ES-7 for various locations within Alley Creek and Little Neck Bay. As noted the duration of time within which bacteria concentrations are expected to be higher than NYS DOH considers safe for primary contact varies with location and with rainfall event size. Generally, a value of around 24 hours is reasonable for Alley Creek (AC1) and Little Neck Bay (OW2).

Table ES-7. Time to Recover (hours) To Fecal = 1,000 cfu/100mL and Entero = 130 cfu/100mL

	AC1		OW2		LN1		DMA	
Interval	Fecal	Entero	Fecal	Entero	Fecal	Entero	Fecal	Entero
<0.1	-	-	-	-	-	-	-	-
0.1-0.4	5	10	-	-	-	-	-	-
0.4-0.8	8	21	4	11	-	-	-	-
0.8-1.0	12	26	5	16	-	-	-	2
1.0-1.5	12	31	7	27	-	7	-	4
>1.5	14	31	12	27	-	16	2	12

Primary contact uses may be suspended for 24 hours following rain events to protect public health.

Summary of Recommendations

Overall water quality in Alley Creek and Little Neck Bay is expected to be marginally improved with the recommendations presented in this LTCP. Human bacteria discharged to Alley Creek through the overflow from the Alley Creek CSO Retention facility are expected to be greatly reduced with these recommendations. Little Neck Bay's water quality is also expected to benefit from these recommendations.

The identified elements for the Alley Creek and Little Neck Bay LTCP are:

1. DEP will continue to use the Alley Creek CSO Retention Facility to capture CSOs thus reducing overflows by 132 mgd per year.
2. DEP will continue to implement the Green Infrastructure program.
3. DEP will implement the steps necessary (i.e. funding, design, permitting, etc.) to construct a new facility at the existing Alley Creek CSO Retention Facility to disinfect during the recreational season (May 1st to October 31st).
4. The LTCP includes a UAA that identifies feasible site-specific WQ targets based on the projected performance of the selected CSO controls. A post construction monitoring program will be initiated after the WWFP improvements are operational. Based upon the results of such monitoring, the site-specific WQ targets may need to be reviewed
5. DEP will establish with the NYC Department of Health and Mental Hygiene through public notification a 24-hour wet weather advisory during the Recreational Season (May 1 to October 31), during which swimming and bathing would not be recommended. The LTCP includes a recovery time analysis that can be used to establish the 24-hour wet weather advisory for public notification.

In summary, this LTCP is expected to reduce the human contributed CSO bacteria and bacteria discharged to Alley Creek from CSOs. Little Neck Bay is expected to benefit from disinfection at the Alley Creek CSO Retention Facility. The overall water quality attainment in Alley Creek and Little Neck Bay is anticipated to marginally improve but will be significantly impacted by the bacteria standards and the stormwater contributions. The recommendations are expected to provide improvement beyond the existing WQS.

DEP is committed to improving water quality in these waterbodies, which will be advanced by the improvements and recommendations presented in this plan. These goals and recommendations have been balanced with input from the public and awareness of the cost to the citizens of New York City. The use of the UAA process will allow DEP and DEC to advance the goal of achieving the primary contact WQ criteria in Alley Creek and improve the already high attainment of the Class SB WQ criteria for Little Neck Bay.

Since submittal of the last Alley Creek LTCP in November 2013, the following significant changes have been included in this June 2014 submittal:

- Additional data were collected and evaluated in Section 2.0:
  - Alley Creek CSO Retention Facility effluent data
  - Flow and bacteria data at Oakland Lake and Long Island Expressway (LIE) Pond
  - Microbial Source Tracking (MST) data on Oakland Lake
  - Harbor Survey Monitoring data in Alley Creek
  - Illicit discharge tracking data in Alley Creek
- Models were updated with the new data and the baseline analyses were updated in Section 6.0, as applicable.
- Recreational season disinfection and partial High Level Sewer Separation alternatives were added and more detailed revisions were made to Section 8.0.
- Recreational season disinfection was added as a recommendation in Section 9.0.
- For the BEACH Act of 2000, the 90-day enterococci seasonal GM was removed, and water quality compliance with it was assessed for Little Neck Bay as a rolling 30-day GM of 35 cfu/100mL during the recreational season.
- A revised recreational season period from May 1st through October 31st and a bathing season period from Memorial Day through Labor Day was used.
- RWQC criteria were evaluated. The GM of 35 cfu/100mL and STV of 130 cfu/100mL were applied. There was insufficient time to evaluate the 30 cfu/100mL and 110 cfu/100mL, respectively, although the conclusions are expected to be similar.
- Site-specific targets were identified that would allow waterbody improvements to be achieved.
- A recovery time analysis was added to assess the time to return to the site-specific targets after storm events of various sizes.
- A revised UAA for Alley Creek is provided.

1.0 INTRODUCTION

This Long Term Control Plan (LTCP) for Alley Creek and Little Neck Bay was prepared pursuant to the Combined Sewer Overflow (CSO) Order on Consent (DEC Case No. CO2-20110512-25), dated March 8, 2012 (2012 Order on Consent). The 2012 Order on Consent is a modification of the 2005 CSO Order on Consent (DEC Case No. CO2-20000107-8). Under the 2012 Order on Consent, the New York City Department of Environmental Protection (DEP) is required to submit 11 waterbody-specific LTCPs to the New York State Department of Environmental Conservation (DEC) by December 2017. The Alley Creek and Little Neck Bay LTCP is the first of the LTCPs under the 2012 Order on Consent to be completed. Previous versions of this LTCP were submitted to DEC on July 2 and November 12, 2013[(1)].

1.1 Goal Statement

The following is the LTCP Introductory Goal Statement, which appears as Appendix C in the 2012 Order on Consent. 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 the City's concentrated urban environment, human intervention, and current waterbody uses, among other factors. DEP will identify appropriate water quality outcomes based on site-specific evaluations in the drainage basin specific LTCP, consistent with the requirements of the CSO Control Policy and Clean Water Act (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[2] of the Clean Water Act, or*

[1] DEC indicated that the July submittal was not approvable as submitted. DEP re-submitted the LTCP with revisions in November 2013; DEC disapproved that submittal. DEP challenged the disapproval of the November submittal and believes that the LTCP was an approvable plan per the 2012 Order on Consent . However, DEP has made further revisions to the LTCP in response to DEC comments received in review letters dated September 12 and December 12, 2013, as well as in subsequent technical meetings held between DEC and DEP.

[2] This LTCP is designed to meet the existing WQS that have been promulgated by DEC. To the extent that this LTCP provides, analyzes, or selects alternatives that may lead to achievement of targets beyond what are required under existing WQS, DEP provides these analyses and/or commitments in order to improve water quality beyond the requirements of the CSO Control Policy and other applicable law. DEP reserves all rights to with respect to any administrative and/or rulemaking process that DEC may engage in to revise WQS.

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 a UAA for Alley Creek as discussed later in the LTCP.

1.2 Regulatory Requirements (Federal, State, Local)

The waters of the City of New York are subject to Federal and New York State regulation. The following sections provide an overview of the regulatory issues relevant to long term CSO planning. Detailed discussions of regulatory requirements are also provided in the June 2009 Alley Creek and Little Neck Bay WWFP (DEP, 2009).

1.2.a Federal Regulatory Requirements

The Clean Water Act (CWA) established the regulatory framework to control surface water pollution, and gave EPA the authority to implement pollution control programs. The CWA established the National Pollutant Discharge Elimination System (NPDES) permit program. NPDES regulates point sources discharging pollutants into waters of the United States. CSOs and municipal separate storm sewer systems (MS4) are also subject to regulatory control under the NPDES program. In New York, the NPDES permit program is administered by the DEC, and is thus a State Pollution Discharge Elimination System (SPDES) program. New York City 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 water quality standards (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 "list"). The list identifies the pollutant or 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 each waterbody and associated pollutant/stressor on the list. Pollution controls based on the TMDL serve as the means to attain and maintain water quality standards for the impaired waterbody.

DEC included Little Neck Bay in the 2014 Draft New York State Section 303 (d) list of impaired waterbodies for pathogens associated with CSO discharges, storm discharges, and urban runoff. DEC previously included Alley Creek on a separate supplemental list referenced as the 2012 Other Impaired Waterbody Segments not Listed, which includes waterbody segments not listed elsewhere because "development of TMDL is not necessary" (Category 4b). This Category 4b designation includes waters of the state that do not fully support designated uses and are considered impaired. Alley Creek is listed as Category 4b based upon impairment for floatables and oxygen demand due to CSO discharges, storm discharges, and urban runoff (Table 1-1). Furthermore, DEC has listed Little Neck Bay under Category 4a (for waterbodies having a TMDL) based upon the fact that Little Neck Bay was included in the Long Island Sound TMDL.

Table 1-1. Waterbody Impairments and Listings (with Source of Impairment)

Waterbody	Pathogens	DO/Oxygen Demand	Floatables	Reference
Little Neck Bay	(1) Urban/Storm/CSO	(4a) Municipal, Urban, CSOs	--------	2014 Draft NYS 303(d) Impaired Water List
Alley Creek	---------	(4b) Urban/Storm/CSO	(4b) CSOs, Urban/Storm	2012 Other Impaired Waterbody Segments not Listed

Notes:

(1) Individual Waterbodies with Impairment Requiring a TMDL

(4a) Impaired Waters NOT INCLUDED on the NYS 2012 Section 303(d) List; TMDL development is not necessary, since a TMDL has already been established for the segment/pollutant.

(4b) Impaired Waters NOT INCLUDED on the NYS 2012 Section 303(d) List; a TMDL is not needed, since other required control measures are expected to result in restoration in a reasonable period of time.

1.2.b Federal CSO Policy

The 1994 EPA CSO Control Policy provides guidance to permittees and NPDES permitting authorities as to the development and implementation of an LTCP, in accordance with the provisions of the CWA. The CSO Control Policy was first established in 1994 and later codified as part of the CWA in 2000.

1.2.c New York State Policies and Regulations

The State of New York (NYS) has established WQS for all navigable waters within its jurisdiction. Little Neck Bay is classified as an SB waterbody, defined as "suitable for fish, shellfish and wildlife propagation and survival". The best usages of Class SB waters are "primary and secondary contact recreation and fishing" (6 NYCRR 701.11). Alley Creek is classified as a Class I waterbody, which is defined as "suitable for fish, shellfish and wildlife propagation and survival". The best usages of Class I waters are "secondary contact recreation and fishing" (6 NYCRR 701.13).

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 Interstate Environmental District includes all tidal waters of greater New York City, including Alley Creek and Little Neck Bay. The IEC has recently been incorporated into and is now a district of the New England Interstate Water Pollution Control Commission (NEIWPCC), a similar multi-state compact of which NYS is a member.

Both waterbodies are classified as Type A under the IEC system. Details concerning the IEC classifications are presented in Section 2.2.

1.2.d Administrative Consent Order

The City and DEC have entered into Orders on Consent to address CSO issues, including the 2005 CSO Order on Consent, which was issued to bring all DEP CSO-related matters into compliance with the provisions of the CWA and the New York State Environmental Conservation Law (ECL), and requires implementation of LTCPs. The 2005 Order on Consent required DEP to evaluate and implement CSO abatement strategies on an enforceable timetable for 18 waterbodies and, ultimately, for citywide long-term CSO control, in accordance with the 1994 EPA CSO Control Policy. The 2005 Order on Consent was modified as of April 14, 2008, to change certain construction milestone dates. In addition, DEP and DEC entered into a separate Memorandum of Understanding (MOU) to facilitate WQS reviews in accordance with the EPA CSO Control Policy. The last modification prior to 2012 occurred in 2009, which addressed the completion of the Flushing Creek CSO Retention Facility.

In March 2012, DEP and DEC amended the 2005 Order to provide for incorporation of Green Infrastructure (GI) into the LTCP process, as proposed under the City's 2010 Green Infrastructure Plan, and to update certain project plans and milestone dates.

1.3 LTCP Planning Approach

The LTCP planning approach includes several phases. The first is the characterization phase – an assessment of current waterbody and watershed characteristics, system operation and management practices, the status of current green and grey infrastructure projects, and an assessment of current system performance. DEP is gathering the majority of this information from field observations, historical records, analysis of studies and reports, and collection of new data. The next phase involves the identification and analysis of alternatives to reduce the frequency of wet weather discharges and improve water quality. Alternatives include a combination of green and grey infrastructure elements that are carefully evaluated using both the collection system and receiving waterbody models. Following the analysis of alternatives, a recommended plan, along with an implementation schedule and strategy, is provided. If the proposed alternative does not achieve existing WQS or the Section 101(a)(2) goals of CWA, the LTCP will include a UAA 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 builds upon prior efforts by capturing the findings and recommendations from the previous facility planning documents for this watershed. The LTCP integrates and builds on this existing body of work.

In June 2009, DEP issued the Alley Creek and Little Neck Bay Waterbody/Watershed Facility Plan (WWFP), which DEC approved in October, 2009. The WWFP, which was prepared pursuant to the 2005 Order on Consent, 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 this watershed. Several of the recommended improvements, which were selected to target the attainment of existing WQS, were set forth in earlier facilities planning efforts and have since been completed; these include the 5-MG Alley Creek CSO Retention Facility, along with extensive improvements to the upstream combined and separate collections systems within the Alley Creek watershed.

Aside from the improvements in the Alley Creek drainage area, additional improvements have been made or are underway to improve the conveyance of wet weather flows to the Tallman Island Wastewater Treatment Plant (WWTP). This includes completed modifications to Regulator TI-R09 (increased open area of side-overflow windows, raised weir), and Regulator TI-R10 that was removed and replaced with a section of pipe. In addition, construction is underway to construct a parallel Whitestone Interceptor in conjunction with some regulator modifications that is projected to significantly increase the hours in which the Tallman Island WWTP will treat two times design dry weather flow (2xDDWF). DEP incorporated these sewer system improvements into the baseline conditions for this LTCP. Further discussion of these improvements is contained in Section 4.0.

1.3.b Coordination with DEC

As part of the LTCP process, DEP strove to share ideas, report on LTCP progress, and propose strategies and solutions to address wet weather challenges for the Alley Creek and Little Neck Bay LTCP with DEC.

During the early phases of the LTCP development, representatives from DEP and DEC, along with their technical consultants, conducted technical meetings during the development of the Alley Creek and Little Neck Bay LTCP. The purpose of these early meetings was to discuss the plan components, including technical analysis, the proposed recommended plan, and resulting water quality benefits, as well as coordination for public meetings and other stakeholder presentations. On a quarterly basis, DEC, DEP, and outside technical consultants also convened for a larger progress meeting that typically included technical staff and representatives from DEP and DEC's legal departments, as well as department chiefs who oversee the execution of the CSO program.

In addition to these meetings, DEP and DEC co-hosted the LTCP public kick-off meeting, sharing the responsibility for presentation of material and execution of the event. While not co-hosting the second public meeting, DEC did send a representative who read an official statement from the department.

1.3.c Watershed Planning

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

1.3.d Public Participation Efforts

A concerted effort was made during the Alley Creek and Little Neck Bay LTCP planning process to involve all relevant and interested stakeholders, and keep interested parties informed about the project. A public outreach participation plan was developed and implemented throughout the process; the plan is posted and regularly updated on DEP's LTCP program website, www.nyc.gov/dep/ltcp.

Specific objectives of this initiative included the following:

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

The public participation efforts for this Alley Creek and Little Neck Bay LTCP are discussed in detail in Section 7.0.

2.0 WATERSHED/WATERBODY CHARACTERISTICS

This section summarizes the major characteristics of the Alley Creek and Little Neck Bay watershed and waterbody, building upon earlier documents that present a characterization of the area. These include the WWFP for Alley Creek and Little Neck Bay (DEP, 2009), which describes the characteristics of the watershed and waterbody.

2.1 Watershed Characteristics

This subsection contains a summary of the watershed characteristics as they relate to the sewer system configuration, performance, and impacts to the adjacent waterbodies, as well as the modeled representation of the collection system used for analyzing system performance and CSO control alternatives.

2.1.a Description of Watershed

The Alley Creek and Little Neck Bay watershed is urbanized and sub-urbanized, comprised primarily of residential areas with some commercial, industrial, and open space/outdoor recreation areas. The Alley Creek and Little Neck Bay watersheds consist of approximately 4,879 acres, located on the north shore of eastern Queens County, adjacent to the Nassau County border. The land surrounding Alley Creek is mostly parkland, while that surrounding Little Neck Bay is largely residential. Several parks are found within the watershed; most notable is the Alley Pond Park, which is adjacent to Alley Creek on its eastern, western, and southern shores, south of the Little Neck Bridge (Northern Boulevard). As described later in this section, the area is served by a complex wastewater system comprised of combined, separate, and storm sewers; interceptor sewers and pumping stations; several CSO and stormwater outfalls; and a CSO retention tank, the Alley Creek CSO Retention Facility.

Although the watershed has undergone major changes as this part of the City has developed, significant effort and interest by the citizens living in the area and New York City agencies has resulted in recognition of the ecological, environmental and educational value of Alley Creek and its tidal wetlands. In contrast to the filling in of wetlands and “hardening” of the shoreline with bulkheads that characterizes most of New York City’s pre-colonial wetlands, much of Alley Creek’s wetlands and the Little Neck Bay wetlands in Udalls Cove are designated parks.

The urbanization of the Alley Creek and Little Neck Bay drainage area has led to the creation of both a combined sewer system (CSS) and separate sewer system (SSS), including its companion stormwater systems that discharge to the two waterbodies. Combined sewage which does not overflow through any of the CSO structures is conveyed to the Tallman Island WWTP for treatment. As shown in Figure 2-1, Alley Creek and Little Neck Bay are located along the eastern edge of the Tallman Island WWTP tributary area.

As a residential community within New York City, several large and notable transportation corridors cross the watershed providing access between dense commercial and residential areas. These access routes include the Cross Island Parkway, Long Island Expressway, Grand Central Parkway, and the Long Island Railroad (Figure 2-2). These transportation corridors limit access to some portions of the waterbodies, and must be taken into consideration when developing CSO control solutions.

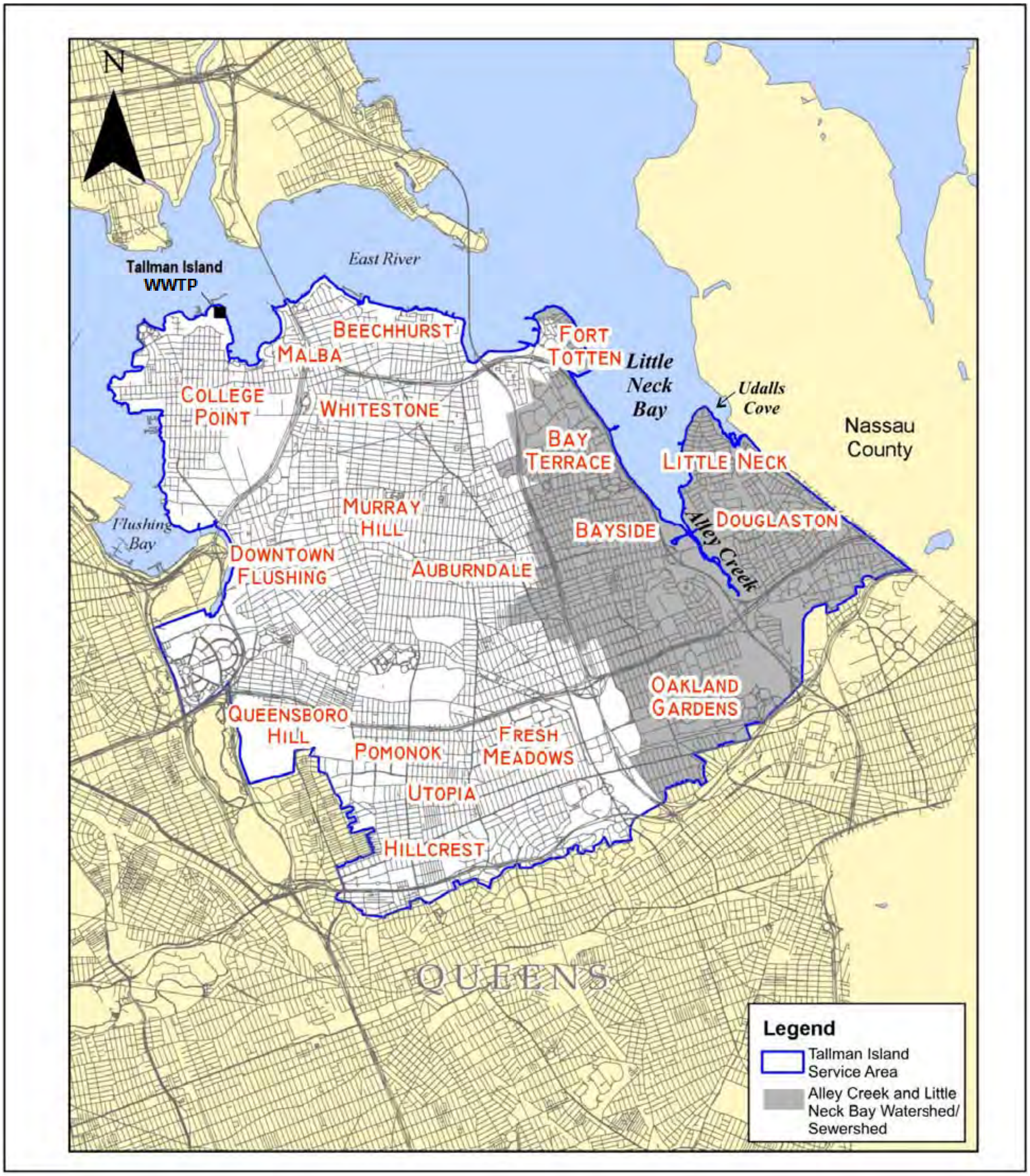


Figure 2-1. Alley Creek and Little Neck Bay Watershed Within Tallman WWTP

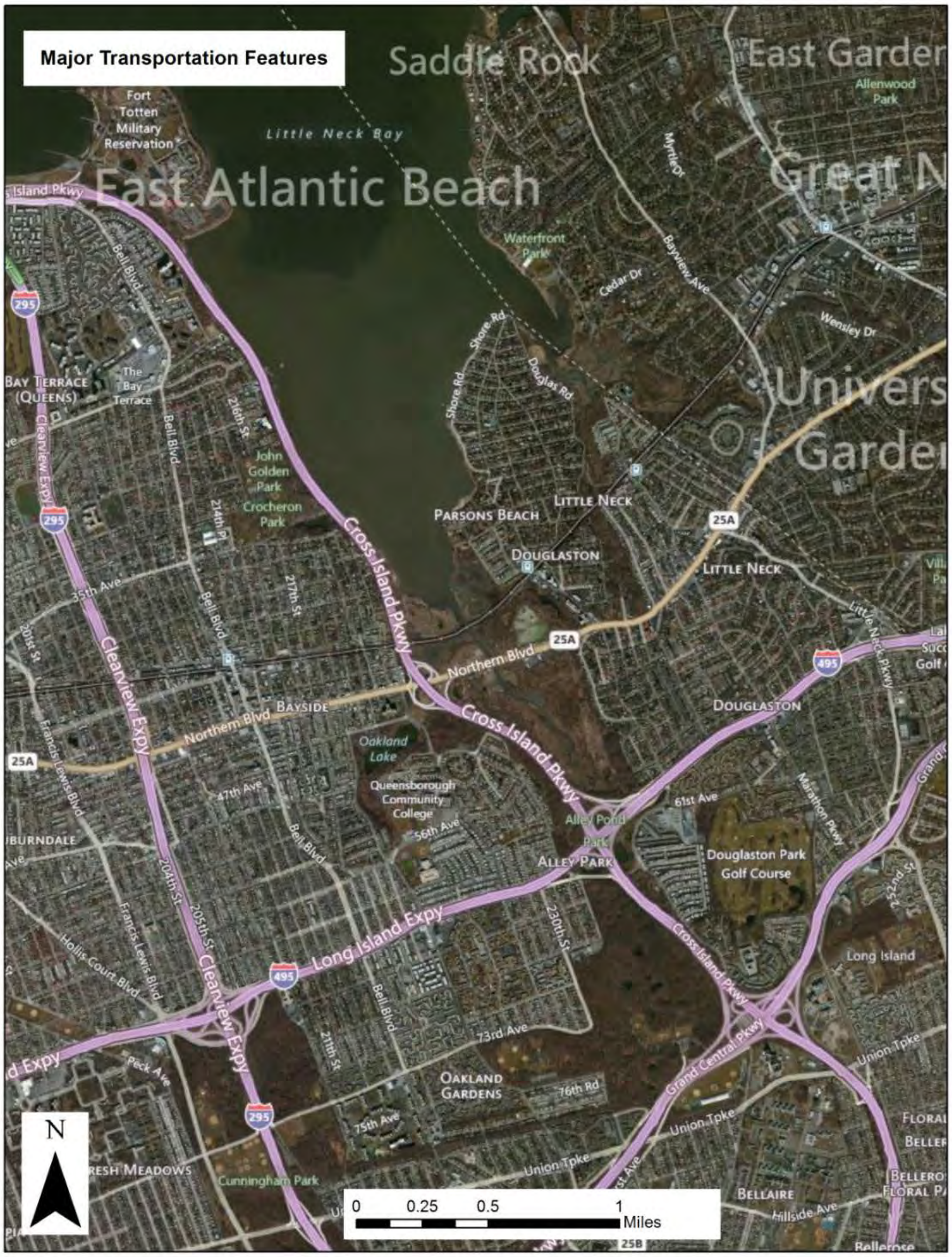


Figure 2-2. Major Transportation Features of Alley Creek and Little Neck Bay

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

Existing land use for the watershed is shown in Figure 2-3**,** and generally aligns with the established zoning. Starting at the northeast edge of the waterbody within NYC, land immediately southeast of Udalls Cove is zoned C3 (commercial local retail), while surrounding land is zoned for low density residential, detached and attached (R1-2, R-2 and R3-1). The whole Douglaston Peninsula is zoned for detached housing on large lots (R1-2). The land immediately surrounding Alley Creek is designated parkland. The residential area to the east of the creek is R1-2, while that to the west is R2. Residential land on the western shore, north of the railroad tracks is zoned R3-2 and R2. Moving north, Crocheron Park and John Golden Park are designated parkland. The area between John Golden Park and Fort Totten is known as Bayside. Previous zoning allowed R5 (mid-density, including multi-story rowhouses). The New York City Department of City Planning (DCP) rezoned 350 blocks in the Bayside area of northeastern Queens, Community District 11 (CD11). Much of the area is now rezoned to contextual districts, permitting development of only one- and two-family homes, to maintain Bayside's longstanding neighborhood character. To curb recent development trends toward unusually large single-family houses in areas currently zoned R2, DCP established a new low-density contextual zoning district, R2A. This new district limits floor area and height and other bulk regulations that are different from the former R2 district (DEP website 2005). Fort Totten is zoned R3-1, C3 and NA-4. The NA-4 designation is a Special Natural Area District (SNAD). This protects the area by limiting modifications in topography, by preserving trees, plant and marine life, and natural water courses, and by requiring clustered development to maximize preservation of natural features. Generalized land use within the New York City portion of the Alley Creek and Little Neck Bay assessment area within the riparian area of ¼-mile of Alley Creek and Little Neck Bay shoreline is shown in Figure 2-4. Land use within the Alley Creek and Little Neck Bay drainage area is summarized in Table 2-1. The main land use is residential, with sizeable fractions of Open Space and Outdoor Recreation and Vacant Land.

Table 2-1. Land Use within the Alley Creek and Little Neck Bay Drainage Area

Land Use Category	Percent of Area	
	Riparian Area (1/4-mile radius) Percent	Drainage Area Percent
Commercial	1	4
Industrial	0	0
Open Space & Outdoor Recreation	29	15
Mixed Use & Other	2	3
Public Facilities	17	7
Residential	38	62
Transportation & Utility	2	1
Vacant Land	11	8

As of the report date, there are no proposed land use changes or major NYC development projects in the Alley Creek or Little Neck Bay assessment area.

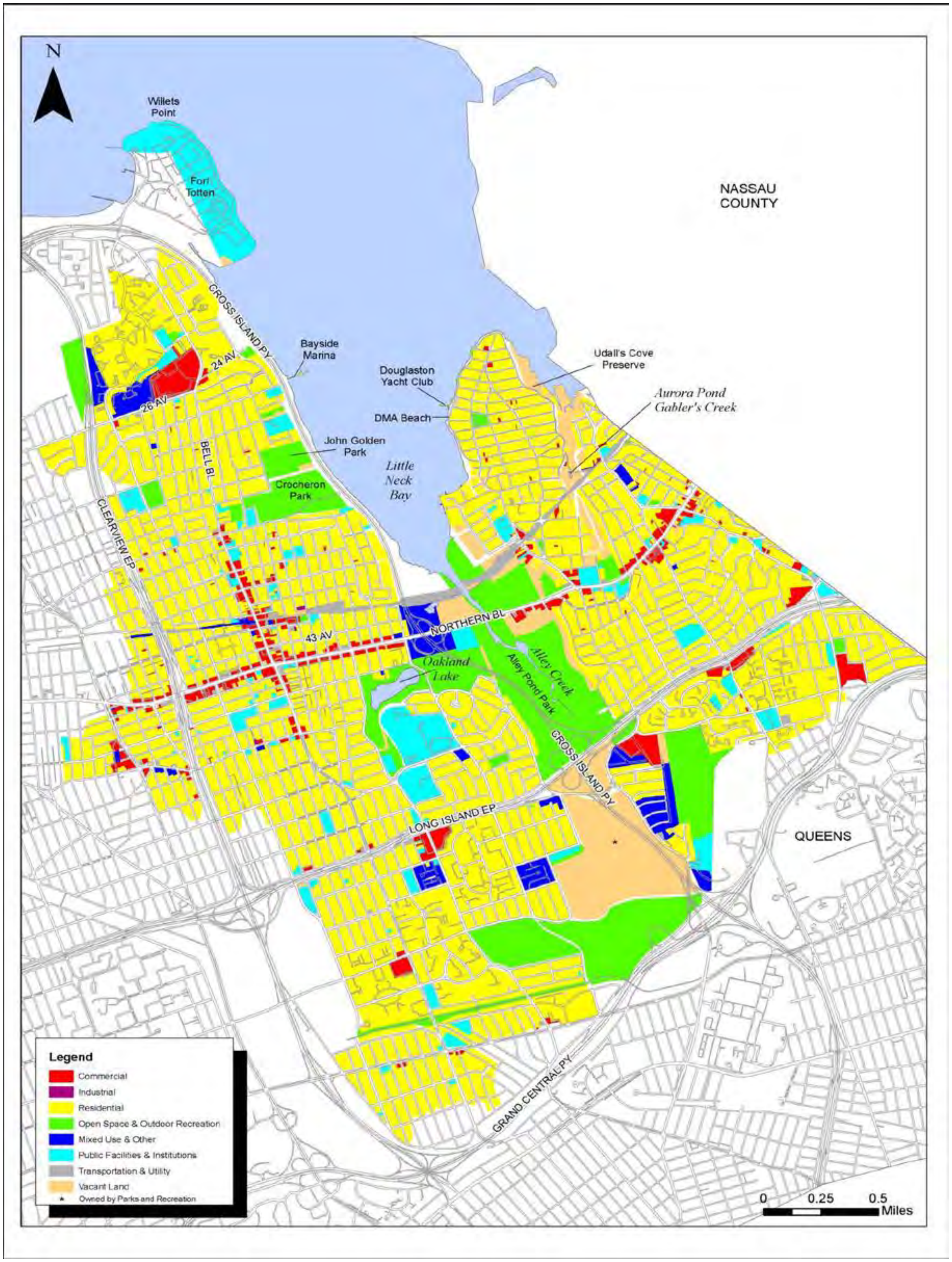


Figure 2-3. Land Use in Alley Creek/Little Neck Basin

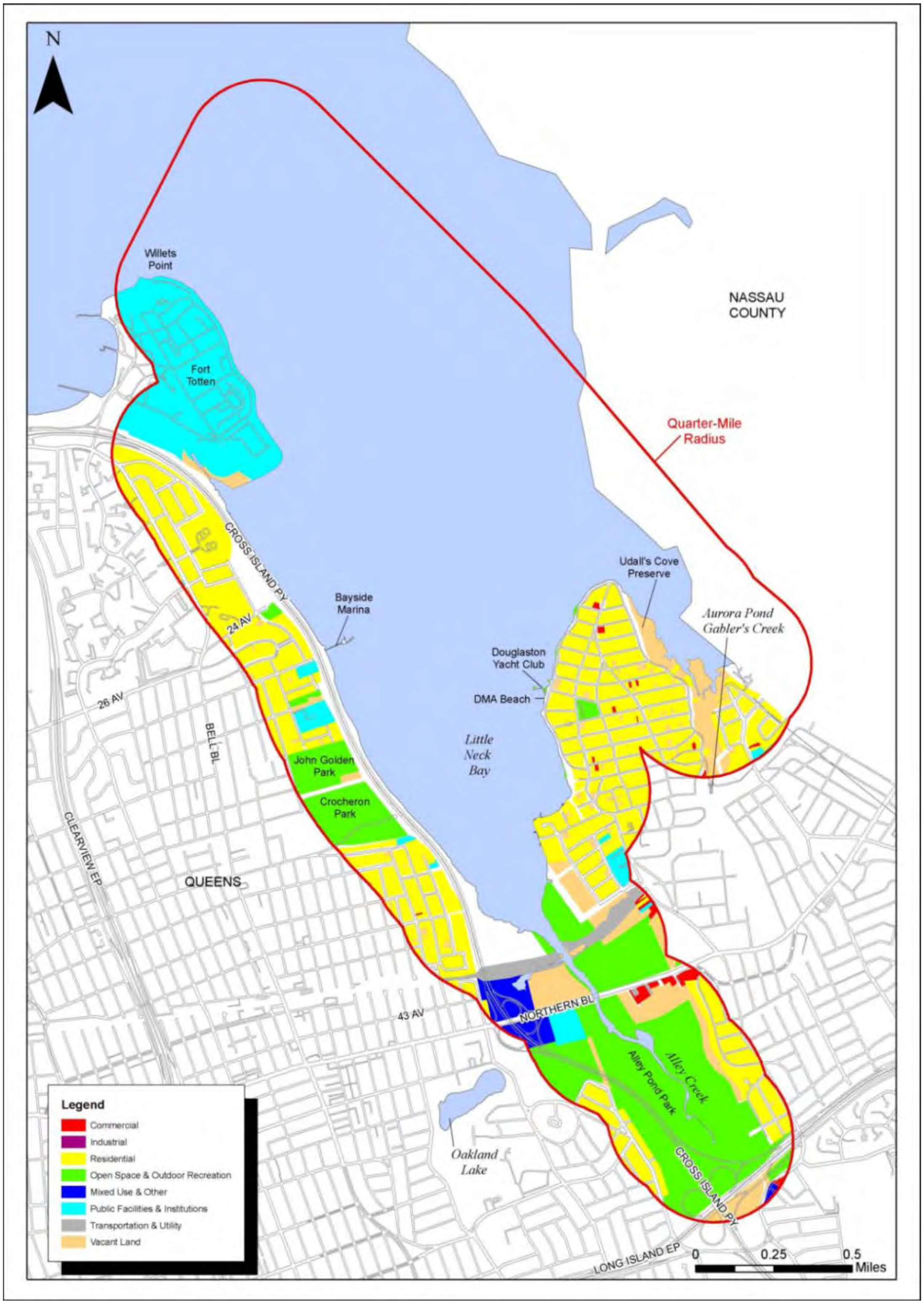


Figure 2-4. ¼ Mile Land Use in Alley Creek and Little Neck Bay

2.1.a.2 Permitted Discharges

The Belgrave WWTP, SPDES NY-0026841, located in Great Neck, Nassau County, discharges to the head of Udalls Cove (Little Neck Bay), near 34th Avenue and 255th Street. The Belgrave WWTP is a 2.0-MGD wastewater treatment plant discharging an average of 1.3 MGD of secondary treated, disinfected effluent (Figure 2-5).

In addition to the Belgrave WWTP, there are several permitted CSO and stormwater discharge points. These are discussed in more detail in Section 2.1.c.

Figure 2-5. Location of the Belgrave WWTP, Adjacent to Udalls Cove (View NE)

2.1.a.3 Impervious Cover Analysis

Impervious surfaces within a watershed are those characterized by an artificial surface, such as concrete, asphalt, or rooftop. Rainfall occurring on an impervious surface will experience a small initial loss through ponding and seasonal evaporation on that surface, with the remaining rainfall volume becoming overland runoff that directly flows into the sewer system and/or separate stormwater system. The impervious surface is important when characterizing a watershed and CSS performance, as well as construction of hydraulic models used to simulate the performance of the CSS.

A representation of the impervious cover was made in the 13 NYC WWTPs combined area drainage models developed in 2007 to support the several WWFPs that were submitted to DEC in 2009. However, as described below, efforts to update the model and the impervious surface representation have been recently completed.

As the City started to focus attention on the use of GI to manage street runoff by either slowing it down prior to 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 essential. In addition, the City realized that it would be important to distinguish between impervious surfaces that directly introduce runoff (Directly Connected Impervious Areas, or DCIA) to the sewer system from those impervious surfaces that may not contribute any runoff to the sewers. For example, a rooftop with roof 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 pervious surface adjacent to a park may not contribute any runoff to the CSS and as such would not be considered to be directly connected.

In 2009 and 2010, DEP invested in the development of high quality satellite measurements of impervious surfaces required to conduct the analyses that improved the differentiation between pervious and impervious surfaces, as well as the different types of impervious surfaces. The data and the approach used are described in detail in the IW Citywide Model Recalibration Report (DEP, 2012a).

The result of this effort yielded an updated model representation of the areas that contribute runoff to the CSS. This improved set of data aided in model recalibration, and provided the DEP with a better idea of where GI can be deployed to reduce the runoff contributions from impervious surfaces that contribute flow to the collection system. The result of the recalibration efforts was a slight increase in the amount of runoff that enters the CSS tributary to the Tallman Island WWTP.

2.1.a.4 Population Growth and Projected Flows

The DEP Bureau of Environmental Planning and Analysis (BEPA) routinely develop water consumption and dry weather wastewater flow projections for DEP for planning purposes. Water and wastewater demand projections were developed by BEPA in 2012; an average per capita water demand of 75 gallons per capita per day was determined to be representative of future uses. The year 2040 was established as the planning horizon, and populations for that time were developed by the DCP and the New York Transportation Metropolitan Council.

The 2040 population projection figures were then used with the dry weather per capita sewage flows to establish the dry weather sewage flows contained in the IW model for the Tallman Island WWTP sewershed. This was accomplished by using GIS tools to proportion the 2040 populations locally from the 2010 census information for each landside subcatchment tributary to each CSO. Per capita dry weather sanitary sewage flows for these landside model subcatchments were established as the ratio of two factors: the year per capita dry weather sanitary sewage flow, and 2040 estimated population for the landside model subcatchment within the Tallman Island WWTP service area.

2.1.a.5 Update Landside Modeling

The Alley Creek and Little Neck Bay watershed is part of the overall Tallman Island WWTP system model (TI model). Several modifications to the collection system that is tributary to the Tallman Island WWTP have occurred since the model was calibrated in 2007. Since the TI model has been used for analyses associated with the annual reporting requirements of the SPDES permit BMPs and PCM for the Flushing Creek CSO Retention Facility, many of these changes have already been incorporated into the model. Major changes to the modeled representation of the collection system that have been made since the 2007 update include:

- Representation of the Flushing Creek CSO Retention Facility for model simulations after May, 2007.

- Representation of the Alley Creek CSO Retention Facility for model simulations after March 10, 2011.

- Inclusion of the Bowery Bay drainage areas that contribute CSOs to the Flushing Creek CSO Retention Facility and to TI-010. Because the overflows from a portion of the Bowery Bay High Level sewershed conveyed to this tank through the Park Avenue outfall, this model update was performed to avoid the need to run the Bowery Bay model as a precursor to every Tallman Island model run.

In addition to changes made to the modeled representation of the collection system configuration, several other changes have been made to the model, including:

- ***Runoff generation methodology***, including the identification of pervious and impervious surfaces. As described in Section 2.1.a.3 above, the impervious surfaces were also categorized into DCIAs 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, the DEP Bureau of Water and Sewer Operations (BWSO) have been developing a GIS system that will provide the most up-to-date information available on the existing sewers, regulators, outfalls, and pump stations. As part of the update and model recalibration, data from the GIS repository for interceptor sewers were used. The models will continue to evolve and be updated as more information becomes available from this source and any other field information.

- ***Interceptor Sediment Cleaning Data.*** DEP recently completed a citywide interceptor sediment inspection and cleaning program. From April 2009 to May 2011, approximately 136 miles of the City's interceptor sewers were inspected. Data on the average and maximum sediment 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, for sections not yet 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 (NYC), 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. Based on the calibration period, the appropriate dry weather flows for 2005 or 2006 or another calendar year was used.

- ***Precipitation.*** A review of the rainfall records for model simulations was undertaken as part of this exercise, as discussed in Section 2.1.b below.

In 2012, DEP recalibrated 13 of the City's landside models after the updates and enhancements were complete. This effort and calibration results are included in the IW Citywide Recalibration Report (DEP, 2012a) required by the updated Order on Consent. Following this report, DEP submitted to DEC a Hydraulic Analysis report in December 2012. 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 component of the model, which had been modified since October 2007 using updated satellite data. 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. These areas ranged from 15 to 400 acres in spatial extent. A range of areas with different land use mixes was selected to support the development of standardized set of coefficients that can be applied to other unmonitored areas of the City. 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 subjected to flow regulation. Where necessary, runoff coefficients were further adjusted 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 potential backwater conditions from throttling at the WWTPs. The flow measured in these downstream locations would further be impacted by regulation at in-system control points (regulator, internal reliefs, etc.). During this step in the recalibration, minimal changes were made to runoff coefficients.

The result of this effort is a model with better representation of the collection system and its tributary area for the Tallman Island WWTP basin, including Alley Creek and Little Neck Bay. This updated model is used for the alternatives analysis as part of this LTCP. A comprehensive discussion of the recalibration effort can be found in the IW Citywide Recalibration Report (DEP, 2012a).

2.1.b Review and Confirm Adequacy of Design Rainfall Year

DEP has been consistently applying the 1988 annual precipitation characteristics to the landside IW models to develop pollutant loads from combined and separately sewered drainage areas. To date, 1988 has been considered to be representative of long-term average conditions, and therefore has been used for analyzing facilities where "typical" rather than extreme conditions serve as the basis of design, in accordance with EPA CSO policy of using an "average annual basis" for analyses. The selection of 1988 as the average condition was re-considered, however, in light of the increasing concerns over climate change, with the potential for more extreme and possibly more frequent storm events. Recent landside modeling analyses in the City have used the 2008 precipitation pattern to drive the runoff-conveyance processes, along with the 2008 tide observations, which DEP believes to be more representative than 1988 conditions as a typical year, that includes some extreme storms also.

The 2009 Alley Creek WWFP was based on 1988 rainfall conditions, but future baseline/alternative runs are performed using 2008 as the typical precipitation year. A comparison of these rainfall years, which led to the selection of 2008, is provided in Table 2-2.

Table 2-2. Comparison of Rainfall Years to Support Evaluation of Alternatives

Parameter	WWFP JFK 1988	Present Day Average 1969-2010	Present Best Fit JFK 2008
Annual Rainfall (in)	40.7	45.5	46.3
July Rainfall (in)	6.7	4.3	3.3
November Rainfall (in)	6.3	3.7	3.3
Number of Very Wet Days (>2.0 in)	3	2.4	3
Average Peak Storm Intensity (in/hr)	0.15	0.15	0.15

2.1.c Description of Sewer System

The Alley Creek and Little Neck Bay watershed and sewershed are divided between two major political jurisdictions – the Borough of Queens (Queens County, within NYC), and Nassau County, Long Island. Most of the Queens County portion of the watershed is served by the Tallman Island WWTP and associated collection system, as shown on Figure 2-6. The Douglas Manor neighborhood, on the east bank of Little Neck Bay in Queens, is served by private on-site septic systems. Wastewater management in the Nassau County portion of the watershed is accomplished by three sanitary sewer districts: the Belgrave Water Pollution Control District, the Great Neck Water Pollution Control District, and the Village of Great Neck. The treated effluent from the Belgrave WWTP discharges to Udalls Cove, on the east side of Little Neck Bay. The WWTPs for the other two districts discharge to Manhasset Bay, on the east side of the Great Neck Peninsula. In addition, many properties use on-site septic systems, which are not in the service areas of these three sewer districts. The locations of the three wastewater treatment facilities and the respective sewershed boundaries are as shown in Figure 2-6.

The following section describes the major features of the Tallman Island WWTP tributary area, including the Alley Creek and Little Neck Bay watershed.

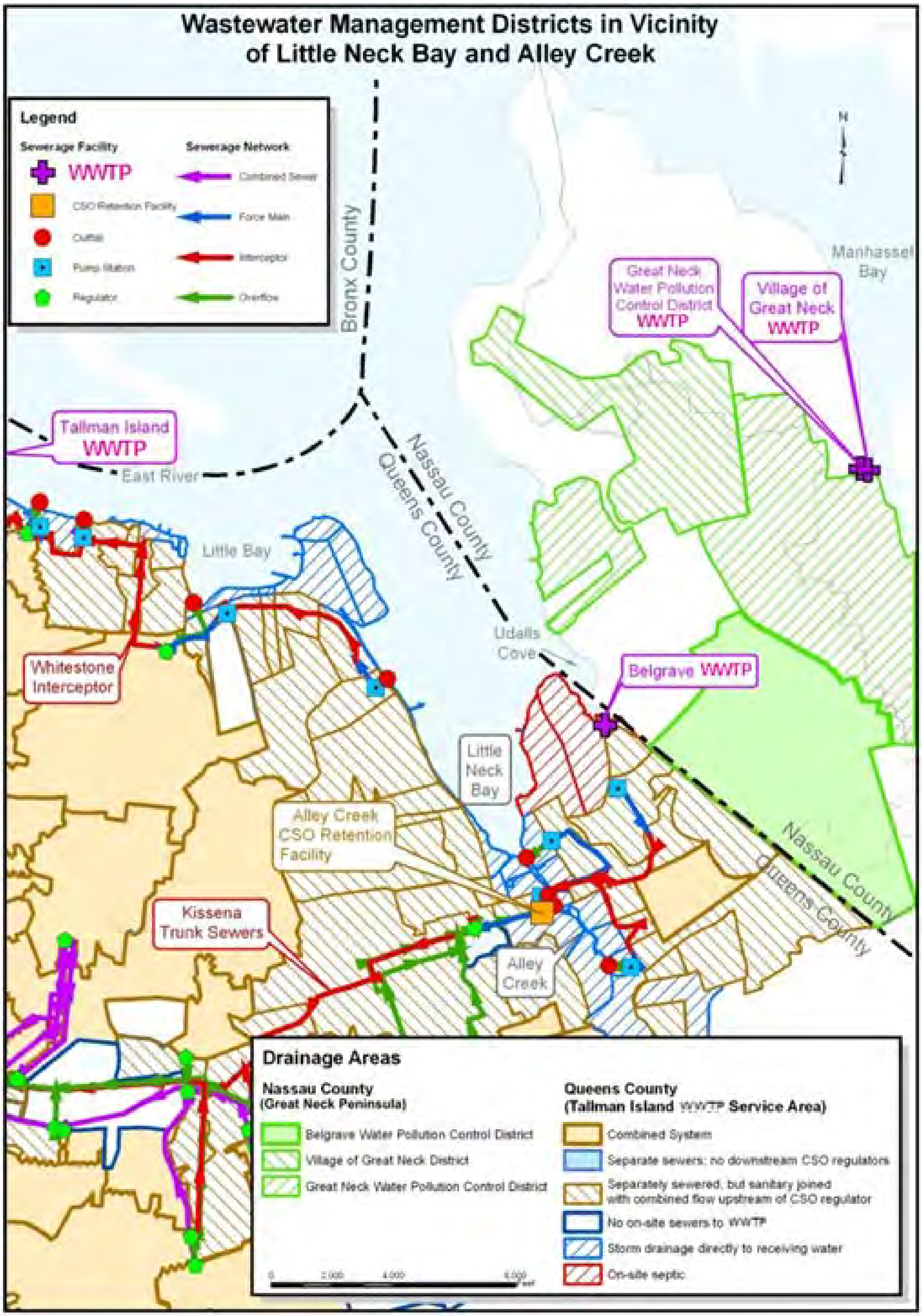


Figure 2-6. Alley Creek Wastewater Service Areas

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

Alley Creek and Little Neck Bay are served by the Tallman Island WWTP. The Tallman Island sewershed includes both sanitary (SSS) and combined (CSS) sewersheds, as summarized in Table 2-3 and Appendix A. CSO outfalls that discharge to Alley Creek and Little Neck Bay are summarized in Table 2-4. The Tallman Island service area includes:

- 16 pumping stations, with five serving combined system areas;
- 49 combined sewer flow regulator structures; and
- 24 CSO discharge outfalls, two of which are permanently bulkheaded.

Table 2-3. Tallman Island WWTP Drainage Area[(1)]: Acreage Per Sewer Category

Sewer Area Description	Area (acres)
Combined	**8,712**
Separate • Fully-separated • Watershed separately sewered, but with sanitary sewage subsequently flowing into a combined interceptor, and stormwater discharging either directly to receiving water or into a combined interceptor	**5,903** (923) (4,980)
Total	**14,615**

[(1)]An additional 3,080 acres of area, for facility planning and certain permitting purposes, are considered to be part of the Tallman Island drainage area, but do not contribute to the WWTP. These include areas with direct drainage of stormwater to water courses (either directly or via storm sewers), other areas not served by piped drainage systems (e.g., parks and cemeteries), and areas that use "on-site" septic systems (Douglas Manor on Douglaston Peninsula).

Table 2-4. Alley Creek and Little Neck Bay Drainage Area: Acreage By Outfall/Regulator

Outfall	Outfall Drainage Area	Regulator	Regulator Drainage Area	Regulated Drainage Area Type	Receiving Water
East River					
TI-006	597.3	24th Ave PS	74.8	Separate	Little Neck Bay
		Clear View PS	522.5	Separate	Little Neck Bay
TI-007	1074.9	Old Douglaston PS	1074.9	Combined and Separate	Alley Creek
TI-008	1044.4	R46	404.4	Combined	Alley Creek
		R47	455.9	Combined and Separate	Alley Creek
		R49	80.5	Separate	Alley Creek
TI-024	376.2	New Douglaston PS	77.1	Separate	Alley Creek
TI-025	1550.7	Alley Creek CSO Retention Facility	1550.7	Combined and Separate	Alley Creek

The Tallman Island WWTP is located at 127-01 134th Street, in the College Point section of Queens, on a 31-acre site adjacent to Powells Cove, leading into the Upper East River, and bounded by Powells Cove Boulevard. The Tallman Island WWTP serves a sewered area in the northeast section of Queens, including the communities of Little Neck, Douglaston, Oakland Gardens, Bayside, Auburndale, Bay Terrace, Murray Hill, Fresh Meadows, Hillcrest, Utopia, Pomonok, Downtown Flushing, Malba, Beechhurst, Whitestone, College Point, and Queensboro Hill, as shown on Figure 2-1. The collection system is shown on Figure 2-7. The total sewer length that feeds into the Tallman Island WWTP, including sanitary, combined, and interceptor sewers, is 490 miles.

The Tallman Island WWTP has been providing full secondary treatment since 1978. Processes include primary screening, raw sewage pumping, grit removal and primary settling, air-activated sludge capable of operating in the step aeration mode, final settling, and chlorine disinfection. The Tallman Island WWTP has a DDWF capacity of 80 MGD, and is designed to receive a maximum flow of 160 MGD (2xDDWF) with 120 MGD (1.5xDDWF) receiving secondary treatment. Flows over 120 MGD receive primary treatment and disinfection.

The Tallman Island WWTP includes four principal interceptors: Main, College Point, Flushing and Whitestone.

- The Main Interceptor is directly tributary to the Tallman Island WWTP, and picks up flow from the other three interceptors.

- The College Point Interceptor carries flow from sewersheds to the west of the WWTP, then discharges in the Powell’s Cove PS, which discharges into the Main Interceptor within the WWTP premises.

- The Flushing Interceptor can be considered an extension of the Main Interceptor south of the Whitestone connection, and serves most of the areas to the south in the system. The Flushing Interceptor also picks up flow from the southeast areas of the system, along the Kissena Corridor Interceptor (via trunk sewers upstream of the TI-R31 regulator), and from the Douglaston area. The Alley Creek area drains to Tallman Island WWTP via the Kissena Corridor Interceptor.

- The Whitestone Interceptor discharges to the Main Interceptor from the west side, shortly upstream of the College Point interceptor connection, via gravity discharge. The Whitestone conveys flow from the area east of the WWTP along the East River.

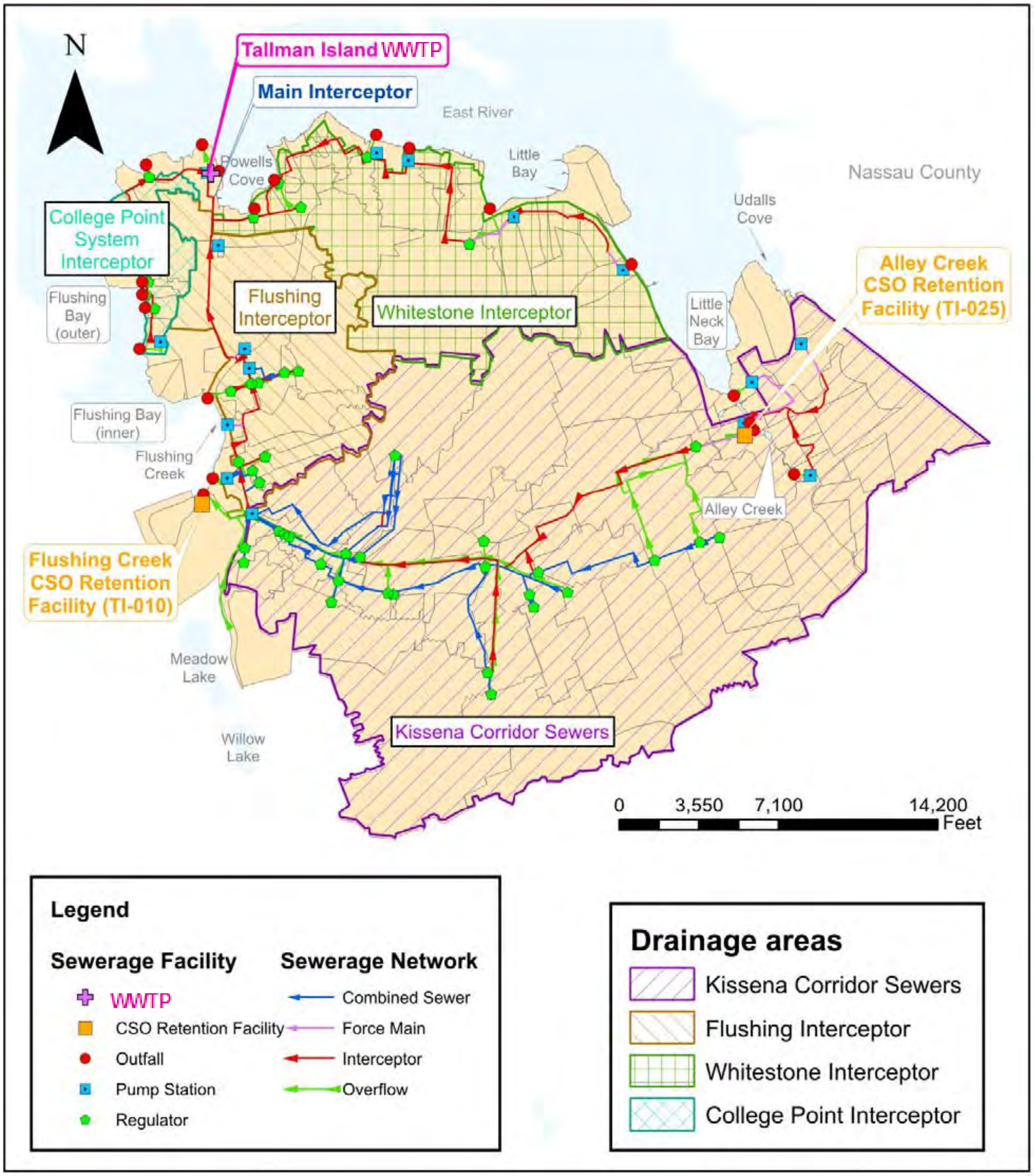


Figure 2-7. Tallman Island WWTP Service Area

This service area also includes two CSO retention facilities that were planned, designed and constructed based on the East River Facility Planning and WWFP. The first one is the Flushing Creek CSO Retention Facility, with a total capacity of 43.4 MG (28.4 MG of offline storage and 15 MG of inline storage in large outfall pipes). This facility has been operational since May 2007. Post-event, retained flow is pumped to the upper end of the Flushing Interceptor, upstream of Regulator TI-009. This structure was reconstructed in 2005 to provide adequate capacity to convey both sanitary flows and dewatered flow from the retention tank subsequent to wet weather periods.

The second facility is the Alley Creek CSO Retention Facility, which became operational as of March 11, 2011. This facility has an offline storage capacity of 5 MG. During wet weather, flows that reach the TI-008 CSO regulator are directed to the offline facility by the diversion weir in Chamber 6 of the Alley Creek CSO Retention Facility. When the storage facility reaches capacity, excess water overflows an effluent weir and is discharged to Alley Creek through Outfall TI-025, after receiving floatables control. The facility also provides some degree of primary settling. Post-event dewatering of this facility is accomplished through the upgraded Old Douglaston PS, which has a peak capacity of 8.5 MGD.

Tallman Island Non-Sewered Areas

Some areas within the Tallman Island service area are considered direct drainage areas and on-site septic areas, as shown in Figure 2-8, where stormwater drains directly to receiving waters without entering the CSS. Generally, these are shoreline areas adjacent to waterbodies, and were delineated based on topography and the resultant direction of stormwater overland sheet flow. In addition, the on-site septic areas, located in the northern portion of Douglaston Peninsula, are unsewered. Stormwater flows across lawns and down gutters to Little Neck Bay. Further, near-surface groundwater flow is a potential source of pollutants to Little Neck Bay.

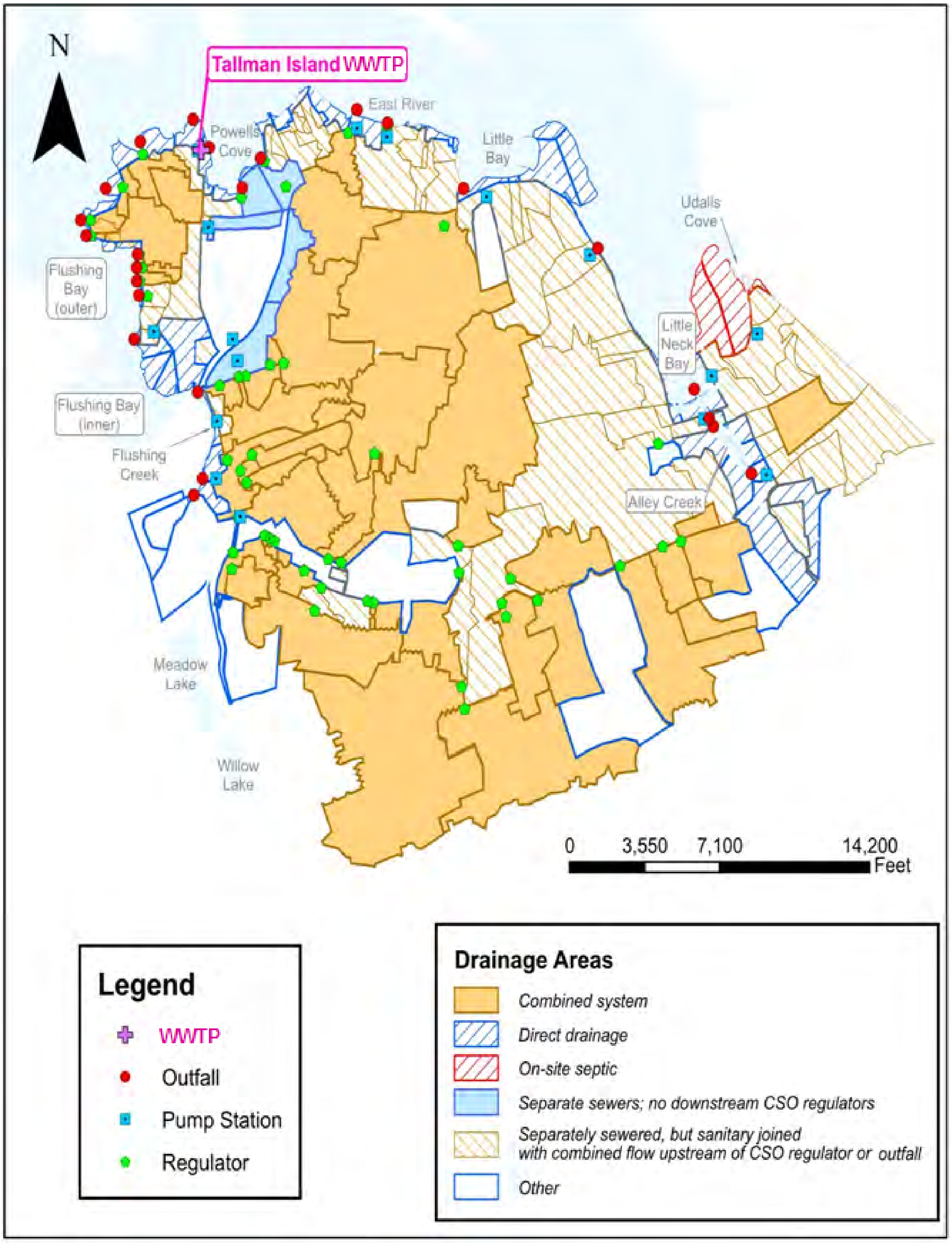


Figure 2-8. Tallman Island WWTP Drainage Area

Tallman Island Stormwater Outfalls

There are nine permitted stormwater outfalls discharging to Alley Creek and Little Neck Bay, as shown on Figure 2-9; these include TI-623, TI-624, TI-633, TI-653, TI-654, TI-655, TI-656, TI-658 and TI-660. These outfalls drain stormwater runoff from the separate sanitary sewer areas around Alley Creek and Little Neck Bay. While runoff from these areas does not enter the combined system, the direct stormwater discharges to Alley Creek and Little Neck Bay can impact water quality.

Tallman Island/Alley Creek CSOs

The Tallman Island SPDES permitted CSO outfalls to Alley Creek are TI-007, TI-008, TI-009, TI-024 and TI-025. CSO outfall TI-006 discharges to Little Neck Bay. The locations of Alley Creek and Little Neck Bay SPDES CSO outfalls are shown on Figure 2-9. Note that TI-025 is the CSO outfall for the Alley Creek CSO Retention Facility, and TI-008 and TI-025 are used to convey and discharge a large portion of stormwater. In addition, outfalls TI-007, TI-006 and TI-024 serve as emergency bypasses for pump stations, and are therefore designated as CSO outfalls. Under normal conditions, TI-006 and TI-024 discharge stormwater from their tributary areas, and TI-007 can overflow during large precipitation events.

Wet weather flows in the CSS, with incidental sanitary and stormwater contributions as summarized above result in CSO discharges to the nearby waterbodies when the flows exceed the hydraulic capacity of the system, or the specific capacity of the local regulator structure.

Douglas Manor

The area on the eastern shore of Little Neck Bay is known as Douglas Manor. The neighborhood is predominantly composed of single family residences served by private on-site septic systems, built in individual lots zoned as R1-1 and R1-2, except for the Douglaston Club House, which is a three-story structure with a 17,100 sq. ft. building area, located on a 102,060 sq. ft. lot zoned for open space/outdoor recreation. Approximately 58 acres of drainage area generate runoff upstream of Shore Road, a waterfront roadway that follows the alignment of the eastern shore of Little Neck Bay. The Douglas Manor Association (DMA) manages a permitted private community beach known as DMA Beach, along Shore Road. The location of DMA Beach and Douglaston Club House, and photos depicting the overall residential land use of the neighborhood can be seen in Figure 2-10.

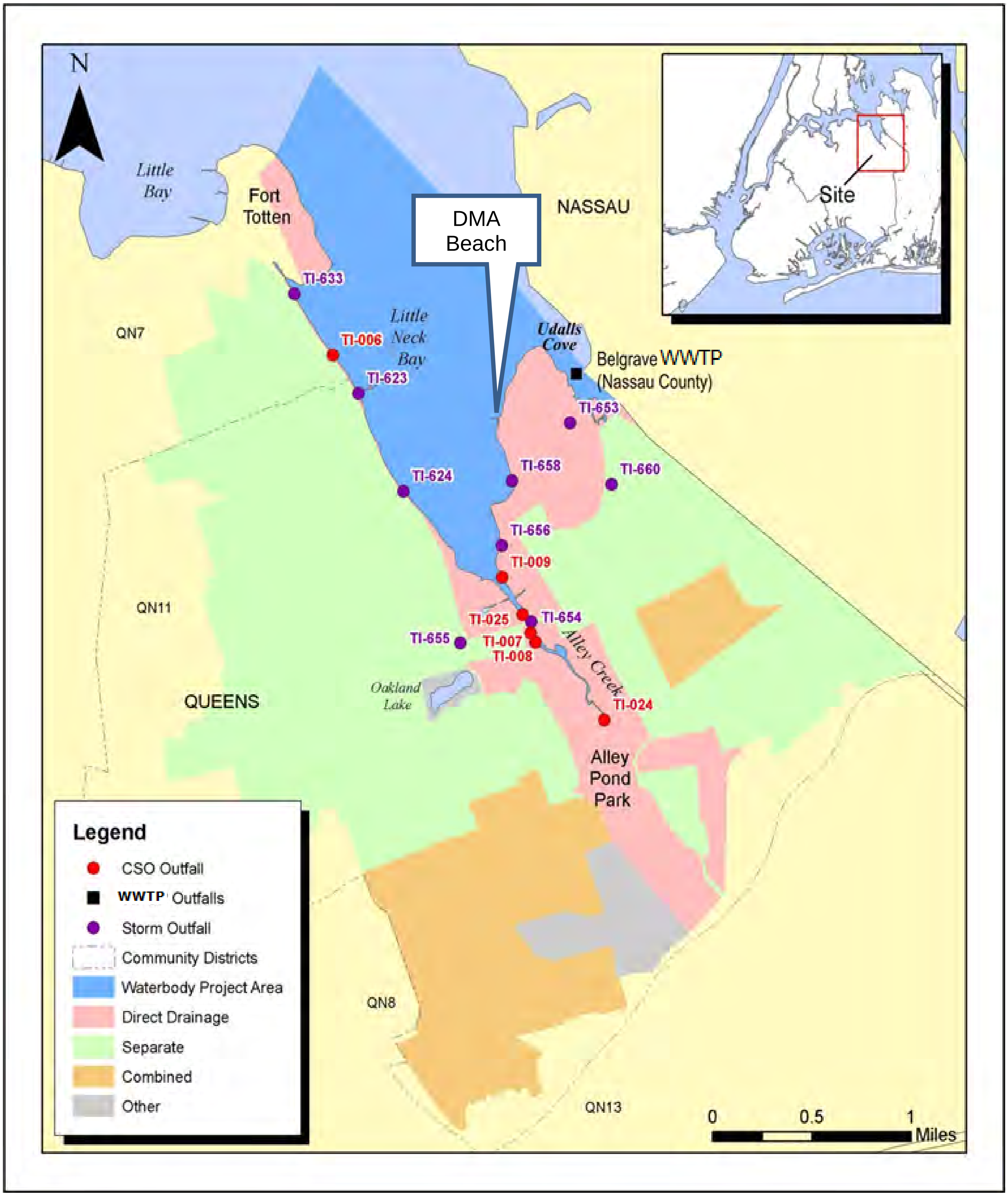


Figure 2-9. Alley Creek and Little Neck Bay SPDES Permitted Outfalls

Figure 2-10. Douglas Manor Community

2.1.c.2 Stormwater and Wastewater Characteristics

Pollutant loadings for the sources identified and discussed in Section 2.1.c.1 were assessed for their impacts on water quality in Alley Creek and Little Neck Bay. The pollutant concentrations found in wastewater, combined sewage, and stormwater can vary based on a number of factors, including flow rate, runoff contribution, and the matrix of the waste discharged to the system from domestic and non-domestic customers. Since the matrix of these waste streams can vary, it can be challenging to identify a single concentration of pollutants to use for analyzing the impact of discharges from these systems to the two waterbodies.

Tallman Island Stormwater Outfalls: Stormwater overflow concentrations are assigned an Event Mean Concentrations (EMC) for inclusion in the water quality model calibration and LTCP baseline analyses. Historical information and data collected from sampling events were used to guide the selection of concentrations of BOD, TSS, total coliform, fecal coliform, and enterococci to use in calculating pollutant loadings from the various sources. Table 2-5 shows EMC stormwater concentrations for NYC stormwater discharges to Alley Creek and Little Neck Bay from the Tallman Island WWTP service area. Previously collected citywide sampling data from Inner Harbor Facility Planning Study (DEP, 1994) was combined with data for the EPA Harbor Estuary Program (HydroQual, 2005a) to develop these stormwater concentrations. The IW sewer system model (Section 2.1.a.5) is used to generate the flows from NYC storm sewer outfalls and concentrations noted in Table 2-5 are associated with the flows to develop pollutant loadings.

Tallman Island CSOs: CSO pollutant concentrations can be extremely variable and are a function of many factors. Generally, CSO concentrations are a function of local sanitary sewage and runoff entering the combined sewers. For the modeling analyses, CSO concentrations were calculated based on a mass balance of Tallman Island WWTP sanitary sewage concentrations and EMC stormwater runoff concentrations during each hour of each storm event. Influent dry-weather samples at the NYC WWTPs were used to model sanitary concentrations (DEP process control records; HydroQual, 2005b). These sanitary sewage influent concentrations are summarized in Table 2-5. Storm runoff concentrations entering the combined sewers was taken as those values shown in Table 2-5. The IW model is run in the water quality mode and traces the amount of sanitary sewage and the amount of stormwater at each location within the model. When there is a CSO discharge, its pollutant concentrations will have the calculated mix of sanitary sewage and storm runoff pollutants for each hour of overflow.

Alley Creek CSO Retention Facility Discharges: A different approach was taken for the calculation of the Alley Creek CSO Retention Facility effluent bacteria concentrations. The Alley Creek CSO Retention Facility bacteria concentrations were characterized by direct measurements from three storm events in 2013. These concentrations are as shown in Figure 2-11, a cumulative frequency distribution graphic. Both individual sample points are shown as well as the trend line that best fits the data distribution. Measured fecal coliform concentrations are log-normally distributed as is typical for this type of data and values range from 27,300 to 3,400,000 MPN/100mL. Similarly, enterococci concentrations are also log normally distributed and range from 24,000 to 580,000 MPN/100mL. These observed concentrations are beyond the range that DEP would expect from combined sewage which should be more highly reflective of stormwater runoff concentrations. In response to these elevated concentrations, and as discussed later in Section 8.0, DEP is evaluating disinfection of the Alley Creek CSO Retention Facility overflows as one of several potential LTCP control measures.

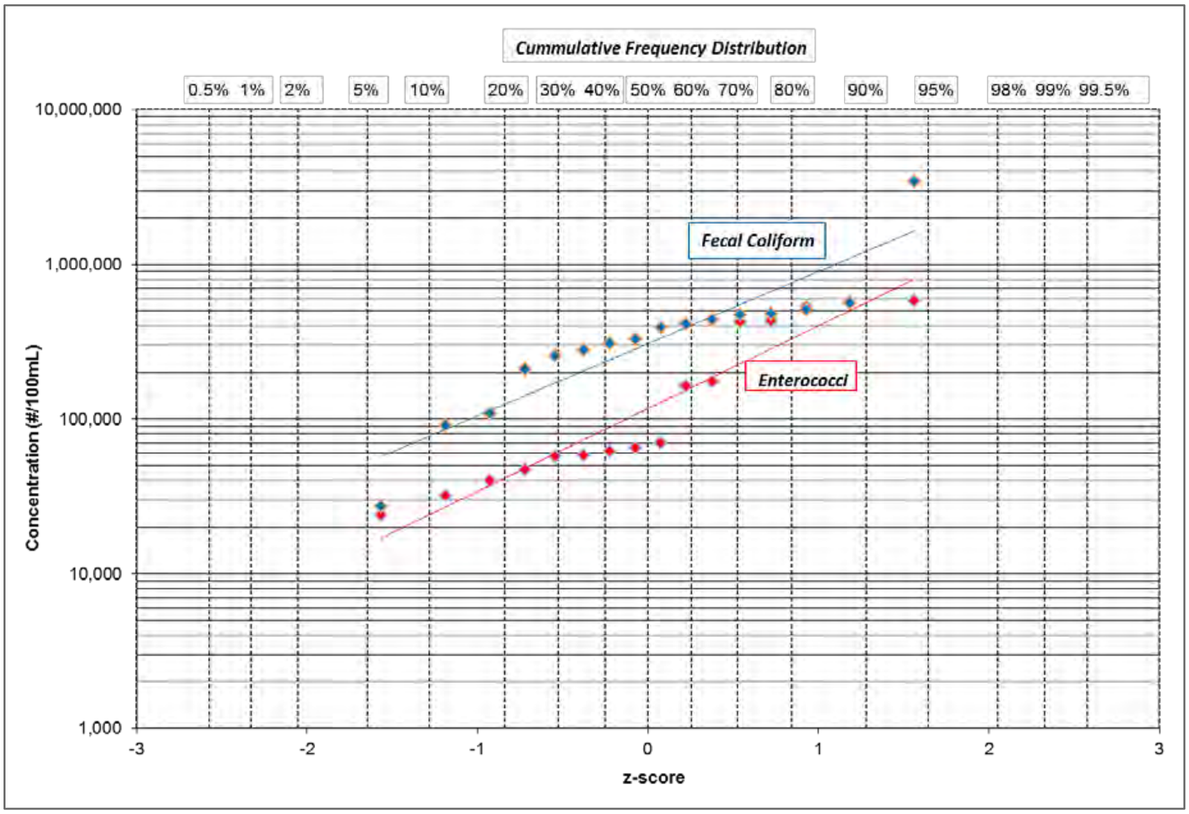


Figure 2-11. Alley Creek CSO Retention Facility Bacteria 2013 Sampling Data

Table 2-5. Sanitary and Stormwater Discharge Concentrations, Tallman Island WWTP

Constituent	Sanitary Concentration	Stormwater Concentration
$CBOD_5$ (mg/L) [(1)]	115	15
TSS (mg/L) [(1)]	140	15
Total Coliform Bacteria (MPN/100mL) [(2,3)]	$25x10^6$	150,000
Fecal Coliform Bacteria (MPN/100mL) [(2,3)]	$4x10^6$	35,000
Enterococci (MPN/100mL) [(2,3)]	$1x10^6$	15,000

[(1)] 2011, 2012, 2013 DEP Process Control TI WWTP operational records
[(2)] Hydroqual Memo to DEP, 2005a.
[(3)] Bacterial concentrations expressed as "most probable number" (MPN) of cells per 100 mL.

Nassau County Source Concentrations: Stormwater inflows to Little Neck Bay from Nassau County were assigned the concentrations presented in Table 2-6. Effluent quality data for the Belgrave WWTP, which discharges in to Little Neck Bay, were taken from DEC discharge monitoring reports (DMR) submitted by the Nassau County Department of Public Works, as shown on Table 2-7. The WWTP discharges an average of 1.3 MGD. Total coliform, fecal coliform, and enterococci are assumed to be negligible as the facility provides disinfection.

Table 2-6. Stormwater Discharge Concentrations, Nassau County

Constituent	Stormwater Concentration
CBOD5 (mg/L) (1)	15
TSS (mg/L) (1)	15
Total Coliform Bacteria (MPN/100mL) (2,3)	50,000
Fecal Coliform Bacteria (MPN/100mL) (2,3)	25,000
Enterococci (MPN/100mL) (2,3)	15,000

(1) HydroQual, 2005b.
(2) Hydroqual Memo to DEP, 2005a.
(3) Bacterial concentrations expressed as "most probable number" (MPN) of cells per 100 ml.

Table 2-7. Belgrave WWTP (Nassau County) Discharge – Effluent[(1)]

Constituent	Concentration
$CBOD_5$ (mg/L)	10
TSS (mg/L)	10
Total Coliform Bacteria (MPN/100mL) [(2)]	<200
Fecal Coliform Bacteria (MPN/100mL) [(2)]	<200
Enterococci (MPN/100mL) [(2)]	<200

(1) DEC, DMR data, 475 MG/yr, at an average flow rate of 1.3 MGD.
(2) Disinfection practiced year-round.

Other Sources: A sampling program targeting other sources of pollutants contributing to Alley Creek and Little Neck Bay was implemented as part of this LTCP. Data were collected to supplement the flows/volumes and concentrations of various sources of pollutants to Alley Creek and Little Neck Bay. During dry weather, the flows and concentrations were collected from Oakland Lake and from a pond located south of the Long Island Expressway (LIE), named as the LIE Pond; these are continuous sources of flow and pollutants to Alley Creek. Both fresh water impoundments support recreational activities, such as bird-watching of diverse species of waterfowl that inhabit them, and as such, bacteria sampling was a vital element of this sampling program. Sampling of the sources above was conducted to provide information to the water quality modeling tasks. The locations of these sources are depicted in Figure 2-12.

Six samples were collected from the Oakland Lake and LIE Pond outflows to characterize ambient bacteria concentrations. Samples were also collected for Microbial Source Tracking (MST) analysis at the Oakland Lake (outlet) and at LIE Pond. The MST method used sought the identification of species and genus of the enterococci and fecal coliform bacteria sampled that would allow a comparison with libraries of bacteria data to determine the most likely sources of the bacteria. The MST results and the lack of a suitable bacteria database, however, did not support a conclusive determination of the sources for any of the locations sampled. Flows were measured for both of these locations. The fecal coliform and enterococci data for both ponds are presented in Table 2-8. Oakland Lake concentrations were based on dry-weather samples collected at the lake outlet during 2012 and 2014. The LIE Pond concentrations were based on the dry-weather GM of samples collected during February 2013 and late 2013/early 2014. Oakland Lake flows were determined based on monitoring of the lake outflow in the storm sewer that bypasses Chamber 6 upstream of the Alley Creek CSO Retention Facility in 2012 and 2014. The LIE Pond flows were based on a few discrete measurements in 2012 and continuous flow monitoring in 2014. The Oakland Lake and LIE Pond sources of flow and pollutants were used in the water quality model calibrations for 2011 and 2012 and included as part of the LTCP baseline analysis. Further discussion of the MST testing is found in Section 2.2.a.6 and summarized in Table 2-21.

Table 2-8. Upper Alley Creek Source Loadings Characteristics

Source	Flow (MGD)	Enterococci (org./100 mL)	Fecal Coliform (cfu/100 mL)	BOD-5 (mg/L)
Oakland Lake flow through outfall TI-008	2.5 (variable)	130	150	15
LIE Pond	1.5 (variable)	75	75	0
See Figures 2-9 and 2-12 for source locations.				

These results suggest that the concentrations of bacteria are from non-human sources as they do not exhibit the high concentrations of bacteria found when illicit discharges are present. Although they are not noted as significant sources of bacteria, these other sources provide a continuous source of bacteria to Alley Creek and are therefore carried forward through the baseline analyses presented in Section 6.0.

Illicit Sources: As later discussed in Section 2.2.a.6, elevated bacteria concentrations in Alley Creek indicated the potential presence of illicit discharges. As required by the DEC SPDES permits, DEPs illicit sewer connection tracking and removal enforcement program had traced and eliminated 11 illegal connections to the storm sewers that discharged through outfall TI-024 in 2011. However, during the LTCP development, review of additional data indicated that potential illicit discharges still existed somewhere along Alley Creek. As a result, sampling was conducted in 2014 as part of the LTCP development to track these potential illicit discharges to their source. As noted above sampling was conducted on the Oakland Lake and LIE Pond outflows, which found that although there were low levels of bacteria present, there were no signs of illicit discharges. Douglaston PS records were also reviewed and staff interviewed, again indicating that this was not a source of bacteria in dry weather. Further, sampling and visual inspections were made of storm sewers and of the CSO regulators and outfalls (TI-007, TI-008, TI-024 and TI-025) in 2013 and 2014, all of which indicated that the only remaining source of potential illicit discharges was outfall TI-024.

DEP is continuing to inspect the TI-024 system and locate the source of the illicit connections. As sources are found, appropriate corrective actions will be taken in accordance with DEP's standard procedures for these investigations. Illicit connections to this outfall, although apparently low in flow, discharge elevated concentrations of bacteria, thereby impacting bacteria levels in Alley Creek near the mouth of the creek where DEP conducts routine sampling (Station AC1). Based on sampling data and calibration of the water quality model, bacteria concentrations and flows associated with outfall TI-024 were developed as provided in Table 2-9.

Table 2-9. Upper Alley Creek Source Loadings Characteristics

Source	Flow (MGD)	Enterococci (org./100mL)	Fecal Coliform (cfu/100mL)	BOD-5 (mg/L)
TI-024 Illicit Connections	0.003 to 0.04	1,000,000	4,000,000	15
TI-024 Infiltration	0.2	0	0	6.3
See Figures 2-9 and 2-11 for source locations				

Figure 2-12. Upper Alley Creek Point – Source Locations

At TI-024, estimated groundwater infiltration was developed from short-term continuous metering of a 96 inch by 72-inch diameter storm sewer discharging through TI-024 during 2012 and 2013. Suspected illicit connections were detected through visual observations and four bacteria samples collected in February 2014 with fecal coliform concentrations that ranged from 29,000 to 50,000 cfu/100mL. The final concentrations for use in model calibrations were estimated as part of the calibration process. These loads were subsequently removed for the water quality model baseline analysis, assuming that illicit discharges would be abated outside of the LTCP process.

DMA Local Sources: The DMA Beach area has historically exhibited elevated bacteria concentrations. These local sources and other remote bacteria sources result in frequent closures of this bathing area (Figure 2-24). Receiving water sampling conducted in 2012 showed bathing area waterfront ertoerococci GM concentrations of about 151 cfu/100mL. Sampling in the receiving water at locations just offshore from DMA Beach in deeper water revealed a GM concentration of 37 cfu/100mL. The former elevated concentration right on the beach being so much higher than the sample collected slightly off shore suggests local bacteria sources rather than the source being remote from the beach.

At DMA, runoff from the impervious surfaces of the lots and public roadways, along with the rainfall volume that exceeds the infiltration capacity of the pervious surfaces, is discharged to Little Neck Bay in the vicinity of DMA Beach, at the seven main locations as shown in Figure 2-13. Most of the runoff is conveyed as surface sheet-flow or poorly-defined shallow surface flow, until crossing a concrete retaining wall between Shore Road and the beach. The main runoff drainage paths of the approximately 14 acres contributing directly to DMA Beach can be seen in Figure 2-13.

During dry weather, near surface groundwater flows downslope toward Little Neck Bay from DMA, likely carrying bacteria from septic systems with it. This suspected source of pollutants may also generate higher loadings during wet periods at a local geographical scale, when the ground water flow is higher. Groundwater flows were estimated by assuming 200 homes, with four persons per household contributing 75 gallons per capita per day. Concentrations were adjusted as part of the calibration process. These loads were subsequently removed from the LTCP baseline analysis, assuming that this source would be abated outside of the LTCP process.

The characteristics, summarized in Table 2-10, associated with the dry and wet weather sources of pollutants suspected to be associated with the on-site septic systems in the DMA area were developed through the process of calibrating the water quality model.

Table 2-10. DMA Source Loadings Characteristics

Source	Flow (MGD)	Enterococci (org./100 mL)	Fecal Coliform (cfu/100 mL)	BOD-5 (mg/L)
DMA groundwater inflow (continuous)	0.06	50,000	100,000	0
DMA stormwater	Calculated from rainfall and runoff coefficient	300,000	700,000	15

NYCDOT Capital Project HWQ-985 is currently progressing to redirect some of this sheet-flow with the primary intention of protecting the concrete retaining wall from static force loads that compromise its stability. This project will divert runoff from the current discharge points on both sides of the pier at DMA Beach to a location farther south of the recreational area. The planned future configuration is as shown in Figure 2-14. This project is expected to be completed in 2016.

Figure 2-13. Little Neck Bay and DMA Beach Overland Drainage Characteristics

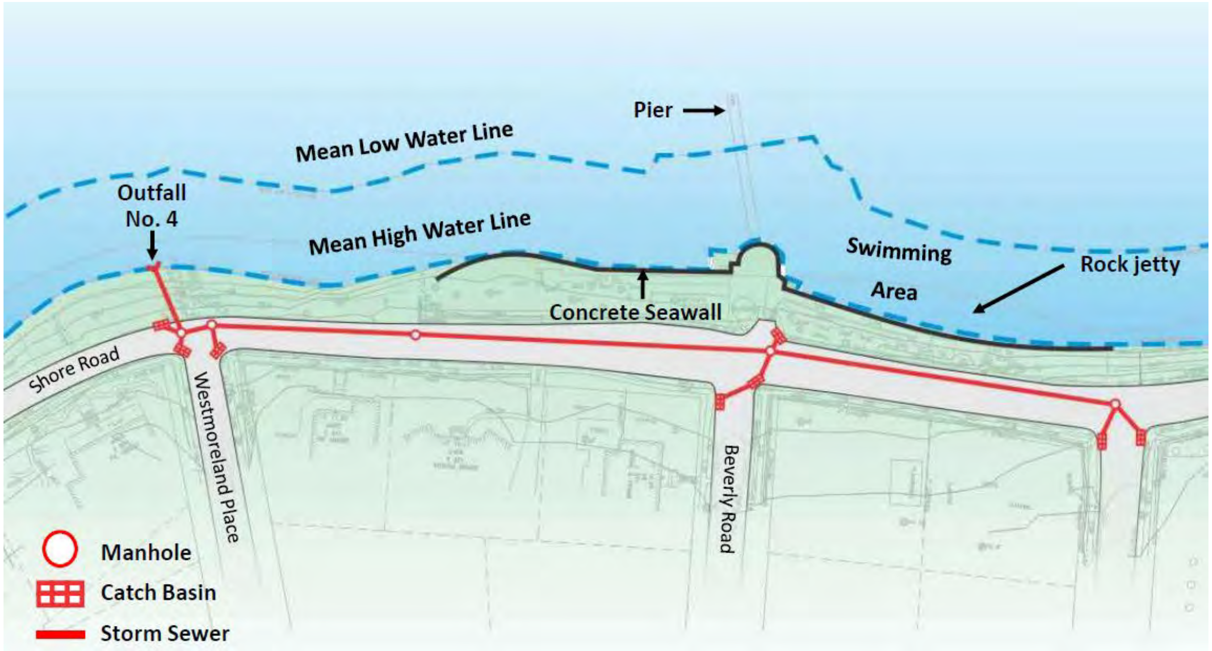


Figure 2-14. DMA Planned Drainage Improvements

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 sub-section), to provide further insight into the hydraulic capacities of key system components and system responses to various wet weather conditions. The IW model was updated in the Alley Creek drainage area after this effort was completed, and in support of the development of this LTCP. Thus, the model results reported in this sub-section, while relevant for their intended use to document overall system-wide performance beyond the Alley Creek watershed, may differ slightly from volumes reported in the remainder of this LTCP. The hydraulic analyses can be divided into the following major components:

- Annual simulations to estimate the number of annual hours that the WWTP is predicted to receive and treat up to 2xDDWF for rainfall year 2008, and 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 Citywide 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 DWFs

Model simulations were conducted to estimate the annual number of hours that the Tallman Island WWTP would be expected to treat 2xDDWF for the 2008 precipitation year, which contained a total precipitation of 46.26 inches, as measured at the JFK Airport. These simulations were conducted using projected 2040 DWFs for the re-calibrated model conditions as described in the June 2012 IW Citywide Recalibration Report. For the simulation, the primary input conditions that applied were as follows:

- Projected 2040 DWF conditions.
- 2008 tides and precipitation data.
- WWTP at 2xDDWF capacity of 160 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.

For this simulation the Tallman Island service area included the two CSO retention facilities, the new Whitestone Interceptor extension and associated sewer/regulator improvements. The simulation of the 2008 annual rainfall year resulted in a prediction that the Tallman Island WWTP would operate at its 2xDDWF capacity for 99 hours up from the very limited number of hours (generally less than 10 hours a year) that the plant reached that capacity historically.

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 model. 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 in the model for WWFP conditions implemented. The maximum flow rates and maximum depths predicted by the model for each sewer segment in the model 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 also 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.

- Between 78 and 93 percent (by length) of the interceptors were predicted to flow at full depth or higher. Between 56 and 59 percent (by length) of the combined sewers were also predicted to flow at full depth, and 72 percent of the combined sewers flowed at least 75 percent full.

- The results for the system condition with WWFP improvements showed that the overall peak plant inflow and HGL near the plant improved, in comparison to the non-WWFP conditions in the Tallman Island service area.

- About 72 percent of the combined sewers (by length) reached a depth of at least 75 percent under the WWFP simulations. This indicates that little additional potential exists for in-line storage capability in the Tallman Island system.

Based on the review of various metrics, the Tallman Island system generally exhibits full or near-full pipe flows during wet weather, allowing little potential for inline storage capability.

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

The DEP has made substantial improvements to the Alley Creek drainage system in which over $90M was spent under Contract ER-AC1 to help eliminate historical flooding along Springfield Boulevard in Queens. These drainage system improvements, which took place from December 2002 through December 2006, consisted of installation of larger combined sewers in certain segments of the sewershed to increase conveyance capacity; construction of storm sewers in select drainage areas to reduce volume of storm water entering the combined system; and construction of associated combined and stormwater outfalls to discharge the excess wet weather flows. These drainage area improvements have substantially mitigated historical flooding issues.

DEP maintains the operation of the collection systems throughout the five boroughs using a combination of reactive and proactive maintenance techniques. The City's "Call 311" system routes complaints of sewer issues to DEP for response and resolution. Though not every call reporting flooding or sewer backups (SBUs) 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

In the last decade, DEP has implemented technologies and procedures to enhance its use of proactive sewer maintenance practices. DEP has many programs and staff devoted to sewer maintenance, inspection and analysis. GIS and Computerized Maintenance and Management System CMMS systems provide DEP with expanded data tracking and mapping capabilities, and can facilitate identification of trends to allow provision of better service to its customers. As referenced above, reactive and proactive system inspections result in maintenance including cleaning and repair as necessary. Figure 2-15 illustrates the interceptors that were cleaned within the Alley Creek sewershed.

DEP conducted a sediment accumulation analysis to quantify levels of sediments in the combined sewer system and verify that the baseline assumptions are valid for this CSO LTCP. Field crews investigated each location, and estimated sediment depth using a rod and tape. Field crews also verified sewer pipe sizes shown on the maps, and noted physical conditions of the sewers. The data were then used to

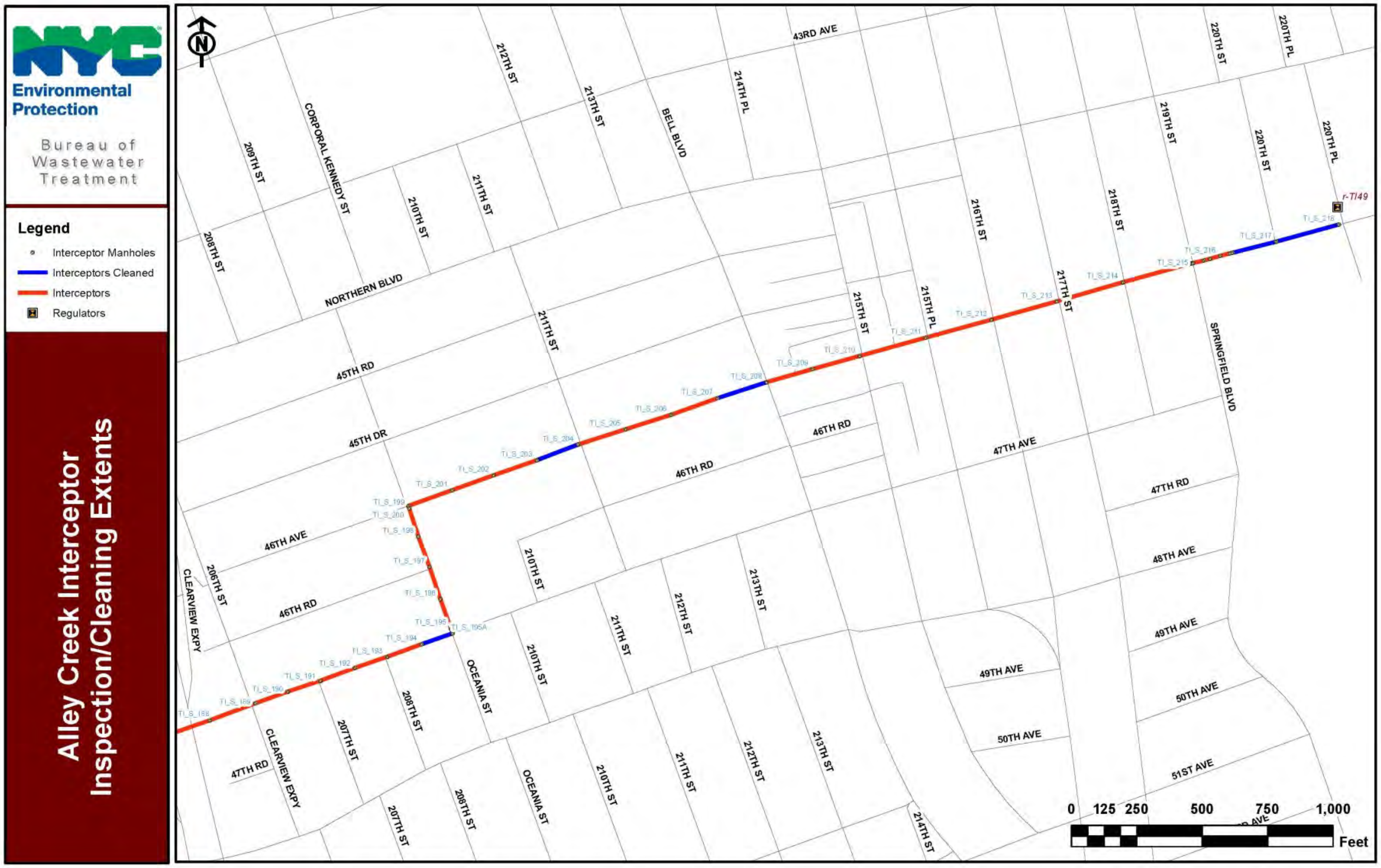


Figure 2-15. Alley Creek Interceptor Inspection Cleaning Extents

estimate the sediment levels as a percentage of overall sewer cross sectional area. Table 2-11 shows the sediment depths for the interceptors in the Alley Creek sewershed.

DEP will continue implementing it's programmatic interceptor cleaning program to ensure conveyance of 2xDDWF to the treatment plant.

Table 2-11. Alley Creek Interceptor Inspection-Cleaning Map, 2012

Pipe ID	Surveyed Length (ft)	Pipe Diameter (in)	Avg Sed. Depth (in)	Date Cleaning Completed
TI_S_188	176.7	60	3.9	
TI_S_189	186.5	60	4.2	
TI_S_190	138.8	60	2.5	
TI_S_191	136.7	60	4.7	
TI_S_192	141.1	60	1.7	
TI_S_193	138.2	60	3.1	
TI_S_194	140.9	60	4.3	
TI_S_195	19.3	60	10.7	7/11/2012
TI_S_195A	124.2	60	9.1	7/11/2012
TI_S_196	144.4	60	7.7	
TI_S_197	132.1	60	5.7	
TI_S_198	120.7	60	5.2	
TI_S_199	112.8	60	5.9	
TI_S_200	8.5	60	4.9	
TI_S_201	178.1	60	5	
TI_S_202	168.2	60	5.3	
TI_S_203	176.7	60	8.6	
TI_S_204	170.2	60	13	5/19/2012
TI_S_205	189.5	54	6.8	
TI_S_206	186.5	54	5.9	
TI_S_207	190.0	54	4.4	
TI_S_208	198.5	54	8.8	5/18/2012
TI_S_209	182.3	54	2.8	
TI_S_210	185.0	54	4	
TI_S_211	261.0	54	3.2	
TI_S_212	264.2	54	4.4	
TI_S_213	260.6	54	5.3	
TI_S_214	260.1	54	4.4	
TI_S_215	21.1	54	8.7	7/3/2012
TI_S_215A	255.0	54	5.4	
TI_S_216	40.4	54	5.3	
TI_S_216A	25.1	54	6	
TI_S_216B	43.2	54	7.7	
TI_S_217	177.6	54	9.5	5/7/2012
TI_S_217A	11.3	54	5.3	
TI_S_217B	36.4	54	8.2	
TI_S_218	241.0	54	10.3	5/7/2012

2.1.c.6 Status of Receiving Wastewater Treatment Plants (WWTPs)

The Alley Creek and Little Neck Bay basin is entirely within the Tallman Island WWTP service area. DEP is currently upgrading the Tallman Island WWTP for Biological Nutrient Removal (BNR) as well as improvements that will enhance the collection system and treatment facility to convey, accept, and treat influent at twice the plant's design dry weather flow capacity during storm events. With respect to conveyance capacity to the WWTP, the status of the project work as of May 2014 is as follows.

- The majority of the new Whitestone Interceptor and turning chambers have been constructed.
- The connection of the interceptor (Connection Chamber) to the Tallman Island WWTP is complete, but not activated.
- The connection of the interceptor to the existing Whitestone Interceptor (Diversion Chamber) is ongoing.
- The work on the regulator modifications is to be initiated.

2.2 Waterbody Characteristics

This section of the report describes the features and attributes of Alley Creek and Little Neck Bay. Characterizing the features of these waterbodies is important for assessing the impact of wet weather inputs and creating approaches and solutions that mitigate the impacts from wet weather discharges.

2.2.a Description of Waterbody

Alley Creek and Little Neck Bay are tidal waterbodies located in eastern Queens and western Nassau County, New York. Alley Creek is tributary to Little Neck Bay, and the Bay is tributary to the East River. Alley Creek and Udalls Cove, an embayment of Little Neck Bay, have major areas of watershed preserved as parkland adjacent to the water. However, water quality in Alley Creek and Little Neck Bay is influenced by CSO and stormwater discharges. The following section describes the present-day physical and water quality characteristics of Alley Creek and Little Neck Bay, along with their 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 includes five saline classifications for marine waters. DEC considers the Class SA and Class SB classifications to fulfill the CWA. Class SC supports aquatic life and recreation, but the primary and secondary recreational uses of the waterbody are limited due to other factors. Class I supports aquatic life protection as well as secondary contact recreation. SD waters shall be suitable only for fish, shellfish and wildlife survival because natural or man-made conditions limit the attainment of higher standards. DEC has classified Alley Creek as Class I, and Little Neck Bay as Class SB.

Numerical criteria corresponding to these waterbody classifications are as shown in Table 2-12. DEP conducted water quality assessments where the data is represented by % attainment with pathogen targets. For this LTCP, in accordance 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.

Dissolved oxygen (DO) is the numerical criterion that DEC uses to establish whether a waterbody supports aquatic life uses. 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 criteria, New York State has narrative criteria to protect aesthetics in all waters within its jurisdiction, regardless of classification (see Section 1.2.c.). As indicated in Table 2-13, these narrative criteria apply to all five classes of marine waters.

Table 2-12. New York State Numerical Surface WQS (Saline)

Class	Usage	Dissolved Oxygen (mg/L)	Total Coliform (MPN/100mL)	Fecal Coliform (MPN/100mL)	Enterococci (MPN/100mL)
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
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	≤ 10,000(6)	≤ 2,000(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	N/A	N/A	N/A

(1) Chronic criterion 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.,

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

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

Note that the enterococci criterion of 35 MNP/100 mL listed in Table 2-12, although not promulgated by DEC, is now an enforceable standard in New York State as EPA established January 1, 2005, as the date upon which the criteria must be adopted for all coastal recreational waters. According to the DEC interpretation of the BEACH Act of 2000, the criterion applies on a 30-day moving GM basis during recreational season (May 1st to October 31st). Furthermore, DEC interprets that this criterion is not applicable to the tributaries of the Long Island Sound and the East River tributaries.

Currently, DEC is conducting its federally-mandated "triennial review" of the NYS WQS, in which States are required to review their water quality standards every three years. DEC is in the pre-public proposal phase of this rule, and staff is considering a wide-range of revisions/additions to water quality standards regulations.

Table 2-13. 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 wastes or other wastes that will cause deposition or impair the waters for their best usages.
Oil and floating substances	SA, SB, SC, I, SD A, B, C, D	No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease.
Garbage, cinders, ashes, oils, sludge and other refuse	SA, SB, SC, I, SD A, B, C, D	None in any amounts.
Phosphorus and nitrogen	SA, SB, SC, I, SD A, B, C, D	None in any amounts that will result in growth of algae, weeds and slimes that will impair the waters for their best usages.

Interstate Environmental Commission (IEC)

The States of New York, New Jersey, and Connecticut are signatory to the Tri-State Compact that designated the Interstate Environmental District and created the IEC. The IEC includes all tidal waters of greater New York City. Alley Creek and Little Neck Bay are interstate waters and are regulated by IEC as Class A waters. Numerical criteria for IEC-regulated waterbodies are shown in Table 2-14, while narrative criteria are shown in Table 2-15.

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 CSS is being operated with reasonable care, maintenance, and efficiency. Although IEC regulations are intended to be consistent with State WQS, the three-tiered IEC system and the five New York State marine classifications in New York Harbor do not provide for an exact spatial overlap.

Table 2-14. 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 Br.; 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

Table 2-15. 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

For designated bathing beach areas, the EPA criteria require that an enterococci reference level of 104 cfu/100 mL to be used by agencies for announcing bathing advisories or beach closings in response to pollution events. DMA is a private club with a permit to operate a beach by DOHMH. DOHMH uses a 30-day moving GM of 35 cfu/100mL 100mL during the bathing season (Memorial Day to Labor Day). If the GM exceeds that value, the beach is closed pending additional analysis. Enterococci of 104 cfu/100mL are an advisory upper limit used by DOHMH. If beach enterococci data are greater than 104 cfu/100mL, a pollution advisory is posted on the DOHMH website. Additional sampling is initiated, and the advisory is removed when water quality is acceptable for primary contact recreation. Advisories are posted at the beach and on the agency web-site. In addition, there is a preemptive standing advisory for DMA Beach for no swimming for 48 hours after a rainfall of 0.2 inches in 2 hours, or a rainfall of 0.4 inches in 24 hours.

For non-designated beach areas of primary contact recreation, which are used infrequently for primary contact, the EPA criteria require that an enterococci reference level of 501 cfu/100 mL be considered indicative of pollution events.

Little Neck Bay is classified SB (primary contact recreation use). With the exception of the DMA Beach, Little Neck Bay is used infrequently for primary contact recreation. These reference levels, according to the EPA documents, are not criteria, but are to be used as determined by the State agencies in making decisions related to recreational uses and pollution control needs. For bathing beaches, these reference levels are to be used for announcing beach advisories or beach closings in response to pollution events.

EPA released Recreational Water Quality Criteria (RWQC) recommendations in December 2012 (2012 EPA RWQC) which are designed to protect human health in coastal and non-coastal waters designated for primary recreation 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 bacteria found in water with fecal contamination. However, the BEACH Act of 2000 directs coastal states to adopt and submit to EPA revised recreational WQS for bathing waters by December 2015.

The 2012 EPA RWQC offers two sets of numeric concentration thresholds, as listed in Table 2-16, and includes limits for both the GM (30-day) and a statistical threshold value (STV). The STV is intended to be a value that should not be exceeded by more than 10 percent of the samples taken.

Table 2-16. 2012 EPA RWQC Recommendations

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

It is not known at this time how DEC will implement the 2012 EPA RWQC. Recent input from DEC has stated that Recommendation 2 will be used to update water quality criteria. The LTCP analyses were based on the enterococci numerical criteria associated with Recommendation 1.

2.2.a.2 Physical Waterbody Characteristics

Alley Creek and Little Neck Bay are located in the northeastern corner of Queens, near the Nassau County border. Alley Creek opens into the southeast end of Little Neck Bay. Little Neck Bay opens to the East River, between Willets Point and Elm Point, near the western portion of the Long Island Sound. Udalls Cove, an embayment on the eastern shore of Little Neck Bay, spans the Queens/Nassau County border, between Douglas Manor and Great Neck Estates.

Alley Creek is located at the southern end of Little Neck Bay, and is contained within Alley Pond Park. The tidal tributary runs northward and its mouth opens to Little Neck Bay. The 624-acre park contains forests, several ponds, facilities for active landside recreation, salt marshes and wetlands, and the creek itself. The creek constitutes one of the few remaining undisturbed marsh systems in the City. The head of Alley Creek is near the intersection of the Cross Island Parkway and the Long Island Expressway.

Freshwater flows to Alley Creek include stormwater and CSO discharge. Alley Creek water quality is also influenced by the saline water of Little Neck Bay.

Little Neck Bay comprises an area of approximately 1,515 acres. This open water fish and wildlife habitat extends to Fort Totten in the west, and the village of Elm Point, Nassau County in the east. The bay is bordered by residential development, Fort Totten and the Cross Island Parkway. According to the New York City Comprehensive Waterfront Plan entitled “Plan for the Queens Waterfront” issued by the DCP, Little Neck Bay is one of the major waterfowl wintering areas on Long Island’s north shore. In addition to waterfowl use, Little Neck Bay is a productive area for marine fish and shellfish. As a result of the abundant fisheries in the bay and its proximity to the metropolitan New York area, Little Neck Bay is a regionally important recreational fishing resource.

Udalls Cove is located in the northeastern corner of Queens and extends into Nassau County. The New York City portion consists of an area of approximately 52 acres, from Little Neck Bay to the vicinity of Northern Boulevard. Most of Udalls Cove is mapped as parkland and managed by DPR as the Udalls Cove Preserve.

Little Neck Bay, Alley Creek, and Udalls Cove are located within the Coastal Zone Boundary and within a Special Natural Waterfront Boundary as designated by the DCP. All three waterbodies are also located within Significant Coastal Fish and Wildlife Habitats, as designated by the New York State Department of State (DOS).

Shoreline Physical Characterization

Alley Creek is predominantly characterized by natural, vegetated shorelines, except for the footings of the bridges for the Long Island Railroad and Northern Boulevard. The Creek is contained within Alley Pond Park, except for the eastern shore north of the Long Island Railroad. Little Neck Bay is generally characterized by altered shorelines, mainly rip-rap, with some bulkhead from Bay Street to Shore Road and from Westmorland Drive to Bayview Avenue in Douglaston. Based on field observations, vegetation exists on the waterside of some of the altered areas of Parsons Beach and Douglaston. Natural, sandy and natural, vegetated areas exist along the shores of Little Neck Bay in the inlet on the southeastern portion of Fort Totten, near the mouth of Alley Creek, along the Parsons Beach and Douglaston shore, and in Udalls Cove. Most of the natural shoreline areas are within parkland. Small piers also exist along the shores, mainly along the Douglaston Peninsula.

Figures 2-16, 2-17 and 2-18 show shoreline typical for the regions of the study area. Figure 2-16 shows the rip-rap that typically fortifies much of the western shoreline of Little Neck Bay. Figure 2-17 shows the varied types of bulkheading, rip-rap and natural shoreline found along the eastern shoreline of Little Neck Bay. Figure 2-18 shows the natural shorelines typical around the southern end of Little Neck Bay and Alley Creek.

The shorelines of Udalls Cove, an embayment of Little Neck Bay, consist primarily of natural, vegetated areas. Intact, concrete bulkhead areas exist from Bayview Drive to the mouth of the cove. Along Virginia Point near the Nassau County border, dilapidated timber bulkheads exist among the wetland vegetation. Much of the shoreline along the western edge of the cove borders residential areas or the esplanade park that runs between Marinette Street and the water. These areas are natural, in the sense that they lack riprap or bulkheading, although many of these areas are maintained by landscapers, and may have been modified during road and property development.

In Udalls Cove, from the Long Island Railroad in the south to north of Sandhill Road, Gablers Creek runs through the wetlands of Aurora Pond and the cove. The Gablers Creek in this area is contained within a cobble-lined ditch. Physical shoreline conditions and shoreline habitat are as shown in Figure 2-19.

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 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 18-foot vertical rise for each 200-foot horizontal distance. In general, the three classification parameters describe the shoreline slope well for the purposes of the LTCP project.

Gentle and intermediate slopes characterize the shorelines of Little Neck Bay, Alley Creek and Udalls Cove. The slope of the eastern shoreline of Little Neck Bay is generally characterized as intermediate. The slope of the western shoreline is generally characterized as gentle, with an area of intermediate shoreline located along Fort Totten. The slopes of both shorelines of Alley Creek are characterized as gentle. The slope of the eastern shoreline of Udalls Cove is characterized as gentle. The slope of the western shore is characterized as predominantly gentle, with one area of intermediate slope. The area of intermediate slope extends along the shoreline from Beverly Road to the mouth of the cove. Shoreline slopes are as shown in Figure 2-20.

Figure 2-16. Western Shoreline of Little Neck Bay Near 27th Ave. (Looking West)

Figure 2-17. Eastern Shoreline of Little Neck Bay Near Shorecliff Place (Looking West)

Figure 2-18. Shoreline of Alley Creek (Looking North)

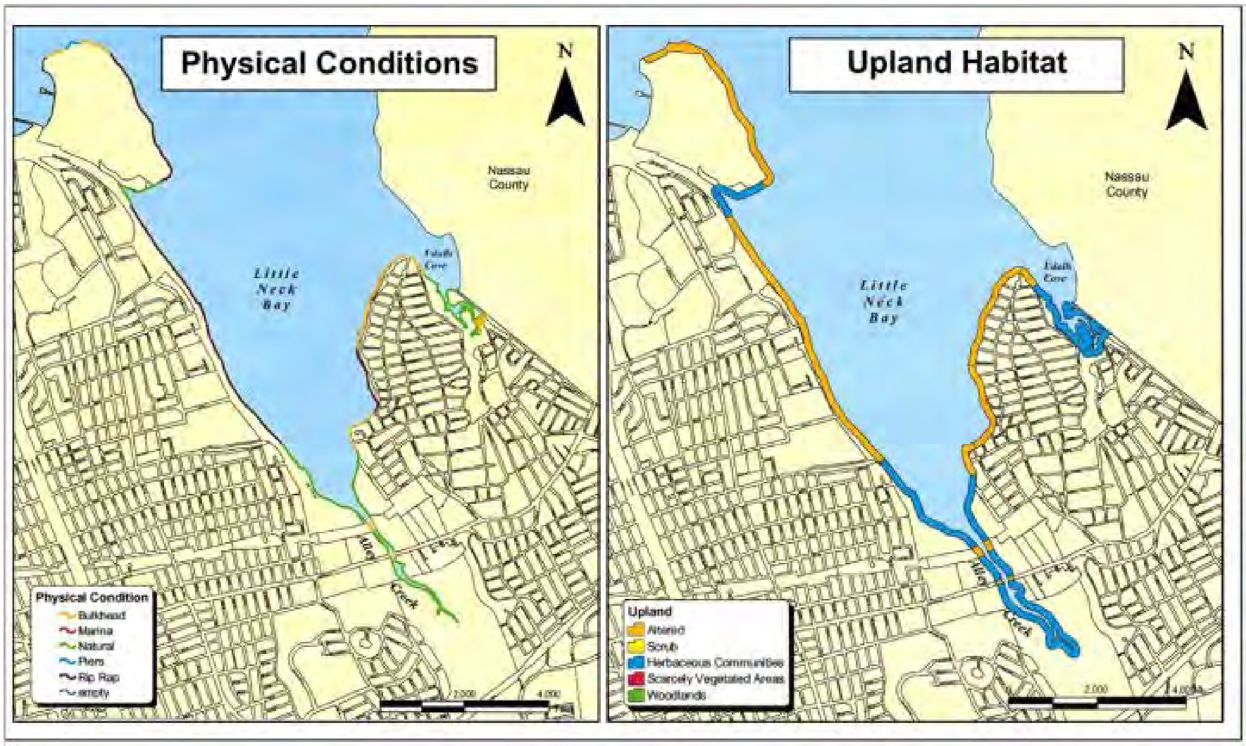


Figure 2-19. Shoreline Physical Conditions and Upland Habitat

Figure 2-20. Alley Creek Existing Shoreline Slope

Waterbody Sediment Surficial Geology/Substrata

The bottom of Little Neck Bay is generally characterized as sand. The bottom of Alley Creek is generally characterized as mud/silt/clay. These classifications have been assigned based on the following two sediment sampling programs, which analyzed sediment grain size: grab samples taken at one HydroQual, Inc. sampling station in 2001; and grab samples taken at three HydroQual sampling stations in 2002. Both sampling programs were conducted as part of a Use and Standards Attainment Study (USA) performed for DEP. For the purpose of defining surficial geology/substrata, those areas where bottom samples were more than 50 percent mud/silt/clay were designated as mud/silt/clay; those areas where bottom samples were more than 50 percent sand were designated as sand. Based on one Little Neck Bay grab sample taken by USA (2001), bottom mud/silt/clay composition was approximately 16.5 percent, while sand composition was 83.5 percent.

USA sediment sampling (July 2002) consisted of one grab collected at one station in Little Neck Bay and two in Alley Creek. For the sample obtained in Little Neck Bay, bottom mud/silt/clay composition was approximately 37.40 percent, and sand composition was approximately 62.6 percent. For the two samples obtained in Alley Creek, bottom mud/silt/clay composition ranged from approximately 61.38 to 85.15 percent, while sand composition ranged from approximately 14.85 to 38.62 percent.

Waterbody Type

Little Neck Bay and the mouth of Udalls Cove are classified as embayments. Alley Creek and the portion of Udalls Cover south of Knollwood Avenue are classified as tidal tributaries. Freshwater sources to Udalls Cove include Gablers Creek, the Belgrave WWTP discharge, and discharge from the freshwater wetlands located near the cove. Similarly, Alley Creek receives freshwater from stormwater and CSO discharge, from groundwater inflows, and from the freshwater wetlands located near the Creek. All of the waters in the Alley Creek and Little Neck Bay waterbody assessment area are tidal and saline.

Tidal/Estuarine Systems Biological Systems

Tidal/Estuarine Wetlands

Tidal/Estuarine generalized wetlands in the Alley Creek and Little Neck Bay watershed are as shown in Figure 2-21 and are described in this section. According to the DEC tidal wetlands maps, there are numerous designated wetlands mapped throughout the study area. The western and eastern shorelines of Little Neck Bay support many areas of inter-tidal marshes from Willets Point to the mouth of Alley Creek, with an area of coastal shoals, bars and mudflats mapped to the south and southwest of Fort Totten. Extensive wetlands have been mapped by the DEC on both shores of Little Neck Bay south of Parsons Beach and Crocheron Park and throughout Alley Creek. These extensive wetlands tend to be mapped with high marsh or salt meadow wetlands inland of inter-tidal marsh wetlands, and in some areas, most notably north of the Long Island Railroad and surrounding the mouth of Alley Creek, the wetland areas are mapped on the order of 1,000 feet wide. Formerly connected wetlands are also mapped immediately south of the Long Island Railroad, inland from Alley Creek.

Udalls Cove, an embayment of Little Neck Bay, also supports extensive wetlands, generally with inter-tidal marsh wetlands and high marsh or salt meadow wetlands mapped inland of coastal shoals, bars and mudflats. The open waters of Little Neck Bay are generally mapped as littoral zone. The DEC maps designate three discontinuous inter-tidal wetland areas along the western bank of Little Neck Bay and Alley Creek, from roughly 1,500 feet southeast of Willets Point, along the east and south shorelines of Fort Totten, and south to 23rd Street. Three other areas of discontinuous inter-tidal marsh wetlands are mapped from 28th Road to Crocheron Park. A continuous inter-tidal wetland area is mapped from 35th Avenue to the Long Island Railroad. South of the Long Island Railroad, inter-tidal marshes are mapped roughly from 440 to 520 feet and 880 to 1,500 feet south of Northern Boulevard and 1,860 feet south of Northern Boulevard to the head of Alley Creek. High marsh or salt meadow wetlands are mapped from 37th Avenue to the Long Island Railroad, and from roughly 120 to 1,520 feet south of Northern Boulevard.

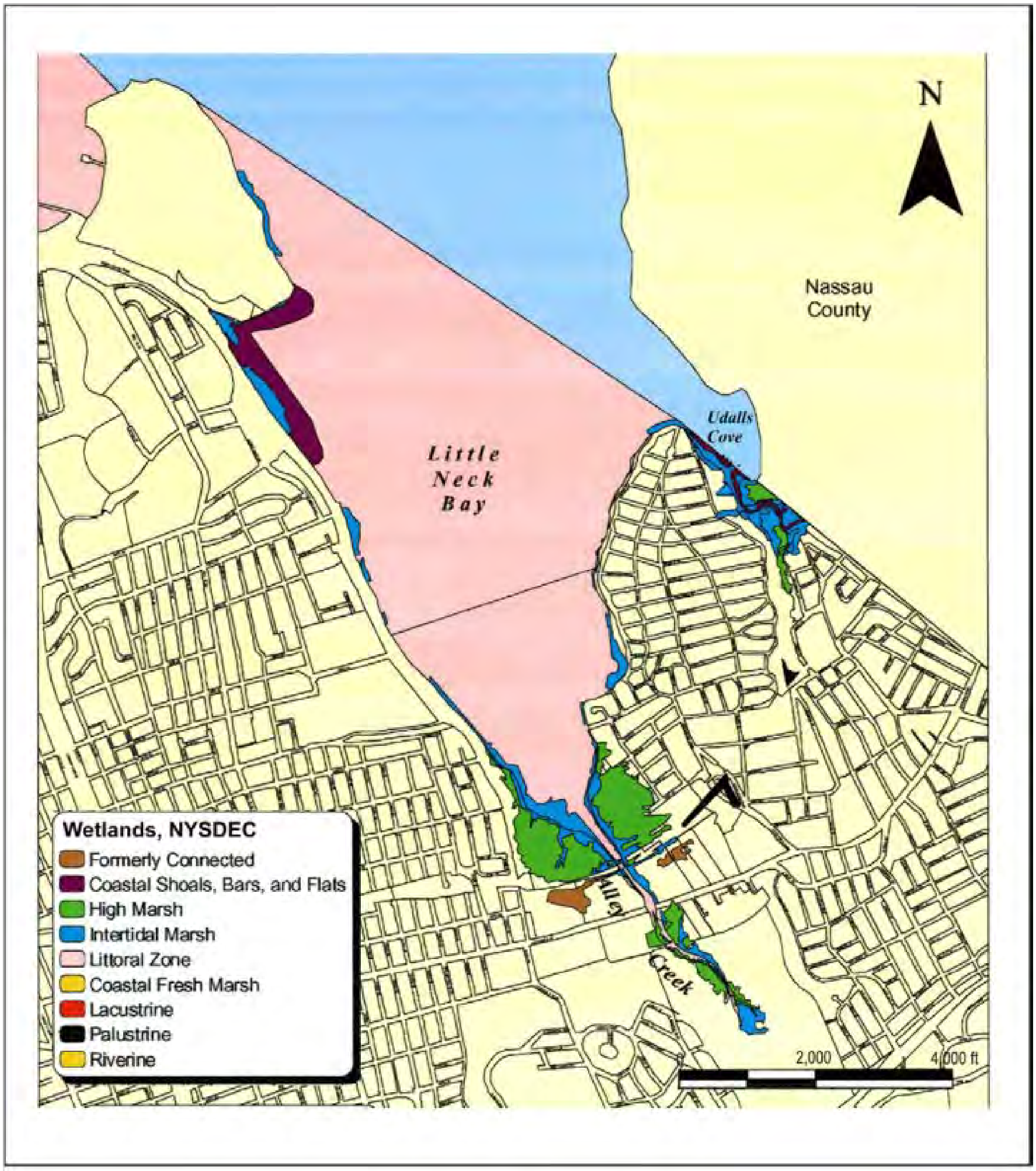


Figure 2-21. DEC Existing Mapped Wetlands. Source: WWFP, June 2009

The DEC maps also show inter-tidal marsh wetlands along the eastern shorelines of Little Neck Bay and Alley Creek. Two areas of inter-tidal marsh wetlands are mapped from the pier at Beverly Road to Manor Road. Other areas of inter-tidal marsh wetlands exist from Arleigh Road to 233rd Street, from Regatta Place to Bay Street, and from just south of Bay Street, to the Long Island Railroad. The DEC maps show inter-tidal marsh wetlands stretching along the eastern shore of Alley Creek, from the Long Island

Railroad to Northern Boulevard. South of Northern Boulevard, the inter-tidal marsh wetlands are not contiguous and are interspersed along the eastern shoreline, from Northern Boulevard to the mouth of Alley Creek, from roughly 100 to 280 feet south of Northern Boulevard, from 360 to 1,380 feet south of Northern Boulevard, and from approximately 1,660 feet south of the boulevard to the head of the Creek. High marsh or salt meadow wetlands are also mapped as interspersed along the eastern shoreline of Little Neck Bay and Alley Creek, from Little Neck Road to the Long Island Railroad, adjacent to the south edge of the Long Island Railroad, from 100 to 720 feet south of Northern Boulevard, from approximately 780 to 800 feet south of Northern Boulevard, and from approximately 1,380 to 1,680 feet south of the boulevard.

Thin extensions of inter-tidal marsh wetlands, from about 20 to 60 feet wide, extend inland from both shorelines of Alley Creek, along the southern edge of the Long Island Railroad, parallel to the train tracks. To the east of Alley Creek, these inter-tidal marsh wetlands extend roughly 840 feet inland along the train tracks, and two areas of formerly connected wetlands are mapped to the south of these inter-tidal wetlands, approximately 300 and 560 feet inland of the Creek. To the west of Alley Creek, the inter-tidal wetlands extend inland approximately 240 feet along the railroad tracks, with a small break between them, and an area of formerly connected wetlands that extends inland for approximately another 1,000 feet.

In the NYC portion of Udalls Cove, the DEC has mapped inter-tidal marsh wetlands from the mouth to approximately 2,500 feet south of the mouth, along both east and west shorelines. High marsh or salt meadow wetland areas are mapped in the study area, from approximately 2,000 feet to 3,000 feet southeast of the mouth of the cove, along the western shoreline of the cove. Coastal shoals, bars and mudflats are mapped throughout the mouth, and along the open water portions of Udalls Cove within the study area. The wetlands of Udalls Cove extend up to 1,600 feet from the western shoreline in New York City to the eastern shoreline in Nassau County.

The United States Fish and Wildlife Service National Wetlands Inventory (NWI) maps show extensive wetlands throughout the Little Neck Bay, Alley Creek, and Udalls Cove study area. The NWI mapped wetlands are as shown in Figure 2-22, and Table 2-17 summarizes the classification used. In the inlet between Forth Totten and Bay Terrace, three adjacent wetland areas – estuarine, inter-tidal, flat, regular (E2FLN); estuarine, inter-tidal, emergent persistent, irregular (E2EM1P); and palustrine, emergent, persistent, semi-permanent (PEM1F) – are mapped in series, stretching to the northwest from the mouth of the inlet on Little Neck Bay. Along the western shoreline of Little Neck Bay, there are two areas of estuarine, inter-tidal, beach/bar, regular (E2BBN) wetlands between 17th and 29th Avenues. Along the eastern shoreline of Little Neck Bay, the NWI has mapped E2BBN wetlands at 33rd Street, and estuarine, inter-tidal, emergent, narrow-leaved persistent, regular (E2EM5N) wetlands along Parsons Beach. South of Crocheron Park, on the western shoreline of Little Neck Bay and Alley Creek, and south of Parsons Beach, on the eastern shoreline of the bay and creek, the NWI has mapped multiple wetland areas along both shorelines that span the waterbodies.

Listed from north to south, these wetland areas include E2EM5N, estuarine, inter-tidal, emergent, narrow-leaved persistent, irregular (E2EM5P); E2EM1P; and another area of E2EM5P; stretching from southern Little Neck Bay to the head of Alley Creek. An area of estuarine, sub-tidal, open water/unknown bottom, sub-tidal (E1OWL) wetland is mapped inland, to the west of Alley Creek, northwest of the Cross Island Expressway cloverleaf, and south of the Long Island Railroad. The open waters of Alley Creek are mapped estuarine, inter-tidal, streambed, irregularly exposed (E2SBM) wetlands.

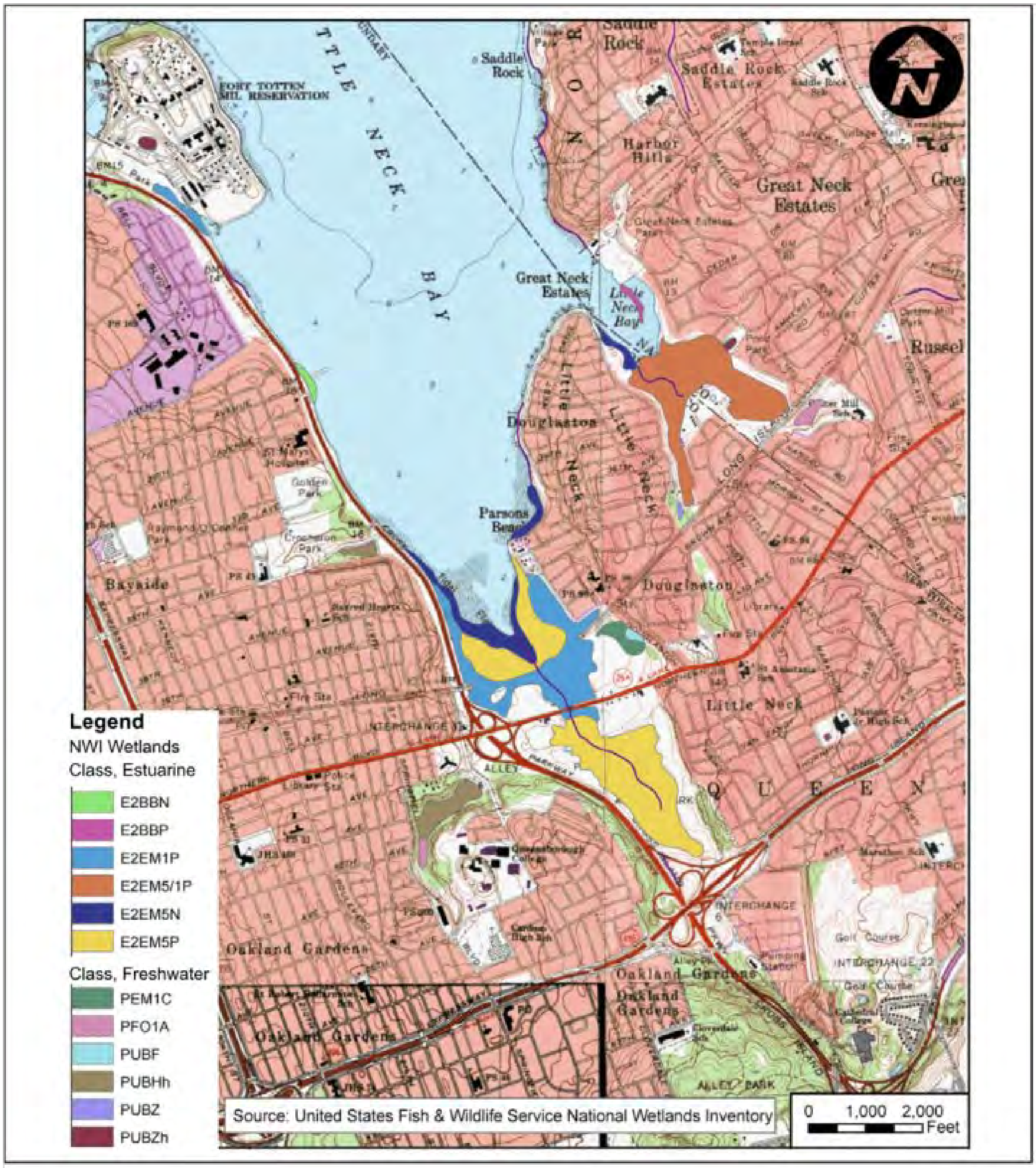


Figure 2-22. National Wetlands Inventory (NWI) Source: WWFP, June 2009

Table 2-17. NWI Classification Codes

NWI Classification	Description
E1OWL	Estuarine, sub-tidal, open water/unknown bottom, sub-tidal
E2BBN	Estuarine, inter-tidal, beach-bar, regular
E2BBP	Estuarine, inter-tidal, beach-bar, irregular
E2EM1P	Estuarine, inter-tidal, emergent-persistent, irregular
E2EM5/1P	Estuarine, inter-tidal, emergent, narrow-leaved persistent/persistent, irregular
E2EM5N	Estuarine, inter-tidal, emergent, narrow-leaved, persistent, regular
E2EM5P	Estuarine, inter-tidal, emergent, narrow-leaved, persistent, irregular
E2FLN	Estuarine, inter-tidal, flat, regular
E2SBM	Estuarine, inter-tidal, streambed, irregularly exposed
PEM1C	Palustrine, emergent, persistent, seasonal
PEM1F	Palustrine, emergent, persistent, semi-permanent
PFO1A	Palustrine, forested, broad-leaved deciduous, temporarily flooded
POWF	Palustrine, open water/unknown bottom, intermittently exposed/permanent
POWZ	Palustrine, open water/unknown bottom, intermittently exposed/permanent
PUBF	Palustrine, unconsolidated bottom, semi-permanent
PUBHh	Palustrine, unconsolidated bottom, permanent, diked/impounded
PUBZ	Palustrine, unconsolidated bottom, intermittently exposed/permanent
PUBZh	Palustrine, unconsolidated bottom, intermittently exposed/permanent, diked/impounded

The NWI mapped multiple wetlands along the shorelines of Udalls Cove. The open waters of the cove are mapped as E10WL. Within the New York City study area of Udalls Cove, the western shoreline north of 28th Avenue is mapped as E2EM5N. South of 28th Avenue, both shorelines of Udalls Cove within the study area are mapped as estuarine, inter-tidal, emergent, narrow-leaved persistent/persistent, irregular (E2EM5/1P) wetlands. The NWI has mapped the waters as E2SBM where the cove's open waters narrow into a tidal river.

Aquatic and Terrestrial Communities

The DCP Plan for the Queens Waterfront (DCP, 1993) reports a diverse range of species supported by the habitat in the Alley Creek and Little Neck Bay area. Little Neck Bay is a productive area for marine finfish and shellfish. The Bay serves as an important nursery and feeding area for striped bass and numerous other species. A variety of finfish species can be found in the tidal shallows and Alley Creek. Although its waters are not certified for commercial shellfishing, Little Neck Bay is a hard clam producing area. Alley Pond Park and Udalls Cove contain abundant shellfish and crustaceans. The habitats also serve as breeding areas for several species of birds, as a spring and fall stopover for several migratory species, and as avian wintering areas for several species. Shorebirds and wading birds use the Udalls Cove area extensively. The area also supports numerous terrestrial and amphibious wildlife species. A more detailed summary of the aquatic and terrestrial communities can be found in the June 2009 Alley Creek and Little Neck Bay WWFP.

Freshwater Systems Biological Systems

The generalized freshwater wetlands areas shown in Figure 2-21 are described in more detail in this section. The DEC Freshwater Wetlands Maps show seven areas of fresh water wetlands in the study area. The areas are mapped in the inlet between Fort Totten and Bay Terrace, extending along the Cross Island Parkway southeast of Totten Avenue; on the west shoreline of Alley Creek, extending south along the Cross Island Parkway from the cloverleaf at Northern Boulevard to the Creek, roughly 800 feet south of Northern Boulevard; inland from the eastern shoreline of Alley Creek, extending along the southern edge of the Long Island Railroad and the western edge of the Douglaston Parkway; in two discontinuous areas along both shorelines of Alley Creek, from roughly 600 feet south of Northern Boulevard to the head of the creek; and in Udalls Cove, from Hollywood Avenue to Sandhill Road, and between Sandhill Road and the Long Island Railroad.

The NWI maps show three areas of freshwater (palustrine) wetlands in the Little Neck Bay, Alley Creek, and Udalls Cove study area, as indicated in Figure 2-22. In the inlet between Fort Totten and Bay Terrace, a palustrine, emergent, persistent, semi-permanent (PEM1F) wetland is mapped at the northeast edge of tidal wetlands, as described above. An area of palustrine, emergent, persistent, seasonal (PEM1C) is mapped inland of the eastern shore of Alley Creek adjacent, to the southern edge of the Long Island Railroad, with an area of palustrine, open water/unknown bottom, intermittently exposed/ permanent (POWF) wetlands adjacent to the PEM1C wetlands. In addition, an area of palustrine, open water/unknown bottom, intermittently exposed/permanent (POWZ) is mapped to the west of Udalls Cove, between Sandhill Road and the Long Island Railroad.

2.2.a.3 Current Public Access and Uses

Alley Creek, its shoreline, areas immediately adjacent to the water, and much of the surrounding drainage area of the creek are within Alley Pond Park. Access to Alley Creek is provided for by the park but no facilities for primary contact recreation are available. The park does not provide any regular secondary contact recreation opportunities; however, the Urban Park Rangers do run structured programs. One such program, “Alley Pond Adventure”, is an overnight summer camping program that includes supervised canoeing (secondary contact recreation use) and fishing.

The major use of Alley Creek is passive non-contact recreation. There are hiking trails that offer views of the water. Another significant, passive use of Alley Creek is for environmental education associated with wetlands habitat. The Alley Pond Environmental Center, located near the mouth of Alley Creek offers an extensive naturalist program with outreach to schools throughout the City.

Swimming (primary contact recreation use) is an existing use in Little Neck Bay at the privately owned bathing beach located on the eastern shore of the bay at Douglas Manor. As seen in Figure 2-9, the DMA Beach is located approximately 0.7 miles north of the mouth of Alley Creek, and approximately one mile downstream from the principal CSO outfall on Alley Creek, TI-025. DOHMH beach bacteria monitoring is conducted weekly during the bathing season from Memorial Day through Labor Day. In addition to the supervised bathing at the DMA Beach, bathing has been reported to occur from the boating docks along this shoreline, but this is not a sanctioned use.

On the western side of Little Neck Bay, access to the water is limited by the Cross Island Parkway, which runs parallel to the shoreline. There is no swimming noted along this shoreline. Access to the Bay for boating (secondary contact recreation use) is provided at the public marina in Bayside, operated under a concession from the DPR. This facility is open seasonally between May 1st and October 31st, and has accommodation for 150 boats. Fort Totten, located at the northeast point of Little Neck Bay, is also operated by DPR, and provides public access for canoeing and kayaking. In addition, fishing is allowed from the docks for special events.

Passive recreation is a major use of Little Neck Bay. There is also a hiking/bicycle path that runs between the shoreline of Little Neck Bay and the Cross Island Parkway, providing viewing of the Bay, and fishing takes place along this pathway. Another wetland area used for environmental education is Aurora Pond, adjacent to Udalls Cove, an eastern tributary to the Little Neck Bay. Environmental education, hiking, biking, and promenades are passive waterbody uses that do not involve either primary or secondary contact with the water. Fishing in Little Neck Bay may include limited contact with the water.

2.2.a.4 Identification of Sensitive Areas

The Federal EPA 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

An analysis of the waters of the Alley Creek and Little Neck Bay with respect to the EPA CSO Control Policy was conducted and is summarized in Table 2-18.

Table 2-18. 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]	Primary Contact Recreation	Public Water Supply Intake	Public Water Supply Protected Area	Shellfish Bed
Alley Creek	None	None	Yes	No[4]	None[5]	None[5]	None
Little Neck Bay	None	None	No	Yes	None[5]	None[5]	None

(1) Classifications or Designations per CSO Policy.
(2) As shown at http://www.sactuaries.noaa.gov/oms/omsmaplarge.html.
(3) DOS Significant Coastal Fish and Wildlife Habitats website (http://nyswaterfronts.com/water-front_natural_narratives.asp).
(4) Existing uses include secondary contact recreation and fishing, Class I.
(5) These waterbodies contain salt water.

This analysis identified two issues of potential concern:

- *Threatened or endangered species at Alley Creek.* The Coastal Fish and Wildlife habitat rating form indicates that the Northern harrier, a threatened (T) bird species, winters in Alley Pond Park.
- *Primary contact recreation in Little Neck Bay.* The DMA Beach, a private beach, is located on the western shore of the Douglaston Peninsula.

The Northern harrier (T) is a raptor whose diet consists strictly of land mammals (mice, voles and insects). Its presence is due to the relatively large protected wetlands in Alley Pond Park rather than the waters or aquatic life of Alley Creek. The presence of the Northern harrier therefore does not define Alley Creek as a sensitive area for threatened species, according to the EPA CSO Control Policy. There are no threatened or endangered species present in Udalls Cove or Little Neck Bay.

Findings for Sensitive Areas

One sensitive area is located within Little Neck Bay – the DMA Beach (Figure 2-10), as defined by the EPA CSO Control Policy. Accordingly, the LTCP addresses the policy requirements, which include: (a) prohibit new or significantly increased overflows; (b) eliminate or relocate overflows that discharge to sensitive areas if physically possible, economically achievable, and as protective as additional treatment, or provide a level of treatment for remaining overflows adequate to meet standards; and (c) provide reassessments in each permit term based on changes in technology, economics, or other circumstances for those locations not eliminated or relocated (EPA, 1995a).

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 Program (HSM) has been the responsibility of DEP's Marine Sciences Section (MSS) 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 the City. The number of water quality parameters measured has also increased from five in 1909, to over 20 at present.

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. During the last decade, water quality in NY Harbor has improved to the point that the waters are now utilized for recreation and commerce throughout the year. Still, impacted areas remain within the Harbor. The LTCP process has begun to focus on those areas within the Harbor that remain impacted; it will examine 10 waterbodies and their drainage basins, and develop a comprehensive plan for each waterbody.

The HSM program focuses on enterococci and fecal coliform bacteria, DO, chlorophyll ‘a’, and Secchi transparency as the water quality parameters of concern. Data are presented in four sections, each delineating a geographic region within the Harbor. Alley Creek and Little Neck Bay are located within the Upper East River – Western Long Island Sound (UER-WLIS) section. This area contains nine open water monitoring stations and five tributary sites. Figure 2-23 shows the location of Stations E11, LN1, and AC1 of the HSM program.

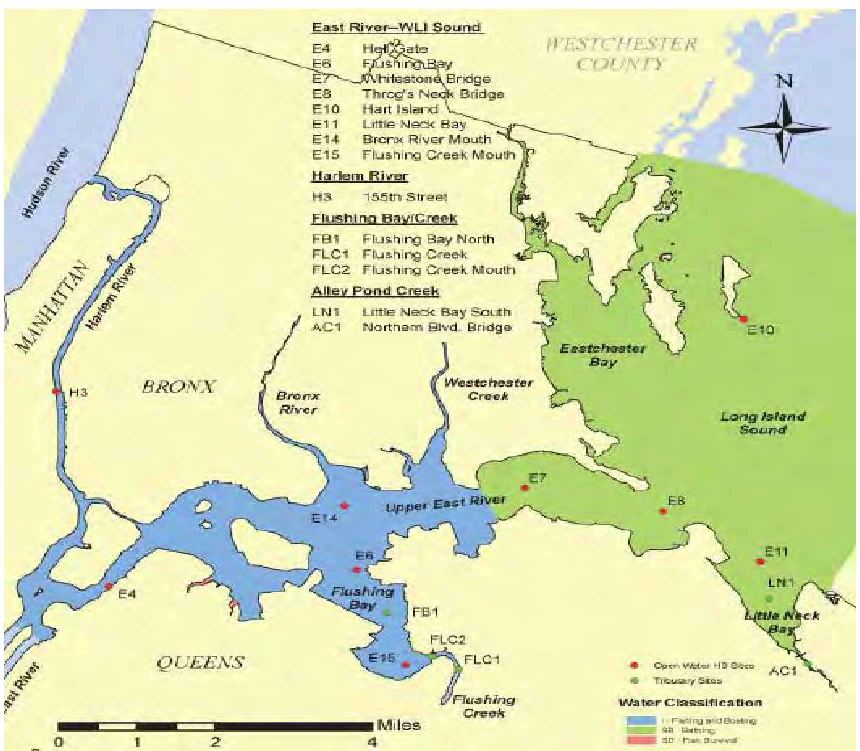


Figure 2-23. Harbor Survey UER-WLIS Region

The following sections provide an overview of the bacteria quality and DO levels of the Alley Creek and Little Neck Bay based on data collected by DEP as part of the HSM Program and as part of this LTCP. Additional information from the HSM program can be found at the following location.

http://www.nyc.gov/html/dep/html/harborwater/harborwater_quality_survey.shtml

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

DEP Harbor Survey Data and Department of Health and Mental Hygiene Data

Recent data collected within Alley Creek and Little Neck Bay are available from sampling conducted by DEP Harbor Survey and from the Department of Health and Mental Hygiene (DOHMH) between 2009 and 2013. DEP Harbor Survey routinely samples locations in Alley Creek and Little Neck Bay, while the DOHMH sampling the DMA Beach. Figure 2-24 provides a summary of the amount of time that DOHMH has measured the bathing area to be in compliance with the 30-day rolling average GM enterococci criterion that they use to open and close the area to bathers. As noted in this graphic, the bathing area only exhibited bathing water quality five percent of the time in the summer of 2011 while in the summer of 2012, it was open nearly 67 percent of the time.

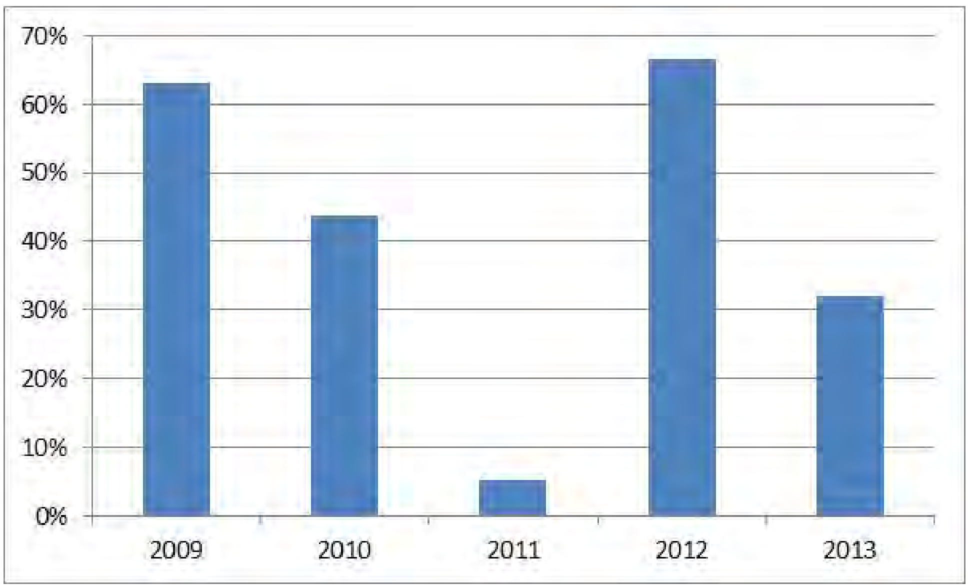


Figure 2-24. Douglaston Manor Association Bathing Area Openings

Percent of Enterococci Samples with 30-day GM<35 cfu/100mL

Figures 2-25 and 2-26 present a number of statistical parameters of the DEP Harbor Survey data set over the same period. Shown on these figures are the site GMs over the noted period, along with data ranges (minimum to maximum and 25th percentile to 75th percentile). For reference purposes, the monthly GM water quality criterion for fecal coliform is also shown.

Figures 2-25 and 2-26 present fecal coliform bacteria data collected at Stations AC1, LN1 and E11, in Alley Creek, Little Neck Bay and at the DMA Beach. The data in Figure 2-25 represent the period of January 2009 through March 2011, prior to when the Alley Creek CSO Retention Facility came on-line, whereas Figure 2-26 shows the data collected at those stations for the period post Alley Creek CSO Retention Facility. Similarly, Figures 2-27 and 2-28 present enterococci data collected at the same locations for the same time periods.

The data indicate that the bacteria concentrations within Alley Creek are elevated within the data period GMs for enterococci at approximately 500 cfu/100mL and for fecal coliform bacteria near 2,000 cfu/100mL. The 75th percentile excursions above these values reach nearly 2,000 cfu/100mL for enterococci and exceed 5,000 cfu/100mL for fecal coliform bacteria.

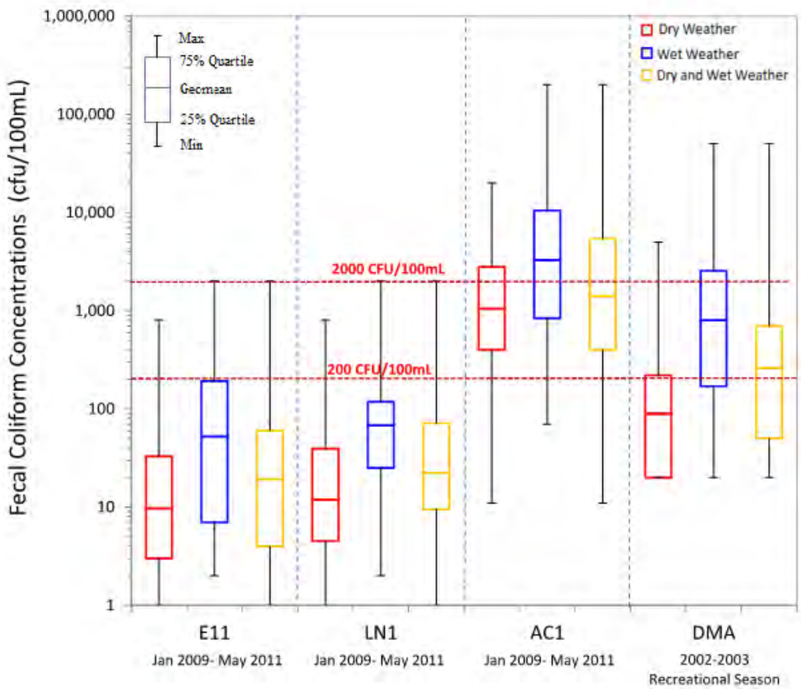


Figure 2-25. Fecal Coliform Data – Prior to Alley Creek CSO Retention Facility

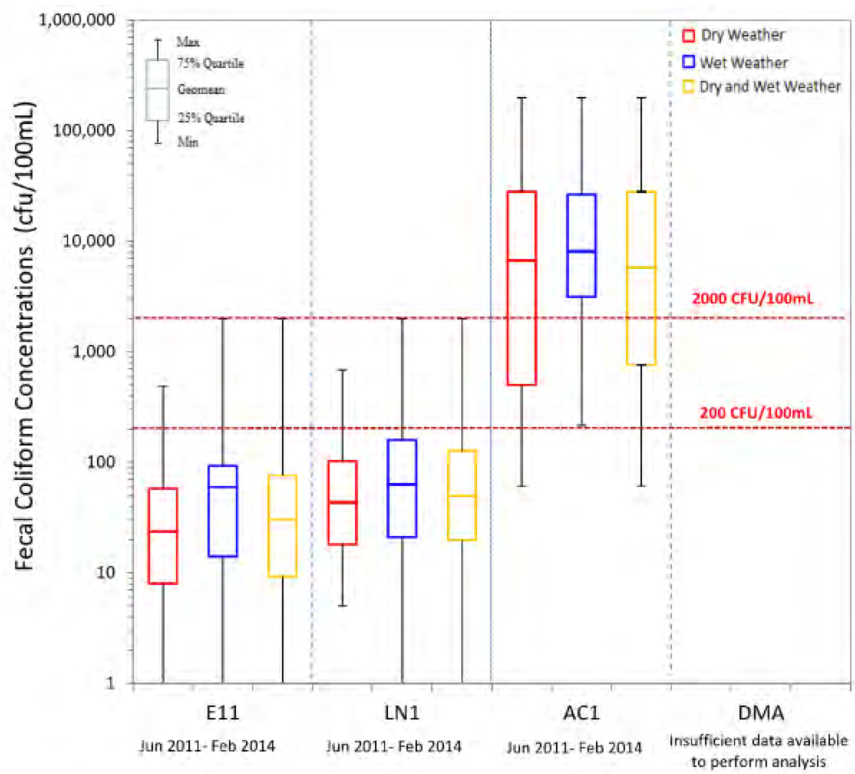


Figure 2-26. Fecal Coliform Data – Post Alley Creek CSO Retention Facility

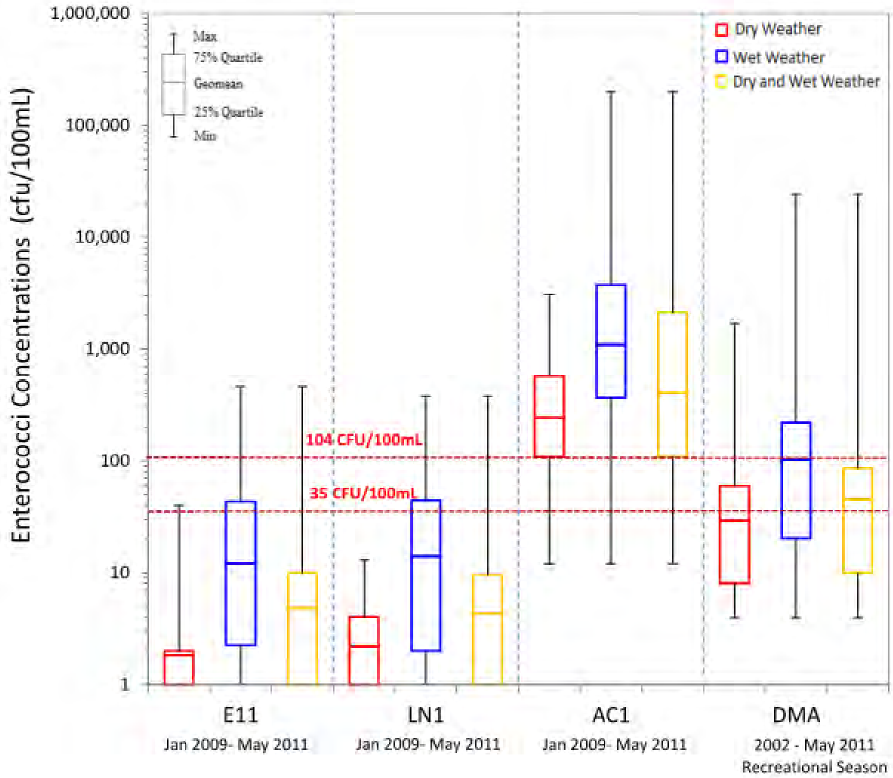


Figure 2-27. Enterococci Data – Prior to Alley Creek CSO Retention Facility

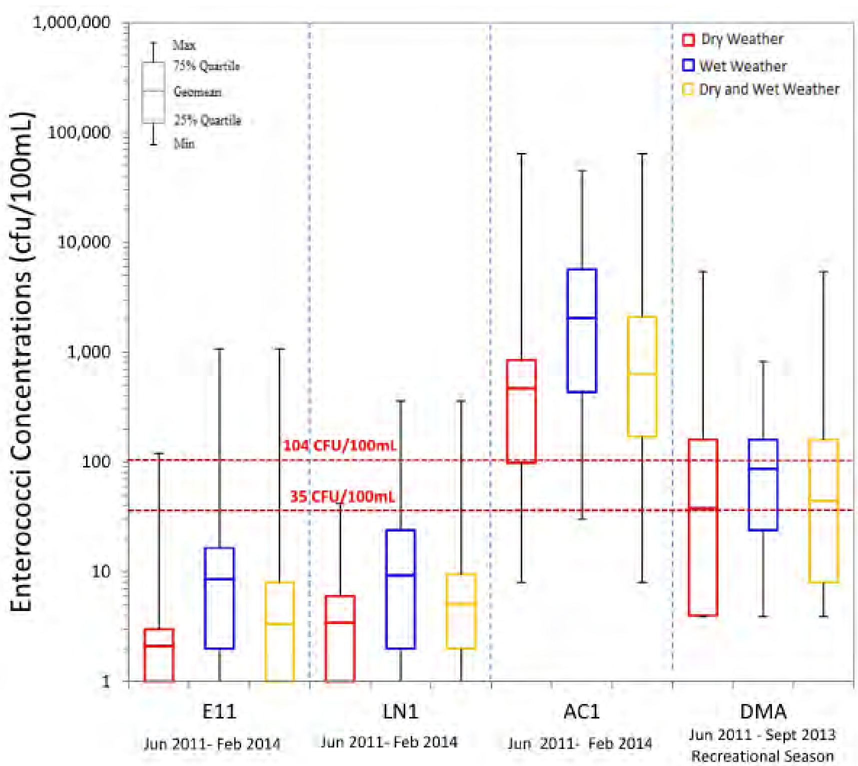


Figure 2-28. Enterococci Data – Post Alley Creek CSO Retention Facility

While it is apparent that the GMs increased slightly from pre- to post-retention Alley Creek CSO Retention Facility conditions, this appears in-part to be due to the extreme amount of rainfall in 2011 (Table 2-19). However, the data also indicate the possible presence of illicit dry weather sources during the period of record as many of the dry weather samples were elevated above expected background levels but still were not as high as those found in the wet weather samples. As noted in these graphics, dry weather fecal coliform concentrations had a GM of near 7,000 cfu/100mL for the post-construction period, with excursions as high as 200,000 cfu/100mL. Enterococci concentrations were lower with a GM of close to 500 cfu/100mL and excursions of up to over 50,000 cfu/100mL.

Table 2-19. LaGuardia Airport Summer Rainfall

Monthly Total Volume (in)			
	June	***July***	***August***
2009	8.46	6.62	2.66
2010	1.67	2.52	2.36
2011	3.85	2.94	17.32
2012	4.19	3.77	2.95
2013	8.16	2.8	1.97

The period GM summary of the bacteria data collected at Station AC1, presented in Table 2-20, shows that the post-construction concentrations increase in both wet and dry weather after the Alley Creek CSO Retention Facility came online. Since, the concentrations of bacteria at this location are elevated above expected background levels and increase during certain periods (particularly 2013), it can be deduced that this location is influenced by the presence of dry weather discharges. A temporal presentation of the data (Figure 2-29) demonstrates this issue by the large increase in bacteria concentrations in the middle of 2013. The data then return to pre-elevated lower levels in late 2013 and early 2014. The data then return to pre-elevated lower levels in late 2013 and early 2014. Accordingly, as discussed in Section 2.1.c.2, DEP conducted extensive investigations to locate the sources of the illicit connections. A previous illicit connection track-down investigation in 2011 located and eliminated 11 illicit connections within the Alley Creek drainage area. DEP believed they had found and abated all sources of illicit connections by late 2012 and reported as such to the DEC. However, as indicated by the bacteria data, it appears that there were additional sources not found and as such DEP initiated another track-down effort in late 2013. The results of this renewed track-down effort will be reported to DEC quarterly moving forward until concentrations at Station AC1 are reduced.

Table 2-20. Bacteria Data Summary – AC1 – Period GM

	Pre-Construction (January 2009 to March 2011)		Post-Construction (April 2011 to March 2014)	
	Dry	**Wet**	**Dry**	**Wet**
Fecal Coliform (#/100mL)	1,047	3,283	6,722	8,126
Enterococci (#/100mL)	240	1,091	468	2,036

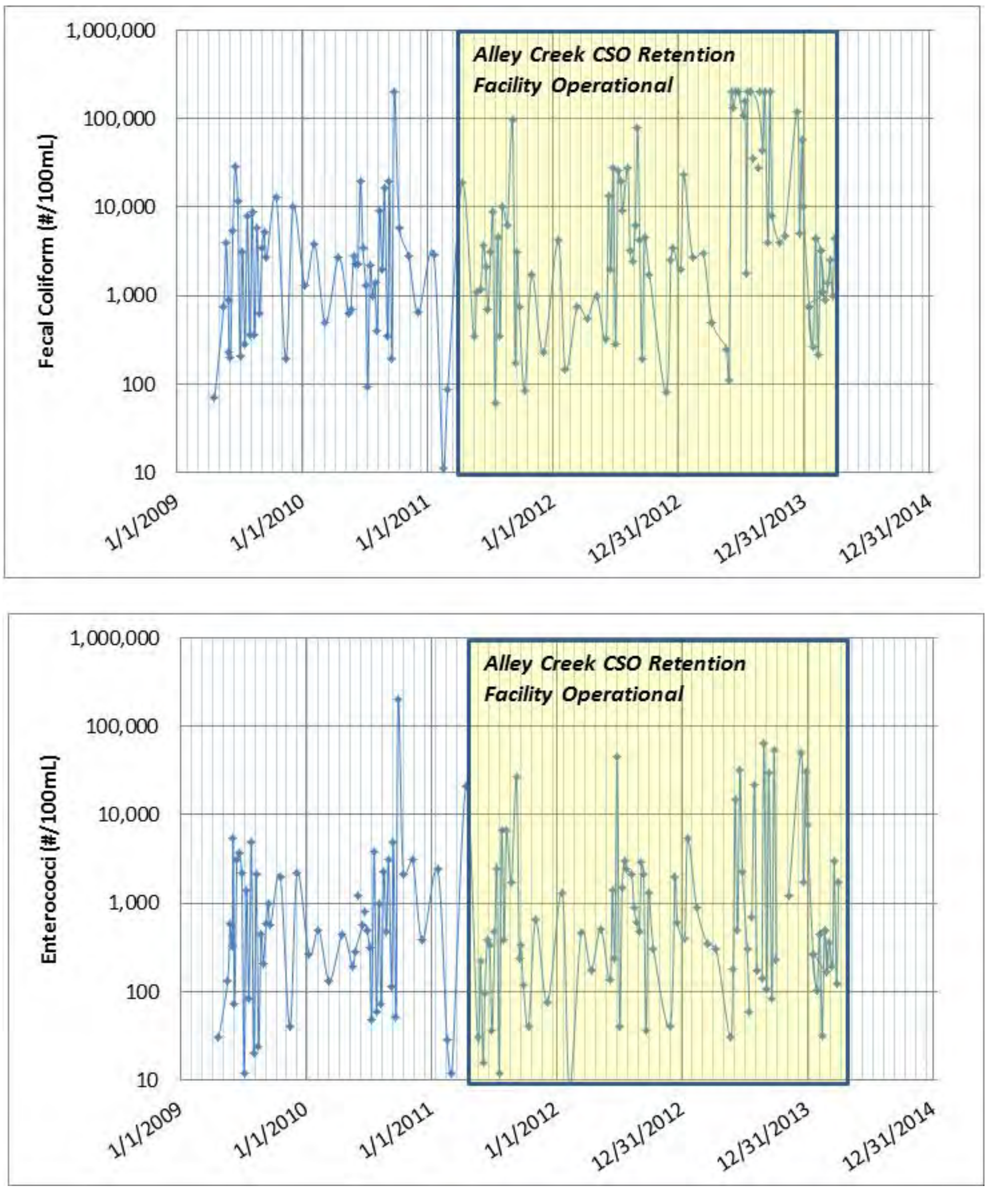


Figure 2-29. Bacteria Concentrations – AC1 Sampling Station

Microbial Source Tracking

Because of a large resident population of waterfowl in both impoundments, it was speculated that the observed elevated bacteria in Alley Creek might be from a source other than humans. To test this, MST was performed to attempt to determine the host (bird, dog, or human) that contributed the observed fecal pollution to the waterbodies. Fecal pollution can originate from point sources such as sewage, effluent from wastewater treatment plants and stormwater, and from non-point sources such as leaking septic systems, agriculture or wildlife runoff where the entry point of contamination to surface waters is not obvious. In either case, mammalian sources leave genetic tracers that can be detected in the laboratory.

Detection and quantification of gene biomarkers for human, bird, and dog sources were performed by Source Molecular Laboratory, based in Florida, using quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology proprietary to the laboratory. A general marker was quantified as copy numbers per mL, which is roughly analogous to bacteria concentrations (although not related). Then two human markers, one bird marker, and one dog marker were targeted for presence/absence, and if found to be present, quantified in the same manner as the general marker. Those results that were below the detection limits of the associated genetic assay were classified as negative. A negative result is not definitive of the absence of fecal contamination. As previously noted, due to the low bacteria levels in the samples, the results cannot be considered to be absolute. The results for the five sampling events are summarized in Table 2-21.

Table 2-21. TOC MST Sampling Results

Date	**1/3/2014**		**1/11/2014**		**2/1/2014**		**2/12/2014**		**2/25/2014**	
Location	**Hum 1**	**Hum 2**	**Hum 1**	**Hum 2**	**Hum 1**	**Hum 2**	**Hum 1**	**Hum 2**	**Hum 1**	**Hum 2**
Oakland Lake Outlet	-	-	-	-	-	Positive	-	-	-	-
Oakland Lake main Inflow (OL6)	Positive	Positive	-	-	-	-	-	-	-	-
LIE Pond	-	-	-	-	-	-	-	-	-	-
Location	Bird		Bird		Bird		Bird		Bird	
Oakland Lake	Positive (t)		Positive (d)		Positive (t)		-		-	
Oakland Lake main Inflow (OL6)	Positive		-		-		-		-	
LIE Pond	Positive		-		-		Positive (t)		-	
Location	Dog		Dog		Dog		Dog		Dog	

Date	**1/3/2014**		**1/11/2014**		**2/1/2014**		**2/12/2014**		**2/25/2014**	
Location	**Hum 1**	**Hum 2**	**Hum 1**	**Hum 2**	**Hum 1**	**Hum 2**	**Hum 1**	**Hum 2**	**Hum 1**	**Hum 2**
Oakland Lake	-		-		-		-		-	
Oakland Lake main Inflow (OL6)	Positive		-		-		-		-	
LIE Pond	-		-		-		-		-	

(t): trace; (d) detected in duplicate sample

Bird markers were found to be positive in three of five Oakland Lake samples and two of five LIE Pond samples. The single positive for dog marker detection coincided with positives for all other markers for that event at the QCC outfall, suggesting a higher level of contamination. The dog marker can have a false-positive when human markers are abundant. Only one of two human markers was detected in a single event, suggesting a limited human contribution to the fecal contamination observed.

Source Molecular Laboratory indicated that the results showed trends typical of other projects. However, a set of five measurements at one location may not be statistically significant to make an appropriate interpretation of the overall results, especially considering the relatively infrequent positives in the results. Due to the low bacteria levels, further sampling was not performed. The frequency of positive results is the most important parameter when ranking sites with respect to the contribution of a particular host to the contamination.

Alley Creek LTCP Sampling

To supplement the water quality sampling information that is available from DEP and DOHMH, a sampling program was conducted during the development of this LTCP. This sampling was targeted at developing a better understanding of the spatial variability of the water quality trends within Little Neck Bay especially in the vicinity of DMA Beach. An array of sampling locations, as shown on Figure 2-30, was developed to fill in the areas between the DEP and DOHMH sampling locations. Samples were collected at these locations in both dry and wet weather in November and December 2012. The emphasis of the sampling program was on bacteria indicators although data were developed for other water quality indicators such as DO.

As noted previously in Section 2.1.c.2, MST samples were also collected at DMA Beach. The results obtained did not provide a conclusive determination of the most likely source of the bacteria sampled for the reasons presented in that earlier discussion.

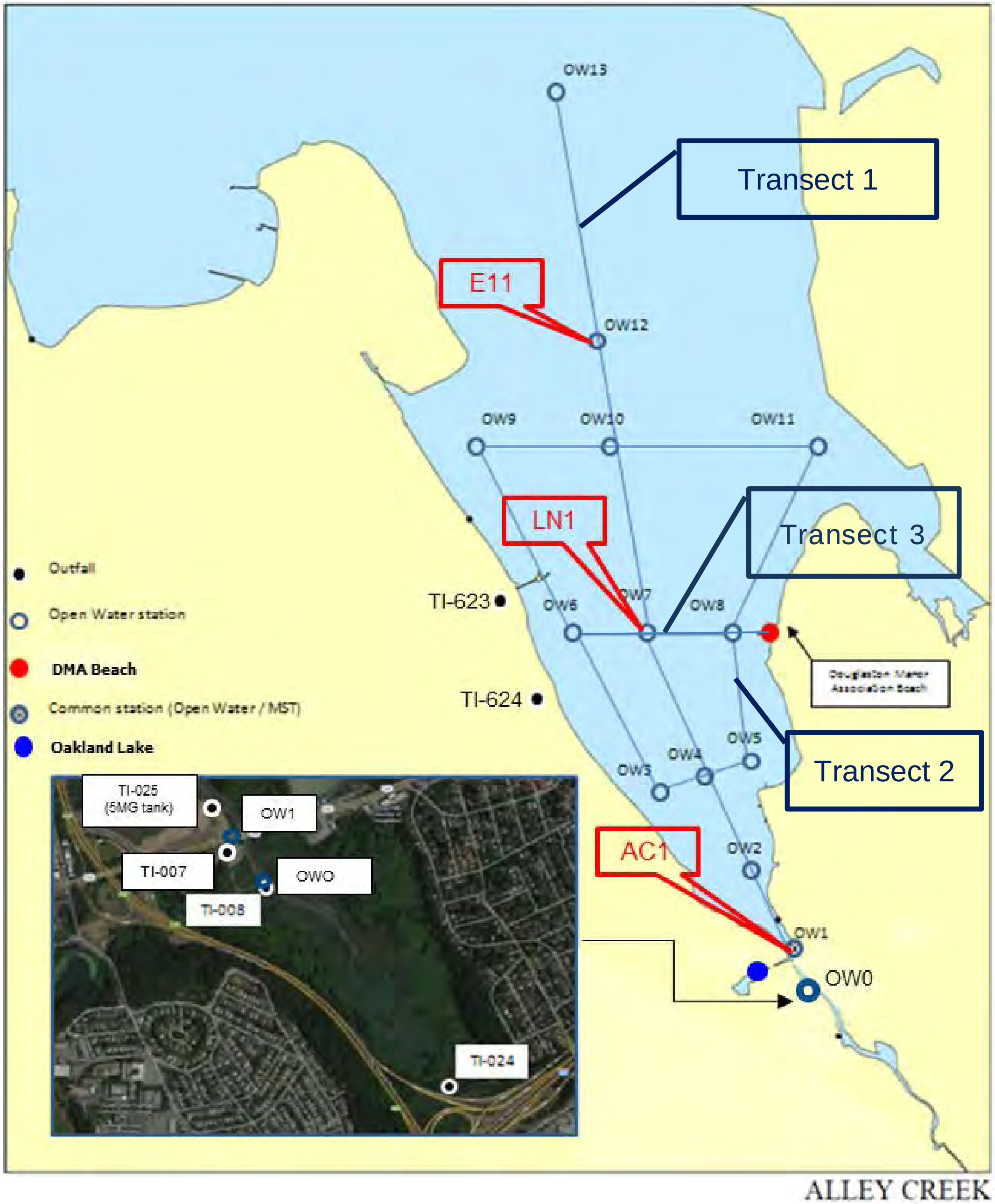


Figure 2-30. 2012 Intensive Sampling and HSM Locations

The results of this sampling effort are provided in Figures 2-31 and 2-32 for enterococci and fecal coliform in wet weather, and Figures 2-33 and 2-34 present these results for dry weather. As shown in Figures 2-31 and 2-32, there appears to be a gradient of bacteria from Alley Creek to the center portion of Little Neck Bay along the Bay centerline (Stations OW2, OW4 and OW7), along the eastern shoreline (Stations OW2, OW5 and OW8), and along the western shoreline (Stations OW2, OW3 and OW6). That gradient has the elevated bacteria concentrations at the locations in Alley Creek, and they decrease from the Creek towards the Upper East River. Locations further removed from Alley Creek (Stations OW9 through OW13) seem to have bacteria concentrations that are almost equal, and appear to be more related to

East River sources then they are related to Alley Creek sources. The lack of a relationship between the values at these outer stations and the inner stations indicates that the bacteria concentrations at these locations are likely associated with other sources of bacteria to the system that are impacting the greater East River and western Long Island Sound.

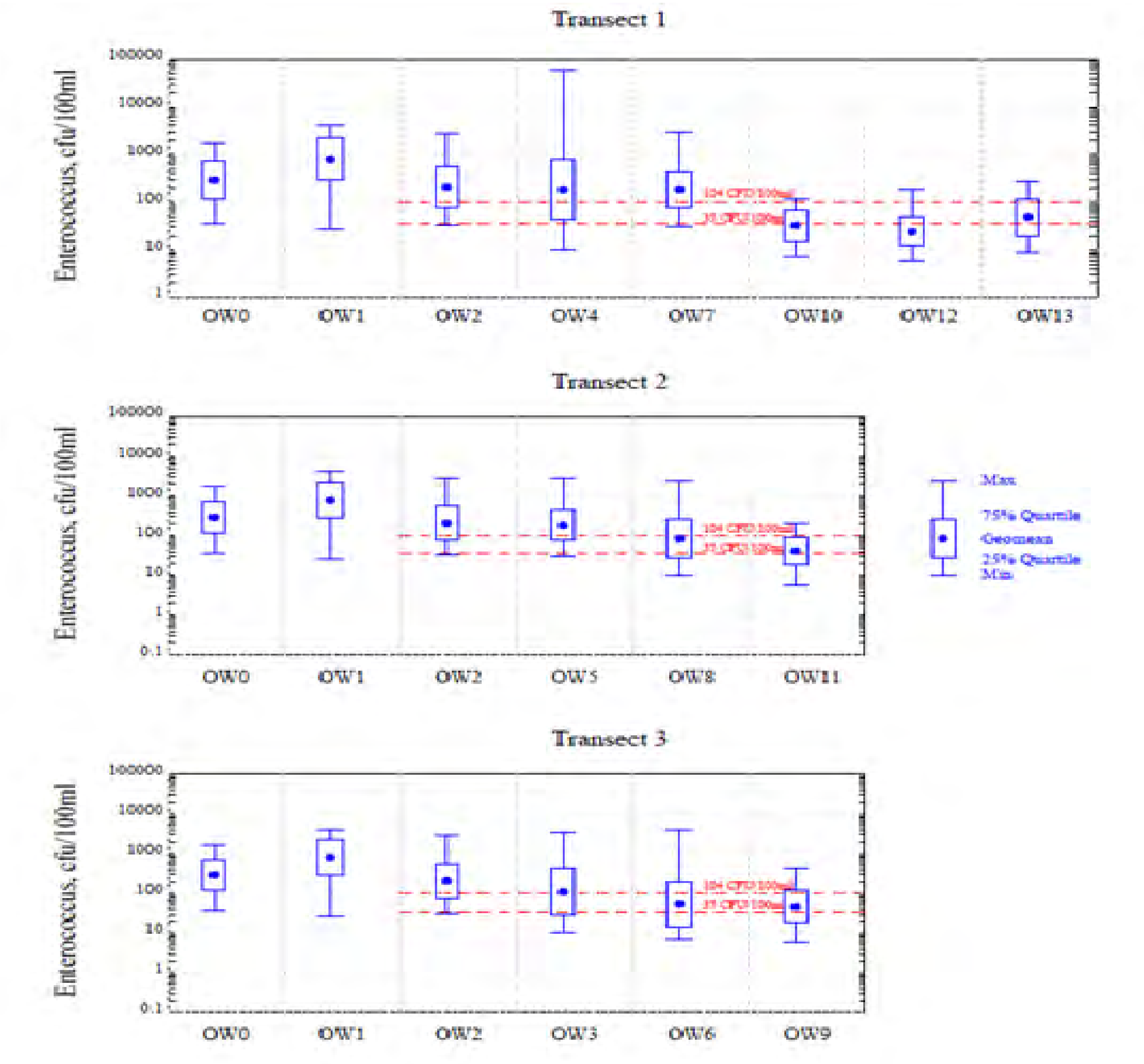


Figure 2-31. FSAP Wet Weather Enterococci Concentrations

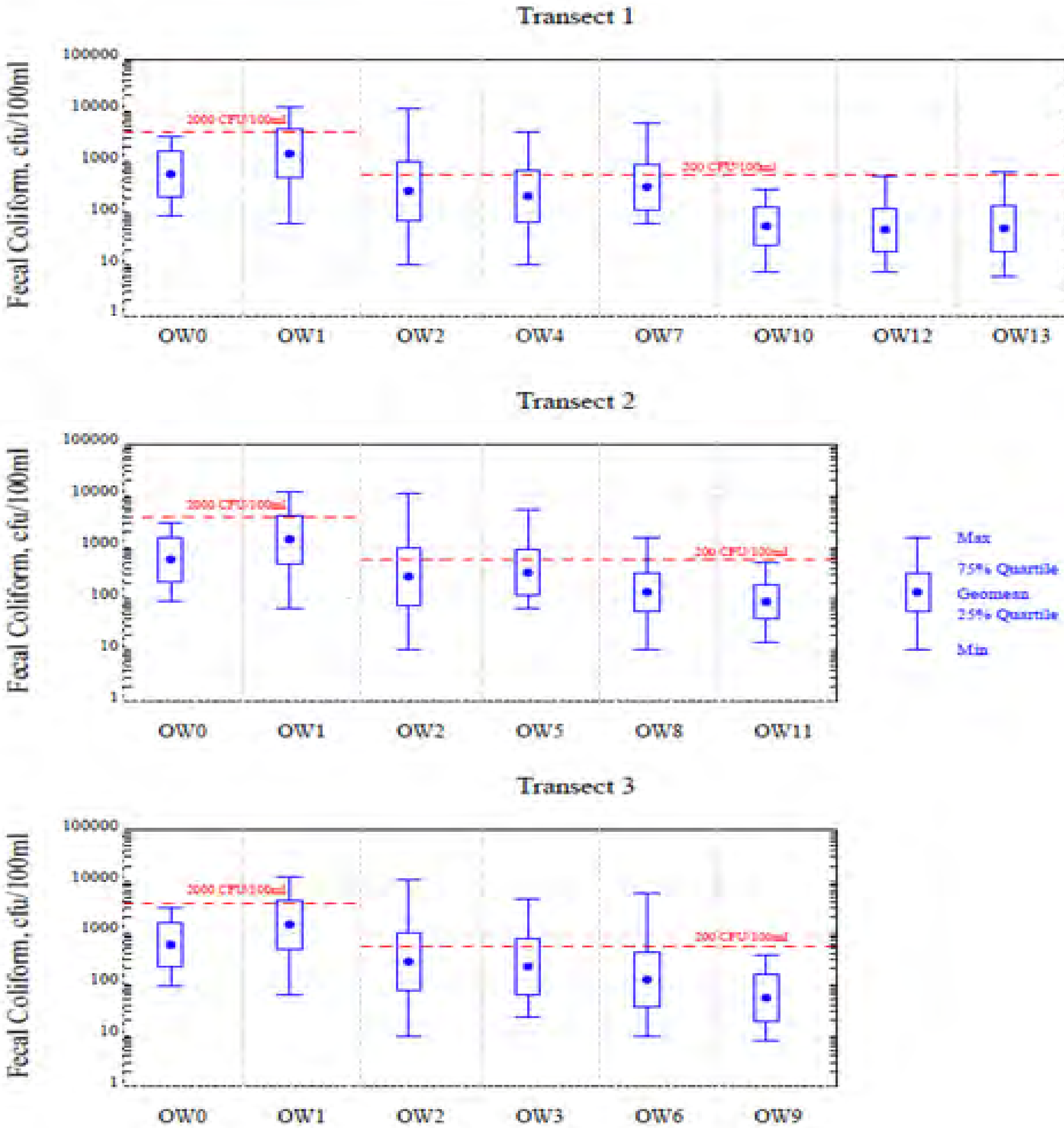


Figure 2-32. FSAP Wet Weather Fecal Coliform Concentrations

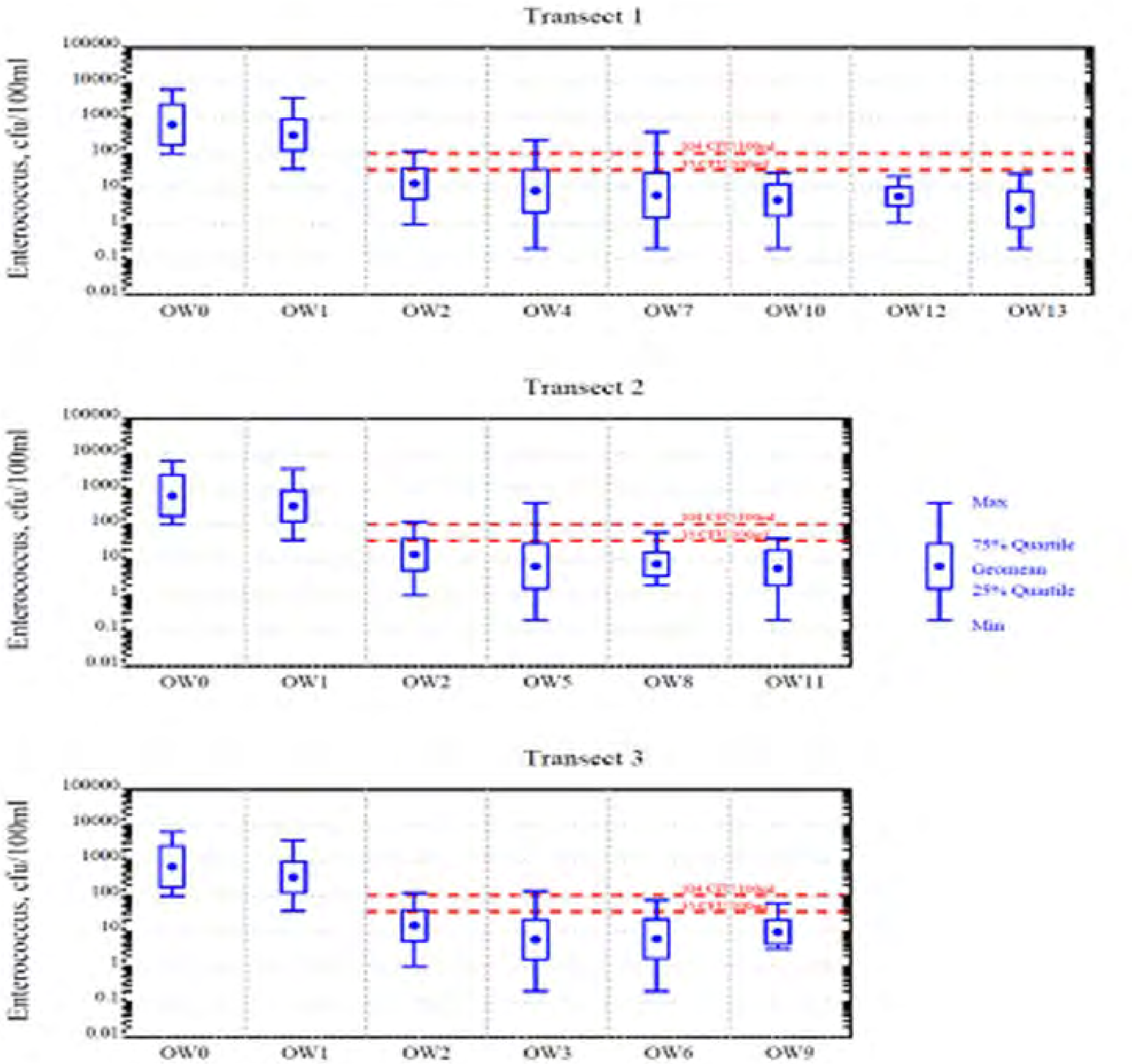


Figure 2-33. FSAP Dry Weather Enterococci Concentrations

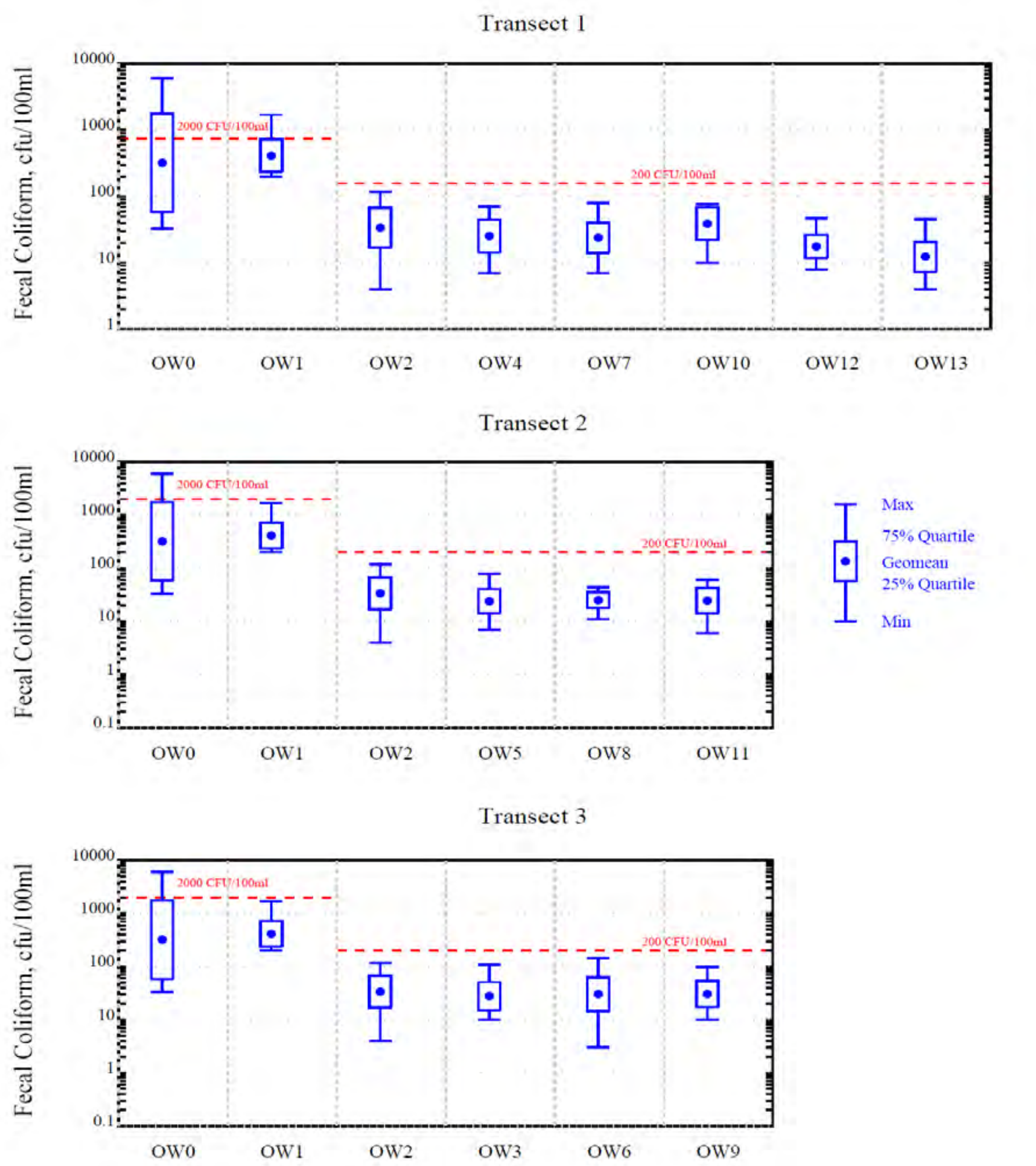


Figure 2-34. FSAP Dry Weather Fecal Coliform Concentrations

Similarly, the concentrations of bacteria at the DMA Beach shoreline that appear on Transect 3 (Stations OW6, OW7, OW8 and DMA Beach), in close vicinity to Station OW8, are higher in wet weather than the Station OW8 concentrations, suggesting a local source of bacteria in the DMA area.

DO concentrations for the period of 2009 through April 2011 and May 2011 through the end of 2012 for Alley Creek and Little Neck Bay areas summarized in Figure 2-35. The figure shows the surface DO concentrations in the upper panel and the bottom level DO concentrations in the lower panel. For the Alley Creek sampling locations (Station AC1), there is only a single DO reading taken (mid-depth), which is displayed in the upper panel. DO concentrations are as shown as the period mean, the 25th percentile and 75th percentile concentrations, as well as the period minimum and maximum values.

Although there are some slight difference in the Bay samples between the surface and bottom, it does not appear that the Bay is stratified with respect to DO. The Bay also appears to be fairly uniform with respect to DO, with the inner location at Station LN1 and the outer Station E11 having very similar DO concentrations.

These data indicate that about 58 percent of the measured DO concentrations in the Bay at Station LN1 are greater than the Class SA chronic criteria of 4.8 mg/L, and 89 percent of the measured samples have DO concentrations greater than the 3.0 mg/L acute criteria, prior to May 2011. After May 2011, these values increase to 75 percent of the measurements being greater than 4.8 mg/L, and 100 percent of the measurements being greater than 3.0 mg/L. Further out into the Bay at Station E11, these data indicate that about 84 percent of the measured DO concentrations are greater than the chronic criteria of 4.8 mg/L, and 98 percent of the measured samples have DO concentrations greater than 3.0 mg/L, prior to May 2011. After May 2011, these values change to 73 percent of the measurements being greater than 4.8 mg/L, and 99 percent of the measurements being greater than 3.0 mg/L. It should be noted that the ERTM results confirmed that the low DO concentrations in Little Neck Bay are, in part, associated with the hypoxia and nutrient enrichment in western Long Island Sound, and are not a result of CSO or stormwater sources.

DO concentrations at Station AC1 are more limited, and prior to May 2011, all the data show concentrations greater than 4.0 mg/L. After May 2011, only 68 percent of the measurements were found to be greater than 4.0 mg/L.

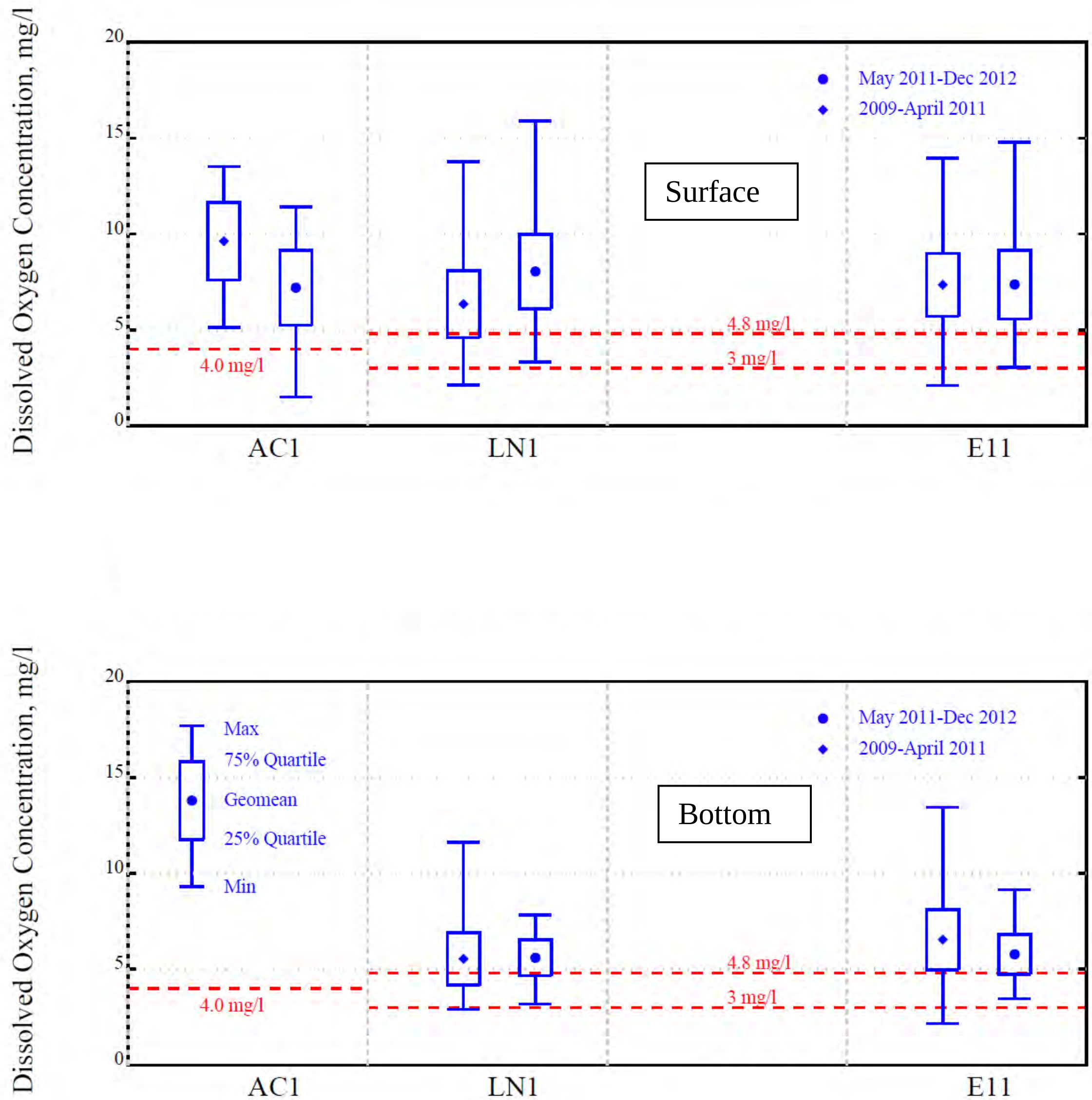


Figure 2-35. Dissolved Oxygen Concentrations

3.0 CSO BEST MANAGEMENT PRACTICES

The SPDES permits for all 14 WWTPs in New York City require DEP to report annually on the progress of the following 13 CSO BMPs:

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

These BMPs are equivalent to the Nine Minimum Controls (NMCs) required under the EPA National Combined Sewer Overflow Policy, which were developed by the EPA to represent BMPs that would serve as technology-based CSO controls. They were intended to be "determined on a best professional judgment basis by the NPDES permitting authority", and to be best available technology-based controls that could be implemented within two years by permittees. 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 may accomplish the goals of the NMCs (EPA 1995a, 1995b). A comparison of the EPA's NMCs to the 13 SPDES BMPs is as shown in Table 3-1.

This section is currently based on the practices summarized in the 2013 Best Management Practices Annual Report.

Table 3-1. Comparison of EPA Nine Minimum Controls Compared with SPDES Permit BMPs

EPA Nine Minimum Controls	SPDES Permit Best Management Practices
NMC 1: Proper Operation 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 System Replacement BMP 9: Combined Sewer Extension BMP 10: Sewer Connection & 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
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 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 Floatable and Settleable Solids
NMC 7: Pollution Prevention to Reduce Contaminants in CSOs	BMP 6: Industrial Pretreatment BMP 7: Control of Floatable and Settleable Solids BMP 12: Control of Runoff
NMC 8: Public Notification	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

EPA Nine Minimum Controls	SPDES Permit Best Management Practices
	BMP 7: Control of Floatable and Settleable Solids

This section presents brief summaries of each BMP and its respective relationship to the federal NMCs. In general, the BMPs address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO and reduce contaminants in the combined sewer system (CSS), thereby reducing water quality impacts.

3.1 Collection System Maintenance and Inspection Program

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer Systems and 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 maximization of flow to the WWTP can be ensured. Specific components of this BMP include:

- Inspection and maintenance of CSO tide gates;
- Telemetering of regulators;
- Reporting of regulator telemetry results;
- Recording and reporting of 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 the performance of cleaning and flushing to remove and prevent solids deposition within the collection system, as well as an evaluation of hydraulic capacity, so that regulators and weirs can be adjusted to maximize the use of system capacity for CSO storage, thereby reducing the amount of overflow. DEP provides general information in the BMP Annual Report, describing the status of Citywide SCADA, regulators, tide gates, interceptors, in-line storage projects, and collection system inspections and cleaning.

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 WWTP operating targets established by the SPDES permits regarding the ability of the WWTP to receive and treat minimum flows during wet weather. The WWTP must be physically capable of receiving a minimum of two times design dry weather flow (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 Wet Weather Operating Plan (WWOP) required in BMP 4.

All of the City's WWTPs are physically capable of receiving a minimum of twice their permit-rated design flow through primary treatment and disinfection per their DEC-approved Wet Weather Operating Plans. The maximum flow that can reach a particular WWTP, however, 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. DEPs operations staff are trained as to 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, as per Section VIII (3) and (4) of the SPDES permits. Analyses presented in the 2013 BMP report indicate that DEP's WWTPs generally complied with this BMP during 2013.

On May 8, 2014, DEC and DEP entered into an administrative consent order that includes an enforceable compliance schedule to ensure that DEP maximizes flow to and through the WWTP during wet weather events

3.4 Wet Weather Operating Plan

To maximize treatment during wet weather events, WWOPs were developed for each WWTP drainage area, in accordance with the DEC publication entitled, *Wet Weather Operations and Wet Weather Operating Plan Development for Wastewater Treatment Plants*. 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 BNR processes, if required.

This BMP addresses NMC 1 (Proper Operation 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). The Tallman Island WWTP WWOP, which includes the Alley Creek CSO Tank WWOP, was approved by DEC in September 2011.

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 flow event be promptly abated and reported to DEC within 24 hours. A written report must follow within 14 days and contain information per SPDES permit requirements. The status of the shoreline survey, the Dry Weather Discharge Investigation report, and a summary of the total bypasses from the treatment and collection system are provided in the BMP Annual Report.

Dry weather overflows from the CSS are prohibited, and it has always been a DEP goal to eliminate dry weather bypasses. An examination of the data for regulators, pump stations and WWTPs revealed that there were no dry weather bypasses to Alley Creek or Little Neck Bay during 2013. That being said, some instream monitoring data collected by DEP showed the potential for a bypass in 2013, but to date DEP has been unable to determine the cause and in late 2013 and early 2014 the instream data no longer show evidence of this potential bypass.

Although dry weather discharges were found in the Tallman Island WWTP drainage area, they were located in storm sewers. Some were corrected and one is still being tracked down (see Section 2.0). Illicit connections to the storm sewer system are not part of the CSO BMP reporting but something that DEP continually tracks down as appropriate. In the Tallman Island sewershed, there was one bypass reported at the Clearview pump station due to electrical equipment problems, and there were two bypasses at the WWTP. As noted above, none of these bypasses impacted Alley Creek or Little Neck Bay.

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 Programs to Reduce Contaminants in CSOs); 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 (SIUs) tributary to CSOs, this BMP addresses the maximization of persistent toxics treatment from industrial sources upstream of CSOs. Specific components of this BMP include:

- Consideration of CSOs in the calculation of local limits for indirect discharges of toxic pollutants;
- Scheduled discharge during conditions of non-CSO, if appropriate for batch discharges of industrial wastewater;
- Analysis of system capacity to maximize delivery of industrial wastewater to the WWTP, especially for continuous discharges;
- Exclusion of non-contact cooling water from the CSS 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 service areas.

Since 2000, the average total industrial metals loading to NYC WWTPs has been declining. As described in the 2013 BMP Annual Report, the average total metals discharged by all regulated industries to the WWTPs was 13.9 lb/day, and the total amount of metals discharged by regulated industrial users remained very low. Applying the same percentage of CSO bypass (1.5 percent) from the CSO report to the current data, it appears that, on average, less than 0.2 lb/day of total metals from regulated industries bypasses to CSOs in 2013 (DEP, 2013a).

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 Programs to Reduce Contaminants in CSOs), 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 scheduled to ensure proper operation of basins.

- Catch Basin Retrofitting: By upgrading basins with obsolete designs to contemporary designs with appropriate street litter capture capability; this program is intended to increase the control of floatable and settleable solids, citywide.

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

- Institutional, Regulatory, and Public Education: Recommendations for alternative City programs and an implementation schedule that will 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 System and CSOs), requiring all combined sewer replacements to be approved by the New York State Department of Health (DOH) 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. The BMP Annual Report describes the general citywide plan, and addresses specific projects occurring in the reporting year. There are no reported projects for the Tallman Island WWTP service area in the Best Management Practices 2013 Annual Report.

3.9 Combined Sewer Extension

To minimize storm water entering the CSS, 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.

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and CSOs). A brief status report is provided in the Best Management Practices 2013 Annual Report, although no combined sewer extension projects were completed during that year.

3.10 Sewer Connection & Extension Prohibitions

This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and CSOs), and prohibits sewer connections and extensions that would exacerbate recurrent instances of either sewer back-up or manhole overflows. Wastewater connections to the CSS downstream of the last regulator or diversion chamber are also prohibited. The BMP Annual Report contains a brief status report for this BMP and provides details pertaining to chronic sewer back-up and manhole overflow notifications submitted to DEC when necessary. For the calendar year 2013, conditions did not require DEP to prohibit additional sewer connections or sewer extensions.

3.11 Septage and Hauled Waste

The discharge or release of septage or hauled waste upstream of a CSO (e.g., scavenger waste) is prohibited under this BMP. Scavenger wastes may only be discharged at designated manholes that never drain into a CSO, and only with a valid permit. This BMP addresses NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and CSOs). The 2008 CSO 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 service areas. The program remained unchanged through the 2013 CSO BMP Annual report.

3.12 Control of Runoff

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

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) as well as NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and CSOs) 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. DEP has posted signs on all CSO outfalls in the Alley Creek drainage area and hosts a web site that notifies the public is there is a potential for elevated pathogen levels associated with wet weather events (www.nyc.gov/html/dep/html/harborwater/nyc_waterbody_advisory_program.shtml). In accordance with this BMP the NYC Department of Health and Mental Hygiene implements and manages a notification program that provides the public with information about bathing water quality. Accordingly, the Wet Weather Advisories, Pollution Advisories and Closures are tabulated for all NYC public and private beaches. Douglas Manor Association (DMA) Beach, a private beach on Little Neck Bay, was closed a total of 63 days and had Pollution Advisories posted for a further 34 days during the 2013 bathing season due to localized elevated bacteria levels.

3.14 Characterization and Monitoring

Previous studies have characterized and described the Tallman Island WWTP collection system and the water quality for Alley Creek and Little Neck Bay (see Chapters 3 and 4 of the Alley Creek and Little Neck Bay WWFP, 2009). Additional data were collected and are analyzed in this LTCP (see Section 2.2). Continuing monitoring occurs under a variety of DEP initiatives, such as floatables monitoring programs and DEP Harbor Monitoring Survey, and is reported in the BMP Annual Reports under SPDES BMPs 1, 5, 6 and 7, as described above.

3.15 CSO BMP Report Summaries

In accordance with the SPDES permit requirements, annual reports summarizing the citywide implementation of the 13 BMPs described above are submitted to DEC. DEP has submitted eleven annual reports to date, covering calendar years 2003 through 2013. Typical reports are divided into 13 sections – one for each of the BMPs in the SPDES permits. Each section of the annual reports 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 Facility Planning for Alley Creek and Little Neck Bay began in 1984, predating the current LTCP program. Evaluation of the Tallman Island WWTP collection system showed that outfall TI-008 was the primary source of CSO discharges to these waterbodies. To address CSO discharges, DEP developed and modified several facility plans including the 2003 Alley Creek CSO Facility Plan (URS, 2003) and the 2009 Alley Creek and Little Neck Bay WWFP. The 2003 Alley Creek CSO Facility Plan proposed to reduce discharges from TI-008 by diverting the flow through a new chamber to a new 5 MG Alley Creek CSO Retention Facility and its new CSO outfall TI-025, located in Alley Creek. The 2009 WWFP recommended retaining the proposed Alley Creek CSO Facilities Plan, the Alley Creek CSO Retention Facility and outfall TI-025. A summary of the grey infrastructure elements of the WWFP are listed as follows:

- New diversion chamber (Chamber 6) to direct CSO to the new Alley Creek CSO Retention Facility and to provide tank bypass to TI-008
- New CSO Retention Facility (5 MG Alley Creek CSO Retention Facility)
- New 1,475 foot long multi-barrel outfall sewer extending to a new outfall on Alley Creek (TI-025)
- New CSO outfall, TI-025, for discharge from the Alley Creek CSO Retention Facility
- Fixed baffle at TI-025 for floatables retention, minimizing release of floatables to Alley Creek
- Expansion and upgrade of Old Douglaston PS to empty the storage tank and convey flow to Tallman Island WWTP after the end of the storm

As described in Section 3.0, a major sewer upgrade project is underway to construct an extension of Whitestone Interceptor. This project is aimed at improving the wet weather conveyance capacity to the Tallman Island WWTP. When this project is completed, it is projected to significantly increase the hours that the Tallman Island WWTP will reach 2xDDWF.

In addition to the grey infrastructure listed above, as part of the construction of the Alley Creek CSO Retention Facility and new outfall, DEP made a significant environmental investment in the creation of a large wet wetland adjacent to the outfall. In 2011, DEP completed a $20M environmental restoration of the northern portion of Alley Pond Park in Bayside, Queens. DEP constructed 8 acres of tidal wetlands and 8 acres of native coastal grassland and shrubland habitat in an effort to reduce CSOs in Alley Creek and Little Neck Bay. The new plantings and restored wetlands absorb stormwater runoff, reducing the amount that enters the receiving waters as well as parts of the sewer system during wet weather events.

Currently, DEP is about to embark on additional work in the area that will be undertaken as part of the resolution of an enforcement matter brought by NYS for the applicable violation(s). The proposed project involves the restoration of approximately 1 to 1.5 acres of wetlands, located near the 8 acres of tidal wetland restoration described above. This Environmental Benefit Project would provide additional ecological benefit by removing anthropogenic fill material to re-establish tidal flushing and proper hydrology to support a tidal wetland community. The work includes the removal of fill material, disposal, new planting soil, plants, a goose exclusion fence and a 2-year maintenance and guarantee period at a cost of just under $1M.

4.1.a Completed Projects

The five million gallon Alley Creek CSO Retention Facility and Old Douglaston Pump Station were operational as of March 11, 2011. DEP certified construction completion of the facilities on June 27, 2011. DEC accepted DEP's certification of completion on September 25, 2012.

4.1.b Ongoing Projects

There are no additional grey infrastructure projects currently in progress.

4.1.c Planned Projects

No additional grey infrastructure projects are planned for the Alley Creek and Little Neck Bay watersheds with the exception of recommendations that are made in this LTCP as described later.

4.2 Other Water Quality Improvement Measures Recommended in Facility Plans (dredging, floatables, aeration)

There are no other water quality improvement measures planned for Alley Creek and Little Neck Bay.

4.3 Post-Construction Monitoring

The Post-Construction Compliance Monitoring (PCM) Program is integral to the optimization of the Alley Creek CSO Retention Facility, providing data for model validation, feedback to facility operations, and an assessment metric for the effectiveness of the facility. Each year's data set is being compiled and evaluated to refine the understanding of the interaction between Alley Creek, Little Neck Bay, and the Alley Creek CSO Retention Facility, with the ultimate goal of fully attaining compliance with current WQS or for supporting a UAA to revise such standards. The PCM program contains three basic components:

1. The Alley Creek CSO Retention Facility WWOP as appended to Tallman Island WWTP WWOP;
2. Receiving water data collection in Alley Creek and Little Neck Bay using existing DEP Harbor Survey Monitoring (HSM) locations and adding stations as necessary; and
3. Modeling of the associated receiving waters to characterize water quality.

The details provided herein are limited to the Alley Creek and Little Neck Bay PCM and may be modified as the citywide program takes form. Any further modifications to the PCM program will be submitted to DEC for review and approval.

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

While Section 2.0 discussed water quality data within Alley Creek and Little Neck Bay in general, this section describes PCM sampling specifically for the purpose of quantifying the effects of the Alley Creek CSO Retention Facility. PCM for the Alley Creek CSO Retention Facility consists of sample collection at one location in Alley Creek (HSM Station AC1) and one location in Little Neck Bay (HSM Station LN1). In addition, as DEP collected water quality samples at two other locations in the immediate vicinity of the PCM location AC1 (LTCP FSAP Stations OW0 and OW1), and in Little Neck Bay south of HSM Station LN1 (Station OW2) are also presented herein. Figure 4-1 presents a map of the PCM and HSM Stations E8, EW11, LN1, and AC1 as well as the sampling locations OW0 and OW1 which were sampled as part of this LTCP.

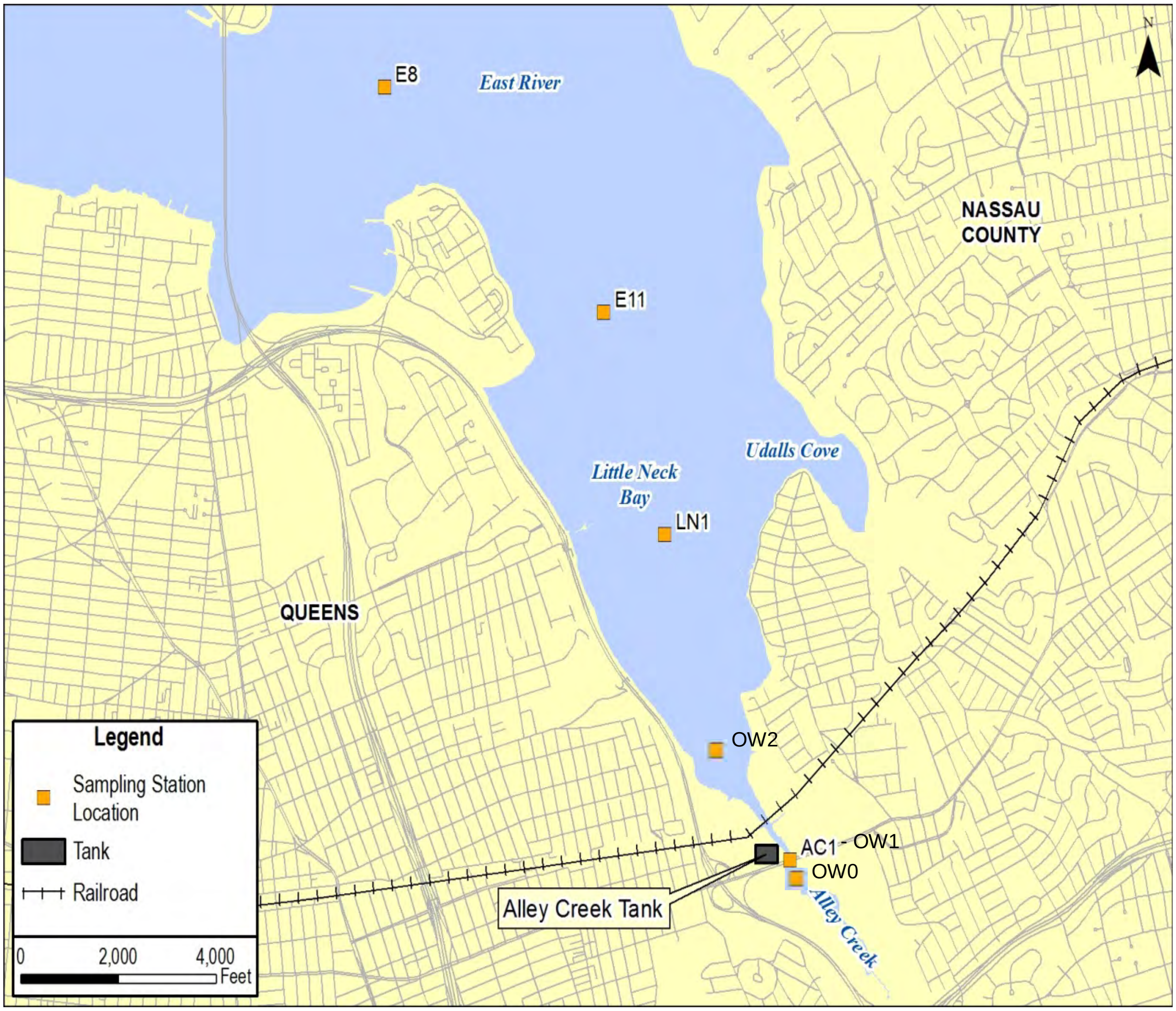


Figure 4-1. Alley Creek CSO Retention Facility
Location of Facility and Water-Quality Monitoring Stations

The Alley Creek and Little Neck Bay monitoring results that were associated with the DEP PCM program for 2012 are presented on Figures 4-2 through 4-5. The results are shown for dissolved oxygen (DO), fecal coliform bacteria, enterococci bacteria, and total suspended solids (TSS), respectively. Additional data collected at Station AC1 between 2009 and 2014 is contained in Section 2.2.a.6. The top panel of each figure shows the daily rainfall for 2012 (at LaGuardia Airport). The second presents the reported overflow volumes discharged from the Alley Creek CSO Retention Facility during the same period. The third panel shows the measured constituent concentrations for the stations in Alley Creek, and the bottom panel shows the measured constituent concentrations for the stations in Little Neck Bay. Applicable NYS WQS (Class I for Alley Creek and SB for Little Neck Bay) are also shown.

On Figure 4-2, the DO-monitoring results for Alley Creek show occasional excursions below the criterion (4.0 mg/L) from July through October. In Little Neck Bay, DO values are generally above the chronic criterion of 4.8 mg/L, one measurement in June and three sampling events during mid-August to early-September. All DO measurements in Little Neck Bay were above the acute criterion of 3.0 mg/L.

Figure 4-3 presents the fecal coliform concentrations measured in Alley Creek and Little Neck Bay. Discrete values in Alley Creek are often above the GM criterion (2,000 cfu/100mL), with the majority of high concentrations occurring during the summer. In Little Neck Bay, most discrete measurements are below the GM criterion of 200 cfu/100mL. The few discrete measurements above the criterion occurred during August, November and December.

As shown on Figure 4-4, enterococci levels in Alley Creek are generally elevated with many values above 1,000 cfu/100mL and some values above 10,000 cfu/100mL. In Little Neck Bay, most samples are less than 10 cfu/100mL but there are a number of values above 35 cfu/100mL during November and December. It should be noted that in the middle of 2013, pathogen concentrations in Alley Creek, increased for reasons that DEP has not been able to resolve despite extensive investigations. It returned to pre-elevated levels later in the year.

Figure 4-5 presents the results of TSS sampling in Alley Creek and Little Neck Bay. TSS concentrations in Alley Creek are quite variable with some measurements greater than 150 mg/L. Measured TSS concentrations are generally below 25 mg/L in Little Neck Bay with a few higher values during August and September.

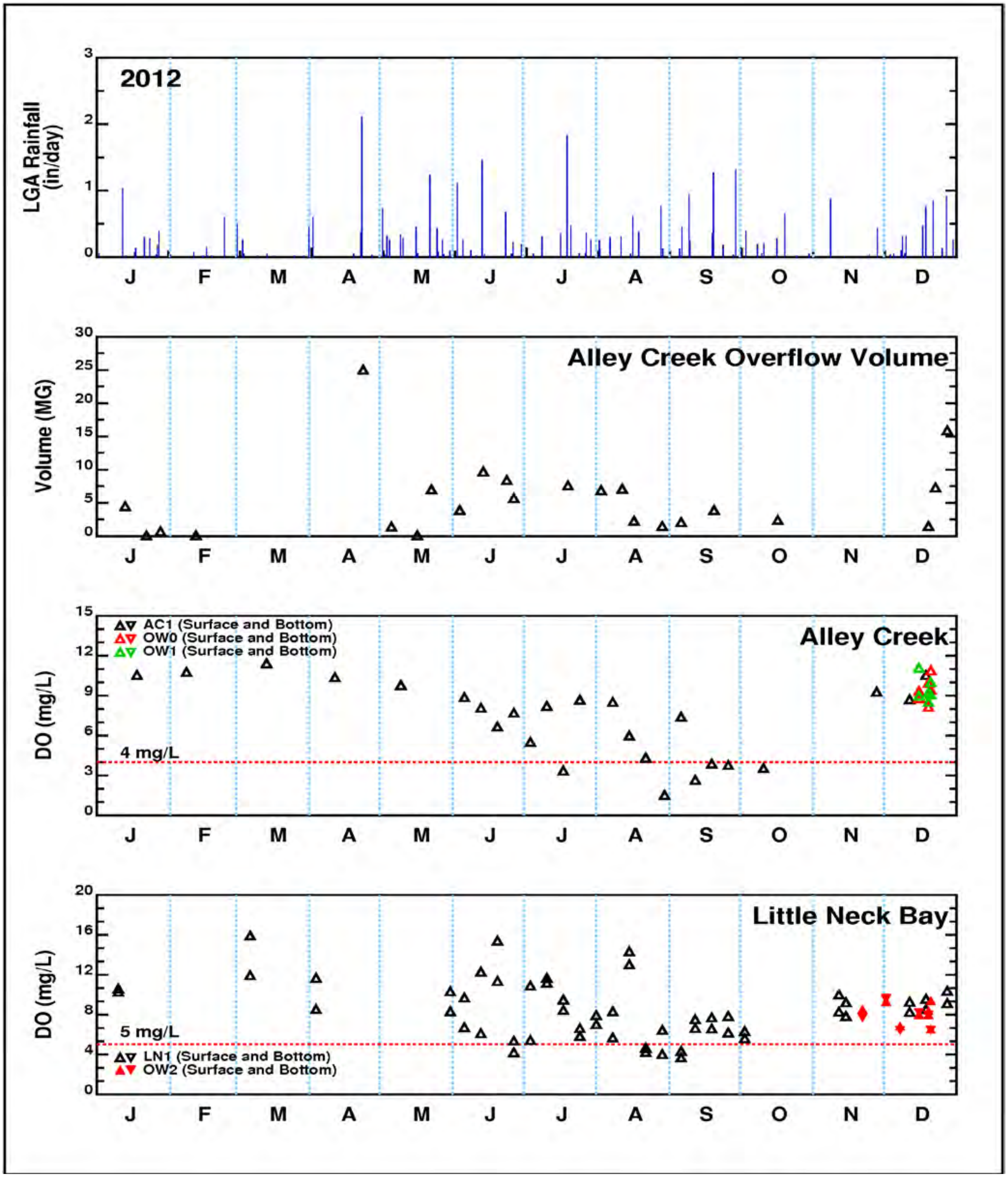


Figure 4-2. Alley Creek CSO Retention Facility
Ambient Water-Quality Monitoring – Dissolved Oxygen, 2012

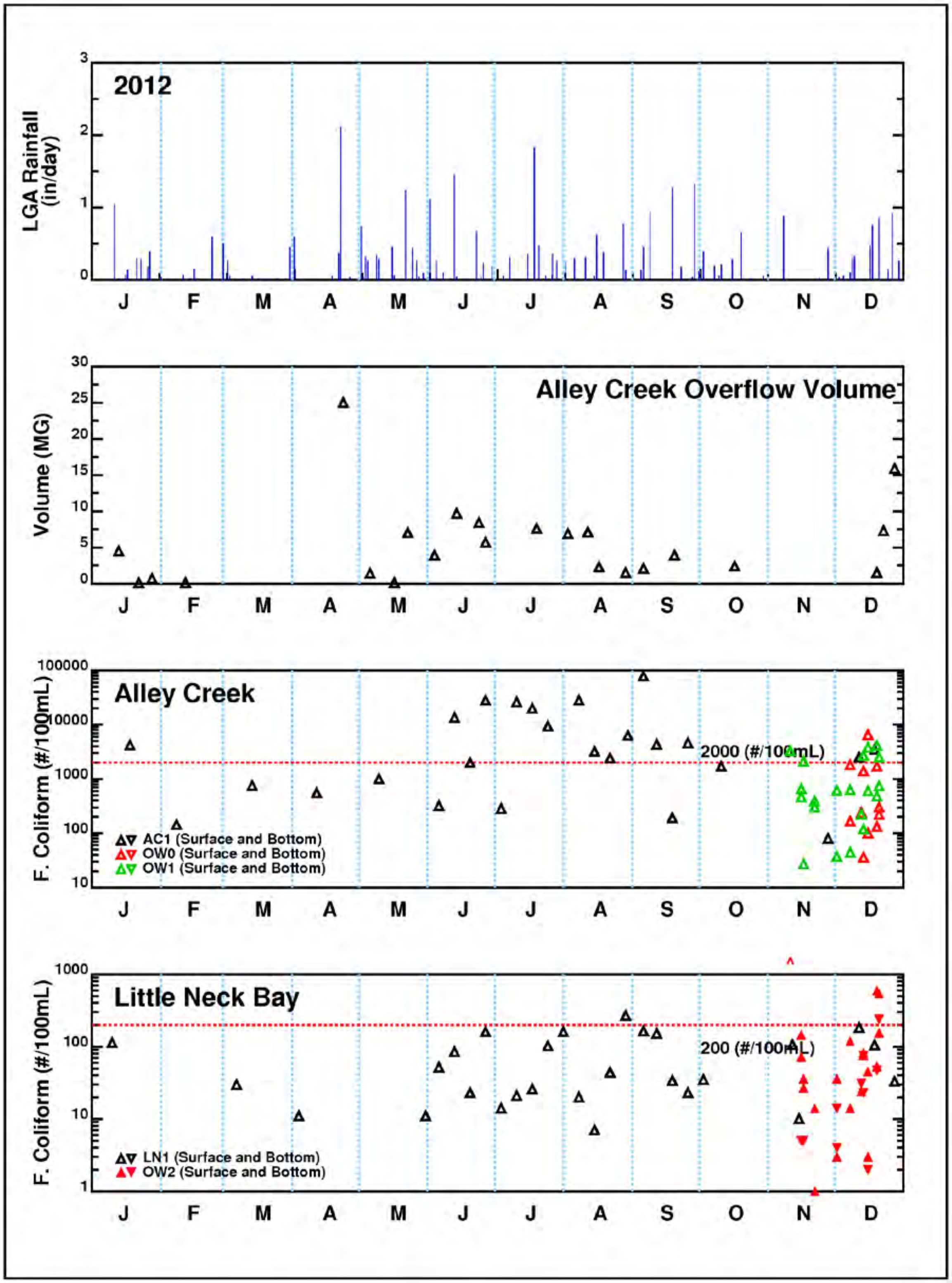


Figure 4-3. Alley Creek CSO Retention Facility - Ambient Water-Quality Monitoring – Fecal Coliform Bacteria, 2012

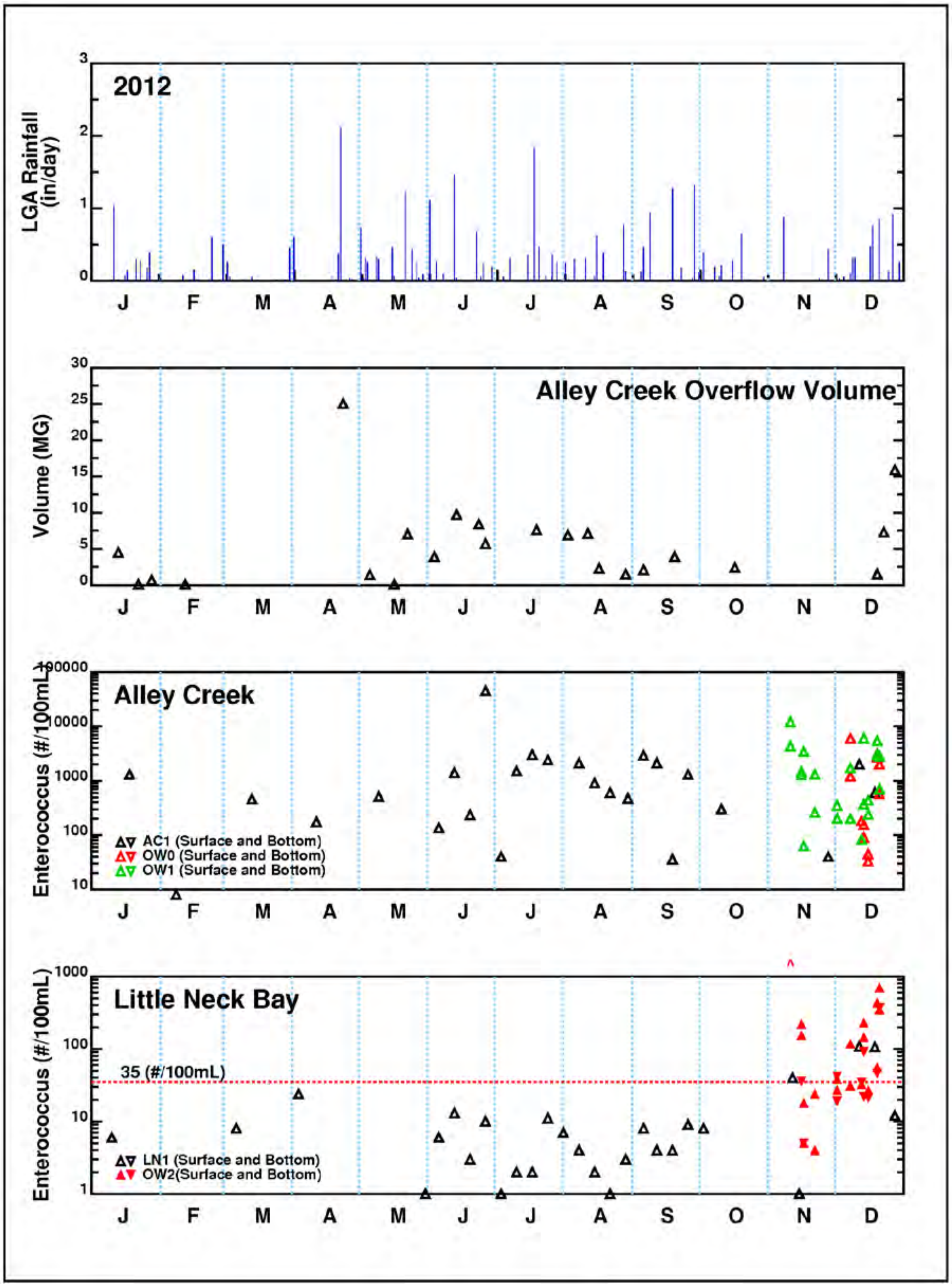


Figure 4-4. Alley Creek CSO Retention Facility
Ambient Water-Quality Monitoring – Enterococci Bacteria, 2012

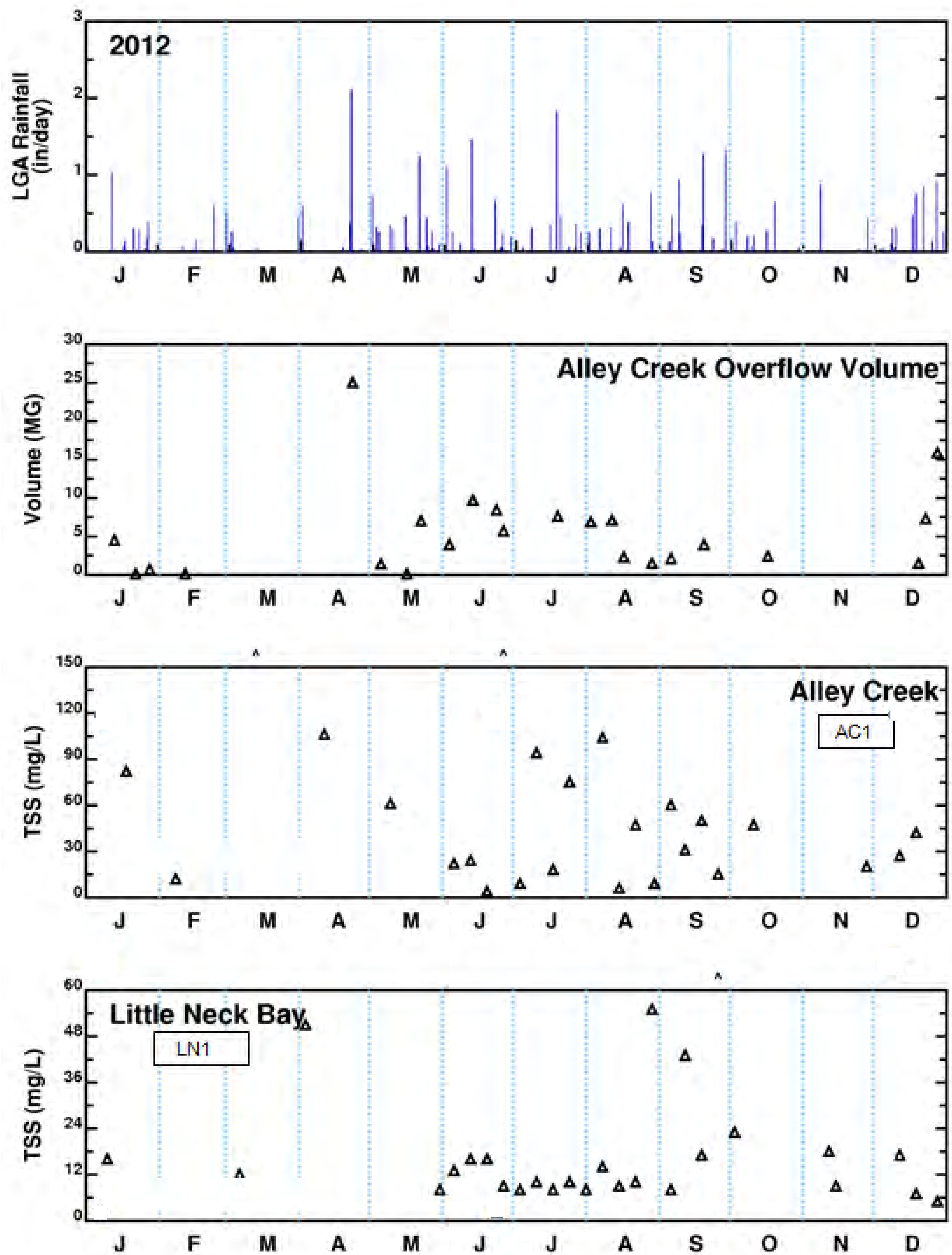


Figure 4-5. Alley Creek CSO Retention Facility Ambient Water-Quality Monitoring – TSS, 2012

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

Flow Monitoring

DEP monitors water-surface elevations and pumped volumes over time at the Alley Creek CSO Retention Facility. Based on these measurements and other information, DEP estimates daily inflow and infiltration (I/I), wet weather retained volume, pump-back volume, and overflow periods and overflow volumes. Table 4-1 presents a summary of the monthly overflow estimates, respectively.

Analysis[1] of rainfall data recorded at the National Weather Service's LaGuardia Airport (LGA) gauge indicates that, with 125 storms totaling 36.18 inches, 2012 had less total rainfall and smaller storms than the long-term average in NYC. Monthly rainfall ranged from 0.91 to 5.06 inches. Analysis of the rainfall that fell on the Alley Creek watershed was developed using NOAA archived rainfall radar imagery and calibration techniques that compare the radar imagery to land-based point rainfall gauges including the LaGuardia gauge. This technique resulted in a total rainfall of 41.7 inches with monthly totals ranging from 1.37 inches to 7.2 inches.

As summarized in Table 4-1, the Alley Creek CSO Retention Facility monitoring data showed that the facility overflowed during 25 storm events in 2012, or about twice a month, meaning that the Alley Creek CSO Retention Facility fully captured flow generated during the other 100 rainfall events (80 percent). DEP reported that the tank retained a total of 256 MG of combined sewage for pump-back and treatment at the Tallman Island WWTP. A more detailed discussion of this information, including detailed discharge monitoring reports and methodology, can be found in the *Post Construction Compliance Monitoring and CSO Retention Facility Overflow Summary for Calendar Year 2012* (August 2013, NYC DEP). DEP recently completed a CSO Flow Monitoring Pilot Study, one of the primary goals of which is to better understand the monitoring technology's ability to measure CSO overflows from regulator structures as well as at CSO storage facilities. The current measurement approach employed at the Alley Creek CSO Retention Facility relies on depth measurements and weir equations that have inherent weaknesses due to the use of indirect measurements of overflows. One result of the CSO Flow Monitoring Pilot Study was that direct flow measurements were found to be the most accurate, and that they are more accurate than the depth and weir calculation approach used previously. DEP is currently working with the firm that completed the pilot program to improve this measurement approach and apply what is learned in the pilot study to more accurately measure the overflow from the Alley Creek CSO Retention Facility. The plan is to inspect the Alley Creek CSO Retention Facility and evaluate improved monitoring approaches.

Table 4-1 also summarizes the model-predicted overflow volumes for each month in 2012. The model-calculated and monitoring-based estimates of monthly retained volume follow the same trends, but model-calculated overflow volumes are consistently higher than the monitoring-based volumes. These modeling results differ and result in a larger overflow volume than those results provided in the *Post Construction Compliance Monitoring (PCM) and CSO Retention Facility Overflow Summary for Calendar Year 2012* (August 2013, NYC DEP) report in the following ways:

- Rainfall Radar Data – Rainfall radar data was used in this LTCP to get a better representation of the rainfall on the watershed. These data resulted in a total of 41.6 inches of rainfall on the

[1] Analyses of rainfall statistics performed using EPA's SYNOP program using minimum inter-event time of 4 hours and minimum storm threshold of zero inches.

watershed, which is 15 percent greater than the 36.2 inches of rainfall observed at the LaGuardia Airport point rain gauge used in the PCM reporting.

- IW model Improvements – Recent inspections of the regulators and a review of the sewer system connectivity resulted in a number of updates to the IW model that were not available when the PCM report was completed.

- Alley Creek CSO Retention Facility Operations – During 2012, a valve that opens to drain the retained water was discovered to intermittently stick in a closed position, while giving the operators a signal that it was open. Upon discovering this faulty valve, it was repaired and the facility operated as designed. This faulty value resulted in a certain number of storms occurring before the tank was completely drained down. The IW modeling contained herein was conducted with this knowledge which was not discovered when the PCM report was developed. As such, results provided to the DEC in the PCM report underestimated overflows from the facility.

As discussed above, DEP will be evaluating its measurement approach for flows retained and discharged from the Alley Creek CSO Retention Facility and determining whether improved methods of monitoring overflows are feasible. When this evaluation is completed, DEP will have information on the accuracy of flow measurements made to date. Thus, variations between model-predicted performance and monitored data are expected.

Table 4-1. Alley Creek CSO Retention Facility - Estimated Monthly Retained Volume and Overflows, 2012

Month	Rain at LGA (in)	Rain Near Alley Creek Tank – from rainfall radar (in)	Monthly Recorded Data	IW Model Data
			Overflow Volume (MG)	Overflow Volume (MG)
January	2.51	2.41	5	2
February	1.43	1.37	0	0
March	0.91	1.27	0	0
April	3.18	3.67	25	25
May	4.67	5.34	9	15
June	4.19	7.2	28	54
July	3.77	3.11	8	9
August	2.95	4.02	18	19
September	5.06	3.81	6	9
October	1.86	3.12	2	4
November	1.35	1.68	0	4
December	4.30	4.70	25	14
Totals:	36.18	41.70	125	157
Number of Overflow Events			24	22
(1) From Monthly Operation Reports				

Even during dry weather, the Alley Creek CSO Retention Facility collects a combination of I/I from the influent sewers and seepage. To quantify the I/I, DEP tracks the water-surface elevations in the Alley Creek CSO Retention Facility cells and estimates[2] the overall I/I on a daily and monthly basis. The I/I estimates are summarized in the Alley Creek CSO Retention Facility monthly operating reports. In 2012, the average I/I rate was 0.55 MGD, with monthly average values ranging from 0.00 to 0.91 MGD and a highest daily estimate of 4.4 MGD (following a large storm event). The Alley Creek CSO Retention Facility is operated such that I/I volumes are pumped back to the WWTP prior to anticipated wet weather events to maximize the rate of capture of combined sewage at the facility. This minor inflow is contained in the IW modeling assumptions.

Effluent Quality

Because Alley Creek CSO Retention Facility is an unmanned facility, overflow effluent quality was not measured during 2012. Limited effluent quality data were, however, sampled as part of the development

[2] For the Alley Creek CSO Retention Facility, DEP's monthly reporting indicates that "Estimated I&I Volume on dry weather days= pump back volume + change in the total retained volume (7:00 a.m.-7:00 a.m.)".

of the LTCP in an attempt to better quantify the loadings to the Alley Creek CSO Retention Facility. Overflow events were sampled in both January and December 2013. Samples were collected from the effluent during one event and from the influent during two other events. The influent samples were collected as a surrogate to the effluent because the Alley Creek CSO Retention Facility overflows so infrequently. Bacteria data from the sampling events was presented in Section 2.0.

4.3.c Assessment of Performance Criteria

The 2003 CSO Abatement Facilities Plan for Alley Creek set forth the basis of design for the Alley Creek CSO Retention Facility. Specifically, the design objectives were to meet, to the extent feasible and practical, DEC Class I water quality criteria for DO and for total and fecal coliform bacteria in Alley Creek by reducing the volume of CSOs discharged. At the time of the Facilities Plan, the primary parameter of concern was DO, as CSO control alone was not deemed cost effective in meeting the bacteria criteria. The Facilities Plan also contained as a secondary objective, independent of CSO abatement, the alleviation of surcharging and street flooding in the area upstream of outfall TI-008. This LTCP focuses on meeting existing WQS and assesses the possibility of attainment of primary contact WQ criteria (see Section 6.0).

CSO Storage

Analysis[3] of the 2012 rainfall records at LGA indicates that there were 125 rainfall events, of which 25 had more than 0.46 inches of rain (the approximate design storm for the Alley Creek CSO Retention Facility). Based on this information and the operational records in the monthly operating reports, the Alley Creek CSO Retention Facility fully captured combined sewage generated in 100 of the 125 storms, or 80 percent of all storms in 2012. Review of the rainfall radar data record showed higher rainfalls over the watershed. Rainfall from this data set exceeded the 0.46 inch threshold a total of 28 times in 2012. In total there were 131 occurrences when rainfall exceeded 0.01 inches (trace). Using this data set, the tank would have fully captured 81 percent of all storms.

Rainfall at LGA exceeded the 0.46-inch design capacity of the Alley Creek CSO Retention Facility during 15 of these 25 overflow events, and inspection of the rainfall radar information indicates that 0.46 inches or more likely occurred over the service area during another four overflow events (January 21, February 11, August 10, and October 15). Another six overflow events occurred during storms that began within 36 hours of prior rainfall so that there was insufficient time for the tank to fully dewater. As a result, the Alley Creek CSO Retention Facility met the CSO-storage metric for 124 of the 125 storms in 2012.

IW modeling performed for the 2012 period indicates that, compared to the pre-tank condition, operation of the Alley Creek CSO Retention Facility reduced the number of CSO events 82 percent, which is above the annual-average target of 70 percent established in the DEC approved Alley Creek CSO Retention Facility Plan (June 2003). In terms of CSO volume, operation of the Alley Creek CSO Retention Facility is calculated to have reduced discharge volume by 63 percent from what would have been 418 MG/yr to 157 MG/yr (Table 4-1), which exceeds the annual-average volume reduction target of 54 percent.

CSO Pollutant-Load Reduction

[3] *Statistic developed using EPA's SYNOP program with 4-hour inter-event time and 0 inch minimum storm threshold.*

Based upon the IW modeling analyses, the operation of the Alley Creek CSO Retention Facility reduced 2012 pollutant loadings of both TSS and BOD by 73 percent, versus the condition before the Alley Creek CSO Retention Facility was constructed, thereby exceeding the annual-average target reductions of 70 and 66 percent, respectively, developed in the approved Alley Creek CSO Facility Plan.

As noted above, the Alley Creek CSO Retention Facility fully captured the influent flow and associated floatables for 100 of the 131 rainfall events in 2012. During the 25 events in 2012 when the Alley Creek CSO Retention Facility did overflow, floatables removal at the facility was enhanced by means of an underflow baffle. Further, the retained floatables were removed either at trash racks at the Old Douglaston PS or the influent screens at the Tallman Island WWTP. Overall, the Alley Creek CSO Retention Facility reduced overflow floatables substantially.

5.0 GREEN INFRASTRUCTURE

By controlling stormwater runoff through the processes of infiltration, evapotranspiration, and capture and reuse (rainwater harvesting), green infrastructure (GI) can help keep stormwater out of combined sewer systems or detain its entry into the system and allowing more flow to reach the WWTPs.[1] As noted in Section 1.0, through its 2010 GI Plan DEP has embraced this approach and the use of GI has been incorporated into the 2012 Order on Consent with DEC.

The 2012 Order on Consent requires DEP to manage the equivalent of stormwater generated by one-inch of runoff from 10 percent of impervious surfaces in combined sewer areas citywide by 2030. In the near term, DEP is required to implement the equivalent GI to attain an application rate of 1.5 percent by December 31, 2015. If this 1.5 percent goal is not met, DEP must certify that it has encumbered $187M for implementation of GI and submit a contingency plan to DEC by June 20, 2016. Over the next 20 years, DEP is planning for $2.4 billion in public and private funding for targeted GI installations and $2.9 billion in cost-effective grey infrastructure upgrades in order to reduce CSOs and gain the co-benefits of GI. An overview of the DEP GI Plan, including citywide and watershed-based implementation, is described below. Pursuant to the Order on Consent, DEP also publishes a "Green Infrastructure Annual Report" every April 30th in order to provide updates on all GI related efforts and the status of implementation. These reports can be found at:
http://www.nyc.gov/html/dep/html/stormwater/nyc_green_infrastructure_plan.shtml

5.1 NYC Green Infrastructure Plan (GI Plan)

The City published the GI Plan in September 2010, which presents an alternative approach to improving water quality through additional CSO volume reductions by outlining strategies to implement decentralized stormwater source controls. DEP estimated that a hybrid green/grey infrastructure approach would reduce CSO volume by an additional 3.8 billion gallons per year (BGY), or approximately 2 BGY more than implementing an all-grey strategy. In addition to its primary objective, enhancing water quality in NYC, the GI Plan will yield co-benefits, which include but are not limited to, improved air quality, urban heat island mitigation, carbon sequestration, increased shade, and increased urban habitat for pollinators and wildlife.

In January 2011, DEP created the Office of Green Infrastructure (OGI) to implement the goals of the GI Plan, and budgeted over $730M including $5M in Environmental Benefits Project (EBP) funds,[2] through FY 2023 for GI projects. OGI, and in partnership with other DEP bureaus and City agencies, is leading the design and construction of GI practices that divert stormwater away from the sewers and direct it to areas where it can be infiltrated, evapotranspired, stored, or detained. OGI has developed standard designs for right-of-way bioswales (ROWBs) and designed other projects that include pervious pavement, rain gardens, and green and blue roofs. The Areawide Strategy and other implementation activities initiated by OGI to achieve the milestones in the 2012 Order on Consent are described in more detail below and in the most recent Green Infrastructure Annual Report available on the DEP website.

[1] U.S. EPA, March 2014. Greening CSO Plans: Planning and Modeling Green Infrastructure for Combined Sewer Overflow (CSO) Control.
[2] EBP projects are undertaken in connection with the settlement of an enforcement action taken by New York State and DEC for violations of New York State law and DEC regulations.

5.2 City-wide Coordination and Implementation

To meet the GI goals of the 2012 Order on Consent, DEP has been identifying Priority CSO Tributary Areas ("Priority Areas") as shown in Figure 5-1, for GI implementation based on several criteria. DEP looks closely at the annual CSO volume, frequency of CSO events, as well as outfalls that may be affected by WWFPs or other system improvements in the future. DEP also notes outfalls in close proximity to existing and future public access locations. DEP will continue to review and expand the number of Priority Areas to ensure sufficient GI implementation toward the Order milestones.

The identification of Priority Areas enables DEP to focus resources on specific outfall tributary areas, analyze potential opportunities, saturate these areas with GI as much as possible, and to achieve efficiencies in design and construction. This Areawide strategy is made possible by DEP's standardized designs and procedures which enable systematic implementation of GI. It also provides an opportunity to measure and evaluate the CSO-related benefits of area-wide GI implementation at the outfall level.

DEP utilizes the Areawide strategy for all public property retrofits as well, as described in more detail in the Green Infrastructure Annual Reports. DEP works directly with its partner agencies on retrofit projects at public schools, public housing, parkland, and other city-owned property within the Priority 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.

In addition to DEP managing its own design and construction contracts through OGI and the Bureau of Engineering Design & Construction (BEDC), the NYC Economic Development Corporation (EDC), Department of Parks and Recreation (DPR), and Department of Design and Construction (DDC) also manage several of these areawide contracts on behalf of DEP.

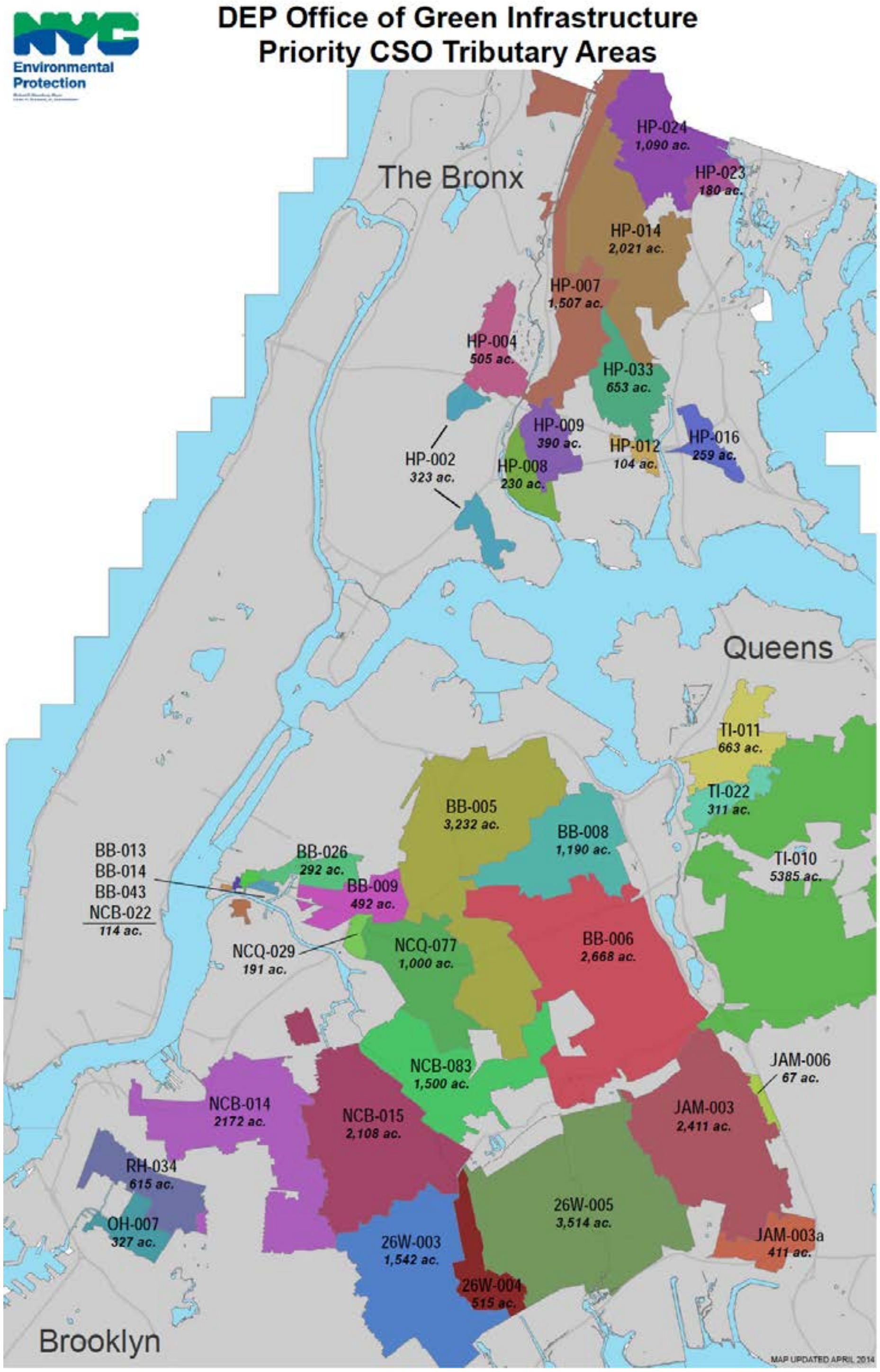


Figure 5-1. Priority CSO Tributary Areas for GI Implementation

5.2.a Community Engagement

Stakeholder participation is a critical success factor for the effective implementation 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 presentations and coordination with elected officials, community boards, stormwater advocacy organizations, green job non-profits, environmental justice organizations, schools and universities, Citizens Advisory Committees (CACs), civic organizations, and other City agencies.

As part of the DEP website update in 2013, DEP reorganized and added new content to the GI pages at www.nyc.gov/dep/greeninfrastructure. Users can now easily access more information on the GI Program, including the types of GI practices most often employed, and DEP's research and development program. Users can also view a map of the Priority CSO Tributary Areas to learn if GI is coming to their neighborhood.

DEP also created an educational video on the GI Program. Posted to DEP's YouTube page, the video gives a brief explanation of the environmental challenges caused by combined sewer overflows while featuring GI technologies such as green roofs, rain gardens and permeable pavers. The video is available at DEP's YouTube page.

In order to provide more information about the GI Program, DEP developed an informational brochure that describes the site-selection and construction process for projects in the right-of-way. The brochure also includes frequently asked questions and answers, and explains the co-benefits of GI.

In addition, DEP will distribute door hangers to notify abutting property owners in advance of GI right–of-way construction projects. During construction in each contract area, DEP and its partner agencies will provide construction liaison staff to be present during construction and to distribute the door hangers to the adjacent property owners. The contact information for the construction liaison will be affixed to the door hangers for owners' use if they find a need to alert the City to a problem during construction.

DEP continues to make presentations to elected officials and their staff, community boards, and other civic and environmental organizations about the GI Program, upcoming construction schedules, and final GI locations as an ongoing part of its outreach efforts. DEP's Quarterly Progress Reports posted on the DEP LTCP webpage also report on the community engagement activities that take place on a quarterly basis.

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

The Green Infrastructure Annual Report contains the most up to date information on completed projects and can be found on the DEP website. Reporting on completed projects on a citywide and watershed basis by April 30th is required as part of the report documents, and the reports are posted on DEP's GI 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, based on information collected and assessed for demonstration projects and on pilot monitoring results. In particular, accumulated information will be used to develop a GI performance metrics report by 2016, relating the benefits of CSO reduction to the amount of constructed GI.

Pilot Monitoring Program:

DEP initiated site selection and design of its Pilot Monitoring Program in 2009. The program has provided DEP opportunities to test different designs and monitoring techniques, to determine the most cost-effective, adaptable, and efficient GI strategies that can be implemented citywide. Specifically, the pilot monitoring has aimed to assess the effectiveness of each of the evaluated source controls at reducing the volume and/or rate of stormwater runoff from the drainage area through measuring quantitative aspects (e.g., source control inflow and outflow rates) as well as qualitative issues (e.g., maintenance requirements, appearance and community perception). Since 2010, more than thirty pilot GI source controls, or GI installations, have been constructed and monitored as part of the pilot program for GI. These practices include right-of-way GI such as enhanced tree pits, rooftop practices like blue roofs and green roofs, subsurface detention systems with open bottoms for infiltration, porous pavement, and bioretention facilities. Data collection began in 2010 and 2011, as construction for each of the 25 monitoring sites was completed. Pilot Monitoring Program results are currently being used to improve GI designs and validate modeling methods and parameters. Results are further discussed in Section 5.3.e.

Neighborhood Demonstration Area Projects:

The Order outlines design, construction, and monitoring milestones for three Neighborhood Demonstration Area Projects (“Demonstration Projects”), which DEP met in 2012 and 2013. DEP has completed construction of GI within a total of 63 acres of tributary area in the Newtown Creek, Hutchinson River and Jamaica Bay CSO tributary areas, and is currently monitoring these practices to study the benefits of GI application on a neighborhood scale and from a variety of techniques. The Demonstration Projects will culminate in the submission of the Post-Construction Monitoring (PCM) report in August 2014. These results will be incorporated into the 2016 Performance Metrics report, which will model the CSO reductions facilitated by GI projects. Pre-construction monitoring for all three Demonstration Projects started in fall 2011, and post-construction monitoring continued throughout 2013.

Construction of ROWBs as part of the Hutchinson River Green Infrastructure Demonstration Area was completed in April 2013 by DPR. There were 22 ROWBs installed within the 24 acre tributary area, and the design and construction costs were approximately $545,000. In the 23 acre Jamaica Bay Green Infrastructure Demonstration Area, DEP completed 31 right-of-way GI installations in 2012 and the permeable pavement retrofit projects at NYCHA’s Seth Low Houses in 2013. The total design and construction costs were approximately $1.3M. In the 16 acre Newtown Creek Green Infrastructure Demonstration Area, DEP constructed 19 ROWBs, two rain gardens, and a subsurface storm chamber system on the site of NYCHA’s Hope Gardens Houses. The projects were completed in 2013, and costs were approximately $1.4M for design and construction. For more information on the Neighborhood Demonstration Areas, see the *2012 Green Infrastructure Annual Report.*

While DEP’s Pilot Monitoring Program provides performance data for individual GI installations, the Neighborhood Demonstration Area Projects will provide standardized methods and information for calculating, tracking, and reporting derived CSO volume reductions and other benefits associated with both multiple installations within a concentrated area and common connections to the sewer system. The data collected from each of the three demonstration areas will enhance DEP’s understanding of the benefits of GI relative to runoff control and CSO reduction. The results will then be extrapolated for calculating and modeling water quality and cost-benefit information on a citywide and waterbody basis.

5.3.b Public Projects

See Section 5.2, "Citywide Coordination and Implementation" in the Green Infrastructure Annual Reports for up-to-date information on completed projects**.**

5.3.c Performance Standard for New Development

DEP's stormwater performance standard (Stormwater Rule), enables the City to manage stormwater runoff more effectively, and to reduce the rate of runoff into the City's combined sewer systems from new development or major site expansions. Promulgated in July 2012,[3] the Stormwater Rule requires any new house or site connections to the City's combined sewer system to comply with stricter stormwater release rates, effectively requiring greater onsite detention. DEP's companion document, Guidelines for the Design and Construction of Stormwater Management Systems*,*[4] assists the development community and licensed professionals in the selection, planning, design, and construction of onsite source controls that comply with the Stormwater Rule.

The Stormwater Rule applies to new development or the alteration of an existing development in combined sewer areas of the City. For a new development, the stormwater release rate[5] is required to be 0.25 cfs or 10 percent of the drainage plan allowable flow, whichever is greater.[6] If the allowable flow is less than 0.25 cfs, then the stormwater release rate shall be equal to the allowable flow. For alterations, the stormwater release rate for the altered area will be directly proportional to the ratio of the altered area to the total site area, and no new points of discharge are permitted.[7]

5.3.d Other Private Projects (Grant Program)

Green Infrastructure Grant Program

Since its introduction in 2011, the Grant Program has sought to strengthen public-private partnerships and public engagement in regard to the design, construction and maintenance of GI. The Order requires the Green Infrastructure Grant Program to commit $3M of Environmental Benefits Program (EBP) funds[8] to projects by 2015.

All private property owners served by combined sewers in NYC are eligible to apply for a GI grant. Grant funding is provided for the design and construction of projects that will reduce or manage a minimum of one inch of stormwater that falls on the selected properties. If selected, DEP will reimburse up to 100 percent of the design and construction costs for the GI project. Preference is given to projects that are

[3] See Chapter 31 of Title 15 of the Rules of the City of New York Governing House/Site Connections to the Sewer System. (New York City, N.Y., Rules, Tit. 15, § 31)

[4] The Guidelines are available at DEP's website, at http://www.nyc.gov/html/dep/pdf/green_infrastructure/stormwater_guidelines_2012_final.pdf

[5] New York City, N.Y., Rules, Tit. 15, § 31-01(b)

[6] Allowable flow is defined as the storm flow from developments based on existing sewer design criteria that can be released into an existing storm or combined sewer.

[7] New York City, N.Y., Rules, Tit. 15, § 31-03(a)(2)

[8] EBP Projects are undertaken by DEP in connection with the settlement of an enforcement action taken by New York State and the New York State Department of Environmental Conservation for violations of New York State law and DEC regulations.

located in priority watersheds, are cost-effective, provide matching funds or other contributions, and include ancillary environmental and community benefits such as increased shade, decreased energy use for cooling buildings, increased awareness about stormwater management, and green jobs development.

See the Green Infrastructure Annual Report for up-to-date information on the Green Infrastructure Grant Program.

Green Roof Tax Abatement

The NYC Green Roof Tax Abatement (GRTA) has provided a fiscal incentive to install green roofs in private property since 2008. DEP has worked with the Mayor's Office of Long Term Planning and Sustainability (OLTPS), DOB, the Department of Finance (DOF) and the Office of Management and Budget (OMB), as well as 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 to improve the next version, and help increase the number of green roofs in the City. Additionally, DEP funded an outreach position to educate applicants and assist them through the abatement process, to help facilitate application approval and respond to issues that may arise.

The tax abatement includes an increase to the value of the abatement from $4.50 to $5.23 per square foot, to continue offsetting construction costs by roughly the same value as the original tax abatement. And given that rooftop farms tend to be larger than typical green roofs (generally around one acre in size), the abatement value cap was also increased from $100,000 to $200,000 to allow such 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 the New York City Department of Finance on a pro rata basis. See the Green Infrastructure Annual Report for up to date information on the Green Roof Tax Abatement.

5.3.e Projected vs. Monitoring Results

Pilot Monitoring Program

As mentioned above, more than 30 pilot GI source controls, or GI installations, have been constructed and monitored as part of the pilot program for GI. Quantitative monitoring parameters included:

- Water quantity: inflow, outflow, infiltration, soil moisture and stage.
- Weather: evaporation, rainfall, wind, relative humidity and solar radiation.
- Water/soil quality: diesel/gas, nutrients, TSS, TOC, salts, metals, soil sampling and infiltrated water sampling.

Quantitative monitoring was conducted primarily through remote monitoring equipment, such as pressure transducer water level loggers in conjunction with weirs or flumes to measure flows, monitoring aspects of source control performance at a 5-minute interval. On-site testing and calibration efforts included infiltration tests and metered discharges, to calibrate flow monitoring equipment and assess the validity of assumptions used in pilot performance analysis.

Monitoring efforts focused on the functionality of the GI and their impact on runoff rates and volumes, along with water and soil quality and typical maintenance requirements. Monitoring activities largely involved remote monitoring equipment that measured water level or flows at a regular interval, supporting analysis of numerous storms throughout at each site.

Monitoring analyses through 2013 demonstrated that all pilot GI types are providing effective stormwater management, particularly for storms with depths of one inch or less. All GI practices have provided benefits for storms greater than one inch, with specific impacts varying based upon location and the type. In many cases, bioretention practices have fully retained the volume of one inch storms they receive.

Monitoring activities will be discontinued at several sites that have multiple years of performance data and have exhibited relatively consistent performance throughout that period. Further monitoring at these locations may be resumed in the future to further examine long-term performance. Monitoring data for these locations is included in the *2012 Pilot Monitoring Report*. In addition, up to date information on the Pilot Monitoring Program can be found in the 2013 Green Infrastructure Annual Report.

Neighborhood Demonstration Area Projects

As previously discussed, the objective of DEP's Neighborhood Demonstration Area Projects is to maximize management of stormwater runoff near where it is generated, and then monitor the reduction of combined sewage originating from the drainage sub-basins. The development of these demonstration projects will culminate in the submission of a PCM Report in August 2014, and ultimately in a 2016 performance metrics report. The 2016 report will relate the benefits of CSO reduction associated with the amount of GI constructed, and detail methods by which DEP will use to calculate the CSO reduction benefits in the future.

The three Neighborhood Demonstration Areas where DEP will test the effectiveness of GI implementation were selected because the existing CSSs were suitable for monitoring flow in a single sewer pipe of a certain size, and are not influenced by surcharging hydraulic conditions. In each of the Demonstration Areas, DEP has identified GI opportunities such as bioswales and stormwater greenstreets in the right-of-way, and on-site detention and retention opportunities on City-owned property.

The combined sewer flow reductions achieved by GI implementation will be monitored through the collection of high quality flow monitoring data at the point at which the combined sewers exit Demonstration Area catchments. Monitoring activities consist of recording flow and depth, using meters placed within key outlet sewers. Data acquisition is continuous, with measurements recorded at 15-minute intervals.

Data analysis will involve a review of changes in pervious and impervious surface coverage between pre- and post-construction conditions, consisting of several elements, including statistical analyses and modeling refinements. The statistical analyses will enable DEP to:

- Determine the overall amount of CSO reduction associated with GI implementation;
- Determine rules of thumb (gallons per acre controlled) for use in scaled-up GI planning and implementation in other (non-demo) areas of the City;
- Determine a representative permeability range for ROWBs infiltration; and
- Utilize monitoring data to inform future ROWB designs.

Project data collected will be used to re-calibrate the IW computer model to the monitored GI flows for both pre- and post-construction conditions. Post-construction performance data will be used to ensure that retention modeling techniques adequately account for the degree of flow reduction within subcatchments with planned GI and equivalent CSO volume reductions.

5.4 Future Green Infrastructure in the Watershed

5.4.a Relationship Between Stormwater Capture and CSO Reduction

CSO reduction and pollutant load reduction through additional stormwater capture in the Alley Creek and Little Neck Bay watersheds can be evaluated using the landside model, developed in IW modeling software, based on the extent of retention and detention practices in combined sewer areas. The extent of retention and detention is configured in terms of a percent of impervious cover where one inch of stormwater is managed through different types of source controls. Retention at different source controls is lumped on a sub-basin or subcatchment level in the landside model, due to their distributed locations within a watershed; this is also due to the fact that the landside model does not include small combined sewers, and cannot model them in a distributed manner. Retention is modeled with the applicable storage and/or infiltration elements. Similarly, the distributed detention locations within a watershed are represented as lumped detention tank, with the applicable storage volume and constricted outlet configured based on allowable peak flows from their respective drainage areas. Modeling methods designed during the development of the GI Plan have been refined over time to better characterize the retention and detention functions.

As reviewed in the existing system configuration, CSO discharges into Alley Creek emanate from outfall TI-025, the effluent chamber of the Alley Creek CSO Retention Facility. The periodic discharges from this outfall include both CSO and stormwater as both are conveyed to the Alley Creek CSO Retention Facility through chamber 6 and diverted to the tank. Therefore, the future GI opportunities will be evaluated in combined and separate areas draining to the tank, to assess the associated reductions in CSOs at TI-025. As discussed in Section 8, two future GI scenarios (10 and 50 percent retention GI) will be evaluated in terms of both CSO volume reduction and pollutant load reductions.

A large volume of stormwater is discharged into Alley Creek and Little Neck Bay from separately sewered drainage areas or direct drainage areas (wetlands, open areas, and parklands). Therefore, GI application in combined or separate areas draining to TI-025 alone would not result in appreciable improvements in water quality of Alley Creek and Little Neck Bay. The 10 percent retention GI application reflects the citywide goal of managing the equivalent of one inch of stormwater generated from 10 percent of impervious surfaces in combined sewer areas by 2030, per the Order. It is important to note, however, that a 50 percent application rate would require the construction of GI projects on public onsite properties as well as private property, since right-of-way opportunities comprise, on average, 30 percent of gross impervious area throughout the City (based on the experience gained by the OGI in the exploration of opportunities for ROWBs). Thus, a 50 percent application rate would be highly difficult to achieve.

5.4.b Opportunities for Cost-Effective CSO Reduction Analysis

Concurrent with the Alley Creek and Little Neck Bay LTCP, DPR's Natural Resources Group (NRG) is preparing the Alley Creek Watershed Plan ("Watershed Plan"), focusing on ecological restoration and stormwater management for the Alley Creek watershed and receiving waterbodies of Little Neck Bay. The development of the Watershed Plan is funded by a New York State Department of State (DOS) grant, with matching funds from New York City. By articulating a vision for the watershed, categorizing impacts and threats to habitat and water quality, and identifying opportunities for restoration, the Watershed Plan is intended to provide a road map for managing and improving ecological resources and maximizing ecological values.

As a first step in developing the Watershed Plan, NRG is characterizing the historic and current land use, ecological communities, and physical and hydrologic conditions of the Alley Creek watershed, by collating existing data and professional and community knowledge, and collecting information from rapid assessments in the field. These field assessments include reconnaissance of the salt marshes, the ephemeral, perennial, and tidal stream reaches, and invasive plant extent in the upland forested areas. Issues identified during the field assessment such as dumping, invasive plants, and erosion, will provide an inventory of potential opportunities for restoration.

As required by DOS, NRG established a Watershed Advisory Committee (WAC), consisting of governmental and non-governmental stakeholders from the watershed, to guide and review the development of the Watershed Plan. Broader community input solicited during a series of public meetings will also be incorporated during Plan development. In addition, to leverage and build on ongoing regional coastal zone restoration efforts, Watershed Plan development is being coordinated with other watershed planning efforts, such as DEP's Alley Creek and Little Neck Bay LTCP and other regional plans, including the Long Island Sound and the NY-NJ Harbor and Estuary Comprehensive Restoration Plans.

In the built landscape of the watershed, a significant component of the Watershed Plan focuses on identifying stormwater management opportunities on DPR's opens spaces, park edges and larger right-of-way opportunities particularly in separately sewered (non-CSO) areas. The goal is to identify several feasible projects for which conceptual designs and costs will be developed, with the ultimate aim of seeking additional funding to support construction. Numeric models will be utilized to assess the potential performance of identified GI opportunities.

In the parkland sections of the watershed, restoration opportunities will be focused on protecting, enhancing and restoring ecological communities and their functions, from forested upland to salt marshes along Little Neck Bay. NRG has reviewed the extent and results of past restoration efforts in the watershed and identified a range of opportunities, from stream channel and riparian corridor vegetation restoration near the headwaters (e.g. along Douglaston Parkway), to vernal pool restoration opportunities in the adjacent upland, closer to the mouth of Alley Creek. Additional opportunities for vegetation community restoration and eliminating inadvertent point source discharges have been flagged in Udall's Cove Park.

Broader ecosystem restoration opportunities will also focus on the management of invasive species and their deleterious effects, such as suppression of natural recruitment of diverse native woody species that help stabilize stream banks. In conjunction with former Mayor Bloomberg's PlaNYC, invasive removal and habitat restoration is currently underway along the eastern shore of Alley Creek, between Northern Boulevard and the Long Island Expressway. Approximately 20 acres of aggressive invasive plant species, such as phragmites, autumn olive, and porcelainberry, are in the process of being controlled and removed. The first phase of replanting with coastal maritime forest species began with a large volunteer event on April 27, 2013, as part of the MillionTreesNYC spring planting day. Contract work will continue in this area until fall of 2015.

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

To meet the incremental citywide GI application rates required by the 2012 on Consent, DEP has developed a watershed prioritization system based on watershed-specific needs. This approach has provided an opportunity to build upon existing data and make informed estimates available; it has also provided DEP with a footprint for ongoing GI implementation.

Watershed-specific implementation rates for GI are estimated based on the best available information from modeling efforts. Specific WWFPs, the Sustainable Stormwater Management Plan, the GI Plan, CSO outfall tiers data, and historic building permit information are all being reviewed to better assess waterbody-specific GI application rates.

The following criteria were applied to compare and prioritize watersheds in order to determine watershed-specific GI application rates:

- WQS
  - Fecal Coliform
  - Total Coliform
  - Dissolved Oxygen
- Cost effective grey investments
  - Planned/constructed grey investments
  - Projected CSO volume reductions
  - Remaining CSO volumes
  - Total capital costs
- The ratio of separate stormwater discharges to CSO discharges
- Preliminary watershed sensitivity to GI in terms of cost per gallon of CSO reduced
- Additional considerations:
  - Background water quality conditions
  - Public concerns and demand for higher uses
  - Site specific limitations (i.e., groundwater, bedrock, soil types, etc.)
  - Presence of high frequency outfalls
  - Eliminated or deferred CSO storage facilities

- o Additional planned CSO controls not captured in WWFPs or 2012 Order on Consent (i.e., high level storm sewers, HLSS)

The overall goal for this prioritization is to distribute GI implementation rates among different priority watersheds, such that the total managed impervious acres will still be achieved in accordance with the 2010 GI Plan, except for the East River and Open Waters.

Green Infrastructure Baseline Application Rate – Alley Creek and Little Neck Bay

Based on the above criteria, the characterization of Alley Creek and Little Neck Bay determined the watershed's individual GI application rate. This particular watershed has one of the smallest total combined sewer impervious areas among the list of managed watersheds, totaling 1,490 acres. This area is significantly controlled by existing CSO facilities and sewer enhancements. Therefore, DEP assumes no investment in GI implementation in the right-of-way or onsite public properties, taking into account water quality with WWFP improvements in place, as well as the potentially more effective allocation of GI resources in other watersheds that can provide more water quality benefits for the same level of implementation.

DEP, however, does expect 45 acres of implemented GI to be managed in onsite private properties in Alley Creek and Little Neck Bay by 2030. This acreage would represent three percent of the total combined sewer impervious area in the watershed, and assumes new development based on DOB building permit data from 2000 to 2011. The data has been projected for the 2012-2030 period, to account for compliance with the stormwater performance standard.

In summary, DEP expects stormwater to be managed through onsite private GI implementation in three percent of the total combined sewer impervious areas in Alley Creek and Little Neck Bay by 2030. Furthermore, as LTCPs are developed, baseline GI application rates for specific watersheds may be adjusted based on the adaptive management approach and requirements set forth in the 2012 Order on Consent. The model has predicted a reduction in annual overflow volume of 0.5 MG as the CSO benefit from this GI implementation, for the 2008 baseline rainfall condition.

6.0 BASELINE CONDITIONS AND PERFORMANCE GAP

Key to development of the LTCP for Alley Creek and Little Neck Bay is the assessment of water quality with applicable water quality standards within each waterbody. Water quality was assessed using the ERTM water quality model, recalibrated with both Harbor Survey and the synoptic water quality data collected in 2012. The ERTM water quality model simulated ambient bacteria concentrations within the two waterbodies for a set of baseline conditions, as described in this section. The InfoWorks (IW) sewer system model was used to provide flows and loads from intermittent wet weather sources as input to the water quality model.

Two types of continuous water quality simulations were performed to evaluate the gap between the calculated bacteria levels and the WQS. A one-year (using average 2008 rainfall) simulation was performed for bacteria and dissolved oxygen (DO). This shorter term continuous simulation served as a basis for evaluation of control alternatives. A 10-year (2002-2011) simulation was performed for bacterias, to assess the baseline conditions, evaluate the performance gap, and analyze the impacts of the final alternative.

This section of the report describes the baseline conditions and the bacteria concentrations calculated by the ERTM water quality model. It further describes the gap between calculated baseline bacteria concentrations and the WQS when the calculated concentrations exceed the criteria.

6.1 Define Baseline Conditions

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

- The design year was established as 2040
- The Tallman Island WWTP receives peak flows at 2xDDWF
- Grey infrastructure includes those recommended in the 2009 WWFP
- Waterbody specific GI application rates are based on the best available information

Mathematical modeling tools were used to calculate the CSO volume and pollutants loads and their impacts on water quality. The performance gap between calculated WQS was assessed herein by comparing the baseline conditions with WQS. In addition, complete removal of CSO was evaluated. Further analyses were conducted for CSO control alternatives in Section 8.0.

The IW model was used to develop stormwater flows, conveyance system flows, and CSO volumes for a defined set of future or baseline conditions. For Alley Creek and Little Neck Bay LTCP, the baseline conditions were developed in a manner consistent with the earlier 2009 Alley Creek and Little Neck Bay WWFP approved by DEC. However, based on more recent data as well as the public comments received on the WWFP, it was recognized that some of the baseline condition model input data needed to be updated, to reflect more recent meteorological conditions as well as current operating characteristics of various collection and conveyance system components. Furthermore, the mathematical models were also updated from their configurations and calibration developed and documented during development of the earlier WWFP. IW model alterations reflected a better understanding of dry and wet weather sources, catchment areas, and new or upgraded physical components of the system. Water quality model updates included more refined model segmentation. Model input changes that have resulted from physical changes in the system were described in Section 2.1. The new IW model network was then used to establish the baseline conditions and was used as a tool to evaluate the impact of alternative operating strategies and physical changes to the system.

Following are the baseline modeling conditions primarily related to DWF rates, wet weather capacity for the Tallman Island WWTP, sewer conditions, precipitation conditions, and tidal boundary conditions. Each of these is briefly discussed in the section below:

- Wet Weather Capacity: The rated wet weather capacity at the Tallman Island WWTP is 160 MGD (2xDDWF). Projects are underway to ensure that the system will convey and treat this wet weather flow. These projects include: the ongoing TI-3 stabilization project, the programmatic interceptor inspection and cleaning program, and the construction of a new parallel interceptor On May 8, 2014, DEC and DEP entered into an administrative consent order that includes an enforceable compliance schedule to ensure that DEP maximizes flow to and through the WWTP during wet weather events.

- Sewer conditions: The IW model was developed to represent the sewer system on a macro scale that included all conveyance elements greater than 48" in equivalent diameter, along with all regulator structures and CSO outfall pipes. Post-cleaning levels of sediments were also included for the interceptors in the collection system, to better reflect actual conveyance capacities to the WWTPs.

6.1.a Hydrological Conditions

Previous evaluations of the Alley Creek watershed used the 1988 precipitation characteristics as the representative typical precipitation year. However, for this LTCP, the precipitation characteristics for 2008 were used for the baseline condition, as well for alternatives evaluations. In addition to the 2008 precipitation pattern, the observed tide conditions that existed in 2008 were also applied in the models as the tidal boundary conditions at the CSO Outfalls that discharge to tidally influenced waterbodies. For longer term 10-year evaluations, the period from 2002 through 2011 was analyzed.

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 growth in the City. In the past, flow estimates were based on the 2000 census, and growth rates were estimated by the Mayor's Office and DCP, to arrive at projected 2045 sanitary flow rates. These flows were then applied to the model, although they were conservative and did not account for flow conservation measures. The updated analyses use the 2010 census data to reassign population values to the watersheds in the model and project up to 2040 sanitary flows. These projections also reflect water conservation measures that have already significantly reduced flows to the WWTPs and freed up capacity in the conveyance system.

6.1.c BMP Findings and Optimization

A list of BMPs, along with brief summaries of each and their respective relationships to the EPA NMCs, were reported in detail in Section 3.0 as they pertain to Alley Creek CSOs. In general, the BMPs address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO and reduce contaminants in the CSS, thereby improving water quality conditions.

The following provides an overview of the specific elements of various DEP, SPDES and BMP activities as they relate to development of the baseline conditions, specifically in setting up and using the IW models to simulate CSO discharges, and in establishing non-CSO discharges that impact water quality in Alley Creek and Little Neck Bay:

- Sentinel Monitoring – In accordance with BMPs #1 and #5, DEP collects quarterly samples of bacteria water quality at the mouth of Alley Creek in dry weather to assess whether dry weather sewage discharges occur. In 2011 and 2012, DEP used its in-house personnel to trace and remove dry weather sewer connections from eleven homes that were improperly connected to storm sewers that discharge through Outfall TI-024. Dye testing and inspections of homes continues to identify and remediate remaining illegal connections on an as needed basis. Although illicit sources of bacteria were included in the water quality model calibration exercises to accurately simulate the observed ambient bacteria concentrations, these sources were excluded from the baseline conditions, to reflect future corrected conditions.

- Interceptor Sediments – DEP inspected and performed cleaning of the Flushing and Whitestone interceptors in 2011. Sewer sediment levels determined through the post-cleaning inspections 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, DEP treats wet weather flows up to 2xDDWF that are conveyed to the Tallman Island WWTP. DEP follows this wet weather plan and received and treated 2xDDWF for a few hours in 2011 and 2012; cleaning of the interceptor sediments has increased the ability of the system to convey 2xDDWF to the treatment plant. With the installation of the Whitestone interceptor extension, the WWTP will be receiving 2xDDWF more frequently. The baseline IW model was setup to simulate CSO discharges with the WWTP accepting and treating 2xDDWF and with the Whitestone interceptor extension, currently being constructed.

- Wet Weather Operation Plans (WWOP) – The Alley Creek CSO Retention Facility WWOP (BMP #4) is contained within the Tallman Island WWTP WWOP. This Plan establishes procedures for pumping down the Alley Creek CSO Retention Facility after wet weather events, to make room for the next event. The IW models were set up to simulate operating conditions and pumping rates/methods consistent with the WWOP.

6.1.d Elements of Facility Plan and GI Plan

Alley Creek and Little Neck Bay LTCP includes the following grey projects recommended in the 2009 WWFP. Construction of this grey infrastructure was completed in early 2011 and the Alley Creek CSO Retention Facility became operational on March 11, 2011. Details of these projects are as follows:

- New 1,475-foot long multi-barrel outfall sewer extending to a new outfall on Alley Creek (TI-025).
- New 5 MG Alley Creek CSO Retention Facility:
  - New diversion chamber (Chamber 6) to direct CSO to the new Alley Creek CSO Retention Facility and to provide tank bypass to TI-008.
  - Weir set within Chamber 6 to pass all flows up to the DEP 5-year design flow into the tank.
  - New CSO outfall, TI-025, for discharge from the tank.
  - Fixed baffle at TI-025 for floatables retention, minimizing release of floatables to Alley Creek.
  - Upgrade of Old Douglaston PS to empty tank and convey flow to Tallman Island WWTP after the end of the storm.

As discussed in Section 5.0, the Alley Creek and Little Neck Bay watershed has one of the smallest total CSS impervious areas of all of the LTCP watersheds. DEP estimated that three percent of the combined sewer impervious area in the watershed (approximately 45 acres) will have new development based on the projections, and will apply on-site GI controls. This level of GI implementation has been assumed in the baseline model.

6.1.e Non CSO Discharges

In several sections of the Tallman Island WWTP drainage area, stormwater drains directly to receiving waters without entering the combined system or separate storm sewer system. These areas are depicted as “Direct Drainage” or “Local Sources” in Figure 2-8 (Section 2.0), and were delineated based on topography and the direction of stormwater runoff flow in those areas. In general, shoreline areas adjacent to waterbodies comprise the direct drainage category. Significant “direct drainage” areas include Fort Totten, Douglaston Manor, and Alley Pond Park, all of which are tributary to Alley Creek and Little Neck Bay. In addition, the northern portion of Douglaston Peninsula, as was indicated in Figure 2-8, is currently unsewered. This area appears to contribute pollutants to adjacent Little Neck Bay waters during dry and wet weather.

“Other” areas are largely comprised of parkland, such as the portions of Flushing Meadows, Corona Park, Kissena, Cunningham and Clearview Parks, and Mt. Hebron and Flushing Cemeteries. These areas were depicted as “other” drainage areas in Figure 2-8. The “other” category also includes special cases, such as the former Flushing Airport in College Point (now a commercial distribution center), where sanitary flow is conveyed to the WWTP, and stormwater is conveyed through separate stormwater collection systems to the receiving waters. The abovementioned areas are generally outside the Alley Creek and Little Neck Bay watershed, including Oakland Lake, Long Island Express (LIE) Pond and an area in the headwaters of Alley Creek.

Overall, the "direct drainage" and "other" areas cover roughly 3,654 acres of the Tallman Island WWTP (1,484 direct drainage acres and 2,170 "other" acres). In Alley Creek and Little Neck Bay, the "direct drainage" and "other" areas are 828 acres and 192 acres, respectively, totaling 1,020 acres.

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

The IW model was used to develop CSO volumes for the baseline conditions; it included the Alley Creek CSO Retention Facility, which is operational, and assumed the implementation of three percent onsite GI. Using these overflow volumes, pollutant loadings from the CSOs were generated using the enterococci, fecal coliform, and BOD concentrations that were used in the recalibration of the Alley Creek portion of the ERTM water quality model. In addition to CSO, pollutant loadings, storm sewer discharges, and other continuous sources of flow impact water quality in Alley Creek and Little Neck Bay.

Continuous flows and loadings from Oakland Lake and the upstream Alley Creek area were assumed to be the same for the baseline condition as they were in the 2011 and 2012 existing conditions, for which the bacteria water quality model was calibrated, with the following exceptions:

- Little Neck Bay DMA area – Localized sources of non CSO contamination were assumed to be mitigated, outside the LTCP program.

- Upper Alley Creek watershed – Track-down work conducted in 2014 showed no obvious sources of contaminated stormwater being discharge into Oakland Lake or the LIE Pond. Additionally, bacteria samples collected within Oakland Lake and its outlet along with the LIE Pond outlet, showed bacteria concentrations that were well below levels that could be considered typical for such urban waterways. One location where illicit discharges were apparent was TI-024, where DEP did find dry weather flows with fecal coliform concentrations of 50,000/100mL. DEP has initiated a source track-down program for this area and will report to DEC quarterly on the progress made. As such, no illicit discharges are included in the baseline conditions, and illicit discharges and other sources of dry-weather contamination into TI-024 at the head end of Alley Creek were assumed to be mitigated.

- During the 2011 and 2012 bacteria model calibrations, stormwater runoff from DMA was assigned higher than typical stormwater bacteria concentrations, which represented the impact of localized sources. Based on the assumption that improvements will be undertaken to address these localized sources, the additional bacteria loading from the stormwater runoff has been eliminated from the future condition baseline evaluations. As such, in the baseline condition, stormwater runoff from the DMA area was assigned the same bacteria concentrations used for other portions of the system that have stormwater discharges within the Alley Creek and Little Neck Bay watershed.

The pollutant concentrations assigned to the various sources of pollution to Alley Creek and Little Neck Bay, are summarized in Table 6-1.

Table 6-1. Pollutant Concentration for Various Sources in Alley Creek

Pollutant Source	***Enterococci (cfu/100mL)***	***Fecal Coliform (cfu/100mL)***	***BOD_5 (mg/L)***
Stormwater	15,000	35,000	15
Alley Creek CSO Retention Facility	Monte Carlo	Monte Carlo	140[1]
Direct Drainage	15,000	35,000	15
Oakland Lake DW	130	150	15
LIE Pond DW	75	75	0
Note 1 – Sanitary sewage concentration. CSO concentrations calculated using IW model and by mass balance.			

Typical (2008) baseline volumes and loads of CSO, stormwater, direct drainage and localized dry weather sources of pollution to Alley Creek are summarized in Table 6-2. The specific SPDES permitted outfalls associated with these sources were shown in Figure 2-9. Additional tables can be found in Appendix A. The information in these tables is provided for the 2008 rainfall condition. CSO effluent concentrations were assigned based on a Monte Carlo analysis that was conducted to reproduce the range and distribution of the observed Alley Creek CSO Retention Facility fecal coliform and enterococci concentrations. As discussed in Section 2.0, the Alley Creek CSO Retention Facility overflow bacteria concentrations were determined by using the monitored tank concentrations, shown in Figure 2-11, and IW modeled overflow volumes. For 2008, the IW model calculates that a total of 132 MG discharges from the Alley Creek CSO Retention Facility

Table 6-2. Annual CSO, Stormwater, Direct Drainage, Local Sources Volumes and Loads (2008 Rainfall)

Totals by Source by Waterbody		**Volume**	**Enterococci**	**Fecal Coliform**	**BOD**
Waterbody	**Source**	**Total Discharge (MG/yr)**	**Total Org (10^12)**	**Total Org (10^12)**	**Total Lbs**
Alley Creek					
	CSO	132.1	789.3	2,170.9	18,507
	Stormwater*	334.9	189.3	1,023.8	42,873
	Local Sources	1,600	5.9	6.4	0
	Total	**2,067**	**984.5**	**2,605**	**61,380**
Little Neck Bay					
	CSO	0	0	0	0
	Stormwater*	450	255.5	596.1	64,855
	Local Sources	0	0	0	0
	Total	**450**	**255.5**	**596.1**	**64,855**

* Includes 47.6 MG/yr direct drainage runoff

6.3 Performance Gap

Concentrations of bacteria and DO in Alley Creek and Little Neck Bay are controlled by a number of factors, including the volumes of all sources of pollutants into the waterbodies and the concentrations of the respective pollutants. Since a large amount of the flow and pollutant loads discharged into these waterbodies are caused by rainfall events, the frequency, duration and amounts of rainfall will also strongly influence water quality in these waterbodies. The Alley Creek portion of the ERTM model was used to simulate bacteria concentrations in the Creek for the baseline conditions, using 2002-2011 data and DO concentrations using 2008 data. Hourly model calculations were saved for post-processing for comparison with the existing and Future Primary Contact WQ Criteria with 2012 modification (RWQC) WQS as further discussed below in Section 6.3.c. The performance gap was then developed as the difference between the model-calculated baseline waterbody DO and bacteria concentrations and the applicable numerical WQS. Accordingly, the analysis is broken up into three sections:

- Existing WQ Criteria;
- Assessment of Alley Creek compliance with the Primary Contact WQ Criteria (Class SC); and
- Future Primary Contact WQ Criteria (2012 EPA RWQC).

The Existing WQ Criteria include Little Neck Bay as a Class SB waterbody and Alley Creek as a Class I waterbody, with the numeric criteria presented in Table 6-3. The enterococci criterion is applied as a rolling 30-day GM for the six-month recreational period from May 1st – October 31st. Existing conditions also consider DMA Beach as an officially recognized swimming beach; therefore the DOHMH criterion for enterococci is applied using a bathing season from Memorial Day to Labor Day rolling 30-day GM. A summary of the criteria that were applied is shown in Table 6-3.

Table 6-3. Classifications and Criteria Applied for Gap Analysis

Analysis	Numerical Criteria Applied		
	Alley Creek	**Little Neck Bay**	**DMA Beach**
Existing WQ Criteria	I (Fecal Monthly GM -2000 cfu/100 mL)	SB (Fecal Monthly GM – 200 cfu/100 mL) SB (Entero rolling 30-d recreational season GM - 35 cfu/100 mL)	SB (Fecal Monthly GM - 200 cfu/100 mL) SB (Entero rolling 30-d bathing season GM- 35 cfu/100 mL)
Primary Contact WQ Criteria	SC* (Fecal Monthly GM - 200 cfu/100 mL)	Same as above	Same as above
Future Primary Contact WQ Criteria	(Entero rolling 30-d recreational season GM – 35 cfu/100 mL+ STV – 130 cfu/100 mL)	(Entero rolling recreational season 30-d GM – 35 cfu/100 mL+ STV – 130 cfu/100 mL)	SB (Entero rolling bathing season 30-d GM – 35 cfu/100 mL+ STV – 130 cfu/100 mL)

Note: GM = Geometric Mean; STV = 90th Percentile Statistical Threshold Value; NYC DOHMH Bathing Season = Memorial Day to Labor Day; Recreational Season = May 1st to October 31st.
*This water quality criteria is not currently assigned to Alley Creek. For such criteria to take effect, DEC must first adopt the criteria in accordance with rulemaking and environmental review requirements.
** This Future Standard has not yet been proposed by DEC. For such standard to take effect, DEC must first adopt the standard in accordance with rulemaking and environmental review requirements. In addition, DEC must follow the required regulatory procedures to reclassify Alley Creek from I to SC.

It should be noted that because Alley Creek is considered a tributary, under the BEACH Act of 2000, the existing enterococci criterion for Class SC does not apply. Also, analyses in this LTCP are performed using the 30-day rolling GM of 35 cfu/100mL and the STV of 130 cfu/100mL for enterococci. In addition, DEC has recently advised DEP that it plans to adopt the 30-d rolling GM for enterococci of 30 cfu/100 ml, with a not to exceed the 90th percentile statistical threshold value (STV) of 110 cfu/100 ml, which is more stringent of the options presented by the 2012 EPA Recommended Recreational Water Quality Criteria.

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

2008 Rainfall Annual Simulation

Typical model results are shown in Figures 6-1 through 6-5, for Alley Creek (Station AC1) and Little Neck Bay (Stations OW2, LN1, DMA, E11), respectively, with 2008 rainfall conditions. As described in Section 2.0, Alley Creek is currently designated as a Class I waterbody, and Little Neck Bay is designated as a Class SB waterbody. As such, both waterbodies have a fecal coliform criterion, and only Little Neck Bay has a recreational season from May 1st – October 31st GM enterococci criterion. The fecal coliform panel in each figure show the Class I fecal coliform criterion of 2,000 org/100mL (dashed red line) and Class SB fecal coliform criterion of 200 org/100mL (dashed green line). The post-processed monthly GM water quality output lines are shown as solid black lines. In the enterococci panel of each figure, the instantaneous (black line) and rolling 30-day GM (blue line) enterococci calculated concentrations are presented.

As illustrated by the figures, the modeling results indicate that at Station AC1 (Figure 6-1), fecal coliform concentrations are in full attainment with the existing water quality criteria of a monthly GM of 2,000 org/100mL. The model calculations also show that the Little Neck Bay Stations (Figures 6-2 through 6-5) are in attainment of the fecal coliform and enterococci criteria during 2008 conditions with the exception of Station OW2, which is in non-attainment of fecal coliform during February. Non-attainment of the enterococci criterion does not occur during the recreational or bathing seasons under 2008 conditions.

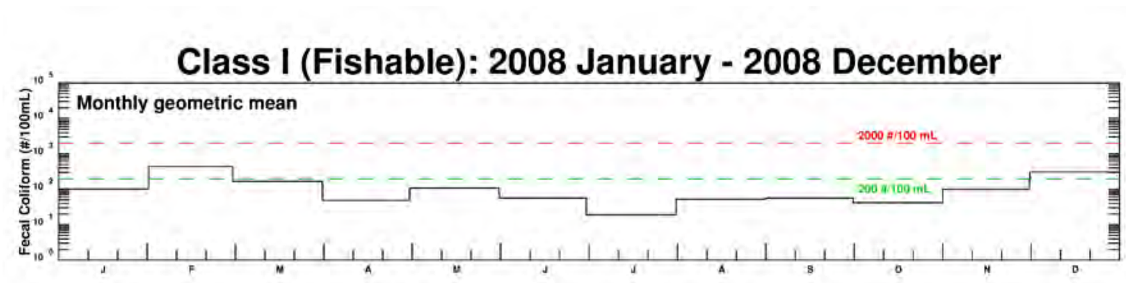


Figure 6-1. Calculated Baseline AC1 Bacteria Concentrations (2008 Rainfall)

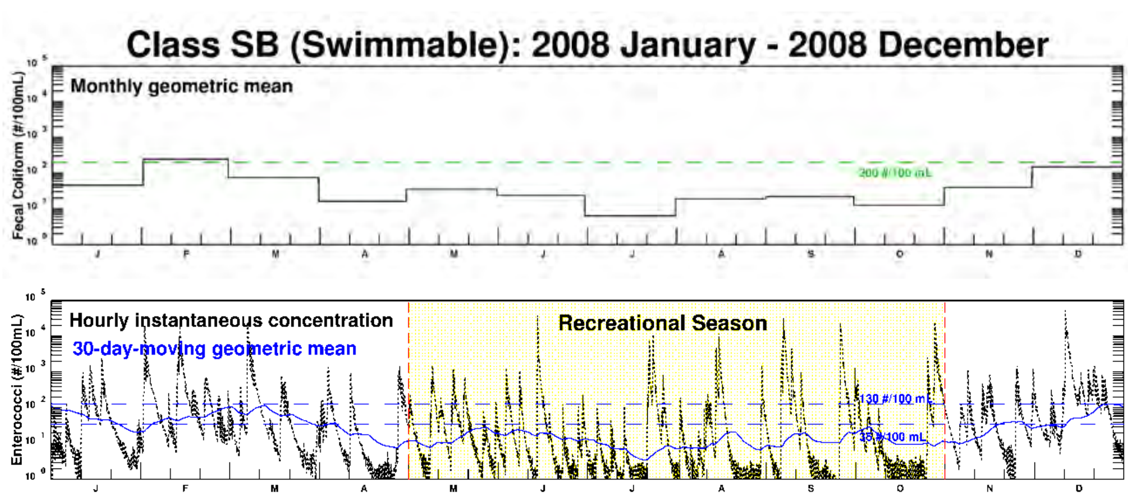


Figure 6-2. Calculated Baseline OW2 Bacteria Concentrations (2008 Rainfall)

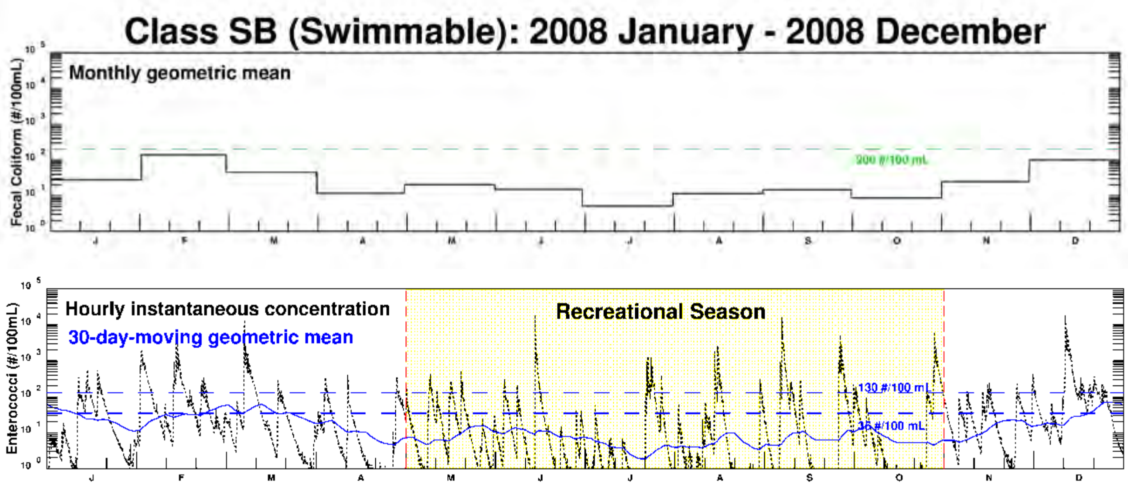


Figure 6-3. Calculated Baseline LN1 Bacteria Concentrations (2008 Rainfall)

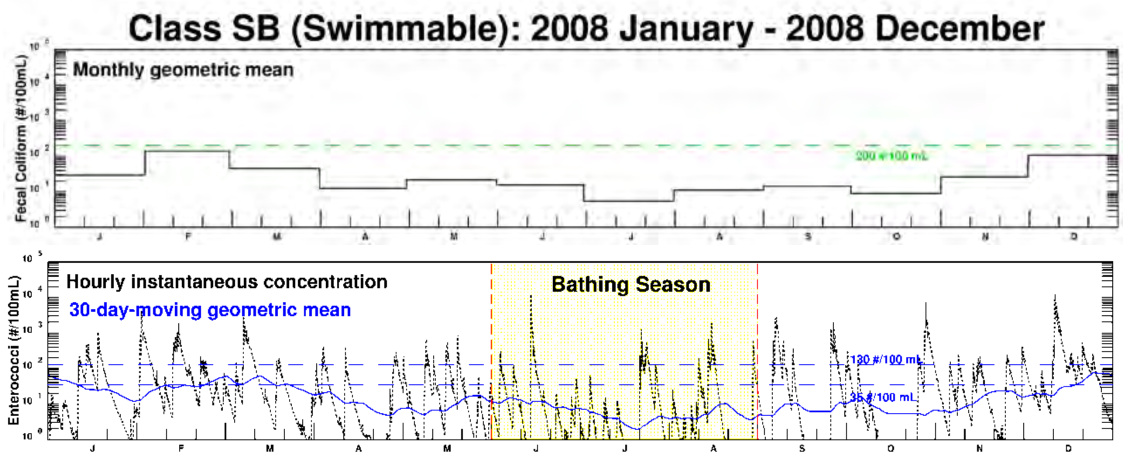


Figure 6-4. Calculated Baseline DMA Bacteria Concentrations (2008 Rainfall)

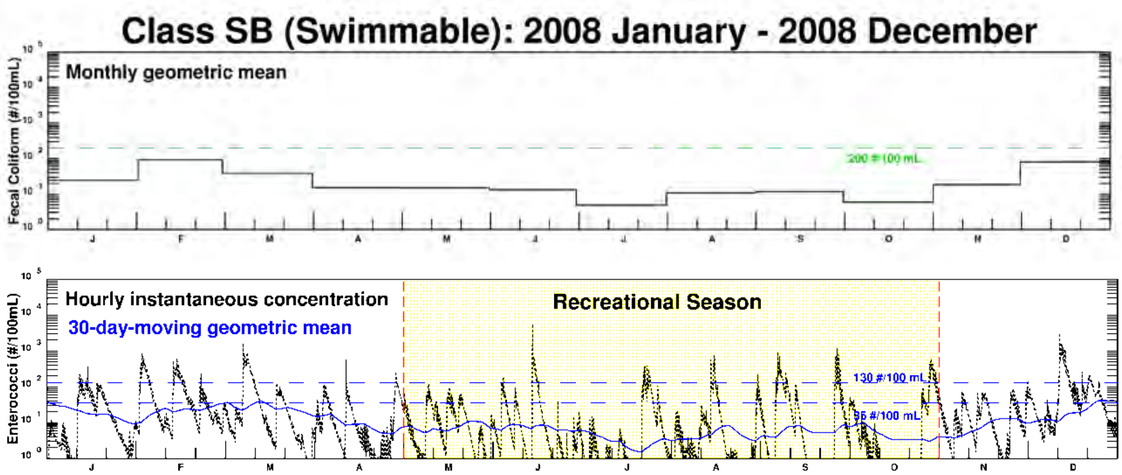


Figure 6-5. Calculated Baseline E11 Bacteria Concentrations (2008 Rainfall)

10-Year Long-Term Simulation

A 10-year baseline simulation of bacteria water quality was also performed for the baseline loading conditions, to assess year-to-year variations in water quality. The results of these simulations are summarized in Figures 6-6 and 6-7 and Tables 6-4 and 6-5. Figure 6-6 shows that the calculated 10-year long-term attainment of the existing fecal coliform criterion under baseline conditions is quite high. Most areas achieve 100 percent attainment, while a small area in lower Little Neck Bay has between 96 and 100 percent attainment of the fecal coliform criterion. Table 6-4 provides further insight into the baseline fecal coliform attainment. As noted in the table, fecal coliform concentrations are calculated to be in attainment 100 percent of the time at all locations for each of the 10 years within the simulation period, with the exception of 2008, 2009 and 2011 for Station OW2, and 2009 for Station LN1, which each have one month of non-attainment.

Modeling indicates that the 10-year percent attainment with the enterococci recreational season rolling 30-day GM criterion is not quite as high as the attainment with the fecal coliform criterion, as shown in Figure 6-7. The majority of Little Neck Bay has greater than 92 percent attainment with the enterococci criterion. The lower portion of Little Neck Bay has attainment ranging from approximately 68 percent to 92 percent. Table 6-5 presents the calculated rolling 30-day recreational period GM for enterococci at each station for the 10-year period, with the exception of DMA, where the bathing season from Memorial Day to Labor Day attainment is presented. The criterion is not applicable at Station AC1, as Alley Creek is an inland waterway. Attainment at all of the stations is quite high with the exception of OW2 where single year attainment is as low as 76 percent.

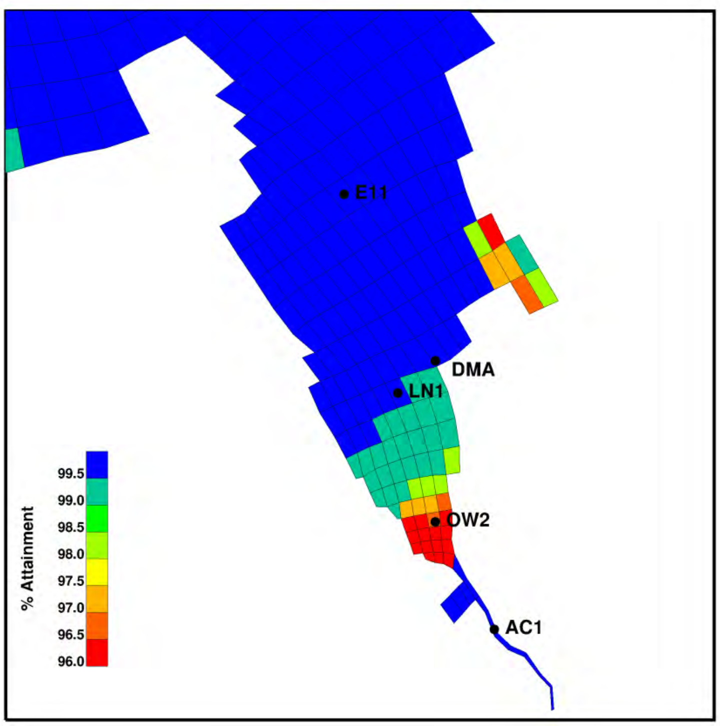


Figure 6-6. 10-Year Attainment of Existing Fecal Coliform Criteria

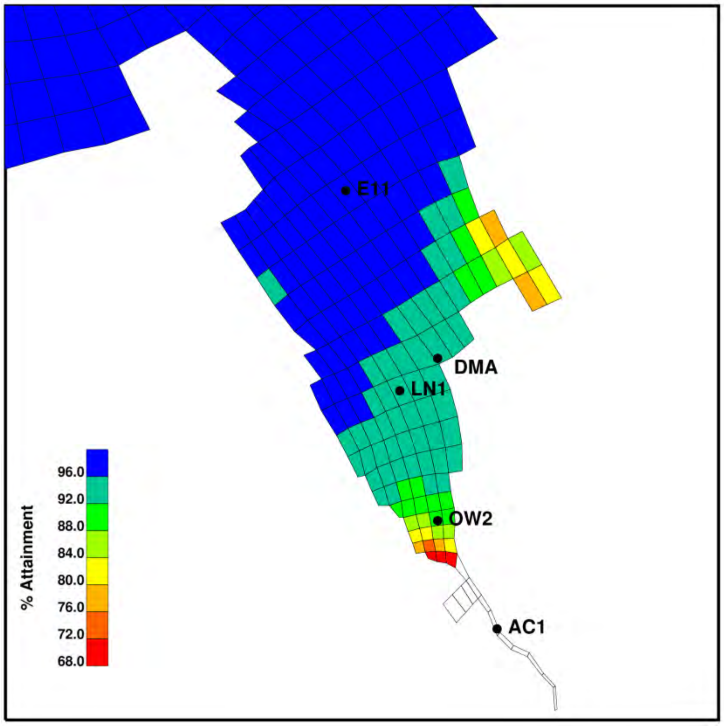


Figure 6-7. 10-Year Attainment of Existing Enterococci Recreational Period Criterion

Table 6-4. Calculated 10-Year Baseline Fecal Coliform* Attainment of Existing Criteria - Percent of Months in Attainment

Station	Projection Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Percent Attainment
AC1	100	100	100	100	100	100	100	100	100	100	100
OW2	100	100	100	100	100	100	92	92	100	92	98
LN1	100	100	100	100	100	100	100	92	100	100	99
DMA	100	100	100	100	100	100	100	100	100	100	100
E11	100	100	100	100	100	100	100	100	100	100	100

*Monthly GM of 2000 cfu/100 ml for AC1 and GM of 200 cfu/100 ml for OW2, LN1, E11 and DMA

Table 6-5. Calculated 10-Year Baseline Enterococci* Recreational Period Attainment (Percent)

Station	Projection Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Percent Attainment
AC1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OW2	98	83	97	96	92	91	100	76	100	76	91
LN1	100	88	100	97	99	92	100	88	100	85	95
DMA(1)	100	75	100	100	97	100	100	91	100	89	95
E11	100	97	100	100	100	95	100	100	100	97	99

1 - DMA Attainment Percent based on Bathing Season
*30 day rolling GM of 35 cfu/100 ml

2008 Rainfall Annual Simulation – Dissolved Oxygen

Water quality model simulation of DO concentrations and measures of attainment with the numerical WQS are presented in Table 6-6. Water quality calculations indicate that the overall attainment with the Class I criterion of 4 mg/L is 98 percent for the year at Station AC1. Under the baseline conditions the calculated DO concentrations tend to be somewhat higher in Little Neck Bay. Even though there are excursions below the DO criteria in a few summer months, DO concentrations were calculated to be in attainment with the WQS a high percent of the time. As noted in Table 6-6, annual DO attainment is between 96 and 99 percent, depending on the area of the Bay.

Table 6-6. Model Calculated DO Attainment (2008 Rainfall)

Station	Critical Month Average (mg/L)	Minimum Monthly Attainment (%)	Annual Attainment (%)
AC1	5.1	89	98
OW2	6.3	99	99
LN1	5.6	66	96
E11	6.0	80	97

The model results for the 10-year baseline period indicate that Alley Creek and Little Neck Bay would meet the existing water quality criteria. Therefore, there is no performance gap for bacteria and DO using existing criteria.

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

Bacteria

The DEC is required to periodically review whether or not a waterbody can be reclassified to its Primary Contact WQ Criteria. This LTCP assessed the level of attainment for Alley Creek, which is a Class I waterbody, if DEC were to re-classify it to Class SC (limited primary contact recreation) .

Model calculations presented in Figure 6-1 show that under the baseline conditions, Station AC1 does not meet the Class SC criterion for fecal coliform for two months during 2008 conditions. Figure 6-8 presents a spatial depiction of the calculated 10-year attainment for Class SC fecal coliform annually (monthly GM of 200 cfu/100 ml) under baseline conditions. Overall; the attainment of the fecal coliform criterion at Station AC1 is 87 percent for the 10-year period. Table 6-7 presents the annual fecal percent attainment at Station AC1. In all, 15 out of 120 months, or 12.5 percent, do not attain the Class SC fecal coliform criterion.

Because Alley Creek would not meet Class SC criteria under baseline conditions, an analysis was conducted to determine how much of the gap between projected water quality and the Class SC criteria was due to CSO discharges, the focus of the LTCP. Figure 6-9 presents the 10-year attainment of the Class SB/SC fecal coliform criterion with 100 percent CSO control. For the discussion that follows, 100 percent CSO control can be taken as either 100 percent volumetric control or disinfection as both would produce similar levels of bacteria attainment according to the model. The 10-year attainment at Station AC1 would improve from 87 percent to 94 percent under the 100 percent CSO control scenario. Table 6-7 presents the annual fecal percent attainment at Station AC1 during the 10-year assessment period with 100 percent CSO control. Seven months would be in non-attainment of the Class SC criterion for fecal coliform under the 100 percent CSO control scenario conditions - representing an improvement of eight months over 10 years or just less than one month per year. Within Little Neck Bay, the area calculated to be in full attainment with the primary contact standard with 100 percent CSO control would increase by 128 acres (9.5 percent improvement). The majority of the improvement occurred within inner Little Neck Bay.

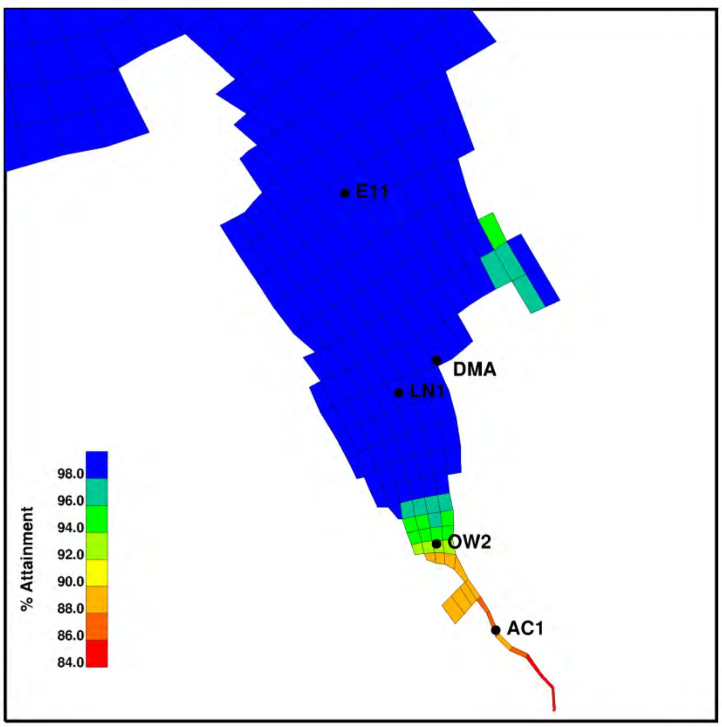


Figure 6-8. 10-Year Attainment of Class SB/SC Fecal Coliform Criterion – Baseline Conditions

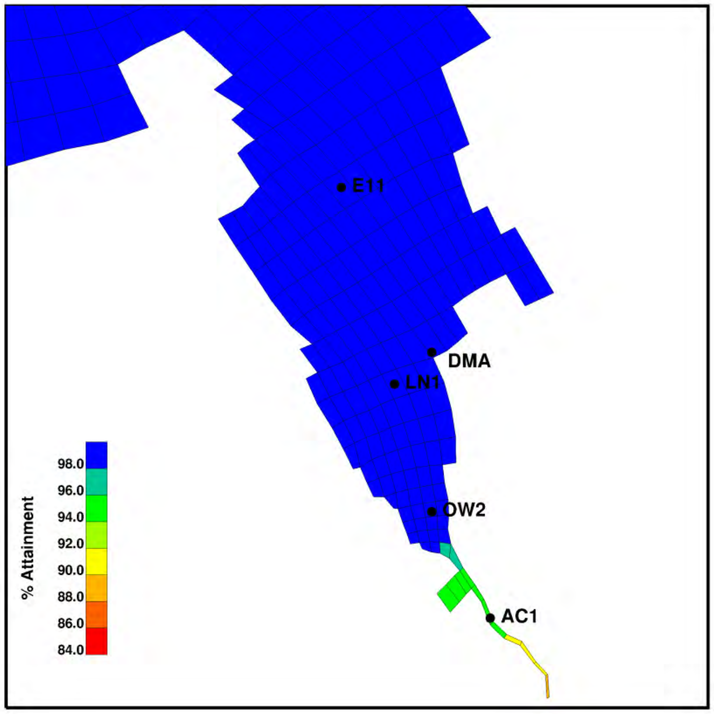


Figure 6-9. 10-Year Attainment of Class SB/SC Fecal Coliform Criterion- 100 Percent CSO Control

Table 6-7. Fecal Coliform Geometric Mean Class SC Attainment Baseline and 100 Percent CSO Control – Station AC1 (10-Year)

Year	Annual Attainment (%)		Recreational Season Attainment (%)	
	Baseline	100% CSO Control	Baseline	100% CSO Control
2002	100	100	100	100
2003	92	100	83	100
2004	100	100	100	100
2005	83	100	83	100
2006	83	92	100	100
2007	83	92	100	100
2008	83	83	100	100
2009	83	83	83	83
2010	83	100	100	100
2011	83	92	83	100
Total	87	94	93	98

The level of attainment of the enterococci criterion when the Alley Creek CSO Retention Facility is 100 percent controlled is presented in Figure 6-10. Overall, the spatial extent of the area with greater than 92 percent attainment in Little Neck Bay is increased. A small section of the southern portion of Little Neck Bay remains with attainment between 80 and 92 percent.

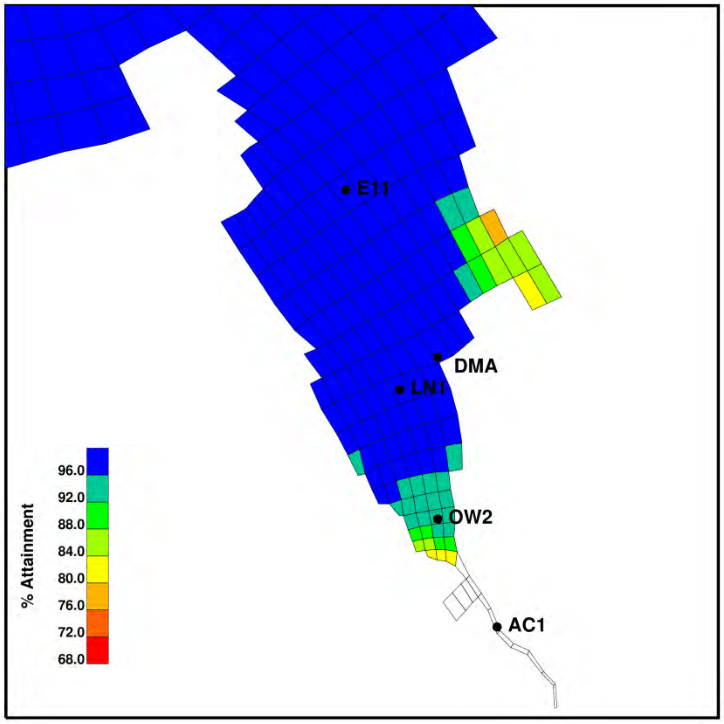


Figure 6-10. 10-Year Attainment with Class SB Recreational Season Enterococci Criterion under the 100 Percent CSO Control

Dissolved Oxygen

Upgrading Alley Creek to Class SC would require that it meet the DO chronic criterion of a daily average DO concentration of greater than or equal to 4.8 mg/L, with some allowance for excursions based on the DO exposure-duration curve, as well as a an acute criterion of never less than 3.0 mg/L. Table 6-8 presents annual attainment with Class SC DO criteria at Station AC1, the location to have the lowest DO concentrations.. Annual attainment of the chronic criteria is reached 95 percent of the time under baseline conditions.

Table 6-8. Model Calculated DO Results for Class SC Criterion at AC1 – Baseline and 100 Percent CSO Control Conditions (10-Year)

Station	Annual Attainment (%)	
	Chronic	Acute
AC1 (Baseline)	95	99
AC1 (100 Percent CSO Control)	96	99

The 100 percent CSO control scenario was evaluated to assess the impact of CSO discharges on non-attainment of the DO criteria, or the gap between attainment and non-attainment caused by CSO discharges. For the discussion that follows, 100 percent CSO control is 100 percent volumetric control. The attainment of the Class SC criteria for DO at Station AC1 with complete CSO control is also presented in Table 6-8. The annual attainment would increase to 96 percent for the chronic criterion.

6.3.c Future Primary Contact WQ Criteria

As noted in Section 2.0, EPA released its Recreational Water Quality Criteria (RWQC) recommendations in December 2012. These included recommendations for recreational water quality criteria for protecting human health in all coastal and non-coastal waters designated for primary contact recreation use. The criteria would include a rolling 30-day GM of either 30 cfu/100mL or 35 cfu/100mL, and a 90th percentile statistical threshold value (STV) during the rolling 30-day period of either 110 cfu/100mL or 130 cfu/100mL. An analysis of the 10-year baseline and 100 percent CSO control conditions model simulation results was conducted using the 35 cfu/100mL GM and 130 cfu/100mL 90th percentile criteria, to assess attainment with these Future Primary Contact WQ Criteria. As noted earlier, DEC has recently advised DEP that it plans to adopt the 30-d rolling GM for enterococci of 30 cfu/100 ml, with a not to exceed the 90th percentile statistical threshold value (STV) of 110 cfu/100 ml, which is more stringent of the options presented by the 2012 EPA RWQC.

10-Year Long-Term Simulation

Figure 6-11 presents the calculated model results for baseline conditions when compared to the Future Primary Contact WQ Criteria of a rolling 30-day GM of 35 cfu/100mL. The figure shows that the 10-year long term recreational season enterococci percent attainment calculated for the baseline within Little Neck Bay are divided into three areas – one area that is in attainment with the future primary contact enterococci criterion a high percentage of the time (outer Little Neck Bay); another zone (inner Little Neck Bay) where attainment with the criterion is predicted as 91%; and Alley Creek, where very low (53 percent) attainment is achieved. Table 6-9 presents the attainment at the five chosen stations with the Future Primary Contact WQ Criteria. While the rolling 30-day GM of 35 cfu/100mL appears to be achievable a high percentage of the time in much of Little Neck Bay, attainment would decline for the 30-day rolling GM of 30 cfu/100mL, and decline still further for the 90th percentile STV criteria.

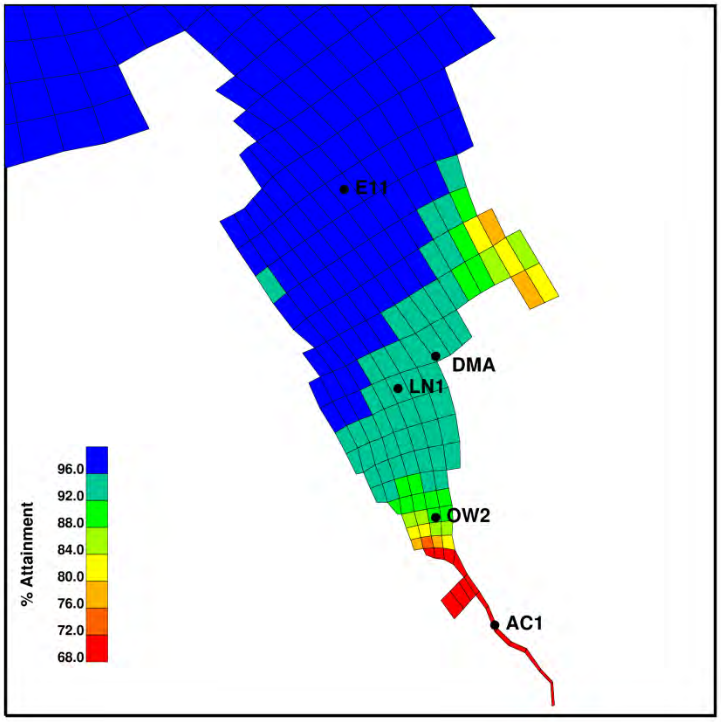


Figure 6-11. Enterococci Recreation Season Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 35 cfu/100mL

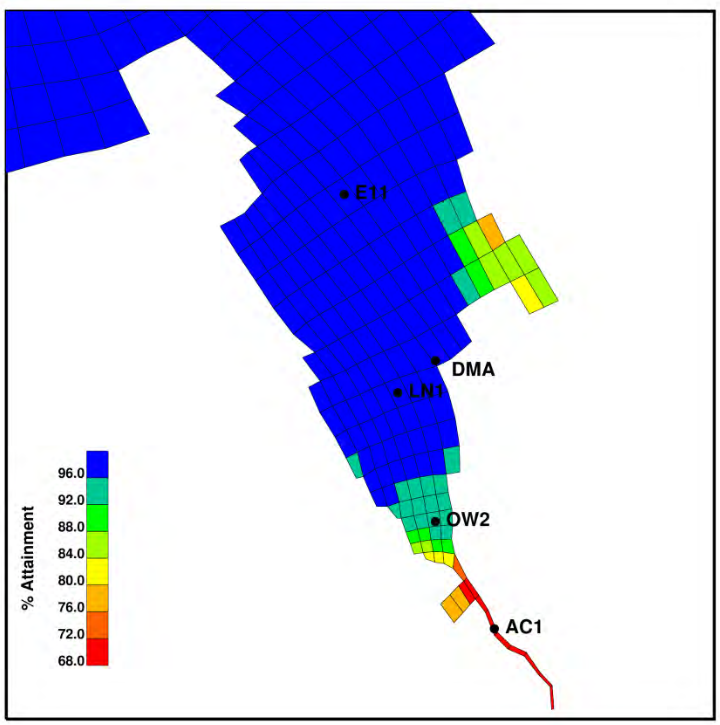


Figure 6-12. Enterococci Recreation Season Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 35 cfu/100mL with 100 Percent CSO Control

Table 6-9. Recreational Season Attainment (10-Year) with Future Primary Contact WQ Criteria

Station	Enterococci Percent Attainment							
	Baseline				100% CSO Control*			
	30-day rolling GM		90th percentile		30-day rolling GM		90th percentile	
	<=35 cfu/ 100mL	<=30 cfu/ 100mL	<=130 cfu/ 100mL	<=110 cfu/ 100mL	<=35 cfu/ 100mL	<=30 cfu/ 100mL	<=130 cfu/ 100mL	<=110 cfu/ 100mL
AC1	53	44	9	7	64	54	10	8
OW2	91	87	25	22	95	93	31	26
LN1	95	94	51	43	99	97	73	60
E11	99	98	75	69	100	99	85	80
DMA	95	93	49	40	99	97	69	58

*Approximately equivalent to disinfection

Figure 6-12 presents the 10-year recreational season attainment of the future enterococci criterion for the 100 percent CSO control. Minor improvements are calculated over the baseline condition. Table 6-9 also presents the attainment of future enterococci criteria for the 100 percent CSO control scenario. Some improvement is calculated nearest the Alley Creek CSO Retention Facility at Stations AC1 and OW2, on the order of 11 percent; lower levels of improvement are predicted at Stations LN1 and DMA. Overall, the 90th percent STV criterion attainment is still low, with only nine percent annual attainment calculated at Station AC1. During the bathing season from Memorial Day to Labor Day, the model predicts DMA Beach would attain the primary contact SB enterococci criterion 99 percent of the time, however STV attainment would be only 69 percent.

6.3.d CSO Volumes and Loadings Needed to Attain Future Primary Contact WQ Criteria

These analyses indicate that complete control of CSOs alone will not close the gap between the predicted baseline enterococci concentrations and the future primary contact criteria rolling 30-day GM criterion of 35 cfu/100mL to achieve 100 percent attainment. 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 Alley Creek and Little Neck Bay. A load source component analysis was conducted for the 2008 baseline condition, to provide a better understanding of how each source type contributes to fecal coliform and enterococci concentrations in Alley Creek and Little Neck Bay. The source types include the East River at the mouth of Little Neck Bay, local source inputs (Oakland Lake and LIE Pond), Nassau County stormwater, NYC stormwater, and CSOs. The analysis was completed at Stations AC1, OW2, LN1, E11 and DMA using the ERTM model. The analysis for fecal coliform included annual GM, the maximum winter month (February) GM, and the maximum summer month (June) GM. The results of the fecal coliform component analysis are presented in Table 6-10. The analysis for enterococci included the calculation of enterococci GMs for the maximum 30-day period during the year and the maximum 30-day period during the bathing season from Memorial Day to Labor Day, as well as the 90th percentile STV values during these periods. The GMs from each source can be added to determine the total GM. The 90th percentile STV concentrations are not necessarily additive, but are presented for illustrative purposes. The partial results of the enterococci component analysis are presented in Table 6-11. A full table of enterococci results is included in Appendix A.

The fecal component analysis shows that both Stations AC1 and OW2 would not be in attainment of the Class SB/SC criterion for the maximum winter month condition. In both cases, CSO contribute approximately one-third of the total GM. In the case of Station AC1, stormwater from direct drainage runoff and stormwater outfalls contributes enough fecal coliform to cause non-attainment of the criterion.

Table 6-10. Fecal Coliform GM Source Components

Source	Station	Fecal Coliform Contribution, cfu/100mL		
		Annual GM	Maximum Winter Month	Maximum Summer Month
East River	AC1	2	6	-
Local Sources	AC1	14	20	12
Nassau County Stormwater	AC1	2	6	-
NYC Stormwater	AC1	79	269	46
CSO	AC1	14	156	6
Total	**AC1**	**111**	**457**	**66**
East River	OW2	3	13	2
Local Sources	OW2	-	4	-
Nassau County Stormwater	OW2	3	13	-
NYC Stormwater	OW2	23	116	15
CSO	OW2	6	83	4
Total	**OW2**	**36**	**229**	**23**
East River	LN1	4	20	3
Local Sources	LN1	0	0	0
Nassau County Stormwater	LN1	4	22	2
NYC Stormwater	LN1	9	50	6
CSO	LN1	3	36	2
Total	**LN1**	**20**	**128**	**13**
East River	E11	10	45	6
Local Sources	E11	0	0	0
Nassau County Stormwater	E11	3	16	3
NYC Stormwater	E11	3	15	2
CSO	E11	-	9	-
Total	**E11**	**17**	**85**	**12**
East River	DMA	4	22	3
Local Sources	DMA	0	0	0
Nassau County Stormwater	DMA	6	27	3
NYC Stormwater	DMA	8	45	6
CSO	DMA	3	35	-
Total	**DMA**	**21**	**128**	**13**

The assessment of the enterococci GM components on an annual and bathing season (Memorial Day to Labor Day) basis does not have regulatory implications, but it is instructive in showing the relative contribution of the various sources to the GM during these periods. The component assessment indicates that NYC stormwater is the largest contributor to the enterococci GM, followed by the CSO. The CSO source contributes on the order of 20 percent to the enterococci GM during these periods. This result is because stormwater is discharged during each rain event and the CSO discharges only once or twice per month. The use of the GM gives more weight to sources that discharge more frequently (e. g. stormwater) than those that discharge less frequently.

Table 6-11. Enterococci GM Source Components

Source	Station	Enterococci Contribution, cfu/100mL	
		Annual 30-day Max. GM	Bathing Season 30-day Max. GM
East River	AC1	4	1
Local Sources	AC1	18	11
Nassau County Stormwater	AC1	4	2
NYC Stormwater	AC1	254	43
CSO	AC1	53	14[1]
Total	**AC1**	**332**	**73**
East River	OW2	6	2
Local Sources	OW2	4	1
Nassau County Stormwater	OW2	8	4
NYC Stormwater	OW2	86	9
CSO	OW2	25	6[1]
Total	**OW2**	**129**	**22**
East River	LN1	8	2
Local Sources	LN1	1	0
Nassau County Stormwater	LN1	15	6
NYC Stormwater	LN1	36	0
CSO	LN1	11	2[1]
Total	**LN1**	**71**	**10**
East River	E11	18	4
Local Sources	E11	0	0
Nassau County Stormwater	E11	12	3
NYC Stormwater	E11	9	0
CSO	E11	3	1[1]
Total	**E11**	**41**	**8**
East River	DMA	9	2
Local Sources	DMA	1	0
Nassau County Stormwater	DMA	20	7
NYC Stormwater	DMA	36	0
CSO	DMA	12	1[1]
Total	**DMA**	**76**	**10**

Note: 1 – not including CSO seasonal disinfection

CSO Contribution to Non-Attainment

Table 6-11 presents the calculated enterococci concentrations for all sources including CSOs. CSOs at all locations except within Alley Creek (AC1), are calculated for the annual and recreational season 30-day GMs to be less than the 2012 RWQC modification criterion of a GM of 35 cfu/100mL for the baseline conditions.

Further reductions in enterococci bacteria will only result from programs that focus on stormwater, if those programs could effectively reduce stormwater sources during the periods during which the maximum GMs are calculated to occur. As those sources are not part of this CSO LTCP with respect to the development of control measures, the alternatives that are the focus of the following sections of this report focus on reduction of the remaining CSOs discharges to Alley Creek and Little Neck Bay.

6.3.e Time to Recover

Another analysis that consisted of examining the calculated hourly fecal coliform and enterococci water quality model simulation results was performed to gain additional insight with respect to the impacts of CSO and MS4 stormwater on Alley Creek and Little Neck Bay water quality. Analyses provided above examine the longer term impacts of wet weather sources, as required by existing and proposed bacteria criterion (monthly GM and 30-day GM). Shorter term impacts are not brought out through these regulatory measures. To gain insight to the shorter term impacts of wet weather sources of bacteria, DEP has reviewed the New York State Department of Health guidelines relative to single sample maximum bacteria concentrations that they believe “constitute a potential hazard to health if used for bathing”. The presumption being that if the bacteria concentrations are lower than these levels, then the water bodies do not pose potential hazardous if primary contact is practiced.

> **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; ….

Basically fecal coliform concentrations that exceed 1,000 cfu/100mL and or enterococci concentrations exceeding 104 cfu/100mL are considered potential hazards by the State Department of Health and should be avoided. Water quality modeling analyses were conducted herein to assess the amount time following the end of rainfall required for the outer portion of Alley Creek and Little Neck Bay to recover and return to concentrations less than 1,000 cfu/100 mL fecal coliform and 130 cfu/100mL enterococci. The value 130 was used instead of 104 as recent EPA guidance indicates that the 104 value will no longer be relevant.

The analyses performed consisted of examining the water quality model calculation for Alley Creek and Little Neck Bay bacteria concentrations for recreation periods (May 1st to October 31st) abstracted from 10-years of model simulations. The time it takes for wet weather elevated bacteria concentrations to return to 1,000 or 130 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 process began with an analysis of the LGA rainfall data for the period of 2002-2011. The SYNOP model was 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 of the 10-year period calculated the 90th percentile rainfall event to be 1.09 in.

The rainfall event data was then compared against water quality model bacteria results for the 10 recreational periods to determine how long it took for the water column concentration to return to target threshold concentrations from the end of the rain event. Since the system is tidal, care was taken to capture the last time the concentration returned to the target threshold after each rain event. To be conservative, the hour in which the concentration reached the target threshold concentration was included, so the minimum time to recover is one hour. The chosen target threshold concentrations were 1,000 cfu/100mL for fecal coliform, and 130 cfu/100mL for enterococci. The various rainfall events were then placed into rain event size "bins" ranging from less than 0.1 in. to greater than 1.5 in., as shown in Table 6-12. Only rain events that reached the target threshold concentrations before the beginning of the next storm were included. The median time to recover for each bin at each water quality station was calculated. The results for the baseline and 100 percent CSO control scenarios are shown in Table 6-12.

The smaller rain event size bins show no difference between the baseline and 100 percent CSO control scenarios. This is because the existing Alley Creek CSO Retention Facility captures these smaller storms. The 1.0 to 1.5 in. rainfall bin is considered the key bin because it includes the 90th percentile rain event. At Station AC1, the time to recover to the fecal coliform target threshold in the 1.0 to 1.5. in. bin is 20 hours under baseline conditions. Complete CSO control reduces this time to 12 hours. The 1.0 to 1.5 in. bin time to recover at Station AC1 for the enterococci target threshold is 45 hours for the baseline conditions, and is reduced to 31 hours for 100 percent CSO control. The times to recover are progressively shorter with distance from Alley Creek to where the time to recover is the minimum one hour at Station E11 for the 1.0 to 1.5 in. bin.

Table 6-12. Time to Recover

Rain Event Size (in)	Station	Time to Recover (hours)			
		Fecal Coliform Threshold (1000 cfu/100mL)		Enterococci Threshold (130 cfu/100mL)	
		Baseline	100% CSO Control	Baseline	100% CSO Control
<0.1	AC1	-	-	-	-
0.1-0.4	AC1	5	5	10	10
0.4-0.8	AC1	8	8	21	21
0.8-1.0	AC1	18	12	33	26
1.0-1.5	AC1	20	12	45	31
>1.5	AC1	29	14	49	31*
<0.1	OW2	-	-	-	-
0.1-0.4	OW2	-	-	-	-
0.4-0.8	OW2	4	4	11	11
0.8-1.0	OW2	9	5	25	16
1.0-1.5	OW2	17	7	33	27
>1.5	OW2	29	12	46	29

Rain Event Size (in)	Station	Time to Recover (hours)			
		Fecal Coliform Threshold (1000 cfu/100mL)		Enterococci Threshold (130 cfu/100mL)	
		Baseline	100% CSO Control	Baseline	100% CSO Control
<0.1	LN1	-	-	-	-
0.1-0.4	LN1	-	-	-	-
0.4-0.8	LN1	-	-	-	-
0.8-1.0	LN1	-	-	-	-
1.0-1.5	LN1	2	-	7	7
>1.5	LN1	16	3	40	19
<0.1	E11	-	-	-	-
0.1-0.4	E11	-	-	-	-
0.4-0.8	E11	-	-	-	-
0.8-1.0	E11	-	-	-	-
1.0-1.5	E11	-	-	-	-
>1.5	E11	2	-	18	5
<0.1	DMA	-	-	-	-
0.1-0.4	DMA	-	-	-	-
0.4-0.8	DMA	-	-	-	-
0.8-1.0	DMA	-	-	2	2
1.0-1.5	DMA	-	-	4	4
>1.5	DMA	15	-	39	16

* - In one case the time to recover for the > 1.5 in. bin was greater than the 1.0 – 1.5 in. bin, so the time to recover was set equal to the time to recover of the 1.0 to 1.5 in. bin.

7.0 PUBLIC PARTICIPATION AND AGENCY COORDINATION

DEP is committed to implementing a proactive and robust public participation program to inform the public of the development of the watershed-specific and Citywide LTCPs. Public outreach and public participation are important aspects of plans designed to reduce CSO-related impacts to achieve waterbody-specific WQS, consistent with the federal CSO Policy and 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 will use to inform and 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 information needs of a variety of stakeholders, in an effort to meet critical milestones in the overall LTCP schedule outlined in the 2012 Order on Consent signed by DEC and DEP on March 8, 2012.

As part of the CSO Quarterly Reports, DEP will report to DEC on public participation activities outlined in the Public Participation Plan. Updates to the Public Participation Plan that are implemented as a result of public comments received will be posted annually to DEP's website, along with the quarterly summary of public participation activities reported to DEC.

7.1 Local Stakeholder Team

DEP began the public participation process for the Alley Creek and Little Neck Bay LTCP by reaching out to the Queens Borough President's Office and Community Board 11, to identify the stakeholders who would be instrumental to the development of this LTCP. Stakeholders identified included citywide and regional groups, including environmental organizations (APEC, Natural Resources Defense Council, Metropolitan Waterfront Alliance, IEC and Udalls Cove Preservation Society); community planning organizations (Douglaston Historical Society, DMA, Bayside Marina); design and economic organizations (Queens Chamber of Commerce and Auburndale Improvement Association); academic and research organizations (Queens College and Polytechnic University of New York); and City government agencies (DCP, DOHMH, and DOH).

Given the proximity of the study area to an existing park, DEP has also worked closely with DPR. In addition to engaging DPR as a stakeholder in the LTCP process, DEP and DPR collaborated in the coordination of data collection and the identification of stormwater management strategies included in DPR's Alley Creek Watershed Planning and Habitat Restoration Study. This two-year study endeavors to identify ways DPR can shift from an opportunistic pursuit of restoration actions to intentional watershed-based restoration planning. As part of this process, DPR identified stakeholders and is in the process of formulating resource management goals for the study, map watershed resource uses and future uses, identify and prioritize opportunities, and help develop a strategy for implementation. DEP plans to continue to meet with DPR and the WAC to coordinate planning efforts and leverage opportunities for plan implementation.

In addition, DEP will continue to coordinate with the DOH and DOHMH regarding fish advisory promotion information and outreach strategies. DEP ensures this information is available to local and regional stakeholders on the LTCP website and at public meetings.

7.2 Summaries of Stakeholder Meetings

DEP has held public meetings and several stakeholder group meetings to aid in the development and execution of the LTCP. The objective of the public meetings and a summary of the discussion are presented below:

Public Meetings

- Public Meeting #1: Alley Creek LTCP Kickoff Meeting (October 24, 2012)

  Objectives: Provide overview of LTCP process, public participation schedule, watershed characteristics and improvement projects; solicit input on waterbody uses.

  DEP and DEC co-hosted a Public Kickoff Meeting to initiate the water quality planning process for long term control of CSOs in the Alley Creek and Little Neck Bay Waterbody. The two-hour event, held at Alley Pond Environmental Center (APEC) in Queens, served to provide overview information about DEP's LTCP Program, present information on the Alley Creek and Little Neck Bay watershed characteristics and status of waterbody improvement projects, obtain public information on waterbody uses in Alley Creek, and describe additional opportunities for public input and outreach. The presentation can be found at http://www.nyc.gov/dep/ltcp. Approximately 15 stakeholders attended the event, from over ten different non-profit, community planning, environmental, economic development, and governmental organizations, as well as the general public.

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

  - CSO reductions and cost of existing and future CSO-related projects in Alley Creek;
  - Modeling baseline assumptions utilized during LTCP development;
  - Rainfall numbers and assumptions utilized during LTCP development;
  - Water quality data collection;
  - Existing Alley Creek and Little Neck Bay CSO discharges; and
  - Future public meeting announcements.

  Stakeholder comments and DEP's responses were emailed to all attendees and posted to DEP's website, and are also described in Appendix B, Long Term Control Plan (LTCP) Alley Creek Kickoff Meeting – Summary of Meeting and Public Comments Received.

- Public Meeting #2: Alley Creek LTCP Alternatives Review Meeting (May 1, 2013)

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

  On May 1, 2013, DEP hosted a second Public Meeting to continue the water quality planning process for long term control of CSOs in Alley Creek and Little Neck Bay. The purpose of the two-hour event, held at APEC in Queens, was to provide background and an overview of the LTCP planning process; present Alley Creek watershed characteristics and status of existing water quality conditions; obtain public input on waterbody uses in Alley Creek and Little Neck Bay; and describe the alternatives identification and selection process. The presentation is on DEP's LTCP Program Website: http://www.nyc.gov/dep/ltcp. Ten stakeholders attended the event, from five different non-profit, community planning, environmental, economic development, and governmental organizations, as well as the general public.

  In response to stakeholder comments, DEP provided detailed information for each of the following as part of the development of the LTCP:

  - Modeling baseline assumptions utilized during LTCP development, including the rainfall conditions utilized;
  - Water quality data collection;
  - Stormwater inputs/contributions to Alley Creek and Little Neck Bay;
  - Green infrastructure and grey infrastructure potential alternatives;
  - Ecological restoration opportunities in Alley Creek and Little Neck Bay;
  - Opportunity to review and comment on the draft Alley Creek LTCP;
  - Existing Alley Creek and Little Neck Bay CSO discharges; and
  - Future public meeting announcements.

  Stakeholder comments and DEP's responses were emailed to all attendees and posted to DEP's website, and are also described in Appendix C, Alley Creek Meeting #2 – Summary of Meeting and Public Comments Received.

  During this Public Meeting #2, there was a high degree of public support for the DEP's findings that additional grey infrastructure-based CSO controls were not warranted due to the improvements that DEP made based on the 2009 WWFP, and the fact that additional construction projects could affect the natural ecosystem conditions in this upper Alley Creek watershed.

- Public Meeting #3: Draft LTCP Review Meeting (TBD)

  Objectives: Present LTCP and associated UAA

This meeting schedule is to be announced. The purpose is to 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

- September 12, 2012

  DEP attended the Queens Borough Cabinet Meeting and presented information on public outreach for the Alley Creek LTCP to Queens Borough President, Helen Marshall, and Queens Borough Cabinet members. In addition to presenting information on public outreach, DEP answered questions regarding the Alley Creek LTCP development schedule and process, elements of the approved Alley Creek WWFP and CSO controls. DEP provided Community Board representatives with a PowerPoint presentation on September 21, 2012, to be forwarded to their constituents. The presentation was also posted to DEP's LTCP Program website: http://www.nyc.gov/dep/ltcp.

- September 29, 2012

  DEP staffed a table at the Little Neck Bay Festival at the APEC in Douglaston, Queens. DEP distributed an Alley Creek LTCP summary, an Alley Creek LTCP Kickoff notice and other LTCP-related educational materials to attendees. Approximately 20 stakeholders from over seven organizations and the broader public asked to be added to DEP's LTCP stakeholder database.

- October 24, 2012

  DEP met with APEC staff to discuss APEC's existing educational programs and ways that DEP can support and build upon these efforts. DEP will continue to meet and work with APEC throughout the development of waterbody-specific LTCPs, to support the development of environmental educational information for grades K-12.

- October 21, 2013

  DEP met with the Queens Borough office to present on the Alley Creek LTCP. In addition to presenting information on public outreach, DEP answered questions regarding the Alley Creek LTCP development schedule and process, elements of the approved Alley Creek WWFP and CSO controls.

7.3 Coordination with Highest Attainable Use

In cases 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 LTCP will include a UAA to examine whether applicable waterbody classifications criteria or standards should be adjusted by the State. The UAA assesses the waterbody's uses, which the State will consider in adjusting WQS, classifications, criteria and developing waterbody-specific criteria.

Comprehensive analysis of baseline conditions, along with the future anticipated conditions after implementing the recommended LTCP projects, show that Alley Creek will remain a highly productive Class I waterbody that can fully support secondary uses, including nature education and wildlife propagation. Alley Creek is in attainment with its current Class I classification, but it is not feasible for the waterbody to meet the water quality criteria associated with the next higher (Class SC) classification.

Furthermore, combinations of natural and manmade features prevent both the opportunity and feasibility of primary contact recreation in Alley Creek. Little Neck Bay generally meets the Class SB criteria, approximately 99 percent of the time for fecal coliform (see Table 6-4) and 95 percent of the time for enterococci (see Table 6-5). It should be noted, however, that the bathing season monthly GM fecal coliform compliance is 100 percent at Douglaston Manor Association (DMA) Beach and 30-day rolling GM enterococci compliance is 95 percent at Douglaston Manor Association (DMA) Beach, the only official bathing beach in the waterbody. However, the continued presence of non-CSO discharges, most notably stormwater from MS4 outfalls, prevents annual attainment of Class SB standards, even when 100 percent CSO volume reduction is considered (see Section 6.0). Given that CSO control alone is projected to not allow Class SB criteria to be met at all times, upgrading the classification of Little Neck Bay to Class SA under the LTCP program is not feasible.

DEP obtained public feedback on waterbody uses in Alley Creek and Little Neck Bay at the May 1, 2013 Public Meeting. That there was a high degree of public support for DEP's findings that additional grey infrastructure-based CSO controls were not warranted due to the improvements made based on the 2009 WWFP. DEP will continue to gather any additional public feedback and will provide the public UAA-related information at the third Alley Creek and Little Neck Bay Public Meeting.

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 outreach tools are accurate, informative, up-to-date and consistent, and are widely distributed and easily accessible. Table 7-1 presents a summary of Alley Creek LTCP public participation activities.

Table 7-1. Summary of Alley 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
Waterbody-specific Community Outreach	Public meetings and open houses	• Kickoff Meeting: October 24, 2012 • Meeting #2: May 1, 2013 • Meeting #3: TBD
	Stakeholder meetings and forums	• Little Neck Bay Festival: September 29, 2012 • APEC meeting: October 24, 2012 • Queens CB 11 on June 10, 2013
	Elected officials briefings	• Queens Borough Cabinet Briefing: September 12, 2012 • Queens Borough Cabinet Meeting:

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

Category	Mechanisms Utilized	Dates (*if applicable*) and Comments
		October 21, 2013
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 2 weeks of receipt
	Update mailing list database	• DEP updates master stakeholder database (700+ stakeholders) after each meeting and briefing
Communication Tools	Program Website or Dedicated Page	• LTCP Program website launched June 26, 2012 and frequently updated • Alley Creek LTCP webpage launched October 1, 2012 and frequently updated
	Social Media	• N/A
	Media Outreach	• Posting Advertisements in local newspapers and emailing stakeholders.
	FAQs	• LTCP FAQs developed and disseminated beginning June 26, 2012 via website, meetings and email
	Print Materials	• LTCP FAQs: June 26, 2012 • LTCP Goal Statement: June 26, 2012 • LTCP Public Participation Plan: June 26, 2012 • Alley Creek Summary: October 15, 2012 • LTCP Program Brochure: February 28, 2013 • 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	• As-needed basis
	Portable Informational Displays	• Poster board displays at meetings
	Advisories and Notifications	• TBD
	Construction Outreach	• N/A
Student Education	Participate in ongoing education	• Little Neck Bay Festival: September 29,

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

Category	Mechanisms Utilized	Dates (*if applicable*) and Comments
	events	2012

DEP launched its LTCP Program website on June 26, 2012. The website provides links to documents related to the LTCP program, including CSO Orders on Consent, approved WWFPs, CSO Quarterly Reports, links to related programs such as the Green Infrastructure Plan, 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. Refer to Appendix D, Summary of Public Comments Received via Email and DEP Responses, for this feedback. 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 specific Alley Creek LTCP webpage was created in September 2012, and includes the following information:

- Alley Creek public participation and education materials
    - Alley Creek and Little Neck Bay Summary Paper
    - Alley Creek Waterbody/Watershed Facility Plan
    - LTCP Public Participation Plan
    - LTCP submitted in November of 2013
    - Article 78 petition
- Alley Creek LTCP Meeting Announcements
- Alley Creek Kickoff Meeting Documents – October 24, 2012
    - Advertisement
    - Meeting Agenda
    - Meeting Presentation
    - Meeting Summary and Response to Comments

- Queens Borough Cabinet Presentation – September 12, 2012
- Alley Creek Meeting #2 Meeting Documents – May 1, 2013
  - Advertisement
  - Meeting Agenda
  - Meeting Presentation

Meeting Summary and Response to Comments

8.0 EVALUATION OF ALTERNATIVES

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

This section contains information about the following:

- The process for developing and evaluating CSO control alternatives that reduce CSO discharges and improve water quality (Section 8.1)
- CSO control alternatives and evaluations of each (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 to select the preferred alternative (Section 8.5)
- Use Attainability Analysis (UAA) and site-specific targets to demonstrate continuing water quality improvements for Alley Creek (Sections 8.6 and 8.7). Wet weather advisories for Little Neck Bay to be protective of primary contact during and following rainfall events.

8.1 Considerations for LTCP Alternatives under the Federal CSO Policy

This LTCP addresses the water quality goals of the federal CWA and associated EPA CSO Control Policy and the New York State Environmental Conservation Law. It builds upon the EPA NMCs, part of the EPA CSO Control Policy, as well as the conclusions presented in DEP's 2009 WWFP Consistent with the LTCP Goal Statement, this LTCP includes a UAA which examines whether applicable waterbody classifications, criteria, or standards should be adjusted by the State because the proposed alternative set forth in this LTCP will not achieve existing WQS or the Section 101(a)(2) goals. The UAA assesses the waterbody's attainable use, which the State will consider in adjusting WQS, classifications, criteria and developing waterbody-specific criteria.

The remainder of Section 8.1 discusses the development and evaluation of CSO control measures and watershed alternatives to comply with the CWA in general, and with the EPA CSO Control Policy in particular. The evaluation factors considered for each alternative are described, followed by the process for evaluating and ranking the alternatives.

8.1.a Performance

Section 6.0 presented evaluations of baseline conditions and concluded that there are no performance gaps because baseline conditions attain current WQS. Specifically, both Alley Creek and Little Neck Bay are in attainment with current DO and bacteria criteria. Also, modeling results indicate that Alley Creek cannot attain the more stringent Primary Contact WQ Criteria, the SC Classification, due to the presence of non-CSO sources of bacteria in the Creek. Therefore, discussion of performance for Alley Creek and Little Neck Bay alternatives will focus on bacteria criteria and standards.

Sensitivity analyses described in Section 6.0 assessed the possibility of attainment for the Primary Contact WQ Criteria (Class SC), and for the 2012 EPA Recommended Recreational Water Quality Criteria that may be adopted by DEC (referred to herein as Future Primary Contact WQ Criteria). The results indicate that although 100 % CSO control (complete removal of bacteria) could result in an incremental increase in attainment, it would not close the bacteria performance gap for Alley Creek when considering existing or WQ criteria. However, when the Primary Contact WQ Criteria (Class SC) was applied during recreational season, full attainment (≥95%) is observed with 100% CSO control. These results are based on the predictions of the calibrated and validated numeric modeling results which will require additional validation from the post-construction monitoring of the preferred alternative.

During the development of control alternatives, performance was examined to evaluate potential WQS attainment. This LTCP includes alternatives that include 0, 25, 50, 75 and 100 percent reductions in CSO volume. However, for some alternative control measures, such as disinfection, there is no reduction in CSO volume, but a reduction in bacteria loading instead. Performance of each control alternative is measured against its ability to meet the WQS and water quality requirements for the 2040 planning horizon. It is essential that proposed control alternatives be capable of meeting the modeled anticipated performance. As such, only proven control measures are included in the plan alternatives.

8.1.b Impact on Sensitive Areas

During the development of alternatives, special consideration was 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, there is one sensitive area within Alley Creek and Little Neck Bay, namely the DMA Beach in Little Neck Bay. The LTCP therefore, addresses the following EPA CSO Control Policy requirements: (a) prohibit new or significantly increased overflows; (b) eliminate or relocate overflows that discharge to sensitive areas if physically possible, economically achievable, and as protective as additional treatment, or provide a level of treatment for remaining overflows adequate to meet standards; and (c) provide for reassessments in each permit term based on changes in technology, economics, or other circumstances for those locations not eliminated or relocated (EPA, 1995a).

8.1.c Cost

Cost estimates for the alternatives were computed using a costing tool based on parametric costing data. This approach is assumed to provide an Association for the Advancement of Cost Engineering

(AACE) Class V estimate (accuracy range of plus 50 percent to minus 30 percent), which is appropriate for this type of planning evaluation.

For the LTCP alternatives, total project cost includes the capital cost of the project, including construction, engineering and other project development costs. Annual operation and maintenance (O&M) costs are then used to calculate the total present worth or value over the projected useful life of the project. To quantify costs and benefits, alternatives are compared based on reductions of CSO discharge volume and bacteria loading against the total cost of the alternative. The resulting graph, called the knee-of-the-curve (KOTC), is used to help select the final recommended alternative. In doing so, the alternative that achieves the greatest appreciable water quality improvements at the lowest cost is selected; this may not necessarily be the lowest cost alternative, however. Beyond the comparative evaluation of alternatives, cost-effectiveness must be assessed from a broader perspective. Recommended alternatives must be capable of achieving water quality goals in a fiscally responsible and affordable manner to ensure that resources are properly allocated across the overall citywide LTCP program.

8.1.d Technical Feasibility

Several factors were considered when evaluating technical feasibility, including:

- Effectiveness in controlling CSO
- Reliability
- Implementation

The effectiveness of CSO control measures was assessed based on their ability to reduce CSO frequency, volume, and intensity. 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 and cost effectiveness of a control measure.

Several site-specific factors were considered when evaluating an alternative's technical feasibility including available space, neighborhood assimilation, impact on parks and green space, and overall practicability of installing the CSO control. In addition, the method of construction was factored into the final selection. Some technologies require specialized construction methods that typically incur additional costs.

8.1.e Cost-Effective Expansion

All alternatives evaluated were sized to handle the 2040 design year CSO volume, 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 additional CSO flows or volumes, should it be needed. In some cases in the analysis, 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 allowed adjustment of the design of future phases based on the performance of already-constructed phases. Lessons learned during operation of the current facilities can be incorporated into the design of the future facilities. However, phased construction also exposes the local community to a longer construction period. For those alternatives that can be expanded, the LTCP discusses how easily they can be expanded, what additional infrastructure may be required, and whether DEP would need to acquire additional land.

As regulatory requirements change, the need for improvements in nutrient removal or disinfection could arise. The ability of a CSO control technology to be retrofitted to handle process improvements improved the rating of that technology.

8.1.f Long Term Phased Implementation

The final recommended plan is structured in a way that makes it adaptable to change via expansion and modifications in response to 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 have to be identified prior to selection of the alternative. These were identified along with permit schedules where appropriate. With the exception of GI, which is assumed to occur on both private and public property, most if not all of the CSO grey technologies are limited to City-owned property and right-of-way acquisitions. Where necessary, DEP will work closely with other State and City agencies.

8.1.g Other Environmental Considerations

Impacts on the environment and surrounding neighborhood will be minimized as much as possible during construction. These considerations include traffic impacts, site access issues, park and wetland disruption, noise pollution, air quality, and odor emissions. To ensure that environmental impacts are minimized, they will be identified with the selection of the recommended plan and communicated to the public. Any identified potential concerns will be addressed in a pre-construction environmental assessment.

8.1.h Community Acceptance

As described in Section 7.0, DEP is committed to involving the public, regulators and other stakeholders throughout the planning process. The scope of the LTCP, background and newly collected data, WQS and it's the development and evaluation of alternatives were presented at two public meetings, one on October 24, 2012 and one on May 1, 2013. Community acceptance of the recommended plan is essential to its success. The Alley Creek and Little Neck Bay LTCP is intended to be an integral part of the community, enhancing the quality of life in the neighborhood while addressing CSOs. The public's health and safety are the first priority of the Plan. Raising awareness of and access to waterbodies is a goal of the Plan and was considered during the alternative analysis. Several CSO control measures, such as GI, have been shown to enhance the community while increasing local property values and, as such, the benefits of GI were considered in the formation of the final recommended plan.

8.1.i Methodology for Ranking Alternatives

The Alley Creek and Little Neck Bay LTCP employed a three-step procedure developed to evaluate and rank control measures and alternatives:

- Step 1: Screening of Potential Control Measures

- Step 2: Development and Ranking of Control Measures

- Step 3: Final Evaluation and Selection of Preferred Watershed-wide Alternative

The goal of the process was to use the criteria described in this section 8.1 and perform a qualitative and quantitative assessment when evaluating alternatives.

An overview of the three-step procedure is presented in Table 8-1 and shown graphically in Figure 8-1. Overall, the methodology for ranking control measures moves from being highly qualitative to more quantitative as the steps progress. In Step 3, quantitative measures including cost estimates, capital and annual operation and maintenance (O&M), and predicted performance data (CSO control measures and water quality impacts) are used to perform the cost performance or KOTC analysis.

Table 8-1. Three-Step Control Measure and Watershed-Wide Alternative Evaluation and Screening Process

Factor	Step 1: Screening of Potential Control Measures	Step 2: Evaluation and Ranking of Control Measures	Step 3: Final Evaluation and Selection of Preferred Watershed-Wide Alternative
Type of Process	Qualitative	Quantitative	Cost/Performance using KOTC
Rating Criteria	Fatal flaw analysis (no quantitative metrics)	Non-economic metrics	1. Lifecycle costs: capital plus annual O&M. 2. Control level performance (see below).
Purpose/Outcome	Selection of the preferred control measures for the watershed under consideration	Determination of the higher-ranked control measures for development of alternatives using the ranking factors	1. Final ranking of alternatives based on cost per MG of CSO volume controlled ($/gallon). 2. Other KOTC parameters could also be considered such as unit cost of pollutant reduction or unit cost of days/hours of additional WQS attainment.
Process Implementation	1. Develop a list of potential control measures in a workshop setting. 2. Evaluate and screen potential control measures based on applicability to the specific waterbody/ watershed. Examine for fatal flaws or weaknesses that would prevent or limit a control measure's efficacy for CSO abatement.	1. Evaluate, score and rank the remaining control measures from Step 1. 2. Develop alternatives for the watershed using the higher ranked control measures. 3. Alternatives will be subjected to economic and cost-performance evaluations in Step 3.	1. Use the most recent waterbody and watershed modeling data to transform the process into a more quantitative direction. 2. Develop updated costing templates with the addition of annual O&M costs. 3. Assess water quality gaps. 4. Perform KOTC analysis using the most viable watershed-wide alternatives.

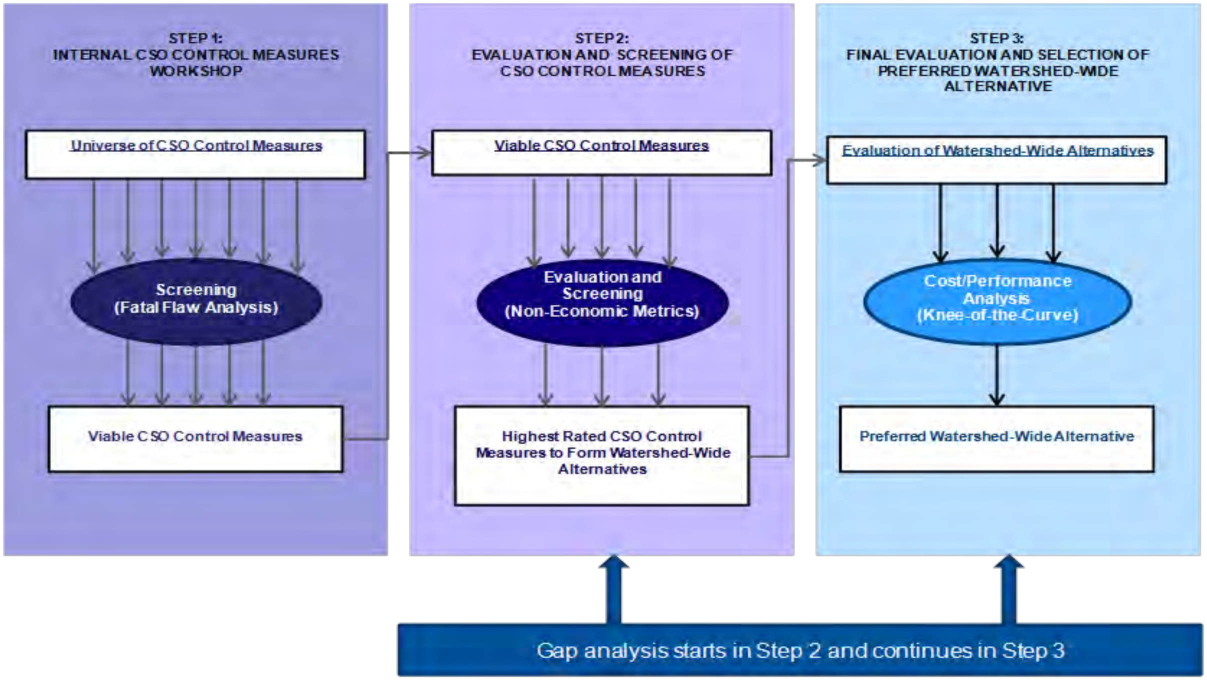


Figure 8-1. Three-Step LTCP Screening and Evaluation Process for Alley Creek and Little Neck Bay Alternatives

In Step 1, the potential technologies and control measures are evaluated qualitatively to judge their ability to meet the LTCP scope and identify fatal flaws that could disqualify a control measure from use in the watershed under consideration. Examples of fatal flaws could include insufficient land or less than desirable siting for a particular technology, a technology that is unproven in addressing the performance objectives required or an approach or alternative that would cause detrimental impact to the local community during and after construction.

In Step 2, the resulting favorable control measures are then rated using pre-defined non-economic criteria or metrics, covering the following three categories:

- Environmental Benefits
- Community and Societal Impacts
- Implementation and O&M Considerations

Factors considered for each of these three categories are described in Table 8-2. Economic considerations are not included in Step 2, but are evaluated in Step 3, when the watershed-wide alternatives are more fully developed. The control measures are rated by assigning a score for each metric with a value of "5" indicating a highly favorable rating and a "1" indicating the most unfavorable rating. The scoring scale is shown in Table 8-3.

Table 8-2. Definitions of Step 2 Metrics

Metric	Description
A. Environmental	
A1. CSO Frequency/ Volume	Decrease in discharge frequency and CSO volume.
A2. Pollutant Reduction/ Water Quality improvements	Decrease in discharge of pollutants including floatables, TSS, BOD and bacteria.
A3. Control of Discharge to Sensitive Areas	Degree to which sensitive areas, such as bathing beaches and marinas, are protected from the remaining CSO discharges.
B. Community/Societal	
B1. Environmental Justice	Degree to which the control measures affects low- and moderate-income neighborhoods.
B2. Ancillary Community Benefits	Benefits include streetscape improvements; enhanced recreational opportunities; localized street flooding; and control of discharge to waterfront public access areas.
B3. Community Disruption/ Potential for Nuisances	Disruption to the affected area during construction and subsequent routine O&M of the control measures including traffic, dust, noise, aesthetics, etc.
C. Implementation and O&M	
C1. Constructability/Permitting	Possible impediments to implementation including, but not limited to: degree of construction difficulty; environmental and operational permitting; presence of hazardous materials, subsurface or topographic conditions; permanent land requirements, easements or deed restrictions; planned redevelopment; inter-governmental jurisdictional issues; and other land use and zoning requirements.
C2. Operating Complexity/ Ease of O&M	Consistency with existing O&M practices and/or level of complexity of the project components including, but not limited to: use of chemicals; reliance on multiple sensors/meters; operation of upstream and/or downstream facilities, etc.
C3. Sustainability	Degree to which the construction and routine O&M of the control measures consumes labor, materials, chemicals, power and fuel over their useful life.

Table 8-3. Step 2 Scoring Scale

Score	General Definition
5	Highly Favorable
4	Favorable
3	Neutral
2	Unfavorable
1	Highly Unfavorable

Because the various metrics are not considered equal in terms of their relative importance, a system of weighting factors was established to ensure that the evaluation, ranking and screening process is reflective of DEP and community goals and objectives for the LTCP program. Different weighting factors were assigned to the three major categories of metrics, with the total adding to 100 percent. Furthermore, weighting factors also were assigned to each metric within each major category as the individual metrics may have different levels of importance within the major category. The overall metric weighting factor is the product of the individual metric weight and the major category weight. The overall metric weighting factors are shown in Table 8-4.

Table 8-4. Weighting Factors for Step 2 Metrics

Major Category	Category Weighting Factor	Metric	Metric Weighting Factor
A. Environmental	0.45	A1. CSO Volume/Frequency	0.16
		A2. Pollutant Reduction/Water Quality Improvements	0.16
		A3. Control of Discharge to Sensitive Areas	0.13
B. Community/ Societal	0.25	B1. Environmental Justice	0.08
		B2. Ancillary Community Benefits	0.08
		B3. Community Disruption/ Potential for Nuisances	0.09
C. Implementation and O&M	0.30	C1. Constructability/Permitting	0.15
		C2. Operating Complexity/Ease of O&M	0.09
		C3. Sustainability	0.06

The most promising or higher ranked control measures then were moved to Step 3, where they were combined to form watershed-wide alternatives. These were then evaluated in greater detail using economic criteria and other cost-performance and water quality attainment criteria. Using these expanded criteria, including the latest results from both updated landside and water quality modeling, cost-performance or KOTC evaluations were performed so that the most environmentally-sound and cost-effective alternative was selected. To construct the cost-performance curves, alternatives were developed to cover a range of CSO control spanning 25, 50, 75 and 100 percent CSO volume capture, or their equivalent, and to address the performance gaps described in Section 6.3.

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

Using this evaluation methodology, 12 control measures were deemed as being viable from the Step 1 process and passed onto Step 2. They were then scored using the metrics shown in Table 8-2, scoring definitions in Table 8-3, and weighting factors in Table 8-4. The results of Step 2 are shown in Table 8-5.

As shown in the table, scores ranged from a high of 4.02 (80.4 percent) for expanding the existing CSO Retention Tank, to a low of 2.17 (43.4 percent) for netting facilities. High Level Sewer Separation (HLSS) and Vertical Treatment System (VTS) storage were also highly ranked, with scores of 3.50 (70.0 percent) and 3.35 (67.0 percent), respectively. System optimization and GI also ranked in the top five control measures, with scores of 2.94 (58.8 percent) and 2.92 (58.4 percent), respectively. It is important to note however, that while GI and system optimization ranked in the top five, they were not able to close the performance gap in water quality as standalone control measures, and would have to be combined with other control measures to fulfill the LTCP scope. Disinfection within the existing Alley Creek CSO Retention Facility had a score of 2.76 (55.2 percent), and was also retained for further evaluation.

The top-ranked control measures from Step 2, listed in Table 8-6, were further developed into alternatives by identifying specific levels of CSO control, along with potential locations for implementation of the control measures. In keeping with the LTCP guidance, the alternatives spanned a range of CSO volumetric and/or pollutant reduction controls, including the 100 percent control level. To assist in this process, the Alley Creek and Little Neck Bay IW model was used to develop sizes of the control measures for various levels of reduction in CSO volume and pollutant loading, most notably bacteria. As shown in Table 8-7, alternatives were matched with targeted CSO volumes, ranging from 15 percent for 10 percent GI coverage, to 100 percent for a 29.5 MG expansion of the existing Alley Creek CSO Retention Tank. It should be noted that GI coverage, as referred in this section, was based upon the concept of retention. Thus, as shown in Table 8-7, a 10 percent GI coverage results in a 15 reduction in CSO volume.

Also, while not providing CSO volume reduction, disinfection within the Alley Creek CSO Retention Facility was included as a 100 percent CSO control measure. The WQ modeling described in Section 6.0 revealed that because of the high level of reduction in the bacteria concentration that would result from disinfection, this control measure was approximately equal to the 100 percent CSO volume control that would be realized with the 29.5 MG expansion of the Alley Creek CSO Retention Facility described later in this section. As noted, in addition to the 100 percent control target, there are also multiple alternatives for the 50 and 75 percent CSO volume targets. Expanded development of the alternatives is presented in the following sections.

Table 8-5. Step 2 Scoring of Control Measures

CSO Control Measure	Environmental			Community/Societal			Implementation/ O&M			Raw Score	Weighted Score	Weighted Score % of Possible Total Score
	CSO Volume & Frequency	Pollutant Reduction/ WQ Improvement	Control of Discharge to Sensitive Areas	Environmental Justice	Ancillary Community Benefits	Community Disruptions/ Potential for Nuisances	Constructability/ Permitting	Operating Complexity/ O&M Requirements	Sustainability			
	16%	16%	13%	8%	8%	9%	15%	9%	6%	No.	No.	%
High Level Sewer Separation (HLSS)	5	3	2	4	4	2	3	5	4	32	3.50	70.0
Stormwater Redirection	2	1	1	4	1	3	1	1	2	16	1.64	32.8
Expand Existing Alley Creek CSO Retention Facility	5	5	5	3	3	4	3	4	2	34	4.02	80.4
Disinfection in Existing Alley Creek CSO Retention Facility	1	4	4	3	3	4	3	1	1	24	2.76	55.2
Chemically Enhanced Settling in Existing Alley Creek CSO Retention Facility	1	3	2	3	3	4	4	2	1	23	2.58	51.6
Bar Screen in Existing Alley Creek CSO Retention Facility	1	1	1	3	3	4	5	2	3	23	2.40	48.0
Increase Pump Station and Interceptor Capacity to WWTP	2	2	2	3	3	3	3	4	2	24	2.58	51.6
VTS Storage	5	4	5	3	3	2	2	2	2	28	3.35	67.0
Netting Facilities	1	2	1	3	3	3	3	2	3	21	2.17	43.4
Green Infrastructure	2	2	2	4	4	3	3	4	5	29	2.92	58.4
System Optimization (Sewer Enhancements)	2	2	2	3	3	5	4	3	4	28	2.94	58.8
Real Time Control (RTC)	2	2	2	5	3	5	2	2	3	24	2.49	49.8

Table 8-6. Control Measures Retained for Watershed-Wide Alternatives Development

Core Control Measure(s)	Remarks
HLSS	1. For closure of moderate to large performance gaps 2. Could be supplemented by GI and/or System Optimization
Expand Existing Alley Creek CSO Retention Facility (or Additional New Downstream Retention Facility)	1. For closure of moderate to large performance gaps 2. Could be supplemented by GI and/or System Optimization
VTS Storage	1. For closure of moderate to large performance gaps 2. Could be supplemented by GI and/or System Optimization 3. For either additional downstream or new upstream storage
Disinfection in Existing Alley Creek CSO Retention Facility	1. For closure of moderate to large performance gaps 2. Could be supplemented by GI and/or System Optimization
GI	Limited to closure of small performance gaps
System Optimization (Sewer Enhancements)	Limited to closure of small performance gaps

Table 8-7. Potential Alternatives for Targeted CSO Volume Control Levels

Target CSO Volume Reduction Percent	Control Measures	Remarks
15	10 percent GI Coverage	See Section 8.2.b
25	3.0 MG Downstream Tank and 2.4 MG Upstream Tank	See Section 8.2.a.3
50	1. 6.5 MG Downstream Tank and 6.7 MG Upstream Tank 2. 100 percent HLSS (51 percent)	1. See Section 8.2.a.3 for tank and treatment alternatives 2. See Section 8.2.a.1 for HLSS alternative
65	50 percent GI Coverage (69 percent)	See Section 8.2.b
75	1. 12 MG Downstream Tank 2. 3.0 MG Downstream Tank and HLSS (71 percent)	1. See Section 8.2.a.3 for tank and treatment alternatives 2. See Section 8.2.d For the hybrid tank plus alternative
100	1. 29.5 MG Downstream Tank 2. Disinfection in Existing Alley Creek CSO Retention Facility	See Section 8.2.a.3 for tank and treatment alternatives

8.2.a Other Future Grey Infrastructure

"Grey infrastructure" refers to single-purpose systems used to control, reduce or eliminate discharges from CSOs. These are the technologies that have been traditionally employed by DEP and other wastewater utilities in their CSO planning and implementation programs, and encompass retention tanks; dedicated and centralized treatment plants, including high-rate physical-chemical treatment (also referred to as high-rate clarification); and other similar capital-intensive facilities. Grey infrastructure implemented under previous CSO control programs and facility plans (such as the 2009 WWFP) was described in Section 4.0 and includes the Alley Creek CSO Retention Facility (a traditional, shallow, below-ground concrete retention tank), along with major related sewer system and pump station modifications.

The existing Alley Creek CSO Retention Facility captures up to 5 MG of CSO volume per storm event, and was designed for capture of over 50 percent of the CSO volume discharged to Alley Creek and Little Neck Bay. For the purpose of this LTCP, "Other Future Grey Infrastructure" refers to potential grey infrastructure beyond existing grey infrastructure control measures implemented based on previous planning documents.

8.2.a.1 High Level Sewer Separation

High Level Sewer Separation (HLSS) also referred to as High Level Storm Sewers, is a form of partial separation of combined sewers only in the streets or other public rights-of-way, while leaving roof leaders or other building connections unaltered. In NYC, this is typically accomplished by constructing a new stormwater system and directing flow from street inlets and catch basins to the new storm sewers. Challenges associated with HLSS include constructing new sewers with minimal disruption to the neighborhoods along the proposed alignment, finding a viable location for any necessary new stormwater outfalls, and avoiding conflicts with recent system improvements upstream of the Alley Creek CSO Retention Facility. Separation of sewers minimizes the amount of sanitary wastewater being discharged to receiving waters, but also results in increased separate stormwater discharges (which also carry pollutants) to receiving waters.

One HLSS alternative was developed for the CSS that is tributary to Regulators 46 and 47; this is referred to as Alternative 1. The CSS associated with these regulators is west of Alley Pond Park (Figure 2-9 in Section 2.0), represents 86 percent of the entire Alley Creek and Little Neck Bay CSS, and corresponds to 16 percent of the total watershed. An enlarged view of the area served by these two regulators is shown in Figure 8-2. Under this alternative, newly-separated stormwater would be conveyed through a new municipal separate storm sewer system (MS4) to Alley Creek along the route shown in Figure 8-3. The new outfall would require permitting under the MS4 program.

Hydraulic modeling using the re-calibrated IW model determined that HLSS could provide up to a 51 percent reduction of the CSO volume. Because this level was deemed to be insufficient to close the performance gap described in Section 6.3, HLSS was also considered in combination with VTS storage (see Section 8.2.d).

Figure 8-2. Combined Sewer Service Area Tributary to Regulators 46 and 47

Figure 8-3. HLSS for CSS Tributary to Regulators 46 and 47 (Alternative 1)

8.2.a.2 Sewer Enhancements

Sewer enhancements, also known as system optimization measures, aim to reduce CSO through improved operating procedures or modifications to the existing collection system infrastructure. Examples include control gate modifications, regulator or weir modifications, inflatable dams and real time control (RTC). These control measures generally retain more of the combined sewage within the existing sewer pipes during storm events. The benefits of retaining this additional volume must be balanced against the potential for sewer back-ups and flooding. Viability of these control measures is system-specific, depending on existing physical parameters such as pipeline diameter, length, slope and elevation.

Evaluations performed under previous facility plans have shown that the Alley Creek and Little Neck Bay sewer system is not suitable to significant CSO reductions through sewer system enhancements or optimization. After updating the IW collection system model and re-examining the state of RTC technology, it was found that the previous conclusions are still valid, and RTC is still not viable within Alley Creek and Little Neck Bay. Elevated static weir heights, opportunities for inflatable dams and/or control gates, and similar alternatives within the sewer system pipes have been eliminated from further consideration, due to risk of flooding in the community. At best, alternatives relying solely on sewer enhancements would be limited to small volume reductions. Although this LTCP does not propose specific alternatives under this control measure category, sewer enhancements could be considered under other alternatives (e.g., additional storage/retention alternatives may need to include sewer enhancements if the evaluation identifies pump station and sewer system conveyance limitations that impact storage dewatering).

8.2.a.3 Retention/Treatment Alternatives

Retention Alternatives

The objective of CSO retention is to reduce overflows by intercepting combined sewage in an offline or inline storage element during wet weather for controlled release into the WWTP after the storm event. Retention control measures considered in this LTCP include traditional, shallow, closed concrete tanks and VTS. More detailed description for traditional tanks can be found in the 2009 Alley Creek and Little Neck Bay WWFP.

As an alternative to a traditional shallow tank, additional capacity could be added by construction of a VTS for the purposes of storage only. Extending deeper into the ground compared to a traditional shallow tank, the VTS can provide a large storage capacity while occupying a smaller ground surface footprint. The smaller footprint may allow for versatility when siting the VTS. As with traditional shallow tanks, VTSs typically require odor control systems, washdown/solids removal systems, tank dewatering pumps, and access for cleaning and maintenance.

Siting considerations are key factors in determining the viability of additional storage and may influence the selection of the type of tank – traditional shallow tank or VTS storage – and its location. Evaluation of the Alley Creek and Little Neck Bay watershed identified two candidate locations for siting additional retention facilities:

- Downstream, near the existing Alley Creek CSO Retention Facility (including both adjacent to the existing tank and to the south of Northern Boulevard); and
- Upstream of the existing tank near the CSO regulators for the CSS area.

Retention Alternatives - Downstream Sites

Downstream sites are near the existing Alley Creek CSO Retention Facility, which is located just north of Northern Boulevard between the Cross Island Parkway and Alley Creek. Additional retention could be constructed adjacent to the existing Alley Creek CSO Retention Facility, sharing the influent sewers, control structures, facility drain piping, and outfall that have already been built. Several retention alternatives, spanning a range of 25 to 100 percent CSO volume reduction, were developed near this downstream location. As shown in Table 8-8, under baseline conditions with the Alley Creek CSO Retention Facility in operation, virtually all of the CSO discharge to Alley Creek and Little Neck Bay is conveyed through outfall TI-025, which is the outfall associated with the Alley Creek CSO Retention Facility.

Table 8-8. Dewatering Time for Retention Alternatives

Outfall	Waterbody	Total CSO Volume in MG/yr				
		Baseline	100 Percent Capture	75 Percent Capture	50 Percent Capture	25 Percent Capture
TI-007	Alley Creek	0.1	0.1	0.1	0.1	0.1
TI-008	Alley Creek	0.0	0.0	0.0	0.0	0.0
TI-009	Little Neck Bay	0.0	0.0	0.0	0.0	0.0
TI-025	Alley Creek	132.5	0.0	33.4	66.8	99.7
Total		132.6	0.1	33.5	66.9	99.8
Additional Tank Volume Required (MG)		--	29.5	12.0	6.5	3.0
Additional Dewatering Capacity for Retention Alternatives (MGD)		NA	15	6	3.5	1.5
Dewatering Time for Retention Alternatives (days)		NA	2.0	2.0	1.8	1.9

To capture 100 percent of the 132.5 MG/yr CSO volume discharged through TI-025, an additional 29.5 MG of retention would be required. For lesser captures of 75, 50, and 25 percent, additional retention volumes of 12 MG, 6.5 MG and 3.0 MG would be required, respectively. Alternatives corresponding to these rates of CSO volume capture are:

- **Alternative 2A – 3.0 MG Retention**. Alternative 2A is designed to capture 25 percent of the CSO volume. Alternative 2A is a 3.0 MG traditional shallow tank located north of and abutting the existing tank but south of the marsh grass (see Figure 8-4). In essence, it is an expansion of the existing Alley Creek CSO Retention Facility that would drain through the existing gravity drain to the Old Douglaston PS. Adequacy of the Old Douglaston PS capacity (8.5 MGD) must be evaluated to determine whether it can handle the additional volume of captured CSO. An optional approach would employ a 3.0 MG VTS storage facility instead of a traditional shallow tank (see Figure 8-5). The VTS alternative would significantly reduce the footprint required for a new retention tank, but would extend to a much greater depth to provide the same storage volume. Because this would place the bottom of the VTS below the drain pipe at the existing Alley Creek CSO Retention Facility, the VTS would not be drained by gravity, but would instead require new pump facilities to dewater the VTS between rain events.

- **Alternative 2B – 6.5 MG Retention**. Alternative 2B is designed to capture 50 percent of the CSO volume and requires a volume of 6.5 MG, through a VTS storage facility located north of the existing tank but south of the marsh grass wetland (see Figure 8-6). Another option would employ a traditional tank located south of Northern Boulevard, as shown in Figure 8-7. To fit within the proposed sites, the 6.5 MG retention alternatives require depths that extend below the drain pipe at the existing Alley Creek CSO Retention Facility and will therefore require new pump facilities to dewater them between rain events.

- **Alternative 2C – 12 MG Retention**. Alternative 2C is a 12 MG traditional rectangular concrete tank designed to capture 75 percent of the CSO volume. The proposed location is south of Northern Boulevard, as shown in Figure 8-8. The required tank depth would extend below the drain pipe at the existing Alley Creek CSO Retention Facility, and this alternative would therefore require new pump facilities to dewater the tank.

- **Alternative 2D – 29.5 MG Retention**. Alternative 2D is designed to capture 100 percent of the CSO volume. This alternative is comprised of a 29.5 MG rectangular tank and a pumping facility to dewater the tank between rain events. The proposed location for the facility is south of Northern Boulevard, as shown in Figure 8-9.

Siting Considerations

The proposed location for these alternatives has potential siting restrictions. The existing retention tank is located adjacent to wetlands in designated special Forever Wild Park Land. Special permits and permissions from regulatory agencies and potentially from the DPR would need to be obtained in order to construct in this area. Note that the larger traditional tank expansions (50, 75 and 100 percent capture) would be difficult to site in the region north of the existing Alley Creek CSO Retention Facility without encroaching into the marsh grass wetland area. Therefore, traditional tank alternatives for 50 to 100 percent capture were placed south of the Alley Creek CSO Retention Facility. Due to the limited space at this location, however, the required volume cannot be obtained unless the new tanks are deeper than the existing tank.

Figure 8-4. Alternative 2A – 3.0 MG Downstream Tank

Figure 8-5. Alternative 2A – Optional Approach for 3.0 MG Downstream Tank

Figure 8-6. Alternative 2B – 6.5 MG Downstream Tank

Figure 8-7. Alternative 2B – Optional Approach for 6.5 MG Downstream Tank

Figure 8-8. Alternative 2C – 6.5 MG Downstream Tank

Figure 8-9. Alternative 2D – 29.5 MG Downstream Tank

Dewatering Considerations

With the exception of Alternative 2A (3.0 MG traditional tank expansion); all of these retention alternatives are deeper than the existing tank and therefore cannot drain by gravity to the Old Douglaston PS. Instead, they would require new pump stations to pump the captured sewage either directly to the collection system in the direction of the Tallman Island WWTP or to the Old Douglaston PS (a two-pump process).

Retention alternatives would temporarily store captured CSO volume until the end of the rain event, after which they would be dewatered into the collection system for conveyance to the Tallman Island WWTP. Potentially competing constraints must be evaluated to determine the feasibility of any retention alternative. The captured CSO volume must be pumped within a reasonable time following a storm event, to avoid generation of odor and corrosion associated with septic conditions, and to dewater the retention tank before the next storm event. At the same time, however, the collection system must be evaluated to determine whether it can convey the additional dewatering flow to Tallman Island WWTP.

There are two locations where flow restrictions may limit the conveyance capacity (Flushing Interceptor Chamber 2 is limited to 58 MGD, and Flushing Interceptor Regulator 9 is limited to 65 MGD). The dewatering scheme for any expanded Alley Creek and Little Neck Bay retention must be coordinated with the dewatering from the existing Alley Creek CSO Retention Facility, along with dewatering from the Flushing Creek CSO Retention Facility, to ensure that conveyance system capacity is not exceeded. Furthermore, dewatering flows from all of these retention facilities combined with dry weather flow must not exceed the Tallman Island WWTP peak design dry weather flow of 80 MGD.

The WWTP and conveyance system constraints were included in the IW model to determine whether they are significant enough to prevent any alternative from being dewatered within the target time of 2-3 days. As shown in Table 8-8, all of the alternatives can be dewatered within the target time.

Retention Alternatives - Upstream Sites

As an option to locating retention tanks or shafts downstream near the existing Alley Creek CSO Retention Facility site, there may be advantages to locating retention facilities upland in the collection system, closer to the CSS. Overflow capture at these upland areas would be more concentrated, as the flow has not yet mixed with flows from stormwater from the downstream separate sewer system (SSS). Therefore, capture of a smaller volume of more concentrated combined sewage from the upland area may reduce the pollutant load to the waterbodies to the same extent as a larger volume of more dilute sewage captured at the existing Alley Creek CSO Retention Facility. However, the upstream CSS area is more highly developed than that near the existing Alley Creek CSO Retention Facility site, making it more difficult to find suitable retention tank sites. Because of the difficulty finding a suitable site, traditional shallow tanks were not considered for upstream locations. Instead, VTSs, which have a smaller footprint, were considered as LTCP alternatives at upland sites. Two such alternatives were developed; both located within the interchange for the Long Island and Clearview Expressways, and designed to capture CSO flow from Regulators 46 and 47:

- **Alternative 3A** is VTS storage designed to capture 25 percent of the CSO volume. It is comprised of a 2.4 MG vertical shaft, along with a 96-inch diameter conduit to convey flow from Regulators 46 and 47 to the shaft, and a force main to convey pump-back from the vertical shaft to the interceptor (see Figure 8-10).

- **Alternative 3B** is VTS storage designed to capture 50 percent of the CSO volume. It is comprised of a 6.7 MG vertical shaft, along with 78-inch x 84-inch and 108-inch x 84-inch conduits to convey flow from Regulators 46 and 47 to the shaft, and a force main to convey pump-back from the vertical shaft to the interceptor (see Figure 8-11).

Figure 8-10. Alternative 3A – 2.4 MG Upstream Tank

Figure 8-11. Alternative 3B – 6.7 MG Upstream Tank

In both cases, VTS storage would be located in City parkland or in New York State Department of Transportation (NYSDOT) property. Thus, both DPR and NYSDOT could have to be involved in the siting and permitting should these alternatives progress further in the evaluation process.

Treatment Alternatives – Disinfection in the Alley Creek CSO Retention Facility

General Description and Layout. Disinfection within the Alley Creek CSO Retention Facility, referred to as Alternative 4, would involve retrofitting the tank with chlorination and dechlorination systems, along with buildings to house the delivery, storage and feed equipment for each of the chemicals. Ancillary electrical, controls and HVAC systems would also be included, along with an operations area. Two chemicals would be used: sodium hypochlorite (NaOCl) for chlorination (disinfection) and sodium bisulfite ($NaHSO_3$) for dechlorination. As shown in Figure 8-12, the sodium hypochlorite would be fed to a mixing chamber located along the influent channels to the Alley Creek CSO Retention Facility. Dechlorination would be provided by feeding sodium bisulfite to diffusers located along the effluent weir. Preliminary siting of the chemical buildings is ongoing. Siting options being evaluated include property adjacent to the Old Douglaston PS, as shown in the figure, a site to the west closer to where the influent channels cross under Northern Boulevard, as well as other sites.

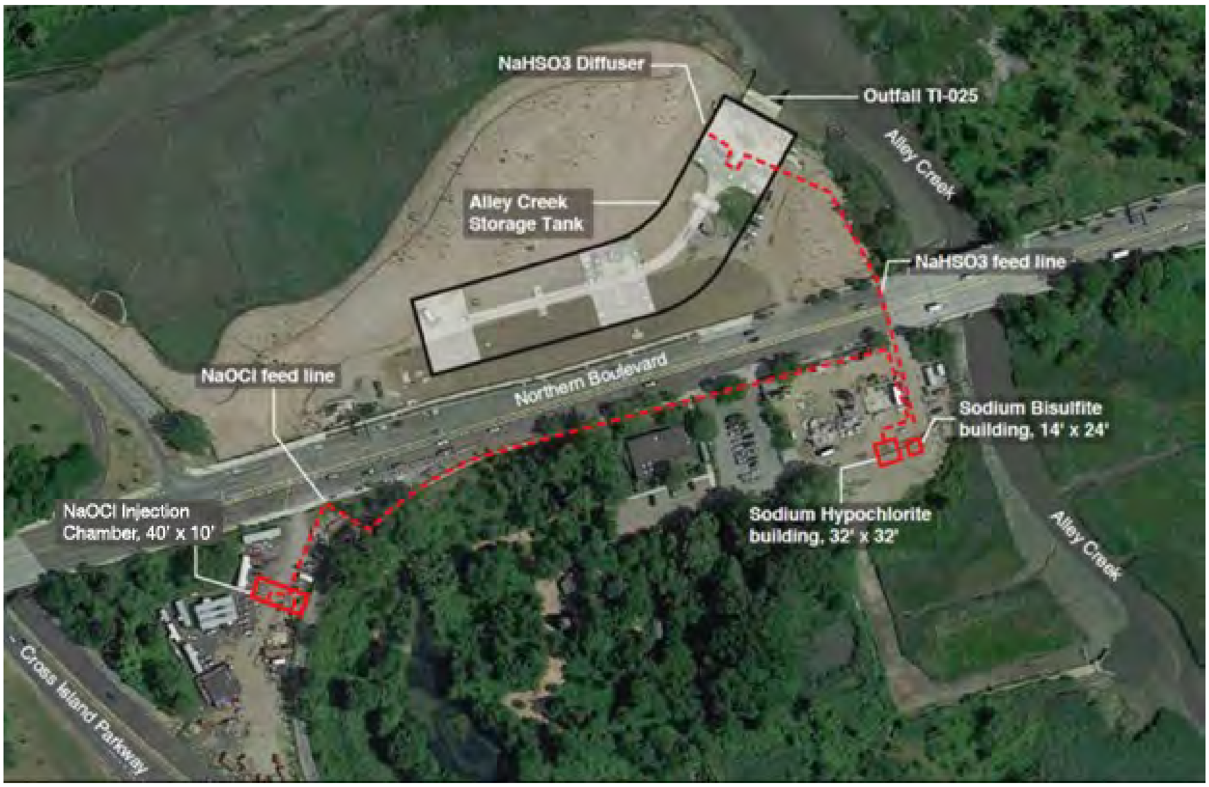


Figure 8-12. Alternative 4 – Disinfection in Existing Alley Creek CSO Retention Facility

Design Flows and Considerations. Because the tank was not designed as a chlorine contact tank, a computational fluid dynamics (CFD) modeling analysis was performed to determine if there would be adequate contact time for CSO disinfection. The CFD modeling confirmed that there will be slightly more than 11 minutes at the design peak of 327 MGD, the 10-minute average typical year peak flow from the IW landside model. This is safely within the range of what is considered high rate disinfection (HRD) typically applied to the disinfection of CSOs (5 to 10 minutes). However, because HRD would be employed, care has to be taken to ensure that proper mixing and dispersion of the chemicals occurs and that an adequate dose can be delivered. To accomplish good mixing and dispersion, diffusers would be installed at the point of injection in the two feed channels to the Alley Creek CSO Retention Facility, well upstream of where the actual tank begins. The dechlorination system would also rely on a diffuser along the tank overflow weir.

Disinfection Alley Creek CSO Retention Facility Survey. A survey of approximately 60 CSO disinfection facilities around the country revealed that kills of up to 4-log reductions (99.99 percent reductions) are readily achievable and that TRC limits, when imposed, typically range from 0.1 mg/L to 1.0 mg/L, with only a few exceptions. There are currently no bacteria or TRC limits in the Alley Creek CSO Retention Facility permit. However, while these facilities are designed to achieve 4-log reductions, they are generally operated throughout the course of the event to provide between a 2-log (99 percent) and 4-log (99.99 percent) reduction in bacteria as influent water quality and bacteria densities can vary widely from event to event and even within individual events. Other important information gained from the survey:

1. Nearly all facilities use sodium hypochlorite as the disinfectant and those that dechlorinate use sodium bisulfite.

2. A majority of the facilities dechlorinate to meet TRC limits in the receiving water bodies.

3. Discharge conditions to Alley Creek are highly sensitive to tidal fluctuations when compared to the other facilities; very little dilution of TRC is expected at low water tidal conditions due to the shallow depths.

Environmental Risks. There are environmental risks associated with chlorination. In addition to disinfection byproducts, the most immediate concern for Alley Creek and Little Neck Bay would be with total residual chlorine (TRC). EPA has established ambient TRC criteria for such discharges at 7.5 µg/L and 13 µg/L as the chronic and acute limits, respectively. ERTM water quality modeling analyses based on 2008 conditions were performed to project the potential effects of TRC within Alley Creek and Little Neck Bay, using an estimated effluent TRC concentration of 0.1 mg/L, the lower end of the typical range of TRC limits observed in the CSO disinfection facility survey. The results of this analysis indicate that the ambient TRC criteria are expected to exceed in Alley Creek and the lower or transition area of Little Neck Bay.

In order to mitigate potential adverse effects of effluent TRC residuals while still achieving sufficient kills of the human-source bacteria from the Alley Creek CSO Retention Facility, an alternative operational strategy was sought. Operating the disinfection at the Alley Creek CSO Retention Facility at the lower end of the 2- to 4-log reduction range would reduce the chlorine dose required throughout each event, and more importantly the resulting TRC. The effluent TRC concentrations would be maintained as low as possible with a target maximum concentration of 0.1 mg/L following dechlorination.

WQ model *Sensitivity to disinfection* To better understand the effectiveness in terms of WQS attainment, the water quality model was run using average rainfall year of 2008 conditions assuming both 2- and a 4-log reduction in bacteria loadings at TI-025. The results, in terms of percent attainment, are reported in Table 8-9 for five stations within the Alley Creek and Little Neck Bay waterbodies for the bathing period (Memorial Day to Labor Day). These results show virtually no difference between the 2-log and 4-log reductions, thus indicating that operating at the 2-log reduction is acceptable. Figure 8-13 follows, showing the concentrations at DMA Beach for the bathing season from Memorial Day to Labor Day, also showing that enterococci for the 2-log reduction is acceptable and very close to the 4-log reduction. Later in this section, attainment of the disinfection alternative is shown for various criteria.

Table 8-9. Bathing Period Attainment with 2- and 4-log Disinfection Operational Strategies – 2008 Conditions

Source	Station	Fecal Coliform	Enterococci	
		Bathing Season, % Attainment	Bathing Season (30-day Rolling), % Attainment	
		Geomean	Geomean	90 th percentile
			< 35 cfu/100ml	< 130 cfu/100 ml
Disinfection 2-LOG-KILL	AC1	100	47	8
Disinfection 4-LOG-KILL	AC1	100	47	8
Disinfection 2-LOG-KILL	OW2	100	100	39
Disinfection 4-LOG-KILL	OW2	100	100	40
Disinfection 2-LOG-KILL	LN1	100	100	100
Disinfection 4-LOG-KILL	LN1	100	100	100
Disinfection 2-LOG-KILL	E11	100	100	100
Disinfection 4-LOG-KILL	E11	100	100	100
Disinfection 2-LOG-KILL	DMA	100	100	91
Disinfection 4-LOG-KILL	DMA	100	100	91

Note: Fecal Coliform percent attainment applies to 200 cfu/100mL and 2000 cfu/100mL for Class SB and Class I, respectively, as applicable.

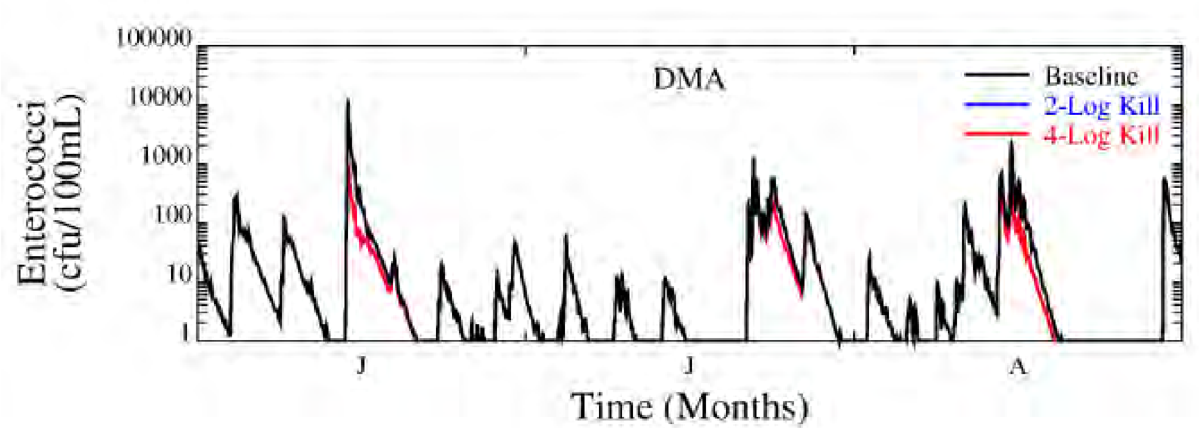


Figure 8-13. Comparison of 2- and 4-Log Reduction Disinfection Strategies for 2008 Conditions

As shown in Table 8-9, there is virtually no difference in overall annual WQS attainment throughout the waterbodies for the two disinfection operational strategies. Further, with respect to DMA Beach, the plots in Figure 8-13 reveal that the bathing season bacteria concentrations are also virtually undiscernible between the 2- and 4-log operational strategies. Thus, the alternative operational strategy of a 2-log kill target can provide a high level of CSO-derived bacteria reduction while protecting the waterbodies from excessive discharges of potentially harmful TRC.

Operating Strategy. Based on the above discussion and analysis, evaluation of the disinfection facilities associated with Alternative 4 was based on the following alternative operational strategy:

- Chlorine, in the form of sodium hypochlorite, would be fed at low doses with a goal of achieving kills in the order of 2-logs, or a 99 percent reduction

- Dechlorination, in the form of sodium bisulfite, would be provided to remove excess TRC with a goal of meeting a maximum TRC effluent concentration of 0.1 mg/L

- Initial sodium hypochlorite feed rate would be based on influent flow and a target dose. As the tank fills, process control would then focus on TRC minimization

- Disinfection would only be performed at the Alley Creek CSO Retention Facility during the recreational season as a further means of reducing the discharge of TRC

While this alternative disinfection operational strategy provides the necessary balance between the reduction in human or CSO-source bacteria and protecting the two waterbodies, future imposition of effluent standards for bacteria and/or TRC by DEC in the Alley Creek CSO Retention Facility permit is possible. It should be noted that none of the satellite CSO facilities surveyed operated without limits for one or both of these criteria. In order to ensure that the disinfection facilities can achieve possible future bacteria and TRC limits, the system should have the ability to provide higher doses of sodium hypochlorite to achieve higher levels of bacteria kills, if required. With regard to the actual doses, based on the preliminary design assumptions, a maximum dose of 10 mg/L of sodium hypochlorite would typically be required for most conditions. However, the system may need to feed at a higher dose, such as 25 mg/L, to compensate for first-flush solids or other anomalies in the influent. Actual bench- and pilot-scale testing should be conducted to establish the actual required doses, both for the initial operational strategy and to meet potentially more restrictive operational parameters in the future. These tests would also establish the sodium bisulfite doses for dechlorination and the expected TRC levels.

Operation and Maintenance. Operation of disinfection and dechlorination at the Alley Creek CSO Retention Facility would pose a number of challenges. The Alley Creek CSO Retention Facility is a satellite facility, which is not currently manned or staffed. As is reflective in the cost estimates of Section 8.4, dedicated operations staff would need to be mobilized and deployed in anticipation of all wet weather events. While this level of effort is reflected in the cost estimates, such operations would incur additional duties to DEP staff who are already currently overburdened during wet weather conditions while adding significant expense cost.

Permitting Issues and Siting Risks. The submittal of a Form 2A to DEC to modify the Tallman Island SPDES permit will likely be required. Effluent bacteria limits or other considerations for operating the facility may be required. Such requirements may result in increased operational costs and beyond what is assumed for this alternative. DEP has been informed by DEC that the TRC impacts would be minimal because CSO discharges from the Ally Creek Retention Facility that contained the residual chlorine would be short term and intermittent, and any excursions of the standards could be handled with a waiver or variance. The proposed location of the chemical buildings is controlled by the New York City Department of Parks and Recreation (DPR) and any siting decision must be made in coordination with the DPR. In addition, it is possible that the siting may require alienation of parkland as well as local land use approvals. Rights-of-way will need to be obtained from the land owners for utilities. Water supply will need to be arranged for and provided. Access to and from the site including a certain amount of truck traffic will be necessary. As the project is further developed, additional siting issues and risks may be identified.

8.2.a.4 Stormwater Redirection

As previously noted, Stormwater Redirection did not score well in the Step 2 analysis as summarized in Table 8-5. In general, the only feasible stormwater redirection, as identified by DEP, would have resulted in the redirection of already separated stormwater from a 36-acre tributary area upstream of the Alley Creek CSO Retention Facility in the vicinity of 56th Avenue, upstream of Springfield Boulevard. This area was recently separated with high level storm sewers as part of a HLSS project to reduce flooding in the local area. It was determined that this tributary area could be diverted away from the Alley Creek CSO Retention Facility and into Oakland Lake. The stormwater from this area is currently conveyed through a 48-inch storm sewer into an 8-foot 6-inch by 8-foot sewer that eventually flows into the Alley Creek CSO Retention Facility. The redirection of this stormwater into Oakland Lake could allow more flow to enter the Alley Creek CSO Retention Facility from the other tributary areas of the collection system that contain both stormwater and CSO flow, thus having higher concentrations of bacteria than the diverted flow.

IW modeling revealed that the redirection would result in a net reduction of 9.0 MGY of treated discharge from the Alley Creek CSO Retention Facility and a corresponding net increase of 16.4 MGY of stormwater into Oakland Lake. The 9.0 MGY represents roughly a 6.8 percent reduction from the current 132 MGY discharge volume from the Alley Creek CSO Retention Facility. When applying the applicable bacteria concentrations of both stormwater and sanitary flow, the resultant changes to the annual fecal coliform loadings into the two waterbodies are as follows:

- 104.6×10^{12} colonies bacteria removed from the Alley Creek CSO Retention Facility effluent and Alley Creek
- 21.7×10^{12} colonies bacteria added to Oakland Lake

Thus, there would be a net decrease in fecal coliform bacteria into the two waterbodies on the order of 83×10^{12} colonies per year. While fecal coliform was used in this analysis due to the fresh water nature of Oakland Lake, a similar redistribution of loadings would be expected for enterococci.

However, while there would be less bacteria being collectively discharged into the two waterbodies, there are a number of other pollutants contained in the redirected stormwater that could have an adverse impact on Oakland Lake. These include total suspended solids (TSS), phosphorus, PAHs and metals as well as floatables and general aesthetics. Thus, the discharge of the additional 16.4 MGY of stormwater would be increasing the loadings of these pollutants to Oakland Lake during every storm event throughout the entire year. DEP had a plan to construct a blue belt project in the Oakland Ravine area to handle this additional flow but it was cancelled due to high costs and concerns regarding detrimental impacts to Oakland Lake. These concerns as well as the minor reductions in bacteria loadings to Alley Creek that would be achieved resulted in a low score for this control alternative.

8.2.b Other Future Green Infrastructure (Various Levels of Penetration)

As discussed in Section 5.0, DEP expects 45 acres of implemented GI to be managed in onsite private properties in Alley Creek and Little Neck Bay watershed by 2030. This acreage would represent three percent of the total CSS impervious area in the watershed. This GI has been included in 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 have not been implemented under previous facility plans and which have not been included in the baseline models.

Two future GI alternatives were developed:

- **Alternative 5A** – GI developed for 10 percent of the combined sewer service area in the Alley Creek and Little Neck Bay watershed. This alternative corresponds to the overall level of GI proposed in the NYC Green Infrastructure Plan. The expected CSO volume reduction for this alternative is 15 percent.

- **Alternative 5B** – GI developed for 50 percent of the combined sewer service area in the Alley Creek and Little Neck Bay watershed. The expected CSO volume reduction for this alternative is 65 percent.

Difficulty finding sites to implement GI control measures is one of the challenges associated with GI. While the citywide goal is to develop GI for 10 percent of New York City's land area, detailed evaluations of the Alley Creek and Little Neck Bay service area found that sufficient, suitable land area is difficult to find. Greater levels of GI would require implementation on public ROW in addition to the assumed level of private GI implementation (three percent) in the baseline conditions. Alternative 5A would require 1,148 ROW bioswales, while Alternative 5B would require the equivalent of 5,743 ROW bioswales. Alternative 5B (50 percent of the Alley Creek and Little Neck Bay watershed) would not be possible without developing GI in Alley Pond Park and diverting some runoff into the park. As mentioned in Section 8.2.a.3., this park is designated special Forever Wild Park Land, and special permits and permissions from regulatory agencies and potentially from DPR would have to be obtained to construct in this area. Due to the potential siting difficulties, Alternative 5B is not feasible, and was thus eliminated from further consideration.

Also, as noted in the City of New York 2010 Green Infrastructure Plan, GI in the Alley Creek and Little Neck Bay watershed may not be cost-effective. With a large retention tank already in place, improvements in CSO reduction through GI would be relatively marginal and would likely have a high unit cost on a dollar- per-captured-gallon basis. It is important to recognize that the high cost of GI with marginal improvement in water quality makes additional GI less cost-effective.

8.2.c 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. Using the two technologies together can enhance their ability to minimize CSO volume, optimize the collection system capacity, and capture storm water flows before they enter the system, thereby reducing CSO. However, preliminary evaluation of GI alternatives indicated that the water quality benefits were not sufficiently cost-effective to warrant the development of any hybrid green/grey alternatives.

Because it is unlikely that HLSS alone would be capable of reducing CSO volume beyond 50 percent, a hybrid combination of HLSS with additional retention was considered. This alternative (Alternative 6) could take one of the following forms:

- HLSS plus closed concrete tank expansion at the existing Alley Creek CSO Retention Facility site; or

- HLSS plus VTS storage at the existing Alley Creek CSO Retention Facility.

Such combinations would be faced with the same challenges as when HLSS and retention control measures are considered independently, namely:

- Siting issues similar to those for tank expansion and VTS storage (park alienation, wetlands, permitting);
- Street disruptions associated with HLSS; and
- The need for routing of major new storm sewers and the permitting of a new MS4 outfall associated with HLSS.

Alternative 6 essentially combines HLSS of Alternative 1 for the areas upstream of Regulators 46 and 47 as described in Section 8.2.a.1, and a new 3.0 MG tank (or 3.0 MG upstream VTS storage) from Alternative 2A (or 2D), located downstream at the Alley Creek CSO Retention Facility site, as described in Section 8.2.a.3.

8.2.d Retained Alternatives

A summary of the alternatives developed for the Alley Creek and Little Neck Bay LTCP is presented in Table 8-10. These alternatives are subjected to economic and cost-performance evaluations in Step 3.

Table 8-10. Summary of Alternatives Developed in Step 2

Alternative	Description
1. HLSS	New HLSS for the CSS tributary to Regulators 46 and 47.
2A. 3.0 MG Additional Downstream Retention	New traditional tank expansion north of the existing Alley Creek CSO Retention Facility or new VTS storage at the existing Alley Creek CSO Retention Facility site.
2B. 6.5 MG Additional Downstream Retention	New VTS storage or new traditional tank expansion at the existing Alley Creek CSO Retention Facility site.
2C. 12 MG Additional Downstream Retention	New traditional tank expansion south of the existing Alley Creek CSO Retention Facility.
2D. 29.5 MG Additional Downstream Retention	New traditional tank expansion south of the existing Alley Creek CSO Retention Facility.
3A. 2.4 MG Additional Upstream Retention	New upstream VTS storage for the CSS tributary to Regulators 46 and 47.
3B. 6.7 MG Additional Upstream Retention	New upstream VTS storage for the CSS tributary to Regulators 46 and 47.
4. Disinfection in Existing Alley Creek CSO Retention Facility	Use of existing 5 MG tank volume for recreational season disinfection plus dechlorination.
5A. 10 percent Green Infrastructure	GI for 10 percent of the CSS area in the Alley Creek and Little Neck Bay watershed.
6. Hybrid - HLSS plus Storage Tank	HLSS for the CSS served by Regulators 46 and 47 plus additional 3.0 MG downstream retention at existing Alley Creek CSO Retention Facility site.

8.3 CSO Reductions and Water Quality Impact of Retained Alternatives

To evaluate their effects on the pollutant loadings and water quality impacts, the retained alternatives listed in Table 8-10 were analyzed using both the Alley Creek and Little Neck Bay watershed (IW) and receiving water/waterbody (ERTM) models. Evaluations of CSO volume reductions and/or bacteria load reductions for each alternative are presented below. In all cases, the reductions shown are relative to the baseline conditions using 2008 JFK rainfall as described in Section 6.0.

8.3.a CSO Reductions for Retained Alternatives

Table 8-11 summarizes the projected CSO reductions for the retained alternatives. Performance of the alternatives ranged from zero to 100 percent CSO volume reduction, with the exception of Alternative 4, Disinfection in Existing CSO Retention Tank, which provides no additional CSO volume reduction, although it has a high level (99 percent) of CSO bacteria reduction on a recreational season basis.

Table 8-11. CSO Volume Performance

Alternative	CSO Volume (MGY)	CSO Volume Reduction Percent
Baseline Conditions	132	0
1. High Level Sewer Separation (HLSS)	65	51
2A. 3.0 MG Additional Downstream Retention	98	25
2B. 6.5 MG Additional Downstream Retention	65	50
2C. 12 MG Additional Downstream Retention	33	75
2D. 29.5 MG Additional Downstream Retention	0	100
3A. 2.4 MG Additional Upstream Retention	98	25
3B. 6.7 MG Additional Upstream Retention	65	50
4. Disinfection in Existing Alley Creek CSO Retention Facility (Recreational Season)	132	0
5A. 10 Percent GI	112	15
6. Hybrid – HLSS plus 3.0 MG Retention	38	71

8.3.b Bacteria Reductions for Retained Alternatives

Water Quality Impacts. A summary of the projected bacteria discharges for the retained alternatives is presented in Table 8-12. The values presented in this table represent the total discharge into Alley Creek and Little Neck Bay from both CSO and stormwater sources. With respect to bacteria discharges, the best-performing alternatives were 100 percent retention (Alternative 2D) and recreational season disinfection (Alternative 4); Alternative 2D reduces the overall fecal coliform loading by roughly 50 percent and the enterococci loading by 42 percent. Alternative 4 reduces the overall fecal coliform loading by about 23 percent and the enterococci loading by roughly 20 percent. Because of the pollutants contained in the stormwater discharges, none of the CSO control alternatives could eliminate all of the bacteria discharged to Alley Creek and Little Neck Bay. HLSS (Alternative 1) was the worst-performing alternative, yielding a net increase in enterococci. Although HLSS would reduce CSO and its associated pollutants, it would also significantly increase the volume of annual stormwater discharges; the increased pollutant loads associated with the increased stormwater would thus exceed the benefits from the reduced CSO.

Table 8-12. Summary of the Total Projected Bacteria Discharges from All Sources – 2008 Rainfall

Alternative	Enterococci Loading (Counts/Year x 10^{12})	Enterococci Reduction Percent	Fecal Loading (Counts/Year x 10^{12})	Fecal Reduction Percent
Baseline Conditions	358.2	0	952.1	0
1. HLSS	377.6	-5.2	899.2	5.4
2A. 3.0 MG Additional Downstream Retention	320.6	10.1	833.1	12.1
2B. 6.5 MG Additional Downstream Retention	282.7	20.4	713.1	24.3
2C. 12 MG Additional Downstream	244.4	30.7	592.6	36.5

Alternative	Enterococci Loading (Counts/Year x 10^{12})	Enterococci Reduction Percent	Fecal Loading (Counts/Year x 10^{12})	Fecal Reduction Percent
Retention				
2D. 29.5 MG Additional Downstream Retention	207.0	40.8	475.1	48.5
3A. 2.4 MG Additional Upstream Retention	304.6	14.5	769.6	18.5
3B. 6.7 MG Additional Upstream Retention	256.2	27.5	607.1	35.0
4. Disinfection in Existing Alley Creek CSO Retention Facility (Recreational Season Operation)	282.9	19.6	715.0	23.3
5A. 10 Percent GI	376.3	5.2	893.9	5.9
6. Hybrid - 3.0 MG Storage plus HLSS	357.9	0.1	844.1	11.0

Using the data presented in the previous two tables, Figure 8-14 shows the relationship between the reductions in CSO volume and total bacteria loading. Alternatives that plot above the diagonal line have a higher reduction in total enterococci loading per unit of CSO volume reduction. Upstream retention alternatives are in this area. Since the upstream flow has not yet been diluted by stormwater from the separately sewered areas, the flow captured upstream is more concentrated, and each gallon captured upstream would therefore remove more bacteria than a gallon captured downstream near the existing Alley Creek CSO Retention Facility.

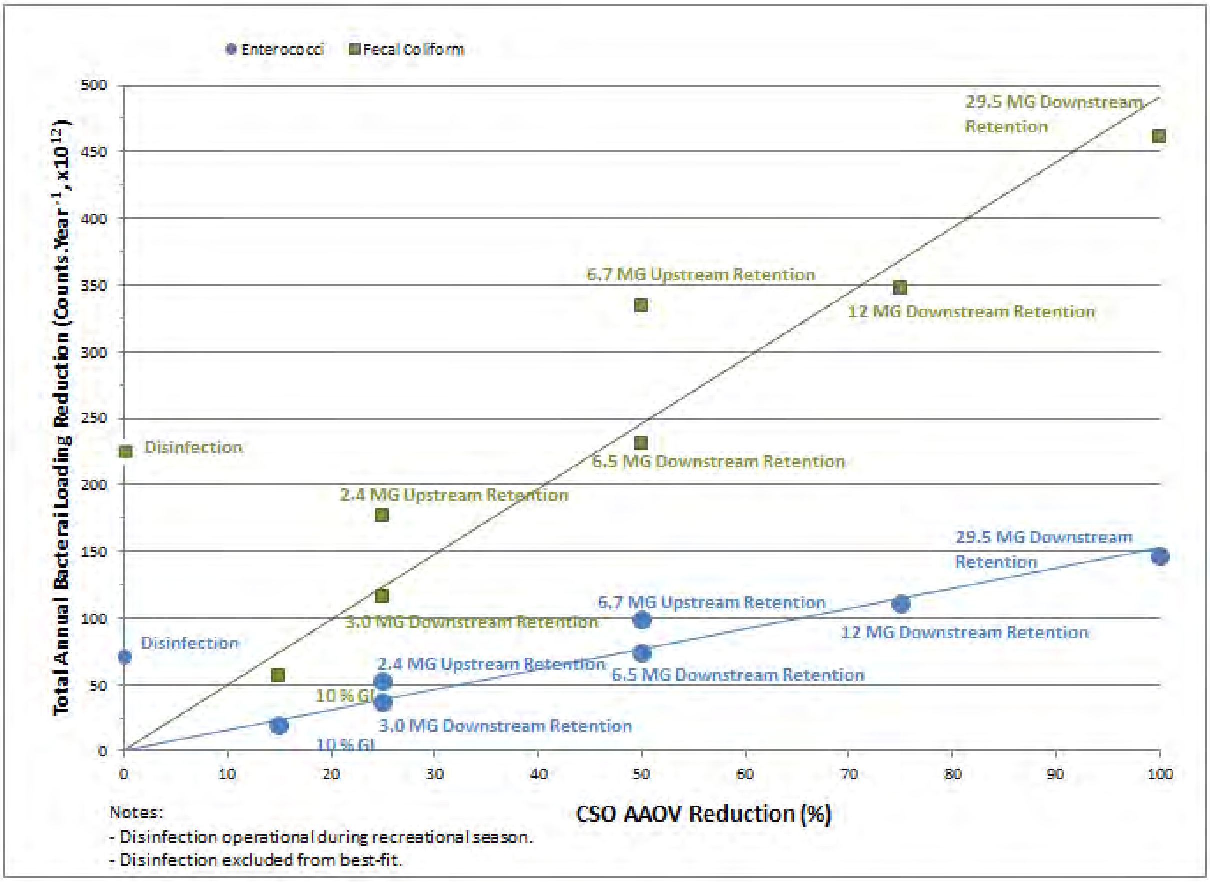


Figure 8-14. CSO Volume Reductions vs. Annual Total Bacteria Loading Reduction - 2008 Rainfall

Water Quality Impacts

This section describes the levels of attainment with applicable bacteria criteria within Alley Creek and Little Neck Bay that would be achieved through implementation of the retained CSO control alternatives listed in Table 8-10.

8.3.b.1 Attainment of Bacteria Standards

Alley Creek

Alley Creek is a Class I Waterbody. Historic and recent water quality monitoring, along with baseline condition modeling using ERTM, revealed that Alley Creek is currently in attainment with the Class I fecal coliform criterion. Because the Class I standards do not include enterococci, there was no need to perform a performance gap analysis with respect to the current waterbody classification. If raising the waterbody classification to the Primary Contact WQ Criteria, Class SC, is considered, none of the alternatives would result in full attainment (≥95%) with existing Class SC bacteria standards annually. As explained in the gap analysis presented in Section 6.3, bacteria loadings from other sources, such as stormwater from MS4 and direct drainage areas and local background dry weather sources, influence the fecal and enterococci concentrations to the extent that even the 100 percent CSO control alternatives would not result in full attainment of the Class SC standards for either fecal coliform or enterococci in Alley Creek for the existing Primary Contact WQ

Criteria (Class SC) or for the Future Primary Contact WQ Criteria with 2012 EPA RWQC. However, full attainment (>95%) is observed with existing SC criteria when the standard is applied during recreational season.

Little Neck Bay

Little Neck Bay is a Class SB Waterbody. As described in Section 6.0, Little Neck Bay is in attainment with the existing Class SB fecal coliform and enterococci criteria essentially 100 percent of the time throughout the 10-year baseline period.

Near DMA Beach, the sole sensitive area in the Alley Creek and Little Neck Bay watershed, attainment with the 30-day GM fecal coliform criterion occurred approximately 100 percent of the time from roughly April through October, a period which includes the recreation season . Overall, the 10-year simulation is in compliance with the NYC DOHMH standard for enterococci 95 percent of the time at the DMA Beach with baseline conditions. When 100 % CSO control is applied, it had a marginal effect, raising the overall attainment of enterococci standards at DMA Beach to 99 percent of the time – a four percent improvement (Table 6-9, page 6-18) A similar marginal improvement would occur at the northern end of the Bay, near the East River, where attainment is already near 100 percent of the time. Attainment would rise 4 percent, from 95 to 99 percent of the time near Harbor Survey Station LN1 with the implementation of 100% CSO control (Table 6-9, page 6-18). At the transition zone in Little Neck Bay (OW2), 100% CSO control alternative resulted in 95% attainment, a four percent increase compared to the baseline. As explained in the gap analysis presented in Section 6.3, enterococci loadings from non-CSO sources such as local background dry weather loadings as well as stormwater loadings both from municipal separate storm sewer system (MS4) and direct drainage areas, would have significant influence on the GM concentration of enterococci, to the extent that even the 100 percent CSO control alternatives would not result in compliance with the primary recreation SB standards for enterococci at all times.

8.4 Cost Estimates for Retained Alternatives

Proper evaluation of the proposed alternatives requires accurate cost estimates for each alternative. The methodology for developing these costs is dependent on the type of technology and its unique operation and maintenance requirements. The capital costs were developed as Probable Bid Cost (PBC). Total net present worth costs were determined using the estimated capital cost plus the net present worth of the projected operation and maintenance (O&M) costs, with an assumed interest rate of three percent over a 20-year life cycle, resulting in a present worth factor of 14.877. Costs are as shown in Table 8-13 in May 2013 dollars.

8.4.a HLSS

Costs for the Alternative 1 (HLSS) include the costs for the local storm sewers and the trunk sewers to convey the stormwater to Alley Creek. Trunk sewer costs are based on the sewer diameter, length, and depth of cover. Manhole costs are based on diameter of the manhole and depth. Where necessary, cost of pile supports for both the trunk sewer and manholes are included.

Cost for the collector sewers is based on the total 843-acre drainage area to be separated (see Figures 8-2 and 8-3). The total cost for HLSS is $658 million (May 2013 dollars), calculated as shown in Table 8-13.

Table 8-13. HLSS Costs

Item	May 2013 Cost ($ Million)
HLSS PBC	657
Annual O&M	0.1
Total HLSS Present Worth	658

8.4.b Retention

Cost estimates for retention using traditional tanks were based on actual bid costs from similar existing tanks built in NYC. A cost curve plotting the storage volume (MG) against the actual bid cost was developed for the existing tanks, with all costs escalated to May 2013 dollars. Cost estimates for retention alternatives using traditional tanks were then read from the cost curve.

Estimated costs for VTS storage include costs for construction of the shafts along with associated costs including odor control equipment, earth work, concrete work, influent and effluent structure, chemical storage and control building, mechanical equipment, electrical equipment, instrumentation and control, process equipment, and site work. Costs are dependent on the desired storage volume and do not include costs associated with land acquisition. For VTS storage located at the upstream site, costs for conduits to convey flow from Regulators 46 and 47 to the VTS are included, as well as costs for conduits to convey dewatering flow from the VTS to the existing collection system.

As shown in Table 8-14, costs for retention alternatives range from $93M to $569M.

Table 8-14. Retention Alternatives Costs

Retention Alternative	May 2013 PBC[1] ($ Million)	Annual O&M Cost ($ Million)	Total Present Worth ($ Million)
2A. 3.0 MG Additional Downstream	$83	$0.7	$93
2B. 6.5 MG Additional Downstream	$145	$0.8	$156
2C. 12 MG Additional Downstream	$294	$1.1	$310
2D. 29.5 MG Additional Downstream	$535	$2.3	$569
3A. 2.4 MG Additional Upstream	$101	$0.8	$113
3B. 6.7 MG Additional Upstream	$160	$0.9	$173

1. Average of costs for traditional shallow tank and VTS storage options.

8.4.c Disinfection in Existing Alley Creek CSO Retention Facility

The estimated costs for Disinfection in the existing Alley Creek CSO Retention Facility (Alternative 4) are summarized in Table 8-15. The Probable Bid Cost is $7.6M, and includes separate feed and storage buildings for the two chemicals, all of the ancillary support systems and equipment, and the associated electrical and instrumentation systems. Also included are the feed lines between the buildings and the tank and diffusers.

In addition to the direct energy and chemical costs, the O&M costs associated with this alternative include a significant amount of additional staff time to maintain the new equipment and systems, even for recreational season disinfection, above and beyond their current responsibilities for the Alley Creek CSO Retention Facility. As described earlier in Section 8.2.a.4, these include extensive pre-event preparations, during-event and post-event activities, including line flushing and general cleaning. These activities are in addition to the close process monitoring typically required during the events themselves, as well as preventative maintenance of all equipment between events. The annual O&M costs were estimated at $250,000, resulting in a 20-year life cycle present worth calculated at $11.3M.

Table 8-15. Disinfection in Existing Alley Creek CSO Retention Facility Costs

Item	Cost May 2013 ($ Million)
Disinfection System PBC	7.6
Annual O&M	0.25
Disinfection Total Present Worth, $M	11.3

8.4.d Green Infrastructure

The estimated capital cost for Alternative 5A (10 percent GI) is $41M. With an expected annual O&M cost of $1.48M and a 20-year life cycle, the estimated present worth cost would be $63M.

8.4.e Hybrid HLSS plus Additional Retention

A total cost of $751M for Alternative 6 (hybrid of HLSS plus additional retention) was obtained by adding the costs for HLSS (Alternative 1) to the costs for Alternative 2A (3.0 MG additional downstream retention), as shown in Table 8-16.

Table 8-16. Hybrid HLSS Plus 3.0 MG Retention Costs

Item	Present Worth May 2013 ($ Million)
HLSS PBC	658
3.0 MG Additional Tank Storage	93
Hybrid HLSS Plus 3.0 MG Retention Total Present Worth, $M	**751**

8.5 Cost-Attainment Curves for Retained Alternatives

The final step of the analysis is determining the cost-effectiveness of the alternatives based on their projected water quality improvement, operational cost, and projected probable cost to construct.

8.5.a Cost-Performance Curves

Figure 8-15 plots the relationship of percent CSO control to the total PBC of the retained alternatives. As noted, there are two points for disinfection: annual equivalent and recreational season (May 1st – October 31st) equivalent. The former represents the actual level of annual CSO control that would be realized with disinfection operational during the recreational season whereas the recreational season point shows the level of CSO control that would occur during the bathing season from Memorial Day to Labor Day and recreational season (May 1^{st} – October 31^{st}).

Percent CSO control ranges from a low of 15 percent (10 percent GI) to a high of 100 percent control (additional 29.5 MG downstream tank and recreational season disinfection within the bathing season), with costs spanning from a low of $11.3M (disinfection) to a high of $751M (additional 3.0 MG downstream retention with HLSS). A second order best-fit cost curve was developed based on alternatives that were judged more cost-effective for the CSO control level. There were outliers both on the negative and positive sides of the curve. The negative outliers, shown in red, were not included in the cost curve. For example, for 50 percent CSO volume reduction, the 6.5 MG Downstream Retention and 6.7 MG Upstream Retention alternatives were more cost-effective than the HLSS alternative. Therefore, the retention alternatives would be preferred with respect to that level of CSO control, rather than the HLSS alternative. Also shown in red is the positive outlier representing the CSO control of disinfection operations during the recreational season from May 1^{st} – October 1^{st}. It, too, was not included in the curve however it is clearly cost-beneficial in terms of CSO control vs. other alternatives. This is in part due to the fact that the Alley Creek CSO Retention Facility is already constructed and can be used as part of the disinfection alternative, thus reducing it's cost.

While the resulting curve does not show a clear KOTC, the two disinfection points, annual equivalent and recreational season are far to the left of the plot. Had the calculated best-fit line been instead hand drawn to include both of these points, a clear KOTC would result, thus suggesting that the disinfection alternative is the most cost-effective from a cost-performance basis.

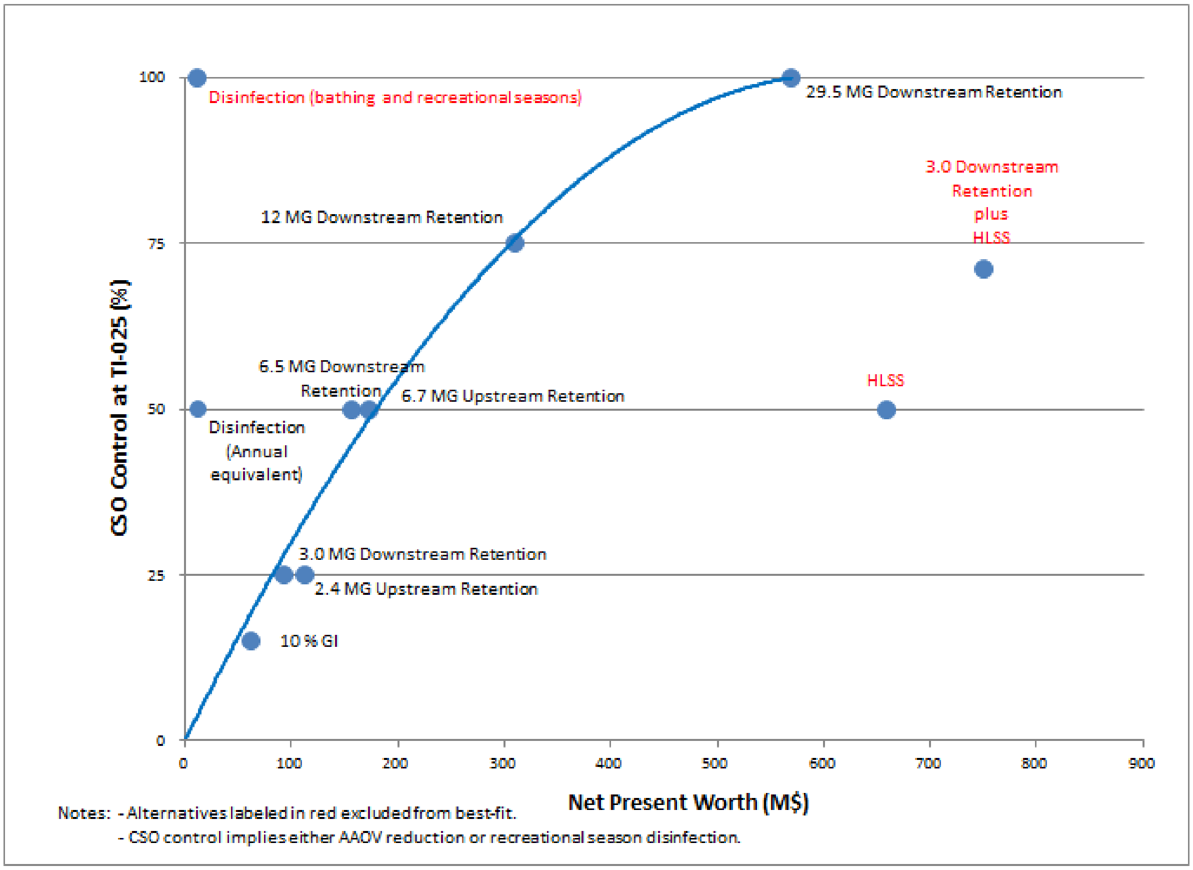


Figure 8-15. Cost vs. CSO Volume Reduction
(except disinfection alternative as noted) - 2008 Rainfall

Along with overall CSO volume control a goal of the LTCP is to reduce bacteria loadings to the waterbody to the extent that such loadings are caused by CSOs. Figures 8-16 and 8-17 plot the cost of the retained alternatives against their associated projected annual enterococci and fecal coliform loading reductions, respectively. The primary Y-axis (left side) shows percent bacteria loading reductions at TI-025, the outfall for the existing Alley Creek CSO Retention Facility. The secondary Y-axis (right side) shows the total loading reductions including other sources of bacteria, most notably, stormwater.

Percent enterococci CSO loading reduction ranged from a low of 0 or near 0 percent (additional 3.0 MG downstream retention plus HLSS, in red to the extreme right on the figure) to a high of 100 percent (29.5 downstream retention). The maximum CSO enterococci loading reduction corresponds to 41 percent reduction in total loadings. The percent CSO fecal coliform loading reduction ranged from a low of around 12 percent (HLSS or 10 percent GI) to a high of 100 percent reduction (29.5 downstream retention). The maximum CSO fecal coliform loading reduction corresponds to 41 percent reduction in total loadings. The costs increase to $751M (additional 3.0 MG downstream retention plus HLSS).

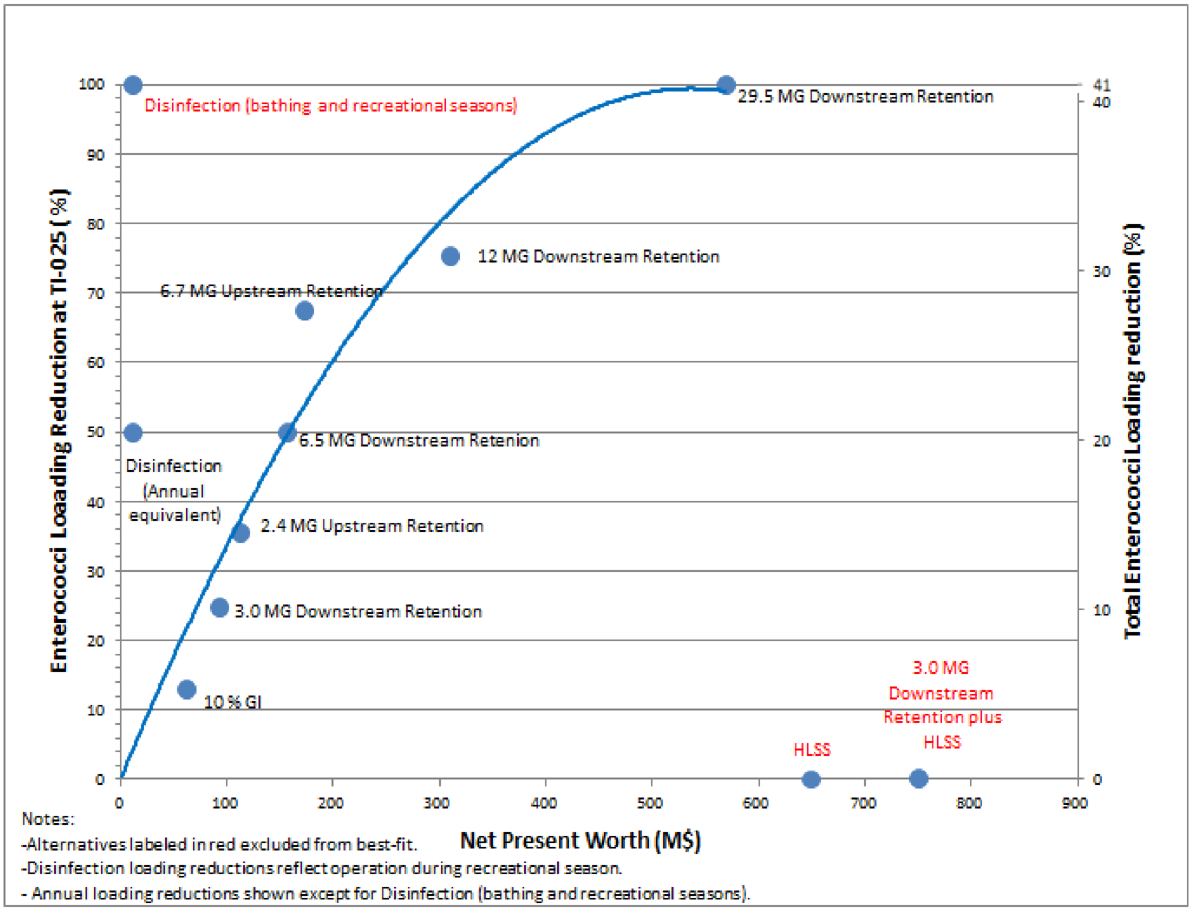


Figure 8-16. Cost vs. Enterococci Loading Reduction - 2008 Rainfall

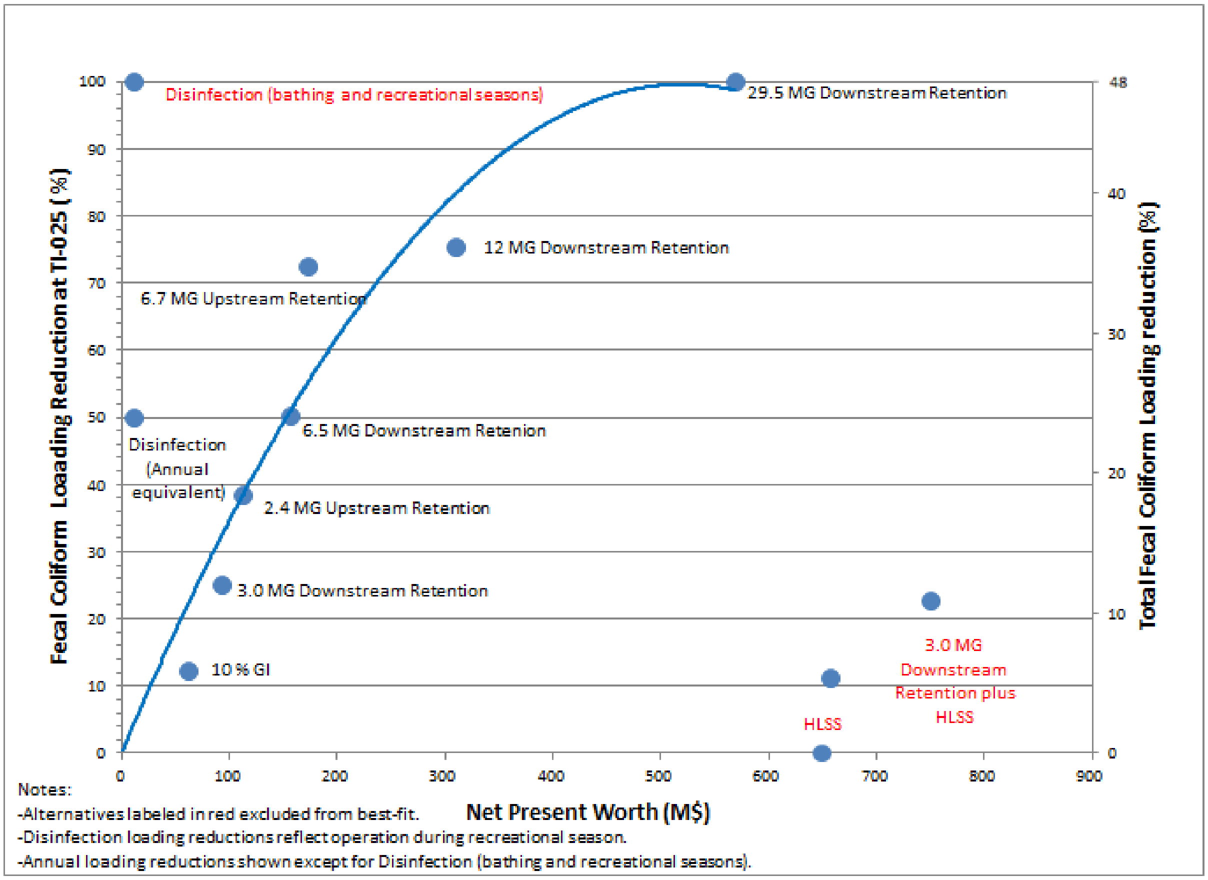


Figure 8-17. Cost vs. Fecal Coliform Loading Reduction – 2008 Rainfall

Best fit curves were again plotted that excluded outliers that are shown in red on the two figures. As with the previous best-fit curve comparing costs versus level of CSO control (Figure 8-15), there are no discernable KOTCs for either enterococci or fecal coliform. However, as with that earlier curve, had the plots been drawn to encompass the two disinfection points, annual equivalent and recreational season, the plot would indicate that disinfection, at $11.3M, is the most cost effective alternative.

8.5.b Cost-Attainment Curves

This section addresses costs of the CSO alternatives versus attainment with existing WQ criteria, Primary Contact WQ Criteria (SC) and Future Primary Contact WQ Criteria with modifications to the bacteria criteria due to 2012 EPA RWQC. As previously discussed in Section 6.0, attainment of existing bacteria criteria occurs essentially 100 percent of the time for both Alley Creek and Little Neck Bay under baseline conditions. Therefore, because there are no performance gaps with existing bacteria criteria, plots demonstrating this 100 percent attainment are embedded in the cost attainment plots developed for the WQS options. These plots are presented as Figures 8-18 through 8-22 for five stations within Alley Creek and Little Neck Bay. In these plots, baseline conditions attainment is represented by the points overlaying the Y-axis. Attainment curves shown reflect results from ERTM runs with typical year rainfall as input (2008 JFK) and therefore may show slightly different results than those provided from the 2002 to 2011 ten year simulations. It should also be noted that, regarding enterococci criteria for the stations within Little Neck Bay, the disinfection points for these curves represent the annual equivalent of operational disinfection during the recreational season – the actual gain in attainment that would occur taking into account the entire year, when considering Future Primary Contact WQ Criteria with 2012 EPA RWQC. However, when these attainment points refer to existing standards, the levels of attainment realized by the operational disinfection during the recreational season are computed for the recreational and bathing seasons, as applicable.

Considering attainment with Future Primary Contact WQ Criteria with 2012 EPA RWQC modification to the enterococci criteria, namely the 35 cfu/100mL 30-day rolling GM and a Statistical Threshold Value (STV) of 130 cfu/100mL, attainment of this enterococci criteria for Little Neck Bay varied with time of year and location in the Bay. Regarding the GM criterion at the northern end of the Bay, the performance gap was small, with annual attainment occurring 96 percent of the time at Station E11 under baseline conditions.

Figure 8-18 shows the modeled improvement in annual attainment at Station E11 for each alternative. When considering an STV of 130 cfu/100mL, the performance gap was small, with annual attainment occurring 69 percent of the time at Station E11 under baseline conditions. As previously discussed, the improvements in attainment of future criteria shown are marginal, rising a maximum of 6 percent, for the alternative with the greatest improvement (100 percent CSO control). Recent input from DEC has stated that the alternate criteria of rolling 30 day GM of 30 cfu/100mL and STV of 110 cfu/100mL will be adopted. However, the attainment analyses included in this LTCP are for 35 and 130 cfu/100mL respectively.

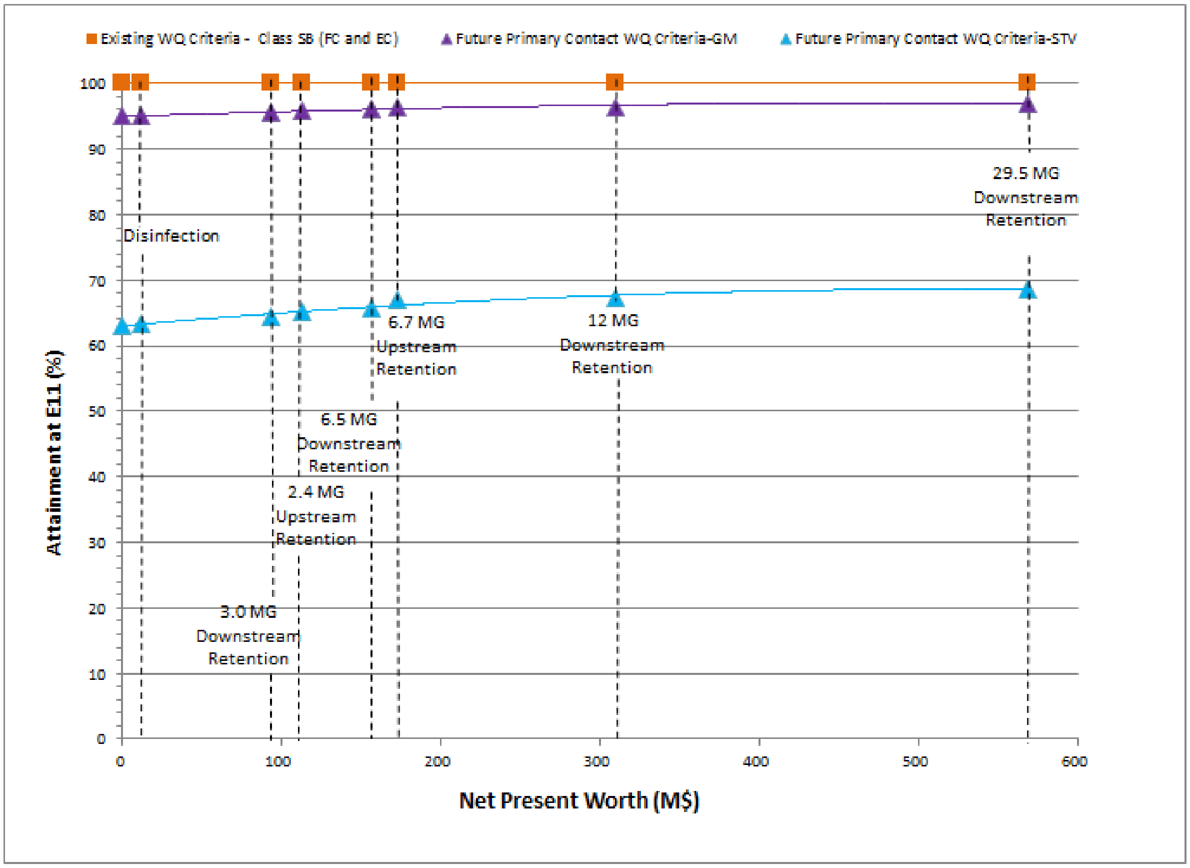


Figure 8-18. Cost vs. Bacteria Attainment near East River (Station E11) – 2008 Rainfall

Figure 8-19 shows the ability of each alternative to attain Class SB WQS at DMA Beach, and summer attainment of NYCDOHMH recreational waters standards as a function of the total project cost. Baseline conditions are in attainment with existing WQ criteria (Class SB and NYCDOHMH) 100 percent of the time. Considering Future Primary Contact WQ Criteria with 2012 EPA RWQC, controlling 100 percent of the CSO would result in a maximum seven percent increase in annual attainment of the STV criterion, with all other alternatives having a lesser degree of improvement. The cost attainment curves for applicable standards for Station LN1, presented in Figure 8-20, are essentially identical to the curves for DMA Beach.

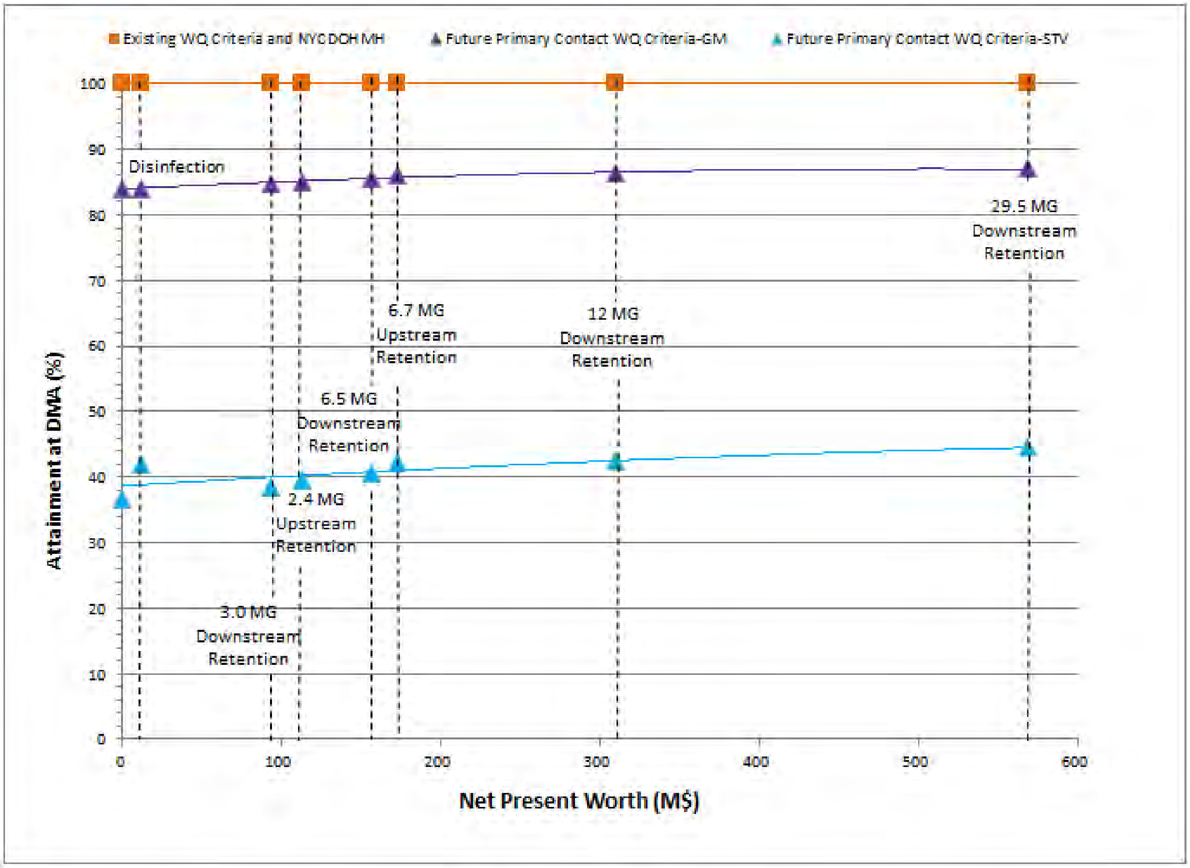


Figure 8-19. Cost vs. Bacteria Attainment at DMA Beach – 2008 Rainfall

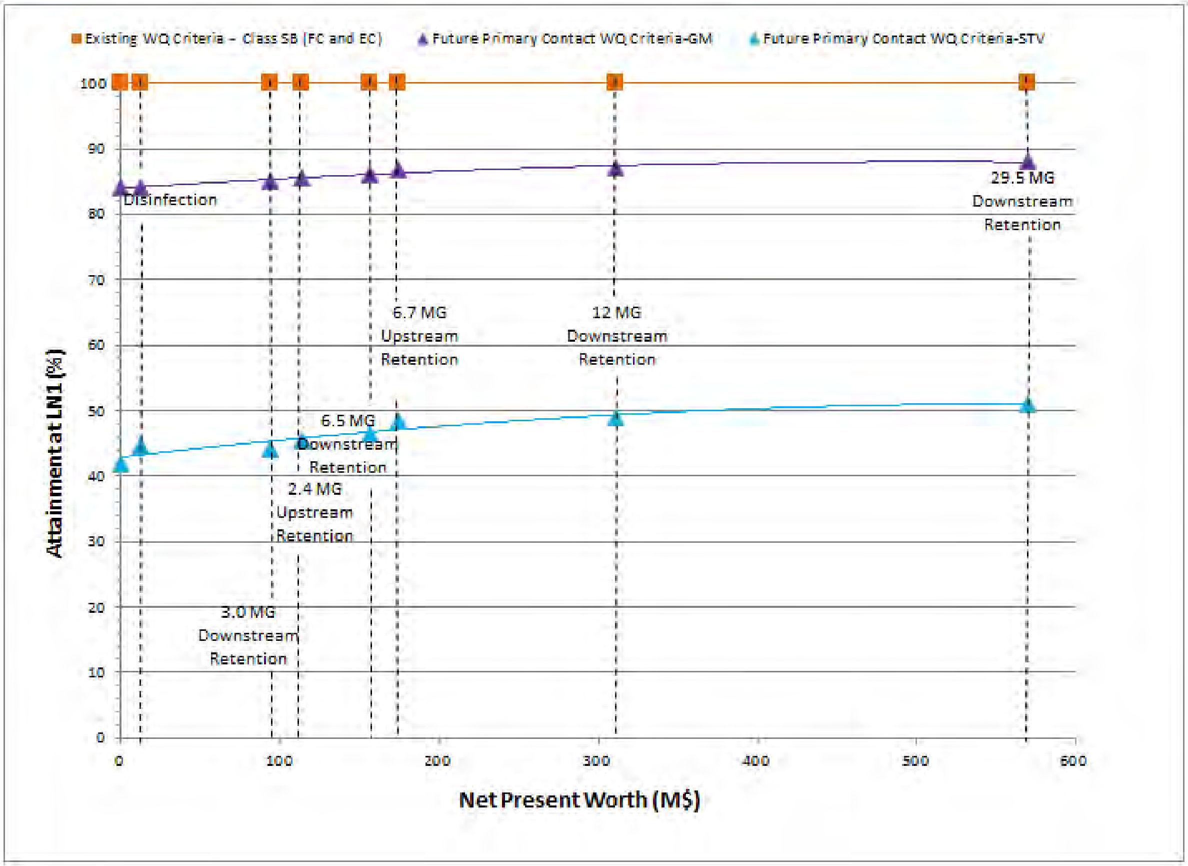


Figure 8-20. Cost vs. Bacteria Attainment at Little Neck Bay (Station LN1) – 2008 Rainfall

Figure 8-21 shows that Station OW2, in the tidal mixing zone between Alley Creek and Little Neck Bay, would attain existing bacteria criteria essentially 100 percent of the time. The figure also depicts the ability of each alternative to attain the 2012 EPA RWQC modification enterococci criteria as a function of the total project cost. Baseline conditions would be in attainment with these criteria approximately 70 percent of the time regarding the GM criterion, and nine percent of the time regarding the STV criterion. Controlling 100 percent of the CSO would result approximately in only a five percent increase in annual attainment of both enterococci criteria, with all other alternatives having a lesser degree of improvement.

Figure 8-22 depicts the attainment gain that would result from multiple alternatives at Station AC1. The curves reflect attainment with existing applicable Class I standard, possible upgrade to Primary Contact WQ Criteria (Class SC), and the Future Primary Contact WQ Criteria with 2012 EPA RWQC. As shown, the largest improvement would be realized in attaining Future Primary Contact WQ Criteria with 2012 EPA RWQC enterococci GM criterion with 100 percent CSO control. Under this scenario, there would only be a six percent increase in attainment over baseline conditions, from 10 percent to 16 percent.

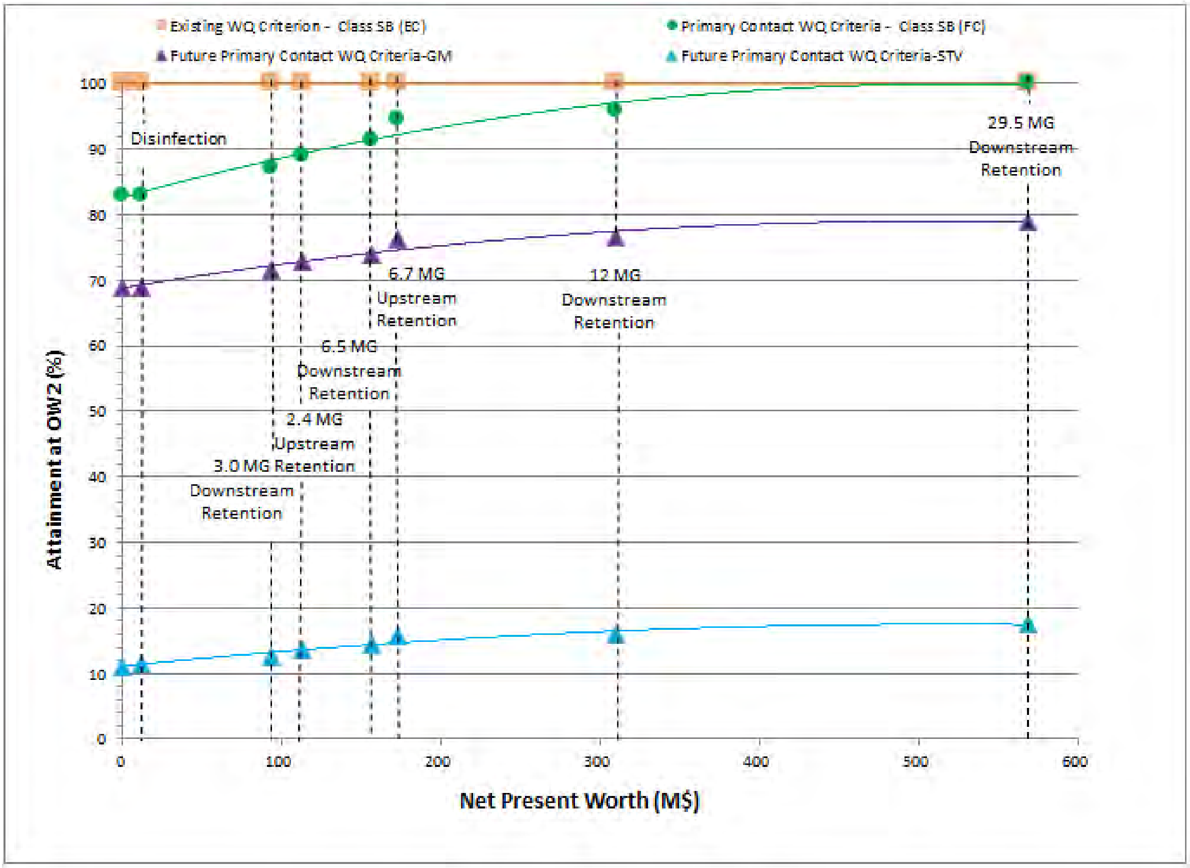


Figure 8-21. Cost vs. Bacteria Attainment at Southern Little Neck Bay (Station OW2) – 2008 Rainfall

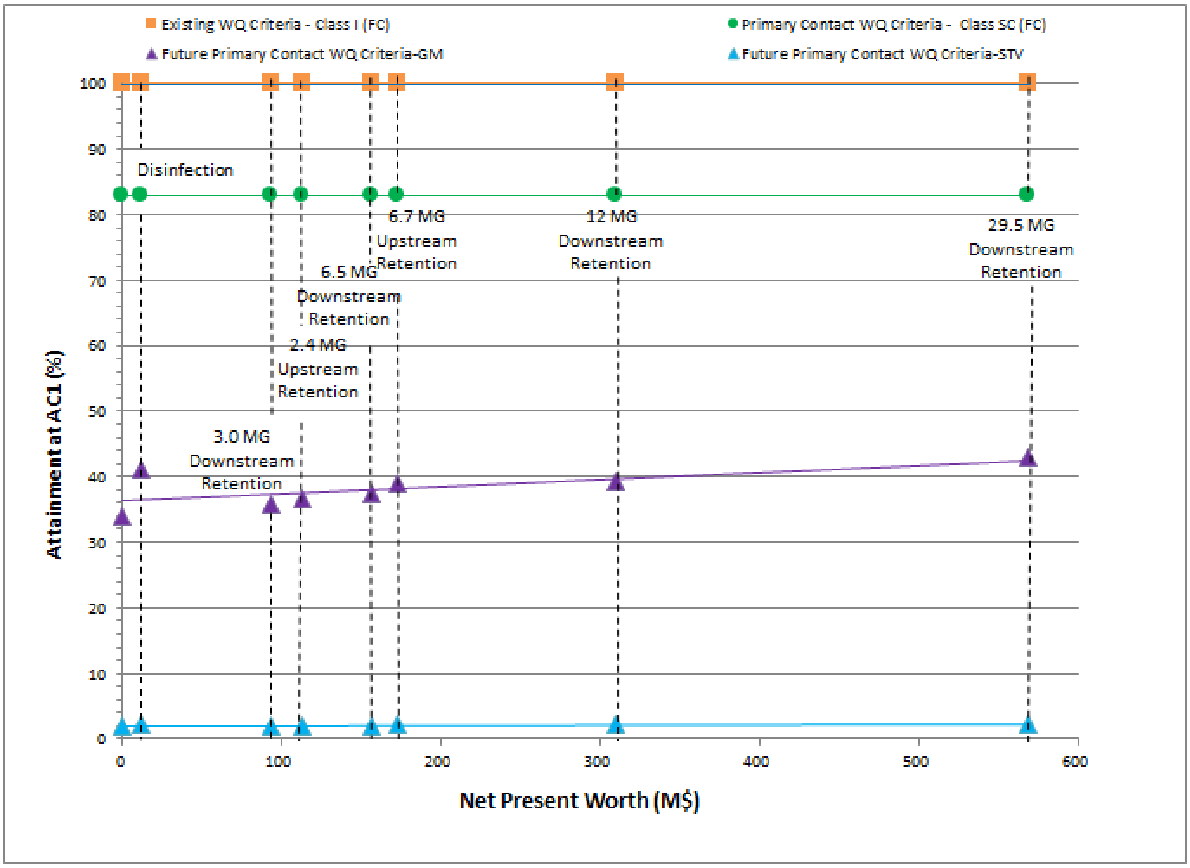


Figure 8-22. Cost vs. Bacteria Attainment at Alley Creek (Station AC1) – 2008 Rainfall

Results show that capturing additional volume of CSO, regardless of the degree of capture, does not significantly improve the attainment of existing or Future Primary Contact WQ Criteria at Station AC1. The remaining non-attainment is caused by other sources of pollution such as stormwater. Ecological and physical changes to the characteristics of the waterbody may also be contributing to future non-attainment.

8.5.c Preferred Alternative

Based upon the series of cost performance (Figures 8-15 through 8-17) and cost attainment (Figures 8-18 through 8-22) plots presented in this section, Alternative 4, Disinfection within the existing Alley Creek CSO Retention Facility, is the most cost effective alternative with respect to CSO control. It also removes the remaining human or CSO-source bacteria discharges. However, it only increases attainment with by a few percent (see below), and poses a risk of chlorine toxicity. The proposed disinfection system, as described in Section 8.2.a.2 and shown graphically in Figure 8-13, is based on the following:

- Disinfection would occur during the recreation season as defined by the period of May through October. The disinfection facilities would be operated to minimize chlorine (sodium hypochlorite) dosing by having a targeted bacteria reduction in the order of 2 logs, or 99 percent

- Dechlorination of the effluent, if necessary, (via sodium bisulfite) would be applied to minimize the discharge of excess chlorine with a maximum effluent concentration of TRC set at 0.1 mg/L

As discussed earlier in this section, this operational strategy of targeted 2-log reduction recreational season disinfection provides the critical balance of high rates of bacteria reduction and protection of the waterbodies from the potential harmful effects of TRC.

The cost attainment plots (Figures 8-18 through 8-22) did not demonstrate significant improvements in the level of attainment with either current or Future Primary Contact WQ Criteria options. These plots were based on the 2008 typical year model simulations. The WQ model was also used to characterize WQS attainment for the recommended alternative of recreational season disinfection by running the model for the full 10 years simulation period as was done for the baseline and 100 percent CSO control conditions. The results of these runs are summarized in Tables 8-17 (annual attainment) and 8-18 (recreation season attainment).

Table 8-17. Calculated 10-year Bacteria Attainment for the Recommended Alternative– Annual Period

Location		Existing WQ Criteria		Primary Contact WQ Criteria (Class SC for Alley Creek)		Future Primary Contact WQ Criteria	
		Criterion	Attainment (%)	Criterion	Attainment (%)	Criterion	Attainment (%)
Alley Creek	AC1	Fecal ≤2,000	100	Fecal ≤200	90	Fecal ≤200	90
Little Neck Bay	OW2	Fecal ≤200	97	Fecal ≤200	97	Fecal ≤200	97
	LN1	Fecal ≤200	99	Fecal ≤200	99	Fecal ≤200	99
	E11	Fecal ≤200	100	Fecal ≤200	100	Fecal ≤200	100
	DMA	Fecal ≤200	100	Fecal ≤200	100	Fecal ≤200	100
		Enterococci ≤35(1)	99	Enterococci ≤35(2)	99	Enterococci ≤35(2)	99

Notes: (1) Bathing season (Memorial Day – Labor Day)
(2) Recreational season (May 1st – October 31st)

Table 8-18. Calculated 10-year Bacteria Attainment for the Recommended Alternative – Recreational Season Only

Location		Existing WQ Criteria		Primary Contact WQ Criteria (Class SC for Alley Creek)		Future Primary Contact WQ Criteria	
		Criterion	Attainment (%)	Criterion	Attainment (%)	Criterion	Attainment (%)
Alley Creek	AC1	Fecal ≤2,000	100	Fecal ≤200	98	Enterococci ≤35(2)	64
						STV≤130(2)	10
Little Neck Bay	OW2	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤35(2)	95
		Enterococci ≤35(2)	95	Enterococci ≤35(2)	95	STV≤130(2)	31
	LN1	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤35(2)	99
		Enterococci ≤35(2)	99	Enterococci ≤35(2)	99	STV≤130(2)	73
	E11	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤35(2)	100
		Enterococci ≤35(2)	100	Enterococci ≤35(2)	100	STV≤130(2)	85
	DMA	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤35(2)	99
		Enterococci ≤35(1)	99	Enterococci ≤35(2)	99	STV≤130(2)	69

Notes: (1) Bathing season (Memorial Day – Labor Day)
(2) Recreational season (May 1st – October 31st)

As noted in Table 8-17 with disinfection during the recreational period, Alley Creek is projected to attain the existing fecal coliform criterion (Class I) 100 percent of the time and attain the fecal criteria for the Primary Contact WQ Criteria (Class SC) 90 percent of the time. This situation changes when examining attainment during the recreational period when disinfection would be practiced (Table 8-18) as compliance with the fecal coliform criterion of the Primary Contact WQ Criteria would increase to 98 percent and would basically be in compliance with the standards. However as noted in Table 8-18, when examining the recreational season, the enterococci criterion (Future Primary Contact

WQ Criteria) will not be attained in Alley Creek. Examination of projected attainment in Little Neck Bay (Table 8-17 and Table 8-18) shows that the Class SB criteria are largely attained for the fecal coliform bacteria criterion. While the attainment is high with existing SB criteria (GM of 35 cfu/100 ml enterococci) at all LNB locations, it drops significantly for the recreational periods for the Future Primary Contact WQ Criteria when the STV values are examined. Table 8-19 shows the projected 90th percentile enterococci concentrations with the recommended plan in place.

8.6 Use Attainability Analysis (UAA)

The CSO Order requires a UAA to be included in LTCPs “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 UAA shall “examine[e] 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 reasons:

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 water body 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 water body, 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 is warranted, considering a potential adjustment to the designated use classification as appropriate. A UAA for Alley Creek is attached hereto as Appendix E.

8.6.a Use Attainability Analysis Elements

The objectives of the CWA are to provide 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 Update.

To simplify this process, DEP and DEC have developed a framework that outlines the steps taken under the LTCP in two possible scenarios:

- Waterbody meets WQ requirements. This may either be the existing WQS (where primary contact is already designated) or assess 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 monitoring.

- 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 discussed in Section 2.0, local background dry weather sources, direct drainage and stormwater introduced through the urbanization of the Alley Creek watershed contribute to bacteria levels in Alley Creek. As noted in Table 6-11 of Section 6.0, “local sources” contribute a summer 30-day maximum GM of 18 cfu/100mL of enterococci at location Station AC1 in Alley Creek for year 2008 conditions. NYC stormwater discharges and direct drainage contribute a maximum 30-day GM of 46 cfu/100mL at this location. At Station OW2 in Little Neck Bay these numbers reduce to 1 cfu/100mL and 16 cfu/100mL, respectively, while at location LN1 they are reduced further to 0 cfu/100mL and36 cfu/100mL, respectively. It should be noted that these two sources alone result in maximum summer 30-day GM concentrations of enterococci that are higher than the primary contact recreation criterion of 35 cfu/100mL for Alley Creek.

DEP is committed to further characterization and reduction of the local sources and is conducting follow-up investigations into their causes and possible mitigation. The goal of this would be to eliminate illicit discharges into Alley Creek. DEP, however, does not believe the dry weather bacteria concentrations emanating from Oakland Lake or the LIE Pond are illicit discharges, but are likely the result of waterfowl or other animals living in these natural settings. It is thus anticipated that these natural sources will remain unchanged in the future and are thus made part of the baseline conditions. In addition, while control of bacteria levels in NYC stormwater is currently being negotiated between the DEC and DEP in the draft Municipal Separate Storm Sewer Systems (MS4) permit, clear direction has not yet been provided as to the levels of stormwater reduction that will be required and/or are feasible. Therefore, although DEP has proposed a plan to control bacteria discharged from the Alley Creek CSO Retention Facility during the recreational season, there will continue to be other sources of bacteria that will preclude attainment of the future enterococci criteria within portions of Little Neck Bay.

8.6.b Fishable/Swimmable Waters

As noted in Section 8.1, and in other previous sections, 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 the SA and SB classifications as fulfillment of the CWA..

The recommended alternative summarized in Section 8.5 results in the following levels of attainment with fishable/swimmable criterion.

Alley Creek

Water quality modeling analyses, conducted for Alley Creek, and summarized in Tables 8-17 and 8-18, shows that the Creek is predicted to comply with the Primary Contact WQ Criteria (Class SC limited primary/secondary contact) monthly fecal coliform criterion of 200 cfu/100mL 90 percent of the time (annual average) in the 10-year simulation period. Compliance with the potential 30-day GM bathing criterion of 35 cfu/100mL enterococci is predicted (Table 8-18) to be 64 percent on average during recreational periods for the recommended plan conditions. As such, Alley Creek would not comply with the existing SC WQS, should they be implemented in the future, based on NYS DEC fecal coliform primary contact recreation standards annually or the Future Primary Contact WQ Criteria (2012 EPA RWQC criteria). However, the recommended alternative results in full attainment (≥95%) of Primary Contact WQ Criteria when applied during the recreational season.

Little Neck Bay

As noted in Section 8.5, Little Neck Bay is for the most part projected to comply, under the recommended plan conditions, with applicable bacteria WQS for Class SB waters fecal coliform and for the 30-day recreational period GM enterococci criteria of 35 cfu/100mL but not for the STV portion of the 2012 RWQC criteria, should they be implemented in the future. The results summarized above and in Table 8-18 indicate that Little Neck Bay attains WQ (primary contact) with the recommended plan except for a small transition zone which come close to attainment (95 percent attainment). Since the existing NYS DEC Primary Contact WQ Criteria are projected to be attained a UAA is not required at this time for Little Neck Bay.

As noted, DEP is proposing disinfection of the Alley Creek CSO Retention Facility during the recreational season to reduce the human source of bacteria during the bathing season (Memorial Day to Labor Day). Even with CSO disinfection, the results are not predicted to change Alley Creek compliance sufficiently enough to attain primary contact WQ criteria 100 percent of the time throughout the entire creek because of the remaining non-CSO bacteria sources. Since the Primary Contact WQ Criteria (Class SC) standards are projected to be un-attainable, a UAA is required at this time for Alley Creek.

A UAA is required to justify this based on the relevant criteria listed above. Since the analyses prove that even 100 percent elimination of CSO sources does not result in attainment, the UAA includes a discussion of factor number 3 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). The UAA also cites the lack of access and channel suitability for primary contact recreation activities as well.

8.6.c Assessment of Highest Attainable Use

The analyses contained herein, as noted above in Section 8.5.c and summarized in Table 8-19 indicate that the existing NYS DEC Class SB (primary contact water quality) criteria for bacteria are projected to be attained to a high degree within all of Little Neck Bay even coming close to full attainment in the small portion of the bay near the mouth of Alley Creek during the recreation season. However, Class SC (limited primary/secondary contact water quality) criteria for bacteria are not predicted to be fully attained within Alley Creek with the recommended alternative. Further, analyses conducted and described in Section 6.0 shows that 100 percent CSO controls would not provide for full compliance with the Primary Contact WQ Criteria or Future Primary Contact WQ Criteria, for Alley Creek.

Table 8-19. Recommended Plan Compliance with Clean Water Act Bacteria Water Quality Criteria

Location		**Bacteria Water Quality Standards Met Under Recommended Plan**		
		Existing WQ Criteria	**Primary Contact WQ Criteria (Class SC for Alley Creek)**	**Future Primary Contact WQ Criteria(1)**
Alley Creek		YES	NO	NO
Little Neck Bay	Inner Bay	YES	N/A	YES
	Outer Bay	YES	N/A	YES
DMA Beach		YES	N/A	YES

Note: YES - indicates attainment is calculated to occur ≥ 95 percent of time.
NO – indicates attainment is calculated to be less ≤ 95 percent of time.
(1) No areas would be in attainment if STV values are adopted in 2015 by NYS DEC

The modeling analysis assessed whether the recommended plan would improve water quality to allow for Class SC criteria in Alley Creek, both annually and for the recreational season. As shown in Tables 8-17 and 8-18, fecal coliform bacteria levels would approach the Class SC criteria, attaining them a high percent of the time. The lowest level of enterococci bacteria attainment of the existing 30-day recreational period GM of 35 cfu/100mL would be 95 percent attainment in the inner portions of Little Neck Bay, which is assumed herein to allow for the designated use. As noted in Table 8-18, attainment with the Future Primary Contact WQ Criteria would not occur 100 percent of the time in Alley Creek with the recommended plan for the enterococci criteria as measured by the 30-day GM and the STV values.

In summary, assuming that local sources of contamination into Little Neck Bay in the vicinity of DMA Beach are controlled, the Bay generally is projected to meet the existing Class SB bacteria criteria, including nearly 100 percent compliance at DMA Beach. Little Neck Bay is projected to attain SB standard and even come close to full attainment in the inner portions of the Bay near the mouth of Alley Creek. Alley Creek, however, cannot attain the primary contact classification of SC, limited primary and secondary contact recreation, through CSO controls alone annually but full attainment is observed when Primary Contact WQ Criteria are applied during recreational season.

8.7 Water Quality Goals

A goal of the Clean Water Act is for all water bodies to attain fishable-swimmable water where that goal can be attained. Analyses provided above indicate that waters in the outer portions of Little Neck Bay including DMA beach can fully support that use with the recommended alternative. Full attainment with the future primary contact recreation STV values, does not appear to be possible based on the analyses contained herein for Alley Creek or Little Neck Bay however.

DEP has developed an approach to move toward the goal of primary contact recreation water quality conditions with the recommended plan to disinfect Alley Creek CSO Retention Facility overflows during the recreational season. However, as noted, the EPA RWQC primary contact recreation geometric mean criteria (GM or STV) cannot be fully attained in Alley Creek nor throughout Little Neck Bay (STV value) even with this additional level of protection. Therefore, DEP is proposing that (a) DEC consider site specific water quality geometric mean targets for Alley Creek, (b) DEP would issue advisories for periods when elevated bacteria concentrations are present in primary contact waters, and (c) DEC not adopt RWQC STV values as proposed at 110 or 130 cfu/100mL. The advisory approach is an approach that has been in place at NYC DOHMH certified bathing beaches for many years (http://www.nyc.gov/html/doh/html/environmental/beach-homepage.shtml).

8.7.a Site-Specific Water Quality Targets

Based on the analyses of the waterbodies, and the WQS associated with the designated uses, the following conclusions can be drawn:

Alley Creek

Alley Creek remains a highly productive Class I waterbody that can fully support existing secondary uses, including nature education and wildlife propagation. Alley Creek is projected to attain its current Class I classification, but because of sources of bacteria to the Creek, such as localized sources and municipal stormwater discharges, it is not feasible for the waterbody to fully meet the water quality criteria associated with the next higher classification of SC except during the recreational season.

As described later in Section 9.0, DEP is committed to investigating ways to improve water quality in Alley Creek by tracking down dry weather sources of bacteria from TI-024, and controlling them to the extent practical. DEP is also engaged in discussions with DEC related to control of municipal stormwater. However, at this time, the nature and full extent of practical controls for these two sources is unknown. Therefore, although attaining fishable/swimmable WQS in Alley Creek is a long term future target, secondary limited primary contact use classification appears to be a practical short-term goal. Such a classification could be protective of primary contact during the recreation season outside of the periods during and after rainfall. Although, combinations of natural and manmade features, as well as desired uses by the public, prevent the opportunity and feasibility of primary contact recreation in Alley Creek.

Little Neck Bay

Little Neck Bay generally meets the Class SB standards almost 100 percent of the time when examined for the DEC fecal coliform monthly criterion, as well as the 30-day recreational season GM enterococci criterion. It should also be noted that the recreational season compliance (30-day rolling GM) is projected to be nearly 100 percent at DMA Beach for the recommended alternative, the only official bathing beach in the waterbody, which is monitored by DOHMH using the 30-day GM criterion. The presence of non-CSO discharges, dry weather sources, and suspected failed septic systems in Douglaston Manor prevents attainment of Class SB standards some times, under existing conditions. However, these local sources will need to be eliminated to continue to improve bacteria compliance in Little Neck Bay so that full attainment of the Class SB is achieved.

Future Water Quality

DEP is committed to improving water quality in Alley Creek and Little Neck Bay. Recreation season disinfection of the overflow from the Alley Creek CSO Retention Facility is one step in that process. Toward that end, DEP suggests that site-specific water quality targets be established for Alley Creek and Little Neck Bay that will allow DEP to continue to improve water quality in the system over time. Site-specific targets are recommended to advance towards the numerical limits established by DEC, SC bacteria standards and Future Primary Contact WQ Criteria with 2012 EPA RWQC. These targets are shown in Table 8-20.

DEP has identified the following higher attainable bacteria targets:

- Recreational Season (May 1st – October 31st): Uses of Alley Creek and Little Neck Bay are generally oriented around the recreational season. During the recreational season, boaters use the waters and DMA Beach is certified for swimming. The preferred alternative in Section 8.5, which DEP intends to pursue, is recreational season disinfection of the Alley Creek CSO Retention Facility effluent so that human bacteria discharged from the retention facility are reduced. With this focus on protecting the general public during the period of primary contract recreation, DEP proposes that water quality targets should be protective where the bathing uses are present and less stringent targets established where primary contact uses do not exist. DEP projects the potential to attain the following numerical site-specific targets during the recreational season against which continual water quality improvements be measured:
    - DMA Beach: Maximum rolling 30-day recreational season GM enterococci value of 35cfu /100mL and Monthly fecal coliform GM concentration of 200 cfu /100mL
    - Little Neck Bay: Maximum rolling 30-day recreational season GM enterococci value of 35 cfu /100mL and Monthly fecal coliform GM concentration of 200 cfu/100mL
    - Alley Creek: 30-day recreational season GM enterococci value of 130 cfu /100mL and Monthly recreational season fecal coliform GM concentration of 200 cfu/100mL

- Non-recreational Season (November 1st – April 30th): Uses in Alley Creek and Little Neck Bay are reduced; boating is still an activity for the transition periods between summer and winter but the number or users is reduced and water temperatures not conducive to primary contact, and, the DMA Beach is not certified by DOHMH for bathing. DEP projects the potential to attain the following numerical site-specific targets during the recreational season against which continual water quality improvements be measured:
  - DMA Beach: Monthly fecal coliform GM concentration of 200 cfu/100mL
  - Little Neck Bay: Monthly fecal coliform GM concentration of 200 cfu/100mL
  - Alley Creek: Monthly fecal coliform GM concentration of 500 cfu /100mL

The identified recreational season water quality targets are summarized in Table 8-20 in comparison to the bacteria water quality criteria. This table also provides a summary of the calculated bacteria criteria attainment. As noted in this table, the plan results in a high level of attainment with these proposed numerical targets.

Also as noted above, DEP does not believe that adoption of the STV portions of the 2012 EPA RWQC is warranted at this time. Analyses presented herein clearly show that adoption of STV values of 130 cfu/100mL is not attainable. Alternatively, DEP believes that if an STV value is required, it should be derived specifically for individual portions of Alley Creek and Little Neck Bay based on measured enterococci concentrations and their variability.

Table 8-20. Summary of Recreational Period Bacteria Water Quality Targets

	Existing WQ Criteria	Primary Contact WQ Criteria	Site-Specific Targets with Disinfection (cfu/100mL)	Attainment with Site Specific Targets (%)
Little Neck Bay	Fecal Coliform ≤ 200 Enterococci ≤ 35(2)	Fecal Coliform No change Enterococci ≤ 35(2)	Fecal Coliform ≤ 200	100
			Enterococci ≤ 35	95(3) 100(4)
Alley Creek	Fecal Coliform ≤ 2000	Fecal Coliform ≤ 200	Fecal Coliform ≤ 200	98
			Enterococci ≤ 130	100

	Existing WQ Criteria	Primary Contact WQ Criteria	Site-Specific Targets with Disinfection (cfu/100mL)	Attainment with Site Specific Targets (%)
DMA Beach	Fecal Coliform ≤ 200	Fecal Coliform No change	Fecal Coliform ≤ 200	100
	Enterococci ≤ 35(1)	Enterococci ≤ 35(2)	Enterococci ≤ 35	99

Notes: (1) Bathing season (Memorial Day – Labor Day)
(2) Recreational season (May 1st – October 31st)

Although Alley Creek will not be capable of supporting primary contact 100 percent of the time and Little Neck Bay comes very close to full attainment, these water bodies could possibly be protective of primary contact should it occur as long as it did not occur during and following rainfall events. In addition, even though Little Neck Bay is projected to be fully capable of primary contact, concentrations of bacteria are elevated during and after rainfall events. Toward that end, DEP has reviewed the New York State Department of Health guidelines relative to single sample maximum bacteria concentrations that they believe "constitutes a potential hazard to health if used for bathing." The presumption is that if the bacteria concentrations are lower than these levels, then the water bodies do not pose a potential hazard if primary contact is practiced.

> **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; ….

Fecal coliform concentrations that exceed 1,000 cfu/100mL and or enterococci concentrations exceeding 104 cfu/100mL are considered potential hazards by the State Department of Health and should be avoided. Water quality modeling analyses described herein assess the amount time following the end of rainfall required for Alley Creek and Little Neck Bay to recover and return to concentrations less than 1,000 cfu/100mL fecal coliform and 130 cfu/100mL enterococci. The value 130 was used instead of 104 as recent EPA guidance indicates that the 104 value will no longer be relevant.

The analyses consisted of examining the water quality model calculated Alley Creek and Little Neck Bay bacteria concentrations for recreation periods (May 1st to October 31st) abstracted from 10 years of model simulations. The time to return (or "time to recover") to 1,000 or 130 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 are summarized in Table 8-21 for various locations within Alley Creek and Little Neck Bay. As noted the duration of time within which bacteria concentrations are expected to be higher than NYS DOH considers safe for primary contact varies with location and with rainfall event size. Generally, a value of around 24 hours is reasonable for Alley Creek (AC1) and Little Neck Bay (OW2).

Table 8-21. Time to Recover (hours) To Fecal = 1,000 cfu/100mL and Entero = 130 cfu/100mL

	AC1		OW2		LN1		DMA	
Interval	**Fecal**	**Entero**	**Fecal**	**Entero**	**Fecal**	**Entero**	**Fecal**	**Entero**
<0.1	-	-	-	-	-	-	-	-
0.1-0.4	5	10	-	-	-	-	-	-
0.4-0.8	8	21	4	11	-	-	-	-
0.8-1.0	12	26	5	16	-	-	-	2
1.0-1.5	12	31	7	27	-	7	-	4
>1.5	14	31	12	27	-	16	2	12

Primary contact uses may be suspended for 24 hours following rain events to protect public health.

8.8 Recommended LTCP Elements to Meet Water Quality Goals

The identified LTCP elements described in this section are the culmination of efforts by DEP to assess the WQS. DEP recognizes that achieving water quality objectives requires more than the reduction of CSO discharges. DEP's CSO Control Facility Planning for these waterbodies began in 1984.

The identified elements for the Alley Creek and Little Neck Bay LTCP are:

1. DEP will continue to use the Alley Creek CSO Retention Facility to capture CSOs thus reducing overflows by 132 mgd per year.
2. DEP will continue to implement the Green Infrastructure program.
3. DEP will implement the steps necessary (i.e. funding, design, permitting, etc.) to construct a new facility at the existing Alley Creek CSO Retention Facility to disinfect during the recreational season (May 1st to October 31st).
4. The LTCP includes a UAA that identifies feasible site-specific WQ targets based on the projected performance of the selected CSO controls. A post construction monitoring program will be initiated after the WWFP improvements are operational. Based upon the results of such monitoring, the site-specific WQ targets may need to be reviewed
5. DEP will establish with the NYC Department of Health and Mental Hygiene through public notification a 24-hour wet weather advisory during the Recreational Season (May 1 to October 31), during which swimming and bathing would not be recommended. The LTCP includes a recovery time analysis that can be used to establish the 24-hour wet weather advisory for public notification.

Section 9.0 presents the implementation of the identified elements.

9.0 Long Term CSO Control Plan Implementation

The evaluations performed for this Alley Creek LTCP concluded is the recommendations be in implemented are from Alternative 4, Disinfection within the Existing Alley Creek CSO Retention Facility, in Section 8. This conclusion was the result of the cost performance and cost attainment analyses that were presented in Section 8.5 that showed that seasonal disinfection, potentially followed by dechlorination, is the preferred alternative. As previously noted in Section 8.5, the recommendation was based on the removal of human or CSO-source bacteria reduction (2-log or 99 percent) that would result from its implementation, not the level of additional attainment of Existing and Future Primary Contact WQ Criteria that would result. As demonstrated in both Sections 6.0 and 8.0, significant gains in WQS attainment cannot be achieved through the control of the CSO discharges alone.

This recommendation follows the sequence of previous CSO planning for Alley Creek and Little Neck Bay. The retention facility was first recommended in the 2003 Facilities Plan, and then re-stated in the 2009 WWFP as the preferred alternative. Following the $130M (million) investment in the watershed for the retention facility, related collection system improvements, and ecological restorations, the existing Alley Creek CSO Retention Facility is again the focus of this latest plan. In the case of this LTCP, the current recommendation is enhancing the effectiveness of the retention facility by further reducing the bacterial loadings to the two waterbodies via the disinfection process.

9.1 Adaptive Management (Phased Implementation)

Adaptive management, as defined by EPA, is the process by which new information about the characteristics of a watershed is incorporated into a watershed management plan. The process relies on establishing a monitoring program, evaluating monitoring data and trends and making adjustments or changes to the plan. In the case of this LTCP, adaptive management may result in future adjustments to the operations of the Alley Creek CSO Retention Facility based on lessons learned.

DEP will continue to apply the principles of adaptive management based on its annual evaluation of PCM data which is collected to optimize the operation and effectiveness of the facility. This will ensure that the facility provides the maximum level of AAOV reduction through timely post- and inter-storm dewatering.

Further, in order to achieve the targeted 2-log reduction of bacteria from the retention facility effluent while striving to minimize the discharge of TRC, DEP will review operational data of the disinfection system, such as sodium hypochlorite dosing and the resulting kills; sodium bisulfite dosing if needed; and the monitoring of effluent TRC concentrations, so that the overall process can be optimized and the potential harmful effects of TRC can be minimized.

Another aspect of the LTCP’s phased adaptive management deals with interim or incremental water quality. Because of the inability to meet future Primary Contact WQ Criteria, the concept of “Site-Specific Targets” was discussed for Alley Creek and Little Neck Bay in Section 8.7, recommendations for such are described in Section 9.7. The water quality of the two waterbodies will be monitored and compared with these incremental targets as part of PCM.

As part of the upcoming municipal separate storm sewer system (MS4) permitting program, the impacts of stormwater on water quality will be addressed by DEP. Since stormwater loads were also found to be significant, this may impact the attainment of Alley Creek and Little Neck Bay along with the proposed CSO control that is recommended in this LTCP.

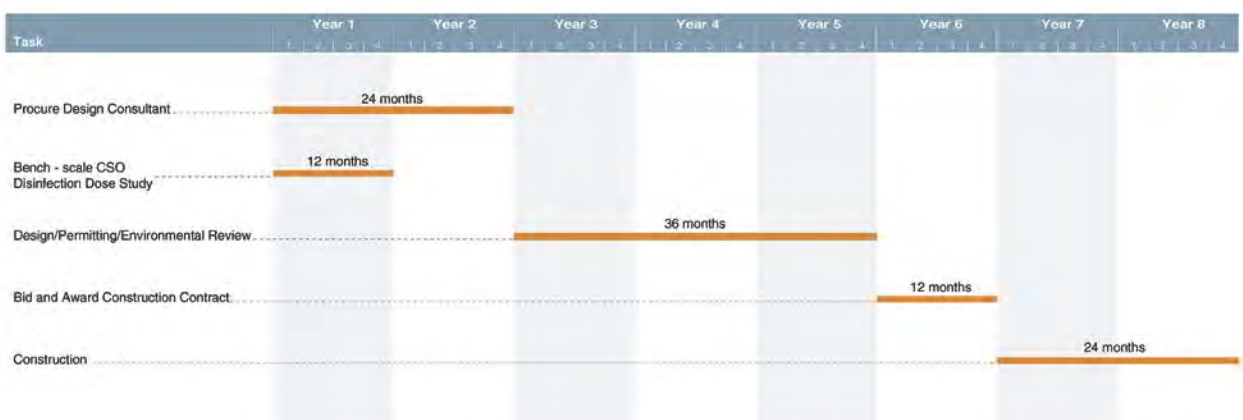
DEP will also continue to monitor water quality of two waterbodies through its ongoing monitoring programs. When evidence of dry weather sources of pollution is found, track downs will be initiated. Such activities will be reported to DEC on a quarterly basis as is currently required.

9.2 Implementation Schedule

The disinfection system and construction will include an interim facility and a Standard Design Facility. The schedule presents the duration of time needed for the Standard Design Facility which begins with the approval of the LTCP by DEC. Figure 9-1 shows the implementation schedule for the construction of disinfection system at the Alley Creek CSO Retention Facilities for the Standard Design Facility. The interim facility requirements and schedule are discussed in Appendix G. The interim facility will allow disinfection to begin at an earlier time and will be removed after the Standard Design Facility is operational. The disinfection facility will be operated from May 1st to October 31st (Recreational Season).

The project will include receiving approval for use of the land from the NYC Department of Parks and Recreation, funding approval, roadway access improvements and DOT approvals, selection of design flows, dosage rates, TRC evaluations, and utilities availability. A more detailed disinfection project approach is presented in Appendix G.

Table 9-1. Alley Creek Disinfection Facility Schedule-Standard Design Facility



9.3 Operation Plan/O&M

DEP is committed to optimizing the operation of the existing Alley Creek CSO Retention Facility. This will ensure that the tank provides the maximum level of overflow volume reduction through timely post- and inter-storm dewatering of groundwater infiltration and tank seepage. DEP will also continue to collect and evaluate PCM data to optimize the operation and effectiveness of the facility. Accordingly, the Standard Operating Procedure (SOP) for such operations was recently revised to reflect this commitment. As a result of these revisions, the following improvement to the SOPs is currently being tested and implemented:

- Stored volume will be pumped back from the Alley Creek CSO Retention Facility when total flow to the Tallman Island WWTP is below 90 MGD after a wet weather event. Previously, this plant flow rate was set at 80 MGD to minimize wet weather impacts on plant performance. This adjustment should provide better capture of CSOs in the facility.

The addition of the proposed disinfection system will require a new WWOP and SOPs, as appropriate, for the retention facility as well. As was noted in Section 9.2, in addition to ensuring proper O&M for said facilities, DEP will strive to optimize their operation as well with the intent of maintaining high rates of disinfection (99 percent) while minimizing the discharge of TRC to the waterbodies.

9.4 Projected Water Quality Improvements

The improvement in water quality resulting from the LTCP recommendation will be the high degree of reduction of human or CSO-source bacteria during the recreational season. During this recreational season, the periodic discharges from the Alley Creek CSO Retention Task from outfall TI-025 will be disinfected.

Other improvements in the water quality of the two waterbodies are expected to continue as the result of ongoing efforts to further quantify and abate, to the extent feasible, the localized sources of pollution in the upper Alley Creek watershed and the application (by new development or re-development) of 3 percent GI. These improvements will be tracked and documented through continued DEP water quality monitoring as part of the PCM and HSM. Other future pollutant reduction programs, such as those pertaining to MS4s, will be implemented based on future watershed characterization and modeling, and other potential MS4 permit requirements that result in improvements in the water quality of the two waterbodies.

9.5 Post Construction Monitoring Plan and Program Reassessment

Ongoing DEP monitoring programs will continue, including PCM associated with the Alley Creek CSO Retention Facility and the HSM. This is in addition to DOHMH's DMA Beach monitoring and DEP's Sentinel Monitoring of the shoreline. Harbor Survey data collected from Stations AC1, LN1 and E11 will be used to periodically review and assess the water quality trends in the waterbodies. Depending upon the findings, the data from these programs could form the basis of additional recommendations for inclusion in, as appropriate, the 2017 Citywide LTCP.

Following the construction of the disinfection system at the retention facility, the seasonal benefits from that operation will be assessed as part of PCM and HSM programs as well.

9.6 Consistency with Federal CSO Policy

The Alley Creek and Little Neck Bay LTCP was developed to comply with the requirements of the EPA CSO Control Policy and associated guidance documents, and the CWA . The LTCP revealed that Alley Creek currently attains the Class I bacteria criteria but cannot support the Primary Contact WQ Criteria classification (SC), even with 100 percent CSO control. It also showed, however, that Alley Creek is not suitable for contact recreation due to several natural and manmade factors listed in the UAA discussion of Section 8.6. A UAA has therefore been prepared and is attached to the LTCP (see Appendix D) as a means to formally demonstrate and acknowledge the suitability of continued Class I designation for Alley Creek.

Unlike Alley Creek, the Class SB Little Neck Bay fully attains the existing bacteria criteria on an annual basis. This high level of attainment also includes 100 percent attainment of NYS DOHMH recreational waters criteria at DMA Beach, the only formal designated swimming beach within the two waterbodies. It should be noted that in a recent communication with the DEC that 95 percent attainment of applicable water quality criteria is interpreted as achieving the existing water quality standards.

9.6.a Affordability and Financial Capability

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." This financial capability guidance contains a two-phased assessment approach. Phase one 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 2 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 bills are less than 1 percent of MHI.
- Mid-range economic impact: average wastewater bills are between 1 percent and 2 percent of MHI.
- Large economic impact: average wastewater bills are greater than 2 percent of MHI.

The second phase develops the Permittee Financial Capability Indicators (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, including 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 the increased likelihood that additional controls would cause substantial economic impact.

The results of the RI and the Permittee Financial Capability Indicators 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.

Importantly, 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 Clean Water Act 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, EPA in 2012 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 green infrastructure (U.S. EPA, 2012). EPA, in conversation with communities, the U.S. Conference of Mayors, and the National Association of Clean Water Agencies, is also preparing a Financial Capability Framework which clarifies and explains the flexibility within their CSO guidance.

This section of this Long Term Control Plan begins to explore affordability and financial capability concerns as outlined in the 1997 and 2001 Guidance documents. This section will also explore additional socioeconomic indicators that reflect affordability concerns within the New York City context. Since DEP is tasked with preparing 10 Long Term Control Plans for individual waterbodies and 1 Long Term Control Plan for the East River and Open Waters, we expect that a complete picture of the effect of the comprehensive CSO Program would be available in 2017 to coincide with the schedule for completion of all the plans.

9.6.a.1 Background on DEP Spending

As the largest water and wastewater utility in the nation, DEP provides over a billion gallons of drinking water daily to more than 8 million NYC residents, visitors and commuters as well as one million upstate customers. DEP maintains over 2,000 square miles of watershed comprised of 19 reservoirs, 3 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 7,400 miles of sewers, 95 pump stations and 14 in-city treatment plants. In wet weather, the system can treat up to 3.5 billion gallons per day of combined storm and sanitary flow. In addition to the treatment plants, DEP has four CSO storage facilities. DEP recently launched a $2.4 billion green infrastructure program, of which $1.5 billion will be funded by DEP, and the remainder will be funded through private partnerships. This Long Term Control Plan (LTCP) for Alley Creek is one of ten waterbody-specific LTCPs that DEP is developing over the next several years in addition to a Citywide LTCP due in 2017 to manage and abate CSOs throughout the NYC's waterbodies.

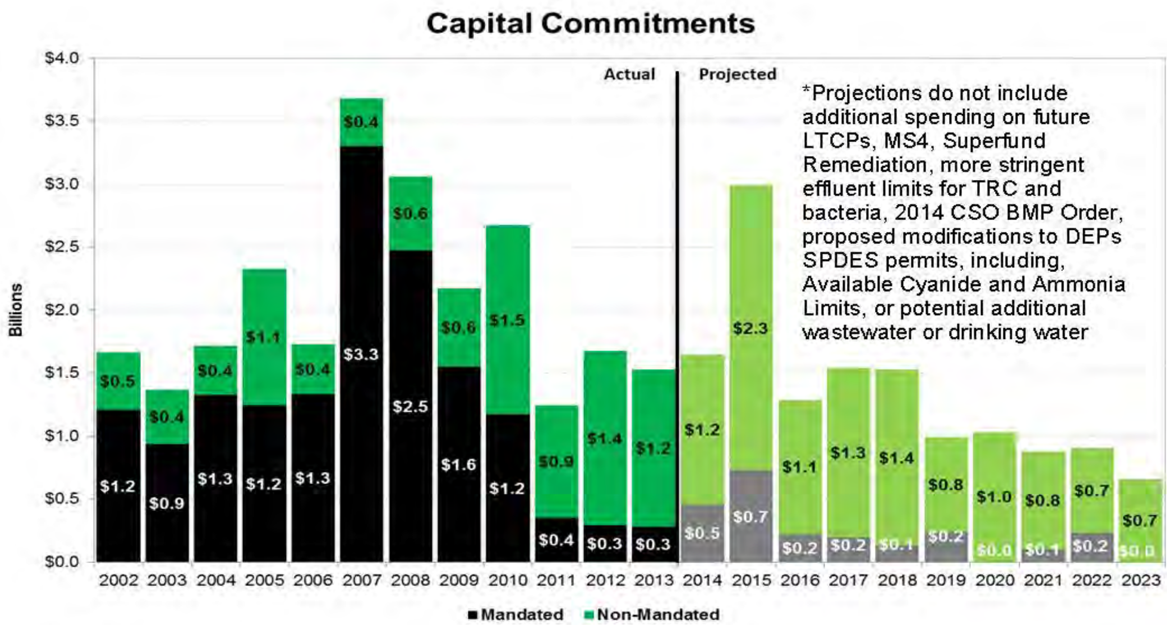


Figure 9-1. Historical and Projected Capital Commitments

9.6.a.2 Currently Budgeted and Recent Completed Mandated Programs

As shown in Figure 9-1, from Fiscal Year (FY) 2002 through FY 2013, 62 percent of DEP's capital spending was for wastewater and water mandates. Many projects have been important investments that safe-guard 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.

Wastewater Mandated Programs

The following wastewater programs and projects have been initiated to comply with Federal and state laws and permits:

- CSO abatement and stormwater management programs

  DEP has initiated a number of projects to reduce CSOs and eliminate excess infiltration and inflow of groundwater and stormwater into the wastewater system. These projects include: construction of CSO abatement facilities, optimization of the wastewater system to reduce the volume of CSO discharge, controls to prevent debris that enters the combined wastewater system from being discharged, dredging of CSO sediments that contribute to low dissolved oxygen (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 must be made by DEP as well as operations and maintenance (O&M) expenses. Historical commitments on and those currently in DEP's 10 year capital plan for CSOs are estimated to be about $3.3 billion. FY13 annual operating costs for stormwater expenses are estimated to have been about $63M. DEP will be required to make additional investments in stormwater controls pursuant to MS4 requirements.

- Biological nutrient removal

  In 2006, NYC entered into a Consent Judgment (Judgment) with the DEC, which required DEP to upgrade five water pollution control plants by 2017 in order to reduce nitrogen discharges and comply with draft State Pollutant Discharge Elimination System nitrogen limits. Pursuant to a modification and amendment to the Judgment, DEP has agreed to upgrade three additional plants and to install additional nitrogen controls at one of the plants, which was included in the original Judgment. As in the case of CSOs and stormwater, these initiatives include capital investments made by DEP ($280 million to date and an additional $123M in the 10-year capital plan) as well as O&M expenses (chemicals alone in FY13 amounted to $2.5M),

- 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 $5 billion. In 2011, DEP certified that the Newtown Creek plant met the effluent discharge requirements of the Clean Water Act, bringing all 14 plants into compliance with the secondary treatment requirements.

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 has promulgated a rule known as Long Term 2 (LT2) that requires 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 have resulted in a federal court consent decree (the Croton Water Treatment Plant Consent Decree), which mandates 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. DEP estimates that the facility will begin operating in 2015. To date, DEP has committed roughly $3.2 billion in capital costs. During start-up and after commencement of operations, DEP will also incur annual expenses for labor, power, chemicals, and other costs associated with plant O&M. For FY15, O&M costs are estimated to be about $23 million.

- Catskill/Delaware Watershed- Filtration Avoidance Determination

  Since 1993, DEP has been operating under a series of Filtration Avoidance Determinations (FADs), which allow the City to avoid filtering surface water from the Catskill and Delaware systems. In 2007, EPA issued a new FAD (2007 FAD), which requires the City to take certain actions over a 10-year period to protect the Catskill and Delaware water supplies. In 2014, the New York State Department of Health issued mid-term revisions to the 2007 FAD. Additional funding has been added to the CIP through 2017 to support these mid-term FAD revisions. DEP has committed about $1.5 billion to date and anticipates that expenditures for the current FAD will amount to $200 million.

- UV Disinfection Facility

  In January 2007, DEP entered into an Administrative Order on Consent (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 $1.6 billion. DEP is also now incurring annual expenses for property taxes, labor, power, and other costs related to plant O&M. FY13 O&M costs were $20.8 million including taxes.

9.6.a.3 Future System Investment

Over the next nine years, the percentage of already identified mandated project costs in the CIP is anticipated to decrease, but DEP will be funding critical but non-mandated state of good repair projects and other projects needed to maintain NYC's infrastructure to deliver clean water and treat wastewater. Moreover, DEP anticipates that there will be additional mandated investments as a result of Municipal Separate Stormwater System (MS4) compliance, proposed modifications to DEP's in-city WWTP SPDES permits, Superfund remediation, CSO LTCPs, the 2014 CSO Best Management Practices Consent Order. It is also possible that DEP will be required to invest in an expensive cover for Hillview Reservoir as well as other additional wastewater and drinking water mandates. Additional detail for anticipated future mandated and non-mandated wastewater programs is provided below, with the exception of CSO LTCPs which are presented in Section 9.6.f.

Potential or Unbudgeted Wastewater Regulations

- MS4 Permit Compliance

  Currently, DEP's separate stormwater system is regulated through DEP's 14 WWTP-specific SPDES permits. On February 5, 2014, DEC issued a draft MS4 permit that will cover MS4 separate stormwater systems for all City agencies. Under the proposed MS4 permit, the permittee will be NYC.

  DEP will be responsible for developing a stormwater management program plan for NYC to facilitate compliance with the proposed permit terms as required by DEC. This plan will also develop the legal authority to implement and enforce the stormwater management program as well as develop enforcement and tracking measures and provide adequate resources to comply with the MS4 permit. Some of the potential permit conditions 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 the NYC to conduct fiscal analysis of the capital and O&M expenditures necessary to meet the requirements of this permit, including any development, implementation and enforcement activities required, within three years of the Effective Permit date.

The draft MS4 permit compliance costs are yet to be estimated. DEP's annual historic stormwater capital and O&M costs have averaged $131.6 million. However, given the more stringent draft permit requirements, 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 departments that are responsible for managing stormwater. Total compliance costs for stormwater programs in other major urban areas, such as Philadelphia and Washington DC, are projected to be $2.4 billion and, $2.6 billion, respectively, which will result in extensive annual expenditures. Each of these programs contains both grey and green infrastructure components, similar to those anticipated for NYC, to meet mandated requirements. The geographic area covered by New York City's MS4 program is larger than the MS4 area in either Philadelphia or Washington DC. New York City's MS4 area is over 131 square miles, while Philadelphia's MS4 area is just over 78 square miles, and Washington DC's area is even less at approximately 31 square miles, or about 25 percent of that in New York City.

- Draft SPDES Permit Compliance

In June 2013, NYSDEC issued draft SPDES permits which, if finalized, will have a substantial impact on DEP's Total Residual Chlorine (TRC) program and set more stringent ammonia and available cyanide limits. These proposed modifications include requirements that DEP:

– Perform a degradation study to evaluate the degradation of TRC from the chlorine contact tanks to the edge of the designated mixing zone for comparison to the water-quality-based effluent limit and standard. The scope of work for this study is required within six months of the effective date of the SPDES permit, and the study must be completed 18 months after the approval of the scope of work. Based upon verbal discussions with DEC, DEP believes that this study may result in the elimination of the 0.4 mg/l uptake credit previously included in the calculation of TRC limits thereby decreasing the effective TRC limits by 0.4 mg/l at every plant.

– Comply with new unionized ammonia limits. These proposed limits will, at some plants, potentially interfere with the chlorination process, particularly at 26th Ward and Jamaica.

– Monitor for available cyanide and ultimately comply with a final effluent limit for available cyanide. Available cyanide can be a byproduct of the chlorination process.

– DEC has also advised DEP that fecal coliform, the parameter that has been historically used to evaluate pathogen kills and chlorination performance/control will be changing to enterococcus. This change will likely be incorporated in the next round of SPDES permits scheduled in the next five years. Enterococcus has been shown to be harder to kill with chlorine and may require process changes to disinfection that would eliminate the option of adding de-chlorination after the existing chlorination process.

The potential future costs for these programs have yet to be determined. Preliminary compliance costs for TRC control and ammonia control are estimated to be up to $$560Mand $840M, respectively.

- CSO Best Management Practices Order

  On May 8, 2014, DEC and DEP entered into an agreement for the monitoring of CSO compliance, reporting requirements for bypasses, and notification of equipment out of service at the WWTP during rain events. The 2014 CSO BMP Order incorporates, expands, and supersedes the 2010 CSO BMP Order by requiring DEP to install new monitoring equipment at identified key regulators and outfalls and to assess compliance with requirements to "Maximize Flow to the WWTP". The costs for compliance for this Order have not yet been determined, but DEP expects this program to have significant capital costs as well as expense costs.

- Superfund Remediation

  There are currently three Superfund sites in NYC, at various 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. The Newtown Creek RI/FS completion is anticipated for 2018, and the Former Wolff-Alport Chemical Corporation has only recently been listed as a Superfund site.

  DEP's ongoing costs for these projects are estimated at about $50-60M for the next ten years, not including design or construction costs for the Gowanus Canal. EPA's selected remedy for the Gowanus Canal requires that NYC build two combined sewage overflow retention tanks. While the EPA estimated cost is $78 million, the DEP estimate based on actual construction experience in NYC is $380-760 million for construction, with an additional $40-80 million for design. Potential alternatives to the EPA selected remedy will be evaluated during the Gowanus LTCP process. Similar Superfund mandated CSO controls at Newtown Creek could add costs of $1 to 2 billion.

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 New York State Department of Health (NYSDOH) and an Administrative Order with EPA, which mandate NYC to begin work on a reservoir cover by the end of 2018. 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 on the order of $1.6 billion.

Other: State of Good Repair Projects and Sustainability/Resiliency Initiatives

Wastewater Projects

- Climate Resiliency

  In October 2013, on the first anniversary of Hurricane 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 Hurricane Sandy, was based on an asset-by-asset analysis of the risks from storm surge under new flood maps at all 14 treatment plants and 58 of NYC's pumping stations, representing more than $1 billion in infrastructure.

  DEP estimates to spend $447 million in cost-effective upgrades at these facilities to protect valuable equipment and minimize disruptions to critical services during future storms. It is estimated that investing in these protective measures today will help protect this infrastructure from over $2 billion in repeated flooding losses over the next 50 years. DEP is currently pursuing funding through the EPA State Revolving Fund Storm Mitigation Loan Program.

  DEP will coordinate this work with the broader coastal protection initiatives, such as engineered barriers and wetlands, described in the 2013 report, "A Stronger, More Resilient New York," and continue 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 green infrastructure 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 in areas of Queens with limited drainage and continued investments and build-out of the Bluebelt system.

- Energy projects at WWTPs

  The City's blueprint for sustainability, *PlaNYC 2030: A Greener, Greater New York*, set a goal of reducing the City's greenhouse gases (GHG) emissions from 2006 levels by 30 percent by 2017. This goal was codified in 2008 under Local Law 22. In order to meet the PlaNYC goal, DEP is working to reduce energy consumption and GHG emissions through: reduction of fugitive methane emissions, investment in cost-effective, clean energy projects, and energy efficiency improvements.

  Fugitive methane emissions from wastewater treatment plants currently account for approximately 170,000 metric tons (MT) of carbon emissions per year and 30% of DEP's overall emissions. To reduce GHG emissions and to increase on-site, clean energy generation, DEP has set a target of 60 percent beneficial use of the biogas produced by 2017. Recent investments by DEP to repair leaks and upgrade emissions control equipment have already resulted in a 30 percent reduction of methane emissions since a peak in 2009. Going forward, DEP has approximately $500 million allocated in its capital improvement plan 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 system is currently in design for the North River WWTP and estimated to be in operation in Spring 2019. This project will replace 10 direct-drive combustion engines, which are over 25 years old and use fuel oil, with five new gas engines enhancing the plant's operational flexibility, reliability, and resiliency. The cogeneration system will produce enough energy to meet the plant's base electrical demand and the thermal demand from the treatment process and building heat, in addition to meeting all of the plants emergency power requirements. The project is taking a holistic approach and includes: (1) improvements to the solids handling process to increase biogas production and reduce treatment, transportation and disposal costs; (2) optimization of biogas usage through treatment and balancing improvements; and (3) flood proofing the facility to the latest FEMA 100-yr flood elevations plus 32 inches to account for sea level rise. The cogeneration system will double the use of anaerobic digester gas produced on-site; eliminate fuel oil use, and off-set utility electricity use, which will reduce carbon emissions by over 10,000 metric tons per year, the equivalent of removing ~2,000 vehicles from the road. The total project cost is estimated at $212M. DEP is also initiating an investment-grade feasibility study to evaluate the installation of cogeneration at the Wards Island WWTP, the City's second largest treatment plant.

To reduce energy use and increase energy efficiency, DEP has completed energy audits at all 14 in-city wastewater treatment plants (WWTPs). Close to 150 energy conservation measures (ECMs) relating to operational and equipment improvements to aeration, boilers, dewatering, digesters, HVAC, electrical, thickening and main sewage pumping systems have been identified and accepted for implementation. Energy reductions from these ECMs have the potential to reduce greenhouse gas emissions by over 160,000 MT of carbon emissions at an approximate cost of $140M. DEP is developing implementation plans for these measures.

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 currently 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 working on projects that will supplement the City's drinking water supply during the shutdown, such as developing the groundwater aquifers in Jamaica, Queens, and implementing demand reduction initiatives, such as offering a toilet replacement program. Construction of the shafts for the bypass tunnel is underway, and the project will culminate with the connection of the bypass tunnel in 2021. The cost for this project is estimated to be about $1.5 billion.

- Gilboa Dam

  DEP is currently investing in a major rehabilitation project at 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. This project is estimated to cost roughly $ 440 million.

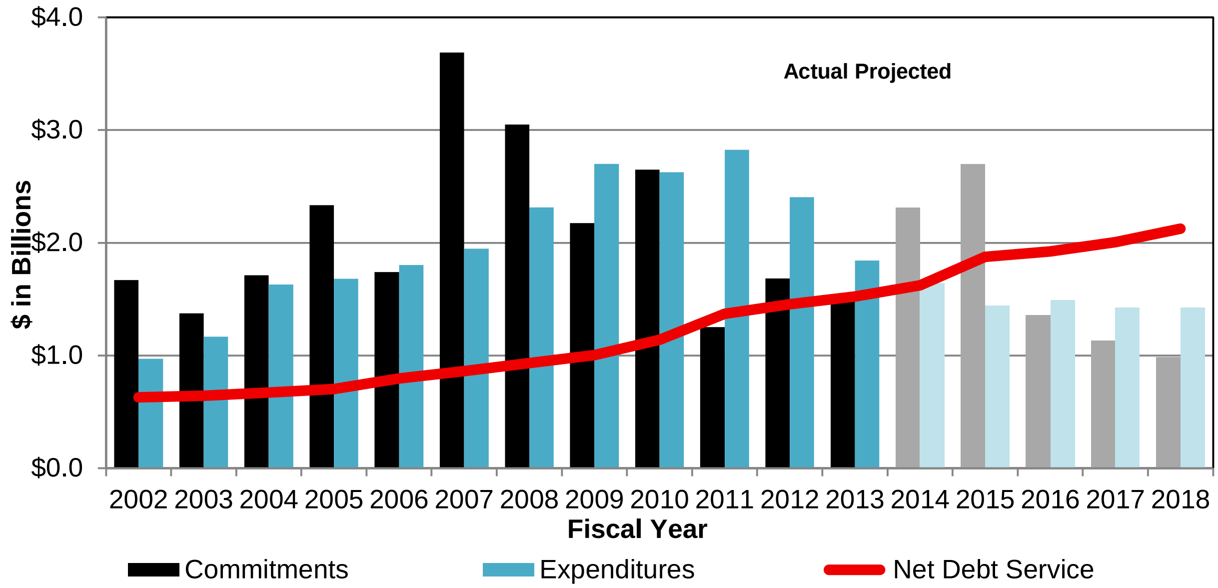


Figure 9-2. Past Costs and Debt Service

As shown in Figure 9-2, increases in capital expenditures have resulted in increased debt. While confirmed expenditures may be on the decline over the next few years, debt service continues to be on the rise in future years, occupying a large percentage of DEP's operating budget (approximately 45 percent in FY15).

9.6.b Background on History of DEP Water and Sewer 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, as well as stormwater service, and maintaining a state of good repair. The NYC Municipal Water Finance Authority ("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.

For FY15, most customers will be charged a uniform water rate of $0.49 per 100 gallons of water. Wastewater charges are levied at 159 percent of water charges ($0.79 per 100 gallons). There is a small percentage of properties that are billed a fixed rate. Under the Multifamily Conservation Program, some properties are billed at a fixed per-unit rate if they comply with certain conservation measures. Some nonprofit institutions are also granted exemption from water and wastewater charges on the condition that their consumption is metered and their consumption falls within specified consumption threshold levels. Select properties can also be granted exemption 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 onsite).

There are also currently a few programs that provide support and assistance for customers in financial distress. 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 (WDAP) 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, or 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. The agency has undertaken an aggressive communications campaign to ensure customers know about these programs and any exclusions they may be qualified to receive, such as the Senior Citizens Homeowner's Exemption and the Disabled Homeowner's Exemption. DEP also just announced the creation of a Home Water Assistance Program (HWAP) to assist low-income homeowners. In this program, DEP will partner with the NYC Human Resources Administration (HRA), which administers the Federal Home Energy Assistance Program (HEAP), to identify homeowners who would be eligible to receive an annual credit on their DEP bill.

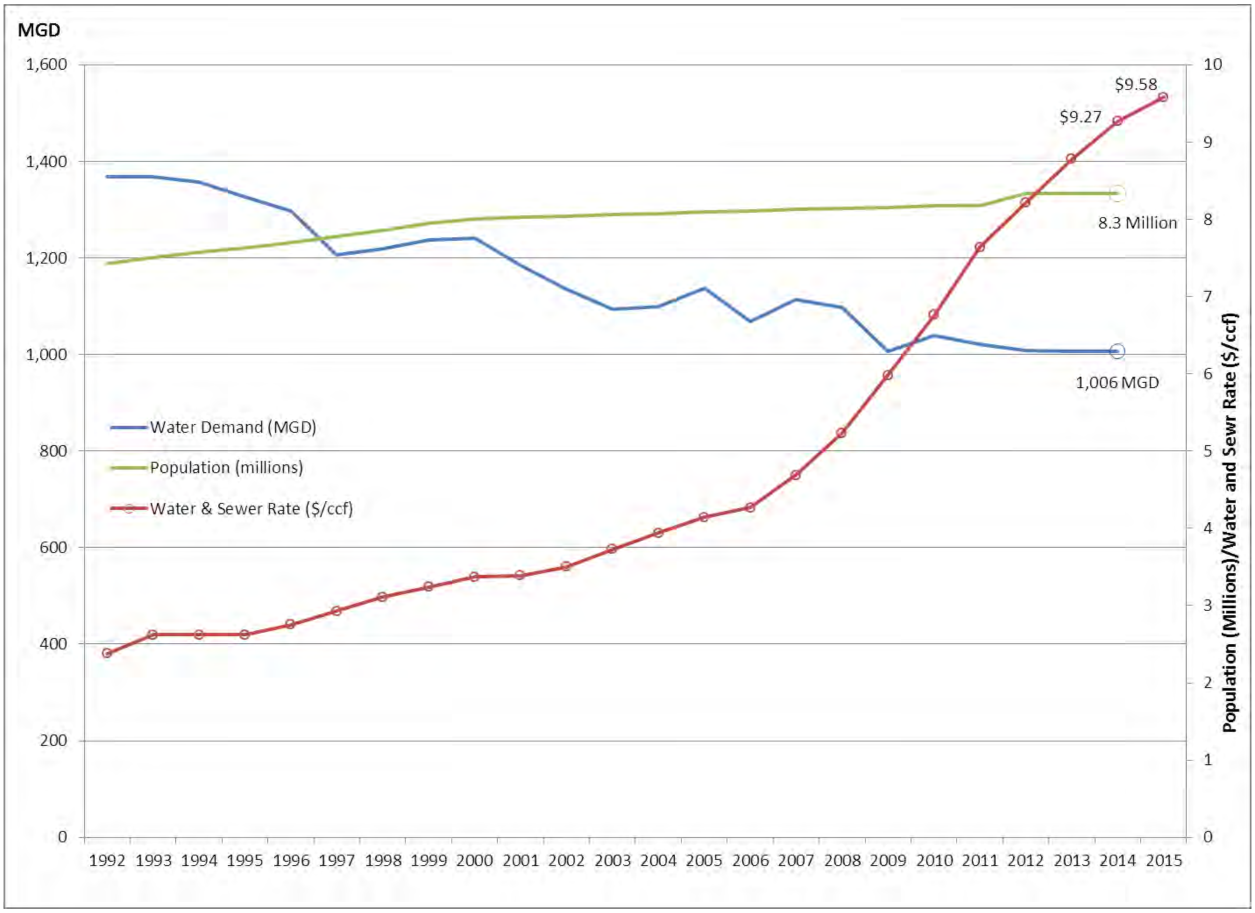


Figure 9-3. Population, Consumption Demand, and Water and Sewer Rates Over Time

Figure 9-3 shows how water and sewer rates have increased over time and how that compares with system demand and population. Despite a modest rise in population, water consumption rates have been falling since the 1990s due to metering and increases in water efficiency measures. At the same time, rates have been rising to meet the cost of service associated with DEP's capital commitments. DEP operations are funded almost entirely through rates paid by our customers with less than 2 percent of spending supported by federal and state assistance over the past 10 years. From FY 2002 to FY 2015, water and sewer rates have risen 173 percent. This is despite the fact that DEP has diligently tried to control operating costs. To mitigate rate increases, DEP has diligently managed operating expenses, and since 2011, the agency has had four budget cuts to be able to self-fund critical agency operating needs. Additionally, DEP has undertaken an agency-wide Operational Excellence (OpX) program to review and improve the efficiency of the agency's operations; to date initiatives have been implemented that result in a recurring annual benefit of $80M.

9.6.c Residential Indicator

As discussed above, the first economic test as part of EPA's 1997 CSO guidance is the residential indicator (RI), which compares the average annual household water pollution control cost (wastewater and stormwater related charges) to the median household income 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. Since the wastewater bill in NYC is a function of water consumption, average household costs are estimated based on consumption rates by household type in Table 9-2 below.

Table 9-2: Residential Water and Wastewater Costs compared to MHI

	Average Annual Wastewater Bill ($/year)	Wastewater RI (Wastewater Bill/MHI*)	Total Water and Wastewater Bill ($/Year)	Water and Wastewater RI (Water and Wastewater Bill/MHI)
Single Family**	629	**1.14%**	1,025	**1.85%**
Multi-family***	409	**0.74%**	666	**1.20%**
Average Household Consumption******	534	**0.97%**	870	**1.57%**
MCP	599	**1.08%**	976	**1.76%**

*Note Latest MHI data is $50,895 based on 2012 ACS data, estimated MHI adjusted to present is $55,308
** Based on 80,000 gallons/year consumption and FY 2015 Rates
*** Based on 52,000 gallons/year consumption and FY 2015 Rates
**** Based on average consumption across all metered residential units of 67,890 gallons/year and FY 2015 rates

As shown in Table 9-2, the RI for wastewater costs varies between 0.74 percent of MHI to 1.14 percent of MHI depending on household type. Since DEP is a water and wastewater utility and the ratepayers receive one bill for both charges, it is also appropriate to look at the total water and wastewater bill in considering the RI, which varies from 1.2 percent to 1.76 percent of MHI.

Based on this initial screen, current wastewater costs pose a low to mid-range economic impact according to the 1997 CSO Guidance. However, there are several limitations to using MHI in the context of 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 690,000 households in NYC (about 23 percent of NYC's total) 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 below.

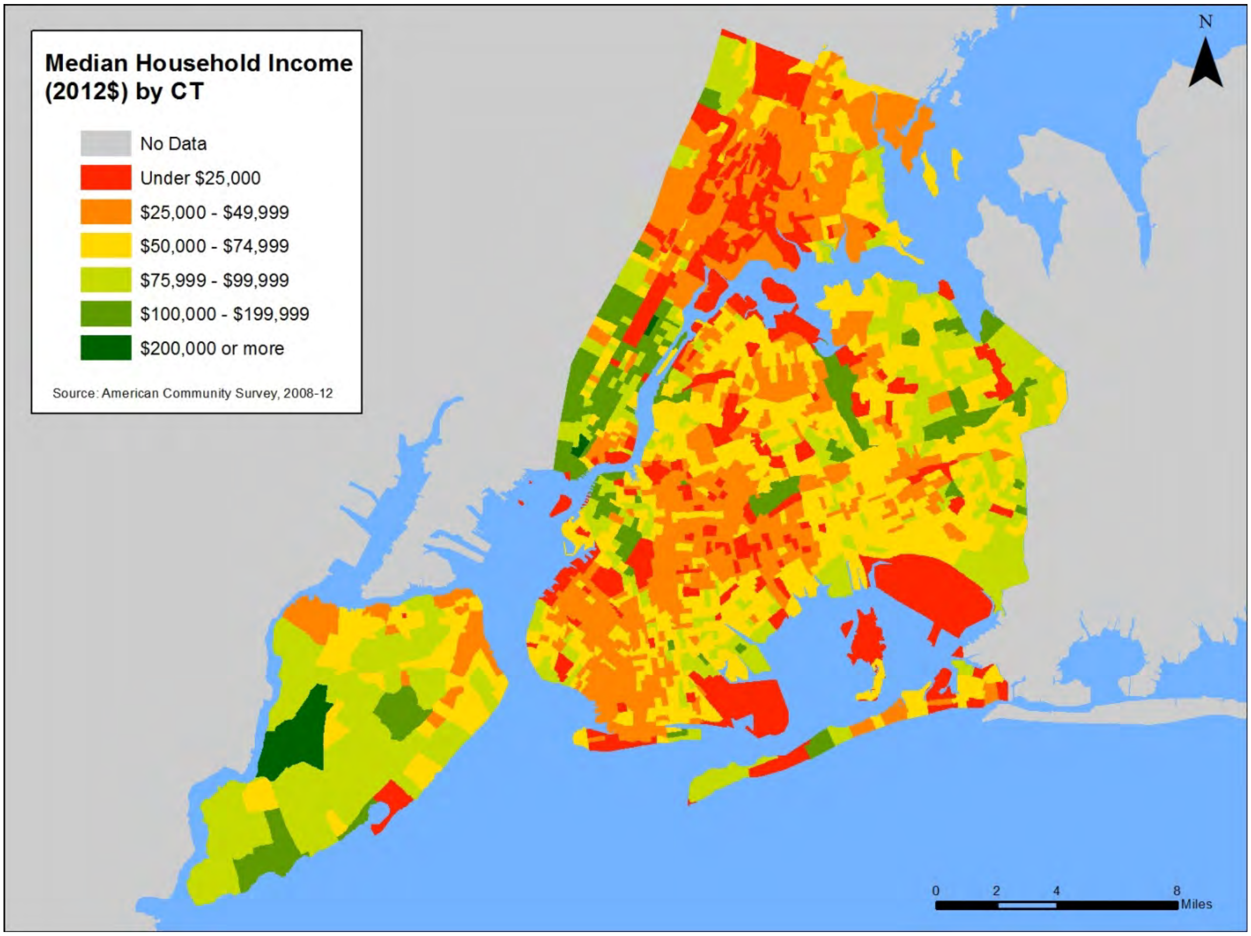
9.6.c.1 Income Levels

In 2012, the latest year for which Census data is available, the MHI in NYC was $50,895. As shown in Table 9-3, across the NYC boroughs, MHI ranged from $32,460 in the Bronx to $70,963 in Staten Island. Figure 9-4 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 9-3. Median Household Income

Location	2012 (MHI)
United States	$51,371
New York City	$50,895
Bronx	$32,460
Brooklyn	$45,230
Manhattan	$67,099
Queens	$54,713
Staten Island	$70,963

Source: U.S. Census Bureau 2012 ACS 1-Year Estimates.



Source: U.S. Census Bureau 2008-2012 ACS 5-Year Estimates.

Figure 9-4. Median Household Income by Census Tract

As shown in Figure 9-5 on the following page, after 2008, MHI in NYC actually decreased for several years, and it has just begun to recover to the 2008 level. At this same time, costs continued to increase.

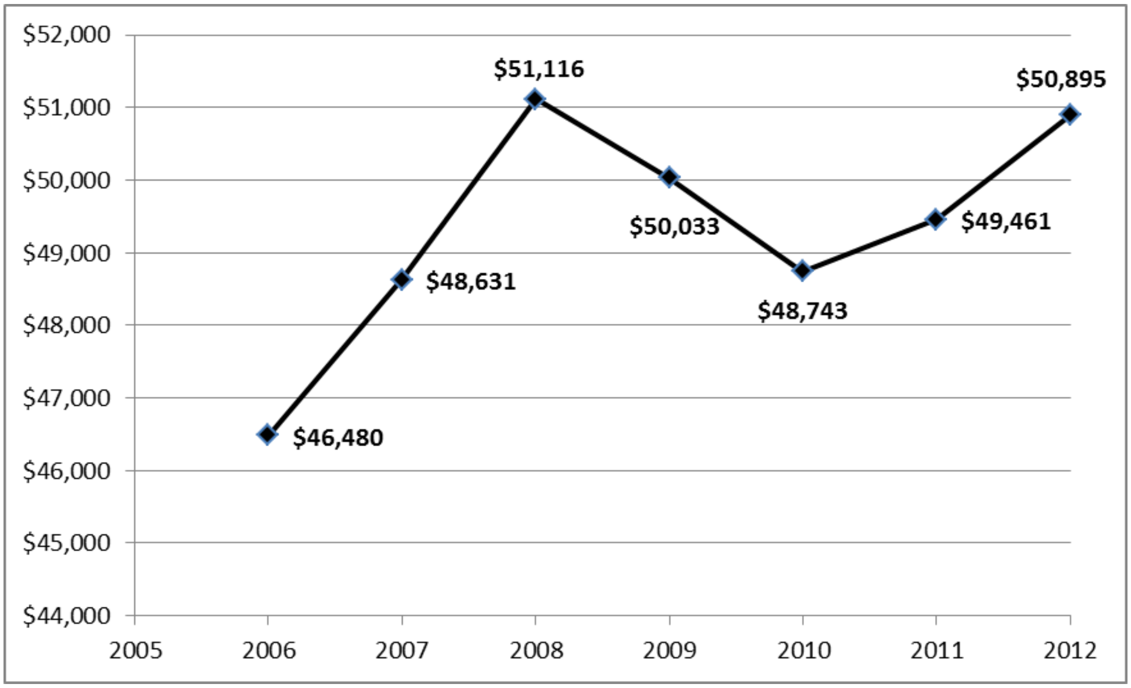


Figure 9-5. NYC Median Household Income Over Time

9.6.c.2 Income Distribution

NYC currently ranks as one of the most unequal cities in the United States in terms of income distribution. NYC's income distribution highlights the need to focus on metrics other than Citywide MHI in order 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 9-6, incomes in NYC are not clustered around the median, but rather there are greater percentages of households at both ends of the economic spectrum. Also, the percentage of the population with middle-class incomes between $20,000 and $100,000 is 11.5 percent less in NYC than in the U.S. generally.

Source: U.S. Census Bureau 2012 ACS 1-Year Estimates.

Figure 9-6. Income Distribution for NYC and U.S.

9.6.c.3 Poverty Rates

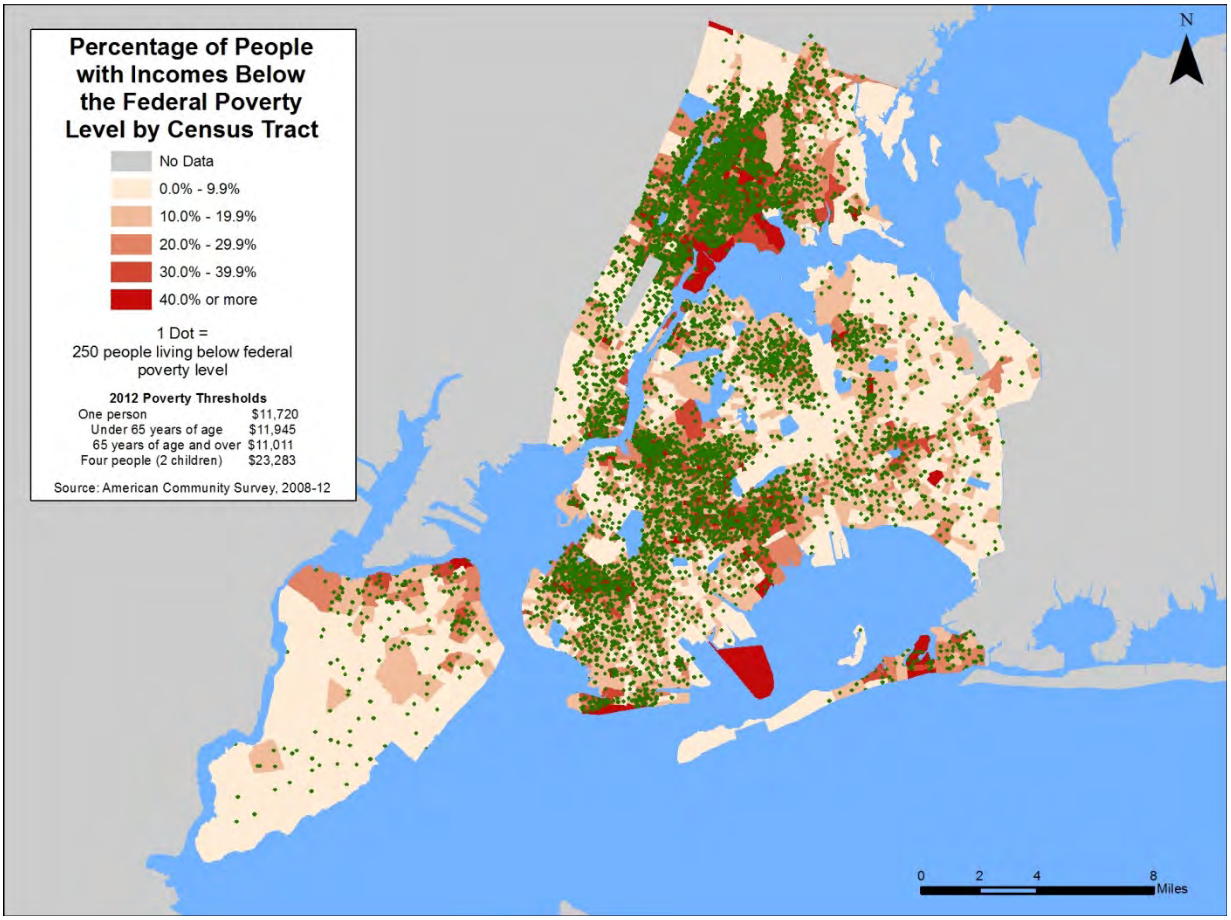
Based on the latest available census data, 21.2 percent of NYC residents are living below the federal poverty level (more than 1.7 million people, which is greater than the entire population of Philadelphia). This compares to a national poverty rate of 15.9 percent despite the similar MHI levels for NYC and the United States as a whole. As shown in Table 9-4, across the NYC boroughs, poverty rates vary from 11.6 percent in Staten Island to 31 percent in the Bronx.

Table 9-4: NYC Poverty Rates

Location	Percentage of Residents Living Below the Federal Poverty Level (%) (ACS 2012)
United States	15.9
New York City	21.2
Bronx	31.0
Brooklyn	24.3
Manhattan	17.8
Queens	16.2
Staten Island	11.6

Figure 9-7 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 concentrated in some areas, there are pockets of poverty throughout NYC. An RI that relies on MHI alone fails to capture these other indicators of economic distress. Two cities with similar MHI could have varying levels of poverty.



Source: U.S. Census Bureau 2008-2012 ACS 5-Year Estimates.

Figure 9-7. Poverty Clusters and Rates in NYC

The New York City Center for Economic Opportunity (CEO) has argued that the official (federal) poverty rate does not provide an accurate measure of the number of households truly living in poverty conditions (CEO, 2011). This is especially relevant in NYC, where the cost of living is among the highest in the nation. According to CEO, federal poverty thresholds do not reflect current spending patterns, differences in the cost of living across the nation, or changes in the American standard of living (CEO, 2011). To provide a more accurate accounting of the percentage of NYC's population living in poverty, CEO developed an alternative poverty measure based on methodology developed by the National Academy of Sciences (NAS).

The NAS-based poverty threshold reflects the need for clothing, shelter, and utilities, as well as food (which is the sole basis for the official poverty threshold). The threshold is established by choosing a point in the distribution of expenditures for these items, plus a small multiplier to account for miscellaneous expenses such as personal care, household supplies, and non-work-related transportation. CEO adjusted the NAS-based threshold to account for the high cost of living in NYC.

In addition, the NAS-based income measure uses a more inclusive definition of resources available to households compared to the federal measure, which is based on pre-tax income. Along with cash income after taxes, it accounts for the cash-equivalent value of nutritional assistance and housing programs (i.e., food stamps and Section 8 housing vouchers). It also recognizes that many families face the costs of commuting to work, child care, and medical out-of-pocket expenses that reduce the income available to meet other needs. This spending is accounted for as deductions from income. Taken together, these adjustments create a level of disposable income that, for some low-income households, can be greater than pre-tax cash income.

CEO's methodology shows that in NYC, poverty-level incomes are actually much higher than those defined at the federal level, which results in a higher percentage of NYC residents living in poverty than is portrayed by national measures. As an example, in 2008, CEO's poverty threshold for a two-adult, two-child household was $30,419. The federal poverty threshold for the same type of household was $21,834. In that year, 22.0 percent of NYC residents (about 1.8 million people) were living below the CEO poverty threshold income; 18.7 percent were living below the federal poverty threshold.

More recently, the U.S. Census Bureau developed a Supplemental Poverty Measure (SPM), reflecting the same general approach as that of CEO. The federal SPM factors in some of the financial and other support offered to low-income households (e.g., housing subsidies, low-income home energy assistance) and also recognizes some nondiscretionary expenses that such households bear (e.g., taxes, out-of-pocket medical expenses, and geographic adjustments for differences in housing costs) (U.S. Census Bureau, 2012).

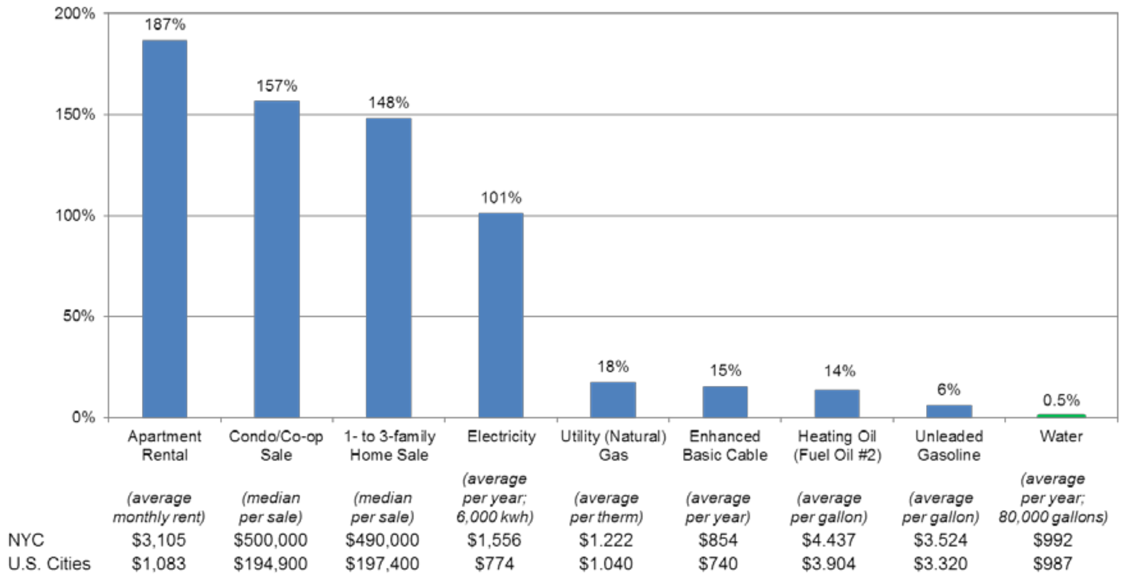
Nationwide, the SPM indicates that there are 5.35 percent more people in poverty than the official poverty threshold would indicate. The SPM also indicates that inside Metropolitan Statistical Areas the difference is 11.2 percent more people in poverty, and within "principal cities," the SPM-implied number of people in poverty is 5.94 percent higher than the official poverty measure indicates.

9.6.c.4 Unemployment Rates

In 2013 the annual average unemployment rate for NYC was 7.7 percent according to NYS Department of Labor, compared to a national average of 7.1 percent. Over the past two decades, NYC's unemployment rate has generally been significantly higher than the national average. Due to the recent recession, the national unemployment rate has increased significantly, moving closer to that of NYC.

9.6.c.5 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 9-8. While water costs are comparable to other average of other U.S. cities, the housing burden is substantially higher.



Source: Wall Street Journal (Apartment Rental); The Real Estate Board of New York and National Association of Realtors (condo/coop and home sales); New York State Energy Research and Development Authority and Bureau of Labor Statistics (electricity and fuel oil #2); U.S. Bureau of Labor Statistics (natural gas and unleaded gasoline); FCC and company websites (enhanced basic cable); NYC FY 2014 Water and Wastewater Rate Survey (water)

Figure 9-8: Comparison of Costs Between NYC and other US Cities

Approximately 67 percent of all households in NYC are renter-occupied, compared to about 35 percent of households nationally. For most renter households in NYC, water and wastewater bills are included in the total rent payment. Rate increases may be passed on to the tenant in the form of a rental increase, or born by the landlord. In recent years, affordability concerns have been compounded by the fact that gross median rents have increased, while median renter income has declined as shown in Figure 9-9 (NYC Housing, 2014).

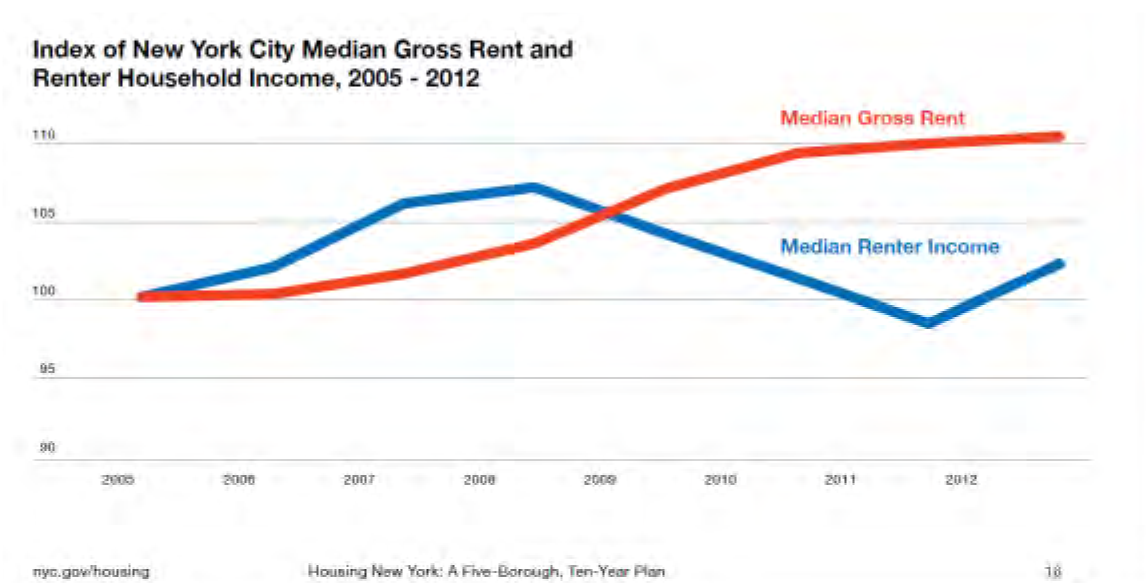


Figure 9-9: Median Gross Rent vs. Median Renter Income

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 Census data shows approximately 21 percent of NYC households (close to 645,000 households) spent between 30 percent and 50 percent of their income on housing, while about 25 percent (748,000 households) spent more than 50 percent. This compares to 20.0 percent of households nationally that spent between 30 percent and 50 percent of their income on housing and 16.2 percent of households nationally that spent more than 50 percent. This means that 46 percent of households in NYC versus 36.2 percent of households nationally spent more than 30 percent of their income on housing.

The New York City Housing Authority is responsible for 172,223 affordable housing units (9 percent of the total renter households in NYC). The agency is estimated to pay about $186M for water and wastewater in FY15. This total represents about 5.9 percent of their $3.14 billion operating budget. Even a small increase in rates could potentially impact the agency's ability to provide affordable housing and/or other programs.

9.6.d Financial Capability Indicators

The second phase of the 1997 CSO Guidance develops the Permittee Financial Capability Indicators (FCI), which are compared to national benchmarks and are used to generate a score that is the average of six economic indicators. Lower FCI scores imply weaker economic conditions. Table 9-5 summarizes the FCI scoring as presented in the 1997 CSO Guidance.

Table 9-5. Financial Capability Indicator Scoring

Financial Capability Metric	Strong (Score = 3)	Mid-range (Score = 2)	Weak (Score = 1)
Debt indicator			
Bond rating (GO 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 of 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 FMPV	Below 2%	2–4%	Above 4%
Property tax revenue collection rate	Above 98%	94–98%	Below 94%

Table 9-6: NYC Financial Capability Indicator Score

Financial capability metric	Actual value	Score
Debt indicators		
Bond rating (GO bonds)	AA (S&P) AA (Fitch) Aa2 (Moody's)	Strong/3
Bond rating (Revenue bonds)	AAA (S&P) AA + (Fitch) Aaa-A (Moody's)	
Overall net debt as percentage of FMPV	4.5%	Midrange/2
GO		
Debt	$41.2 billion	
Market value	$917.7 billion	
Socioeconomic indicators		
Unemployment rate (2013 annual average)	0.6 percentage point above the national average	Mid-range/2
NYC unemployment rate	7.7%	
United States unemployment rate	7.1%	
MHI as percentage of national average	99%	Mid-range/2
Financial management indicators		
Property tax revenues as percentage of FMPV	2.2%	Mid-range/2
Property tax revenue collection rate	98.2%	Strong/3
Permittee Indicators Score		2.3

New York City's FCI score based on this test is presented in Table 9-6 and further described below.

9.6.d.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." Specifically, NYC's G.O. bonds are rated AA by S&P and Fitch and Aa2 by Moody's; and MWFA's General Resolution revenue bonds are rated AAA by S&P, AA+ by Fitch, and Aa1 by Moody's, while MWFA's Second General Resolution revenue bonds (under which most of the Authority's recent debt has been issues) are rated AA+ by S&P, AA+ by Fitch, and Aa2 by Moody's. This results in a "strong" rating for this category.

Nonetheless, NYC's G.O. rating and MWFA's revenue bond ratings are high due to prudent fiscal management, the legal structure of the System, and the Water Board's historical 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 in forecast.

9.6.d.2 Net Debt as a Percentage of FMPV

The second financial benchmark measures NYC's outstanding debt as a percentage of FMPV. Currently NYC has over $41.6 billion in outstanding G.O. debt, and the FMPV within NYC is $917.7 billion. This results in a ratio of outstanding debt to FMPV of 4.5 percent and a "mid-range" rating for this indicator. If $30.6 billion of MWFA revenue bonds that support the System are included, net debt as a percentage of FMPV increases to 7.8 percent, which results in a "weak" rating for this indicator. Furthermore, if NYC's $37.5M of additional debt that is related to other services and infrastructure is included, the resulting ratio is 8.6 percent net debt as a percentage of FMPV.

9.6.d.3 Unemployment rate

For the unemployment benchmark, the 2013 annual average unemployment rates for NYC were compared to those for the United States. NYC's 2013 unemployment rate of 7.7 percent is 0.6 basis points (or 8.5 percent) higher than the national average of 7.1 percent. Based on EPA guidance, NYC's unemployment benchmark would be classified as "mid-range". However, it is important to note that over the past two decades, NYC's unemployment rate has generally been significantly higher than the national average. Due to the recession, the national unemployment is much closer to NYC's unemployment rate. Additionally, the unemployment rate measure identified in the 1997 financial guidance sets a relative comparison at a snapshot in time. It is difficult to predict whether the unemployment gap between the U.S. and NYC will once again widen, and it may be more relevant to look at longer term historical trends, of the service area.

9.6.d.4 MHI

The MHI benchmark compares the community's MHI to the national average. Using ACS 2012 single-year estimates, NYC's MHI is $50,895 and the nation's MHI is $51,371. Thus, NYC's MHI is 99 percent of the national MHI, resulting in a "mid-range" rating for this indicator. However, as discussed above in this section, 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 very misleading indicator of the affordability impacts in a large and diverse city such as NYC.

9.6.d.5 Tax Revenues as a Percentage of Full Market Property Value

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 New York City Property Tax Annual report issued in FY13, NYC had collected $20.1 billion in real property taxes against a $917.7 billion FMPV, which amounts to 2.2 percent of FMPV. For this benchmark, NYC received a "mid-range" score. Also, this figure does not include water and wastewater revenues. Including $3.5 billion of FY13 System revenues increases the ratio to 2.6 percent of FMPV.

However, this indicator (including or excluding water and wastewater revenues) is misleading because NYC obtains a relatively low percentage of its tax revenues from property taxes. In 2007, property taxes accounted for less than 41 percent of NYC's total non-exported taxes, meaning that taxes other than property taxes (e.g., income taxes, sales taxes) account for nearly 60 percent of the locally borne NYC tax burden.

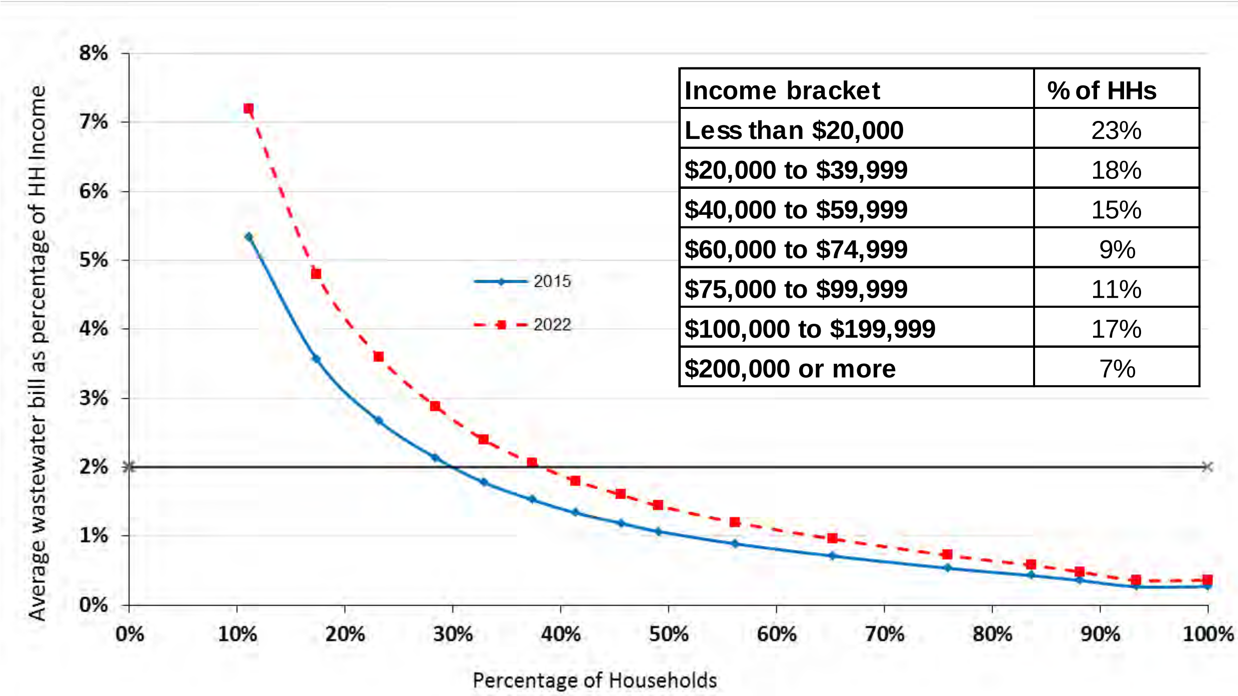
9.6.d.6 Property Tax Collection Rate

The property tax collection rate is a measure of “the efficiency of the tax collection system and the acceptability of tax levels to residents”. This New York City Property Tax Annual report issued in FY13 indicates NYC’s total property tax levy was $20.1 billion, of which 98.2 percent was collected, resulting in a “mid-range” rating for this indicator.

It should be noted, 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 New York City Department of Finance, 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. The real property tax collection rate thus may not accurately reflect the local agency’s ability to collect the revenues used to support water supply and wastewater capital spending.

9.6.e Future Household Costs

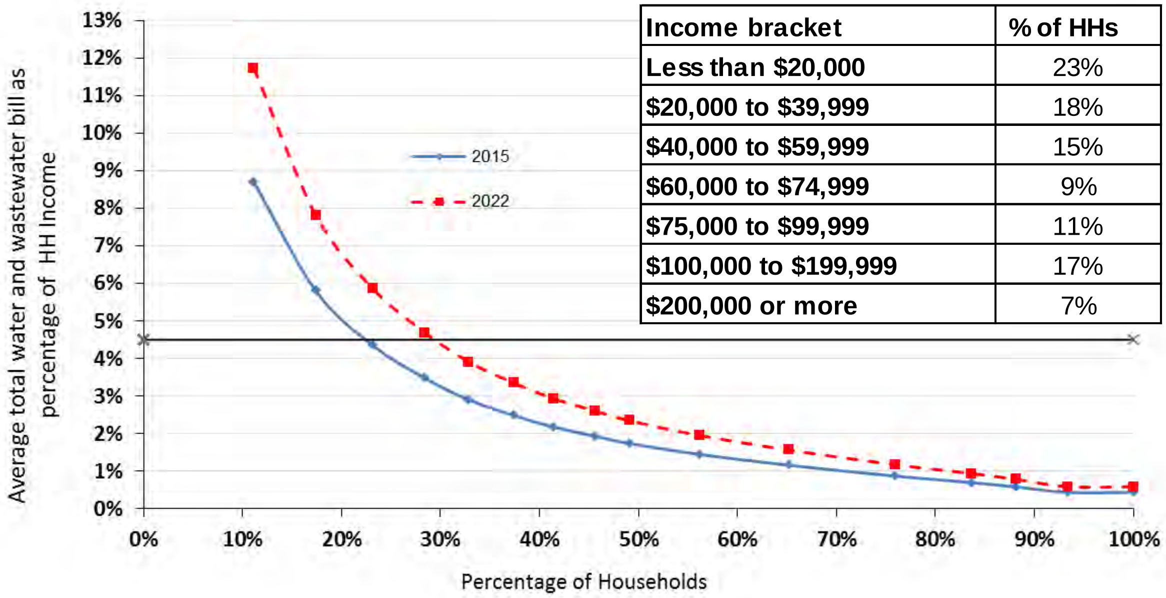
For illustration purposes, Figure 10 shows the average estimated household cost for wastewater services compared to household income versus the percentage of households in various income brackets for the years 2015 and 2022. As shown, 50 percent of households are estimated to pay more than 1 percent of their income on wastewater service in 2015. Roughly 30 percent of households are estimated to pay 2 percent or more of their income on wastewater service alone in 2015. Estimating modest future rate and income increases (based on costs in the CIP and historic Consumer Price Index data, respectively), up to 37 percent of households could be paying more than 2 percent of their income on wastewater services by 2022. These projections are preliminary and do not include additional future wastewater spending associated with the programs outlined in Section 1.1.2 Future System Investment. When accounting for these additional costs, it is likely that an even greater percentage of households could be paying well above 2 percent of their income on wastewater services in the future.



Income bracket	% of HHs
Less than $20,000	23%
$20,000 to $39,999	18%
$40,000 to $59,999	15%
$60,000 to $74,999	9%
$75,000 to $99,999	11%
$100,000 to $199,999	17%
$200,000 or more	7%

Figure 9-10: Estimated Average Wastewater Household Cost Compared to Household Income (FY15 & FY22)

DEP, like many utilities in the nation, provides both water and wastewater service, and its rate payers see one bill. Currently the average combined water and sewer bill is around 1.6 percent of MHI, but 23 percent of households are estimated to be currently paying more than 4.5 percent of their income, and that could increase to about 30 percent of households in future years as shown in Figure 9-11. Again, this estimate does not include additional spending for the additional water and wastewater programs outlined in Section 9.6.a.2 - Future System Investment.



Income bracket	% of HHs
Less than $20,000	23%
$20,000 to $39,999	18%
$40,000 to $59,999	15%
$60,000 to $74,999	9%
$75,000 to $99,999	11%
$100,000 to $199,999	17%
$200,000 or more	7%

Figure 9-11: Estimated Average Total Water and Wastewater Cost as a Percentage of Household Income (FY15 and FY22)

9.6.f 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 potential range of CSO LTCP implementation costs for NYC and describes the potential resulting impacts to future household costs for wastewater service. The information in this section reflects a simplified household impact analysis that will be refined in future LTCP waterbody submittals. All referenced Waterbody / Watershed Facility Plan (WWFP) costs presented in this section have been escalated to June 2014 dollars using the Engineering News-Record City Cost Index (ENRCCI) for New York for comparison purposes.

9.6.f.1 Estimated Costs for Waterbody CSO Recommended Alternative

As discussed in Section 8.8, the principal element of the CSO control alternative recommended in the 2007 Alley Creek and Little Neck Bay Waterbody / Watershed Facility Plan (WWFP), i.e. 5 MG Alley Creek CSO Retention Facility and new CSO outfall, has been constructed. With the facility now in operation, CSO volume has been reduced to 132 million gallons for the 2008 typical year. To date, approximately $138.9 million has been committed to grey CSO control infrastructure.

The recommendations LTCP alternative for Alley Creek and Little Neck Bay is to provide seasonal disinfection the Alley Creek CSO Retention Facility effluent to reduce the human pathogens discharged during the recreational season. DEP is also committed to investigating and reducing the local sources of hum-source pollution to improve water quality of the waterbodies. The recommended LTCP alternative also includes 45 acres of implemented green infrastructure in the Alley Creek and Little Neck Bay watershed by 2030.

The total presented worth cost for the grey component of the LTCP alternative which reflects capital costs and O&M costs over the projected useful life of the project is $11.3M.

DEP's LTCP planning process was initiated in 2012 and will extend until the end of 2017 per the Consent Order schedule. Overall anticipated CSO program costs for NYC will not be known until all of the LTCPs have been developed and approved. However, DEP did develop CSO control costs as part of a previous WWFP effort. These costs are presented in Table 9-7, and they will be supplemented by LTCP recommended alternative costs in future waterbody LTCP affordability sections as new costs become available.

Costs for the recommended alternatives as well as 25 percent, 50 percent, and 100 percent CSO control are included in Table 9-7 to provide a possible range of future CSO control costs. Also, green infrastructure is a major component of the CSO Consent Order. The overall green infrastructure program cost is estimated at $2.4 billion, of which $1.5 billion will be spent by DEP. The green infrastructure program costs are in addition to the grey CSO control costs and are therefore presented as a separate line item. As shown in Table 9-7, overall future CSO control costs could range from $4.1 billion to $85.6 billion.

Table 9-7 also presents CSO control costs that have been committed from FY 2002 through FY 2013 and in DEP's FY2014-2024 CIP. When excluding these committed costs, the range of possible future CSO control costs is $1.1 billion to $82.7 billion.

9.6.f.2 Potential Impacts to Future Household Costs

To estimate the impact of the possible range of future CSO control costs to ratepayers, the annual household cost impact of the future Citywide CSO control costs was calculated for the CSO spending scenarios. The cost estimates presented will evolve over the next few years as the LTCPs are completed for the 10 waterbodies. The cost estimates will be updated as the LTCPs are completed.

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 FY 2015 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. As Table 9-8 shows, the Recommended CSO Control and 25 percent CSO Control scenarios would result in a 2 percent rate increase. The 50 percent CSO Control scenario would result in a double-digit rate increase of 15 percent, and the 100 percent CSO Control scenario would result in a substantial 118 percent rate increase. These rate increases translate into additional annual household costs of up to $1,207. Both the 50 percent and 100 percent CSO control scenarios represent a substantial increase in annual household costs, which only reflects possible future CSO control program costs. The cost of the additional future mandated and non-mandated programs discussed in Section 9.6.a.2 - Future System Investment would further increase the annual burden to ratepayers. For illustrative purposes, estimates for future spending on TRC, Ammonia, MS4, Superfund and Hillview Cover have been assumed in Table 9-8 and Table 9-9, and these are subject to change.

Table 9-7: Range of Potential Future CSO Costs

Waterbody / Watershed[1]	Historical and Current CIP Commitments	Baseline Committed Grey Infrastructure Costs: Committed FY2002-FY2013	Baseline Committed Grey Infrastructure Costs: Committed in 2014-2024 CIP	Baseline Committed Grey Infrastructure Costs: Total Existing Committed	Additional LTCP Recommended Alternative	LTCP Recommended Alternative Cost	25% CSO Control Cost[2]	50% CSO Control Cost[2]	100% CSO Control Cost[2]
Alley Creek and Little Neck Bay	CSO Abatement Facilities and East River CSO	$141,916,025	$ (3,085,000)[3]	$138,831,025	Disinfection in Existing CSO Retention Facility	$11,300,000	$113,000,000	$173,000,000	$569,000,000
Westchester Creek	Hunts Point WPCP Headworks	$7,800,000	$88,425,000	$96,225,000	Green Infrastructure Implementation and Post Construction Monitoring	TBD	$200,000,000	$420,000,000	$731,400,000
Hutchinson River	*Hunts Point WPCP Headworks*	*$3,000,000*	*$0*	*$3,000,000*	*TBD*	*TBD*	*$173,849,412*	*$427,937,014*	*$830,465,268*
Flushing Creek	*Flushing Bay Corona Avenue Vortex Facility, Flushing Bay CSO Retention, Flushing Bay CSO Storage*	*$360,348,471*	*$46,334,000*	*$406,682,471*	*TBD*	*TBD*	*$169,672,037*	*$339,344,073*	*$6,628,747,129*
Bronx River	*Installation of Floatable Control Facilities, Hunts Point Headworks*	*$46,989,901*	*$106,000*	*$47,095,901*	*TBD*	*TBD*	*$36,165,246*	*$90,413,115*	*$1,218,286,583*
Gowanus Canal	*Gowanus Flushing Tunnel Reactivation, Gowanus Facilities Upgrade*	*$174,828,480*	*$3,139,000*	*$177,967,480*	*TBD*	*TBD*	*$249,182,401*	*$529,512,603*	*$1,148,481,688*
Coney Island Creek	*Avenue V Pumping Station, Force Main Upgrade*	*$199,749,241*	*$2,485,000*	*$202,234,241*	*TBD*	*TBD*	*$59,646,395*	*$119,292,789*	*$1,163,462,575*

Waterbody / Watershed[1]	Historical and Current CIP Commitments	Baseline Committed Grey Infrastructure Costs			Additional LTCP Recommended Alternative	LTCP Recommended Alternative Cost	25% CSO Control Cost[2]	50% CSO Control Cost[2]	100% CSO Control Cost[2]
		Committed FY2002-FY2013	Committed in 2014-2024 CIP	Total Existing Committed					
Jamaica Bay	*Improvements of Flow Capacity to Fresh Creek-26th Ward Drainage Area, Hendrix Creek Canal Dredging, Shellbank Destratification, Spring Creek AWCP Upgrade*	*$141,135,131*	*$323,733,000*	*$464,868,131*	*TBD*	*TBD*	*$180,881,883*	*$367,416,325*	*$4,142,534,281*
Flushing Bay[4]	*See Flushing Creek*	*$0*	*$0*	*$0*	*TBD*	*TBD*	*$222,270,368*	*$791,802,838*	*$4,787,918,645*
Newtown Creek	*English Kills Aeration, Newtown Creek Water Quality Facility, Newtown Creek Headworks*	*$160,099,445*	*$91,312,000*	*$251,411,445*	*TBD*	*TBD*	*$566,569,452*	*$1,586,394,467*	*$3,421,512,923*
East River and Open Waters	*Bowery Bay Headworks, Inner Harbor In-Harbor Storage Facilities, Reconstruction of the Port Richmond East Interceptor Throttling Facility, Outer Harbor CSO Regulator Improvements, Hutchinson River CSO*	*$153,145,476*	*$43,131,000*	*$196,276,476*	*TBD*	*TBD*	*$534,921,268*	*$7,016,829,726*	*$59,488,594,159*
Bergen and Thurston Basins[5]	Pumping Station and Force Main Warnerville	*$41,876,325*	$ (180,000)[3]	*$41,696,325*	NA	NA	NA	NA	NA
Paerdegat Basin[5]	Retention Tanks, Paerdegat Basin Water Quality Facility	*$397,605,260*	$ (4,609,000)[3]	*$392,996,260*	NA	NA	NA	NA	NA

Waterbody / Watershed[1]	Historical and Current CIP Commitments	Baseline Committed Grey Infrastructure Costs			Additional LTCP Recommended Alternative	LTCP Recommended Alternative Cost	25% CSO Control Cost[2]	50% CSO Control Cost[2]	100% CSO Control Cost[2]
		Committed FY2002-FY2013	Committed in 2014-2024 CIP	Total Existing Committed					
Green Infrastructure Program[6]	Miscellaneous Projects Associated with City-wide Green Infrastructure Program	$24,200,000	$907,005,000	$931,205,000	Full Implementation of Green Infrastructure Program	$1,500,000,000	$1,500,000,000	$1,500,000,000	$1,500,000,000
TOTAL		*$1,852,693,755*	*$ 1,497,796,000*	*$3,350,489,755*		*$1,511,300,000*	*$4,006,158,462*	*$13,361,942,951*	*$85,630,403,250*

Notes:

1. The shaded waterbody rows include current LTCP alternative and cost information. Other waterbody rows are presented in italics and will be updated in future waterbody LTCP affordability chapters as new alternatives and costs become available.
2. 25%, 50%, and 100% CSO costs are estimated using knee of the curve / cost vs. CSO control plots from WWFPs and LTCPs and do not subtract historic and currently committed costs, which are presented separately. All costs taken from the WWFPs have been escalated to June 2014 dollars for comparison purposes using the ENRCCI for New York.
3. Negative values for Alley Creek and Little Neck Bay, Bergen and Thurston Basins, and Paerdegat Basin reflect a de-registration of committed funds.
4. Committed costs for Flushing Bay are captured in the committed costs reported for Flushing Creek.
5. Bergen and Thurston Basins and Paerdegat Basin are not part of the current LTCP effort; thus, no LTCP detail is provided for them.
6. DEP's green infrastructure program costs are assumed to be the same regardless of the CSO control level.

Table 9-8: CSO Control Program Household Cost Impact

Capital Spending Scenario	Projected Capital Cost ($M)[1]	Annual Debt Service ($M)[2]	% Rate Increase from FY 2015 Rates	Additional Annual Household Cost	
				Single-Family Home	Multi-Family Unit
Current CIP	13,664	839	24	$245	$159
Future Potential Mandated Program Costs for MS4, TRC, Ammonia, Superfund, and Hillview Cover[3]	7,000	430	12	$125	$82
100% CSO Control	82,715	5,079	145	$1,483	$964
50% CSO Control	10,446	641	18	$187	$122
25% CSO Control	1,090	67	2	$20	$13
Citywide LTCP CSO Control Alternatives[4]	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*

Notes:
1. CSO Capital costs have been reduced to reflect historic and currently committed costs for CSO control projects (see Table 6).
2. Assumes bonds are structured for a level debt service amortization over 32 years at a 4.75% interest rate.
3. DEP will face additional future wastewater mandated program costs. While these costs have not been finalized, the following estimated costs for select programs are included to represent potential future annual household cost on top of costs for the CSO control program: MS4 Permit Compliance - $2.5 billion, TRC - $560 million, Ammonia $840 million Superfund Remediation - $1.5 billion million, and $1.6 billion for Hillview Cover.
4. Projected capital cost for the City-wide recommended LTCP CSO control alternatives is not currently available. This information will be included in the City-wide LTCP following completion of the individual waterbody LTCPs.

Table 9-9. Total Estimated Cumulative Future HH Costs/MHI

Capital Spending Scenario	Total Projected Annual Household Cost[1]		Total Water and Wastewater HH Cost / MHI[2]		Total Wastewater HH Cost / MHI[2]	
	Single-family Home	Multi-family Unit	Single-family Home	Multi-family Unit	Single-family Home	Multi-family Unit
FY 2015 Rates	$1,025	$666	1.9%	1.2%	1.1%	0.74%
Current CIP	$1,270	$825	2.0%	1.3%	1.2%	0.81%
Other Future Potential Mandated Program Costs for MS4, TRC, Ammonia, Superfund, and Hillview Cover	$1,395	$907	2.2%	1.5%	1.4%	0.89%
100% CSO Control +CIP +Other	$2,878	$1,871	4.6%	3.0%	2.8%	1.84%
50% CSO Control+CIP+Other	$1,582	$1,029	2.5%	1.6%	1.6%	1.01%
25% CSO Control+CIP+Other	$1,415	$920	2.3%	1.5%	1.4%	0.90%
Citywide LTCP CSO Control Alternatives	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*

Notes:
1. Projected household costs are estimated from rate increases presented in Table 9-7.
2. Future costs were compared to assumed 2020 MHI projection.

Table 9-9 presented above shows the potential range of future spending and its impact on household cost and compared to MHI. 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.

9.6.g 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 $9.9 billion have been completed or are under way 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 New York Harbor and restoring a world-class estuary while creating new public recreation 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 Alley Creek and Little Neck Bay resulting from implementation of the recommended CSO control alternative.

9.6.g.1 Citywide Water Quality Benefits from Previous and Ongoing Programs and Anticipated Alley Creek and Little Neck Bay Water Quality Benefits

Water quality benefits have been documented in New York Harbor and its tributaries from the almost $10 billion investment that NYC has already made in both grey and green infrastructure. Approximately 95 percent of New York 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.

Of the $9.9 billion already invested, 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 Green Infrastructure projects in 26th Ward, Hutchinson River and Newtown Creek watersheds; area wide green infrastructure contracts; Avenue V Pump 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.

More work is needed, and DEP has committed to working with DEC to further reduce CSOs and make other infrastructure improvements to gain additional water quality improvements. The consent order signed in 2012 between DEP and DEC outlines a combined grey and green approach to reduce CSOs. This LTCP for Alley Creek and Little Neck Bay is just one of the detailed plans that DEP is preparing by the year 2017 to evaluate and recommend additional control measures for reducing CSO and improving water quality in New York Harbor (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 Consent Order that DEP and NYSDEC developed is green infrastructure stormwater control measures. DEP is targeting a 10 percent application rate for implementing green infrastructure in combined sewer areas. The green infrastructure 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 the 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 effects on streets and sidewalks, improve air quality, enhance aesthetic quality, and provide recreational opportunities. These are all benefits that contribute to the overall quality of life for residents of NYC.

A detailed discussion of anticipated water quality improvements to Alley Creek and Little Neck Bay is included in Section 8.0, and a copy of the UAA submitted as part of the LTCP is included in the appendix.

9.6.h 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, DEP feels it is important to include a fuller range of future spending obligations and has sought to present an initial picture of that here. 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

As noted above, Alley Creek is currently attaining the Class I bacteria criteria. The assessment of the waterbody indicates that Alley Creek cannot support primary contact water quality (Class SC), nor is it suitable for such uses because of natural and manmade features, such as lack of access, marshy tidal flat conditions, etc. The UAA, described above and attached as Appendix E, was prepared to document these findings.

As discussed above, DEP proposes "Site-Specific Targets" to provide for and monitor the continual improvement of water quality in Alley Creek and Little Neck Bay. These site-specified targets are presented in Table 8-20 with the preferred alternative. They are based on 10-year water quality model simulations that account for CSO and stormwater sources; assume that disinfection is implemented and in operation throughout the recreational season, illicit discharges to the storm system are eliminated, and that suspected DMA septic system contamination issues are corrected. They represent a reasonable range of targets that can be met the majority of the time, given implementation of the recommended LTCP. DEC will review and comment on the site-specific targets as part of the UAA review process.

DEP is seeking a SPDES variance from the anticipated Water Quality Based Effluent Limitation (WQBEL) for the Alley Creek CSO Retention Facility, and the application is attached as Appendix F per DEC requirements. Specifically, the variance request is based on the anticipation of occasional exceedances of WQS for (a) suspended, colloidal and settleable solids; (b) oil and floating substances; and (c) DO. Because complete elimination of periodic excursions from the WQS would require 100 percent CSO control, and because even with their complete removal, DO numeric limits are not fully attained, a variance from the presumed WQBEL of 100 percent CSO control is being requested. The criteria for such a variance are identical to those for a UAA, and DEP anticipates that the same approval framework will be applicable to variance requests. For the Alley Creek CSO Retention Facility SPDES variance, factor #3 is applicable (human-caused conditions or sources of pollution prevent attainment of the standard or guidance value and cannot be remedied or would cause more environmental damage to correct than to leave in place).

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11.0 GLOSSARY

μg/L:	Microgram per liter
1.5xDDWF:	One and One-half Times Design Dry Weather Flow
2xDDWF:	Two Times Design Dry Weather Flow
AAOV:	Annual Average Overflow Volumes
APEC:	Alley Pond Environmental Center
BEACH:	Beaches Environmental Assessment and Coastal Health
BEPA	Bureau of Environmental Planning and Analysis
BGY:	Billon Gallons Per Year
BMP:	Best Management Practice
BNR:	Biological Nutrient Removal
BOD:	Biochemical Oxygen Demand
BWSO:	Bureau of Water and Sewer Operations
CAC:	Citizens Advisory Committee
CEO:	New York City Center for Economic Opportunity
CFR:	Code of Federal Regulation
CFU	Colony-Forming Unit
CIP:	Capital Improvement Program
Conc:	Abbreviation for “Concentration”.
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
DMA Beach:	Douglas Manor Association Beach
DMR:	Discharge Monitoring Report
DNA:	Deoxyribonucleic Acid
DO:	Dissolved Oxygen
DOB:	New York City Department of Buildings
DOF:	New York City Department of Finance
DOH:	New York State Department of Health
DOHMH:	New York City Department of Health and Mental Hygiene
DOS	New York State Department of State
DOT:	New York City Department of Transportation
DPR:	New York City Department of Parks and Recreation
DWF:	Dry Weather Flow
E. Coli:	Escherichia Coli.
EBP:	Environmental Benefit Project
ECL	New York State Environmental Conservation Law
ECM:	Energy Conservation Measure
EMC:	Event Mean Concentration
ENRCCI:	Engineering News-Record City Cost Index
EPA:	United States Environmental Protection Agency
ERTM:	East River Tributaries Model
ET:	Evapotranspiration
FAD:	Filtration Avoidance Determination
FCI:	Financial Capability Indicators
FMPV:	Full Market Property Value

FT	Abbreviation for "Feet"
FY:	Fiscal Year
GI:	Green Infrastructure
GIS:	Geographical Information System
GM:	Geometric Mean
G.O.:	General Obligation
GPD:	Gallons per Day
GPS:	Global Positioning System
GRTA:	NYC Green Roof Tax Abatement
HEAP:	Home Energy Assistance Program
HGL:	Hydraulic Gradient Line
HLSS:	High Level Sewer Separation
HRA:	New York City Human Resources Administration
HRD	High Rate Disinfection
HRT:	High Rate Treatment
HSM	Harbor Survey Monitoring
HVAC	Heating, Ventilation, and Air Conditioning
HWAP:	Home Water Assistance Program
I/I:	Inflow/Infiltration
IEC:	Interstate Environmental Commission
in.:	Abbreviation for "Inches".
IW:	InfoWorks CS™
JFK:	John F. Kennedy International Airport
KOTC:	Knee-of-the-Curve
LA:	Load Allocation
LC:	Loading Capacity

LGA:	LaGuardia Airport
LIE	Long Island Expressway
LNB	Little Neck Bay
LT2	Long Term 2
LTCP:	Long Term Control Plan
mg/L:	milligrams per liter
MG:	Million Gallons
MGD:	Million Gallons Per Day
MGY	Million Gallons Per Year
MHI:	Median Household Income
mL:	milliliters
MOU:	Memorandum of Understanding
MPN:	Most Probable Number
MS4:	Municipal separate storm sewer systems
MSS:	Marine Sciences Section
NaHSO3	Sodium Bisulfite
$NaOCl^-$	Sodium Hypochlorite
NAS:	National Academy of Sciences
NEIWPCC:	New England Interstate Water Pollution Control Commission
NMC:	Nine Minimum Control
No./mL (or #/mL):	Number of bacteria organisms per milliliter
NOAA:	National Oceanic and Atmospheric Administration
NPDES:	National Pollutant Discharge Elimination System
NRG	Natural Resources Group
NWI:	National Wetland Inventory

NYC:	New York City
NYCRR:	New York State Code of Rules and Regulations
NYD:	New York District
NYS	New York State
NYSDOS:	New York State Department of State
O&M:	Operation and Maintenance
OGI:	Office of Green Infrastructure
OMB:	Office of Management and Budget
ONRW:	Outstanding National Resource Waters
PAH:	Polycyclic Aromatic Hydrocarbons
PCM:	Post Construction Monitoring
POTW:	Publicly Owned Treatment Plant
Pounds per day:	lbs/day; unit of measure
PS:	Pump Station or Pumping Station
RI:	Residential Indicator
RI/FS:	Remedial Investigation/Feasibility Study
ROWB:	Right-of-way bioswales
RTC:	Real-Time Control
RWQC:	Recreational Water Quality Criteria
SBU	Sewer Backup
SCADA:	Supervisory Control and Data Acquisition
SIU:	Significant Industrial User
SNAD:	Special Natural Area District
SPDES:	State Pollutant Discharge Elimination System
SPM:	Supplemental Poverty Measure

SSS:	Separate sewer system
STV:	Statistical Threshold Value
TBD:	To Be Determined
TC:	Total coliform
TI	Tallman Island
TMDL:	Total Maximum Daily Load
TOC:	Total Organic Carbon
TRC:	Total Residual Chlorine
TSS:	Total Suspended Solids
UAA:	Use Attainability Analysis
ULURP:	Uniform Land Use Review Procedure
USEPA:	United States Environmental Protection Agency
UV:	Ultraviolet Light
VTS:	Vertical Treatment Shaft
WAC:	Watershed Advisory Committee
WDAP:	Water Debt Assistance Program
WQ	Water Quality
WQBEL	Water Quality Based Effluent Limitation
WQS:	Water Quality Standards
WWFP:	Waterbody/Watershed Facility Plan
WWOP:	Wet Weather Operating Plan
WWTP:	Wastewater Treatment Plant

Appendix A: Supplemental Tables

Tallman Island WWTP Drainage Area: Acreage By Outfall/Regulator

Outfall	Outfall Drainage Area	Regulator	Regulator Drainage Area	Regulated Drainage Area Type	Receiving Water
East River					
TI-003	494.5	R10A	224.6	Separate	Powells Cove
		R10B	269.9	Combined	Powells Cove
		R10	114.2	Separate	Powells Cove
TI-004	68.1	R11	68.1	Combined	East River
TI-005	179.3	R12	179.3	Separate	East River
TI-019	27	R02	27	Combined	East River
TI-020	60.1	R01	60.1	Combined	East River
TI-023	769.9	R13	769.9	Combined	Little Bay
Alley Creek and Little Neck Bay					
TI-006	597.3	24th Ave PS	74.8	Separate	Little Neck Bay
		Clear View PS	522.5	Separate	Little Neck Bay
TI-007	1074.9	Old Douglaston PS	1074.9	Combined and Separate	Alley Creek
TI-008	1044.4	R46	404.4	Combined	Alley Creek
		R47	455.9	Combined and Separate	Alley Creek
		R49	80.5	Separate	Alley Creek
TI-024	376.2	New Douglaston PS	77.1	Separate	Alley Creek
TI-025	1550.7	Alley Creek CSO Retention Facility	1550.7	Combined and Separate	Alley Creek
Flushing Bay and Creek					
TI-010	6416.0	R29	122.9	Combined and Separate	Flushing Creek
		R30	787	Combined and Separate	Flushing Creek
		R31	503.4	Combined, Separate and Other	Flushing Creek
		R32	2.7	Combined	Flushing Creek
		R33	2.5	Combined	Flushing Creek
		R34	7.6	Combined	Flushing Creek
		R35	43.6	Combined	Flushing Creek
		R37	366	Combined	Flushing Creek
		R39	35.3	Combined	Flushing Creek
		R40	135.4	Combined	Flushing Creek
		R40A	119.8	Combined	Flushing Creek

Outfall	Outfall Drainage Area	Regulator	Regulator Drainage Area	Regulated Drainage Area Type	Receiving Water
		R41	529	Combined and Other	Flushing Creek
		R43	515.7	Combined, Separate and Other	Flushing Creek
		R44	141.4	Combined	Flushing Creek
		R45	613.1	Combined	Flushing Creek
		R45A	1043.3	Combined	Flushing Creek
		R50	343.6	Combined	Flushing Creek
		R59	68.6	Combined	Flushing Creek
TI-011	943.2	R09	278.2	Combined and Separate	Flushing Creek
		R51	369.4	Combined	Flushing Creek
		R52	16.3	Combined	Flushing Creek
		R53	46.3	Combined	Flushing Creek
		R54	28.1	Combined	Flushing Creek
TI-012	13	122nd St PS	13	Separate	Flushing Bay
TI-013	28.3	R08	Disconnected from R08	Separate	Flushing Bay
TI-014	18.5	R07	18.5	Combined	Flushing Bay
TI-015	18.6	R06	18.6	Combined	Flushing Bay
TI-016	73.5	R05	73.5	Combined	Flushing Bay
TI-017	3.5	R04	3.5	Combined	Flushing Bay
TI-018	30.9	R03	30.9	Combined	Flushing Bay
TI-022	308.2	R55	156.8	Combined	Flushing Creek
		R56	85	Combined	Flushing Creek
		R57	14.6	Combined	Flushing Creek
		R58	51.8	Combined	Flushing Creek

Note: For locations with regulators in series, the incremental regulator drainage area is listed.

Annual CSO, Stormwater, Direct Drainage,
Local Source Baseline Volumes (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Alley Creek	TI-007	ODPS Bypass	0.1
Alley Creek	TI-008	R07	0.0
Alley Creek	TI-025	R29, R30	**132.0**
Little Neck Bay	TI-009	------	0.0
		Total CSO	**132.1**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge, (MG/Yr)**
Alley Creek	TI-008	Oakland Lake	14.0
Alley Creek	TI-024	NA	122.4
Alley Creek	TI-654	NA	59.8
Alley Creek	TI-655	NA	52.9
Alley Creek	TI-659	NA	24.3
Alley Creek	TI-629	NA	4.1
Alley Creek	TI-630	NA	9.8
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Direct Drainage	NA	NA	47.6
Little Neck Bay	TI-006	NA	174.2
Little Neck Bay	TI-543	NA	13.0
Little Neck Bay	TI-623	NA	2.7
Little Neck Bay	TI-625	NA	114.8
Little Neck Bay	TI-628	NA	29.4
Little Neck Bay	TI-633	NA	33.2
Little Neck Bay	TI-658	NA	15.4
Little Neck Bay	TI-656	NA	12.3
Little Neck Bay	TI-660	NA	51.1
Little Neck Bay	TI-668	NA	3.9
		Total Stormwater	**784.9**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Alley Creek	TI-008	Oakland Lake	670.0
Alley Creek	LIE Pond		930.0
		Total Dry Weather	**1,600.0**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Alley Creek			2,067.0
Little Neck Bay			450.0

Totals by Source			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
CSO			132.1
Stormwater			784.9
Local Sources-Baseflows			1,600.0

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Discharge (MG/Yr)**
Alley Creek	CSO	7	132.1
	Stormwater	19	334.9
	Local Sources	73	1,600.0
		Total	**2,067.0**
Little Neck Bay	CSO	0	0
	Stormwater	100	450.0
	Local Sources	0	0
		Total	**450.0**

**Annual CSO, Stormwater, Direct Drainage,
Local Sources Enterococci Loads (2008 Rainfall)**

Combined Sewer Outfalls

Waterbody	Outfall	Regulator	Total Org.x10^12
Alley Creek	TI-007	ODPS Bypass	0.1
Alley Creek	TI-008	R07	0.0
Alley Creek	TI-025	R29, R30	789.2
Little Neck Bay	TI-009		0.0
		Total CSO	**789.3**

Stormwater Outfalls

Waterbody	Outfall	Regulator	Total Org.x10^12
Alley Creek	TI-008	Oakland Lake	7.1
Alley Creek	TI-024	NA	69.5
Alley Creek	TI-654	NA	34.0
Alley Creek	TI-655	NA	30.0
Alley Creek	TI-659	NA	13.8
Alley Creek	TI-629	NA	2.3
Alley Creek	TI-630	NA	5.6
Direct Drainage	NA	NA	27.0
Little Neck Bay	TI-006	NA	98.9
Little Neck Bay	TI-543	NA	7.4
Little Neck Bay	TI-623	NA	1.5
Little Neck Bay	TI-625	NA	65.2
Little Neck Bay	TI-628	NA	16.7
Little Neck Bay	TI-633	NA	18.8
Little Neck Bay	TI-656	NA	7.0
Little Neck Bay	TI-658	NA	8.8
Little Neck Bay	TI-660	NA	29.0
Little Neck Bay	TI-668	NA	2.2
		Total Stormwater	**444.3**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-008	Oakland Lake	3.3
Alley Creek	LIE Pond		2.6
		Total Dry Weather	**5.9**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek			984.5
Little Neck Bay			255.5

Totals by Source			
Source	**Outfall**	**Regulator**	**Total Org.x10^12**
CSO			789.3
Stormwater			444.8
Local Sources			5.9

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Org.x10^12**
Alley Creek	CSO	80	789.3
	Stormwater	19	189.3
	Local Sources	1	5.9
		Total	**984.5**
Little Neck Bay	CSO	0	0
	Stormwater	100	255.5
	Local Sources	0	0
		Total	**255.5**

Annual CSO, Stormwater, Direct Drainage,
Local Sources Fecal Coliform Loads (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-007	ODPS Bypass	0.1
Alley Creek	TI-008	R07	0.0
Alley Creek	TI-025	R29, R30	2,170.8
Little Neck Bay	TI-009		0.0
		Total CSO	**2,170.9**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-008	Oakland Lake	2.7
Alley Creek	TI-024	NA	162.2
Alley Creek	TI-654	NA	79.2
Alley Creek	TI-655	NA	70.1
Alley Creek	TI-659	NA	32.1
Alley Creek	TI-629	NA	5.4
Alley Creek	TI-630	NA	13.0
Direct Drainage	NA	NA	63.0
Little Neck Bay	TI-006	NA	230.8
Little Neck Bay	TI-543	NA	17.3
Little Neck Bay	TI-623	NA	3.6
Little Neck Bay	TI-625	NA	152.0
Little Neck Bay	TI-628	NA	39.0
Little Neck Bay	TI-633	NA	43.9
Little Neck Bay	TI-656	NA	16.3
Little Neck Bay	TI-658	NA	20.4
Little Neck Bay	TI-660	NA	67.7
Little Neck Bay	TI-668	NA	5.1
		Total Stormwater	**1,023.8**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek	TI-008	Oakland Lake	3.8
Alley Creek	LIE Pond		2.6
		Total Dry Weather	**6.4**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^12**
Alley Creek			2,605.0
Little Neck Bay			596.1

Totals by Source			
Source	**Outfall**	**Regulator**	**Total Org.x10^12**
CSO			2,170.9
Stormwater			1,023.8
Local Sources			6.4

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Org.x10^12**
Alley Creek			
	CSO	50	2,170.9
	Stormwater	49	427.7
	Local Sources	0	6.4
		Total	**2,605.0**
Little Neck Bay			
	CSO	0	0
	Stormwater	100	596.1
	Local Sources	0	0
		Total	**596.1**

**Annual CSO, Stormwater, Direct Drainage,
Local Sources BOD_5 Loads (2008 Rainfall)**

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Alley Creek	TI-007	ODPS Bypass	13
Alley Creek	TI-008	R07	0
Alley Creek	TI-025	R29, R30	18,494
Little Neck Bay	TI-009		0
		Total CSO	**18,507**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Alley Creek	TI-008	Oakland Lake	4,555
Alley Creek	TI-024	NA	15,313
Alley Creek	TI-654	NA	7,481
Alley Creek	TI-655	NA	4,834
Alley Creek	TI-659	NA	3,035
Alley Creek	TI-629	NA	513
Alley Creek	TI-630	NA	1,230
Direct Drainage	NA	NA	5,912
Little Neck Bay	TI-006	NA	21,796
Little Neck Bay	TI-543	NA	1,629
Little Neck Bay	TI-623	NA	341
Little Neck Bay	TI-625	NA	14,358
Little Neck Bay	TI-628	NA	3,681
Little Neck Bay	TI-633	NA	4,150
Little Neck Bay	TI-656	NA	1,539
Little Neck Bay	TI-658	NA	5,382
Little Neck Bay	TI-660	NA	6,397
Little Neck Bay	TI-668	NA	5,582
		Total Stormwater	**107,728**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Alley Creek	TI-008	Oakland Lake	0
Alley Creek	LIE Pond		0
		Total Dry Weather	**0**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Alley Creek			61,380
Little Neck Bay			64,855

Totals by Source			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
CSO			18,507
Stormwater			107,728
Local Sources			0

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Lbs**
Alley Creek			
	CSO	30.2	18,507
	Stormwater	69.8	42,873
	Local Sources	0.0	0
		Total	**61,380**
Little Neck Bay			
	CSO	0.0	0
	Stormwater	100.0	64,855
	Local Sources	0.0	0
		Total	**64,855**

2008 Rainfall Model-Calculated DO and Measures of Attainment for Baseline Conditions (Station AC1)

Station: AC1			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.0 mg/L**
Jan	11.0	7.3	100
Feb	12.0	8.7	100
Mar	11.0	6.4	100
Apr	8.9	5.1	100
May	6.5	3.2	99
Jun	5.1	2.1	89
Jul	6.6	3.1	95
Aug	6.8	3.5	99
Sep	5.6	1.2	91
Oct	8.0	4.4	100
Nov	8.6	4.4	100
Dec	9.7	6.2	100
Year	8.3		**98**

2008 Rainfall Model-Calculated DO and Measures of Attainment for Baseline Conditions (Station LN1)

Station: LN1			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.0 mg/L**
Jan	11.7	10.1	100
Feb	12.9	11.3	100
Mar	12.2	10.8	100
Apr	10.3	9.1	100
May	8.1	6.6	100
Jun	5.9	4.5	98
Jul	5.6	2.8	66
Aug	7.0	3.2	95
Sep	7.4	5.8	100
Oct	9.1	6.6	100
Nov	9.1	7.8	100
Dec	10.3	8.9	100
Year	9.1		**96**

2008 Rainfall Model-Calculated DO and Measures of Attainment for Baseline Conditions (Station E11)

Station: E11			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.8 mg/L**
Jan	10.8	9.5	100
Feb	12.1	10.9	100
Mar	11.9	10.5	100
Apr	10.1	8.8	100
May	8.0	6.3	100
Jun	6.0	4.9	99
Jul	6.0	3.5	80
Aug	6.1	4.2	90
Sep	6.6	5.1	100
Oct	8.0	6.0	100
Nov	8.4	7.3	100
Dec	9.6	8.3	100
Year	8.5		**97**

Monthly Fecal Coliform Geometric Mean (cfu/100mL) – Baseline Condition – AC1 (10-Year Simulation)

Year	Month												Percent Attainment
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2002	63	25	188	93	46	43	14	25	47	86	**222**	76	92
2003	30	132	199	81	74	**227**	32	56	86	51	169	166	92
2004	44	50	129	143	119	37	92	39	76	29	159	116	100
2005	123	81	107	109	22	33	21	16	11	**270**	95	**290**	83
2006	**291**	64	22	90	68	113	46	41	38	149	**218**	55	83
2007	157	67	152	**264**	27	50	66	52	15	80	145	**340**	83
2008	105	**451**	169	50	110	57	19	54	57	43	100	**312**	83
2009	75	41	53	150	71	**404**	79	31	18	144	39	**587**	83
2010	42	187	**243**	40	29	17	15	18	32	51	53	75	92
2011	150	135	**320**	150	53	36	25	**313**	89	104	83	149	83
% Att.	90	90	80	90	100	80	100	90	100	90	80	60	83

Monthly Fecal Coliform Geometric Mean (cfu/100mL) – 100 Percent CSO Control Condition - AC1 (10-Year Simulation)

Year	Month												Percent Attainment
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2002	63	25	161	78	42	36	13	22	36	68	187	83	100
2003	27	106	161	73	66	147	28	45	70	39	125	122	100
2004	44	40	129	108	112	32	59	35	51	26	123	108	100
2005	118	78	89	87	22	33	19	14	11	157	80	177	100
2006	**221**	53	22	77	52	95	32	34	38	89	164	51	92
2007	113	67	110	163	27	43	43	39	15	62	125	**322**	92
2008	96	**289**	137	46	107	49	17	43	41	37	92	**261**	83
2009	68	41	53	117	64	**320**	70	30	17	113	38	**387**	83
2010	36	146	156	37	25	17	15	17	31	41	51	53	100
2011	119	123	**221**	113	47	29	23	161	60	83	67	108	92
% Att.	90	90	90	100	100	90	100	100	100	100	100	70	94

2008 Rainfall Model-Calculated DO and Measures of Attainment for 100 Percent CSO Control Conditions – Class SB Criterion (Station AC1)

Station: AC1			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.8 mg/L**
Jan	11.0	7.3	100
Feb	12.0	8.7	100
Mar	11.0	6.4	100
Apr	8.9	5.1	100
May	6.5	3.2	94
Jun	5.1	2.1	56
Jul	6.6	3.1	82
Aug	6.8	3.5	94
Sep	5.6	1.2	72
Oct	8.0	4.4	99
Nov	8.6	4.4	100
Dec	9.7	6.2	100
Year	**8.3**		**91**

2008 Rainfall Model-Calculated DO and Measures of Attainment for 100 Percent CSO Control Conditions – Class SB Criterion (Station AC1)

Station: AC1			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.8 mg/L**
Jan	11.1	7.5	100
Feb	12.0	8.9	100
Mar	11.1	6.7	100
Apr	9.0	5.2	100
May	6.6	3.4	96
Jun	5.2	2.2	64
Jul	6.7	3.2	85
Aug	7.1	3.6	95
Sep	5.9	1.3	80

Station: AC1			
Month in 2008	**Monthly Average DO (mg/L)**	**Monthly Minimum DO (mg/L)**	**Percent of Time DO>=4.8 mg/L**
Oct	8.1	4.6	99
Nov	8.6	4.6	100
Dec	9.8	6.6	100
Year	**8.4**		**93**

Calculated Baseline Enterococci Concentrations from Various Loading Sources

Source	Station	Enterococci Contribution, cfu/100mL			
		Geometric Mean		90th Percentile	
		Annual	Max 30-day	Annual	Max 30-day
East River	AC1	0	4	3	28
Local Sources	AC1	14	18	21	17
Nassau County Stormwater	AC1	2	4	5	8
NYC Stormwater	AC1	48	254	1,243	4,187
CSO	AC1	8	53	414	1,061
Total	**AC1**	**72**	**332**	**1,685**	**5,302**
East River	OW2	0	6	7	48
Local Sources	OW2	3	4	3	3
Nassau County Stormwater	OW2	2	8	17	26
NYC Stormwater	OW2	12	86	267	654
CSO	OW2	3	25	127	1,142
Total	**OW2**	**20**	**129**	**421**	**1,873**
East River	LN1	0	8	11	69
Local Sources	LN1	1	1	0	0
Nassau County Stormwater	LN1	3	15	37	72
NYC Stormwater	LN1	4	36	89	172
CSO	LN1	1	11	42	270
Total	**LN1**	**9**	**71**	**179**	**583**
East River	E11	3	18	44	172
Local Sources	E11	0	0	0	0

Source	Station	Enterococci Contribution, cfu/100mL			
		Geometric Mean		90th Percentile	
		Annual	Max 30-day	Annual	Max 30-day
Nassau County Stormwater	E11	2	12	22	38
NYC Stormwater	E11	2	9	22	57
CSO	E11	0	3	13	74
Total	**E11**	**7**	**41**	**100**	**339**
East River	DMA	1	9	13	71
Local Sources	DMA	0	1	0	0
Nassau County Stormwater	DMA	3	20	50	88
NYC Stormwater	DMA	3	36	86	170
CSO	DMA	1	12	34	299
Total	**DMA**	**8**	**76**	**183**	**628**

Appendix B: Long Term Control Plan (LTCP) Alley Creek Kickoff Meeting – Summary of Meeting and Public Comments Received

On October 24th, 2012 DEP and the New York State Department of Environmental Conservation (DEC) co-hosted a Public Kickoff Meeting to initiate the water quality planning process for long term control of combined sewer overflows in the Alley Creek and Little Neck Bay Waterbody. The two-hour event, held at the Alley Pond Environmental Center in Queens served to provide overview information about DEP's Long Term Control Plan (LTCP) Program, present information on the Alley Creek watershed characteristics and status of waterbody improvement projects, obtain public information on waterbody uses in Alley Creek, and describe additional opportunities for public input and outreach. The presentation can be found at http://www.nyc.gov/dep/ltcp. Fifteen stakeholders from over 10 different non-profit, community planning, environmental, economic development, governmental organizations and the broader public attended the event.

The Alley Creek LTCP Kickoff Public Meeting was the first opportunity for public participation in a LTCP for the Alley Creek and Little Neck Bay Waterbody. As part of DEP's LTCP Public Participation Plan, Alley Creek's Long Term Control Planning process will be posted on DEP's website, shown above. The public will have more opportunities to provide feedback and participate in the development of Alley Creek's waterbody-specific LTCP. Specific questions asked during the Alley Creek LTCP public kickoff meeting are summarized below with DEP's responses for each.

- What are the CSO related projects in Alley Creek? When will they be built? How much did they cost?
  - *Sewer improvements and a new outfall have already been constructed to help increase sewer system capacity and reduce sewer surcharging and street flooding. This project consisted of installing storm sewers and the construction of a new outfall at a cost of $93 million. In addition, a combined sewer overflow (CSO) retention facility was built to collect about 5 million gallons of combined sewage during rain event. This facility, also referred to as a CSO retention tank, reduces CSOs discharging to Alley Creek by more than 50% or 517 million gallons per year (MGY) down to 256 MGY. The remaining CSO receives partial treatment before being discharged. This facility was built at a cost of $29 million.*

- Which CSO outfalls are connected to the CSO tank? Is TI-024 connected to the tank?
  - *Outfalls TI-008 and TI-025 are connected to the CSO tank. TI-025 receives partially treated overflow from the tank and TI-008 will rarely overflow (under extreme storms) due to the reconfiguration of Chamber 6 weir to divert all flows for a design storm towards the tank. Outfall TI-024 is connected to a pump station relief which rarely overflows.*

- Are the CSO projects that have been built included in the baseline of the model?
  - *Yes, the CSO improvement projects will be part of the baseline in the model.*

- Is DEP using JFK rainfall data only? What years of rainfall numbers is DEP using to model and plan for the long term control of combined sewer overflows in Alley Creek? How is climate change being taken into account?
  - *DEP has been using local rain gauge data (LaGuardia Airport and Douglaston Pump Station) and supplementing with radar rainfall data to support the model calibrations. However, to provide consistency in planning for citywide LTCP projects, DEP is using a specific rainfall record from JFK for baseline and alternatives' analyses scenarios. 2008 data from JFK which includes an annual rainfall of 46.3 inches was chosen based on statistical analyses. Projections for future rainfall and sea level rise conditions will be incorporated into the modeling scenarios as will a longer rainfall record covering the last*

10 years (2002-2011) to assess pathogen compliance for meeting the appropriate water quality standards.

- Does the model take into account wastewater treatment plants that are not controlled by DEP, such as the Great Neck Wastewater Treatment Plant (WWTP) in Nassau County?
  - *Yes, the model accounts for flows and loadings based on discharge monitoring reports for the Belgrave WWTP in Great Neck.*

- How is the water quality data being collected in the Alley Creek and Little Neck Bay Waterbody? Is it automated or manual? Is data being collected from the CSO tank?
  - *DEP's Harbor Survey program collects ambient water quality grab samples at 3 locations in Alley Creek and Little Neck Bay weekly during recreational season (May 1-September 30) and monthly during non-recreational season (October 1-April 30). In addition, NYC DOHMH monitors Douglas Manor Association Beach 5-times in a 30-day period during recreational season for bacteria indicator concentrations. The ambient water quality monitoring data will be supplemented by additional water quality surveys that DEP will conduct in the fall of 2012 during wet and dry weather periods. Overflow data from the tank is being collected as part of the post-construction monitoring program, which will also be used to refine the model for supporting the LTCP project.*

- Does the model simulate tides? Was the sampling activity timed with the tides?
  - *The model does simulate tides. Kings Point is the closest tide station maintained by the National Oceanic and Atmospheric Administration (NOAA). Tidal adjustment factors developed by NOAA are applied to the Kings Point data to develop tidal conditions within AC/LNB waterbody. AC/LNB is part of the larger East River Tributaries Model (ERTM) to be used for the receiving water quality analyses. ERTM covers from Long Island Sound through the lower New York Bay/ Newark Bay areas and simulates the entire tidal variations within this area, calibrated based on NOAA gage data from Sandy Hook (NJ), The Battery and Kings Point. For the additional water quality sampling to be performed by DEP, sampling will take place in morning and afternoon surveys and bottom and top layer samples are collected. This is the protocol for city-wide sampling, being performed in a number of waterbodies over a period of several years.*

- Does the model simulate actual storms?
  - *Yes, the model simulates actual storms for an annual rainfall record. Spatially varied hourly rainfall records are provided as input, but the models have the ability to take 5-minute data if available and needed to meet a project need. Outputs can be generated at 5-minute intervals, although the receiving water quality models typically require hourly average inputs from the watershed models.*

- What is the plume in the satellite images of Alley Creek and Little Neck Bay in the presentation? Could it be smoke?
  - *As this is an image retrieved from publicly available Google maps, which are snapshots taken at different time periods, it is likely that these images had captured cloud cover. Images available from different public-domain sites were reviewed and this cloud cover didn't exist in those images.*

- What is the estimate of total CSO that goes into Little Neck Bay? What is the estimate for the total diluted sewage into Little Neck Bay?

  - *With the tank online, it is projected that 256 MGY of partially treated CSOs would be discharged to Alley Creek before flowing into Little Neck Bay. While the new annual rainfall from 2008 will create more overflows (in comparison to the above estimates developed from 1988 rainfall), DEP anticipates that the tank will perform better than projected and reduce CSOs further. DEP will continue to monitor the post-construction performance of the tank and will update the model with new data and use to generate revised annual overflows into Alley Creek and eventually into the Little Neck Bay.*

- Are there plans for separate sewers in the watershed/waterbody?
  - *DEP will evaluate the potential for separate sewers in the combined sewer area of the watershed and other alternatives as part of the LTCP development process. Stormwater from some portions of the Alley Creek/Little Neck Bay watershed are currently managed using seepage pits and the DEP's capital plan includes installation of new storm sewers in these areas since the seepage pits were originally built as temporary structures to manage Stormwater until new storm sewers were built.*

- Is DEP installing a new outfall on Udall's Cove? Where was storm water going before (at Udall's Cove)? How are storm water outfalls planned in Little Neck Bay and how is this related to the Bluebelt program?
  - *DEP, working with the Department of Parks and Recreation, is installing a new storm sewer outfall and outlet-stilling basin. Previously the stormwater runoff went directly overland into the cove. The project is similar to the DEP Bluebelt program which discharges stormwater into a managed wetland with a forebay before discharging to a receiving waterbody via an outfall structure.*

- When will a date be set for the second public meeting for Alley Creek and Little Neck Bay Long Term Control Plan Public Participation process?
  - *The next public meeting is scheduled for winter 2013. DEP will provide the date of the next meeting to stakeholders and community members well in advance to ensure maximum participation.*

Appendix C: Long Term Control Plan (LTCP) Alley Creek Public Meeting #2 – Summary of Meeting and Public Comments Received

On May 1, 2013, DEP hosted a second Public Meeting to continue the water quality planning process for long term control of combined sewer overflows (CSOs) in Alley Creek and Little Neck Bay. The purpose of the two-hour event, held at the Alley Pond Environmental Center in Queens, was to provide background and an overview of the LTCP planning process, present Alley Creek watershed characteristics and status of existing water quality conditions, obtain public input on waterbody uses in Alley Creek/Little Neck Bay, and describe the alternatives identification and selection process. The presentation is on DEP's LTCP Program Website: http://www.nyc.gov/dep/ltcp. Ten stakeholders from more than five different non-profit, community planning, environmental, economic development, governmental organizations and the broader public attended the event.

The Alley Creek LTCP Public Meeting #2 was the second opportunity for public participation in the LTCP development process for Alley Creek/Little Neck Bay. As part of DEP's LTCP Public Participation Plan, all Alley Creek/Little Neck Bay LTCP development process documents will be posted on the above website. The public will have additional opportunities to provide feedback and participate in the development of this LTCP. Specific questions asked during the meeting and DEP's responses are summarized below.

- What is the overall goal for water quality in Alley Creek/Little Neck Bay?
    - *The goal of each LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with the Federal CSO Policy and water quality goals of the Clean Water Act. Specific water quality goals for all individual LTCPs are subject to public input and evaluation or potential alternatives during the LTCP development process.*

- Will the draft LTCP, to be issued in June 2013, be available for public comment?
    - *Yes, all stakeholders will have the opportunity to review and comment on the draft LTCP. DEP will submit the draft LTCP to DEC on June 30, 2013, at which time DEC will review and determine a date for public release and comment.*

- Regarding the graphs in the presentation, what are the modeled lines colored red and black and is the scale logarithmic?
    - *The red lines are model predictions at the top portion of water quality model segments. Each water quality model cell has ten layers from top to bottom. The black represent bottom depth predictions. Yes, the scale is logarithmic.*

- What are the acceptable levels of enterococci and fecal coliform in Alley Creek/Little Neck Bay?
    - *The fecal coliform monthly geometric mean standard is 200 per 100mL for Class SB (Little Neck Bay) and 2,000 per 100 mL for Class I (Alley Creek). The enterococci standard is 435 per 100 mL for Class SB (Little Neck Bay) and is not listed for Class I waterbodies (Alley Creek).*

- Do the values of enterococci go up to 1,000 per 100 mL? Are the enterococci measured data typically below model predications?
    - *The enterococci values do approach 1,000 per 100 mL. However, data are variable: sometimes model results are higher and sometimes lower. In general, the model results generally follow the trends in the data.*

- Based on the bar graphs of pollutant loadings in the presentation, are the largest loads to Alley Creek/Little Neck Bay from non-CSO sources?

- *Yes, according to the data, stormwater appears to be the source of large pollutant loadings into Alley Creek and Little Neck Bay.*

- Is the bacteria measured in Little Neck Bay resulting from impacts of unsewered areas of Douglas Manor?
    - *No, based on the data, the water quality impacts from Douglas Manor appear to be localized.*

- Is DEP collaborating with Nassau County on reducing storm water pollution load?
    - *DEP anticipates future collaboration with Nassau County during the Municipal Separate Storm Sewer System (MS4) Citywide Permit development and implementation process.*

- What is grey infrastructure?
    - *Grey infrastructure typically denotes large-scale, centralized end-of-pipe controls such as retention tanks or sewer modifications. Examples include: bending weirs, CSO retention tanks and high level storm sewer separation.*

- What is the difference between detention and retention?
    - *Detained stormwater flows are captured, stored and then slowly released to the sewer system. Retained stormwater flows are captured and either infiltrate into the ground, undergo evapotranspiration, or are recycled onsite, and are not released to the sewer system.*

- In the *NYC Green Infrastructure Plan*, a three percent application rate (on private property) is assumed to occur by 2040. What is the basis of this?
    - *DEP estimates that through redevelopment and required adherence to DEP's revised Standards for Stormwater Release Rates, which requires redevelopment and new development projects to achieve a more stringent stormwater release rate in combined sewer areas, that green infrastructure will be implemented on private property. This percentage was developed based on redevelopment project applications received by the New York City Department of Buildings (DOB) over the last 10 years. In addition, DEP offers grants through the NYC Green Infrastructure Grant Program for private and residential properties in combined sewer areas.*

- Why is there not more green infrastructure planned in Alley Creek/Little Neck Bay?
    - *A 10 percent green infrastructure application alternative is being evaluated for the Alley Creek/Little Neck Bay LTCP, based on DEP's target of 10 percent green infrastructure application rate citywide (that is, 10% of the impervious combined sewer area) in combined sewer areas. A 50 percent green infrastructure application alternative (of the impervious combined sewer area) is also being evaluated.*

- The potential project footprint for the 29.5 million gallon CSO retention tank draft alternative would be large. Can DEP consider non-structural alternatives and green infrastructure solutions instead of grey infrastructure alternatives?
    - *As discussed during the presentation, the goal of each LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with the Federal CSO Policy and water quality goals of the Clean Water Act. Therefore, DEP is required to evaluate a myriad of potential alternatives, which will include green infrastructure, during the alternatives analysis component of the LTCP development process. The alternatives analysis is utilized to gauge potential CSO reductions and associated water quality improvements and does not take into account constructability.*

- Regarding the draft alternatives, what is the difference between an “upstream” and “downstream” tank?
  - *An upstream tank would capture flows at the upstream combined sewer area. A downstream tank would capture flows near the combined sewer outfall The downstream tank would need to be larger to achieve the same amount of combined sewer flow reduction since there is more stormwater mixed in.*

- Has the existing five million gallon Alley Creek CSO retention tank resulted in water quality improvements?
  - *Based on initial assessments, the CSO retention tank has contributed to water quality improvements. DEP will continue to assess and quantify water quality improvements.*

- Can the LTCP requirements be modified so that the plan addresses other sources as well as CSOs?
  - *The purpose and scope of all LTCPs, including the Alley Creek/Little Neck Bay LTCP where stormwater is the largest source of watershed pollutants, is to address CSOs in combined sewer areas and not other sources of water quality impairments (e.g., directly discharged stormwater inputs in separately sewered areas). The forthcoming MS4 Citywide Permit will include requirements related to stormwater inputs from separately-sewered drainage areas.*

- The focus of this LTCP should be changed to reducing storm sewer runoff into marsh land and improving habitat, and overall emphasis should be on ecology, rather than recreation.
  - *Each LTCP is a comprehensive evaluation of long term solutions to reduce CSOs and improve water quality in New York City’s waterbodies and waterways and does not focus on reducing storm sewer runoff. Improved or increased recreation is one of the main considerations required for each LTCP. Regarding enhanced ecology, in 2011, DEP completed a $20 million environmental restoration of the northern portion of Alley Pond Park in Bayside, Queens. DEP constructed eight acres of tidal wetlands and eight acres of native coastal grassland and shrubland habitat in an effort to reduce CSOs in Alley Creek and Little Neck Bay. The new plantings and restored wetlands absorb stormwater runoff, reducing the amount that enters and overwhelms the combined sewer system during wet weather events.*

- DEP should consider acquiring property as a means of water quality protection.
  - *In order to control significant amounts of stormwater and to achieve potential water quality improvements equivalent to potential improvements from grey and/or green infrastructure, DEP would need to acquire numerous larger properties, which may be infeasible considering the built-out and highly urbanized nature of New York City. DEP believes that its broad citywide effort to effectively manage stormwater and CSOs using a hybrid grey/green infrastructure approach will lead to improved water quality.*

- DEP should invest in salt marsh restoration. What kind of pollution reduction could be anticipated from salt marshes?
  - *The New York City Department of Parks and Recreation’s (DPR) ongoing and complementary watershed planning and restoration efforts would likely include these evaluations in non-CSO areas contributing to Alley Creek/Little Neck Bay. DEP will be providing support for these efforts even after the submittal of the LTCP on June 30, 2013. Dependent upon the design of the salt marsh, some pollution reduction may be possible.*

- At the end of the public meeting, Mr. Paul Kenline (NYSDEC) read a prepared statement on behalf of NYSDEC. A summary of the statement is included below:

  In March 2012, the State entered into a revised Order on Consent with DEP. This order provides the regulatory and technical framework for New York City to achieve compliance with the Clean Water Act's water quality goals through the development and implementation of CSO Long Term Control Plans. For the next 48 months, the City is required to submit ten waterbody-specific Long Term Control Plans for the State to review, culminating in a Citywide Long Term Control Plan in 2017. The Plans are required to achieve the highest attainable uses of the waters, regardless of their current New York State DEC water quality classification and standards.
  [1]With your input, and in collaboration with the City and EPA, the State will determine what types of water uses will be available to the public by evaluating, selecting and implementing CSO reduction projects or alternatives, including integrating the City's green infrastructure program. This June, DEP is required to submit for review the first of these water quality planning reports, for the Alley Creek/Little Neck Bay waterbodies and the combined sewage drainage areas. The State has had numerous technical discussions and will continue these discussions with the City over issues with the proposed Long Term Control Plan, including evaluating baseline conditions of the sewage treatment system concerning the CSO volume discharged to New York City's waters, verification of baseline conditions, and that DEP has verified the Long Term Control Plan assumption that all sewers are clean and free of significant sediment and/or obstructions by conducting representative physical inspections of larger diameter sewers within the drainage area (Technical Memorandum to DEC regarding Estimation of Sediment Levels for Pipes Represented in the Hydraulic Model of the NYC Sewer System used for LTCP Reporting (DEP, June 21, 2013)). DEC looks forward to reviewing the draft LTCP so that these technical issues may be vetted by the Department's technical staff. The State thanks you again for your interest and participation.

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[1] *NOTE: DEP does not agree with NYSDEC's statement that the Long Term Control Plans are required to achieve the highest attainable uses of the waters, though the Plans will assess the waterbody's highest attainable use. The CSO Consent Order includes the following statement of the goal of the LTCP:*

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.

Appendix D: Summary of Public Comments Received via Email and DEP Responses

- March 29, 2013: Thanks for keeping us all in the loop on the LTCP. That was an eye-opening meeting for me. I, and some of those with whom I spoke, left the meeting wondering if there are other DEP forums in which more feedback is solicited on the direction that the LTCP is taking. For example, I've been told that what largely got people recycling is that it was promoted in schools. When kids came home talking about it, adults started taking more interest. Along those lines, it occurred to me that the City has a captive audience of over a million public school kids. Why don't they all know about how the City functions as infrastructure? Why don't they all know to not do dishes, laundry etc. during rain events? Is there a process in the development of the LTCP for public input like this?
  - *Thanks for writing in. We completely agree. We do have an Education component at DEP to help introduce kids to their City's infrastructure; however this is mostly geared towards the Water Supply system and the watershed. While we would certainly like to do much more, we are also constrained by our resources. However, your suggestion is a good one and we have been exploring ways to tap into the school network to get the word out about what everyone can be doing to improve our City's water and sewer infrastructure.*
- April 17, 2013: I am unable to find the LTCP for Jamaica Bay, Paerdegat Basin that was apparently approved in February 2007. Is that document available? Also, does the Coney Island Water Pollution Control Plant have a Wet Weather Operating Plan?
  - *Thank you for your questions. The Waterbody Watershed Facility Plans (WWFP) for Jamaica Bay and Paerdegat Basin, one of Jamaica Bay's tributaries, was completed in October 2011 and can be found here:*
    http://www.hydroqual.com/projects/ltcp/wbws/jamaica_bay.htm.
  - *WWFPs were the precursor to Long Term Control Plans (LTCPs). The Jamaica Bay and Tributaries LTCP will be completed in June 2016. Please refer to our LTCP Program Website for additional information:*
    http://www.nyc.gov/html/dep/html/cso_long_term_control_plan/index.shtml. The Coney Island Wastewater Treatment Plant (WWTP) does have a wet weather operating plan.

Appendix E: Alley Creek Use Attainability Analysis

EXECUTIVE SUMMARY

The New York City Department of Environmental Protection (DEP) has performed a Use Attainability Analysis (UAA) in accordance with the 2012 CSO Order on Consent for Alley Creek, a Class I waterbody. Detailed analyses conducted during development of the Alley Creek and Little Neck Bay Long Term Control Plan (LTCP) concluded that Little Neck Bay will meet its designated recreational uses for a high percentage of the time, 100 percent for fecal coliform and near 100 percent for enterococci criteria during the recreational season (May 1st through October 31st). Alley Creek, however, was found to be unable to attain Primary Contact Water Quality (WQ) Criteria 100 percent of the time. The inability to meet a primary contact standard is primarily due to direct drainage, CSO and stormwater outfalls, although there are also some local background dry weather sources of pollution in the upper Alley Creek watershed including those created by waterfowl populations and natural wildlife. Based upon modeling, DEP projects that with completion of the projects detailed in this LTCP, there will be some marginal improvement in water quality in Alley Creek. On the basis of these findings, DEP is requesting, through the UAA process, that the New York State Department of Environmental Conservation (DEC) retain the Class SB primary contact recreation classification for Little Neck Bay and consider site-specific targets for Alley Creek.

INTRODUCTION

Regulatory Considerations

DEC has designated Alley Creek as a Class I waterbody with a best use of secondary contact recreation. The Class I classification does not provide for primary contact.

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. This UAA identifies the attainable and existing uses of Alley Creek and compares them to those designated by DEC, in order to provide data to establish appropriate WQS for these waterways. Several factors related to the physical condition of these waterbodies and the actual and possible uses suggest that these uses may not be attainable. 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 Act [CWA] would result in substantial and widespread economic and social impact.

Identification of Existing Uses

The Alley Creek watershed is primarily residential with some commercial, industrial, and open space/outdoor recreation areas. The immediate shorelines of Alley Creek are wholly contained within Alley Pond Park, and tidal wetlands extend from the open water portion of Alley Creek to its banks in most areas.

Much of Alley Creek's wetlands are designated parks because of significant effort and interest on the part of citizens living in the area and in recognition of the ecological, environmental, and educational value of Alley Creek and its tidal wetlands. The natural features of the waterbody limits its use for primary contact. There are no kayak launching locations or swimmable/wading beach areas in this watershed. The marshland nature of the waterbody (Figure 1), its comparatively small incised channel that can be seen in the middle during low tides, and the substrate unsuitable for wading or bathing (Figure 2), make the waterbody unsuitable for primary contact uses.

Figure 1. NYSDEC Wetlands Inventory (2009, WWFP)

Figure 2. Looking North at Little Neck Bridge on Northern Boulevard

Certain areas of Alley Creek are used for secondary contact use and fishing. Local residents are known to fish in the area near the LIRR Bridge at the mouth of Alley Creek via small water craft, and from the Little Neck Bridge on Northern Boulevard. An increasingly popular use of Alley Pond Park is camping, wildlife observation and hiking (Figure 3).

Figure 3. Urban Park Rangers Day Camp Program

There are potential naturally occurring sources of pathogens to Alley Creek. A significant number of waterfowl reside in Alley Pond Park and are regularly visible on the waters of Alley Creek, Oakland Lake and other tributary ponds, as shown in Figure 4. The evidence gathered at this time suggests that this population is contributing pathogen loads to Alley Creek.

Figure 4. Waterfowl Population at LIE Tributary Pond

ATTAINMENT OF DESIGNATED USES

Alley Creek is a Class I waterbody, suitable for secondary contact recreation and aquatic life propagation and survival. As noted previously, Alley Creek is used infrequently for contact recreation of any kind, and no evidence of primary contact recreation could be identified. However, as part of the LTCP, an analysis was performed to assess the level of attainment if DEC were to reclassify Alley Creek to Class SC (limited primary contact recreation).

Water quality modeling indicates that the existing Class I WQS (fecal coliform bacteria) would be achieved with the recommended LTCP projects. Attainment of primary contact criteria (existing and potential future), within Alley Creek, is not anticipated due to multiple pollutant sources other than CSO. A component analysis of pathogen concentrations in Alley Creek showed that non-attainment of the geometric mean during the worst 30-day period occurred throughout, and was a consequence of multiple sources of pathogen loads including direct drainage runoff, stormwater and local background dry weather sources of pollution. Sensitivity analyses performed with removing individual sources indicated that the recommended recreational season disinfection of CSO, would result in 94% annual attainment of the existing Class SC criteria (based on fecal coliform) but could increase up to 98% if such Class SC criteria is applied during the recreational season only.

An analysis was also conducted during the development of the LTCP using 10 years of water quality model projections from 2001 through 2011 to predict the time to recover in Alley Creek following a rain event. Although primary contact uses cannot be attained in Alley Creek, DEP used the primary contact fecal coliform recreation criterion of 1,000 counts/100 ml from the NYS DOH guidelines and 130 counts/100 ml from the 2012 Recreational Water Quality Criteria (RWQC) recommendations in this analysis. The result of the analysis is summarized in Table 1 for Alley Creek. As noted, the duration of time within which pathogen concentrations are expected to be higher than NYS DOH considers safe for primary contact varies based on rainfall event size. Generally, a value of around 24 hours appears to be reasonable.

Table 1. Time to Recover (hrs) to Fecal Coliform of 1,000/100mL and Enterococci of 130/100mL

	AC1	
Interval Storm (in)	**Fecal hrs**	**Entero hrs**
<0.1	-	-
0.1-0.4	5	10
0.4-0.8	8	21
0.8-1.0	12	26
1.0-1.5	12	31
>1.5	14	31

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 that the waterbody will not support primary contact and is intended to advise the water users of the potential health risk associated with this use during this time period.

CONCLUSIONS

The majority of Little Neck Bay attains primary recreation contact water quality criteria over 99 percent of the time. However, Alley Creek is not predicted to attain the Primary Contact WQ Criteria of SC (based on fecal coliform) on an annual basis. In this area, only limited access to the waterbody is possible due to extensive tidal wetlands along the shoreline. As a result, it is used by a very small population for secondary contact uses. Non-attainment is attributable to one or more of the following UAA factors:

- Naturally occurring pollutant concentrations prevent the attainment of the use vicinity [See UAA factor #1 (40 CFR 131.10(g)(2)]
- Naturally-occurring (tidal) low water levels in the receiving water in this vicinity (See UAA factor #2 (40 CFR 131.10(g)(2))
- 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 [See factor #3 (40 CFR 131.10(g)3)].

RECOMMENDATIONS

The majority of Little Neck Bay attains the fishable and swimmable goals of the CWA over 99 percent of the time. Even with the implementation of the proposed plan to disinfect Alley Creek CSO Retention Facility overflows, which DEP projects will result in incremental improvements to water quality, Alley Creek will be unable to attain the primary contact Class SC standards on an annual basis. As such, site-specific targets may be considered for Alley Creek on a temporal basis for recreational and non-recreational season, as described below. In addition, an advisory period is recommended for Alley Creek for a period of 24 hours after the end of a rainfall event that results in an overflow to the creek.

As DEP is committed to improving water quality during the Alley Creek recreation season, DEP is committing to implement disinfection of the overflow from the Alley Creek CSO Retention Facility. DEP has identified below site-specific targets for Alley Creek that will allow DEP to continue to improve water quality over time. Site-specific targets are identified for consideration to advance towards the numerical limits established, or under consideration by DEC, including SC pathogen standards and Future Primary Contact WQ Criteria consistent with the 2012 EPA RWQC. DEP notes that these site-specific targets are based on projections and may require adjustment based upon post-construction monitoring results. These site-specific targets are shown below.

Recreational Season (May 1st – October 31st):

- 30-day recreational season GM enterococci value of 130 cfu /100mL and Monthly recreational season fecal coliform GM concentration of 200 cfu/100mL

Non-recreational Season (November 1st – April 30th):

- Monthly fecal coliform GM concentration of 500 cfu /100mL

Appendix F: SPDES Variance

By submitting this variance application, the New York City Department of Environmental Protection (DEP) is not waiving its right to seek other regulatory options for addressing applicable water quality standards, including a request for water quality standards revisions based upon a Use Attainability Analysis.

APPLICATION FOR VARIANCE

TO WATER QUALITY BASED EFFLUENT LIMITATION

Tallman Island Water Pollution Control Plant

SPDES Permit No NY-0026239

Outfall TI-025

The New York City Department of Environmental Protection (NYCDEP) seeks a variance from the anticipated Water Quality Based Effluent Limitation ("WQBEL") for the Alley Creek CSO Facility permitted under the Tallman Island SPDES Permit as Outfall TI-025. This variance application is based on information set forth in the *Alley Creek Long-Term CSO Control Plan Report* (the "Report") submitted June 2013 as updated November 2013.

This variance request is based on the anticipation of occasional exceedances of the water quality standards for: (a) Suspended, colloidal and settleable solids; (b) Oil and floating substances; and (c) Dissolved oxygen (DO). Modeling and engineering estimations indicate that complete elimination of periodic excursions from those water quality standards would require a water quality-based effluent limitation (WQBEL) of 100% CSO capture. Accordingly, for the reasons set forth below, we hereby request a variance from the presumed WQBEL of 100% CSO capture.

Specifically, DEP requests that the permit will specify "operational conditions" based limits for the Facility as an "alternative effluent control strategy" defined under Section 302(a) of the Clean Water Act. Based on NYSDEC's April 12, 2006 letter regarding the Paerdegat Basin CSO facility, DEP understands that the enforceable conditions for the operation of the Alley Creek Facility would be based on its design specifications, its Wet Weather Operating Plan (WWOP), and the 14 BMPs for CSOs for the duration of the variance. This approach is consistent with NYSDEC's stated belief that numerical effluent limits are not appropriate for CSO-based discharges such as those that will occasionally occur from the Alley Creek CSO Retention Facility due to episodic heavy or intense rainfall events.

Alley Creek CSO Retention Facility

The Alley Creek CSO Retention Facility provides 5 million gallons of in-line storage of combined sewage. The facility was completed in June 2011 and was certified as being operational as of March 11, 2011. The facility has been in continuous operation since that time and remains so presently. The anticipated performance of the facility under typical annual conditions was a 54 percent CSO volume reduction, a 70 percent TSS loading reduction, and a 66 percent reduction in BOD discharged to Alley Creek. The resulting water quality benefits are expected to meet the WQS for pathogens in both Alley Creek and Little Neck Bay, and the dissolved oxygen standard at least 96 percent of the time during a typical rainfall year.

Because of its flow-through configuration, CSO discharges through the facility receive solids and floatables removal. However, the New York State standard for Suspended, Colloidal and Settleable Solids is “None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.” Similarly, for Oil and Floating Substances the limit is “No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease” (6 NYCRR Part 702.17). There is therefore a practical limitation to the facility being able to attain these WQBELs. Further, minimum DO requirements in Alley Creek (4.0 mg/L) and Little Neck Bay (4.8 mg/L) cannot be attained even with 100% CSO removal.

Environmental Benefits

The Alley Creek CSO Retention Facility significantly improves the water quality and environmental conditions in Alley Creek and Little Neck Bay, as demonstrated in the Alley Creek LTCP. Bacteriological conditions will improve to a level whereby the existing Class Icriteria for total coliform and fecal coliform should be fully achieved. Dissolved oxygen (DO) will also significantly improve, and is expected to be attained at least 96% of the time. Odors will be substantially eliminated by the high level capture of settleable material, and the benthic habitat and diversity of aquatic life in Alley Creek is expected to improve accordingly.

Regulatory Assessment

As described in the Alley Creek LTCP, complete attainment of numerical and narrative water quality criteria applicable to Alley Creek and Little Neck Bay would not be achieved even with 100% capture of CSO discharges, which would require an additional 29.5 million gallon storage facility with an estimated cost of $569 million. The Alley Creek CSO facility was selected based on the "knee-of-the-curve” analysis consistent with USEPA's CSO Control Policy.

USEPA guidance as contained in *Coordinating CSO Long-Term Planning with WQS Reviews* provides for regulatory reviews and revision, as appropriate, of water quality standards when considering CSO control plans to reflect the site-specific wet weather impact of CSOs and to reconcile designated uses with what is attainable cost-effectively. However, NYSDEC has stated that it prefers that DEP apply for a variance to the presumed WQBELs rather than seek water quality standards revisions.

Application for Variance to WQBELs

As noted, the requirements for variances to effluent limitations are based on standards and guidance values and contained in 6 NYCRR Part 702.17. Complete elimination of periodic excursions from the following water quality standards applicable to Alley Creek and Little Neck Bay would require a WQBEL of 100% CSO capture.

Water Quality Standards for Class I Waters*

Parameter	Standard
Suspended, colloidal and settleable solids	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best
Oil and floating debris	No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease.
Dissolved Oxygen	Not less than 4.0 mg/L at any time (Alley Creek)

*Compiled from 6 NYCRR Part 703.

In order to meet the above-referenced standards, DEP would be required to attain 100% CSO capture, As this level of CSO capture is neither cost-effective nor consistent with CSO Control Policy specifications, we request a variance to the presumed WQBEL of 100% CSO capture.

The following narrative presents the information or the source of information to support this application under 6 NYCRR Part 702.17. Responses are provided to those subsections of Section 702.17 which are applicable to DEP and to the Alley Creek CSO Facility.

Sec. 702.17(a) [DEC] may grant, to a SPDES permittee, a variance to a water quality-based effluent limitation included in a SPDES permit.

As the SPDES permittee, DEP seeks a variance to the presumed water quality based effluent limitation of 100% CSO retention for the Alley Creek CSO Retention Facility. The variance should be incorporated into the Tallman Island WPCP SPDES Permit, NY-0026239.

Sec. 702.17(a)(1) A variance applies only to the permittee identified in such variance and only to the pollutant specified in the variance, A variance does not affect or require the department to modify a corresponding standard or guidance value.

The variance is requested for the following effluent constituents in the periodic overflows from the Alley Creek CSO Retention Facility.

- Suspended, colloidal and settleable solids;
- Oil and floating substances;
- BOD and other oxygen demanding substances (for DO).

It is understood that this variance is only applicable to the Tallman Island WPCP SPDES permit governing the Alley Creek Facility and would not modify any water quality standard or guidance value.

Sec. 702.17(a)(3) A variance shall not be granted that would likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of such species critical habitat.

The LTCP notes that the Northern Harrier (Circus cyaneus) is a threatened species known to over-winter in Alley Pond Park. Northern Harriers feed on small animals such as mice and voles, for which they hunt by flying low over fields and marshes. They eat their prey on the ground, they perch on low posts or trees, and their nests are concealed on the ground in grasses or wetland vegetation.

Because this bird species does not feed on aquatic life and does not use water for habitat, the variance would not jeopardize its continued existence or result in the destruction or adverse modification of its critical habitat.

Sec. 702.17(a)(4)) A variance shall not be granted if standards or guidance values will be attained by implementing effluent limits required under section 750-1.11(a) of this Title and by the permittee implementing cost-effective and reasonable best management practices for nonpoint source control.

The requirements applicable to CSO outfalls and CSO retention facilities are set forth in NYSDEC's Technical and Operational Guidance (TOGS) 1.6.3, which requires that all technology based effluent limits for CSOs must be developed using Best Professional Judgment (BPJ). BPJ has been used to develop the Alley Creek LTCP and some excursions from water quality standards are expected after implementation. Best management practices applied for nonpoint source control will also not achieve attainment.

Sec. 702.17(a)(5) A variance term shall not exceed the term of the SPDES permit. Where the term of the variance is the same as the permit, the variance shall stay in effect until the permit is reissued, modified or revoked.

DEP acknowledges that the variance will not exceed the term of the Tallman Island WPCP SPDES permit; however, in the absence of a UAA, it is likely that the variance will need to be renewed. As appropriate, DEP may timely file an application for such renewal.

Sec. 702.17(b)(1), (2), (3) (4) and (5) A variance may be granted if the requestor demonstrates that achieving the effluent limitation is not feasible because:

(1) *Naturally occurring pollutant concentrations prevent attainment of the standard or guidance value,*

(2) *Natural, ephemeral, intermittent or low flow conditions or water levels prevent attainment, unless these conditions may be compensated for by the discharge of sufficient volume of effluent to enable the standard or guidance value to be met without violating water conservation requirements,*

(3) *Human-caused conditions or sources of pollution prevent attainment of the standard or guidance value and cannot be remedied or would cause more environmental damage to correct them to leave in place,*

(4) Dams, diversions or other types of hydrologic modifications preclude attainment of the standard or guidance value, and it is not feasible to restore the waterbody to its original condition or to operate such modification in a way that would result in such attainment,

(5) Physical conditions related to the natural features of the waterbody, such as the lack of a proper substrate cover, flow, depth, pools, riffles, and the like, unrelated to chemical water quality, preclude attainment of the standard or guidance value; or

(6) Controls more stringent than those required by Section 750-1.11(a) would result in substantial and widespread economic and social impact.

This subsection requires the applicant to demonstrate that achieving the WQBEL is not feasible due to a number of site-specific factors. These factors established by New York State Environmental Conservation Law are the same as those in 40 CFR 131.10(g) which indicate Federal requirements for a Use Attainability Analysis (UAA). In the framework DEP and DEC have agreed to for UAAs, at least one of these six criteria must be met, and it is expected that this agreement would also be applicable to a SPDES Variance request. Because 100% CSO removal does not enable attainment, factor #3 at a minimum would provide justification (human caused conditions).

Sec. 702.17(c) In addition to the requirements of subdivision (b) of this section, the requestor shall also characterize, using adequate and sufficient data and principles, any increased risk to human health and the environment associated with granting the variance compared with attainment of the standard or guidance value absent the variance, and demonstrate to the satisfaction of the department that the risk will not adversely affect the public health, safety and welfare.

This subsection requires the applicant to demonstrate to NYSDEC any increased risk to human health associated with granting of the variance compared with attainment of the water quality standards absent the granting of the variance. As noted above under Sec. 702.17(a)(1), this variance application is for suspended, colloidal and settleable solids, and oil and floating substances in the periodic overflows from the Alley Creek CSO Retention Facility. These substances pose no significant risk to human health. In addition, pathogen criteria are expected to be fully attained and therefore no variance is requested for these parameters. Very limited risk to the environment is expected absent attainment of the standard.

Sec. 702.17(d), The requestor shall submit a written application for a variance to the department. The application shall include:

(I) All relevant information demonstrating that achieving the effluent limitation is not feasible based on subdivision (b) of this section; and

(2) All relevant information demonstrating compliance with the conditions in subdivision (c) of this section.

This application and the Alley Creek LTCP satisfy the requirements of this subsection.

Appendix G: Disinfection Approach for Alley Creek CSO Retention Facility

1.0 INTRODUCTION

This document summarizes DEP's proposed disinfection approach for Alley Creek and, in particular, provides details with respect to a proposed interim disinfection facility ("Interim Facility"). The implementation of the Interim Facility would (i) advance the timeline for disinfecting the Alley Creek CSO Retention Facility overflows and (ii) enable DEP to obtain operational performance data on the disinfection of the variable flows and loads associated with CSOs to inform the development of a Standard Design Facility.

DEP's operational strategy for both the Interim Facility and the Standard Design Facility is to reduce human source bacteria to the maximum extent feasible while limiting the TRC level in the discharge to the receiving water to limit toxicity impacts to the receiving water. DEC has informed DEP that TRC impacts would be minimal because the CSO discharges from the Alley Creek retention tank containing residual chlorine would be short-termed and intermittent. DEC has further stated that any excursions of the standards could be handled through a wavier or variance. For both facilities, disinfection will be practiced during the recreational season, defined by DEC as May 1st to October 31.

1.1 Standard Design Facility

A conceptual design and layout for a Standard Design disinfection system for the Alley Creek CSO Retention Facility is presented in this LTCP based on experience and evaluations of similar CSO disinfection facilities in New York State and elsewhere across the country. The basic design involves retrofitting the existing CSO tank with a chlorination and dechlorination system using a two chemical system of sodium hypochlorite for chlorination and sodium bisulfite for dechlorination, if necessary. The Standard Design Facility described in Section 8 of this LTCP will be delivered through a design-bid-build approach, the standard method of procuring and constructing DEP capital facilities. To allow for the required steps in the design-bid-build approach, a schedule of approximately nine years will be necessary to fully implement the facilities described in the LTCP. These steps will proceed on a parallel path with the design and construction of the Interim Facility.

The nine year schedule is necessary to provide sufficient time to: obtain funding for initiating design, procure a design consultant, coordinate with other agencies (i.e. DOT and DPR, as well as possibly seek alienation legislation), undertake site acquisition, conduct environmental review, obtain necessary permit, complete design, bid the project and construct the required facilities.

1.2 Interim Facility

As was recently discussed with DEC, DEP will progress with an Interim Facility to advance the schedule for initiating disinfection of overflows from the Alley Creek CSO Retention Facility. This Interim Facility will also provide an opportunity to collect performance data and can be used to inform the design of the Standard Design Facility.

The Interim Facility is envisioned to be temporary in nature and assumed not to require permanent buildings, or major capital construction, however, it is possible that it could involve alienation of parkland. The Interim Facility would most likely be skid or trailer mounted with climate control and ventilation systems to protect the chemicals, pumps and instrumentation. Utility hookups for water and electricity service to the trailers are also assumed. A roadway for chemical delivery and access to the Interim Facility is needed and would be part of the construction work. DEP is considering both solid (calcium hypochlorite) and liquid (sodium hypochlorite) forms of disinfection. Further investigations of a solid vs liquid system are needed as the solid systems tend to be for smaller applications and the applicability will depend on the design criteria that will be established during the detailed design of the Standard Design Facility. Typically, these small systems can have difficulty providing sufficient dose at very high peak flow rates, which can reach 350 MGD.

The Interim Facility may need to be custom designed and constructed, as DEP is not aware of any sufficiently sized Interim Facility that is readily available from a vendor or manufacturer. The Interim Facility is expected to be procured and constructed through a DEP Job Order Contractor (JOC) to further expedite the implementation schedule

1.2.a Interim Facility Siting

One challenge with implementing the Interim Facility is siting the necessary temporary facilities. Based on a search of NYC property records it was determined that DEP does not own available adequate siting to meet the needs of establishing the Interim System. After a review of the surrounding area, two potential sites along the influent sewer route have been preliminarily identified and are shown on Figure 1 as “Site 1” and “Site 2”. Site 1 located north of Northern Boulevard is owned by the NYC Department of Parks and Site 2, the land south of Northern Boulevard is believed to be controlled by the NYC Department of Transportation. Site 2 is located within the cloverleaf interchange for the Cross Island Parkway and Northern Blvd. Negotiating an agreement and/or an MOU with landowners would be required to temporarily site the facilities.

Figure 1. Alley Creek CSO Facility

1.2.b Interim Facility Operations

The Interim Facility operation would be triggered by combined sewer flows entering the Alley Creek CSO Retention Facility. Therefore, all flows entering the tank would be targeted for disinfection resulting in dosing of events that do not create an overflow. The CSO volume that is fully captured by tank and chlorinated will be pumped back to the Tallman Island WWTP, in accordance with the wet weather operating plan. The disinfected tank flow is not expected to have any impact on plant performance as any residual chlorine in the CSO pump back flow will be consumed as the pump back flow is introduced into the collection system.

A preliminary evaluation was conducted to determine the 10-minute peak flows to the Alley Creek CSO Retention Facility during the recreational season for the 2008 average rainfall year. The analysis was performed with the InfoWorks landside model and presented below in Figure 2 to ascertain the range of flows that should be expected when an Interim Facility is in service. For the average year (2008) the peak 10-minute flow was determined to be 352 MGD, with the influent flow below 240 MGD 99.9% of the time and below 101 MGD 99.0% of the time. Due to the highly variable flow, the design will need to consider sizing of metering pumps and chemical storage to effectively cover the wide range of influent flows. The design will need to consider a longer term rainfall record as peak flows will likely be higher than those in the average year and well as the targeted flow to disinfect (i.e. 99% , 99.9%).

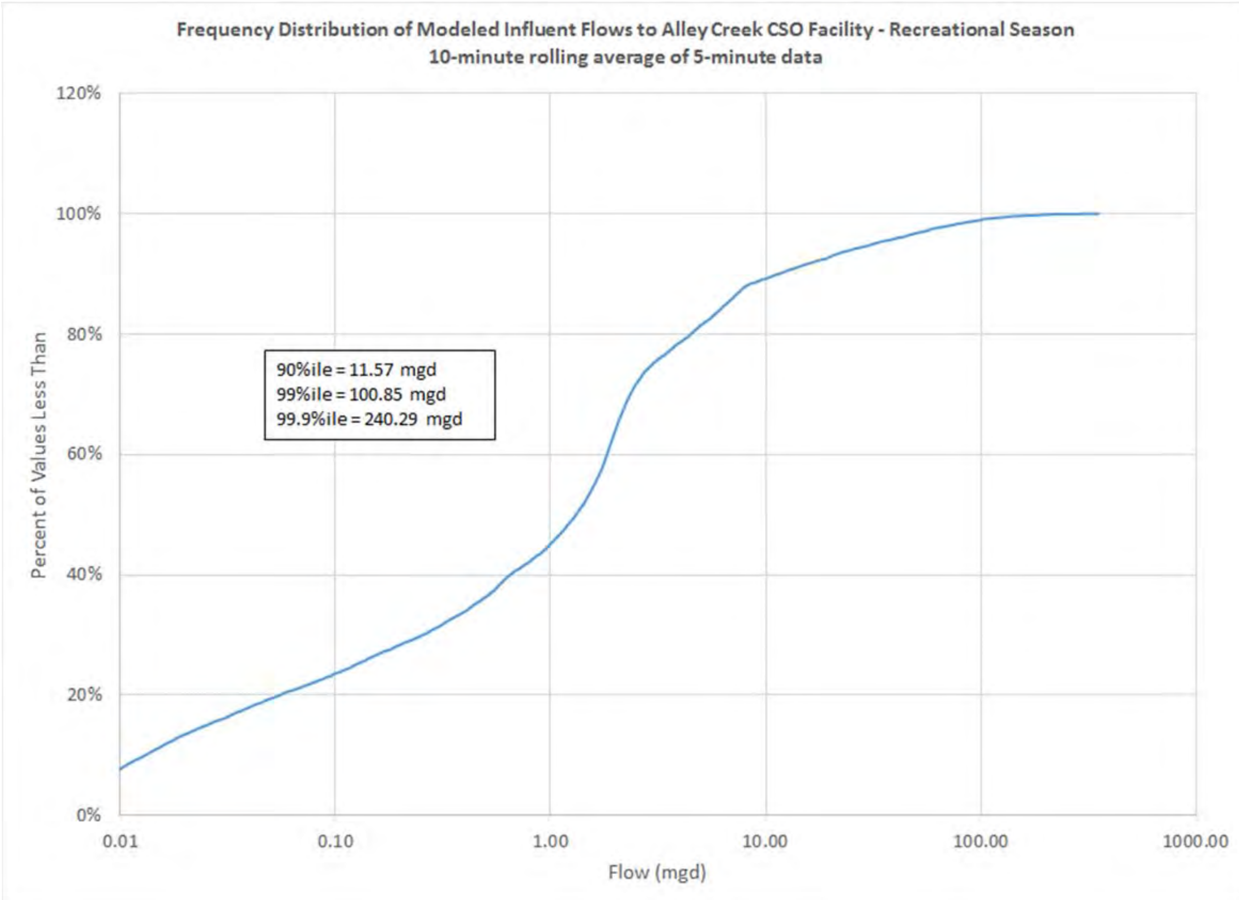

Figure 2. Frequency Distribution of Modeled Influent Flow to Alley Creek CSO Retention Facility – Recreational Season

1.3 Schedule for Interim Facility

The schedule for start-up of the Interim Facility is dependent upon negotiating an agreement with the property owners for the siting of the Interim Facility. DEP will work toward initiating seasonal disinfection by May 2019 as previously agreed to with DEC, contingent upon successfully obtaining a site. The design of the Interim Facility will be advanced in parallel with discussion with the property owners. Once a siting agreement is reached, DEP will initiate the procurement of the trailer mounter/skid mounted unit and should be able to initiate disinfection earlier than the May 2019 date.