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

Combined Sewer Overflow Long Term Control Plan for Alley Creek and Little Neck Bay Appendix H: Supplemental Documentation

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Department of Environmental Protection
Bureau of Wastewater Treatment

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1. INTRODUCTION

1. **Purpose**

This Supplemental Documentation contains DEP's responses to DEC's comment letter, dated January 23, 2015, on the June 2014 Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) for the Alley Creek and Little Neck Bay. The Supplemental Documentation is now made part of the referenced LTCP as Appendix H.

The LTCP, as supplemented herein, summarizes DEP's plans for managing the CSO discharges into the Alley Creek and Little Neck Bay including the findings and recommendations to advance the waterbody's level of compliance with applicable Water Quality Standards.

2. **Format**

The document has been divided into sections reflecting the specific area of concern, such as General Comments, Executive Summary, and the various sections of the LTCP in which DEC comments were received.

In addition to containing responses to specific comments, the document also includes: a revised Executive Summary as Attachment 1; revised Section 6 as Attachment 2; revised Section 8 as Attachment 3; revised Appendix E, Use Attainability Analysis as Attachment 4; and revised Appendix G, Disinfection Approach for Alley Creek CSO Retention Facility as Attachment 5. Collectively, the Supplemental Documentation and attachments, plus the original June 2014 submittal, constitute the overall revised Alley Creek and Little Neck Bay LTCP.

It should be noted that in addition to responding to specific comments in the above referenced letter, the revised Section 6, revised Section 8, revised ES and revised UAA also reflect modifications that DEP and DEC agreed upon relative to the reference to attainment of DO criteria and recommended primary contact enterococci RWQC of 30 cfu/100mL and 110 cfu/100mL for GM and STV, respectively.

The following conventions were used with respect to the numbering of figures and tables:

- When revisions were made to existing tables of Section 2 from the June 2014 LTCP, both the original and the revised tables are included in the response along with their original numbering (e.g., **Table 2-19. "Title"**) plus the revised numbering (e.g., **Table 2-19. "Title" (Revised)).**

- When revisions were made to existing figures from the June 2014 LTCP, the original figures were not included and only the revised figure is shown in the Supplemental Documentation (e.g., **Figure 9-1. "Title" (Revised)**).

- When an entire new table or figure was added, it was numbered using the prefix ES denoting Executive Summary and a prefix identifying them as new added material (e.g., **New Table ES. "Title"**).

2. RESPONSE TO COMMENTS

2.1 GENERAL COMMENT

DEC Comment No. 1
Remove language that is related to the Article 78 litigation and any other legal qualifiers that create uncertainty about the City's commitments within the LTCP. The Department has highlighted some language in the attached electronic file of the LTCP in yellow that needs to be removed or revised. As noted in the cover letter to this attachment, the Department acknowledges that, pending settlement of the Alley Creek LTCP litigation, the City's submission of the June 2014 Alley Creek LTCP is subject to and without waiver of the City's positions in that litigation. In addition, please be advised that the proposed rulemaking for the Class SD and I waters does not propose a reclassification of these waters to Class SC, but rather the regulatory changes will add primary contact recreation as a designated use to the existing classifications. The LTCP should be revised to reflect this proposed change.

***DEP Response*:**
In response to DEC comment No. 1, DEP notes that certain language was included in the LTCP submittal to reserve DEP's rights pursuant to the Article 78 litigation directly related to the Alley Creek LTCP. As DEC acknowledges that the City's submission of the June 2014 Alley Creek LTCP is subject to and without waiver of the City's positions in that litigation, DEP has removed and/or modified language in the LTCP as set forth below and in the attached supplement. As set forth in this supplementary submittal, footnote 1 to the Executive Summary has been modified to provide only a historical recitation of the submittal and resubmittal of the LTCP, footnote 2 to the Executive Summary has been deleted and footnote 1 to Appendix C has also been deleted. Other language highlighted by DEC has been modified to reflect technically factual statements. DEP has also modified the text to reflect that the proposed rulemaking did not propose a reclassification of these waters to Class SC. DEP also notes that the City has submitted comments to DEC's proposed rule.

Type	Language
Page ES-1, Footnotes 1 and 2	[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 CSO 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.~~
Page ES-3, Table ES-1 Footnote 4	[4]~~This~~ The Potential Future Primary Contact WQ Criteria ~~Standard has~~ have not yet been adopted ~~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 re-classify Alley Creek from I to SC.~~
Page ES-3, Text	"be if DEC were to apply a 200 mg fecal coliform WQ criteria for primary contact ~~re-classify Alley Creek to a Class SC - limited primary contact recreation~~."
Page 1-1, Footnotes 1 and 2	[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 CSO 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.~~
Page 6-7, Table 6-3 Footnotes * and **	*This water quality standard ~~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~~ The Potential Future Primary Contact WQ Criteria ~~Standard has~~ have not yet been adopted ~~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 re-classify Alley Creek from I to SC.~~
Page 6-12, Text	This LTCP assessed the level of attainment for Alley Creek, which is a Class I waterbody, if DEC were to apply a 200 mg fecal coliform WQ criteria for primary contact. ~~re-classify it to Class SC (limited primary contact recreation).~~
Page 8-54, Text	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 (b~~e~~) DEC not adopt RWQC STV values as proposed at 110 or 130 cfu/100mL.
Page 8-59, Text	4. The LTCP includes a UAA that ~~identifies feasible site-specific~~ assesses compliance with Primary Contact WQ ~~targets~~ Criteria based on the projected performance of the selected CSO controls.
Page C-4, Footnote 1	~~[1]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.~~

2.2 SPECIFIC COMMENTS

2.2.1 EXECUTIVE SUMMARY

DEC Comment No. 2
Figures ES-3, ES-4, 8-15, 8-16, and 8-17: It appears that the location of the seasonal and annual disinfection alternative markers on the graph is reversed.

***DEP Response*:**
The seasonal and annual points shown for the disinfection alternative in the above mentioned figures depict the seasonal and annual equivalent CSO control obtained with operation of the proposed disinfection facility during the recreational season exclusively. Hence, operating the disinfection facility during the same period to which the seasonal CSO reduction is computed leads to approximately 100 percent CSO control; when the CSO reduction is computed on an annual basis, it yields approximately 59 percent CSO control.

2.2.2 SECTION 2.0 – WATERSHED/WATERBODY CHARACTERISTICS

DEC Comment No. 3
Table 2-19: Provide the monthly rainfall for all months and annual total for years listed.

***DEP Response*:**
The requested rainfall data has been added to Table 2-19.

Current Table:

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

Proposed Table:

Table 2-19. LaGuardia Airport Annual Rainfall (Revised)

Monthly Total Volume (in)													
	Jan	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sept***	***Oct***	***Nov***	***Dec***	***Total***
2009	2.63	0.88	1.46	4.69	3.98	8.46	6.62	2.66	1.84	4.92	1.41	6.81	**46.38**
2010	1.79	5.02	9.55	2.55	2.9	1.67	2.52	2.36	2.76	4.62	1.74	3.16	**40.66**
2011	3.95	3.33	5.96	5.07	3.97	3.85	2.94	17.32	7.61	4.56	2.85	3.93	**65.33**
2012	2.5	1.34	1.0	3.18	4.67	4.19	3.77	2.95	5.06	2.39	1.35	4.31	**36.73**
2013	2.64	3.2	2.43	1.16	4.99	8.16	2.8	1.97	3.3	0.44	2.77	4.47	**38.35**

DEC Comment No. 4
Page 2-64: Incorrect reference to Class SA waters.

***DEP Response*:**
Reference to Class SA has been replaced with reference to Class SB.

Current language: "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"

Proposed language: "These data indicate that about 58 percent of the measured DO concentrations in the Bay at Station LN1 are greater than the Class SB 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."

DEC Comment No. 5
Section 2.l.c.2: Provide an update on the track-down of illicit discharges to Alley Creek.

***DEP Response*:**
From October 2013 to November 2014, DEP has identified and notified 23 establishments with illicit connections to the separate stormwater system tributary to Outfall TI-024. The owners were issued Commissioner's Orders and promptly removed the illicit connections. Further investigations will be conducted by the Compliance Monitoring Section.

2.2.3 SECTION 8.0 – EVALUATION OF ALTERNATIVES

DEC Comment No. 6
Section 8.1.a: The wording in the following sentence is confusing:

"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."

***DEP Response*:**
The Revised Section 8 provided in Attachment 3 provides further clarification.

DEC Comment No. 7
Per the discussion between the City and Department on January 8, 2015, revise the discussion of the chlorination/dechlorination demonstration project to reflect the City's plans to conduct the project at Spring Creek CSO retention facility. The City shall submit a scope of work to the Department for completion of the Spring Creek CSO retention facility chlorination/ dechlorination demonstration project within 60 days of the date of this letter.

***DEP Response*:**
DEP is preparing this new scope of work for the Spring Creek CSO disinfection demonstration study and has been granted until May 1, 2015 to submit this to the Department.

DEC Comment No. 8
Per the discussion between the Department and City on January 8, 2015, eliminate the site-specific standards from the LTCP but include a general discussion on the spatial and temporal extent of non-attainment with water quality standards within the waterbody during period of analysis.

***DEP Response*:**
Revised Section 8, revised UAA and revised ES reflect these proposed modifications.

DEC Comment No. 9
In reference to the discussion between the Department and City on January 12, 2015, the Time to Recover analysis should be conducted for the August 15 design storm for the point of compliance of OW2 for the selected alternative using the fecal coliform single sample standard of 1000 cfu/100mL only. Table 8-21 can be deleted from the LTCP.

***DEP Response*:**
Table 8-21 remains in the original Section 8 of the LTCP. Revised Section 6, revised Section 8, revised UAA and revised ES reflect the proposed modifications.

DEC Comment No. 10
Sections 8.2.b and 8.5: Provide more detailed discussion on how the CSO reduction volumes were calculated for the two GI alternatives 5A and 5B.

***DEP Response*:**

CSO reductions are calculated by the InfoWorks model by performing a typical year (2008) simulation with the additional green infrastructure controls in place only applied to CSO drainage areas, and comparing the CSO discharge to the baseline quantity. The 10 percent and 50 percent additional GI scenarios were each developed by removing that proportion of impervious area from the remaining "unmanaged" areas in the Alley Creek watershed (after the initial baseline GI was already applied). This additional impervious area was then modeled to infiltrate into the ground (versus directly running off and contributing to the CSO).

DEC Comment No. 11

Table 8-17: Information in the columns entitled Primary Contact WQ Criteria and Future Primary Contact WQ Criteria are identical but the future criteria will be entero only.

***DEP Response*:**

The Potential Future Primary Contact WQ Criteria will be reporting attainment for entero only.

2.2.4 SECTION 9.0 – LONG TERM CSO CONTROL PLAN IMPLEMENTATION

DEC Comment No. 12
Table 9-1: The schedule provided in Table 9-1 shall be revised to reflect a construction start for the permanent chlorination facility of no later than year 5. The schedule shall also be revised to include the Spring Creek CSO retention facility chlorination/dechlorination demonstration project.

***DEP Response*:**
The schedule proposed in the LTCP has been revisited and updated as shown in the revised figure below, nevertheless, even after further analysis of the schedule, we do not find it possible to initiate construction of the disinfection facility by year 5.

In the updated schedule provided below, the consultant procurement period was reduced to 18 months. However we do not see an opportunity to reduce the design/permitting/site acquisition phase. Since submitting the LTCP, DEP has confirmed that the site surrounding the Alley Creek CSO Facility is owned by the New York City Department of Parks & Recreation (DPR). Acquiring the land for the disinfection facility will require coordination with DPR and may also require alienation of parkland. According to the Handbook on Alienation and Conversion of Municipal Parkland in New York, alienation requires legislation enacted by the New York State Legislature, a process that will likely extend the site acquisition phase of this proposed project.

The schedule for the Spring Creek facility will be submitted by May 1st in accordance to the recent time extension granted by DEC to develop the scope and schedule for the demonstration facility.

Current Language and Figure: 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

Proposed Language and Figure: The implementation schedule for the seasonal disinfection facilities for the Alley Creek CSO Retention Tank is presented in Figure 9-1. The proposed disinfection facility will be operated during the recreational season, from May 1st through October 31st. The schedule presents the duration of time needed to perform the engineering design, advertise and bid the construction contracts and complete the actions identified in this LTCP.

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.

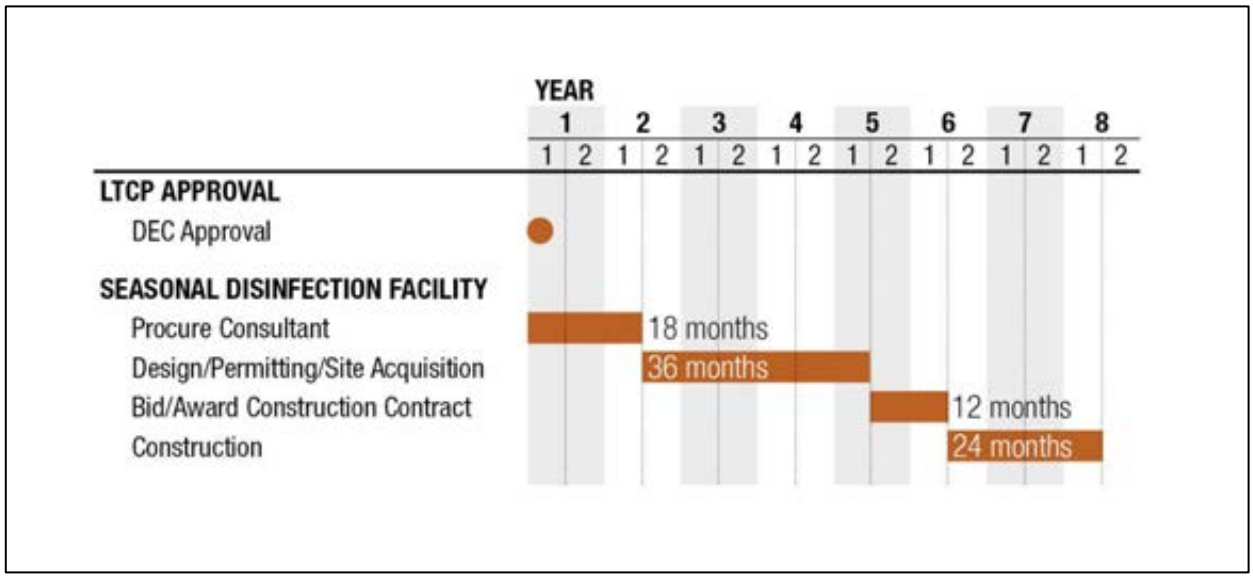


Figure 9-1. Alley Creek Seasonal Disinfection Facility Implementation Schedule

ATTACHMENT 1

Revised Executive Summary

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).

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 CSO Order on Consent). The 2012 CSO Order on Consent is a modification of the 2005 CSO Order on Consent (DEC Case No. CO2-20000107-8). Under the 2012 CSO 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 CSO 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 CSO 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 conditioned on verification through rigorous post-construction compliance monitoring (PCM).

[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. However, DEP has made further revisions to the LTCP in response to DEC comments received in review letters dated September 12, 2013 and December 12, 2013, as well as in subsequent technical meetings held between DEC and DEP.

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 waterbody, 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 through 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 will likely 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". Adoption of such a standard would require future rulemaking. Since the outcome of such rulemaking is unknown at this time, the analyses conducted in this LTCP considered these numerical criteria as Potential Future Recreational Water Quality Standards. 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/100mL)	SB (Fecal Monthly GM – 200 cfu/100mL) SB (Entero rolling 30-d recreational season GM - 35 cfu/100mL)	SB (Fecal Monthly GM - 200 cfu/100mL) SB (Entero rolling 30-d bathing season GM- 35 cfu/100mL)
Primary Contact WQ Criteria(1)	SC (Fecal Monthly GM – 200 cfu/100mL	----	----
Potential Future Primary Contact WQ Criteria(2)	(Entero rolling 30-d recreational season GM – 30 cfu/100mL + STV – 110 cfu/100mL)	(Entero rolling recreational season 30-d GM – 30 cfu/100mL+ STV – 110 cfu/100mL)	SB (Entero rolling bathing season 30-d GM – 30 cfu/100mL + STV – 110 cfu/100mL)

Notes:

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

(1) This water quality standard is not currently assigned to Alley Creek.

(2) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.

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 of primary contact would be in Alley Creek based on a fecal coliform monthly GM – 200 cfu/100mL. Regarding Little Neck Bay, this LTCP assesses existing WQS (Class SB – primary contact recreation). The fecal coliform 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 hereinafter referred to as “Potential Future Primary Contact WQ Criteria” or “Future Primary Contact WQ Criteria” as referred to in the *CSO LTCP for Alley Creek – June 2014*. A complete summary of existing and Potential 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/100mLl 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 $\leq$95 percent at the AC1 location. Attainment results with the future primary contact recreation enterococci standard showed spatial variability among locations: while the attainment with GM of 30 cfu/100mLl enterococci was higher at LNB locations ($\geq$89 percent) during the recreational season, it was significantly lower (48 percent) at the Alley Creek tributary location (AC1). When STV values are taken into account, the attainment values dropped significantly at all locations, ranging from 75 percent at the outer Bay (E11) to 8 percent 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.

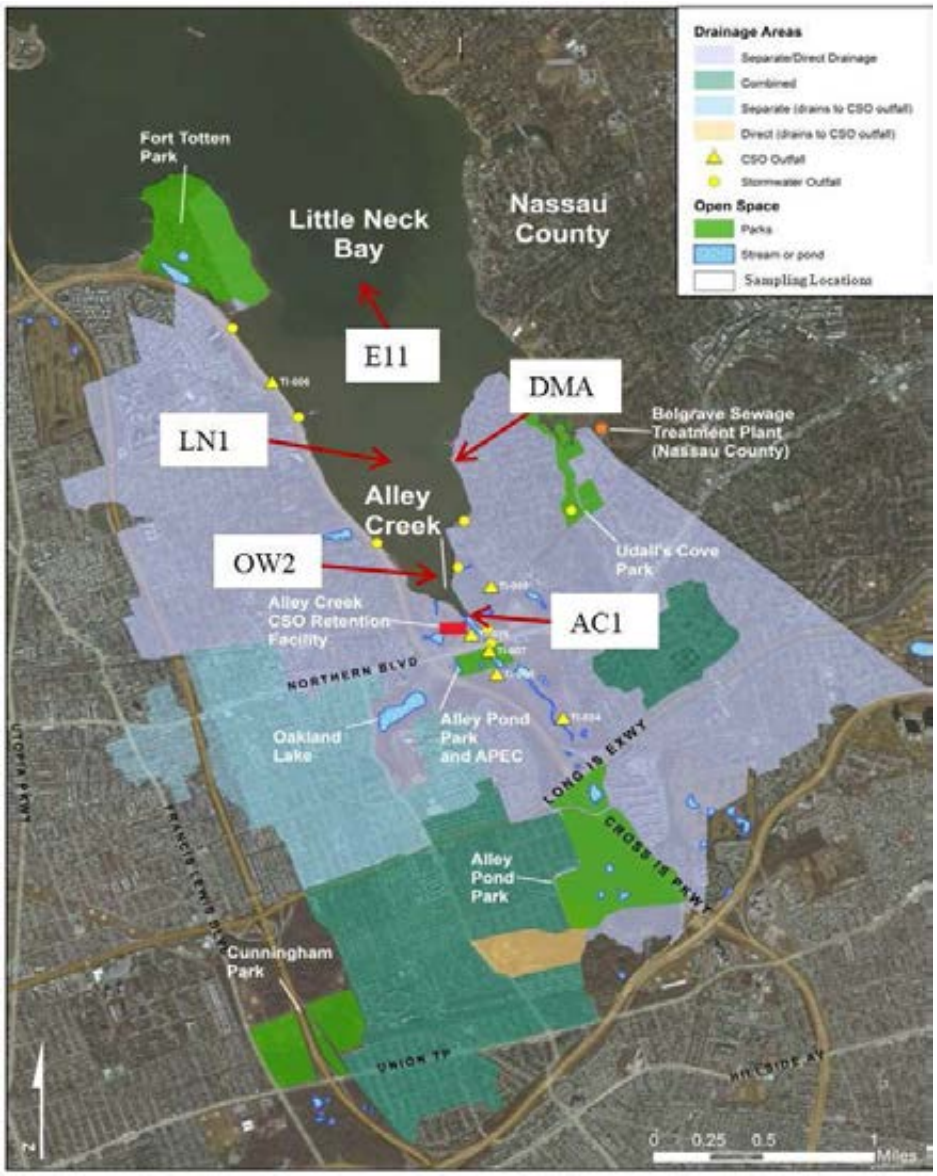
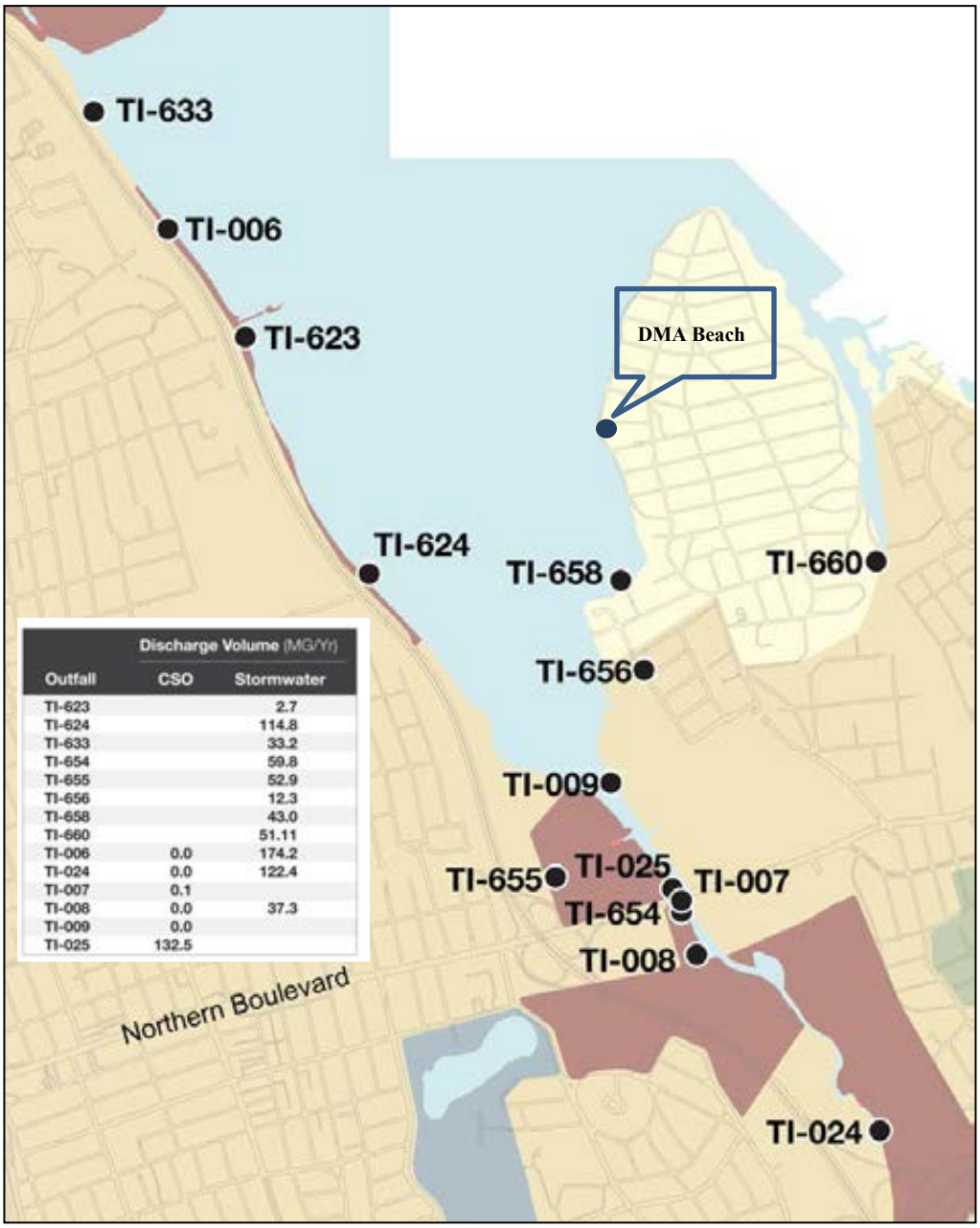


Figure ES-1. Watershed Characteristics and Sampling Locations



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 on-site public properties. However, DEP projects that approximately 45 acres will be managed through on-site 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 stormwater separate drainage area. 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 Potential 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 Potential 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 Waterbody/Watershed Facility Plan (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 the preferred alternative and 100 percent CSO control scenario. 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

Location		Existing WQ Criteria[1]		Alley Creek Primary Contact WQ Criteria (Class SC)		Potential Future Primary Contact WQ Criteria
		Fecal Coliform[2] (%)	Entero[3] (%)	Fecal Coliform[2] (%)	Entero[3] (%)	Entero[4] (%)
Alley Creek	AC1	YES	NA	87	N/A	44
Little Neck Bay	OW2	YES	91	N/A		87
	LN1	YES	YES			94
	E11	YES	YES			YES
Bathing Area	DMA	YES	YES			93

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.
(4) Little Neck Bay including Bathing Area – Attainment shown for 30 MPN/100mL applicable to a 30-day rolling GM during recreational season.

Table ES-3 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)		Potential Future Primary Contact WQ Criteria
		Fecal Coliform[2] (%)	Entero[3] (%)	Fecal Coliform[2] (%)	Entero[3] (%)	Entero[4] (%)
Alley Creek	AC1	YES	NA	94	N/A	54
Little Neck Bay	OW2	YES	YES	N/A		93
	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.
(4) Little Neck Bay including Bathing Area – Attainment shown for 30 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 100 percent CSO control attainment of the STV criterion within Little Neck Bay varies from about 75 percent at WQ Station E11 to about 10 percent at WQ Station OW2.

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 Potential 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 Use Attainability Analysis (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 operation and maintenance (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 Storm Sewers)	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	54[(4)]	59	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

Notes:
(1) CSO annual volume 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.
(4) Remaining untreated CSO volume during the non-recreational season.

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. 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.

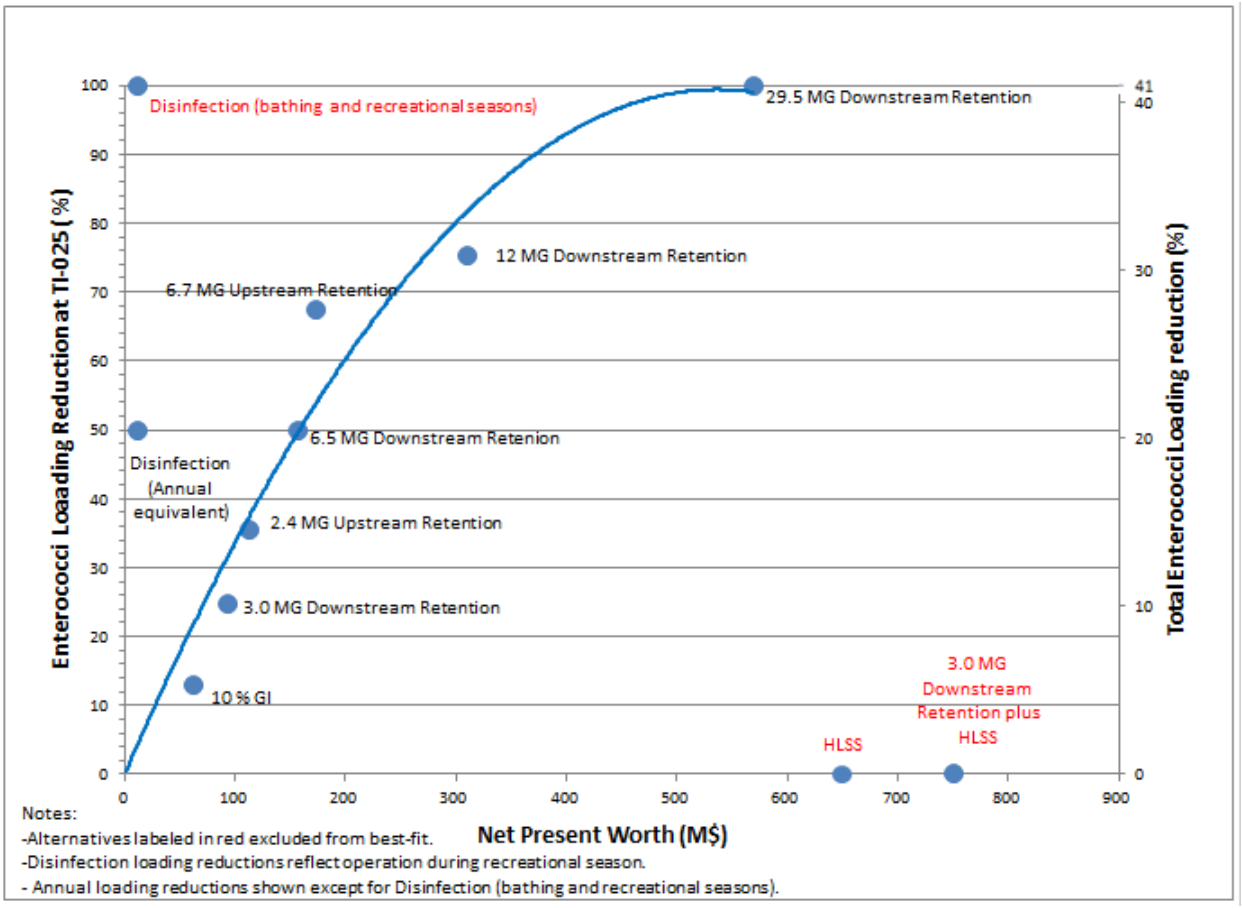


Figure ES-3. Cost vs. Enterococci Loading Reduction - 2008 Rainfall

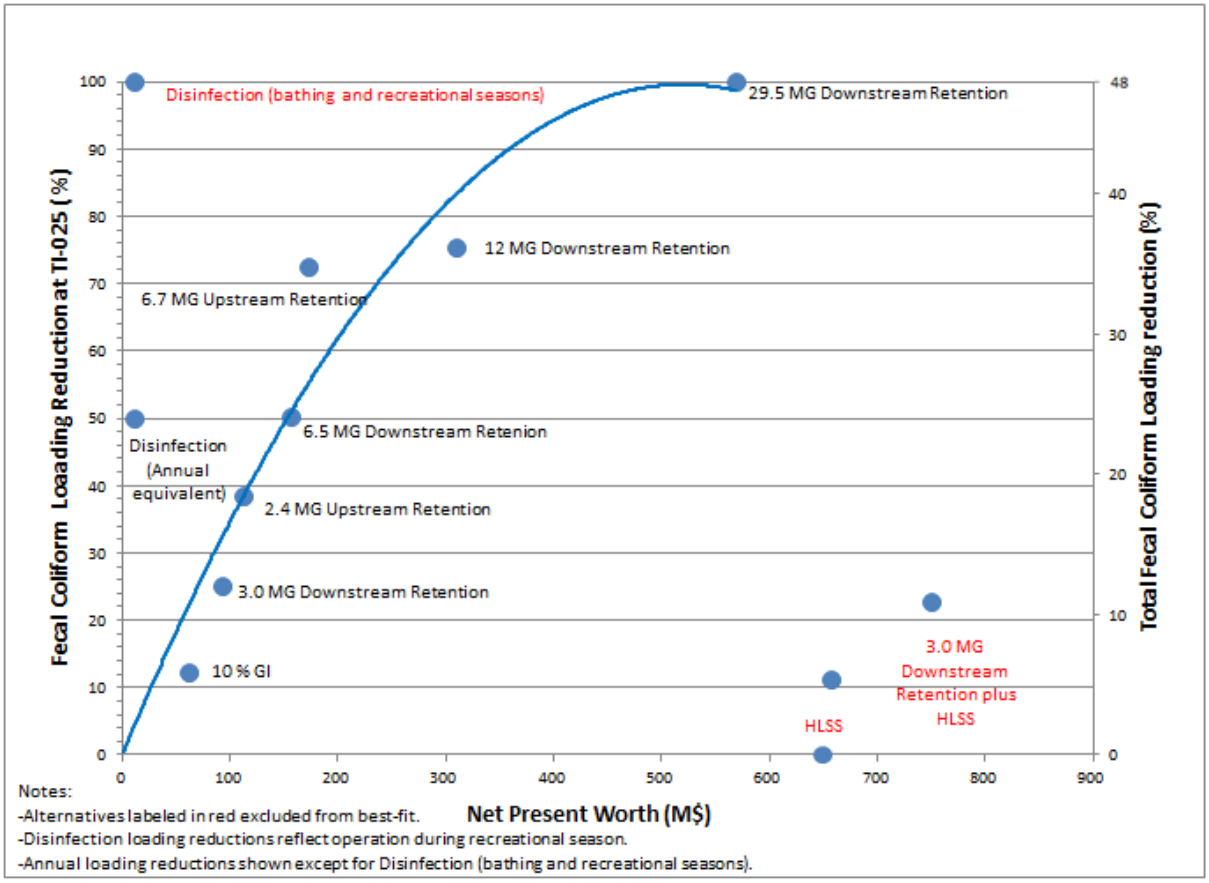


Figure ES-4. Cost vs. Fecal Coliform Loading Reduction – 2008 Rainfall

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 Potential 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, 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 LTCP recommends the continued operation of the Alley Creek CSO Retention Facility with the addition of seasonal disinfection to control human bacteria and has evaluated the compliance with WQS based on the predicted performance of the selected CSO controls.

Achieving the predicted performance of the selected CSO controls 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 non-attainment of Primary Contact WQ Criteria based on projected performance of selected CSO controls in the UAA.

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 through 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 the Potential 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 would be in compliance in Little Neck Bay except for the inner (southern) portions of the Bay (OW2) and DMA.

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)		Potential Future Primary Contact WQ Criteria
		Fecal Coliform[2] (%)	Entero[3] (%)	Fecal Coliform[2] (%)	Entero[3] (%)	Entero[4] (%)
Alley Creek	AC1	YES	N/A	90	N/A	48
Little Neck Bay	OW2	YES	YES	N/A		89
	LN1	YES	YES			YES
	E11	YES	YES			YES
Bathing Area	DMA	YES	YES			94

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.
(4) Little Neck Bay including Bathing Area – Attainment shown for 30 MPN/100mL applicable to a 30-day rolling GM during recreational season.

Attainment of the STV criterion of the Potential 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 30 cfu/100mL and 110 cfu/100mL for the GM and STV criteria, respectively.

Water quality model simulation of DO concentrations and measures of attainment with the numerical WQS are presented in Table ES-6 for the preferred alternative. 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. With the preferred alternative, 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 ES-6, annual DO attainment is between 96 and 99 percent, depending on the area of the Bay.

Table ES-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

UAA, WQ Compliance and Time to Recovery

Since the recommended LTCP alternatives 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 assesses compliance with Primary Contact WQ Criteria and proposes advisories based on the predicted performance of the selected CSO controls.

Water quality modeling analyses were conducted to assess the amount of time following the end of rainfall required for Alley Creek and Little Neck Bay to recover and return to fecal coliform concentrations less than 1,000 cfu/100mL for the recreation periods (May 1st through October 31st) determined from the simulation of the August 14-15, 2008 JFK rainfall event.

The results of this analysis are summarized in Table ES-7 for various locations within Alley Creek and Little Neck Bay. As noted, the duration of time within which fecal coliform bacteria concentrations are expected to be higher than New York State Department of Health (DOH) considers safe for primary contact varies with location. Generally, a value of 24 hours is reasonable for Alley Creek (AC1) and Little Neck Bay (OW2).

Wet weather advisory notifications may be considered for given durations following rain events to protect public health.

Table ES-7. Time to Recovery (hours) to Fecal Coliform Target of 1,000 cfu/100mL

Station	Time to Recovery (hrs) Fecal Coliform Target (1,000 cfu/100mL)		
	Baseline	Preferred Alternative	100% CSO control
AC1	26	10	10
OW2	24	9	9
LN1	20	5	5
DMA	22	-	-
E11	-	-	-

Alley Creek and Little Neck Bay are expected to attain the dissolved oxygen criterion at least 95 percent of the time, the desired target of the DEC. As that goal is attained, both areas are deemed to be in compliance with the DO criterion and there is no need for a UAA as it relates to DO.

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., demonstration, 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 through October 31st). Demonstration will be conducted at the Spring Creek CSO retention facility.

4. The LTCP includes a UAA that assesses compliance with Primary Contact WQ Criteria based on projected performance of the selected CSO controls.

5. A Post-Construction Compliance Monitoring Program will be initiated after the LTCP improvements are operational.

6. DEP will establish with the DOHMH through public notification a wet weather advisory during the recreational season (May 1st through October 31st), during which swimming and bathing would not be recommended. The LTCP includes a recovery time analysis that can be used to establish the duration of the 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.

Section 9.0 presents the implementation of the identified elements in detail. Significant coordination, funding approvals, land acquisitions and permitting will be required for the design and construction. The implementation schedule is depicted in Figure ES-5.

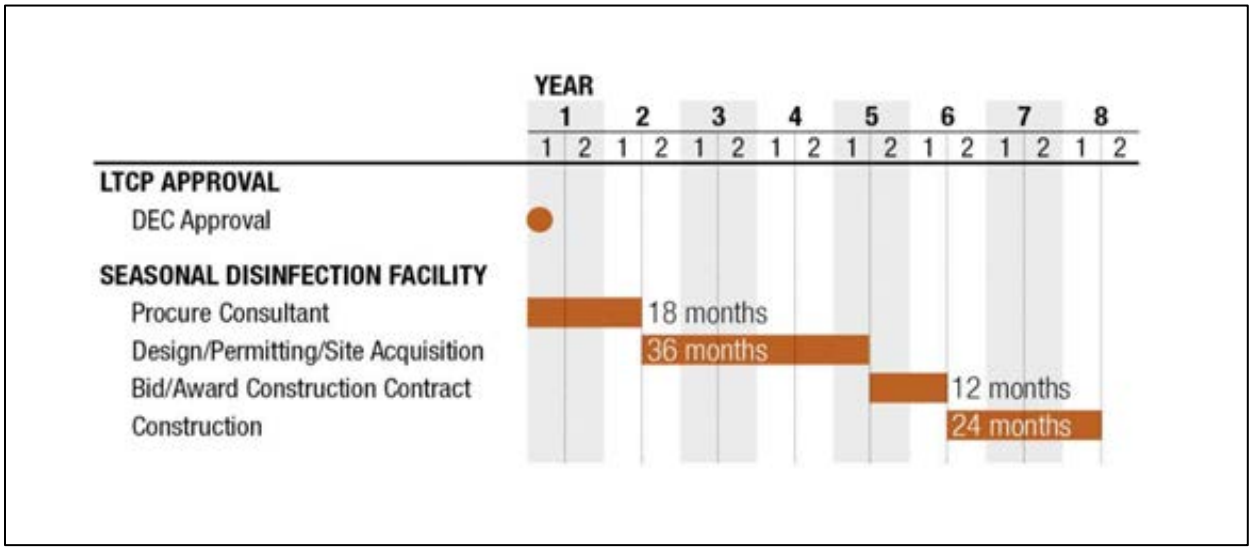


Figure ES-5. Alley Creek Seasonal Disinfection Facility Implementation Schedule

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 the submittal of the Alley Creek LTCP in November 2013, the following significant changes have been included in this May 2015 Supplemental Documentation and prior submittals:

- 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 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 Storm Sewer 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.
- Potential Future RWQC criteria were evaluated. The GM of 30 cfu/100mL and STV of 110 cfu/100mL were applied.
- A recovery time analysis was added to assess the time to return to the fecal coliform target of 1,000 cfu/100mL for the August 14-15, 2008 JFK rainfall event.
- A revised UAA for Alley Creek is provided.

ATTACHMENT 2

Revised Section 6.0: Baseline Conditions and Performance Gap

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 bacteria, 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 NYC. 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 (O&M) 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 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 11 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 on-site 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 Douglas Manor Association (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

Notes:
(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(1)	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(1)	450	255.5	596.1	64,855
	Local Sources	0	0	0	0
	Total	**450**	**255.5**	**596.1**	**64,855**

Notes:
(1) 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 the Potential 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
- Potential 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 through 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/100mL)	SB (Fecal Monthly GM – 200 cfu/100mL) SB (Entero rolling 30-d recreational season GM - 35 cfu/100mL)	SB (Fecal Monthly GM - 200 cfu/100mL) SB (Entero rolling 30-d bathing season GM- 35 cfu/100mL)
Primary Contact WQ Criteria	SC(1) (Fecal Monthly GM - 200 cfu/100mL)	Same as above	Same as above
Potential Future Primary Contact WQ Criteria	(Entero rolling 30-d recreational season GM – 30 cfu/100mL+ STV – 110 cfu/100mL)	(Entero rolling recreational season 30-d GM – 30 cfu/100mL+ STV – 110 cfu/100mL)	SB (Entero rolling bathing season 30-d GM – 30 cfu/100mL+ STV – 110 cfu/100mL)

Notes:
GM = Geometric Mean; STV = 90th Percentile Statistical Threshold Value; NYC DOHMH Bathing Season = Memorial Day to Labor Day; Recreational Season = May 1st through October 31st.
(1) This water quality standard is not currently assigned to Alley Creek.
(2) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.

It should be noted that because Alley Creek is considered a tributary, under the BEACH Act of 2000, the existing enterococci criterion for Class SB would not apply. Also, analyses in this LTCP using the 2012

EPA Recommended Recreational Water Quality Criteria are performed using the 30-day rolling GM of 30 cfu/100mL and the STV of 110 cfu/100mL for enterococci.

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 through 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.

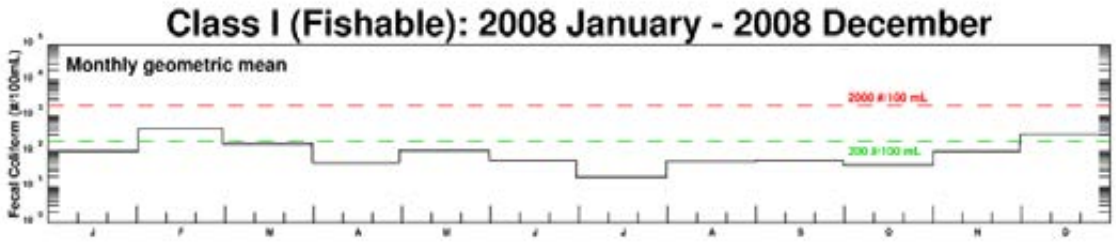


Figure 6-1. Calculated Baseline AC1 Bacteria Concentrations (2008 Rainfall)

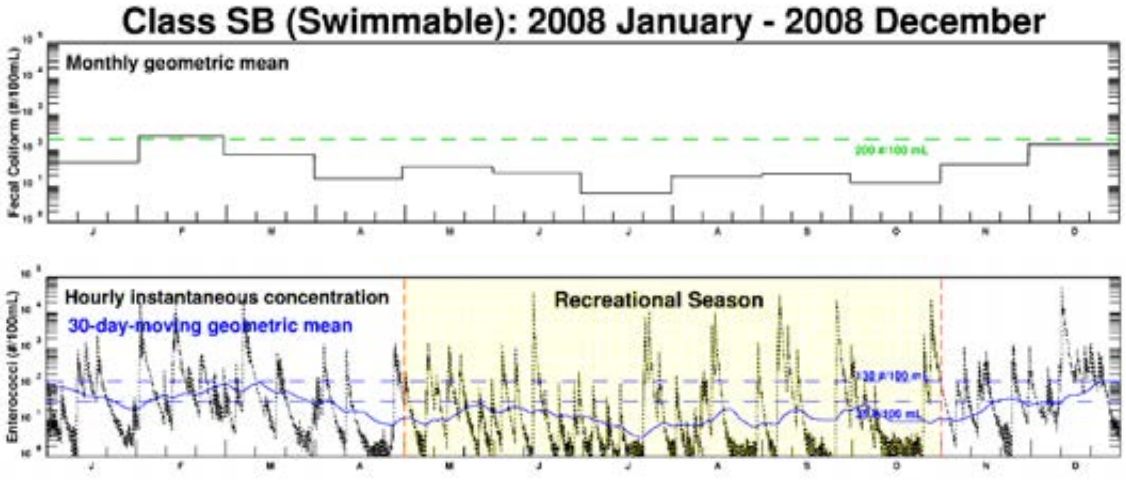


Figure 6-2. Calculated Baseline OW2 Bacteria Concentrations (2008 Rainfall)

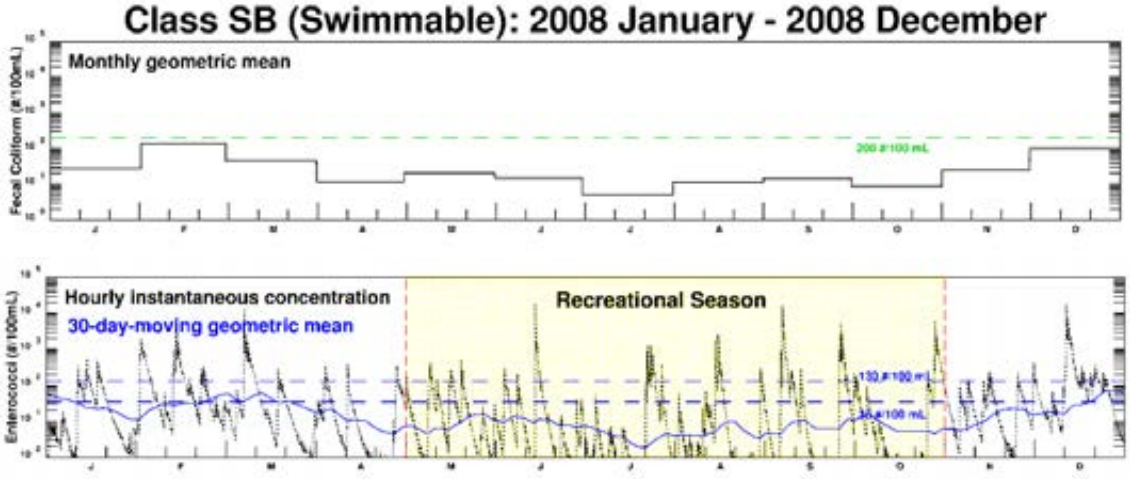


Figure 6-3. Calculated Baseline LN1 Bacteria Concentrations (2008 Rainfall)

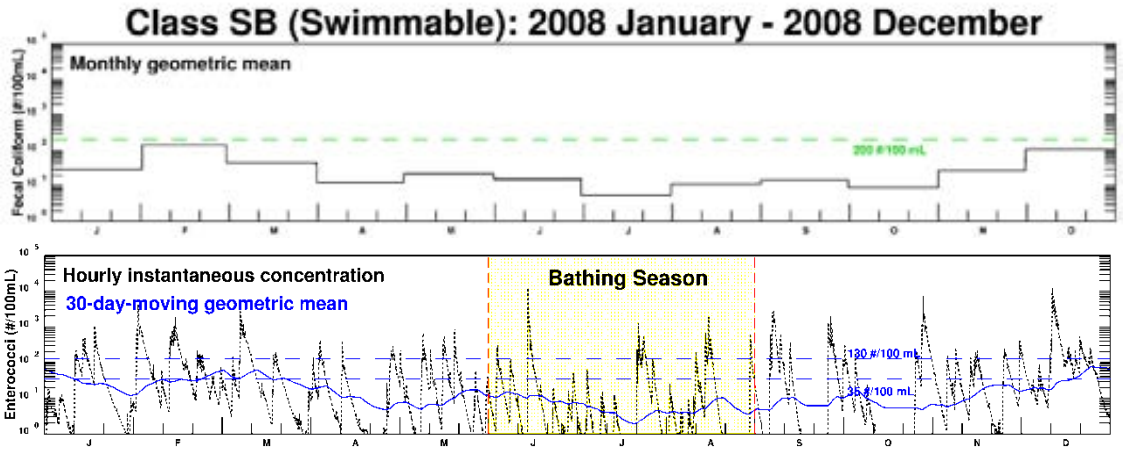


Figure 6-4. Calculated Baseline DMA Bacteria Concentrations (2008 Rainfall)

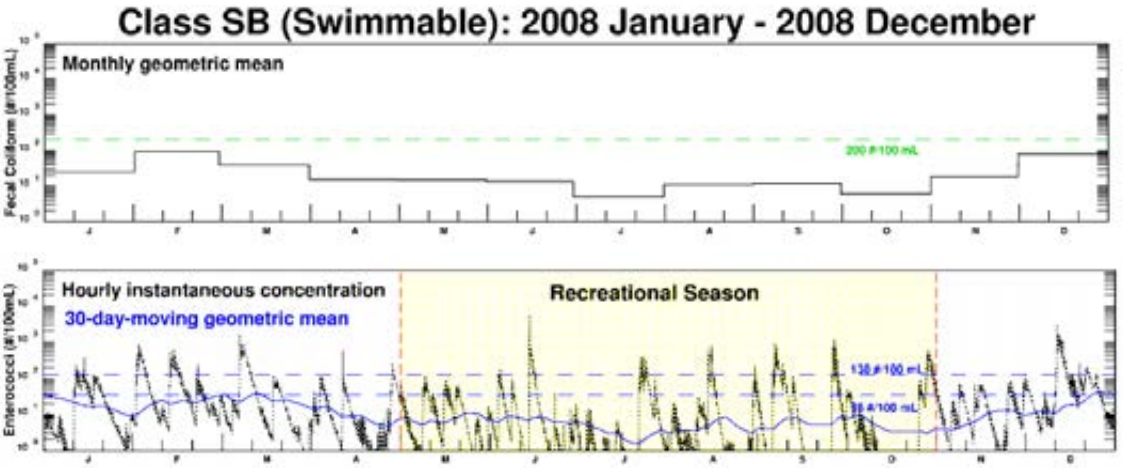


Figure 6-5. Calculated Baseline E11 Bacteria Concentrations (2008 Rainfall)

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.

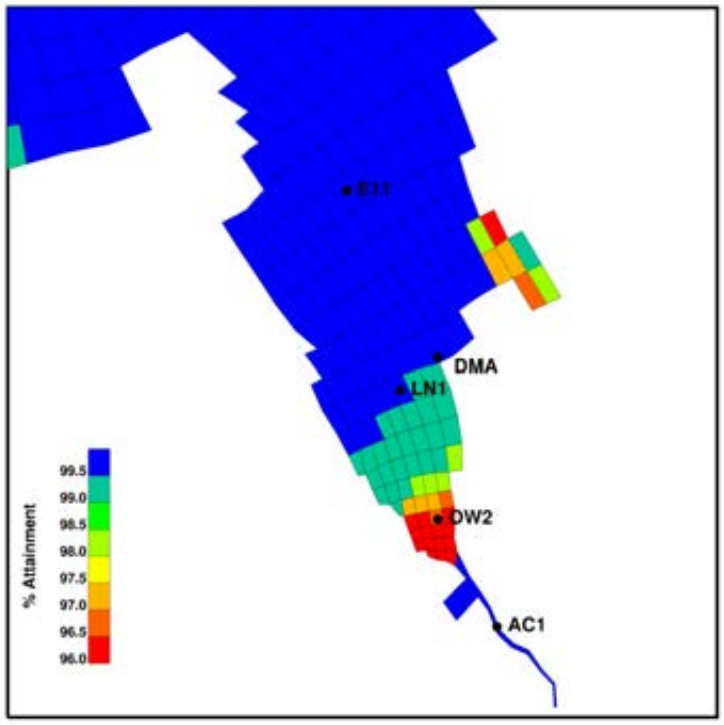


Figure 6-6. 10-Year Attainment of Existing Fecal Coliform Criteria

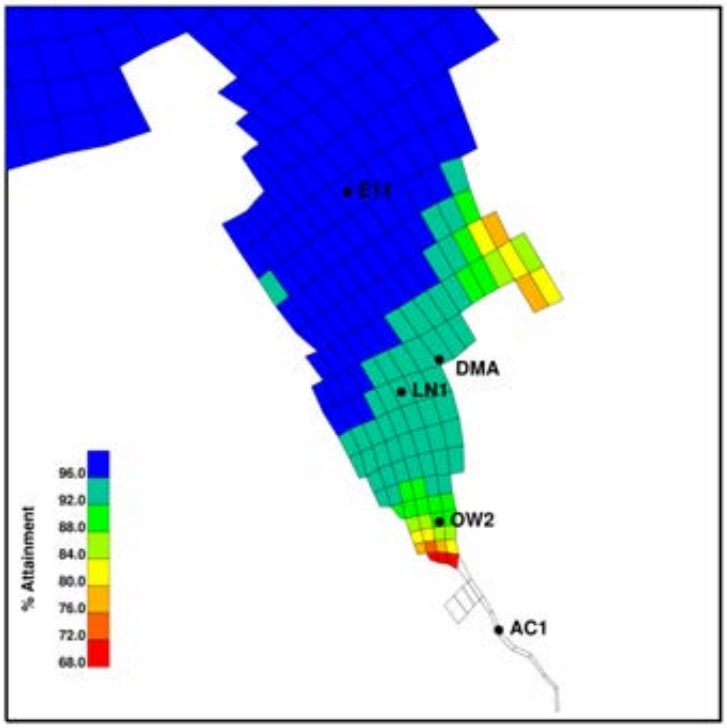


Figure 6-7. 10-Year Attainment of Existing Enterococci Recreational Period Criterion

Table 6-4. Calculated 10-Year Baseline Fecal Coliform(1) 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

Notes:
(1) Monthly GM of 2000 cfu/100mL for AC1 and GM of 200 cfu/100mL for OW2, LN1, E11 and DMA.

Table 6-5. Calculated 10-Year Baseline Enterococci[1] Recreational Period Existing Criterion 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[2]	100	75	100	100	97	100	100	91	100	89	95
E11	100	97	100	100	100	95	100	100	100	97	99

Notes:
(1) 30 day rolling GM of 35 cfu/100mL.l
(2) DMA Attainment Percent based on Bathing Season.

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, and attainment of primary contact for Alley Creek based on a fecal coliform monthly GM – 200 cfu/100mL.

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/100mL) 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.

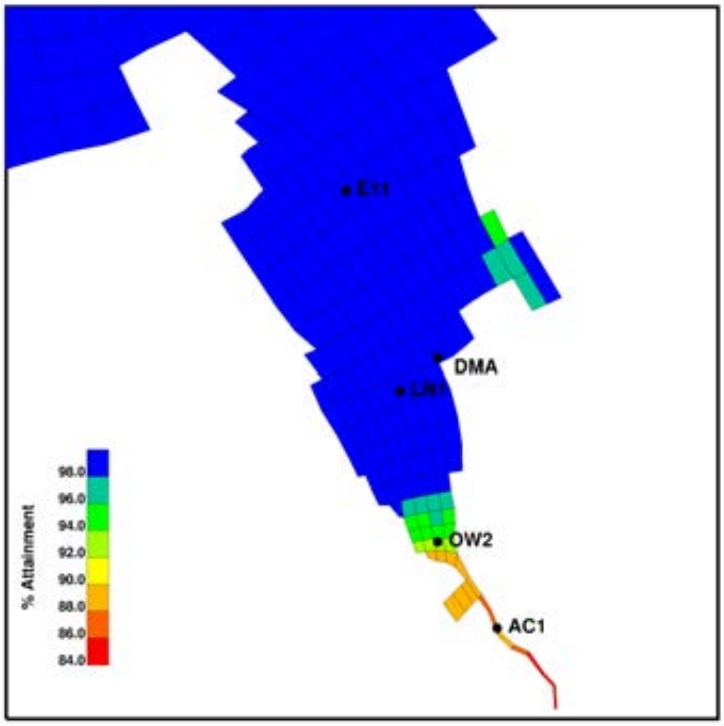


Figure 6-8. 10-Year Attainment of Class SB/SC Fecal Coliform Criterion – Baseline Conditions

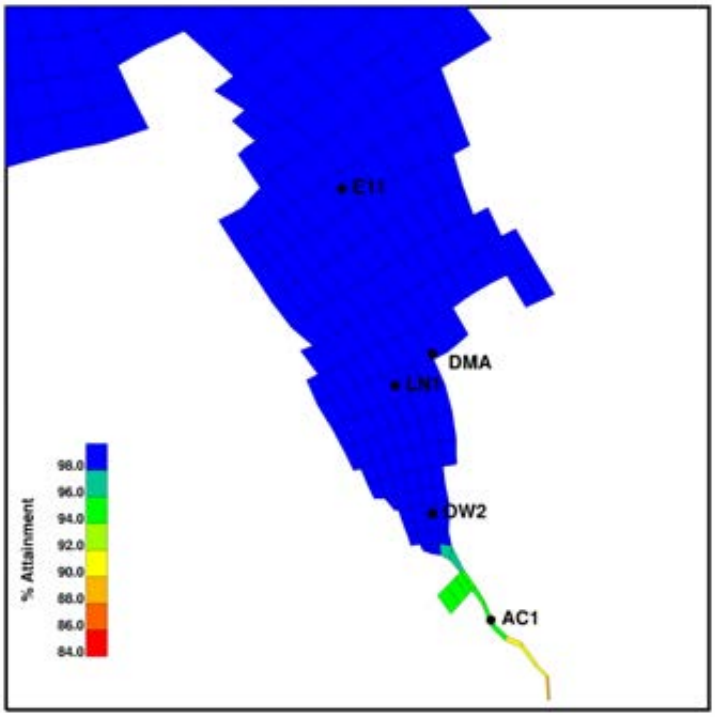


Figure 6-9. 10-Year Attainment of Class SB/SC Fecal Coliform Criterion-100 Percent CSO Control

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.

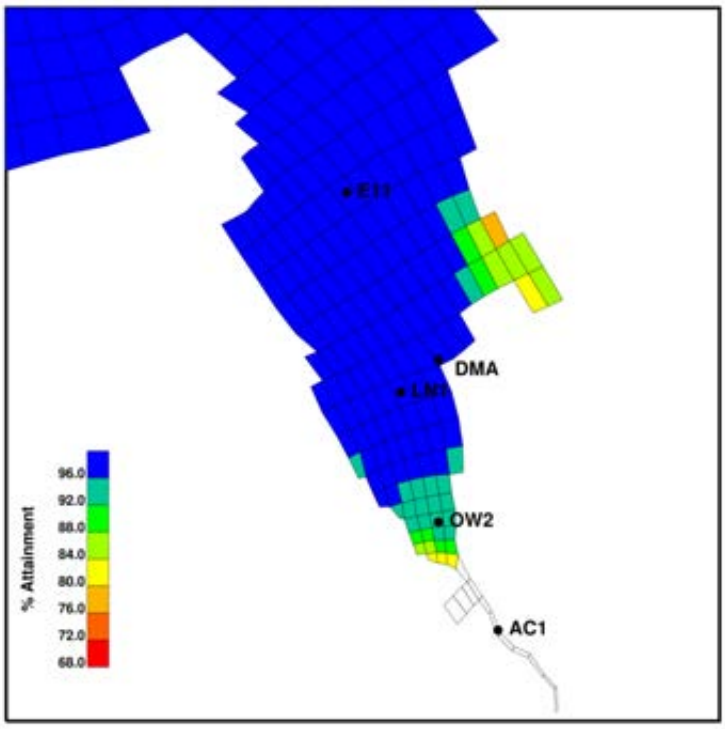


Figure 6-10. 10-Year Attainment with Class SB Recreational Season Enterococci Existing Criterion under the 100 Percent CSO Control

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 Potential 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 RWQC 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 30 cfu/100mL GM and 110 cfu/100mL 90th percentile criteria, to assess attainment with these Potential Future Primary Contact WQ Criteria.

10-Year Long Term Simulation

Figure 6-11 presents the calculated model results for baseline conditions when compared to the Potential Future Primary Contact WQ Criteria of a rolling 30-day GM of 30 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 87 percent; and Alley Creek, where very low (44 percent) attainment is achieved. Table 6-9 presents the attainment at the five chosen stations with the Potential Future Primary Contact WQ Criteria.

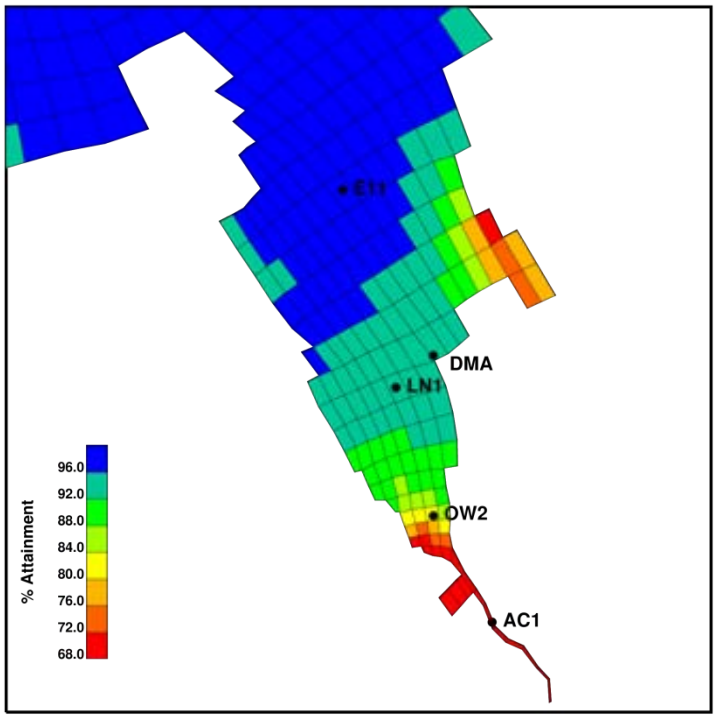


Figure 6-11. Enterococci Recreation Season Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 30 cfu/100mL

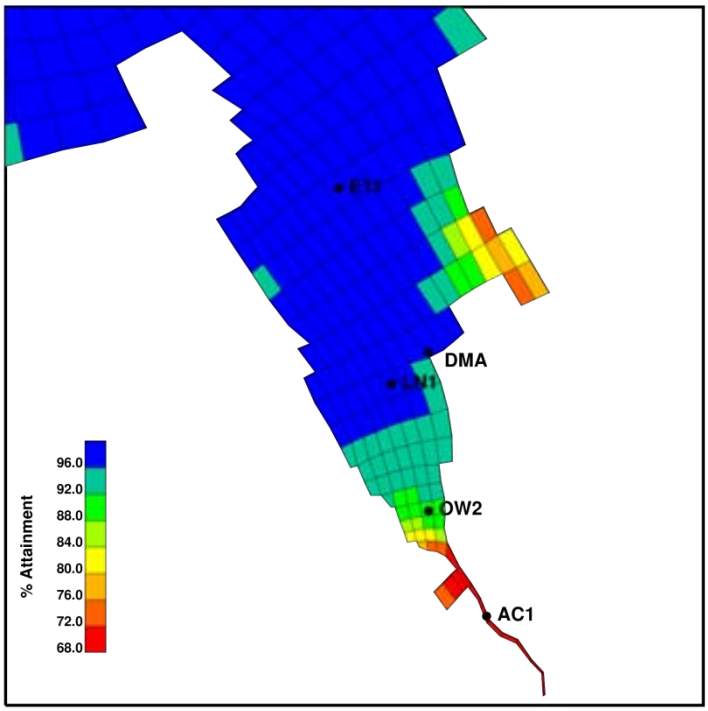


Figure 6-12. Enterococci Recreation Season Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 30 cfu/100mL with 100 Percent CSO Control

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

Station	Enterococci Percent Attainment							
	Baseline				100% CSO Control(1)			
	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

Notes:
(1) 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 10 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 97 percent of the time; however STV attainment would be only 69 percent.

6.3.d CSO Volumes and Loadings Needed to Attain Potential 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 Potential Future Primary Contact Criteria rolling 30-day GM criterion of 30 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.

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 6-10. 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**

.

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**

Notes:

(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 bathing season 30-day GMs to be less than the 2012 EPA RWQC modification criterion of a GM of 30 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.

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; ….

6.3.e Time to Recovery

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.

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 of time following the end of a typical rainfall event required for Alley Creek and Little Neck Bay to recover and return to fecal coliform concentrations less than 1,000 cfu/100mL.

The analyses consisted of examining the water quality model calculation for Alley Creek and Little Neck Bay bacteria concentrations for the selected August 14-15, 2008 JFK rainfall event. The time to return (or "time to recovery") to a 1,000 cfu/100mL fecal coliform concentration was then tabulated for each location within Alley Creek and Little Neck Bay. 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. Based on this information, a storm approximating the 90th percentile storm was chosen from the 2008 recreational period as a design storm. This design storm was the August 14-15, 2008 JFK rainfall event, which resulted in 1.02 inches of precipitation. A principal feature of this storm, aside from its volume, was that the time until the next rainfall allows concentrations time to reach the fecal target concentration.

Table 6-12 presents the time to recovery for the baseline condition and the 100 percent CSO control scenario. Under the baseline conditions, Station AC1 has a time to recovery of 26 hours. DEC has indicated that it is desirable to have a time to recovery of less than 24 hours. The other stations in Little Neck Bay have times to recovery ranging between 20 and 24 hours. Station E11, in the East River, was not calculated to have a concentration greater than 1,000 cfu/100mL during the period after this precipitation event; thus, there is not time to recovery. Once the CSO loading is removed, the maximum time to recovery is 10 hours, at Station AC1, so Alley Creek and Little Neck Bay would be expected to have times to recovery less than 24 hours for a storm of this magnitude. In the case of time to recovery, the gap between the existing time to recovery and the desired time to recovery can be achieved with CSO controls.

Table 6-12. Time to Recovery

Station	Time to Recovery (hours)	
	Fecal Coliform Threshold (1,000 cfu/100mL)	
	Baseline	100% CSO Control
AC1	26	10
OW2	24	9
LN1	20	5
DMA	22	-
E11	-	-

ATTACHMENT 3

Revised Section 8.0: Evaluation of Alternatives

8.0 EVALUATION OF ALTERNATIVES

This section of the Long Term Control Plan (LTCP) describes the development and evaluation of combined sewer overflow (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) for Alley Creek that assesses compliance with Primary Contact WQ Criteria and proposes advisories based on the predicted performance of the selected CSO controls.

8.1 Considerations for LTCP Alternatives under the Federal CSO Policy

This LTCP addresses the water quality goals of the federal Clean Water Act (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 New York City Department of Environmental Protection's (DEP) 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 water quality standards (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 New York State Department of Environmental Conservation (DEC) (referred to herein as Potential Future Primary Contact WQ Criteria). The results indicate that although 100 percent 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 bacteria criteria (94% annual attainment of the Class SC Fecal coliform criterion) or enterococci Potential Future WQ criteria. However, when the Primary Contact WQ Criteria (Class SC) was applied during recreational season, full attainment ($\geq$95%) is observed with 100 percent 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 compliance 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 (ROW) 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 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 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.

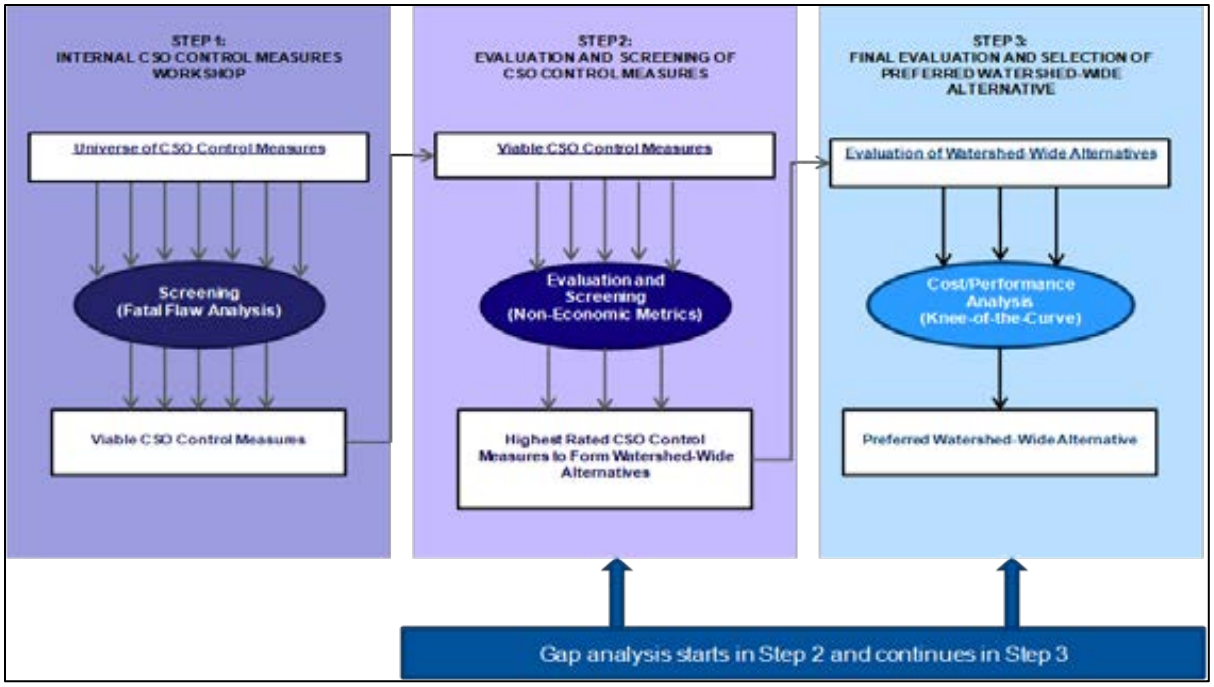


Figure 8-1. Three-Step LTCP Screening and Evaluation Process for Alley Creek and Little Neck Bay Alternatives

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, total suspended solids (TSS), biochemical oxygen demand (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 Storm Sewers (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 Storm Sewers (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	0 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 also referred to as High Level Storm Sewers (HLSS), 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 combined sewer system (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 recalibrated 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 off-line or in-line storage element during wet weather for controlled release into the wastewater treatment plant (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% Capture	75% Capture	50% Capture	25% 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 New York City Department of Parks & Recreation (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.

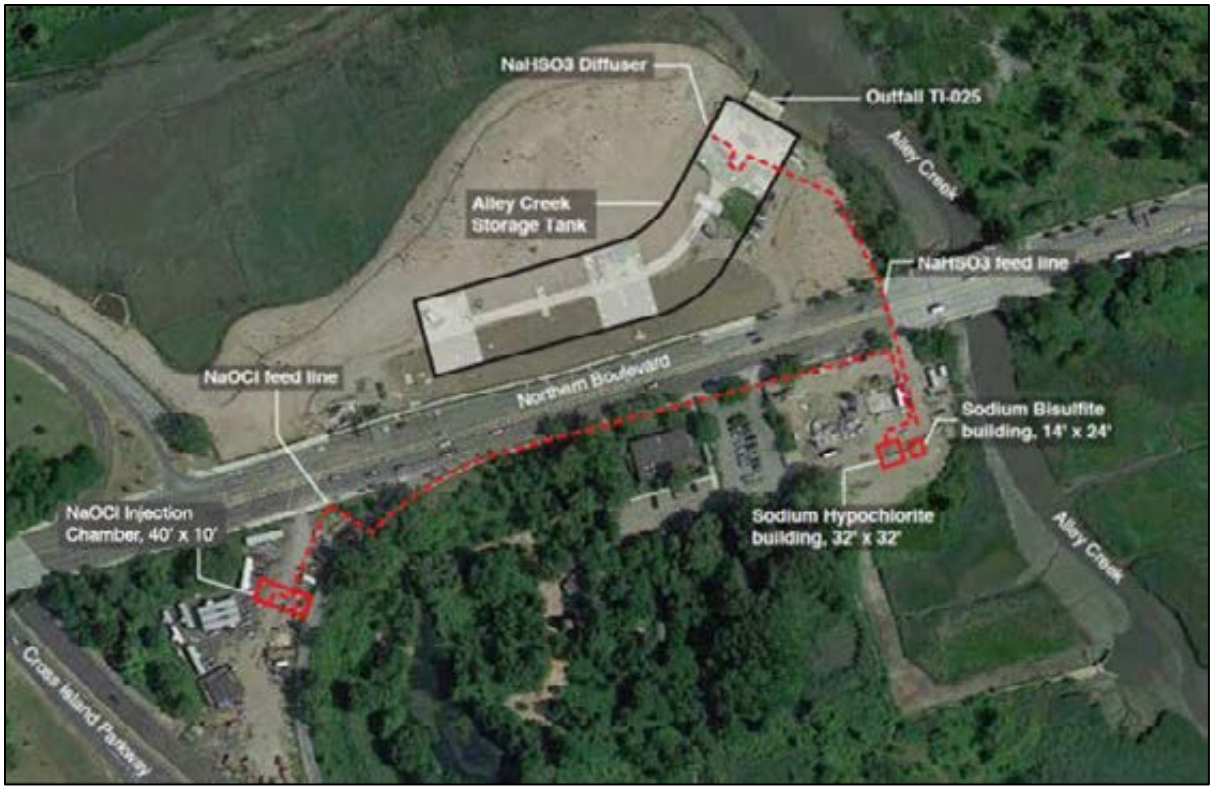


Figure 8-12. Alternative 4 – Disinfection in Existing Alley Creek CSO Retention Facility

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 total residual chlorine (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 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 Attainment (%)	
		Bathing Season, % Attainment	Bathing Season (30-day Rolling), % Attainment	
		Geomean	Geomean	90th percentile
			<=30cfu/100mL	<=110cfu/100mL
Disfection 2-LOG-KILL	AC1	100	22	7
Disfection 4-LOG-KILL	AC1	100	22	7
Disfection 2-LOG-KILL	OW2	100	100	25
Disfection 4-LOG-KILL	OW2	100	100	28
Disfection 2-LOG-KILL	LN1	100	100	88
Disfection 4-LOG-KILL	LN1	100	100	94
Disfection 2-LOG-KILL	E11	100	100	100
Disfection 4-LOG-KILL	E11	100	100	100
Disfection 2-LOG-KILL	DMA	100	100	81
Disfection 4-LOG-KILL	DMA	100	100	81

Note: Fecal coliform percent attainment for 200 cfu/100 mL and 2,000 cfu/100 mL, for Class SB and Class I, respectively, as applicable.

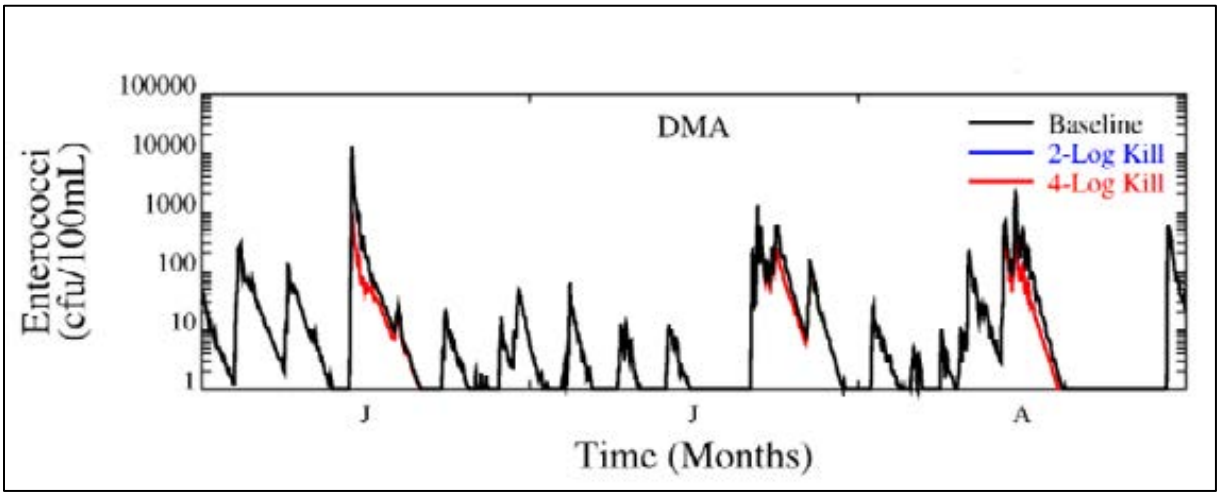


Figure 8-13. Comparison of 2- and 4-Log Reduction Disinfection Strategies for 2008 Conditions

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 demonstration testing will be conducted at the Spring Creek CSO Facility 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 State Pollutant Discharge Elimination System (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 Alley 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 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:

- $104.6x10^{12}$ colonies bacteria removed from the Alley Creek CSO Retention Facility effluent and Alley Creek

- $21.7x10^{12}$ 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 $83x10^{12}$ colonies per year. While fecal coliform was used in this analysis due to the freshwater 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 on-site 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 stormwater 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 Storm Sewers (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)	54(1)	59
5A. 10 Percent GI	112	15
6. Hybrid – HLSS plus 3.0 MG Retention	38	71

Notes:

(1) Remaining untreated CSO volume during the non-recreational season.

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 Retention	244.4	30.7	592.6	36.5
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.

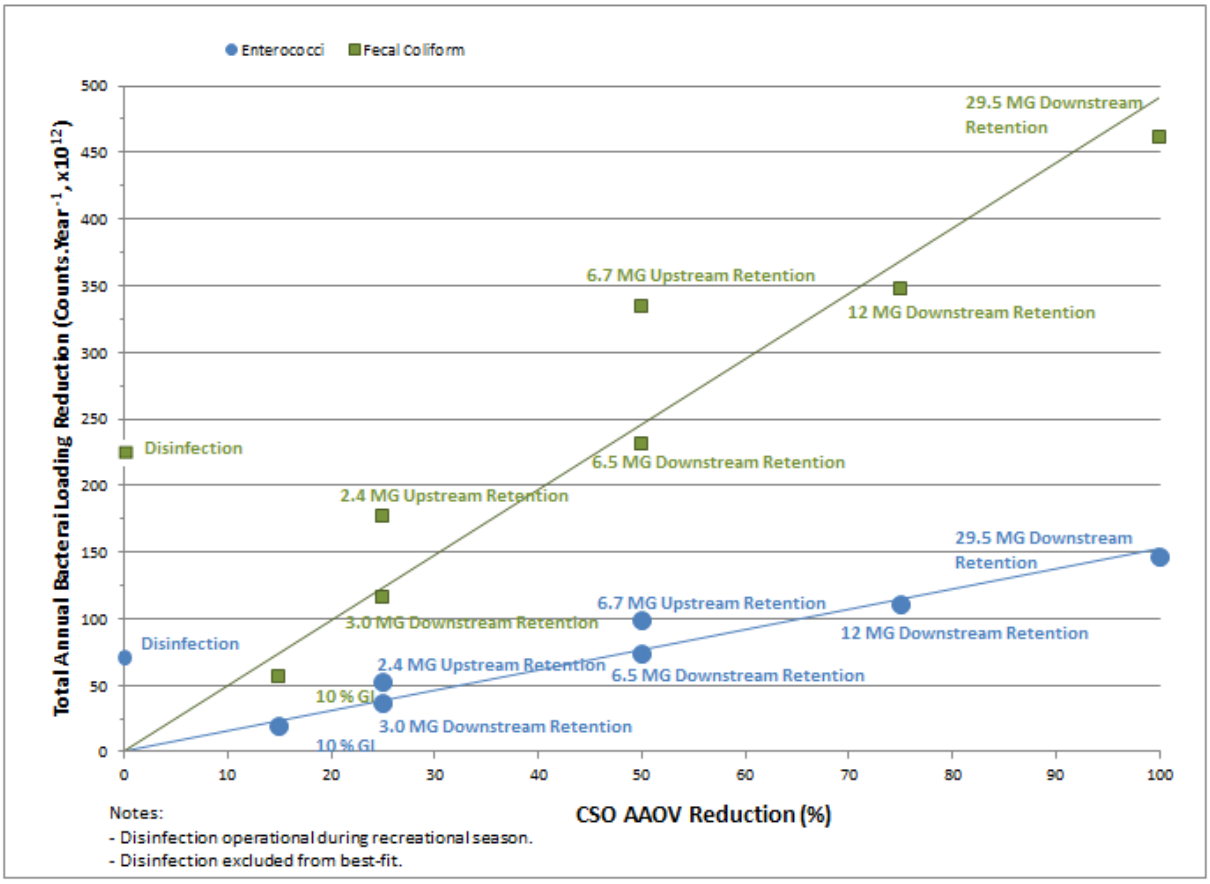


Figure 8-14. CSO Volume Reductions vs. Annual Total Bacteria Loading Reduction - 2008 Rainfall Water Quality Impacts

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 Potential 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 the 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 geometric mean (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 New York City Department of Health and Mental Hygiene (DOHMH) standard for enterococci 95 percent of the time at the DMA Beach with baseline conditions. When 100 percent 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 percent CSO control (Table 6-9, page 6-18). At the transition zone in Little Neck Bay (OW2), 100 percent CSO control alternative resulted in 95 percent 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 O&M 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 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 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 $658M (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

Notes:
(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 PBC 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 through 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 1st through October 31st).

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 1st through October 1st. 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 its 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.

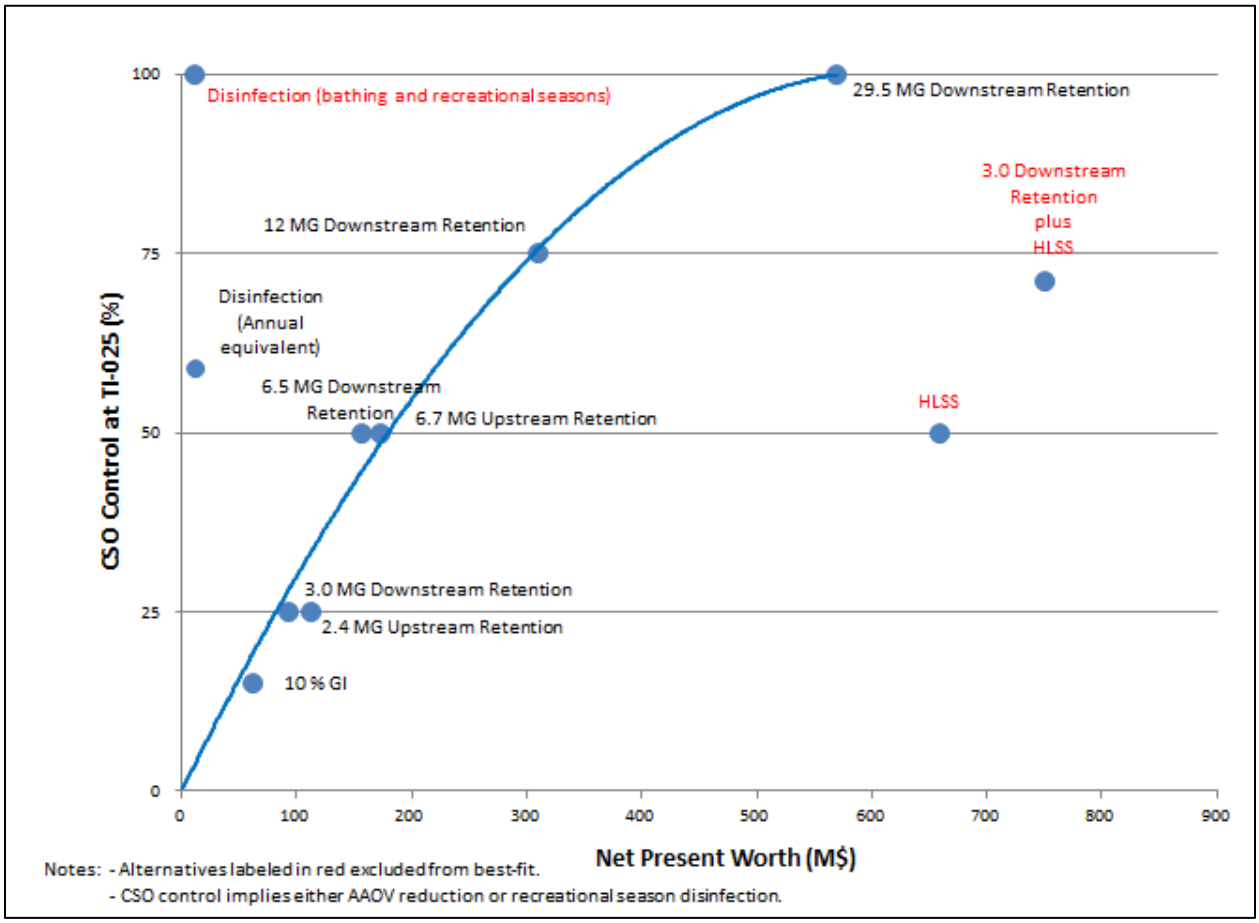


Figure 8-15. Cost vs. CSO Volume Reduction
(except disinfection alternative as noted) - 2008 Rainfall

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 MG 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).

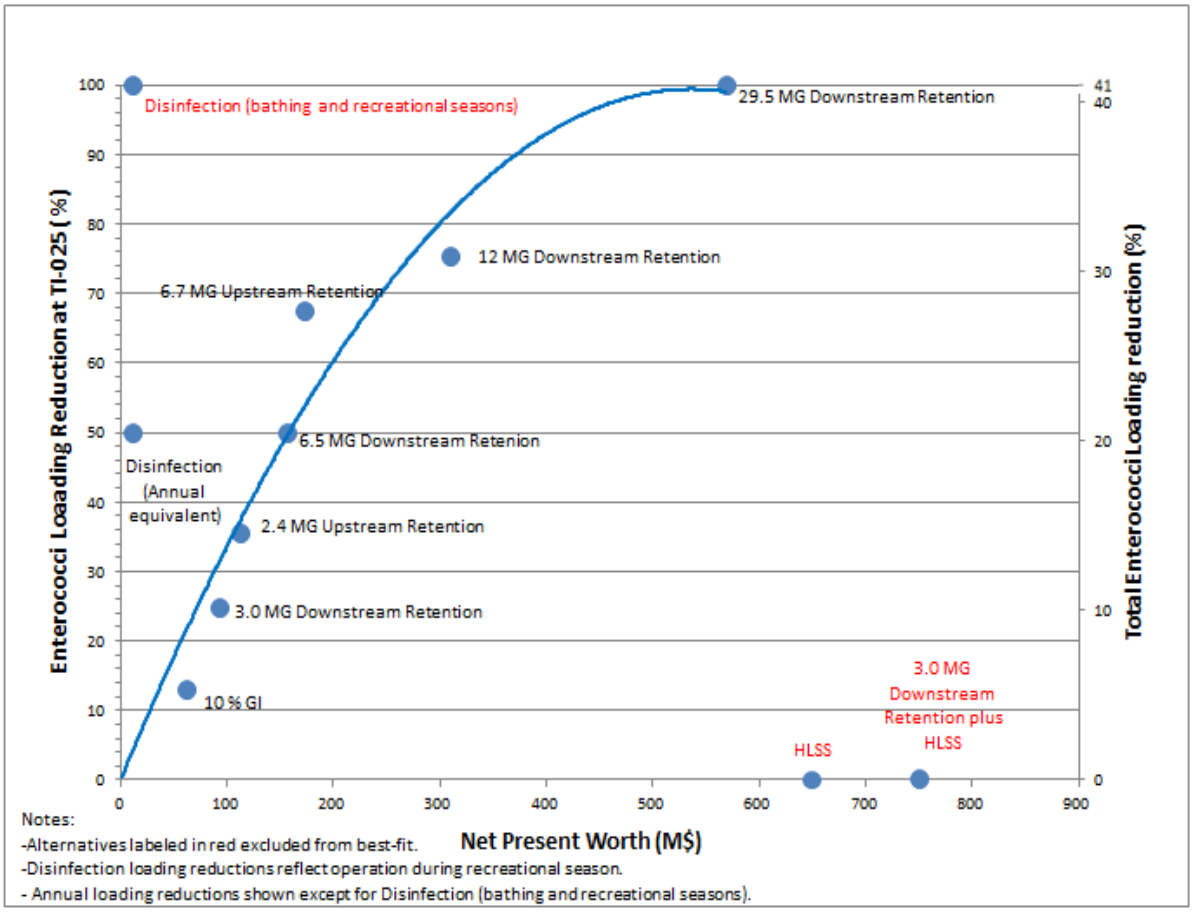


Figure 8-16. Cost vs. Enterococci Loading Reduction - 2008 Rainfall

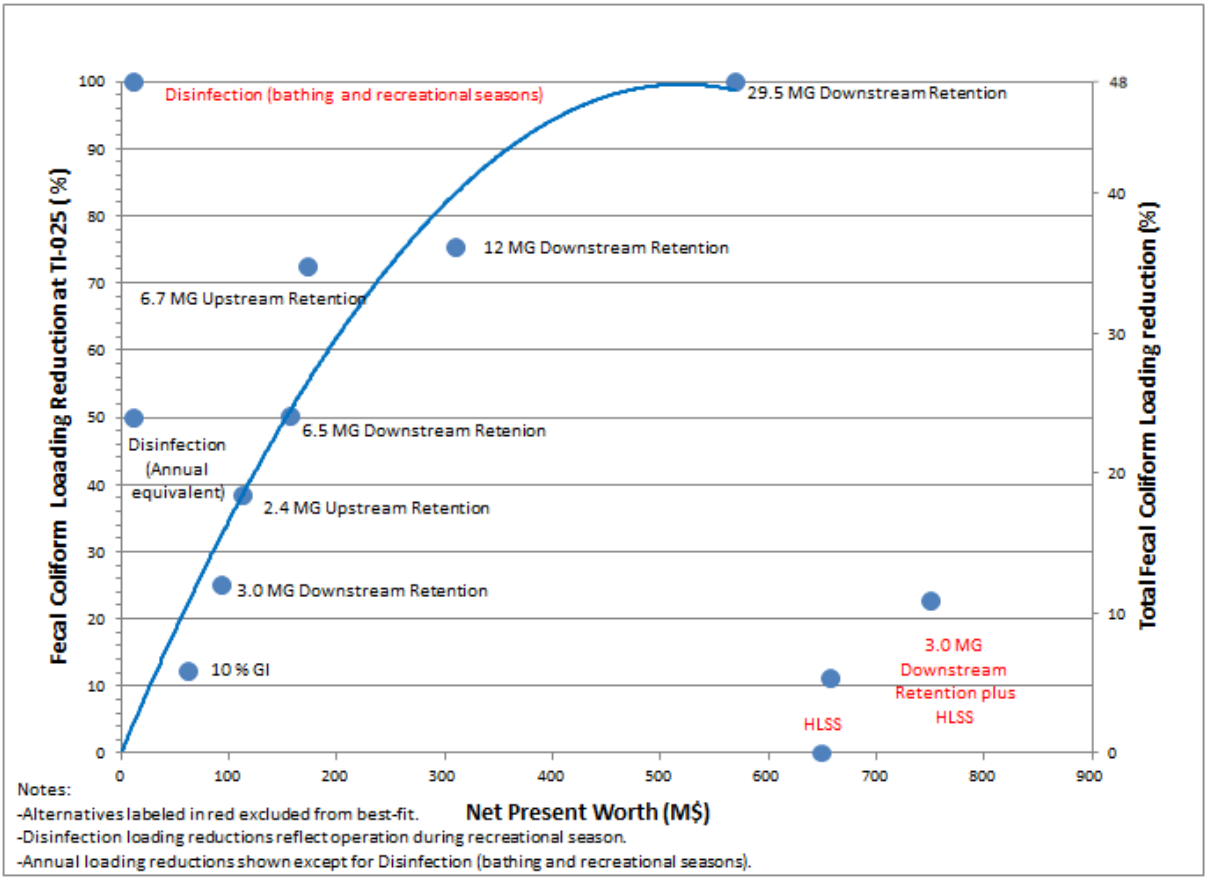


Figure 8-17. Cost vs. Fecal Coliform Loading Reduction – 2008 Rainfall

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 Potential 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 Potential Future Primary Contact WQ Criteria with 2012 EPA RWQC. However, when these attainment points refer to bacteria Existing WQ Criteria, 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 Potential Future Primary Contact WQ Criteria with 2012 EPA RWQC modification to the enterococci criteria, namely the 30 cfu/100mL 30-day rolling GM and a statistical threshold value (STV) of 110 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 91 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 110 cfu/100mL, the performance gap was small, with annual attainment occurring 60 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 11 percent, for the alternative with the greatest improvement (100 percent CSO control).

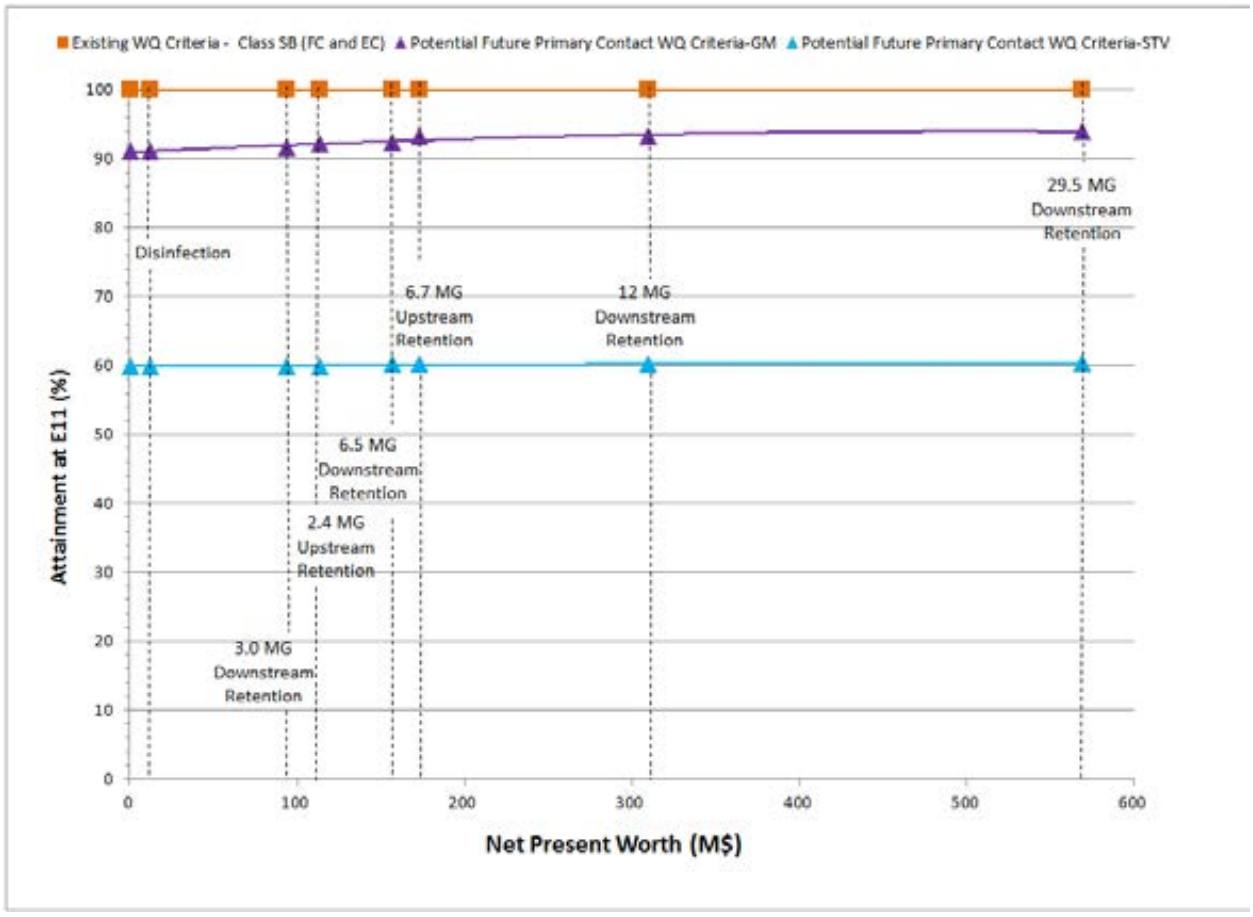


Figure 8-18. Cost vs. Bacteria Attainment near East River (Station E11) – 2008 Rainfall

Figure 8-19 shows the ability of each alternative to attain Class SB WQS at DMA Beach, and summer attainment of DOHMH recreational waters standards as a function of the total project cost. Baseline conditions are in attainment with Existing WQ Criteria (Class SB and DOHMH) 100 percent of the time. Considering Potential Future Primary Contact WQ Criteria with 2012 EPA RWQC, controlling 100 percent of the CSO would result in a maximum five percent increase in annual attainment of the GM 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.

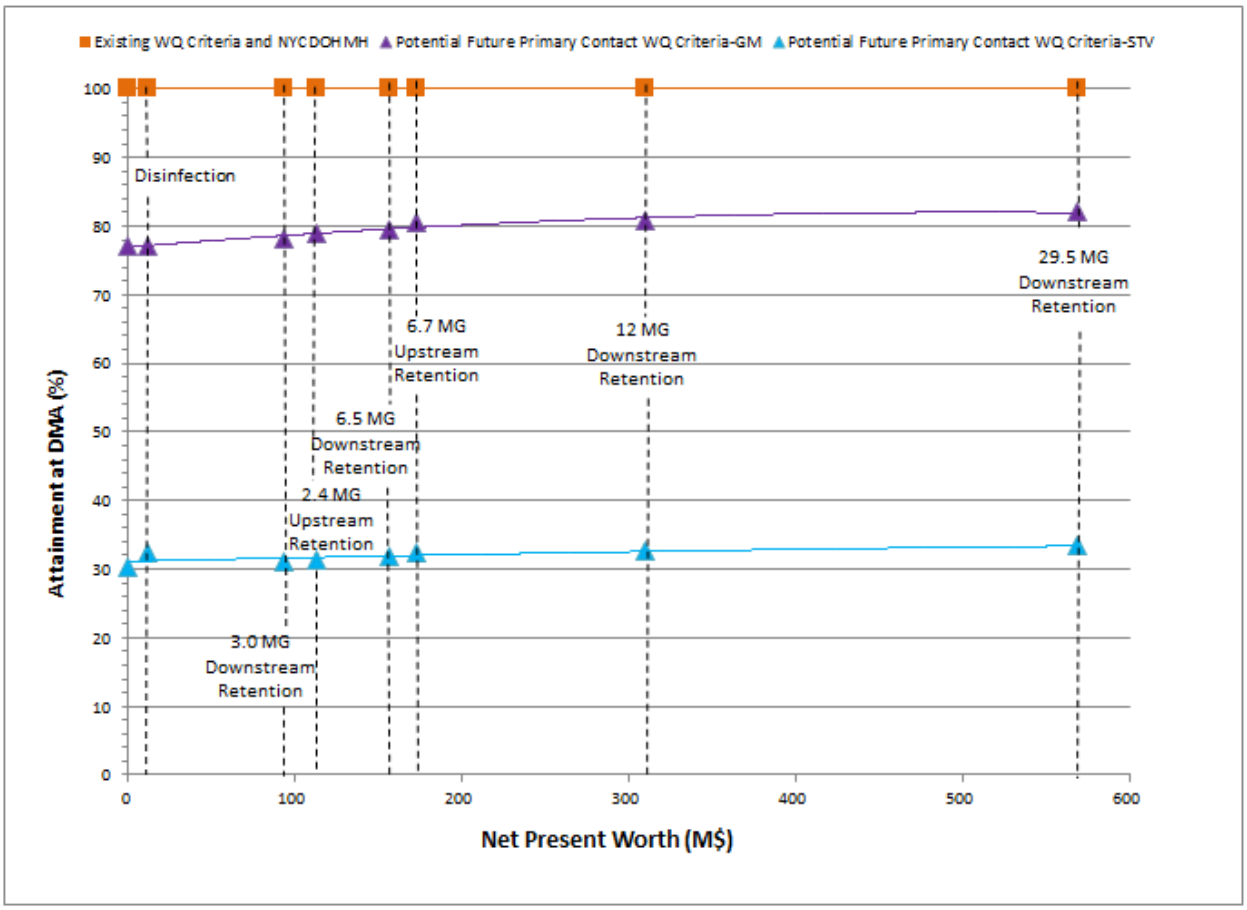


Figure 8-19. Cost vs. Bacteria Attainment at DMA Beach – 2008 Rainfall

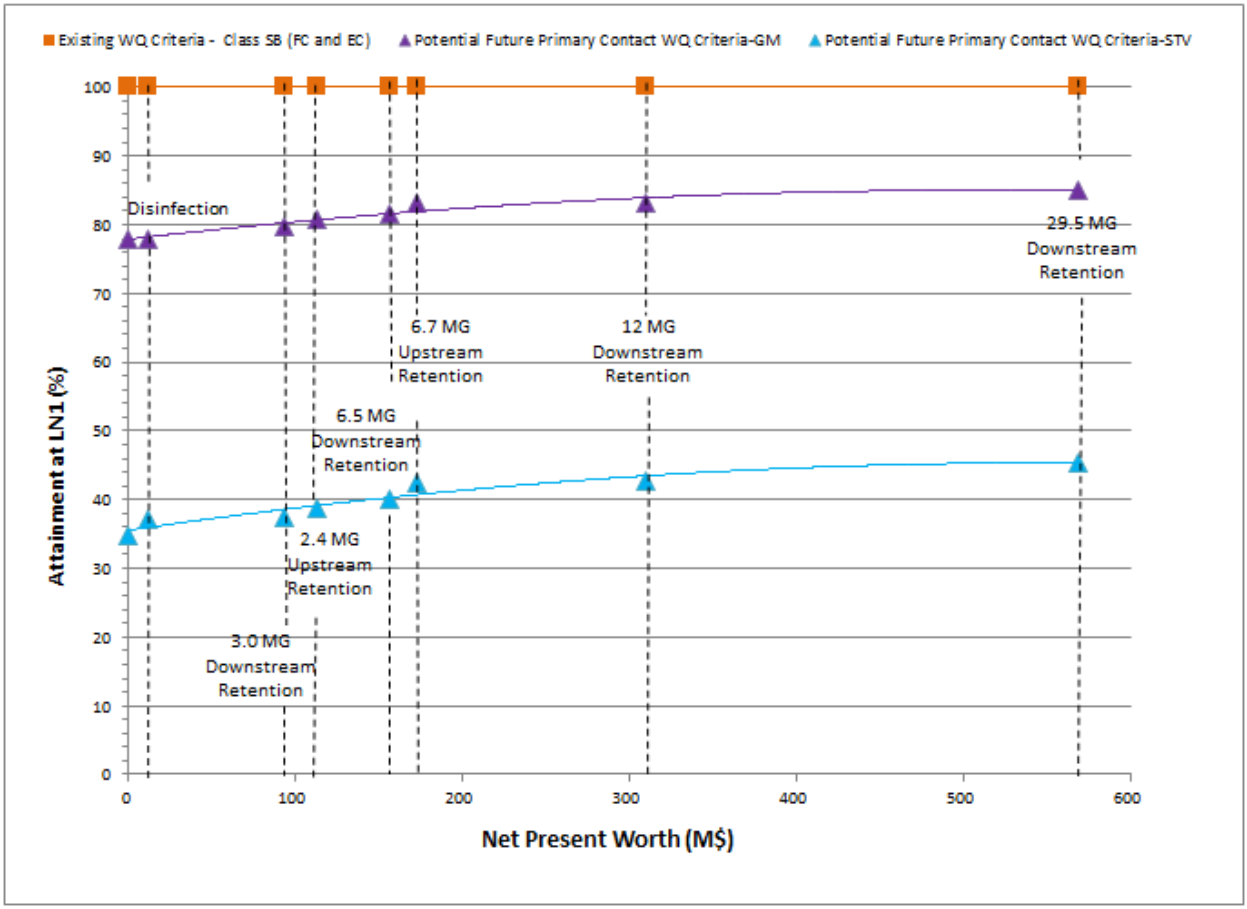


Figure 8-20. Cost vs. Bacteria Attainment at Little Neck Bay (Station LN1) – 2008 Rainfall

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 67 percent of the time regarding the GM criterion, and eight percent of the time regarding the STV criterion. Controlling 100 percent of the CSO would result approximately in a maximum 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 Potential Future Primary Contact WQ Criteria with 2012 EPA RWQC. As shown, the largest improvement would be realized in attaining Potential 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 maximum nine percent increase in attainment over baseline conditions, from 26 percent to 35 percent.

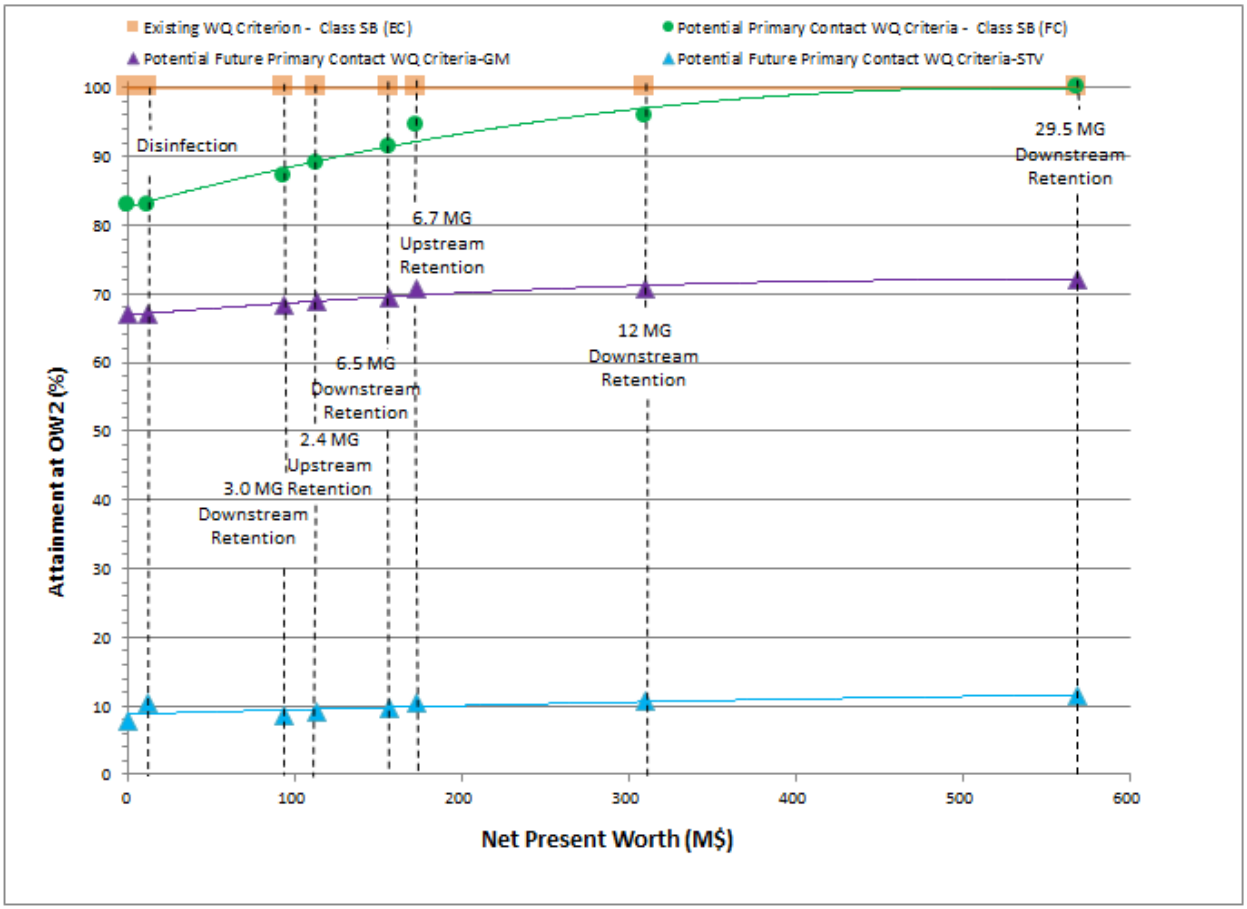


Figure 8-21. Cost vs. Bacteria Attainment at Inner Little Neck Bay (Station OW2) – 2008 Rainfall

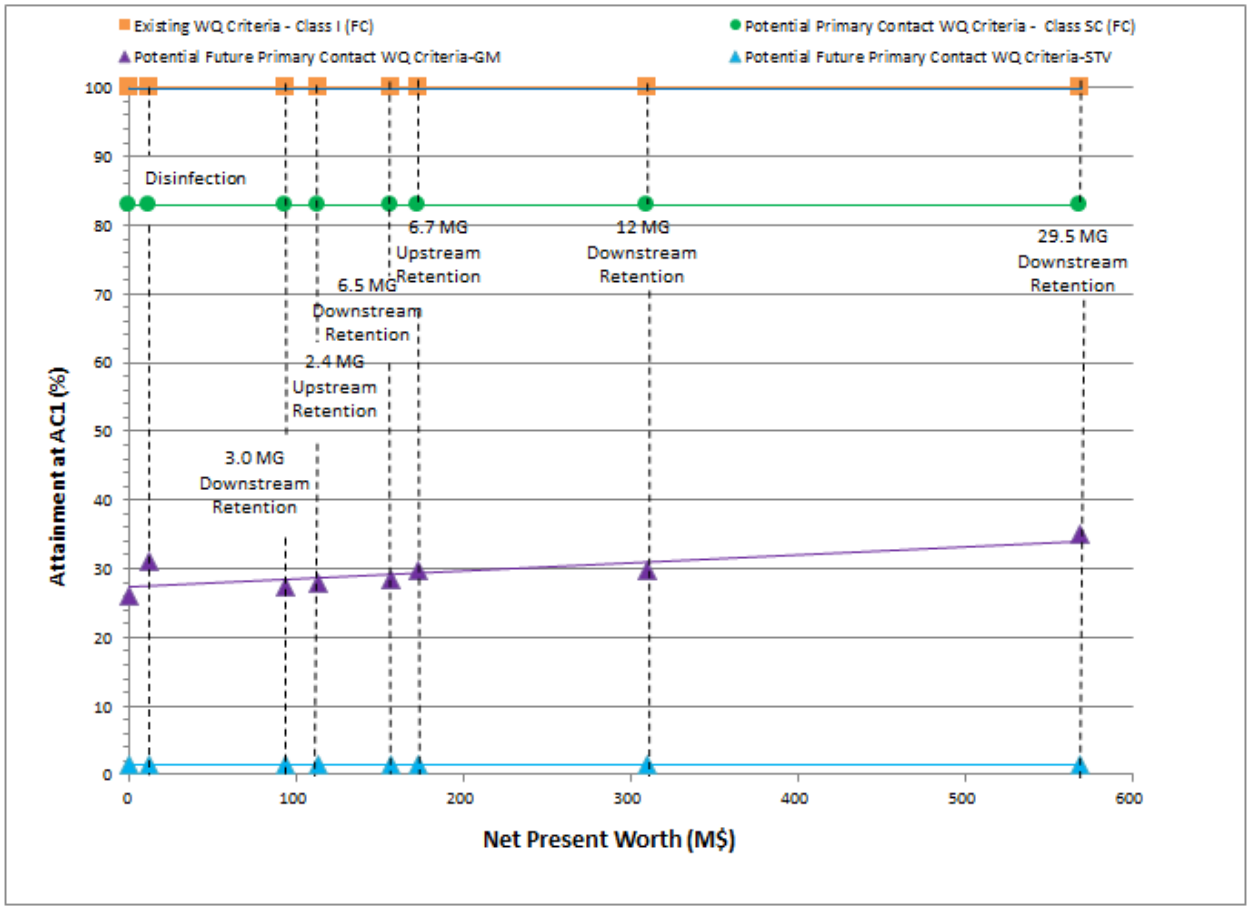


Figure 8-22. Cost vs. Bacteria Attainment at Alley Creek (Station AC1) – 2008 Rainfall

Results show that capturing additional volume of CSO, regardless of the degree of capture, does not significantly improve the attainment of existing or Potential 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 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 Potential 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, depicting spatial and temporal attainment of WQ criteria, 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)		Potential 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	Enterococci ≤30(2)	89
	LN1	Fecal ≤200	99	Fecal ≤200	99	Enterococci ≤30(2)	95
	E11	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤30(2)	99
	DMA	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤30(2)	94
		Enterococci ≤35(1)	99	Enterococci ≤35(2)	99		

Notes:
(1) Bathing season (Memorial Day – Labor Day).
(2) Recreational season (May 1st through 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)		Potential Future Primary Contact WQ Criteria	
		Criterion	Attainment (%)	Criterion	Attainment (%)	Criterion	Attainment (%)
Alley Creek	AC1	Fecal ≤2,000	100	Fecal ≤200	98	Enterococci ≤30(2)	48
						STV≤110(2)	8
Little Neck Bay	OW2	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤30(2)	89
		Enterococci ≤35(2)	95	Enterococci ≤35(2)	95		
						STV≤110(2)	25
	LN1	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤30(2)	95
		Enterococci ≤35(2)	99	Enterococci ≤35(2)	99		
						STV≤110(2)	51
	E11	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤30(2)	99
		Enterococci ≤35(2)	100	Enterococci ≤35(2)	100		
						STV≤110(2)	75
	DMA	Fecal ≤200	100	Fecal ≤200	100	Enterococci ≤30(2)	94
		Enterococci ≤35(1)	99	Enterococci ≤35(2)	99		
						STV≤110(2)	50

Notes:
(1) Bathing season (Memorial Day – Labor Day)
(2) Recreational season (May 1st through 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 (Potential 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/100mL enterococci) at all LNB locations, it drops significantly for the recreational periods for the Potential 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.

The WQ model was also used to characterize WQS attainment for the recommended alternative by running the model for a 1-year simulation period as was done for the baseline to assess the impacts on dissolved oxygen of the recommended alternative. Since the recommended alternative is to provide disinfection to the CSO overflows during the recreational season, it was assumed that there would be no change in CSO overflow volumes or organic carbon loadings associated with the proposed alternative. The results of these runs were the same as provided for the baseline condition in Tables 6-6 and 6-8. Model results indicate that Alley Creek will attain the existing and Class SC criterion in excess of the DEC desired target of 95 percent annual attainment.

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 CWA, 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 "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 waterbody to its original condition or to operate such modification in a way that would result in the attainment of the use; or

5. Physical conditions related to the natural features of the waterbody, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

6. Controls more stringent than those required by Sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

As part of the LTCP, elements of a UAA, including the six conditions presented above, will be used to determine if changes to the designated use 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 compliance 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 and 36 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 30 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 as part of the 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 the upstream tributary section 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.

Fecal Coliform

The recommended alternative summarized in Section 8.5 results in the following levels of bacteria 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 recreational season criterion of 30 cfu/100mL enterococci is predicted (Table 8-18) to be 48 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 Potential Future Primary Contact WQ Criteria (2012 EPA RWQC). However, the recommended alternative results in full attainment ($\geq$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 30 cfu/100mL, except in a small portion of the Inner Bay, close to the mouth of Alley Creek and at DMA, but not for the STV portion of the 2012 EPA RWQC criteria throughout, should they be implemented in the future. The results summarized above and in Table 8-18 indicate that Little Neck Bay attains WQ compliance (primary contact) with the recommended plan except for a small transition zone which come close to compliance (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.

Dissolved Oxygen

Alley Creek and Little Neck Bay are expected to attain the dissolved oxygen criterion at least 95 percent of the time, the desired target of the DEC. As that goal is attained, both areas are deemed to be in compliance with the DO criterion and there is no need for a UAA as it relates to DO.

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 Potential 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)	Potential Future Primary Contact WQ Criteria[(1)]
Alley Creek		YES	NO	NO
Little Neck Bay	Inner Bay	YES	N/A	NO
	Outer Bay	YES	N/A	YES
DMA Beach		YES	N/A	NO

Notes:
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 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 Potential 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 the recreational season.

8.7 Water Quality Goals

A goal of the CWA 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 potential 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 2012 EPA RWQC primary contact recreation geometric mean criteria (GM or STV) cannot be fully attained in Alley Creek nor in Little Neck Bay (STV value throughout and GM at the Inner Bay portion and DMA) even with this additional level of protection. Therefore, DEP is proposing that: (a) DEP would issue advisories for periods when elevated bacteria concentrations are present in primary contact waters; and (b) 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 DOHMH certified bathing beaches for many years (http://www.nyc.gov/html/doh/html/environmental/beach-homepage.shtml).

Based on the analyses of these 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 sometimes, 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.

8.7.a 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. 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 of time following the end of a typical rainfall event required for Alley Creek and Little Neck Bay to recover and return to fecal coliform concentrations less than 1,000 cfu/100mL.

The analyses consisted of examining the water quality model calculation for Alley Creek and Little Neck Bay bacteria concentrations for the selected August 14-15, 2008 JFK rainfall event. Details on the selection of this storm event is provided in Section 6 of this LTCP. The time to return (or "time to recovery") to a 1,000 cfu/100mL fecal coliform concentration was then tabulated for each location within Alley Creek and Little Neck Bay. The results of this analysis are summarized in Table 8-20 for various locations within these waterbodies. As noted, the duration of time within which fecal coliform bacteria concentrations are expected to be higher than New York State Department of Health (DOH) considers safe for primary contact varies with location. Generally, a value of around 24 hours is reasonable for Alley Creek (AC1) and Little Neck Bay (OW2). Wet weather advisory notifications may be considered for given durations following rain events to protect public health.

Table 8-20. Time to Recovery (hours) to Fecal Target of 1,000 cfu/100mL

Station	Time to Recovery (hrs) Fecal Coliform Target (1,000 cfu/100mL)
	Preferred Alternative
AC1	10
OW2	9
LN1	5
DMA	-
E11	-

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. demonstration, 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 through October 31st). Demonstration will be conducted at the Spring Creek CSO retention facility.

4. The LTCP includes a UAA that assesses compliance with Primary Contact WQ Criteria based on the projected performance of the selected CSO controls.

5. A post-construction compliance monitoring program will be initiated after the LTCP improvements are operational.

6. DEP will establish with the NYC Department of Health and Mental Hygiene, through public notification, a wet weather advisory during the recreational season (May 1st through October 31st), during which swimming and bathing would not be recommended. The LTCP includes a recovery time analysis that can be used to establish duration of the wet weather advisory for public notification.

Section 9.0 presents the implementation of the identified elements.

ATTACHMENT 4

Revised Appendix E: Alley Creek Use Attainability Analysis

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.

Fecal Coliform

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 was found to be meeting recreational season fecal coliform criteria 98 percent while the annual attainment was lower (90%). On the other hand, the attainment was 64 percent for enterococci criteria during the recreational season. There are multiple factors that might be affecting the achievement of higher pathogen attainments in Alley Creek such as discharges from direct drainage, combined sewer overflow (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, although such improvement is not sufficient to bring the waterbody into compliance with the Primary Contact WQ Criteria on an annual basis. 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, providing an assessment of compliance with seasonal Primary Contact WQ Criteria in Alley Creek based on projected performance of the selected CSO controls, and recommending the implementation of a wet weather advisory period.

Dissolved Oxygen

Alley Creek and Little Neck Bay are expected to attain the dissolved oxygen criterion at least 95 percent of the time, the desired target of the DEC. As that goal is attained, both areas are deemed to be in compliance with the DO criterion and there is no need for a UAA as it relates to DO.

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 water quality standards (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.

7. Stringent than those required by sections 301(b) and 306 of the Clean Water 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.

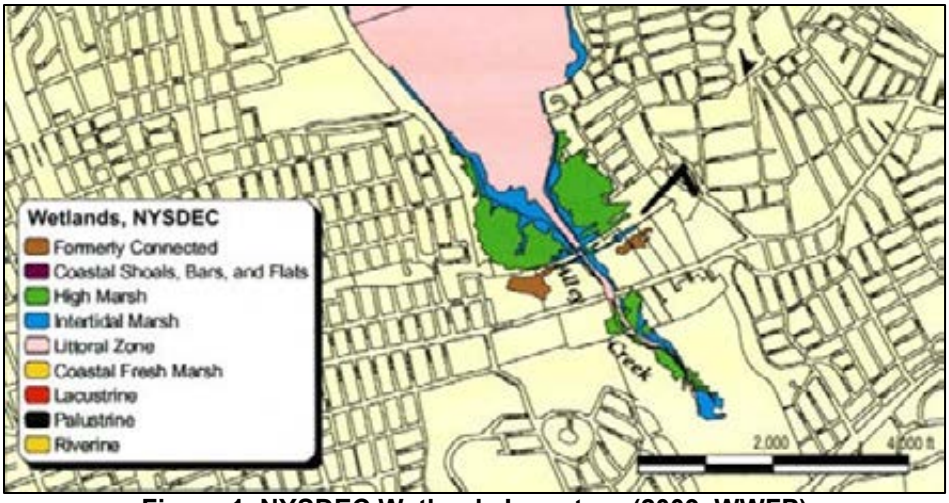


Figure 1. NYSDEC Wetlands Inventory (2009, WWFP)

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 Long Island Rail Road (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 Long Island Expressway 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 of primary contact for Alley Creek based on a fecal coliform monthly GM – 200 cfu/100mL.

Water quality modeling indicates that the existing Class I WQS (fecal coliform bacteria) would be achieved with the recommended LTCP projects. While the attainment with primary contact enterococci criterion is not anticipated in Alley Creek, the primary contact fecal coliform attainment is projected to be higher both annually (90%) and during recreational season (98%). There are multiple factors that might be affecting the ability to achieve higher pathogen attainments in Alley Creek such as discharges from direct drainage, combined sewer overflow (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. An analysis was also conducted during the development of the LTCP using the August 14-15, 2008 JFK rainfall event to determine the time to recovery in Alley Creek. Although primary contact uses cannot be attained in Alley Creek, DEP used the primary contact fecal coliform recreation criterion of 1,000 cfu/100mL from the New York State Department of Health (DOH) guidelines. The analysis indicated that a time to recovery of 24 hours at WQ Station AC1 is adequate to allow fecal coliform concentrations to return to 1000 cfu/100mL or less. 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. However, with the selected CSO controls in place, the Primary Contact WQ Criteria can be attained seasonally. As such, an advisory period is recommended for Alley Creek 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.

ATTACHMENT 5

Revised Appendix G: Disinfection Approach for Alley Creek CSO Retention Facility

The Interim Disinfection Facility previously discussed in Appendix G of the *Combined Sewer Overflow Long Term Control Plan for Alley Creek* dated June 2014 LTCP is no longer being proposed. Instead, DEP is preparing a new scope of work for the Spring Creek CSO disinfection demonstration study and has been granted until May 1, 2015 to submit this to DEC. Therefore, Appendix G of the Alley has been eliminated in its entirety.