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

Combined Sewer Overflow Long Term Control Plan for Flushing Creek Appendix F: 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 March 23, 2015, on the December 2014 Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) for Flushing Creek. The Supplemental Documentation is now made part of the referenced LTCP as Appendix F.

The LTCP, as supplemented herein, summarizes DEP's plans for managing the CSO discharges into Flushing Creek 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 areas 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 and a Revised Appendix E, Use Attainability Analysis as Attachment 2. Collectively, the Supplemental Documentation and attachments, plus the original December 2014 submittal, constitute the overall revised Flushing Creek LTCP.

It should be noted that in addition to responding to specific comments in the above referenced letter, the revised ES and revised UAA also reflect modifications that DEP and DEC agreed upon relative to the reference to attainment of DO criteria.

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 December 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 December 2014 LTCP, both the original figures and the revised figures were included in the Supplemental Documentation. The revised figures are identified as such (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 COMMENTS

DEC Comment No. 1a on the *Flushing Creek LTCP*:
The City should incorporate revisions consistent with previous guidance provided by the Department for the Alley Creek, Westchester Creek, and Hutchinson River LTCPs, such as an analysis of Time to Recover for the baseline, 100 percent CSO removal, and selected alternative scenarios using the August 2008 design storm; elimination of site-specific targets, etc. that are relevant for the Flushing Creek LTCP.

***DEP Response*:**
Based upon the applicable comments provided by DEC on the abovementioned LTCPs, the following modifications to the CSO LTCP for Flushing Creek December 2014 have been made:

***Global modification to Combined Sewer Overflow Long Term Control Plan for Flushing Creek December 2014*:**

- *Where it reads: "Future Primary Contact Water Quality Criteria"; it should read: "Potential Future Primary Contact Water Quality Criteria"*

In response to DEC comment No. 1 on the Alley Creek LTCP, DEP notes that certain language was included in the Flushing Creek December 2014 LTCP submittal to reserve DEP's rights pursuant to the Article 78 litigation directly related to the Alley Creek LTCP. DEP has removed and/or modified language in the LTCP as set forth below and in the attached supplement to make it consistent with prior submittals, as applicable. 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. The table below summarizes revisions to the modified language.

Type	Language
December 2014 LTCP Table ES-1 and Table 6-3 Notes 1, 2 and 3 and Footnote 1	(1) DEC has publicly noticed a proposed rulemaking~~ which, if promulgated, would~~ to amend 6 NYCRR Parts 701 ~~to require that the quality of Class I and Class SD waters be suitable for "primary contact recreation" and to adopt corresponding total and fecal coliform standards in 6 NYCRR Part~~ and 703. The proposed total and fecal coliform standards for Class I are the same as the existing standards for Class SC waters. (2) This water quality standard ~~criteria~~ is not currently assigned to Flushing Creek.~~ For such criteria to take effect, DEC must first adopt the criteria in accordance with rulemaking and environmental review requirements.~~ (3) ~~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.~~ [1]The Flushing Creek LTCP evaluates compliance with various primary contact WQ numerical limits including the Primary Contact fecal coliform WQ Criteria (Class SC WQS). With ~~the~~ DEC's December 3, 2014 proposed rulemaking ~~by DEC~~ to change Class I fecal coliform bacteria criteria to 200 cfu/100mL, Class SC and proposed Class I fecal coliform criteria would both retain the 200 cfu/100mL limitation. ~~As such, the term Class SC criteria used in this LTCP is interchangeable with the proposed Class I numerical criteria when used in the context of bacteria WQ limits.~~
December 2014 LTCP Page 1-3 Footnote	~~[1]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.~~
December 2014 LTCP Page 2-37	Currently, DEC is conducting its federally-mandated "triennial review" of the NYS WQS~~, in which States are required to review their WQS every three years~~. DEC has publicly noticed a proposed rulemaking ~~which, if promulgated, would~~ to amend 6 NYCRR Parts 701 ~~to require that the quality of Class I and Class SD waters be suitable for "primary contact recreation", and to adopt corresponding total and fecal coliform standards in 6 NYCRR Park~~ and 703. The proposed total and fecal coliform standards for Class I are the same as the existing standards for Class SC waters.
December 2014 LTCP Page 6-9	DEC has recently advised DEP that it will likely ~~plans to~~ adopt the 30-day rolling geometric mean (GM) for enterococci of 30 cfu/100mL, with a not-to-exceed 90th percentile statistical threshold value (STV) of 110 cfu/100mL, which is ~~the more stringent of the recommendations presented in~~ the EPA Recommended Recreational Water Quality Criteria "2012 EPA RWQC". Adoption of such a standard would require rulemaking. Inasmuch as 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 and Table 6-3 to evaluate the proposed alternatives. ~~As such, analyses in this LTCP are performed using the 30-day rolling GM of 30 cfu/100mL and the STV of 110 cfu/100mL for enterococci.~~
December 2014 LTCP Page 6-9, Footnote 1	[1]The Flushing Creek LTCP evaluates compliance with various primary contact WQ numerical limits including the Primary Contact fecal coliform WQ Criteria (Class SC WQS). With ~~the~~ DEC's December 3, 2014 proposed rulemaking ~~by DEC~~ to change Class I fecal coliform bacteria criteria to 200 cfu/100mL, Class SC and proposed Class I fecal coliform criteria would both retain the

	200 cfu/100mL limitation. ~~As such, the term Class SC criteria used in this LTCP is interchangeable with the proposed Class I numerical criteria when used in the context of bacteria WQ limits.~~
December 2014 LTCP Page 6-11	~~The~~ DEC is required to periodically review whether a waterbody can be reclassified to its next higher classification. This LTCP assessed the level of attainment for Flushing Creek if DEC were to apply a 200 cfu/100mL fecal coliform WQ criteria for primary contact ~~reclassify it to Class SC (limited primary contact recreation) from the current Class I~~. This assessment also addresses the situation if the proposed DEC rulemaking to ~~at~~ amend the fecal coliform 200 cfu/100mL criteria ~~to~~ for the Class I criteria is adopted.
December 2014 LTCP Page 6-16	An additional analysis ~~that consisted of examining~~ of 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 non-CSO sources on Flushing Creek water quality.
December 2014 LTCP Page 8-1	If deemed necessary under these conditions, the UAA would assess ~~the~~ compliance ~~of~~ with the next higher classification and ~~which~~ the State would consider that when ~~in~~ adjusting water quality standards (WQS) ~~and developing waterbody-specific criteria~~.
December 2014 LTCP Page 9-1, Footnote 1	[1]DEC has publicly noticed a proposed rulemaking ~~which, if promulgated, would~~ to amend Parts 701 ~~to require that the quality of Class I and Class SD waters be suitable for "primary contact recreation", and to adopt corresponding total and fecal coliform standards in 6 NYCRR Part~~ and 703 ~~(Proposed Rulemaking)~~. If promulgated, the Class I standard for fecal coliform would be the same as that for current Class SB waterbodies. ~~As such, the term Class SC criteria used in this LTCP is interchangeable with the proposed Class I numerical criteria when used in the context of bacteria WQ limits.~~ The proposed total and fecal coliform standards for Class I are the same as the existing standards for Class SC waters.

Modifications to Section 1:

DEC Comment No. 2a on the *Westchester Creek LTCP*:
In Section 1.2.d, the LTCP states that adoption of the Green Infrastructure Plan resulted in elimination of some grey infrastructure, which is not correct. The changes made to the CSO Order 2012 did not reflect a tradeoff between green and grey infrastructure and the LTCP must be revised to reflect this fact.

DEP Response:
The statement in Section 1.2.d in the Flushing Creek LTCP has been revised as follows.

Current language: "In March 2012, DEP and DEC amended the 2005 Order to provide for incorporation of Green Infrastructure (GI) into the LTCP process as proposed under the City's Green Infrastructure Plan, and to update certain project plans and milestone dates. In doing so, some of the grey infrastructure projects planned earlier were eliminated from the Order."

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

Modifications to Section 2:

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

DEP Response:
Additional rainfall data have 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**

Modifications to Section 5:

DEC Comment No. 10 on the *Hutchinson River LTCP*:
The statement provided in Section 5.4.b makes no sense.

DEP Response:
The statement has been revised. The sentence in Section 5.4.b of the Flushing Creek LTCP should be replaced. See below.

Current Language: "There were no GI-related cost-effective opportunities for CSO reduction to report in this section."

Proposed Language: "For each LTCP, the citywide target for managing one inch of rain on 10 percent of the impervious area in combined sewered areas has been broken out into estimated targets for each waterbody and used to calculate the baseline CSO reductions from green infrastructure projects. The estimated targets for each waterbody are the best information available because the green infrastructure implementation is being carried out simultaneously as the LTCPs are developed. At this time, there are no additional green infrastructure projects identified in the watershed that would exceed the baseline target rate (as described above and below). The Green Infrastructure Program will be implemented through 2030 and the final penetration rate will be reassessed as part of the adaptive management approach."

DEC Comment No. 8 on *Alley Creek LTCP*; DEC Comments No. 5d on the *Westchester Creek LTCP* and DEC Comment No. 14 on the *Hutchinson River LTCP*:
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 1,000 cfu/100mL only. Table 8-21 can be deleted from the LTCP.

Table 6-11 should also indicate the number of rainfall events included in each "bin".

Table 6-20 should include a footnote to explain the meaning of the * for some of the recovery times.

DEP Response:
DEP proposes a new "time to recovery table" based on the August 14-15, 2008 JFK rainfall event. See proposed revisions to Section 6.

Current Language: "Fecal coliform concentrations that exceed 1,000 cfu/100mL and or enterococci concentrations exceeding 110 cfu/100mL are considered potential hazards by the NYSDOH. Water quality modeling analyses were conducted to assess the amount of time following the end of a rainfall required for Flushing Creek to recover and return to concentrations less than 1,000 cfu/100mL fecal coliform and 110 cfu/100mL enterococci. The value 110 was used instead of 104 as recent EPA guidance (2012 EPA RWQC) indicates that the 104 value will no longer be relevant.

The water quality model calculation for Flushing Creek bacteria concentrations for recreation periods (May 1st through October 31st) were extracted from 10-years of model simulations. The time it takes for wet weather elevated bacteria concentrations to return to 1,000 or 110 was then calculated for each storm within the various size categories and used to calculate the median time for bacteria levels to return to below the concentration threshold after the end of rainfall was then calculated for each rainfall category.

The process began with an analysis of the nearby LaGuardia Airport 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 resulted in a 90th percentile rainfall event of 1.09 inches.

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; ….

The rainfall event data was then compared against water quality model bacteria results for the ten recreational seasons to determine how long it took for the water column concentration to return to target threshold concentrations from the end of the rain event. Since the system is tidal, the change in concentration over time is not a constant decrease, so the last time the concentration returned to the target threshold after each rain event was considered (as opposed to the first, which might have been the result of tidal influences). To be conservative, the hour in which the concentration reached the target threshold concentration was included, so the minimum time to recover is one hour. The chosen target threshold concentrations were 1,000 cfu/100mL for fecal coliform, and 110 cfu/100mL for enterococci. The various rainfall events were then placed into rain event

size "bins" ranging from less than 0.1 inch to greater than 1.5 inch, as shown in Table 6-12. Only rain events that reached the target threshold concentrations before the beginning of the next storm were included. The median time to recover for each bin at each water quality station was calculated.

The results for the baseline and 100 percent CSO control scenarios are shown in Table 6-12. As noted in Table 6-12, the time to recover is generally lengthy and greater than 48 hours for storm sizes that exceed about 0.4 inches and can be upwards of 72 hours for larger storms. With respect to time to recover to enterococci concentrations that are less than 110 cfu/100mL, even 100 percent CSO removal of Flushing Creek discharges does not have a major impact. With 100 percent removal of Flushing Creek CSO discharges, time to recover at locations OW5 and OW6 are not significantly changed from the baseline conditions. It should be noted that fecal coliform concentrations tend to remain below 1,000 cfu/100mL for locations toward the head end of Flushing Creek."

Table 6-12. Time to Recover

Rain Event Size (in)	Station	Time to Recover (hours)			
		Fecal Coliform Threshold (1,000 cfu/100mL)		Enterococci Threshold (110 cfu/100mL)	
		Baseline	100% CSO Control	Baseline	100% CSO Control
<0.1	OW-03	-(1)	-	-	-
0.1-0.4	OW-03	8	-	18	3
0.4-0.8	OW-03	35	-	55	15
0.8-1.0	OW-03	50	-	66	64
1.0-1.5	OW-03	69	-	92	81
>1.5	OW-03	69(2)	-	92(2)	81(2)
<0.1	OW-04	-	-	-	-
0.1-0.4	OW-04	5	-	13	-
0.4-0.8	OW-04	40	-	55	14
0.8-1.0	OW-04	50	-	63	64
1.0-1.5	OW-04	68	-	90	81
>1.5	OW-04	68(2)	-	90(2)	81(2)
<0.1	OW-05	-	-	-	-
0.1-0.4	OW-05	-	-	8	-
0.4-0.8	OW-05	40	-	54	9
0.8-1.0	OW-05	50	-	63	62
1.0-1.5	OW-05	65	-	87	80
>1.5	OW-05	65(2)	46	87(2)	80(2)
<0.1	OW-06	-	-	-	-
0.1-0.4	OW-06	-	-	5	-
0.4-0.8	OW-06	38	-	53	8
0.8-1.0	OW-06	51	42	64	61
1.0-1.5	OW-06	64	46	85	78
>1.5	OW-06	64(2)	46	85(2)	78(2)

Notes:
(1) "-" indicates elevated bacteria concentrations return to the 1,000 cfu/100mL and 110 cfu/100mL threshold levels prior to the end of the rainfall events.
(2) In a few cases the time to recover was calculated to be less than the next smaller rain event bin. In those cases, both bins were set equal to the higher time to recover.

<u>Proposed Language</u>: "Fecal coliform concentrations that exceed 1,000 cfu/100mL and or enterococci concentrations exceeding 104 cfu/100mL are considered potential hazards by the NYSDOH. Water quality modeling analyses were conducted to assess the amount of time following the end of a rainfall required for Flushing Creek to recover and return to fecal coliform concentrations less than 1,000 cfu/100mL.

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; ….

The water quality model calculation for Flushing Creek fecal coliform concentrations for recreation periods (May 1st through October 31st) were extracted from the August 14-15, 2008 JFK rainfall event. The time it takes for wet weather elevated fecal coliform bacteria concentrations to return to 1,000 cfu/100 mL was then tabulated for each WQ station along the Creek.

The process began with an analysis of the nearby LaGuardia Airport 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 resulted in a 90th percentile rainfall event of 1.09 inches.

Based on this information, a storm approximating the 90th percentile storm was chosen from the 2008 recreational 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 target fecal coliform 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 OW3 has a time to recovery of 58 hours. DEC has indicated that it is desirable to have a time to recovery of less than 24 hours. The other stations in Flushing Creek have times to recovery ranging between 54 to 58 hours.

When 100 percent CSO control of discharges to Flushing Creek are considered, Station OW6, closer to Flushing Bay, was calculated to have a concentration greater than 1,000 cfu/100mL during the period after this precipitation event and it takes two hours for fecal coliform levels to return to this target. However, for the remainder of the Stations there is no time to recovery as the fecal coliform levels would not reach the 1,000 cfu/100 mL fecal coliform concentration throughout or after the event. As expected, these results

infer that upon removal of the CSO discharges to Flushing Creek, the relative impacts from the CSO discharges to Flushing Bay will become more prominent."

Table 6-12. Time to Recovery (Revised)

Station	Time to Recovery (hours)	
	Fecal Coliform Threshold (1,000 cfu/100mL)	
	Baseline	100% CSO Control
OW-3	58	-
OW-4	58	-
OW-5	57	-
OW-6	54	2

Modifications to Section 8 (Page 8-45 through Page 8-46):

Current Language: *"Analyses were conducted with the ERTM model to evaluate the length of time fecal coliform concentrations and enterococci concentrations would exceed target values of 1,000 and 110 cfu/100mL, respectively. These target values are discussed further in Section 8.7.a, and represent concentrations above which bathing would be unadvisable. These analyses were performed for the baseline conditions of upstream freshwater bacteria concentrations unchanged from present levels, with the exception that suspected illicit dry weather discharges are currently being investigated and will be removed when located. The analysis was conducted for a rainfall event sequence that occurred August 14, 2008 (0.96 inches) and August 15, 2008 (1.02 inches) which fell over approximately 4 hour periods each day, which is a rainfall event that represents about a 90th percentile event.*

The results of this analysis are shown in Figure 8-23 for both fecal coliform bacteria and enterococci. The results represent the amount of time it takes after the end of the August 14-15 rainfall for the bacteria concentrations to return to the target levels at Station OW-3, closest to Outfall TI-010 associated with the preferred alternative, or Alternative 3. This rate of reduction is then followed by Alternative 6 – Tunnel 75 percent CSO control. The explanation for this is as follows: for a given wet weather event during the recreational season (May 1st through October 31st), the preferred alternative provides nearly 100 percent bacteria loading reduction at Outfalls TI-010 and TI-011, beyond the 75 percent bacteria loading reduction provided by the Alternative 6 tunnel. As also shown, for the enterococci time to recover, the larger tunnel from Alternative 7 (100% vs. 75% CSO control) does not provide a significant improvement over the smaller Alternative 6 tunnel. There is no time to recover to the fecal coliform target of 1,000 cfu/100mL for the larger Alternative 7 tunnel because the loading reduction provided prevents the fecal coliform levels at Station OW-3 from reaching this threshold value for this event.

Alternative 3 realizes times to recover of 33 and 62 hours, for the fecal coliform and enterococci targets, respectively."

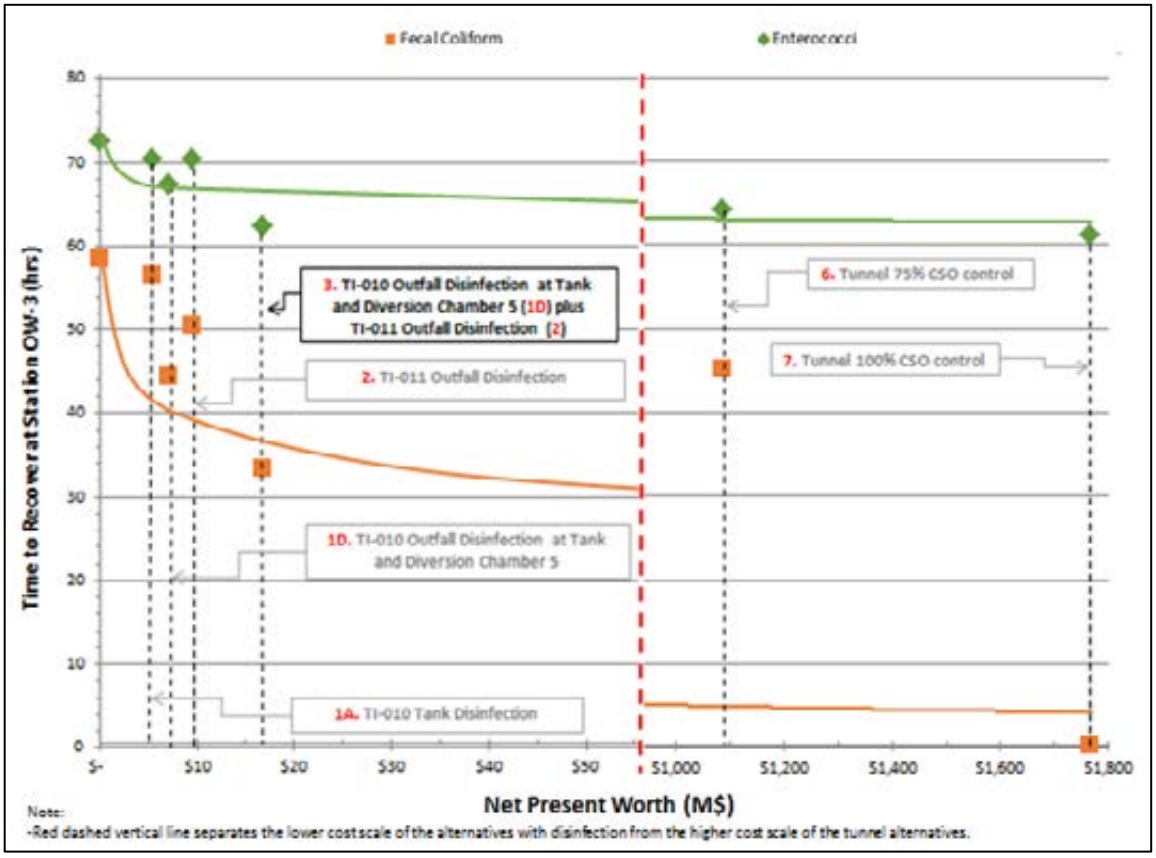


Figure 8-23. Time to Recover at Station OW-3

<u>Proposed Language:</u> *"Analyses were conducted with the ERTM model to evaluate the length of time fecal coliform concentrations and enterococci concentrations would exceed target values of 1,000 cfu/100mL. This target value is discussed further in Section 8.7.a, and represents a concentration above which bathing would be unadvisable. This analysis was performed for the baseline conditions of upstream freshwater bacteria concentrations unchanged from present levels, with the exception that suspected illicit dry weather discharges are currently being investigated and will be removed when located. The analysis was conducted for a rainfall event sequence that occurred August 14, 2008 (0.96 inches) and August 15, 2008 (1.02 inches) which fell over approximately 4 hour periods each day, which is a rainfall event that represents about a 90th percentile event. Section 6.0 provides details on the selection of the August 14-15, 2008 JFK rainfall event.*

The results of this analysis are shown in Figure 8-23. The results represent the amount of time it takes after the end of the August 14-15, 2008 JFK rainfall event for the fecal coliform concentration to return to the target levels at Station OW-3, closest to Outfall TI-010 associated with the preferred alternative, or Alternative 3. This rate of reduction is then followed by Alternative 6 – Tunnel 75 percent CSO control. The explanation for this is as follows: for a given wet weather event during the recreational season (May 1st

through October 31st), the preferred alternative provides nearly 100 percent bacteria loading reduction at Outfalls TI-010 and TI-011, beyond the 75 percent bacteria loading reduction provided by the Alternative 6 tunnel. There is no time to recovery to the fecal coliform target of 1,000 cfu/100mL for the larger Alternative 7 tunnel because the loading reduction provided prevents the fecal coliform levels at Station OW-3 from reaching this threshold value for this event.

Alternative 3 realizes times to recovery of 33 hours for the fecal coliform target."

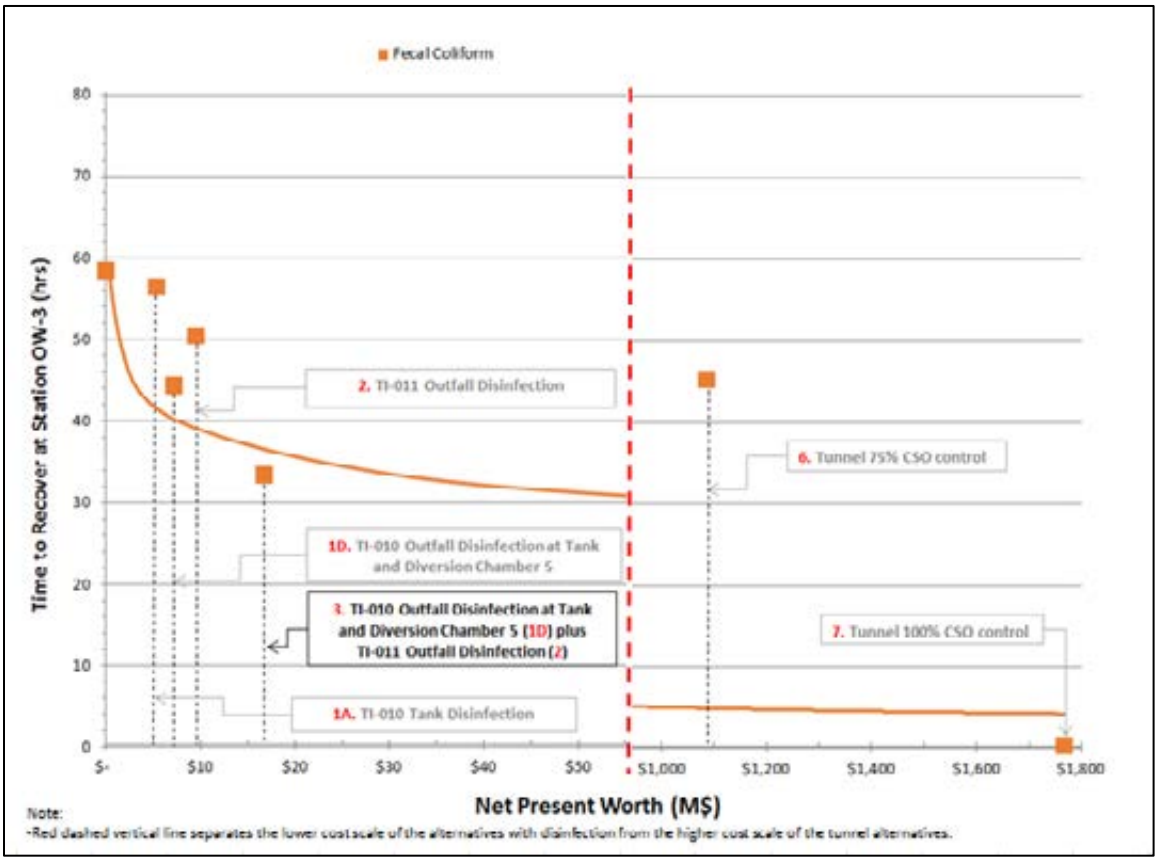


Figure 8-23. Time to Recovery at Station OW-3 (Revised)

DEC Comment No. 20 on the *Hutchinson River LTCP* and DEC Comment 6a on the *Westchester Creek LTCP*:
In Section 8.6 and Appendix D, the City shall include an evaluation of attainment of the dissolved oxygen standard for the Use Attainability Analysis.

In Section 8.1.a (as well as other sections, e.g. Section 7.3), the LTCP states that there are no performance gaps for the baseline conditions to attain the current Class I water quality standards, however, Sections 6.3.a and 9.4 clearly indicate that the dissolved oxygen standard is not fully attained under the baseline conditions. The discussion or performance of the Westchester Creek alternatives and cost-attainment analysis must also consider attainment of dissolved oxygen standard.

Section 8.6 in the Flushing Creek LTCP has been revised as follows (Page 8-47).

Current Language: "As part of the LTCP, elements of a UAA, including the six conditions presented above, can be used to determine if changes to the designated use is warranted, considering a potential adjustment to the designated use classification as appropriate. Because Flushing Creek is not expected to meet Primary Contact (Class SC) bacteria standards with the implementation of the preferred alternative, a UAA is attached hereto in Appendix E."

Proposed Language: "As part of the LTCP, elements of a UAA, including the six conditions presented above, can be used to determine if changes to the designated use are warranted, considering a potential adjustment to the designated use classification as appropriate. Because Flushing Creek is not expected to meet Primary Contact (Class SC) bacteria standards with the implementation of the preferred alternative and; Flushing Creek does attain the existing dissolved oxygen criterion and is not projected to attain the Class SC dissolved oxygen criterion, even when control of 100 percent of the CSO discharges to the Creek is considered, a UAA is attached hereto in Appendix E."

DEC Comment No. 8 on the *Alley Creek LTCP*; DEC Comment No. 6k on the *Westchester Creek LTCP*; and DEC Comment No. 19 on the *Hutchinson River LTCP*:
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*:**
The following references to site-specific water quality targets should be eliminated:

- *Refer to the Revised Executive Summary;*
- *Refer to the Revised UAA;*
- *Section 9: delete "the concept of "Site-Specific Targets" is discussed for Flushing Creek in Section 8.7 and Appendix D" from Page 9-1 and "DEP proposes "Site-Specific Targets" to provide a feasible compliance target and also allow DEP to continue to improve water quality in Flushing Creek." and "DEP anticipates that DEC will review and comment on the site-specific targets as part of LTCP review process." from Page 9-35;*
- *Refer to proposed text below for Section 8:*

Section 8.7 in the Flushing Creek LTCP has been revised as follows (Pages 8-48 through 8-52)

Current Language:

"Table 8-17 summarizes the compliance for the preferred plan.

Table 8-17. Preferred Plan Compliance with Bacteria Water Quality Criteria

Meets Existing WQ Criteria[1,2] (Class I)	Meets Primary Contact WQ Criteria[1] (Class SC)	Meets Future Primary Contact WQ Criteria[2]
YES	NO	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) Annual attainment
(2) Recreational season attainment (rolling 30-day GM Enterococci and STV value)

8.7 Water Quality Goals

Based on the analyses of Flushing Creek, and the WQS associated with the designated uses, the following conclusions can be drawn on both existing and further water quality goals:

8.7.a Existing Goals

Flushing Creek remains a highly productive Class I waterbody that can fully support existing uses: kayaking and wildlife propagation. Flushing Creek is in attainment with its current Class I classification. Furthermore, manmade features, shoreline access and industrial uses prevent the opportunity and feasibility of primary contact recreation in Flushing Creek.

This LTCP conducted assessments for attainment with the primary recreation water quality standard spatially and temporally and identified site-specific targets that will allow DEP to continue to improve water quality over time. As such, the Primary Contact WQ Criteria of Class SC and Future Primary Contact WQ Criteria could be considered for the recreational period with site-specific targets, as further described below.

8.7.b Future Water Quality

DEP is committed to improving water quality in Westchester Creek. Toward that end, DEP has identified site-specific water quality targets for Westchester Creek that will allow DEP to continue to improve water quality in the system over time. Site-specific targets are recommended for consideration to advance towards the numerical limits established, or under consideration by DEC, including Primary Contact WQ Criteria (Class SC) or proposed Class I fecal coliform criterion of 200 cfu/100mL and enterococci Future Primary Contact WQ Criteria consistent with the 2012 EPA RWQC. It is clear from this LTCP that full attainment with primary contact standards cannot be readily achieved. These targets were developed using the 10-year water quality modeling simulations and assessing bacteria concentrations that provide for 95 percent attainment of the fecal coliform criteria of a monthly GM of 200 cfu/100mL and an enterococci criteria of a rolling 30-day GM of 30 cfu/100mL. DEP notes that these targets are based

on projections and may require adjustment based upon PCM results. These targets are shown below.

- *Recreational Season Site-Specific Targets: Uses of Flushing Creek generally oriented around the recreational season (May 1st through October 31st). DEP proposes that the following numerical site-specific targets be established for Flushing Creek for the recreational season (May 1st through October 31st) against which continual water quality improvements be measured:*
  - *Maximum rolling 30-day GM enterococci value of 180 cfu/00mL*
  - *Monthly fecal coliform GM concentration of 700 cfu/100mL*
- *Non-Recreational Season Site-Specific Targets: DEP proposes that the following numerical site-specific targets be established for Flushing Creek for the non-recreational season against which continual water quality improvements be measured:*
  - *Monthly fecal coliform GM concentration of 2,000 cfu/100mL*

These water quality targets are summarized in Table 8-18 in comparison to the existing and primary contact pathogen WQ Criteria. This table also provides a summary of the calculated pathogen criteria attainment. As noted in the table, the preferred plan results in a high level of attainment with these identified site-specific pathogen targets. DEP recommends that these site-specific targets be re-evaluated when the Flushing Bay LTCP is prepared in 2017.

Table 8-18. Summary of Recommended Flushing Creek Bacteria Water Quality Targets

Location	Existing WQ Criteria (Class I)	Primary Contact WQ Criteria (Class SC)	Site-specific Targets (cfu/100mL)	Attainment(3) with Site-specific Targets (%)
Recreational Season	Fecal Coliform(1) ≤ 2000	Fecal Coliform(1) ≤ 200	Fecal Coliform ≤ 700	95
			Enterococci ≤ 180(2)	95
Non-Recreational Season	Fecal Coliform(1) ≤ 2000	Fecal Coliform(1) ≤ 200	Fecal Coliform ≤ 2,000	95

Notes:
(1) Monthly GM.
(2) 30-day rolling average GM during the recreational season (May 1st through October 31st).
(3) At location OW-3. Attainment at all other locations is higher.

Also, as noted above, DEP does not believe that adoption of the STV portions of the proposed 2012 EPA RWQC is warranted at this time. Analyses presented herein (Table 8-15) clearly show that attaining the STV value of 110 cfu/100mL is not achievable. Alternatively, DEP believes that if a STV value is required, it should be derived

specifically for individual portions of Flushing Creek based on measured enterococci concentrations and their variability.

If Flushing Creek were upgraded to Primary Contact WQ Criteria (limited primary contact – Class SC), it would not be capable of supporting primary contact 100 percent of the time. Even with anticipated reductions in CSO loadings resulting from the preferred plan and GI, the waterbody could possibly be protective of primary contact should it occur, as long as it did not occur during and following rainfall events. Toward that end, DEP has performed an analysis to assess the amount of time following the end of a rainfall required for Flushing Creek to recover and return to concentrations less than 1,000 cfu/100mL fecal coliform and 110 cfu/100mL enterococci. The value 110 was used instead of 104, as recent EPA guidance indicates that the 104 value will no longer be relevant.
The analyses consisted of examining the water quality model calculations for Flushing Creek bacteria concentrations for the recreational season (May 1st through October 31st), abstracted from 10-years of model simulations. The time to return to 1,000 or 110 was then calculated for each storm with the various size categories and the median time after the end of rainfall was then calculated for each rainfall category.

The results of these analyses for the preferred plan are summarized in Table 8-19 for Flushing Creek. As noted, the duration of time within which pathogen concentrations are expected to be higher than New York State Department of Health (NYSDOH) considers safe for primary contact varies with location and with rainfall event size. Generally, a value of 72 hours would be typical for Flushing Creek for storms with rainfall volumes of less than 1 inch.

Table 8-19. Time to Recover (Hours) at Flushing Creek

Interval	OW-03		OW-04		OW-05		OW-06	
	Fecal(1)	Entero(2)	Fecal(1)	Entero(2)	Fecal(1)	Entero(2)	Fecal	Entero(2)
<0.1	-	-	-	-	-	-	-	-
0.1 – 0.4	8	17	5	11	-	5	-	-
0.4 – 0.8	21	45	17	48	13	49	3	49
0.8 – 1.0	42	65	44	63	45	62	44	62
1.0 – 1.5	56	84	55	85	56	80	54	78
>1.5	56(3)	84(3)	55(3)	85(3)	56(3)	80(3)	54(3)	78(3)

Notes:
"-" indicates median elevated bacteria concentrations return to the 1,000 cfu/100mL and 110 cfu/100mL threshold levels prior to the end of the rainfall events.
(1) Threshold for Fecal coliform is 1,000 cfu/100mL.
(2) Threshold for Enterococci is 110 cfu/100mL
(3) In a few cases the time to recover was calculated to be less than the next smaller rain event bin. In those cases, both bins were set equal to the higher time to recover.

8.8 Recommended LTCP Elements to Meet Water Quality Goals

Water quality in Flushing Creek will be improved with the preferred alternative and the implementation of the planned GI projects and recommendations made herein. The Flushing Creek LTCP identified the following actions:

1. *The LTCP includes feasible site-specific WQ targets based on the projected performance of the selected CSO controls. A PCM program will be initiated after the LTCP improvements are operational. Based upon the results of such monitoring, the site-specific WQ targets may need to be reviewed.*

2. *DEP will issue a wet weather advisory during the recreational season (May 1st through October 31st), alerting the public that the water may be unsafe for recreational uses.*

3. *DEP will continue to operate the Flushing Bay CSO Retention Facility in accordance with its Wet Weather Operating Plan.*
4. *DEP will continue to implement the Green Infrastructure Program.*
5. *DEP will implement the design and construction of seasonal disinfection of the TI-010 Outfall Disinfection at the Flushing Bay CSO Retention Facility and Diversion Chamber 5 plus Outfall TI-011 Outfall Disinfection, which will provide DEP with the most efficient means of controlling a high percent of baseline CSO loadings and striving towards meeting Class SC Primary Contact WQ Criteria, particularly during the recreational season (May 1st through October 31st). The Capital Cost is estimated to be $6.89M, annual O&M is $0.66M, and the Total Present Worth is $16.70M.*

6. *A UAA is provided with site-specific targets for Flushing Creek. This UAA should be revisited upon completion of the Flushing Bay LTCP.*

7. *A SPDES variance is included in Appendix C.*

Section 9.0 presents the implementation schedule of these actions."

Proposed Language:

"Table 8-17 summarizes the compliance for the preferred plan.

Table 8-17. Preferred Plan Compliance with Bacteria Water Quality Criteria (Revised)

Meets Existing WQ Criteria(1) (Class I)	Meets Primary Contact WQ Criteria(1) (Class SC)	Meets Potential Future Primary Contact WQ Criteria(2)
YES	NO	NO

Notes:
YES indicates attainment is calculated to occur ≥ 95 percent of time.
NO indicates attainment is calculated to occur ≤ 95 percent of time.
(1) Annual attainment.
(2) Recreational season attainment (rolling 30-day GM Enterococci and STV value).

8.7 Water Quality Goals

Based on the analyses of Flushing Creek, and the WQS associated with the designated uses, the following conclusions can be drawn on both existing and further water quality goals:

8.7.a Existing Goals

Flushing Creek remains a highly productive Class I waterbody that can fully support existing uses: kayaking and wildlife propagation. Flushing Creek is in attainment with its current Class I classification. Furthermore, manmade features, shoreline access and industrial uses prevent the opportunity and feasibility of primary contact recreation in Flushing Creek.

This LTCP conducted assessments for attainment with the primary recreation water quality standard spatially and temporally and provided a time to recovery analysis to potentially support wet weather advisories to allow DEP to continue to improve water quality over time.

8.7.b Future Water Quality

DEP is committed to improving water quality in Flushing Creek. Toward that end, DEP has identified time to recovery to a fecal coliform target of 1,000 cfu/100 mL throughout Flushing Creek that will allow DEP to continue to improve water quality in the system over time, advancing towards the numerical limits established, or under consideration by DEC, including Primary Contact WQ Criteria (Class SC) or proposed Class I fecal coliform criterion of 200 cfu/100mL and enterococci Potential Future Primary Contact WQ Criteria consistent with the 2012 EPA RWQC. It is clear from this LTCP that full attainment with primary contact standards cannot be readily achieved. Also, as noted, DEP does not believe that adoption of the STV portions of the proposed 2012 EPA RWQC is warranted at this time. Analyses presented herein (Table 8-15) clearly show

that attaining the STV value of 110 cfu/100mL is not achievable. Alternatively, DEP believes that if a STV value is required, it should be derived specifically for individual portions of Flushing Creek based on measured enterococci concentrations and their variability.

If Flushing Creek were upgraded to Primary Contact WQ Criteria (limited primary contact – Class SC), it would not be capable of supporting primary contact 100 percent of the time. Even with anticipated reductions in CSO loadings resulting from the preferred alternative and GI, the waterbody could possibly be protective of primary contact should it occur, as long as it did not occur during and following rainfall events. Toward that end, DEP has performed an analysis to assess the amount of time following the end of a rainfall required for Flushing Creek to recover and return to concentrations less than 1,000 cfu/100mL fecal coliform.

The analyses consisted of examining the water quality model calculations for Flushing Creek fecal coliform bacteria concentrations for the August 14-15, 2008 JFK rainfall event. Details on the selection of this rainfall event are provided in Section 6.0. The time to return to 1,000 cfu/100 mL was then tabulated for each location along the Creek. The results of this analysis for the preferred plan are summarized in Table 8-19 for Flushing Creek. As noted, the duration of time within which pathogen concentrations are expected to be higher than New York State Department of Health (NYSDOH) considers safe for primary contact varies with location along the Creek. Generally, a value of 48 hours would be typical for Flushing Creek for storms with rainfall volumes of less than 1 inch.

Table 8-19. Time to Recovery (Hours) at Flushing Creek (Revised)

Station	Time to Recovery (hours)
	Fecal Coliform Threshold (1,000 cfu/100mL)
	Preferred Alternative
OW-3	33
OW-4	40
OW-5	41
OW-6	42

8.8 Recommended LTCP Elements to Meet Water Quality Goals

Water quality in Flushing Creek will be improved with the preferred alternative and the implementation of the planned GI projects and recommendations made herein. The Flushing Creek LTCP identified the following actions:

1. *The LTCP includes a time to recovery analysis based on the projected performance of the selected CSO controls.*

2. *A PCM program will be initiated after the LTCP improvements are operational. Based upon the results of such monitoring, the projected attainment may need to be reviewed.*

3. *DEP will issue a wet weather advisory during the recreational season (May 1st through October 31st), alerting the public that the water may be unsafe for recreational uses.*

4. *DEP will continue to operate the Flushing Bay CSO Retention Facility in accordance with its Wet Weather Operating Plan.*

5. *DEP will continue to implement the Green Infrastructure Program.*

6. *DEP will implement the design and construction of seasonal disinfection of the TI-010 Outfall Disinfection at the Flushing Bay CSO Retention Facility and Diversion Chamber 5 plus Outfall TI-011 Outfall Disinfection, which will provide DEP with the most efficient means of controlling a high percent of baseline CSO loadings and striving towards meeting Class SC Primary Contact WQ Criteria, particularly during the recreational season (May 1st through October 31st). The Capital Cost is estimated to be $6.89M, annual O&M is $0.66M, and the Total Present Worth is $16.70M.*

7. *A UAA is provided recommending that Wet Weather Advisories are implemented for Flushing Creek. This UAA should be revisited upon completion of the Flushing Bay LTCP.*

8. *A SPDES variance is included in Appendix C.*

Section 9.0 presents the implementation schedule of these actions."

DEC Comment No. 1b on the *Flushing Creek LTCP*:
The Flushing Creek LTCP indicates that the projected attainment levels with bacterial water quality standards in Flushing Creek will not be known until the Flushing Bay LTCP is complete, because CSOs in Flushing Bay are impacting water quality in Flushing Creek. Previous studies have not highlighted the impacts of Flushing Bay CSO discharges on Flushing Creek and it would seem more likely that Flushing Creek CSO discharges are impacting Flushing Bay water quality. Regardless of the alternative selected for Flushing Bay, please confirm that the City will implement disinfection of the CSOs at TI-010 and TI-011 for Flushing Creek as proposed in the LTCP.

***DEP Response*:**
The City confirms its commitment to implement disinfection of the CSOs at Outfalls TI-010 and TI-011, as described in Section 8.8, regardless of the relative impact that CSO discharges to Flushing Bay have on the attainment of WQS in the Flushing Creek.

DEC Comment No. 1c on the *Flushing Creek LTCP*:
In reference to comment 2 above, the LTCP presents data and conclusions in various sections of the report on attainment levels for two scenarios involving 100 percent reduction of CSOs: 1) 100 percent reduction of CSOs in Flushing Creek, and 2) 100 percent reduction of CSOs in both Flushing Creek and Flushing Bay. At times, it is not always clear which scenario is associated with the data and conclusions, such as in Tables 6-7 and 6-10. As such, it is

recommended that the Tables and LTCP discussion clearly indicate which scenario is associated with the data and conclusions.

***DEP Response*:**
All tables in the report that refer to 100 percent CSO control consider CSO discharges to the Flushing Creek, exclusively.

DEC Comment No. 1d on the *Flushing Creek LTCP*:
The 2015 NYC Panel on Climate Change estimates potential sea level rise elevations for future time periods including 2020, 2050, 2080, and 2100. The plan includes a 30" sea level rise prediction by 2050, which should have a fairly considerable impact in the Flushing Creek drainage area. Please advise the Department on how the City plans to incorporate these predictions into the CSO planning efforts in the future.

***DEP Response*:**
DEP has evaluated the impact of sea level rise on CSO discharges and has determined that higher receiving water levels would reduce CSO discharges. Because it is a more conservative approach, the analyses included in the LTCP do not include sea level rise. In addition, during the design of any new CSO facilities, future sea level rise will be taken into account.

2.2 SPECIFIC COMMENTS

2.2.1 EXECUTIVE SUMMARY

DEC Comment No. 2 on the *Flushing Creek LTCP*:
Executive Summary: Include information on the attainment levels with the dissolved oxygen standard in the Executive Summary.

***DEP Response*:**
The Revised Executive Summary includes the requested information.

DEC Comment No. 3 on the *Flushing Creek LTCP*:
Executive Summary and Sections 2.1.c.2 and 8.5.d: Table ES-2 shows high concentrations of bacteria in the waterbody and the LTCP also mentions in several sections the on-going investigations by the City for possible illicit discharges. Provide an update on the City's track down efforts.

***DEP Response*:**
DEP has initiated the source trackdown program to investigate suspected illicit discharges. DEP's Compliance Monitoring Section conducted sampling in December 2014. The results suggested that illicit discharges may exist. DEP is in the process of investigating and will work to ensure that all illicit connections are tracked down and corrected. This is a high priority for DEP and updates from the trackdown program will be provided to DEC Region 2.

2.2.2 SECTION 2.0 – WATERSHED/WATERBODY CHARACTERISTICS

DEC Comment No. 4 on the *Flushing Creek LTCP*:
Section 2, p. 2-26: Provide a more detailed explanation of the difference in CSO concentrations for discharges from CSO outfalls TI-011 and TI-010, as the LTCP states that TI-011 overflows have higher bacteria concentrations than TI-010 overflows.

***DEP Response*:**
The CSO bacteria concentrations assigned at TI-010 and TI-011 were based on measured bacteria concentrations. The data indicate that bacteria concentrations are higher at TI-011 than TI-010. CSO concentrations will vary based on the mixture of sanitary and stormwater flow and the bacteria concentrations of the sanitary and stormwater emanating from a particular subcatchment area. The drainage area tributary to TI-010 includes a sizeable area of parkland increasing the proportion of stormwater to sanitary sewage in the flow reaching TI-010 creating a dilution effect.

DEC Comment No. 5 on the *Flushing Creek LTCP*:
Section 2, p. 2-48: The LTCP states that the Harbor Survey Monitoring program data for 2006 to 2013 for Flushing Creek did not capture fecal concentrations above 4000 cfu/100mL. Provide an explanation for this limitation in the dataset.

***DEP Response*:**
The concentrations were reported at a peak of 4,000 cfu/100mL. It was found that the appropriate dilution factor was not used by the laboratory for examining higher bacteria counts. This situation has been resolved to allow for examination of higher peak concentrations.

DEC Comment No. 6 on the *Flushing Creek LTCP*:
Section 2, Figure 2-7 and p. 2-53: According to the Department's Region 2 office, there are several MS4 outfalls that discharge into Willow Lake and Meadow Lake, which might be contributing to the higher bacterial load identified by the Citizen Testing in Willow Lake as well as at sample location OW3 in Flushing Creek. The City should confirm the presence of these outfalls and incorporate potential loads into the LTCP analyses.

***DEP Response*:**
The potential contributions from stormwater discharges into Willow and Meadow Lakes are fully captured and taken into account within the loadings assigned to the water quality model (ERTM) near the freshwater/saline boundary, whose water quality is represented by Station OW3 in the LTCP analyses. These loadings were established based on the bacteria concentrations measured throughout the LTCP intensive sampling period at Stations OW1 and OW2, both downstream of the lakes and upstream of the freshwater/saline boundary.

DEC Comment No. 7 on the *Flushing Creek LTCP*:
Section 2: Figures 2-1 and 2-3 show different drainage areas; reconcile the differences.

***DEP Response*:**
Figure 2-3 has been revised as shown below.

Current Figure:

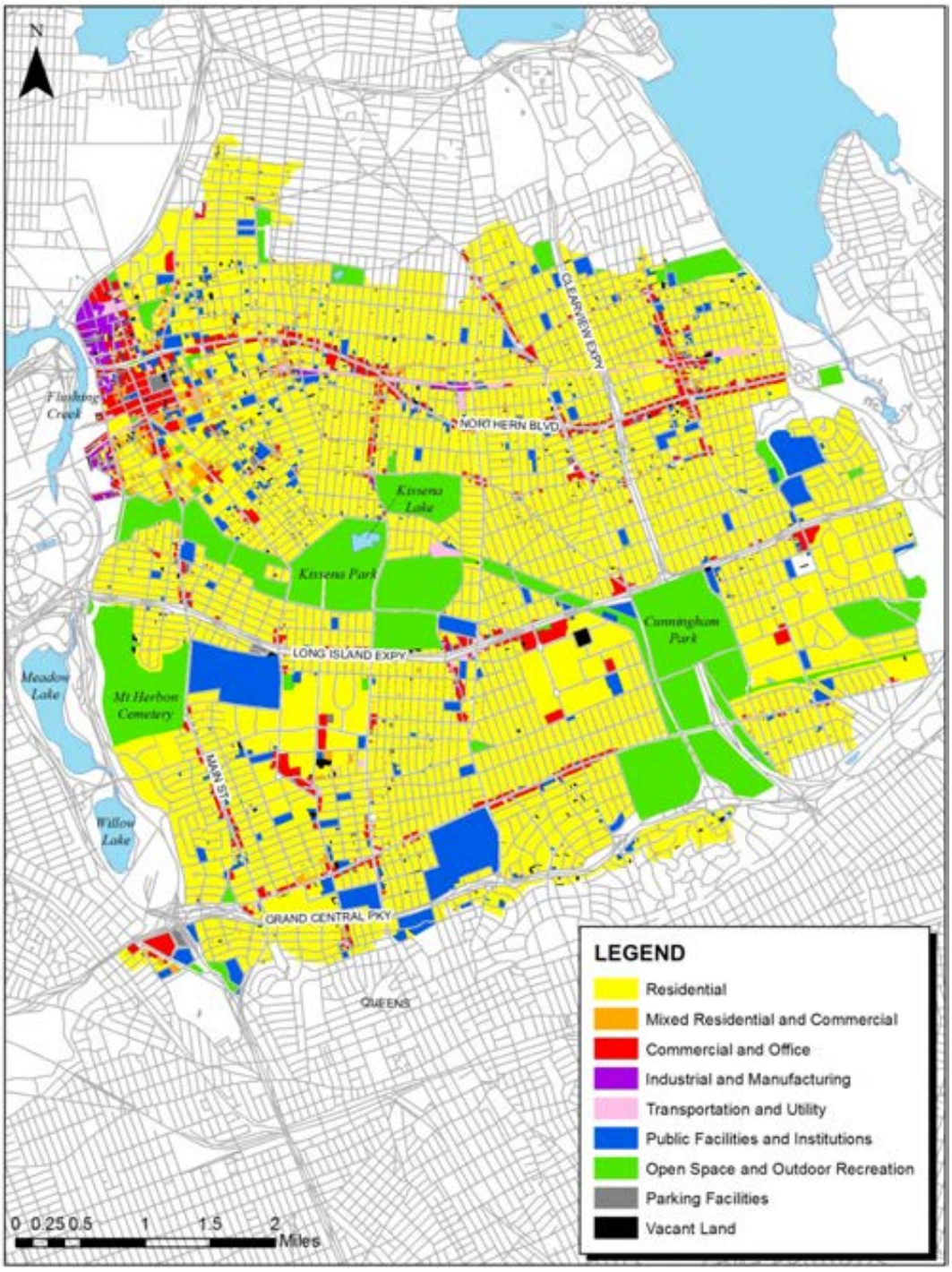


Figure 2-3. Land Use in Flushing Creek Watershed

Proposed Figure:

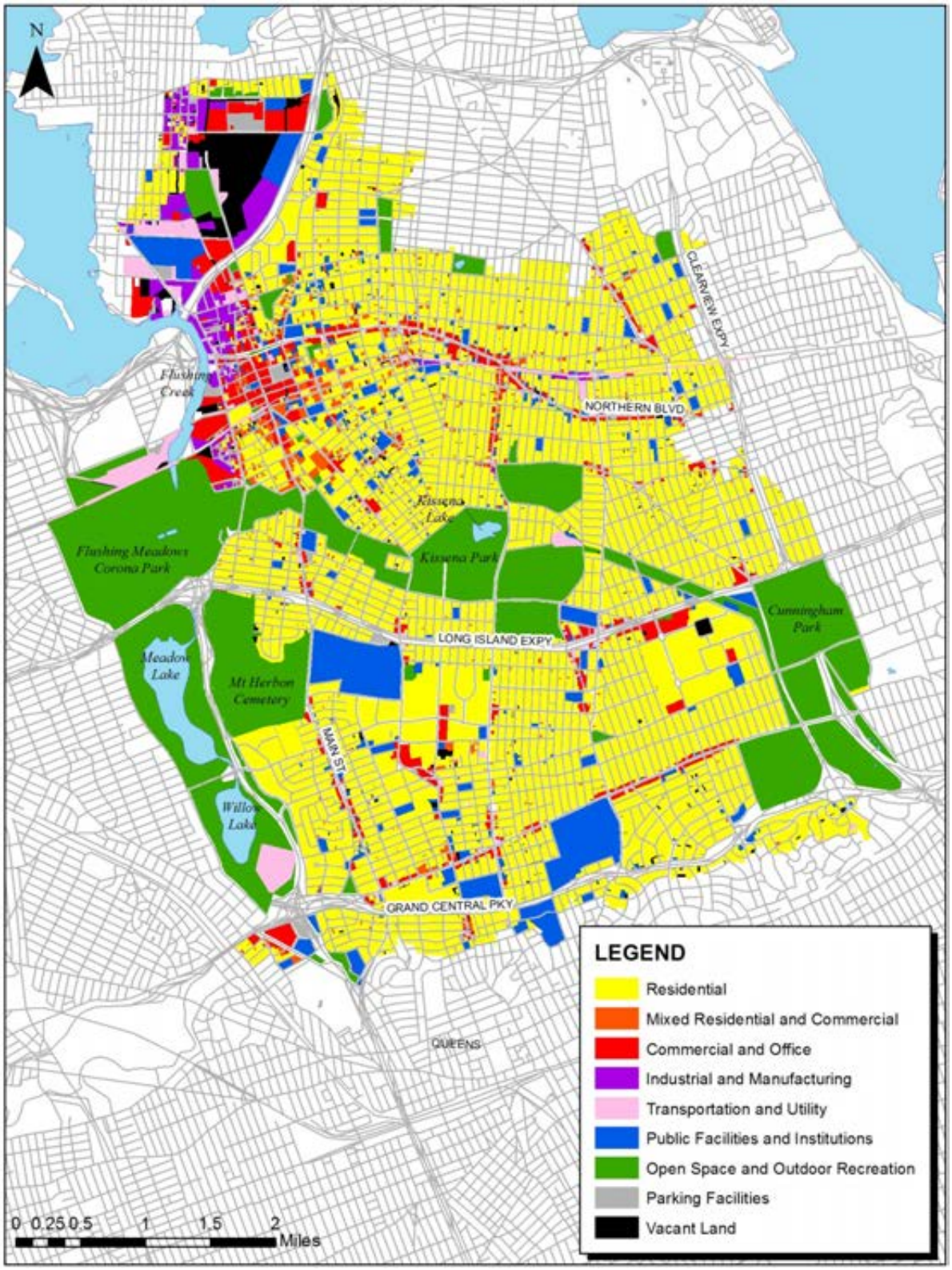


Figure 2-3. Land Use in Flushing Creek Watershed (Revised)

DEC Comment No. 8 on the *Flushing Creek LTCP*:
Section 2.1.c.4: This section does not mention if there are any known bottlenecks; confirm if there are any bottlenecks in the collection system as well as problem areas identified from the 311 service.

DEP Response:
Sections 2.1.c.4 and 2.1.c.5 have been revised as follows (Pages 2-32 through 2-33)

Current Language:

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

DEP has made substantial improvements to the Alley Creek drainage system, a major contributor to the Tallman Island conveyance and treatment system, in which over $90M were spent under Contract ER-AC1 to help eliminate historical flooding issues. These drainage system improvements took place between December 2002 and December 2006, and consisted of installing larger combined sewers in certain segments of the sewershed to increase conveyance capacity; constructing storm sewers in select drainage areas to reduce volume of stormwater entering the combined system; and constructing associated combined and stormwater outfalls to discharge the excess wet weather flows. These drainage area improvements have substantially mitigated these historical flooding issues. DEP maintains the operation of the collection systems throughout the five boroughs using a combination of reactive and proactive maintenance techniques. NYC's "Call 311" system routes complaints of sewer issues to DEP for response and resolution. Though not every call reporting flooding or sewer back-ups (SBUs) correspond to an actual issue with the municipal sewer system, each call to 311 is responded to. Sewer functionality impediments identified during a DEP response effort are corrected as necessary.

2.1.c.5 Findings from Interceptor Inspections

In the last decade, DEP has implemented technologies and procedures to enhance its use of proactive sewer maintenance practices. DEP has many programs and staff devoted to sewer maintenance, inspection and analysis. GIS and Computerized Maintenance and Management Systems (CMMS) provide DEP with expanded data tracking and mapping capabilities, and can facilitate identification of trends to allow provision of better service to its customers. As referenced above, reactive and proactive system inspections result in maintenance including cleaning and repair as necessary. Figure 2-13 illustrates the intercepting sewers that were cleaned in the Borough of Queens, encompassing the entire Flushing Creek watershed. Throughout 2013, a total of 20,441 feet of intercepting sewers were cleaned in the Tallman Island WWTP and Bowery Bay WWTP conveyance systems leading to the removal of 111 cubic yards of sediment.

DEP also conducted a sediment accumulation analysis to quantify levels of sediments in the CSS and verify that the baseline assumptions are valid for this CSO LTCP. For this analysis, the normal approximation to the hypergeometric distribution was used to randomly select a sample subset of sewers representative of the modeled system as a

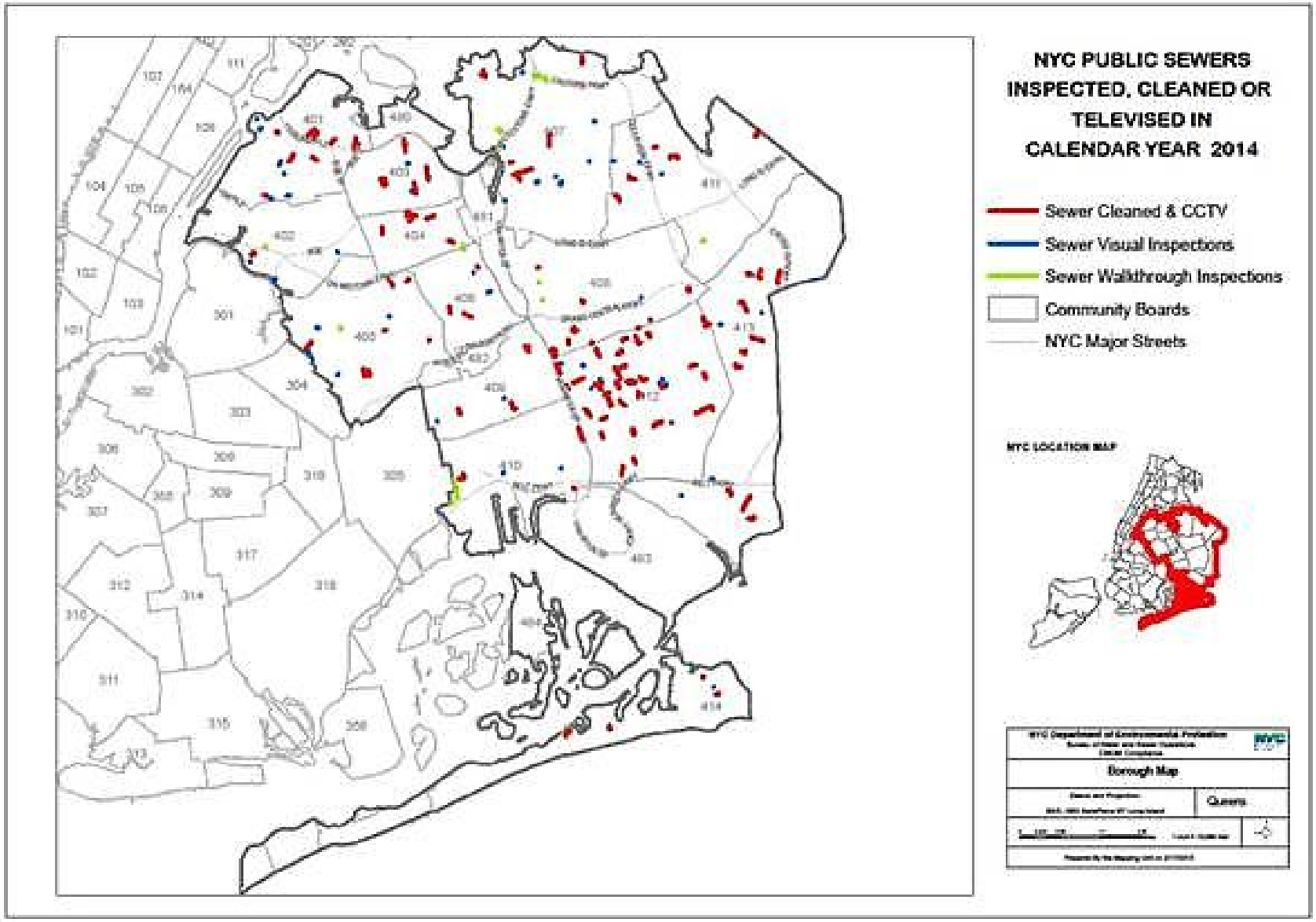
whole, with a confidence level commensurate to that of the IW watershed model itself. Field crews investigated each location, and estimated sediment depth using a rod and tape. Field crews also verified sewer pipe sizes shown on the maps, and noted physical conditions of the sewers. The data were then used to estimate the sediment levels as a percentage of overall sewer area. The aggregate mean for the entire City was approximately 1.25 percent, with a standard deviation of 2.02 percent; the mean sediment accumulation in the Tallman Island drainage area was 1.00 percent, with a standard deviation of 1.63 percent."

Proposed Language:

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

There are no known system bottlenecks and areas prone to flooding in the Flushing Creek watershed. DEP conducts regular sewer inspections and cleaning as reported in the SPDES BMP Annual reports. Figure 2-13 shows the sewers inspected and cleaned throughout 2014 in Queens, which encompasses the entire watershed of the Flushing Creek.

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



New Figure 2-13. Sewers Inspected and Cleaned Throughout 2014

The City's "Call 311" system routes complaints of sewer issues to DEP for response and resolution. Though not every call reporting flooding or sewer backups (SBUs) corresponds to an actual issue with the sewer system, each 311 call is responded to. Sewer functionality impediments identified during a DEP response effort are corrected as necessary.

An analysis of the 311 database for the period of January 1, 2012 to May 15, 2015 for the Flushing Creek drainage area was conducted. This analysis revealed that a majority of the complaints (84%) were related to catch basin clogging/flooding, approximately 16% of the complaints were logged as street flooding, and less than 1% were categorized as highway flooding. All complaints were resolved and resolution was documented in the 311 database.

2.1.c.5 Findings from Interceptor Inspections

In the last decade, DEP has implemented technologies and procedures to enhance its use of proactive sewer maintenance practices. DEP has many programs and staff devoted to sewer maintenance, inspection and analysis. GIS and Computerized Maintenance and Management Systems (CMMS) provide DEP with expanded data tracking and mapping capabilities, and can facilitate identification of trends to allow provision of better service to its customers. As referenced above, reactive and proactive system inspections result in maintenance including cleaning and repair as necessary. Figure 2-13 illustrates the intercepting sewers that were cleaned in the Borough of Queens, encompassing the entire Flushing Creek watershed. Throughout 2014, a total of 27,546 feet of intercepting sewers were cleaned in the Tallman Island WWTP and Bowery Bay WWTP conveyance systems leading to the removal of 991 cubic yards of sediment."

DEC Comment No. 9 on the *Flushing Creek LTCP*:
Section 2.2.a.3: Discuss any existing educational efforts by organizations or schools as part of waterbody uses.

***DEP Response*:**
DEP's Education unit develops and implements programs for children in grades pre-K through college to inform them about the drinking water supply and delivery system and the wastewater/stormwater collection and treatment process. We conduct a variety of education programs, including teacher professional development, field trips, classroom and assembly presentations, and curriculum development throughout schools citywide. Our recent efforts in Queens, and specifically in Flushing, have included in-school visits and presentation to community members. In addition, we worked with local teens and the organizations, RowNY and Groundswell, to create a new water-themed mural for the boathouse in Flushing Meadows-Corona Park, Queens.

DEC Comment No. 10 on the *Flushing Creek LTCP*:
Section 2.2.a.6: Indicate the number of samples from each sampling effort.

***DEP Response*:**
The number of bacteria samples for the timeframe concurrent with the LTCP sampling program is as follows:

LTCP Sampling Program: 335 Fecal coliform; 335 Enterococci.
Harbor Survey Program: 14 Fecal coliform; 14 Enterococci.
Sentinel Monitoring: 2 Fecal coliform; 0 Enterococci.
Third Party Data: 0 Fecal Coliform; 0 Enterococci.

2.2.3 SECTION 4.0 – GREY INFRASTRUCTURE

DEC Comment No. 11 on the *Flushing Creek LTCP*:
Section 4, p. 4-10: The LTCP states that the Flushing Bay CSO Retention Facility still relies on a temporary flow monitoring setup to measure tank overflows. As part of the selected alternative for the Flushing Creek LTCP, please confirm that the City will provide a permanent flow monitoring system for the CSO Retention Facility.

DEP Response:
DEP is currently taking steps towards implementing a permanent flow monitoring system at the Flushing Bay CSO Retention Facility.

DEC Comment No. 12 on the *Flushing Creek LTCP*:
Section 4: Table 4-1 includes the retained volume for the CSO Retention Facility however; this retained volume only includes the volume of CSO and I/I pumped back from the tank, not the in-line storage volume. The table heading should be revised to reflect that volumes are pumped back only.

***DEP Response*:**
Table 4-1 has been revised as follows.

Current Table:

Table 4-1. Flushing Bay CSO Retention Facility - Estimated Monthly Retained Volume and Overflows, 2013

Month	Rain(1) Near Flushing Bay Tank (in)	Retained Volume(2,3) (MG)	Monthly Recorded Overflow Volume(2) (MG)
January	2.20	217	0
February	3.65	232	13
March	2.46	242	3
April	1.49	164	0
May	4.03	197	36
June	7.89	290	75
July	2.64	225	3
August	2.59	211	3
September	2.08	190	7
October	0.37	122	0
November	2.64	158	2
December	4.79	236	4
Totals	**36.83**	**2,484**	**146**

Notes:
(1) Rainfall based on gauge-adjusted radar rainfall (provided by Vieux & Associates) for tank drainage area, as used for all model calculations.
(2) Based on water-level measurements and pump-back values from monthly operation reports provided to DEC.
(3) Retained volume includes combined sewage and I/I retained in the tank and pumped back for treatment at WWTP.

Proposed Table:

Table 4-1. Flushing Bay CSO Retention Facility - Estimated Monthly Retained Volume and Overflows, 2013 (Revised)

Month	Rain[1] Near Flushing Bay Tank (in)	Retained Volume[2,3] (MG)	Monthly Recorded Overflow Volume[2] (MG)
January	2.20	217	0
February	3.65	232	13
March	2.46	242	3
April	1.49	164	0
May	4.03	197	36
June	7.89	290	75
July	2.64	225	3
August	2.59	211	3
September	2.08	190	7
October	0.37	122	0
November	2.64	158	2
December	4.79	236	4
Totals	**36.83**	**2,484**	**146**

Notes:
(1) Rainfall based on gauge-adjusted radar rainfall (provided by Vieux & Associates) for tank drainage area, as used for all model calculations.
(2) Based on water-level measurements and pump-back values from monthly operation reports provided to DEC.
(3) Retained volume includes combined sewage and I/I retained in the tank and pumped back for treatment at the WWTP, exclusively.

2.2.4 SECTION 6.0 – BASELINE CONDITIONS AND PERFORMANCE GAP

DEC Comment No. 13 on the *Flushing Creek LTCP*:
Section 6, p. 6-14: The first paragraph states " ..... slightly improved compliance with **feca1 coliform** Primary Contact.....” however it should refer to the **dissolved oxygen** standard.

***DEP Response*:**
The text has been revised as follows.

Current language: *“Results indicated that complete removal of CSO discharges from both Flushing Creek and Flushing Bay slightly improved compliance with fecal coliform Primary Contact criterion but did not achieve the DEC goal of 95 percent compliance.”*

Proposed Language: *“Results indicated that complete removal of CSO discharges from both Flushing Creek and Flushing Bay slightly improved compliance with the dissolved oxygen criterion but did not achieve the DEC goal of 95 percent compliance.”*

DEC Comment No. 14 on the *Flushing Creek LTCP*:
Section 6: The sanitary sewage concentration values for Enterococci should be similar in Tables 2-6, 2-7, and 6-1.

***DEP Response*:**
Table 2-6 has been revised as follows.

Current Table:

Table 2-6. Sanitary and Stormwater Discharge Concentrations
Tallman Island and Bowery Bay WWTP Service Areas

Constituent	Sanitary Concentration	Stormwater Concentration
$CBOD_5$ (mg/L) (1)	140	15
TSS (mg/L) (1)	130	15
Total Coliform Bacteria (MPN/100mL) (2,3)	$25x10^6$	150,000
Fecal Coliform Bacteria (MPN/100mL) (2,3)	$4x10^6$	35,000
Enterococci (MPN/100mL) (2,3)	$1x10^6$	15,000

Notes:
(1) HydroQual, 2005b.
(2) HydroQual Memo to DEP, 2005a.
(3) Bacterial concentrations expressed as “most probable number” (MPN) of cells per 100mL.

Proposed Table:

Table 2-6. Sanitary and Stormwater Discharge Concentrations
Tallman Island and Bowery Bay WWTP Service Areas (Revised)

Constituent	Sanitary Concentration	Stormwater Concentration
$CBOD_5$ (mg/L) (1)	140	15
TSS (mg/L) (1)	130	15
Total Coliform Bacteria (cfu/100mL) (2,3)	$25x10^6$	150,000
Fecal Coliform Bacteria (cfu/100mL) (2,3)	$4x10^6$	35,000
Enterococci (cfu/100mL) (2,3)	$6x10^5$	15,000

Notes:
(1) HydroQual, 2005b.
(2) HydroQual Memo to DEP, 2005a.
(3) Bacterial concentrations expressed as “colony forming units” per 100mL.

2.2.5 SECTION 8.0 – EVALUATION OF ALTERNATIVES

DEC Comment No. 15 on the *Flushing Creek LTCP*:
Section 8: The selected alternative includes disinfection of CSOs from TI-011 and Diversion Chamber 5 that will not provide for floatables or settleable solids removal prior to disinfection. Explain the assumptions made regarding the effectiveness of the disinfection of the unscreened and unsettled CSOs, compared to overflow from the storage tank with screening. Given the lack of screening, it is likely that the disinfection will be less effective and far more costly at TI-011 and Diversion Chamber 5. The Department requests that preliminary screens be assessed and included for CSOs at TI-011 and Diversion Chamber 5. The screening can be co-located with the chlorination but design to ensure chlorination occurs downstream of the screens.

***DEP Response*:**
As discussed previously with DEC, pilot testing will be conducted at the Spring Creek Auxiliary Water Pollution Control Plant (AWPCP) to develop dose-response curves that will guide the design for effective disinfection at the three locations proposed for Flushing Creek. The Spring Creek AWPCP does not have influent screening, only screens at the pump-back/dewatering wet well, and therefore the pilot testing will identify the appropriate dosing strategy for unscreened, unsettled CSO.

As discussed with DEC at the April 7, 2015 meeting, the ability to provide screens at the disinfection locations is discussed in this Supplemental Documentation; however the inclusion of solids and floatables capture and the specific location of the chlorine injection with relation to any solids and floatables control will be determined during the final design.

DEC Comment No. 16 on the *Flushing Creek LTCP*:
Section 8: As part of the disinfection alternatives, the City should consider two sewer system modifications:

DEC Comment No. 16a on the *Flushing Creek LTCP*:
Diversion of additional flows from the CSO retention tank bypass structures into the retention tank to take advantage of existing screening and settling capacities of the tank.

***DEP Response*:**
Modeling was completed during the development of the LTCP to evaluate diverting bypass flow into the tank. The model was used to raise weirs in Diversion Chambers 3/5. As part of this run, the model was revised to lower the tank effluent weirs two feet below their as-built elevation, from +2 feet AD to +0 ft AD. Modeling results indicated that the portion of TI-010 annual overflow that is first routed through the tank (receiving screening and settling) would increase by 86%. However, overall overflow to Flushing Creek through Outfall TI-010 would also increase. The alternative would increase annual average CSO volume to the Creek by nearly 90 million gallons. The 90 million gallon increase to TI-010 is the result of the additional flow through the Flushing Bay CSO Retention Facility. The total flow in the system remains constant with the flow to the WWTP being reduced by 90 million gallons. The total flow through the retention facility

is increased by approximately 300 million gallons giving an overall increase in partially treated flow of 210 million gallons. The hydraulic grade line upstream of the retention facility is reduced by approximately 0.25 feet. This option would require changes to the real-time control of the weirs at Diversion Chamber 3/5 as well as the retention facility.

DEC Comment No. 16b on the *Flushing Creek LTCP*:
Diversion of additional flow from Kissena Corridor CSO lines into TI-010 outfall that otherwise would flow into the Flushing Interceptor during wet weather, in order to maximize the benefits for disinfection of TI-010 overflows.

***DEP Response*:**
Modeling was completed during the development of the LTCP to evaluate throttling flow from the TI-010 tributary area into the Flushing Interceptor in order to free up capacity in the interceptor so that it could handle additional flow from the TI-022 and TI-011 tributary area. Two alternative scenarios were evaluated, one with the Flushing Bay CSO Retention Facility weir at its existing elevation and one with the weir lowered by two feet to elevation +0 ft AD to maximize flow through the tank and minimize bypassing. Both scenarios resulted in reduced annual overflow volumes at TI-022 and TI-011, as well as additional flow being routed through the tank before being discharged at TI-010. However, both scenarios also resulted in increased annual average total overflow volumes to Flushing Creek. Keeping the existing weir elevation resulted in an overall increase of over 900 million gallons per year. Lowering the weir elevation resulted in an increase of over one billion gallons per year. This option throttles the flow in the Flushing Interceptor downstream of R-31 limiting the flow to approximately 150% of peak DWF and lowers the weirs around the Flushing Bay CSO Retention Facility to maintain upstream hydraulic grade as shown in the table below:

Structure	HGL (ft.)	
	Baseline	Interceptor Throttling
Diversion Chamber 2	4.25	2.50
Diversion Chamber 3	4.25	2.00
	4.25	2.00
	4.25	2.00
R-31	12.85	12.00
Diversion Chamber 4	4.25	4.00
Flushing Bay CSO Retention Facility Weir	2.00	0.00

Optimization of the weir elevations at Diversion Chambers 2, 3/5, 4 and R-31 could potentially reduce the amount of additional untreated overflow at TI-010 and send more flow through the Flushing Creek CSO Retention Facility, but this would increase the HGL in the Kissena Corridor.

DEC Comment No. 17 on the *Flushing Creek LTCP*:
Section 8.1.a: The first sentence states that there are no performance gaps because the baseline conditions meet the Existing WQ Criteria, however, the second paragraph states that the dissolved oxygen criterion is not attained. Revise the first paragraph to reflect the attainment with all of the Existing WQ Criteria, including dissolved oxygen.

***DEP Response*:**
The sentence has been revised as follows.

Current language: "Section 6.0 presented evaluations of baseline LTCP conditions and concluded that there are no performance gaps because baseline conditions attain Existing WQ Criteria (Class I)."

Proposed language: "Section 6.0 presented evaluations of baseline LTCP conditions and concluded that there are no performance gaps regarding bacteria because baseline conditions attain bacteria Existing WQ Criteria (Class I). However, the existing dissolved oxygen criterion for Class I is not attained under baseline conditions."

DEC Comment No. 18 on the *Flushing Creek LTCP*:
Section 8, p. 8-13: The LTCP states that the proposed chlorination study will be at Alley Creek rather than Spring Creek.

***DEP Response*:**
The text states that the chlorination studies were proposed as part of the Alley Creek LTCP and does not specify the physical location at which such studies will take place. DEP proposes the following language revision for clarification.

Current language: "Towards this end, DEP has proposed to conduct chlorination studies as part of the Alley Creek LTCP implementation."

Proposed language: "Towards this end, DEP has proposed to conduct chlorination studies as part of the Alley Creek LTCP implementation. These studies are planned to take place at the Spring Creek Auxiliary Water Pollution Control Plant (AWPCP)."

DEC Comment No. 19 on the *Flushing Creek LTCP*:
Section 8, p. 8-15: The LTCP states that the odor control facilities are not currently being used at the Flushing Bay CSO Retention Facility and a portion of the odor control chlorination system could be used for disinfecting the CSOs. The City shall confirm that any use of the chlorination system will not limit the ability to conduct odor control at the Retention Facility.

***DEP Response*:**
The costs presented in the LTCP include measures to retrofit the existing odor control facilities. DEP is committed to maintain a functional odor control system at the Flushing Bay CSO Retention Facility.

DEC Comment No. 20 on the *Flushing Creek LTCP*:
Section 8.2.a.3: Provide a more detailed schematic illustrating the locations of the chlorination at the CSO Retention Facility, Diversion Chamber 5, and TI-011, and clearly indicate which portions of the flow at each location will be disinfected.

DEP Response:
A portion of Section 8.2.a.3 has been revised as follows (Pages 8-14 through 8-16).

Current Language:

"TI-010 Disinfection

The existing Flushing Bay CSO Retention Facility is just upstream of TI-010 and provides a significant opportunity to maximize the benefit of this existing infrastructure by using it not only for storage but also for disinfection as it would provide contact time in excess of 14 minutes for all flows anticipated in the typical year. This is longer than what is considered necessary for high rate disinfection of CSO flows (5 to 10 minutes). The initial concept for disinfecting at the Flushing Bay CSO Retention Facility is to dose chlorine just downstream of the influent screens. However, modeling indicates that just under half of the CSO discharged from TI-010 in the recreational season (May 1st through October 31st) bypasses the Flushing Bay CSO Retention Facility due to the configuration of the tributary sewers. The bypassing occurs at a number of regulators and diversion chambers just upstream of the tank depending on the upstream hydraulic gradeline. The majority of the bypass occurs through Diversion Chamber No. 5 (DC-5), but additional bypasses can occur at DC-2, DC-4 and Regulator 31 (See Figure 8-5).

Figure 8-5. Combined Sewer Configuration near the Flushing Bay CSO Retention Facility

Due to the high percentage of flow bypassing the tank, additional dosing locations were evaluated to determine the optimum dosing location that would provide disinfection for the largest proportion of TI-010 CSO discharges in the recreational season (May 1st through October 31st). Table 8-2 compares the possible dosing locations. Options A, B and D only add disinfection and do not otherwise alter the existing system configuration of the tank or gate operation. Option C considers other system configuration changes, including raising the effluent weir of the retention facility from +2.0 to +2.5 and modifying the DC-5 gate protocols. Option D would entail dosing at two locations. The system changes accompanying Option C would alter the operation of the tank, which currently operates in flow-through mode when it fills above elevation +2.0. By raising the weir and changing the DC-5 gate operation, excess flow would instead bypass the tank through DC-5, where chlorine dosing would occur. Above elevation +2.5 the tank would again operate in flow-through mode.

Table 8-2. Optional Disinfection Dosing Locations for TI-010

Dosing Location(s)	Proportion of TI-010 Rec Season CSO Volume Disinfected (%)	Waterbody-wide Rec Season Fecal Reduction (%)	Waterbody-wide Rec Season Enterococcus Reduction (%)	NPW ($ Millions)
A. Downstream of Tank Screens	49	14.4	23.8	5.5
B. Upstream of DC-3	71	21.6	35.9	6.4
C. Upstream of DC-5	85	25.1	42.0	6.2
D. Tank Screens + U/S of DC-5	88	25.6	43.0	7.2

Dosing for each of the TI-010 disinfection options is relatively close in proximity to the existing retention facility. The existing facility is equipped with a chemical facility for odor control consisting of separate tanks, pumps, piping, fill stations and containment for sodium hypochlorite and sodium hydroxide. These facilities were commissioned when the facility was brought on-line, but have never been operated. To provide for CSO disinfection, a portion of the odor control sodium hypochlorite system would be converted to CSO disinfection facilities. Costs for converting the existing facilities, as well as for keeping the odor control system operational, are included in the costs in Table 8-2. For some of the alternatives, with dosing locations upstream of the tank screens, it may also be necessary to include some flow control structures to increase detention time in the outfall pipe upstream of TI-010. The structures would add between $6M to $7M to the cost of either facility plus any land acquisition costs.

TI-011 Disinfection

Siting a new chlorine contact tank near TI-011 would be very challenging because the area around TI-011 is densely developed. To avoid the significant land acquisition challenges associated with siting a contact tank, using the existing outfall to provide contact time was evaluated. It was determined that dosing just downstream of Regulator TI-R09 would provide contact time in excess of 6 minutes for all flows anticipated in the

typical year recreational season (May 1st through October 31st). This minimum contact time is adequate for high rate disinfection and would occur for only minutes during the recreational season (May 1st through October 31st) at the very peak flow. Much longer contact times will be available during lower flows, which occur the majority of the time. Siting options for the chlorination building were evaluated and three possible sites were identified, including a DEP maintenance garage site and two Consolidated Edison sites. Figure 8-6 shows one possible location for the chlorination facilities within an existing DEP garage at Downing Street and 32nd Avenue.

Figure 8-6. Example TI-011 Disinfection Facility Location and NaOCl Solution Pipe Routing

Disinfection of TI-011 would result in a waterbody-wide recreational season (May 1st through October 31st) fecal coliform reduction of 63.3 percent and enterococcus reduction of 42.9 percent. Comparing this to Table 8-2, disinfection of TI-011 would provide a greater reduction in fecal coliform than all of the TI-010 disinfection options and a similar reduction in enterococcus to that of TI-010 Option D. This is partially due to the efficiency of the dosing locations for each alternative. While nearly 80 percent more CSO discharges from TI-010 than from TI-011, only a portion of the CSO at TI-010 would get disinfected. Additionally, water quality sampling at both locations shows that average fecal concentrations at TI-011 are five times greater than at TI-010 (1,355,000 compared to 268,500 cfu/100mL) and enterococcus concentrations are nearly twice as high (151,737 compared to 77,802 cfu/100mL). The drainage area tributary to TI-010 includes the Flushing Bay CSO Retention Facility, which provides some bacteria reduction through solids settling and a sizeable area of parkland increasing the proportion of stormwater to sanitary sewage in the flow reaching TI-010 creating a dilution effect.

Disinfection Options B, C and D for TI-010 and the disinfection alternative for TI-011 would all rely, at least in part, on contact time provided in the existing outfalls. Minimum contact times have been evaluated based on modeled 5-minute peak flows and are considered to be adequate for high rate disinfection. However, the design flow rate, as well as the target minimum contact time for any disinfection facilities, will be confirmed during design. If it is decided to target a longer contact time, control structures may be required at the end of the outfalls to increase contact volumes throughout each event. Alternatively, control structures would also likely be necessary if dechlorination is

required in the future to provide for improved process control. These structures would need to be located within the easement above the outfalls or on private property adjacent to the outfalls. The control structures and dechlorination facilities would add between $6M to $7M to each of the disinfection alternatives costs identified below, plus any additional land acquisition costs. All siting considerations for the chlorination facilities and any potential future dechlorination facilities would require further evaluation."

Proposed Language:

"TI-010 Disinfection

The existing Flushing Bay CSO Retention Facility is just upstream of TI-010 and provides a significant opportunity to maximize the benefit of this existing infrastructure by using it not only for storage but also for disinfection, as it would provide contact time in excess of 14 minutes for all flows anticipated in the typical year. This is longer than what is considered necessary for high rate disinfection of CSO flows (5 to 10 minutes). The initial concept for disinfecting at the Flushing Bay CSO Retention Facility was to dose chlorine just downstream of the influent screens. However, modeling indicates that just under half of the CSO discharged from TI-010 in the recreational season (May 1st through October 31st) bypasses the Flushing Bay CSO Retention Facility due to the configuration of the tributary sewers. The bypassing occurs at a number of regulators and diversion chambers just upstream of the tank depending on the upstream hydraulic gradeline. The majority of the bypass occurs through Diversion Chamber No. 5 (DC-5), but additional bypasses can occur at DC-2, DC-4 and Regulator 31 (See Figure 8-5).

Figure 8-5. Combined Sewer Configuration near the Flushing Bay CSO Retention Facility (Revised)

Due to the high percentage of flow bypassing the tank, additional dosing locations were evaluated to determine the optimum dosing location that would provide disinfection for the largest proportion of TI-010 CSO discharges in the recreational season (May 1st through October 31st). Table 8-2 compares the possible dosing locations, which are also highlighted on Figure 8-5. Options A, B and D only add disinfection and do not otherwise alter the existing system configuration of the tank or gate operation. Option C considers other system configuration changes, including raising the effluent weir of the retention facility from +2.0 to +2.5 and modifying the DC-5 gate protocols. Option D would entail dosing at two locations. The system changes accompanying Option C would alter the operation of the tank, which currently operates in flow-through mode when it fills above elevation +2.0. By raising the weir and changing the DC-5 gate operation, excess flow would instead bypass the tank through DC-5, where chlorine dosing would occur. Above elevation +2.5 the tank would again operate in flow-through mode.

Table 8-2. Optional Disinfection Dosing Locations for TI-010 (Revised)

Dosing Location(s)	Total Baseline Recreational Season CSO Volume (MGY)		Proportion of Recreational Season CSO Volume Disinfected (%)		Waterbody-wide Recreational Season Bacteria Reduction (%)		CSO Volume Disinfected (MGY)	NPW ($ Millions)
	Waterbody-wide	TI-010	Waterbody-wide	TI-010	Fecal	Entero		
A.Downstream of Tank Screens	682	430	31	49	14.4	23.8	211	5.5
B. Upstream of DC-3	682	430	44	71	21.6	35.9	303	6.4
C. Upstream of DC-5	682	430	53	85	25.1	42.0	361	6.2
D. Tank Screens + U/S of DC-5	682	430	56	88	25.6	43.0	379	7.2

Dosing for each of the TI-010 disinfection options is relatively close in proximity to the existing retention facility. The existing facility is equipped with a chemical facility for odor control consisting of separate tanks, pumps, piping, fill stations and containment for sodium hypochlorite and sodium hydroxide. These facilities were commissioned when the facility was brought on-line, but have never been operated. To provide for CSO disinfection, a portion of the odor control sodium hypochlorite system would be converted to CSO disinfection facilities. Costs for converting the existing facilities, as well as for keeping the odor control system operational, are included in the costs in Table 8-2. For some of the alternatives, with dosing locations upstream of the tank screens, it may also be necessary to include some flow control structures to increase detention time in the outfall pipe upstream of TI-010. The structures would add between $6M to $7M to the cost of either facility plus any land acquisition costs.

TI-011 Disinfection

Siting a new chlorine contact tank near TI-011 would be very challenging because the area around TI-011 is densely developed. To avoid the significant land acquisition challenges associated with siting a contact tank, using the existing outfall to provide contact time was evaluated. It was determined that dosing just downstream of Regulator TI-R09 would provide contact time in excess of 6 minutes for all flows anticipated in the typical year recreational season (May 1st through October 31st). This minimum contact time is adequate for high rate disinfection and would occur for only minutes during the recreational season (May 1st through October 31st) at the very peak flow. Much longer contact times will be available during lower flows, which occur the majority of the time. Siting options for the chlorination building were evaluated and three possible sites were identified, including a DEP maintenance garage site and two Consolidated Edison sites. Figure 8-6 shows one possible location for the chlorination facilities within an existing DEP garage at Downing Street and 32nd Avenue. The projected performance and cost of disinfection at TI-011 are summarized in the New Table below.

New Table. Characteristics of Disinfection for TI-011

Dosing Location	Total Baseline Recreational Season CSO Volume (MGY)		Proportion of Recreational Season CSO Volume Disinfected (%)		Waterbody-wide Recreational Season Bacteria Reduction (%)		CSO Volume Disinfected (MGY)	NPW ($ Millions)
	Waterbody-wide	TI-011	Waterbody-wide	TI-011	Fecal	Entero		
Regulator 9	682	206	30	100	63.3	42.9	206	9.5

Figure 8-6. Example TI-011 Disinfection Facility Location and NaOCl Solution Pipe Routing (Revised)

Disinfection of TI-011 would result in a waterbody-wide recreational season (May 1st through October 31st) fecal coliform reduction of 63.3 percent and enterococcus reduction of 42.9 percent. Comparing this to Table 8-2, disinfection of TI-011 would provide a greater reduction in fecal coliform than all of the TI-010 disinfection options and a similar reduction in enterococcus to that of TI-010 Option D. This is partially due to the efficiency of the dosing locations for each alternative. While nearly 80 percent more CSO discharges from TI-010 than from TI-011, only a portion of the CSO at TI-010 would get disinfected. Additionally, water quality sampling at both locations shows that average fecal concentrations at TI-011 are five times greater than at TI-010 (1,355,000 compared to 268,500 cfu/100mL) and enterococcus concentrations are nearly twice as high (151,737 compared to 77,802 cfu/100mL). The drainage area tributary to TI-010 includes the Flushing Bay CSO Retention Facility, which provides some bacteria reduction through solids settling and a sizeable area of parkland increasing the proportion of stormwater to sanitary sewage in the flow reaching TI-010 creating a dilution effect.

Disinfection Options B, C and D for TI-010 and the disinfection alternative for TI-011 would all rely, at least in part, on contact time provided in the existing outfalls. Minimum contact times have been evaluated based on modeled 5-minute peak flows and are considered to be adequate for high rate disinfection. However, the design flow rate, as well as the target minimum contact time for any disinfection facilities, will be confirmed during design. If it is decided to target a longer contact time, control structures may be required at the end of the outfalls to increase contact volumes throughout each event. Alternatively, control structures would also likely be necessary if dechlorination is required in the future to provide for improved process control. These structures would need to be located within the easement above the outfalls or on private property adjacent to the outfalls. The control structures and dechlorination facilities would add between $6M to $7M to each of the disinfection alternatives costs identified below, plus any additional land acquisition costs. All siting considerations for the chlorination facilities and any potential future dechlorination facilities would require further evaluation."

DEC Comment No. 21 on the *Flushing Creek LTCP*:
Section 8: On p. 8-36, it states that the selected alternative will result in increases in attainment levels for Primary Contact Recreation standards from 83 percent to 100 percent at OW6 for the recreational season, however, the information on Table 8-15 indicates that attainment levels will only be 92 percent for OW6 for the selected alternative. A similar inconsistency exists for statements related to OW3. Reconcile the conflicting statements.

***DEP Response*:**
The attainment results reported under Section 8.5.b are based on the 2008 typical year model runs, whereas the attainment results reported under Section 8.5.c are based on the 10 year model runs.

DEC Comment No. 22 on the *Flushing Creek LTCP*:
Section 8: For the estimation of costs, indicate the projected number of years used to determine the NPW for the alternatives and if the NPW includes a STW full time for maintenance and operation. Also, it appears that Alternative 1A includes O&M costs for 20 years whereas the other alternatives only considered 15 years for O&M, please reconcile or explain this difference.

***DEP Response*:**
All cost estimates are based on 20-year NPW. O&M costs for disinfection assume staffing from May to October only and include one supervisor and one operator. The disinfection alternative for TI-010, which included a new control structure, contained an additional labor cost for periodic maintenance of the control structure (assumed to be twice a month for the entire year).

DEC Comment No. 23 on the *Flushing Creek LTCP*:
Sections 8.5.c and 8.5.d: Section 8.5.d states that the selected alternative will result in nearly 100 percent reduction of bacterial loads from outfalls TI-010 and TI-011**,** however, in Section 8.5.c, it states the selected alternative will reduce bacterial loads by 88 percent. Reconcile the conflicting statements. In addition, based on the description of the selected alternative, it appears that only a portion of the flow from TI-010 will be disinfected, not all of the flow, such as the bypass around the tank.

***DEP Response*:**
The text has been revised as follows.

Current language: "The explanation for this is as follows: for a given wet weather event during the recreational season (May 1st through October 31st), the preferred alternative provides nearly 100 percent bacteria loading reduction at Outfalls TI-010 and TI-011, beyond the 75 percent bacteria loading reduction provided by the Alternative 6 tunnel."

Proposed language: "The explanation for this is as follows: for a given wet weather event during the recreational season (May 1st through October 31st), the preferred alternative provides nearly 88 percent bacteria loading reduction at Outfalls TI-010 and TI-011, beyond the 75 percent bacteria loading reduction provided by the Alternative 6 tunnel."

DEC Comment No. 24 on the *Flushing Creek LTCP*:
Section 8: The City should provide a more detailed description of the siting of the chlorination facilities, including a description of the site acquisition efforts conducted to date, information on site ownership, possible siting issues, and schedule to complete necessary site access.

***DEP Response*:**
DEP has currently been conducting desktop research study based on existing land use, structures, potential natural resource permitting constraints, and potential hazardous material issues in order to site LTCP facilities. The screening study is broken up into two steps. Step 1 eliminates properties that are outside of the CSO proximity search radius (1,000 feet), properties that are small and are non-contiguous with other study properties or properties zoned for dense residential development. Step 2 assess parcels identified in step 1 and evaluates them based on desktop research to identify natural resources, available land area, and hazardous materials. After the completion of the screening analysis, the study sites were ranked based on the feasibility of constructing and operating a CSO facility within the study site.

Ideally, subject properties identified at the conclusion of the study would include DEP-owned property and/or New York City-owned property. However, many of the properties identified include privately-owned commercial or industrial property. In addition, many NYC-owned properties identified at the conclusion of the study include parkland. Before a project can be undertaken on a privately-owned or park property various requirements must be scheduled for and undertaken. Privately owned parcels must first be acquired which requires ULURP, an approximately seven month public review process that cannot start until environmental review is complete (therefore the entire process, including application and review, is usually upwards of a year); further, acquisition may require timely negotiations and site preparation may require potential demolition on existing structures. Parcels identified on parkland would require negotiations with NYCDPR and possible legislative approval for alienation of parkland and associated mitigation, which can take over a year.

Parcels with natural resources such as wetlands would require on-site delineation, permitting, and potential mitigation. Parcels that have been identified as having potential hazmat issues would require a Phase II environmental investigation and in turn may require remediation. As a result, these additional, more extensive analyses would be handled during the project's design phase rather than during the screening process.

2.2.6 SECTION 9.0 - LONG TERM CSO CONTROL PLAN IMPLEMENTATION

DEC Comment No. 25 on the *Flushing Creek LTCP*:
Section 9: The implementation schedule on p. 9-3 needs to include site acquisition as a separate activity with linkages to the other schedule elements with enforceable milestones.

DEP Response and Schedule:
The implementation schedule has been revised to include site acquisition activities. Consistent with other waterbody-specific LTCP implementation schedules, the design task activity has been relabeled "design/permitting/site acquisition" to better reflect the activities that occur during the design phase.

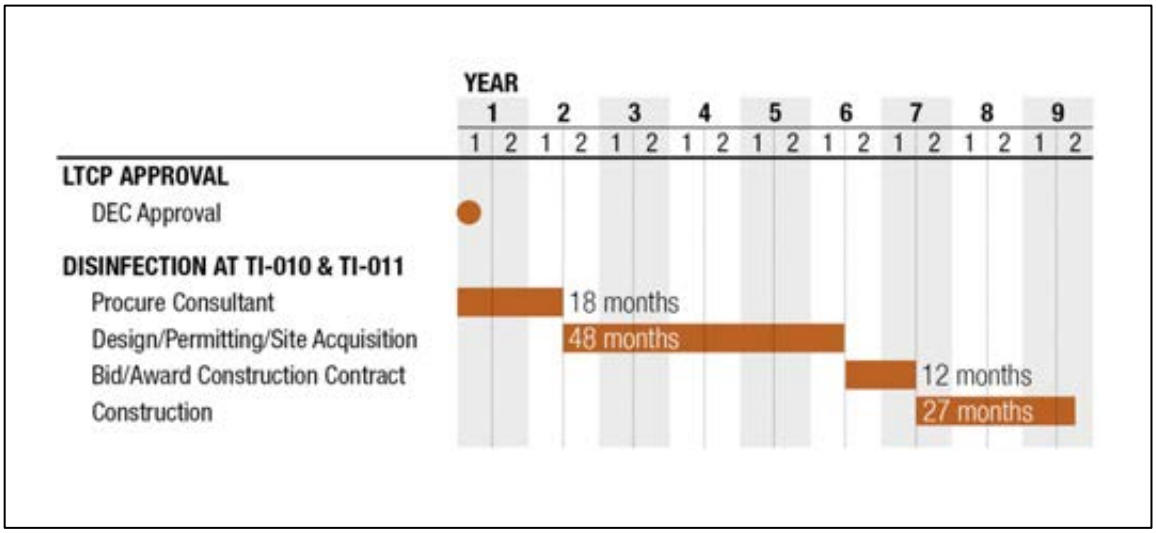


Figure 9-1. Implementation Schedule (Revised)

DEC Comment No. 26 on the *Flushing Creek LTCP*:
Section 9: The City may want to consider streamlining the affordability and financial capability information provided in Section 9.

DEP Response:
DEP notes DEC's comment and will give this consideration for future LTCPs. The affordability and financial capability analysis is an important part of the LTCP.

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 that are consistent with the Federal CSO Control Policy and the Clean Water Act (CWA).

1. BACKGROUND

This Long Term Control Plan (LTCP) for Flushing Creek 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 Flushing Creek LTCP is the fourth of the LTCPs to be completed under the 2012 CSO Order on Consent.

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 Federal 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 pathogen targets and associated recovery times. For this LTCP, in accordance with guidance from DEC, 95 percent attainment of applicable water quality criteria constitutes compliance with the existing WQS or the Section 101(a)(2) goals, conditioned on verification through rigorous post-construction compliance monitoring (PCM).

Regulatory Requirements

The waters of the City of New York (NYC) 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.

DEC has designated the saline portion of the Flushing 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. Class I waters include a fecal coliform bacteria indicator criterion that is

currently listed in the DEC WQS. DEC has publicly noticed a proposed rulemaking to amend 6 NYCRR Parts 701 and 703. The proposed total and fecal coliform standards for Class I are the same as the existing standards for Class SC waters.

The criteria assessed in this LTCP include the applicable Existing WQ Criteria (Class I – Secondary Contact) (referred to hereinafter as Existing WQ Criteria) for Flushing Creek. The next higher classification category for Flushing Creek is Class SC[1] (referred to hereinafter as Primary Contact WQ Criteria). It should also be noted that the enterococci criteria do not apply to the saline or freshwater sections of Flushing Creek. As described above, the 2012 EPA RWQC recommended certain changes to the bacterial water quality criteria for primary contact. As such, this LTCP includes attainment analysis both for Existing WQ Criteria, for Primary Contact WQ Criteria and for the proposed 2012 EPA RWQC (referred to hereinafter as the "Potential Future Primary Contact WQ Criteria").

Table ES-1 summarizes the Existing WQ Criteria, Primary Contact WQ Criteria and Potential Future Primary Contact WQ Criteria applied in this LTCP.

Table ES-1. Classifications and Criteria Applied for Gap Analysis (1)(Revised)

Analysis	Numerical Criteria Applied
Existing WQ Criteria(1)	I: Fecal Monthly GM ≤ 2,000 cfu/100mL DO daily average ≥ 4.8 mg/L; DO never < 3.0 mg/L
Primary Contact WQ Criteria(2)	SC: Fecal Monthly GM≤200 cfu/100mL DO daily average ≥ 4.8 mg/L; DO never < 3.0 mg/L
Potential Future Primary Contact WQ Criteria(3)	Entero: rolling 30-d GM – 30 cfu/100mL Entero: STV – 110 cfu/100mL

Notes:
GM = Geometric Mean; STV = 90th Percentile Statistical Threshold Value.
(1) DEC has publicly noticed a proposed rulemaking to amend 6 NYCRR Parts 701 and 703. The proposed total and fecal coliform standards for Class I are the same as the existing standards for Class SC waters.
(2) This water quality standard is not currently assigned to Flushing Creek.
(3) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.

The waterbody was calculated to attain the existing Class I fecal coliform water quality criterion of GM ≤ 2,000 cfu/100mL 96.7 percent of the time. Flushing Creek thus exceeds the DEC goal of 95 percent attainment and therefore can be said to be in full attainment of the bacteria Existing WQ Criteria. Therefore there is no gap between the baseline water quality conditions for fecal coliform bacteria and the water quality for the Existing WQ Criteria.

Further analyses of current Primary Contact WQ (Class SC) Criteria demonstrated that the attainment of the corresponding fecal coliform criterion of 200 cfu/100mL would be lower than 95 percent at all stations, both annually and seasonally for baseline and 100 percent CSO control conditions.

[1] The Flushing Creek LTCP evaluates compliance with various primary contact WQ numerical limits including the Primary Contact fecal coliform WQ Criteria (Class SC WQS). With DEC's December 3, 2014 proposed rulemaking to change Class I fecal coliform bacteria criteria to 200 cfu/100mL, Class SC and proposed Class I fecal coliform criteria would both retain the 200 cfu/100mL limitation.

In addition, analyses on attainment with more stringent Potential Future Primary Contact WQ Criteria indicated that the gap between the Future Primary Contact recreation criteria (GM of 30 cfu/100mL and statistical threshold value (STV) of 110 cfu/100mL) and the baseline conditions could not be closed even with complete removal of the Flushing Creek CSOs.

As both Primary Contact WQ Criteria (Class SC) and Potential Future Primary Contact WQ Criteria would not be achieved with the removal of 100 percent CSO discharges from Flushing Creek, on an annual or recreational season (May 1st through October 31st) basis, a sensitivity analysis was performed for the 2008 conditions to assess whether complete removal of the CSO discharges from outfalls in nearby Flushing Bay would improve conditions. The results of that analysis indicated that complete removal of both Flushing Creek and Flushing Bay CSOs would improve annual and seasonal attainment of Primary Contact WQ Criteria (Class SC) as well as Potential Future Primary Contact recreation GM criterion to 100 percent. However, attainment of the Potential Future Primary Contact recreation STV criterion would not be accomplished.

A Use Attainability Analysis (UAA) for Flushing Creek is included with this LTCP. It is recognized that the UAA may need to be updated in June 2017 with the conclusion of the Flushing Bay LTCP; due to Flushing Creek's overall water quality attainment being impacted by Flushing Bay. DEP is proposing to submit a comprehensive UAA for both Flushing Bay and Flushing Creek, if required, when the Flushing Bay LTCP is completed in June 2017. A State Pollutant Discharge Elimination System (SPDES) Permit Variance is provided for the Flushing Bay CSO Retention Facility as requested by the DEC.

On December 3, 2014, DEC publicly noticed a proposed rulemaking to amend 6 NYCRR Part 701 and 703. In developing the Flushing Creek LTCP, these proposed new regulations are referred to as Potential Future Primary Contact WQ Criteria. At the conclusion of DEC rulemaking, the LTCP will be reviewed for impacts to the findings.

Flushing Creek Watershed

The Flushing Creek watershed is highly urbanized, comprised primarily of residential areas with some commercial, industrial, institutional and open space/outdoor recreation areas. The watershed comprises approximately 9,954 acres, located on the north shore of Queens County. The majority of the land surrounding the shores of Flushing Creek is industrial, commercial, vacant or used in support of transportation related features. The shoreline at the head of Flushing Creek, upstream of the Long Island Railroad (LIRR) tracks is surrounded by the Flushing Meadows-Corona Park, a notable open space/outdoor recreation area that occupies close to 20 percent of the Flushing Creek watershed. The watershed has undergone major changes as this part of NYC has developed. As it developed, the condition of the waterbody and its shoreline has been influenced by engineered sewer systems, filled-in wetlands and an overall "hardening" of the western shoreline with bulkheads. Flushing Creek watershed drainage characteristics are shown in Figure ES-1.

Figure ES-1. Flushing Creek Watershed Characteristics

The area is served by a complex collection system comprised of: combined, separate, and storm sewers; interceptor sewers and pumping stations; several CSO and stormwater outfalls; and a CSO retention tank. The majority of the watershed is served by the Tallman Island Wastewater Treatment Plant (WWTP). A smaller drainage area on the southeastern end of the watershed is served by the Bowery Bay WWTP. The major CSO and stormwater outfalls are shown in Figure ES-2. The sampling locations for Flushing Creek are shown in Figure ES-3.

The area is currently undergoing several zoning changes and planning efforts are underway for the area. Section 2 of the LTCP discusses these changes.

Green Infrastructure

DEP is planning to make significant investments in Green Infrastructure (GI) in the Flushing Creek watershed within the Tallman Island WWTP service area. DEP projects that GI penetration rates would manage 8 percent of the impervious surfaces within the Flushing Creek/Bay portion of the Tallman Island combined sewer service area and 13 percent of the impervious surfaces in the Flushing Creek/Bay portion of the Bowery Bay WWTP combined sewer service area by 2030. This accounts for ROW practices, public property retrofits, GI implementation on private properties, and for conservatively estimated new development trends based on DOB building permit data from 2000 to 2011 and has projected that data for the 2012-2030 period to account for compliance with the stormwater performance standard. The model has predicted a reduction in annual overflow volume of 46 million gallons (MG) from this GI implementation based on the 2008 baseline rainfall condition.

2. FINDINGS

Current Water Quality Conditions

Analysis of water quality in Flushing Creek was based on data collected from October 2013 to May 2014. Table ES-2 presents fecal coliform bacteria data collected at Stations OW-1, OW-2, OW-3, OW-4, OW-5 and OW-6 in Flushing Creek. The data in Table ES-2 shows the bacteria levels from the upstream (OW-1) to downstream (OW-6) locations. The sampling data were found to be below the Existing WQ Criteria for Class I for fecal coliform which is 2,000 cfu/100mL at all locations except the OW-3 and OW-4 for a wet weather condition. The Primary Contact WQ Criteria for fecal (200 cfu/100mL) and the Potential Future Primary Contact WQ Criteria for enterococci (30 cfu/100mL) would be exceeded at several locations.

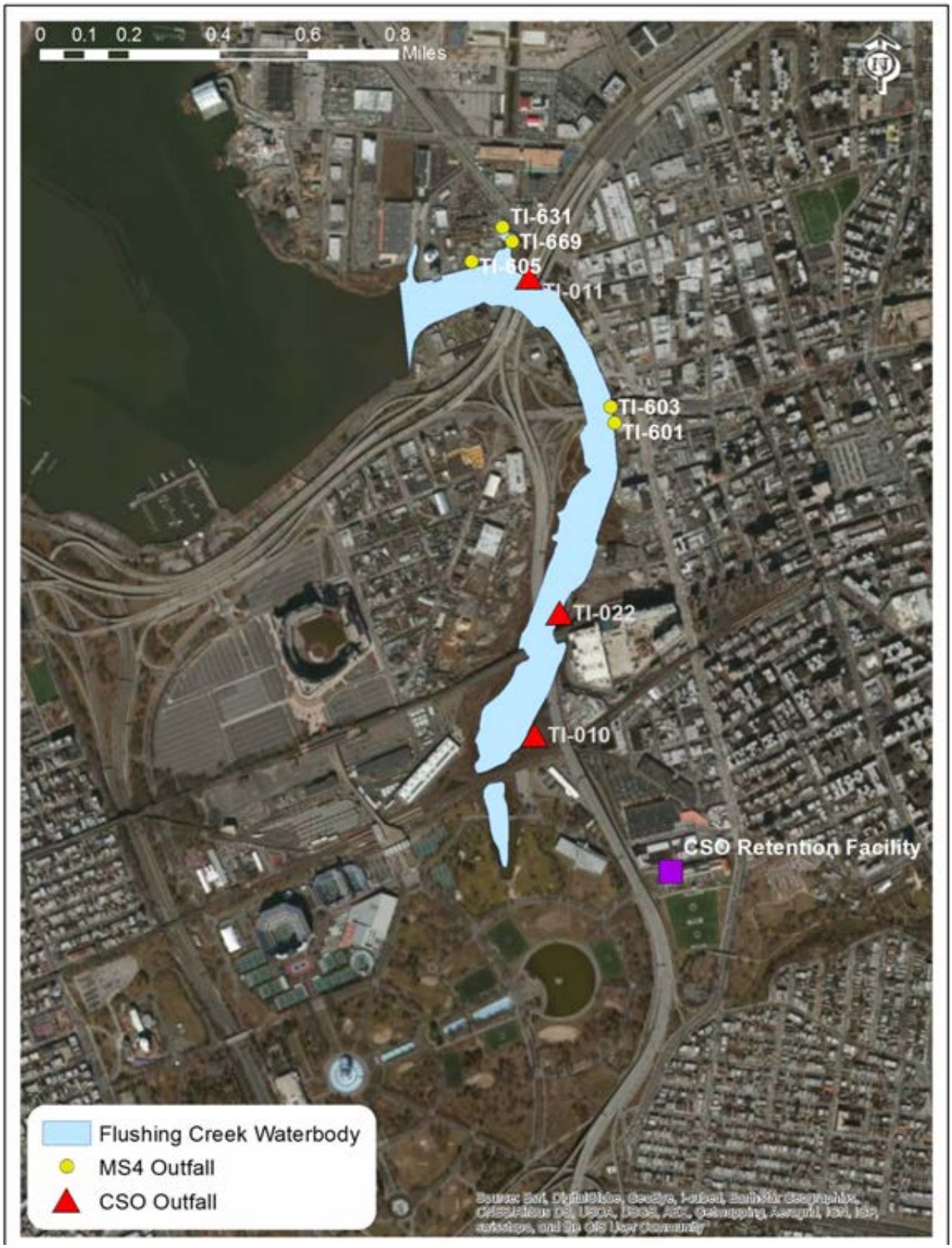


Figure ES-2. Flushing Creek CSO and DEP MS4 Discharge Locations

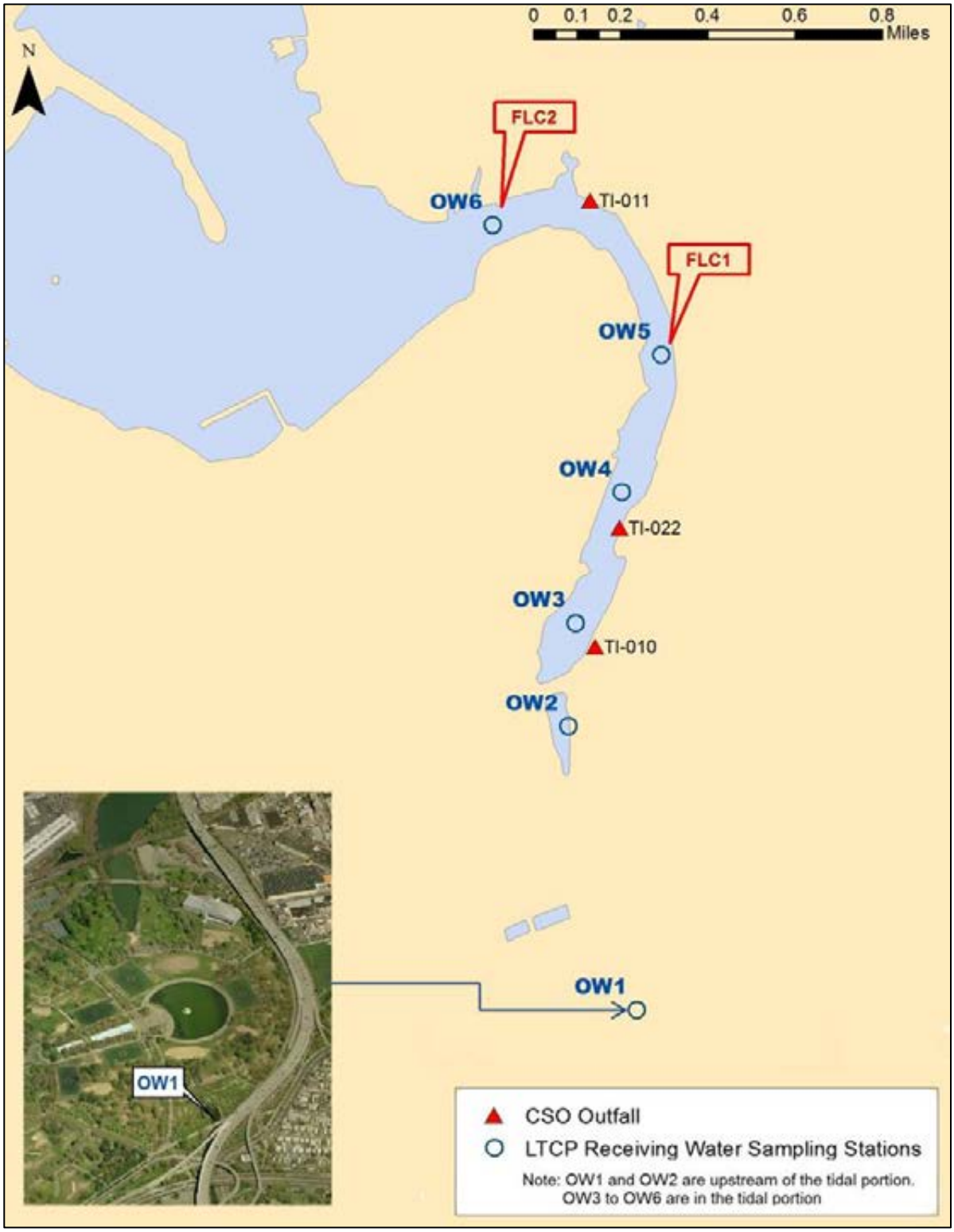


Figure ES-3. Field Sampling and Analysis Program (FSAP) and Harbor Survey Monitoring Program Sampling Locations

Table ES-2. Geometric Means of In-stream Bacteria Samples

Creek Station	Location	Enterococci (cfu/100mL)		Fecal Coliform (cfu/100mL)	
		Dry	Wet	Dry	Wet
OW-1	Willow and Meadow Lake	32	51	130	131
OW-2		20	99	100	433
OW-3	Flushing Creek	95	863	524	3,310
OW-4		23	494	119	2,176
OW-5		20	497	112	1,894
OW-6		14	221	77	910

Stations OW-1 and OW-2 are upstream of the saline portion, while the stations below OW-2 are in the saline section. The highest values for enterococci bacteria and fecal coliform were found in the saline section of the Creek. The higher concentrations for dry weather fecal coliform and enterococci at OW-3 are being investigated by DEP for possible illicit discharges.

Baseline Conditions, 100 Percent CSO Control and Performance Gap

Analyses utilizing computer models were conducted as part of this LTCP to assess attainment with Existing WQ Criteria (Class I) and Potential Future Primary Contact WQ Criteria for the Flushing Creek freshwater and saline sections. 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 to the waterbody. These sources would primarily be direct drainage runoff, stormwater and CSO. It should be also noted that Flushing Bay inputs impacts the Flushing Creek water quality attainments. This analysis is presented for Existing WQ Criteria and Potential Future Primary Contact WQ Criteria.

2. Determine potential attainment levels with 100 percent of CSO controlled or no discharge of CSO to the waterbody, keeping the remaining non-CSO 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). This model was verified with Harbor Survey data and the synoptic water quality data collected as part of the LTCP. Model outputs for fecal and enterococci bacteria as well as dissolved oxygen (DO) were compared with various monitoring data sets. The InfoWorks CS™ (IW) sewer system model was used to provide flows and loads from intermittent wet weather sources as input to the ERTM water quality model. All water quality models were calibrated to the data collected by the LTCP and Harbor Survey sampling programs and then used to make the water quality modeling projections.

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 and Bowery Bay WWTPs would receive peak flows at two times design dry weather flow (2xDDWF), and waterbody-specific GI application rates would be based on the best available information. In the case of Flushing Creek, GI was assumed to have 8 percent coverage. The water quality assessments were conducted using continuous water quality simulations: a one year (2008 rainfall) simulation for bacteria and DO assessment to support alternatives evaluation; and a 10-year (2002 to 2011 rainfall) simulation for bacteria for attainment analysis for the baseline, 100 percent CSO control and the preferred alternative model simulations.

The annual average baseline loadings for 2008 are presented in Table ES-3.

Table ES-3. Annual CSO, Stormwater, and Direct Drainage Volumes and Loads (2008 Rainfall)

Source	Volumetric Discharge (MG/yr)	Enterococci Load (cfu x 10^{12})	Fecal Coliform Load (cfu x 10^{12})	BOD Load (Lbs)
CSO	1,340	5,115	30,730	269,960
Stormwater/Direct Drainage	645	300	630	80,665
Meadow/Willow Lake	455	8	25	57,010
Total	**2,440**	**5,423**	**31,385**	**407,635**

Tables ES-4 and ES-5 show the simulation results for the maximum monthly GM for fecal coliform using a 10-year model simulation for the baseline and 100 percent CSO control. The tables present both the value of the maximum monthly GM and the percent attainment by year. Table ES-4 shows the calculated maximum monthly GMs and the attainment with the existing fecal coliform water quality criterion of 2,000 cfu/100mL. The table shows the fecal coliform concentrations are in attainment a high percentage of the time for the Existing WQ Criteria (2,000 cfu/100mL).

Table ES-5 shows the baseline simulation maximum GMs and attainment for the Primary Contact WQ Criteria or Class SC (200 cfu/100mL fecal coliform). The annual and recreational season (May 1st through October 31st) attainment percentages are shown. The annual attainment and recreational attainment are below 95 percent. The recreational season (May 1st through October 31st) attainment level is greater than 95 percent in 1 of the 10 years (2010).

Table ES-6 presents the 100 percent CSO control simulation for Primary Contact WQ Criteria (Class SC). It shows the annual attainment percentages are below 95 percent. However, the recreational season (May 1st through October 31st) attainment levels are greater than 95 percent in 6 of the 10 years.

The Potential Future Primary Contact WQ Criteria for enterococci of 30 cfu/100mL and a 90 percent STV of 110 cfu/100mL is presented in Table ES-7 and Table ES-8. The results of these simulations do not meet the potential future enterococci criteria. As noted before, the Flushing Creek water quality is impacted by the Flushing Bay. The Flushing Bay LTCP is planned for June 2017 and will identify reductions in CSO loads that may impact Flushing Creek. DEP plans to update the model simulations results provided in these tables when the Flushing Bay LTCP is prepared.

Tables ES-7 and ES-8 represent the attainment levels of the enterococci criteria for the baseline and 100 percent CSO control simulations. Table ES-8 shows that with all CSO controlled, the attainment levels for the 30 day GM average between 61 and 67 percent, along with very low attainment of the STV values. This shows that even with all CSO removed the Potential Future Primary Contact WQ Criteria for the 2012 RWQC criteria will not be attained. Table ES-7 shows the baseline simulation with an average attainment of the 30 day GM ranging from 32 to 50 percent and very low compliance with the STV value.

Table ES-4. Calculated 10-Year Baseline Fecal Coliform Maximum Monthly GM Concentrations and Attainment of Existing WQ Criteria (Class I) - Percent of Months in Attainment

Station	(a) Maximum Monthly Fecal Coliform Geometric Mean (cfu/100mL)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
	November	June	April	December	January	December	February	December	March	August	
OW-3	1,135	1,354	834	1,346	1,600	2,184	2,319	4,259	1,275	2,265	1,857
OW-4	1,134	1,296	773	1,324	1,438	2,331	2,379	4,275	1,190	2,146	1,829
OW-5	1,026	1,196	682	1,176	1,264	2,093	2,115	3,808	1,121	1,920	1,640
OW-6	941	1,038	520	1,025	1,129	1,807	1,775	3,508	1,015	1,571	1,433
Station	**(b) Fecal Coliform – Annual Attainment (Percent of Months)**										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
OW-3	100	100	100	100	100	92	92	92	100	92	97
OW-4	100	100	100	100	100	92	92	92	100	92	97
OW-5	100	100	100	100	100	92	92	92	100	100	98
OW-6	100	100	100	100	100	100	100	92	100	100	99

Table ES-5. Calculated 10-Year Baseline Fecal Coliform Maximum Monthly GM and Attainment of Class SC Criterion - Percent of Months in Attainment Baseline

Station	(a) Maximum Monthly Fecal Coliform Geometric Mean (cfu/100mL)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
	November	June	April	December	January	December	February	December	March	August	
OW-3	1,135	1,354	834	1,346	1,600	2,184	2,319	4,259	1,275	2,265	1,857
OW-4	1,134	1,269	773	1,324	1,438	2,331	2,379	4,275	1,190	2,146	1,826
OW-5	1,026	1,196	682	1,176	1,264	2,093	2,115	3,808	1,121	1,920	1,640
OW-6	941	1,038	520	1,025	1,129	1,807	1,775	3,508	1,015	1,571	1,433
Station	**(b) Fecal Coliform – Annual Attainment (Percent of Months)**										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
OW-3	50	42	33	42	33	33	25	42	75	17	39
OW-4	58	42	42	42	33	33	42	42	75	25	43
OW-5	67	42	42	42	42	33	42	50	75	42	48
OW-6	75	50	42	50	42	50	50	58	75	42	53
Station	**(c) Fecal Coliform – Recreational Season Attainment (Percent of Months)**										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
OW-3	67	67	50	83	50	67	50	50	100	33	62
OW-4	83	67	67	83	50	67	67	50	100	50	68
OW-5	100	67	67	83	67	67	67	50	100	67	74
OW-6	100	83	67	83	67	83	83	50	100	67	78

Table ES-6. Calculated 10-Year Baseline Fecal Coliform Maximum Monthly GM and Attainment of Class SC Criterion - Percent of Months in Attainment with 100 Percent CSO Removal

Station	(a) Maximum Monthly Fecal Coliform Geometric Mean (cfu/100mL)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
	November	December	December	December	January	December	February	December	March	March	
OW-3	303	365	230	442	482	522	457	1,114	453	459	483
OW-4	320	376	216	447	475	568	477	1,256	482	483	510
OW-5	392	426	260	493	535	680	565	1,529	557	540	598
OW-6	450	451	291	508	535	770	625	1,769	617	553	657
Station	**(b) Fecal Coliform – Annual Attainment (Percent of Months)**										
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Average**
OW-3	83	75	75	83	83	83	75	75	83	58	77
OW-4	83	75	83	83	83	83	83	75	83	67	80
OW-5	83	67	75	83	83	83	75	75	83	58	77
OW-6	83	67	92	67	83	83	75	75	83	75	78
Station	**(c) Fecal Coliform – Recreational Season Attainment (Percent of Months)**										
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Average**
OW-3	100	83	100	83	100	100	100	83	100	83	93
OW-4	100	83	100	83	100	100	100	83	100	83	93
OW-5	100	83	100	83	100	100	100	83	100	83	93
OW-6	100	83	100	83	100	100	100	83	100	83	93

Table ES-7. Recreational Season Maximum Rolling 30-day GM and Attainment with Potential Future Primary Contact WQ Criteria with 2012 EPA RWQC for Enterococci for Baseline Simulation

Station	(a) Maximum Rolling 30 Day Enterococci Geometric Mean (cfu/100mL)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
OW-3	209	938	205	367	540	477	143	558	136	626	420
OW-4	205	863	183	318	504	447	146	526	126	577	390
OW-5	187	782	163	270	446	402	141	478	118	519	351
OW-6	173	703	129	217	392	350	126	456	105	436	309
Station	(b) Enterococci – Recreational Attainment with Potential Future Primary Contact WQ Criteria with 30-Day GM of 30 cfu/100mL for Enterococci for Baseline Simulation (Percent)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
OW-3	37	29	12	61	21	37	24	24	67	12	32
OW-4	43	41	29	70	26	47	34	28	68	19	41
OW-5	52	47	33	72	28	49	39	31	68	24	44
OW-6	59	51	42	78	32	52	46	37	70	33	50
Station	(c) Enterococci – Recreational Attainment with Potential Future Primary Contact WQ Criteria with STV of 110 cfu/100mL for Enterococci for Baseline Simulation (Percent)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
OW-3	3	0	0	17	0	0	0	0	1	0	2
OW-4	4	0	0	18	0	0	0	0	3	0	3
OW-5	4	0	0	18	0	0	0	0	6	0	3
OW-6	8	0	0	21	0	0	0	0	5	0	3

Table ES-8. Recreational Season Maximum Rolling 30-day GM and Attainment with Potential Future Primary Contact WQ Criteria with 2012 EPA RWQC for Enterococci with 100 Percent CSO Removal

Station	(a) Maximum Rolling 30 Day Enterococci Geometric Mean (cfu/100mL)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
OW-3	90	272	92	127	156	176	62	155	65	154	135
OW-4	85	272	80	116	154	173	57	149	61	154	130
OW-5	98	325	83	124	182	194	67	181	66	189	151
OW-6	103	365	76	129	206	205	75	214	66	219	166
Station	(b) Enterococci – Recreational Attainment with Potential Future Primary Contact WQ Criteria with 30-Day GM of 30 cfu/100mL for Enterococci (Percent)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
OW-3	65	61	51	87	45	59	70	44	75	51	61
OW-4	78	67	61	90	61	61	81	52	83	57	69
OW-5	75	65	57	90	57	61	76	45	83	56	67
OW-6	78	66	58	90	58	60	75	44	84	56	67
Station	(c) Enterococci – Recreational Attainment with Potential Future Primary Contact WQ Criteria with STV of 110 cfu/100mL for Enterococci (Percent)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
OW-3	12	2	0	36	1	10	5	9	19	6	10
OW-4	11	2	0	37	1	10	5	14	24	7	11
OW-5	11	2	0	36	1	9	4	4	12	4	8
OW-6	11	2	0	35	1	0	4	3	12	2	7

Public Outreach

DEP followed a comprehensive public participation plan to ensure engagement of interested stakeholders in the LTCP process. Stakeholders included local residents and citywide and regional groups, a number of whom offered comments at two public meetings held for this LTCP. DEP received comments from the Stormwater Infrastructure Matters Coalition (SWIM), Friends of Flushing Creek, Empire Dragon Boat Team and one citizen after the public meeting. DEP will continue to gather public feedback on waterbody uses and will provide related information to the public at the third Flushing Creek Public Meeting. The third meeting will present the final identified preferred alternative to the public after DEC's review of the LTCP.

The public commented that future development along Flushing Creek should be considered by DEP in the development of the alternatives. Additional information on the public outreach activities is presented in Section 7 and Appendix B, Public Meeting Materials.

Evaluation of Alternatives

A multi-step process was used to evaluate control measures and CSO control alternatives. The evaluation process considered factors related to environmental benefits, community and societal impacts and considerations related to implementation and Operation and Maintenance (O&M). Following the comments from technical workshops, the retained alternatives were subjected to a functional review and cost performance, and cost attainment evaluations where economic factors were introduced. Table ES-9 presents the retained alternatives.

The Flushing Creek alternatives vary significantly in cost ranging in net present worth value from approximately $5M to $1.8B. DEP's preferred alternative, Alternative 3, TI-010 Outfall Disinfection at Tank and Diversion Structure 5 plus TI-011 Outfall Disinfection, is valued at a construction cost of $6.89M and a present worth of $16.3M. The annual O&M costs for this alternative were estimated to be $0.66M. The LTCP cost estimates are considered Association for the Advancement of Cost Engineering (AACE) Class 5 estimates (accuracy range of -50 percent to +100 percent), which is typical and appropriate for this type of planning evaluation. Therefore, the construction cost of the preferred alternative could range from $3.4M to $13.8M. This alternative would achieve a fecal coliform load reduction of 88 percent in the recreational season (May 1st through October 31st). The cost-effectiveness of the alternatives was assessed by determining percent attainment of applicable Existing WQ Criteria, Primary Contact WQ Criteria or Potential Future Primary Contact WQ Criteria for 2008. Figure ES-4 presents the approximate mid-point of Flushing Creek and is presented as an example cost performance curve at Creek Station OW-5. The plot presents net present worth versus percent attainment for the Existing WQ Criteria (Class I), Primary Contact WQ Criteria (Class SC) and the Potential Future Primary Contact WQ Criteria and the recreational season (May 1st through October 31st). Alternative 3 is the fourth line from the left axis. As indicated in Figure ES-4, alternatives with higher costs than Alternative 3 would not result in significant gains in attainment of WQ Criteria. Section 8 presents the attainment versus cost curves for locations OW-6, OW-4, and OW-3.

Table ES-9. Summary of Retained Alternatives

Alternative	Description
1A. TI-010 Tank Disinfection	Chlorinate influent to the Flushing Bay CSO Retention Facility during the recreational season (May 1st through October 31st) just downstream of the influent screens. Contact time would be provided in the tank and downstream outfall sewers.
1B. TI-010 Outfall Disinfection at Diversion Chamber 3	Chlorinate flows entering Diversion Chamber No. 3 during the recreational season (May 1st through October 31st). Contact time would be provided in the tank and various sewers upstream, downstream and bypassing the tank.
1C. TI-010 Outfall Disinfection at Diversion Chamber 5	Raise the tank effluent weir and modify Diversion Chamber No. 5 gate control protocols. Chlorinate flows entering Diversion Chamber No. 5 during the recreational season (May 1st through October 31st). Tank would operate as an off-line tank when the upstream Hydraulic Grade Line (HGL) is between +2.0 and +2.5. Contact time would be provided in the outfall sewers that bypass the tank.
1D. TI-010 Outfall Disinfection at Tank and Diversion Chamber 5	Chlorinate influent flows to the Flushing Bay CSO Retention Facility just downstream of the influent screens and flows entering Diversion Chamber No. 5 during the recreational season (May 1st through October 31st). Contact time would be provided in the tank and outfall sewers that bypass the tank.
2. TI-011 Outfall Disinfection	Chlorinate flows in the TI-011 outfall just downstream of Regulator TI-R09 during the recreational season (May 1st through October 31st). Contact time would be provided in the TI-011 outfall.
3. TI-010 Outfall Disinfection at Tank and Diversion Chamber 5 plus TI-011 Outfall Disinfection	Implement both Alternative 1D and 2 to maximize the volume of recreational season (May 1st through October 31st) overflow to Flushing Creek that is disinfected.
4. 25% Control Tunnel	13-ft. dia., 4,530 LF tunnel to capture 25% of overflow from all three Flushing Creek CSOs. Includes a dewatering pump station (PS) and FM to the Tallman Island WWTP.
5. 50% Control Tunnel	24-ft. dia., 5,710 LF tunnel to capture 50% of overflow from all three Flushing Creek CSOs. Includes dewatering PS and High Rate Clarification (HRC) facility to process dewatering prior to discharging to Flushing Creek.
6. 75% Control Tunnel	32-ft. dia., 7,530 LF tunnel to capture 75% of overflow from all three Flushing Creek CSOs. Includes dewatering PS and HRC facility to process dewatering prior to discharging to Flushing Creek.
7. 100% Control Tunnel	40-ft. dia., 13,840 LF tunnel to capture 100% of overflow from all three Flushing Creek CSOs. Includes dewatering PS and HRC facility to process dewatering prior to discharging to Flushing Creek.

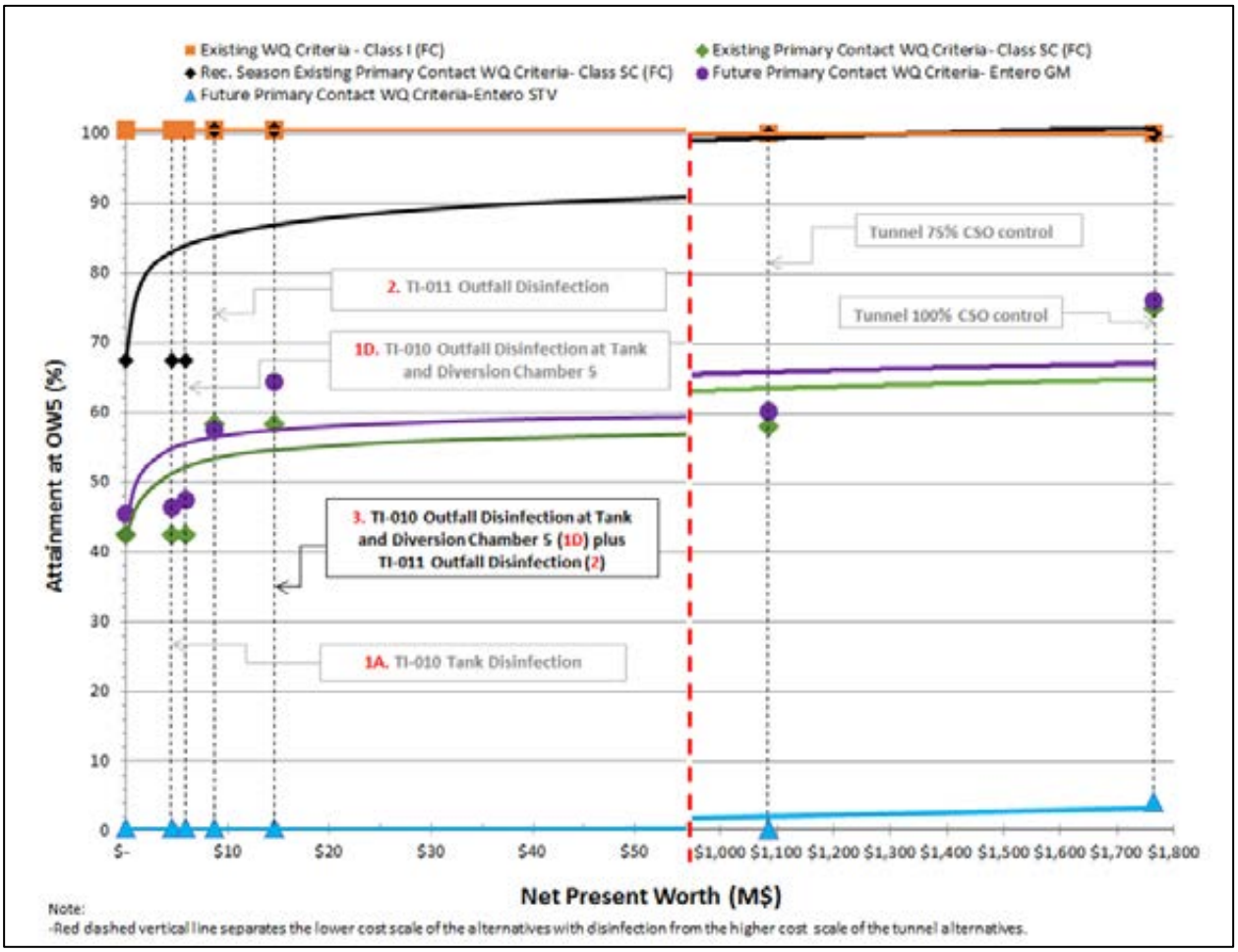


Figure ES-4. Cost vs. Bacteria Attainment at Station OW-5 (2008 Rainfall)

The preferred Alternative 3 consists of the following:

1. Disinfection at TI-010 and TI-011. TI-010 will include re-purposing the existing building to provide disinfection and TI-011 will build a new facility at the existing DEP site or a nearby site.

2. A 99 percent log kill is targeted without dechlorination. The need for dechlorination will be determined with the DEP study being conducted as part of a Spring Creek disinfection study.

   The present worth costs of the Alternative 3 facilities total $16.3M. The estimated construction cost is $6.89M. The O&M annual costs are $0.66M. A breakdown of the costs is shown below:

   - TI-010 Outfall Disinfection at the Tank and Chamber 5 construction cost is $1.97M and the annual O&M cost is $0.35M.
   - TI-011 Outfall Disinfection construction cost is $4.92M with an annual O&M cost of $0.31M.

The preferred Alternative 3 is presented in Figures ES-5 and ES-6. The implementation schedule is presented in Section 9.

Figure ES-5. Alternative 3 – TI-010 Disinfection at the Tank and Diversion Chamber No. 5

Figure ES-6. Alternative 3 – TI-011 Outfall Disinfection Downstream of Regulator TI-R09

3. RECOMMENDATIONS

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

The LTCP analyses and recommendations for Flushing Creek LTCP are summarized below for the following items:

1. Water Quality Modeling Results;
2. UAA assessing attainment of Existing WQ Criteria and Primary Contact WQ Criteria and proposing wet weather advisories while DEP continues to improve water quality in the waterbody; and
3. Summary of Recommendations.

Water Quality Modeling Results

The calculated percent attainment for the recreational season (May 1st through October 31st) for the Existing WQ Criteria, Primary Contact WQ Criteria and Potential Future Primary Contact WQ Criteria for the preferred alternative (Alternative 3) is shown in Table ES-10. Annual attainment for the Existing WQ Criteria is shown in Table ES-11. It should be noted that Flushing Bay has an influence on the Flushing Creek attainment. The attainment estimates presented may be revised after the Flushing Bay LTCP is completed.

Table ES-10. Calculated 10-Year Bacteria Attainment for Preferred Plan – Recreational Season (May 1st – October 31st)

Station	Existing WQ Criteria (Class I)		Primary Contact WQ Criteria (Class SC)		Potential Future Primary Contact WQ Criteria	
	Criterion (cfu/100mL)	Attainment (%)	Criterion (cfu/100mL)	Attainment (%)	Criterion (cfu/100mL)	Attainment (%)
OW-3	Fecal ≤2,000	100	Fecal ≤200	78	Enterococci ≤30	45
					STV≤110	3
OW-4	Fecal ≤2,000	100	Fecal ≤200	82	Enterococci ≤30	55
					STV≤110	3
OW-5	Fecal ≤2,000	100	Fecal ≤200	90	Enterococci ≤30	59
					STV≤110	5
OW-6	Fecal ≤2,000	100	Fecal ≤200	92	Enterococci ≤30	62
					STV≤110	6

Table ES-11. Calculated 10-Year Bacteria Attainment for Preferred Plan – Annual Period

Station	Existing WQ Criteria (Class I)		Primary Contact WQ Criteria (Class SC)	
	Criterion (cfu/100mL)	Attainment (%)	Criterion (cfu/100mL)	Attainment (%)
OW-3	Fecal ≤2,000	100	Fecal ≤200	67
OW-4	Fecal ≤2,000	100	Fecal ≤200	67
OW-5	Fecal ≤2,000	100	Fecal ≤200	75
OW-6	Fecal ≤2,000	100	Fecal ≤200	75

Attainment levels for the Existing WQ Criteria across the year meet the Class I criterion. Attainment of the Primary Contact WQ Criteria for fecal coliform (200 cfu/100mL) and Potential Future Primary Contact WQ Criteria for enterococci (30 cfu/100mL) are presented in Tables ES-11 and ES-12 for the recreational season (May 1st through October 31st) and annual period. The attainment levels are below the 95 percent level for the Primary Contact WQ Criteria.

Attainment of the future STV upper 90th percentile values contained in the Potential Future Primary Contact WQ Criteria is difficult if not impossible to achieve. Maximum enterococci concentrations achieved with the preferred alternative will not meet the Potential Future Primary Contact WQ Criteria STV concentration of 110 cfu/100mL.

Identified UAA

The Flushing Creek waterbody is influenced by CSOs discharged into Flushing Creek, as well as Flushing Bay. The analysis of impacts from the CSO discharges in Flushing Creek is provided in this LTCP. The impacts from Flushing Bay have yet to be determined and are planned for June 2017 with the completion of the Flushing Bay LTCP. The Flushing Bay LTCP recommendations will have an impact on the Flushing Creek water quality. The Flushing Creek UAA will be updated at that time to include the Flushing Bay LTCP findings.

A Revised UAA is included in Revised Appendix E included as Attachment 2.

A Time to Recovery analysis was also done for Flushing Creek. Estimated times in hours are presented in Table ES-12 and described in Section 8. The longer times are associated with the higher rainfall intervals.

Table ES-12. Time to Recovery

Station	Time to Recovery (hours)
	Fecal Coliform Threshold (1,000 cfu/100mL)
	Preferred Alternative
OW-3	33
OW-4	40
OW-5	41
OW-6	42

The annual attainment for dissolved oxygen for Flushing Creek for the preferred alternative is shown below in Table ES-13. There is a high level of DO attainment for the never-less-than 3 mg/L component of the water quality criteria. The daily average 4.8 mg/L criterion is not fully attained.

Table ES-13. Model Calculated DO Percent Compliance Results for Class SC Criteria – Preferred Alternative

Station	Class SC Dissolved Oxygen Attainment (Percent)	
	Chronic (4.8 mg/L)	Acute (3.0 mg/L)
OW-3	78	92
OW-4	80	95
OW-5	81	97
OW-6	90	99

Summary of Recommendations

Water quality in Flushing Creek will be improved with the preferred alternative set forth and the implementation of the planned GI projects and recommendations made herein.

The Flushing Creek LTCP identified the following actions:

1. The LTCP includes a UAA based on the projected performance of the selected CSO controls. A PCM program will be initiated after the LTCP improvements are operational. This UAA should be revisited upon completion of the Flushing Bay LTCP.

2. DEP will issue a wet weather advisory during the recreational season (May 1st through October 31st), alerting the public that the water may be unsafe for recreational uses. DEP will continue to operate the Flushing Bay CSO Retention Facility in accordance with its Wet Weather Operating Plan.

3. DEP will continue to implement the Green Infrastructure Program.

4. DEP will implement the design and construction of seasonal disinfection of the TI-010 Outfall Disinfection at the Flushing Bay CSO Retention Tank and Diversion Chamber 5 plus Outfall TI-011 Outfall Disinfection, which will provide DEP with the most efficient means of controlling a high percent of baseline CSO discharges and striving towards meeting Class SC Primary Contact WQ Criteria, particularly during the recreational season (May 1st through October 31st). The Capital Cost is estimated to be $6.89M, annual O&M is $0.66M, and the Total Present Worth is $16.70M.

5. A SPDES Variance is included in Appendix C.

Flushing Creek Projects Outside the LTCP

Section 9 of the LTCP presents activities on which DEP and the U.S. Army Corps of Engineers are collaborating for a dredging and wetlands restoration analysis in Flushing Creek. DEP also identified additional wetland restoration opportunities in other parts of the Creek. These studies are being investigated to determine the water quality benefits and may be done by DEP. They are being evaluated outside the LTCP process.

DEP is committed to improving water quality in Flushing Creek, which will be advanced by the improvements and recommendations presented in this plan. These identified actions have been balanced with input from the public and awareness of the cost to the citizens of New York City.

ATTACHMENT 2

Revised Appendix E: Flushing Creek Use Attainability Analysis

APPENDIX E: USE ATTAINABILITY ANALYSIS

EXECUTIVE SUMMARY

The New York City Department of Environmental Protection (DEP) has performed a Use Attainability Analysis (UAA) for Flushing Creek in accordance with the 2012 CSO Order on Consent. Flushing Creek is a tributary of the Upper East River, currently designated as a Class I waterbody along its saline reach downstream of the Tide Gate Bridge in Flushing Meadow Park (Porpoise Bridge). The Creek is designated as Class B along the upstream freshwater reach, from the Porpoise Bridge up to Willow Lake, which is considered for purposes of this Long Term Control Plan (LTCP) to be the upstream limit of the study area. Flushing Creek flows in a northerly direction towards Flushing Bay. Flushing Bay opens to the Upper East River (Figure 1). The Willow and Meadow Lakes outflow, the combined sewer overflows (CSOs) and stormwater constitute the sources of freshwater flows into Flushing Creek. The saline interchange with Flushing Bay waters, the various sources of pollutant loadings, as well as their impacts on the water quality (WQ) conditions of the saline portions of the Creek, were analyzed within the LTCP framework. This analysis concluded that a draft UAA is to be appended to the LTCP report, and that such UAA is pending a revision of its content and factors supporting it, to be conducted post-Flushing Bay LTCP submittal.

The Flushing Creek watershed is located within Queens County in its entirety. According to Title 6 NYCRR, Chapter X, Part 935, the Flushing Creek saltwater front is at the Tide Gate Bridge in Flushing Meadow Park, also known as Porpoise Bridge, in northern Queens County. Per design, the tide gates at the Porpoise Bridge impede the saline CSO impacted waters from migrating into the freshwater section of the Creek. Therefore, this UAA considers the saline section of the Flushing Creek exclusively, as defined above.

Detailed analyses performed during the Flushing Creek LTCP concluded that the Existing WQ Criteria for the designated Class I secondary contact uses in the saline section of Flushing Creek are attained for the corresponding fecal coliform criterion under baseline conditions. It is noted that, based on New York State Department of Environmental Conservation's (DEC) interpretation of the enterococci criterion proposed in the BEACH ACT of 2000, the criterion is not applicable to Flushing Creek as this waterbody is a tributary of the Upper East River.

However, as discussed in the supporting information in the Flushing Creek LTCP report, the waterbody is not expected to attain the next higher classification, i.e. Class SC, with the implementation of the LTCP preferred alternative or even with 100 percent Flushing Creek CSO control conditions. Based on a technical assessment, the non-attainment is due, in part, to the bacteria and carbon loadings originating in Flushing Bay and carried upstream to the saline reach of Flushing Creek. The inability to meet the primary contact standard is also due to direct drainage and urban runoff impacts to Flushing Bay, as well as physical and hydrological characteristics of the Creek. Based upon modeling, DEP projects that with the completion of the projects listed in this LTCP for the Flushing Creek watershed, there will be a significant improvement in WQ in Flushing Creek. However, full attainment of the next higher classification (i.e., Class SC), is only feasible when further mitigation of CSO and potentially stormwater discharges to Flushing Bay is considered. On the basis of these findings, DEP is requesting, through the UAA process, that the DEC consider maintaining the Class I designation for the saline section of Flushing

Creek and proposes the issuance of wet weather advisories during the recreational season (May 1st through October 31st) to protect infrequent primary contact use, should it occur.

Figure 1. Aerial View of Flushing Creek

INTRODUCTION

Regulatory Considerations

DEC has designated the saline portion of Flushing Creek as a Class I waterbody. The best usages of Class I waters are "secondary contact recreation and fishing" (6 NYCRR 701.13). The next higher classification is Class SC. The best usages of Class SC waters are "limited primary and secondary contact recreation and fishing" (6 NYCRR 701.11). The SC classification is presumed by DEC to be equivalent to attaining the fishable and swimmable goals of the Clean Water Act (CWA). In addition, DEC has proposed new total and fecal coliform criteria for Class I waters.

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. Here, Flushing Creek meets the existing designated use classification (existing Class I) bacteria criterion and does not meet the corresponding dissolved oxygen criterion. Furthermore, complete elimination of CSO discharges to the Creek will not result in attainment of the classification of SC or the proposed fecal coliform Class I criterion of 200 cfu/100mL.

Based on the above, this UAA identifies the attainable and existing uses of Flushing Creek and compares them to those designated by DEC, in order to provide data to establish appropriate WQ targets for this waterway. An examination of several factors related to the physical condition of the waterbody and the actual and possible uses suggests that the uses listed in the SC classification 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 WQ, preclude attainment of aquatic life protection uses; or

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

Identification of Existing Uses

The waterfront area surrounding saline Flushing Creek is dominated by industry and is intensely developed. No formal waterfront access facilities exist along Flushing Creek. There are no known informal access areas to Flushing Creek. Limited access to the waters of saline Flushing Creek preclude access for bathing or canoe/kayak launching due to rip-rap or bulkheads along the shoreline, as illustrated in Figures 2a and 2b. Figure 3 shows the uses identified by the public. As shown, identified uses within Flushing Creek are limited to kayaking in Meadow Lake.

Figure 2a. Shoreline View of Flushing Creek from Whitestone Expressway (Looking South)

Flushing Creek is not suitable for bathing and as such there are no New York City Department of Health and Mental Hygiene (DOHMH) certified bathing beaches anywhere within the waterbody. There are no areas known to be frequented by the public for full body immersion. As such, the bulk of the waterbody is not conducive to primary contact uses.

Figure 2b. Flushing Creek Shoreline (Looking Northeast from Van Wyck Expressway)

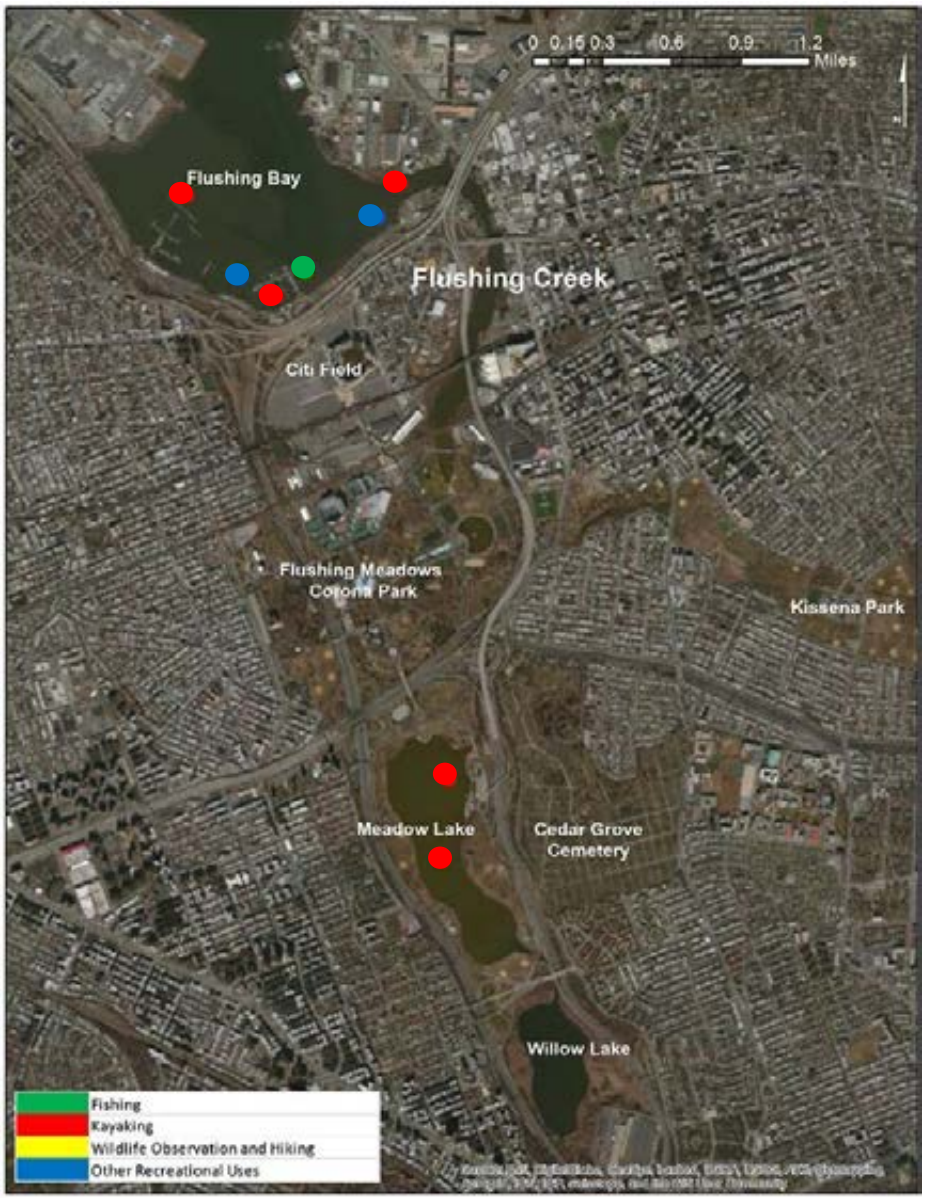


Figure 3. Uses Identified by the Public

ATTAINMENT OF DESIGNATED USES

The saline portion of Flushing Creek is a Class I waterbody. This classification is suitable for secondary contact recreation and aquatic life propagation and survival. As noted previously, Flushing Creek is not suitable for primary contact recreation. At the public meetings there were no reports of full body immersion occurrences and this is not a common or supported use.

WQ modeling and observed data indicate that the existing Class I (secondary contact) bacteria criterion is being achieved. With respect to the Class SC WQS, or the proposed fecal coliform Class I criteria, the attainment of the fecal coliform numeric criteria throughout the entirety of Flushing Creek is not possible 100 percent of the time primarily due to CSOs discharged to the Creek and Flushing Bay, as well as

additional pollutant sources other than CSO (namely, direct drainage and urban stormwater). With complete removal of Flushing Creek CSOs, attainment is still not possible.

Furthermore, an analysis was conducted during the development of the LTCP using the August 14-15, 2008 JFK rainfall event to predict the time to recovery in Flushing Creek following a rain event, an approach consistent with DEC direction. Details on the selection of this storm event are provided in Section 6.0. As primary contact uses during the recreational season (May 1st through October 31st) require attainment a high percent of the time, DEP used a primary contact fecal coliform target of 1,000 cfu/100mL from the New York State Department of Health (NYSDOH) guidelines. The result of the analysis is summarized in the Supplemental Documentation complementing the Flushing Creek LTCP. As noted, the duration of time after a rainfall event within which bacteria concentrations are expected to be higher than DOH considers safe for primary contact varies based on the size of the rainfall event.

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 timeframe during which the waterbody will not support primary contact. It is intended to advise the water users of the potential health risk associated with this use during the recovery period.

CONCLUSIONS

Flushing Creek attains the existing Class I WQS bacteria criteria but cannot fully achieve the dissolved oxygen criterion or Primary Contact WQ Criteria of Class SC, for fecal coliform or dissolved oxygen on an annual basis. However, the analyses show that Primary Contact WQ bacteria criteria can be attained throughout the recreational season (May 1st through October 31st) a high percent (>78 percent of the time) of the time with the caveat that during and after rain events, bacteria levels will be elevated. Flushing Creek is not used for primary contact recreation, so the non-attainment of fishable/swimmable standards during and after rainfall or during the non-recreational season would not impact existing waterbody uses. Non-attainment of Primary Contact WQ Criteria is attributable to the following UAA factors:

Fecal Coliform

- Human caused conditions or sources of pollution (CSO, direct drainage and urban runoff), create high bacteria levels after storms that prevent the attainment of the use and cannot fully be remedied through correction of Flushing Creek CSOs (UAA factor #3).

- Changes to the shoreline to channelize it and protect it, created bulkheads and steep rip-rap lined banks limiting access to Flushing Creek along the majority of the eastern shoreline (UAA factor #4).

Dissolved Oxygen

- 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 modifications in a way that would result in attainment of the use (UAA factor #4).

- Physical conditions related to the natural features of the waterbody, such as the lack of proper substrate, cover, flow, depth, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses (UAA factor #5).

RECOMMENDATIONS

Flushing Creek attains the existing Class I criterion for fecal coliform bacteria. Protecting Primary Contact WQ Criteria in Flushing Creek is possible on a limited basis; hence, DEP has conducted analyses to project the time required for the waterbody to return to fecal coliform concentrations considered safe for primary contact by NYSDOH.

The above mentioned analyses will support the issuance of wet weather advisories considering that with the anticipated reductions in CSO overflows resulting from grey and green infrastructure, the Flushing Creek could be protective of infrequent primary contact during the recreational season (May 1st through October 31st), should it occur, as long as it did not occur during or following rainfall events.

Further, DEP has indicated that through the control of CSOs that discharge to Flushing Bay, it would be possible to further reduce fecal coliform bacteria levels in Flushing Creek. What is not known at this time is the level of Flushing Bay CSO controls needed to fully attain Class SC standards (or the proposed Class I coliform criteria) in Flushing Creek, the cost for those controls and the physical alterations and environmental impacts resulting from such levels of control. This additional information will be developed in June 2017 with the completion of the Flushing Bay LTCP. At such time, the Flushing Creek UAA would be retracted or amended.