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ENGINEERING PLANNING REPORT

Hasbrouck Avenue CSO Sewershed

Prepared For:

City of Kingston

October 2017

Services provided in New York by T&B Engineering PC

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SECTION 1

Section 1
Project Background & History

The City of Kingston is a combined sewer system of 7.4 square miles and comprised of 22 drainage areas. The City is served by a treatment plant located on Rondout Landing, near the Rondout Creek, which has a nominal peak flow capacity of 10.25 million gallons per day (mgd).

The 2010 Kingston Long Term Control Plan (LTCP) developed alternatives to achieve compliance with the USEPA CSO Control Policy. The LTCP recommended a staged approach that focused on the Hasbrouck combined sewer system. The Hasbrouck CSO generates 92 percent of the wastewater discharged to the Rondout Creek in a typical year. The first stage of the improvements to the Hasbrouck system included direct measurement of discharges, and modulation of the control gate to maximize flow to the WWTF. The second stage included post-construction flow monitoring, model recalibration and on-going water quality sampling. This stage is on-going and water quality sampling that has occurred after the CSO modifications indicated the Rondout Creek met Water Quality Standards (WQS). Should future sampling indicate WQS are not being met, the third stage of improvements would include a CSO storage tank.

Rather than plan for a large storage improvement, the City would prefer to determine if there are cost effective approaches to sewer separation that would simultaneously improve existing infrastructure, reduce CSO volume, and improve water quality of the Rondout Creek by removing inflow from the sewer system and sending it to the storm drainage system.

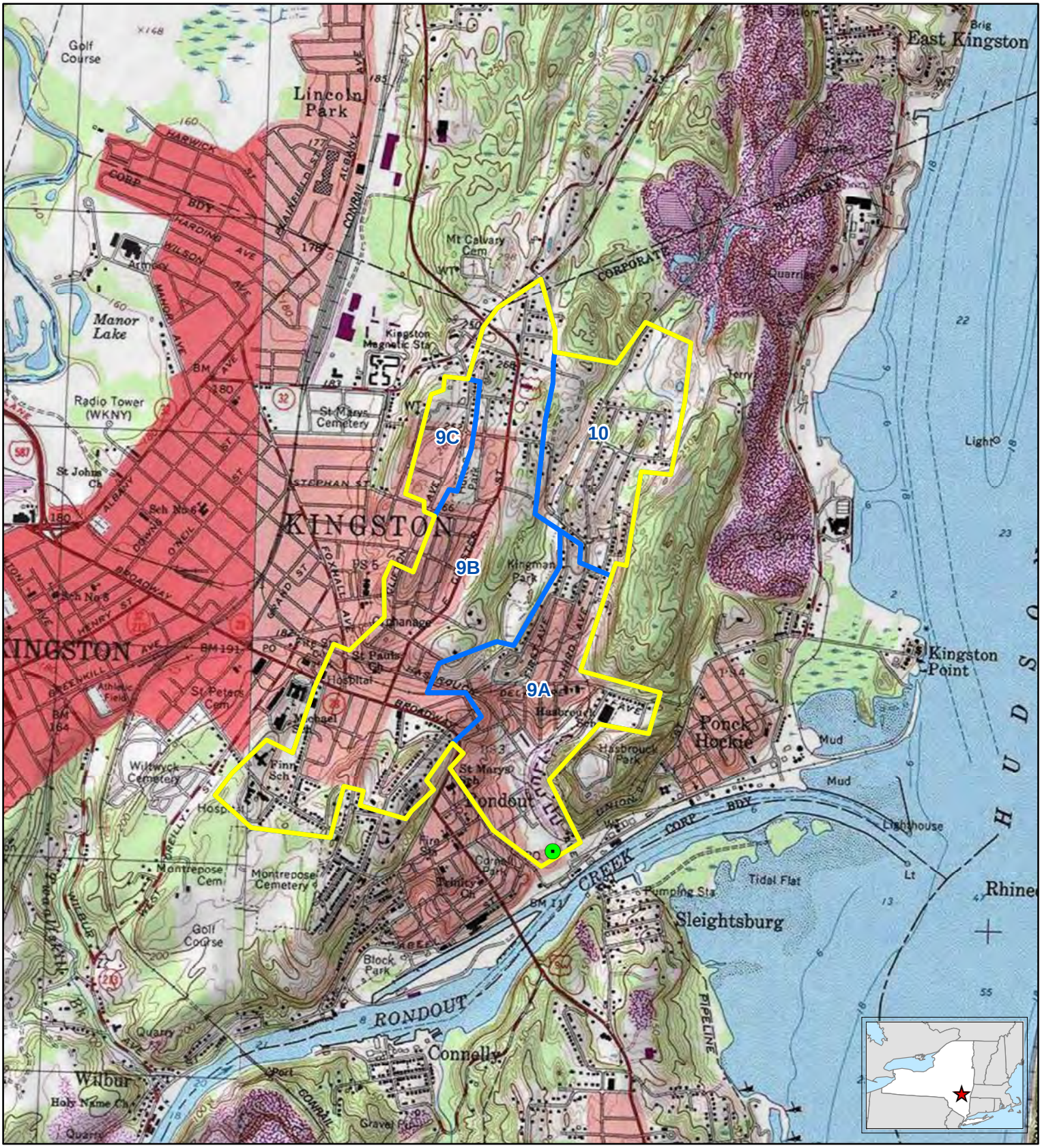
1.1 Evaluation Scope

Tighe & Bond, providing services in New York through T&B Engineering, PC (T&B), was engaged by the City of Kingston to provide cost effective stormwater separation alternatives for the Hasbrouck combined sewer system and to prepare an Engineering Report in a format consistent with NYS Environmental Facility Corporation (EFC) New York State Clean Water Revolving Fund Engineering Report guidelines. The scope also included conformation of the City's existing AutoCAD maps and GIS data layers to existing and field collected data.

1.2 Site Information

1.2.1 Location

The Hasbrouck combined sewer system is located in the south-east section of the City of Kingston, as shown in Figure 1-1. The Hasbrouck system is divided into smaller drainage areas, 9A, 9B, 9C, and 10, that are part of the City of Kingston's city wide sewer drainage division. U.S. Route 9W, called Frank Koenig Blvd within Kingston, runs North-South through the area.



Legend

- Hasbrouck Ave CSO 005
- Hasbrouck Ave CSO Sewer Shed
- Sub-Sewer Shed

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Based on USGS Topographic Map for Kingston, NY

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FIGURE 1-1
SITE LOCATION

Hasbrouck Combined Sewer System Engineering Report
Kingston, New York

April 2017

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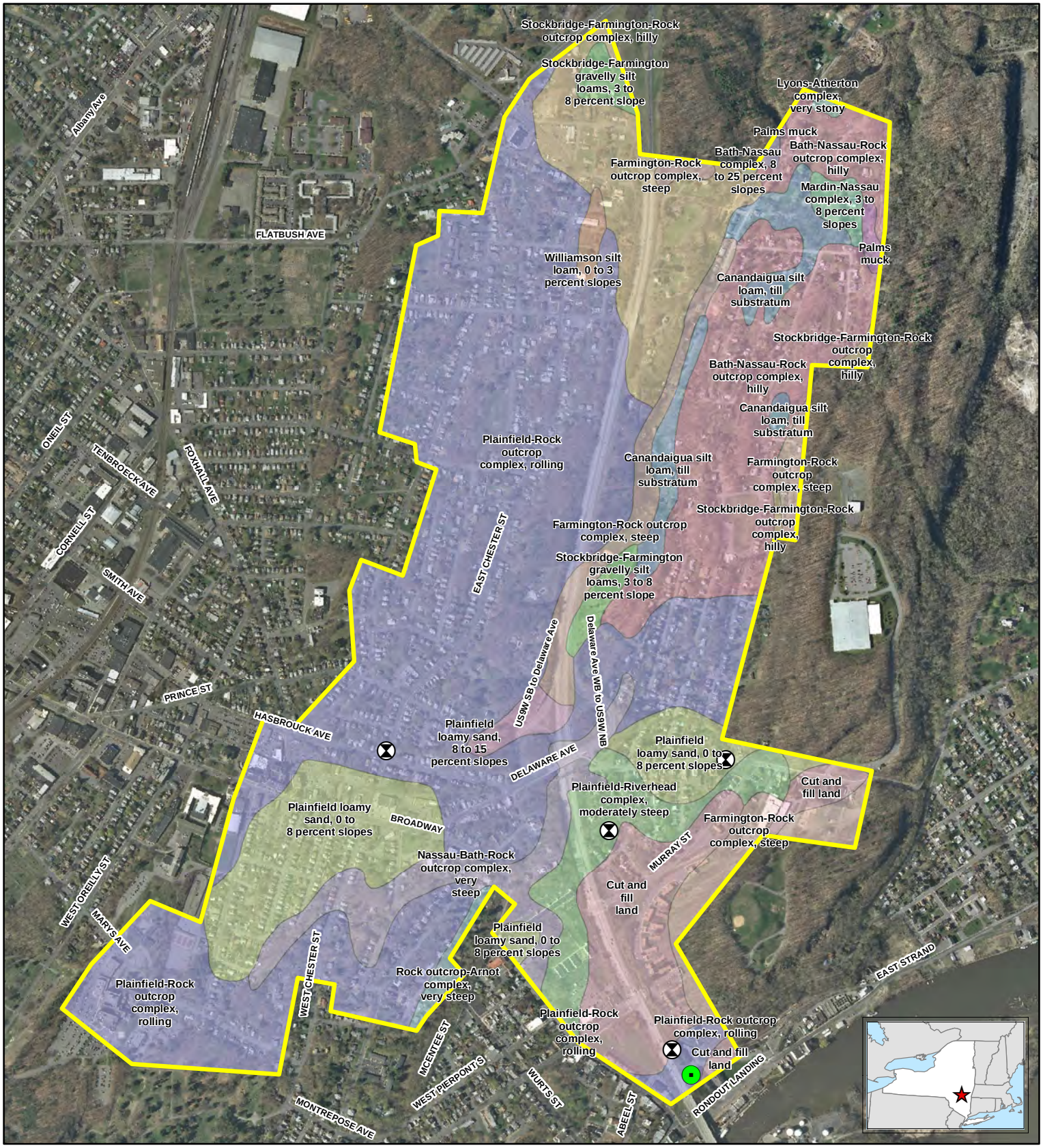
1.2.2 Geologic Conditions

The Hasbrouck combined sewer system area is composed of a variety of soils, but with five soils - Plainfield-Rock outcrop complex (PrC), Bath-Nassau-Rock outcrop complex (BOD), Plainfield loamy sand (PlB), Cut and fill land (CF), and Stockbridge-Farmington-Rock outcrop complex (STD) – comprising over 80 percent of the composition. Refer to Figure 1-2.

The eastern half of the Hasbrouck area is comprised mostly of PrC (72%), PlB (11%), and STD (11%). Plainfield-Rock outcrop consists of somewhat deep, excessively drained soils formed from sandy deposits with surface bedrock outcroppings. They are rolling, sandy soils on deltas, outwash plains, and terraces, with slope ranges from 0 to 25 percent. Permeability ranges from very high in Plainfield soils to very low in rock outcrops. Plainfield loamy sand, which is present on the southern end of the area, consists of somewhat deep, excessively drained soils formed from sandy deposits. They are mostly level, sandy soils on deltas, outwash plains, and terraces, with slope ranges from 0 to 8 percent. Permeability ranges from high to very high. Stockbridge-Farmington-Rock outcrop, which is present on the northern end of the area, consists of shallow to somewhat deep, well drained to somewhat excessively drained soils formed from loamy till with surface rock outcroppings. They are hilly, silty soils on hills, ridges, benches, and till plains, with slope ranges from 15 to 25 percent. Permeability ranges from very low to very high.

The western half of the Hasbrouck area is comprised mostly of BOD (25%), PrC (18%), CF (18%), and PlB (7%), with small amounts of a large number of other soils. Bath-Nassau-Rock outcrop, present on the northern end of the area, consists of shallow to somewhat deep, well drained to somewhat excessively drained soils formed from loamy till with surface bedrock outcroppings. They are hilly, gravelly soils on hills, ridges, benches, and till plains, with slope ranges from 10 to 15 percent. Permeability ranges from moderately low to moderately high. PrC, present on the center and southern end of the area, is the same as described above. Cut and fill land, present on the southern end of the area, is 80 percent Udorthents or similar soils, which consists of deep, somewhat excessively drained soils. They mostly level, gravelly soils with slope ranges from 0 to 8 percent. Permeability ranges from moderately low to high. Plainfield loamy sand, present on the center of the area, is the same as described above.



Legend

- Hasbrouck Ave CSO 005
- Hasbrouck Ave CSO Sewer Shed
- Flow Meters

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FIGURE **1-2**
SOILS

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Kingston, New York

April 2017

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1.2.3 Environmental Resources & Floodplain

The Hasbrouck combined sewer system area was found to be entirely within the New York State Department of Environmental Conservation (NYSDEC) rare plants and rare animals check zone and area south of Delaware Ave was found to be within the significant natural communities check zone as shown on their Environmental Resource Mapping tool, see Figure 1-3 below. The locations shown in the Environmental Resource Mapper Rare Plants and Rare Animals layer and the Significant Natural Communities layer are not precise locations. Rather, they show those generalized areas where NY Natural Heritage has information in its databases regarding rare species. These generalized areas show the vicinity of actual, confirmed observations and collections of rare animals and rare plants. The precise locations, as well as the species of the animal or plant, are not provided by this tool.

Figure 1-3 also shows United States Fish & Wildlife Service (USFWS) National Wetlands Inventory (NWI) listed wetlands and surface waters. The NWI wetlands located within the Hasbrouck area are circled and the riverine located in the north-east section of the area is a seasonal waterbody.

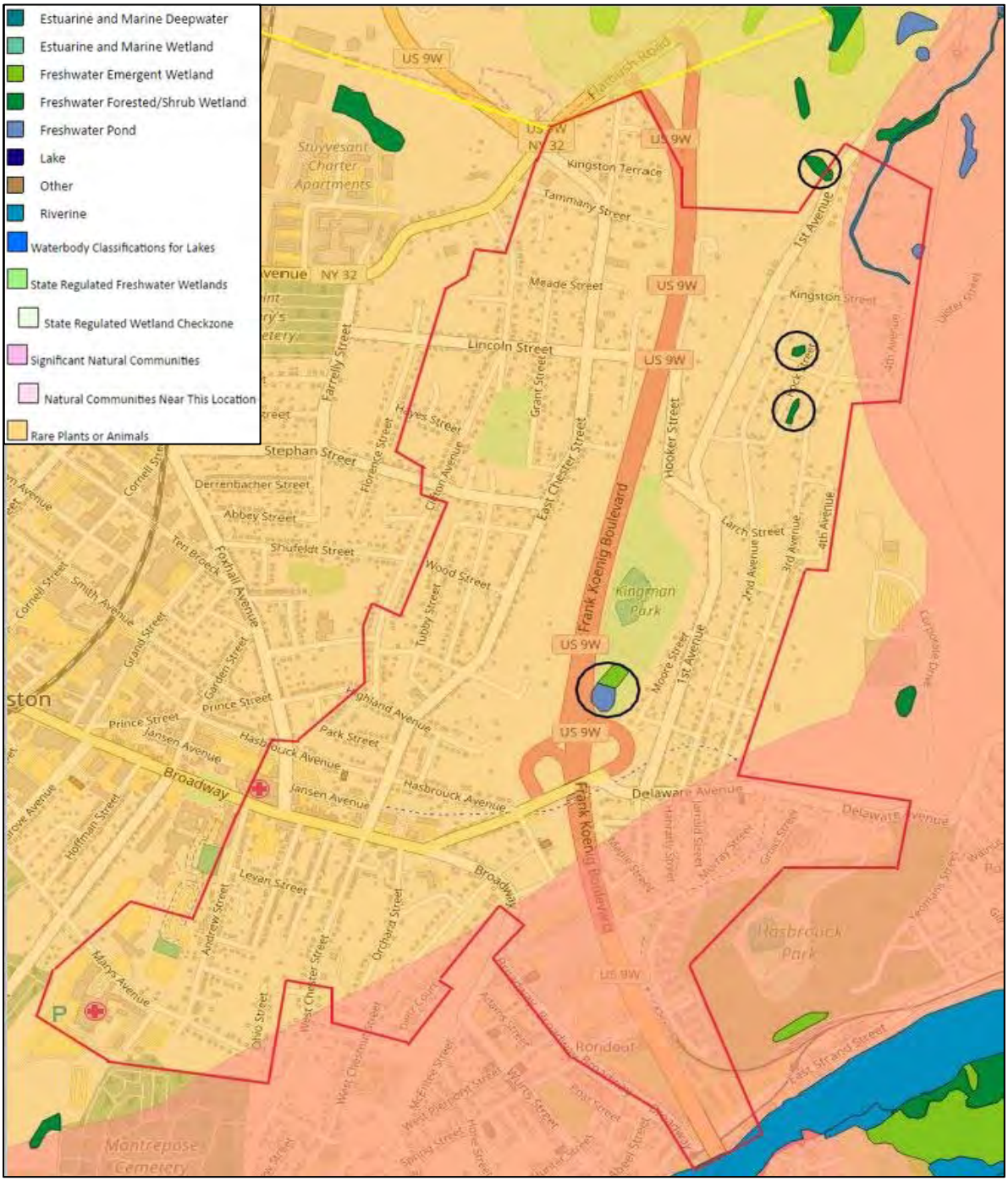

Figure 1-3 Environmental Resources

Typically for projects that take place on existing, previously disturbed parcels and road/road right-of-ways, additional or new mitigation is not required because there are no new long-term effects.

Figure 1-4 Floodplains

As shown in Figure 1-4, there is a minor section of the Hasbrouck area that is located in a floodplain, along the Rondout Creek. The majority of the area is identified as Zone X, an area if minimal flood hazard. Additionally, the CSO structure and regulator is located outside of the floodplain.

1.3 Ownership & Service Area

The City of Kingston owns and maintains the CSO structure and the sewage transmission mains and sewage pumps of the Hasbrouck combined sewer system. There are no required nor existing inter-municipal agreements impacting the service area. There are no industrial discharges into the sewer system in the service area. The wastewater flow in the service area is largely residential in nature.

1.3.1 Population Trends

According to the US Census Bureau the population change for Kingston has remained fairly minimal over the last few decades. Table 1.1 below lists the values that were recorded for the U.S. Decennial Census, with year 2014 estimated by the Census Bureau.

TABLE 1.1

Kingston Population

Year	Population	Growth Percentage
1990	23,095	-
2000	23,456	1.6 %
2010	23,893	1.9 %
2015	23,436	-1.9 %

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SECTION 2

Section 2
Existing Conditions

2.1 Existing Flows

The Hasbrouck combined sewer system transmits wastewater and surface runoff from roughly 700 acres of land. From the 2010 Kingston Long Term Control Plan (LTCP), in dry weather conditions the flow remains under 2 million gallons per day (MGD) and flow transmits normally into the WWTF, in wet weather conditions the flow increases significantly due to inflow from surface runoff and can reach peaks of 65 MGD. This increased flow rate can activate the CSO and divert flow directly into the Rondout Creek, bypassing the WWTF. In 2015 , the Hasbrouck CSO has activated of 59 times, releasing 123 million gallons (MG) into the Rondout Creek.

2.1.1 Flow Metering

In addition to historical data on flows in the Hasbrouck area, flow metering was completed to better characterize the drainage area. Table 2-1 below summarizes the average and peak flows for the Hasbrouck system for a 4-week period between August 26 and September 22, 2016.

TABLE 2-1
Hasbrouck System Average and Peak Flows, Aug-Sep 2016

Period	Average (MGD)	Peak (MGD)
Aug 26th – Sep 1st	0.82	1.32
Sep 2nd – Sep 8th	0.85	1.37
Sep 9th – Sep 15th	0.81	2.61
Sep 16th – Sep 22nd	0.96	38.90
Aug 26th – Sep 22nd	0.86	38.90

The period from August 26th to September 8th received minimal rainfall, totaling 0.04 inches. The period from September 9th to September 15th received 0.07 inches of rainfall, most of which occurred during a small storm event on September 11th, which contributed to the increased peak during this period, but it did not affect the average. The period from September 16th to September 22nd received 0.20 inches of rainfall, most of which occurred during an extended storm event on September 18th and 19th, which caused the peak flow rate to spike and it was significant enough to affect the average flow.

2.2 Future Flows

The Hasbrouck combined sewer system area consists of moderate to high density residential and commercial land use that is fully developed. No additional flow sources for the Hasbrouck area are anticipated in the future.

2.3 Existing System

The Hasbrouck combined sewer system is shown on Figure 2-1 that provides an overall layout of the system including approximate locations of the various components of the existing sewer system including the gravity sanitary sewers, manholes, sewerage pump stations, their related force mains, low-pressure sewers, and the existing wastewater treatment facility (WWTF), which is located just outside of the Hasbrouck system area. The Hasbrouck system receives flow from four drainage areas, 9A, 9B, 9C, and 10, as shown previously on Figure 1-1.

The Hasbrouck system has approximately 15 miles of gravity, low pressure, and force sewer mains to transmit wastewater within the system. These transmission mains are mainly constructed of vitrified clay pipes (VCP), with improvements and replacements constructed from varying materials depending on their age. The low pressure mains located in Drainage Area 10 serve grinder pumps in individual homes that are maintained by the homeowner. The force mains are pressurized by pump stations maintained by the City. There are five pump stations in the Hasbrouck system. Their location and pump capacity are provided in Table 2-2 below.

TABLE 2-2
Hasbrouck System Pump Stations

Pump Station	Drainage Area	Location	Capacity
Lincoln Street Pump Station (PS 3)	9C	Clifton Ave./Lincoln St.	0.50 MGD @ 33' TDH
Tammany Street Pump Station (PS 7)	9B	End Tammany St./9W	0.05 MGD @ 25' TDH
East Chester Pump Station (PS 8)	9B	E. Chester St. between Meade St./Lincoln St.	0.09 MGD @ 28' TDH
Kingston Street Pump Station (PS 9)	10	Kingston St./Rock St.	0.07 MGD @ 20' TDH
Fourth Avenue Pump Station (PS 10)	10	Halfway down 4th Ave.	0.05 MGD @ 25' TDH

Legend

- Pump Station
- Hasbrouck Ave CSO 005
- Hasbrouck Ave CSO Sewer Shed

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FIGURE 2-1
PUMP STATION LOCATIONS

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Kingston, New York

April 2017

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2.4 History

The City of Kingston wastewater system was constructed in the 1940's. Over the years several infrastructure projects improved the collection system that consists of approximately 80 miles of pipe ranging from 4 to 60 inches in diameter and a total combined sewer area of approximately 7.4 square miles . Wastewater is conveyed through both gravity systems and twenty-seven pumping stations, and is regulated at four outfall locations within the Rondout Creek tributary of the Hudson River: Wilbur, Hunter, Broadway and Hasbrouck. Kingston reduced the 14 previous outfalls during the 1980's and 1990's, and of these four current outfalls, Hasbrouck generates the highest discharge at 92%.

2.5 Condition of Existing Facilities

2.5.1 Field Investigation

In order to determine the existing conditions of the Hasbrouck combined sewer system T&B conducted field investigations. These investigations concentrated on verifying and updating the existing CAD documentation that was based on the original system map from 1977 and providing new GIS data/layers that accurately reflect current conditions of the Hasbrouck system. This mapping was essential to understanding the existing system connectivity and ways the existing infrastructure could support sewer separation.

2.5.2 Video Inspection

During field inspection and subsequent analysis of the drainage area, several areas were identified that needed remote inspection to verify pipeline connectivity and general condition. The City completed these inspections on in November and December 2016. Table 2-3 provides a list of the areas video inspected.

TABLE 2-3
Video Inspection Locations

ID No.	Location	MH References
1	Intersection of Andrew St and Levan St	81 to 78; 57 to 56
2	Intersection of Broadway and E. Chester St	various
3	Intersection of Hasbrouck St and Foxhall Ave	72A, 188, 196
4a	Intersection of Hasbrouck St and Delaware Ave	various
4b	Pipe(s) in Delaware Ave to intersection	n/a
4c	Pipe(s) under 9W, intersection to Debois Ave	n/a
5	E. Chester Street	117-110
6	E. Chester Street	Various
7	E. Chester Street	19, 160
8	Clifton Avenue	n/a
9	Clifton Avenue	8
10	Hooker Street	n/a
11	Lawn area, between Larch St and High Street	n/a

2.5.3 Flow Metering

As previously described flow metering was completed from August 26th through September 22nd of 2016. In order to better characterize the area, four different subareas were created. A flow meter was provided at each subarea. Figure 2-2 provides the location of the installed meters. The meters and their locations are summarized in Table 2-4.

TABLE 2-4

Flow Metering

ID No.	Location	Tributary Drainage Area (AC)	Linear Feet of Pipe
1	East Chester Street at Hasbrouck Street	165	20,900
2	Delaware Avenue at Murray Street	150	18,350
3	Maple Street near Dubois Place	153	18,050
4	Hudson Valley Landing near Meadow Street	94	9,150

Table 2-5 provides a summary of the average and peak flows recorded at each of flow metering locations during the metering period.

TABLE 2-5

Flow Metering Results

ID No.	Location	Dry Weather Flow (MGD)	Peak Flow (MGD)
1	East Chester Street at Hasbrouck Street	0.22	4.13
2	Delaware Avenue at Murray Street	0.08	2.43
3	Maple Street near Dubois Place	0.32	11.67
4	Hudson Valley Landing near Meadow Street	0.86	38.90

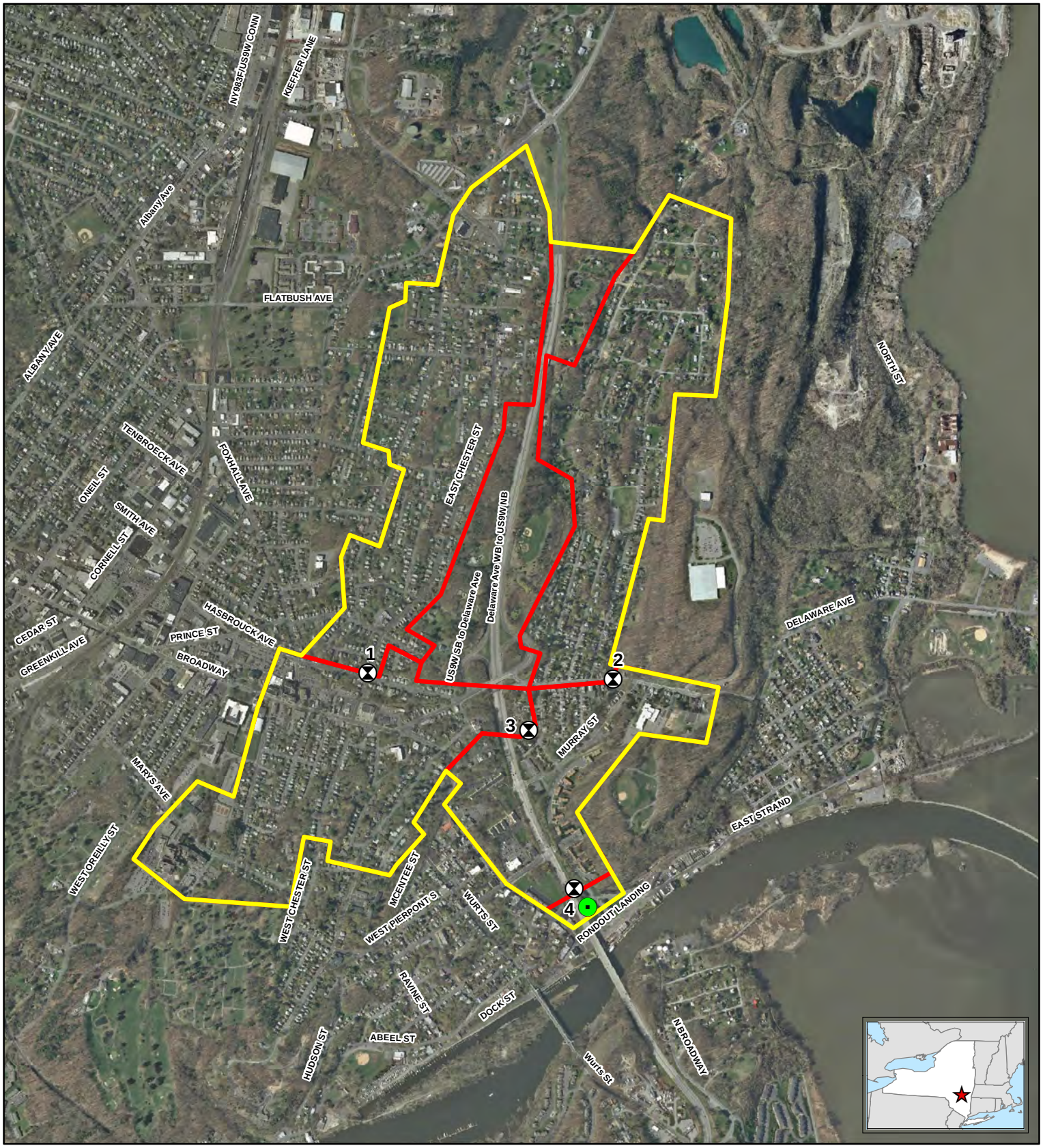
In order to verify the flow meter was recording accurate conditions, the flows at meter location No. 4 were compared to flows at the Hasbrouck CSO flow meter. While this meter records flows in the diversion structure outfall, based upon review of the flow meter output graph it is likely the diversion gate was closed (100% closed) during the peak storm conditions.

TABLE 2-6

Hasbrouck CSO Flow Metering Comparison

Location	Peak Flow (MGD)	Volume (MG)
Hasbrouck CSO Overflow	43.0	0.659
Flow Meter No. 4	38.9	0.673

It is also noted that the Kingston LTCP recorded a peak Hasbrouck CSO influent flow rate of 65 MGD during their flow metering period.



Legend

- Hasbrouck Ave CSO 005
- Flow Meters
- Hasbrouck Ave CSO Sewer Shed
- Tributary Flow Meter Area

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FIGURE 2-2
FLOW METER LOCATIONS

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Kingston, New York

April 2017

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In order to understand the how different portions of the Hasbrouck area are impacted by stormwater, a model was created based upon the results of the flow metering. Due to the very limited amount of rainfall collected during the flow metering period, the model calibration is based upon the September 19th storm, alone. It is important to note that while the calibrated model can provide general scope of magnitude results appropriate for this analysis, the model is not appropriate for detailed design. Model calibration appropriate for design must include multiple storm events. The results of the model calibration are presented in Appendix A.

The calibrated model was then used to simulate the impacts of the 2-month return frequency design storm. The 2-month design storm is based upon 50% of a 1-year 24-hour accumulation of 2.58 inches as provided by the National Oceanic and Atmospheric Administration's Atlas 14 Point Precipitation Frequency Estimate and the USDA Soil Conservation Service Type II rainfall distribution curve that is geographically appropriate for Kingston. This design storm was utilized as the LTCP indicates that four to six overflows per year should "serve as a benchmark for the extent of the City's system improvements that may become necessary to meet receiving stream water quality standards". A 2-month storm return frequency represents a storm that occurs six times a year. Table 2-7 presents the results of the design storm analysis.

TABLE 2-7
Design Storm Modeling Data

Drainage Area No.	Modeled 2-mo Storm Inflow Peak (MGD)	Modeled 2-mo Storm Inflow Volume (MG)	Area Pipe Length (ft)	Inflow Ratio (Gal/Ft. Pipe)	Percentage of Total Storm Flow
1	8.2	0.8	20,900	36	9%
2	5.5	0.5	18,350	28	6%
3	17.6	1.7	18,050	92	21%
4	54.9	5.1	9,150	556	63%

The final column of this table provided general guidance on the drainage areas with the highest inflow quantity (Subarea H-4 – Strand) and lowest inflow quantity (Subarea H-2 - Delaware). Due to the very low groundwater elevations during the flow metering period, no impacts from infiltration are assumed.

2.6 Compliance Issues

The LTCP developed for the City of Kingston identifies alternatives to meet compliance with USEPA CSO Control Policy. The study has determined that the existing WWTF system captures for treatment 89 percent of wet weather flows that exceeds the USEPA CSO Policy criteria of 85 percent capture. Should water quality standards (WQS) based on post-construction monitoring not be met at some future date after implementation of modifications to the Hasbrouck control gate, the next phase of recommended improvements to the system would include a CSO storage tank. Due to the cost of this proposed addition, the City of Kingston requests the consideration of alternative approaches to sewer separation that would reduce volume and improve water quality by

sending inflow to the storm drainage system. It is anticipated that modifications would address water quality standards successfully, and maintain required standards.

2.7 Financial Status of Existing Facilities

A section of the 2017 Adopted Budget for the City of Kingston is provided as Appendix B. The 2017 Adopted Budget includes the 2017 Sewer Fund Budget, which contains expenses and revenues for Administration, Sanitary Sewers, Pumping Station, Industrial Pretreatment Program, Wastewater Treatment, Medical, Debt, and Transfers. The projected annual operating expenses for the Sanitary Sewers, Pumping Station, and Wastewater Treatment is $3,271,105. Of this total, annual electric costs are estimated at $235,880. Sewer customers are charged for sewer use based on the amount of water from the Kingston Water Department used by each user.

The 2017 Adopted Budget Sewer Fund includes $1,358,825 in debts and transfers.

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SECTION 3

Section 3
Alternatives Analysis

3.1 Definition of the Problem

The 2010 Kingston Long Term Control Plan (LTCP) developed alternatives to achieve compliance with the USEPA CSO Control Policy. The LTCP recommended a staged approach that focused on the Hasbrouck combined sewer system, which releases 92 percent of the untreated wastewater into the Rondout Creek in a typical year. The first stage of improvements included direct measurement of discharges, and modulation of the control gate to maximize flow to the WWTF. Water quality sampling after the CSO modifications indicated the Rondout Creek met Water Quality Standards (WQS). The City will continue to sample the Rondout Creek as required for compliance with NYSDEC. Should sampling indicate WQS are not being met, the third stage of improvements recommended by the LTCP would include a CSO storage tank sized to reduce Hasbrouck CSO discharges to 5 overflows per year.

While CSO storage can be a cost-effective means to reduce CSOs, this solution does not provide any improvements to existing infrastructure. This study is intended to evaluate opportunities to improve existing infrastructure by separating sewers in the Hasbrouck combined sewer system and simultaneously reduce CSO volume and improve water quality of the Rondout Creek by removing inflow from the sewer system and sending it to a storm drainage system.

Three alternatives were evaluated for sewer improvements: Alternative 1: No-Action; Alternative 2: Phased Partial Separation; Alternative 3: Green Infrastructure.

3.2 Alternative 1: No-Action Alternative

As the water quality testing has shown that the Rondout Creek currently meets WQS, taking no action is an option and is considered among the alternatives. If no alternative action is taken, a CSO storage tank may be required.

3.3 Alternative 2: Phased Partial Separation

Phased partial separation would consist of completing separation projects in the public portions of the collection system over time. The separation projects would focus on direct inflow sources as these are most accessible, and installation of separate storm infrastructure creates a better incentive and feasibility for private connection separation.

As presented earlier the separation phases have been generally based upon the subareas determined during the flow metering evaluation. Should even smaller projects be desirable, these could be further separated during a design phase.

3.3.1 Phasing Criteria

Two key criteria were used to determine recommended phasing; infrastructure connectivity and priority of the area for separation.

Infrastructure connectivity refers to the feasibility of separating an area. Most of the subareas are not directly connected to a permitted stormwater outfall. Providing separation for these areas may mean providing piping from a significant distance, or through significant obstructions such as divided highways.

Separation priority was determined by the results of the flow metering analysis for the 2-month frequency design storm. As presented in Section 2, the inflow for the 2-month storm was divided by the linear feet of sewer in the area to create a gal/ft rate. The subareas with the highest rate were given the highest priority.

3.3.2 Recommended Phasing

Figure 3-1 provides the recommended phasing for separation based upon priority data from storm inflow and infrastructure connectivity. The storm flow impact assumes 50% of the drainage source is the result of public connections that will be remediated by partial separation. The remaining 50% is considered to be the result of private connections such as sump pumps and downspouts.

TABLE 3-1

Phasing Plan

Phase	Description	Estimated Annual Flow Reduction at Hasbrouck (%)[1]	(MG)[2]
A	DA 4 partial separation of 58 acres of tributary area	20%	44
B	DA 4 partial separation of 12 acres of tributary area,	24%	54
C	DA 3 separation of 153 acres of tributary area	34%	77
D	DA 1 partial separation of 165 acres of tributary area	39%	87
E	DA 4 partial separation of 24 acres of tributary area, DA 2 partial separation of 150 acres of tributary area	50%	113

[1] Based upon flow contribution percentages developed in Table 2-7

[2] The 2010 LTCP indicated typical annual 27 MG overflow at the Hasbrouck CSO and a 88% wet weather capture rate, resulting in typical annual wet weather flow volume of 225 MG reaching the Hasbrouck CSO.

In addition to the above flow data, the constructability and flow path of the Flow Areas were also evaluated. Typically, sewer separation is conducted from downstream to upstream. Coincidentally, the flow area with the greatest separation efficiency based on gallons of CSO flow was also the terminal flow area. Therefore, separation of Flow Meter Area 4 was the most attractive area to begin separation with.

Currently, one combined sewer pipe carries all the combined sewer flow in the CSO 005 sewer shed. This pipe runs from MH 34 at the intersection of 9W and Murray Street to CSO 005. In order to facilitate upstream separation of all phases, a new separated drain trunkline was required to discharge all the separated storm flow from the complete sewer separation phases. An existing 36" separated storm drain discharge point exists at Rondout Drive. Therefore, the first phase (Phase A) includes the installation of a new 36" storm drain trunkline from the existing drain along Rondout Drive to Murray Street. At the completion of the sewer shed separation, this pipe shall carry the separated sewer flow from all of the sewer shed to the combined sewer main that will remain as the separated sewer to the CSO. Lastly, this phase also includes immediate separation of two

areas in this phase. The first area consists of two existing separated streets, Jarold Street and Hanratty Street, which discharge to Murray Street. Their sewer flow will remain discharging to the separated sewer in Murray Street and their storm flow will be connected to the new 36" storm drain. The second area, are the separated streets on the west side of Route 9W. The second area separation is facilitated by the installation of a new 18" storm drain across 9W which will connect to the new 36" storm drain in Roundout Drive. The remainder of the streets within Flow Area 4 shall be separated in Phases B and E. Figure 3-2 provides a schematic of the proposed phasing.

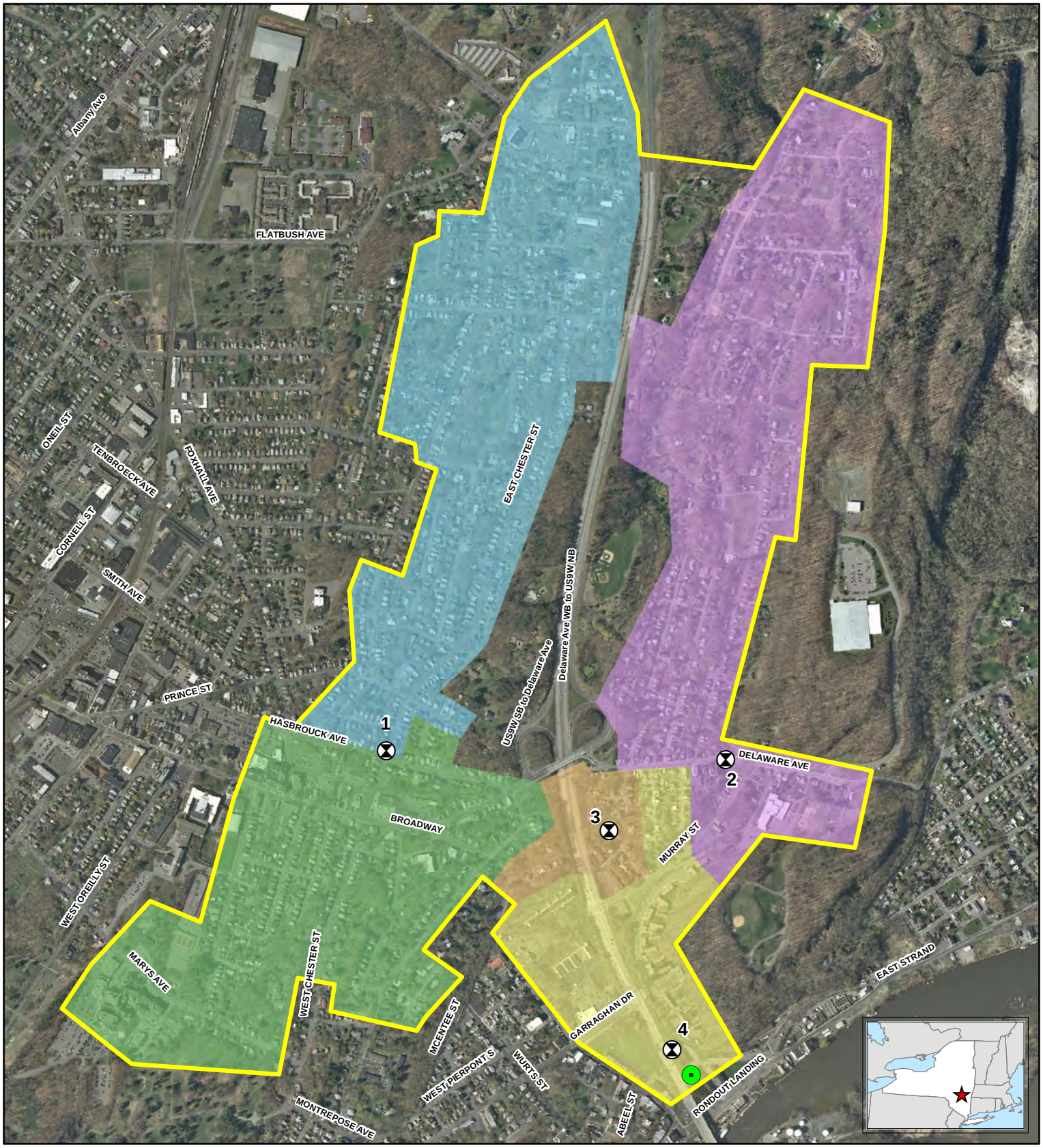
The next phase (Phase B) recommends the separation of a portion of Flow Area 4. Currently, there is one 24" combined sewer pipe that carries the flow from Flow Areas 1 and 3 across Route 9W. This crossing is located just south of the Route 9W interchange at Delaware Avenue. In order to facilitate upstream sewer separation, new separated sewer trunkline and storm drain trunklines are required. Doing so allows for the immediate separation of Flow Area 3 prior to the separation of Flow Area 1. Therefore, one 18" sanitary sewer and two 24" storm drains are proposed at top of an existing abandoned rail road bridge, located between the existing crossing and the Route 9W interchange. It is anticipated that a deck surface will be installed over the pipes to restore access across the bridge. A sketch of the proposed layout is provided in Appendix C. It is important to note that the soon to be constructed Kingston Connectivity Project plans to utilize the rail road bridge. We see no conflict between using the bridge to transport these pipes and its function as part of the future pedestrian trail.

From the rail road crossing, the two separated flows will diverge along separate alignments. The sanitary sewer will proceed to Murray Street, along the Route 9W interchange and connect to the existing 42" storm drain at Dubois Ave. The existing 42" pipe will remain as a separated sanitary sewer. The storm drain will continue down Maple Street in a new 30" pipe and connect to the new 36" trunkline at Murray Street. Of note, the existing combined sewer in Maple Street could have been used to carry this separated storm drain, however, doing so would not allow immediate separation of the streets in this phase as there is upstream combined sewer contribution from Flow Area 1Figure 3-3 provides a schematic of the proposed phasing.

As previously noted, the third phase (Phase C) includes the separation of Flow Area 3. After the sewer separation of all the streets within this phase, CSO flow from Flow Area 3 will be eliminated. Figure 3-4 provides a schematic of the proposed phasing.

The forth phase (Phase D) includes sewer separation of Flow Area 1 and will discharge to the separated trunklines installed in Phase B. One item of note, is the disposition of the existing combined sewer in Maple Street. It has known condition issues and this phasing plan allows for its abandonment. After the sewer separation of all the streets within this phase, CSO flow from Flow Area 1 will be eliminated. Figure 3-5 provides a schematic of the proposed phasing.

The last phase (Phase E) includes the separation of Flow Area 2 and a portion of Flow Area 4. The separation of this area will utilize the new separated trunklines from the previous phases. It will also include the upsizing of the existing separated sewer on Murray Street from 10" to 12". The existing 10" sewer in Murray is undersized to carry the separated sewer flows from Flow Area 2 and a portion of Flow Area 4. After the sewer separation of all the streets within this phase, CSO flow from Flow Area 2 will be eliminated. Figure 3-6 provides a schematic of the proposed phasing.



Legend

- Hasbrouck Ave CSO 005
- Flow Meters
- Hasbrouck Ave CSO Sewer Shed
- Phase A
- Phase B
- Phase C
- Phase D
- Phase E

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FIGURE 3-1
RECOMMENDED SEWER SEPARATION PHASING

Hasbrouck Combined Sewer System Engineering Report
Kingston, New York

April 2017

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K-0094

LEGEND

EXISTING INFRASTRUCTURE

- HASBROUCK AVE CSO SEWERSHED
- EXISTING COMBINED SEWER
- EXISTING SEPARATED DRAIN
- EXISTING SEPARATED SEWER
- FLOW METER
- PUMP STATION

PHASING LIMITS OF WORK

- PHASE A
- PHASE B
- PHASE C
- PHASE D
- PHASE E

DETAILED PHASING PIPE DISPOSITION

- PROPOSED STORM DRAIN
- PROPOSED SANITARY SEWER
- PROPOSED ABANDONED

FLOW METER 1

FLOW METER 2

FLOW METER 3

FLOW METER 4

CSO 005

KWWTF

RONDOUT CREEK

3.CONTINUE 36" SD TO MURRAY STREET. CONNECT SEPARATED STREET.

2. INSTALL 12" SD TO CONNECT SEPARATED STREETS TO NEW 36" SD

1B. INSTALL 36" SD. PIPE WILL CARRY SEPARATED FLOW FROM EACH PHASE AS COMPLETED.

4. INSTALL 18" SD TO 36" SD TO SEPARATED WEST SIDE OF ROUTE 9W

1A. UPSIZE EXISTING 24" SD WITH NEW 36" SD PIPE

FIGURE 3-2
PHASE A

HASBROUCK COMBINED SEWER SYSTEM ENGINEERING REPORT
KINGSTON, NEW YORK
SCALE: 1"=400'

400' 0' 200' 400'
SCALE: 1"=400'

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1B. INSTALL 2-24" SD ACROSS RR BRIDGE. CONTINUE 30" SD DOWN MAPLE STREET TO 36" SD IN RONDOUT DRIVE

1A. INSTALL 18" SS ACROSS RAIL ROAD ALONG ROUTE 9W TO EXISTING 42" SD AT DUBOIS PLACE

2. INSTALL 12" SD TO EXISTING SEPARATED SD on WEST SIDE OF ROUTE 9W

12" SD

36" SD

18" SD

36" SD

FLOW METER 1

FLOW METER 2

FLOW METER 3

FLOW METER 4

CSO 005

KWWTF

RONDOUT CREEK

LEGEND

EXISTING INFRASTRUCTURE

- HASBROUCK AVE CSO SEWERSHED
- EXISTING COMBINED SEWER
- EXISTING SEPARATED DRAIN
- EXISTING SEPARATED SEWER
- FLOW METER
- PUMP STATION

PHASING LIMITS OF WORK

- PHASE A
- PHASE B
- PHASE C
- PHASE D
- PHASE E

DETAILED PHASING PIPE DISPOSITION

- PROPOSED STORM DRAIN
- PROPOSED SANITARY SEWER
- PROPOSED ABANDONED

FIGURE 3-3
PHASE B

HASBROUCK COMBINED SEWER SYSTEM ENGINEERING REPORT
KINGSTON, NEW YORK
SCALE: 1"=400'

400' 0' 200' 400'
SCALE: 1"=400'

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LEGEND

EXISTING INFRASTRUCTURE

- HASBROUCK AVE CSO SEWERSHED
- EXISTING COMBINED SEWER
- EXISTING SEPARATED DRAIN
- EXISTING SEPARATED SEWER
- FLOW METER
- PUMP STATION

PHASING LIMITS OF WORK

- PHASE A
- PHASE B
- PHASE C
- PHASE D
- PHASE E

DETAILED PHASING PIPE DISPOSITION

- PROPOSED STORM DRAIN
- PROPOSED SANITARY SEWER
- PROPOSED ABANDONED

FLOW METER 1

FLOW METER 2

FLOW METER 3

FLOW METER 4

2–24" SD
18" SS

12" SD

36" SD

36" SD

18" SD

36" SD

SEPARATE ALL STREETS IN PHASE

CSO 005

KWWTF

RONDOUT CREEK

FIGURE 3-4
PHASE C

HASBROUCK COMBINED SEWER SYSTEM ENGINEERING REPORT
KINGSTON, NEW YORK
SCALE: 1"=400'

400' 0' 200' 400'
SCALE: 1"=400'

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1. SEPARATE ALL STREETS IN PHASE

2. ABANDON EXISTING COMBINED SEWER

2–24" SD

18" SD

12" SD

36" SD

36" SD

18" SD

36" SD

FLOW METER 1

FLOW METER 2

FLOW METER 3

FLOW METER 4

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RONDOUT CREEK

LEGEND

EXISTING INFRASTRUCTURE

- HASBROUCK AVE CSO SEWERSHED
- EXISTING COMBINED SEWER
- EXISTING SEPARATED DRAIN
- EXISTING SEPARATED SEWER
- FLOW METER
- PUMP STATION

PHASING LIMITS OF WORK

- PHASE A
- PHASE B
- PHASE C
- PHASE D
- PHASE E

DETAILED PHASING PIPE DISPOSITION

- PROPOSED STORM DRAIN
- PROPOSED SANITARY SEWER
- PROPOSED ABANDONED

FIGURE 3-5
PHASE D

HASBROUCK COMBINED SEWER
SYSTEM ENGINEERING REPORT
KINGSTON, NEW YORK
SCALE: 1"=400'

400' 0' 200' 400'
SCALE: 1"=400'

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1A. INSTALL 12" SEWER ON DELAWARE AVENUE

3. SEPARATE ALL STREETS IN PHASE

FLOW METER 1

FLOW METER 2

FLOW METER 3

FLOW METER 4

2–24" SS

18" SS

1B. INSTALL 12" SEWER ON MURRAY STREET FROM DELAWARE AVE TO MAPLE STREET

2. INSTALL NEW CONNECTION FROM EXISTING COMBINED TO NEW 36" SD.

36" SD

4. ABANDON EXISTING COMBINED SEWER FROM JAROLD ST TO ROUTE 9W

36" SD

18" SD

12" SD

5. AT COMPLETION OF PHASE D SEPARATION, EXISTING COMBINED SEWER TO REMAIN AS SEPARATED SEWER

36" SD

CSO 005

KWWTF

RONDOUT CREEK

LEGEND

EXISTING INFRASTRUCTURE

- HASBROUCK AVE CSO SEWERSHED
- EXISTING COMBINED SEWER
- EXISTING SEPARATED DRAIN
- EXISTING SEPARATED SEWER
- FLOW METER
- PUMP STATION

PHASING LIMITS OF WORK

- PHASE A
- PHASE B
- PHASE C
- PHASE D
- PHASE E

DETAILED PHASING PIPE DISPOSITION

- PROPOSED STORM DRAIN
- PROPOSED SANITARY SEWER
- PROPOSED ABANDONED

FIGURE 3-6
PHASE E

HASBROUCK COMBINED SEWER SYSTEM ENGINEERING REPORT
KINGSTON, NEW YORK
SCALE: 1"=400'

400' 0' 200' 400'
SCALE: 1"=400'

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3.4 Alternative 3: Green Infrastructure

Alternative to sewer separation, Green Infrastructure (GI) approaches were considered for the Hasbrouck Area. GI is a network of decentralized stormwater management practices that can capture and infiltrate rain where it falls, thus reducing stormwater runoff.

Significant guidance on utilizing Green Infrastructure to reduce runoff is included in New York State Stormwater Management Design Manual, Chapter 5: Green Infrastructure Practices, published January 2015. The approach for GI improvements in the Hasbrouck Area was based upon guidance included in this document.

Using GI practices to decentralize stormwater control in a combined sewer system has the potential to reduce the frequency and volume of CSO events. Distributed, small scale stormwater facilities and site-design techniques mimic natural hydrologic processes, thereby slowing down, capturing, and infiltrating rain where it falls, resulting in a reduction of stormwater volumes and peak flows into the combined system. Typical GI practices appropriate for urban areas include disconnection, rain harvesting, rain gardens (bio-retention), green roofs, infiltration, street planters, and porous/permeable pavement. Table 3-2 based on DEC's guidance, shows these practices and presents a brief description of each. GI practices that utilize undisturbed natural areas have not been included as those areas are not present in the Hasbrouck Sewershed. Practices not appropriate to the dense urban environmental include:

- Conservation of Natural Areas
- Vegetated Swales
- Tree Planting
- Stream Daylighting
- Tree Planting

TABLE 3-2

Green Infrastructure Practices

Green Stormwater Infrastructure Practice	Description
 **Disconnection**	Disconnection refers to the practice of directing runoff from impervious areas such as roofs or parking lots onto pervious areas such as lawns or vegetative strips, rather than directly into storm drains or combined sewers

TABLE 3-2
Green Infrastructure Practices

 **Rain Harvesting**	Rain harvesting systems including rain barrels and cisterns collect runoff from rooftops and convey it to a cistern tank where the water is available for uses that do not depend on potable water, like irrigation.
 **Rain Gardens**	Rain gardens are shallow depressions filled with an engineered soil mix that supports vegetative growth. They are designed to store and infiltrate captured runoff, and retain water for plant uptake.
 **Filter Strips**	Filter Strips areas of vegetation that are designed to filter sheet flow runoff. They can be used in conjunction with infiltration practices to removed particulates and reduce clogging.
 **Stormwater Planters**	Stormwater planters are typically placed along sidewalks or parking areas. They consist of concrete boxes filled with an engineered soil that supports vegetative growth. Beneath the soil is a gravel bed that provides additional storage as the captured runoff infiltrates into the existing soil below. Street planters also can be designed with underdrains to avoid ponding on sites with inadequate infiltration capacity.
 **Porous Pavement**	Permeable pavement and paver systems are excavated areas filled with gravel and paved over with a permeable concrete or asphalt mix. They may also be overset with a layer of pavers. Rainfall passes through the pavement or pavers into the gravel storage layer below where it can infiltrate at natural rates into the site's native soil.

TABLE 3-2
Green Infrastructure Practices

 **Green Roofs**	Green roofs (also known as vegetated roofs or eco-roofs) are vegetated detention systems placed on roof surfaces that capture and temporarily store rainwater in a soil medium. They typically have a waterproof membrane, a drainage layer, and a lightweight growing medium populated with plants that absorb and evaporate water.

As the main focus of this study was to investigate activities that could occur on part of the City-owned portions of the sewer system, several of these practices were not considered for implementation as a sewer separation alternative, but are recommended to be considered for future stormwater reduction:

- Downspout disconnection
- Rain Harvesting
- Green Roofs

In addition to the remaining alternatives, decentralized stormwater detention or infiltration was considered. While not strictly a green infrastructure practice, using detention or infiltration ponds to collect stormwater and slowly release its flow back into the combined system, significantly reducing peaks, is fitting to include in this analysis.

Of the considered alternatives there are two methods that are used to mitigate the impact of stormwater run-off; infiltration practices that direct stormwater runoff into the ground water aquifer, and detention practices that capture and release specific stormwater volumes back into the collection system. The opportunity for each of these items is discussed in the following sections.

3.4.1 Infiltration Green Infrastructure Opportunities

To identify areas where green infrastructure improvements that utilize infiltration may be appropriate a desktop screening of the Hasbrouck area was completed. Screening criteria included:

- Depth to Water Table
- Depth to Bedrock
- Soil Permeability
- Slope of Surface

Figures 3-7 to 3-10 provide graphic results of this analysis.

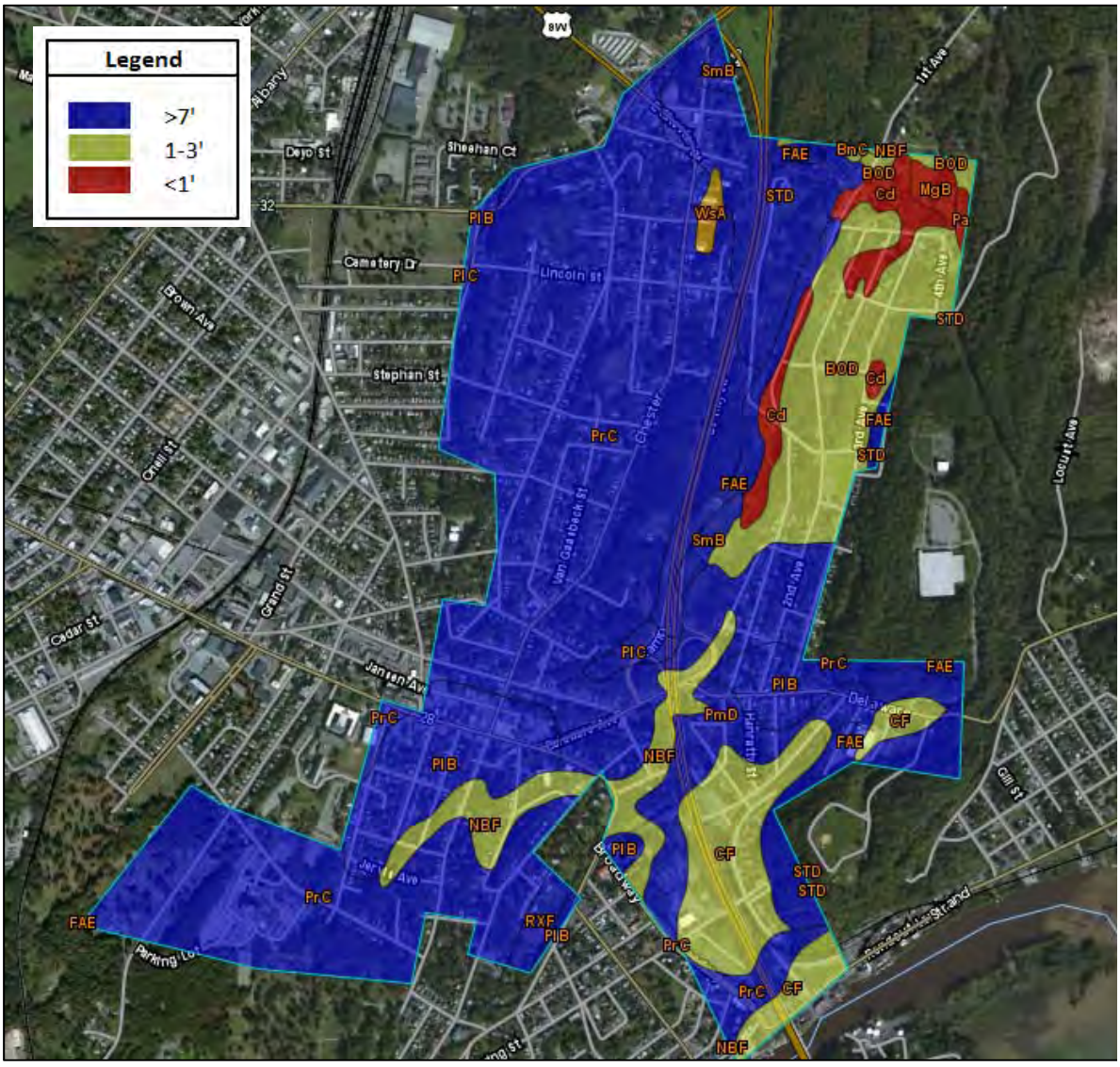

Figure 3-7 Depth to Water Table

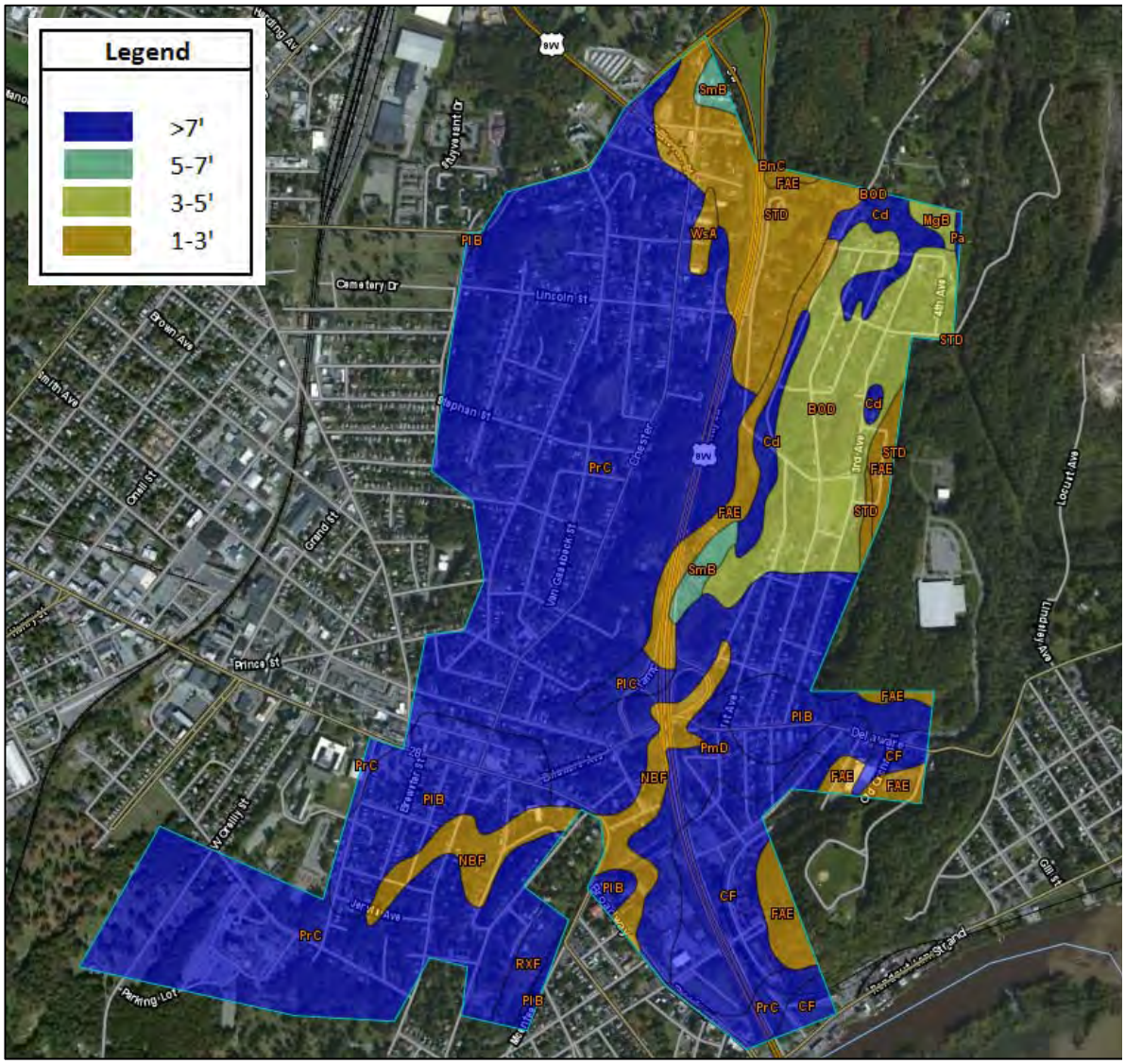

Figure 3-8 Depth to Bedrock

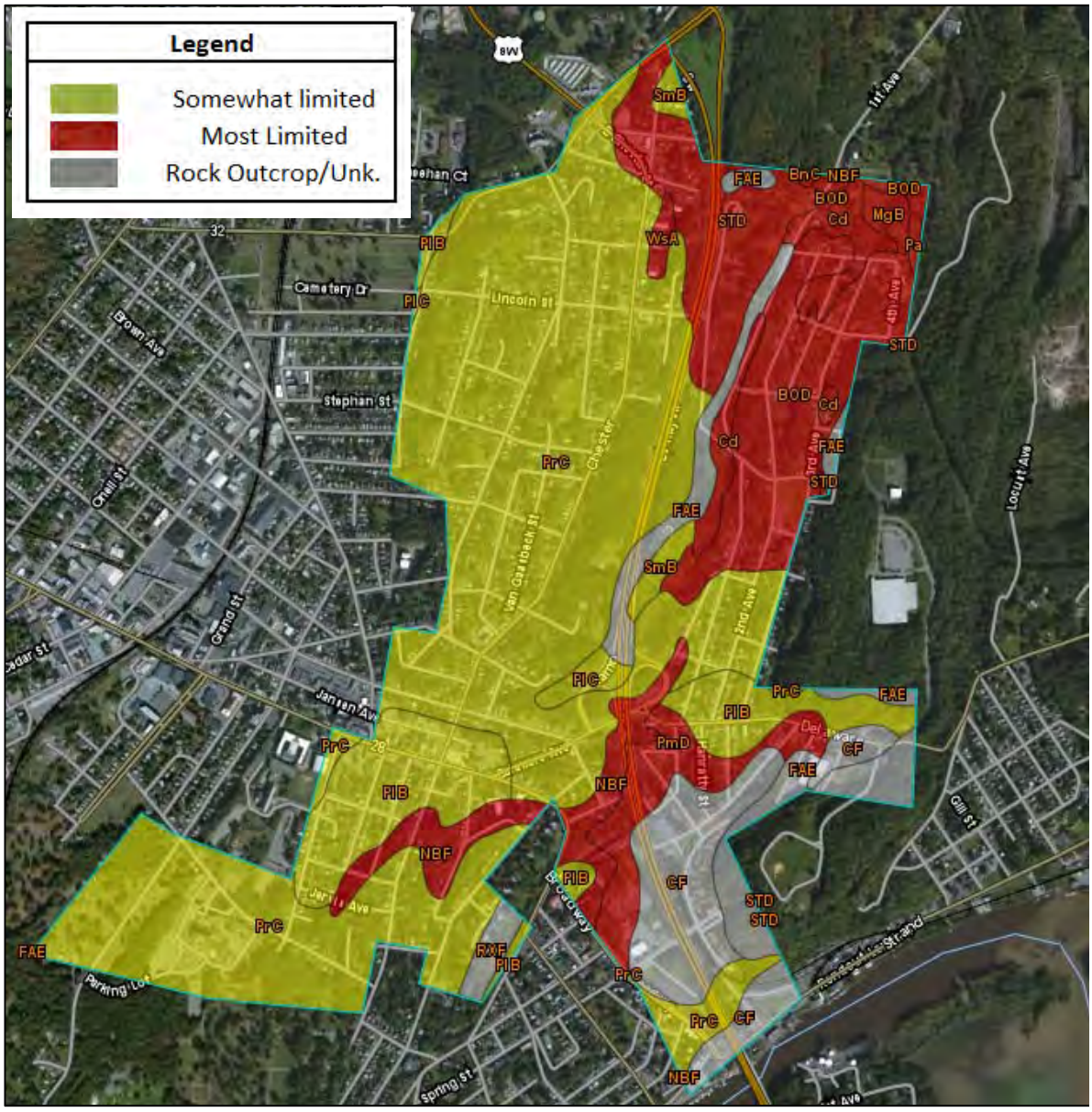

Figure 3-9 Soil Permeability

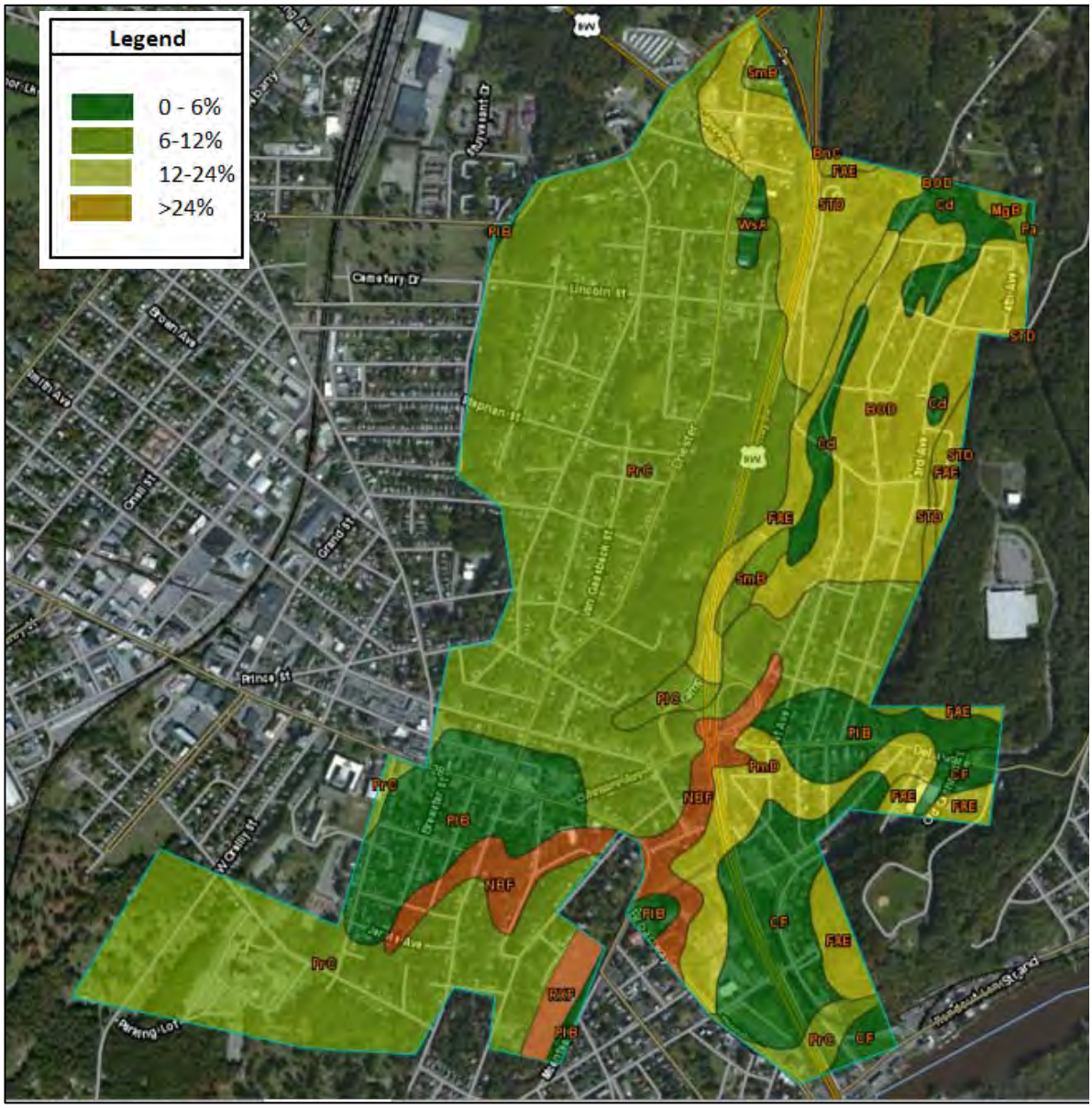

Figure 3-10 Topography Slope

The results of the desk top analysis identified two areas that appear suitable for infiltration or bio-retention practices; the Broadway area and the Delaware area.

Figure 3-11 Areas Suitable to Infiltration Practices

The Broadway area is located to the west of Route 9W, and is comprised of urban commercial district and dense residential.

The Delaware area is located to the east of Route 9W and is comprised of dense residential with some small commercial parcels. This area has an existing infiltration basin that is part of the 9W access ramp.

Site visits were conducted in both of these areas and there is very little available space for larger infiltration practices, regardless of ownership. The only significant open space is located on a private parcel, 295 Broadway, which is occupied by an apartment building.

In addition to this private parcel, there is a substantial amount of paved parking areas that are associated with private parcels.

Both of the areas were reviewed for City parcel ownership, as shown on Figures 3-12 and 3-14.

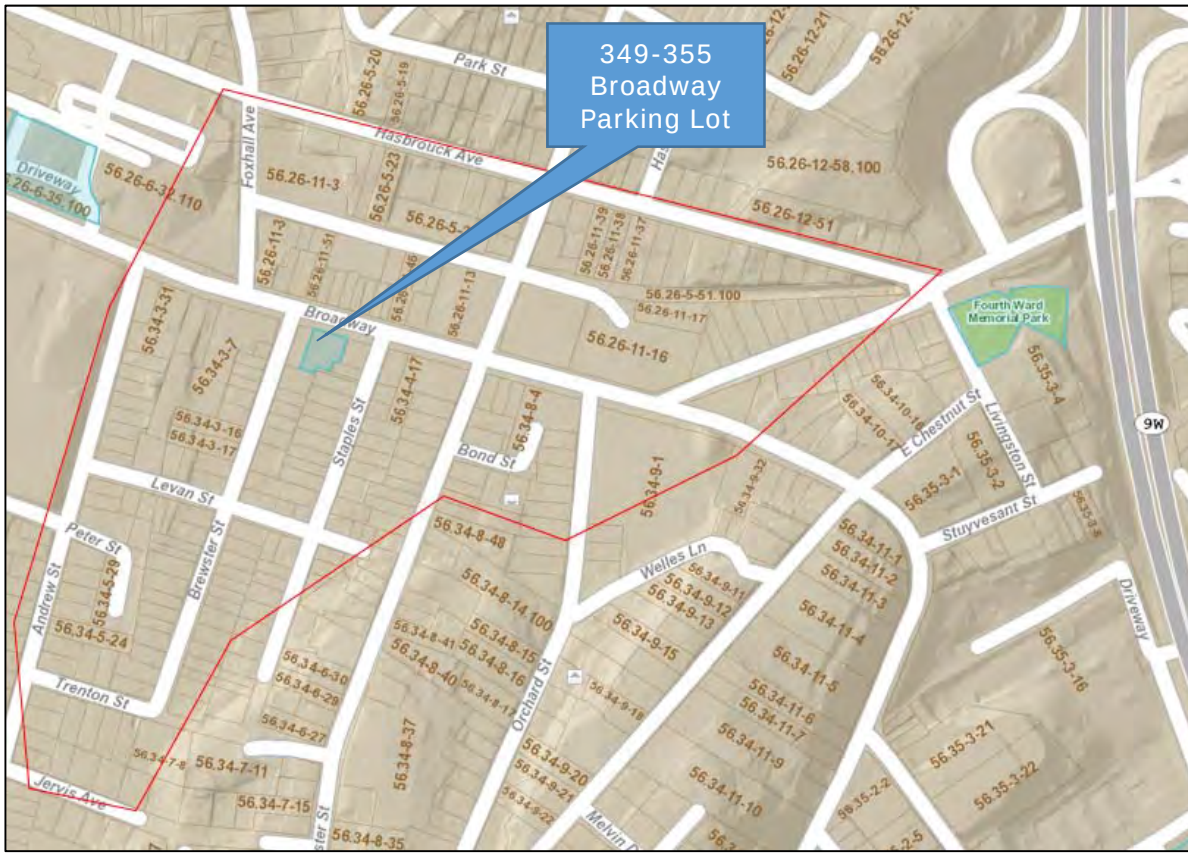

Figure 3-12 Broadway Area, City Owned Parcels

Figure 3-13 349-355 Broadway Parking Lot, City of Kingston

Figure 3-14 Delaware Area, City Owned Parcels

Figure 3-15 449 Delaware, City of Kingston

3.4.2 Detention Green Infrastructure Opportunities

Green infrastructure improvements that utilize detention can generally be placed anywhere in the drainage area, regardless of hydrogeological conditions. The most important consideration is parcel ownership and sufficient space. Figure 3-16 provides City-owned parcels within the Hasbrouck CSO drainage area.

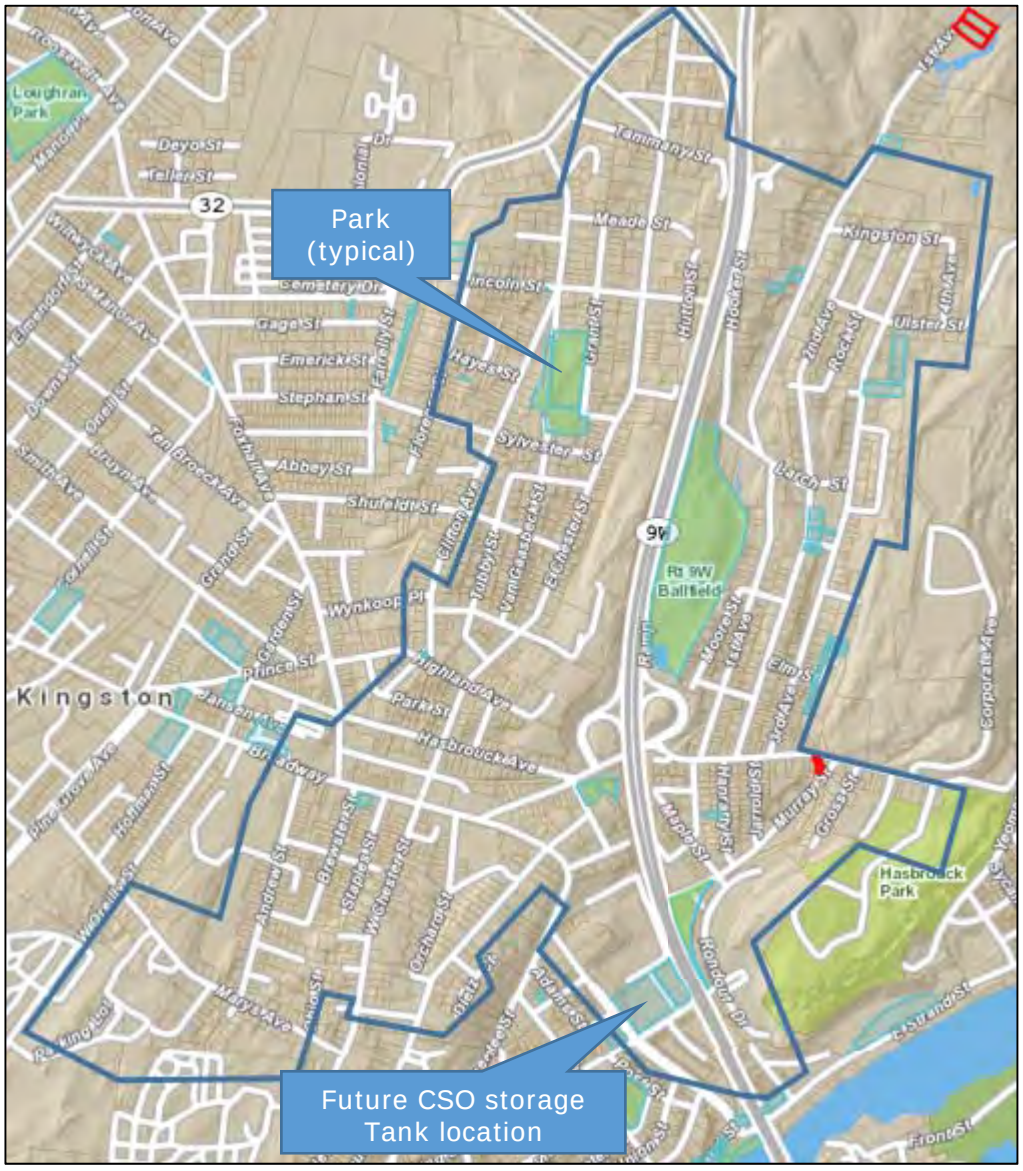

Figure 3-16 Hasbrouck Sewershed City Owned Parcels

The largest parcels in this area are parks including, north to south; Hutton Park, Route 9W Ballfields, Forth Ward Memorial Park, Rondout Community Garden & Park. Parks are very challenging for implementation of larger stormwater projects.

As explained in the New York State Office of Parks, Recreation and Historic Preservation's Handbook on the Alienation and Conversion of Municipal Parkland in New York, "once land has been dedicated to use as a park, it cannot be diverted for uses other than recreation, in whole or in part, temporarily or permanently, even for another public purpose, without legislative approval." The Handbook specifically states that the granting of temporary or permanent easements for the installation of underground facilities such as water and sewer pipelines may also constitute alienation. Alienation could potentially be triggered by the granting of easements to maintain storage or infiltration facilities.

Should installation of stormwater facilities and/or granting of easements be determined to constitute an alienation of parkland, State parkland alienation legislation would be required, supported by a Municipal Home Rule Request. To prevent a net loss of parkland to the public, it is preferred that parkland alienation legislation include a provision requiring the acquisition and dedication of substitute parkland for the lands being alienated. It may be possible to satisfy this requirement with other City-owned parcels. In some instances, an acceptable alternative may be to set aside funds equal to the fair market value of the parkland being alienated, for the purchase of additional parklands.

The parcels across from the Public Safety Building are reserved for a future CSO storage tank.

There are several larger parcels located in the area tributary to Flow Meter 2, adjacent to Second and Third Avenues. As this drainage area is quite far from the existing CSO and storm drain outfall, the first review was for potential of access to a second discharge location. After storm detention, an ideal scenario would be to release to an outfall, versus return to the combined sewer. Figure 3-17 shows there is a stream in this area, but the City owned parcels are not adjacent and field observation indicated the true start of the stream is further north than indicated by NYSDEC Resource Mapping.

Figure 3-17 City Owned Parcels in DA 2

Currently, the two northern parcels are heavily wooded, and would require substantial clearing. The remaining available parcels are too small for effective storm mitigation.

3.4.3 Green Infrastructure Recommendations

In general, due to the dense urban development, lack of City owned properties, and large quantity of stormwater produced, there is not substantial opportunity in the Hasbrouck sewershed for green infrastructure to significantly mitigate CSO activations. However, in terms of phased projects that will have a cumulative impact on reducing stormwater, there is potential for including green infrastructure improvements in the City's overall stormwater approach.

The best opportunity identified in the Hasbrouck area is the City-owned Broadway parking lot. The City has recently completed parking lot improvement projects at two other parking areas; the North and South lots in the Stockade District. These projects included stormwater management practices that would applicable at the Broadway lot. Due to the size of the lot and the proximity of adjacent buildings, a large stormwater detention or infiltration system is not recommended for this location.

Rather than large stormwater remediation efforts, given the dense land use types, and lack of large parcels, stormwater planters have the greatest potential for use in Kingston. Currently the City is planning to install stormwater planters along a portion of Broadway in conjunction with a street improvement project.

Two types of street planter systems could be used, those intended to facilitate infiltration, and those intended to slow down stormwater peaks, but return flow slowly to the combined sewer. Figure 3-18 provides a schematic of a typical stormwater planter.

The impact of infiltration /detention style planters varies significantly based upon the runoff area that discharges to the particular planter. This green infrastructure improvement has is infinitely phase-able, with as few or as many planters installed at one time.

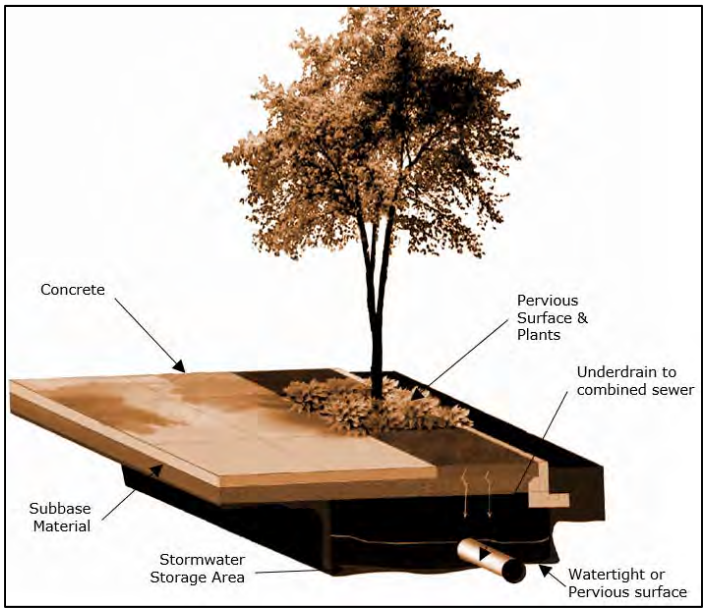

Figure 3-18 Stormwater Planter

To understand the potential impact of stormwater plants, Runoff Reduction calculations were completed in accordance with the NYSDEC stormwater manual guidance. The following assumptions were made:

Estimated Sidewalk Length Tributary to Each Planter:	50	feet
Estimated Planter Width	10	feet
Estimated Catchment Area	500	sq ft
	0.01	ac
Impervious Area (%)	100%	
Impervious Area	0.010	ac

The Runoff Coefficient was calculated using the following equation:

Rv = 0.05 + 0.009 x (I)

Where "I" is the percent impervious area (100%)

Rv = 0.05 + 0.009 x (100) = 0.95

The Runoff Coefficient was then used to calculate the Runoff Volume:

Runoff Volume = (A x Rv x P)/12 x 43,560

Where:

A: Catchment Area = 0.01 acre

Rv: Runoff Coefficient = 0.95

P: Precipitation = 2.58 inches (2-month design storm)

Runoff Volume = (0.01 acre x 0.95 x 2.58)/12 x 43,560 = 89 cu ft

The quantity of runoff that could be reduced using planters was then calculated using the NYSDEC manual guidelines. These calculations can be found in Appendix C.

Table 3-3 provides the estimated run off reductions assuming 65% of the subcatchment areas can use this style of improvement.

TABLE 3-3
Stormwater Planter Calculated Runoff Reduction

Drainage Area No.	Area Pipe Length (ft)	Estimated Length of Infiltration/ Detention Planters[1]	Number of Planter Catchment Areas	2-Mo Storm Runoff Volume Reduction Per Planter (Gallons)	2-Mo Storm Runoff Volume Reduction (MG)
1	20,900	27,200	544	300	0.16
2	18,350	23,800	476	300	0.14
3	18,050	23,500	470	300	0.14
4	9,150	11,900	238	300	0.07
Total	66,450	86,400	1,728	300	0.52

[1] Based on sewer mapping review assumes street improvements would occur along 65% of the area pipe length, on both sides of the street

Table 3-4 provides the overall impact of this reduction on the total area run off.

TABLE 3-4
Stormwater Planter Calculated Runoff Reduction Impact

Drainage Area No.	Modeled 2-mo Storm Inflow Volume (MG)	2-Mo Storm Planter Runoff Volume Reduction (MG)	% Reduction of Flow Volume at 2-mo Storm
1	0.8	0.16	20%
2	0.5	0.14	29%
3	1.7	0.14	8%
4	5.1	0.07	1%
Total	8.1	0.52	6%

3.5 Alternative Costs

3.5.1 Cost Approach

The budgetary cost estimates are based on Class 4 level construction cost estimates, as defined by the Association for the Advancement of Cost Engineering (AACE) International Recommended Practices and Standards. According to AACE International Recommended Practices and Standards, the estimate class designators are labeled Class 1, 2, 3, 4, and 5, where a Class 5 estimate is based on the lowest level of project definition and a Class 1 estimate is closest to full project definition and maturity. The end usage for a Class 4 estimate is conceptual studies or feasibility. The expected accuracy range of a Class 4 estimate is between +50% and -30%. The level of project definition for a Class 4 estimate is between 1% and 15%. The costs include equipment costs, demolition/removal of existing equipment, temporary provisions (if applicable), facilities and bypasses (if necessary to complete the work), and costs regarding installation and start-up of improvements. The costs are based upon recently completed project bid forms, quotes from equipment manufacturers and data contained in R.S. Means Construction Cost Data. Allowances were included for contractor markup, installation, general conditions, and engineering and contingency costs.

3.5.2 Do Nothing Costs

Should no alternative stormwater abatement be determined Kingston will continue to sample water quality, and may need to continue to the next stage of the LTCP – Construction of a CSO storage facility. As described in the LTCP, the tank would store the CSO overflow and slowly release the stored volume back to the Kingston Waste Water Treatment Plant at a rate within the plant's treatment capacity. However, storms with rain intensities that generate runoff volumes exceeding the storage design capacity would cause untreated CSO discharges.

Kington's LTCP included costs for this 1.3 million gallon storage facility which included the tank, flushing system, pump station and piping. Table 3-5 below presents the cost updated to today's value.

TABLE 3-5

Revised Storage Tank Costs

Construction Cost October 2010[1] ($M)	Adjusted Cost to Present[2] ($M)	Contingency & Engineering($M)[3]	Total Project Cost ($M)
$3.50	$4.10	$1.24	**$5.34**

[1]Combined Sewer Overflow Long Term Control Plan, Malcome Pirnie, Inc.

[2]Construction cost adjusted based on the ratio of the current and October 2010 ENR Indices (ENR Index equation = 10530/8921).

We feel it is important to note that the EPA Combined Sewer Overflow Control Manual provides general guidance for estimating CSO storage facilities.

Cost ($M) = 2.14 x 3.637 x (volume(MG))$^{0.826}$

Using this formula, construction cost for a 1.3 MG CSO storage facility is $9.7 M. More than twice the escalated construction cost presented in the LTCP.

Additionally, our past construction experience of CSO storage and satellite treatment facilities indicates this cost may be low. Based on previous projects, we estimate this facility construction cost at $6.6 M. An opinion of probable cost for this facility is provided in Appendix C. These two alternative costs are presented in Table 3-6.

TABLE 3-6

Hasbrouck CSO Storage Costs

Method	Construction Cost ($M)	Contingency & Engineering($M)[1]	Total Project Cost ($M)
USEPA Formula	$9.7	$3.9	$13.6
Planning Report OPC	$6.6	$2.2	$8.9

[1] 20% contingency, 20% engineering

3.5.3 Phased Partial Sewer Separation Costs

Sewer separation is a common and effective method of eliminating CSO discharges. Sewer separation consists of the construction of a new pipeline dedicated to handling either sanitary sewage or stormwater, thus providing two separate pipelines in lieu of the single existing combined line. Generally, a new sanitary sewer is installed because it is usually smaller in size than the required storm line and therefore costs less to install, and it provides new pipes with tight joints that minimize the amount of groundwater infiltration into the system. In this case, the existing combined sewer would remain and be used for conveying stormwater flow. However, in Kingston there is a prevalence of difficult trenching conditions due to ledge outcrops and hard, dense clay. Therefore, the costs were developed assuming a high storm drain would be installed and the existing combined pipe would remain as the sanitary sewer. Detail survey and design are required to confirm these assumptions. Table 3-7 below presents the adjusted unit prices by phase and Table 3-8 presents the cost for this method of CSO abatement.

TABLE 3-7

Phased Partial Sewer Separation Unit Costs

Phase	Drainage Area Description			Separation Unit Price[1]
	% Dense Urban	% 15-20 ft Deep	% >20 ft Deep	
A	10%	10%	0%	$315
B	0%	10%	0%	$305
C	0%	10%	0%	$305
D	0%	10%	0%	$305
E	0%	10%	0%	$305

[1] Separation unit price based on a cost from similar combined sewer separation projects, including $300 base cost, $100 additional for urban areas, $50 additional for 15-20 ft depth or $100 for >20 ft depth. Unit cost includes contractor's general conditions.

TABLE 3-8

Total Phased Sewer Separation Costs

Phase	Construction Cost ($M)	Police, Contingency & Engineering($M)[1]	Total Project Costs ($M)
A	$0.6	$0.2	$0.8
B	$1.5	$0.6	$2.1
C	$5.5	$2.3	$7.8
D	$6.4	$2.6	$9.0
E	$6.5	$2.6	$9.1
Total	**$20.4**	**$6.4**	**$26.8**

[1] % varies Police, 20% contingency, 20% engineering

3.5.4 Green Infrastructure Costs

Two potential green infrastructure projects were evaluated; construction of green infrastructure improvements at the Broadway Parking Lot and construction of infiltration/detention planters.

Based on our recent parking lot construction within the City, , we estimate the construction cost of the Broadway Parking Lot to be $84,000 as provided in Table 3-9. The opinion of probable cost is provided in Appendix C.

TABLE 3-9

Broadway Parking Lot Green Infrastructure Improvements

Construction Cost ($)	Contingency & Engineering($)[1]	Total Project Costs ($)
$84,000	$29,200	$113,000

[1] 20% contingency, 20% engineering

Recent construction projects for planter infiltration/detention projects provide a unit cost of approximately $1,000 per linear foot of planter strip. These costs were based on projects with a minimum project length greater than 1,000 feet and include new sidewalks, curbs, crosswalks, porous pavement or plants and trees between the sidewalk and curb, underdrainage piping and connection to existing drainage systems. For example, installing a detention/infiltration planter system along both sides of Broadway, from Delaware to Foxhall Avenue would be approximately 3,000 linear feet, and have a construction cost of $3.0M. Table 3-10 presents the cost for using infiltration/detention planter green infrastructure for all areas of the Hasbrouck drainage area. While necessary for comparison purposes, this approach is not recommended.

TABLE 3-10
Green Infrastructure Planter Costs

Drainage Area No.	Area Pipe Length (ft)	Estimated Length of Infiltration / Detention Planters[1]	Detention / Infiltration Planter Cost ($ M)	Contingency & Engineering ($M)[2]	Total Project Costs ($M)
1	20,900	27,200	$27.2	$10.8	$38.0
2	18,350	23,800	$23.8	$9.5	$33.3
3	18,050	23,500	$23.5	$9.4	$32.9
4	9,150	11,900	$11.9	$4.8	$16.7
Total	66,450	86,400	$86.4	$34.6	$121.0

[1] Based on sewer mapping review assumes street improvements would occur along 65% of the area pipe length, on both sides of the street

[2] 20% contingency, 20% engineering

3.5.5 Alternative Cost Comparison

As discussed in Section 3.4.5, Green Infrastructure is not recommended as a comprehensive approach to stormwater flow reduction at the Hasbrouck CSO regulator structure. The remaining two alternatives; the do-nothing alternative resulting in a CSO storage facility and phased partial sewer separation are compared utilizing annual costs and a present worth summary in the sections below.

Annual Debt Service Payment

The annual debt service payment assumes a 30-year loan at 2.5% interest rate. This is consistent across all project types. The debt service calculation assumes no project grants; the project is funded through low-interest loans or bonding.

Annual Operation & Maintenance

The annual operation and maintenance costs presented for both alternatives are based upon existing operation costs for the system and are presented in Appendix C. The present worth O&M costs are based upon uniform series present worth over 20 years.

Additional Treatment Plant Flow

The annual flow to the Kingston Wastewater Treatment Plant is approximately 2,200 MG. As presented in Appendix B, the 2017 The annual treatment plant budget is $1,874,540. The budget costs are presented in labor and contracted costs. While labor costs are not anticipated to be significantly impacted by increased or reduced flows, contracted costs are assumed to have a proportional relationship with flows. Contracted costs total $994,633, making the flow dependent treatment cost approximately $452 per gallon.

As presented in the City of Kingston LTCP, the storage tank is anticipated to capture 90% of CSO overflows. The 2015 overflow volume at the Hasbrouck CSO was 123 MG, thus 110 MG of additional flow will be directed to the treatment plant after it leaves the storage facility. The storage facility will not reduce any of the current flows directed toward the

wastewater treatment plant as the diversion to the storage tank occurs after the CSO diversion.

The flow reductions resulting from partial sewer separation are presented in Table 3-1. As these reductions take place across the drainage area, they will reduce flows that reach the wastewater treatment plant.

Table 3-11 provides the annual estimated project costs.

TABLE 3-11
Annual Cost Comparison

Project	Project Cost	Annual Debt Service Payment	Annual Operation & Maintenance	Additional Flow to Treatment Plant (MG)	Annual Cost Wastewater Treatment	Total Annual Cost
CSO Storage Facility	$8,940,000	$309,700	$191,600	110	$49,700	$551,000
Phase A Separation	$837,000	$29,000	$3,400	-24	$(10,900)	$21,500
Phase B Separation	$2,033,000	$70,400	$700	-29	$(13,100)	$58,000
Phase C Separation	$7,817,000	$270,800	$8,900	-42	$(19,000)	$260,700
Phase D Separation	$8,988,000	$311,300	$9,600	-48	$(21,700)	$299,200
Phase E Separation	$9,139,000	$316,600	$10,200	-62	$(28,000)	$298,800

Total of all sewer separation is $28,814,000 This is not an equivalent comparison to storage as storage remediates less than a 1 year storm while complete separation mitigates 500+ year storm and thus is not presented in a manner that indicated equivalency.

3.5.6 Life Cycle Cost Analysis

The present worth value calculations are presented in Appendix C and include present worth annual O&M and project salvage value. Table 3-12 provides the present worth value of the alternatives evaluated.

TABLE 3-12
Net Present Worth Comparison

Project	Project Cost	Salvage Value	Present Day O&M Value	Net Present Worth
CSO Storage Facility	$8,363,000	$4,663,200	$3,389,000	$7,088,800
Phase A Separation	$778,000	$466,800	$60,000	$391,200
Phase B Separation	$1,888,000	$1,132,800	$12,000	$767,200
Phase C Separation	$7,267,000	$4,360,200	$157,000	$3,063,800
Phase D Separation	$8,351,000	$5,010,600	$170,000	$3,510,400
Phase E Separation	$8,490,000	$5,094,000	$180,000	$3,576,000

Total of all sewer separation is $28,814,000. This value is not an equivalent comparison to storage as storage remediates less than a 1 year storm while complete separation mitigates 500+ year storm.

Tables 3-13 provides information of the project cost in relation to the cost per gallon of flow reduction reaching the Hasbrouck CSO regulator structure for use in prioritization and planning of future projects.

TABLE 3-13
Cost per Annual Flow Reduction

Project	Estimated Annual Hasbrouck Flow Reduction (MG)[2]	Project Cost	Cost per Gallon Estimated Hasbrouck Flow Reduction	Project Net Present Worth	Cost per Gallon Estimated Hasbrouck Flow Reduction
CSO Storage Facility	0	$8,940,000	NA[1]	$7,088,800	NA[1]
Phase A Separation	44	$837,000	$0.02	$391,200	$0.01
Phase B Separation	9	$2,033,000	$0.22	$767,200	$0.08
Phase C Separation	23	$7,817,000	$0.34	$3,063,800	$0.13
Phase D Separation	11	$8,988,000	$0.85	$3,510,400	$0.33
Phase E Separation	26	$9,139,000	$0.35	$3,576,000	$0.14

Notes:
1 the storage facility does not remove any wet weather flow from the Hasbrouck CSO sewershed.
2 The 2010 LTCP indicated typical annual 27 MG overflow at the Hasbrouck CSO and a 88% wet weather capture rate, resulting in typical annual wet weather flow volume of 225 MG reaching the Hasbrouck CSO.

3.6 Non-Monetary Factors

While Tables 3-11 - 3-13 provide information of the project cost, it does not consider many factors. These are presented below.

- Kingston's infrastructure is old and in some areas known to be in disrepair. While partial separation costs have generally assumed new storm drains, new sewers can be provided where poor conditions are indicated. Storage and green infrastructure improvements provide no improvements to infrastructure. It is likely in these areas infrastructure will need to be replaced regardless, requiring new pipes in the ground without the positive impact from partial separation.

- The City would likely implement a project over time. A single storage facility provides no ability for construction phasing. Both partial separation and green infrastructure improvements allow for smaller projects that will provide stormwater reduction benefits.

- While not recommended as a general approach, green infrastructure improvements have many positive impacts on urban streetscapes and have additional funding sources other projects may not qualify for. They can be successful and cost effective as part of comprehensive street improvements.

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SECTION 4

Section 4
Recommendation & Implementation

4.1 Recommended Alternative

4.1.1 Basis of Selection

Partial separation Phase A is recommended over the eventual construction of a CSO storage facility for several reasons.

While complete partial separation (Phases A-E) is a more expensive alternative, completion of all phases is not necessary to reduce annual CSO activations. As separation projects proceed, the City can carefully monitor impact on overflow occurrences and volume and make decisions on when and if to proceed.

For the purposes of this report, delineating the Hasbrouck sewer shed into drainage areas to permit flow metering and analysis was necessary. However, once Phase A is complete, Phases B - E can be implemented in much smaller phases if desired, allowing fuller project scalability.

As previously noted, Kingston's infrastructure is old and in some areas known to be in disrepair. While partial separation costs have generally assumed new storm drains, new sewers can be provided where poor conditions are indicated. Storage and green infrastructure improvements provide no improvements to infrastructure. It is likely in these areas infrastructure will need to be replaced regardless, requiring new pipes in the ground without the positive impact from partial separation.

Surcharged conditions are damaging to sewer pipes intended for gravity flow. Pressure on joints of clay and concrete pipe can lead to failure or soil entering the sewer system. Removing stormwater from the system preserves the integrity of these pipes, potentially allowing for less invasive remediation techniques if necessary. Once a significant collapse or joint failure occurs, dig and replace is typically the only alternative.

Storage facilities pose a significant operation and maintenance burden that would result in an increase to sewer budget while providing no improved service or reliability to rate payers. Also the City is working hard to minimize regular confined space entry; storage tank cleaning will increase staff confined space entry requirements.

The City has also noticed recent patterns of storm events where flow peaks remain elevated for a substantial period (several days) over the precipitation event. While the storage facility may be able to capture the event overflow, it may not be able to return the flow back to the collection system for several days; increasing the likelihood that a second storm event may occur, and the tank will have no capacity to capture that event.

Once separate storm drains are in place, the City has far greater opportunity to remediate non-public sources of stormwater such as connected roof leaders, further reducing stormwater in the collection system. Infiltration and Inflow Studies typically consist of the following components and is recommended for the Hasbrouck area once separation is complete and the City still encounters an excessive quantity of inflow/infiltration in the Hasbrouck Area.

- Flow metering to determine high flow areas
- TV inspection and smoke testing of high flow area pipe
- Inspection of manhole condition
- Building inspections to identify private I/I sources.

While not the basis for the recommended alternative, it is recommended that Green infrastructure improvements be included to any comprehensive street improvements in the Hasbrouck Area. This approach is specifically recommended on Broadway which presents opportunity for both planter strip infiltration and parking lot improvements. Green infrastructure improvements have many positive impacts on urban streetscapes and have additional funding sources other projects may not qualify for. They can be successful and cost effective as part of comprehensive street improvements.

4.1.2 Cost Estimate

Table 4-1 presents the annual fee presented in Table 3-11 for partial separation Phase. It also presents the same project if a 20% grant was secured for this project.

TABLE 4-1
Recommended Project Costs

	100% Loan Funding		20% Grant/80% Loan Funding	
Project	Project Cost	Total Annual Cost[1]	Project Cost	Total Annual Cost[1]
Phase A Separation	$837,000	$21,500	$669,600	$15,700

[1] Includes debt service, O&M and reduction in WWTP operation cost

4.1.3 Project Implementation & Schedule

Figure 4-1, attached, presents the proposed implementation schedule for the Hasbrouck partial separation project - Phase A.

The following permits are reviews are anticipated as part of this project:

- NYSDEC SPDES Municipal Application Form NY-2A – Permit Modification
- NYSDEC Notice of Intent for Stormwater Discharges Associated with Construction Activity
- NYSDEC SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems
- New York State Environmental Quality Review Act
- Fish & Wildlife Environmental Review (No impacts anticipated)
- State Historic Preservation Act Review (No impacts anticipated)

4.1.4 Community Engagement

During the development of this report, input has been provided by City staff that provided comments and feedback to ensure its contents was consistent with priorities, financial and management resources, and physical infrastructure of the City of Kingston. Staff contributing to this report effort included:

- Ralph Swenson, PE, City Engineer
- Alan Adin, Engineering Technician
- Allen Winchell, Wastewater Treatment Plant Senior Operator
- Jeremy Mernin, Wastewater Treatment Plant Operator
- Joseph Chenier, Department of Public Works Superintendent

A public notice indicating this report has been completed will be published and noticed on the City website. A copy of this report will be made available for public review. Any comments received will be incorporated by addendum.

4.1.5 Attachments

The signed Engineering Report Certification and Smart Growth Assessment Form are included in Appendix D.

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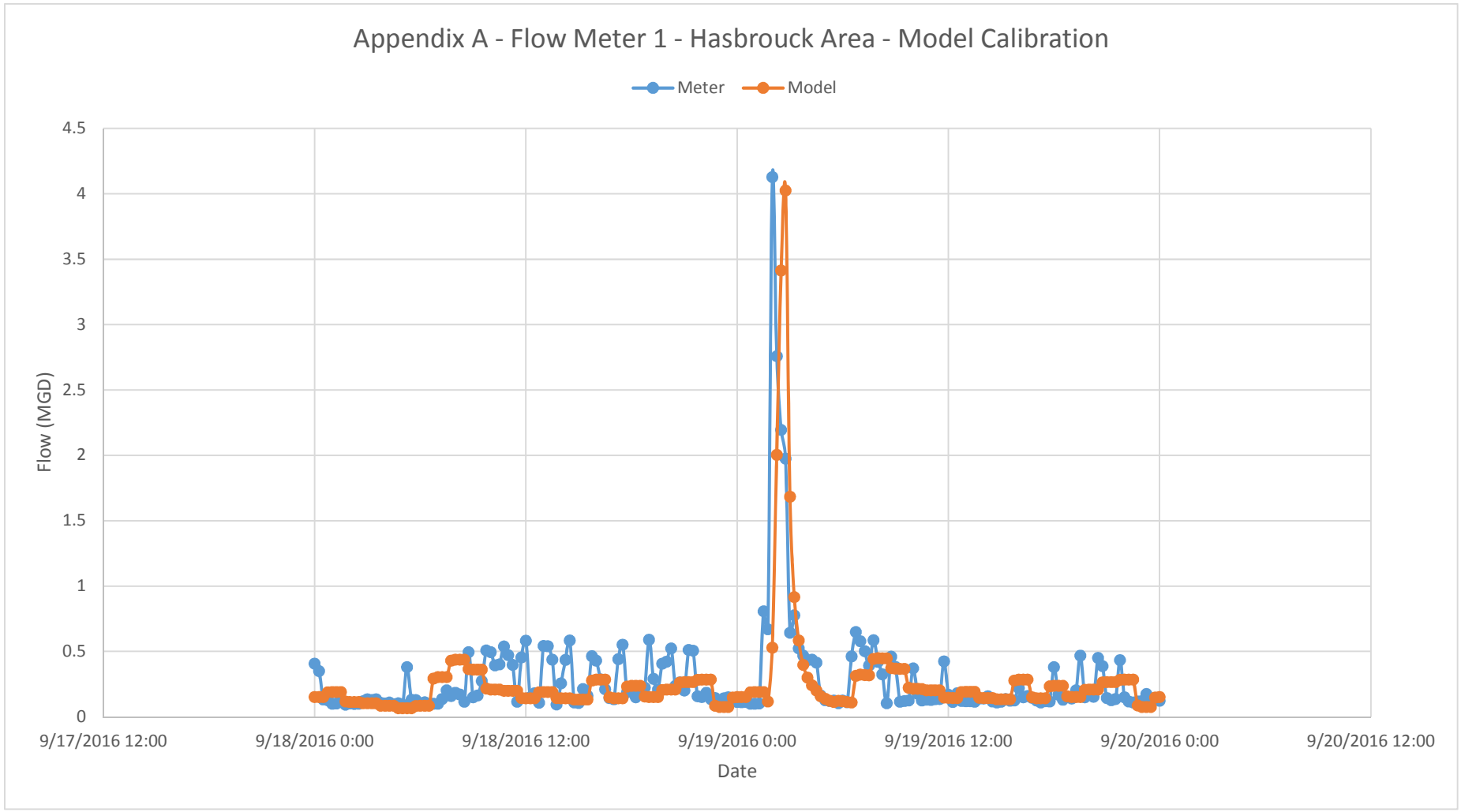
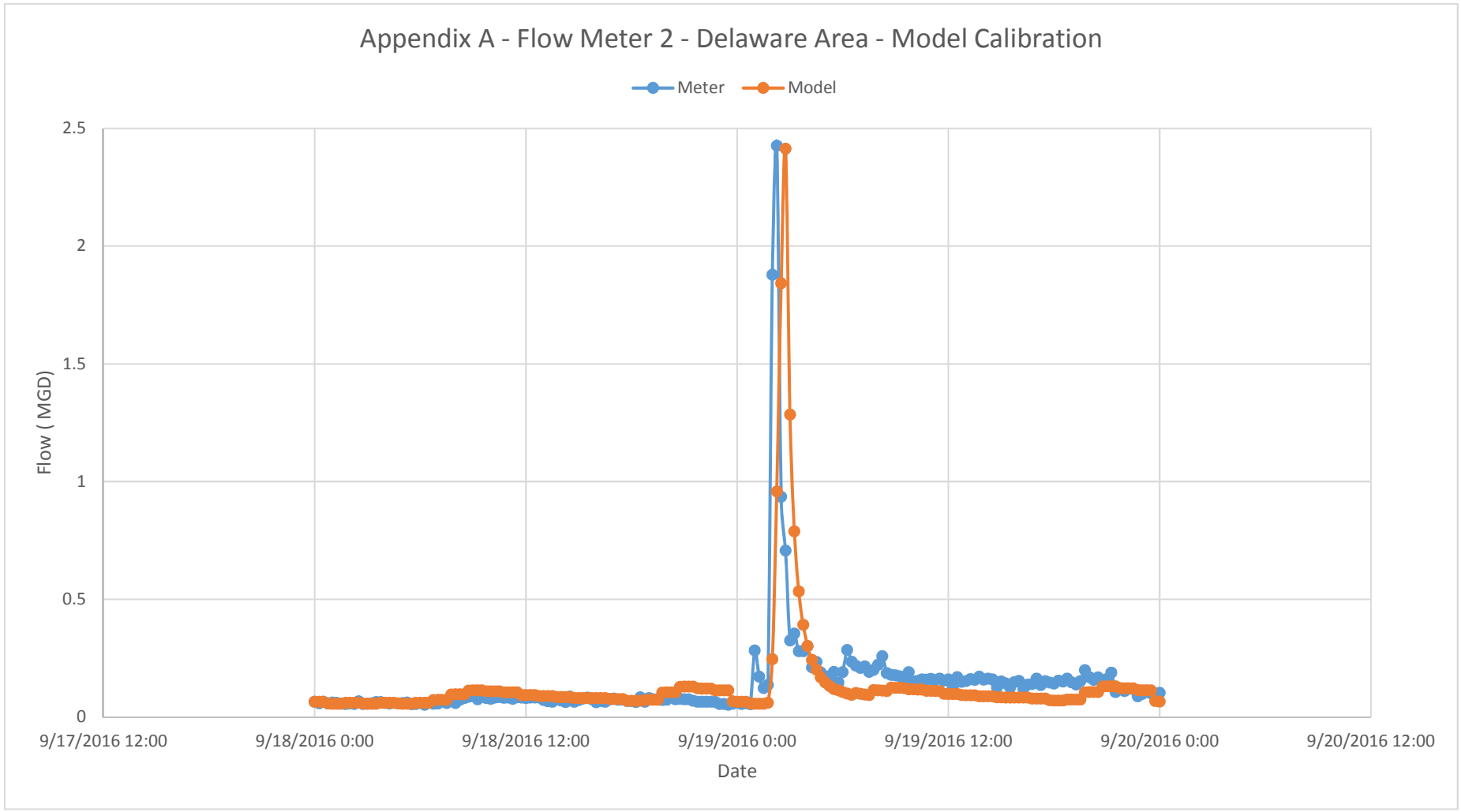
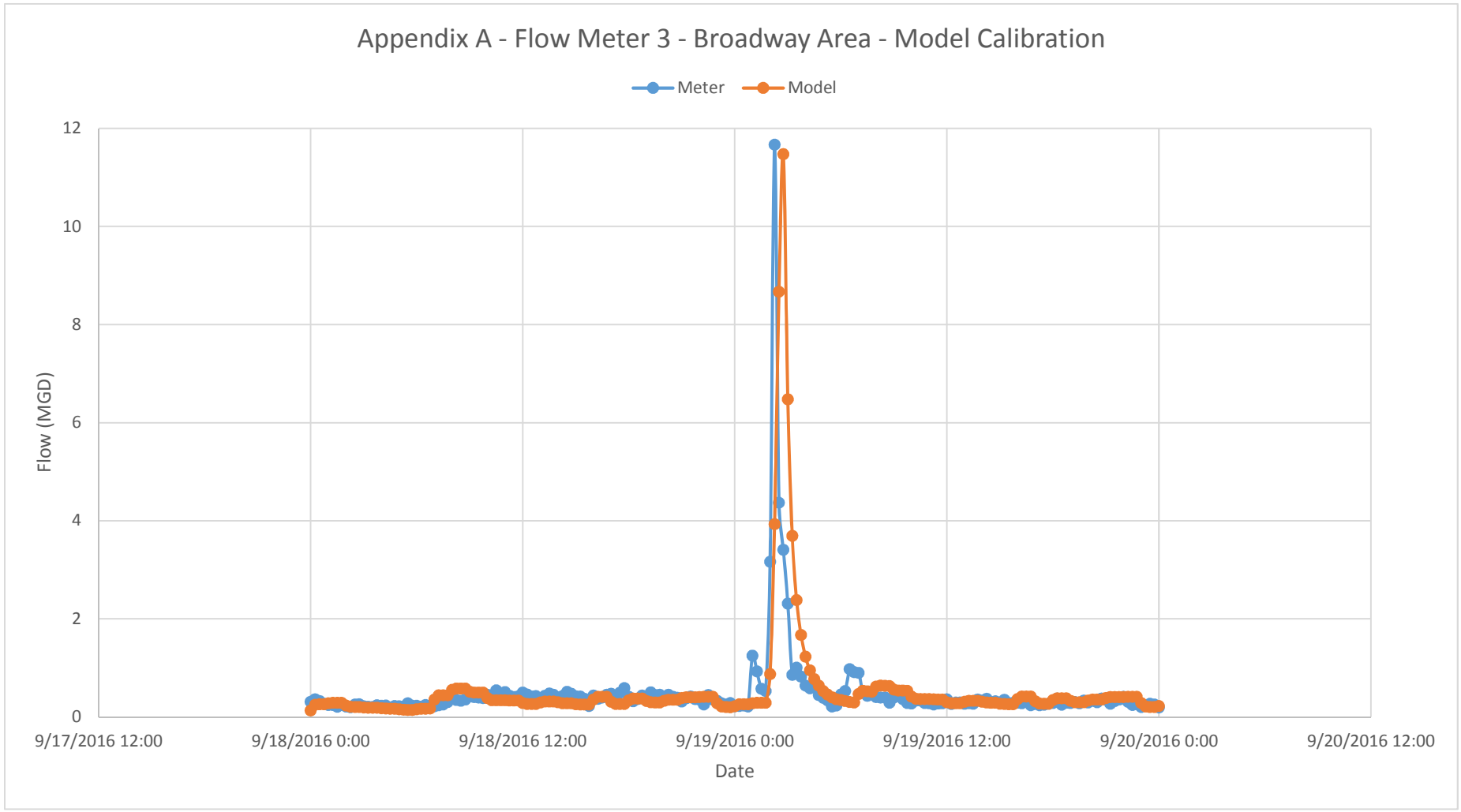
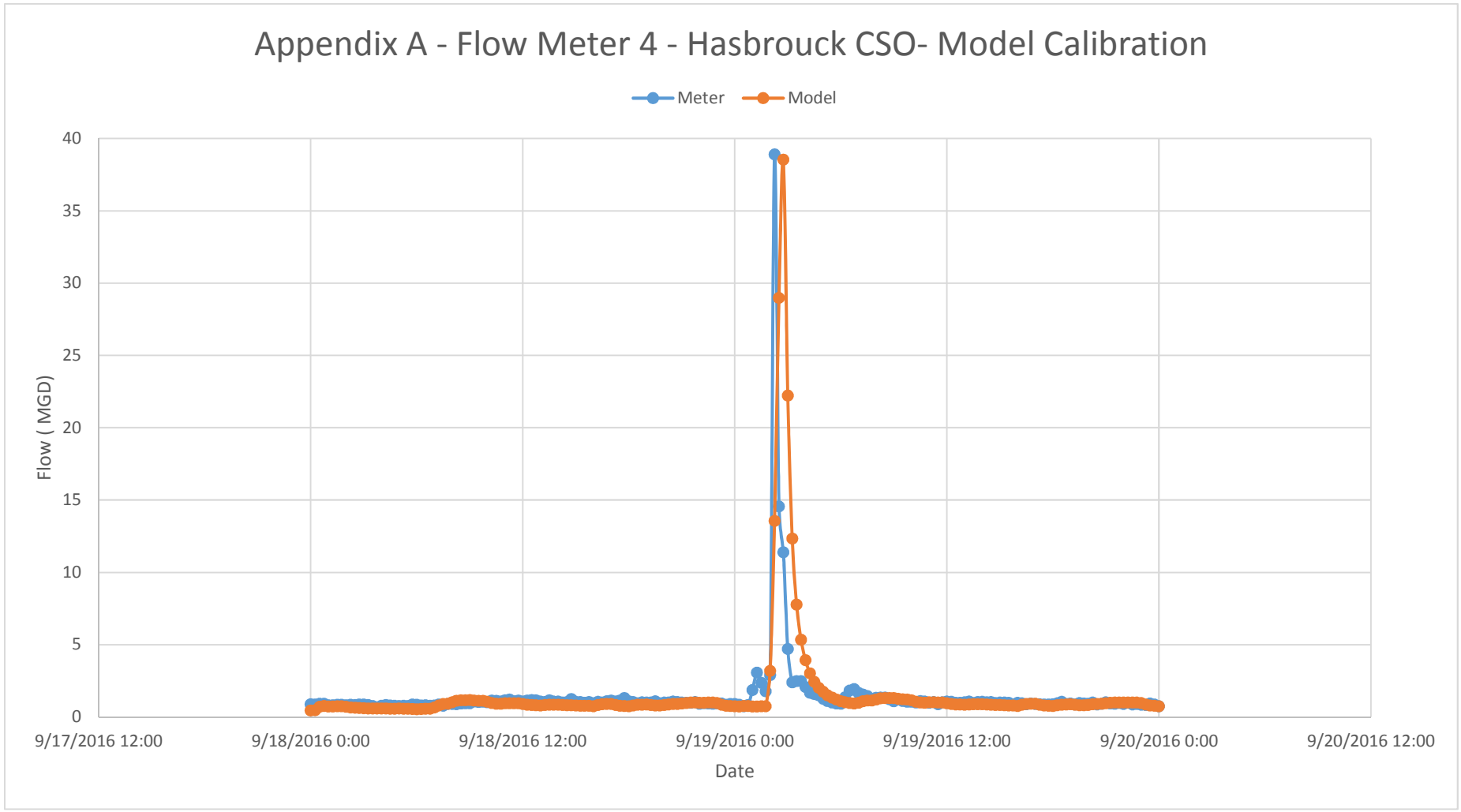
APPENDIX A

Appendix A
Model Calibration Results


Appendix A - Flow Meter 1 - Hasbrouck Area - Model Calibration
Meter
Model
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Flow (MGD)
9/17/2016 12:00
9/18/2016 0:00
9/18/2016 12:00
9/19/2016 0:00
9/19/2016 12:00
9/20/2016 0:00
9/20/2016 12:00
Date


Appendix A - Flow Meter 2 - Delaware Area - Model Calibration
Meter
Model
2.5
2
1.5
1
0.5
0
Flow (MGD)
9/17/2016 12:00
9/18/2016 0:00
9/18/2016 12:00
9/19/2016 0:00
9/19/2016 12:00
9/20/2016 0:00
9/20/2016 12:00
Date


Appendix A - Flow Meter 3 - Broadway Area - Model Calibration
Meter
Model
12
10
8
6
4
2
0
Flow (MGD)
9/17/2016 12:00
9/18/2016 0:00
9/18/2016 12:00
9/19/2016 0:00
9/19/2016 12:00
9/20/2016 0:00
9/20/2016 12:00
Date


Appendix A - Flow Meter 4 - Hasbrouck CSO- Model Calibration
Meter
Model
40
35
30
25
20
15
10
5
0
Flow (MGD)
9/17/2016 12:00
9/18/2016 0:00
9/18/2016 12:00
9/19/2016 0:00
9/19/2016 12:00
9/20/2016 0:00
9/20/2016 12:00
Date

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APPENDIX B

Appendix B
City of Kingston 2017 Adopted Budget
Sewer Fund

City of Kingston

2017 Adopted Budget

Steven T. Noble, Mayor

CITY OF KINGSTON
2017 ADOPTED BUDGET
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2017 ADOPTED BUDGET
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2017 ADOPTED BUDGET
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	Garage	A5132	113
	Landfill	A8163	124
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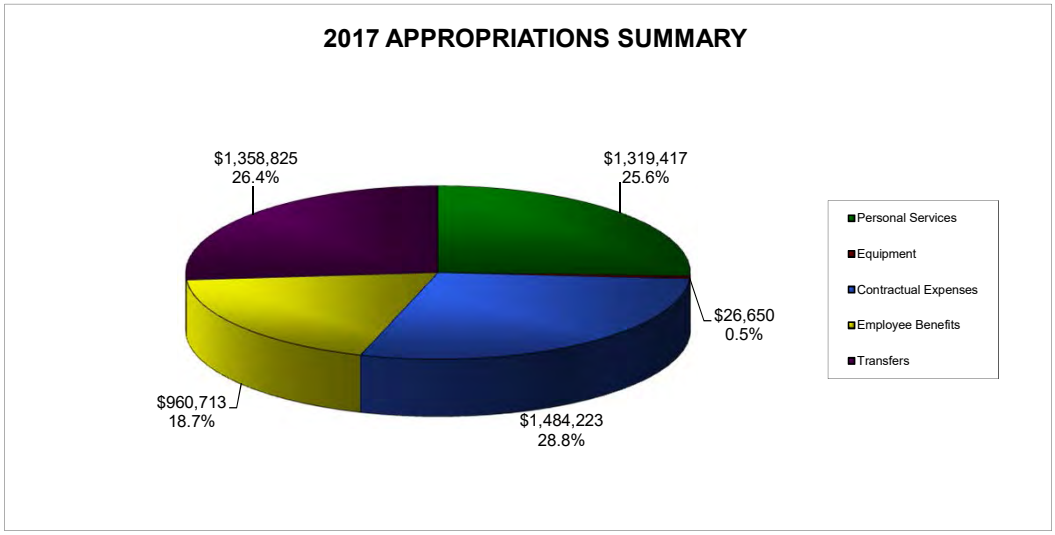
CITY OF KINGSTON
SEWER FUND
OVERALL BUDGET SUMMARY

	2015 Actual	2016 Budget As Modified	2017 Requested Budget	2017 Recommended Budget	2017 Adopted Budget
Appropriations:					
Personal Services	$1,289,838	$1,364,319	$1,363,399	$1,319,417	$1,319,417
Equipment	46,846	102,384	26,650	26,650	26,650
Contractual Expenses	2,037,992	1,771,460	1,645,223	1,484,223	1,484,223
Employee Benefits	1,180,813	849,256	927,846	960,713	960,713
Transfers	391,259	1,291,967	1,258,825	1,358,825	1,358,825
Total	$4,946,748	$5,379,386	$5,221,943	$5,149,828	$5,149,828
Revenues:					
Local Sources	$5,157,634	$5,025,923	$5,221,943	$5,149,828	$5,149,828
Appropriated Fund Balance	(210,886)	353,463			
Total	$4,946,748	$5,379,386	$5,221,943	$5,149,828	$5,149,828



CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
1380	**FISCAL AGENT FEES**						
CONTRACTED EXPENSES							
411	CONSULTANTS	12,094					
SUBTOTAL:	CONTRACTED EXPENSES	12,094	0	0	0	0	0
	TOTAL EXPENSE:FISCAL AGENT FEES	12,094	0	0	0	0	0

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
1930	**JUDGEMENT & CLAIMS**						
CONTRACTED EXPENSES							
401	GENERAL CONTRACT EXPENSE	0	10,000	10,000	10,000	10,000	10,000
SUBTOTAL:	CONTRACTED EXPENSES	0	10,000	10,000	10,000	10,000	10,000
	TOTAL EXPENSE:JUDGEMENT/CLAIMS	0	10,000	10,000	10,000	10,000	10,000

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
1990	**CONTINGENCY**						
CONTRACTED EXPENSES							
404	MISCELLANEOUS	0	79,000	79,000	50,000	125,000	125,000
SUBTOTAL:	CONTRACTED EXPENSES	0	79,000	79,000	50,000	125,000	125,000
	TOTAL EXPENSE:CONTINGENCY	0	79,000	79,000	50,000	125,000	125,000

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
1994	**DEPRECIATION**						
CONTRACTED EXPENSES							
490	DEPRECIATION	942,701					
SUBTOTAL:	CONTRACTED EXPENSES	942,701	0	0	0	0	0
	TOTAL EXPENSE:DEPRECIATION	942,701	0	0	0	0	0

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
8110	**ADMINISTRATION**						
PERSONAL SERVICES							
101	REGULAR PAY	189,023	199,987	199,987	187,938	194,604	194,604
102	LONGEVITY PAY	3,867	4,029	4,029	3,499	3,499	3,499
SUBTOTAL:	PERSONAL SERVICES	192,890	204,016	204,016	191,437	198,103	198,103
EMPLOYEE BENEFITS							
811	SOCIAL SECURITY	14,505	15,607	15,607	14,645	15,155	15,155
812	NYS RETIREMENT	(53,458)	37,743	37,743	36,373	37,640	37,640
821	HOSPITAL & MEDICAL	518,640			0	65,481	65,481
822	DENTAL INSURANCE				0	2,517	2,517
826	OPTICAL INSURANCE				0	676	676
SUBTOTAL:	EMPLOYEE BENEFITS	479,687	53,350	53,350	51,018	121,469	121,469
	TOTAL EXPENSE:ADMINISTRATION	672,577	257,366	257,366	242,455	319,572	319,572

CITY OF KINGSTON
PERSONNEL SUMMARY
2017 BUDGET

POSITION TITLE	# OF POSITIONS 2016/2017	BUDGET AS MODIFIED 2016	REQUESTED 2017	RECEOMMENDED 2017	ADOPTED 2017
G8110-Admin.					
Mayor	0.20/0.20	15,000	15,000	15,000	15,000
Comptroller	0.25/0.25	24,181	24,181	24,181	24,181
Superintendent	0.30/0.30	25,643	25,643	25,643	25,643
Dep. Superintendent	0.00/0.20		14,000	14,000	14,000
Asst. Superintendent	0.20/0.00	11,720	0	0	0
Civil Engineer	0.20/0.20	20,554	20,554	20,554	20,554
Engineering Tech.	0.25/0.25	13,472	13,472	13,472	13,472
Prin. Account Clerk	0.20/0.20	9,776	9,776	9,776	9,776
Admin. Asst.	0.20/0.20	8,254	8,667	8,667	8,667
Oper.& Finance Adm.	0.20/0.20	10,778	10,778	10,778	10,778
Sr. Account Clerk	0.35/0.35	15,355	15,355	15,355	15,355
Payroll Clerk	0.25/0.25	10,968	10,968	10,968	10,968
Account Clerk	0.20/0.00	8,260	0	0	0
Dispatcher	0.20/0.20	8,774	8,774	8,774	8,774
Director of IT	0.10/0.10	6,117	6,117	7,500	7,500
Network Sup. Tech.	0.00/0.10		0	5,283	5,283
Purchasing Asst.	0.10/0.10	4,653	4,653	4,653	4,653
Clerk	0.20/0.00	6,482	0	0	0
Total-G8110	3.40/2.90	199,987	187,938	194,604	194,604

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT	DEPARTMENT NAME	ACTUAL	BUDGET	REVISED BUDGET	REQUESTED	RECOMMENDED	ADOPTED
ACCT#	ACCT NAME	2015	2016	2016	2017	2017	2017
EXPENSES:							
8120	**SANITARY SEWERS**						
PERSONAL SERVICES							
101	REGULAR PAY	419,694	437,138	437,138	439,263	439,263	439,263
102	LONGEVITY PAY	12,600	12,800	12,800	14,550	14,150	14,150
103	OVERTIME PAY	31,501	44,000	44,000	44,000	35,000	35,000
105	RETIREMENT ACCUMULATION				7,500	0	0
109	TEMPORARY STATUS CHANGE	0	1,000	1,000	1,000	1,000	1,000
118	STANDBY PAY	7,710	7,800	7,800	7,800	7,800	7,800
SUBTOTAL:	PERSONAL SERVICES	471,505	502,738	502,738	514,113	497,213	497,213
CONTRACTED EXPENSES							
422	ELECTRICITY	12,229	16,500	16,500	15,000	15,000	15,000
426	VEHICLE FUEL	25,965	37,000	37,000	37,000	30,000	30,000
441	MAINTENANCE OF EQUIPMENT	645	1,500	1,500	1,500	1,500	1,500
443	MAINTENANCE OF BUILDING	2,232	8,000	8,000	8,000	7,000	7,000
444	VEHICLE MAINTENANCE	36,268	35,900	35,900	35,900	35,900	35,900
472	CONTRACTED SERVICES	31,504	25,000	25,000	25,000	25,000	25,000
474	FIXED MECHANICAL EQUIPMENT	111	1,000	1,000	1,000	1,000	1,000
480	SAFETY GEAR	1,628	5,000	5,000	5,000	5,000	5,000
484	CHEMICAL MATERIALS & SUPPLIES	2,766	17,500	17,500	17,500	12,500	12,500
486	CLEANING & SANITATION SUPPLIES	35	2,000	2,000	2,000	2,000	2,000
487	CONST. MATERIALS & SUPPLIES	40,488	83,000	94,935	83,000	75,000	75,000
498	SLUDGE DISPOSAL	8,155	20,000	20,000	20,000	18,000	18,000
SUBTOTAL:	CONTRACTED EXPENSES	162,026	252,400	264,335	250,900	227,900	227,900
EMPLOYEE BENEFITS							
811	SOCIAL SECURITY	35,584	38,505	38,505	39,345	38,083	38,083
812	NYS RETIREMENT	81,218	93,007	93,007	96,180	94,470	94,470
821	HOSPITAL & MEDICAL	215,371	221,460	221,460	241,226	241,226	241,226
822	DENTAL INSURANCE	3,083	8,120	8,120	8,120	8,120	8,120
826	OPTICAL INSURANCE	1,149	2,337	2,337	2,337	2,337	2,337
834	UNIFORM ALLOWANCE	1,397	1,700	1,700	1,700	1,700	1,700
835	MEAL ALLOWANCE	222	600	600	600	600	600
SUBTOTAL:	EMPLOYEE BENEFITS	338,026	365,729	365,729	389,508	386,536	386,536
	TOTAL EXPENSE:SANITARY SEWERS	971,557	1,120,867	1,132,802	1,154,521	1,111,649	1,111,649
REVENUES:							
8120	**SANITARY SEWERS**						
1090	PENALTIES	24,617	30,000	30,000	30,000	30,000	30,000
2000	EMPLOYEES 10% MEDICAL INS.	10,136	11,000	11,000	10,000	10,000	10,000
2122	SEWER SERVICE CHARGES	4,508,648	4,550,623	4,550,623	4,786,818	4,677,953	4,677,953
2124	NEW SEWER HOOK UP	1,750	3,000	3,000	3,000	3,000	3,000
2680	INSURANCE RECOVERY	737					
2770	OTHER UNCLASSIFIED REVENUE	10					
	TOTAL REVENUE:SANITARY SEWERS	4,545,899	4,594,623	4,594,623	4,829,818	4,720,953	4,720,953

CITY OF KINGSTON
PERSONNEL SUMMARY
2017 BUDGET

POSITION TITLE	# OF POSITIONS 2016/2017	BUDGET AS MODIFIED 2016	REQUESTED 2017	RECEOMMENDED 2017	ADOPTED 2017
G8120-San. Sewer					
Sewer Foreman	1.00/1.00	47,818	48,880	48,880	48,880
HMEO	5.00/5.00	218,292	219,355	219,355	219,355
Maintenance Asst.	1.00/1.00	43,871	43,871	43,871	43,871
Laborer	2.00/2.00	80,630	80,630	80,630	80,630
Working Supervisor	1.00/1.00	46,527	46,527	46,527	46,527
Total-G8120	10.00/10.00	437,138	439,263	439,263	439,263

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT / ACCT#	DEPARTMENT NAME / ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
8121	**PUMPING STATION**						
PERSONAL SERVICES							
101	REGULAR PAY	83,854	81,144	81,144	83,831	83,831	83,831
102	LONGEVITY PAY	1,350	1,350	1,350	1,550	1,550	1,550
103	OVERTIME PAY	1,800	5,000	5,000	5,034	5,034	5,034
105	RETIREMENT ACCUMULATION	3,072					
109	TEMPORARY STATUS CHANGE	0	50	50	50	50	50
SUBTOTAL:	PERSONAL SERVICES	90,076	87,544	87,544	90,465	90,465	90,465
EQUIPMENT							
211	OTHER EQUIPMENT	0	0	9,900	5,000	5,000	5,000
SUBTOTAL:	EQUIPMENT	0	0	9,900	5,000	5,000	5,000
CONTRACTED EXPENSES							
421	TELEPHONE				660	660	660
422	ELECTRICITY	39,093	45,000	45,000	45,880	45,880	45,880
423	NATURAL GAS	907	750	750	750	750	750
424	FUEL OIL	0	500	500	500	500	500
426	VEHICLE FUEL	1,162	5,000	5,000	5,000	4,000	4,000
443	MAINTENANCE OF BUILDING	670	2,185	2,185	3,500	3,500	3,500
444	VEHICLE MAINTENANCE	940	3,000	3,000	2,500	2,500	2,500
471	SERVICE CONTRACTS	10,480	10,180	11,755	10,200	10,200	10,200
472	CONTRACTED SERVICES	0	2,500	2,500	2,500	2,500	2,500
474	FIXED MECHANICAL EQUIPMENT	12,759	13,000	21,986	13,000	13,000	13,000
483	ELECTRICAL MATERIALS & SUPPL.	788	5,800	5,800	5,800	5,800	5,800
484	CHEMICAL MATERIALS & SUPPLIES	18,595	20,023	20,023	20,000	20,000	20,000
487	CONST. MATERIALS & SUPPLIES	870	925	925	950	950	950
498	SLUDGE DISPOSAL	0	20,000	20,000	20,000	15,000	15,000
SUBTOTAL:	CONTRACTED EXPENSES	86,263	128,863	139,424	131,240	125,240	125,240
EMPLOYEE BENEFITS							
811	SOCIAL SECURITY	6,774	6,720	6,720	6,921	6,944	6,944
812	NYS RETIREMENT	11,614	16,196	16,196	17,188	17,188	17,188
821	HOSPITAL & MEDICAL	26,920	31,393	31,393	36,026	36,026	36,026
822	DENTAL INSURANCE	1,746	1,624	1,624	1,624	1,624	1,624
826	OPTICAL INSURANCE	590	361	361	361	361	361
834	UNIFORM ALLOWANCE	430	768	768	0	768	768
835	MEAL ALLOWANCE	0	50	50	0	50	50
836	TOOL ALLOWANCE	250	250	250	0	250	250
SUBTOTAL:	EMPLOYEE BENEFITS	48,324	57,362	57,362	62,120	63,211	63,211
	TOTAL EXPENSE:PUMPING STATION	224,663	273,769	294,230	288,825	283,916	283,916

REVENUES:							
8121	**PUMPING STATION**						
2680	INSURANCE RECOVERY	13,761					
	TOTAL REVENUE:PUMPING STATION	13,761	0	0	0	0	0

CITY OF KINGSTON
PERSONNEL SUMMARY
2017 BUDGET

POSITION TITLE	# OF POSITIONS 2016/2017	BUDGET AS MODIFIED 2016	REQUESTED 2017	RECEOMMENDED 2017	ADOPTED 2017
G8121-Pump Sta.					
Mechanic	1.00/0.00	40,829	0	0	0
Laborer	1.00/1.00	40,315	40,315	40,315	40,315
Operator	0.00/1.00		43,516	43,516	43,516
Total-G8121	2.00/2.00	81,144	83,831	83,831	83,831

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
8122	**INDUSTRIAL PRETREAT. PROG.**						
CONTRACTED EXPENSES							
403	BOOKS,LITERATURE,PERIODICALS	0	250	250	250	250	250
462	DUES, SEMINARS, ASSOC. FEES	0	100	100	100	100	100
464	ADVERTISING	0	100	100	100	100	100
472	CONTRACTED SERVICES	0	1,000	1,000	1,000	1,000	1,000
SUBTOTAL:	CONTRACTED EXPENSES	0	1,450	1,450	1,450	1,450	1,450
	TOTAL EXPENSE:INDUSTRIAL PRETREAT.	0	1,450	1,450	1,450	1,450	1,450

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT / ACCT#	DEPARTMENT NAME / ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
8130	**WASTE WATER TREATMENT**						
PERSONAL SERVICES							
101	REGULAR PAY	432,006	443,752	443,752	437,510	403,762	403,762
102	LONGEVITY PAY	14,000	14,000	14,000	11,350	11,350	11,350
103	OVERTIME PAY	80,652	108,074	108,074	107,217	107,217	107,217
108	COMP TIME PAYOUT	3,074					
109	TEMPORARY STATUS CHANGE	3,139	1,585	1,585	1,065	1,065	1,065
110	SHIFT DIFFERENTIAL	2,496	2,610	2,610	2,442	2,442	2,442
118	STANDBY PAY				7,800	7,800	7,800
SUBTOTAL:	PERSONAL SERVICES	535,367	570,021	570,021	567,384	533,636	533,636
EQUIPMENT							
203	MOTOR VEHICLES	0	0	27,651			
211	OTHER EQUIPMENT	46,846	30,810	64,833	21,650	21,650	21,650
SUBTOTAL:	EQUIPMENT	46,846	30,810	92,484	21,650	21,650	21,650
CONTRACTED EXPENSES							
401	GENERAL CONTRACT EXPENSE	30,864	47,408	47,408	48,000	48,000	48,000
402	OFFICE SUPPLIES	1,454	1,215	1,215	1,515	1,515	1,515
403	BOOKS,LITERATURE,PERIODICALS	216	210	210	210	210	210
411	CONSULTANTS	11,878	0	250,514	2,500	2,500	2,500
421	TELEPHONE	2,082	1,530	1,530	1,320	1,320	1,320
422	ELECTRICITY	182,437	215,000	215,000	215,000	175,000	175,000
423	NATURAL GAS	16,242	30,000	30,000	30,000	25,000	25,000
424	FUEL OIL	786	4,855	4,855	4,855	4,855	4,855
426	VEHICLE FUEL	4,261	5,000	5,000	3,380	3,380	3,380
430	MULTI-PERIL INSURANCE	75,000	100,000	100,000	100,000	140,000	140,000
443	MAINTENANCE OF BUILDING	2,703	5,100	5,100	5,000	5,000	5,000
444	VEHICLE MAINTENANCE	7,747	4,800	4,800	3,000	7,000	7,000
462	DUES, SEMINARS, ASSOC. FEES	459	2,500	2,500	2,500	2,500	2,500
463	POSTAGE, FREIGHT & EXPRESS	190	100	100	100	100	100
464	ADVERTISING	162	75	75	100	100	100
470	ASLAN CONTRACT	146,318	304,644	304,644	313,779	313,779	313,779
471	SERVICE CONTRACTS	4,440	7,500	7,500	7,537	7,537	7,537
472	CONTRACTED SERVICES	76,677	77,184	77,184	79,499	79,499	79,499
474	FIXED MECHANICAL EQUIPMENT	62,902	75,000	83,879	45,000	45,000	45,000
479	MINOR EQUIPMENT	2,026	2,346	2,346	1,896	1,896	1,896
481	LAB MATERIALS & SUPPLIES	4,767	3,353	3,353	4,043	4,043	4,043
482	MECHANICAL MATERIALS & SUPPL.	2,755	5,000	5,000	4,500	4,500	4,500
483	ELECTRICAL MATERIALS & SUPPL.	15,742	29,450	29,450	26,700	26,700	26,700
484	CHEMICAL MATERIALS & SUPPLIES	50,483	60,229	60,229	60,791	60,791	60,791
485	GENERAL MATERIALS & SUPPLIES	817	1,940	1,940	1,890	1,890	1,890
486	CLEANING & SANITATION SUPPLIES	6,313	5,838	5,838	6,088	6,088	6,088
487	PLANT MAINTENANCE SUPPLIES	5,264	6,180	6,180	6,430	6,430	6,430
498	SLUDGE DISPOSAL	119,923	21,401	21,401	226,000	20,000	20,000
SUBTOTAL:	CONTRACTED EXPENSES	834,909	1,017,858	1,277,251	1,201,633	994,633	994,633
EMPLOYEE BENEFITS							
811	SOCIAL SECURITY	40,432	43,631	43,631	43,430	40,848	40,848
812	NYS RETIREMENT	94,897	105,454	105,454	107,803	101,391	101,391
821	HOSPITAL & MEDICAL	168,046	209,241	209,241	195,868	170,218	170,218
822	DENTAL INSURANCE	4,665	8,120	8,120	8,120	7,308	7,308
826	OPTICAL INSURANCE	1,564	2,204	2,204	1,938	1,691	1,691
834	UNIFORM ALLOWANCE	4,921	3,840	3,840	3,840	3,840	3,840
835	MEAL ALLOWANCE	1	75	75	75	75	75
836	TOOL ALLOWANCE	250	250	250	250	250	250
SUBTOTAL:	EMPLOYEE BENEFITS	314,776	372,815	372,815	361,324	325,621	325,621
	TOTAL EXPENSE:WASTE WTR .TREATMENT	1,731,897	1,991,504	2,312,571	2,151,991	1,875,540	1,875,540

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
REVENUES:							
8130	**WASTE WATER TREATMENT**						
2000	EMPLOYEES 10% MEDICAL INS.	8,935	11,000	11,000	10,000	10,000	10,000
2123	OTHER INCOME - LEACHATE	155,750	185,000	185,000	175,000	211,750	211,750
2374	PORT EWEN COST PORTION	210,181	235,000	235,000	205,000	205,000	205,000
2401	INTEREST & EARNINGS	167	300	300	300	300	300
2680	INSURANCE RECOVERY	543	0	0	0	0	0
3389	NYS GRANT	12,152					
4589	FEDERAL ASSISTANCE	12,627					
	TOTAL REVENUE:WASTE WTR.TREATMENT	400,354	431,300	431,300	390,300	427,050	427,050

CITY OF KINGSTON
PERSONNEL SUMMARY
2017 BUDGET

POSITION TITLE	# OF POSITIONS 2016/2017	BUDGET AS MODIFIED 2016	REQUESTED 2017	RECEOMMENDED 2017	ADOPTED 2017
G8130-Treat.Plant					
Sr. Operator	1.00/1.00	58,598	58,598	58,598	58,598
Mechanic	1.00/1.00	46,060	46,060	46,060	46,060
Administrative Aide	1.00/1.00	43,871	43,871	43,871	43,871
Laborer	4.00/3.00	161,260	154,693	120,945	120,945
Operator	1.00/2.00	48,880	90,417	90,417	90,417
Operator Trainee	1.00/0.00	41,212	0	0	0
HMEO	1.00/1.00	43,871	43,871	43,871	43,871
Total-G8130	10.00/9.00	443,752	437,510	403,762	403,762

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
9060	**HOSPITAL - MEDICAL**						
EMPLOYEE BENEFITS							
821	HOSPITAL & MEDICAL				63,876	63,876	63,876
SUBTOTAL:	EMPLOYEE BENEFITS	0	0	0	63,876	63,876	63,876
	TOTAL EXPENSE:HOSPITAL-MEDICAL	0	0	0	63,876	63,876	63,876
REVENUES:							
9060	**HOSPITAL - MEDICAL**						
2000	RETIREES SHARE MEDICAL INS.				1,825	1,825	1,825
	TOTAL REVENUE:HOSPITAL-MEDICAL	0	0	0	1,825	1,825	1,825

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
REVENUES:							
9710	**TRANSFERS**						
5031	INTERFUND TRANSFERS	189,076					
	TOTAL REVENUE:TRANSFERS	189,076	0	0	0	0	0

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
9785	**INSTALLMENT PURCHASE DEBT**						
TRANSFERS							
906	PRINCIPAL	0	208,914	208,914	216,246	216,246	216,246
907	INTEREST	62,064	54,983	54,983	47,652	47,652	47,652
SUBTOTAL:	TRANSFERS	62,064	263,897	263,897	263,898	263,898	263,898
	TOTAL EXPENSE:INSTALL.PURCH.DEBT	62,064	263,897	263,897	263,898	263,898	263,898

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
9901	**TRANSFER TO DEBT SERVICE**						
TRANSFERS							
900	TRANSFER TO DEBT SERVICE	208,531	930,496	930,496	897,353	897,353	897,353
901	TRANSFERS	(4,939)					
SUBTOTAL:	TRANSFERS	203,592	930,496	930,496	897,353	897,353	897,353
	TOTAL EXPENSE:TRANS.TO DEBT SERV.	203,592	930,496	930,496	897,353	897,353	897,353

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
9905	**TRANSFER TO CAPITAL**						
TRANSFERS							
900	TRANSFERS	118,413					
SUBTOTAL:	TRANSFERS	118,413	0	0	0	0	0
	TOTAL EXPENSE:TRANS.TO CAPITAL	118,413	0	0	0	0	0

CITY OF KINGSTON
SEWER FUND BUDGET
2017

ADM UNIT ACCT#	DEPARTMENT NAME ACCT NAME	ACTUAL 2015	BUDGET 2016	REVISED BUDGET 2016	REQUESTED 2017	RECOMMENDED 2017	ADOPTED 2017
EXPENSES:							
9950	**TRANSFERS - BANS**						
TRANSFERS							
906	BOND ANTICIPATION NOTES PRIN.	(1,250)	79,979	79,979	79,979	179,979	179,979
907	BOND ANTICIPATION NOTES INT.	8,440	17,595	17,595	17,595	17,595	17,595
SUBTOTAL:	TRANSFERS	7,190	97,574	97,574	97,574	197,574	197,574
	TOTAL EXPENSE:TRANSFERS-BANS	7,190	97,574	97,574	97,574	197,574	197,574
REVENUES:							
9950	**TRANSFERS - BANS**						
2711	PREMIUM ON OBLIGATION	8,545					
	TOTAL REVENUE:TRANSFERS-BANS	8,545	0	0	0	0	0

CITY OF KINGSTON
PERSONNEL DETAIL
2017 BUDGET

EMPLOYEE NAME	TITLE	HOME DEPT	STEP	REG. PAY .101	LONGEVITY .102	OTHER PAY .1XX	FICA .811	RETIREMENT .812	MEDICAL .821	DENTAL .822	OPTICAL .826	TOTAL
Adin, A.	Engineering Tech.*	8110	6	13,472	525		1,071	2,659	6,413	203	62	24,404
Alsdorf, R.	Laborer	8130	6	40,315	1,550		3,203	7,954	11,309	812	114	65,257
Bockelmann, M.	Payroll Clerk*	8110	6	10,968	387		869	2,157	6,413	203	62	21,058
Boyle, E.	Dep. Superintendent*	8110		14,000	310		1,095	2,719	600	162	49	18,935
Chenier, J.	Superintendent*	8110		25,643			1,962	4,872	7,695	244	74	40,490
Couillard, B.	Laborer	8130	6	40,315	1,550		3,203	7,954	24,717	812	247	78,798
Crowley, D.	Mechanic	8130	6	46,060	2,100		3,684	9,150	25,650	812	247	87,704
DeCicco, W.	Sr. Account Clerk*	8110	6	10,968	337		865	2,148	6,179	203	62	20,762
Fabiano, L.	Working Supervisor	8120	6	46,527	1,700		3,689	9,163	25,650	812	247	87,788
Glass, P.	Dispatcher*	8110	6	8,774	420		703	1,747	5,130	162	49	16,986
Huppert, C.	Administrative Aide	8130	6	43,871	1,350		3,459	8,592	25,650	812	247	83,981
Knox, C.	Prin. Account Clerk*	8110	6	9,776	310		772	1,916	2,104	162	23	15,063
Markle, D.	HMEO	8120	6	43,871	900		3,425	8,506	24,717	812	247	82,478
McDonough, R.	Laborer	8121	6	40,315	1,550		3,203	7,954	24,717	812	247	78,798
McIntosh, K.	Director of IT*	8110		7,500	90		581	1,442	2,565	81	25	12,284
Mernin, J.	Operator	8130	1	41,537			3,178	7,892	10,518	812	114	64,051
Noble, S	Mayor*	8110		15,000			1,148	2,850	600	162		19,760
Oxendine, A.	HMEO	8120	6	43,871	1,350		3,459	8,592	11,309	812	114	69,507
Quesnell, D.	Sr. Account Clerk*	8110	6	4,387	90		342	851	2,565	81	25	8,341
Rice, J.	Operator	8121	2	43,516			3,329	8,268	11,309	812	114	67,348
Salvino, S.	HMEO	8120	6	43,871	1,100		3,440	8,544	25,650	812	247	83,665
Scheffel, R.	HMEO	8130	6	43,871			3,356	8,335	24,717	812	247	81,339
Steele, M.	HMEO	8120	6	43,871	1,550		3,475	8,630	25,650	812	247	84,235
Swenson, R.	Civil Engineer*	8110		20,554	180		1,586	3,939	5,130	162	49	31,601
Tacti, E.	Network Sup. Tech.*	8110	5	5,283			404	1,004	2,472	81	25	9,268
Terpening, R.	Operator	8130	6	48,880	1,700		3,869	9,610	11,309	812	114	76,295
Thomas, R.	Laborer	8130	6	40,315	1,550		3,203	7,954	25,039	812	247	79,120
Topple, M.	Admin. Assistant*	8110	3	8,667			663	1,647	4,943	162	49	16,132
Tuey, J.	Comptroller*	8110		24,181	275		1,871	4,647	6,413	203	62	37,651
Turck, J.	Maintenance Asst.	8120	6	43,871	2,100		3,517	8,734	25,650	812	247	84,931
Washington, L.	Laborer	8120	6	40,315	1,700		3,214	7,983	25,650	812	247	79,921
Wiley, E.	HMEO	8120	6	43,871	1,100		3,440	8,544	25,650	812	247	83,665
Williams, J.	Sewer Foreman	8120	6	48,880	1,100		3,823	9,496	25,650	812	247	90,009
Williams, M. D.	Laborer	8120	6	40,315	1,550		3,203	7,954	25,650	812	247	79,731
Wiltshire, M.	Oper.& Finance Adm.*	8110	6	10,778	420		857	2,128	5,130	162	49	19,524
Winchell, A.	Senior Operator	8130	6	58,598	1,550		4,601	11,428	11,309	812	114	88,412
Woltman, B.	Purchasing Asst.*	8110	6	4,653	155		368	914	1,131	81	11	7,313
.103	Overtime					147,251	11,265	27,978				186,493
.105	Retirement Accum.					0	0					0
.108	Comp Time Payout						0	0				0
.109	Temp. Status Change					2,115	162	402				2,679
.110	Shift Differential					2,442	187	464				3,093
.118	Standby Pay					15,600	1,193	2,964				19,757
.835	Meal Allowance					725	55					780
.836	Tool Allowance					500	38					538
Total-Sewer				1,121,460	30,549	168,633	101,029	250,689	512,951	19,569	5,065	2,209,946

*Part General/Sewer Fund

Tighe&Bond

APPENDIX C

Appendix C
Opinion of Probable Costs

Appendix C
Sewer Separation
Opinion of Probable Cost

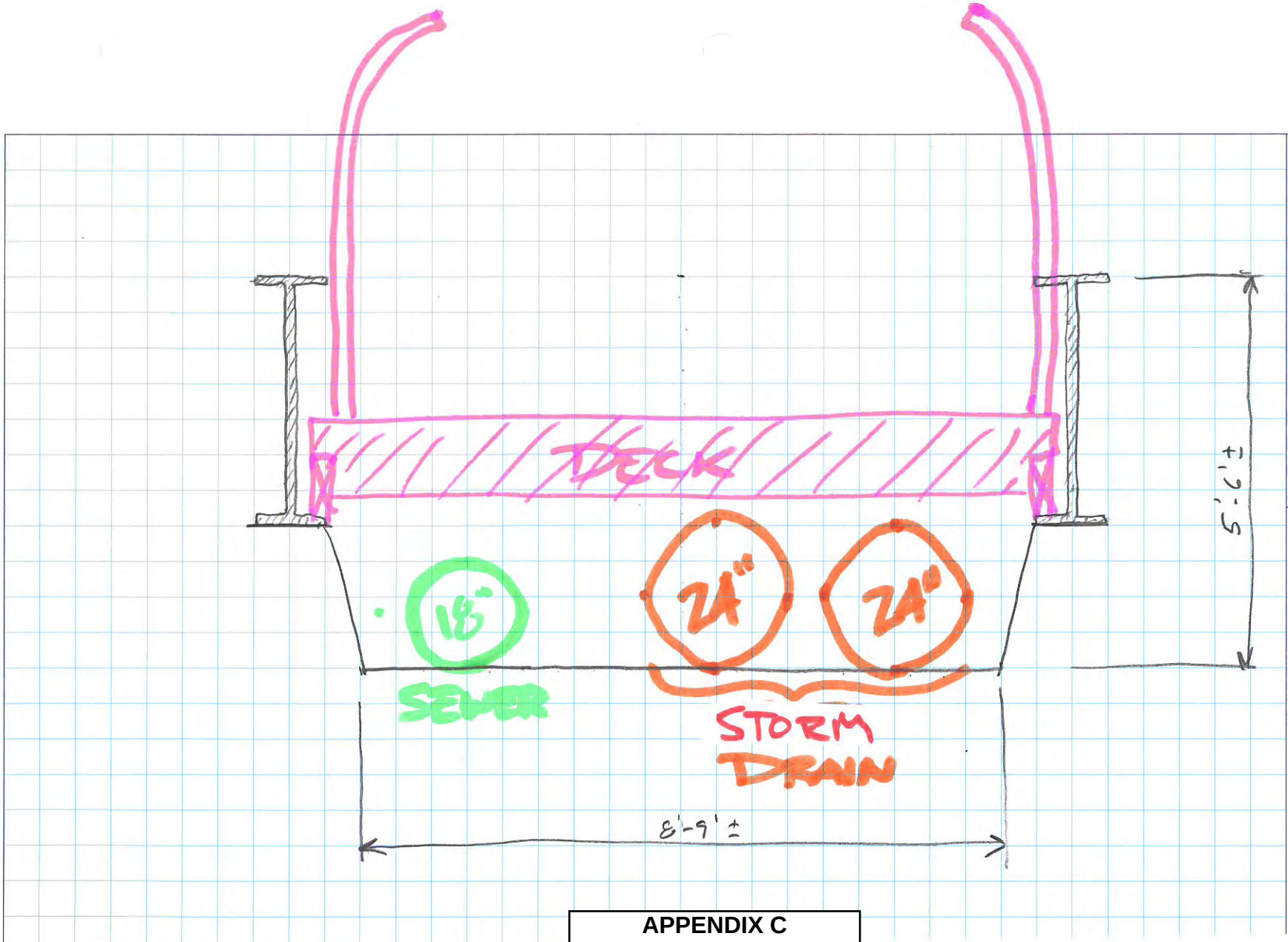
Separation Costs for Phase: **A**
Total Separation Unit Price per Drainage Area Descriptions: $315
Total Length Separated (lf): 1,825

Location	Sewershed	Combined Sewer Separation Quanity 8-inch	12-inch	18-inch	Quantity	Unit	Unit Cost	Subtotal	Comment
Connections from Existing Separated Sewer to new 36" SD									
Henratty Street - 12" SD					150	LF	$315	$ 47,250	
9W - Garraghan Drive - 18" SD					125	LF	$315	$ 39,375	
Proposed Trunklines									
Trunkline - 36" SD to CSO					1,550	LF	$330	$ 511,500	
							Subtotal	**$598,125**	
							General Conditions (15%)	**$ -**	included in unit price
							Construction Cost	**$598,125**	
							Contingency (20%)	**$119,625**	
							Engineering (20%)	**$119,625**	
							Total Project Cost (Rounded to nearest $1,000)	**$837,000**	

Appendix C
Sewer Separation
Opinion of Probable Cost

Separation Costs for Phase: **B**
Total Separation Unit Price per Drainage Area Descriptions: $315 (varies for other work)
Total Length Separated (lf): 6,900

Location	Sewershed	Combined Sewer Separation Quanity 8-inch	12-inch	18-inch	Quanity	Unit	Unit Cost	Subtotal	Comment
Sewer Separation									
Murray Street	9A	200			200	LF	$315	$ 63,000	Up size existing sewer
Connections from Existing Separated Sewer to Existing SD trunkline along 9W									
Stuyvesant Street - 12" SD					400	LF	$300	$ 120,000	
Proposed Trunklines									
30" SD - RR bridge to Murray Street to new 30" SD at Rondout Drive					1,200	LF	$310	$ 372,000	
18" SS - RR bridge to Murray Street to existing 42" SD at Dubois Ave					900	LF	$300	$ 270,000	
Rail Road Bridge									
18" DI SS					280	LF	$460	$ 128,800	
2-24" DI SD					560	LF	$500	$ 280,000	
Glulam Timber Deck					2800	SF	$70	$ 196,000	
Chainlink Fence - Steel w top rail, 72"					560	LF	$40	$ 22,400	
							Subtotal	**$1,452,200**	
							General Conditions (15%)	**$ -**	included in unit price
							Construction Cost	**$1,452,200**	
							Contingency (20%)	**$290,440**	
							Engineering (20%)	**$290,440**	
							Total Project Cost (Rounded to nearest $1,000)	**$2,033,000**	



Tighe&Bond
Consulting Engineers
Environmental Specialists

JOB NO. _____ SHEET _____
CLIENT _____
SUBJECT _____
PREPARED BY _____ DATE _____ CHECKED BY _____

APPENDIX C
PHASE B
RAIL ROAD CROSSING

Appendix C
Sewer Separation
Opinion of Probable Cost

Separation Costs for Phase: **C**
Total Separation Unit Price per Drainage Area Descriptions: $305
Total Length Separated (lf): 18,050

Location	Sewershed	Combined Sewer Separation Quanity 8-inch	12-inch	18-inch	Quanity	Unit	Unit Cost	Subtotal	Comment
Sewer Separation									
East Chester	9B			600	600	LF	$305	$ 183,000	24"
West Chester	9B			1,350	1,350	LF	$305	$ 411,750	
Hasbrouck Place	9B	300	300		600	LF	$305	$ 183,000	
Hasbrouck Street	9B	900			900	LF	$305	$ 274,500	
Foxhall Ave	9B	300			300	LF	$305	$ 91,500	
Janisen Ave	9B			700	700	LF	$305	$ 213,500	2 pipes, 15" to 18" and 30"
Janisen Ave x-country	9B			700	700	LF	$305	$ 213,500	30"
Broadway, to staples	9B		750		750	LF	$305	$ 228,750	15"
Broadway, staples to Delaware	9B			750	750	LF	$305	$ 228,750	2 pipes, 24" brick and 24"
Broadway, Delware to Chestnut	9B			600	600	LF	$305	$ 183,000	
Delware Ave	9B			850	850	LF	$305	$ 259,250	24" to 30", partial 2 pipes
Orchard Street	9B			1,400	1,400	LF	$305	$ 427,000	1/2 15", 1/2 18"
Chestnut to Orchard	9B		250		250	LF	$305	$ 76,250	
Chestnut Street	9B	150	600		750	LF	$305	$ 228,750	
Melvin Dr	9B	200			200	LF	$305	$ 61,000	10"
Dietz Court	9B	450			450	LF	$305	$ 137,250	
Bond Street	9B	150			150	LF	$305	$ 45,750	
Staples Street	9B		350	600	950	LF	$305	$ 289,750	2 pipes, 20" and 24"
Levan Street	9B			650	650	LF	$305	$ 198,250	
Brewster Street	9B		1,050		1,050	LF	$305	$ 320,250	
Trenton Street	9B	300			300	LF	$305	$ 91,500	
Andrew Street	9B		450	1,300	1,750	LF	$305	$ 533,750	
Jervis Avenue	9B	450			450	LF	$305	$ 137,250	
Marys Avenue	9B	1,200			1,200	LF	$305	$ 366,000	
Webster Street	9B	400			400	LF	$305	$ 122,000	
							Subtotal	**$5,505,250**	
							General Conditions (15%)	**$ -**	included in unit price
							Construction Cost	**$5,505,250**	
							Police (2%)	**$110,105**	
							Contingency (20%)	**$1,101,050**	
							Engineering (20%)	**$1,101,050**	
							Total Project Cost (Rounded to nearest $1,000)	**$7,817,000**	

Appendix C
Sewer Separation
Opinion of Probable Cost

Separation Costs for Phase: **D**
Total Separation Unit Price per Drainage Area Descriptions: $305
Total Length Separated (lf): 20,900

Location	Sewershed	Combined Sewer Separation Quanity 8-inch	12-inch	18-inch	Total Length	Unit	Unit Cost	Subtotal	Comment
Sewer Separation									
Lincoln Street	9C	550			550	LF	$305	$ 167,750	
Sherian Street	9C	300			300	LF	$305	$ 91,500	
Hayes Street	9C	450			450	LF	$305	$ 137,250	
Clifton Avenue	9C	2,050			2,050	LF	$305	$ 625,250	
Lisa Lane	9B	350			350	LF	$305	$ 106,750	
Kingston Terrace	9B	300			300	LF	$305	$ 91,500	
Lisa Lane Xcountry	9B	800			800	LF	$305	$ 244,000	
East Chester St Ext	9B	500			500	LF	$305	$ 152,500	
East Chester St	9B	1450	1350	2,600	5,400	LF	$305	$ 1,647,000	10" existing included in 12"; two pipes from Wood St to Hasbrouck - 18" & 20"
Tammany Street	9B	800			800	LF	$305	$ 244,000	one gravity 804', one LP 523'
Meade Street	9B	350			350	LF	$305	$ 106,750	
Grant Street	9B	1,400			1,400	LF	$305	$ 427,000	
Garrison Street	9B	250			250	LF	$305	$ 76,250	
Lincoln Street	9B	1,100			1,100	LF	$305	$ 335,500	388' low pressure sewer
Huton Street	9B	500			500	LF	$305	$ 152,500	
Clifton Avenue	9B	300		850	1,150	LF	$305	$ 350,750	15" existing included in 18"
Sylvester Street	9B	650			650	LF	$305	$ 198,250	
Cassidy Street	9B	400			400	LF	$305	$ 122,000	
VanGaasbeck Street	9B	500	350		850	LF	$305	$ 259,250	
Tubby Street	9B	350	650		1,000	LF	$305	$ 305,000	10" existing included in 12"
Hemlock Avenue	9B	250	400		650	LF	$305	$ 198,250	10" existing included in 12"
Highland Avenue	9B	450		100	550	LF	$305	$ 167,750	West end 15", East end 6"
Park Street	9B	550			550	LF	$305	$ 167,750	
							Subtotal	**$6,374,500**	
							General Conditions (15%)	**$ -**	included in unit price
							Construction Cost	**$6,374,500**	
							Police (1%)	**$63,745**	
							Contingency (20%)	**$1,274,900**	
							Engineering (20%)	**$1,274,900**	
							Total Project Cost (Rounded to nearest $1,000)	**$8,988,000**	

Appendix C
Sewer Separation
Opinion of Probable Cost

Separation Costs for Phase: **E**
Total Separation Unit Price per Drainage Area Descriptions: $305
Total Length Separated (lf): 21,250

Location	Sewershed	Combined Sewer Separation Quanity 8-inch	12-inch	18-inch	Total Length	Unit	Unit Cost	Subtotal	Comment
Sewer Separation									
Ulster Street	10	200			200	LF	$305	$ 61,000	
Forth Avenue	10	650			650	LF	$305	$ 198,250	Additional 422' low pressure no included
Kingston Street	10	1,000			1,000	LF	$305	$ 305,000	Additional 427' low pressure no included
Third Avenue	10	350	850	1,000	2,200	LF	$305	$ 671,000	15" existing included in 18"
Rock Street	10	150			150	LF	$305	$ 45,750	
Second Avenue	10	1,850			1,850	LF	$305	$ 564,250	
First Avenue	10		1,950		1,950	LF	$305	$ 594,750	unknown distance north of kingston is low pressure not included; 10" existing included in 12"
Hooker Street	10	850			850	LF	$305	$ 259,250	
Larch Street	10		1,200		1,200	LF	$305	$ 366,000	
Foruna Street	10	100			100	LF	$305	$ 30,500	
Pulaski Street	10	200			200	LF	$305	$ 61,000	
First Avenue	9A	400		1,900	2,300	LF	$305	$ 701,500	
Second Avenue	9A	800	300	700	1,800	LF	$305	$ 549,000	
High Street	9A	200			200	LF	$305	$ 61,000	
Third Avenue	9A			1,750	1,750	LF	$305	$ 533,750	
Moore Street	9A	800			800	LF	$305	$ 244,000	
Cross Street	9A	350			350	LF	$305	$ 106,750	6"
Gross Street	9A	350			350	LF	$305	$ 106,750	8"
Old Orchard Road	9A		300	200	500	LF	$305	$ 152,500	mix of 12" and 18"
Hasbrouck Park Road	9A		250		250	LF	$305	$ 76,250	12"
Delware Avenue	9A			850	850	LF	$305	$ 259,250	24"
Delware Ave to Murray	9A			250	250	LF	$305	$ 76,250	30"
Murray Street	9A	1,500			1,500	LF	$305	$ 457,500	
							Subtotal	**$6,481,250**	
							General Conditions (15%)	**$ -**	included in unit price
							Construction Cost	**$6,481,250**	
							Police (1%)	**$64,813**	
							Contingency (20%)	**$1,296,250**	
							Engineering (20%)	**$1,296,250**	
							Total Project Cost (Rounded to nearest $1,000)	**$9,139,000**	

Appendix C
1.3 MG Storage Tank
Opinion of Probable Cost

Description	Quantity	Unit	Unit Cost	Subtotal
Site work	1	LS	$175,000	$175,000
Tank Excavation and Backfill	16391	CY	$30	$491,732
3/4" Crushed Stone	342	CY	$25	$8,542
Dewatering	1	LS	$25,000	$25,000
Tank Base Slab	2050	CY	$770	$1,578,529
Tank Roof	2050	CY	$770	$1,578,529
Tank Walls	391	CY	$960	$375,054
Tank Fill Concrete	1287	CY	$640	$824,069
Tank Precast Conc. Double Tee	7020	SF	$25	$175,500
Tank Precast Conc. Column	40	LF	$260	$10,400
Tank Precast Conc. Beam	100	LF	$195	$19,500
Flushing Gates	2	EA	$42,300	$84,600
Wetwell Chamber	1	LS	$80,000	$80,000
Mechanical - Pumps and Appurtenances	1	LS	$180,000	$180,000
Electrical - Pump Controls, Generator	1	LS	$100,000	$100,000
Roof Topping	43	CY	$1,000	$43,000
Loaming & Seeding and Restoration	1	LS	$18,000	$18,000
			Subtotal	**$5,767,455**
			General Conditions (15%)	**$865,118**
			Construction Cost	**$6,632,573**
			Contingency (20%)	**$1,153,491**
			Engineering (20%)	**$1,153,491**
			Total Project Cost (Rounded to nearest $1,000)	**$8,940,000**

Appendix C
Opinion of Probable Cost
Present Worth Analysis

Project	Project Cost	Salvage Items	Item Value	Service Life	Life Remaining	20-yr Depreciation[1]	Salvage Value	Present Day O&M Value	Net Present Worth
CSO Storage Facility	$ 8,940,000	Concrete tanks	$ 7,772,000	50	30	$ 3,108,800	$ 4,663,200	$ 3,389,000	$ 7,665,800
Phase A Separation	$ 837,000	Entire project	$ 837,000	50	30	$ 334,800	$ 502,200	$ 60,000	$ 394,800
Phase B Separation	$ 2,033,000	Entire project	$ 2,033,000	50	30	$ 813,200	$ 1,219,800	$ 12,000	$ 825,200
Phase C Separation	$ 7,817,000	Entire project	$ 7,817,000	50	30	$ 3,126,800	$ 4,690,200	$ 157,000	$ 3,283,800
Phase D Separation	$ 8,988,000	Entire project	$ 8,988,000	50	30	$ 3,595,200	$ 5,392,800	$ 170,000	$ 3,765,200
Phase E Separation	$ 9,139,000	Entire project	$ 9,139,000	50	30	$ 3,655,600	$ 5,483,400	$ 180,000	$ 3,835,600

Notes:
(1) Assumes 2.0% straight-line depreciation

Appendix C
Broadway Parking Lot
Opinion of Probable Cost

Description	Quantity	Unit	Unit Cost	Subtotal
Mobilization	1	LS	$8,400	$8,400
Asphalt Removal & Subgrade Prep	1	LS	$5,000	$5,000
Sedimentation & Erosion Control	1	LS	$2,000	$2,000
Excavation	300	CY	$15	$4,500
Aggregate Subbase	260	CY	$45	$11,700
Bituminous Concrete Pavement	120	CY	$120	$14,400
Concrete Apron & Sidewalk	1	LS	$3,500	$3,500
Drainage Improvements	1	LS	$14,000	$14,000
Topsoil, Seeding & Planting	1	LS	$6,500	$6,500
Pavement Marking & Signage	1	LS	$3,000	$3,000
			Subtotal	**$73,000**
			General Conditions (15%)	**$11,000**
			Construction Total:	**$84,000**
			Contingency (20%)	**$14,600**
			Engineering (20%)	**$14,600**
			Total (Rounded to nearest $1,000)	**$113,000**

Stormwater Planter Worksheet

Af=WQv*(df)/[k*(hf+df)(tf)]

where:

Af Required Surface Area (ft2)

WQv Water Quality Volume (ft^3)

df Depth of the Soil Medium (ft)

k The Hyrdaulic Conductivity (ft/day), usually set at 4 ft/day when soil is loosely ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil***

hf Average Height of Water above planter bed (ft)

tf The Design Time to Filter the Treatment Volume Through the Filter Media (days)

Design Point:	

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
1	0.01	0.01	1.00	0.95	88.97	2.58	

Calculate the Mimimum Filter Area			
Parameter	**Value**	**Units**	
WQv	89	*ft^3*	*WQv*
Depth of Soil Media	2	*ft*	*df*
Hydraulic Conductivity	2	*ft/d*	*k*
Average Height of Ponding	0.5	*ft*	*hf*
Filter Time	1	*d*	*tf*
Required Area of Filter	36	*ft^2*	*Af*

Area of Filter		
Width	4	*ft*
Length	10	*ft*
Area Provided	40	*ft^2*
Volume Provided	100	

Runoff Reduction	
Soil Type	C
Flow Through Planter?	*Yes*

Determine the Runoff Reduction			
RRv	**89**	***ft^3***	
RRv Applied	**40**	***ft^3***	

Tighe&Bond

APPENDIX D

Appendix D
Engineering Report Certification & Smart Growth Assessment Form

APPENDIX B

Engineering Report Certification

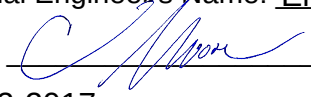
To Be Provided by the Professional Engineer Preparing the Report

During the preparation of this Engineering Report, I have studied and evaluated the cost and effectiveness of the processes, materials, techniques, and technologies for carrying out the proposed project or activity for which assistance is being sought from the New York State Clean Water State Revolving Fund. I have recommended for selection, to the maximum extent practicable, a project or activity that maximizes the potential for efficient water use, reuse, recapture, and conservation, and energy conservation, taking into account the cost of constructing the project or activity, the cost of operating and maintaining the project or activity over the life of the project or activity, and the cost of replacing the project and activity.

Title of Engineering Report: Hasbrouck Avenue CSO Sewershed Planning Report

Date of Report: August 2017

Professional Engineer's Name: Erin K. Moore, P.E., T&B Engineering, P.C.

Signature: 

Date: 8-22-2017

NEW YORK STATE OF OPPORTUNITY. | Department of Health | Environmental Facilities Corporation

Smart Growth Assessment Form
New York State Revolving Funds (CWSRF & DWSRF)

This form should be completed by the applicant's project engineer or other design professional.[1] Please refer to EFC's "Smart Growth Guidance".[2]

Applicant Information

SRF Applicant: City of Kingston SRF No.: EPG#54659

Project Name: Hasbrouck Avenue CSO Sewershed Planning Report

Is project construction complete? ☐ Yes, date: ☒ No

Project Summary: (provide a short project summary in plain language including the location of the area the project serves)
This project includes the assessment of different alternatives to remove stormwater from the Hasbrouck Avenue CSO sewershed. The Hasbrouck Avenue CSO is the largest in the City. LTCP approach for this area includes construction of a 1.3 MG CSO storage tank. Alternatives considered for this evaluation include continued plans for storage, partial separation and green infrastructure improvements. Partial separation is recommended.

Section 1 – Screening Questions

1. Prior Approvals

1A. Has the project been previously approved for SRF financing? ☐ Yes ☒ No

1B. If so, what was the SRF project number(s) for the prior approval(s)? SRF No.:

Is the scope of the project substantially the same as that which was approved? ☐ Yes ☐ No

IF THE PROJECT WAS PREVIOUSLY APPROVED BY EFC'S BOARD AND THE SCOPE OF THE PROJECT HAS NOT MATERIALLY CHANGED, THE PROJECT IS **NOT** SUBJECT TO SMART GROWTH REVIEW. SKIP TO SIGNATURE BLOCK.

2. New or Expanded Infrastructure

2A. Does the project add new wastewater collection/new water mains or a new wastewater treatment system/water treatment plant? ☐ Yes ☒ No
Note: A new infrastructure project adds wastewater collection/water mains or a wastewater treatment/water treatment plant where none existed previously

2B. Will the project result in either: ☐ Yes ☒ No

An increase of the State Pollution Discharge Elimination System (SPDES) permitted flow capacity for an existing treatment system;

OR

An increase such that a NYSDEC water withdrawal permit will need to be obtained or modified, or result in the NYSDOH approving an increase in the capacity of the water treatment plant?

[1] If project construction is complete and the project was not previously financed through the SRF, an authorized municipal representative may complete and sign this assessment.
[2] Available at www.efc.ny.gov/smartgrowth

Note: An expanded infrastructure project results in an increase of the SPDES permitted flow capacity for the wastewater treatment system, or an increase of the permitted water withdrawal or the permitted flow capacity for the water treatment system.

IF THE ANSWER IS "NO" TO BOTH "2A" and "2B" ON THE PREVIOUS PAGE, THE PROJECT IS NOT SUBJECT TO FURTHER SMART GROWTH REVIEW. SKIP TO SIGNATURE BLOCK.

3. Court or Administrative Consent Orders

3A. Is the project expressly required by a court or administrative consent order? ☐ Yes ☒ No

3B. If so, have you previously submitted the order to NYS EFC or DOH? If not, please attach. ☐ Yes ☐ No

Section 2 – Additional Information Needed for Relevant Smart Growth Criteria

EFC has determined that the following smart growth criteria are relevant for SRF projects and that projects must meet each of these criteria to the extent practicable:

1. Uses or Improves Existing Infrastructure

1A. Does the project use or improve existing infrastructure? ☒ Yes ☐ No

Please describe:

This project include use of existing combined sewer pipe as separated sewer pipe and also includes improvements to piping infrastructure where needed.

2. Serves a Municipal Center

Projects must serve an area in either 2A, 2B or 2C to the extent practicable.

2A. Does the project serve an area **limited** to one or more of the following municipal centers?

i. A City or incorporated Village ☒Yes ☐No

ii. A central business district ☐Yes ☐No

iii. A main street ☐Yes ☐No

iv. A downtown area ☒Yes ☐No

v. A Brownfield Opportunity Area ☐Yes ☐No
(for more information, go to www.dos.ny.gov & search "Brownfield")

vi. A downtown area of a Local Waterfront Revitalization Program Area ☐Yes ☐No
(for more information, go to www.dos.ny.gov and search "Waterfront Revitalization")

vii. An area of transit-oriented development ☐Yes ☐No

viii. An Environmental Justice Area ☒Yes ☐No
(for more information, go to www.dec.ny.gov/public/899.html)

ix. A Hardship/Poverty Area ☐Yes ☐No
Note: Projects that primarily serve census tracts and block numbering areas with a poverty rate of at least twenty percent according to the latest census data

Please describe all selections:

This project is completely within the municipal boundaries of the City of Kingston. It serves the Kingston Housing Authority, the City Police & Court, City Fire Department. Much of the project area is within an Environmental Justice Area as designated on mapping by NYSDEC Office of Environmental Justice.

2B. If the project serves an area located outside of a municipal center, does it serve an area located adjacent to a municipal center which has clearly defined borders, designated for concentrated development in a municipal or regional comprehensive plan and exhibit strong land use, transportation, infrastructure and economic connections to an existing municipal center? ☐Yes ☐No

Please describe:

2C. If the project is not located in a municipal center as defined above, is the area designated by a comprehensive plan and identified in zoning ordinance as a future municipal center? ☐Yes ☐No

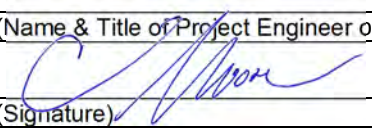
Please describe and reference applicable plans:

3. Resiliency Criteria

3A. Was there consideration of future physical climate risk due to sea-level rise, storm surge, and/or flooding during the planning of this project? ☐Yes ☐No

Please describe:

Signature Block: By entering your name in the box below, you agree that you are authorized to act on behalf of the applicant and that the information contained in this Smart Growth Assessment is true, correct and complete to the best of your knowledge and belief.

Applicant:	Phone Number:
Erin K. Moore, PE, Project Manager, T&B Engineering, P.C., 845-835-8080	
(Name & Title of Project Engineer or Design Professional or Authorized Municipal Representative)	
	8-22-2017
(Signature)	(Date)