A. INTRODUCTION

This chapter assesses the potential effects of the proposed project on existing and planned water and sewer infrastructure. It has been prepared in accordance with 2014 *City Environmental Quality Review (CEQR) Technical Manual* methodologies. Implementation of the proposed project would not generate new water or sewer demand. Although construction of the proposed project would require relocation and/or replacement of water lines and hydrants in some areas, water service would not be affected. Existing sewer infrastructure would be altered, and new sewer infrastructure would be installed as part of the proposed project. Therefore, this chapter focuses only on potential significant adverse effects on the sewer system as a result of the proposed project.

STUDY AREA

The potential effects of the proposed project on sewer infrastructure was assessed for the study area, inclusive of the project protected area and the drainage protected area, as shown in **Figure 5.8-1** and described below.

PROJECT PROTECTED AREA

The project protected area is defined as the area proposed to be protected against overland storm surge flooding, as defined by the Federal Emergency Management Agency (FEMA) 100-year Special Flood Hazard Area. In addition, the protected area also takes into consideration the 90th percentile 2050s sea level rise assumptions for the area between Montgomery Street and East 25th Street. In total, the protected area, as outlined in **Figure 5.8-1**, is composed of about 380 acres and is located along approximately 2.4 miles of the southeastern Manhattan waterfront between Montgomery Street and East 25th Street.

DRAINAGE PROTECTED AREA

The drainage protected area encompasses the project protected area as well as the lateral sewers, regulators, outfalls, and other sewer infrastructure that serve or are tributary to those that serve the project protected area. In total, the drainage protected area, as outlined in **Figure 5.8-1**, is composed of about 1,100 acres and is located along the southeastern Manhattan waterfront between Montgomery Street and East 25th Street and extending inland to Broadway. Since the drainage protected area fully encompasses the project protected area, the consolidated sewer area protected by the proposed project will be referred to as the “drainage protected area” for the remainder of the chapter.

STUDY AREA

The drainage protected area is serviced by water mains, storm drains, and combined sewer infrastructure. All sewer flow within the drainage protected area is pumped to the New York City Department of Environmental Protection’s (DEP) Newtown Creek Wastewater Treatment Plant (WWTP) located across the East River in Brooklyn, New York. Combined sewer flow is pumped

Capital Project SANDRESM1
EAST SIDE COASTAL RESILIENCY PROJECT

Water and Sewer Study Area
Figure 5.8-1

to the Newtown Creek WWTP via the Manhattan Pump Station, which is located within the drainage protected area at East 13th Street and Avenue D.

The drainage protected area is part of a larger sewershed, the "study area," that is also serviced by the Manhattan Pump Station, and, ultimately, the Newtown Creek WWTP, which extends to approximately East 70th Street on the east side of Broadway and to West 14th Street on the west side of Broadway, as shown in **Figure 5.8-1**. A sewershed typically describes a geographic region in which all stormwater and wastewater is conveyed to a single point, or outlet, before being conveyed to a wastewater treatment plant. All sewers in the Manhattan Pump Station service area are hydraulically connected via the interceptor, which is a large-diameter (up to 108-inch) sewer pipe that collects flows from smaller-diameter pipes that serve DEP's customers and conveys flow to the pump station. The larger sewershed area (the study area) is approximately 4,300 acres, the majority of which is highly developed and covered by impervious surfaces, resulting in higher rainfall volumes entering the sewer system during rainfall events.

Modifications to sewers anywhere within this larger sewershed have the potential to impact other sewers in the study area; therefore, proposed drainage modifications were analyzed for impacts to the study area.

B. PRINCIPAL CONCLUSIONS

NO ACTION ALTERNATIVE (ALTERNATIVE 1)

The No Action Alternative is the future condition without the proposed project and assumes that no new comprehensive coastal protection system is installed in the proposed project area. The No Action Alternative would not change existing water and sewer infrastructure in the study area. The No Action Alternative would not provide comprehensive coastal flood protection for the protected area. Projects independent of the proposed project that are planned or ongoing would continue as planned. During a design storm, the protected area would be subject to overland flooding (which refers to flooding that exceeds the elevation of the coastal topography) from storm surge and rainfall and there would potentially be sewer infrastructure surcharge.[1] Targeted resiliency measures proposed in the protected area may reduce the effects of coastal flooding in specific locations but would not provide comprehensive flood protection. Under this alternative, the combined sewer system within the study area would continue to comply with conditions set by the Newtown Creek WWTP SPDES permit and be consistent with the Clean Water Act, CSO Control Policy, and the CSO Abatement Program and CSO Long-Term Control Plan.

PREFERRED ALTERNATIVE (ALTERNATIVE 4): FLOOD PROTECTION SYSTEM WITH A RAISED EAST RIVER PARK

The Preferred Alternative proposes to move the line of flood protection further into East River Park, thereby protecting both the community and the park from design storm events, as well as increased tidal inundation resulting from sea level rise. The Preferred Alternative would raise the majority of East River Park, limiting the length of wall between the community and the waterfront to provide for enhanced neighborhood connectivity and integration, as well as reducing the potential for flooding, wave damage, and the resulting scouring and erosion in East River Park.

[1] Surcharge refers to the condition in which combined sewer flow exceeds the capacity of sewer pipes and/or drainage infrastructure, potentially resulting in backups in sewer pipes and, ultimately, above-grade flooding.

The existing sewer system would be modified to isolate the drainage protected area from the larger sewershed during design storm events to prevent coastal floodwaters from inundating the drainage protected area. The existing sewer system would also be modified to increase its capacity to convey wet-weather flows during design storm events with coincident rainfall events, thereby managing flooding within the drainage protected area. By raising the grade of East River Park, the extents of floodproofing needed for the sewer infrastructure would be reduced under this alternative as compared to Alternatives 2 and 3. The Preferred Alternative would also reconstruct and reconfigure the Park's underground sewer and water infrastructure, including outfalls and their tide gates within the park, to withstand the loads of the proposed flood protection system and elevated parkland. The Preferred Alternative would be consistent with the Clean Water Act, CSO Control Policy, and the CSO Abatement Program and CSO Long-Term Control Plan. Therefore, there would be no adverse effects to sewer infrastructure as a result of implementation of the Preferred Alternative.

OTHER ALTERNATIVES

The Flood Protection System on the West Side of East River Park – Baseline Alternative (Alternative 2), The Flood Protection System on the West Side of East River Park – Enhanced Park and Access Alternative (Alternative 3), and The Flood Protection System East of FDR Drive (Alternative 5) would include the same modifications to the sewer system to isolate the drainage protected area and increase hydraulic capacity as the Preferred Alternative. Alternatives 2 and 3 would not include reconstruction of the drainage infrastructure within East River Park and would require more floodproofing of existing sewer infrastructure within the Park compared to the Preferred Alternative. These alternatives would be consistent with the Clean Water Act, CSO Control Policy, and the CSO Abatement Program and CSO Long-Term Control Plan. Therefore, there would be no adverse effects to sewer infrastructure as a result of implementation of the Other Alternatives.

C. REGULATORY CONTEXT

The regulatory context for the proposed project includes the following federal, state and local laws, programs, rules, legal requirements, and policies for which each of the alternatives have been analyzed to result in a determination of environmental effects with project implementation.

FEDERAL

CLEAN WATER ACT (33 USC §§ 1251 TO 1387)

The Federal Water Pollution Control Act, also known as the Clean Water Act, is the primary federal law in the United States governing water pollution. It regulates point sources of water pollution, such as discharges of municipal sewage and industrial wastewater, and the discharge of dredged or fill material into navigable waters and other waters of the United States. The Act also regulates non-point source pollution from sources other than the end of a pipe, such as runoff from streets, agricultural fields, construction sites and mining that enter waterbodies.

Under Section 401 of the Act, any applicant for a federal permit or any license for an activity that may result in a discharge to navigable waters must provide to the federal agency issuing a permit a certificate, either from the state where the discharge would occur or from an interstate water pollution control agency, that the discharge would comply with Sections 301, 302, 303, 306, 307, and 316 (b) of the Clean Water Act. Applicants for discharges to navigable waters in the State of New York must obtain a Water Quality Certificate from the New York State Department of Environmental Conservation (NYSDEC).

Section 402 of the Act provides guidance on the National Pollutant Discharge Elimination System (NPDES), which governs the issuance of permits to control and prevent water pollution at point sources that discharge pollutants. In the State of New York, the NPDES permit program is administered through NYSDEC's State Pollution Discharge Elimination System (SPDES) permit program. Consistency with the Clean Water Act is evaluated for the proposed project as changes to the sewer system (e.g., outfall locations and capacities) may require modifications to the study area's existing SPDES permit in accordance with the requirements of the Clean Water Act.

COMBINED SEWER OVERFLOW CONTROL POLICY

The objective of the CSO Control Policy (EPA FRL-4732-7, 59 Federal Register 18688) is to provide guidance to help areas served by combined sewer systems meet the objectives of the Clean Water Act. The policy provides site-specific guidance and flexibility to help communities implement appropriate CSO controls to meet appropriate health and environmental objectives. It also ensures that CSOs only occur as a result of wet weather events, and that all discharge points are in compliance with the technological and water quality requirements of the Clean Water Act. It also establishes reporting measures to assess the progress made on federal, state, and local levels in enforcing and implementing the policy. Consistency with the CSO Control Policy is evaluated for the proposed project to confirm that any changes to the combined sewer system meet the study area's CSO control objectives.

NEW YORK STATE

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM

Title 8 of Article 17 of the New York Environmental Conservation Law, Water Pollution Control, authorized the creation of the SPDES to regulate discharges to the state's waters. Activities requiring a SPDES permit include point source discharges of wastewater into surface or ground waters of the State, including the intake and discharge of water for cooling purposes; constructing or operating a disposal system (sewage treatment plant); discharge of stormwater; and construction activities that disturb one acre or more. Consistency with SPDES is evaluated for the proposed project as changes to the sewer system (e.g., outfall locations and capacities) may require modifications to the study area's existing SPDES permit and because construction activities would disturb an area greater than one acre.

NEW YORK STATE SANITARY CODE

Part 5 of the New York State Sanitary code (10 NYCRR 5) regulates public water supply. It ensures protection of drinking water resources both at the source and throughout water treatment and distribution processes. This code is evaluated for the proposed project to ensure compliance for any modifications to or reconstruction of the existing water distribution system in the study area as a result of the proposed project.

NEW YORK CITY

RULES OF THE CITY OF NEW YORK

Chapter 20 of Title 15 of the Rules of the City of New York establishes guidelines and restrictions regarding the use and supply of water. This rule encompasses all water supply infrastructure in the city. Chapter 31 of Title 15 of the Rules of the City of New York establishes guidelines for the issuance of permits for the construction, repair, alteration, and inspection of all sewer connections. All permit applications are to be submitted to and reviewed by DEP. The proposed project consists of water and sewer construction. As such, these guidelines were evaluated for the proposed project to confirm that all proposed water and sewer modifications and construction are designed in accordance with the Rules of the City of New York.

COMBINED SEWER OVERFLOW ABATEMENT PROGRAM AND COMBINED SEWER OVERFLOW LONG-TERM CONTROL PLAN (DEP)

Implemented by DEP, the objective of this program and long-term control plan is to reduce pollution in and around the City's waters. The plan provides for field investigations, sewer system and water quality monitoring, and modeling in areas that are heavily impacted by combined sewer overflows (CSO) to determine appropriate mitigation measures. The program aims to establish source controls and stormwater best management practices suited for New York City. The CSO abatement program is under a 2005 Consent Order, which was executed between NYSDEC and DEP and contains milestones for the completion of various projects and planning documents associated with the program. A 2011 modification to the Consent Order contained changes to various planned and ongoing CSO abatement construction projects as well as to long-term control plan (LTCP) milestones, funding for green infrastructure, and fines for any missed LTCP milestones. A Citywide Open Waters LTCP is currently in the early development stage and includes the East River within the study area. Consistency with the long-term control plan is evaluated for the proposed project as changes are proposed to the existing combined sewer system under the With Action Alternatives.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) PERMIT

Issued by NYSDEC, the Municipal Separate Storm Sewer System (MS4) permit is a Citywide permit under the Clean Water Act intended to manage urban sources of stormwater runoff to reduce pollutants discharging to separate storm sewer systems. The purpose of the permit is to protect and improve water quality in receiving waterbodies. Under this permit, the City is developing a Stormwater Management Program to address issues including runoff from municipal operations and facilities, floatable and settleable trash and debris, construction site stormwater runoff, and post-construction stormwater management. The guidelines of the MS4 permit are considered for the proposed project as they relate to the project's proposed modifications to the storm and combined sewer systems.

D. METHODOLOGY

WATER AND SEWER INFRASTRUCTURE OVERVIEW

The majority of the drainage protected area is serviced by a combined sewer system. In areas serviced by combined sewer infrastructure, sanitary sewer flows and stormwater flows are conveyed together in a single pipe to treatment facilities before the treated effluent is discharged to nearby waterbodies. The City's SPDES permits for each WWTP regulate these discharges. During dry weather, only sanitary flow is conveyed through the combined sewer pipes. However, during and following precipitation events, such as rainfall and snowmelt, the combined sewer pipes convey both sanitary flow and stormwater. In those wet weather conditions, the WWTPs treat the combined sewage at their maximum treatment rates in accordance with the WWTP's SPDES permit, and the excess combined sewage overflows into the City's surrounding waterbodies at designated outfall locations. The flow to the outfalls is controlled by structures known as regulators (see **Figure 5.8-2**).

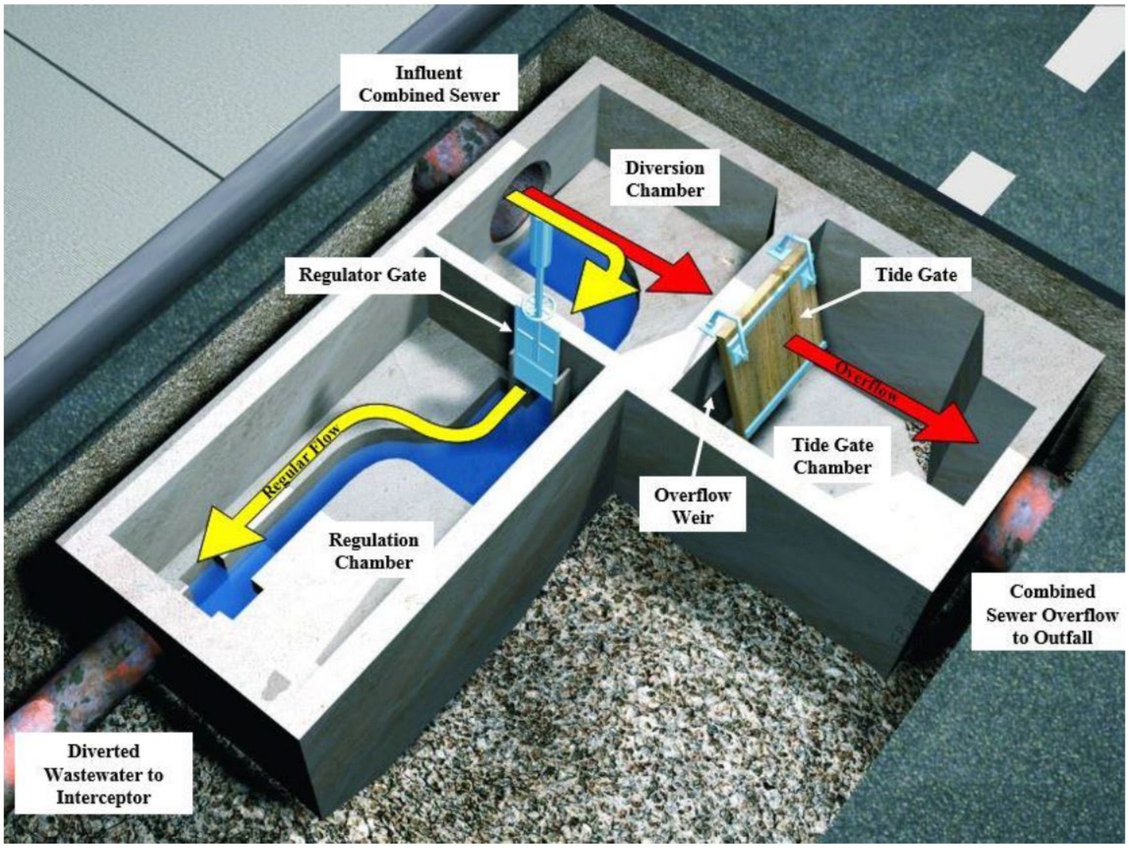

Figure 5.8-2: Combined Sewer Regulators

These regulators prevent overloading of the interceptor and downstream treatment facilities (e.g., WWTPs and pump stations) during high flow events by diverting flow in excess of the system's capacity to CSO outfalls.

DEP employs static regulators, which passively respond to variations in the water level of the combined sewer, to regulate the flow to the interceptor. Regulators typically consist of a diversion chamber, a regulation chamber, and a tide gate chamber, as shown in **Figure 5.8-2**. The incoming flow from lateral sewers (sewers upstream of the regulators) first enters the diversion chamber that directs the sewage to the regulation chamber. The regulation chamber directs flow to the interceptor.

Generally, the regulation chamber and downstream pipes can convey up to twice the dry weather flow rate to the interceptor. In addition to controlling flow into the interceptor via the regulation chamber, the diversion chamber also directs flows that exceed capacity of the system downstream of the regulator to the outfall via the tide gate chamber. If the downstream capacity is exceeded, excess combined sewer flow overtops the overflow weir in the diversion chamber and enters the tide gate chamber. The tide gate chamber outlets this excess volume through the outfall associated with the regulator. When CSOs do occur, per federal, state, and local requirements, DEP monitors the outfalls and publishes advisories when CSO discharges pose a contact risk for the affected waterbodies.

In order to outlet flow to the receiving waterbody, the water elevation, or hydraulic grade line (HGL), in the regulator must be higher than the receiving water body's tide level. In this way, the tide gate also prevents water from the receiving waterbody from entering the combined sewer system. During high tide and storm surges, the tide gate passively shuts and is held closed, so long as the tide level is higher than the HGL in the regulator. If the tide level is equal to or greater than the HGL in the tide gate chamber, any excess sewer flow will back up in the sewer system until the tidal elevation decreases or the sewer system reaches an HGL greater than the tidal level and flow is able to passively exit through the outfall. The backup of flow in the sewer system can result in surcharging of the combined sewer system at the regulators and in the lateral sewers upstream of the regulators, which can result in backups in sewer service connections and possibly above-grade flooding.

Within the project area, there are 23 combined sewer outfalls that discharge directly to the East River. The flow to these outfalls is regulated under the Newtown Creek WWTP SPDES permit and controlled by 20 regulators, some of which have more than one associated outfall, located along the waterfront. Under the With Action Alternatives, a portion of the regulators and sewers that serve the drainage protected area will be on the unprotected side of the proposed flood protection system, though the exact number varies based on the location of the line of protection and therefore varies between alternatives. Each of these regulators is equipped with a set of manholes and vented access hatches. The hatches relieve pressure within the system as water flows through the structures. Similarly, all conveyance pipes within the combined sewer system contain access manholes for periodic maintenance. Any unprotected manholes or hatches could serve as a potential pathway for overland floodwaters to enter the drainage protected area during a design storm event.

IMPACT ASSESSMENT APPROACH

As described above, the wet-weather functionality of the combined sewer system in the drainage protected area is directly affected by tidal conditions at the outfall tide gates. Under the design storm for the proposed project, the 100-year storm surge event is anticipated to passively hold the tide gates closed, preventing excess wet weather flows in the combined sewer system from being released through the outfalls. The drainage protected area is also vulnerable to overland surge waters inundating the sewer system via manholes and regulator hatches on sewer infrastructure on the unprotected side of the flood protection system. As such, the proposed project includes drainage components to hydraulically isolate the drainage protected area from the larger sewershed (unprotected portion of the study area) and from overland surge. The project will also provide sewer capacity for the protected area to offset the loss of capacity during the design storm when the outfalls are closed. The hydraulic isolation prevents surge waters from inundating the drainage protected area through the existing sewer system. The additional sewer capacity reduces the risk of backups within the sewer system that have the potential to result in above-ground flooding. These drainage system improvements are included in the With Action Alternatives.

DRAINAGE DESIGN STORM

To determine the appropriate drainage components required, an InfoWorks Integrated Catchment Model based on data and models previously developed and verified by the U.S. Environmental Protection Agency (EPA) was developed to evaluate the flooding risk in the drainage protected area without drainage isolation or management components. The flooding risk is dependent on the characteristics of the rainfall event that occurs in conjunction with a storm surge event. In coordination with DEP, potential effects as a result of implementing the proposed project were modeled and evaluated for a 5-year, second quartile National Oceanic and Atmospheric

Administration (NOAA) Atlas 14 24-hour rainfall event coincident with a present-day 100-year surge tide (drainage design storm).[2]

Under the design storm scenario, the 5-year rainfall event was modeled assuming that the rainfall intensity peaked in the middle of a 100-year coastal surge event. This scenario is representative of a coastal storm event in which the combined sewers are conveying wet weather flows and the existing sewer system's drainage capacity is impaired by closed outfalls during elevated tidal conditions. The five-year rainfall and 100-year surge events are defined by their statistical probabilities, a one-in-five and one-in-one hundred chance event in a given year, respectively. Of the hurricanes and tropical storms that strike the New York City area every year, the majority are less severe than 5-year rainfall and 100-year coastal surge events, making the probability of a storm more severe than the drainage design storm unlikely.

MODEL ANALYSIS

The model estimated the predicted sewer surcharge and above-grade flood risk for the drainage protected area under the influence of the coincident design rainfall and design storm conditions described above. The model determines the HGL in the sewers within the drainage protected area, and thus, can identify locations of surcharge within the drainage protected area. Coupled with topography and building footprint data, the model determines whether surcharged sewer depths are sufficient to result in backups and above-grade flooding. The model can then identify flow paths of above-grade surcharged waters and estimate floodwater depth. Similarly, the model can determine the potential for coastal inundation of the sewer system during a surge event if the surge elevation is high enough to enter the system through manholes or access hatches located at grade.

For the drainage protected area, the modeled peak HGL was analyzed at specific locations within the sewer system. The differences in modeled HGL at these locations between the No Action Alternative and the proposed project under storm conditions were then compared to assess flood potential. The modeled results were also used to determine the drainage management requirements to maintain or improve current levels of sewer service within the drainage protected area under design storm conditions.

The outfalls, regulators, and interceptor in the unprotected portion of the study area were modeled as well to assess the potential effects of the proposed project. The overland storm surge is anticipated to be the primary cause of flooding in the unprotected portion of the study area under the storm condition for all alternatives, including the No Action Alternative. Therefore, the model for these areas was not used to determine above-grade flooding, which would be dominated by coastal surge waters. Instead, the model was used to identify and analyze any changes in the interceptor and regulator HGLs and any changes in CSOs in the study area as a result of the proposed project.

E. AFFECTED ENVIRONMENT

As described above, the affected environment for evaluating potential effects of the proposed project on sewer infrastructure consists of the combined sewer system and associated outfalls, regulators, and interceptor in the Manhattan Pump Station service area (study area). All sewers in the study area are hydraulically connected via the interceptor that conveys flow to the Manhattan Pump Station, located at East 13th Street and Avenue C within the drainage protected area. From

[2] National Oceanic and Atmospheric Administration (NOAA) Atlas 14 design rainfall events are based on statistical analysis of historical rainfall records for the northeast region.

there, the sewer flow is pumped to the Newtown Creek WWTP located across the East River in Brooklyn, New York, for treatment before being discharged to the East River. Because all sewer flow from the study area is conveyed by the interceptor to the Manhattan Pump Station, modifications to the sewer infrastructure within the drainage protected area have the potential to affect sewers in the study area.

As noted above, a SPDES permit issued by NYSDEC regulates the effluent from the Newtown Creek WWTP. The largest of New York City's 14 treatment plants, Newtown Creek WWTP is designed to treat up to 700 mgd of flow. Upgrades to the Newtown Creek WWTP, which were completed in 2013, increased the plant's wet weather capacity by an additional 90 mgd (to 700 mgd) and improved the quality of treatment. The plant serves a drainage area of 15,656 acres, which includes the southern and eastern midtown sections of Manhattan as well as the northeast section of Brooklyn and western section of Queens, as shown in **Figure 5.8-3**.

During dry weather, the flow conveyed to Newtown Creek WWTP through the combined sewer pipes is exclusively sanitary flow. In 2014, the average dry weather flow to the Newtown Creek WWTP was 200 mgd, with an estimated 110 mgd of the flow coming from the Manhattan service area through the Manhattan Pump Station. The Manhattan Pump Station has a rated capacity of 400 mgd. The study area, including the drainage protected area, constitutes a portion of Newtown Creek WWTP's Manhattan service area and therefore a portion of the plant's capacity. The average dry weather flow to the Manhattan Pump Station from the drainage protected area is approximately 40 mgd. The remainder of the study area contributes, on average, 41 mgd and 29 mgd of dry weather flow from the areas north and south of the drainage protected area, respectively.

However, during and immediately following precipitation events, such as rainfall and snowmelt, the combined sewer pipes convey both sanitary flow and stormwater, generally up to twice the dry weather flow rate. The study area is approximately 1,100 acres, the majority of which is highly developed and covered by impervious surfaces, resulting in high rainfall volumes entering the sewer system compared to less developed areas where stormwater can infiltrate into the ground via pervious surfaces. Wet weather flow enters the combined sewer system through storm drains, located primarily at the intersections of roadways and along the curb. An exception to this is several storm drains along the FDR Drive in the northern portion of the project area that are operated by the New York State Department of Transportation (NYSDOT) and drain directly to outfalls along the East River. Otherwise, the combined sewer pipes in the drainage protected area are generally located in the right-of-way of existing roadways. These roadways run east–west towards the East River. The regulators are located along these alignments; the outfalls are located at the terminus of these pipes near the shoreline.

The drainage protected area includes combined sewer infrastructure (i.e., sewers and regulators) within East River Park and the FDR, portions of which are not protected from coastal surge by the proposed project, depending on the project alternative. Lateral sewers conveying flow to the regulators from the drainage protected area run generally in a west-to-east alignment, leading to each regulator. Branch interceptor pipelines consolidate the flow from the regulators along the eastern side of the drainage protected area. Outfall piping extends from each regulator to the bulkhead where excess combined flow is released. Each of these regulators is equipped with a set of access manholes and vented access hatches. The hatches relieve pressure within the system as water flows through the structures. This infrastructure requires regular operations and maintenance, which is conducted by DEP.

Approximate Boundaries of NYC Wastewater Treatment Plant Service Areas

Figure 5.8-3

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F. ENVIRONMENTAL EFFECTS

A detailed description of the alternatives analyzed in this chapter is presented in Chapter 2.0, "Project Alternatives."

NO ACTION ALTERNATIVE (ALTERNATIVE 1)

NON-STORM CONDITIONS

The No Action Alternative is the future condition without the proposed project and assumes that no new comprehensive coastal protection system is installed in the proposed project area. The build year for the proposed project is 2025 and accordingly, the No Action Alternative assumes that projects planned or currently under construction in the project area are completed by the 2025 analysis year (i.e., No Action projects). A list of these planned projects is included in **Appendix A1**. To the extent that any of these projects would involve disturbance, excavation, or minor water or sewer modifications, it is not anticipated to result in adverse effects to water and sewer infrastructure.

As described in Chapter 5.1, "Land Use, Zoning, and Public Policy," several residential developments are currently proposed and underway within the study area, including the drainage protected area. Projected changes in residential units and population in the study area are not expected to significantly increase the dry weather combined sewer flow.

Under non-storm conditions for the No Action Alternative, the sewer infrastructure in the study area would remain unchanged. Dry weather flow in the sewer system can be expected to change with increases in population but these increases would not be expected to compromise the service provided by the existing infrastructure. The combined sewer system within the study area would continue to comply with conditions set by the Newtown Creek WWTP SPDES permit and be consistent with the Clean Water Act, CSO Control Policy, and the CSO Abatement Program and CSO Long-Term Control Plan.

STORM CONDITIONS

In a storm event where the height of the storm surge is insufficient to close the tide gates or limit flow to the outfalls, rainfall would flow to the combined sewers through the catch basins. Combined sewage would be conveyed through existing infrastructure at full capacity to Manhattan Pump Station and Newtown Creek WWTP. Any excess flow would be released to the combined sewer outfalls, and little to no surface flooding or sewer backups would be experienced due to surcharge from the sewers, provided the combined flow does not exceed the capacity of the existing sewer and outfall system. CSOs within the study area would be regulated by the Newtown Creek WWTP SPDES permit and would be consistent with the Clean Water Act, CSO Control Policy, and the CSO Abatement Program and CSO Long-Term Control Plan.

In the event of a design storm under the No Action Alternative, no comprehensive flood protection measures would be implemented. In the event of high storm surge elevation, the existing tide gates regulating flow through the outfall pipes would passively shut to prevent surge waters from entering the system. In this configuration, the release of excess combined sewer flow to the outfalls would be governed by the surge height. Closure of the outfalls increases the potential for the sewer pipelines to surcharge from excess wet weather flows and tidal inundation, potentially resulting in above-grade flooding and sewer backups. Overland flooding can compound capacity limitations and, as a result, sewer system backups: the overland flooding from surge tides can infiltrate into and inundate sewer systems through catch basins, manholes, and vented access hatches on the regulator chambers and other sewer structures, filling the sewer system with surge waters and limiting its ability to manage combined sewer flow.

If the design storm were to occur under the No Action Alternative, the surge elevation would primarily govern the extent of inland flooding.[3] The design surge elevation exceeds the height of the coastal topography along the project protected area so inland flooding would occur in areas below the design surge elevation. Overland surge flooding would enter the combined sewer system through manholes and vented hatches in the floodplain, limiting the capacity of the sewer to convey combined flow. This sewer inundation has the potential to result in sewer backups beyond the extents of overland surge (the inland boundary of the project protected area). These conditions were confirmed with the InfoWorks model, which then served to define the design parameters for the drainage isolation and management components.

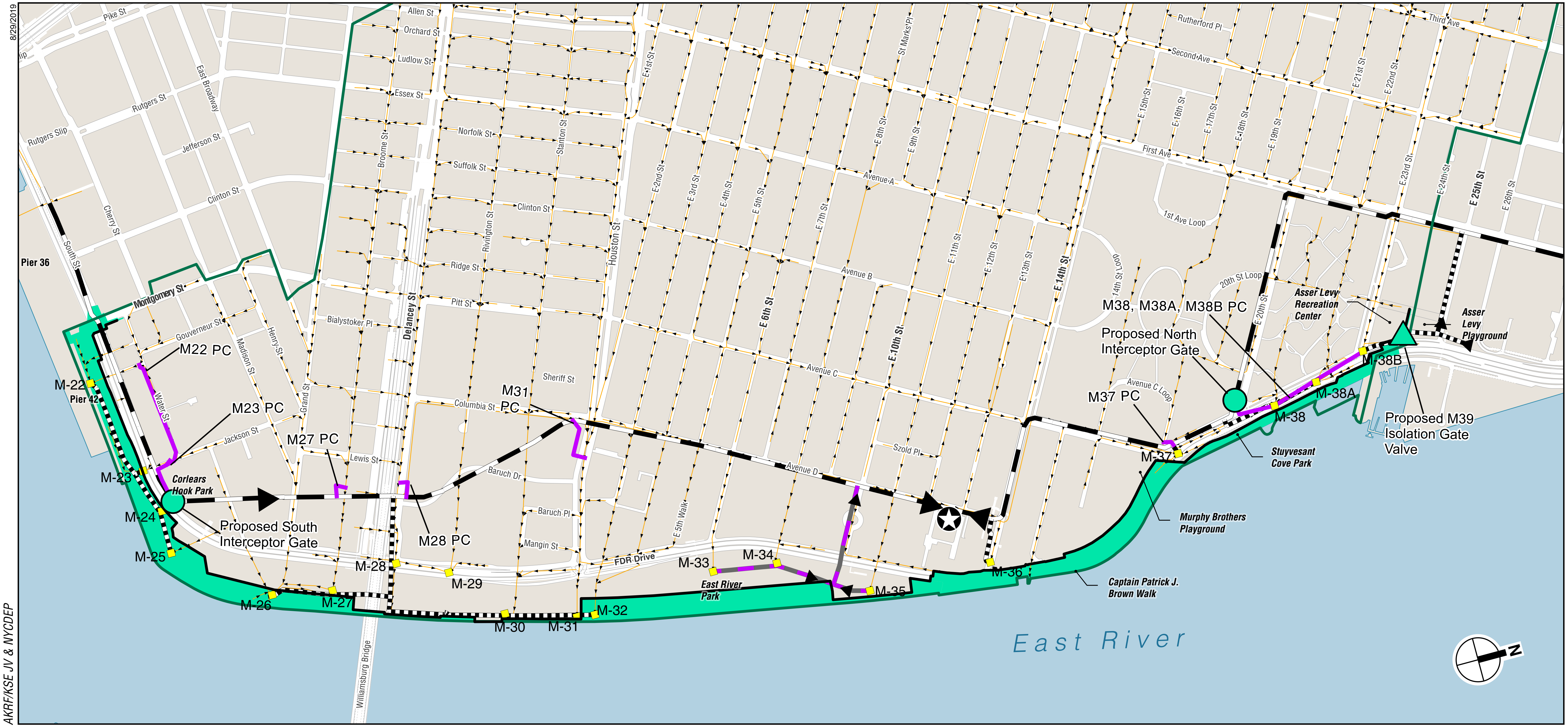
PREFERRED ALTERNATIVE (ALTERNATIVE 4): FLOOD PROTECTION SYSTEM WITH A RAISED EAST RIVER PARK

The Preferred Alternative proposes to move the line of flood protection in East River Park into the park, thereby protecting both the community and the majority of the park from design storm events, as well as protecting it from increased tidal inundation resulting from sea level rise. The Preferred Alternative includes modifications to the existing sewer system to control flow into the drainage protected area from the larger sewershed (i.e., drainage isolation). The Preferred Alternative also includes elements to manage flooding within the drainage protected area (i.e., drainage management). A portion of the park's underground water and drainage infrastructure are reaching the end of their serviceable life and are in need of repair. Therefore, this park infrastructure would be reconstructed and reconfigured to repair it and to ensure that it could withstand the additional loading from the added fill materials once the Park is raised. In addition to these modifications, this alternative would require some limited relocation of existing water and sewer infrastructure within the project area to accommodate proposed project features.

DRAINAGE ISOLATION

Measures to isolate the drainage protected area from the unprotected portions of the study area would be implemented to eliminate potential pathways for storm surge waters to inundate the existing sewer system and flood inland areas. The measures include: (1) installing interceptor gates on the existing 108-inch diameter interceptor at the northern and southern extremes of the drainage protected area sewershed, generally in the vicinity of East 20th Street and Avenue C to the north and between Corlears Hook Park and the FDR Drive to the south; (2) floodproofing the regulators, manholes, and other combined sewer infrastructure on the unprotected side of the flood protection system; (3) replacing existing tide gates on the combined sewer outfall pipes that serve the drainage protected area and rerouting storm drainage; and (4) installing one isolation gate valve in the existing Regulator M-39, located within Asser Levy Playground, to isolate a branch interceptor that crosses the flood protection system alignment at the northern boundary of the drainage protected area. These measures, depicted in **Figure 5.8-4**, would prevent storm surge water from entering the sewer system through existing combined sewers, the outfall pipes, or through at-grade access points (i.e., manholes and hatches) for existing sewer infrastructure on the portion of the drainage protected area that is unprotected from overland coastal surge events. Fewer manholes and

[3] Inland flooding refers to flooding during a coastal flood event as a result of rainfall coincident with a storm surge. This inland flooding occurs due to sewer surcharge and the potential accumulation of rainfall that does not enter the sewer system due to drainage systems at design capacity.



Drainage Isolation

- Proposed Isolation Gate Valve at Regulator M-39
- Proposed Interceptor Gate
- Proposed Floodproofing of Unprotected Sewer Infrastructure

Drainage Management

- Proposed Parallel Conveyance (PC)
- Proposed Upsized Branch Interceptor

- Existing Regulators
- Existing Lateral Sewers in Drainage Protected Area
- Existing Branch Interceptors
- Existing Interceptor

- Manhattan Pump Station
- Drainage Protected Area
- Flood Protection Alignment

0 — 1,000 FEET

Drainage Isolation and Management Components
Figure 5.8-4

regulators would require floodproofing under this alternative as compared to Alternatives 2 and 3 (described below) due to the more eastward alignment of the line of protection within East River Park.

Interceptor Gates

The proposed interceptor gates are large watertight gates that would be installed within a new chamber on the existing interceptor, as shown in **Figure 5.8-5**. The interceptor gates would require a self-contained and submersible device to open and close the gates (actuator). The actuator would be powered by connection to the existing power grid and a hydraulic system. Backup provisions (i.e., a portable generator) would be provided to operate the gate if power is lost during a design storm.

The interceptor gate and actuator would be installed entirely below grade. At grade, the chamber would be provided with an access hatch and manholes for maintenance and operation by DEP staff. Above-grade components of the interceptor gates would include a single-story building adjacent to the chamber that contains the controls, electrical, hydraulic, and other ancillary components to operate the interceptor gates. The building would be provided with a water main connection to provide water for periodic flushing of critical interceptor gate components within the chamber. The interceptor gate locations, shown in **Figure 5.8-4**, were selected for their ability to isolate the portion of the interceptor that serves the drainage protected area's sewers, thereby preventing surge waters in unprotected portions of the study area from entering the drainage protected area through the interceptor.

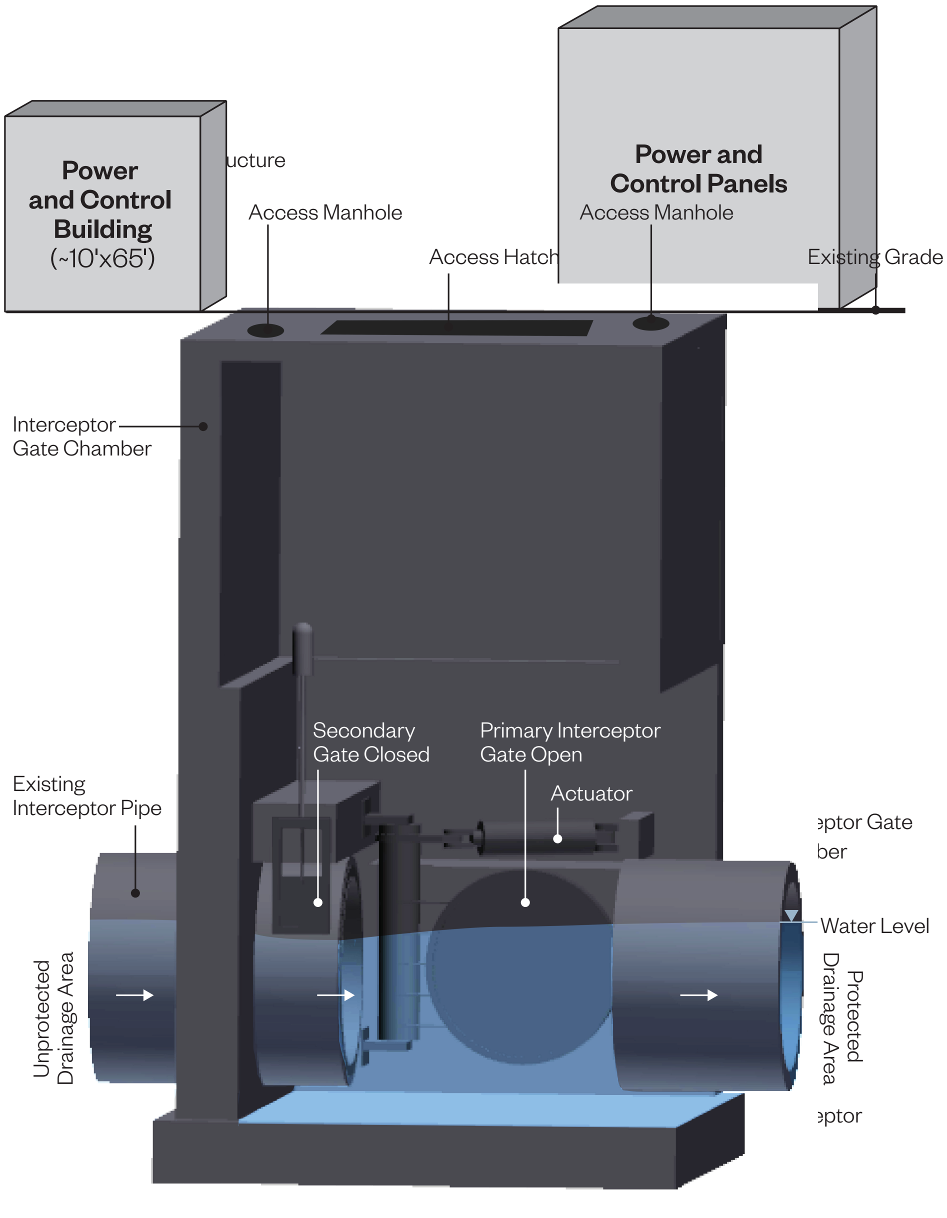
The interceptor gates would be designed to allow for operational flexibility during design storm events to control flow from the upstream areas into the drainage protected area, according to a protocol established by a pre-approved operations and maintenance plan. If required, the gates would be able to close completely to allow for full isolation of the drainage protected area. The gates would remain open, except in the case of a forecasted design storm event, during which pre-approved operations procedures would be followed to close the gates. The gates may also be opened and shut during periodic maintenance in accordance with pre-approved operations procedures while ensuring continued sewer service.

As shown in **Figure 5.8-5**, a smaller, secondary gate would be included as part of each interceptor gate chamber. The secondary gates would allow continued sewer service for areas outside of the protected area when the primary interceptor gates are closed. These smaller openings would convey one to two times the average dry weather flow, depending on the HGL in the interceptor, to maintain normal levels of sewer service for the entire study area.

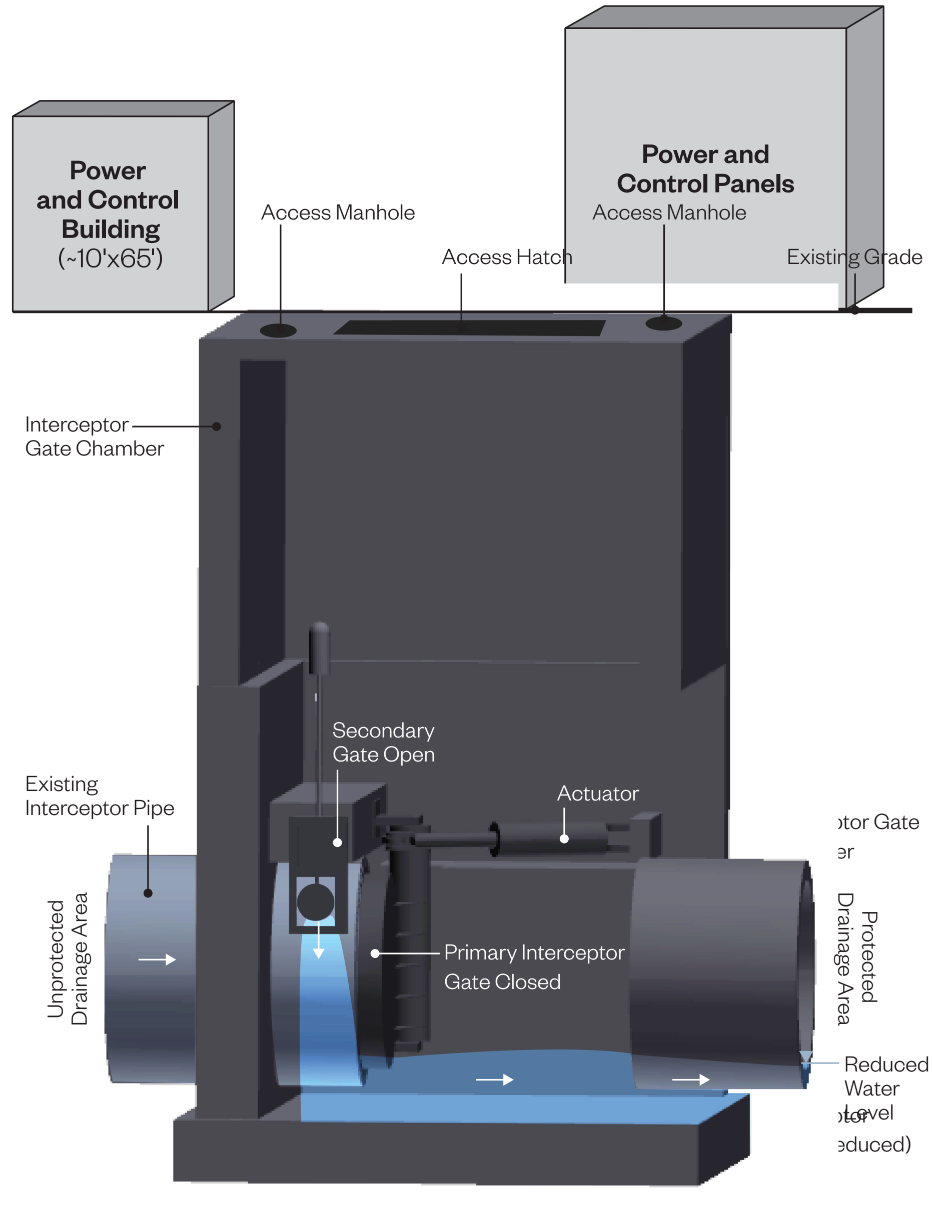
Regulators, Drainage Structures, and Manholes

Drainage isolation for the regulators and other sewer structures in unprotected areas of the drainage protected area would involve replacing each of their existing vented access hatches with lockable vented hatches that could be sealed (i.e., floodproofed) under design storm conditions to prevent water intrusion into the system. In addition, each regulator would be strengthened. External strengthening may include lining, patching, jet-grouting, sheet piling, or excavating to reinforce the existing structure walls. There may also be installation of a reinforced concrete slab above each structure and of low-infiltrating fill around each structure.

Another point of entry to the sewer system for surge waters is through the existing manholes on the unprotected side of the flood protection system. These manholes would be modified to prevent loss of the manhole lid during a surge event, which would otherwise allow large volumes of water into



Non-Storm Condition: Primary Interceptor Gate Open



Storm Condition: Primary Interceptor Gate Closes

Not to Scale

Non-Storm Condition: Interceptor Gate Open

Storm Condition: Interceptor Gate Closes

Note: Some interceptor gate chamber components are not shown for clarity.

Not to Scale

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Interceptor Gate Concept

Figure 5.8-5

the system. Manhole modifications would involve installation of an inner pressure cover and outer traffic cover. The inner cover could be positioned to allow the sewer to vent as under existing conditions. Under normal operation, the inner cover locks of modified manholes would not be engaged and would facilitate system venting. In advance of a design storm, the inner covers would be engaged to effectively seal them to prevent water entry. Following the design storm event, covers that were locked would be unsealed and returned to the venting position. In addition, durable accessways designed for heavy work vehicle loads (H-20 loading) would be installed to allow for future maintenance access. Manholes that are less structurally stable would be either partially or fully replaced in addition to the replacement of the frame and cover. Manholes requiring additional support would follow the methods described above for external strengthening of the regulators.

Tide Gate Replacement and Storm Drainage Rerouting

To ensure proper functioning of the tide gates during the design storm event, it is proposed that the existing tide gates on the combined sewer outfall pipes that serve the drainage protected area be replaced as part of the Preferred Alternative.

Storm drainage that currently connects to the combined sewer system located on the unprotected side of the proposed flood protection system, would be rerouted and connected to the outfalls downstream of the tide gates. This would ensure the storm drainage system is isolated from the combined sewer system within the protected area and would eliminate the need for floodproofing of storm drains on the unprotected side of the flood protection system. Storm drainage that currently connects to the combined sewer system upstream of the tide gates that would be located on the protected side of the flood protection system would maintain its current configuration. Storm drainage that currently outlets downstream of the tide gates or to separate storm sewer outfalls that would be located on the protected side of the flood protection system would be rerouted to convey wet weather flow to the combined sewer system or outfitted with a tide gate to prevent against potential backflow into the protected area storm drain system under a design storm event.

Isolation Gate Valve

A sewer crosses from the protected to the unprotected side of the flood protection system alignment at the northern end of the drainage protected area. This conduit has the potential to convey floodwaters from unprotected study area sewers into the drainage protected area under a design storm event. To reduce this risk, an isolation gate valve is proposed to be installed on the sewer within regulator M-39, as shown in **Figure 5.8-4**. The gate valve would be closed in advance of a design storm event to isolate the drainage protected area and reopened following the design storm event.

DRAINAGE MANAGEMENT

In addition to the isolation measures outlined above, the Preferred Alternative includes drainage management elements to ameliorate the reduced sewer capacity due to outfall closure during a design storm event. The proposed drainage management would reduce the risk of sewer backups and associated flooding within the drainage protected area during a design storm. These drainage elements include installing additional combined sewers, termed “parallel conveyance,” within the drainage protected area to augment the capacity of the existing sewer system. Specifically, nine parallel conveyance connections are proposed, as shown in **Figure 5.8-4** and described below.

The existing branch interceptors—sewers that convey flow from the regulator to the main interceptor—generally define the system’s conveyance capacity. As described above, when outfall capacity is limited, sewer surcharge can occur once the capacity of the branch interceptors is met.

The parallel conveyance system, so named based on its functional orientation parallel to the existing branch interceptors, leverages the available capacity in the interceptor and Manhattan Pump Station by augmenting the upstream capacities of the branch interceptors and lateral sewers when the outfalls are closed or limited. The parallel conveyance would connect the lateral sewers to the interceptor in locations with the greatest ability to provide sewer surcharge relief under the design storm conditions as indicated by the InfoWorks model.

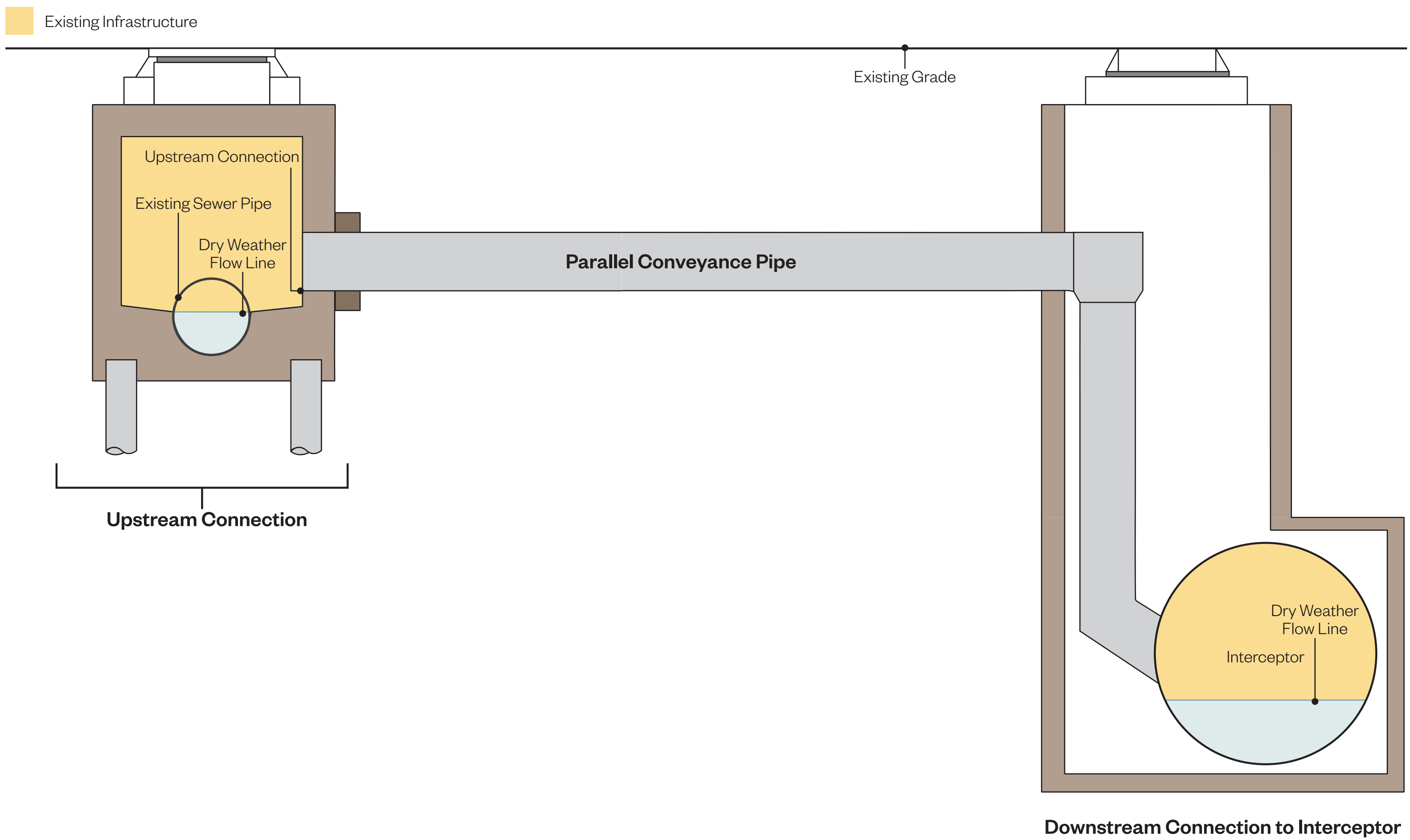
Parallel conveyance pipes are proposed at nine locations, namely for regulators M-22, M-23, M-27, M-28, M-31, M-37, M-38, M-38A, and M-38B. This parallel conveyance infrastructure would convey excess combined sewer flows to the interceptor, as shown in **Figure 5.8-4**. Each parallel conveyance pipe would consist of a new upstream connection to a regulator or lateral sewer, a downstream connection to the interceptor, and a connecting length of pipe. The parallel conveyance pipes would range from 18 to 48 inches in diameter and require no above ground features. The parallel conveyance would be sited within rights-of-way, where possible, similar to existing sewer pipes. Where siting is not possible within rights-of-way, some parallel conveyance infrastructure would be sited in private property. The parallel conveyance pipes and connections would include manholes for access similar to the existing sewer pipes, generally every 200 to 250 feet, at pipe bends, and at all connections to allow access for maintenance and repairs, as needed, and would be sited within roadways and paved pathways, where possible. The parallel conveyance concept is shown in **Figure 5.8-6**. In addition, similar to the parallel conveyance, this alternative also proposes to increase the size of the branch interceptor in order to increase the conveyance capacity to the Manhattan Pump Station for three sub-drainage areas within the protected area: M-33, M-34, and M-35, as shown in **Figure 5.8-4**.

INFRASTRUCTURE RECONSTRUCTION

The Preferred Alternative also includes reconstructing the water and sewer infrastructure within the portion of East River Park that would be elevated, including outfalls, regulators, tide gates and chambers, and other water and sewer infrastructure, to withstand the loads of the proposed flood protection system and elevated parkland, as shown in **Figure 5.8-7**. The outfalls and regulators within the portion of East River Park that would be elevated would also be replaced and hardened to account for resiliency. In some cases, the sewer infrastructure will be rebuilt with additional capacity compared to existing conditions. In most cases, the existing infrastructure would be abandoned in place and the new infrastructure would be reconstructed adjacent to the existing locations, although the outfalls would be relocated slightly along the East River Park bulkhead. Of the existing 11 outfalls, two would be combined as part of the outfall reconstruction effort.

NON-STORM CONDITIONS

Under non-storm conditions, implementation of the Preferred Alternative would not alter the normal function and performance of the combined sewer system. The large interceptor gates and the isolation gate valve in regulator M-39 would remain open. However, under rainfall events or periods of high sewer flow, combined sewer flow would be conveyed to the interceptor via both the existing branch interceptors and the parallel conveyance. During rainfall events that result in CSOs, there is a potential for redistribution of overflows in the across the outfalls in the study area due to the modifications described above. However, the overall volume of CSO from outfalls in the study area would not vary substantially from existing conditions and is not anticipated to impact water quality in the East River. A hydraulic model simulation indicated that with the proposed parallel conveyance in place, CSOs from outfalls within the project area would decrease compared to the No Action Alternative, while CSOs from outfalls upstream of the project area would increase



Not to Scale

Parallel Conveyance Concept
Figure 5.8-6

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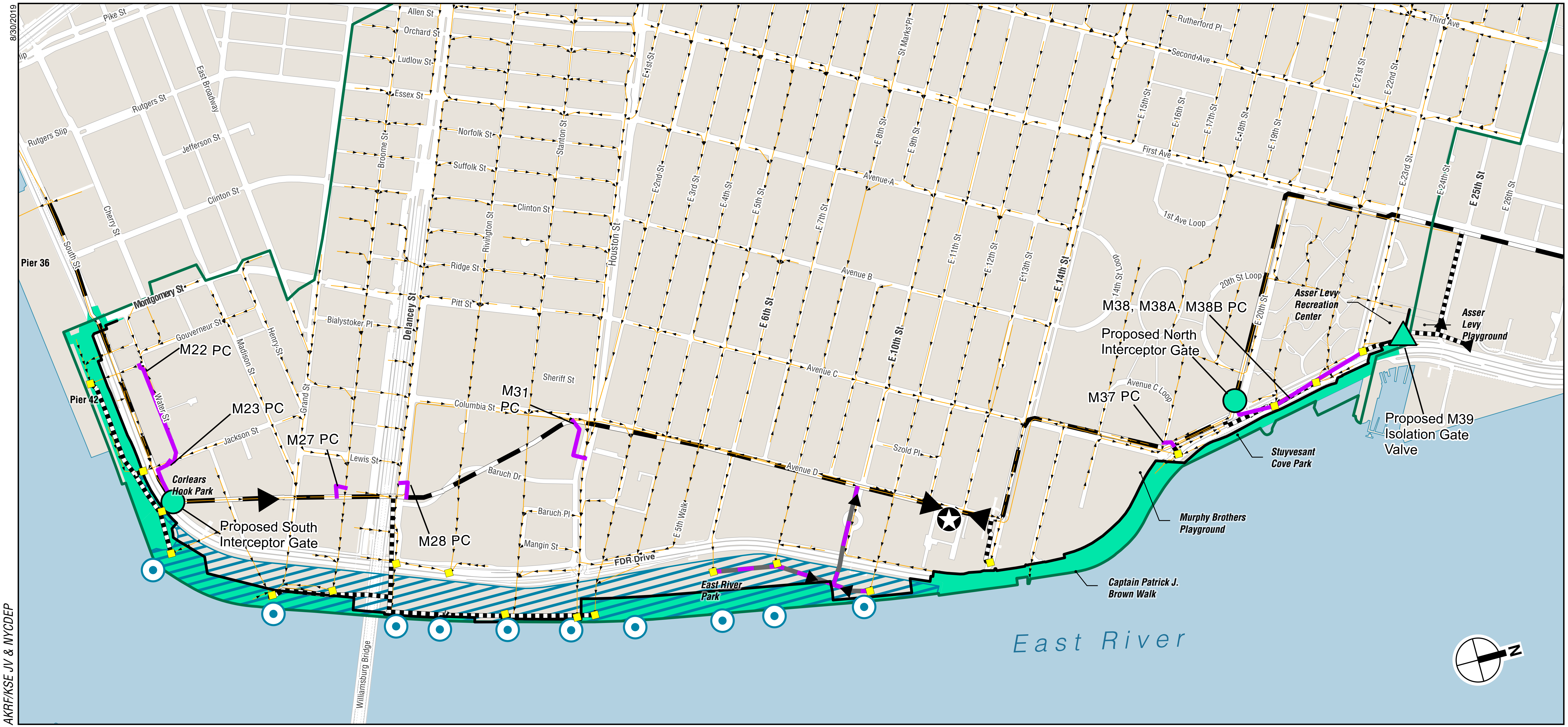

AKRF/KSE JV & NYCDEP

Drainage Isolation

Proposed Isolation Gate Valve at Regulator M-39

Proposed Interceptor Gate

Proposed Floodproofing of Unprotected Sewer Infrastructure

Drainage Management

Proposed Parallel Conveyance (PC)

Proposed Upsized Branch Interceptor

Infrastructure Reconstruction

Proposed Infrastructure Reconstruction

Proposed Reconstructed Outfall Location

Existing Regulators

Existing Lateral Sewers in Drainage Protected Area

Existing Branch Interceptors

Existing Interceptor

Manhattan Pump Station

Drainage Protected Area

Flood Protection Alignment

0 1,000 FEET

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EAST SIDE COASTAL RESILIENCY PROJECT

Infrastructure Reconstruction, Drainage Isolation, and Drainage Management Components
Figure 5.8-7

by approximately the same volume. While the annual CSO volumes would vary depending on annual rainfall and tidal conditions, this model simulation indicates no anticipated increase in total CSO volume from the study area as a result of constructing the proposed parallel conveyance. During wet weather events, storm water that flows into the reconfigured storm drainage system on the unprotected side of the flood protection system would flow to the outfalls, instead of to the combined sewer system as it does under existing conditions. This increase in storm water flows to the outfalls would not increase the volume of CSO from the outfalls.

STORM CONDITIONS

Sewer operations would differ from the No Action Alternative only when a design storm is forecast. Upon forecast of a design storm event, the proposed drainage infrastructure would be inspected for functionality and cleaned as needed. In accordance with pre-approved operation procedures, all closure structures would be put into place and manholes and regulator hatches on the unprotected side of the flood protection system alignment would be sealed to eliminate potential entryways for surge waters. In addition, the isolation gate valve on the northern unprotected lateral sewer in regulator M-39 would be closed.

Before the arrival of the design storm and in accordance with a pre-approved operations and maintenance protocol, the interceptor gates would be operated to isolate the drainage protected area from the study area. The interceptor gates would allow operational flexibility to manage the level of sewer service provided by the Manhattan Pump Station for areas upstream of the interceptor gates (i.e., outside of the protected area) via the smaller, secondary interceptor gates. During the design storm, the primary and secondary interceptor gates may be used to limit the interceptor flow from the areas upstream of the drainage protected area to provide additional capacity for drainage management within the drainage protected area and to protect the Manhattan Pump Station from receiving more flow than its rated capacity.

If the primary interceptor gates are fully closed, combined flow to the Manhattan Pump Station from the sewershed outside of the drainage protected area would be reduced. Complete closure of both the primary and secondary interceptor gates has the potential to increase the HGL within the main interceptor to the north and the south of the drainage protected area as the combined flow would no longer be conveyed to the Manhattan Pump Station. Since the main interceptor is fed by appurtenant branch interceptor pipes, the increased HGL within the main interceptor has the potential to result in increases in HGL within these branch interceptors and their upstream regulators and lateral sewers. However, whether and to what extent the elevation of HGL within the branch sewers increases depends upon a variety of factors, including the elevation of the branch interceptor connection points to the main interceptor and the outfall capacities at the regulators.

Modeling of the sewer system under the design storm conditions, including operation of the interceptor gates and other isolation measures, showed negligible increases in the HGL in the main interceptor to the north and south of the drainage protected area compared to the No Action Alternative. However, any additional sewer backup due to the interceptor gate closures is anticipated to occur in unprotected portions of the study area which would be affected by the design storm surge. Any minor contribution to this flooding due to sewer surcharge would be indiscernible from the surface flooding experienced as a result of the storm surge. If interceptor gate closure limits flow prior to a surge event, the outfalls to the north and south of the drainage protected area would continue to outlet excess flow through the outfalls until the surge is of sufficient height to close the outfall tide gates. In sum, any flooding experienced upstream of the interceptor gates would be comparable to flooding experienced under the No Action Alternative design storm condition.

During the design storm event, the storm surge would passively hold the tide gates closed, isolating the protected area combined sewer system from surge inundation. Excess combined sewer flow would be conveyed by the parallel conveyance and upsized branch interceptor to the interceptor, thereby maximizing drainage within the protected area and maximizing flow to the Manhattan Pump Station. Modeling results confirmed that the drainage isolation and management components proposed as part of the Preferred Alternative would address the flooding and sewer surcharge anticipated under the design storm conditions within the drainage protected area. Storm surge could result in overland flooding in areas on the unprotected side of the flood protection system alignment that are below the flood elevation and/or subject to wave action, sea level rise, and sewer surcharge, including portions of East River Park. However, the portions of East River Park that are vulnerable to these effects are significantly reduced under the Preferred Alternative compared to the No Action Alternative and Alternatives 2 and 3, described below.

In portions of the storm drainage system that do not connect to the combined sewer system, tide gates on storm outfalls would be held closed by storm surge, potentially resulting in storm sewer backups above the ground elevation. In these cases, wet weather flow would be managed locally without impacts to the protected area landscaping or land uses. The reconstructed outfalls proposed under this alternative would not change the current CSO volumes from the project drainage area.

Following a design storm event, once the surge waters recede and sewer levels equilibrate, the interceptor gates and other isolation measures would be returned to their non-storm condition positions. As the surge recedes, and the sewer system gradually equilibrates, the outfall tide gates would permit the release of excess combined flow and flooding in the areas north and south of the drainage protected area would gradually recede via the sewer system or overland flow back to the East River, as under the No Action Alternative.

ROUTINE OPERATION AND MAINTENANCE

The proposed drainage elements of the Preferred Alternative would not alter daily operation of existing sewer infrastructure in the study area under typical dry weather conditions. Operation and maintenance of this infrastructure would require trucks and personnel to access the proposed sewer infrastructure components (i.e., interceptor gate chambers and buildings, isolation gate valve, floodproofed manholes, regulators, tide gates, and parallel conveyance manholes and connections). Regular equipment exercising and inspection would be conducted for the proposed sewer infrastructure, in accordance with operation and maintenance procedures for the City’s sewer infrastructure and a pre-approved operations and maintenance protocol developed for the proposed project.

The Preferred Alternative would be consistent with all Federal, State, and City regulations, including the Clean Water Act, CSO Control Policy, and the CSO Abatement Program and CSO Long-Term Control Plan. Any water relocation or reconstruction associated with the Preferred Alternative will be done in accordance with the New York State Sanitary Code. Therefore, there would be no adverse effects to water and sewer infrastructure as a result of implementation of the Preferred Alternative.

OTHER ALTERNATIVE (ALTERNATIVE 2): FLOOD PROTECTION SYSTEM ON THE WEST SIDE OF EAST RIVER PARK – BASELINE

Alternative 2 would include the same drainage isolation and drainage management elements as the Preferred Alternative. In Project Area One, the line of flood protection would generally be located on the west side of East River Park instead of along the waterfront, which would require floodproofing more existing sewer infrastructure that would not be protected during design storm events and rerouting more storm drainage on the unprotected side of the flood protection system downstream of the tide gates. Alternative 2 would not require extensive reconstruction of water and sewer infrastructure in East River Park as the load on existing sewers would not significantly differ. However, as the existing infrastructure would not be reconstructed, the existing tide gates on outfalls serving the drainage protected area would be replaced to ensure their ability to prevent East River surge flows from entering the sewer system and inundating the drainage protected area. This would not alter the functionality of the existing systems. Operation of sewer infrastructure during non-storm and storm conditions would be the same as the Preferred Alternative. This alternative would continue to be consistent with the Clean Water Act, CSO Control Policy, and the CSO Abatement Program and CSO Long-Term Control Plan. Therefore, there would be no adverse effects to sewer infrastructure as a result of implementation of Alternative 2.

OTHER ALTERNATIVE (ALTERNATIVE 3): FLOOD PROTECTION SYSTEM ON THE WEST SIDE OF EAST RIVER PARK – ENHANCED PARK AND ACCESS

Alternative 3 would result in the same effects to sewer infrastructure as described for Alternative 2. Therefore, there would be no adverse effects to sewer infrastructure as a result of implementation of Alternative 3.

OTHER ALTERNATIVE (ALTERNATIVE 5): FLOOD PROTECTION SYSTEM EAST OF FDR DRIVE

Alternative 5 includes the same resiliency measures, drainage elements, underground park water and sewer infrastructure reconstruction, and park improvements identified under the Preferred Alternative. Fewer combined sewer system regulators and manholes would need to be floodproofed under this alternative, compared to the Preferred Alternative. Operation of sewer infrastructure during non-storm and storm conditions would be the same as the Preferred Alternative. This alternative would continue to be consistent with the Clean Water Act, CSO Control Policy, and the CSO Abatement Program and CSO Long-Term Control Plan. Therefore, there would be no adverse effects to sewer infrastructure as a result of implementation of Alternative 2. Therefore, there would be no adverse effects to sewer infrastructure as a result of implementation of Alternative 5. ✷