Chapter 14: Infrastructure

A. INTRODUCTION

This chapter evaluates the potential effects of the Proposed Actions on New York City's water supply, sanitary sewage treatment, and stormwater management infrastructure. It describes the existing water supply and wastewater infrastructure in the vicinity of the project sites and identifies changes to water supply, stormwater, and wastewater conditions that would occur in the Future with and without the Proposed Actions.

PRINCIPAL CONCLUSIONS

The Proposed Actions would result in increased demands on New York City's water supply and sanitary sewage treatment systems by as much as 1.25 million gallons per day. The municipal systems have adequate overall capacity to meet the projected demands, though local improvements in City water mains and sewer infrastructure will be necessary to relieve local constraints in water supply, sewer infrastructure, and stormwater management networks in order to accommodate the Proposed Actions. The City has committed to make these improvements, in the required timeframe, to support the proposed development that would result from the Proposed Actions. Therefore, the Proposed Actions would not have a significant adverse impact on the City water supply, sanitary sewage, and stormwater management systems.

In addition, these sewer and water demands would be reduced because the proposed developments would include sustainable design strategies to reduce potable water usage and sewage demands. For the Development Site, the Developer has committed to incorporating water conservation measures, rainwater collection systems and green roofs into the Development Site that would reduce demands on New York City's water supply and stormwater management systems. The Developer has also committed to seek Leadership in Energy and Environmental Design (LEED) Silver certification from the Green Building Certification Institute (GBCI), which prescribes at least a 20 percent reduction in water usage compared to the baseline condition. In addition, a portion of the increased sanitary sewage flow would be offset by diverting stormwater runoff from the combined sewer system to separate storm sewers and implementing water conservation measures as part of the Proposed Actions.

The New York City Department of Environmental Protection (DEP) water supply system has adequate capacity to supply the necessary water to meet the demands associated with each of the project sites; however, some new local distribution mains in the immediate vicinity of the Development Site would be required in order to meet project-generated demands and maintain service supply pressures for customers and fire protection. The *No. 7 Subway Extension – Hudson Yards Rezoning and Development Program Final Generic Environmental Impact Statement ("Hudson Yards FGEIS")* identified necessary modifications to water supply infrastructure to ensure that users throughout the Hudson Yards area have an adequate water supply at stable pressure for all conditions and to accommodate the redevelopment of the adjacent Hudson Yards area, including the Development Site.

The Proposed Actions would result in an increase in the volume of sanitary sewage generated and discharged into the DEP combined sewer system. The North River Water Pollution Control Plant has ample dry weather capacity to handle this additional sewage. New sanitary flows into the combined sewer system from the Development Site may exacerbate the combined sewer overflows (CSOs) at affected outfalls by displacing other wastewater volumes from other sources. Additional modeling was performed subsequent to the DEIS to analyze in greater detail the projected effects of the Proposed Actions on CSOs. This modeling indicates that during a representative year, the Proposed Actions would result in a minor increase in CSO volume and would not increase the number of CSO events associated with the North River Water Pollution Control Plant collection system as a whole, though one additional CSO event annually could occur at three outfalls. Nevertheless, because of the available assimilative capacity of the Hudson River, those increases were determined not to have a significant adverse impact on water quality. Under existing conditions, some stormwater runoff drains into the combined sewer system and can contribute to CSO events. Under the Proposed Actions, stormwater runoff would drain directly to the Hudson River and, therefore, would not contribute to CSO events. The Proposed Actions would also implement mechanisms at the Development Site to decrease sanitary flows, relative to the base flow analysis, to the combined sewer system and slow down and treat stormwater runoff to the Hudson River.

The Proposed Actions would reduce the quantity and improve the quality of stormwater runoff discharged from the Development Site with several measures. Landscaped areas would allow for some subsurface infiltration of rainfall, and green roofs and rainwater harvesting systems would provide additional runoff capture, and reduce the rate of discharges that would occur. The incorporation of best management practices (BMPs) into the stormwater management plan for the Development Site would result in reduced levels of suspended solids and other contaminants carried by surface runoff, thereby improving the quality of existing stormwater runoff from the Development Site that discharges directly into the Hudson River.

DEP has developed an Amended Drainage Plan for the Hudson Yards area that identifies improvements to the existing storm and combined sewer system infrastructure that are necessary to accommodate the full build out of the Hudson Yards area. The Amended Drainage Plan provides for the construction of new storm sewers along the West 33rd Street and Twelfth Avenue frontages of the Development Site that would divert existing stormwater runoff from the combined sewer system. The Amended Drainage Plan also identifies replacement of the existing combined sewer in West 33rd Street with a separate storm sewer and sanitary sewer. These sewers would be adequately sized to handle the flows that would be discharged from the Development Site as well as the adjacent Hudson Yards area, based on the development density allowed by the proposed zoning under the Proposed Actions.

The two Additional Housing Sites would generate minor additional sanitary sewage flows and sanitary sewage flows and site stormwater runoff would drain into the existing combined sewer system. Design and construction for the two Additional Housing Sites would incorporate BMPs and sustainable measures to control the rates of stormwater discharges from each site. Existing combined sewer infrastructure in the vicinity of the Additional Housing Sites is adequate to accommodate the relatively minor increases in flows that would be generated by the developments in these sites.

PlaNYC, the City's long-term sustainability plan, and the Sustainable Stormwater Management Plan (2008) developed by the Mayor's Office as a key initiative of PlaNYC, identify a number of strategies for meeting water quality goals that focus on promoting cost-effective source

controls for stormwater management. While the majority of the initiatives are targeted towards City agencies for implementation, the Proposed Actions would include the following measures consistent with PlaNYC and the Sustainable Stormwater Management Plan: (1) divert runoff from the combined sewer system into high level storm sewers (HLSS); (2) incorporate various source control features into proposed buildings and site open space design to promote stormwater collection and management to reduce the quantity of offsite discharges and improve the quality of runoff that is discharged into the Hudson River; and (3) incorporate measures to promote the efficient use and conservation of domestic water to reduce sewage generation rates.

B. METHODOLOGY

The *City Environmental Quality Review (CEQR) Technical Manual* identifies actions that may have an exceptionally large demand for water, such as large developments that use more than 1 million gallons per day (gpd), as potentially requiring an infrastructure assessment. A complete analysis of the potential impact of the Proposed Actions on the municipal water supply, wastewater treatment, and stormwater management systems has been completed in accordance with the *CEQR Technical Manual* guidelines.

As described in Chapter 2, "Framework for Analysis," the analysis of the Proposed Actions was performed for the expected year of completion of the project—2019. In addition, an assessment of the Proposed Actions' potential environmental impact was undertaken for a 2017 interim year of development. The following analysis considers the potential for significant adverse impacts of the Proposed Actions in the Future with the Proposed Actions condition (2019) and then for the interim Future with the Proposed Actions condition (2017).

WATER SUPPLY

In accordance with the *CEQR Technical Manual,* the study area for the water supply system evaluation includes the entire area serviced by the Croton gravity system in addition to pressure regulators from the Catskill/Delaware System. Water pressure regulators reduce the water pressure within the water mains to levels suitable for public use. The water supply system is a gravity-fed system which relies on the elevation gradient created by the heights of the Hillview Reservoir in Yonkers for Catskill/Delaware Water and the Jerome Park Reservoir in the Bronx for Croton water. Average daily water usage for existing and future conditions was calculated based on rates provided by the *CEQR Technical Manual*.

The estimated water demands that would be generated by the Proposed Actions were evaluated in terms of the existing water supply system capacity and the adequacy of existing supply distribution infrastructure to service these demands.

New York City has a comprehensive water conservation program to reduce water use through water metering and requirements that plumbing fixtures meet low-flow criteria in existing and new buildings (Local Law No. 29, 1989). The *CEQR Technical Manual* usage rates reflect the effects of Local Law No. 29. The usage rates estimated for the Proposed Actions do not include savings that would result if sustainable green building measures were incorporated into the proposed designs.

WASTEWATER

In conformance with the *CEQR Technical Manual,* the study area for the wastewater analysis includes the entire area serviced by the North River Water Pollution Control Plant. Consistent

with *CEQR Technical Manual* guidance, the volume of sanitary sewage that would be generated as a result of the Proposed Actions to be treated at the North River Water Pollution Control Plant is assumed to be equal to the estimated potable water demand, except for water use associated with air conditioning systems which typically result in minimal discharges to the sewer system from cooling towers and condensate losses. The estimated wastewater flow is evaluated relative to the current and projected volumes of wastewater that the North River Water Pollution Control Plant will treat, and whether the additional volume could result in the North River Water Pollution Control Plant exceeding the allowable discharge limits for the plant.

The existing sewer network in the vicinity of the Development Site was identified in the *Hudson Yards FGEIS* as insufficient to handle projected demand that would be associated with the Hudson Yards area projected development. As a result, the DEP has prepared an Amended Drainage Plan for the Hudson Yards area, which includes the area bounded to the west by Twelfth Avenue and to the east by Tenth Avenue, between West 40th Street and West 32nd Street, and which includes the northern portion of the Development Site. The adequacy of this Amended Drainage Plan to accommodate the additional wastewater that would be generated by the Proposed Actions is evaluated in order to identify requirements for any additional sewer infrastructure.

STORMWATER

In accordance with the *CEQR Technical Manual*, stormwater can be of concern if it transmits new or increased levels of pollutants to the City's water bodies, which in the case of the Proposed Actions is the Hudson River. This is particularly of concern for development of sites that would result in new areas of impervious surfaces creating a large increase in the discharge rate of stormwater runoff offsite, or, if the development would result in an increase in wastewater flows in a combined sewer system.

During wet weather events, excess diluted wastewater (sewage and stormwater runoff) flows could be discharged into the Hudson River through CSOs. Adverse impacts would occur if the Proposed Actions would result in significant degradation to the water quality of the Hudson River, increase the frequency or extent of CSO events or flooding, or increase the levels of erosion and sedimentation from activities associated with the Proposed Actions. A detailed hydraulic model was applied for the *Hudson Yards FGEIS* to provide a cumulative assessment of CSOs from the entire North River drainage area for future conditions. The results of this hydraulic study (*Analysis of Combined Sewer Overflows and Future Water Quality*, prepared by HydroQual Environmental Engineers and Scientists, PC in association with HydroQual, Inc, October 27, 2004) are used as the basis for assessing the potential impact of the Proposed Actions on water quality.

Subsequently, HydroQual performed additional detailed analyses using an updated model of the North River Water Pollution Control Plant collection system to explicitly examine the impacts of the Proposed Actions on the system hydraulics and CSOs. The additional analyses involved modeling the Development Site as a distinct subcatchment, and adjusting model inputs to be consistent with the assumptions detailed in Chapter 2, "Framework for Analysis," for projected development by 2019 in the Future with and without the Proposed Actions. This supplemental study is summarized in Appendix M1.

Stormwater management systems that may be incorporated into the Proposed Actions are evaluated for impact on the number and severity of CSO events and other water quality considerations that may be associated with stormwater runoff from the project sites.

C. EXISTING CONDITIONS

WATER SUPPLY

The City water supply system is operated and maintained by DEP. The City's domestic drinking water supply is provided by reservoirs in the Catskill, Delaware, and Croton watersheds in Upstate New York. Water is conveyed to the City from these watersheds via a series of reservoirs, aqueducts, and tunnels, over a distance of approximately 125 miles. Water from the Catskill/Delaware System is conveyed by Water Tunnel No. 1, which provides water to the boroughs of the Bronx, Manhattan, and Brooklyn; and Water Tunnel No. 2, which serves the Bronx, Queens, Brooklyn, and Staten Island. Water from the Croton System is conveyed from Westchester and Putnam Counties via the New Croton Aqueduct to the Bronx and Manhattan.

A third tunnel, Water Tunnel No. 3, originating at Hillview Reservoir in Yonkers, is under construction. Water Tunnel No. 3 is intended to improve the City's water supply, and allow for the inspection and necessary repair of the century-old Water Tunnels No. 1 and No. 2. The first phase of Water Tunnel No. 3 has been constructed, a portion of which now serves the Bronx, upper Manhattan, and Roosevelt Island. Phase 2 of Water Tunnel No. 3, currently under construction, is intended to provide service to Midtown and Lower Manhattan, Brooklyn, and Queens. It is anticipated that the Manhattan leg will be completed and become operational in 2013, providing improved water supply to the project sites and surrounding area. One of the construction access shafts for Phase 2 work on the tunnel is located adjacent to the Tenth Avenue Site. Another access shaft is located on the eastern portion of the Caemmerer Rail Yard (Eastern Rail Yard) near Tenth Avenue and West 30th Street.

Manhattan, including the project sites, is served by the Catskill/Delaware System via Water Tunnel No. 1 and the Croton System. The project sites are located within two water pressure zones: the Low and Middle Intermediate Pressure Zones. The Low Pressure Zone, which is generally located between Tenth and Twelfth Avenues, is primarily fed by the Croton System, but also uses Catskill/Delaware System regulators located at West 135th Street as backup feeds. The Middle Intermediate Pressure Zone, located east of the Low Pressure Zone between West 34th and West 54th Streets, is fed through multiple regulators along Sixth Avenue from Water Tunnel No. 1. In the vicinity of the project sites, Water Tunnel No. 1 is located several hundred feet below Sixth Avenue and Broadway. Water Tunnel No. 1 ranges between 10 and 14 feet in diameter. Water ascends from Water Tunnel No. 1 through shafts at West 42nd and West 23rd Streets to trunk mains ranging between 20 inches and 48 inches in diameter, which are typically buried at least four feet below grade. The gravity-fed system provides an average of 40 to 45 pounds per square inch (psi) of water pressure within the trunk mains that supply the project sites. Slight variations in pressure can occur during peak use periods and while fire hydrants are in use.

The Development Site is located entirely within the Low Pressure Zone which historically had supply constraints because the Amtrak Empire Line railroad cut, which runs north of West 33rd Street between Tenth and Eleventh Avenues, precluded frequent cross supply connections in local east-west streets between trunk mains within the Low Pressure Zone and trunk mains of the Middle Intermediate Pressure Zone farther to the east.

The principal trunk mains that would supply the Development Site run north-to-south in nearby avenues. These include a 36-inch main in Tenth Avenue that reduces to a 20-inch main south of West 34th Street; and two 20-inch mains under Twelfth Avenue (Route 9A). A trunk main in

Eleventh Avenue extends south only as far as West 38th Street. The trunk mains feed distribution mains, which form a network of smaller diameter pipes, most commonly of 12-inch and 20-inch diameter, that run in both east-to-west cross streets and the avenues in the general vicinity of the project sites and provide water sources to individual buildings and fire hydrants. The Development Site is serviced by existing 12-inch mains in both West 30th and West 33rd Streets, as well as the 20-inch diameter trunk mains in Twelfth Avenue. There are no trunk or distribution water mains located along the eastern frontage of the Development Site between the abutments of the Eleventh Avenue viaduct.

On average, the City currently consumes approximately 1.1 billion gallons of water each day. Daily consumption peaked at 1.512 billion gallons per day in 1979, when the City's population was 7.1 million. Despite an increase to the current population of 8.2 million, as well as substantial levels of new construction and redevelopment citywide, average daily consumption has been slowly declining each year so that current consumption is approximately 28 percent less than the 1979 peak. These reductions in water consumption are attributed to several factors, including installation of water-saving plumbing fixtures in renovations and new construction as mandated by Local Law 29 of 1989, improved system repair and maintenance to reduce pipe leakage and other system losses, and metering of usage.

The Development Site contains several Long Island Rail Road (LIRR) buildings that support the daily operations of the LIRR, including: a railroad interior cleaning facility with a raised platform, a yard operations building, a transportation building, an emergency facilities building, and storage. The southern section of the Development Site, between West 30th Street and the approximate location of West 31st Street, includes land ("terra firma") that is not occupied by LIRR operations. A portion of the terra firma is currently occupied on a month-to-month basis by a private bus operator, the New York City Department of Sanitation (DSNY), and a New York City Transit (NYCT) storage area. The High Line runs along Twelfth Avenue, the western edge of the Development Site, and along West 30th Street, the southern boundary of the Development Site.

Existing water consumption at the Development Site is primarily related to LIRR operations within the Caemmerer Rail Yard, which include interior cleaning of commuter railcars. The Caemmerer Rail Yard contains an internal water distribution piping network, supplied from the DEP system, for domestic supply, yard hydrants, and other fire protection systems.

Water consumption and sanitary sewage generation from these existing uses is estimated based upon the number of employees and the various site activities. No vehicle car washing is performed at these facilities. Water consumption and sanitary sewage discharge rates have been conservatively estimated to be equivalent, although losses due to leakage, evaporation, and other factors typically result in marginally lower sewage discharges compared to water consumption rates. Estimated existing daily water usage and sewage generation rates for the Development Site are presented in Table 14-1.

Table 14-1
Development Site:
Existing Water Consumption and Sanitary Sewage

Uses	Estimated Staffing Level By Shift				Rate (gpd/ person)	Total (gpd)
	Day	Evening	Night	Total		
Caemmerer Rail Yard (LIRR) Staff Uses						
Railcar Mechanics Building: Staff	30	9	9	48	25	1,200
Railcar Mechanics Building: Police	2	2	2	6	25	150
Railcar Appearance Maintainers Building: Staff	56	10	10	76	25	1,900
Storage and Toilet Repair Building: Staff	7	4	4	15	25	375
Subtotal: Caemmerer Rail Yard Staff Domestic Sewage						*3,625*
Toilet Servicing of Trainsets: Cars Per Shift	75	20	50	145	100	14,500
Caemmerer Rail Yard Totals						**18,125**
Other Uses along West 30th Street (estimated)				200	25	5,000
TOTAL						**23,125**

Note: gpd = gallons per day
Source: LIRR

Existing water consumption at the Additional Housing Sites is negligible. The Ninth Avenue Site, located at the southeast corner of the intersection of Ninth Avenue and West 54th Street, is currently a parking lot for an adjacent NYCT maintenance facility. The Tenth Avenue Site, located west of Tenth Avenue and extending for the full block between West 47th and West 48th Streets, consists of the airspace over the existing open cut for Amtrak's Empire Line railroad tracks. The Ninth Avenue Site is serviced by existing 12-inch distribution mains in West 54th Street and Ninth Avenue. The Tenth Avenue Site is similarly serviced by 12-inch diameter mains. There are 48-inch diameter trunk mains located in both Ninth and Tenth Avenues in the vicinity of the Additional Housing Sites.

WASTEWATER AND STORMWATER

Most sanitary sewage in the City is collected and conveyed through a combined sewer system operated and maintained by DEP. The system treats approximately 1.4 billion gallons of wastewater daily. A combined sewer system conveys sanitary sewage to the Water Pollution Control Plant in dry weather and a combination of stormwater and sanitary sewage in wet weather. The sanitary sewage comes from residential, commercial, industrial, and municipal buildings. The stormwater runoff drains from City streets, building roofs, and other site surfaces. The local collection sewers connect to larger trunk and interceptor sewers. Each trunk sewer feeds into the interceptor sewer through a "regulator" chamber that controls the flow from the trunk sewer to the interceptor.

When the combined wet weather flow exceeds the capacity of sewers conveying the effluent to the Water Pollution Control Plant or the capacity of the Water Pollution Control Plant to treat it, some fraction will overflow into the nearest surface water body. The purpose of a regulator is to divert sanitary flow from the combined sewers to the intercepting sewer during normal flow periods (dry weather), and limit the flow to the intercepting sewer to twice dry weather flow during storm events (wet weather). Tide gates placed on the CSO downstream of the regulator chamber keep tidewater from backflowing into the regulator chamber during periods of low sewer flow.

Generally, stormwater contains lower concentrations of pollutants than sanitary sewage. As a result, the concentration of pollutants in combined sewage discharges during CSO events will be

lower than if the discharge consisted solely of sanitary sewage; however, because some CSO discharges can cause violations of water quality standards, the City is taking various steps to reduce the frequency and severity of CSO events. In 2007, DEP treated 447 billion gallons of sanitary sewage and 35 billion gallons of stormwater. Wet weather capture and treatment volumes at Water Pollution Control Plants have increased over time and are estimated to capture and treat about 75 percent of the combined sewage present in the sewer system each year. Because of the costs associated with expanding Water Pollution Control Plant capacity and operation, the City now requires new development projects to consider source control mechanisms to reduce the volumes of sanitary sewage and stormwater.

The Proposed Actions are located within the service area for the North River Water Pollution Control Plant, which is located on a platform over the Hudson River in Manhattan along Twelfth Avenue, between West 135th and West 145th Streets. The North River Water Pollution Control Plant service area extends from Bank Street to the northern tip of Manhattan, and from Central Park west to the Hudson River. South of Central Park, the eastern boundary of the district generally follows Broadway.

The North River Water Pollution Control Plant is regulated by the New York State Department of Environmental Conservation (NYSDEC), which issues a permit regulating its discharge of treated effluent. This State Pollutant Discharge Elimination System (SPDES) permit restricts the daily flow at the plant to 170 million gallons per day (mgd), based on a 12-month rolling average. The daily flow averaged 126 mgd, in 2008, well below the 170 mgd permitted limit. The North River Water Pollution Control Plant has a wet-weather capacity of 340 mgd, or twice its permitted dry-weather discharge rate, to allow for the treatment of peak dry weather flows and some wet weather flow.

The sewers in the vicinity of the project sites are part of the network of combined sewers consisting of small diameter collector pipes and larger trunk and interceptor sewers. The ages of these sewers vary greatly, but most of the sewers in the area were installed between the 1840s and 1940s. Generally, wastewater generated in the vicinity of the project sites flows westerly and northerly in collector and trunk sewers towards the intercepting sewer under Twelfth Avenue.

The intercepting sewer (under Twelfth Avenue) serving the area in the vicinity of the project sites is an 8' x 8' sewer between West 26th Street and West 40th Street and 8'-6" x 8'-6" sewer between West 40th Street and West 49th Street. Flow into the intercepting sewer is controlled by regulators along the length of the intercepting sewer. Regulators that would likely handle wastewater generated by the Proposed Actions at all the project sites are located at West 30th Street (N-45, SPDES Outfall No. 027), West 34th Street (N-44, SPDES Outfall No. 052) and West 48th Street (N-34 & N-33, SPDES Outfall No. 033).

As part of the *Hudson Yards FGEIS*, a detailed analysis of the additional pollutant loadings and potential impacts on the water quality of the Hudson River was performed by HydroQual Environmental Engineers and Scientists, P.C. in association with HydroQual, Inc. (HydroQual). The analysis included a detailed hydraulic model to analyze the size and number of CSO events associated with the North River Water Pollution Control Plant tributary area, and used this model to estimate the impacts of the Hudson Yards area projected development and other assumed developments throughout the tributary area on future CSO events. The study used 2003 DEP operational practices, among other inputs, to estimate CSO volumes.

As a result of SPDES permit requirements and other regulatory actions, DEP is required to engage in a series of BMPs that have been developed to maximize wastewater flows to the

Water Pollution Control Plant for treatment, improve the quality of stormwater entering the system, and install improved monitoring and control instrumentation, among other items to improve system operation and improve water quality. In implementing these BMPs, DEP has since 2004 operated the North River Water Pollution Control Plant in a manner that has allowed higher wet-weather inflow rates than in the past while still avoiding disruptions to the treatment process. These enhanced "throttling" practices, which were not included in the earlier *Hudson Yards FGEIS* analysis, have allowed the Water Pollution Control Plant to maintain flow rates very close to the permitted capacity of 340 mgd for extended periods in wet weather, thereby reducing CSO discharges to the receiving waters.

As discussed above for water supply, the sanitary sewage generated by existing uses at the Development Site was estimated based on staffing levels provided by LIRR for the various operations contained within the Caemmerer Rail Yard, and consideration of the activities and facilities of other uses at the Development Site (see Table 14-1).

A sanitary sewer system collects sanitary sewage from facilities throughout the Caemmerer Rail Yard and conveys it to a pumping station, located west of, and near the south abutment of the Eleventh Avenue viaduct which crosses over the rail yard. The pumping station conveys sewage from the Caemmerer Rail Yard by force main into the DEP combined system via a 4' x 2' - 8" sewer that runs from the viaduct abutment southward to tie into a trunk sewer network that runs west in West 30th Street to the interceptor sewer in Twelfth Avenue. Site connections servicing the other use along the West 30th Street frontage of the Development Site also tie into the West 30th Street sewers.

Combined sewers are located within the streets fronting the Additional Housing Sites. However, these sites do not generate any existing sanitary sewage because the Ninth Avenue Site is a parking lot and the Tenth Avenue Site contains the airspace above the Amtrak's Empire Line railroad tracks.

An extensive closed system of inlets and underground piping drains the existing Caemmerer Rail Yard. The surfaces are covered by a densely packed configuration of railroad tracks, paved service lanes and access roads, building roofs, and other paved work pads. As a result, the surface is largely impervious and most of the rainwater landing on the site is channeled as runoff into the yard drainage system. All of the Caemmerer Rail Yard stormwater runoff is conveyed to a 43" x 68" box culvert that runs westerly near the southern boundary of the yard to outfall into the Hudson River. The culvert exits the Caemmerer Rail Yard near the extension of West 31st Street with Twelfth Avenue. The culvert runs south under the southbound lanes of Twelfth Avenue to tie into a DEP combined sewer outfall at West 30th Street downstream of Regulator N-45. Because the tie-in for the LIRR private sewer is downstream of the regulator chamber, the runoff from the Caemmerer Rail Yard has no opportunity to discharge into the City combined sewer system, and instead is considered to be a direct stormwater discharge into the Hudson River. The outfall is regulated under the NYSDEC's General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s). The LIRR is the permittee for the MS4 stormwater discharge from the Caemmerer Rail Yard.

The existing DSNY, bus storage, and NYCT facilities located along the West 30th Street frontage of the Development Site are entirely impervious, covered by buildings, pavement, and the viaduct for the unused elevated High Line. Stormwater runoff from these facilities drains by a combination of inlet drains and surface flows into street catch basins into the existing combined sewer system within West 30th Street. Depending on downstream flows within the interceptor sewer, Regulator N-45 either allows this drainage with effluent from other sources entering the regulator to drain

into the interceptor sewer for treatment at the North River Water Pollution Control Plant, or diverts some or all of the flows as a CSO event to discharge directly into the Hudson River.

The Additional Housing Sites drain into DEP combined sewers. The Ninth Avenue Site, currently used as a surface parking lot, drains via surface flow into the existing combined sewers located within the frontage streets. The ground surface is relatively impervious because it is a combination of hard packed gravel and remnants of ground floor and pavement slabs left from the demolition of buildings which previously occupied the site. The Tenth Avenue Site is an open cut, below surrounding grades, for Amtrak's Empire Line. This railroad line consists of two tracks on ballasted bed. The cut has a series of inlets that collect excess runoff which connects to the DEP combined sewer system at multiple locations along the length of the line; however, the majority of runoff that accumulates in the cut in this vicinity drains via infiltration into the subgrade.

Existing stormwater runoff from the project sites has been estimated based on existing surface conditions and applying standard runoff coefficients to the Rational Formula. The Rational Formula is used for estimating stormwater runoff rates from sites, which relates peak discharge from the site to the average rainfall intensity over the time period required for the flow to concentrate over the site (rainfall intensity), the surface characteristics of the site (runoff coefficient), and the site area (drainage tributary area). The runoff rate is greatest for a site that is covered by impervious surfaces such as building roofs and pavements, and least for flat, heavily landscaped sites that retain a majority of the rainfall through surface infiltration, absorption, and temporary storage.

Composite runoff coefficients, weighted to reflect the relative percentages of the various types of existing ground surfaces, have been calculated for each of the project sites, as shown in Table 14-2 for the Development Site and Table 14-3 for the Additional Housing Sites. As shown in the tables, both the existing LIRR Yard (Site A) and the DSNY/NYCT/bus storage (Site B) portions of the Development Site are relatively impervious and nearly all stormwater is discharged offsite.

Table 14-2
Development Site:
Existing Site Drainage - Composite Runoff Coefficient

	Surface type[1]	Roof[2]	Paved	Railroad Tracks	Grass and Softscape	Total
LIRR Yard (Site A)	Percent of Area	6%	13%	81%	0%	100%
	Surface Area (sf)	26,973	58,442	364,135	-	449,550
	Runoff Coefficient	1.00	0.85	0.85	0.20	0.86
Other Site Uses - West 30th St. Frontage (Site B)	Percent of Area	31%	69%	0%	0%	100%
	Surface Area (sf)	37,382	83,204	-		120,586
	Runoff Coefficient	1.00	0.85	0.85	0.20	0.90

Notes: sf = square feet
1. Runoff coefficients for each surface type provided by DEP.
2. Roof areas include four buildings and the High Line.

Table 14-3
Additional Housing Sites:
Existing Site Drainage - Composite Runoff Coefficient

	Surface type[1]	Roof	Paved	Railroad Tracks[2]	Grass and Softscape	Total
Ninth Avenue Site	Percent of Area	0%	100%	0%	0%	100%
	Surface Area (sf)	-	23,712	-	-	23,712
	Runoff Coefficient	1.00	0.85	N/A	0.20	0.85
Tenth Avenue Site	Percent of Area	0%	0%	100%	0%	100%
	Surface Area (sf)	-	-	20,000	-	20,000
	Runoff Coefficient	1.00	0.85	0.20	0.20	0.20

Notes: sf = square feet; N/A = not applicable
1. Runoff coefficients for each surface type provided by DEP.
2. Open rail cut with minimal closed drainage system connections tying into DEP system.

A similar runoff characteristic is indicated for the Ninth Avenue Site. Only the Tenth Avenue Site has a low runoff coefficient because the site consists entirely of unpaved railroad cut that has a limited closed drainage system.

The existing wastewater and stormwater discharge characteristics for the project sites were estimated for various rainfall events including an average rainfall event expected in a representative year, 90th percentile rainfall event, and 100th percentile rainfall event, to depict the existing discharge volumes into combined sewer system and discharge volumes directly into the Hudson River. Using the existing sanitary sewage rates (see Table 14-1) for the Development Site and the composite runoff coefficients (see Table 14-2 and 14-3), flow volumes from the project sites have been estimated for a range of rainfall events, as shown on Table 14-4 for the Development Site and Table 14-5 for the Additional Housing Sites.

Table 14-4
Development Site:
Existing Stormwater[1] and Sanitary Sewage[2] Flow Volumes

		Site A - LIRR Caemmerer Yard[3]				Site B - West 30th Street Frontage[4]				Sites A&B
Rainfall Volume (in) *	Rainfall Duration (hr)*	Runoff Volume To River (mg)[5]	Runoff Volume To CSS (mg)	Sanitary Volume To CSS (mg)	Total Volume To CSS (mg)	Runoff Volume To River (mg)	Runoff Volume To CSS (mg) [6]	Sanitary Volume To CSS (mg)	Total Volume To CSS (mg)	Total Volume To CSS (mg)
0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.40	3.00	0.10	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03
1.20	10.00	0.29	0.00	0.01	0.01	0.00	0.08	0.00	0.08	0.09
2.50	26.00	0.60	0.00	0.02	0.02	0.00	0.17	0.00	0.17	0.19

Notes:
CSS = combined sewer system
* Based on information provided by DEP.

1. Runoff volumes for existing conditions have been calculated as follows:
   Qvol = [Rvol x A x RC x 7.48gal/1,000,000mgd per gal], where
   Qvol = Total volume of Rainfall for 24-hour storm event discharged offsite, mg
   Rvol = Rainfall Volume, in inches for the corresponding Rainfall Return Period listed
   A = Site Area, in sq ft
   RC = Rainfall Runoff Coefficient, as per Table 14-2.
2. See Table 14-1 for estimate of existing sanitary flows.
3. Area = 449,550 sf (10.32 acres)
4. Area = 120,586 sf (2.77 acres)
5. Caemmerer Rail Yard storm drain ties into DEP West 30th Street outfall downstream of Regulator 45.
6. Site B drains into West 30th Street combined sewer (upstream of Regulator 45).

Table 14-5
Additional Housing Sites:
Existing Stormwater[1] and Sanitary Sewage[2] Flow Volumes

		Ninth Avenue Site[3]				Tenth Avenue Site[4]				Both
Rainfall Volume (in) *	Rainfall Duration (hr)*	Runoff Volume To River (mg)	Runoff Volume To CSS (mg) [5]	Sanitary Volume To CSS (mg)	Total Volume To CSS (mg)	Runoff Volume To River (mg)	Runoff Volume To CSS (mg)	Sanitary Volume To CSS (mg)[5]	Total Volume To CSS (mg)	Total Volume To CSS (mg)
0.00	3.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.40	3.00	0.000	0.005	0.000	0.005	0.000	0.001	0.000	0.001	0.006
1.20	10.00	0.000	0.015	0.000	0.015	0.000	0.003	0.000	0.003	0.018
2.50	26.00	0.000	0.031	0.000	0.031	0.000	0.006	0.000	0.006	0.038

Notes:
CSS = combined sewer system
* Based on information provided by DEP.

1. Runoff volumes for existing conditions have been calculated as follows:
   Qvol = [R_{vol} x A x RC x 7.48gal/1,000,000mgd per gal], where
   Q_{vol} = Total volume of Rainfall for 24-hour storm event discharged offsite, mg
   R_{vol} = Rainfall Volume, in inches for the corresponding Rainfall Return Period listed
   A = Site Area, in sq ft
   RC = Rainfall Runoff Coefficient, as per Table 14-3.
2. There are no existing sanitary flows from either Additional Housing Site.
3. Area = 23,712 sf (0.54 acre).
4. Area = 20,000 sf (0.46 acre).
5. All site runoff discharges into the combined sewer system.

Runoff rates from rainfall events are typically calculated as the volume of flow over a specific period of time. Sewage flows are more typically estimated based on average daily sewage flows as mgd. As a result, for purposes of comparison to the CSO volumes at affected outfalls, the flow volume tables show rates as converted from cfs and mgd to volumes in millions of gallons (MG) based on specific rainfall durations for the 1988 calendar year.

Based on the volume estimates shown in Tables 14-4 and 14-5, it is clear that the existing project sites generate minimal sanitary sewage, and the majority of the demands on the City combined sewer system come from stormwater runoff. The largest generator of stormwater runoff, the existing LIRR yard, discharges directly into the Hudson River.

Existing sanitary sewage flows from the Development Site are minor when compared to baseline generation from the surrounding area. The *Hudson Yards FGEIS* estimated existing sewage demand within the Hudson Yards rezoning area to be 1.1 mgd. The 0.02 mgd demand estimate for total sanitary sewage generation from the Development Site is approximately 2.7 percent of the total sewage generation for the surrounding area.

D. THE FUTURE WITHOUT THE PROPOSED ACTIONS

It is assumed that operations within the Western Rail Yard in the Future without the Proposed Actions would continue much the same as existing conditions. As described in Chapter 2, "Framework for Analysis," some of the Hudson Yards area projected development will occur by 2019 in the Future without the Proposed Actions. It is also assumed that the related infrastructure improvements—the DEP Trunk Plan and the Amended Drainage Plan—would be implemented as necessary to meet the additional demands generated by the developments associated with the Hudson Yards rezoning.

WATER SUPPLY

The overall water supply system in New York City is not expected to be affected in the Future without the Proposed Actions. It is anticipated that DEP will institute a new City-wide water conservation program as outlined in PlaNYC to reduce daily usage demand by 5 percent or 60 mgd. The results of this conservation initiative may offset much of the increased demands City-wide that may result from population growth and new development. DEP has updated the Manhattan Trunk Main Master Plan (hereafter referred to as "Trunk Plan"). The Trunk Plan is an overview of the rehabilitation required to the existing, aging trunk water main system in Manhattan (20 inches and larger). Improvements, mainly connections to Water Tunnel No. 3, which are presently under construction, are included in this plan. As described in the *Hudson Yards FGEIS*, water supply improvements necessitated by the Hudson Yards area projected development are accounted for in the Trunk Plan.

In the 2019 analysis year, it is assumed that the LIRR uses currently on the Development Site would remain, and no notable changes would be expected with respect to water supply requirements. By 2019, some of the development associated with the Hudson Yards rezoning will be under construction (see Chapter 2, "Framework for Analysis," for a detailed list of these projects). In addition, it is assumed that the necessary expansions and upgrades of the local DEP water distribution network in the vicinity, as identified in the *Hudson Yards FGEIS*, will have been completed in accordance with DEP's Trunk Plan. Improvements to the water distribution network will include the installation of a new water main along Eleventh Avenue between West 38th and West 29th Streets, and upgrades to the water main along Tenth Avenue. Depending on the construction program for other infrastructure improvements in local streets to accommodate the Hudson Yards projected development, additional aging distribution mains may also be replaced and upsized in various local cross streets.

By 2019, it is likely that the Manhattan segment of Phase 2 construction of Water Tunnel No. 3 will be completed. Completion of the tunnel and implementation of components of the Trunk Plan, which will connect supply shafts from the Water Tunnel No. 3 into the trunk network, will provide additional supply and system pressure stability to the local service area in which the project sites are located. Existing system distribution supply pressure is an average of 40 to 45 pounds per square inch (psi) of water pressure within the trunk mains supplying the study area, but variations in pressure occur during peak use periods and when fire hydrants are in use.

The *Hudson Yards FGEIS* estimated water usage within the Hudson Yards area will increase to 4.7 mgd from the existing 1.1 mgd, and ultimately reach 13.2 mgd when the full build-out of the Hudson Yards area occurs (assumed to be in 2025). These estimated demand numbers include water required for domestic use as well as makeup water for air conditioning systems. As identified in the *Hudson Yards FGEIS*, with the improvements to system infrastructure in place, these demand requirements can be adequately serviced.

WASTEWATER AND STORMWATER

The project sites would continue to be served by the North River Water Pollution Control Plant and the sanitary sewage treatment system and local storm and combined sewers in the vicinity of the project sites would not be affected in the Future without the Proposed Actions, similar to the conditions described above for future water supply. Stormwater and sanitary sewage generation rates from the various facilities located at the project sites would continue at levels the same as existing rates.

Assuming that sanitary sewage rates from the Hudson Yards area projected development increase at the same rate as estimated water supply demands, the sewage load on the North River Water Pollution Control Plant system will increase to 2.8 mgd from the existing 1.1 mgd, and ultimately reach 8.6 mgd when the full build-out of Hudson Yards area occurs. The majority of these loads will be handled by the combined sewer system, which will require improvements to accommodate the substantial increase in sanitary sewage generation that will occur as a result of additional growth and development within the Hudson Yards area.

DEP has developed an Amended Drainage Plan for the Hudson Yard area. As part of the Amended Drainage Plan for the Hudson Yards area, a new 4′ x 2′ storm sewer is proposed for installation in West 33rd Street from Eleventh Avenue west to the outfall at the Hudson River. This storm sewer would divert some stormwater runoff from the combined sewers that connect to Regulator N-44 (SPDES Outfall No. 052); thereby accommodating increased sanitary sewage flows into the regulator without significantly impacting CSO events. Other infrastructure improvements in the Amended Drainage Plan include a parallel 5′ x 4′ combined sewer along West 33rd Street that would connect to the intercepting sewer through Regulator N-43 at West 36th Street and Twelfth Avenue. The Amended Drainage Plan does not affect the existing combined sewers that run west along West 30th Street from Eleventh Avenue to Regulator N-45.

The HydroQual sewer modeling study prepared for the *Hudson Yards FGEIS* analyzed impacts that the Hudson Yards area projected development and other assumed local development and population growth would have on CSO events and water quality as a result of the CSO discharges. For the full build-out of the Hudson Yards area, the study employed a regional model and distributed sanitary flows associated with these developments across affected catchment areas. The projected increases in future CSO discharges were based on conservative assumptions that do not reflect the Amended Drainage Plan provisions for diversion of some stormwater runoff into separate storm sewers from the combined sewer system, other possible system modifications to allow additional flows to be effectively transported within the interceptor sewer for treatment, and the impact that various sustainable design elements could have on reducing the overall increase in sewage and stormwater runoff generated by the Hudson Yards area projected development. The HydroQual study for the *Hudson Yards FGEIS* used the projected CSO volumes as the basis for assessing the impacts of the additional CSO discharges on water quality of the Hudson River, and concluded that these water quality impacts would be minimal. The HydroQual study calculated pollutant loadings using observed discharge concentrations and the estimated incremental flows for the projected future conditions. Because the Hudson River consists of such a large volume of water, it has extensive assimilative capabilities to quickly disperse pollutants. For this reason, the HydroQual study indicated that in some cases, any increased pollutant loadings associated with increases in CSOs would remain unchanged for dissolved oxygen, total suspended solids and coliform and increases in the concentrations of total nitrogen and phosphorus, copper, lead, and zinc would be minor, and would remain within the allowable concentrations for NYSDEC Class 1 water quality standards. For this reason, it was concluded that the additional CSO discharges would have no significant impact on water quality.

Additional modeling studies were performed by HydroQual subsequent to the DEIS in order to estimate the specific impact of the Proposed Actions on CSO discharges from the North River Water Pollution Control Plant collection system for the 2019 analysis year. For details of this analysis, refer to Appendix M1. The additional modeling uses an updated hydrology/hydraulic model of the North River Water Pollution Control Plant system, calibrated with actual system flow data from 2007 and 2008. The model was run for the 2019 Future without the Proposed Actions condition using DEP's 2020 dry weather sanitary flow projection of 128 mgd, which

includes a total flow increment of 5.56 mgd attributable to the various development projects in the Future without the Proposed Actions (included in Table 2-1 of Chapter 2, "Framework for Analysis") 0.20 mgd for the Manhattanville project, and other background growth resulting from general population growth in Manhattan. The model projects a total CSO volume of 501 mg annually in 2019 throughout the North River Water Pollution Control Plant system. This volume, a reduction from future CSO volumes forecast by the previous study for the *Hudson Yards FGEIS*, is the result of several factors, primarily DEP's recent optimization of operations at the North River Water Pollution Control Plant to maximize inflow rates during wet-weather, consistent with applicable regulatory requirements in the SPDES permit.

E. PROBABLE IMPACTS OF THE PROPOSED ACTIONS–2019

Implementation of the Proposed Actions would require construction of a platform over the northern two-thirds of the Development Site in order for existing LIRR rail operations to continue largely unchanged. The DSNY, NYCT, and bus storage facilities located along the southern portion of the Development Site would be relocated. The High Line would remain and be adaptively reused to create new public open space and integrated into the proposed site design for the Development Site. In order to facilitate construction of the platform over the existing rail yard and maintain LIRR yard operations, four existing LIRR buildings within the yard would also require reconstruction.

Three development options are under consideration for the Development Site: a Maximum Residential Scenario-Office Option; a Maximum Residential Scenario-Hotel Option; and a Maximum Commercial Scenario. Each was analyzed, based on the generation rates for various use categories from the *CEQR Technical Manual,* to determine which would generate the largest (worst-case) water and sanitary sewage demand requirements. The Maximum Residential Scenario-Office Option would generate the largest demands and, therefore, is assumed as the worst-case scenario for the impact assessment. As the site plan and building footprints do not change for any of the three development scenarios, the stormwater runoff base flow rates associated with each scenario are the same.

For analysis purposes, the Development Site has been subdivided into two equal areas, the northern half and southern half. These areas approximate the assumed surface drainage sub-tributary areas that would be used as a basis for proposed infrastructure design for the Development Site.

WATER SUPPLY

The Proposed Actions would generate increased demand on the DEP water supply system. Water demand and sewage generation rates for the Proposed Actions have been estimated using generation rates from the *CEQR Technical Manual*. For the base condition water and sanitary sewage generation rates for the Proposed Actions, see Table 14-6 for the Development Site and Table 14-7 for the Additional Housing Sites.

In accordance with the *CEQR Technical Manual,* water and sewage generation rates are assumed to be equal except that water consumed by air conditioning systems generally is lost through evaporation from cooling towers and other system losses and as a result is not discharged offsite into sanitary sewers as a wastewater. The demand rates for domestic water supply assume that low-flow fixtures would be implemented, as required by Local Law No. 29. However, in order to establish a conservative base demand "worst case scenario" for assessing the impacts of the

Proposed Actions, and because detailed design information regarding specific measures that would be incorporated into the construction of various building elements for the Development Site has not been developed at this time, no other adjustments have been made for possible water consumption and sewage generation reductions that may be feasible if other sustainable or green building concepts are incorporated into the proposed design and construction of the facilities.

Table 14-6
Development Site:
Proposed Water and Sewage Demand

Proposed Use[1]	Generation Rate[2]	Development Site North Half		Development Site South Half		Development Site Total Demand (gpd)
		Size	Demand (gpd)	Size	Demand (gpd)	
Residential[3]	112 gpd/person	1,580 Units	297,293	3,787 units	708,799	1,006,092
Hotel	N/A	N/A	N/A	N/A	N/A	N/A
Office						
Domestic[4]	25 gpd/person	1,495,000 sf	149,500	N/A	N/A	149,500
Air Conditioning[6]	0.17 gpd/sf		254,150			254,150
Retail						
Domestic	0.17 gpd/sf	187,000 sf	31,790	33,000	5,810	37,400
Air Conditioning[6]	0.17 gpd/sf		31,790		5,810	37,400
School[5]						
Domestic	30 gpd/student	N/A	N/A	750 Student	22,500	22,500
Air Conditioning[6]	0.10 gpd/sf			120,000 sf	12,000	12,000
LIRR Caemmerer Rail Yard[7]	Approx. Same as existing (see Table 14-1)	--	20,000	--	--	20,000
Total Sewage Demand			**498,583**		**737,109**	**1,235,692**
Total Water Demand			**784,523**		**754,919**	**1,539,442**

Notes: gpd = gallons per day; sf = square feet
1. Reasonable worst-case development scenario for 2019 using the Maximum Residential Scenario-Office Option. Office is larger consumer than hotel based on 250 gross square feet (gsf)/office occupant vs. average of 1 occupant per hotel room (1,200 rooms @ gsf = 750 sf, 10 percent function space)
2. Generation rates as per the *CEQR Technical Manual*
3. Residential demand based on average of 1.68 residents per unit (see Chapter 4, "Socioeconomic Conditions.")
4. Office demand based on 250 gsf per occupant (see Chapter 4, "Socioeconomic Conditions.")
5. School demand based on 750 student capacity.
6. Water used in air conditioning systems not included in sewage demand.
7. Existing and proposed sanitary usage for LIRR Caemmerer Rail Yard is assumed to be the same even though new LIRR facilities proposed would have water conserving fixtures to reduce demand; CEQR Demand Generation Rate of 25 gpd used for both existing and future conditions.

Table 14-7
Additional Housing Sites:
Proposed Water and Sewage Demands

Proposed Use	Generation Rate[1]	Ninth Avenue Site		Tenth Avenue Site	
		Size	Demand (gpd)	Size	Demand (gpd)
Residential[2]	112 gpd/person	108 Units	30,240	204 Units	57,120
Office[3]					
Domestic	25 gpd/person	3,000 gsf	3,000	N/A	0
Air Conditioning[4]	0.17 gpd/sf		5,100		0
Retail					
Domestic	0.17 gpd/sf	6,750 gsf	1,148	10,800	1,836
Air Conditioning[4]	0.17 gpd/sf		1,148		1,836
Total Sewage Demand			**34,388**		**58,956**
Total Water Demand			**40,635**		**60,792**

Notes: gpd = gallons per day; sf = square feet; gsf = gross square feet
1. Generation rates as per the *CEQR Technical Manual*
2. Residential population based on 2.50 residents per unit for affordable housing units (see Chapter 4, "Socioeconomic Conditions.")
3. Office population based on 250 gsf per occupant (see Chapter 4, "Socioeconomic Conditions.")
4. Water used in air conditioning systems not included in sewage demand.

The Proposed Actions would generate water demands of approximately 1.54 mgd for the Development Site and 0.10 mgd for the Additional Housing Sites, which is a substantial increase over the estimated existing demand of 0.02 mgd for all of the sites. These estimated demands include water for domestic uses as well as makeup water for air conditioning systems.

As discussed above for the Future without the Proposed Actions, the *Hudson Yards FGEIS* estimated water usage within the Hudson Yard area will increase to 4.7 mgd (in the interim year of 2010 for that project) from the existing 1.1 mgd, and ultimately reach 13.2 mgd when the full build-out of the Hudson Yards area occurs (assumed to be in 2025). The demand associated with the Proposed Actions is approximately 13 percent of the ultimate demand associated with the Hudson Yards area build-out.

The proposed Development Site buildings would likely be supplied with water from mains located within West 30th and West 33rd Streets. Although the existing 12-inch mains in these streets can supply sufficient water to the Development Site, they are considered to be undersized based on current DEP practice for maintaining supply at a stable pressure under all service conditions. Based upon the amount of other utility construction that is likely to be required, these distribution mains are recommended for upgrade as part of other street and utility infrastructure upgrades that would be required for the Proposed Actions. The Trunk Plan may also recommend increasing the size of these mains for the same reasons.

As discussed above for the Future without the Proposed Actions, by 2019 it is assumed that some of the Hudson Yards area projected development will be under construction, and that necessary expansions and upgrades of the local DEP water distribution network in the vicinity will have been completed in accordance with the DEP's Trunk Plan and other City programs for the improvement of local street infrastructure. Improvements to the water distribution network will include the installation of a new water main along Eleventh Avenue between West 38th and West 29th Streets, and upgrades to the water main along Tenth Avenue. By 2019, it is likely that the Manhattan segment of Phase 2 construction of Water Tunnel No. 3 will be completed. Completion of the tunnel will provide additional supply and enhance system pressure stability to the local area.

With these system improvements, the increased demand requirements associated with the Proposed Actions can be adequately serviced. The demand represents less than 0.01 percent (1/100 of one percent) of the 1.5 billion gallons of water supplied daily to New York City by DEP. The City has committed to make these improvements, in the required timeframe, to support the proposed development that would result from the Proposed Actions.

The estimated proposed water demands of 0.1 mgd for the Additional Housing Sites are considered minor and can be supplied without affecting local service by existing distribution mains in the local streets fronting these project sites.

WASTEWATER AND STORMWATER

The Proposed Actions would result in increased generation of sanitary sewage from the project sites, as estimated in Table 14-6 for the Development Site and Table 14-7 for the Additional Housing Sites. The estimated base daily volume for the Development Site would be 1.24 mgd and 0.10 mgd for the Additional Housing Sites. These base flow rates do not reflect reductions that would result from various sustainable or green building elements that would be incorporated into the proposed design and construction.

Stormwater runoff from the sites would not increase because the existing site surfaces are largely impervious. Various sustainable or green building elements would be implemented into the

proposed design and construction of the Development Site; however, the estimated stormwater flow rates provided in Tables 14-9 and 14-10 are conservative for developing a base condition or worst-case for evaluating impacts of the Proposed Actions. A Stormwater Pollution Prevention Plan (SWPPP) would be required as part of the detailed design process for the Development Site; BMPs that would be implemented or may be considered for the Proposed Actions to reduce demand rates for water, sewage, and stormwater runoff are discussed below as part of the discussion of "Best Management Practices and PLaNYC."

The site design for the Development Site would consist of a variety of surfaces, including building roofs, pavements and walks, and softscapes containing plantings and lawns. The runoff coefficients, which determine the amount of water that flows off of a given surface, vary for each of these surface types. By averaging the relative areas of each surface type together, a composite runoff coefficient has been developed to reflect the proposed site design concept, as shown in Table 14-8. The composite runoff coefficients have been calculated conservatively using a coefficient of 0.85 percent for softscapes that assumes a minimum depth of planting soil areas because construction would occur on top of a structural deck slab over the existing rail yard. Typically a coefficient of 0.2 percent would be used, reflecting the infiltration capacity of subsurface soils under landscaped areas to absorb and retain large percentages of the total rainfall accumulation onsite.

Table 14-8
Development Site:
Proposed Runoff Coefficient

		Roofs	Pavement and walks	High Line	Grass and Softscape	Totals
Site 1 Development Site North	Percent of area	44%	31%	4%	21%	100%
	Surface Area (sf)	124,100	89,800	10,800	60,400	285,100
	Runoff Coefficient	1.00	0.85	1.00	0.85	0.92
Site 2 Development Site South	Percent of area	36%	23%	10%	31%	100%
	Surface Area (sf)	103,600	66,500	27,300	87,700	285,100
	Runoff Coefficient	1.00	0.85	1.00	0. 85	0.90

Notes: sf = square feet
1. Runoff coefficients based on no rooftop rainwater harvesting used to establish baseline "worst case" runoff condition for the Development Site.

Estimated proposed wastewater and stormwater discharge flow characteristics from the project sites have been developed for a range of rainfall events using conservative baseline conditions, similar to the approach used to develop the estimated existing wastewater and stormwater discharge characteristics; these proposed rates are shown in Table 14-9 for the Development Site and in Table 14-10 for the Additional Housing Sites. Storm runoff rates have been calculated by the Rational Formula using the composite runoff coefficients indicated in Table 14-8. Sanitary sewage generation rates are in Table 14-6. For both of the Additional Housing Sites, the proposed building footprints are assumed to cover nearly the entire site areas. Accordingly, a runoff coefficient of 1.0 has been conservatively selected to model baseline runoff from both sites. Sanitary sewage generation rates for both sites are shown in Table 14-7, and the estimated proposed flows for a range of rainfall volumes are summarized in Table 14-10.

Table 14-9
Development Site:
Proposed Stormwater[1] and Sanitary Sewage[2] Flow Volumes

Rainfall Volume (in) *	Rainfall Duration (hr)*	Site 1 - Development Site Northern Half (West 33rd Street)[3] Runoff Volume To River (mg)[5]	Runoff Volume To CSS (mg)	Sanitary Volume To CSS (mg)[3]	Total Volume To CSS (MG)	Site 2 - Development Site Southern Half (West 30th Street)[4] Runoff Volume To River (mg)[5]	Runoff Volume To CSS (mg)	Sanitary Volume To CSS (mg)[6]	Total Volume To CSS (mg)	Sites 1 & 2 Total Volume To CSS (mg)
0.00	3.00	0.00	0.00	0.08	0.08	0.00	0.00	0.12	0.12	0.20
0.40	3.00	0.07	0.00	0.08	0.08	0.06	0.00	0.12	0.12	0.20
1.20	10.00	0.20	0.00	0.24	0.24	0.19	0.00	0.35	0.35	0.58
2.50	26.00	0.41	0.00	0.41	0.41	0.40	0.00	0.60	0.60	1.01

Notes:
CSS = combined sewer system
* Based on information provided by DEP.
1. Runoff volumes for proposed conditions have been calculated as follows:
   Qvol = [R_{vol} x A x RC x 7.48gal/1,000,000mgd per gal], where
   Q_{vol} = Total volume of Rainfall for 24-hour storm event discharged offsite, mg
   R_{vol} = Rainfall Volume, in inches for the corresponding Rainfall Return Period listed
   A = Site Area, in sq ft
   RC = Rainfall Runoff Coefficient, as per Table 14-8
2. See Table 14-6 for estimate of Plan sanitary sewage flows.
3. Area = 1/2 of Total site = 285,068 sf (6.54 acre).
4. Area = 1/2 of Total site = 285,068 sf (6.54 acre).
5. "Site 1" to drain directly to Hudson River in new West 33rd Street separate storm sewer.
   "Site 2" to drain into existing LIRR yard drain directly to Hudson River.
6. Runoff from WR-1 and WR-5 are included in "Site 2" drainage area to West 30th Street.

Table 14-10
Additional Housing Sites:
Proposed Stormwater[1] and Sanitary Sewage[2] Flow Volumes

Rainfall Volume (in) *	Rainfall Duration (hr)*	Ninth Avenue Site[3] Runoff Volume To River (mg)	Runoff Volume To CSS (mg)	Sanitary Volume To CSS (mg)	Total Volume To CSS (mg)	Tenth Avenue Site[4] Runoff Volume To River (mg)	Runoff Volume To CSS (mg)	Sanitary Volume To CSS (mg)	Total Volume To CSS (mg)	Both Total Volume To CSS (mg)
0.00	3.00	0.000	0.000	0.005	0.005	0.000	0.000	0.009	0.009	0.015
0.40	3.00	0.000	0.006	0.005	0.011	0.000	0.005	0.009	0.014	0.026
1.20	10.00	0.000	0.018	0.016	0.034	0.000	0.015	0.028	0.043	0.076
2.50	26.00	0.000	0.037	0.028	0.065	0.000	0.031	0.048	0.079	0.144

Notes:
CSS = combined sewer system
* Based on information provided by DEP.

1. Runoff volumes for proposed conditions have been calculated as follows:
   Qvol = [R_{vol} x A x RC x 7.48gal/1,000,000mgd per gal], where
   Q_{vol} = Total volume of Rainfall for 24-hour storm event discharged offsite, mg
   R_{vol} = Rainfall Volume, in inches for the corresponding Rainfall Return Period listed
   A = Site Area, in sq ft
   RC = Rainfall Runoff Coefficient, as per Table 14-9.
2. See Table 14-7 for estimate of Plan sanitary sewage flows.
3. Area = 23,712 sf (0.54 acre).
4. Area = 20,000 sf (0.46 acre).

The drainage analysis assumes that all stormwater runoff from the Development Site would be diverted from the combined sewer system to storm sewers that outfall directly into the Hudson River. The southern third of the Development Site would no longer drain into the City's

combined sewer in West 30th Street as it would use the LIRR 43″ x 68″ box culvert that drains the existing rail yard directly into the Hudson River. Drainage from the northern half of the Development Site would flow into a new storm sewer in West 33rd Street. As discussed above for the Future without the Proposed Actions, the Amended Drainage Plan for the Hudson Yards area includes the construction of a new 4′ x 2′ storm sewer in West 33rd Street from Eleventh Avenue west to outfall at the Hudson River.

A comparison of Tables 14-4 and 14-9 indicates that several changes in stormwater runoff characteristics at the Development Site would occur as a result of the Proposed Actions:

- There would be a marginal reduction in total site runoff because of the introduction of softscape surfaces that would reduce the overall runoff rate compared to the existing conditions;
- The total flow into the combined sewer system would increase as a result of the increase in sanitary flows generated by the Proposed Actions from both the Development site and the Additional Housing Sites. Because these added flows may displace effluent in the combined sewer system, the Proposed Actions may exacerbate CSO's events at the affected outfalls.

Use of the existing LIRR culvert for the Development Site would be subject to an agreement between the Metropolitan Transportation Authority (MTA)/LIRR and the Developer. The culvert would continue to be used on a limited basis for conveying drainage from the eastern portion of the Caemmerer Rail Yard (Eastern Rail Yard) and would also be required for drainage of the portion of the yard under the Development Site in case of fire or a break in a yard water main. The existing outfall is regulated as a MS4 discharge which would allow for proposed runoff to be discharged through this stormwater culvert.

A SWPPP would be required for the Development Site as part of the necessary application to the NYSDEC for a temporary construction SPDES permit which is required for construction activities on sites larger than 1 acre, post construction; post construction BMPs are required as part of the SWPPP. Provisions for on-site retention or detention of a portion of the site runoff may be components of the SWPPP.

In the Future with the Proposed Actions, the project sites and surrounding areas would continue to be served by the North River Water Pollution Control Plant and the sanitary sewage treatment system. In addition to the estimated stormwater and sanitary sewage flows that would be generated by the Proposed Actions, other nearby growth and projected Hudson Yards area development will also add to the load demands on the storm and combined sewer system sewers within the local area and on the North River Water Pollution Control Plant.

As discussed in the Future without the Proposed Actions, DEP has developed an Amended Drainage Plan for the Hudson Yards area, which will also accommodate the Development Site. The infrastructure improvements are required to accommodate the substantial increase in sanitary sewage generation that will occur as a result of additional growth and development within the Hudson Yards rezoning areas. The Amended Drainage Plan includes a new storm sewer in West 33rd Street from Eleventh Avenue to outfall in the Hudson River. The Development Site would discharge proposed stormwater into this 4′ x 2′ storm sewer and avoid discharging any stormwater into the combined sewer system. Other infrastructure improvements in the Amended Drainage Plan include a parallel 5′ x 4′ combined sewer, which would convey sewage from the north half of the Development Site and adjacent parcels along West 33rd Street. The Amended Drainage Plan would not change the existing combined sewers that run west

along West 30th Street from Eleventh Avenue, which would be used to convey sanitary sewage from the southern half of the Development Site.

With the system improvements, the increased demand required due to the Proposed Actions can be adequately serviced. The City has committed to make these improvements, in the required timeframe, to support the proposed development that would result from the Proposed Actions.

As discussed for the Future without the Proposed Actions, by 2019 it is assumed that some of the Hudson Yards area projected development will be under construction, and that annual CSO volumes would increase from regulators handling effluent from the Hudson Yards area projected development. The potential impact that the Proposed Actions could have on CSOs has been considered on the basis of projected changes between existing and future flow rates from the Development Site.

For the Development Site, despite the diversion of all storm flows from the combined sewer system to storm sewers for the Future with the Proposed Actions, the total sanitary flows from the Development Site into the combined sewer system would increase compared to existing combined flows from onsite sanitary sewage and stormwater runoff (refer to Table 14-4 for the existing condition and Table 14-9 for the projected future condition). This incremental increase, depending upon downstream and upstream conditions within the combined sewer system, could displace wastewater volumes from other sources and result in a greater volume of CSO discharge during these rainfall events.

The Proposed Actions would implement mechanisms at the Development Site to decrease sanitary flows, relative to the base flow analysis, to the combined sewer system and slow down and treat stormwater runoff to the Hudson River. The outline of a development concept plan for water conservation and stormwater management BMPs that would be incorporated into the design for the Development Site are described below. This includes strategies that would be developed to implement water conservation measures as part of the Proposed Actions in order to obtain LEED certification for the Development Site. These strategies focus on methods to minimize the increased sanitary flows compared to the baseline conditions established in this chapter.

As discussed in Section D, "The Future without the Proposed Actions," additional modeling studies were performed by HydroQual subsequent to the DEIS to update the results of the prior analysis (see Appendix M1 for the additional modeling studies). The modeling was also undertaken to determine the potential impact of the Proposed Actions on CSO discharges from individual outfalls. The study modeled two scenarios for conditions in 2019 in the Future with the Proposed Actions—a condition (2019 Build-CEQR) that reflects the proposed stormwater and sanitary sewage flow volumes as indicated on Table 14-9 and a scenario (2019 Build-LEED) that assumes the water conservation measures consistent with LEED certification that would reduce sanitary flows by a minimum of 20 percent.

The results of this modeling indicate that the Proposed Actions would have a minor impact on projected future CSO volumes and number of CSO events at several outfalls. The Proposed Actions would contribute to an increase in CSO volume of approximately 2.2 mg annually. Table 14-11 presents all outfalls that are predicted to experience an increase in either volume or CSO events. Outfalls NR-027 and NR-028 are associated with the two regulators that provide direct drainage of the Western Rail Yard Development Site. As presented in Table 14-11, the volume increases above the 2019 Future without the Proposed Actions at these outfalls are 0.5

mg per year (compared to 44.5 mg per year) and 0.4 mg per year (compared to 4.2 MG per year), respectively. One additional CSO event would occur annually at NR-028.

By displacing other flows from the interceptor system, the added flows can lead to increased CSO volumes at regulators further away from the Development Site. The remaining 13 outfalls in Table 14-11 are predicted to experience an increase in volume ranging from less than 0.1 mg per year to 0.2 mg per year (with an overall average increase of 0.5 percent), and two of these outfalls would experience one additional CSO event each. The flow reductions associated with the 2019 Build-LEED scenario (see Appendix M1 for additional information) would proportionally reduce CSO volumes.

Although the increased CSO volume would initiate one additional CSO event per year locally at three outfalls (R-N30 at West 59th Street, R-N43 at West 36th Street, and R-N49 at West 23rd Street), the analysis indicates that the Proposed Actions would not increase the number of storms that cause CSO discharges from the North River Water Pollution Control Plant collection system to increase from the 51 CSO events per year projected for the 2019 Future without the Proposed Actions.

Table 14-11
Development Site:
Outfalls With Increased CSO Volumes/Events

		2019 No-Build		2019 Build (Incremental Difference to 2019 No-Build)	
Outfall	Regulator	CSO Volume (mg/Year)	CSO Events Number/Year	Additional CSO Volume (mg/Year)	Additional CSO Events At Individual Outfalls[2] Number/Year
NR-010	R-N10	6.1	15	0.1	0
NR-055	R-N08	0.9	9	0.1	0
NR-017	R-N03	42.6	30	0.1	0
NR-006	R-N16	47.8	26	0.2	0
NR-043	R-N23	70.8	19	0.1	0
NR-036	R-N30	11.8	19	0.1	1
NR-048	R-N40	2.8	10	0.1	0
NR-028	R-N43	4.2	8	0.4	1
NR-027	R-N45	44.5	11	0.5	0
NR-026	R-N46	19.1	27	0.1	0
NR-025	R-N47	12.1	15	0.1	0
NR-024	R-N49	8.0	15	0.0	1
NR-023	R-N50	24.7	11	0.1	0
NR-022	R-N51	10.0	17	0.1	0
NR-049	R-N52	8.3	27	0.1	0
Total Increase for 2019 Build				**2.2**	**3**

Notes: mg = million gallon
1. Source: *Impact of the Proposed Western Rail Yard Development on Combined-Sewer Discharges*, HyrdoQual, Inc., September 30, 2009, 2019-Build CEQR Scenario.
2. The number of CSO events associated with the North River WPCP collection system is not impacted by the Proposed Actions, but there are three individual outfalls that would experience one additional CSO event.

The additional CSO modeling completed for the Proposed Actions included updated projections of sewage demands for the Future with the Proposed Actions compared to the *Hudson Yards FGEIS*, representing a reduction from CSO volumes forecast for the previous water quality study prepared by HydroQual. As previously discussed, the HydroQual study for the *Hudson Yards*

FGEIS used projected CSO volumes as the basis for assessing the impacts of the additional CSO discharges on water quality in the Hudson River, and concluded that water quality impacts would be minimal, largely because the Hudson River consists of such a large volume of water and has extensive assimilative capabilities to quickly disperse pollutants. For this reason, the results of the previous water quality study are applicable to the Proposed Actions and indicate that for the increase in CSO volumes projected for the Future with the Proposed Actions, water-quality concentrations would remain unchanged for dissolved oxygen, total suspended solids and coliform, and increases in the concentrations of total nitrogen, phosphorus, copper, lead, and zinc would be minor and would remain within the allowable concentrations for NYSDEC Class 1 water quality standards. Therefore, it is concluded that the modeled CSO discharges for the Proposed Actions would have no significant impact on water quality.

In summary, DEP has developed an Amended Drainage Plan for the Hudson Yards area that identifies improvements to the existing storm and combined sewer system infrastructure that are necessary to accommodate the full build out of the Hudson Yards area, and the City has committed to make these improvements (see Appendix M2 for correspondence), in the required timeframe, to support the development that would result from the Proposed Actions. The Amended Drainage Plan includes the construction of new separate storm sewers which would divert all runoff from the Development Site from the combined sewer system. In addition, the sewer demands generated by the Proposed Actions would be reduced because the Developer has committed to incorporating water conservation measures, rainwater collection systems and green roofs into the Development Site that would reduce demands on New York City's water supply, sanitary sewer and stormwater management systems, consistent with LEED Silver certification which prescribes at least a 20 percent reduction in water usage compared to the baseline condition. Therefore, the Proposed Actions would not have a significant adverse impact on the City's sanitary sewage and stormwater management systems, or on the water quality receiving waters.

BEST MANAGEMENT PRACTICES AND PLANYC

It is anticipated that the Proposed Actions would incorporate various sustainable design elements and BMPs into the proposed design and construction of the various building elements on the Development Site, which would result in reductions to the estimated generation rates for water demand, sanitary sewage, and stormwater runoff.

The Developer has committed to incorporating several sustainable design elements into construction of the Development Site, including:

- Capturing stormwater from building roofs for beneficial reuse as cooling tower makeup, and irrigation for site landscaping.
- Green roofs on other selected buildings
- Providing extensive green space (softscapes) as part of the proposed site design.
- Water conserving models for residential dishwashers and residential clothes washers.
- LEED Silver certification, which requires as a prerequisite for certification at least a 20 percent reduction in water usage compared to the baseline condition.

In addition, the Developer is also considering more extensive mechanisms, including a stormwater collection system to harvest or detain a significant portion of the runoff from the Development Site. These elements considered by the Developer are consistent with three general

strategies for reducing demands on public water supply, drainage, and sewer infrastructure, which are: (1) reduce water consumption; (2) retain, reuse, and recycle water onsite; and (3) reduce the rate of onsite runoff to the sewer system and provide onsite water quality treatment. As noted above, a SWPPP would be required for the Development Site that incorporates feasible measures to reduce runoff rates below the baseline levels and implement stormwater management techniques to address quality concerns associated with the uncontrolled discharge of stormwater runoff into the Hudson River. The NYSDEC would review and approve the SWPPP. DEP would also review the SWPPP for consistency with sewer system rules, requirements and standards. At such time, detailed site design information would be provided in the SWPPP. The general strategies for evaluating potential BMPs are described in more detail as follows:

Reduce Consumption. Reducing water consumption lessens the demand on the City's water supply system, and as the majority of water consumed onsite is discharged as sanitary sewage offsite, consumption demand reductions translate directly into lower demand loading on the combined sewer system. BMPs to reduce consumption include using ultra low flow plumbing fixtures and designing landscapes for vegetation that requires minimal or no irrigation.

Supply Substitution. Supply substitutions to retain, reuse, and recycle water onsite include harvesting rainwater for landscape irrigation and other non-potable supply requirements.

Stormwater Volume. BMPs for stormwater management focus on limiting the volume of onsite runoff to the sewer system, reducing the discharge rates or onsite runoff to the sewer system, and provide onsite water quality treatment of runoff discharges. The uncontrolled discharge of surface runoff contributes to CSO events and the associated water quality issues. Methods for capturing and retaining stormwater onsite include harvesting for irrigation and permanent water features; onsite retention; and green roofs.

Stormwater Discharge Rate. Many of the strategies for reducing the volume of onsite runoff to the sewer system can also reduce the rate of discharge. For example, while green roofs typically do not capture the entire rainfall amount, the initial rain saturates the substrata so that excess runoff may not begin to drain from the roof until after the rainfall has ended. Simple mechanical mechanisms such as rooftop detention that restrict the amount of water that can enter downspouts are effective at slowing down the rate of discharge.

Stormwater Quality. BMPs for improving the quality of onsite runoff to the sewer system include minimizing the use of fertilizers and herbicides based on plant selection in landscape areas and green roofs and other onsite features such as vegetated swales that can effectively filter many contaminants.

Some of these BMPs would also be feasible and appropriate for incorporation into the Additional Housing Sites. As described in Chapter 1, "Project Description," the New York City Department of Housing Preservation and Development (HPD) would be responsible for soliciting proposals for the Additional Housing Sites in accordance with the Mayor's new Housing Marketplace Plan, which among other requirements mandates that the selected developer(s) participate in both the New York State Energy Research and Development Authority's Multifamily Performance program – Green Affordable Housing Component; and the Enterprise Community Partners' Green Community program tailored specifically for HPD projects. No developers have been selected for these Additional Housing Sites yet, and as a result, no detailed evaluation of the environmental commitments and BMPs that would be incorporated into these projects has been conducted.

PlaNYC and the Sustainable Stormwater Management Plan (2008) developed by the Mayor's Office as a key initiative of PlaNYC, identify a number of strategies for meeting water quality goals which focus on promoting cost-effective source controls for stormwater management. The environmental commitments and types of BMPs that are anticipated to be incorporated into the SWPPP for the Development Site are consistent with PlaNYC in the following ways:

- Divert runoff into HLSS from the combined sewer system (water quality initiative to increase use of HLSS);
- Incorporate various source control features into buildings and site open space design to promote stormwater collection and management to reduce the quantity of onsite runoff discharges to the sewer system and provide onsite water quality treatment of onsite runoff that is discharged into the Hudson River (water quality initiative to pilot promising BMPs); and
- Incorporate measures to promote the efficient use and conservation of domestic water to reduce sewage generation rates (water network initiative to maximize existing facilities).

F. PROBABLE IMPACTS OF THE PROPOSED ACTIONS–2017

As described in Chapter 2, "Framework for Analysis," for analysis purposes, the interim year of development of the Proposed Actions is 2017. By 2017, construction on the Development Site is anticipated to be complete for the three buildings closest to Eleventh Avenue, the central open space area, and a plaza located at the northeast corner of the site. Total program floor area would comprise 1.49 million gsf of office space or a 1,200 room convention-style hotel in the north building, retail space of up to 162,750 sf gsf, and up to 1,558 residential units in the two southerly buildings. The interim development would also include the PS/IS school, and 850 accessory parking spaces. This mixture of land uses is the same for the 2017 Future with the Proposed Actions condition as the 2019 Future with the Proposed Actions condition—residential, commercial, community facility, open space, and parking. In addition, the platform over the existing rail yard would be constructed in stages sequenced to the construction of the mixed use development above. As stated above, the City has committed to make the local improvements in City water mains and sewer infrastructure, in the required timeframe, to support the proposed development that would result from the Proposed Actions.

Given (1) the similarity of uses between the interim and full build years, (2) that the interim year would have a smaller amount of development, and (3) that the 2019 Future with the Proposed Actions condition would not result in a significant adverse impact on water, sewage treatment, and stormwater management (see above), the Proposed Actions would also not result in any significant adverse impacts on water, sewage treatment, and stormwater management in the 2017 Future with the Proposed Actions condition. Therefore, the Proposed Actions would not have a significant adverse impact on the City water supply, sanitary sewage, and stormwater management systems ✷