Chapter 13: Infrastructure

A. INTRODUCTION

This chapter evaluates the potential impacts of the proposed project on New York City's infrastructure, including its water supply, sanitary sewage treatment, and stormwater discharge systems. The development site currently discharges into a combined sanitary and stormwater sewer system that conveys sanitary and stormwater flows to the North River Water Pollution Control Plant (WPCP), which is owned, operated, and maintained by New York City Environmental Protection (NYCDEP), and is located along the Hudson River in Manhattan between West 137th and West 145th Streets.

As discussed in this chapter, the proposed project (either scenario) would not result in any significant adverse impacts related to infrastructure in terms of water supply, sanitary sewage, or stormwater runoff. In the future with the proposed project, the development site would continue to be fully developed, as it is under existing conditions, and there would be no increase in the amount of impervious surface on the project site or the site's runoff coefficient compared to both the No Action condition and existing conditions. Furthermore, although the total flow to the combined sewer system with the proposed project (both scenarios) would be slightly higher than in the No Action condition, it would be less than under existing conditions.

B. METHODOLOGY

The infrastructure assessment provided in this chapter describes existing infrastructure conditions, describes expected future conditions through 2014, and then presents the impacts of the proposed project. The analysis presents the expected total water demand and sewage generation from the development site from both the Single-Tenant Office Scenario and the Multi-Tenant Office Scenario, and the incremental increase when compared to the future without the proposed project (the "No Action" condition). The analysis also describes the ability of the systems to meet the new demand.

The water supply assessment discusses current and future water demand from the development site based on rates from the *City Environmental Quality Review (CEQR) Technical Manual.* The water demand is compared to the total water demand on the New York City water supply system to determine if the water supply system would be adversely affected.

The sanitary sewage analysis focuses on the effects of increased sanitary flows to the North River WPCP and determining whether increased flows would exceed the permitted and design capacity of the WPCP or its ability to properly treat the sewage.

The stormwater analysis provides a qualitative discussion of the stormwater flows from the development site into the combined sewer system and qualitatively describes the reductions in the stormwater flows during precipitation events that would occur with the proposed project's stormwater management measures.

C. EXISTING CONDITIONS

WATER SUPPLY

The New York City water supply system is composed of three watersheds—the Croton, the Delaware, and the Catskill—and extends as far north as the Catskill Mountains. During 2007, the system delivered just less than 1.1 billion gallons of water per day to its customers in the five boroughs and Westchester County. From these watersheds, water is carried to the city via a conveyance system composed of reservoirs, aqueducts, and tunnels extending as far as 125 miles north of the city. Within the city, a grid of water pipes distributes water to customers.

The Croton system collects water from Westchester and Putnam Counties and delivers it to the Jerome Park Reservoir in the Bronx. From there, it is distributed to the Bronx and Manhattan through the New Croton Aqueduct, which travels beneath the Bronx and Manhattan.

Water consumption in the city averages approximately 1.0 to 1.1 billion gallons per day. Average consumption in Manhattan is estimated at 400 million gallons per day (mgd); peak consumption is approximately 500 mgd. The Croton system has a lower pressure than the Delaware and Catskill systems and supplies primarily to domestic users in the areas of lower elevation. The Delaware and Catskill systems serve the fire hydrants and domestic uses in areas where both systems exist.

Currently, the development site is served by 12-inch diameter water lines in Seventh Avenue and West 32nd and West 33rd Streets. A 20-inch trunk main is located under Seventh Avenue. According to NYCDEP, there are no operational problems with the water distribution or pressure in the development site area.

Currently, the 1,700-room Hotel Pennsylvania occupies the development site. The building is approximately 1.4 million gross square feet (gsf) in size, and in addition to the rooms, about 46,400 gsf is occupied by retail uses. Using the water rates in the 2001 *City Environmental Quality Review (CEQR) Technical Manual*, the building (when fully occupied) consumes about 530,388 gallons per day (gpd) of potable water. Of this demand, approximately 140,000 gpd is for air conditioning and does not enter the sewer system. About 390,388 gpd is consumptive uses, and the water becomes sanitary sewage.

SANITARY SEWAGE

SANITARY FLOWS TO THE NORTH RIVER WPCP

The development site is located within the approximately 6,030-acre service area of the North River WPCP, which provides secondary treatment (85 percent removal of solids and biological oxygen demand organics) and discharges treated wastewater or "effluent" into the Hudson River. The effluent is regulated by a State Pollutant Discharge Elimination System (SPDES) permit issued by the New York State Department of Environmental Conservation (NYSDEC). The North River WPCP is permitted to treat a flow of 170 mgd. The primary treatment capacity of the WPCP is twice the design dry weather flow, or 340 mgd. This allows the plant to treat a certain volume of combined sanitary and storm flows during wet weather events. The average flow rate at the plant for the latest 12 months of available NYCDEP records is 126 mgd (see **Table 13-1**). Consequently, the North River WPCP currently receives flow at approximately 74 percent of its permitted 170 mgd dry weather capacity.

Table 13-1
Monthly Average Actual Flows to the North River WPCP

Month	Average Dry Weather Flow (mgd)
December 2007	129
November 2007	122
January 2008	122
February 2008	133
March 2008	129
April 2008	123
May 2008	123
June 2008	126
July 2008	126
August 2008	125
September 2008	134
October 2008	125

Source: NYCDEP, October 2008.

The combined sewer in Seventh Avenue is 4 feet by 6 feet. As discussed above, about 390,388 gpd or 0.23 percent of the total sanitary sewage flow to the North River WPCP comes from the Hotel Pennsylvania.

COMBINED SEWER SYSTEM

Almost all sewers within the North River WPCP service area collect both sanitary sewage and stormwater runoff that comes from roof and street drainage. In dry weather, the collection lines convey only sanitary sewage to the North River WPCP. However, during and immediately after precipitation events such as rain and snow melts, the combined sewers carry both sanitary sewage and stormwater.

In New York City, combined sewers were originally built to convey both sewage and stormwater to the nearest waterbody, and the sewer lines were sized to handle storm events. When the public health consequences of discharging untreated sanitary sewage to ambient waters were realized in the early 1900s, a system of regional WPCPs was constructed. Because construction of a new system of separate sanitary sewers was considered to be too disruptive and costly, a simpler system of "interceptors" was built to convey sanitary sewage from the existing combined sewer network to the WPCPs. Since it was prohibitively expensive to design the interceptors and WPCPs to handle the large storm events that the combined sewers could deliver, these facilities were sized to handle two times the design dry weather (sanitary) flow associated with each area. To limit the amount of flow that reaches the interceptors and WPCPs, a system of "regulators" allows excessive wet weather flows to bypass treatment and overflow to the receiving waters. When the combined sewer flow exceeds two times the design dry weather flow at the regulator, the flow goes over a weir in a diversion chamber and this overflow is discharged to the receiving water body as a combined sewer overflow (CSO). By diverting excess flows to the receiving waters as CSOs, the regulators protect the city's WPCPs from flooding and process disruptions, and also prevent upstream flooding from sewage backups into homes and streets. These CSO discharges, however, are untreated.

WET WEATHER CONDITIONS

Stormwater runoff is generated by rainwater that collects on the surfaces of land or built structures. The volume of runoff generated by these surfaces varies depending on the type of land cover, which can be pervious (soil or landscaped surfaces that allow more percolation to the ground below, generating less runoff) or impervious (surfaces such as roads and buildings that impede percolation and generate greater runoff). For example, runoff from a suburban yard will percolate into the ground with less runoff to a local street, and the runoff coefficient from this type of land surface is typically about 0.20 (20 percent runoff). In contrast, a building roof has no percolation and, therefore, has a runoff coefficient of 1.00 (100 percent runoff). Paved areas (e.g., streets and sidewalks) primarily generate runoff, with some percolation to the ground below (a runoff coefficient of 0.85).

The development site is occupied by the Hotel Pennsylvania and, because the site is comprised of impervious surfaces, has a runoff coefficient of 1.00. Stormwater runoff, sanitary, and total combined flows to the combined sewer system were estimated for existing conditions using the NYCDEP flow calculations matrix. Total volume to the combined sewer system for different rainfall events is shown in **Table 13-2**. Further detail on the flow calculations matrix is provided in Appendix D, "Infrastructure."

Table 13-2
Total Flow Volume to the Combined Sewer System: Existing Conditions

Rainfall Volume (inches)	Rainfall Duration (hours)	Runoff Volume to Combined Sewer System (MG)	Sanitary Volume to Combined Sewer System (MG)	Total Volume to Combined Sewer System (MG)
0.00	3.80	0.000	0.062	0.062
0.40	3.80	0.020	0.062	0.082
1.20	11.30	0.059	0.184	0.243
2.50	19.50	0.123	0.317	0.440

Notes: See Appendix D, "Infrastructure."
MG = million gallons.
Sources: NYCDEP; AKRF, Inc.

D. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the proposed project (the "No Action" condition), the development site will be developed with a 1.6 million gross-square-foot as-of-right building (the "No Action building") containing commercial office uses. **Table 13-3** shows the consumptive and total water demand of the No Action building. The total water demand will be approximately 253,691 gpd, of which about 138,902 gpd is for consumptive uses, which will become sanitary sewage. This amount of sanitary sewage would represent a decrease from existing conditions, which currently generates 390,388 gpd of sanitary sewage.

In the No Action condition, the development site will be developed with the No Action building, and the site will continue to have a runoff coefficient of 1.00. As in existing conditions, the project site will be comprised of impervious surfaces in the No Action condition.

Table 13-4 estimates the total flow volume (stormwater runoff and sanitary flows) to the combined sewer system in the No Action condition. As shown below, it is projected that the No Action condition would result in a decrease in total flow volume compared to existing conditions.

Table 13-3
Projected Water Use and Sewage Generation: No Action Building

Use	Unit	Rate[1] (gallons per day)	Consumptive Water Use	Air Conditioning[1]	Total Water Demand
Office	5,280 employees	25	132,000	107,887	239,887
Retail	40,600 square feet	0.17	6,902	6,902	13,804
		Total Water Demand	**138,902**	**114,789**	**253,691**

Notes: [1] 2001 *CEQR Technical Manual*, Table 3L-2 "Water Usage and Sewage Generation Rates for Use in Impact Assessment"
Office: 250 square feet per worker.
Retail: 300 square feet per worker.

Table 13-4
Total Flow Volume to the Combined Sewer System: No Action Condition

Rainfall Volume (inches)	Rainfall Duration (hours)	Runoff Volume to Combined Sewer System (MG)	Sanitary Volume to Combined Sewer System (MG)	Total Volume to Combined Sewer System (MG)
0.00	3.80	0.000	0.022	0.022
0.40	3.80	0.020	0.022	0.042
1.20	11.30	0.059	0.065	0.124
2.50	19.50	0.123	0.113	0.236

Notes: See Appendix D, "Infrastructure."
MG = million gallons
Sources: NYCDEP; AKRF, Inc.

Based on population projections from the New York City Department of City Planning (DCP), NYCDEP projects that the sanitary flows to the North River WPCP will be 125 mgd. The actual flows to each WPCP include both sanitary flows and the portion of the stormwater flows that reach and are treated by the plant. The projected sanitary flows do not include any stormwater flows that reach the WPCP. Based on analyses done for the No. 7 Extension Project and for the Hudson Yards Rezoning and Development Program, the contribution of wet weather to the actual flows to the North River WPCP is about 3 mgd. Therefore, the expected actual flow expected in 2014 will be approximately 129 mgd.

E. PROBABLE IMPACTS OF THE PROPOSED PROJECT

WATER SUPPLY

In the future with the proposed project, it is estimated that the Single-Tenant Office Scenario would result in a total water demand of approximately 464,824 gpd (see **Table 13-5**), 0.04 percent of the water demand in New York City. The incremental water demand over the No Action building would be 211,133 gpd, which would be just under 0.02 percent of the water demand in New York City.

It is estimated that the Multi-Tenant Office Scenario would result in a total water demand of 501,736 gpd (see **Table 13-6**), 0.05 percent of the water demand in New York City. The

incremental water demand over the No Action building would be 248,045 gpd, which would be just over 0.02 percent of the water demand in New York City.

Table 13-5
Projected Water Use and Sewage Generation: Single-Tenant Office Scenario

Use	Unit	Rate[1] (gallons per day)	Consumptive Water Use	Air Conditioning[1]	Total Water Demand
Office	6,138 employees	25	153,450	153,460	306,910
Trading Floors	3,750 employees	25	93,750	57,950	151,700
Retail	18,266 square feet	0.17	3,104	3,110	6,214
Total Water Demand			**250,304**	**214,520**	**462,824**

Source: [1]*CEQR Technical Manual*, Table 3L-2 "Water Usage and Sewage Generation Rates for Use in Impact Assessment."
Notes: Office: 250 square feet per worker.
Trading Floor: 750 employees per floor.
Retail: 300 square feet per worker.

Table 13-6
Projected Water Use and Sewage Generation: Multi-Tenant Office Scenario

Use	Unit	Rate[1] gallons per day	Consumptive Water Use	Air Conditioning[1]	Total Water Demand
Office	7,575 employees	25	189,375	189,381	378,756
Retail	361,711 square feet	0.17	61,490	61,490	122,980
Total Water Demand			**250,865**	**250,871**	**501,736**

Source: [1]*CEQR Technical Manual*, Table 3L-2 "Water Usage and Sewage Generation Rates for Use in Impact Assessment."
Notes: Office: 250 square feet per worker.
Retail: 300 square feet per worker.

These incremental increases in water demand are negligible compared to the city's demand for potable water. The water demand under the proposed project is not expected to increase from existing water demand (Hotel Pennsylvania) and is instead expected to decrease. Therefore, water demand from the proposed project (either scenario) would not have any significant adverse impact on the water supply system.

SANITARY SEWAGE

The Single-Tenant Office Scenario would discharge about 250,304 gpd of sanitary flow to the North River WPCP (see **Table 13-5**), the equivalent of about 0.19 percent of the current sewage handled by the WPCP. This is an increment of 111,402 gpd over the No Action building, or 0.09 percent of the current sewage handled by the WPCP.

The Multi-Tenant Office Scenario would discharge about 250,865 gpd of sanitary flow to the North River WPCP (see **Table 13-6**), the equivalent of about 0.19 percent of the current sewage handled by the WPCP. This is an increment of 111,963 gpd over the No Action building, or 0.09 percent of the current sewage handled by the WPCP.

Both the incremental and the total sanitary sewage flows from the proposed project (either scenario) would be less than the estimated sanitary flows from the existing Hotel Pennsylvania, which currently generates a sanitary sewage flow of approximately 390,388 gpd. The proposed project would not adversely affect the treatment efficiencies of the WPCP or cause the plant to

not properly treat wastewater prior to discharge to the Hudson River. Overall, the proposed project would not cause significant adverse impacts on the sanitary sewer system. Furthermore, this analysis conservatively does not include the reductions that would be expected from the proposed project's water saving features, which would reduce sewage generation.

WET WEATHER CONDITIONS

In the future with the proposed project, the development site would continue to be fully developed and there would be no increase in the amount of impervious surface on the project site or the site's runoff coefficient compared to both the No Action condition and existing conditions. **Tables 13-7 and 13-8** estimate the total flow volume (stormwater runoff and sanitary flows) to the combined sewer system under the Single-Tenant Office and Multi-Tenant Office Scenarios, respectively. As shown below, both scenarios would result in a slight increase in total flow volume compared to the No Action condition. However, compared to existing flows with the Hotel Pennsylvania, the proposed project would result in a decrease in total flows because the total sanitary sewage flows from the proposed project (either scenario) would be less than the estimated sanitary flows from the existing Hotel Pennsylvania and the amount of impervious surface on the site would not increase. Therefore, the proposed project would not have a significant adverse impact on CSO events or water quality in the Hudson River.

Table 13-7
Total Flow Volume to the Combined Sewer System: Single-Tenant Office Scenario

Rainfall Volume (inches)	Rainfall Duration (hours)	Runoff Volume to Combined Sewer System (MG)	Sanitary Volume to Combined Sewer System (MG)	Total Volume to Combined Sewer System (MG)
0.00	3.80	0.000	0.040	0.040
0.40	3.80	0.020	0.040	0.059
1.20	11.30	0.059	0.118	0.177
2.50	19.50	0.123	0.203	0.326

Notes: See Appendix D, "Infrastructure."
MG = million gallons
Sources: NYCDEP; AKRF, Inc.

Table 13-8
Total Flow Volume to the Combined Sewer System: Multi-Tenant Office Scenario

Rainfall Volume (inches)	Rainfall Duration (hours)	Runoff Volume to Combined Sewer System (MG)	Sanitary Volume to Combined Sewer System (MG)	Total Volume to Combined Sewer System (MG)
0.00	3.80	0.000	0.040	0.040
0.40	3.80	0.020	0.040	0.059
1.20	11.30	0.059	0.118	0.177
2.50	19.50	0.123	0.204	0.327

Notes: See Appendix D, "Infrastructure."
MG = million gallons
Sources: NYCDEP; AKRF, Inc.

The inclusion of green roof technology and potentially other water detention measures in the Multi-Tenant Office Scenario, and the collection of stormwater from the podium roof for irrigation of the landscaped rooftop amenity space in the Single-Tenant Office Scenario would reduce the peak flow into the sewer system during storm events. As discussed above, the analysis conservatively does not include the reductions that would be expected from these measures. The project sponsors would obtain a sewer connection permit from NYCDEP before the proposed project is connected to the city's sewer system. As part of this permitting process, NYCDEP would determine how much stormwater would have to be detained on-site. In addition to detention, green roofs, rainwater harvesting, and other water conservation measures could be implemented.

F. CONCLUSION

WATER SUPPLY

Water demands of the proposed project would not overburden the city's water supply system. Based on water demand rates in the *CEQR Technical Manual*, the Single-Tenant Office Scenario would generate a water demand of 464,824 gpd, an increment of 211,133 gpd over the No Action building's demand. The Multi-Tenant Office Scenario would result in a total water demand of 501,736 gpd, an increment of 248,045 gpd over the No Action building's demand. Neither scenario would adversely affect the capacity of the city's water supply system in providing water to the development site; nor would either impact water pressure for local users. Furthermore, the incremental water demand would be less than the development site's existing total water demand and would not have a significant adverse impact on the water supply system.

SANITARY SEWAGE

The North River WPCP handled an average of 126 mgd of sewage flow over the past 12 months and is designed to treat a dry weather flow of 170 mgd. Based on rates in the *CEQR Technical Manual*, the Single-Tenant Office Scenario would result in sanitary sewage discharge of approximately 250,304 gpd, an increment of 111,402 gpd over the No Action building, or 0.09 percent of the current sewage handled by the WPCP. The Multi-Tenant Office Scenario would result in a sanitary sewage discharge of approximately 250,865 gpd, an increment of 111,963 gpd over the No Action building, or 0.09 percent of the current sewage handled by the WPCP. The projected increase in sanitary sewage resulting from either scenario would not cause the North River WPCP to exceed its operational capacity or the SPDES-permitted capacity of 170 mgd. Furthermore, the incremental sewage generation would be less than the development site's existing total sewage generation and would not have a significant adverse impact on the water supply system.

WET WEATHER CONDITIONS

Currently, all stormwater from the development site is discharged directly into the combined sewer system during a precipitation event. This discharge contributes to CSO events in the Hudson River. In the future with the proposed project, the development site would continue to be fully developed, as it is under existing conditions, and there would be no increase in the amount of impervious surface on the project site or the site's runoff coefficient compared to both the No Action condition and existing conditions. Stormwater would continue to enter the combined sewer system and would be discharged to the combined sewer system at an allowable rate as determined by NYCDEP. As described above, the proposed project (both scenarios) would result in a slight

increase in combined flows compared to the No Action condition, but would result in a decrease in combined flows compared to existing conditions. Therefore, the proposed project would not have a significant adverse impact on CSO events or water quality in the Hudson River.

Furthermore, with the proposed project, water saving features, such as low-flow toilets and faucet aerators, would be incorporated into the operations of the proposed project (both scenarios); the Multi-Tenant Office Scenario would incorporate green roof technology and potentially other water detention measures; and with the Single-Tenant Office Scenario, stormwater from the podium roof would be collected and used to irrigate the landscaped rooftop amenity space. Together, these measures would reduce the peak flow into the sewer system during storm events.

SUSTAINABLE DESIGN MEASURES AND PLANYC

The project sponsor would include green roof technology and potentially other water detention measures above the project's podium base in the Multi-Tenant Office Scenario. In the Single-Tenant Office Scenario, stormwater from the podium roof would be collected and used to irrigate the landscaped rooftop amenity space. These measures would reduce peak flow into the sewer system during storm events. Water saving features, such as low-flow toilets and faucet aerators, would also be incorporated into the operations of the proposed project (both scenarios). While such measures would reduce water demand and sewage generation, the analysis conservatively does not include the reductions that would be expected. Therefore, the impact analysis overstates the water demand and sewage generation that would be generated by the proposed project.

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 sustainable design measures described above would be consistent with PlaNYC and the Sustainable Stormwater Management Plan. ✷