# Chapter 14: Infrastructure

## A. INTRODUCTION

The workers, students, visitors, and residents expected from the projected development as a result of the Proposed Actions would create new demands for drinking water and wastewater treatment. The potential effects on those municipal services are discussed in this chapter. Because there are existing buildings on sites where new development is expected, this analysis considers the difference between continued uses of those buildings in the future without the Proposed Actions and the expected development associated with the Proposed Actions.

### PRINCIPAL CONCLUSIONS

By 2015, the uses from the Proposed Actions are expected to generate net new water usage of about 411,929 gallons per day (gpd) and net new wastewater flows of 204,081 gpd within the Project Area. The difference between water demand and sewage generation is caused by water demand for air conditioning, which evaporates and does not enter the sewer system. By 2030, the net new water usage is estimated to be 1,809,848 gpd, and net new sanitary sewage flow would be 953,964 gpd.

The projected development that would likely result from the Proposed Actions would create new demand for water and wastewater treatment. With the Proposed Actions, an amended drainage plan would be instituted for the Project Area, and a new sewer system would be constructed in Subdistrict A that would separate stormwater and sanitary flow, sending storm flows directly to the Hudson River through an existing CSO outfall at the western terminus of St. Clair Place. With the proposed amended drainage plan sewers built by the applicant, the local wastewater collection system would have the capacity to meet the expected demand. Therefore, no significant adverse impacts on these services are expected to result.

## B. AMENDED DRAINAGE PLAN

A drainage plan reflects the zoning of an area, and the Proposed Actions include a change in zoning, which triggers the need for an evaluation of the area's existing drainage plan. Because the Proposed Actions involve rezoning and increased density, an analysis of the effects on the sewer system in the area was undertaken. In accordance with New York City Department of Environmental Protection (DEP) procedure, a hydraulic analysis was performed. Development in New York City must either comply with an area's adopted drainage plan or propose an amendment to the plan. Because sewage flows would exceed the capacity of a number of sewers, an amendment to the New York City drainage plan was developed. As presented below, the amendment provides for sufficient capacity in the future to accommodate the flows from all of the proposed buildings that would be allowed under the rezoning. Some of the improvements would be operational by 2015, and others would not be operational until 2030. The amendment is currently being reviewed by DEP. The analysis presented in this chapter assumes that the amended drainage plan would be in place in the analysis of the future with the Proposed Actions.

The sanitary, stormwater, and combined systems affected by the amended drainage plan are described below. The affected combined sewers are discussed first, followed by a description of the proposed separate stormwater system.

## COMBINED SEWERS

Combined sewers to be upgraded in the Project Area by the amended drainage plan include:

- 4-foot by 2-foot-8-inch combined sewer in the east side of Broadway between West 135th and West 130th Streets;
- 15-inch combined sewer in the west side of Broadway between West 130th and West 129th Streets;
- 15-inch combined sewer segment in West 129th Street between West 125th Street and Broadway;
- 5-foot-6-inch by 7-foot combined sewer in West 125th Street between West 129th Street and Twelfth Avenue;
- 15-inch combined sewer in West 133rd Street between Twelfth Avenue and Broadway; and
- 8-foot-6-inch by 7-foot combined sewer in Twelfth Avenue between West 125th and West 129th Streets.

Sewer lines adjacent to Columbia University's proposed development would be replaced by Columbia University. All upgraded sewer lines, both within and outside the Project Area, would be designed and built to DEP standards, and approved by DEP before construction.

All the combined sewers in the Project Area are tributary to the 8-foot-6-inch by 7-foot combined sewer in Twelfth Avenue between West 125th and West 129th Streets. This sewer would not be adequate to accommodate the new flows that could occur with the Proposed Actions. As a result, another 8-foot-6-inch by 7-foot combined sewer would be installed adjacent to the existing one, to accommodate the additional flow.

## STORM SEWERS

To reduce the total design flow to the twin combined sewers, all of the stormwater flow from West 132nd to West 130th Streets between Twelfth Avenue and Broadway would be collected through new separate storm sewers (which would replace, together with a new sanitary sewer system, the existing combined sewers in these streets). The stormwater generated will be discharged by gravity through an existing CSO outfall. The new storm sewer would run south along Twelfth Avenue, south along Marginal Street, and west along St. Clair Place to an existing CSO outfall. Installation of the separate stormwater lines within Subdistrict A (along West 130th, West 131st, and West 132nd Streets) would occur during construction of the Proposed Actions' below-grade facility (see Chapter 21, "Construction," for construction scheduling and sequencing). Construction of the separate stormwater system west of Subdistrict A would last approximately nine months to a year. Construction activities would involve the placement of new stormwater lines under the streets using "cut-and-cover" techniques. This new stormwater system would be designed to divert stormwater out of the combined sewer system at a rate of up to 42 million gallons per day (mgd [equivalent to 65 cubic feet per second]). This stormwater would discharge directly into the Hudson River. It is important to note that this is an instantaneous flow rate that does not necessarily last for a day. Although it is likely that the

stormwater line under West 130th Street would be installed before 2015, a conservative analysis would assume that the installation of all of the stormwater sewer lines would occur after 2015. Therefore, for the 2015 future with the Proposed Actions, two scenarios were analyzed: the Proposed Actions with a partial stormwater system in place in 2015, and the Proposed Actions with no separate stormwater system in place in 2015. As mentioned earlier, the 2030 analysis accounts for a fully operational separate stormwater system. The new separate stormwater system would be in place to convey stormwater to the river before the existing combined sewers would be removed as part of the development process. By 2030, over the course of a year, the proposed stormwater system is expected to divert approximately 9.9 million gallons of stormwater and reduce the intensity of combined sewer overflow (CSO) events from the combined sewer system. The changes in flow volumes and number of CSO events are discussed below. The connection to the existing outfall would require a New York State Pollutant Discharge Elimination System (SPDES) permit for stormwater discharges to the Hudson River. The sanitary sewage flow from buildings on those streets would be discharged into the combined sewers in Twelfth Avenue and Broadway. The effects of these changes on natural resources and water quality are described in Chapter 11, "Natural Resources," and in Appendix E.1, "Water Quality Modeling."

Construction of the majority of the separate stormwater sewers is currently scheduled for between 2015 and 2030. Sewer construction work primarily is a "cut-and-cover" technique. A trench would be excavated in the street, and the sewer pipe placed in accordance with DEP design standards and specifications. The trench would then be backfilled and the pavement patched. The new sewers would be constructed while the old sewers remain in place. The new sewers would be connected to the system at manholes, and then the old sewers would be disconnected. DEP regularly performs this task at sites throughout the City. Therefore, no interruptions to service are expected. Chapter 21 has a more detailed analysis of potential impacts associated with the upgrading of the sewer system. The sewer system would be improved, and the work would not cause significant adverse impacts.

## C. EXISTING CONDITIONS

### WATER SUPPLY

New York City's water supply system is composed of three watersheds—Croton, Delaware, and Catskill—and extends as far north as the Catskill Mountains. In 2006, DEP delivered an average of approximately 1,069 million gallons of water per day (mgd) to the five boroughs and Westchester County. From these watersheds, water is carried to the City via a conveyance system made up 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 supplied an average of 22 mgd, primarily to users in the lower-elevation portions of Manhattan and the Bronx, which includes the Project Area. Groundwater from the Brooklyn Queens Aquifer supplied about 2 mgd, less than 1 percent of the average daily supply.

The Delaware and Catskill systems supply all five boroughs and delivered about 98 percent of the City's drinking water in 2005. The Delaware and Catskill water systems collect water from watershed areas in the Catskill Mountains and deliver it to the Kensico Reservoir in Westchester County. This reservoir acts as the seasonally balancing reservoir. Summer demand is usually greater than winter demand. From the Kensico Reservoir, water is sent to the Hillview Reservoir in Yonkers, which balances the daily fluctuations in water demand and pressure to the system.

From there, water is delivered to the City through three tunnels, Tunnel Nos. 1, 2, and 3. Tunnel No. 1 carries water through the Bronx and Manhattan to Brooklyn; Tunnel No. 2 travels through the Bronx, Queens, Brooklyn, and then through the Richmond Tunnel to Staten Island; and Tunnel No. 3 goes through the Bronx and Manhattan, terminating in Queens.

Both the Catskill/Delaware and Croton systems supply water to the area. An interconnected grid of 6- and 12-inch water mains runs beneath the Project Area and the surrounding streets. These 6- and 12-inch water mains supply water to individual lots and buildings. This grid system equalizes water pressure in an area and allows a section to be cut off for repair and maintenance without affecting users not directly connected to that section. According to DEP, there are currently no problems with the water distribution system's capacity, coverage, or pressure in the area.

As discussed in Chapter 1, "Project Description," the Project Area is currently occupied by warehouse, transportation, utility, retail, office, residential, and institutional uses. Using the *City Environmental Quality Review* (*CEQR) Technical Manual* water usage rate of 112 gallons per day (gpd) per person, the 291 residents within the project area consume about 32,592 gpd of water. The estimated 2,766 workers in the Project Area consume about 69,150 gpd. Therefore, the existing water demand in the Project Area is estimated to total approximately 101,742 gpd. (See Chapter 4, "Socioeconomic Conditions," for a discussion of existing residents and businesses.) This estimate includes consumptive water use (sinks and toilets), but does not include air conditioning during the summer. Domestic water use enters the sewer system, while water from air conditioning evaporates.

## SANITARY SEWAGE

### *WASTEWATER TREATMENT*

The Project Area is entirely within the service area of DEP's North River Water Pollution Control Plant (WPCP), which discharges treated wastewater flows (or effluent) into the Hudson River. A SPDES permit issued by DEC regulates the quality and the quantity of effluent from this WPCP for the purposes of protecting the water quality of the Hudson River and regional water quality as a whole. The North River WPCP is designed and permitted to treat a monthly flow of 170 mgd. The average actual monthly flow rate at the plant for the latest 12 months of records available (September 2006 through August 2007) is 127 mgd, which is lower than the plant's treatment capacity (see Table 14-1). The plant handles greater volumes during storm events due to stormwater inflows to the plant.

Combined sewers that collect stormwater runoff (from roof and street drainage) and sanitary sewage serve the Project Area, except along Twelfth Avenue, where some of the stormwater is collected in separate stormwater sewers and discharged directly into the Hudson River. Stormwater from Riverside Drive, which is elevated above Twelfth Avenue, is discharged directly onto Twelfth Avenue, where it then flows into the separate stormwater sewers that discharge into the Hudson River.

Based on the existing water demand, the existing residents and businesses in the Project Area generate approximately 101,742 gpd of sanitary sewage. The water used by air conditioning evaporates into the air and does not become sanitary sewage.

**Table 14-1**
**Actual Flows at North River WPCP**

| Year | Month | Flow (mgd) |
|---|---|---|
| 2006 | September | 127 |
| | October | 130 |
| | November | 129 |
| | December | 115 |
| 2007 | January | 119 |
| | February | 118 |
| | March | 125 |
| | April | NA |
| | May | 118 |
| | June | 131 |
| | July | 137 |
| | August | 137 |
| **12-month average** | | **127** |
| **Notes:** | SPDES permit flow 170 mgd. | |
| **Source:** | DEP. | |

*STORMWATER AND COMBINED SEWERS OVERFLOWS (CSO)*

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 WPCP. However, during and immediately after precipitation events, such as rain and snow melts, the sewers carry both sanitary sewage and stormwater, referred to as combined flows, which can result in CSO events. During these periods, untreated combined flows are discharged via outfalls to local receiving waters, e.g., the Hudson and Harlem Rivers, to avoid damage to the WPCP. The tributary area of the North River WPCP is a highly urbanized land surface comprised primarily of impervious surfaces (e.g., building roofs, street pavement), which generate runoff. At the project site almost all of the runoff is from impervious cover.

The conveyance capacity of the system is referred to as the wet weather capacity. In New York City, nearly all sewers are combined, so pipes are sized to handle loads that are much greater than the average dry weather flow, or even the peak dry weather flow. Wet weather flows, which last beyond the cessation of the precipitation event, are much greater than peak dry weather flows. In wet weather events, the volume of wastewater and combined flows in the collection system often increases well beyond the capacity of the WPCP to adequately treat such flows. Therefore, to prevent the WPCP treatment process from being overwhelmed, excess wet weather flows are discharged from the collection system directly into local waters. When the wet weather capacity of the system is exceeded, this combined wastewater and runoff overflows from control points known as regulators into the receiving waters (e.g., the Hudson and Harlem Rivers) without treatment. These regulators prevent a surcharge (sewage flows under pressure) in the collection system and are designed to direct the combined sewer flow that is above the system's capacity to the receiving waters via an outfall sewer. Certain storms generate large volumes of stormwater that exceed the capacity of the North River WPCP. In those situations, the North River WPCP treats a maximum volume of 340 mgd (twice the design dry weather flow) of combined sewage. The North River WPCP cannot accept more than 340 mgd.

The Project Area is mostly developed, and therefore much of the runoff from impervious areas flows into the combined system and is discharged into the Hudson River. The Project Area makes up about 13 percent of the area regulator's service area. During precipitation events, the regulator sends the combined sanitary sewage and precipitation to the North River WPCP until the plant reaches its capacity. When over capacity, the untreated combined sewage and stormwater is discharged into the Hudson River as a CSO event. Currently, this regulator overflows approximately 27 times per year and discharges about 73.6 million gallons per year (mgy) of untreated combined sewage and stormwater into the Hudson River, as CSO events. The impact of CSO events on local water quality in open waters tend to be transitory because of the mixing capacity of the receiving waters and the sanitary flows are diluted by runoff.

A 2004 Administrative Consent Order requires DEP to plan, design, and construct over 30 CSO abatement projects Citywide. These projects include off-line retention tanks, sewer separation, flushing tunnels, throttling facilities, and numerous other projects designed to optimize the operation of the sewer collection system, pumping stations, and treatment plants during wet weather events. Overall objectives are to provide more treatment for wet weather flow than required under a 1992 Administrative Consent Order. Benefits include water quality improvements and floatables removal. This is expected to result in a 90 percent removal efficiency for floatables. In the long term, it is expected that these projects would result in improved water uses and continued improvements in the water quality of New York City's waterways.

## D. 2015 FUTURE WITHOUT THE PROPOSED ACTIONS

Minimal growth and development within the Project Area would occur in the future without the Proposed Actions by 2015. The known developments are presented in detail in Chapter 2, "Procedural and Analytical Framework." They are not expected to place any large demands on the water supply and sewage systems.

### WATER SUPPLY

In the future without the Proposed Actions, the overall water supply system in New York City is not expected to change in any substantial way. However, certain changes are expected to the water supply system within the City. The City has initiated a comprehensive water conservation program that seeks to reduce water use by implementing a metering program and requiring that all new plumbing fixtures in the City, including those in existing and new structures, be of low-flow design (Local Law No. 29, 1989). Other measures—including leak detection programs, water meters, and locking fire hydrant caps—are aimed at further reducing the City's water needs and will serve to reduce water demand and flows to sewage facilities. DEP projects that over the next decade, the savings from these conservation measures will offset some of the expected increase in water demand from consumers. In addition, Stage 2 of water supply Tunnel No. 3 is now under construction in Manhattan, Queens, and Brooklyn. When Tunnel No. 3 is completed, it will enhance and improve the adequacy and dependability of the entire water supply system and improve service and pressure to outlying areas of the City. It will also allow DEP to inspect and repair Tunnel No. 1 for the first time since it was activated.

The projected minimal growth in the Project Area is not expected to change the water demand in the Project Area in the future without the Proposed Actions.

### SANITARY SEWAGE

Without the Proposed Actions, little increase in sewage flows is expected from the Project Area by 2015. DEP expects the North River WPCP to remain within its SPDES permit limits. DEP has developed flow projections for each of its WPCPs. In 2015, the projected dry weather flow at the North River WPCP is estimated to be 125 mgd. The average actual flow, which includes wet weather, is projected to be 133 mgd.

The projects within the Project Area expected to be developed by 2015 will only minimally increase sewage generation.

### COMBINED SEWER OVERFLOWS

In 2015 without the Proposed Actions, the number of CSO events is not expected to increase above 27 events per year. The volume of CSO is expected to increase from 73.6 to 74.9 mgy. The volume increase is due to the projected background growth in population and sanitary sewage within the regulator's service area. In comparison, the expected total CSO volume of the entire North River WPCP service area in 2015 is 494 mgy.

## E. 2015 FUTURE WITH THE PROPOSED ACTIONS

The rate of water demand and sewage generation is based on those given in the 2001 *CEQR Technical Manual*. The rates in the *CEQR Technical Manual* are generally based on the number of workers. Table 14-2 shows the conversion factors used to translate the gross square feet (gsf) of the new buildings and uses into workers and users.

**Table 14-2**
**Water and Sewage Conversion Factors**

| Use | Conversion Factor |
|---|---|
| Faculty/student housing | 2.62 residents per 800-square-foot unit |
| Active ground-floor use | 400 square feet per worker |
| Academic research space | 900 square feet per worker |
| Academic space | 320 square feet per worker/student |
| Recreation | 1,750 square feet per worker |
| Community facility | 500 square feet per worker |
| Storage space | 10,000 square feet per worker |
| Academic research support | 1,200 square feet per worker |
| Program support | 625 square feet per worker |
| Mechanical and electrical space | 1,200 square feet per worker |
| Parking | 7,150 square feet per worker |
| Office | 250 square feet per worker |
| **Source:** Columbia University | |

As described in Chapters 1 and 2, by 2015 the reasonable worst-case development scenario for the Project Area includes full development of the projected development sites in Subdistricts B, C, and the Other Areas, and the first phase of development of Subdistrict A. Since the actual program for the development of Subdistrict A (the Academic Mixed-Use Area) would vary depending on Columbia University's needs over the long-term future, maximum and minimum ranges of floor areas for each expected use were established for the Academic Mixed-Use Development for the 2015 and 2030 development. For infrastructure analysis purposes, a reasonable worst-case development scenario was developed to determine the likely maximum amount of water consumed and sewage generated from proposed new uses in the Academic Mixed-Use Area. The

infrastructure reasonable worst-case development scenario maximizes the uses that generate the greatest water demand, such as active ground-floor uses and housing for graduate students, faculty, and other employees. Table 14-3 presents the reasonable worst case for water demand.

**Table 14-3**
**Expected Maximum Water Demand with the Proposed Actions in 2015**

| Use | Size (sq ft) | Domestic Consumption Rate (gal/day) | Domestic Demand (gpd) | AC Consumption Rate (gal/day) | AC Demand (gpd) | Total Demand (gpd) |
|---|---|---|---|---|---|---|
| **Academic Mixed-Use Area** | | | | | | |
| Housing | 175,000 | 112 | 64,400 | 0.10/sq ft | 17,500 | 81,900 |
| Research | 370,000 | 25 | 10,275 | 0.17/sq ft | 62,900 | 73,175 |
| Academic | 378,439 | 25 | 29,575 | 0.10/sq ft | 37,844 | 67,419 |
| Active ground floor | 180,000 | 0.17/sq ft | 30,600 | 0.17/sq ft | 30,600 | 61,200 |
| **Subtotal Above Grade** | **1,103,439** | **NA** | **134,650** | **NA** | **148,844** | **283,694** |
| **Use** | **Size (sq ft)** | **Consumption Rate (gal/day)** | **Domestic Demand (gpd)** | **Consumption Rate (gal/day)** | **AC Demand (gpd)** | **Total Demand (gpd)** |
| Mechanical space | 112,700 | 25 | 2,350 | 0 | 0 | 2,350 |
| Parking | 8,847 | 25 | 25 | 0 | 0 | 25 |
| Storage | 55,255 | 25 | 150 | 0 | 0 | 150 |
| Program support | 58,563 | 25 | 2,350 | 0.10/sq ft | 5,856 | 8,206 |
| Academic | 69,830 | 25 | 2,800 | 0.10/sq ft | 6,983 | 9,783 |
| **Subtotal Below Grade** | **305,195** | **NA** | **7,675** | **NA** | **12,839** | **20,514** |
| **Subtotal** | **1,408,634** | **NA** | **142,325** | **N/A** | **161,683** | **304,208** |
| **Subdistricts B, C, and Other Areas** | | | | | | |
| Retail | 124,196 | 0.17/sq ft | 21,113 | 0.17/sq ft | 21,113 | 42,226 |
| Office | 54,808 | 25 | 5,475 | 0.10/sq ft | 5,481 | 10,956 |
| Residential | 88,819 | 112 | 32,579 | 0.10/sq ft | 8,882 | 41,461 |
| Community facilities | 61,698 | 0.17/sq ft | 10,489 | 0.17/sq ft | 10,489 | 20,978 |
| **Subtotal** | **347,481** | **N/A** | **69,656** | **N/A** | **45,965** | **115,621** |
| **Total** | **1,756,115** | **N/A** | **211,981** | **N/A** | **207,648** | **419,829** |

**Notes:**
Rates from *CEQR Technical Manual.* Consumption rates are per person except where denoted as per square foot.
Development in Subdistricts B, C, and Other Areas is total development.
AC = Air conditioning

## WATER SUPPLY

Potential impacts on water supply in 2015 would be due to the increased demand from the Proposed Actions and from the construction activities, which would entail relocating some water supply services. The anticipated water demand is estimated at approximately 419,829 gallons per day (gpd) from development in the Academic Mixed-Use Area, Subdistrict B,[1] and the Other Areas. It is expected that by 2015, no residents would be displaced, but that 316 jobs would be displaced by the new uses. Using the *CEQR Technical Manual* rate of 25 gallons per person per day of water consumption, the overall water demand in the Project Area would thereby be reduced by about 7,900 gpd. Therefore, the net increase in demand (total new water demand minus displaced demand) anticipated with the Proposed Actions would be about 411,929 gpd, which

[1] CPC is contemplating certain modifications to Subdistrict B that would not result in any projected development sites in Subdistrict B. The proposed modifications are more fully described in Chapter 29, "Modifications to the Proposed Actions."

would be an increase of 0.037 percent to the City's current water demand. This increased demand would not be large enough to significantly impact the water supply system's ability to deliver water reliably based on the C*EQR Technical Manual* criteria, and demand for water is not expected to affect local water pressure. As part of the engineering and design effort, DEP's water supply engineers would be consulted to ensure adequate water and water pressure to service the surrounding area and for fire protection and other emergency needs.

## SANITARY SEWAGE

Sanitary sewage generation is conservatively assumed to be equal to the domestic water demand less the water used by air conditioning, which evaporates and does not enter the sewer system. As shown in Table 14-3, by 2015, new sewage generation in the Academic Mixed-Use Area, Subdistrict B, and the Other Areas would be about 211,981 gpd (total of domestic demand column), which would be conveyed to the North River WPCP. Existing uses that would be displaced by the Proposed Actions currently generate about 7,900 gpd. Therefore, the net additional flow with the Proposed Actions would be about 204,081 gpd. This volume is about 0.12 percent of the SPDES permitted flow. With the amended drainage plan in place, the additional sanitary sewage expected to result from the Proposed Actions would not significantly impact the combined sewer system. To ensure this, the weir height at the existing regulator servicing the Project Area (NR23) has to be modified as part of the amended drainage plan due to the increase in the sanitary flow in order to send the new two times dry weather flow to the WPCP. Further, the additional sewage generation would not cause the North River WPCP to exceed its design capacity or SPDES permit flow limit. Therefore, sewage generated from the Proposed Actions in 2015 would not cause any significant adverse impacts on wastewater infrastructure systems.

As discussed in Chapter 11 and Appendix E.1, this volume would not have a significant adverse impact on the water quality of the Hudson River. The New York City sewer system is designed to handle CSO events and would not experience a significant adverse impact.

## POTENTIAL CONSERVATION MEASURES

Columbia University has stated that it is developing new energy and environmental design guidelines in the retrofitting and operations of new buildings. The guidelines will closely follow many of the latest developments and published guidelines that have been developed by private groups and government agencies. Columbia University also intends to track innovations in this rapidly developing field and take advantage of developing technologies. The water consumption and sewage generation rates are from the *CEQR Technical Manual* and do not include expected reductions from the energy and environmental design policy. Therefore, the water consumption and sewage generation estimates in this Environmental Impact Statement (EIS) are conservative, and the actual rates and quantities would likely be less than used in the analysis.

## COMBINED SEWER OVERFLOWS

As presented in Table 14-4, with the Proposed Actions and without the partial stormwater system operational in 2015, the volume of CSO is expected to increase by approximately 0.3 mgy, and the number of CSO events to increase by 1 event. These calculations are based on the modeling analysis presented in Appendix E.1.

**Table 14-4**
**2015 CSO Volumes (million gallons per year) and Frequency of Discharge into the Hudson River**

| Condition | CSO Volume Discharged into Hudson River (mg) | Incremental Change Compared with No Build | Events per Year | Incremental Change Compared with No Build |
|---|---|---|---|---|
| Existing | 73.6 | 1.3 | 27 | 0 |
| No Build | 74.9 | 0.0 | 27 | N/A |
| Future with the Proposed Actions without the Partial Separate Stormwater System | 75.2 | + 0.3 | 28 | 1 |
| Future with the Proposed Actions with the Partial Separate Stormwater System | 74.3 | -0.6 | 27 | 0 |

With the Proposed Actions and with the partial stormwater system operational in 2015, the volume of CSO is expected to decrease by approximately 0.6 mgy, and the number of CSO events to remain unchanged. (As described in Appendix E.1, simulations utilized a standardized rainfall condition, specifically 1988. 1988 has been chosen as the base year for DEP's Use and Standards Attainment and the Long Term CSO Control Plan projects for all of New York City.) The decrease in CSO volume would be due to the new separate stormwater system servicing the half blocks north and south of West 130th Street between Broadway and Twelfth Avenue. This portion of the separate stormwater system would remove the stormwater discharged into the combined sewer system from 3.9 acres with only sanitary sewage from this area being discharged into the combined sewers. It is estimated that during a typical year, approximately 3.2 mgy would be diverted into the separate stormwater system. The annual CSO volume (0.6 mgy) reduction is smaller than the volume of stormwater that would be diverted to the new stormwater system (3.2 mgy), because not all storm events generate CSO events.

This volume of diversion with the partial stormwater system will not significantly lower the total flows to the North River WPCP over the course of a year. As discussed in Chapter 11 and Appendix E.1, these volumes of CSO, both with and without the partial stormwater system, would not have a significant adverse impact on the water quality of the Hudson River. The New York City sewer system is designed to handle CSO events and would not experience a significant adverse impact.

## LIQUID LABORATORY WASTE

The laboratories in the proposed research buildings and, to a lesser degree, the academic buildings would generate chemical and radiological liquid wastes that would not be disposed of in the New York City sewer system. Little biological liquid waste is generated in laboratories because it is generally absorbed by the bedding materials (see Chapter 22, "Public Health," for a discussion on the disposal of biological waste). DEP and the New York City Department of

Health (DOH) have established standards for chemical and radiological wastes that can be discharged into the sewer system. However, Columbia University has instituted stricter standards for liquid laboratory wastes. No discharge of untreated liquid chemical or radiological waste into the public sewer system is allowed. (A complete description of how Columbia University oversees the use and disposal of chemicals, radionuclides, and other materials that could affect public health is presented in Chapter 22.) As summarized below, Columbia University has a system for classifying, collecting, storing, and disposing liquid chemical and radiological wastes. This system would be implemented in the University buildings at the Manhattanville university area. These policies follow all applicable New York State, New York City, and federal regulations.

*TYPICAL CHEMICALS AND RADIONUCLIDES USED IN THE LABORATORIES*

In its science and medical laboratories, Columbia University currently uses over 1,000 regulated chemicals. Many of these are in liquid form. Typical chemicals include acids and bases, which are corrosive. Other chemicals are considered to be hazardous, such as organic solvents and halogenated and non-halogenated solvents. Toxic and reactive chemicals are also used in the existing Columbia University laboratories. It is expected that similar chemicals would be used in the laboratories and research buildings in the Project Area. In addition, medical services use liquid scintillation for analyzing blood samples that have been exposed to radioactivity. Certain other analyses use radionuclides in a liquid form. The handling of all of these materials follows applicable New York State, New York City, and federal regulations.

*STORAGE AND DISPOSAL OF LIQUID CHEMICAL AND RADIOLOGICAL WASTES*

As mentioned above and described in detail in Chapter 22, Columbia University has a strictly enforced policy of prohibiting the disposal of untreated liquid chemical and radiological wastes into the City's sewer system. This includes certain wastes used in mechanical systems, such as solvents used for cleaning in the central energy plants. This policy is expected to be instituted and enforced at the new Manhattanville university area.

Columbia currently stores these liquid wastes in a designated area of the laboratory inside specially marked containers. The containers are specifically designed for each specific type of waste so that they do not corrode or leak, and they are inspected regularly to ensure they are in sound condition. In addition, the storage areas have additional safety features, such as containment and protective equipment. The storage areas are inspected at least weekly by personnel trained in the handling and storage of chemicals. Columbia's Environmental Health and Safety Office or Radiation Safety Office, as appropriate, arranges for the collection and transport of the waste to a central storage area. Private contractors then pick up the waste and take it to private laboratories for neutralization and disposal. The handling, storage, transportation, and disposal of these materials follow all applicable New York State, New York City, and federal regulations.

*CONCLUSION*

These same strict health and safety practices would be adopted and enforced in the University buildings at the proposed Manhattanville university area. Therefore, no significant adverse impacts from the collection, transportation, and disposal of liquid chemical and radioactive wastes are expected.

# F. 2030 FUTURE WITHOUT THE PROPOSED ACTIONS

By 2030, minimal growth and development within the Project Area is expected to occur in the future without the Proposed Actions.

### WATER SUPPLY

DEP expects to complete Water Tunnel No. 3 by 2020, and one of the other water tunnels may be temporarily taken out of service for inspection and/or repair. The basic water distribution system is expected to remain the same.

### SANITARY SEWAGE

Without the Proposed Actions, little increase in sewage flows is expected from the Project Area by 2030. DEP projects that the dry weather flow at the North River WPCP would be 132 mgd, which would be within its SPDES permit limit of 170 mgd. The average wet weather flow of 8 mgd would increase the actual average daily flow to 140 mgd, which is still within the permit limit.

### COMBINED SEWER OVERFLOWS

In 2030 without the Proposed Actions, the volume of CSO is expected to increase from 74.9 (2015 No Build condition) to 77.4 mgy, and the number of CSO events increase by 2, from 27 to 29 events per year. The increase in volume and events is due to the background population growth. In comparison, the expected total CSO volume of the entire North River WPCP service area in 2030 is 512 mgy.

# G. 2030 FUTURE WITH THE PROPOSED ACTIONS

Similar to the analysis for Subdistrict A in 2015, ranges of floor areas have been established to develop the reasonable worst-case development scenario for Subdistrict A in 2030. The 2030 maximum and minimum floor ranges are fully described in Chapter 1. Similar to the 2015 analysis, for purposes of conducting a conservative infrastructure analysis, the reasonable worst-case development scenario includes the maximum amount of faculty and student housing and other uses that would have the highest water demand and sewage generation. Table 14-5 presents the 2030 incremental water demand in the Academic Mixed-Use Area.

### STREET RECONSTRUCTION AND NEW UTILITY LINES

As part of the construction between 2015 and 2030, West 131st Street and West 132nd Street between Twelfth Avenue and Broadway would be excavated to allow construction of the underground space. Only one street would be excavated at a time, and the other east–west streets would remain in service. As part of the excavation, all of the utilities currently in the street would be capped and the utility lines removed. From street-grade level to approximately 8 to 10 feet below street-grade level, the street would remain a mapped New York City street. The area from the bottom of the underground space to 8 to 10 feet below existing street grade would become part of Columbia's below-grade space. After construction of the underground facilities, the utilities, including water and sanitary sewer lines, would be placed in the street

**Table 14-5**
**Expected Maximum Incremental Water Demand with the Proposed Actions in 2030**

| Use | Size (sq ft) | Domestic Consumption Rate (gal/day) | Domestic Demand (gpd) | AC Consumption Rate (gal/day) | AC Demand (gpd) | Total Demand (gpd) |
|---|---|---|---|---|---|---|
| Housing | 1,300,000 | 112 | 476,840 | 0.10/sq ft | 130,000 | 606,840 |
| Research | 960,000 | 25 | 26,675 | 0.17/sq ft | 163,200 | 189,875 |
| Academic | 1,915,016 | 25 | 149,625 | 0.10/sq ft | 191,500 | 341,135 |
| Active ground floor | 600,000 | 0.17/sq ft | 102,000 | 0.17/sq ft | 102,000 | 204,000 |
| **Subtotal Above Grade** | **4,775,016** | **NA** | **755,140** | **NA** | **586,700** | **1,341,850** |
| Mechanical space | 226,397 | 25 | 4,725 | 0 | 0 | 4,725 |
| Parking | 888,980 | 25 | 3,100 | 0 | 0 | 3,100 |
| Storage | 358,818 | 25 | 900 | 0 | 0 | 900 |
| Recreation | 145,431 | 65 | 31,510 | 0.17/sq ft | 24,723 | 56,233 |
| Program support | 296,201 | 25 | 11,850 | 0.10/sq ft | 29,620 | 41,470 |
| Academic | 69,830 | 25 | 2,800 | 0.10/sq ft | 6,983 | 9,783 |
| **Subtotal Below Grade** | **1,985,657** | **NA** | **54,885** | **NA** | **61,326** | **116,211** |
| **TOTAL** | **6,760,673** | **N/A** | **810,025** | **N/A** | **648,026** | **1,458,061** |

**Notes:**
Rates from *CEQR Technical Manual.* Consumption rates are per person except where denoted as per square foot.
AC = Air conditioning

bed. Water, power, telecommunications, and sanitary sewer service would be provided to active buildings during the period that the street is being excavated. Maintenance of these services would be coordinated with the appropriate City agencies and private utilities. This would include coordination with agencies that provide emergency response, such as police and fire. The relocation of the water mains would be reviewed and approved by DEP.

## WATER SUPPLY

In 2030, the anticipated incremental water demand is estimated at approximately 1,458,061 gpd from development in the Academic Mixed-Use Area. It is expected that approximately 291 residents and 786 jobs would be displaced between 2015 and 2030. A total of 1,102 jobs would be displaced by 2030. This would reduce the water demand by 60,142 gpd. Therefore, the incremental water demand would be about 1,397,919 gpd. The total water demand from the Proposed Actions, including the 2015 and 2030 increments, would be about 1,809,848 gpd. Compared with the average annual demand of about 1,100,000,000 gpd, this increased demand would be about 0.16 percent and not be large enough to significantly affect the New York City water supply system, according to *CEQR Technical Manual* criteria. The system would be able to deliver water reliably, and demand for water is not expected to affect local water pressure.

## SANITARY SEWAGE

Sanitary sewage generation is conservatively assumed to be equal to the domestic water demand. The water used by air conditioning evaporates and does not enter the sewer system. As discussed above, by 2015 the Proposed Actions would generate sewage at a rate of approximately 204,081

gpd. Between 2016 and 2030, new sewage generation from the Proposed Actions would be about 810,025 gpd. Existing uses that would be displaced by the Proposed Actions between 2016 and 2030 currently generate approximately 60,192 gpd, which would result in a net of about 749,883 gpd. Therefore, the total anticipated sewage generation from the Proposed Actions, including the 2015 and 2030 increments, would be about 953,964 gpd. This sewage would be conveyed to the North River WPCP. This volume would be about 0.56 percent of the SPDES permitted flow. With the amended drainage plan in place, the additional sanitary sewage expected to result from the Proposed Actions would not significantly impact the combined sewer system. Further, the additional sanitary flow would not cause the North River WPCP to exceed its design capacity or SPDES permit flow limit. Therefore, sewage generated from the Proposed Actions would not cause any significant adverse impacts on infrastructure systems. To ensure this, the weir height at the existing regulator servicing the Project Area (NR23) has to be modified as part of the amended drainage plan due to the increase in sanitary flow in order to send the new two times dry weather flow to the WPCP.

## COMBINED SEWER OVERFLOWS

Table 14-6 presents the expected volume and frequency of CSO events to be discharged into the Hudson River, with and without the Proposed Actions, in both the 2015 and 2030 analysis years. These calculations are based on the modeling analysis presented in Appendix E.1.

With the entire separate stormwater system in place, as discussed above under "B. Amended Drainage Plan," 9.9 mgy of stormwater would be diverted from the combined system and discharged directly into the Hudson River through an existing CSO outfall. In 2030, with the Proposed Actions and the 9.9 mgy of stormwater diverted from the combined system, the volume of CSO discharged from the regulator serving the Project Area would be reduced by approximately 1.6 mgy compared with the No Build condition. The number of CSO events is not expected to change from the No Build condition and would remain at 29 per year. The decrease in CSO volume is due to the new separate stormwater system servicing the Academic Mixed-Used Area. The separate stormwater system would remove the stormwater discharged into the combined sewer system from 12.36 acres with only sanitary sewage from this area being discharged into the combined sewers. It is estimated that during a typical year, about 9.9 mgy would be diverted into the separate stormwater system. The annual CSO volume (1.6 mgy) reduction is smaller than the volume of stormwater that would be diverted to the new stormwater system (9.9 mgy), because not all storm events generate CSO events.

This volume of diversion will not significantly lower the total flows to the North River WPCP over the course of a year. However, the total volume of CSO discharged from all CSO outfalls in the North River WPCP service area is expected to decrease by 1.8 mgy. As discussed in Chapter 11 and Appendix E.1, this volume would not have a significant adverse impact on the water quality of the Hudson River. The New York City sewer system is designed to handle CSO events and would not experience a significant adverse impact.

Also shown in Table 14-6 is a comparison of 2030 conditions with the Proposed Actions, with and without the separate stormwater system. Without a separate stormwater system, the 9.9 mgy of stormwater would continue to flow into the combined system, and the volume of CSO discharged into the Hudson River would be approximately 3.0 mgy more than without the separate stormwater system. This is presented for comparison purposes only, since the EIS assumes that the amended drainage plan (which includes the separate stormwater system) would be in place if the Proposed Actions were to be adopted.

**Table 14-6**
**CSO Volume (million gallons per year)and Frequency of Discharges into the Hudson River**

| Condition | | CSO Volume Discharged into Hudson River (mg) | Incremental Change Compared with No Build | Frequency of CSO Events | Incremental Change Compared with No Build |
|---|---|---|---|---|---|
| Existing Conditions | | 73.6 | 1.3 | 27 | NA |
| 2015 | Future No Build | 74.9 | 0.0 | 27 | 0 |
| | Future with the Proposed Actions | 74.3 | -0.6 | 27 | 0 |
| 2030 | Future No Build | 77.4 | NA | 29 | NA |
| | Future with the Proposed Actions[1] | 75.8 | -1.6 | 29 | 0 |
| | Future with the Proposed Actions and without a Separate Stormwater System[2] | 78.8 | 1.4 | 29 | 0 |

**Notes:**
[1] Presents the effects on CSO discharges from the Proposed Actions with the separate stormwater system.
[2] Presents the effects on CSO discharges from the Proposed Actions without the separate stormwater system. This condition is not proposed as part of the Proposed Actions. The analysis is presented for comparison purposes only.

## LIQUID LABORATORY WASTE

As in 2015, the laboratories operating in 2030 in the proposed research buildings and, to a lesser degree, the academic buildings would generate liquid wastes that are not suitable for disposal in the New York City sewer system. DEP and DOH have established standards for liquid chemical and radiological wastes that can be discharged into the sewer system. However, as previously discussed, Columbia University has instituted stricter standards for liquid laboratory wastes and does not allow the discharge of untreated liquid chemicals or radiological wastes into the public sewer system. No discharge of untreated liquid chemical or radiological waste into the public sewer system is allowed. (A complete description of how Columbia University oversees the use and disposal of chemicals, radionuclides, and other materials that could affect public health is in Chapter 22.)

These same strict health and safety practices would be adopted and enforced in the University buildings at the proposed Manhattanville university area. These policies follow all applicable New York State, New York City, and federal regulations. Therefore, no significant adverse impacts from the collection, transportation, and disposal of liquid chemical and radioactive wastes are expected. ✷