The New York City
Municipal Water Finance Authority

AECOM

Fiscal Year 2020

CONSULTING ENGINEER'S REPORT

February 28, 2020

Front cover:
NYCDEP (14) Wastewater Resource Recovery Facilities (WRRFs) and
Newtown Creek WRRF digesters

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February 28, 2020

Ms. Olga Chernat
Executive Director
New York City Municipal Water Finance Authority
255 Greenwich Street
New York, NY 10007

Re: New York City Municipal Water
Finance Authority
Fiscal Year 2020 Consulting Engineer's Report

Dear Ms. Chernat:

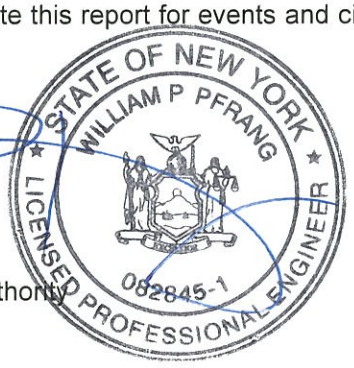
We herewith submit the Fiscal Year (FY) 2020 Consulting Engineer's Report on the operation of the Water and Sewer System of the City of New York (hereinafter referred to as "The System"). This Report addresses the condition and operation of The System as it presently stands, as well as the adequacy of capital and operating programs for Fiscal Years 2020 and 2021.

It is our opinion that The System condition is adequate and that it continues to be managed by the New York City Department of Environmental Protection (NYCDEP) in a professional and prudent manner. The current capital budget allocations for FY 2020 and FY 2021 are adequate for the immediate needs of The System.

The information presented in this report is based on the Preliminary Budget released on January 16, 2020. It is important to note that budgetary planning will continue past the date of this report and revisions may be made. It is our opinion, however, that meaningful observations and conclusions can be drawn at this time, although the final budget allocations may change during the budget finalization process.

We are not required to update this report for events and circumstances occurring after the date of this Report.

Very truly yours,



William Pfrang, P.E., BCEE
Consulting Engineer for
Municipal Water Finance Authority

Document #5592

THE NEW YORK CITY MUNICIPAL WATER FINANCE AUTHORITY

FISCAL YEAR 2020 CONSULTING ENGINEER'S REPORT

PREPARED BY

AECOM

February 28, 2020

Document #5592

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1.0 EXECUTIVE SUMMARY

This Report addresses the condition of The System and the adequacy of the capital program and operating budgets for Fiscal Years 2020 and 2021 as presented in the New York City Department of Environmental Protection (NYCDEP) Preliminary Budget released on January 16, 2020.

The NYCDEP is charged with the responsibility of the overall operation and maintenance of the vast water and wastewater infrastructure serving New York City (NYC). NYCDEP's vision is "*to be a world class water and wastewater utility, while building a sustainable future for all New Yorkers*". The critical mission of NYCDEP is to enrich the environment and protect public health for all New Yorkers by providing high quality drinking water, managing wastewater and stormwater, and reducing air, noise and hazardous materials pollution in NYC[1]. The scope of this report will focus on the water and wastewater systems. NYCDEP remains vigilant in providing operation and maintenance of water and wastewater infrastructure comprising significant capital assets and providing long-term planning of future needs. In recent years NYCDEP has implemented new programs and infrastructure to meet more stringent regulatory requirements (Biological Nitrogen Removal (BNR) for wastewater resource recovery facilities, Combined Sewer Overflow (CSO) treatment facilities, and water treatment facilities). While providing these infrastructure improvements, DEP is also tasked to maintain its water and wastewater infrastructure to comply with strict regulations and avoid critical failure of processes and assets. In light of climate change, it is essential for NYCDEP to continue its efforts to maintain a resilient and sustainable water and wastewater system. NYCDEP must constantly manage risks and prioritize competing needs of The System to achieve its objectives. Considering the magnitude of the overall infrastructure and the operational service required, it is our opinion that:

- The System continues to be managed in a professional and prudent manner with an appropriate regard for the level of service afforded to the users within the available funding.
- The physical condition of The System receives an "adequate rating", our highest rating. Due to the size and complexity of The System, NYCDEP always requires future capital investments for the replacement and/or repair of aging infrastructure in a systematic and cost-effective manner.
- NYCDEP capital and expense budget projections for FY 2020 satisfy the immediate needs for The System including legally mandated projects, which comprise approximately 29% of the capital budget for FY 2020.
- NYCDEP capital budget projections for FY 2021 satisfy the immediate needs for the System including legally mandated projects, which comprise approximately 29% of the capital budget for FY 2021. Expense budget projections for FY 2021 are currently being evaluated based upon the projected new needs of The System and may require adjustment when the evaluation is complete.
- NYCDEP capital planning is an ongoing iterative process addressing priorities and needs of The System. The NYCDEP is responsive to the long-term requirements of the service area.

[1] NYCDEP 2018 Strategic Plan, *Enriching Our Legacy*.

- Staffing levels are approximately 96% of approved allocations, which reflects a significant decrease in vacancies. NYCDEP has identified additional needs and skill sets to meet the requirements of new facilities coming on-line and more complex facility operation requirements and to improve preventive maintenance and corrective maintenance (PM/CM) programs. NYCDEP is also evaluating its future needs focusing on succession planning, transfer of knowledge, filling vacancies and staff retention in anticipation of departure of experienced NYCDEP employees that are eligible for retirement in the near future.

2.0 PURPOSE AND SCOPE OF THE REPORT

The purpose of this report is to provide engineering information pertinent to the condition of the Water and Sewer System (The System) serving NYC and the adequacy of the proposed Capital Improvement Program (CIP) funds. Since 1983, AECOM (formerly Metcalf & Eddy) has provided engineering services related to the NYC Water and Wastewater Operations Evaluation Study (Study) and has provided services to the NYC Municipal Water Finance Authority (Authority) since 1985. Certain studies and analyses were performed in anticipation of the creation of the Authority and were used in developing the information included in the Municipal Water Finance Authority Official Statements under the captions: "CAPITAL IMPROVEMENT AND FINANCING PROGRAM — Ten Year Capital Strategy, Current Capital Plan and the Capital Improvement Program", "THE SYSTEM — The Water System", and "THE SYSTEM — The Sewer System". AECOM has performed ongoing evaluations of the condition of The System, which has included independently reviewing the capital and operating programs pertaining to water and wastewater, reviewing select pertinent studies associated with the long-term development of The System, and conducting Due Diligence interviews with key individuals responsible for managing the activities of the NYCDEP.

The report addresses the issues listed below:

- present physical condition of The System,
- Fiscal Year (FY) 2020[2] capital budget and FY 2021 projected capital budget for The System,
- FY 2020 expense budget and FY 2021 projected expense budget relative to operation and maintenance of The System,
- overview of the Preliminary Four-Year Current Capital Plan for FYs 2021 to 2024 and,
- management of The System.

[2] The NYCDEP Fiscal Year begins on July 1 and ends on June 30. FY 2020 began on July 1, 2019 and ends on June 30, 2020.

3.0 METHODOLOGY FOR ANALYSIS

The analyses conducted by AECOM were accomplished utilizing the following methods:

- Due Diligence interviews with representatives of the NYCDEP and discussions with representatives of the Authority,
- review of documentation relative to the ongoing budgetary process,
- review of the status of ongoing major programs and review of select reports/ presentations provided by NYCDEP,
- information gathered from visiting operating facilities and major on-going construction programs, and
- consideration of national and local trends in the water and wastewater industry (federal, state and local regulations, resource recovery, aging infrastructure, resiliency, climate change impacts, energy programs, other issues).

The budgetary process is ongoing and was not concluded by the time of this report's publication. It is anticipated that the Executive Plan will be released in April 2020. Observations and conclusions presented herein are therefore based on budget data as it stood at the date of this report. It is our opinion that these observations and conclusions are meaningful with respect to The System. It should be noted, however, that these observations and conclusions are subject to change based on the final outcome of the budgetary process.

4.0 MANAGEMENT AND OPERATION OF THE NYCDEP SYSTEM

NYCDEP Strategic Plan

NYCDEP released its Strategic Plan in June 2018, the *2018 Strategic Plan Enriching Our Legacy*. NYCDEP updated the mission and vision of the organization to reflect the shifting priorities and to meet new objectives. The Plan identifies eight core values that pertain to how NYCDEP conducts business; these core values are safety, integrity, service, diversity, support, transparency, sustainability, and innovation. NYCDEP published *Year One Progress Report,* the annual update of the Strategic Plan in June 2019, to monitor performance and provide accountability of their progress in implementing the Strategic Plan goals. The 2019 Progress Report Strategic Plan provides an update on the implementation of the following seven goals and forty-three specific initiatives that will guide NYCDEP to focus on their priorities:

- Provide world-class and sustainable water and wastewater services now and for future generations (includes thirteen specific initiatives)
- Control local sources of pollution to improve quality of life (includes six specific initiatives)
- Reduce our carbon impact and mitigate the effects of climate change (includes four specific initiatives)
- Increase public awareness of our operations and improve service to our customers and the business community (includes six specific initiatives)
- Cultivate a diverse and highly qualified workforce to meet future challenges (includes four specific initiatives)
- Maximize operational efficiencies across the agency (includes five specific initiatives)
- Leverage innovative approaches to improve performance (includes five specific initiatives)

NYCDEP is on schedule for almost 70% of the strategic initiatives within the first year of the Plan, with the remaining initiatives either delayed or not started yet. NYCDEP considered a wide range of factors in the development and implementation of the Plan, including current and anticipated mandates, institutional knowledge of The System, financial planning, technology and industry trends, workforce demographics, customer service, and the economic impact of water rates to customers. The Strategic Plan will evolve over the years to reflect emerging and changing trends in the industry while adhering to the NYCDEP visionary goals.

Organizational Structure

NYCDEP maintains an ongoing close collaboration among all the bureaus since many complex programs impact multiple disciplines and operating bureaus. The NYCDEP is currently organized into the following Bureaus:

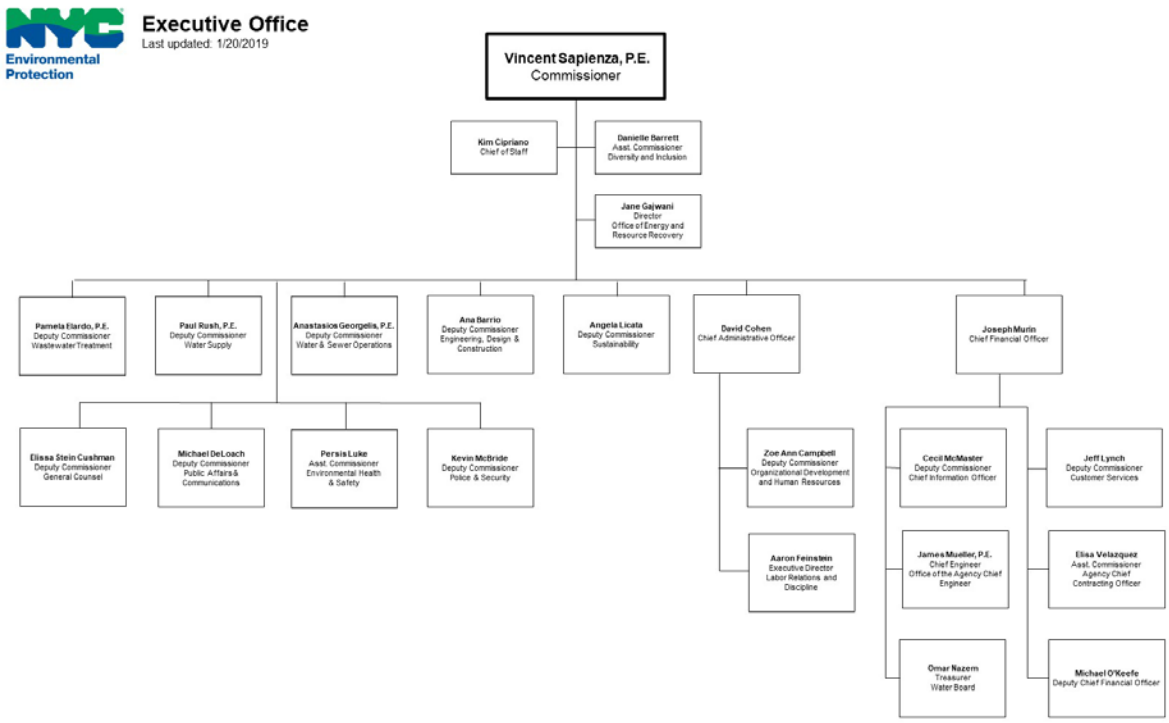


Figure 4-1: NYCDEP Executive Level Organizational Chart

- The following offices and bureaus report directly to the Commissioner: Chief of Staff, Bureau of Public Affairs and Communications, Assistant Commissioner of Diversity and Inclusion, General Counsel, Environmental Health & Safety (EH&S), the Chief Financial Officer, Police and Security, Chief Administrative Officer, Bureau of Wastewater Treatment (BWT), Bureau of Water Supply (BWS), Bureau of Water and Sewer Operations (BWSO), Office of Energy and Resource Recovery Programs, Sustainability, and Bureau of Engineering, Design, and Construction (BEDC).

- The Chief Financial Officer oversees the Budget Office, Bureau of Customer Service, the Office of the Agency Chief Engineer (OACE), the Office of Agency Chief Contracting Officer (ACCO), Information Technology, Management Analysis, and Planning and Auditing.

    - The main function of the OACE is planning, capital funding and program prioritization and optimization within NYCDEP. The OACE is organized within the following directorates: Capital Budget; Wastewater Integrated Planning; Water Supply and Distribution Integrated Planning; Asset Management and Data Analytics; Business Analysis and Optimization; Engineering Guidelines and Standards. The OACE coordinates with the Capital Planning section of the Operating Bureaus (BWS, BWT and BWSO). The OACE also collaborates with BEDC, BWS, BWT, BWSO, Sustainability, and Office of Energy and Resource Recovery to integrate projects and setting priorities across all NYCDEP. The OACE will also be the lead on key goals and strategies outlines in the 2018 DEP Strategic Plan.

- The three Operations Bureaus consist of the Bureau of Water Supply (BWS), the Bureau of Water and Sewer Operations (BWSO), and the Bureau of Wastewater Treatment (BWT). The Deputy Commissioner of each operating Bureau reports directly to the Commissioner. The key responsibilities of each operating bureau are:

- BWS is responsible for delivering high quality drinking water to the City of New York. It is organized into seven directorates (Planning, Watershed Protection, Source Water Operations, Water Treatment Operations, Water Quality, Management Services/Budget and Environmental Health/Safety) that report directly to the Deputy Commissioner of BWS. A Research Application section within BWS focuses on applying national and international research developments to BWS best practices and to help prepare for future challenges. The Water Treatment Operations Directorate focuses on the treatment of water leaving the reservoirs before it moves toward the distribution system. Once the water leaves the Hillview Reservoir and Croton Water Filtration Plant (WFP), it enters the distribution system that is operated and maintained by BWSO. BWS' responsibilities include the management, operation and maintenance of the Croton WFP, Catskill/Delaware Ultraviolet (Cat/Del UV) Disinfection Facility, Hillview Reservoir, Jerome Park Reservoir, and Chlorination and Fluoridation at Delaware Aqueduct Shaft 18, Pleasantville Alum Plant and all associated dams, aqueducts, shafts, waterworks and support systems. The Source Water Operations Directorate is responsible for the storage and transmission of drinking water, maintenance of reservoirs, dams and other infrastructure, downstream releases and treatment at upstate wastewater treatment plants. BWS conducts extensive monitoring of water quality, both within the city's distribution system and throughout the upstate watersheds. BWS is also responsible for the overall management and implementation of the city's Watershed Protection Program and for complying with the city's Filtration Avoidance Determination (FAD) program. BWS is updating and finalizing a Strategic Plan for water supply planning and operation for 2020 through 2024.

- BWSO is responsible for the operation and maintenance of the city's drinking water distribution system, wastewater collection system, Bluebelts and Green Infrastructure. BWSO field operations are responsible for the following: (1) that residences and businesses have an adequate supply of potable water, (2) that there is sufficient water for fire protection, and (3) that the wastewater collection system is properly functioning. BWSO coordinates closely with the New York City Department of Design and Construction (NYCDDC), since NYCDDC does the design of the water mains and sewers that BWSO operates and maintains. BWSO is heavily focused on stormwater management issues and has an intensive program to alleviate the Southeast Queens flooding problem. The Green Jobs/ Green Infrastructure Maintenance are part of BWSO. BWSO is in the process of implementing online permitting for water, sewer and stormwater connections.

- BWT is responsible for the operation and maintenance of the fourteen in-city Wastewater Resource Recovery Facilities (WRRF), the City's 96 wastewater pump stations, interceptors, CSO regulators, sludge dewatering facilities, fleet of marine vessels, laboratories, and the control of discharges from combined sewer overflows. Two Assistant Commissioners (Capital Planning/Delivery and Wastewater Treatment/Resource Recovery Operations) report directly to the Deputy Commissioner of BWT. BWT Mission statement is "We safely convey and treat wastewater, manage stormwater, and recover valuable resources to protect public health and enhance the environment to sustain the economy and quality of life for all who live, work and play in NYC". BWT Vision statement is "Advance a state of good repair through engaged employees and responsible asset management and become a leader in wastewater resource recovery". BWT plans to further drive decision-making through data driven analytics. Because of the energy-intensive nature of their facilities, BWT coordinates closely with the Office of Energy and Resource Recovery Programs. BWT's Research and Development Plan will focus on innovation, one of NYCDEP's core values. BWT continues to focus on organizational development planning to identify and evaluate the current and future staffing and skill set needs of BWT operations. Seven Area Facility Managers (two WRRFs per Facility Manager) provide senior leadership in the

operation of the fourteen wastewater resource recovery facilities. The Area Facility Managers report to the Director of Plant Operations. Working with the Chief Operators of the individual plants, the Area Facility Managers provide overall operational consistency. Each Area Facility Manager has an assigned Reliability Centered Maintenance Engineers (RCME) who coordinates maintenance operations.

- Capital Improvement Program Delivery is executed by the Bureau of Engineering, Design, and Construction (BEDC). BEDC is organized into the following directorates: Water System Capital Program, Wastewater Capital Program, and In-House Design. BEDC is responsible for project delivery consisting of the design and construction of capital improvement projects, including major water transmission facilities, water treatment facilities, wastewater treatment facilities, wastewater pumping stations, and stormwater/CSO facilities. BEDC implements many of these projects with contract services for planning, design, construction and construction management (CM), along with an In-House Design (IHD) group. BEDC continues to find ways to improve business practices that will have a positive impact on project implementation, such as streamlining procurement processes for improved efficiency and the development of front-end business cases. These improvements will benefit overall project execution with better controls on project schedules and project costs/change orders.

- The Office of Energy and Resource Recovery Programs is responsible for the coordination of energy management for all operating bureaus and overall NYCDEP energy initiatives and works closely with NYC Department of Citywide Administrative Services (DCAS). This Office guides and oversees NYCDEP's energy, biosolids and residuals, organics/ food waste, resource recovery, and greenhouse gas (GHG) policy, planning, projects, budgeting, research and studies. This Office advises on energy and GHG related expense and capital funding, in addition to seeking outside funding sources for projects, such as those available through DCAS. The Office of Energy and Resource Recovery is also managing the development of the recently initiated Energy and Carbon Neutrality (ECN) Plan.

- The Bureau of Sustainability at NYCDEP is responsible for the development and implementation of environmental policy and strategy, including water and air quality, the noise code, and other quality of life issues. The Group includes the Bureau of Environmental Planning and Analysis (BEPA), Hazardous Materials and Superfund Planning & Analysis, and the Bureau of Environmental Compliance (BEC). Coordinating and tracking the many elements of the Green Infrastructure Plan occurs within BEPA. BEPA is also responsible for conducting environmental reviews for NYCDEP, providing technical assistance for the preservation of natural resources, conducting long range planning (population/ employment, consumption and demand/flow), conducting strategic planning to help ensure appropriate forecasting, trend analysis, regulatory review, scientific modeling, and research. BEPA continues the work on the climate change task force and helps NYCDEP plan for the new growth stimulated by rezoning throughout the city. The Sustainability Group is also responsible for implementing and tracking the One NYC sustainability initiatives for NYCDEP. The Hazardous Materials and Superfund Planning & Analysis group coordinates Superfund Programs. BEC is made up of the Division of Air & Noise Policy, Permitting and Enforcement and the Asbestos Control Program. BEC is responsible for responding to air and noise code complaints, maintaining the database of facilities containing hazardous and toxic material, overseeing remediation of hazardous waste municipal landfills, managing investigation of contaminated sites and responding to hazardous material emergency incidents.

5.0 OVERVIEW OF THE SYSTEM

NYCDEP is charged with the operation, maintenance and management of a vast complex system of water, wastewater and stormwater infrastructure.

5.1 Water Supply System

The NYC water is supplied from three upstate watersheds (Delaware, Catskill and Croton), which extend as far as 125 miles north of NYC, consisting of 19 collecting reservoirs (in the Delaware, Catskill, and Croton Systems), three controlled lakes (in the Croton System), and three additional balancing and distribution reservoirs (Kensico, Hillview and Jerome Reservoirs) as shown in Figure 5-1. The NYC water supply system has a total available storage capacity of 570 billion gallons. NYCDEP maintains operational flexibility to vary the water supply from all three water systems, as it deems necessary.

NYCDEP also maintains wells in Queens; however, the groundwater supply system has not been providing water to the NYC distribution network since 2007. NYCDEP submitted the groundwater permits renewal in December 2017 so that the groundwater will be available as a back-up water supply, if necessary. However, the upstate surface water supply is the primary source water for NYC.

Croton System

The Croton water supply system, the NYC's oldest water supply, was put into service in 1842 with the construction of the Old Croton Aqueduct delivering water to the City and continued to expand; and now includes several reservoirs (New Croton, Croton Falls Main, Cross River, West Branch, Titicus, Amawalk, East Branch, Muscoot, Bog Brook, Middle Branch, Boyds Corner, Croton Falls Diverting), all of which now feed into The New Croton Aqueduct.

The Croton System delivers water by gravity from the New Croton Reservoir through the New Croton Aqueduct to the Jerome Park Reservoir in the Bronx. The water is then sent to the Croton WFP, which came online in May 2015. The Croton WFP has a maximum capacity of 290 MGD and is divided into Plant A and Plant B. The water treatment processes consist of chemical addition, dissolved air flotation (DAF), and filtration followed by UV disinfection. The Croton WFP is located beneath Van Cortlandt Park in the Bronx. It is the largest underground water filtration plant in the United States. The Croton WFP is also the largest stacked DAF filter plant in the United States. After treatment, the water is conveyed through concrete lined pressure water tunnels to the distribution service areas. Use of the Croton WFP varies based upon NYCDEP's operational needs. The Croton WFP provides NYCDEP with a valuable and flexible resource.

The Catskill System

The Catskill system was put into service in 1915 and provided water to all five boroughs by 1917. The Catskill system is made up of the Schoharie Reservoir and the Ashokan Reservoir, which feed water to the City by gravity via the Catskill Aqueduct. The balancing reservoir at Kensico, and the distribution reservoir at Hillview were implemented as part of the Catskill system. The system also included City Tunnel No.1 which conveys water from Hillview Reservoir by gravity to the City and which was put into

operation in 1917. City Tunnel No.1 is a deep rock tunnel which connects into the water supply distribution network via a series of riser shafts.

The Catskill Aqueduct is for most of its length a near surface aqueduct, with pressure tunnels only where the aqueduct alignment encounters low terrain, the most significant being the Hudson River valley. The near surface portions of the aqueduct are presently being cleaned to improve capacity, and plans are underway to investigate methods to reduce leakages in the pressure tunnel portions of the aqueduct.

The Delaware System

Construction of the Delaware system began in 1937. The Delaware watershed was put into service in phases and is comprised of four reservoirs - Cannonsville Reservoir completed in 1964, Pepacton Reservoir completed in 1955, Neversink Reservoir completed in 1954 and Roundout Reservoir completed in 1950, which receives water by gravity from the other reservoirs in the Delaware System. Delaware water is conveyed by gravity to Kensico Reservoir by the Delaware Aqueduct, via Shafts 17 and 18. The Delaware Aqueduct continues to Hillview Reservoir via the Eastview site and was connected into the balancing storage at Hillview by two new gate chambers with connecting conduits to the existing chambers at the reservoir. At that time City Tunnel No.2 was constructed, which is a deep rock tunnel connected to the city distribution network by a series of riser shafts. The Delaware Aqueduct is a deep concrete lined pressure tunnel which passes about 600 feet below the Hudson River. Over the years leakage has developed at some sections of the pressure tunnel, most notably at the Hudson River crossing. A bypass tunnel is presently under construction at the Hudson River which will allow the leaking portion of the aqueduct to be taken out of service.

Filtration Avoidance of Catskill and Delaware Water Supplies

Water from the upstate reservoirs is conveyed by gravity through an extensive system of tunnels and aqueducts. The 92-mile Catskill Aqueduct conveys water from the Ashokan Reservoir to the Kensico Reservoir and the 85-mile Delaware Aqueduct conveys water from the Rondout Reservoir to the West Branch Reservoir and then to the Kensico Reservoir. Because of the high quality water in the upstate reservoirs and well protected water supply, the US Environmental Protection Agency (USEPA) granted NYC a waiver from the federal requirement to filter drinking water originating from surface water supplies. As a result, the Delaware and Catskill watersheds do not require filtration and the watersheds are protected by a mandated Filtration Avoidance Determination (FAD), which specifies disinfection requirements and identifies watershed source protection requirements to maintain its high level of water quality. Water entering the distribution system is treated with chlorine, fluoride, food-grade phosphoric acid and sodium hydroxide. BWS disinfects Catskill and Delaware water systems at Kensico Reservoir Shaft 18 and additional chlorine disinfection occurs prior to entering the distribution system at Hillview Reservoir.

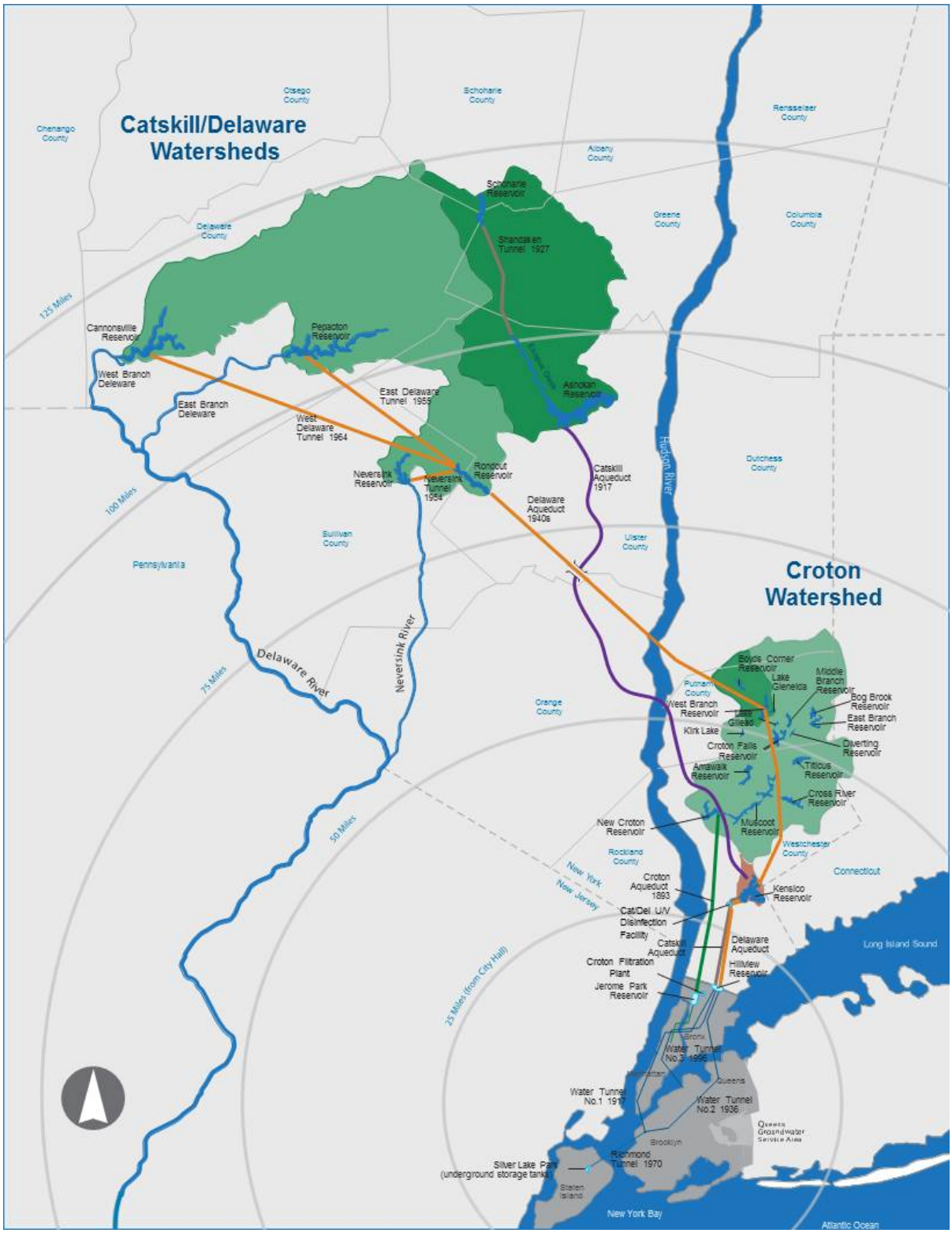


Figure 5-1: New York City Water Supply System

A condition of the FAD was that DEP was mandated to provide UV treatment to Catskill and Delaware water. Accordingly, a UV facility was completed in 2012 at the 153-acre Eastview site which is on the alignment of both the Delaware Aqueduct and the Catskill Aqueduct. The Catskill/Delaware Ultraviolet Disinfection (Cat/Del UV) Facility, which treats water from Kensico Reservoir feeds water to NYC through the Hillview Reservoir. The Cat/Del UV Facility has a capacity of 2.4 BGD and is the largest UV facility in the United States. At present the UV facility at Eastview can only be supplied via the Delaware Aqueduct from Shaft 18 on Kensico Reservoir. Hydraulic limitations prevent the use of the Catskill Aqueduct for this purpose. In order to provide system redundancy, DEP is in the process of designing an additional tunnel from Kensico Reservoir to the UV facility at Eastview. This is referred to as the Kensico-Eastview Tunnel.

Connection to the Distribution System

Both the Kensico Reservoir (30.6 billion gallons storage capacity) and the Hillview Reservoir (900 million gallons storage capacity) serve as balancing reservoirs for the water system, handling the daily and hourly fluctuations of water demand, respectively. Located downstream of the UV facility at Eastview, Hillview reservoir is an uncovered reservoir and as such is not in compliance with Federal Regulations that require finished water reservoirs to be covered. Under a 2019 Consent Decree, DEP is presently undertaking planning studies to evaluate alternative ways of achieving compliance.

Water from Hillview Reservoir is conveyed by gravity to the city through three tunnels as indicated on Figure 5-2. City Tunnel No. 1 was constructed as part of the Catskill system, and City Tunnel No. 2 as part of the Delaware system. City Tunnel No. 3, which is partially in operation and partially under construction, first came into operation in 1996. All three tunnels are deep concrete lined tunnels which connect into the surface distribution network by a series of riser shafts.

Most of the water from the Croton WFP is pumped into the city tunnels, with some water conveyed by gravity to the lower supply areas. The water distribution system from the three city tunnels consists of a network of approximately 7,000 miles of water mains, as well as valves, fire hydrants, distribution facilities, gatehouses, pump stations, water quality monitoring stations, laboratories and maintenance and repair yards.

The average daily NYC water delivered for fiscal year (FY) 2019 was 990.9 million gallons per day (MGD)[3], which provides for more than 8.6 million residents of New York City, and transients consisting primarily of tourists and daily commuters. It should be noted that current average daily water delivery in NYC is about 35% less than the delivery levels experienced in the early 1990s. If the conservation measures currently in place remain effective there will be no immediate need for the city to develop additional long-term water sources to meet normal demand. The Water System also provides potable water (approximately 105 MGD) to upstate consumers in parts of Westchester, Putnam, Ulster, and Orange Counties (population approximately one million people).

[3] Water delivery data provided by NYCDEP BWS

Figure 5-2: New York City Water Conveyance Infrastructure

5.2 Wastewater System

The NYCDEP wastewater treatment system is comprised of fourteen (14) in-city WRRFs that discharge into receiving bodies surrounding NYC, as indicated in Figure 5-3 and is operated by the BWT. In addition, there are seven upstate WRRFs and one community septic system that are operated by BWS which are necessary to protect the NYC upstate watersheds. The in-city WRRFs have an average design capacity of 1.8 Billion Gallons per Day (BGD) and are treating approximately 1.31 BGD of wastewater consisting of municipal sewage and some stormwater from combined sewers.

The NYC sewage collection system is divided into 14 drainage areas, which correspond to each of the 14 WRRFs. The sewage collection system comprises approximately 152 miles of intercepting sewers and 7,500 miles of sewer pipes of varying size and material, which are classified as sanitary, storm or combined sewers. Much like many other older cities, the NYC collection system consists primarily of combined sewers (approximately 60% of NYC land area is served by combined sewers). During dry weather, the combined sewers carry municipal wastewater to the WRRFs. During a wet weather event, municipal wastewater, and rainwater from surface water runoff is also collected in the combined sewers. Most of the flow is sent to the WRRFs while excess combined sewer flow discharges to the receiving water as combined sewer overflow (CSO). There are approximately 426 permitted CSO outfalls and four CSO retention facilities (Paerdegat, Alley Creek, Spring Creek, Flushing Bay) that provide screening, settling and storage of the CSO before discharging. The stormwater remaining in the CSO facilities after the wet weather event is then directed to the WRRFs for treatment.

The in-city WRRFs provide secondary treatment in accordance with their State Pollutant Discharge Elimination System (SPDES) permits. Additionally, eight of the WRRFs are required to provide Biological Nitrogen Removal (BNR) to meet Total Maximum Discharge Limit (TMDL) regulatory requirements that have been set to protect the Upper East River and Jamaica Bay receiving waters. Four of the Upper East River WRRFs and two of the Jamaica Bay WWRFs are currently operating in BNR mode. The Rockaway WRRF and Coney Island WRRF are currently being upgraded to BNR. The liquid biosolids produced during wastewater treatment processing is transported by five DEP-owned, inner-harbor sludge vessels to centralized sludge dewatering facilities located at six WRRFs. Dried biosolids and other treatment by-products are collected by third-party contractors who take responsibility for final disposal.

Additional NYCDEP infrastructure that supports the wastewater system includes 96 wastewater pump stations, two in-stream aeration facilities, 497 flow regulators, 148,000 stormwater catch basins, and six testing laboratories.

Until recently, the WRRFs were referred to as Wastewater Treatments Plants (WWTPs) describing their primary function which is to treat municipal wastewater so that the treated effluent can be discharged to the receiving waters surrounding New York City without negatively impacting water quality in accordance with the regulatory requirements set by the New York State Department of Environmental Conservation (NYSDEC). The facilities are now being referred to as Wastewater Resource Recovery Facilities (WRRFs) indicating that valuable resources can be recovered from the municipal wastewater. Recovered resources include reclaimed water which can be used to meet non-

potable water demand, wastewater biosolids suitable for agricultural reuse, and methane gas can be used as a green energy source. The wastewater industry has adopted this change from wastewater treatment to resource recovery, focusing on the products and benefits of the wastewater treatment rather than the waste coming into facilities.

The transition from WTTP to WRRF is further necessitated by the Mayoral initiative to minimize NYC's reliance on fossil fuels and intent to minimize GHG emissions. This will require DEP in general and BWT specifically to upgrade facilities to meet scheduled goals. Studies are currently underway to identify the future capital investment necessary to meet these goals.

WASTEWATER RESOURCE RECOVERY FACILITIES					
ID No.	Name	BNR Facility	Biosolids Dewatering Facilities	Capacity (MGD)	2018 Avg (MGD)
MANHATTAN					
1	Wards Island	✓	✓	275	215
2	North River			170	114
BRONX					
3	Hunts Point	✓	✓	200	146
BROOKLYN					
4	Newtown Creek			310	221
5	26th Ward	✓	✓	85	50
6	Coney Island	✓		110	100
7	Red Hook		✓	60	33
8	Owls Head			120	96
QUEENS					
9	Tallman Island	✓		80	62
10	Jamaica	✓		100	82
11	Bowery Bay	✓	✓	150	107
12	Rockaway	✓		45	18
STATEN ISLAND					
13	Port Richmond			60	30
14	Oakwood Beach		✓	40	33
TOTAL				1,805	1,307

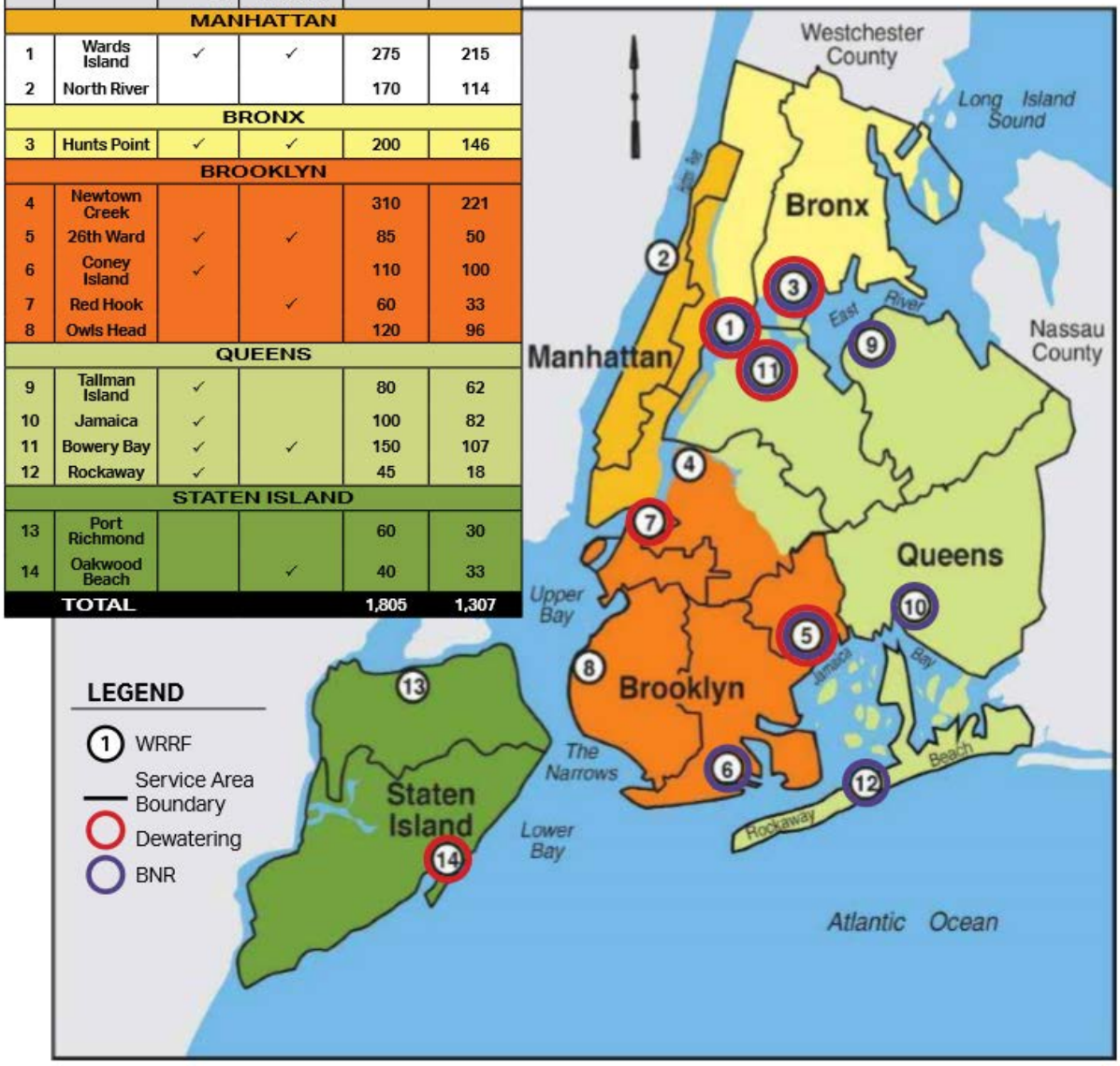


Figure 5-3: New York City Wastewater Resource Recovery Facilities (WRRF)

6.0 CAPITAL IMPROVEMENT PROGRAM (CIP)

6.1 Overview

Budgeting is a lengthy and comprehensive process, especially for an agency operating such a large and complex system as the NYCDEP. NYCDEP budgeting is an ongoing, iterative process that considers significant and substantial needs including regulatory requirements, legal mandates, mayoral initiatives, state of good repair (SOGR), energy projects, capacity enhancements, dependability, environmental, health, and safety (EH&S) compliance requirements, localized community drivers, security measures, and climate change adaptation/resiliency improvements. These many needs must be met within the funding limitations. NYCDEP seeks opportunities for synergies with project implementation such as addressing SOGR needs along with energy and resource recovery and flood resiliency requirements. Project schedules, cost estimate updates, technical issues, regulatory updates, emergency events, reoccurring events and legal issues may impact project prioritization and the overall budgeting process. NYCDEP is continuously evaluating projects to prioritize NYCDEP's most critical needs first. This challenging budget exercise requires NYCDEP to evaluate project elements and scheduling to best efficiently address the most immediate needs. As the projects are fully developed, scheduling modifications are necessary within the 10-Year Capital Strategy. As such, the 10-Year Capital Strategy is constantly being adjusted and published every two years.

The NYCDEP CIP consists of the Preliminary Ten-Year Capital Strategy for FY 2020 through FY 2029 and the Current Capital Plan for FY 2020 through FY 2024. The Current Capital Plan was published on January 16, 2020 and it is updated quarterly. The Current Capital Plan supersedes the Ten-Year Capital Strategy for FY 2020 through FY 2024. The Ten-Year Capital Strategy is updated every two years. The next Ten-Year Capital Strategy will be released in January 2021. This report reviews the Current Capital Plan, including the capital budget for FY 2020, which ends on June 30, 2020, and the preliminary capital budget for FY 2021, which ends on June 30, 2021. AECOM has reviewed the Preliminary Four-Year Current Capital Plan and met with key individuals responsible for budgetary planning to provide an assessment of its adequacy. It is anticipated that the Mayor will issue the Executive Budget in April 2020. Our findings are summarized in the following paragraphs.

FY 2020 Capital Budget

The FY 2020 budget is set at $2.31 billion. Approximately 29% of FY 2020 funding supports regulatory mandated projects, consisting primarily of CSO (green and grey infrastructure) projects, the FAD programs, and TRC reduction program. Significant funding is also included in FY 2020 for NYCDEP priority projects such as City Tunnel #3 completion and activation, sewer emergency contracts for water and sewer work, build-out for the Southeast Queens program, water distribution system and wastewater collection sewer work, wastewater treatment plant SOGR projects, water supply infrastructure SOGR projects, and Bluebelt land acquisition and construction.

FY 2021 Preliminary Capital Budget

The FY 2021 preliminary capital budget is set at $2.37 billion. Approximately 29% of FY 2021 funding supports regulatory mandated projects, such as CSO projects (grey and green infrastructure), the

Kensico Eastview connection tunnel, the FAD program and storm sewer build-out requirements. Significant funding is also included in FY 2021 for NYCDEP priority projects such as wastewater treatment SOGR projects, the Southeast Queens storm sewer program, specific sewer and water main work, and water supply infrastructure SOGR projects.

Regarding the Current Capital Plan for FY 2020 to FY 2024

The Capital Improvement Plan for FY 2020 through FY 2024 consists of $10.46 billion in funding. Figure 6-1 shows the funding allocated per fiscal year in the Current Capital Plan for FY 2020 to FY 2024. Mandated and other NYCDEP priority project funding is shown per fiscal year. Approximately 22% of the total funding for FY 2020 through FY 2024 is dedicated to regulatory mandated projects. Most of the mandated projects in FY 2020 through FY 2024 consist of the green and grey CSO-related infrastructure, the Kensico Eastview connection tunnel, the FAD program, and the TRC program. The majority of the remaining capital improvement program for FY 2020 through FY 2024 must be planned and budgeted based solely on its importance to the overall System and NYCDEP prioritization as determined by NYCDEP, such as the state of good repair needs of the older assets in The System, City Tunnel #3 completion and activation, the Southeast Queens storm sewer buildout program, and significantly more BWSO water main replacement and sewer work.

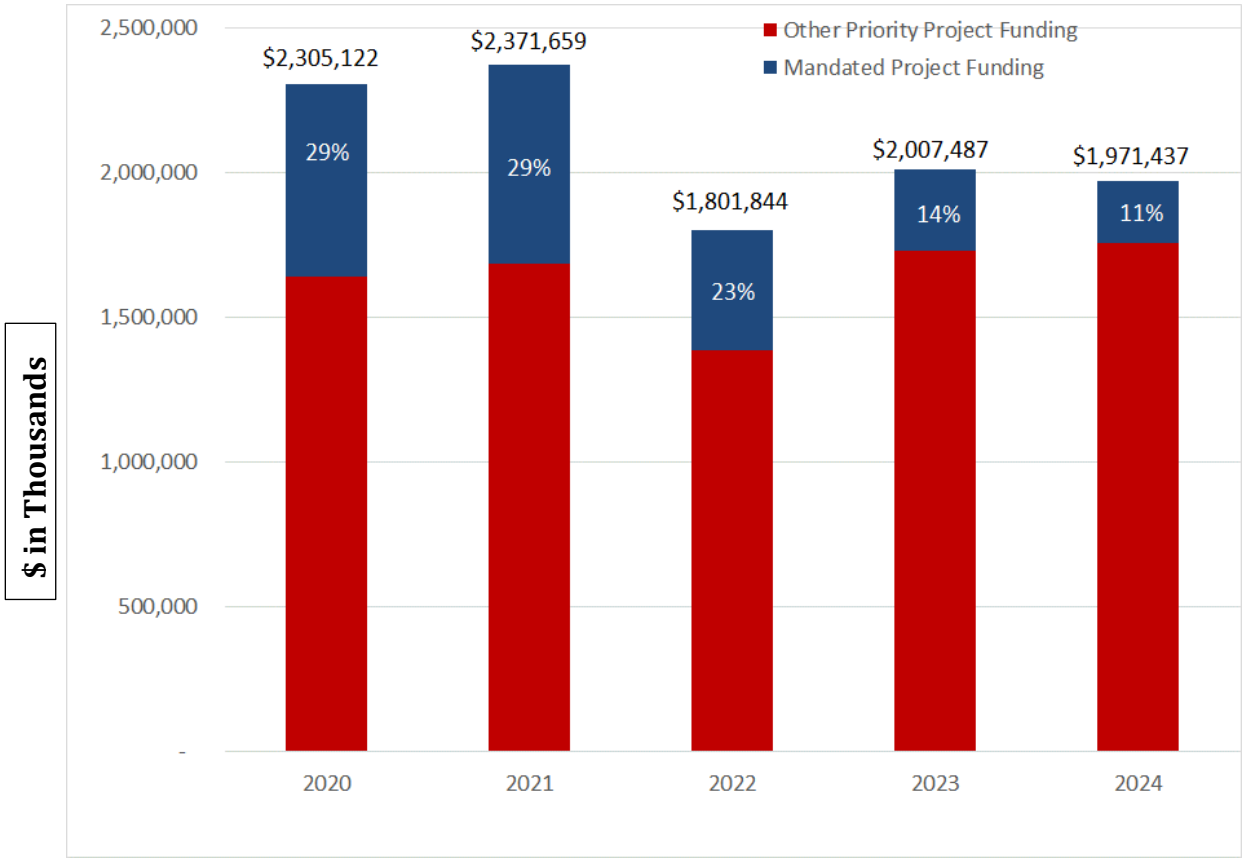


Figure 6-1: Current Capital Plan ($ in thousands) for FY 2020 – FY 2024

Figure 6-2 shows how the funding is allocated by each operating bureau over the next four years. BWSO's funding is the largest part of the total CIP and covers water and sewer main replacement, Southeast Queens Stormwater Program, City Tunnel #3 completion, Bluebelts, emergency water and sewer contracts, and other BWSO projects. BWT's funding is next and covers SOGR needs for wastewater infrastructure, CSO Program, Gowanus Superfund program, resiliency projects, the TRC Program, and other BWT projects. BWS's funding covers SOGR needs for water supply infrastructure, FAD requirements, KEC tunnel, and other BWS projects. The OGI and BEPA's funding covers the green infrastructure program and BEPA projects. The remaining funding includes projects within BEDC, BCS, Police and Security, Facilities Management, Fleet, Office of Information Technology, Department of Parks and Recreation and other bureaus.

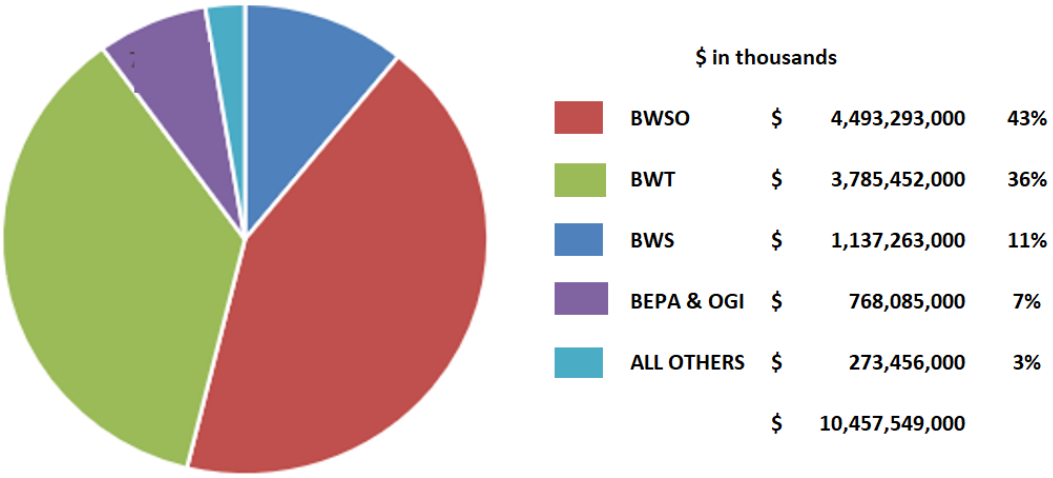


Figure 6-2: Current Capital Plan ($ in thousands)
FY 2020 through FY 2024 by NYCDEP Operating Bureaus

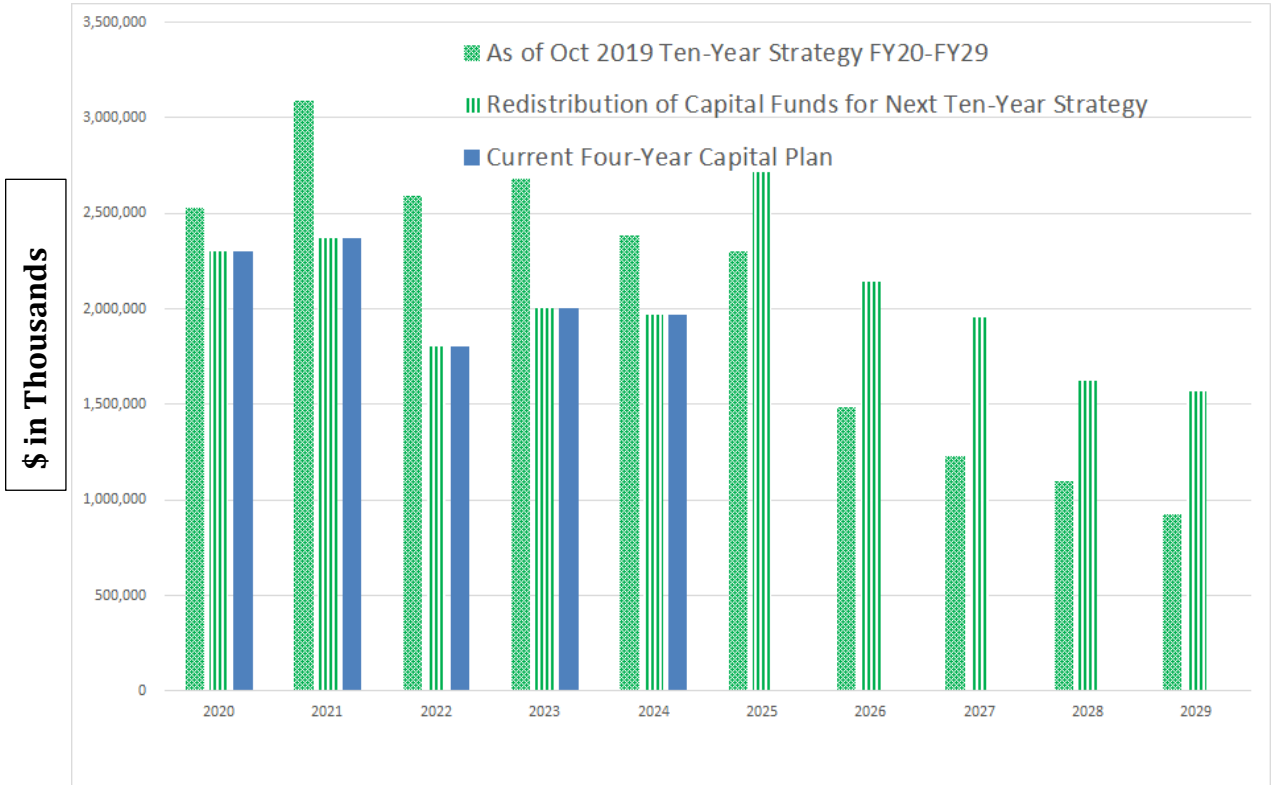


Figure 6-3: Comparison of CIP Redistributed Funds from Current Capital Plan to Outer Years of CIP as of Jan 2020

Figure 6-3 shows a comparison between the Ten-Year Capital Strategy published last year, the Current 4-Year Plan, and the tentative Ten-Year Capital Strategy that is now under consideration. The Current Capital Plan reflects a net reduction of approximately $2.8 billion in FY 2020 through FY 2024 from the previously released Ten-Year Capital Strategy.

The reduction of $2.8 billion of the Current Capital Plan for FY 2020 through FY 2024 is due to schedule changes for individual capital projects, which caused a shift in funding needs to years beyond the Current Capital Plan but within the Ten-year CIP. The Ten-year CIP with the redistribution of shifted projects outside the Current Capital Plan totals $20.45 billion, which is $218 million more than the CIP released in October 2019. The next Preliminary Ten-Year Capital Strategy is expected to be released in January 2021 and will reflect updated project cost estimates, schedule, and project priorities.

As discussed later in this report, the mandated CSO Program and the Hillview Cover will require additional funding in the future and will extend beyond the next ten year planning horizon. It is anticipated that there will be a continuous need to fund regulatory mandated projects. There will also be an increased and continuous need for SOGR funding due to the age of the NYCDEP infrastructure and the ability to more readily identify needs using Asset Management tools. Based upon the age of the infrastructure, there will be a need to replace wastewater and water system assets in accordance with a proactive, systematic data-driven plan that minimizes reactive replacements brought about by asset failures.

6.2 System-wide Programs

Asset Management

As is the case in most US cities and municipalities, the NYCDEP water and wastewater infrastructure is aging. Therefore, it is necessary to refurbish or replace infrastructure in a planned manner to cost effectively minimize risk of failure. The NYCDEP has refined and implemented its Asset Management program significantly in order to set priorities for the continued refurbishment of its physical assets. The Asset Management program provides a uniform methodology for a comprehensive evaluation of capital assets throughout The System and allows a systematic approach to schedule preventive maintenance and upgrade physical assets so that capital improvements can progress in an orderly manner. To further improve upon this effort, a pilot program at the Port Richmond WRRF is underway to take a more detailed appraisal of its asset management program. The pilot program will help BWT further identify needs by assessing life cycle costs of equipment and will provide a bottom up approach to identify needs for equipment repair/replacement. Pending the outcome of the pilot program, BWT will expand to all 14 WRRFs. NYCDEP has formed an Asset Management Working Group to coordinate and strengthen all asset management activities.

In addition to the Port Richmond WRRF pilot program, NYCDEP is considering several other studies/assessment tools that will support the long-term requirements of the NYCDEP assets. NYCDEP will be performing Integrated Master Planning for all 14 drainage areas. In addition, energy feasibility studies are being performed to identify opportunities to reduce energy consumption and costs. Resiliency improvements are also ongoing to protect facilities from projected sea level rise and increasing storm intensities due to changing weather patterns. These efforts will identify needed improvements that will then have to be organized and prioritized. With the completion of these studies/assessments, additional Facility Plans will continue to be prepared to effectively group and prioritize the needed upgrades for each WRRF as part of a systematic approach to guide capital investment planning. BWT has begun Facility Planning for the WRRFs.

NYCDEP Asset Management program includes the majority of the water and wastewater infrastructure. The Asset Management program will be used in the development of the funding needs for the state of good repair for future capital budgets. Utilizing the asset management tools, the operating bureaus submit business cases to OACE for review and prioritization This effort is based upon a collaborative approach between the operating bureaus and OACE so that all stakeholders have input throughout the process. Business case project prioritization is based upon a scoring of the following criteria: physical condition, performance/process condition, regulatory/environmental, service level/reliability, efficiency/energy, O&M and hazard, community, public image and financial. All potential projects receive a numerical rating. NYCDEP will perform continuous real time updating of the status of the many NYCDEP physical assets to reflect completion of improvement projects and condition survey updates for operating assets. The capital program for the state of good repair projects is determined based upon the highest numerically rated projects within the available funding. The principles of Asset Management have been effectively applied to many water and wastewater utilities worldwide and the NYCDEP's progress in Asset Management is a positive development. The continued integration of the

NYCDEP Asset Management program with the Capital Improvement Program for the prioritization of the replacement and rehabilitation of NYCDEP assets is anticipated.

NYCDEP Sustainability Initiatives

NYCDEP continues to further implement sustainability in planning, design, construction of new facilities and everyday operations of current facilities. Sustainability is a core value identified in the *2018 Strategic Plan*, which supports the NYCDEP vision to "*be a world-class water and wastewater utility, while building a sustainable future for all New Yorkers"*. One of the seven goals of the *2018 Strategic Plan* is to reduce GHG emissions and mitigate the effects of climate change. NYCDEP has identified four strategic initiatives (SI) to achieve this sustainability goal:

- Reduce greenhouse gas emissions and expand renewable energy sources (SI#20).
- Restore natural habitats throughout New York Harbor (SI#21).
- Expand the green infrastructure program (SI#22).
- Expand integrated water management through water conservation, water reuse, and resource recovery (SI#23).

There have been many sustainability Local Laws passed in NYC over the past several years that impact water supply and wastewater resource recovery facility operations. This past year there have been more aggressive goals set for energy and carbon neutrality that impacts many city agencies. Therefore, NYCDEP continues to evaluate current and future facility operations and long-term planning.

The NYCDEP Panel for Sustainable Infrastructure (PSI) is made up of representatives from BWT, BWSO, BEDC, BEPA, OACE, and the Commissioner's Office that looks at sustainable planning, design, construction and operations for water and wastewater infrastructure projects by evaluating environmental, social, and economic standards throughout the project life cycle and into operations. Some of the ways the PSI strives to incorporate sustainability across NYCDEP-initiatives is through inter-bureau networking, sustainability local law compliance and tracking, generation of best practices, and site visits to assess evolving technologies.

Greenhouse Gas Reduction and Energy Planning. Mayor deBlasio released *One City: Built to Last* in September 2014 with further aggressive reductions of GHG emissions and carbon management. New York City Office of Sustainability committed to an 80% citywide reduction in green-house gas emissions from FY 2006 base year levels by 2050 (also known as 80 by 50). Also, an interim goal of 35% reduction of green-house gas emissions from 2006 base year levels in municipal government operations is required by 2025.

On April 22, 2015, Mayor deBlasio released *One New York, The Plan for a Strong and Just City Report* (OneNYC). This comprehensive plan focuses on four principles - growth, sustainability, resiliency and equity. OneNYC is an expansion of the previous citywide sustainability plan, PlaNYC. GHG reduction and energy planning are being incorporated into NYCDEP's planning and design projects. OneNYC2050 was released in April 2019 which lays out long-term goals for NYC, which among many

other goals is to achieve energy and carbon neutrality by 2050. Annual Progress Reports are issued providing progress on the OneNYC initiatives. The next update Progress Report is planned for April 2020.

In accordance with Local Law 66 of 2014, the NYC Mayor's Office of Sustainability released a report in September 2016 titled, *Roadmap to 80 x 50 Report*. In September 2017, NYC released the report titled *1.5°C: Aligning New York City with the Paris Climate Agreement*. This plan further committed NYC to a goal of reducing citywide GHG emissions 80% by 2050 and an interim energy reduction goal of 20% by 2025 for City-owned buildings.

More recently in 2019, New York City Council passed eight sustainability-focused local laws entitled the "Climate Mobilization Act". Local Law 97 mandates 40% reduction in City government GHG emissions by 2025 from the 2006 baseline, and a 50% reduction by 2030, which is a more aggressive target from what was originally planned. These aggressive reductions goals are interim measures that must be achieved in advance of the long-term energy and carbon neutrality outlined in *OneNYC2050*. Although the GHG and energy reduction targets are citywide, NYCDEP will have a significant role since NYCDEP energy-intensive operations makes them the second largest municipal emitter of GHG and the third largest municipal energy consumer. Local Law 94 requires installation of green roofs or solar photovoltaic electricity generating systems on certain buildings. NYCDEP projects are evaluating these recent local law requirements. In response to climate change, the NYCDEP Strategic Plan (Strategic Initiative #20) and recent NYC local laws, NYCDEP initiated an Energy and Carbon Neutrality (ECN) Plan. The program goals are presented in the following figure.

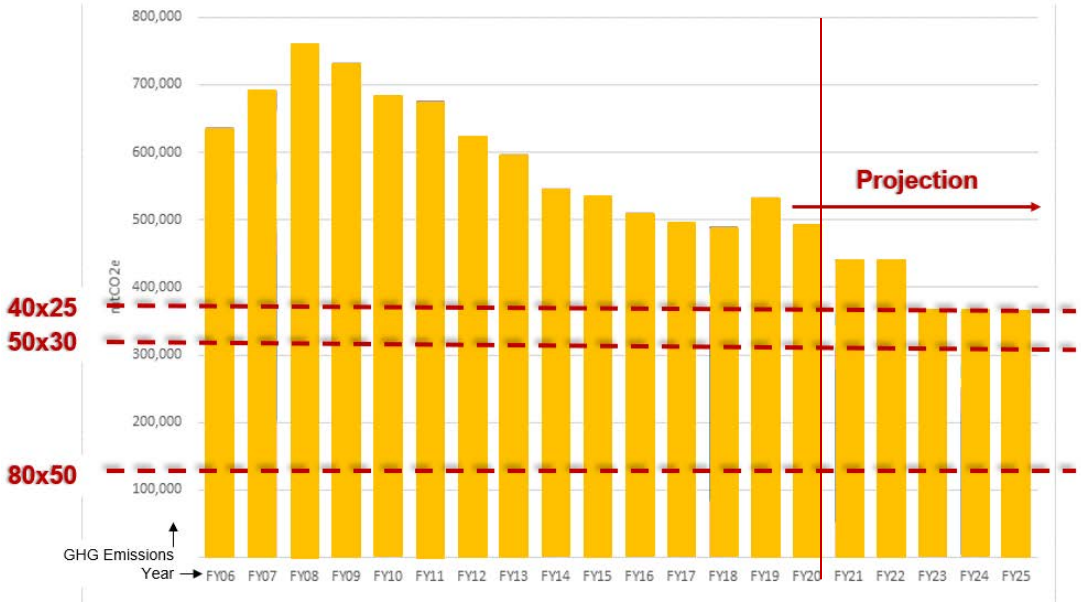


Figure 6-4 NYCDEP GHG Emissions by FY and Goals for GHG Reductions

The ECN Plan is an aggressive multi-agency multi-phase plan to address short-term (40% GHG emissions by 2025), mid-term (50% GHG emissions by 2030), and long-term (80% GHG emissions by 2050) effort goals for significant GHG reductions and energy usage throughout all NYCDEP operations. The main focus areas of the ECN Plan include: DEP-wide Energy and Carbon Neutrality; Energy Neutrality at the 14 In-city WRRFs; Biosolids/ Residuals Optimization; Energy, GHG and Biosolids Data Management; Energy, GHG and Biosolids Demonstration Projects. It is anticipated that significant collaboration and coordination across all DEP Bureaus, along with other City agencies and external stakeholders will lead to the success of ECN Plan. Energy bureau liaisons within each Bureau coordinate with the Office of Energy and Resource Recovery. For NYCDEP to comply with the Climate Mobilization Act and to become carbon and energy neutral in the long-term, NYCDEP will need to make aggressive changes to all aspects of DEP project implementation from prioritization, decision-making, planning, design, construction, operation and maintenance.

NYCDEP has reduced its GHG emissions by approximately 17% since FY 2006 base year, despite the addition of energy-intensive facilities and processes coming on-line since the base year. The first goal will be to reach a 40% GHG emission reduction by the Year 2025. To date, NYCDEP is approximately half way to achieving this first interim milestone. The ECN Plan will evaluate carbon management and net energy neutrality of the NYCDEP operations. In order for the NYCDEP to become net energy neutral, a cost-effective analysis is required to evaluate energy efficiencies, energy generation and renewable energy initiatives. The results of this Plan will form NYCDEP's strategic plan to achieve energy neutral operations.

NYCDEP has secured some funding through the Department of Citywide Administrative Services (DCAS) programs - Accelerated Conservation and Efficiency (ACE) and the Expenses for Conservation and Efficiency Leadership (ExCEL) for energy and GHG reduction projects. The Office of Energy and Resource Recovery will continue to coordinate DCAS for additional source of funding or co-funding with NYCDEP for energy projects.

With new systems and facilities coming on-line, NYCDEP Office of Energy and Resource Recovery Programs will assist in the planning of reliable sources of power, both from conventional and renewable sources. NYCDEP continues to implement energy conservation measures (ECMs) at each of the WRRFs. NYCDEP is evaluating the incorporation of energy efficiency with SOGR projects though the SOGR-ECM Integration Study for all 14 WRRFs. This study evaluates existing ECMs and identifies new ECMs, then prioritizes energy projects around the SOGR needs of the facilities to optimize operating costs and bring significant potential GHG reductions. NYCDEP continues to look for synergies to coordinate SOGR upgrades with GHG reduction opportunities. For example, the energy intensive centrifuges at Newtown Creek WRRF will be replaced with gravity belt thickeners (GBT).

NYCDEP is participating in an innovative resource recovery program at the Newtown Creek WRRF, the largest wastewater treatment plant in NYC. As part of the Newtown Creek/National Grid public private partnership, NYCDEP will send anaerobic digester gas (ADG) to a digester gas conditioning system to be owned and operated by National Grid. The product gas, referred to as renewable natural gas, will be pipe-line quality gas and will be added to National Grid's natural gas supply network. This

project will improve local air quality, reduce citywide greenhouse gas emissions, reduce fossil fuel consumption, and supplement the citywide natural gas supply. This project is anticipated to be operational in Spring 2020. Another public private partnership ongoing at Newtown Creek WRRF is with Waste Management (WM), Inc. Newtown Creek WRRF is accepting food wastes from NYC public schools, NYC residents, the green markets, and commercial establishments. The food waste, delivered by WM, Inc. is added to the digesters to increase the production of ADG. NYCDEP has successfully completed a one-year monitoring and testing pilot study under a grant from New York State Energy Research and Development Authority (NYSERDA) to evaluate the food waste/ADG co-digestion in Newtown Creek digesters. Due to the success of that study, NYCDEP has entered into a more comprehensive three-year demonstration project in collaboration with NYSERDA, Bucknell University and Manhattan College. Phase 1 of the demonstration operated with the addition of 85 tons per day (tpd) of food waste. Phase 2 of the demonstration is currently operating with the addition of 170-180 tpd. In Phase 3, NYCDEP plans to co-digest as many as 250 tpd of food waste at Newtown Creek within another year. The Office of Energy and Resource Recovery Programs continues to evaluate system-wide implications of this demonstration. Approximately 500 tpd of food waste is the estimated capacity for co-digestion of food waste at Newtown Creek. The food waste co-digestion and the ADG sent to National Grid projects at Newtown Creek serve as a model for integrating renewable energy in a dense urban environment. Food waste co-digestion will be evaluated at other NYCDEP WRRFs, where applicable.

Other energy projects that NYCDEP is implementing are cogeneration facilities and solar panels at NYCDEP facilities. A combined heat and power (CHP) facility is currently under construction at North River WRRF. CHP is also being evaluated at other WRRFs in NYC. Solar panels (1.2-megawatt (MW) system) have been installed at the Port Richmond WRRF in Staten Island since 2015. Based upon the results of a recently completed feasibility study, solar photovoltaic (PV) and battery storage will be installed at the Wards Island WRRF. A feasibility study for solar installations at five locations in the upstate watershed was completed this year. A Feasibility Study was also completed for hydroelectric potential at Shaft 4, the Catskill Aqueduct and Delaware Aqueduct Interconnection.

NYCDEP completed a Feasibility Study to determine the viability of a hydroelectric facility at Cannonsville Dam. Based upon the study, a 6-megawatt hydroelectric facility is being developed. This is a significantly smaller facility compared to the original 14-megawatt facility with a 9,000 square foot powerhouse. This smaller revised plan qualifies for a license exemption from FERC. The facility will be licensed by NYC. The hydroelectric facility will use water that is continuously released downstream of the Cannonsville Reservoir. The proposed hydroelectric plant consists of two 3-megawatt generators inside a 4,400 square-foot powerhouse, adjacent to the West Delaware Release Chamber. There is $8 million in funding for a hydroelectric facility at the Cannonsville Reservoir in the Current Capital Plan. DCAS is providing additional funding for the Cannonsville Hydroelectric Facility. NYCDEP's main priorities continue to be dam safety, maintaining operational control over the dams and the ability to meet flow management agreements.

Climate Change Adaptation and Resiliency

NYCDEP has been actively focused on the effects of climate change to both the water supply and wastewater system, in particular the impact of rising sea levels and changes to the intensity and frequency of precipitation events throughout the upstate watershed and in-city. BEPA hosted an inter-bureau NYCDEP Climate Change Workshop, a collaborative effort of presenting and sharing what each bureau is doing to combat climate change across the NYCDEP.

The New York City Panel on Climate Change (NPCC) is an independent body that advises the city on climate risks and resiliency. In February 2015, Mayor de Blasio announced the release of the NPCC 2015 report titled *Building the Knowledge Base for Climate Resiliency*. This report provides climate projections for temperature, precipitation and sea level rise through year 2100. The NPCC recommends setting up a climate change monitoring system, so that resiliency measures can be adapted as changes continue evolve in the future. The NPCC has identified that the City has been experiencing climate change impacts and expects those impacts to only get worse in the future. Some climate change impacts include extreme weather, coastal flooding and droughts that could impact the operation of the water and wastewater system.

In April 2018, the Mayor's Office of Recovery and Resiliency released *Climate Resiliency Design Guidelines* version 2.0. The Guidelines were developed based on the New York City Panel on Climate Change's regional climate projections that inform New York City resiliency policy. The NPCC published an updated report in March 2019.

NYCDEP has been planning and evaluating climate change adaptation requirements for the past several years, well before Superstorm Sandy impacted the NYC area. Adaptation refers to those actions that must be taken to allow NYCDEP facilities to meet their intended functions when considering projected sea level rise and more intense storm events. In May 2008, NYCDEP released its Climate Change Program Assessment and Action Plan. Following its release, the NYCDEP began studying the effects of climate change on the city's stormwater/wastewater collection system in more detail to determine what level of infrastructure and policy modifications are necessary to alleviate potential damage from more intense, more frequent storm events and projected rising sea levels. In May 2010, the NYC Panel on Climate Change released a report titled *Climate Change Adaptation in New York City: Building a Risk Management Response*, which among other important information, includes climate trends and projections for NYC, which NYCDEP has used for analysis and planning.

After Superstorm Sandy significantly impacted the New York City area in October 2012, NYCDEP continued to strengthen its work on climate change adaptation and resiliency. In December 2012, the Mayor's Office formed the Special Initiative for Rebuilding and Resiliency (SIRR). In June 2013, NYC released a comprehensive document entitled *A Stronger, More Resilient New York,* which covered citywide infrastructure impacts and community rebuilding and resiliency plans. Subsequently, NYCDEP released the *NYC Wastewater Resiliency Plan, Climate Risk Assessment and Adaptation Study* in October 2013. This Plan provided a comprehensive assessment of wastewater facilities at risk from future storms with proposed measures to protect equipment to reduce the risk of damage and loss of service. The study evaluated infrastructure at the NYCDEP WRRFs and wastewater pump stations to

identify and prioritize facilities most at risk for flood damage. The framework used for this study consisted of climate analysis, risk analysis and adaptation analysis. The possible adaptation strategies ranged in varying degrees of resiliency, effectiveness and cost.

The NYCDEP Resiliency Program is on-going and being managed by BEDC. There are established contracting mechanisms to implement resiliency projects across 14 WRRFS and 96 pump stations. The resiliency construction contracts have been initiated this past year to address resiliency upgrades at the WRRFs and pump stations. NYCDEP plans to secure funding and financing through the NYSDEC Storm Mitigation Loan Program (SMLP) and through the Flood Emergency Management Agency (FEMA) for these resiliency upgrades. Prioritizing the resiliency capital projects is an important step in the planning process. The criteria being used for prioritization of projects and needs includes operational, environmental, social and financial metrics. NYCDEP has adopted new design standards to account for the critical flood elevation with FEMA maps. NYCDEP has developed *Resiliency Design Guidelines*. As part of the October 2013 study, Storm Surge Guidance was also developed for all 14 NYCDEP WRRFs to assist NYCDEP staff in preparing for another storm.

Along with many other NYC agencies, NYCDEP will play a role in the Eastside Coastal Resiliency (ESCR) project. This project will provide improved coastal protection by reducing flood risk due to coastal storms and sea level rise on Manhattan's East Side. The CIP includes $167 million for NYCDEP's participation in the ESCR project.

Climate change adaptation evaluations are also taking place for other parts of The System. BWS is focused on climate change impacts on the water supply side using their Operation Support Tool (OST) models, the watershed protection program and improving flexibility in operations with increased water supply interconnections. BWS is also conducting extensive research on the impact that climate change will have on the current and future water supply system. NYCDEP is co-sponsoring a study (along with the DRBC) of the F.E. Walter Reservoir in White Haven, PA in order to plan for climate change, sea level rise and the future management of water resources in the Delaware River Basin. The USACE study will evaluate if the F.E. Walter Reservoir can help the Delaware River deal with future droughts, sea level rise, and salt water intrusion because of climate change.

NYCDEP's Green Infrastructure Program provides a comprehensive adaptive approach to stormwater management. The plan is based on implementing citywide green infrastructure improvements to reduce the volume of stormwater that reaches the engineered (grey infrastructure) stormwater collection system. NYCDEP continues to focus on climate change as it evaluates its stormwater management needs.

NYCDEP maintains strong involvement with the climate change science community on the city, state, national and international level. On the national level, NYCDEP maintains utility membership and actively engages with the Water Utility Climate Alliance (WUCA) and the National Association of Clean Water Agencies (NACWA).

Climate change adaptation is a challenge facing all water and wastewater utilities and should be considered in short-term and long-term utility planning. There is uncertainty inherent in climate science

due to the magnitude, variability, timing and frequency of localized events and their impacts on The System. However, despite the uncertainty of climate change prediction, rational capital investments must be considered to protect NYCDEP facilities. NYCDEP's Resiliency Program Management provides a framework for the implementation of climate change adaptation and resiliency in a systematic prioritized approach at NYCDEP WRRFs and pump stations.

6.3 Program Accomplishments

There are a number of program accomplishments during the past year that are noteworthy. These items play an essential role in the development and advancement of the CIP and provide for prudent and professional management of the System.

- NYCDEP completed boring the by-pass tunnel around the leaking section of the Delaware Aqueduct under the Hudson River, as part of the Water for the Future Program. The work was completed ahead of schedule. Installation of the steel liners of the by-pass tunnel is currently underway.

- In preparation for the Delaware Aqueduct shutdown planned for October 2022, the second of the three planned Catskill Aqueduct shutdowns began in November 2019 and the shutdown was competed in January 2020. This shutdown of the Catskill Aqueduct allowed cleaning portions of the interior concrete surface of the aqueduct, removal of biofilm, repair of cracks and, removal of slide gates.

- The micro-tunnel boring machine (MTBM) was lifted from Schoharie Reservoir this past summer after excavation was completed on over 2,000 linear feet of tunnel that will be used to release water downstream of the reservoir into Schoharie Creek.

- Specific resiliency upgrades at certain wastewater resource recovery facilities and pump stations moved into the construction phase.

- NYCDEP initiated the kick-off to the Energy Carbon Neutrality Plan, which consists of a comprehensive planning study, demonstration pilots, and a framework for decision making for the NYCDEP operations to become energy and carbon neutral. The results of this plan will have far-reaching impacts on future capital programs and overall NYCDEP operations and management of the system.

6.4 Capital Improvement Program Highlights for the Water System (Supply, Treatment, and Conveyance Programs)

A number of NYCDEP projects and programs for the water system are in various stages of implementation (planning, design, and construction). Many of these significant programs are described below.

Catskill/Delaware Water Supply System Filtration Avoidance

On December 28, 2017, the New York State Department of Health (NYSDOH) issued another 10-year Filtration Avoidance Determination (FAD), known as the 2017 FAD to the NYCDEP for the Catskill and Delaware watersheds. The 2017 FAD consists of a watershed protection program for 2017-2027. The new FAD requires NYCDEP to continue its core watershed protection programs that are already established and in place, such as land acquisition in the protected watershed, whole farm planning,

stream management and various upgrades to wastewater infrastructure in the watersheds. In addition, the FAD contains new requirements, which includes expanding the small business septic program in the Catskills, development of a community wastewater treatment facility for the hamlet of Shokan near Ashokan Reservoir and protecting additional streamside lands through the Conservation Reserve Enhancement Program and the Streamside Acquisition Program. The FAD has several milestones and implementation schedules for the required programs.

National Academies of Sciences, Engineering, and Medicine (NASEM) expert panel has begun reviewing the current FAD programs. Although the FAD spans ten years there is a halfway point review planned at the five-year mark. This review will be based upon the findings of the expert panel and could impact the future capital investment program. The NASEM Final Recommendations Report on the FAD review is expected in mid-2020. NASEM released a report on their independent review of the NYCDEP Operation Support Tool (OST). The report summarizes their recommendations to improve and maintain the OST for continued use for NYCDEP decision-making in the future.

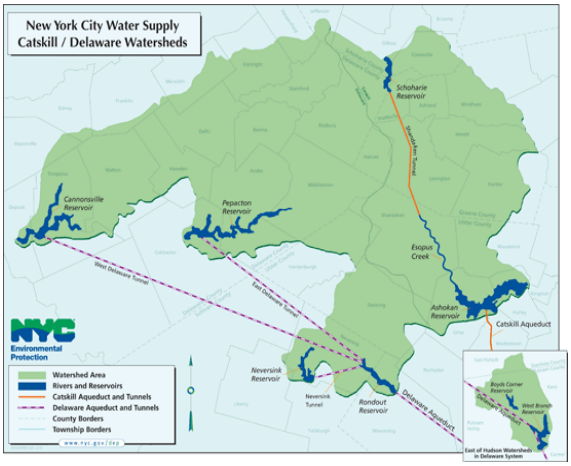


Figure 6-5: Filtration Avoidance Determination (FAD) for the Delaware and Catskill Watersheds

Funding for FAD programs comes from both the NYCDEP capital budget and the annual expense budgets. The continuation of the existing FAD program is currently funded in the Current Capital Plan at a level of approximately $118.7 million. Additional capital funding will be required in the next Ten-Year Capital Strategy for the second half of the ten-year FAD to continue to support FAD programs. It is anticipated that funding for the FAD will be included in the NYCDEP expense budget for the duration of the FAD.

As part of the continuous long-term planning efforts, NYCDEP will update its planning level studies, if it were ever to become necessary to build a filtration plant for the Delaware and Catskill water supply. NYCDEP is planning a comprehensive review of filtration methods and technologies, which will result in the development of a new conceptual design for a filtration facility, and updated cost estimates. The NYCDEP capital and expense financial investment in FAD programs are a far more cost-effective means to protect the Catskill/ Delaware water supply than building a filtration plan with high operation and maintenance costs.

Water for the Future (WFF)

Figure 6-6: Delaware Aqueduct by-pass tunnel installation of steel liner

The Water for the Future program is a comprehensive program that requires continued thorough coordination throughout the entire NYCDEP. It consists of two main components; (1) fixing the Delaware Aqueduct in two areas where significant leaking has been noted and (2) supplementing NYC water supply during the period when these water transmission elements are out-of-service. A strong organizational structure is in place within BEDC and across all operating bureaus (with designated liaisons) and executive management, to continue with the construction, implementation and risk management of the program due to its magnitude and complexity. There is approximately $111 million in the CIP for the Water for the Future program, which consists of $21 million for the continued construction of by-pass tunnel and repairs and $90 million in water supply augmentation and conservation-related projects (when the Delaware Aqueduct is not in service for by-pass connection). Engineering studies conducted during the project development have identified improvements that will result in shorter shutdown periods and less required water supply augmentation reducing the overall program cost, compared to the original program.

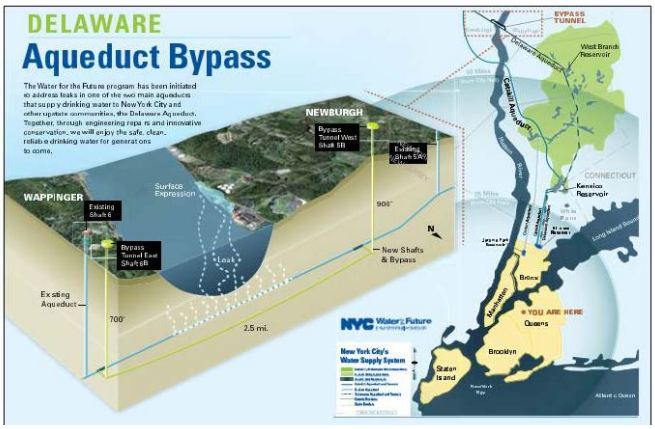


Figure 6-7: Delaware Aqueduct Bypass Program

After evaluating several repair alternatives, NYCDEP developed a comprehensive plan to build a two-and-a-half-mile bypass tunnel around the leaking section under the river in the area of Roseton, NY and to perform repairs of the concrete liner in upstream areas near Wawarsing, NY. In 2013, NYCDEP began construction of two new shafts, Shaft 5B (in the Town of Newburgh) and Shaft 6B (in the Town of Wappinger). Construction of the two vertical shafts has been completed (contract BT#1). The tunnel construction contract (contract BT#2) was initiated in the summer of 2015. A tunnel boring machine (TBM) was utilized for the construction of the new tunnel between the two shafts. The TBM was assembled 845 feet below ground in Newburgh at the bottom of the shaft in a bell-out chamber. It is approximately 470 feet in length and weighs 2.7 million pounds. The TBM began tunnel construction in January 2018, and the tunneling was completed in August 2019. The by-pass tunnel will be steel lined, and the 16-foot diameter steel liners are currently being installed inside the first layer of the concrete tunnel. Once the

230 steel liners are installed in the tunnel and welded together, they will be coated with a second layer of concrete. This design of the bypass tunnel will provide structural stability and prevent future leaks .

Construction to connect the bypass tunnel with the existing Delaware Aqueduct is planned for October 2022. These connections will require taking the Delaware Aqueduct out-of-service and dewatering the aqueduct. As the overall work will take several months, it will be scheduled during the low water demand season to minimize the possibility of water shortages.

The NYCDEP has been evaluating and planning strategies for water supply augmentation to meet the demands of The System when water supply system components are out-of-service, either planned (when the Delaware Aqueduct is shut down to connect the bypass tunnel to the existing tunnel and to make the other upstream repairs) or unplanned. NYCDEP is currently implementing demand management measures and optimization of the Upper Catskill Aqueduct to increase its capacity.

NYCDEP released *One Water NYC: 2018 Water Demand Management Plan* in June 2018, and more recently the *Water Demand Management Plan June 2019 Annual Update* was released. NYCDEP's current Water Demand Management Plan has achieved 10 mgd in water savings. The plan focuses on the following key strategies for managing water demand, which consists of: The Municipal Water Efficiency Program, the Residential Water Efficiency Program, the Non-Residential Water Efficiency Program, Water Distribution System Optimization, Water Supply Shortage Management, and Wholesale Customers Demand Management. NYCDEP anticipates an additional 10 mgd reduction in water consumption citywide by October 2022 with the continuation of the multi-pronged planned water demand management program. NYCDEP created an interactive online map identifying the location of water conservation projects, the estimated demand savings, and the estimated energy and greenhouse gas reductions anticipated from each project.

NYCDEP has initiated 10-week shutdowns of the Catskill Aqueduct over a three-year period to repair and rehabilitate the Upper Catskill Aqueduct (from Ashokan Reservoir to Kensico Reservoir). NYCDEP completed Catskill Aqueduct shutdowns starting in October 2018 that lasted several weeks. This project includes full inspection, implementation of mechanical and structural upgrades, and removal of the biofilm with chemical addition to increase the capacity to its historical flows. A second planned shutdown of the Catskill Aqueduct was carried out from November 2019 – January 2020. During this shutdown biofilm was removed, cracks were grouted, repairs were made to tunnel liner, debris and sediment were removed, and tunnel inspections were made. A shorter duration shutdown is planned in the Spring 2020 to make repairs and an additional 10-week shutdown is expected in the Fall 2020. It is anticipated that 40 MGD of additional capacity in the Catskill Aqueduct will be available when this project is completed. Catskill Aqueduct shutdown also requires close coordination with the upstate users to maintain sufficient water quantity during the shutdown.

This project includes full inspection, implementation of mechanical and structural upgrades, and removal of the biofilm with chemical addition and will increase the capacity to its historical flows.

Catskill Aqueduct Roundout Pressure Tunnel

NYCDEP began monitoring the Catskill Aqueduct pressure tunnel due to leaks beneath the Roundout Creek using a remote operated vehicle. United States Geological Survey (USGS) is monitoring the area and performing an investigation study for the pressure tunnels along the Catskill Aqueduct. Funding of $42 million is included in the Current Capital Plan for repair of the leaks identified in the Roundout Creek area; however, additional funding will be needed in the outer years of the CIP. Once the Delaware repairs are completed, it is anticipated that NYCDEP will further address these leaks in the Catskill Aqueduct tunnel section. A long-term solution will need to be devised to address the other suspected leaks in the pressurized tunnel portion of the Catskill Aqueduct.

Hillview Reservoir

Federal regulations administered by USEPA, Long Term 2 Enhanced Surface Water Treatment Rule (LT2) requires the Hillview Reservoir to be covered. However there have been a series of compliance agreements with several commitments to cover the Hillview Reservoir between NYCDEP and the regulators dating back to 1996 that predate the LT2 requirement.

Figure 6-8: Hillview Reservoir located in Yonkers

In 2017, the USEPA declined to reconsider the requirement to cover finished water reservoirs such as Hillview. NYCDEP requested that NYSDOH and USEPA further extend the deadline to complete construction of the cover to enable NYCDEP to complete two higher priority water supply infrastructure capital improvements: construction of the Kensico Eastview Connection (KEC) tunnel and Hillview Reservoir Improvements. NYSDOH and USEPA agreed to extend the schedule for construction of the cover to 2049. A federal Consent Decree, known as the Hillview Consent Decree was approved by the federal court in May 2019. The Hillview Consent Decree includes new deadlines for covering the reservoir, along with design and construction milestones for the KEC tunnel, the Hillview Reservoir Improvements, and stipulated penalties to enforce such milestones. The Consent Decree also includes $1 million civil penalty payable to the United States and a $250,000 penalty to the State ($50,000 in cash and $200,000 as an environmental benefit project).

NYCDEP is undertaking a facility planning study, which will allow NYCDEP to analyze alternative ways to achieve LT2 compliance. NYCDEP plans to evaluate cover alternatives to identify the most cost-effective solution before committing capital investment funding. There is no capital funding in the CIP since the construction of the cover is well beyond the 10-year budget planning period. However, there is funding for the pre-cursor projects that are mandated in the Hillview Consent Decree.

The Hillview Reservoir Improvements include significant SOGR work for the ancillary facilities that include modification of chambers, chemical addition upgrades, flow control improvements, and other upgrades. Funding is included in the Current Capital Plan for $41.6 million for this work at Hillview; additional funding will be included in the outer years of the CIP for Hillview Modifications.

Kensico Eastview Connection (KEC) Tunnel

NYCDEP has determined that the KEC tunnel is essential to improve redundancy and increase operational flexibility by having a secondary means to convey water from the Kensico Reservoir to the CAT/DEL UV Facility. The Catskill Aqueduct has not been able to convey water between Kensico and the UV Facility due to hydraulic limitations. As a result, the Delaware Aqueduct has been the only means to convey water from Kensico to the UV plant. The KEC tunnel project will add another connection between these two vital components of the water supply. This is an important high priority project for NYCDEP. Funding of $139 Million is included in the Current Capital Plan; additional funding will be included in the outer years of the CIP. The project is currently in the design phase.

The KEC tunnel will be approximately two miles in length, starting at an intake chamber on the western side of the Kensico Reservoir to a connection point at the UV Facility. The finished tunnel will be approximately 27 feet in diameter and 400 to 500 feet below ground. The tunnel will carry a maximum of 2.6 billion gallons of water each day. Its design accounts for future growth in the City and Westchester County, the potential addition of treatment facilities, and the need to periodically take other aqueducts out-of-service for maintenance or inspection.

The project also includes new facilities and site work at Kensico Reservoir and the UV Facility. The intake chamber that draws water from Kensico will be upgraded and increased to connect to the new tunnel. The Kensico Reservoir's shoreline around that intake will also be improved to prevent sediment from entering the tunnel. The chemical feed systems at Kensico Reservoir will be upgraded to meet the needs of the Delaware Aqueduct and the new tunnel.

Dam Safety

Upstate reservoir dams are critical infrastructure for NYCDEP operations and the safety of the surrounding communities. NYCDEP has committed to go beyond the level of protection currently mandated by New York State, which requires existing dams to be capable of safely passing half of the probable maximum flood (PMF). When capital improvements are made at a dam, NYCDEP commits to providing that the dams safely pass the full PMF.

Due to significant SOGR needs to provide continued dam safety, there is $166 million in funding for the Olive Bridge Dam at the Ashokan Reservoir and the upper/lower outlet structures. The full long-term rehabilitation upgrades for the Gilboa Dam that brought the dam into compliance with the NYSDEC dam safety guidelines have been completed. The remaining upgrades at Gilboa Dam and Schoharie Reservoir are funded at approximately $23 million in the Current Capital Plan. The New Croton Dam requires reconstruction and is funded in the budget with $15.5 million. Additional funding for these dam

programs is in the outer years of the CIP. NYCDEP expects to add funding for Delaware system dam upgrades in the next Ten-Year Capital Plan.

NYCDEP has installed additional equipment at several upstate dams to enhance the monitoring capacity during and after storms. In addition to capital programs, NYCDEP maintains an inspection and maintenance program to support dam safety. NYCDEP continues their dam inspection program using engineering contracts and in-house NYCDEP inspectors. NYCDEP operates and maintains a safe dam system for upstate and in-city dams, based upon capital upgrades, inspection and maintenance program, and emergency action plans.

Ashokan Century Program

In 2017 as part of their commitment to SOGR upgrades in the watershed, NYCDEP announced the Ashokan Century Program. This program will upgrade all infrastructure associated with the Ashokan Reservoir in the Catskill watershed. In addition to the upgrade to the Olive Bridge Dam, this program will include upgrades to the Ashokan Reservoir spillway, dividing weir bridge, and the Ashokan Reservoir headworks. This program has been estimated at $750 million. The replacement of the dividing weir bridge over Ashokan Reservoir is funded in the outer years of the CIP. Additional funding will be required for the Ashokan SOGR projects in future budgets.

City Tunnel No. 3, Stage 2

Most of the tunneling work for City Tunnel No. 3, Stage 2 has been completed. There is funding of $634 million in the Current Capital Plan for the completion, activation and shaft work (Shafts 17B and 18B) for City Tunnel No. 3, Stage 2 Brooklyn/Queens leg. Most of that funding is in FY 2020 and FY 2022. Construction of the shafts is anticipated to begin in 2020. As of December 2017, City Tunnel No. 3 Brooklyn/Queens leg achieved activation-readiness, which means it is available in case of an emergency. NYCDEP maintains a Stakeholder Management Plan for continuous internal and external communications. There is significant ongoing coordination required with NYCDOT and other city agencies. Full operation of City Tunnel No. 3 Brooklyn/Queens leg is expected once the funded construction contracts are completed. Design is also underway for the connection of the Brooklyn/Queens leg of City Tunnel No. 3 to the Richmond Downtake Chamber, which will connect City Tunnel No. 3 to Staten Island. NYCDEP plans to conduct inspections of CT#1 and then eventually CT#2 once CT#3 is fully in service. Funding of $30.3 million is included in the CIP for NYC DDC trunk water main connection projects for City Tunnel No. 3.

Water Main and Sewer Replacement

The Current Capital Plan includes $1.7 billion for water main and sewer replacement throughout the City from FY 2020 through FY 2024. It is anticipated that a $128 million increase in water main replacement will be included in the Executive Plan for the next two years. This additional capital funding will allow the NYCDEP to achieve approximately 1% annual replacement rate for NYC water mains.

BWSO coordinates closely with NYCDDC and other city agencies for water and sewer projects. NYCDEP utilizes several parameters for the selection of water main and sewer replacement, including

the age, size, material, and historical performance of the current pipes. The construction of new water and sewer pipes is coordinated with other utility underground infrastructure construction projects. NYCDEP is working to develop a predictive model to forecast the likelihood of future water main breaks.

6.5 Capital Improvement Program Highlights for the Wastewater and Stormwater System

Several NYCDEP projects and programs for the wastewater and stormwater system are in various stages of planning, design, and construction. Many of these significant programs are described below.

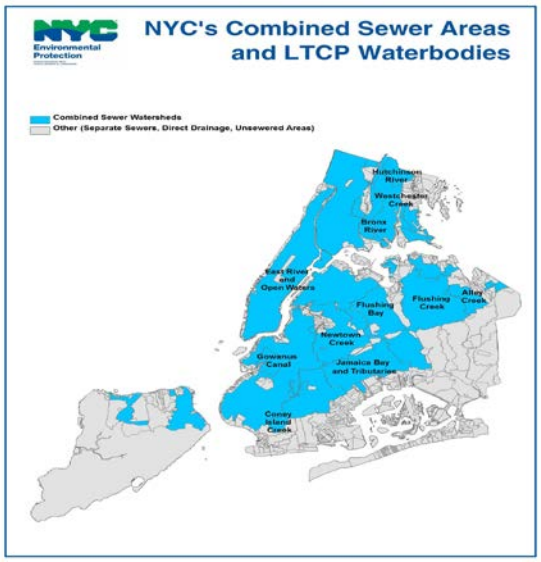


Figure 6-9: Combined Sewer Areas and CSO LTCP Waterbodies

Combined Sewer Overflow (CSO) Program

The 2012 CSO Consent Order Modification incorporates a hybrid approach of green and grey infrastructure control strategies. The modified Consent Order is based upon an adaptive management approach to solving the CSO water quality issues which incorporates the Green Infrastructure (GI) Planning. The CSO Order contains milestones and schedules governing the planning, design and construction of a significant number of projects for NYCDEP's Citywide CSO Program. As required by the Order, NYCDEP has developed several waterbody-specific Long-Term Control Plans (LTCPs) to control CSOs and improve water quality in NYC's waterbodies and waterways. The goal of each LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with the Federal CSO Policy and the water quality goals of the federal Clean Water Act (CWA).

NYCDEP has submitted ten of the eleven LTCPs to NYSDEC. Each approved LTCP identifies plans at each CSO LTCP waterbody. Figure 6-10 along with the following table presents the status of the LTCPs:

Table 6-1: Status of CSO Long Term Control Plans

Waterbody/LTCP	Status of LTCP
Alley Creek	Approved March 2017
Westchester Creek	Approved August 2017
Hutchinson River	Approved March 2017
Flushing Creek	Approved March 2017
Bronx River	Approved March 2017
Gowanus Canal	Approved March 2017
Flushing Bay	Approved March 2017
Coney Island Creek	Approved April 2018
Newtown Creek	Approved June 2018
Jamaica Bay and Tributaries	Submitted June 2018, Pending approval
Citywide/Open Waters	Revised submittal date March 2020

NYCDEP held the annual citywide public meeting for the CSO Long Term Control Plan in December 2018. This annual meeting provided an update on the entire CSO Program, provided status updates on LTCP progress and the NYC Green Infrastructure Program, discussed affordability and public participation within the CSO Program. NYCDEP held a public meeting for the Citywide/ Open Waters CSO Plan in January 2020.

The recommended projects in the approved LTCPs are now enforceable requirements under the CSO Consent Order. Based upon the recommended plans and projects derived from the ten submitted CSO LTCPs, NYCDEP has estimated an additional $5 billion in CSO projects to mitigate the impacts of CSOs. Several of these CSO projects are planned outside this ten-year planning period, and therefore are not included in the CIP. The Citywide/ Open Waters LTCP is almost complete and will be submitted to NYSDEC in March 2020. The Current Capital Plan includes approximately $898.8 million in funding for grey infrastructure capital projects for implementation of the CSO Program, which includes $463 million for the CSO retention tank at the Gowanus Superfund site, required due to the federal EPA Superfund Program. Funding for disinfection facilities, required as part of the LTCPs at Alley Creek, Hutchinson River and Flushing Creek are included in the Current Capital Plan. Additional funding will be required in the outer years of the CIP in additional to funding beyond the current budget planning period to implement infrastructure required as part of the approved LTCPs.

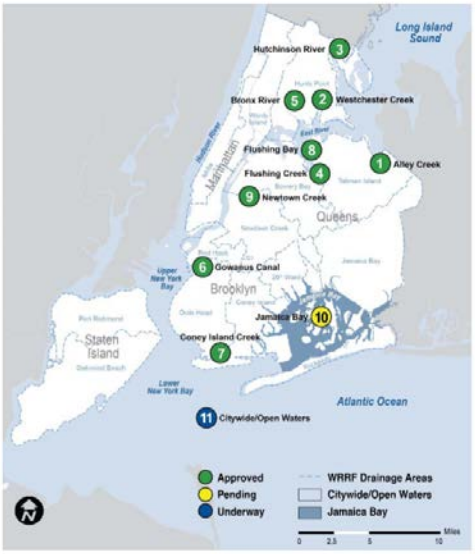


Figure 6-10 Status of CSO LTCPs

The LTCPs are based upon the current water quality standards for fecal coliform bacteria. Environmental groups have sued USEPA over the NY State's 2015 water quality standards. The claim is that water quality standards should be for enterococcus bacteria rather than fecal coliform. In June 2019, NYSDEC amended the water quality standards for all coastal primary contact recreational waters to be based upon enterococcus and upgraded classifications of certain waters in New York Harbor. NYCDEP may be required to revise the LTCPs based upon enterococcus bacteria rather than fecal coliform standard due to the 2019 amendment to water quality standards and additional potential amendments to the standards for non-swimmable waters. If this occurs, there can be significant additional costs required to comply with the CSO 2012 Consent Order.

Green Infrastructure (GI)

Green infrastructure is an approach to wet weather management that is cost-effective, sustainable and environmentally friendly. Several cities across the country have implemented green infrastructure for wet weather management and water quality control issues. In September 2010, NYCDEP released NYC's Green Infrastructure Plan. The Plan is an adaptive approach to incorporating green infrastructure into NYCDEP's overall CSO program. The initial goal was to capture the first inch of rainfall on 10% of the impervious areas in combined sewer watersheds through detention or infiltration over a 20-year period. As the GI Program has evolved and advanced, the goal has changed from 1-inch of rain to 1.5-inches of rain captured. DEP's adaptive management strategy includes regular monitoring of green infrastructure performance, continuous evaluation of lessons learned in the field, furthering the understanding of green infrastructure co-benefits, and development of additional cost-effective tools to implement GI. NYCDEP's ongoing Research and Development Program assists in this effort.

Figure 6-11: Green Infrastructure Rain Garden

Figure 6-12: Green Infrastructure Annual Report

The implementation of the GI Program in NYC focuses on three distinct locations; (1) public right of way rain gardens, (2) GI on public property (3) GI on private properties. There are approximately 4,700 total green infrastructure assets currently installed in NYC, primarily in rights-of-way (public sidewalks and streets). An additional 7,600 GI assets (rain gardens and infiltration basins)

on public right-of-ways are either in construction or will be in construction within the next two years. The rain gardens are designed to manage up to 2,500 gallons each during a storm. NYCDEP coordinates with many city agencies and partnering agencies to implement green infrastructure on city property. These partnerships include NYC Parks and Recreation, NYCDOT, NYCDDC, Economic Development Corporation (EDC), NYC Housing Authority (NYCHA), Department of Education (DOE), School Construction Authority (SCA), Trust for Public Land (TPL), other city agencies, and non-profit organizations. Three design contracts are underway for on-site public property retrofits at schools, parks and NYCHA properties.

NYCDEP is introducing the Private Property Green Infrastructure Retrofit Incentive Program in order to aggressively expanding green infrastructure retrofits on private property. The NYCDEP submits an annual report updating NYSDEC on the progress of the GI Plan. The 2018 Annual Report was submitted April 30, 2019. It provides a comprehensive summary of the green infrastructure program in NYC. The concept of a "greened acre" was introduced to the GI Program. A "greened acre" represents a volume of runoff managed by a green infrastructure project. It is the same as an "equivalent impervious acre", which is the term referenced and used in the CSO Consent Order. The "greened acre" was derived from the Performance Metrics Report, since the "greened acre" represents the metrics and targets of green infrastructure projects in a volumetric unit. There have been 467 greened acres in NYC from 2010-2017. As of 2017, the GI Program has reduced approximately 200 million gallons of CSO volume per year, a significant step toward the goal of 1.67 billion gallons per year of CSO reduction. The next annual update, the Annual Report for 2019 will be released on April 30, 2020.

NYCDEP has implemented a database, known as NYC GreenHUB for green infrastructure tracking (geographic location, cubic feet of stormwater managed, soil classification, permeability data, year constructed, and other data).

The Current Capital Plan includes approximately $663.8 million in funding for green infrastructure projects. Components of the GI program are also funded through the expense budget, maintenance of the GI assets. NYCDEP continues aggressive efforts for optimizing the GI Program.

Southeast Queens Stormwater Infrastructure

NYCDEP is continuing a comprehensive program to improve drainage to address flooding issues in Southeast Queens. NYC has made a commitment of $1.9 billion to construct infrastructure projects in Southeast Queens to buildout the drainage system and reduce flooding. In the Current Capital Plan, $1.136 billion is funded for the Southeast Queens storm sewer program. The Southeast Queens Program consists of 45 projects overall. There have been 10 substantially completed projects and another 11 that are currently under active construction. An additional 25 projects are currently in the planning and design phase and will break ground in the coming years. The majority of the funding will go towards the construction of priority large trunk sewer spines that will add capacity to the sewer system and include crossings of the LIRR, Air Train, Belt Parkway, Van Wyck Expressway, and Nassau Expressway. Several smaller storm sewer projects are in the planning, design, or construction phases. These smaller local storm sewer projects will connect neighborhoods to these trunk storm sewer spines. NYCDEP is aggressively working on this storm sewer build-out program in Southeast Queens.

NYCDEP provides continuous public outreach and program updates to the Southeast Queens community. The buildout of the drainage system in Southeast Queens is collaboration between NYCDEP, NYCDDC and NYCDOT. NYCDEP maintains close coordination with other city agencies. NYCDEP plans to implement projects in a phased approach on a priority basis. Green infrastructure and Bluebelts are also being constructed in Southeast Queens to help manage stormwater.

Combined Heat and Power (CHP) Facility at North River WRRF

A project for a Cogeneration Facility at North River WRRF was developed as a sustainability project to provide significant GHG emission reductions and achieve a SOGR to replace the engine-driven, main sewage pumps and engine blowers that are near the end of their useful life. The North River WRRF Cogeneration Facility is currently under construction, and completion is anticipated in 2022. Additional funding of $31.2 million is included in the CIP. The project consists of replacing the engines driving the main sewage pumps with electric motors, and the existing engine-driven aeration blowers with new aeration blowers with electric motors. The new cogeneration facilities will provide new gas driven engines and generators which will provide electricity to drive the main sewage pumps and the nine high speed turbo aeration blowers, and heat for digester and building heating. The new engines would operate on both digester gas and natural gas. Fuel oil will no longer be required at the WRRF.

Hunts Point WRRF Digesters and Sludge Thickening

NYCDEP is planning a major sludge processing upgrade at the Hunts Point WRRF that will improve digestion performance, enhance biosolids quality to enable more beneficial reuse, and increase biogas production. Replacement and upgrade of the digesters at Hunts Point WRRF is funded in the Current Capital Plan at a level of $393 million in FY 2021. The upgrade to the sludge thickening equipment is an integral part of the overall sludge processing facilities and improved thickening will make the digesters operate more efficiently. Funding for the sludge thickeners at Hunts Point is in the CIP at a level of $29.5 million. Additional funding will be required in the next budget cycle for construction of the sludge thickener upgrades.

The sludge thickeners reduce the volume of water that passes through the digesters, which reduces the energy required for heating and increases solids retention time sufficiently to produce product that meets the criteria for Class "B" Biosolids so that the full program goals are attained. It is important that the schedules of these two projects (digesters and sludge thickening) are coordinated so that both process upgrades will be operational at the same time to fully meet the project goals. NYCDEP plans to implement Sludge thickening upgrades at Hunts Point WRRF in phases. There is need for coordination with the new digesters.

As discussed earlier in the report, NYCDEP is evaluating potential energy projects in collaboration with SOGR needs. It is anticipated that digesters and sludge thickening at other WRRFs will be evaluated.

Citywide Nitrogen Removal Program

The Upper East River (UER) WRRFs (Hunts Point, Bowery Bay, Tallman Island, and Wards Island WRRFs) and two of the Jamaica Bay WRRFs (26th Ward and Jamaica WRRFs) have been operating

in Step Feed BNR mode as required by the Nitrogen Consent Judgment for the Phase I Facility Plan and a Stipulation and Order Modifying the Nitrogen Consent Judgment.

NYCDEP and NYSDEC entered into the First Amended Nitrogen Consent Judgement (FANCJ) in 2011 which requires, among other things, nitrogen removal upgrades at the Jamaica Bay WRRFs, construction milestones for the Jamaica Bay WRRFs, and interim nitrogen effluent discharge limits for Jamaica Bay. The two remaining Jamaica Bay WRRFs, Rockaway WRRF and Coney Island WRRF are currently under construction for BNR upgrades; construction completion for BNR upgrades at Rockaway is projected in 2020 and for Coney Island at the end of 2022. NYCDEP is evaluating alternatives for future use and operations at the Rockaway WRRF facility. The interim nitrogen load limits for the Jamaica Bay WRRFs are currently being met. The final performance-based nitrogen limit for Jamaica Bay will go into effect 19 months after the last construction completion of nitrogen control upgrades at the Coney Island WRRF. NYCDEP submitted a Jamaica Bay Feasibility Study in January 2020 to evaluate the available nitrogen removal technologies and optimization techniques for existing infrastructure, to identify potential measures to reduce nitrogen discharges from the Jamaica Bay WRRFs and to improve DO water quality in the Jamaica Bay.

Glycerol has been selected as the supplemental carbon source for additional nitrogen removal. The supplemental carbon addition for Phase II BNR at the UER WRRFs (Hunts Point, Bowery Bay, Tallman Island and Wards Island WRRFs) and the Jamaica Bay WRRFs (Jamaica and 26th Ward WRRFs) is operational. The Consent Judgement requires reducing the combined nitrogen discharges in the WRRF effluent for the UER WRRFs by 58.5 percent by January 2017. The UER WRRFs achieved the required level of nitrogen removals in advance of the milestone. By September 2016, nitrogen discharges from the UER WRRFs had been reduced by approximately 61 percent. However, NYCDEP received a Notice of Violation (NOV) from NYSDEC due to exceedance of the UER TN aggregate limits for the time period of May through August 2018. NYCDEP and NYSDEC are in negotiations for a Nitrogen Consent Order for a settlement of the NOV.

There is funding of $22.3 million in the budget for the conversion of the Sharon® demonstration facility at Wards Island to another nitrogen removal process, known as Anammox.

Total Residual Chlorine (TRC)

Prior to discharge to a receiving body, wastewater effluent is disinfected with chlorine at the WRRFs. Excessive residual chlorine can be toxic to aquatic life in the receiving water body. A TRC modified Consent Order between NYSDEC and NYCDEP became effective March 2018, which includes interim TRC limits, proposed final TRC limits and a compliance schedule for the TRC upgrade projects required at the WRRFs. There is $125.6 million in the Current Capital Plan for the TRC program.

Rockaway WRRF

Due to several factors including low wastewater flows, NYCDEP has been evaluating alternatives for future operation of the Rockaway WRRF. NYCDEP completed a Facility Plan for Rockaway WRRF in 2014, which analyzed alternatives for future Rockaway WRRF operations. The evaluation considers

maintaining wastewater treatment operations at the Rockaway WRRF or diverting wastewater to 26th Ward WRRF for treatment. Significant upgrades for SOGR and flood resiliency are required at Rockaway WRRF to maintain continuous operation. Two consolidation plans were evaluated to transfer the wastewater flows to 26th Ward WRRF across the Jamaica Bay: horizontal directional drilling (HDD) with open cut conveyance and tunneling under Jamaica Bay with tunnel boring machine (TBM). A pumping station would be required for the consolidation options. The Facility Plan underwent a Value Engineering workshop in December 2014. This project has also undergone an Envision™ triple bottom line evaluation. NYCDEP is currently updating the alternative analysis to determine the best solution for future Rockaway wastewater flow. Additional studies are underway that may impact this decision, such as the Rockaway infiltration/inflow (I/I) studies. There is currently approximately $37.3 million in SOGR funding for Rockaway WRRF in the Current Capital Plan. However, after a decision has been determined for future operations, significant additional funding may be required for upgrades to serve the Rockaway drainage basin.

Bluebelts

NYCDEP has been successful in developing effective Bluebelt sites in the South Shore of Staten Island since the 1990s. Bluebelts are an innovative stormwater drainage system made up of wetlands, streams and ponds. NYCDEP is evaluating expansion of the program to sites on the North Shore of Staten Island, Queens and the Bronx, where they would be effective. Approximately $281.6 million is included in the Current Capital Plan for land acquisition and construction to expand the Bluebelts for stormwater management.

Figure 6-13: Bluebelt Program in Staten Island

6.6 Superfund Designations

NYC has been identified as a potential responsible party (PRP) for the following three Superfund sites – Gowanus Canal, Newtown Creek, and Wolff-Alport Chemical Company. This may have future potential financial impacts to NYC; however, the extent to which NYC will be responsible has not yet been fully determined for the Newtown Creek and the Wolff-Alport Chemical Company sites.

In March 2010, the Gowanus Canal was declared a Superfund site and USEPA notified NYC that they are considered a PRP for hazardous waste under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). On September 30, 2013, USEPA issued its Record of Decision (ROD) for the Gowanus Canal, establishing the dredging, capping and source control requirements. The ROD requires NYC to build two CSO retention tanks as part of the source control component due to the CSO contribution at Gowanus Canal. In May 2014, USEPA issued a Unilateral Administrative Order requiring the City to design major components of the remedy for the Gowanus Canal, including the CSO retention tanks. In June 2016, USEPA issued a memorandum stating that the size of the two CSO storage tanks should be 8-million gallons at RH-034 outfall and 4-million gallons

at OH-007 outfall. NYCDEP is proceeding with the siting and design of the CSO Facility at Owl's Head Outfall OH-007 in accordance with the Unilateral Order. Funding of approximately $453 million is included in the Current Capital Plan for the Gowanus Canal CSO retention facility. It is anticipated that additional funding will be required in the outer years of the Ten-Year Capital Strategy for construction of the two tanks, as the stages of the project progresses. NYCDEP anticipates the cost of the two tanks to be approximately $1.2 billion. The design costs of the in-canal portion of the remediation (dredging and capping of sediments) has been allocated between NYC and twenty other parties. In January 2020, the USEPA issued a Unilateral Order to the six largest PRPs to implement the in-canal remediation in the upper reach of the Canal, the first of three portions where tis work will occur.

In September 2010, Newtown Creek was declared a Superfund site. In July 2011, NYCDEP has entered into an Administrative Settlement Agreement and Order on Consent with EPA, along with five other PRPs that own or operate facilities adjacent to Newtown Creek in the investigation of conditions in Newtown Creek and the evaluation of feasible remedies. The Remedial Investigation/Feasibility Study (RI/FS) is ongoing and is expected to take approximately 11 years. The city is responsible for a portion of the cost of the study; however, the settlement does not cover any remediation that might eventually be required by USEPA to address the contamination identified as a result of the investigation and evaluation. NYCDEP is coordinating with the NYSDEC and the USEPA regarding the recommended plans for the Newtown Creek CSO LTCP along with the Newtown Creek Superfund program.

In May 2014, the USEPA listed Wolff-Alport Chemical Company in Queens as a Superfund site, based upon radioactive contamination at the site. USEPA has indicated that the Superfund process would include an investigation of impacts to the NYCDEP sewer system from operations at the chemical company site. Radioactive material was disposed on-site and also into the sewer system. In September 2017, USEPA issues its ROD requiring jet washing and replacement of sewers and excavation of contaminated portions of the right-of-away. In December 2017, USEPA notified NYC of its status of a PRP for the work on City property pertaining to this Superfund site. In September 2019, the USEPA issued a Unilateral Administrative Order requiring the City to perform additional investigatory work and develop a remedial design in accordance with the ROD.

NYC operated a wastewater treatment plant in the Town of Mt. Kisco which was decommissioned in the 1960s. Elevated radiation levels have been detected throughout the site. These levels are most likely due to the operations of Canadian Radium & Uranium Corporation (CRUC) which processed radioactive materials in Mt. Kisco and most likely sent wastewater to the Mt. Kisco WWTP. Based upon DEP's former operation of the Mt. Kisco WWTP, DEP signed an Order of Consent with NYSDEC, which commits NYCDEP to fund an environmental study of the site. After completion of the study, NYCDEP may be required to fund remedial design and remedial action at the site, along with waste disposal, which could amount to significant costs.

6.7 Potential Future Long-Term Water and Wastewater Projects Beyond Current Budget Planning

City Tunnel No. 3, Stage 3 and Stage 4

The long-term planning for the next phase of City Tunnel No. 3 is the Stage 3 (known as Kensico City Tunnel) and the Stage 4 extension. The Stage 3, Kensico City Tunnel would extend from Kensico Reservoir to Tunnel 3, south of Hillview Reservoir. Stage 4 would deliver additional water to the eastern parts of the Bronx and Queens. It would extend southeast from the northern end of Stage I in the Bronx to Queens and then southwest to interconnect with the Queens portion of Stage 2. City Tunnel No. 3 Stage 4 will enable The System to maintain full service even if Tunnel 1 or 2 were shut down. NYCDEP must decide on its next long-term priorities and needs, and therefore a schedule or budget for this anticipated next phase will have to be developed. These stages would incur beyond the current CIP planning period.

Potential Further Nitrogen Removal in NYC WRRFs

The USEPA Long Island Sound Study is evaluating further nitrogen reductions for the Long Island Sound. The results of this analysis have the potential to impact NYCDEP UER WRRFs by requiring further nitrogen removals. NYCDEP will continue to remain involved and will provide meaningful input throughout this Nitrogen Reduction Strategy.

7.0 EXPENSE BUDGET

The FY 2020 expense budget released in the Preliminary Plan is $1.490 billion. The proposed FY 2020 expense budget in the Preliminary Plan is $1.399 billion. Expense budget projections for FY 2021 are currently being evaluated based upon the new needs of The System and will require adjustment when the evaluation is complete. The FY 2021 expense budget is expected to increase and be updated in the Executive Budget, to be released in April 2020. The expense budget is made up of both Personal Services (PS) costs and Other than Personal Services (OTPS) costs. The personnel services budget is made up of staff salary, fringe benefits and pension costs. The OTPS makes up the remaining expense budget, including taxes, chemicals, supplies, fuel oil, gasoline, biosolids, equipment, contract services, leases, FAD, training, and other requirements/needs. There are many competing needs within the Expense budget each year; therefore, NYCDEP must continue to evaluate all requirements of the water and wastewater system when completing the expense budget. In accordance with applicable regulations and directives, NYC decides the projects (or elements of a project) that are eligible for capital funding. The remaining needs are covered in the expense budget. In addition to the day-to-day requirements to operate and maintain the NYCDEP system, the expense budget must also cover planning studies that are necessary to prioritize capital investments but the studies, themselves, are not capital eligible. Planning studies/Facility Plans are important aspects of long-term management of The System and should be carried out before any significant capital funds are committed to a specific facility.

8.0 PERFORMANCE OVERVIEW

Water Conservation

Figure 8-1 presents the annual water demand for the City over the last 27 years. Water conservation measures taken by NYCDEP in the 1990s have resulted in a steady reduction in the overall water demand. Water demand has decreased by approximately 35% since the 1990s. More recent declines in water consumption have been noted most likely attributed to continued conservation measures, water usage metering, availability of easily accessible data for tracking, and weather patterns. New York's per capita water demand has declined from its peak of 213 gallons a day per person in 1979 to 115 gallons a day per person in 2017. This change reflects a 46% reduction in per capita water demand.[4]

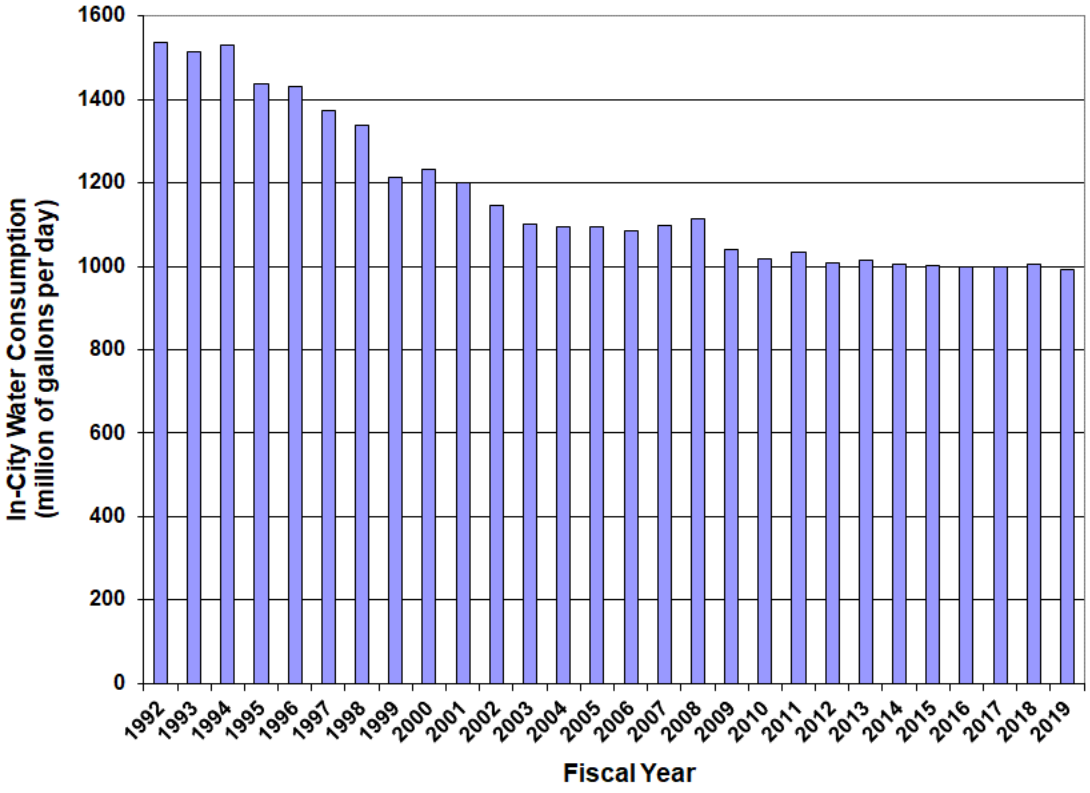


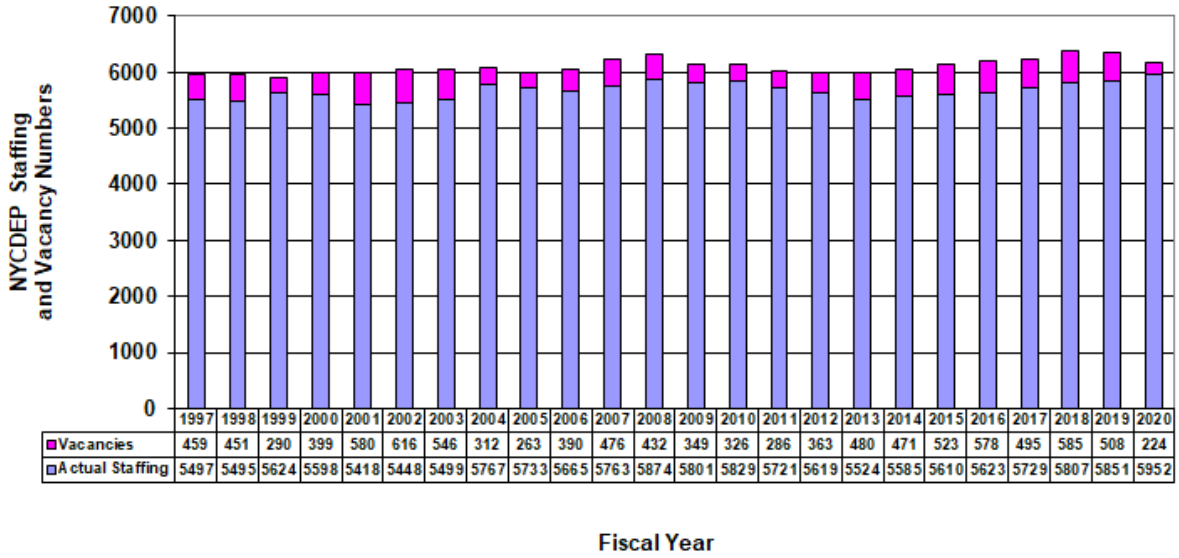
Figure 8-1: New York City Average Daily Water Demand in Million Gallons per Day (MGD)

System Staffing Levels

Staffing levels are approximately 96.4% of current allocations, an increase from 92% last year. Approved positions for the entire NYCDEP system are currently at 6,176 for FY 2020 and vacancies currently stand at 224. This reflects a significant decrease in vacancies from 508 to 224 compared to FY 2019, as shown in Figure 8-2. NYCDEP aggressively works to fill vacancies and has seen

[4] *One Water NYC: 2018 Water Demand Management Plan*, NYCDEP.

improvements in attracting highly skilled and qualified staff, as shown in the decrease in vacancies to a low of 3.6% of approved headcount. This low vacancy is notable considering the trend of high vacancies that are common among many water and wastewater utilities nationwide. The workforce development challenges exist in the water and wastewater industry due to the increasing aging workforce along with the high number of retirements, and the ongoing challenge of hiring new employees with the necessary skills. NYCDEP Organizational Development is developing and implementing succession planning and staff retention programs. A large number of NYCDEP staff is eligible to retire in the near future (1/2 the current workforce is eligible to retire in the next 10 years). Recruitment, training and succession planning are essential to maintain a skilled DEP workforce. NYCDEP maintains a strong diverse workforce. A goal of the *2018 Strategic Plan* is to continue to cultivate a diverse and highly qualified workforce to meet future challenges. NYCDEP has identified strategies to help implement this goal, such as leveraging diverse recruitment sources, improving training for hiring supervisors and conducting a review of the hiring processes.



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Vacancies	459	451	290	399	580	616	546	312	263	390	476	432	349	326	286	363	480	471	523	578	495	585	508	224
Actual Staffing	5497	5495	5624	5598	5418	5448	5499	5767	5733	5665	5763	5874	5801	5829	5721	5619	5524	5585	5610	5623	5729	5807	5851	5952

Figure 8-2: NYCDEP – Staffing and Vacancy Levels FY 1997-2020

NYCDEP continues evaluating current and future staffing needs and skill sets to meet both operational and maintenance needs of the vast system and implementation of the capital program. Additional staff will be required as the NYCDEP adds new facilities and equipment. The operating bureaus are evaluating means to operate more efficiently.

BWT has added an Organizational Development Director to evaluate their staffing needs. BWT has been successful in trying to fill Sewage Treatment Worker (STW) positions, as it is important for knowledge transfer, mentoring programs that encourage the interaction between experienced staff and new hires. BWT is continuing to implement a process which will improve flexibility to get STWs on board. BWT has been successful in filling current staffing vacancies. In addition, BWT have identified new staffing needs as new facilities come on-line (CSO facilities, BNR facilities, TRC facilities) for the operation and maintenance of the new facilities. BWT has also identified additional operations staff to

provide timely preventive maintenance and minimize the more costly corrective maintenance requirements.

For BWS, retention of skilled staff and succession planning is challenging particularly for licensed operators of new water treatment facilities; BWS will remain focused on succession planning and retention of licensed operators.

BWSO has identified new needs in their staffing in order to expand the pro-active inspection of water mains. BWSO will add three additional crews to improve valve inspection and exercising so that they can meet an annual goal. By increasing the valve inspection, crews will be more able to promptly shut off water when there is a water main break. There will also be an increase in the Green Jobs that perform maintenance of green infrastructure assets throughout the City, over the next few years as the GI Program expands and more assets require maintenance.

Another goal of the 2018 Strategic Plan is to maximize operational efficiencies across the agency. This goal will be implemented with various strategic initiatives, which includes in-sourcing (expanding in-house capabilities, where appropriate) to improve capital program delivery and maintenance and operations, streamline procurement practices, and use predictive analytics to drive operational efficiencies. NYCDEP continues to evaluate the cost-effectiveness of in-sourcing some tasks/needs that are currently provided by contract services. If NYCDEP determines that insourcing is a viable means of achieving the same result, it is anticipated that additional staff will be identified and needed. NYCDEP will look to provide a balance of in-sourcing and contract service where appropriate.

Operational Performance Indicators

There are many operational parameters that can be reviewed to assess the effectiveness of operating programs. Several performance indicators for water and sewer operations are summarized below. However, there are other parameters that impact these indicators, such as localized weather patterns.

There were 460 water main breaks reported in FY 2019, which translates to 6.6 breaks per 100 miles of main over a 12-month period. The number of water mains breaks in FY 2019 decreased compared with FY 2018 (see Figure 8-3). The range of water main breaks that NYC has recently experienced remains below water main breaks experienced by other municipalities in the United States (various studies show overall average annual break rates for all pipe materials average 25 breaks per mile, 21-25 breaks per mile, 14 breaks/100 miles depending upon the study and utilities surveyed). NYCDEP BWSO operations continue a preventive maintenance program to target pressure reducing valves by exercising valves and inspecting regulators to help prevent the occurrence of water main breaks, costly repairs, leaks and disruption of service. The majority of water main breaks occur in the winter since the water mains are impacted by the freeze/thaw cycles in the colder temperatures. NYCDEP continued to restore water to residents within an average of 4.8 hours after confirming the water main break. NYCDEP will enhance inter-agency coordination; NYCDEP and NYC Emergency Management will meet with several agencies, including FDNY, NYCDOT, Con Edison, National Grid, Metropolitan Transit Authority (MTA) to review communication and coordination protocols to expedite water shut-off and service return during emergency events.

NYCDEP achieved approximately 83 miles of new water main replacement this past year. Based upon future capital funding, NYCDEP plans to target a 1% or 100-year annual water main replacement cycle (approximately 65 miles/year), which is more than the national average. Utilities have a 125-year water main replacement rate as a national average, which is an average of 0.8% of installed pipe replacement each year. The average age of the water mains throughout NYC is 63 years.

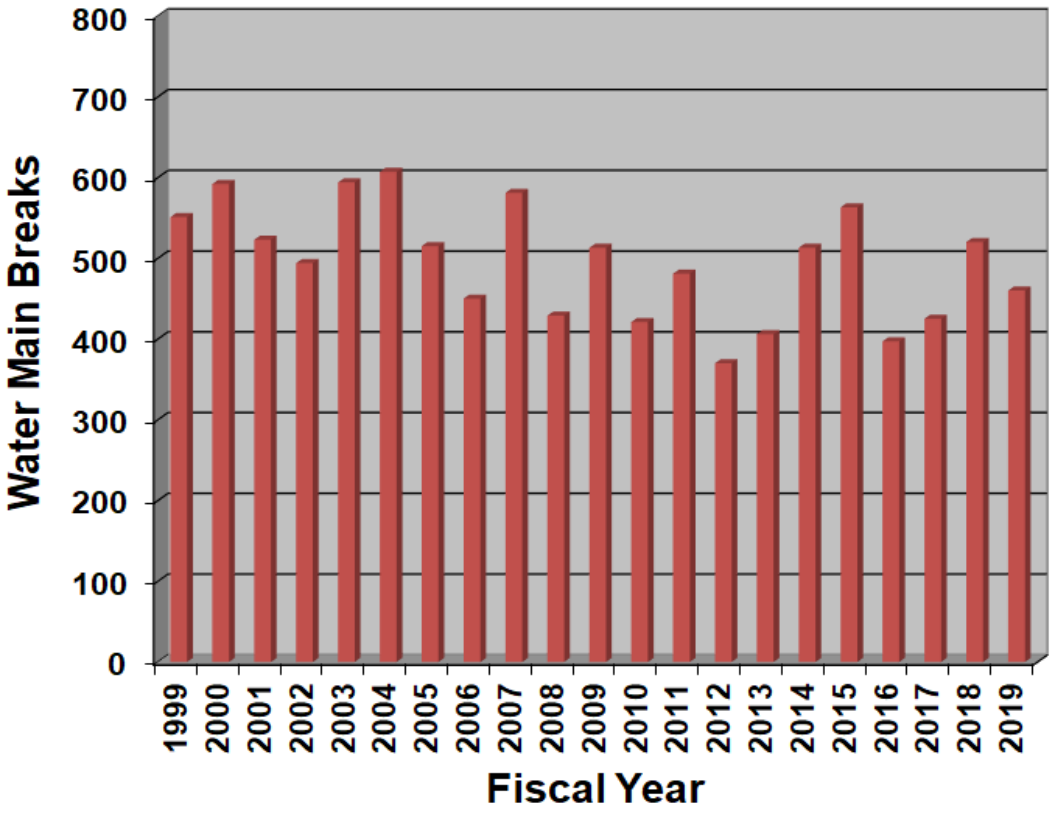


Figure 8-3: Total NYCDEP Water Main Breaks per Fiscal Year

Approximately 0.46% of total fire hydrants were broken and inoperative in FY 2019. The average time to repair or replace high priority broken or inoperative hydrants (as determined by the Fire Department) by NYCDEP was 2.5 days in FY 2019, which is less than the target time for repair or replacement of seven days. The number of catch basins that were surveyed and inspected in FY 2019 was 101.4% of the total (148,000 catch basins). The total number of catch basins that were cleaned by NYCDEP in FY 2019 is 48,756. BWSO field crews are using tablets in the field to track catch basin cleaning data.

As shown in Figure 8-4, NYCDEP received 11,965 sewer backup (SBU) complaints in FY 2019, which is made up of 2,177 confirmed SBUs (on NYCDEP infrastructure) and 9,796 unconfirmed SBUs (not on NYCDEP infrastructure or not found). Response time for SBUs was 3.6 hours on average, which is similar to the past several years and well below the target of seven hours. NYCDEP has found that the significant majority of confirmed sewer backups can be attributed to fats, oils and grease (FOG) buildup

in the sewers. NYCDEP has continued to implement and expand aggressive operational and public outreach initiatives to address the FOG problem in the sewers. NYCDEP continues to use a public outreach campaign to educate the public what should not be flushed down the toilet (wipes, cooking oil, and many other personal hygiene products) as they impact the operation of sewers and treatment plants. This campaign is known as **Trash It. Don't Flush It. FatbergFree.nyc**.

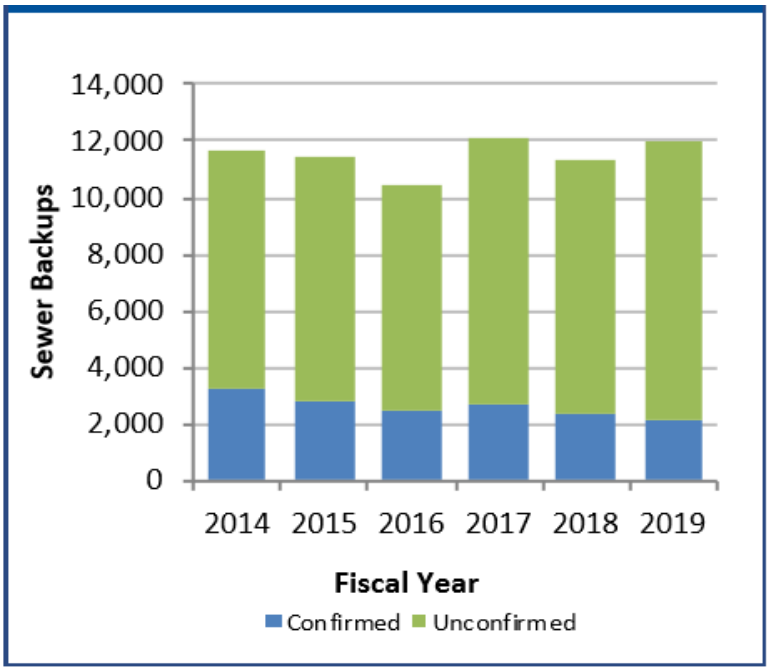


Figure 8-4: Sewer Backup (SBU) Complaints

NYCDEP uses a data-driven risk management approach to operate and maintain the sewer system, targeting specific locations with recurring problems. A group within BWSO known as Collection Systems Investigations (CSI), is a specialized unit that targets in-house engineering and contract resources to address sewer system performance issues. The Sewer Operations and Analysis Program (SOAP) at NYCDEP allows for a more proactive rather than reactive approach. This group analyzes areas with recurring problems to determine the cause of the problem and then determines a remediation plan (degreasing, cleaning, repair, replacement). BWSO's top priority remains its core work, which consists of sewer television inspections, sewer cleaning, catch basin reconstruction and cleaning, hydrant repair, installation of new water mains.

NYCDEP submitted a Sewer Backup Prevention and Response Plan to the NYSDEC in May 2017. In July 2017, NYCDEP commenced a three-year pilot program (July 2017 – June 2020), known as a

Figure 8-5 State of the Sewers 2019

Targeted Sewer Inspection Pilot (TSIP). The goal of the pilot is to further reduce the frequency of confirmed SBUs throughout NYC. During the pilot NYCDEP will perform two cycles of visual inspections of the sanitary sewers over the 3-year period across specific geographic areas in Brooklyn and Queens that historically have had the highest number of SBUs. BWSO plans to complete 55,000 sewer segment inspections by June 2020. Based upon the results of the SBU pilot, additional SBU performance metrics may be identified. The increased inspections for these targeted areas reflect a proactive position rather than reactive for NYCDEP operations. BWSO issued a report entitled, A Plan to Prevent Confirmed Sewer Backups in December 2019. BWSO also issued a State of the Sewers 2019 Report, which documents several metrics on the sewer operations annually.

On November 30, 2019, there was a significant sewer collapse in South Ozone Park, Queens. NYCDEP BWSO crews responded quickly. A temporary by-pass was installed while a new sewer line was being constructed. Repairs were completed in early February 2020 which included installation of 1,200 linear feet of new 48-inch sewer. The 42-inch sewer line that failed unexpectedly, was built in 1987 by the NYSDOT as part of the Nassau Expressway construction and is now abandoned.

Operational and Maintenance Program Summary and Updates

Water Supply and Treatment Operations. NYCDEP strives to increase the reliability, flexibility and redundancy of overall water supply operations. The interconnection of the Delaware Aqueduct with the Catskill Aqueduct at Shaft #4, which allows water from the Delaware Aqueduct to be diverted to the Catskill Aqueduct, has been operational since 2015. This interconnection provides operational flexibility and an additional tool in dealing with turbidity incidents following high rainfall in the Catskill watershed. The upgrades at the Croton Falls Pump Station and the Cross River Pump Station provide conveyance flexibility to NYCDEP and provide the ability for Croton water to be supplied to the Delaware Aqueduct, if required in emergencies or when parts of the system are out of service for planned or unplanned maintenance. During the Catskill Aqueduct shutdown this past winter (November 2019 – January 2020), Croton Falls and Cross River Pump Stations were operational to deliver additional flow to the Delaware Aqueduct. NYCDEP received NYSDOH approval prior to operating Croton Falls and Cross River Pump Stations. In additional, the connection between the Catskill Aqueduct and Croton allows blended water to be sent to the Croton WFP if necessary. NYCDEP continues to maintain/ increase operational flexibility in the operations of the vast network of upstate reservoirs and aqueducts in order to reliably deliver safe drinking water to NYC.

Croton Operations. The Croton WFP began sending treated drinking water to the NYC distribution network in May 2015. In November 2015, Croton demonstrated operating at full water production rate (290 MGD). The water produced at the Croton WFP is varied depending upon the needs of the overall

water supply and distribution system. Depending upon the water supply demands, NYCDEP will continue to vary water production at the Croton WFP. Croton WFP was operational at the end of 2019 during portions of the Catskill Aqueduct shutdown. NYCDEP scientists and engineers continue to evaluate seasonal variations in water quality from the Croton watershed and is planning to implement operational and equipment process modifications to address taste and odor issues.

UV Operations. The Cat/Del UV Facility has been in operation since October 2012. NYCDEP BWS Operations staff successfully took over 100% control of the facility on June 15, 2013. The facility is operated and maintained with approximately 52 NYCDEP BWS staff. The UV facility is the largest UV water disinfection facility in the world and consists of fifty-six 40 MGD UV disinfection units. It is currently receiving and providing UV disinfection to all Cat/Del waters and has a capacity to disinfect 2.4 billion gallons per day. Currently water is transferred from the Kensico Reservoir to the Cat/Del UV Facility via the Delaware Aqueduct. The Consent Order for the Cat/Del UV Facility was terminated July 2016.

Drinking Water Quality and Quantity. NYCDEP released the New York City 2019 Drinking Water Supply and Quality Report on February 24, 2020. NYCDEP conducts significant monitoring of the source water and in-city water quality. In FY 2019, NYCDEP collected 36,300 samples from the in-city distribution system and performed approximately 456,500 analyses, meeting all state and federal monitoring requirements. In addition, NYCDEP collected more than 15,000 samples and performed approximately 262,500 analyses from the upstate reservoirs and watersheds. Approximately 2 million robotic monitoring measurements were made to support FAD watershed protection programs and to optimize water quality. Microbiologists, chemists and other scientists with the BWS test water from key locations across the watershed and the City at NYCDEP laboratories. NYCDEP water quality laboratories are located in Hawthorne, Kingston, Grahamsville and Queens. As of February 27, 2020, the overall storage in NYC's water supply system stands at 91.6% of capacity, compared to the normal levels at this time of 90.8% of capacity.

NYCDEP BWS initiated an Emerging Contaminant Monitoring Project (ECMP) throughout the NYC watershed in 2019. Among over 140 emerging contaminants that are being tested, per- and polyfluoroalkyl substances (PFAS) were part of the analysis, including perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). The results are posted quarterly on the NYCDEP website. These materials were often not detected, or they were detected at levels below New York State's proposed standard of 10 parts per trillion (ppt) (PFOS, PFOA).

NYCDEP utilizes the Operation Support Tool (OST) for various decision making and operating modes. The OST model links water quality and water quantity models, uses near real-time data for reservoir levels, stream flows entering reservoirs, snowpack and water quality in streams and reservoirs, and it includes National Weather service forecasts.

Wastewater Operations. BWT utilizes predictive maintenance methods in order to better identify maintenance and replacement cycles and overall increase reliability of the WRRF's equipment. Examples of predictive maintenance include measuring mechanical wear on equipment parts and using

thermographic cameras to examine electrical systems. This program is anticipated to save on capital replacement and energy costs.

BNR Operations at the Wastewater Resource Recovery Facilities . NYCDEP has been operating in Step Feed BNR mode at several of the NYCDEP WRRFs (Hunts Point, Bowery Bay, Tallman Island, Wards Island, 26th Ward and Jamaica WRRFs). Due to the long-term planning and significant capital projects that have been implemented, NYCDEP operations had been achieving the final total nitrogen (TN) removals established for the Upper East River. Due to the required upgrades at the plants, the UER WRRFs have seen an approximate 61% reduction in total nitrogen in the effluent. However, NYCDEP received a NOV from NYSDEC due to exceedance of the UER TN aggregate limits for the time period of May through August 2018. NYCDEP and NYSDEC are currently negotiating terms of a Consent Order. The final TN load for Jamaica Bay will be performance-based and will go into effect 19 months after construction completion of the BNR upgrades at the Coney Island WRRF.

Figure 8-6 New York Harbor Water Quality Report

Harbor Water Quality. NYC has been collecting and maintaining records of water quality data for over 100 years. The New York Harbor Water Quality Survey currently consists of 89 sampling stations harbor-wide, with 40 located in open waters and another 49 located in tributaries. NYCDEP has increased the number of monitoring sites throughout the harbor and at the mouth of key tributaries in order to evaluate the effectiveness of the NYCDEP stormwater management and CSO control projects. The number of water quality parameters measured has increased from five in 1909 to 27 water quality parameters at present.

The water quality in the harbor has continued to improve as a result of the maintenance and operation of the wastewater resource recovery facilities and the combined sewer overflow programs. Figures 8-7 and 8-8 below demonstrate the improvements in water quality over the past 50 years as indicated by the increased dissolved oxygen concentrations and reduced Fecal Coliform counts. The trend graphs for the 2018 Harbor Survey data have been modified to reflect the extension of the bathing season by the NYC City Council. All trend graphs that are presented include data collected from the extended recreational bathing season, beginning of May to the end of October, rather than the beginning of June to the end of September, as previous graphs have shown. In FY 2018, 92% of the harbor survey stations met the fishable standard of 5 mg/L for dissolved oxygen.

Sludge Vessels. In FY 2014, NYCDEP commissioned three new sludge vessels, the Motor Vessel (M/V) Hunts Point, the M/V Port Richmond and the M/V Rockaway. The three new ships join the M/V North River and the M/V Red Hook sludge vessels. The sludge vessels transport liquid sludge from the six WRRFs not served by onsite dewatering facilities to those WRRFs with dewatering facilities.

Biosolids. NYCDEP typically produces 1,400 wet tons per day of biosolids from the wastewater treatment operations at the 14 WRRFs. NYCDEP is developing a Biosolids Strategic Plan to identify alternative end uses for NYCDEP biosolids. The majority of biosolids from NYCDEP WRRFs have been landfilled in recent years. However, BWT plans to increase the beneficial reuse of biosolids, starting with a beneficial reuse contract for 10% of NYC biosolids, and increasing the amount of beneficial reuse contracts going forward. Beneficial reuse of biosolids supports the OneNYC mayoral initiative of zero waste to landfills by 2030 due to the significant environmental and sustainability benefits it provides.

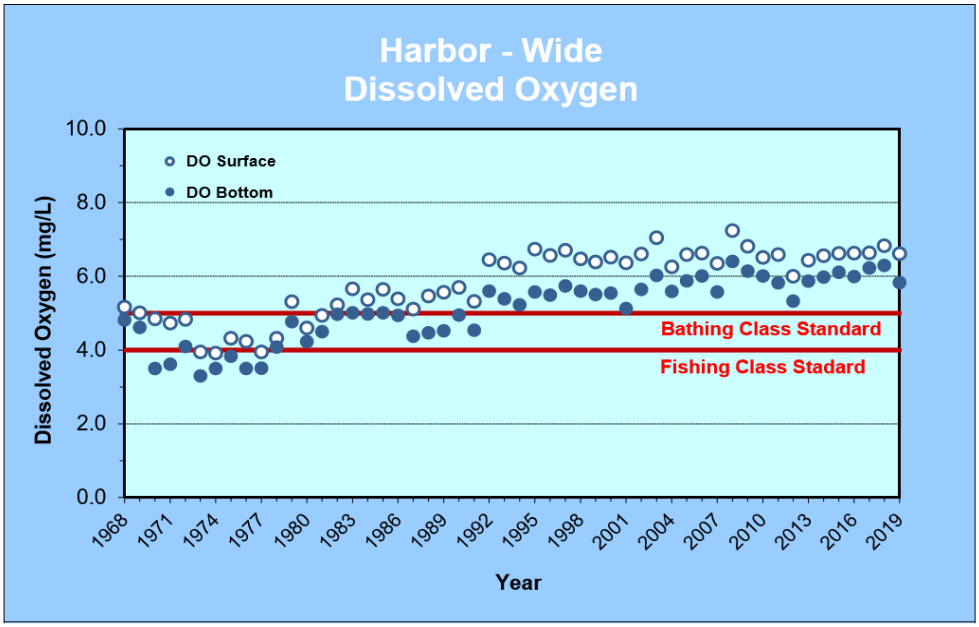


Figure 8-7: Dissolved Oxygen for Harbor Survey Key Stations (1968-2019)

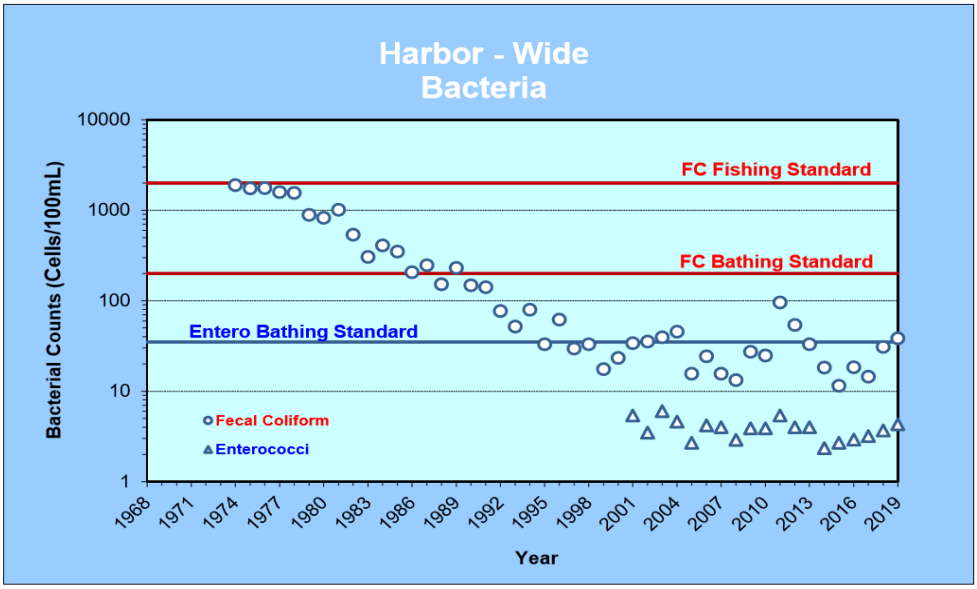


Figure 8-8: Fecal Coliform Counts and Enterococci for Harbor Survey Key Stations (1974-2019)

Environmental Health & Safety (EH&S). NYCDEP maintains a robust and comprehensive EH&S program across all bureaus throughout the NYCDEP. NYCDEP provides consistent EH&S training so that staff can carry out their work responsibilities safely and in compliance with the many local, state and federal regulations. The EH&S Group is responsible for a comprehensive EH&S compliance program, all EH&S training, audits, EH&S employee surveys and the NYCDEP internal compliance office. EH&S is carried out by in-house NYCDEP management and staff as well as EH&S contracts. Safety is one of NYCDEP's core values as identified in the Strategic Plan. Over the past decade, NYCDEP has created a culture where safety comes first for every employee, contractor and the public. The Strategic Plan Progress Report highlighted NYCDEP Safety Value Ambassadors.

Permit Updates

Wastewater Treatment. NYSDEC issued final State Pollutant Discharge Elimination System (SPDES) permits for the 14 NYC WRRFs on October 15, 2015. NYCDEP is in discussions with NYSDEC for new SPDES permits as the current SPDES permits for the 14 WRRFs are expiring in 2020. NYCDEP is operating in accordance with the current SPDES permits for 14 WRRFs. Based upon diligent wastewater treatment plant operations, 99.6% of the NYCDEP wastewater treatment plant effluent met state pollutant discharge elimination standards in FY 2019. For the first four months of FY 2020, 99.7% of the NYCDEP wastewater plant effluent met state pollutant discharge elimination standards.

Stormwater. NYSDEC issued a final municipal separate storm sewer system (MS4) permit for NYC on August 1, 2015. A portion of New York City has separate storm and sanitary sewer systems. The storm sewers are addressed under the MS4 permit and the separate sanitary sewers send flows to the WRRFs, which operate under the SPDES permits. NYC is the permit holder since the MS4 requirements covers 14 city-chartered agencies. However, NYCDEP coordinates all required activities under the permit. In October 2013, an Executive Order was signed addressing coordination and implementation of stormwater controls and MS4 permit requirements for NYCDEP and other NYC agencies. Memorandums of Understanding (MOUs) have been developed between NYCDEP and the chartered city agencies that are impacted by the MS4 permit. As required by the MS4 permit, NYC established legal authority in 2017 with the passage of Local law 97. The city has established a Stormwater Controls Working Group that includes representatives from each agency that meet quarterly to discuss stormwater program development tasks and permit-related information. The MS4 permit includes robust requirements, which significantly expand the city's obligations to reduce pollutants discharging to the storm sewers. The MS4 permit requires NYC to submit a Stormwater Management Program (SWMP) Plan within three years of the effective date of the permit. The SWMP was submitted August 1, 2018. Key components of the SWMP include public education and outreach, mapping, illicit discharge detection and elimination (IDDE), construction site stormwater runoff control, post-construction stormwater management, pollution prevention and good housekeeping for municipal operations, industrial stormwater sources, control of floatables and settleable debris, monitoring and assessment of controls, and impaired waters. The SWMP Plan was approved by NYSDEC in March 2019. The MS4 includes annual reporting requirements. The 2018 Annual Report covered the period August 1, 2018 to December 31, 2018. Among other requirements, NYC submitted a fiscal analysis of the capital, operating and maintenance costs necessary to meet the requirements of the permit August

1, 2018. The MS4 permit expires in 2020; NYCDEP and NYSDCE are currently negotiating a new MS4 permit.

As part of NYCDEP's public outreach and education, in June 2017 NYCDEP announced the launch of *Don't Trash Our Waters*, a public awareness campaign aimed at reducing litter and improving the health of New York City's waterbodies.

9.0 OTHER NOTEWORTHY ISSUES AND COMMENTS

Lead

The USEPA proposed Long-Term Revisions (LTR) to the Lead and Copper Rule (LCR) to improve public health protection by making practical changes and to streamline the rule requirements. The public comment period for the revised Lead and Copper Rule ended February 2020. NYC provided comments during the public comment process. NYCDEP has been engaged with the National Drinking Water Advisory Council (NDWAC) Lead and Copper Rule Working Group, Water Research Foundation expert panel, and others. NYCDEP has taken a pro-active approach and has initiated studies to further optimize corrosion control, better understand lead exposure and help prepare for the LTR LCR. NYCDEP is currently working on lead research as part of the BWS Research Program. BWS is conducting a pilot program in City Island in the Bronx to further optimize corrosion control treatment by increasing the orthophosphate (PO4) dosage.

NYCDEP has been in compliance with the current Lead and Copper Rule. NYCDEP has an active corrosion control program in place in order to reduce lead absorption from service lines and internal plumbing. NYCDEP treats the water with food grade phosphoric acid and sodium hydroxide. Sodium hydroxide is added to raise the pH and reduce corrosivity, which prevents the leaching of lead from pipes into the drinking water. Phosphoric acid is added to create a protective film on pipes that reduces the release of metals, such as lead, from household plumbing. Under the current federal Lead and Copper Rule, mandated at-the-tap lead monitoring is conducted at select households throughout New York City. In 2018, based on the results of this monitoring, the 90th percentile did not exceed 15 µg/L, the established standard or Action Level for lead. The at-the-tap monitoring results are presented in the annual New York City Drinking Water Supply and Quality Report.

In January 2019, Mayor deBlasio released a plan called LeadFreeNYC, a comprehensive roadmap to eliminating lead exposure in NYC children, which includes many ways to eradicate lead exposure.

A NYS Health Department grant of $5.3 million has been given to NYC for NYCDEP to pilot a program to replace lead service lines for low-income single-family homeowners. As part of this LeadFreeNYC program, NYCDEP has also posted a map of NYC with potential lead service lines on the LeadFreeNYC website.

NYC residents can request a free lead kit to test their water. NYCDEP's Water Quality Lead Unit has made improvements to the free lead testing program by revising the sampling and mailing instructions to better explain the procedures. NYCDEP plans to start a marketing campaign to inform more New Yorkers that NYC offers free water testing kits for any resident that requests one.

Renewable Rikers

In 2019, City Council passed legislation for the closing of the Rikers Island Detention Facility by 2026. Subsequently, City Council introduced legislation that requires studies to be completed to determine future use of Rikers Island, known as Renewable Rikers. NYCDEP will conduct a feasibility study to evaluate the relocation of the four Upper East River (Bowery Bay, Tallman Island, Hunts Point, Wards

Island) WRRFs to Rikers Island. NYC Mayor's Office of Sustainability will conduct a feasibility study to evaluate different types of renewable energy sources combined with battery storage to be located on Rikers Island. Rikers Island consists of 413 acres and is located in the East River between the Bronx and Queens.

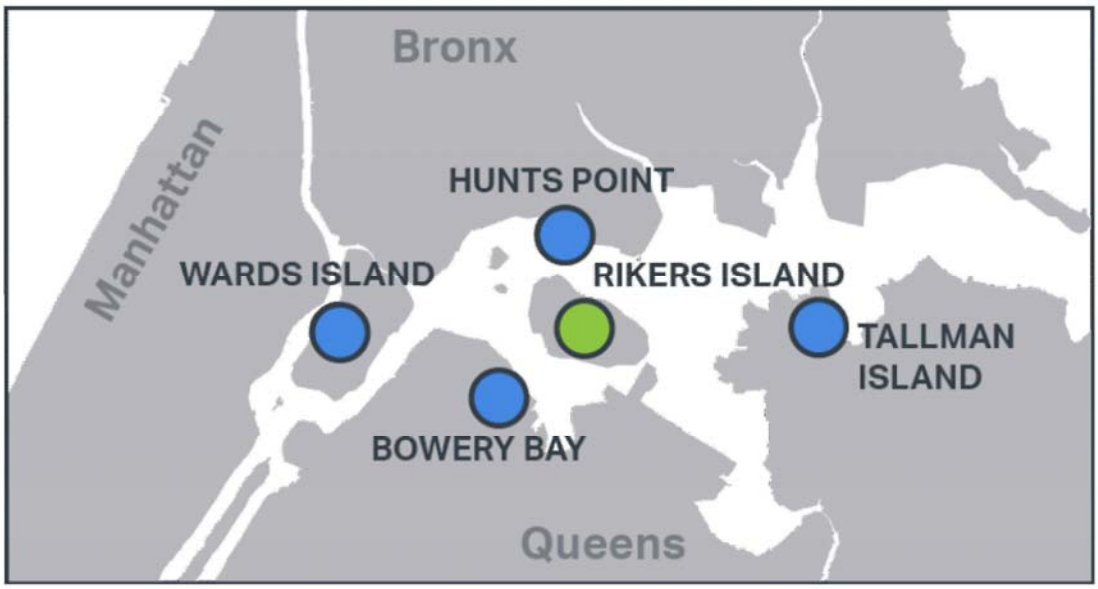


Figure 9-1: Location of Rikers Island and Four NYCDEP WRRFs

Awards

NYCDEP capital program, operations and customer service have been recognized throughout the industry by professional and trade organizations. Two NYCDEP projects, the Gowanus Combined Sewer Overflow Facility and the Bluebelt Program, were honored by the Public Design Commission at its 37th Annual Awards for Excellence in Design.

J.D. Power 2019 Water Utility Residential Customer Satisfaction Study measures satisfaction among residential customers of 89 water utilities, in four geographic regions: Midwest, Northeast, South, and West. NYCDEP ranked #1 in the Northeast Region and placed #6 in overall customer service nationally.

The American Council of Engineering Companies (ACEC) New York awarded the 2020 Platinum Engineering Excellence Award to the Alley Creek Tidal Wetland Restoration.

Institute for Sustainable Infrastructure (ISI) awarded the Envision Gold Award to NYCDEP for the sustainable design of the 235th Street Pump Station rehabilitation in December 2019.

10.0 SUMMARY AND CONCLUSIONS

Considering the magnitude of the overall infrastructure and the level of operational service required, it is our opinion that:

- The System continues to be managed in a professional and prudent manner with an appropriate regard for the level of service afforded to the users within the available funding.
- The physical condition of The System receives an "adequate rating", our highest rating. Due to the size and complexity of The System, NYCDEP requires future capital investments for the continuous replacement and/or repair of aging infrastructure in a systematic and cost-effective manner.
- NYCDEP capital and expense budget projections for FY 2020 satisfy the immediate needs for The System including legally mandated projects, which comprise approximately 29% of the capital budget for FY 2020.
- NYCDEP capital budget projections for FY 2021 satisfy the immediate needs for the System including legally mandated projects, which comprise approximately 29% of the capital budget for FY 2021. Expense budget projections for FY 2021 are currently being evaluated based upon the projected new needs of The System and may require adjustment when the evaluation is complete.
- NYCDEP capital planning is an ongoing iterative process addressing priorities and needs of The System. The Capital Improvement Program (CIP) for Fiscal Years 2020-2024 is responsive to the long-term requirements of the service area.
- Staffing levels are approximately 96% of approved allocations, which reflects a significant decrease in vacancies. NYCDEP has identified additional needs and skill sets to meet the requirements of new facilities coming on-line and more complex facility operation requirements and to improve PM/CM programs. NYCDEP is also evaluating its future needs focusing on succession planning, transfer of knowledge, filling vacancies and staff retention in anticipation of departure of experienced NYCDEP employees that are eligible for retirement in the near future.

Regarding System Management

In our opinion, The System continues to be managed in a professional and prudent manner with an appropriate regard for the level of service afforded to the users. The physical condition of The System receives an adequate rating. In our opinion, the NYCDEP facilities and infrastructure are in adequate condition. NYCDEP faces similar issues to many other large urban areas nationwide, such as aging infrastructure, strict regulatory requirements and ongoing climate change resiliency concerns. NYCDEP continues to successfully manage the overall operations of the NYC large and complex water and wastewater system, and prioritize the most important projects and programs. An Asset Management program is being used by NYCDEP that better identifies the needs and costs for infrastructure upgrades. Capital funding will need to be allocated to address the state of good repair of aging infrastructure in order to avoid critical failure of essential processes. These needs will have to continue to be addressed and implemented in a systematic way. NYCDEP is taking a proactive approach prioritizing its needs and spending money (capital investment and operating expenses) where it will have the greatest impact to the water and wastewater system operations, reliability and

redundancy, and to the water quality in the upstate watershed and the surrounding NYC waterways. Projects that address climate change impacts and adaptation to the system are in various stages of implementation (feasibility planning, design and construction) based upon sound cost-effective analysis and this process will need to continue as additional resiliency projects are identified. Prioritization of greatest need is a significant factor in moving forward with implementation of climate change resiliency. NYCDEP must remain diligent to make sure operational needs continue to be met while capital programs are identified and implemented in a timely manner. Because of the vast and extensive nature of the NYCDEP facilities and its aging infrastructure, continued diligence and future capital improvements will continue to be required in the near term and long term.

Regarding the Capital Improvement Program (CIP)

Projects/Programs that will require additional funding in future budgets include:

- *SOGR:* As indicated throughout the report, significant additional funding in future budgets will be required for the continuation of SOGR projects due to the aging infrastructure throughout the wastewater and water system. Specifically, additional funds have been identified for the Hunts Point sludge thickening projects.

- *Climate Change Resiliency, Energy Carbon Neutrality, and Sustainability Projects*: NYCDEP is seeking supplemental funding mechanisms for climate change resiliency and energy carbon neutrality projects. There may be a need in the future for additional NYCDEP funding to pursue these projects. This might result in an incremental cost added to some state of good repair projects or entirely new projects. Additional funding needs may be identified in the next budgeting cycle.

- *Combined Sewer Overflow (CSO) Program*: NYCDEP has submitted ten Long Term Control Plans (LTCPs) and is required to submit one remaining LTCP. Additional funding will continue to be required for implementation of the CSO projects that have been identified in the LTCPs in the future budget cycles beyond the ten year horizon.

- *Hillview Cover:* Based upon the schedule and the results of the planning study in the Hillview Consent Decree, significant funding will need to be added to future capital plans.

- *Superfund Sites:* Additional funding will be required for Gowanus Canal Superfund Facility. Once studies have been completed, additional funding will be required for other Superfund sites.

11.0 LIST OF ACRONYMS

ACCO	Agency Chief Contracting Officer
ACE	Accelerated Conservation and Efficiency
ACEC	American Council of Engineering Companies (ACEC)
ADG	Anaerobic Digester Gas
AUV	automated underwater vehicle
BEC	Bureau of Environmental Compliance
BEDC	Bureau of Engineering, Design, and Construction
BEPA	Bureau of Environmental Planning and Analysis
BGD	Billion Gallons per Day
BNR	Biological Nitrogen Removal
BWS	Bureau of Water Supply
BWSO	Bureau of Water and Sewer Operations
BWT	Bureau of Wastewater Treatment
CAG	Community Advisory Group
Cat/Del	Catskill/Delaware
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CHP	Combined Heat and Power
CIP	Capital Improvement Program
CM	construction management
CMOM	Capacity, Management, Operations and Maintenance
CRUC	Canadian Radium & Uranium Corporation
CSI	Collection Systems Investigations
CSO	Combined Sewer Overflow
CWA	Clean Water Act
CY	calendar year
DAF	Dissolved Air Flotation
DCAS	Department of Citywide Administrative Services
DOE	Department of Education
ECM	Energy Conservation Measure
ECMP	Emerging Contaminant Monitoring Project
ECN	Energy Carbon Neutrality
EDC	Economic Development Corporation
EIS	Environmental Impact Statement
ESCR	Eastside Coastal Resiliency
ePMIS	Enterprise Project Management Information System
EH&S	Environmental Health & Safety
ExCEL	Expenses for Conservation and Efficiency Leadership
FAD	Filtration Avoidance Determination
FDNY	New York City Fire Department
FEIS	Final Environmental Impact Statement
FEMA	Flood Emergency Management Agency
FERC	Federal Energy Regulatory Commissioner
FOG	fats, oils and grease

FY	Fiscal Year (NYCDEP Fiscal Year begins on July 1 and ends on June 30)
GBT	gravity belt thickeners
GHG	greenhouse gas
GI	Green Infrastructure
HDD	Horizontal Directional Drilling
IDDE	illicit discharge detection and elimination
IHD	in-house design
ISI	Institute for Sustainable Infrastructure
GBT	gravity belt thickeners
KEC	Kensico Eastview Connection Tunnel
KPI	Key Performance Indicator
LCR	Lead and Copper Rule
LIRR	Long Island Railroad
LL	Local Law
LT2	Long Term 2 Enhanced Surface Water Treatment Rule
LTCPs	Long Term Control Plans
LTR	Long-Term Revisions
mg/L	milligrams per liter
MGD	Million Gallons per Day
MOU	Memorandums of Understanding
MS4	Municipal Separate Storm Sewer System
MTA	Metropolitan Transit Authority
MTBM	micro-tunnel boring machine
MW	megawatt
M/V	Motor Vessel
NACWA	National Association of Clean Water Agencies
NASEM	National Academies of Sciences, Engineering and Medicine
NDWAC	National Drinking Water Advisory Council
NOV	Notice of Violation
NYC	New York City
NYCDDC	New York City Department of Design and Construction
NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
NPCC	New York City Panel on Climate Change
NRDC	Natural Resources Defense Council
NYCDOT	New York City Department of Transportation
NYCHA	NYC Housing Authority
NYSDOH	New York State Department of Health
NYSERDA	New York State Energy Research and Development Authority
OACE	Office of the Agency Chief Engineer
OTPS	Other than Personal Services
OST	Operation Support Tool
PFOA	perfluorooctanic acid
PFOS	perfluoroctanesulfonic acid

PFAS	per- and polyfluoroalkyl substances
PM/CM	preventive maintenance/corrective maintenance
PMF	probable maximum flood
PO4	orthophosphate
Ppt	parts per trillion
PRP	Potential Responsible Party
PS	Personal Services
PV	Photovoltaic
ROD	Record of Decision
ROV	remote operated vehicle
ROW	Right of Way
RWB	Rondout-West Branch
SBU	Sewer Backup
SCA	School Construction Authority
SCADA	Supervisory Control and Data Acquisition
SIRR	Special Initiative for Rebuilding and Resiliency
SOAP	Sewer Operations and Analysis Program
SOGR	State of Good Repair
SOPs	Standard Operating Procedures
SPDES	State Pollutant Discharge Elimination System
SMLP	Storm Mitigation Loan Program
SWMP	Stormwater Management Program
TBM	tunnel boring machine
TMDL	Total Maximum Discharge Limit
tpd	tons per day
TPL	Trust for Public Land
TRC	Total Residual Chlorine
TSIP	Targeted Sewer Inspection Pilot
UER	Upper East River
µg/L	micrograms/L
ULURP	Uniform Land Use Review Procedure
USDOJ	United States Department of Justice
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
WM	Waste Management
WFF	Water for Future
WFP	Water Filtration Plant
WRRF	Wastewater Resource Recovery Facility
WUCA	Water Utility Climate Alliance
WWTP	Wastewater Treatment Plant
WRRF	Wastewater Resource Recovery Facility

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