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March 1, 2017

Mr. Alan Anders Chief 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 2017 Consulting Engineer's Report

Dear Mr. Anders:

We herewith submit the Fiscal Year 2017 Consulting Engineer's Report on the operation of the Water and Sewer System of the City of New York. 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 2017 and 2018.

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 Fiscal Year 2017 and Fiscal Year 2018 are adequate for the immediate needs of the System.

It is important to note that much of the data utilized for the analyses conducted by AECOM has been generated by the on-going budgetary process. The budgetary planning will continue past the date of this report and revisions may be made. However, it is our opinion that meaningful observations and conclusions can be made at this time, although the final budget allocations are subject to change based on the outcome of the budgetary process. It is these observations and conclusions that are presented hereinafter.

We have no responsibility 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



THE NEW YORK CITY MUNICIPAL WATER FINANCE AUTHORITY

FISCAL YEAR 2017 CONSULTING ENGINEER'S REPORT

PREPARED BY

AECOM

March 1, 2017

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1.0 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 New York City (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, independently reviewing the capital and operating programs pertaining to water and wastewater, reviewing 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 New York City Department of Environmental Protection (NYCDEP).

The report addresses the issues listed below:

- present physical condition of The System,
- Fiscal Year (FY) 2017 capital budget and FY 2018 projected capital budget for The System,
- Fiscal Year 2017 expense budget and FY 2018 projected expense budget relative to operation and maintenance of The System,
- overview of the Preliminary Ten Year Capital Strategy for Fiscal Years 2018 to 2027, and
- management of The System.

2.0 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,
- information gathered from visiting operating facilities and major on-going construction programs,
- review of documentation relative to the ongoing budgetary process, and
- consideration of national and local trends in the water and wastewater industry (regulations, resource recovery, other issues).

The budgetary process is ongoing and was not concluded by the time of this report's publication. 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 outcome of the budgetary process.



3.0 THE CONSULTING ENGINEER

AECOM companies have served the water and wastewater industry for over 100 years and NYC as a consulting engineer for many decades dealing with water supply, water distribution, sewage collection, and wastewater treatment. AECOM is one of the largest consulting engineering firms in the United States and is recognized internationally as a leader in providing services to the water and wastewater industry. AECOM is a global leader in all the markets for which it provides professional technical and management support services including architecture, asset management, construction, cost management, design/planning, economics, engineering, environmental services, international development, operations and maintenance, planning and consultancy, program management/ construction management, risk management/resiliency and technical services. These services are provided in several market areas including water, transportation, power and oil/ gas/chemicals. AECOM currently has more than 87,000 employees worldwide and serves clients in more than 150 countries and on all seven continents. In 2016, Engineering News Record (ENR) magazine ranked AECOM #1 in the top 500 overall design firm category for the seventh consecutive year.

4.0 THE CONSULTING ENGINEER'S CONCLUSIONS

- 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 within the available funding.
- NYCDEP capital and expense budget projections for FY 2017 satisfy the immediate needs for The System including legally mandated projects, which comprise approximately 22% of the capital budget for FY 2017.
- NYCDEP capital budget projections for FY 2018 satisfy the immediate needs for the System including legally mandated projects, which comprise approximately 16% of the capital budget for FY 2018. Expense budget projections for FY 2018 are currently being evaluated based upon the projected new needs of The System and may require adjustment when the evaluation is complete.
- The physical condition of The System receives an adequate rating.
- Staffing levels are approximately 92% of current allocations. NYCDEP continues to focus on recruitment practices, succession planning and training in order to strengthen and incentivize NYCDEP staff. NYCDEP continues evaluating current and future staffing needs and skill sets to meet both operation needs and implementation of the capital program.

5.0 OVERVIEW OF THE SYSTEM

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

5.1 Water Supply System

The NYC water is supplied from three upstate watersheds (Delaware, Catskill and Croton), which extends as far as 125 miles north of NYC, consisting of 21 reservoirs and three controlled lakes, as shown in Figure 1. NYCDEP maintains operational flexibility to vary the water supply from all three water systems; the Catskill, Delaware and Croton systems. NYCDEP also maintains wells in





Figure 1: New York City Water Supply System



Queens; however, the groundwater supply system has not been providing water to the NYC distribution network since 2007. NYCDEP plans to renew the groundwater permits in December 2017 so that the groundwater will be available as a back-up water supply, if necessary. The average daily NYC water consumption for calendar year (CY) 2016 was 1.002 billion gallons per day (BGD), which has not changed significantly since 2010. The Water System also provides potable water to upstate consumers. Upstate water consumption for CY 2016 was 114 million gallons per day (MGD), which has also remained steady. It should be noted that current average daily water consumption in NYC is about 35% less than the consumption levels experienced in the early 1990s. If the conservation measures 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 New York City water supply is conveyed by gravity from the upstate reservoirs through an extensive system of tunnels and aqueducts. The Catskill Aqueduct conveys water from the Ashokan Reservoir to the Kensico Reservoir and the Delaware Aqueduct conveys water from the Rondout Reservoir to the Kensico Reservoir. Because of the high quality water in the upstate reservoirs, 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. The Catskill/Delaware UV Disinfection Facility, treating water from Kensico Reservoir as mandated in the FAD, commenced operations in the fall of 2012 and feeds water to NYC through the Hillview Reservoir. The UV Facility, located on a 153 acre facility between the Kensico and Hillview reservoirs has a capacity of 2.4 BGD and is the largest UV facility in the United States. The UV Facility consists of 56 UV disinfection units that contain a total of 11,760 large UV light bulbs.

The Croton System delivers water from the New Croton Reservoir through the New Croton Aqueduct to the Jerome Park Reservoir in the Bronx. From there, the water is sent to the Croton Water Filtration Plant (WFP), which came online and started to send water into the NYC distribution system 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. Croton WFP has been in operation for the majority of 2016. Over the last several months, the Croton WFP has an average production of over 200 MGD, representing about 20% of the overall NYC water demand. The Croton WFP has provided NYCDEP with a valuable and flexible resource as experienced in the drought conditions in the fall and winter of 2016.

Both Kensico and Hillview Reservoirs serve as balancing reservoirs for the water system, handling the daily and hourly fluctuations of water demand, respectively. Figure 2 shows the NYCDEP conveyance facilities downstream of these reservoirs. Water from Hillview Reservoir is conveyed to the city through three tunnels, City Tunnel No. 1, City Tunnel No. 2, and City Tunnel No. 3, which is partially in operation and partially under construction. Water from the Croton WFP to NYC is pumped into the city tunnels. 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.





Figure 2: New York City Water Conveyance Infrastructure



5.2 Wastewater System

The NYCDEP wastewater system is comprised of fourteen (14) in-city Wastewater Treatment Plants (WWTPs) that discharge into receiving bodies surrounding NYC, as indicated in Figure 3 and is operated by the Bureau of Wastewater Treatment (BWT). There are eight upstate WWTPs and one community septic system that are operated by Bureau of Water Supply (BWS) which are necessary to protect the NYC watersheds. The NYC WWTPs have a capacity of 1.8 BGD and they are currently treating approximately 1.3 BGD of municipal wastewater and consisting of municipal sewage and some stormwater from combined sewers.

The NYC sewer system is divided into 14 drainage areas, which correspond to each of the WWTPs. The NYCDEP in-city WWTPs provide physical, chemical and biological treatment of the wastewater flows to achieve secondary treatment standards in accordance with their State Pollutant Discharge Elimination System (SPDES) permits. As indicated in Figure 3, eight of the WWTPs 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 vereiving waters. Four of the Upper East River WWTPs and two of the Jamaica Bay WWTPs have been upgraded and are currently operating in BNR mode. The Rockaway and Coney Island WWTPs are future. While the main purpose of the WWTPs is to protect the receiving waters surrounding New York City, the industry is rapidly evolving and WWTPs are now being considered as Water Resource Recovery Facilities (WWRF) where treated wastewater effluent can be recycled and beneficially used to meet non-potable water demand, wastewater treatment sludge can be reclaimed as biosolids suitable for use as soil conditioner, and methane gas created during the anaerobic stabilization of sludge can be used as a green energy source.

The sewer system is comprised of approximately 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 WWTPs. 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 WWTPs while excess combined sewer flow discharges to the receiving water as combined sewer overflow (CSO). There are approximately 490 combined sewer regulators and 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 WWTPs for treatment. Additional NYCDEP infrastructure that supports the wastewater system includes 96 wastewater pump stations, 148,000 catch basins, laboratories, eight sludge dewatering facilities (six dewatering facilities currently active) and innerharbor vessels which transport sludge between facilities.



Figure 3: New York City Wastewater Treatment Plants

6.0 MANAGEMENT OF THE SYSTEM

Organizational Structure

Effective July 1, 2016, Vincent Sapienza became the Acting Commissioner for the NYCDEP. NYCDEP is organized into seven functional areas: (1) Utility Operations, (2) Capital Program Delivery, (3) Sustainability and Regulatory Compliance, (4) Financial Management, Administration and Customer Service, (5) Legal Affairs, (6) Police and Security and (7) Executive.

- The Utility Operations consist of the three operating Bureaus: Bureau of Wastewater Treatment (BWT), Bureau of Water Supply (BWS) and (BWSO). The Deputy Commissioner of each operating Bureau reports directly to the Commissioner. The key responsibilities of each operating bureau are:
 - BWT is responsible for the operation and maintenance of the fourteen in-city 0 WWTPs, the City's 96 wastewater pump stations (PSs), interceptors CSO regulators, sludge dewatering facilities, fleet of marine vessels, laboratories, and the control of discharges from combined sewer overflows. Because of the energy-intensive nature of their facilities, the Office of Energy and Performance has been moved under BWT and is responsible for the consolidation of energy issues for all operating bureaus and NYCDEP energy initiatives. BWT has also developed new groups for data networking/ Supervisory Control and Data Acquisition (SCADA) development and for the coordination of the Asset Management program. BWT is developing a biosolids recovery program and has identified the need for a new Biosolids Program Manager to lead the Biosolids Strategic Planning effort. BWT is focused on organizational development planning to identify and evaluate the current and future staffing and skill set needs of BWT operations. Currently, seven Area Facility Managers (two WWTPs per Facility Manager) provide senior leadership in the operation of the fourteen wastewater treatment plants. Working with the Chief Operators of the individual plants, the Area Facility Managers provide overall operational consistency. Each Area Facility Manager has an assigned Maintenance Facilitator who coordinates maintenance operations. Three Performance Analysts, who are experienced process engineers, have been assigned to the wastewater treatment plants.
 - BWS is responsible for managing, operating, maintaining and protecting the City's 0 water supply system to deliver a sufficient quantity of high quality drinking water. Last year all drinking water treatment operations were consolidated under BWS under two directorates - Water Treatment Operations Directorate and Source Water Operations Directorate. The Water Treatment Operations Directorate focuses on the treatment of water once it leaves the reservoirs and moves toward the distribution system. Their responsibilities include the management, operation and maintenance of Kensico Reservoir and its facilities, CAT/DEL UV Disinfection Facility, Hillview Reservoir, and the Croton Water Filtration Plant. 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 provisions of the city's Watershed Protection Program and for complying with the city's Filtration Avoidance Determination (FAD) program. BWS has been undertaking a strategic planning study and plans to release this in the near future.



- BWSO is responsible for the operation and maintenance of the city's drinking water distribution system, wastewater collection system, Bluebelts and Green Infrastructure (Green Jobs). BWSO field operations are responsible for the following: (1) that residences and businesses will have an adequate supply of potable water, (2) that there will be sufficient water for fire protection, and (3) that the wastewater collection system is properly functioning. BWSO coordinates closely with the NYC Department of Design and Construction (DDC), since DDC does the design of the water mains and sewers that BWSO is responsible for once in use. BWSO is heavily focused on stormwater management issues and has an intensive program to alleviate the Southeast Queens flooding issues.
- Capital Improvement Program Delivery is executed by the Bureau of Engineering, Design, and Construction (BEDC). BEDC is responsible for managing the design and construction of capital improvement projects, including major water transmission facilities, water treatment facilities, wastewater treatment and disposal facilities, wastewater pumping stations, and stormwater/CSO facilities. A newly created group within BEDC, known as the Office of Stormwater Planning and Engineering (OSPE) provides strategic planning associated with wet weather flow management. OSPE consists of three groups: Stormwater Engineering, Water Quality Planning, and Program Coordination. OSPE will collaborate with Sustainability, BWSO and BWT and other city agencies to address current and future long-term planning for stormwater infrastructure. A portion of the Green Infrastructure group has moved over to BEDC, within the in-house design group, to perform the design and construction elements of the GI Program. BEDC has developed a Continuous Improvement Program that provides ways to improve business practices that will have positive impact on project implementation, such as project schedules and change orders. The BEDC Sustainability Group uses Envision[™] ', a sustainability certification rating system, to perform triple bottom line evaluations on BEDC projects.
- 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 of 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 OneNYC sustainability initiatives for NYCDEP. 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.
- The Chief Financial Officer oversees the Budget Office, Bureau of Customer Service, the Office of Agency Chief Contracting Officer, Information Technology, Engineering Audit, Fleet Management, and other administrative divisions. The Chief Administrative Officer oversees Labor Relations, Discipline, Organizational Development, Human Resources, and Environmental Health & Safety (EH&S).



- The Legal Affairs Department is responsible for handling NYCDEP's legal matters.
- The Bureau of Police and Security is responsible for protecting the city water supply and the associated critical infrastructure from unauthorized access, acts of sabotage or terrorism, pollution and crime.
- The Executive Level includes the Commissioner, Chief of Staff and Bureau of Public Affairs.

7.0 CAPITAL IMPROVEMENT PROGRAM (CIP)

7.1 Overview

Budgeting is a lengthy and comprehensive process, especially for an agency operating such a large and complex system as is the responsibility of the NYCDEP. NYCDEP budgeting is an ongoing iterative process that takes into account needs including regulatory requirements/legal mandates, mayoral initiatives such as OneNYC, state of good repair (SOGR) projects to maintain existing infrastructure, energy projects, capacity issues, dependability, environmental, health, and safety (EH&S) compliance requirements, localized community drivers, climate change adaptation and resiliency, and other facility improvements. Sometimes these many needs are competing with each other for funding, however, NYCDEP seeks for opportunities for synergies with project implementation such as addressing SOGR needs along with energy projects and flood resiliency projects. 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 competing projects to determine the most important funding requirements across all NYCDEP programs to prioritize NYCDEP's most critical needs first.

The NYCDEP CIP consists of the Ten Year Capital Strategy, along with the Four Year Current Capital Plan, which is updated quarterly. The Ten Year Strategy is updated every two years. The Preliminary Ten Year Capital Strategy for FY 2017 through FY 2027 was released on January 24, 2017 and is the document considered herein. This review includes the budget for FY 2017, which ends on June 30, 2017, and the budget for FY 2018, which begins on July 1, 2017. AECOM has reviewed the Preliminary Ten Year Capital Strategy 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 2017. Our findings are summarized in the following paragraphs.

Regarding FY 2017

The Preliminary Plan FY 2017 budget is set at \$3.196 billion. Approximately 22% of FY 2017 funding supports regulatory mandated projects, consisting primarily of CSO (green and grey infrastructure) projects, the North River cogeneration facility, citywide repairs of intercepting sewers and CSO reduction sewer system improvements. Additional regulatory mandated projects in FY 2017 include current filtration avoidance determination (FAD) requirements, Croton WFP including park projects, the total residual chlorine (TRC) program and some BNR upgrades. Significant funding is also included in FY 2017 for NYCDEP priority projects such as the accelerated water main replacement work, Southeast Queens program, water distribution system and wastewater collection sewer work, the Bluebelt program, wastewater treatment plant SOGR projects, water supply infrastructure SOGR projects, emergency contracts for water and sewer work, and City Tunnel #3 completion, activation and shaft work, and water supply infrastructure SOGR projects.



Regarding FY 2018

The Preliminary Plan FY 2018 budget is set at \$3.007 billion. Approximately 16% of FY 2018 funding supports legally mandated projects, such as CSO projects (grey and green infrastructure), storm sewer build-out and FAD requirements. Significant funding is also included in FY 2018 for NYCDEP priority projects such as the Southeast Queens storm sewer program, wastewater treatment and conveyance SOGR projects, specific sewer and water main work, the Bluebelt program, and water supply infrastructure SOGR projects.

Regarding the Ten Year Capital Strategy for FY 2017 to FY 2027

The Preliminary Ten Year Capital Strategy for FY 2017-2027 consists of \$20.8 billion in funding, approximately \$5.3 billion greater than the previous Ten Year Capital Strategy, which was released February 2015. Approximately 20% of the total funding for FY 2017-2027 is dedicated to regulatory mandated projects. As shown in Figure 4, there have been significantly less mandated projects during the past several years, as compared to FY 2008. For FY 2008 through FY 2010, the overall budget consisted of a high percentage of regulatory mandated project costs due to the construction of the Croton WFP, UV Facility, and the Newtown Creek WWTP Upgrade projects. The majority of the mandated projects in FY 2017-FY 2027 consists of the North River cogeneration facility, green and grey CSO-related infrastructure, storm sewer build-out, current FAD requirements, TRC program and some BNR projects. The majority of the remaining capital improvement program 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 system and significantly more BWSO water main replacement and sewer work. However, as discussed later in this report, the mandated CSO Program and the Hillview Cover may require additional funding in the future and may extend beyond the ten year planning horizon. Although, it is not anticipated that there will be many large mandated projects occurring simultaneously as there were in FY 2008-FY 2010, there is likelihood for the need to fund regulatory mandated projects will continue. It is anticipated there will be continued increased need for SOGR funding due to the age of the NYCDEP infrastructure and the ability to more readily identify needs using the Asset Management tools now in place.

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 maintain and upgrade physical assets so that capital improvements can progress in an orderly manner.

In addition to the asset condition assessment NYCDEP is undertaking a number of other studies/assessment tools that will support the long-term requirements of the WWTP assets. These include Infiltration and Inflow (I&I) assessments (currently being considered for the Rockaway, Coney Island, and Oakwood Beach WWTPs), which will identify improvements necessary to reduce extraneous water flow reaching each facility, energy audits at all WWTPs to identify opportunities to reduce energy consumption and costs, and resiliency improvements to protect facilities from projected sea level rise and increasing storm intensities due to changing weather patterns. These studies will identify needed improvements that will then have to be organized and prioritized. With the completion of these studies/assessments, Facility Plans should be prepared for each WWTP to effectively group and prioritize the needed upgrades for each WWTP as part of a systematic approach to guide capital investment planning.





Figure 4: NYCDEP Historical and Projected Budgets

7.2 System-wide Programs

Climate Change Adaptation and Resiliency

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 its 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 larger, more frequent storm events and projected rising sea levels. In May 2010, the NYC Panel on Climate Change released a report entitled *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. In addition, BEPA completed a two-year pilot study to develop an adaptation and optimization strategy to minimize global climate change risks for NYCDEP infrastructure using one WWTP (Hunts Point) and one drainage area (Flushing Bay).



When Superstorm Sandy significantly impacted the New York City area in October 2012, NYCDEP made a clear decision to continue 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 WWTPs 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.

NYCDEP BEDC has an on-going Resiliency Program and has established contracting mechanisms to implement resiliency projects across 14 WWTPS and 96 PSs. There are four contracts in place to prepare construction bid documents to address resiliency upgrades at the WWTPs and PSs. 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. As facilities are being upgraded the results of the October 2013, study will be reassessed with detailed site analyses during the design. 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 WWTPs 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 Preliminary Ten Year Capital Strategy includes \$170 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 through the use of their Operation Support Tool (OST) models, the watershed protection program and improving flexibility in operations with increased water supply interconnections.

NYCDEP's 2010 Green Infrastructure Plan outlined 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. NYCDEP initiated a three-year working partnership with Copenhagen, Denmark. The knowledge sharing between the NYCDEP and Copenhagen will involve best practices in response to intense rain events and stormwater management. On the national level, NYCDEP maintains utility membership and actively engaged with the Water Utility Climate Alliance (WUCA) and the National Association of Clean Water Agencies (NACWA).

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 entitled *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 resilience measures can be adapted as changes continue to evolve in the future.

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 will provide a framework for the implementation of climate change adaptation and resiliency in a systematic prioritized approach at NYCDEP WWTPs and PSs.

OneNYC: NYCDEP Sustainability Initiatives

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 sustainability plan, PlaNYC. Along with resiliency as discussed above, greenhouse gas reduction and energy planning are being incorporated into NYCDEP's planning and design projects. A Progress Report was issued in April 2016 providing progress on the OneNYC initiatives.

Greenhouse Gas Reduction Requirements. Mayor deBlasio released *One City: Built to Last* in September 2014 with further aggressive reductions of greenhouse gas emissions and carbon management. New York City Office of Sustainability committed to an 80 percent citywide reduction of 2006 base year levels in green-house gas emissions 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. In accordance with Local Law 66 of 2014, the NYC Mayor's Office of Sustainability released a report entitled, Roadmap to 80 x 50 Report in September 2016.

NYCDEP is performing a study to determine how NYCDEP will contribute to the city's overall 80 by 50 GHG reductions. The study 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 study 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.

Energy Planning. With new systems and facilities coming on-line, it is in the best interest of the NYCDEP to assist in the planning of reliable sources of power, both from conventional and renewable sources. NYCDEP is looking at energy conservation measures (ECMs) at each of the WWTPs. NYCDEP is evaluating the incorporation of energy efficiency with SOGR projects though the SOGR-ECM Integration Study for all 14 WWTPs. This study will evaluate existing and identify new ECMs, then prioritize energy projects around the SOGR needs to optimize operating costs and bring significant potential GHG reductions.

NYCDEP is participating in an innovative resource recovery program at the Newtown Creek WWTP, their largest wastewater treatment plant. As part of the Newtown Creek/National Grid public private partnership, NYCDEP will send ADG to a biogas purification facility to be constructed and operated by National Grid, where the ADG will be purified to pipe-line quality gas. The product gas will then be added to National Grid's natural gas supply network. This project will improve local air quality, reduce citywide greenhouse gas emissions, utilize a renewable energy resource, and supplement the citywide natural gas supply. Another public private partnership ongoing at Newtown Creek WWTP is with Waste Management, Inc. Newtown Creek is accepting food wastes from NYC public schools



and the green markets. The food waste, delivered by Waste Management, 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 implemented a more comprehensive three-year demonstration project through 2018 in collaboration with NYSERDA, WERF, Bucknell University and Manhattan College. Phase 1 of the demonstration operated with the addition 20 tpd of food waste, Phase 2 will operate with 100 tpd and Phase 3 will operate at 250 tpd through June 2018. If the demonstration project is successful and full-scale is implemented, the goal would be to send 500 tpd of food waste to Newtown Creek for co-digestion. The food waste co-digestion and the excess 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 WWTPs, where applicable.

Other energy projects that NYCDEP is implementing are cogeneration facilities and solar panels at NYCDEP facilities. Cogeneration at North River WWTP is proceeding. Cogeneration at other WWTPs is being evaluated. Solar panels have been installed at the Port Richmond WWTP in Staten Island. In September 2016, NYCDEP and NYC DCAS solicited a request for information (RFI) for additional solar installations at wastewater treatment plants throughout NYC.

In 2014, NYCDEP received a Federal Energy Regulatory Commissioner (FERC) license for the installation of a 14 megawatt hydroelectric facility consisting of four hydro-electric turbines at Cannonsville Reservoir and Dam in the NYC upstate watershed. In the summer of 2015, while the contractor was on site drilling borings in preparation of the hydroelectric facility design and construction phases, turbid flow was found below the dam. It is thought that the drilling connected into artesian conditions which were known to exist in areas of the dam foundation. The Cannonsville Dam remains well monitored and is deemed safe; however, all drilling for the hydropower facility was halted. NYCDEP's main concerns are dam safety, maintaining operational control over the dams and the ability to meet flow management agreements. NYCDEP is planning to conduct a Feasibility Study to determine the viability of a hydroelectric facility at Cannonsville Dam in the future. In April 2016, FERC granted NYCDEP a two-year extension of the construction milestones that are required under the FERC license. NYCDEP will seek an additional eight year construction milestone postponement through federal legislation. There is \$8 million in design funding for a hydro-electric facility at the Cannonsville Reservoir in the Preliminary Ten Year Capital Strategy.

Asset Management

NYCDEP has initiated a new five-year Asset Management contract, to provide a third party independent review of all assets. NYCDEP Asset Management program includes the majority of the water and wastewater infrastructure. The results of the Asset Management program will be used in the development of the funding needs for the state of good repair for future capital budgets. This effort is based upon a collaborative approach between the operating bureaus so that all stakeholders have input throughout the process. Business case project prioritization is based upon a scoring of the physical condition, performance/process condition, regulatory/environmental, following criteria: 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 has completed several Asset Management Guidance Documents that establish criteria project prioritization. The 2016 OmniBus Consent Order requires NYCDEP to submit annual updates of the NYCDEP Asset Management Program to NYSDEC.

7.3 Capital Program Accomplishments

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

- NYCDEP fulfilled all requirements of the Croton WFP Consent Order, allowing for termination of the long standing Croton Consent Order. The Croton WFP continues operations as determined by NYCDEP needs.
- Activation of the water tunnel under the New York Harbor, connecting Brooklyn to Staten Island to serve as the back-up water supply for Staten Island was completed in 2016.
- Completion of the shafts necessary for the Delaware Aqueduct by-pass tunnel, part of the Water for the Future Program occurred in 2016.
- The four UER WWTPs have been operating in compliance with the combined nitrogen discharge limit by January 1, 2017, as required by the Nitrogen Consent Order.
- 7.4 Capital Improvement Program Highlights for the Water System (Supply, Treatment, and Conveyance Programs)

Kensico Eastview Connection (KEC2) Tunnel

NYCDEP has completed preliminary studies to evaluate options to improve redundancy and increase operational flexibility to allow additional flow to be conveyed from the Kensico Reservoir for treatment at the CAT/DEL UV Facility. NYCDEP assembled an expert panel to evaluate the options. This is an important high priority project for NYCDEP therefore they have decided to move forward with design of a new tunnel, Kensico Eastview Connection (KEC2) Tunnel. Funding of \$1.242 billion is included in the Ten Year Capital Strategy. NYCDEP continues to evaluate project schedule as the sequencing of KEC2 may impact other water system projects.

Water for the Future

The Water for the Future program consists of two main components; fixing the Delaware Aqueduct in two areas where significant leaking has been noted (installing a by-pass tunnel and making repairs) and supplementing NYC water supply during the period when these water transmission elements are out-of-service. Background and details of these components are included below. The Water for the Future program is a comprehensive program that requires thorough coordination throughout the entire NYCDEP. A strong organizational structure is in place within BEDC and across all operating bureaus (with designated liaisons) and executive management, to continue with the planning, design, construction, implementation and risk management of the Water for the Future program due to the magnitude and complexity of the program. There is approximately \$262.2 million in funding in the Preliminary Ten Year Capital Strategy for the Water for the Future program, which consists of \$36.67 million for the by-pass tunnel and repairs and \$225.55 million in water supply augmentation projects (when the Delaware Aqueduct is not in service for by-pass connection). Engineering studies conducted during the progression of the project development have identified program improvements that will result in shorter shutdown periods and less required water supply augmentation which has reduced the overall program cost.



Since the early 1990s, NYCDEP has closely monitored the Rondout-West Branch (RWB) Tunnel portion of the Delaware Aqueduct that has shown evidence of water leakage through cracking of the aqueduct concrete. NYCDEP has performed a series of tunnel leak investigations including geological investigations, tunnel flow monitoring, well monitoring, surface expression monitoring, automated underwater vehicle (AUV) investigations, remote operated vehicle (ROV) investigations and a series of underwater diver inspections at Shaft #6. After evaluating several repair alternatives, NYCDEP developed a comprehensive plan to build a two and a half mile bypass tunnel around the leaking section 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), which are required for the construction of the bypass tunnel. The construction contract (contract BT#2) was initiated in the summer of 2015. The tunnel boring between the two shafts is anticipated to begin in 2017. The connections to the bypass tunnel with the existing aqueduct are planned for October 2022. These connections will require taking the Delaware Aqueduct out of service and dewatering the aqueduct.

The NYCDEP has been evaluating strategies for water supply augmentation to meet the demands of the system when water supply system components are out-of-service, either planned or unplanned. Several projects are funded in the Preliminary Ten Year Capital Plan to provide operational flexibility for NYCDEP to provide a safe, reliable water supply when the Delaware Aqueduct is shut down to connect the bypass tunnel to the existing tunnel and to make the other upstream repairs. NYCDEP is currently planning for one shutdown while the new bypass tunnel is being connected to the existing tunnel. NYCDEP is currently planning to implement demand management measures and optimization of the Upper Catskill Aqueduct to increase its capacity as water supply augmentation projects that will be in place before the tunnel is taken out-of-service. Reactivation of the Queens groundwater system is no longer required as part of the water supply augmentation plan for this project; however, NYCDEP plans to renew the groundwater permits in 2017 for added protection against drought or other emergency.

NYCDEP is implementing a Water Demand Management Plan that identifies five 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 and Water Supply Shortage Management. NYCDEP's near term goal is to reduce demand by 50 MGD through these five strategies. NYCDEP anticipates a 5% overall reduction of water consumption citywide by 2020 due to the planned water demand management program. NYCDEP is currently in the development phase of an Upstate Water Conservation Program, which will help lower water demand for non-New York City communities consuming city water. As part of the Water Demand Management Plan strategies, NYCDEP launched the On-site Water Reuse Grant Pilot Program in November 2016. The purpose of this cost-sharing program is to provide commercial, mixed-use, and multi-family residential property owners with incentives to install water reuse systems.

A project to repair and rehabilitate the Upper Catskill Aqueduct (from Ashokan Reservoir to Kensico Reservoir) is funded at \$155 million in the Preliminary Ten Year Capital Strategy. 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. It is anticipated that 40 MGD of additional capacity in the Catskill Aqueduct will be available when this project is completed.

Additional water transmission projects are underway to increase the reliability and flexibility of 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 gives 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 would provide the ability for Croton water to be supplied to the Delaware Aqueduct, if required in emergencies.

A Notice of Completion for the Draft Environmental Impact Statement (DEIS) was issued on September 19, 2016 for the Water for the Future: Upstate Water Supply Resiliency Project, which includes the rehabilitation of the Catskill Aqueduct, WFF Shutdown System Operations, and Inspection and Repair of the RWBT.

Catskill/Delaware Water Supply System Filtration Avoidance

NYCDEP continues to operate under the 2007 Filtration Avoidance Determination (FAD) for the Catskill/Delaware systems. The 2007 FAD consists of a watershed protection program for 2007-2017, broken down into two five-year periods. The United States Environmental Protection Agency (USEPA) transferred primacy to the New York State Department of Health (NYSDOH) after the 2007 FAD was issued.

NYCDEP submitted the Watershed Protection Program Summary and Assessment to NYSDOH in March 2016. This report provides a required five-year assessment of the water quality and program status. NYCDEP submitted a Long-Term Watershed Protection Plan to NYSDOH on December 16, 2016, which is presents a source water protection plan that forms the basis for the next 10-year FAD. This Plan proposes watershed protection efforts so that the Cat/Del drinking water continues to meet filtration avoidance criteria. NYCDEP proposes the continuation of programs that protect and improve water quality. NYCDEP and NYSDOH have commenced and will continue discussions and negotiations for the next FAD. It is anticipated that a draft FAD could be released for public comment this CL 2017.

The continuation of the existing FAD program is funded in the Preliminary Ten Year Current Plan at a level of approximately \$181.4 million. Funding for some of the FAD programs has moved from the capital budget to the expense budget. Additional capital funding may be required to support the next FAD program beyond the current 2017 FAD, pending the outcome of the ongoing negotiations for the next FAD.

NYCDEP's 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. NYCDEP has held workshops for technical review of the OST modeling and monitoring system by leading water supply experts, water scientists, academics and engineers. As required by the 2007 FAD, NYCDEP has convened an expert panel with the National Academies of Science, Water Science and Technology Board to evaluate the OST model and its applications.

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 required 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 \$474.7 million in funding for the Olive Bridge Dam at the Ashokan Reservoir and the upper/lower outlet. The Dividing Weir Bridge at Ashokan Reservoir is also in need of replacement and is funded with \$265 million in the Ten Year Capital Strategy. 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 are funded at approximately \$64.9 million in the Preliminary Ten Year



Capital Strategy. The New Croton Dam requires reconstruction and is funded in the budget with \$145 million.

NYCDEP has installed additional monitoring 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.

City Tunnel No. 3, Stage 2

Most of the tunneling work for City Tunnel No. 3, Stage 2 has been constructed. There is funding of \$702.7 million in the Preliminary Ten Year Capital Strategy for the completion, activation and shaft work (Shafts 17B and 18B) for City Tunnel No. 3, Stage 2 Brooklyn Queens leg. It is anticipated that the City Tunnel No. 3 Brooklyn/Queens leg will be activation-ready by the end of 2017, which means it will be available as a back-up in case of an emergency. Full operation of City Tunnel No. 3 Brooklyn/Queens leg is soon 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 the Staten Island. NYCDEP plans to conduct inspections of CT#1, CT#2 once CT#3 is fully in service. Funding of \$67.4 million is included in the Preliminary Ten Year Capital Strategy for DDC trunk water main projects for City Tunnel No. 3.

Accelerated Water Main and Sewer Replacement

Significant additional funding has been allocated in the Ten Year Current Capital Plan for the acceleration of water main and sewer replacement. NYCDEP anticipates working with DDC to address areas with recurring problems and replacement of the oldest cast iron assets, when possible. There is \$303.6 million in the Preliminary Ten Year Capital Strategy for the accelerated program funding.

An Underground Infrastructure Working Group was established in 2014 to provide close collaboration of city agencies and private utilities to perform necessary upgrades to aging underground infrastructure and install and construct new underground infrastructure. The Working Group includes the NYCDEP, Department of Transportation (DOT), Department of Design and Construction (DDC), Department of Buildings (DOB), Fire Department (NYFD), the Economic Development Corporation (EDC), and the Mayor's Office of Long-Term Planning and Sustainability. NYCDEP is working diligently with other city agencies and private gas utilities (Con Edison and National Grid) to coordinate underground construction projects, accelerate the pace of replacement of old infrastructure and make improvements to emergency response.

Hillview Reservoir Cover

The Hillview cover is required by federal regulations administered by USEPA, Long Term 2 Enhanced Surface Water Treatment Rule (LT2) and an Administrative Consent Order with NYSDOH and USEPA, which includes a schedule for installation. NYCDEP and USEPA executed a revised Administrative Order in May 2010, which provided an extension of time for construction of the Hillview cover. According to the current Administrative Consent Order, the site preparation construction contract is required to start by January 31, 2017, construction start for the East Basin cover is required by December 31, 2018, and construction completion of the cover by May 31, 2028. This revised Order also allows NYCDEP to submit an additional time deferral request. In October 2010, NYCDEP requested an additional six years, due to planned water system projects that would not permit Hillview cover construction simultaneously, due to the need to complete several water related



projects that would need to be completed prior to construction at Hillview for a cover. In February 2011, NYCDEP received a letter from the United States Department of Justice (USDOJ) indicating that this issue had been referred to them. NYCDEP submitted a proposal to the USEPA in the spring of 2012, In August 2011, USEPA announced that it is reviewing the requirements of LT2 for controlling microbial risks, including covering reservoirs, such as Hillview Reservoir. At that time, USDOJ and the city had agreed to defer negotiations over revised dates until USEPA completes its review.

USEPA notified NYCDEP in December 2016 that the USEPA will not be amending the LT2 Rule or providing a waiver for the Hillview Cover. On January 2017, EPA published in the Federal Register its decision not to revise the reservoir cover requirement under the LT2. NYCDEP plans to negotiate schedules to build the cover for inclusion in the Consent Order Agreement. NYCDEP's most recent cost estimate for a concrete cover is \$1.6 billion. However, NYCDEP plans to further evaluate cover alternatives before committing capital investment funding.

There is no funding for construction of the Hillview cover in the Preliminary Ten Year Capital Strategy. Depending upon the outcome of the discussions with USEPA regarding the additional time extension, funding may be required in later years of the Ten Year Plan or in future budget planning periods.

Croton Water Filtration Plant

NYCDEP sent potable water into the NYC distribution network on May 7, 2015 well before the Croton Consent Order milestone date of May 17, 2015. In November 2015, the Croton WFP operated at full capacity and delivered 290 MGD to high level and low level service areas. NYCDEP submitted the requirements for the Final Completed Works Approval to NYSDOH in 2016. The Croton Consent Order was terminated by the Department of Justice on September 28, 2016, after the NYCDEP successfully completed the requirement to operate the facility for more than a year.`

Approximately \$97.633 million is included in the Preliminary Ten Year Capital Strategy for facilities associated with the Croton WFP, which includes the off-site facilities, the permanent Mosholu Golf Club House, construction change orders and the New Croton Aqueduct. Funding of approximately \$46.9 million is included in the CIP for payments to the Parks Department in connection with the Croton WFP. NYCDEP is reviewing the energy demand for standby power for the Croton WFP to increase dependability in case of a major power outage. The additional facilities for standby power are currently not funded in the Croton budget.

7.5 Capital Improvement Program Highlights for the Wastewater and Stormwater System

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) Plan. 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 continues developing ten waterbody-specific Long Term Control Plans (LTCPs) for NYC tributaries, in addition to one citywide LTCP to reduce 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 Clean Water Act (CWA).

NYCDEP has submitted several LTCPs to NYSDEC. The Alley Creek LTCP was originally submitted to NYSDEC in July 2013, and then a revised Alley Creek LTCP was submitted in November 2013 followed by another revised Alley Creek LTCP in June 2014. NYCDEP also submitted the following



LTCPs: the Westchester Creek LTCP in June 2014, the Hutchinson River LTCP in September 2014, the Flushing Creek LTCP in December 2014, the Bronx River LTCP in June 2015, the Gowanus Canal LTCP in June 2015, Coney Island Creek LTCP in June 2016 and the Flushing Bay LTCP in December 2016. NYCDEP is proceeding with the remaining LTCPs. The Jamaica Tributaries and Bay LTCP and the Newtown Creek LTCP are both due to NYSDEC in June 2017. The due dates for the Harlem River LTCP and the Citywide LTCP are still pending.

The NYSDEC and NYCDEP are currently in negotiations for a revised CSO Order. It is anticipated that the revised CSO Order would address future obligations and commitments of the NYC CSO Program.

The Preliminary Ten Year Capital Plan includes approximately \$1.884 billion in funding for grey infrastructure capital projects for implementation of the CSO Program, which includes \$735 million for the CSO retention tank at the Gowanus Superfund site, required due to the federal EPA Superfund Program. Funding for disinfection facilities at Alley Creek, Hutchinson River and Flushing Creek are included in the Ten Year Capital Strategy. Pending the negotiations for the revised CSO Consent Order, additional funding may be required in the Ten Year Plan and beyond the current budget planning period. NYCDEP has completed a financial affordability assessment for the CSO Long-Term Control Plan.

Green Infrastructure

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. The overall goal of NYC's Green Infrastructure Plan, which NYCDEP released in September 2010, is 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. The Green Infrastructure Plan presents an adaptive approach to incorporating green infrastructure into NYCDEP's overall CSO program. 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. NYCDEP's ongoing Research and Development Program will assist in this effort.

The NYCDEP was unable to meet the first milestone on December 31, 2015, which was capturing the equivalent of stormwater generated by one-inch of precipitation on 1.5% of impervious areas in NYC. However, NYCDEP submitted a Contingency Plan to NYSDEC in June 2016. Although NYCDEP fell short of the 1.5% implementation rate of the first milestone, NYCDEP provided NYSDEC with certification verifying that NYCDEP encumbered \$259 million is capital funds and \$26 million in expense funds for the GI Program and therefore met the financial commitment, as outlined in the Consent Order. As the Order allows NYCDEP to employ adaptive management principles for green infrastructure, the Contingency Plan includes a list of specific green infrastructure projects along with a schedule to make-up the shortfall and to reach the 1.5% green infrastructure implementation rate. NYCDEP has also developed a database, known as Green Hub for green infrastructure tracking. The Green Infrastructure Grant Program will continue for the private sector in 2017 for green infrastructure projects such as right of way bioswales, blue roofs, green roofs and porous pavement on private property and in sidewalks in combined sewered areas.

The Preliminary Ten Year Capital Strategy includes approximately \$1.082 billion in funding for green infrastructure projects.



Southeast Queens Stormwater Infrastructure

NYCDEP is performing a comprehensive program to improve drainage to address flooding issues in Southeast Queens. In the Preliminary Ten Year Capital Strategy, \$1.567 billion is funded for FY 2017–FY 2027 for the Southeast Queens storm sewer program. 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. NYCDEP maintains close coordination with other city agencies.

Cogeneration Facility at North River WWTP

A project for a Cogeneration Facility at North River WWTP was developed as a sustainability project to meet the needs of GHG emission reductions and achieving 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 WWTP Cogeneration Facility is funded in FY 2017 of the Preliminary Ten Year Capital Strategy at a level of \$201.5 million. This project consists of replacing the main sewage pump engines with electric motors, and the existing engine-driven aeration blowers with new aeration blower with electric motors. The new cogeneration facilities will provide new gas driven engines and generators which will provide electrically to drive the main sewage pumps and the nine high speed turbo aeration blowers and heat for digester and building heating. When completed, the cogeneration system will provide all the electrical and heat energy necessary to operate the North River WWTP.

Hunts Point WWTP Digesters

NYCDEP is planning a major sludge stabilization facility upgrade at the Hunts Point WWTP that will allow processed wastewater biosolids to be fully stabilized and recycled for beneficial reuse. Replacement and upgrade of the digesters at Hunts Point WWTP is funded in the Preliminary Ten Year Capital Strategy at \$220 million in FY 2020. While the planned project to upgrade the sludge thickening is an integral part of the overall sludge stabilization facilities, this project is not included in the current budget. Additional funding will be required in the future to upgrade the thickeners to provide sufficient solids retention time to result in a sludge stabilization product meeting the criteria for Class "B" Biosolids so that the full program goals are attained.

Citywide Nitrogen Removal Program

The Upper East River (UER) WWTPs (Hunts Point, Bowery Bay, Tallman Island, and Wards Island WWTPs) and two of the Jamaica Bay WWTPs (26th Ward and Jamaica WWTPs) 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, NYSDEC and Natural Resources Defense Council (NRDC) entered into a Jamaica Bay Agreement, which includes nitrogen removal upgrades at Rockaway WWTP and Coney Island WWTP, construction milestones for the Jamaica Bay WWTPs interim nitrogen effluent limits for Jamaica Bay and the funding of an environmental benefits project for the saltwater marsh restoration in Jamaica Bay. Funding is currently included in the Preliminary Ten Year Capital Strategy for the nitrogen removal upgrades at Coney Island and Rockaway at a combined level of \$52.6 million. NYCDEP is evaluating alternatives for future use and operations at the Rockaway WWTP facility. Pending the outcome of these evaluations additional funding may be required for BNR upgrades at Rockaway WWTP.

Glycerol has been selected as the supplemental carbon source for additional nitrogen removal. The supplemental carbon addition for Phase II BNR at the UER WWTPs (Hunts Point, Bowery Bay and Wards Island WWTPs) and the Jamaica Bay WWTPs (Jamaica and 26th Ward WWTPs) is operational. It is anticipated that the Tallman Island WWTP supplemental carbon addition facilities



will be operational in March 2017. The Consent Judgement required reducing the combined nitrogen discharges in the WWTP effluent for the UER WWTPs by 58.5 percent by January 2017. The UER WWTPs achieved the required level of nitrogen removals in advance of the milestone. By September 2016, nitrogen discharges from the UER WWTPs have been reduced by approximately 61 percent.

Total Residual Chlorine (TRC)

Prior to discharge to a receiving body, wastewater effluent is disinfected with chlorine at the WWTPs. Excessive residual chlorine can be toxic to aquatic life in the receiving water body. A TRC Consent Order between NYSDEC and NYCDEP became effective October 2015, which includes interim TRC limits, proposed final TRC limits and a compliance schedule for the TRC upgrade projects required at each of the WWTPs. It has already been determined that six WWTPs are unable to achieve the proposed final TRC limits through system optimization. These six plants are North River (NR), Coney Island (CI), Newtown Creek (NC), Owls Head (OH), 26th Ward (26th W) and Oakwood Beach (OB). NYCDEP is proceeding with the design and construction of dechlorination facilities at five of these WWTPs (North River, Coney Island, Newtown Creek, Owls Head and Oakwood Beach). NYCDEP will submit a TRC Facility Plan for 26th Ward WWTP.

For the remaining eight WWTPS, NYCDEP will undergo a performance demonstration period with system optimization, consistent with USEPA and NYSDEC guidance. Upon completion of the performance testing period, NYCDEP will either demonstrate compliance with the proposed TRC final effluents or submit a TRC Facility Plan to determine other required upgrades. The Consent Order also requires an ambient water quality monitoring program.

NYCDEP and NYSDEC have been in discussions with potential modifications to the TRC Consent Order. There is \$195.5 million in the Ten Year Capital Strategy for the TRC program for dechlorination facilities at the required WWTPs and continued water quality monitoring program at the other WWTPs.

Rockaway WWTP

Due to several factors including low wastewater flows at the Rockaway WWTP along with the Hurricane Sandy impacts to the plant, NYCDEP has been evaluating alternatives for future operation of the Rockaway WWTP. NYCDEP completed a Facility Plan for Rockaway WWTP in 2014, which analyzed alternatives for future Rockaway WWTP operations. The evaluation considered maintaining wastewater treatment operations at the existing Rockaway WWTP or sending wastewater to 26th Ward WWTP for treatment. Significant SOGR upgrades, BNR upgrades and resiliency measures are required at Rockaway WWTP to maintain continuous operation. Two consolidation plans were evaluated to transfer the wastewater flows to 26th Ward WWTP 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 continues to evaluate alternatives to determine the best solution for future Rockaway wastewater flow. There is currently approximately \$52 million in SOGR funding for Rockaway WWTP in the Preliminary Ten Year Capital Strategy. However, after a decision has been determined for future operations, significant additional funding may be required for serving the Rockaway drainage basin.

Bluebelts

NYCDEP has been developing Bluebelt sites in Staten Island since the 1990s. Bluebelts are an innovative stormwater drainage system made up of wetlands, streams and ponds. NYCDEP plans to expand the program to park property sites in Queens and the Bronx. Approximately \$527.3 million is



included in the Preliminary Ten Year Capital Strategy for land acquisition and construction to expand the Bluebelts for stormwater management.

7.6 Superfund Designations

In March 2010, the Gowanus Canal was declared a Superfund site and USEPA has notified NYC that they are considered a potential responsible party (PRP) for hazardous waste under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) for the Superfund sites. 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 December 2013, NYCDEP completed and reactivated the Gowanus Canal Flushing Tunnel to directly improve water quality and circulation within the 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. NYCDEP and USEPA negotiated an Administrative Order in June 2016 regarding the parallel design for the Red Hook Outfall RH-034 CSO facility at two different locations. 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 \$735.3 million is included in the Preliminary Ten Year Capital Strategy for the Gowanus Canal CSO retention tanks. Additional funding may be required in later years.

In September 2010, Newtown Creek was declared a Superfund site. NYCDEP has entered into an Administrative Settlement Agreement and Order on Consent with EPA, along with five other potential responsible parties 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. The RI/FS is expected to take several 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.

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.

There are future potential financial impacts to NYC for the Superfund sites; however, the extent to which NYC will be responsible has not yet been fully determined.

7.7 Potential Water and Wastewater Projects Beyond Ten Year Capital Strategy

Kensico-City Tunnel (KCT)

Due to other priority needs of the water conveyance system, KCT is not in the NYCDEP current financial planning period and therefore, there is no funding included in the CIP. The original proposed KCT tunnel would extend from the Kensico Reservoir to the interconnecting valve chamber of City Tunnel No. 3, Stage I, south of Hillview Reservoir. It is anticipated that NYCDEP will evaluate the needs of KCT in relation to the current Kensico Eastview Connection tunnel project. Cost estimates will depend upon specific routing, shaft locations and connections.

Potential Further Nitrogen Removal in NYC WWTPs

The New York/New Jersey Harbor Estuary Program (HEP) is a National Estuary Program that has been sanctioned by the USEPA to restore the waters of the Lower Harbor Estuary and the tidally influenced portions of all rivers and streams that empty into the Estuary. The HEP was convened as



a partnership of federal, state, and local governments; scientists; civic and environmental advocates; the fishing community; business and labor leaders; and educators (called the Management Conference). NYCDEP submitted a report to USEPA in 2007 that evaluated the capital investment cost of upgrading four WWTPs (Owls Head WWTP, Red Hook WWTP, North River WWTP, and Port Richmond WWTP) to provide nitrogen and carbon removal at four different levels of treatment. The water quality impacts on the Harbor Estuary are now being evaluated by USEPA for the various levels of treatment. Through this methodology, it is expected that USEPA and the Management Conference will determine which treatment upgrades, if any, will be required for NYC. Funding is not in the current budget for HEP-related upgrades. Upon completion of the HEP studies and based upon negotiations with USEPA, funding may be required in a later planning period.

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 WWTPs by requiring further nitrogen removals. NYCDEP will continue to remain involved and will provide input throughout this Nitrogen Reduction Strategy.

8.0 EXPENSE BUDGET

The FY 2017 expense budget in January Plan is \$1.584 billion. The proposed FY 2018 expense budget in the January Plan is \$1.218 billion. The FY 2018 expense budget is expected to be updated in the Executive Budget and released in April 2017. The expense budget is made up on Personal Services (PS) and Other than Personal Services (OTPS). 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 others 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 and capital investments but the studies, themselves, are not capital eligible. Planning studies/Facility Plans are important aspects of longterm management of the system and should be carried out before any significant capital funds are committed to a specific facility.

9.0 PERFORMANCE OVERVIEW

Water Conservation

Figure 5 presents the annual water demand for more than the last 20 years. Water conservation measures taken by NYCDEP in the 1990s have resulted in a steady reduction in the overall water demand. More recent declines in water consumption have been noted most likely due to continued conservation measures, water usage metering, economic downturn and weather patterns.





Figure 5: New York City Average Daily Water Demand in Million Gallons per Day (MGD)

System Staffing Levels

Approved positions for the System presently stand at 6,224 for FY 2017 and vacancies currently stand at 495. This reflects a slight increase in budgeted headcount and a decrease in vacancies compared to FY 2016, as shown in Figure 6. Successful improvements for the recruitment and personnel procurement process have occurred with the creation of Organizational Development position within NYCDEP's management. NYCDEP has seen improvements in attracting highly skilled and qualified staff. NYCDEP Organizational Development is also developing and implementing succession planning and staff retention programs. Recruitment, training and succession planning are essential to maintain a skilled DEP workforce. NYCDEP maintains a strong diverse workforce.

Although the overall NYCDEP staffing plan has remained relatively constant, there have been increases and decreases in specific bureaus. Some changes in staffing over the past few years are attributed to reorganization, such as the group responsible for Croton Water Filtration Plant and Hillview Reservoirs moving from BWSO to BWS, as well as "Green" jobs moving over from Parks Department to BWSO. However, there has been a decrease in the number of BWT staff over the past several years. As NYCDEP's bureaus, particularly BWT and BWSO, evolve their operations and staffing to accommodate changes in regulations, new equipment and processes, and sustainable infrastructure, the NYCDEP will be conducting organizational analyses to evaluate the skill sets needed for continued future operation.





Fiscal Year



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.

There were 395 water main breaks reported in FY 2016, which translates to 5.6 breaks per 100 miles of main. The number of water mains breaks in FY 2016 has decreased compared with the last few years (see Figure 7). NYCDEP BWSO operations continue a preventative 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 range of water main breaks that NYC has recently experienced remains below that of other municipalities in the United States. NYCDEP continued to restore water to residents within an average of 4.2 hours after confirming the water main break, which reflects a decrease in time required to restore water.





Figure 7: Total NYCDEP Water Main Breaks per Fiscal Year

Approximately 0.51% of total fire hydrants were broken and inoperative in FY 2016, similar to last year. The average time to repair or replace high priority broken or inoperative hydrants (as determined by the Fire Department) by NYCDEP was 2.9 days in FY 2016, which is slightly longer than last year but far less that the target time for repair or replacement of 7 days. Approximately 31.3% of catch basins were surveyed and inspected in FY 2016. The total number of catch basins that were cleaned by NYCDEP in FY 2016 is 30,534. In accordance with Local Law, starting in FY 2017 (July 1, 2016), BWSO commenced catch basins cleaning annually instead of once every three years.

NYCDEP received 10,469 sewer backup (SBU) complaints in FY 2016, which is made up of 2,503 confirmed SBUs (on NYCDEP infrastructure) and 7,960 unconfirmed SBUs (not on NYCDEP infrastructure or not found). As shown in Figure 8, there has been a decrease in both confirmed and unconfirmed SBUs in the past few years. Response time for SBUs was 3.7 hours on average, which is lower than the past several years and well below the target of 7 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.





Figure 8: Sewer Backup (SBU) Complaints

NYCDEP uses a data-driven risk management approach to operate and maintain the sewer system, targeting specific locations with reoccurring problems. A group within BWSO addresses the Capacity, Management, Operations, and Maintenance (CMOM) program and related issues with specific Standard Operating Procedures (SOPs) in place. The Sewer Operations and Analysis Program (SOAP) at NYCDEP allows for a more proactive rather than reactive approach. This group analyzes areas with reoccurring 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 televising of sewers, sewer cleaning, catch basin reconstruction and cleaning, hydrant repair, installation of new water mains.

On August 31, 2016, USEPA issued the NYCDEP a Unilateral Administrative Compliance Order regarding sewer backups. NYCDEP is required to submit a Sewer Management Plan Report to the NYSDEC in May 2017.

Operational and Maintenance Program Significant Accomplishments

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 capacity, 290 MGD. The operations at the Croton WFP have varied depending upon the operational needs of the overall water supply and distribution system. The Croton WFP was operating at about 100 mgd in 2016 but needed to ramp up water production due to drought conditions. In October 2016, Croton WFP increased operations to 140 mgd and then again in December 2016 the plant increased to 235 mgd. The Croton WFP operated most of CL 2016, which was extremely helpful to have Croton water available during the dry conditions in 2016. Depending upon the needs of the overall system, NYCDEP will continue to vary the operations at the Croton WFP.

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 all Cat/Del waters and it is designed to disinfect 2.4 billion gallons per day. In



December 2014, NYCDEP received an agreement from NYSDOH to lower the UV dosage. The Consent Order for the Cat/Del UV Facility was terminated July 2016.

Drinking Water Quality. NYCDEP recently released the New York City 2016 Drinking Water Supply and Quality Report. NYCDEP conducts significant monitoring of the source water and in-city water quality. In CY 2016, NYCDEP collected 36,300 samples from the in-city distribution system and performed approximately 407,500 analyses, meeting all state and federal monitoring requirements. In addition, NYCDEP collected 15,200 samples and performed 231,700 analyses from the upstate watersheds, and completed approximately 1.5 million robotic monitoring measurements 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.

BNR Operations. NYCDEP has been operating in Step Feed BNR mode at several of the WWTPs, Hunts Point, Bowery Bay, Tallman Island, Wards Island WWTPs, 26th Ward and Jamaica WWTPs. Due to the long-term planning and significant capital projects that have been implemented, NYCDEP's operations have been achieving the interim total nitrogen (TN) removals established for the Upper East River and Jamaica Bay waterbodies. Due to the required upgrades at the plants, the UER WWTPs have seen an approximate 61% reduction in total nitrogen in the effluent.

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 harborwide. 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 over 20 at present.

The water quality in the harbor has continued to improve as a result of the maintenance and operation of the wastewater treatment plants and the combined sewer overflow programs. Figures 9 and 10 below demonstrate the improvements in water quality over the past 42 years as indicated by the increased dissolved oxygen concentrations and reduced Fecal Coliform counts. The trend graphs for the 2016 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 2016, 90% of the harbor survey stations met the fishable standard of 5 mg/L for dissolved oxygen. The percentage of wastewater treatment plant effluent that met federal standards in FY 2016 was 99.5%.

Sludge Vessels. In 2014, NYCDEP commissioned three new sludge vessels, the Motor Vessel (M/V) Hunt's 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 wastewater treatment plants not served by onsite dewatering facilities to those wastewater treatment plants with dewatering facilities.

Biosolids. NYCDEP is planning to develop a Biosolids Strategic Plan to identify alternative applications for NYCDEP biosolids.





Figure 9: Dissolved Oxygen for Harbor Survey Key Stations (1968-2016)





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.

Permit Updates

NYSDEC issued final State Pollutant Discharge Elimination System (SPDES) permits for the 14 NYC WWTPs on October 15, 2015. NYCDEP is operating in accordance with the current SPDES permits for 14 WWTPs. Based upon diligent wastewater treatment plant operations, as stated previously 99.5% of the NYCDEP wastewater treatment plant effluent met federal standards in FY 2016. For the first four months of FY 2017, 99.9% of the NYCDEP wastewater plant effluent met federal standards.

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 WWTPs, 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. 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 is due 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 MS4 states annual reporting requirements. NYCDEP submitted the first MS4 Annual Progress Report in 2016. Among other requirements, NYC must also submit a fiscal analysis of the capital, operating and maintenance costs necessary to meet the requirements of the permit within three years, due August 1, 2018.

Operations and Maintenance Program Summary

NYCDEP continues evaluating current and future staffing needs and skill sets to meet both operational needs and implementation of the capital program. Additional staff will be required as the growing demands of NYCDEP operations continue. Succession planning, recruitment practices, staff retention and training will continue to be a key priority for NYCDEP management. The operating bureaus continue to evaluate and find effective means to operate more efficiently without impacting the overall operation and maintenance (O&M) of the System. NYCDEP will continue to evaluate ways to implement energy efficiency and energy management into operations.

10.0 OTHER NOTEWORTHY ISSUES AND COMMENTS

Drought Management

The NYCDEP Drought Management and Contingency Plan include three levels of drought severity: Drought Watch, Drought Warning and Drought Emergency. A Drought Emergency is further



subdivided into four stages based upon the severity of the drought and requires that more stringent and restrictive measures be taken. Guidelines that identify when these drought conditions should be dictated are based upon many factors, including hydrologic and meteorological conditions, operational considerations, current storage capacity and projected demands. The Delaware River Basin Commission (DRBC) declared a Drought Watch on November 23, 2016, since the combined storage in the total of NYCDEP's Delaware reservoirs (Neversink, Pepacton and Cannonsville) fell below 40% storage. This DRBC Drought Watch limited the amount of water withdrawals that NYCDEP was allowed to take from the Delaware reservoirs. The basin-wide drought watch of the Delaware River was lifted January 18, 2017. NYC has not invoked a NYC water supply system drought watch however NYCDEP continues to monitor conditions very closely. NYC would declare a water supply system drought watch when either one of the two largest water systems (Delaware or Catskill) has less than a 50% chance of refilling by the start of the next water year, which starts on June 1. Based upon recent precipitation, NYCDEP projects with 85% probability that both water systems should refill by June 1, 2017. NYCDEP continues to operate the Croton WFP which has provided NYCDEP with significant flexibility during these dry conditions. As of February 21, 2017, the overall storage in NYC's water supply system stands at 80.2%, compared to the normal levels at this time of 87.8%.

Lead and Copper Rule

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 federal Lead and Copper Rule, mandated at-the-tap lead monitoring is conducted at select households throughout New York City. In 2016, 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 addition to the mandated at-the-tap monitoring, NYC residents can request a free lead kit to test their water. NYCDEP's Water Quality Lead Unit recently made improvements to the free lead testing program by revising the sampling and mailing instructions to better explain the procedures.

The USEPA is considering Long-Term Revisions to the Lead and Copper Rule to improve public health protection by making practical changes and to streamline the rule requirements. NYCDEP has been engaged with the National Drinking Water Advisory Council (NDWAC) Lead and Copper Rule Working Group.

Awards

NYCDEP capital program and operations have been recognized throughout the industry by professional organizations. NYCDEP was awarded the inaugural Utility of the Future (UOTF) Today Recognition Program in 2016 from a collaborative group of water industry organizations including the National Association of Clean Water Agencies (NACWA), the Water Environment Federation (WEF), the Water Environment & Reuse Foundation (WE&RF) and the WateReuse Association, along with input from the USEPA. This award recognized 61 utilities, both public and private, across the United States, Canada and Denmark that demonstrated exceptional progress and performance in the treatment of wastewater. They were selected based on how closely they adopted UOTF practices such as water reuse, watershed stewardship, community partnering/engagement, and nutrient recovery.

The American Council of Engineering Companies (ACEC) New York awarded the NYCDEP Gilboa Dam reconstruction project the Diamond Award in Engineering Excellence in the water resources



category in 2016. NYCDEP's expansion of the Staten Island Bluebelt program has received the Envision Silver Award from the Institute for Sustainable Infrastructure (ISI). The selection process reviews project performance across several sustainability criteria, including community, quality of life, management, planning, materials, energy, water, environmental impacts, emissions, and resilience.

The National Association of Clean Water Agencies (NACWA) recognized eight NYCDEP WWTPs with its Peak Performance awards for performance throughout 2015. The Hunts Point, Oakwood Beach and Red Hook plants each received gold awards for perfect compliance records. The Jamaica, Wards Island, Rockaway, Bowery Bay and Newtown Creek WWTs were each recipients of silver awards.

11.0 SUMMARY AND CONCLUSIONS

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, our highest rating.

Regarding the Capital Improvement Program (CIP)

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

- *Hillview Cover:* Depending upon the outcome of discussions regarding a revised implementation schedule for the Hillview cover, significant funding will need to be added to the budget.
- SOGR: As indicated throughout the report, significant additional funding in future budgets will be required for the continuation of SOGR projects. Specifically, additional funds are required for the Hunts Point sludge thickening project.
- Climate Change Resiliency, Energy Efficiency, and Sustainability Projects: NYCDEP is seeking other funding mechanisms for climate change resiliency and energy efficiency projects. There might 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 may be identified in the next budgeting cycle.
- Combined Sewer Overflow (CSO) Program: NYCDEP has submitted several Long Term Control Plans (LTCPs) and will continue to submit LTCPs in the next year. NYCDEP and NYSDEC are currently negotiating modifications for a revised CSO Program. Depending upon the outcome of the studies and the ongoing discussions, additional funding may be required for the CSO Program.
- *Municipal Separate Storm Sewer System (MS4):* Capital costs have not yet been identified. NYC is required to submit a fiscal analysis of the capital, operating and maintenance costs necessary to meet the requirements by August 2018.

Regarding the Physical Condition of the System

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 water and wastewater system, and



prioritize the most important projects and programs. As indicated, an Asset Management program is being utilized by NYCDEP that better identifies the needs and costs for infrastructure upgrades. These needs will have to continue to be addressed and implemented as they are identified. 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. NYCDEP has started to move from the planning stage to implementation phase of climate change adaptation based upon sound cost-effective analysis and this process will need to continue. Prioritization of greatest need is a significant factor in moving forward with implementation of climate change resiliency. Because of the vast and extensive nature of the NYCDEP facilities, continued diligence and future capital improvements will continue to be required.