New York City Department of Environmental Protection

Long-Term Watershed Protection Plan

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Table of Contents

List of Figures

List of Tables

List of Acronyms

AUV	autonomous underwater vehicle
AWSMP	Ashokan Watershed Stream Management Program
BMP	best management practice
BODR	Basis of Design Report
CAT/DEL	Catskill/Delaware
CATUEC	Catskill Upper Effluent Chamber
CDIC	Catskill/Delaware Interconnection Chamber
CDUV	Catskill/Delaware Ultraviolet Disinfection Facility
CE	conservation easement
CP	Forest Management Plan Conservation Practices
CREP	Conservation Reserve Enhancement Program
CRISP	Catskill Regional Invasive Species Partnership
CSBI	Catskill Streams Buffer Initiative
CUNY	City University of New York
CUNRF	City University of New York Research Foundation
CWC	Catskill Watershed Corporation
CWMP	Community Wastewater Management Program
DEM	Digital Elevation Model
DEP	New York City Department of Environmental Protection
DMAP	Deer Management Assistance Permit
DOHMH	New York City Department of Health and Mental Hygiene
EAB	emerald ash borer
EFC	New York State Environmental Facilities Corporation
EIS	environmental impact statement
ELAP	Environmental Laboratory Approval Program
EOC	Emergency Operations Centers
EOH	East of Hudson
EOHWC	East of Hudson Watershed Corporation
EWP	Emergency Watershed Protection
FAD	Filtration Avoidance Determination
FBO	Flood Buyout
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FMP	New York City Forest Management Plan
GCSWCD	Greene County Soil and Water Conservation District
GI	gastrointestinal illness
GIS	Geographic Information System
GPS	Global Positioning System
GWLF	Generalized Watershed Loading Functions
HEFS	Hydrologic Ensemble Forecast Service
HMGP	Hazard Mitigation Grant Program

IRSP	individual residential stormwater plan
ISAC	Invasive Species Advisory Committee
ISC	New York State Invasive Species Council
ISWG	Invasive Species Working Group
JV	Joint Venture
LAP	Land Acquisition Program
LFA	Local Flood Analysis
LiDAR	Light Detection and Ranging
LIMS	Laboratory Information Management System
LT2ESWTR	Long-term 2 Enhanced Surface Water Treatment Rule
MAP	Management Assistance Program
MFO	Master Forest Owner
MGD	million gallons per day
MMI	Milone & MacBroom, Inc.
MOA	New York City Memorandum of Agreement
NHD	National Hydrography Dataset
NMP	nutrient management plan
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
NWI	National Wetlands Inventory
NYC	New York City
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OECD	Organization for Economic Cooperation and Development
OST	Operations Support Tool
PRISM	Partnership for Regional Invasive Species Management
RBAP	Riparian Buffer Acquisition Program
ROV	remote operated vehicle
RWBT	Rondout-West Branch Tunnel
SEQRA	State Environmental Quality Review Act
SMIP	Stream Management Implementation Program
SMP	Stream Management Program
SPDES	State Pollutant Discharge Elimination System
SSMP	Septic System Management Program
SSTS	subsurface sewage treatment system
SUNY	State University of New York
SWCD	Soil and Water Conservation District
SWE	snow water equivalent
SWPPP	stormwater pollution prevention plan
SWTR	Surface Water Treatment Rule
THM	trihalomethane
TP	total phosphorus
TSI	Trophic State Index

TTHM	Total trihalomethane
UCSWCD	Ulster County Soil and Water Conservation District
UFI	Upstate Freshwater Institute
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
WAC	Watershed Agricultural Council
WaLIS	Watershed Lands Information System
WAP	Watershed Agricultural Program
WCDEF	Westchester County Department of Environmental Facilities
WDRAP	Waterborne Disease Risk Assessment Program
WFP	whole farm plan
WOH	West of Hudson
WRF	Water Research Foundation
WR&R	New York City Watershed Rules and Regulations
WSP	Water Supply Permit
WSPS	Water and Sewer Permitting System
WWQMP	Watershed Water Quality Monitoring Plan
WWTP	wastewater treatment plant

Acknowledgements

The New York City Department of Environmental Protection is charged with providing an ample supply of clean water to more than 9 million people every day. DEP meets this mandate through the efforts of hundreds of dedicated professionals. This plan provides DEP's vision for the next phase of its comprehensive program to protect water quality and public health. Although the staff members who help make all this possible are too numerous to mention here, their efforts are recognized and appreciated. We acknowledge the Bureau of Water Supply, under the direction of Deputy Commissioner Paul V. Rush, P.E., and its Directorates of Source Water Operations, Treatment Operations, Water Quality, Watershed Protection Programs and Planning. The vital support of Management Services and Budget, and Compliance staff, along with the Bureaus of Police and Security, Legal Affairs, Information Technology, Engineering Design and Construction, and the NYC Law Department is also acknowledged.

1. Introduction

This report presents New York City's Long-Term Watershed Protection Program (the Program), submitted to the New York State Department of Health (NYSDOH) in support of a new filtration waiver for the Catskill/Delaware systems. The Program for the next Filtration Avoidance Determination (FAD) covers a ten year period. Through periodic assessments, the New York City Department of Environmental Protection (DEP) has demonstrated the ongoing effectiveness of the overall program in preserving the high quality of the Catskill/Delaware waters. The City's most recent assessment, issued in March 2016, confirms that water quality status and trends continue to point to a safe, reliable supply of drinking water for half the population of New York State.

This document should be viewed in context of the City's long-running source water protection program. Since its first filtration waiver was issued by New York State nearly 25 years ago, DEP has produced a multitude of reports detailing program progress and documenting the continued high quality of the Catskill/Delaware supply. For specifics about the implementation of watershed protection programs, refer to the Annual Reports prepared pursuant to the FAD. DEP also produces dozens of semi-annual and annual reports on FAD programs, publishes reports on special studies, and prepares an annual water quality statement which gives detailed information about water quality (www.nyc.gov/html/dep/html/watershed_protection).

Figure 1.1 Map of the New York City water supply system.

1.1 Water Supply System Overview

The New York City (NYC or City) water supply system consists of three surface water sources (the Croton, the Catskill, and the Delaware) and a system of wells in Queens (the Queens Groundwater System) (see Figure 1.1). The three upstate water collection systems include 19 reservoirs and three controlled lakes with a total storage capacity of approximately 580 billion gallons. They were designed and built with various interconnections to increase flexibility to meet quality and quantity goals and to mitigate the impact of localized droughts and water quality impairments. The system supplies drinking water to almost half the population of the State of New York – over eight million people in NYC and one million people in Westchester, Putnam, Orange, and Ulster Counties – plus the millions of commuters and tourists who visit the City throughout the year. Overall consumption in 2015 averaged approximately 1.1 billion gallons a day, which includes both in-City and upstate demand. In-City, overall demand has decreased dramatically since 1990 as a direct result of significant investments by DEP in demand management. Figure 1.2 shows water demand in New York City since 1960, documenting a 30% decrease in the past 25 years, despite rising population.

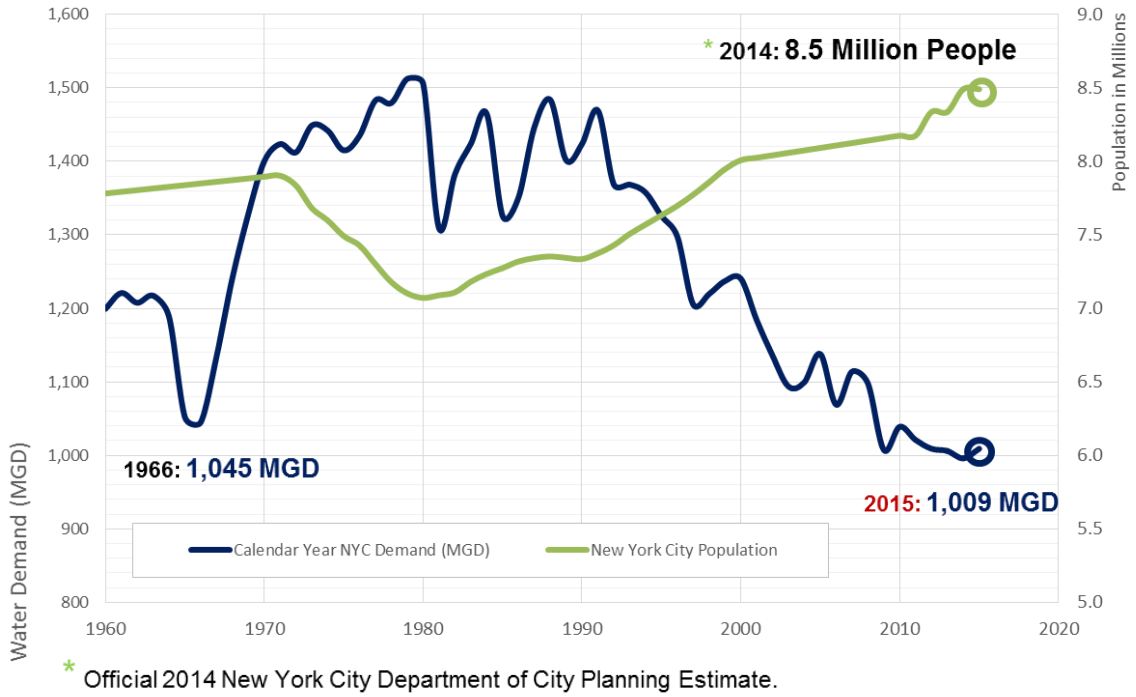

Figure 1.2 New York City water consumption.

The Croton watershed is located entirely east of the Hudson River in Westchester, Putnam and Dutchess Counties, with a small portion in the State of Connecticut. The oldest of the three systems, the Croton system, has been in service for more than 170 years. The watershed covers approximately 375 square miles. Croton's 12 reservoirs and three controlled lakes are connected primarily via streams and rivers, and ultimately drain to the New Croton Reservoir in Westchester County. Historically, approximately 10% of the City's average daily water demand has been supplied by the Croton, although in times of drought the Croton system may supply significantly more water.

In 2015, DEP completed construction and began operation of a water treatment plant to filter the Croton Supply. While the Croton system usually met all current health-based regulatory standards for an unfiltered surface water supply, it has experienced periodic violations of the aesthetic standards for color, taste and odor. In addition, DEP did not believe that the Croton system would be able to meet stricter disinfection by-product rules recently promulgated. Now that the Croton Water Filtration Plant is in service, with a capacity of 290 million gallons per day (MGD), DEP can once again reliably deliver Croton water to NYC consumers.

The Catskill system consists of two reservoirs located west of the Hudson River – Ashokan Reservoir in Ulster County and Schoharie Reservoir in Schoharie, Delaware and Greene counties. The Catskill system was constructed in the early part of the 20th century, and Ashokan Reservoir went into service in 1915. Since Schoharie Reservoir was completed in 1926, water travels through the 18-mile Shandaken Tunnel, which empties into the Esopus Creek at Allaben and then travels 12 miles to the Ashokan Reservoir. Water leaves Ashokan via the 75-mile long section of the Catskill Aqueduct, to reach Kensico Reservoir in Westchester County. The Catskill system supplies, on average, 40% of the City's daily water supply.

The Delaware system was completed in the 1950s and 1960s, and is comprised of four reservoirs: Cannonsville, Pepacton and Neversink reservoirs which are built on tributaries to the Delaware River, and Rondout Reservoir which is formed by damming Rondout Creek, a tributary to the Hudson River. Water travels through tunnels from each of the Delaware basin reservoirs into Rondout Reservoir; water then leaves Rondout and travels to West Branch Reservoir in Putnam County via the Rondout-West Branch Tunnel portion of the Delaware Aqueduct. Water from West Branch then flows through another section of the Delaware Aqueduct to the Kensico Reservoir. The Delaware system provides the remainder of the City's supply. Because waters from the Catskill and Delaware watershed are commingled at Kensico Reservoir, they are frequently referred to as one system: the CAT/DEL system.

In the late 1980s, the City decided to apply for filtration avoidance for the Catskill/Delaware system under the terms of the Surface Water Treatment Rule (SWTR; see "Regulatory Context," below). Since that time, DEP and its partner agencies and organizations have developed and deployed a comprehensive watershed monitoring and protection program designed to maintain and enhance the high quality of CAT/DEL water. This program has been

recognized internationally as a model for watershed protection and has allowed the City to secure a series of waivers from the filtration requirements of the SWTR.

1.2 Regulatory Context

The Safe Drinking Water Act (SDWA) amendments of 1986 required the United States Environmental Protection Agency (USEPA) to develop criteria under which filtration would be required for public surface water supplies. In 1989, USEPA promulgated the SWTR, which requires all public water supply systems supplied by unfiltered surface water sources to either provide filtration or meet certain criteria. The filtration avoidance criteria are comprised of the following:

- Objective Water Quality Criteria – the water supply must meet certain levels for specified constituents including coliforms, turbidity and disinfection by-products.
- Operational Criteria – a system must demonstrate compliance with certain disinfection requirements for inactivation of *Giardia* and viruses; maintain a minimum chlorine residual entering and throughout the distribution system; provide uninterrupted disinfection with redundancy; and undergo an annual on-site inspection by the primacy agency to review the condition of disinfection equipment.
- Watershed Control Criteria – a system must establish and maintain an effective watershed control program to minimize the potential for contamination of source waters by *Giardia* and viruses.

The City first applied for a waiver for the CAT/DEL system from the filtration requirements of the SWTR in 1991. This first application was filed with NYSDOH, because at the time the City and NYSDOH believed that NYSDOH had primacy to administer the SWTR for all water supply systems in New York State (NYS). NYSDOH granted a one-year filtration waiver. Subsequently, it was determined that USEPA had retained primacy for the SWTR. In mid-1992, DEP submitted a thirteen-volume application to USEPA, describing in detail the City's plans for protecting the CAT/DEL supply. On January 19, 1993, USEPA issued a conditional determination granting filtration avoidance until December 31, 1993. The waiver incorporated many elements of the program the City had described in mid-1992, and was conditioned upon the City meeting 66 deadlines for implementing studies to identify potential pollution sources, developing programs to ensure long-term protection of the watershed, and addressing existing sources of contamination in the watershed. USEPA also imposed substantial reporting requirements on the City, to monitor the City's progress.

DEP submitted a second application for continued avoidance to USEPA in September 1993. This application was based upon the knowledge gained by the City through initiation of its watershed studies and programs and laid out a long-term strategy for protecting water quality in the Catskill/ Delaware system. Again, USEPA determined that the City's program met the SWTR criteria for filtration avoidance, although it did express concerns about the program's

ability to meet the criteria in the future. On December 30, 1993, USEPA issued a second conditional determination, containing 150 requirements related primarily to enhanced watershed protection and monitoring programs. USEPA also required that the City proceed with design of a filtration facility for the CAT/DEL supply, so that no time would be lost should USEPA decide that filtration was necessary in the future.

Two critical pieces of the watershed protection program that DEP described in September 1993, and that USEPA incorporated into the December 1993 Determination, were implementation of a land acquisition program and promulgation of revised watershed regulations. Primarily due to the objections of watershed communities over the potential impact that those programs might have on the character and economic viability of their communities, DEP was unable to move forward with implementation of those key program elements. It was against this backdrop that Governor Pataki convened a group of stakeholders to try to come to an accord. The negotiations involved the City, the State, USEPA, representatives of the counties, towns and residents of the watershed, and representatives from environmental groups. This unique coalition came together with the dual goals of protecting water quality for generations to come and preserving the economic viability of watershed communities. In November 1995, the parties reached an Agreement in Principle that set forth the framework of an agreement that would allow the City to advance its watershed protection program while protecting the economic viability of watershed communities. It took another 14 months to finalize the details of an agreement and, in January 1997, the parties signed the Watershed Memorandum of Agreement (MOA). The MOA supplemented the City's existing watershed protection program with approximately $350 million in additional funding for economic and environmental partnership programs with upstate communities, including a water quality investment program and a regional economic development fund. The MOA established the institutional framework and relationships needed to implement the range of protection programs identified as necessary by the City, the State, and USEPA. The State issued a water supply permit to allow the City to purchase land in the watershed, and approved a revision to the City’s Watershed Regulations governing certain aspects of new development in the watershed. The City also secured a 5-year waiver from the filtration requirements for the CAT/DEL system.

In March 2006, the City submitted to USEPA a rigorous, science-based assessment of Catskill/Delaware water quality, followed in December 2006 by an enhanced, comprehensive long-term plan for watershed protection efforts. That long-term plan represented a significant enhancement to the City's watershed protection efforts and relied in part on the continued support and cooperation of the City's partners. The plan formed the basis of an updated FAD, issued by USEPA in July 2007. Significantly, the 2007 FAD was the first FAD to cover a full 10-year period, signaling the growing confidence of all parties that source water protection has become a sustainable alternative to filtration for the City’s CAT/DEL supply.

Following issuance of the 2007 FAD, USEPA granted NYSDOH primary regulatory responsibility for the SWTR as it applies to the CAT/DEL supply. In March 2011, DEP issued

another detailed assessment of program activity and water quality, which formed the basis of a revised long-term plan submitted to NYSDOH in December 2011. In late summer 2011, two significant storms swept through the region, devastating communities and significantly impacting water quality in portions of the NYC supply. In the wake of the storms, a large group of watershed stakeholders came together to discuss developing and enhancing certain programs to promote flood resiliency and minimize water supply impacts from future events. Following these discussions, NYSDOH issued a Revised 2007 FAD in May 2014. The Revised 2007 FAD demonstrated DEP's ability to continue to implement proven programs, as well as the ability to adapt strategies as needed to anticipate and respond to changing conditions. DEP's source water protection program continues to be an international model for sustainable water supply management and public health protection.

Also after the 2007 FAD was issued, the State issued a new 15-year Water Supply Permit to allow the City to continue to purchase lands for source water protection. At the time, the MOA parties reaffirmed their commitment to the partnership and executed a supplemental agreement updating certain commitments.

1.3 New York City's Source Water Protection Program for the Catskill/Delaware Systems

DEP is responsible for operating, maintaining and protecting the City's water supply and distribution system. This document, *New York City's 2016 Long Term Watershed Protection Plan,* has been prepared to comply with NYSDOH's Revised 2007 FAD for the Catskill/Delaware Water Supply Systems.

To demonstrate its eligibility for a filtration waiver, DEP advanced a program to assess and address water quality threats in the Catskill/Delaware system. DEP's strategy is based on a simple premise: it is better to keep the water clean at its source than it is to treat it after it has been polluted. To meet the goal of public health protection, DEP has designed and deployed a mix of remedial programs (intended to clean up existing sources of pollution) and protective programs (to prevent new sources of pollution). These efforts provided the basis for a series of waivers from the filtration requirements of the SWTR (January 1993, December 1993, January 1997, May 1997, November 2002, July 2007 and May 2014).

1.3.1 Assessing the Potential Threats to the Water Supply

Since the inception of the program in the early 1990s, the City has made great progress in assessing potential sources of water contamination and designing and implementing programs to address those sources. Each year, DEP collects and analyzes tens of thousands of samples from more than 450 sites throughout the watershed – at aqueducts, reservoirs, streams and wastewater treatment plants (WWTPs). The purpose of this intensive monitoring effort is to help operate and manage the system to provide the best possible water at all times, to develop a record to identify water quality trends, and to focus watershed management efforts. This robust monitoring program provides the scientific underpinnings for the source water protection program.

Based on the information collected through the monitoring program, DEP developed a comprehensive strategy for the protection of source water quality, designed to address existing sources of pollution and prevent new sources. Each element of the watershed protection effort is conducted at a specific spatial and temporal scale to ensure the maintenance of the already high quality of the Catskill/Delaware waters. This effort yields benefits for water consumers as well as the tens of thousands of people who live, work and recreate in the watershed, and the millions in communities downstream of the reservoirs.

1.3.2 Highlights of the Watershed Protection Program

Effective implementation of this multi-faceted program depends on support from and cooperation with the City's watershed partners. DEP regularly works with many agencies, organizations and communities throughout the region to advance initiatives. These partnerships are vital to the continued success of the source water protection program and recognize the need to strike a balance between protecting water quality and preserving the communities in the watershed. The contributions of many of these groups are acknowledged throughout this report.

Significant progress continues on implementation of several key watershed protection initiatives: the Watershed Agricultural Program; the acquisition of sensitive watershed lands; the enforcement of Watershed Regulations; the Stream Management Program (SMP); and the continuation of environmental and economic partnership programs that target specific sources of pollution in the watershed. In addition, DEP continued its enhanced watershed protection efforts in the Kensico Reservoir basin and completed the upgrades of non-City owned watershed WWTPs. Figure 1.3 and Figure 1.4 map the myriad projects completed by DEP and its partners in the Catskill/Delaware and Croton watersheds since 1997. Key watershed protection program highlights include:

Watershed Agricultural Program

Since 1992, the Watershed Agricultural Program (WAP) has promoted a non-regulatory, voluntary, incentive-based and farmer-led approach to controlling agricultural sources of pollution while supporting the economic viability of the watershed's farmed landscape. Working through the Watershed Agricultural Council (WAC), the City funds development of farm pollution prevention plans and implementation of structural and non-structural best management practices (BMPs). To date, 192 large farm operations in the Catskill/Delaware watersheds have signed up for the WAP, of which 184 farms (96%) have a Whole Farm Plan. A total of 350 active farms currently have Whole Farm Plans, including smaller scale farming operations and farms located East of Hudson. The WAP has implemented approximately 7,168 BMPs on all participating farms at a cumulative cost of $58 million, not including planning, design and administrative expenses. The Conservation Reserve Enhancement Program (CREP), which pays farmers to take sensitive riparian buffer lands out of active farm use and re-establish a vegetative buffer, has enrolled more than 1,820 acres of riparian buffers and an estimated 9,000 head of livestock have been excluded from streams.

Land Acquisition

The Land Acquisition Program (LAP) seeks to protect sensitive lands from development through willing seller/willing buyer transactions. Watershed-wide, DEP has secured 115,573 acres in fee simple or conservation easement (CE), with another 26,242 acres of farm easements secured by the WAC. Overall, the City and State now protect 38% of lands in the Catskill/Delaware system. While the overall level of protection is impressive, even higher levels of protection have been achieved in the key basins – Ashokan, Rondout, West Branch and Kensico – which range from 41% to 66% protected.

Watershed Regulations

Since 1997, DEP has reviewed more than 16,800 applications for projects that proposed one or more regulated activities, as well as performed routine compliance inspections at regulated wastewater facilities and active construction sites, and responded to violations of permit standards to enforce corrective actions. DEP works with applicants to ensure new development in the watershed is undertaken in a manner that is fully protective of critical water supply resources; overall more than 98% of DEP's regulatory determinations are project approvals.

Wastewater Programs

DEP has implemented an array of programs intended to improve the treatment of wastewater across the watershed. The City, in conjunction with its partners, has continued to implement programs that have remediated more than 5,000 failing septic systems. All WWTPs – including City- and non-City-owned – have been upgraded to tertiary treatment, and DEP funds a significant portion of ongoing operation and maintenance. New WWTPs, or other community wastewater solutions, have been implemented in 16 communities, resulting in more than 2,432 septic systems being decommissioned.

Stream Management Program

The Stream Management Program (SMP) promotes the protection and/or restoration of stream system stability and ecological integrity by providing for the long-term stewardship of streams and floodplains. Over the past five years, a significant focus of the SMP was responding to the devastating storms of 2011, and working closely with federal, State and local partners to implement restoration projects. DEP augmented SMP funding to support new science-based efforts for local flood hazard mitigation, to protect water quality and improve community resiliency.

Ultraviolet (UV) Disinfection Facility

In 2012, DEP began operation of a UV disinfection facility to treat all water from the Catskill/Delaware supply. The facility, the largest of its kind in the world, provides an additional barrier for public health protection and complements DEP's efforts to keep the water clean at the source.

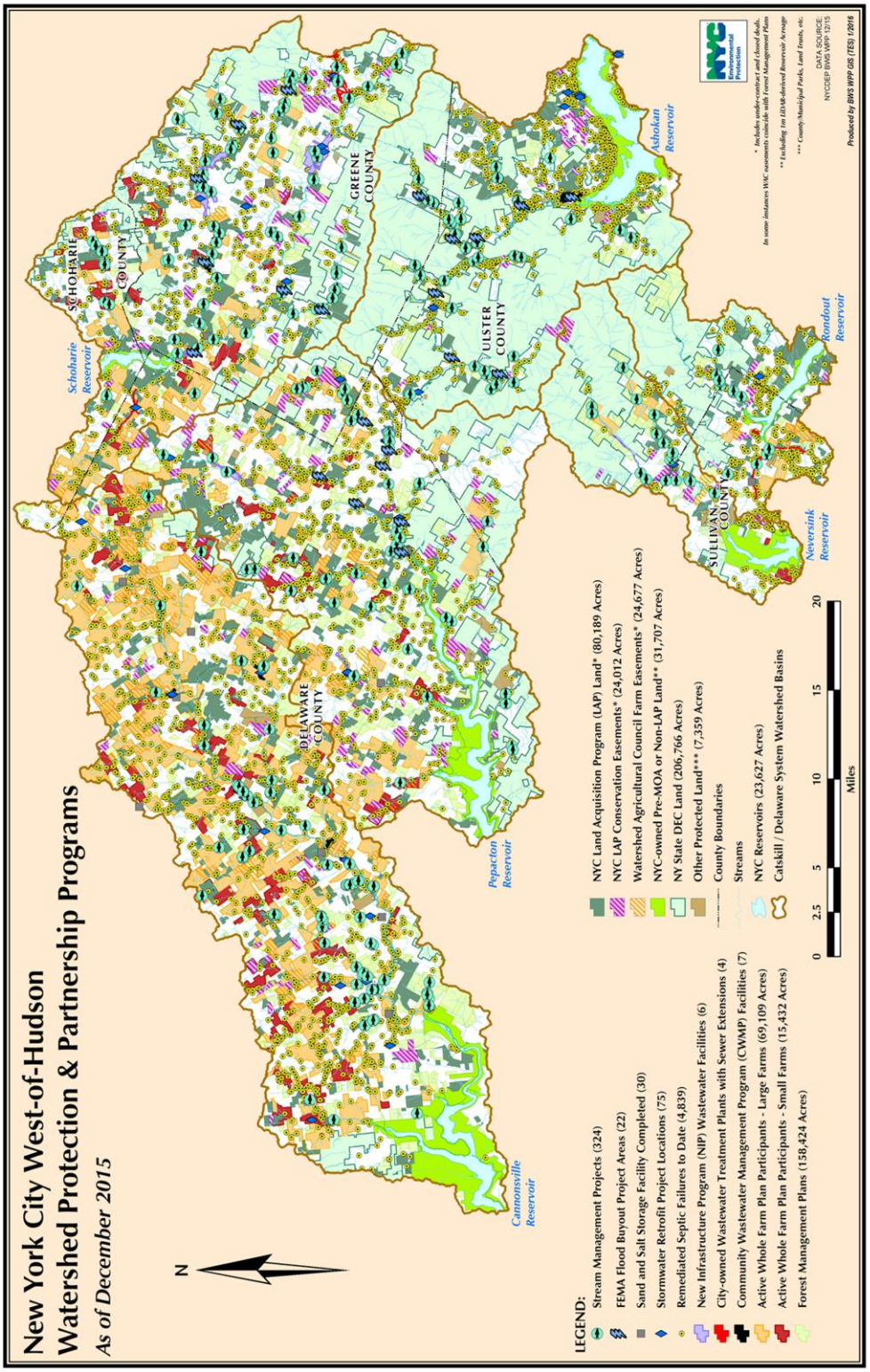

Figure 1.3 Map showing status of the partnership programs West of Hudson.

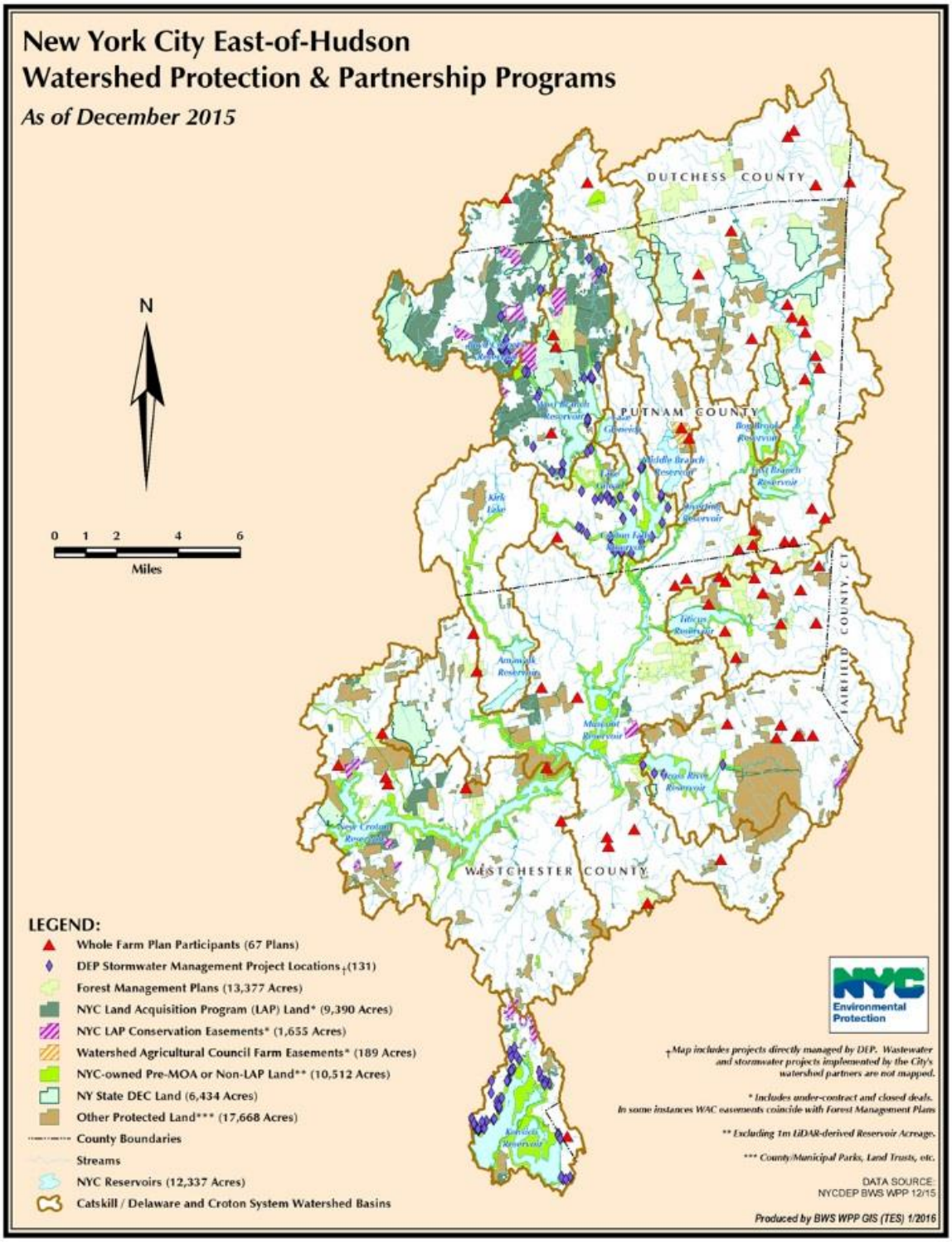

Figure 1.4 Map showing status of the partnership programs East of Hudson.

Waterborne Disease Risk Assessment Program

The Waterborne Disease Risk Assessment Program (WDRAP) continues to track in-City disease rates, with a goal of identifying whether there are any outbreaks that can be linked to the water supply. The Program evaluates multiple data streams daily and over longer periods, and has continued to refine surveillance activities. There was no evidence of an outbreak of waterborne disease in NYC during this period, including following three severe storms (Irene, Lee, and Sandy).

1.3.3 Water Quality Conditions

Every five years, DEP undertakes a comprehensive review of water quality conditions throughout the Catskill/Delaware system. That review, most recently completed and published in March 2016, incorporates a massive amount of water quality data, collected at different spatial and temporal scales, to provide a complete picture of water quality status and trends. DEP then compares those water quality results with information on implementation of source water protection programs, to evaluate program effectiveness and guide decision making on future program implementation. The March 2016 assessment, available on DEP's web site, confirms the continued excellent quality of water from the Catskill/Delaware system and points to certain localized improvements that are a result of program implementation. A summary of those water quality findings is provided below.

Water Quality Monitoring Overview

DEP conducts extensive water quality monitoring throughout the watershed. The 2016 Watershed Water Quality Monitoring Plan (WWQMP) describes this monitoring plan. The plan and its associated addenda are designed to meet the broad range of DEP's many regulatory and informational requirements. The overall goal of the plan is to establish an objective-based water quality monitoring network, which provides scientifically defensible information regarding the understanding, protection, and management of the New York City water supply. The objectives of this monitoring plan have been defined by the requirements of those who ultimately require the information, including DEP program administrators, regulators, and other external agencies. As such, monitoring requirements were derived from legally binding mandates, stakeholder agreements, operations, and watershed management information needs. The plan covers four major areas that require ongoing attention: Compliance, FAD Program Evaluation, Surveillance Monitoring, and Modeling Support, with many specific objectives within these major areas.

As New York City's water supply is one of the few large water supplies in the country that qualifies for Filtration Avoidance, based on both objective water quality criteria and subjective watershed protection requirements, USEPA has specified many requirements in the 2007 FAD and the Revised 2007 FAD that must be met to protect public health. These objectives form the basis for the City's ongoing assessment of watershed conditions, changes in water quality, and ultimately any modifications to the strategies, management, and policies of the long-term watershed protection program. The City also conducts a periodic assessment of the

effectiveness of the watershed protection program. DEP's water quality monitoring data, including data relating to stream benthic macroinvertebrates, are essential to perform this evaluation. Program effects on water quality are reported in the Watershed Protection Summary and Assessment reports which are produced approximately every five years.

Samples collected under the auspices of the WWQMP are brought to DEP laboratories for analysis. The laboratories are certified by NYSDOH's Environmental Laboratory Approval Program (ELAP) for over 100 environmental analyses in the non-potable and potable water categories. These analyses include physical analytes (e.g., pH, turbidity, color, conductivity), chemical parameters (e.g., nitrates, phosphates, chloride, chlorine residual, alkalinity), microbiological parameters (e.g., total and fecal coliform bacteria, algae), trace metals (e.g., lead, copper, arsenic, mercury, nickel), and organic parameters (e.g., organic carbon).

In addition to the water quality monitoring discussed above, DEP has developed a continuous water quality monitoring program and continues to update a Robotic Water Quality Monitoring Network (RoboMon) in the watershed. Continuous monitoring data are obtained at key aqueduct and intake locations, key upstate reservoirs, and selected watershed tributaries to provide critical data for immediate use in decision making by water supply managers, as well as for water quality model development and model forecasting.

In summary, the monitoring plan has been designed to meet the broad range of DEP's regulatory obligations and informational needs. These requirements include: compliance with all federal, state, and local regulations to ensure safety of the water supply for public health; watershed protection and improvement to meet the terms of the 2007 FAD and the Revised 2007 FAD; the need for current and future predictions of watershed conditions and reservoir water quality to ensure that operational decisions and policies are fully supported over the long term; and that ongoing surveillance of the water supply will continue to ensure delivery of the best water quality to consumers.

Water Quality Data Analysis

The accumulation of a long-term database has allowed DEP to identify and address existing water quality conditions, identify long-term trends, guide operations, and determine effectiveness of watershed programs. The 2016 Watershed Protection Program Summary and Assessment provides the most recent evaluation of water quality conditions and uses all data available since the beginning of DEP's first FAD in 1993. This allows DEP to examine trends over more than two decades. It provides a view of water quality changes in the context of variation caused by natural events such as floods and droughts, which are not sufficiently represented in a five- year time period. Long-term data are needed to show the effects of the watershed protection programs because there are time lags between program implementation (causes) and water quality changes (effects). The water quality data from the early 1990s represents conditions at the outset of Filtration Avoidance when many watershed protection programs were in their infancy. Sufficient time has now passed since programs have been in

place that the major effects of programs on water quality have become apparent. Since many programs were implemented in the decade between 2000 and 2010, the current conditions are a phase when the effects of the watershed programs are reflected in water quality, as surface water reaches its new 'steady state' with watershed conditions.

There are several important factors that govern water quality over the long term. Perhaps the two most important are climate, as a determinant of precipitation and therefore water residence times, and land use, as a determinant of substance loadings. Given the general environmental conditions in each basin, DEP has examined the effectiveness of watershed protection programs to maintain a clean water supply through a series of analyses. These include the status and trends of water quality in streams and reservoirs as indicated by various analytes or indices, the trophic response of reservoirs, and pathogen assessment. This has allowed DEP to demonstrate central tendencies and trends in the water quality data over an extended time period during and after watershed protection program implementation.

In addition to water quality samples, macroinvertebrate indices were calculated to provide insight into the ecological conditions of streams and changes in water quality. Macroinvertebrates biologically integrate conditions over time so they are seen as important indicators of stream water quality. The impact of the waterfowl management program and its ability to control and reduce fecal coliform bacteria have been demonstrated over the past 25 years and selected case studies are presented to demonstrate the effectiveness of this program. Finally, an analysis of pathogen transport through the system provides much insight into the benefit of NYC's sequential system of reservoirs and the natural processes that improve water quality as it travels towards distribution. With these approaches, DEP has examined the relationships between watershed protection and water quality changes.

Water Quality Conditions for the Catskill and Delaware Systems

Overall, the water quality in the Catskill and Delaware reservoirs remains excellent which is a reflection of the ongoing investment in watershed protection. Total phosphorus reductions from a combination of wastewater treatment plant upgrades, septic system improvements, and extensive implementation of BMPs have been significant. For example, Cannonsville Reservoir geometric mean total phosphorus was 26.8 µg L-1 in 1991 and was 14.9 µg L-1 in 2015. While the Catskill System encounters intermittent increases in turbidity and phosphorus associated with storm events, the system recovers rapidly.

Water Quality Conditions for the East of Hudson Catskill/Delaware Basin System

Water quality in West Branch and Kensico basins continues to be excellent. Decreasing trends in turbidity, fecal coliforms, and total phosphorus in the inputs to West Branch were attributed to improvements made through watershed protection programs. The Cross River and Croton Falls basins are classified as "potential" Delaware system basins because water from these basins only enters the Delaware Aqueduct when intentionally pumped into it, and this is a rare occurrence. Water quality in the Cross River and Croton Falls basins has been generally

good. The median Trophic State Index (TSI) was in the eutrophic range for both reservoirs and the basins remain listed as phosphorus-restricted. Trends in turbidity were downward for the output from Cross River basin and attributed primarily to recovery from drawdown related to dam repairs. Additional details on the water quality assessment and long-term trends can be found in the 2016 Watershed Protection Summary and Assessment Report.

Trophic Response of Reservoirs

The trophic response of reservoirs to the combined effects of watershed protection programs and major environmental events was examined through four relationships selected from the Programme on Eutrophication sponsored by the Organization for Economic Cooperation and Development. These analyses highlight the biological responses to major environmental drivers such as hurricanes and floods as well as overall shifts in nutrients, algal biomass, and transparency over the course of time and have supported the policy of reducing total phosphorus as a means of eutrophication control.

There have been vast improvements in the Cannonsville Reservoir over the past 25 years for mean and maximum chlorophyll, phosphorus, and Secchi depth. More subtle changes have taken place in the other reservoirs and the trends statistics are appropriate for characterization of those changes. In contrast, the variations in the Catskill System Reservoirs are highly dependent on extreme hydrological events and turbidity that can persist in the reservoirs for several months. Kensico appears to have slowly decreasing phosphorus levels, while West Branch seems to drift up, which may be due to operations. In the East of Hudson (EOH) reservoirs equipped with pump stations that can supplement the Delaware Aqueduct, Cross River and the main basin of Croton Falls generally have similar water quality; however, the upstream sites of Croton Falls tend to be more eutrophic.

Water Quality Modeling Program

In addition to statistical analysis, DEP conducts extensive modeling analyses. Models are used by DEP to manage water quality over both long- and short-term periods. Model analysis using the long-term database allows DEP to separate the effects of important natural factors that influence water quality from the effects of watershed protection programs. Further, it allows DEP to estimate the relative effects of different watershed protection programs and may be used to guide priorities. DEP employs models for short-term events (on the order of months) to optimize reservoir operations and to determine when treatment may be necessary. Model application is thus used at DEP for diagnostic analysis and water supply decision support.

DEP continues to aggressively build its modeling capabilities. In the near future, calibration and validation of the spatially distributed models will give us greater insight into the effects of specific watershed protection measures so that DEP can continue to refine project implementation for maximum effectiveness.

1.4 DEP's Long-Term Program

Over the past 25 years of source water protection, the City has developed and implemented a multi-faceted, comprehensive long-term program that forms the basis for its continued filtration waiver. DEP's plan for the next ten years is outlined in the following sections of this document. The proposed program represents DEP's continued commitment to long-term watershed protection. The City expects that, so long as the Catskill/Delaware system remains unfiltered, these core programs will remain in place in some fashion.

DEP continues to review and refine programs, based on accomplishments to date and watershed and water quality conditions. As described above, virtually every program element has achieved a very high level of implementation, and direct water quality benefits have been observed. In many cases, programs have transitioned from intensive implementation to a maintenance phase. In other cases, program focus has shifted geographically or greater emphasis has been placed on certain types of activities. These program modifications are to be expected – in fact, are necessary – as DEP's efforts have matured. In the coming decade the City will continue to evaluate and adjust programs as needed to ensure the continued effectiveness and cost-effectiveness.

This plan represents the first-ever 10-year source water protection plan developed by DEP. It includes a full suite of programmatic commitments through 2027. By preparing this plan, DEP is demonstrating the City's long-term commitment to support activities that sustain and protect public health. The scope of the plan also provides stakeholders – watershed communities, contracting partners, water supply consumers, environmental parties and regulators – certainty about the levels of implementation across a range of programs for the coming decade.

As part of this plan, DEP will contract with the National Research Council (NRC) to conduct an expert panel review of the source water protection program. In 2000, an NRC panel reviewed the City's proposed watershed management plan and provided a strong endorsement of the approach to public health protection. A new panel will be convened to evaluate DEP's implementation of that plan and to offer suggestions on the next phase of source water protection. DEP expects that the findings of the review will be used to make adjustments to the proposed level and mix of programs set forth in this plan.

Independent of and reinforcing DEP's commitments under the FAD, the 2010 Water Supply Permit requires DEP to fund and implement many of these same programs. Consistent with the language of the Surface Water Treatment Rule, the FAD requires DEP to implement its watershed control program without regard to cost and does not characterize requirements in terms of monetary commitments. Similarly, while the partnership between the City and the watershed communities, among other entities, is an important element of DEP's ability to implement the watershed control program effectively, and therefore important to filtration avoidance, the FAD itself focuses on program implementation rather than specifically on partnership commitments. DEP will comply with its commitments under the Water Supply

Permit, but notes that these requirements are not themselves enforceable requirements of the FAD.

Support from and cooperation with watershed partners is essential to the successful implementation of the City's program. It is important to emphasize that no protection program for the City's water supply, no matter how carefully crafted, can succeed without support and involvement of the City's partners and watershed stakeholders. Perhaps the greatest achievement of the past quarter century has been the development of vital, locally-based organizations working with the DEP on the common goal of watershed protection. Initially the City was reluctant to cede responsibility for program implementation to others, but the development of successful partnerships with organizations like the Catskill Watershed Corporation (CWC), the Watershed Agricultural Council, and county Soil and Water Conservation Districts, led the City to recognize that long-term watershed protection can and will be advanced through such partnerships. Continued cooperation with DEP's implementation partners is an integral part of the City's long-term vision for protecting the water supply. To promote collaboration, over time DEP intends to co-locate a new office with CWC. CWC is already advancing plans for a new facility in Arkville. By sharing work space – centrally located in the heart of the watershed – DEP and CWC can further improve coordination and responsiveness to watershed communities.

In 2015, representatives of watershed communities contacted DEP to voice concerns about some aspects of the source water protection efforts. That outreach resulted in an ongoing series of discussions among a broad group of watershed stakeholders about specific watershed program elements. Consensus has emerged on a number of issues and to the extent possible those agreements are reflected in this document. On other topics, the stakeholders have recognized the need for further, targeted discussion; DEP expects that these discussions will result in more effective and efficient implementation of several programs. DEP is committed to the ongoing discussions and greatly appreciates the cooperative spirit of the dialogue.

2. Long-Term Watershed Protection Program

2.1 Filtration Avoidance Criteria Requirements

The Surface Water Treatment Rule (SWTR) and the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) established requirements for unfiltered surface water supply systems, some specifically identified as filtration avoidance criteria, which require that all surface water supplies provide filtration unless certain source water quality, disinfection, and site-specific avoidance criteria are met. In addition, the supplier must comply with: (1) the Revised Total Coliform Rule (RTCR), and (2) the Stage 1 Disinfectant and Disinfection Byproducts Rule. The 2007 FAD required ongoing monitoring and periodic reporting related to SDWA compliance activities. In addition, there are some reporting requirements relating to SDWA compliance, that while not specifically required under the SWTR, and therefore not included as a FAD reporting requirement below, will be reported elsewhere for SDWA compliance purposes. This includes: 1) reporting to NYSDOH and USEPA on the monthly operational status of the UV plant as required by LT2 and New York State Sanitary Code requirements, and reporting the Stage 2 Disinfectant and Disinfection Byproducts Rule monitoring results; and 2) notifying NYSDOH and USEPA by the end of the day when a sample from a RTCR distribution system compliance site tests positive for *E. coli*.

DEP will continue the above monitoring requirements as specified in the SWTR, and in accordance with the milestones contained therein, and in accordance with any additions/clarifications below.

Table 2.1 Filtration Avoidance Criteria Requirements

Requirement	***Due Date***
Continue to meet SWTR filtration avoidance criteria (40 CFR §141.71 and §141.171, and 10 NYCRR §5-1.30) and submit reports and certification of compliance on: • §141.71(a)(1) and §5-1.30(c)(1) - raw water fecal coliform concentrations • §141.71(a)(2) and §5-1.30(c)(2) - raw water turbidity sampling • §141.71(b)(1)(i)/§141.72(a)(1) and §5-1.30(c)(3) - raw water disinfection CT values • §141.71(b)(1)(ii)/§141.72(a)(2) and §5-1.30(c)(4) - operational status of Kensico and Hillview disinfection facilities, including generators and alarm systems • §141.71(b)(1)(iii)/§141.72(a)(3) and §5-1.30(c)(5) - entry point chlorine residual levels	Monthly

Requirement	*Due Date*
• §141.71(b)(1)(iv)/§141.72(a)(4) and §5-1.30(c)(6) - distribution system disinfection levels (the City will include a discussion of any remedial measures taken if chlorine residual levels are not maintained throughout system) • §141.71(b)(5) and §5-1.30(c)(10) - distribution system coliform monitoring, including a summary of the number of samples taken, how many tested positive for total coliform, whether the required number of repeat samples were taken at the required locations, and which, if any, total coliform positive samples were also *E. coli* positive. For each *E. coli* positive sample, include the investigation of potential causes, problems identified and what has or will be done to remediate problems. Include copies of any public notices issued as well as dates and frequency of issuance.	
All requirements described in §141.71(b)(4) and §5-1.30(c)(8) must continue to be met. Notify NYSDOH/USEPA within twenty-four hours of any suspected waterborne disease outbreak.	Event Based
All requirements described in §141.71(b)(6) and §5-1.30(c)(9) must continue to be met. Submit report on disinfection byproduct monitoring results.	Quarterly
Notify NYSDOH/USEPA within twenty-four hours, if at any time the chlorine residual falls below 0.2 mg/l in the water entering the distribution system.	Event Based
Notify NYSDOH/USEPA by the close of the next business day, whether or not the chlorine residual was restored within 4 hours.	Event Based
Report on the operational status of Kensico Reservoir, West Branch Reservoir (on-line or by-pass), Hillview Reservoir, and whether any of these reservoirs experienced unusual water quality conditions.	Monthly
Regarding the emergency/dependability use of Croton Falls and Cross River source water: (A) The City shall not introduce Croton Falls or Cross River source water into the Catskill/Delaware water supply system without the prior written approval of NYSDOH. (B) As a condition of approval, the City must demonstrate continuing, substantial compliance with the watershed protection program elements being implemented in the Croton Falls and Cross River watersheds that are contained in this Determination. (C) As a condition of approval, the City will submit water quality data and	Continuous

Requirement	*Due Date*
monitor water quality at Croton Falls and/or Cross River, pursuant to the approved sampling plan submitted to NYSDOH/USEPA in May 2010, or as revised thereafter. NYSDOH approval under this Section may include additional conditions, including but not limited to, project schedules or specific operating goals or parameters for the City's water supply facilities (such as maximizing use of the Croton Filtration Plant, or operation of the Catskill/Delaware UV Plant at 3-log inactivation). As used in this Section, the term "NYSDOH" is defined as the primacy agency. In evaluating requests for approval from the City, the primacy agency shall consult with USEPA.	
Contract with the NRC to conduct an Expert Panel review of the City's Long-Term Watershed Protection Plan, water quality and water quality trends, and anticipated future activities that might adversely impact the water supply and its ability to comply with 40 CFR §141.71 and §141.171, and 10 NYCRR §5-1.30. Evaluate the adequacy of the City's Watershed Protection Programs for addressing these concerns and provide recommendations, as necessary, for improving programs. • Issue Commence Work notice to NRC. • Upon request of the NRC provide any necessary background information and respond to any pertinent questions within the scope of the review. • Ensure the schedule for public meetings is widely available either on a project-specific website, NRC website or the DEP website. • Report on the status of the Expert Panel review in the FAD Annual. • Provide the final report to NYSDOH, USEPA and NYSDEC. • Convene a public meeting with the regulators and watershed stakeholders to discuss the major findings and recommendations of the NRC Expert Panel review.	1/31/18 Ongoing Ongoing Annually, 3/31 Commence Work + 33 mo. Date of final report + 4 mo.

Table 2.2 Filtration Avoidance Criteria Reporting Milestones

Report Description	*Due Date*
Report on program implementation in the FAD Annual report.	Annually, 3/31

2.2 Environmental Infrastructure

2.2.1 Septic and Sewer Programs

DEP implements a comprehensive set of programs that serve to reduce the number of failing or potentially failing septic systems in the watershed. The Septic and Sewer Programs are composed of the following elements:

- Septic Remediation and Replacement Program;
- Small Business Program;
- Cluster System Program;
- Septic Maintenance Program;
- Sewer Extension Program; and
- Alternate Design and Other Septic Systems.

Septic Remediation and Replacement Program

The Septic Remediation and Replacement Program provides for pump-outs and inspections of septic systems serving single or two-family residences in the West of Hudson (WOH) watershed; upgrades of substandard systems; and remediation or replacement of systems that are failing or reasonably likely to fail in the near future. Participation is currently available to residential properties within 700 feet of a watercourse or within the 60-day Travel Time Area. The near-term goal is to ensure funding is in place to remediate/replace approximately 300 failing or likely-to-fail septic systems per year.

Table 2.3 Septic Remediation and Replacement Program Planned Activities/Milestones

Activity	***Due Date***
In accordance with Program Rules, provide adequate funding in support of the Septic Remediation and Replacement Program at a funding level sufficient to address 300 septic systems per year.	Ongoing

Small Business Program

The Small Business Septic System Rehabilitation and Replacement Program helps pay for the repair or replacement of failed septic systems serving small businesses (those employing 100 or fewer people) in the WOH watershed. Through CWC, eligible business owners are reimbursed 75% of the cost of septic repairs. The near-term goal is to ensure funding is in place to remediate/replace failing septic systems serving small businesses. As part of discussions with watershed stakeholders in 2016, DEP has agreed to fund an expansion of the CWC Small Business Septic System Program to make local government entities and not-for-profit institutions

eligible for 75% of the costs of repairs to septic systems. DEP has also agreed to provide funding for certain alterations or modifications of septic systems serving small businesses, local government entities and not-for profit institutions; the exact terms of funding for alterations and modifications will be finalized in early 2017.

Table 2.4 Small Business Program Planned Activities/Milestones

Activity	***Due Date***
In accordance with Program Rules, provide adequate funding in support of the Small Business Program provided that the need for such funding has been demonstrated.	Ongoing

Cluster System Program

The Cluster System Program funds the planning, design, and construction of cluster systems in thirteen communities in the WOH watershed. Through CWC, eligible communities may elect to establish districts that would support cluster systems and tie multiple properties to a single disposal system. This enables communities to locate disposal systems on larger sites in areas where existing structures were sited on insufficiently sized lots. The near-term goal is to ensure funding is in place to remediate failing septic systems through construction of cluster systems. DEP intends to work with CWC to evaluate the program and determine whether any modifications are needed to facilitate the advancement of the program.

Table 2.5 Cluster System Program Planned Activities/Milestones

Activity	***Due Date***
In accordance with Program Rules, provide adequate funding in support of the Cluster System Program component of the Septic Remediation and Replacement Program.	Ongoing

Septic Maintenance Program

The Septic System Maintenance Program is a voluntary program open to home owners who constructed new septic systems after 1997 or participated in the septic repair program, and is intended to reduce the occurrence of septic system failures through regular pump-outs and maintenance. Through CWC, home owners are reimbursed 50% of eligible costs for pump-outs and maintenance. As part of the program, CWC also develops and disseminates septic system maintenance educational materials. The near-term goal is to continue to fund 50% of the cost for septic pump-outs to qualified properties to enhance the functioning and reduce the incidence of failures of septic systems throughout the WOH watershed.

Table 2.6 Septic Maintenance Program Planned Activities/Milestones

Activity	*Due Date*
Provide funding, if necessary, to allow maintenance each year of 20% of the total number of septic systems eligible under the Septic Maintenance Program Rules.	Ongoing

Sewer Extension Program

The Sewer Extension Program funds the design and construction of wastewater sewer extensions connected to City-owned WWTPs discharging in the WOH watershed. The goal of this program is to reduce the number of failing or potentially failing septic systems by extending WWTP service to priority areas. DEP completed projects in the towns of Roxbury (Grand Gorge WWTP); Hunter-Haines Falls (Tannersville WWTP); Neversink (Grahamsville WWTP); and Hunter-Showers Road (Tannersville WWTP). DEP anticipates that the sewer extension projects now under construction in Shandaken (Pine Hill WWTP) and Middletown (Margaretville WWTP) will be completed before the 2017 FAD is in place. The near-term goal is to ensure these last projects are complete and conclude program.

Table 2.7 Sewer Extension Program Planned Activities/Milestones

Activity	*Due Date*
Construct sewer extension projects in Shandaken (Pine Hill WWTP), Middletown (Margaretville WWTP).	TBD (expected to be complete before FAD)

Alternate Design Septic Program

The Alternate Design Septic Program funds the eligible incremental compliance costs of the septic provisions of the Watershed Regulations for new septic systems to the extent they exceed state and federal requirements. The City funded the Alternate Design Septic Program under the Watershed MOA. The near-term goal is to support the use of the funding to cover the eligible incremental costs to comply with the septic system provisions of the Watershed Regulations.

Table 2.8 Alternate Design Septic Program Planned Activities/Milestones

Activity	*Due Date*
Support the use of the already provided funding to cover the eligible incremental costs to comply with the septic system provisions of the WRR to the extent that they are not otherwise required by state or federal regulations.	Ongoing

Table 2.9 Septic and Sewer Program Reporting Milestones

Report Description	*Due Date*
Report on program implementation in the FAD Annual Report: • Septic Remediation and Replacement Program; • Small Business Program; • Cluster System Program; • Septic Maintenance Program; • Sewer Extension Program; and • Alternate Design and Other Septic Systems.	Annually, 3/31

2.2.2 Community Wastewater Management Program

The Community Wastewater Management Program (CWMP) funds construction of community septic systems and/or septic maintenance districts in communities identified in Paragraph 122 of the MOA (the 8-22 communities).

Table 2.10 Status of Community Wastewater Management Program projects

Community	*Project*	*Flow* (gpd)*	*Status*
Bloomville	Community Septic w/ Sand Filter	30,000	Completed 2009
Boiceville	Collection System w/ WWTP	75,000	Completed 2010
Hamden	Community Septic w/ Sand Filter	26,000	Completed 2009
DeLancey	Septic Maintenance District	na	Completed 2007
Bovina	Community Septic System	25,000	Completed 2006
Ashland	Collection System w/ WWTP	26,000	Completed 2011
Haines Falls	NA – Sewer Extension Program	na	Completed 2006
Trout Creek	Community Septic w/ Sand Filter	16,000	Completed 2014
Lexington	Community Septic w/ Sand Filter	19,000	Completed 2016

South Kortright	Collection System pump to Hobart	20,000	Completed 2016
Shandaken	TBD	*36,000*	Study Phase
West Conesville	TBD	*15,000*	Study Phase
Claryville	TBD	*16,000*	Study Phase
Halcottsville	TBD	*19,000*	Study Phase
New Kingston	TBD	*13,000*	Study Phase

**Flow in italics is estimated*

The goals of the CWMP are to approve block grants for Shandaken and West Conesville to proceed to design and construction following completion of Study Phase and complete the study, design, and construction of projects for the final three communities (Claryville, Halcottsville, and New Kingston). The timeline of the Design Phase commences when the proposed project outlined in the Study Phase is approved by the parties. The timeline of the Construction Phase commences when the plans drafted during the Design Phase are approved by the parties.

By letter dated November 9, 2016, NYSDOH directed DEP to fund construction of a new WWTP to serve the hamlet of Shokan in the Town of Olive. The letter set forth certain milestones for initiation and completion of the project. DEP is reviewing those milestones and will provide a response in writing to NYSDOH in early 2017.

Table 2.11 Community Wastewater Management Program Planned Activities/Milestones

Activity	***Due Date***
Design complete for Shandaken, West Conesville	One year from date of completed Study Phase (Est. 6/30/17)
Construction complete for Shandaken, West Conesville	Two years from date of completed Design Phase
Preliminary study complete for Claryville, Halcottsville, New Kingston	6/30/17
Design complete for Claryville, Halcottsville, New Kingston	One year from date of completed Study Phase

Construction complete for Claryville, Halcottsville, New Kingston	Two years from date of completed Design Phase

Table 2.12 Community Wastewater Management Program Reporting Milestones

Report Description	***Due Date***
Report on program implementation in the FAD Annual Report: • Shandaken; • West Conesville; • Claryville; • Halcottsville; and • New Kingston.	Annually, 3/31

2.2.3 Stormwater Programs

Future Stormwater Controls Programs

The Future Stormwater Controls Programs pay for the incremental costs of stormwater measures required solely by the Watershed Regulations, but not otherwise required by state and federal law, in stormwater pollution prevention plans and individual residential stormwater plans for new construction after May 1, 1997. As part of the MOA, DEP established two Stormwater Cost-Sharing Programs: (1) Future Stormwater Controls paid for by the City for Single Family Houses; Small Businesses and Low Income Housing Program and (2) the WOH Future Stormwater Controls Program.

The Future Stormwater Controls paid for by the City Program, reimburses low income housing projects and single family home owners 100% and small businesses 50% of eligible costs. The million Future Stormwater Controls Program is administered by CWC and reimburses municipalities and large businesses 100% and small businesses 50% for eligible costs. DEP has committed to replenish funding for the Future Stormwater Controls Program to ensure the continued availability of funding to assist applicants. In addition, the City is working with CWC to provide funding to allow CWC to administer the program under MOA Paragraph 145, which anticipated that the costs of certain Future Stormwater Controls would be paid directly by the City.

Additionally, DEP provided CWC with funds for an appropriate position at CWC to assist applicants undertaking regulated activities to comply with the stormwater provisions of the Watershed Regulations.

The goal of the Future Stormwater Controls Programs is to provide payment of eligible incremental costs to comply with the stormwater provisions of the Watershed Regulations to the extent they exceed State and federal requirements and consistent with the Future Stormwater Controls Program Rules. The funds assist applicants undertaking regulated activities to comply with the stormwater provisions of the Watershed Regulations, and provide funding in accordance with the MOA for certain incremental costs for single family homes, small businesses, and low-income housing.

Table 2.13 Future Stormwater Controls Programs Planned Activities/Milestones

Activity	***Due Date***
Fund, in accordance with the MOA, the eligible incremental costs to comply with the stormwater provisions of the WRR to the extent that they are not otherwise required by federal or State law.	Ongoing
Ensure adequate funding for an appropriate position at CWC to assist applicants undertaking regulated activities to comply with the stormwater provisions of the City's Watershed Regulations.	Ongoing

Stormwater Retrofit Program

The Stormwater Retrofit Program, administered by CWC, provides funding for the design, permitting, construction, and maintenance of stormwater best management practices to address existing stormwater runoff in concentrated areas of impervious surfaces in the WOH watershed based on water-quality priorities.

The goal of the Stormwater Retrofit Program is to continue support of the installation of stormwater best management practices and community-wide stormwater infrastructure assessment and planning consistent with the Stormwater Retrofit Program Rules and within agreed-upon Program funding throughout the WOH watershed. Support the use of Program funding for retrofit projects installed in coordination with Community Wastewater Management Program projects.

Table 2.14 Stormwater Retrofit Program Planned Activities/Milestones

Activity	***Due Date***
Continue to provide the funding needed to allow the Stormwater Retrofit Program to continue at a level of activity that has been maintained since the inception of the Program consistent with the Stormwater Retrofit Program Rules, provided the demonstrated need for such funding continues.	Ongoing

Support the use of Program funding for retrofit projects installed in coordination with Community Wastewater Management Program projects.	Ongoing
Continue to provide the funding needed for the Operations and Maintenance of retrofit projects funded through the Stormwater Retrofit Program consistent with the Stormwater Retrofit Program Rules, provided the demonstrated need for such funding continues.	Ongoing

Table 2.15 Stormwater Programs Reporting Milestones

Report Description	***Due Date***
Report on program implementation in the FAD Annual Report • Future Stormwater Controls Programs; and • Stormwater Retrofit Program.	Annually, 3/31

2.3 Protection and Remediation Programs

2.3.1 Waterfowl Management Program

In 1992, as part of DEP's original Watershed Protection/Filtration Avoidance Program, a Waterfowl Management Program was established to measure the level of potential impact imposed by wildlife at the Kensico Reservoir. Waterbird species (geese, gulls, ducks, swans, cormorants, and duck-like birds) were surveyed to determine species richness (species diversity) and evenness (species population). Preliminary surveys conducted by DEP indicated several waterbird populations fluctuations occurred daily (diurnal/nocturnal), seasonally, and spatially on the reservoirs. A strong relationship between avian populations and bacteria (fecal coliform) levels from untreated water samples was established. As a result, DEP instituted a Waterfowl Management Program starting in 1993 to reduce or eliminate where possible, all waterbird activity in order to mitigate seasonal fecal coliform bacteria elevations. A similar program was also established on a daily, year-round basis at Hillview Reservoir. The program has continued through the present with an expansion for "as needed" services to several more reservoirs. The Waterfowl Management Program remains an important element of the FAD. Since its inception in 1993, the program has been highly effective in controlling fecal coliform contributions from birds which assists the City in meeting federal and state drinking water quality standards.

Under the new Filtration Avoidance Determination period, the Waterfowl Management Program will continue the waterbird management at Kensico Reservoir and Hillview Reservoir through a permanent program and including several other reservoirs throughout the NYC Water

Supply on an "as needed" basis. Each reservoir has been categorized with a different level of mitigative intensity using similar waterfowl management techniques including a standard daily operation at Kensico and Hillview Reservoirs and an "as needed" program triggered by increases in bacteria levels and elevated waterbird populations at three additional reservoirs (West Branch, Rondout, and Ashokan). An "as needed" program will also be implemented for Croton Falls and Cross River Reservoirs prior to the start-up of the Reservoir's pump station. In addition, a variety of bird deterrent measures will be employed and modified as deemed necessary on an annual basis.

The term "as needed" refers to implementation of avian management measures based on the following criteria:

- Fecal coliform bacteria concentrations approaching or exceeding 20 colony-forming units at reservoir effluent structures coincident with elevated bird populations;
- Current bird populations, including roosting or staging locations relative to water intakes;
- Recent weather events;
- Operational flow conditions within the reservoir (i.e., elevations and flow patterns and amounts);
- Reservoir ice coverage and watershed snow cover; and
- Determination that active bird management measures would be effective in reducing bird populations and fecal coliform bacteria levels.

The term "bird dispersal" refers to use of pyrotechnics, motorboats, airboats, remote control motorboats, propane cannons, and other methods employed to physically chase or deter waterbirds from inhabiting the reservoirs. The term "bird deterrence" refers to preventive methods employed to prevent waterbirds from inhabiting the reservoirs. Such bird deterrent measures include nest and egg depredation, overhead bird deterrent wires, bird netting on shaft buildings, meadow maintenance, and other methods.

The management of waterbird populations will continue to assist New York City in maintaining compliance with the federal Surface Water Treatment Rule standard for fecal coliform bacteria.

Table 2.16 Waterfowl Management Program Planned Activities/Milestones

Activity	***Due Date***
Active Waterbird Dispersal – Kensico Reservoir	Annually, 8/1 to 3/31
Active Waterbird Dispersal – Hillview Reservoir	Year-round
"As Needed" Bird Dispersal – West Branch, Rondout, Ashokan, Croton Falls, and Cross River Reservoirs	Annually, 8/1 to 4/15
"As Needed" Bird Deterrent Measures – Kensico, West Branch, Rondout, Ashokan, Croton Falls, Cross River, and Hillview	Year-round

Table 2.17 Waterfowl Management Program Reporting Milestones

Report Description	***Due Date***
Annual summary of Waterfowl Management Program activities at all reservoirs, including wildlife management at Hillview Reservoir (8/1 to 7/31)	Annually, 10/31

2.3.2 Land Acquisition

LAP was initiated in 1997 following execution of the Watershed Memorandum of Agreement, the Water Supply Permit, and the 1997 FAD. In the last twenty years, the City has secured over 140,000 acres of land and conservation easements ("CEs"), which is added to 34,193 acres of protected buffer land surrounding the reservoirs that was owned by the City as of 1997.

DEP efforts to acquire land have been particularly successful in the highest priority areas. As of 1997, only 2.3% of land in the West Branch/Boyd's Corners Reservoir basin was owned by the City, with another 12.6% protected by other entities; today, 34.2% is owned by the City and 49.1% of the basin is protected in total. Similarly, only 1.9% of land in the Rondout Reservoir basin was owned by the City in 1997; 14.5% is now owned by the City and, including land owned by other entities, Rondout is now 50.9% protected. 41.4% of the Kensico basin, 66.5% of the Ashokan, and 61.2% of the Neversink basin are now protected. Thus all of the highest priority basins, as well as Neversink, enjoy levels of protection between 41% and 66% due principally or in part to the City's acquisition efforts since 1997. The remaining basins of the CAT/DEL system – Cannonsville, Pepacton, and Schoharie – stand at 23%, 33%, and 34% protected, respectively. Since 1997, almost entirely through the City's efforts, protected status of the entire watershed has increased from 24.7% to 38.4%.

The City concentrates on acquisition of properties that contain both development potential and proximity to surface water features, where development would pose a relatively greater threat to future water quality than on properties without both of those elements. The quality of acres protected by the City – in addition to the overall quantity and their location relative to the City's distribution system – is therefore important as well.

The significant progress made since 1997 in protecting land within various priority areas, basins, and sub-basins has led to shifts in LAP strategies over time. The 2012-2022 Long Term Plan for LAP (issued by the City in September 2009) accounts for this progress and refocused acquisition activities toward less-protected basins and sub-basins. This shift likewise reflects the fact that land in many of the basins where the City has made significant progress is relatively more expensive than land in less-protected basins. Thus the marginal benefits of increasing protected status from, say, 50% to 51% in an expensive and highly-protected sub-basin is generally considered less compelling or cost-effective than increasing protected status from 10% to 11% in a less-protected, lower-cost sub-basin.

In 1997 as part of the MOA, DEP committed to provide funds to watershed communities to offset any costs incurred by the communities in the review of proposed City land purchases. In discussions with stakeholders in 2016, DEP has agreed to increase the cap on the funding available for eligible community costs related to the review of acquisitions to $40,000 per community.

The City's successor Water Supply Permit (WSP), issued by NYSDEC on December 24, 2010, authorizes the City to acquire up to 106,712 acres of land or CEs between January 2010 and January 2025. In 2022, DEP will submit an application to NYSDEC for renewal of the WSP. Because the existing WSP expires during the period of this 10-year plan, DEP's solicitation plan matches the term of the existing WSP. If and when the WSP is renewed , DEP will propose additional solicitation based on LAP status. Prior to receiving the 2010 WSP, DEP completed an environmental impact statement (EIS), which concluded that the maximum acreage DEP projected acquiring in the watershed would not have a significant adverse environmental impact. In the context of the EIS, DEP conducted a number of "Town Level Assessments," analyses of certain acquisition levels to assess potential impacts on the amount of remaining developable land in watershed communities. Since 2010, acquisitions in a handful of communities has approached, and in one case exceeded, the levels that were assessed. While approaching or exceeding of these assessment levels does not indicate that there is, or will be, a significant adverse environmental impact in these communities, DEP has committed to refreshing the analysis in approximately 20 watershed towns based on currently available data. Pending completion of that revised analysis, which will commence in early 2017, DEP intends to temporarily suspend outgoing solicitation of landowners in seven towns; DEP will continue to accept landowner-initiated discussions in those towns.

In 2016, DEP reconvened a group of land trusts, along with watershed community representatives and regulatory agencies, to revisit opportunities for land trust participation in DEP's efforts to protect public health through land protection. Those discussions are ongoing and may result in specific initiatives that complement existing LAP efforts.

The goals for the Land Acquisition Program through 2027 are to:

- Continue to acquire land and CEs in and pursuant to all program requirements set forth in the MOA, FAD and WSP;
- Adjust solicitation levels to account for the high level of protection achieved to date by LAP; and
- Continue to work with and support partners to secure properties and CEs pursuant to the applicable programs – the Farm and Forest Conservation Easement Program(s), the NYC-Funded Flood Buyout Program (NYCFFBO), and the Streamside Acquisition Program (SAP), and related requirements.

Table 2.18 Land Acquisition Program Planned Activities/Milestones

Activity	***Due Date***
Continue to provide sufficient funding to support the Land Acquisition Program	Ongoing
Submit solicitation plans for each two-year period. Plans will include a commitment to solicit at least 35,000 acres annually through 2024. SAP and NYCFFBO acres may be credited 2 acres for every 1 solicited pursuant to the agreed methodology. A total of up to 10,000 acres/year of WAC, SAP, and NYCFFBO acres may be credited towards solicitation goals.	Biennially beginning October 2018
During annual budget discussions with NYSDOH, USEPA and NYSDEC, discuss potential need for any additional monies beyond that already committed to all land acquisition programs. If such funding is needed, sequester the funds.	Annually, 11/30
Continue implementation of a $5 million Pilot SAP.	Ongoing, in accordance with the 2010 WSP
Continue to work with land trusts regarding large properties with dwellings that could be pre-acquired by land trusts and vacant portions conveyed to the City, subject to support by the local town and interested land trust(s).	Ongoing, in accordance with the 2010 WSP

Activity	*Due Date*
Implement the NYCFFBO program, which is consistent with the 2010 WSP, as amended, and agreements with local stakeholders. Properties may be eligible for the Program based on expected flood mitigation and water quality benefits derived.	Ongoing
Based on the requirements of the Water Supply Permit, DEP shall submit written evaluation of its ancillary programs to NYSDOH, USEPA and NYSDEC, making recommendations as to whether the WAC easement acquisition Programs, NYCFFBO Program and SAP should be continued, modified, or terminated, as well as any proposed improvements to the programs. If a determination is made by NYSDOH, USEPA, NYSDEC, and the City not to continue any of the programs, all unused funds allocated to such programs, with any earnings thereon, are to be returned to the City to be deposited in the LAP-segregated account for use by the LAP.	12/15/18
If requested by a local governmental entity which has applied to Federal Emergency Management Agency (FEMA) for funding, participate in any future FEMA/State Office of Emergency Management (SOEM) Flood Buy-out (FBO) Program, providing up to 25% of the eligible costs as the local match for each watershed property participating in the program.	As required by FEMA/SOEM FBO program rules
Submit application for renewal of the Water Supply Permit.	6/30/22

Table 2.19 Land Acquisition Program Reporting Milestones

Report Description	*Due Date*
Submit semi-annual reports on program activities and status.	Semi-annually, 3/31 in FAD Annual Report and 7/31

2.3.3 Land Management

The City has made a significant investment in purchasing water supply lands and conservation easements. Purchasing the land is one step; however, to maximize the utility of these lands in protecting the long-term water supply for the City, they must be monitored, managed and secured properly. Effective and routine monitoring of lands and easements is vital to discovering encroachments, timber trespass and overuse of fee lands and potential violations

for easements. DEP inspects fee lands on a prioritized basis per its fee monitoring policy (up to once per year) and easements bi-annually which enables DEP to identify and address encroachments expeditiously.

The City supports and provides for many recreational uses of its land. As the second largest public land holder in the watershed, the City has been successful in opening many of its lands and waters for expanded recreational uses, consistent with its mission to protect water quality. Improving some of these lands for recreational access, particularly along the reservoirs can help address the impacts of overuse if they arise. City lands can also be an important economic component to local communities and the City continues to allow various uses of its lands such as issuing revocable land use permits and allowing agricultural uses.

The goals of the Land Management Program are to:

- Conduct routine monitoring and inspections of City watershed protection lands to meet the primary mission of water quality protection;
- Ensure encroachments and other unauthorized uses of City land are dealt with in a timely manner;
- Facilitate and coordinate the protection and wise use of City lands and natural resources;
- Provide community benefits through allowing compatible recreation and agricultural uses and issuing revocable land use permits;
- Ensure the long-term protection and management of the City's significant investment in fee-lands conservation easements;
- Ensure that all conservation easements - those held by DEP and WAC - are administered effectively including regular monitoring, consideration of activity requests, and documentation and correction of any violations that occur; provide for stewardship funding to WAC as previously agreed; and
- Engage recreational users through education and outreach.

Table 2.20 Land Management Program Planned Activities/Milestones

Activity	***Due Date***
Monitor and actively manage water supply lands	Ongoing
Monitor and enforce DEP watershed conservation easements including those held by WAC	Ongoing
Continue to assess and implement strategies to increase the public's	Ongoing

recreational use of water supply lands	
When appropriate, inform regulators if and when recreational use policy or proposals are modified to any significant degree	Ongoing
Engage recreational users of City land through outreach and events	Ongoing

Table 2.21 Land Management Program Reporting Milestones

Report Description	***Due Date***
Report on program implementation in the FAD Annual report.	Annually, 3/31

2.3.4 Watershed Agricultural Program

The Watershed Agricultural Program (WAP) represents a successful longstanding partnership between DEP and the Watershed Agricultural Council (WAC) that began in 1992 as a pilot program on ten watershed farms and has since accumulated over two decades of experience, local leadership, and extensive on-the-ground accomplishments spanning across more than 440 farms. The WAP's primary activities include the voluntary development of Whole Farm Plans and the implementation of agricultural BMPs, along with the establishment of riparian buffers through the federal Conservation Reserve Enhancement Program (CREP). The WAP also supports nutrient management planning, precision feed management, and diverse educational programs that collectively provide farmers with a comprehensive suite of technical assistance and financial incentives to improve farm management and reduce pollution risks.

To date, the WAP has developed more than 440 Whole Farm Plans (approximately 350 of which are still active) and implemented over 7,100 BMPs on watershed farms, in addition to enrolling more than 1,800 acres of riparian buffers in the CREP. Nearly 120 farms participate in the Nutrient Management Credit Program and up to 60 farms are being recruited for the new Precision Feed Management Program. For the past five years, the WAP has met or exceeded all of its FAD metrics, many of which have been set at the 90% participation threshold for active large farms in the West of Hudson watershed. However, the WAP's historical focus on recruiting new participants and developing Whole Farm Plans for these participants has resulted in the accumulation of a large BMP workload that needs to be addressed and managed in a more sustainable manner moving forward.

After two decades of expansion, the WAP is now transitioning into a mature program that is striving to balance water quality priorities with the need to maintain positive relationships with hundreds of voluntary participants. Over the next few years, it will be crucial for the WAP to remain flexible and responsive to participant needs and pollution risks in the context of shifting

farmer demographics and evolving agricultural operations. Looking ahead, priority WAP activities will include the need to repair or replace existing BMPs in a timely manner to maintain nearly $60 million worth of water quality investments, and managing the growing complexity of an extensive portfolio of voluntary Whole Farm Plans in various stages of implementation. Within this portfolio, the WAP has identified nearly $5 million worth of BMP repairs/replacements and over $31 million worth of new BMPs that are pending implementation (of which $24 million are in the highest priority pollutant categories I-VI); reducing the backlog of BMPs and improving the timeliness of BMP implementation across the portfolio of Whole Farm Plans that are already approved will become an increased focus of the WAP in the years ahead.

Current goals of the program are to:

- Develop a new approach for investigating and repairing certain WAP-implemented BMPs using an in-house field crew of WAP technicians, with a goal of reducing the BMP backlog and becoming more responsive to the BMP repair needs of participants;
- Maintain at least 135 eligible farms in the Nutrient Management Credit Program;
- Maintain up to 60 eligible farms in the Precision Feed Management Program; and
- Engage greater numbers of WAP participants in farmer education programs in order to improve and enhance farm operation decisions and management behaviors.

Table 2.22 Watershed Agricultural Program Planned Activities/Milestones

Activity	***Due Date***
Manage the current portfolio of active Whole Farm Plans, including the revision of existing plans as needed and the development of new plans on eligible priority farms on a case-by-case basis	Ongoing
Conduct annual status reviews on at least 90% of all active Whole Farms Plans every calendar year, with a goal of 100%	Ongoing
Continue to implement new priority BMPs on active participating farms with Whole Farm Plans according to the following milestones: • Design, encumber, and schedule for implementation within a two-year timeframe at least 50% of all identified BMPs within pollutant categories I-VI by the end of calendar year 2022 • By the end of 2024, implement all viable BMPs that were designed and encumbered through calendar year 2022	Ongoing 12/31/22 12/31/24

Activity	*Due Date*
Continue to repair/replace existing BMPs on active participating farms with Whole Farm Plans according to the following milestones: • Design, encumber, and schedule for implementation within a two-year timeframe at least 50% of all identified BMPs needing repair/replacement by the end of calendar year 2022 • By the end of 2024, repair/replace all viable BMPs that were designed and encumbered through calendar year 2022	Ongoing 12/31/22 12/31/24
Continue to develop and update nutrient management plans on active participating farms that require such a plan	Ongoing
Continue to offer the Nutrient Management Credit Program to eligible farms	Ongoing
Continue to implement the Precision Feed Management Program on up to 60 eligible farms	Ongoing
Continue to develop new CREP contracts and re-enroll expiring contracts as needed	Ongoing
Continue to implement a Farmer Education Program	Ongoing
Continue to implement an Economic Viability Program	Ongoing
In consultation with WAC, assess the adequacy of current WAP metrics and submit a report that recommends the continuation of current metrics and/or the consideration of potential new metrics.	6/30/23
Meet with the NYSDOH/USEPA and NYSDEC to discuss the WAP's metrics and specifically to discuss future BMP implementation milestones for calendar year 2024 and beyond	9/30/23

Table 2.23 Watershed Agricultural Program Reporting Milestones

Report Description	***Due Date***
Report on program implementation in the FAD Annual report including: • Number of new and revised Whole Farm Plans completed and approved, as well as the total number and percentage of active plans in relation to the current universe of WAP participants; • Number, types and dollar amounts of both new BMPs and repaired/replaced BMPs implemented each year; • Number, types, and dollar amounts of both new BMPs and repaired/replaced BMPs designed and scheduled for implementation in the following year; • Cumulative progress made each year toward reducing the BMP backlog in relation to projected BMP implementation milestones for 2022; • Number and percentage of annual status reviews completed on active Whole Farm Plans; • Number of new and updated nutrient management plans completed, as well as the percentage of current plans on all active participating farms that require such a plan; • Number of farms participating in the Nutrient Management Credit Program; • Number of farms participating in the Precision Feed Management Program and a summary of accomplishments; • Number of new and re-enrolled CREP contracts completed, along with a summary of total enrolled and re-enrolled acres; and • Summary of Farmer Education Program accomplishments.	Annually, 3/31
WAP Metrics Assessment and Recommendations Report	6/30/23

2.3.5 Watershed Forestry Program

The Watershed Forestry Program is a longstanding partnership between DEP, the Watershed Agricultural Council, and the United States Forest Service that began in 1997 and has since accumulated nearly two decades of experience working closely with landowners, loggers, foresters, and the wood products industry. A primary focus of the Watershed Forestry Program is to promote good forest stewardship and encourage long-term management of the watershed forests for both water quality protection and economic viability purposes. A secondary focus is to promote the value and importance of a working forest landscape to both upstate watershed residents and downstate water consumers through targeted education and public outreach.

To achieve its objectives, the Watershed Forestry Program supports the development and implementation of forest management plans; the implementation of BMPs during and after timber harvesting operations; professional training for loggers and foresters; educational programs for watershed landowners; teacher training and educational programs for upstate and downstate students; and coordination of a watershed model forest program that supports demonstration purposes as well as education and outreach.

In recent years, the Watershed Forestry Program has placed greater emphasis on internal assessment and refinement, which has produced various programmatic modifications and will likely result in continued future improvements. The most significant example is the 2014-2015 redesign of the WAC Forest Management Planning Program, which resulted in a new eligibility requirement that all future WAC-funded plans and plan updates must enroll in New York's forest tax abatement program and the development of a new interactive website for landowners (MyWoodlot.com); this type of innovation is important to ensure continued program effectiveness based on twenty years of knowledge and experience.

Another tool for monitoring future program effectiveness is the Conservation Awareness Index (CAI), which is a recently developed survey that assesses landowners' awareness of four conservation choices they are likely to face; CAI represents a promising new tool to assist with future evaluation efforts.

The goals of the Watershed Forestry Program are to:

- Continue to monitor the use and progress of the new MyWoodlot.com website as a tool for understanding the needs and interests of watershed landowners.
- Explore potential modifications and improvements to the Management Assistance Program (MAP) that may be needed to support and compliment the recently redesigned WAC Forest Management Planning Program.

Table 2.24 Watershed Forestry Program Planned Activities/Milestones

Activity	***Due Date***
Continue to support the development of forest management plans and the implementation of these plans through the Management Assistance Program (MAP), with a goal of completing at least 60 MAP projects per year	Ongoing
Continue to support the implementation of forestry BMPs, with a focus on road BMP projects and forestry stream crossing projects	Ongoing
Continue to support the Croton Trees for Tribs Program, with a goal of completing 6 projects per year	Ongoing
Continue to support professional training for loggers and foresters	Ongoing
Continue to support educational programs for landowners	Ongoing
Continue to support school-based education programs for teachers and students in both the watershed and New York City	Ongoing
Continue to support and coordinate four watershed model forests	Ongoing

Table 2.25 Watershed Forestry Program Reporting Milestones

Report Description	***Due Date***
Report on program implementation in the FAD Annual report including: • Number of forest management plans completed and acres of forestland enrolled in the 480-a program; • Number and types of MAP projects completed; • Number and types of forestry BMP projects completed; • Number of Croton Trees for Tribs projects completed; • Summary of logger and forester training accomplishments; • Summary of landowner education accomplishments;	Annually, 3/31

• Summary of school-based education accomplishments; and • Summary of model forest accomplishments.	
Report on CAI evaluation results for the watershed forest management planning program and landowner education programs	12/31/21 12/31/26

2.3.6 Stream Management Program

The City will continue to implement the SMP through a series of contractual partnerships with the County Soil and Water Conservation Districts (SWCDs) and the Cornell Cooperative Extension of Ulster County. Program components include annual action planning based on stream assessments and stakeholder input; water quality-driven Stream Projects; stakeholder-driven Stream Management Implementation Program (SMIP) projects; the Catskill Streams Buffer Initiative (CSBI); Flood Hazard Mitigation projects; and Education, Outreach and Training.

The SMP continues to strengthen and improve these core program components through advances in staff experience and professional development, ongoing assessments of river corridors and floodplain modeling, and close coordination with stakeholders.

The SMP delivers both water quality-driven projects and projects intended to meet community and stakeholder stream management priorities.

- Water Quality-driven projects – SMP basin teams will initiate an expedited review of current water-quality in each reservoir basin, review the ability to impact water quality through stream management activities in the basins, and renew or revise water quality-based project priorities. This process will guide the selection of the next round of water-quality driven projects. These projects treat a documented source of water quality impairment or prevent an emerging source. They can be reach-scale channel stability restorations and/or hillslope stabilizations that remove turbidity sources or they can be smaller scale (bank stabilization), treating a documented source of water quality impairment where channel modifications are unnecessary or impractical.
- Stakeholder-driven projects are delivered through the Stream Management Implementation Program (SMIP), which funds projects included in or supported by stream management plans developed by municipalities that have entered into Memorandum of Understandings (MOUs) with a SWCD. While many of these projects improve or protect water quality, and those that do are prioritized, these projects are multi-objective and are intended to advance stakeholder interests in stream management. SMIP projects can include flood hazard mitigation projects;

enhanced recreational access; upgrading undersized culverts to improve stream stability and water quality; studies in habitat, stream and ecosystem integrity; critical area seeding and roadside ditch best management practices; support for municipal policy development; training scholarships for stakeholders; and the development and delivery of school programs.

Additionally, in response to Tropical Storms Irene and Lee in 2011, the City and watershed stakeholders developed the Local Flood Hazard Mitigation Program (LFHMP) to both mitigate the hazards caused by flooding in streamside communities and address sources of pollution related to flood waters. The LHFMP commenced by conducting Local Flood Analysis (LFA) to identify factors that exacerbate flooding and flood risks in population centers. Projects are expected to move toward implementation in the near future. The City has provided funding for the Flood Hazard Mitigation Implementation Program (FHMIP) through a contract with the Catskill Watershed Corporation to implement LFA recommended projects. Additional funding has been earmarked for floodplain property acquisition through the DEP Land Acquisition Program. Funding has also been provided through the SMP contracts to fund LFAs and implement flood hazard mitigation projects involving streams and floodplains. The highest priority projects identified in LFAs are those that would lower flood elevations at a community or stream reach scale.

The City will also continue to work with the United States Geological Survey to conduct the ongoing turbidity and suspended sediment source and yield monitoring study that began in October 2016 in the Esopus Creek and Stony Clove Creek watersheds. This study evaluates stream management projects' effectiveness in turbidity reduction and its findings will be used to prioritize site selection for future stream management projects. At least three turbidity reduction stream projects will be identified in the Stony Clove watershed and implemented as part of the study.

In 2016, the City initiated a Stream Studies Program to support the research needs for stream management objectives. The first phase of this new effort includes (1) conducting the Esopus Creek and Stony Clove Creek turbidity/suspended sediment studies with USGS, (2) updating the Catskill Mountain bankfull discharge and channel geometry regional curves, and (3) expanding the Natural Channel Design Reference Reach database. Starting in 2017, the SMP will work with SMP partners to determine what additional programmatic research is necessary to support stream management objectives for the West of Hudson watersheds. Stream bedload sediment transport is a potential research topic identified by the City and the SMP partners. Pursuing coarse sediment transport data in mountain streams dominated by storm-driven hydrology is a very technically challenging task. The City will work with SMP partners to determine the need for this data, investigate options to obtain needed data for successful program implementation, and initiate potential research efforts where warranted.

The Catskill Streams Buffer Initiative seeks to restore riparian buffers where gaps exist along stream corridors using Catskill native plant materials, as well as to educate landowners about the importance of stewarding intact riparian buffers. The focus of CSBI has been on non-agricultural lands and has complemented the Conservation Reserve Enhancement Program which restores riparian buffers on agricultural lands. CREP eligibility criteria expanded recently to allow CREP to be implemented on non-agricultural lands that have a past history of agricultural use. In this FAD period, a partnership between CSBI and CREP will be explored to enable CREP to be implemented through the CSBI on these non-agricultural lands.

Education, outreach and training initiatives continue to be an essential component of the SMP, providing knowledge, tools, and funding to the numerous individual and agency stream managers in the Watershed. The SMP will maintain the existing level of staffing and support to each SMP basin program team to ensure that new stakeholders are quickly educated and integrated into the SMP.

Table 2.26 Stream Management Program Planned Activities/Milestones

Activity	***Due Date***
Water-Quality Based Stream Projects and Site Selection	
• DEP and Contract Partners will meet to review water quality analyses to outline the water quality basis for project site selection and to prioritize the main stems and/or sub-basins for stream feature inventories	12 months after 2017 FAD effective date
• Six stream feature inventories will be conducted in the prioritized tributaries/main stems of the major SMP basins (Schoharie, Ashokan, Nev/Ron, Cannonsville and Pepacton) to identify water quality threats and support project site prioritization	12/31/22
• Design and complete construction of 24 Stream Projects* that have a principal benefit of water quality protection or improvement. A minimum of 3 of the 24 shall be in the Stony Clove watershed (Ashokan) to support the Water Quality Monitoring Study and a total of at least 6 of the 24 projects shall be in the Ashokan watershed. Stream Projects will be selected based on a water quality-based site selection process and in accordance with the review and prioritization of basin-scale water quality priorities described above. Beginning in 2017, projects completed beyond those required for the Revised 2007 FAD will be counted towards this requirement.	12/31/27

Activity	*Due Date*
• The City will propose projects for FAD approval in November of each year * Stream Projects may be delayed due to flood events which necessitate a shift in program focus to response and recovery operations. Floods can also change project priorities. Delays can also result from shifts in landowner cooperation.	Annually, 11/30
CSBI Continue implementation of CSBI by providing technical assistance and conservation guidance to riparian landowners. (This program is also included in the Riparian Buffer Protection Program.)	
• Convene annual meeting of Riparian Buffer Working Group	Annually, 2/28
• Facilitate the supply of native plant materials to the CSBI	Ongoing
• Implement Education, Outreach, and Marketing Strategy with partners	Ongoing
• Seek to establish a partnership between the CSBI program and the CREP program to enable CREP to be implemented on former agricultural lands through the CSBI	12/31/17
• Review progress in extending CREP to eligible non-agricultural lands through CSBI	6/30/21
• Complete revegetation of a minimum of 5 streambank miles throughout the West of Hudson watershed. This metric may be adjusted upon review of progress in extending CREP to former agricultural lands through a partnership with the CSBI.	11/30/27
SMIP Continue the local funding programs for the enhanced implementation of stream management plan recommendations, including LFA recommended projects, in the Schoharie, Cannonsville, Pepacton, Neversink, Rondout and Ashokan basins. Complete commitment of funds for a minimum of 100 SMIP projects throughout the West of Hudson watershed.	Ongoing
Education/Outreach/Training Continue to implement the Education/Outreach/Training strategy for	Ongoing

Activity	*Due Date*
municipal officials with program partners and maintain base education and outreach existing programming in the SMP basin programs	
Annual Meeting and Action Plans Meet annually with county contracting partners to review progress made in the previous year within each program area (Stream Projects, CSBI, SMIP, LFHMP and Education/Outreach/Training) and re-evaluate priorities as the basis for preparing new Action Plans for the coming year, especially after major flood events. Action plans and program activities should place priority on projects that will enhance water quality, and restore or protect stream system stability. This meeting will also provide an opportunity for discussion on the research advanced by each basin team and DEP during the year as well as next steps.	Annually, 2/28
Addendum A Coordinate with NYSDEC regarding the implementation of Addendum A to the 1993 Memorandum of Understanding between NYSDEC and the City as it pertains to the review of Article 15 Stream Disturbance Permits, to enhance coordination between the agencies with the goal of ensuring consistency with the recommendations in stream management plans and implementation of stream management projects	As Needed
Local Flood Hazard Mitigation Program (LFHMP) • Complete LFAs and provide funding toward implementation of LFA-recommended projects through both the SMP and the CWC in the West of Hudson watershed • Coordinate the LFHMP funding program with State and Federal flood hazard mitigation agencies to ensure consistency and thereby maximize funding to the Watershed communities • Continue to provide technical support, education, and training to watershed communities to support their use of Flood Insurance Rate Maps (FIRMs) and their participation in a variety of floodplain management, flood hazard mitigation, and flood preparedness programs	12/31/27 Ongoing Ongoing

Activity	*Due Date*
Water Quality Monitoring Studies • Continued collection and analysis of data for the Esopus Creek Watershed Turbidity/Suspended Sediment Study • Submit the final Esopus Creek Watershed Turbidity/Suspended Sediment Study Design • Submit 3 proposed Stony Clove restoration projects for approval	Ongoing 1/31/17 1/31/19
Ashokan Projects Complete construction of 7 stream management projects within the Ashokan basin with a goal of protecting water quality, in particular by reducing turbidity.	11/30/18
Progress Meeting Convene progress meetings with NYSDOH/USEPA and NYSDEC. An office-based meeting shall be held by 8/30, and a field-based meeting shall be held following construction season by 10/31	Twice a year, by 8/30 and 10/31

Table 2.27 Stream Management Program Reporting Milestones

Report Description	*Due Date*
Water Quality Based Stream Projects and Site Selection Submit brief basin specific reports outlining the water quality basis for Stream Project Site Selection in the basin during the FAD period and that prioritizes main stem and/or sub-basins for stream feature inventories	12 months from the date of FAD issuance
CSBI Submit a brief summary report reviewing progress in establishing a partnership with the CREP to implement CREP on eligible non-agricultural lands through the CSBI. Review progress in extending CREP to eligible non-agricultural lands through CSBI.	12/31/17 6/30/21
Action Plans Each year, submit a rolling two-year Action Plan for each basin that	Annually, 5/31

Report Description	*Due Date*
outlines the upcoming projects in the program areas (Stream Projects, CSBI, SMIP, Education/Outreach/Training, LFHMP)	
Local Flood Hazard Mitigation Program (LFHMP) Evaluate the LFHMP for its contribution to the protection of water quality and recommend steps for enhancing this protection in the future	6/30/18 6/30/21
Water Quality Monitoring Studies Submit biennial status reports on study findings Submit first five year study findings Submit final study findings	 Commence 3/31/19 11/30/22 11/30/27
Annual Report Report on program implementation in the FAD Annual Report: • site selection of water quality based projects; • Catskill Stream Buffer Initiative; • Stream Management Implementation Projects; • Local Flood Hazard Mitigation Program; and • Water Quality studies.	Annually, 3/31

2.3.7 Riparian Buffer Protection Program

The Riparian Buffer Protection Program, initiated under the 2007 FAD, now consists of several separate efforts undertaken by different DEP units, including the Land Acquisition, Watershed Agricultural, Stream Management, and Forestry Programs. The multi-program approach to protecting and restoring buffers ensures buffers on both public and private land are protected, managed and in many cases restored.

The Riparian Buffers Protection Program is enhanced by DEP's Streamside Acquisition Program[1] which is currently piloting the acquisition of riparian buffers in designated areas within the Schoharie Watershed. This FAD section includes this requirement, and it is also referenced in the Land Acquisition Program section.

[1] Formerly titled the Riparian Buffer Acquisition Program.

The City will continue to implement the Program. The general milestones set forth in previous FAD requirements remain relevant and form the basis for near-term FAD implementation requirements of the RBP Program. The City will continue to implement the RBP Program in accordance with the milestones below.

Table 2.28 Riparian Buffers Protection Program Planned Activities/Milestones

Activity	***Due Date***
Continue existing programs that are protective of riparian buffers including, but not limited to, watershed regulations, agricultural programs, land acquisition, stream management, and land management	Ongoing
Continue implementation of CREP	Ongoing
Continue implementation of the CSBI by providing technical assistance and conservation guidance to riparian landowners. • Convene annual meeting of Riparian Buffer Working Group • Facilitate the supply of native plant materials to the CSBI • Implement Education, Outreach, and Marketing Strategy with partners • Seek to establish a partnership between the CSBI program and the CREP program to enable CREP to be implemented on former agricultural lands through the CSBI • Review progress in extending CREP to eligible non-agricultural lands through CSBI • Complete revegetation of a minimum of 5 streambank miles throughout the West of Hudson watershed. This metric may be adjusted upon review of progress in extending CREP to former agricultural lands through a partnership with the CSBI.	 Annually, 2/28 Ongoing Ongoing 12/31/17 6/30/21 11/30/27
Continue to seek enhanced management agreements (voluntary 10-year or purchased perpetual) for all current and future stream restoration projects	Ongoing
Continue implementation of the Pilot Streamside Acquisition Program	Ongoing, in accordance with the 2010 WSP

Table 2.29 Riparian Buffers Protection Program Reporting Milestones

Report Description	*Due Date*
SAP Based on the requirements of the Water Supply Permit, DEP shall submit written evaluation of the SAP and discuss whether it should be continued, modified, or terminated, as well as any proposed improvements to the program	12/15/18
CSBI Submit a brief summary report reviewing progress in establishing a partnership with the CREP to implement CREP on eligible non-agricultural lands through the CSBI. Review progress in extending CREP to eligible non-agricultural lands through CSBI.	12/31/17 6/30/21
The FAD annual report will reference the other FAD programs where the completed Riparian Buffer Protection Program details will be described	Annually, 3/31

2.3.8 Ecosystem Protection Program

The Ecosystem Protection Program combines goals and activities for numerous programs as provided below.

Forestry

The City has significant forest land holdings and continues to acquire forest lands for the management and protection of the water supply. These forests must be professionally managed to meet the goals for maintaining forest ecosystem integrity to protect and enhance the water supply. Older City lands are commonly declining in forest vigor, have limited diversity and/or have little to no forest regeneration critical for the future of the forest. Some recently acquired City lands have trees with low forest vigor due to management practices of previous landowners. To address these forest conditions, DEP foresters conduct forest assessments and implement silvicultural prescriptions to increase the diversity of species and age structure to enhance forest vigor and resiliency to meet the forest goals.

With the purpose of protecting water quality through the long-term management of City forest lands, a comprehensive watershed forest management plan was completed in 2011 in partnership with the U.S. Forest Service. The Watershed Forest Management Plan defines the desired forest conditions and sets forth the management goals, objectives, strategies and

guidelines for all current and future City-owned water supply lands, and basin specific objectives where appropriate, based on current scientific principles for the management of watersheds and natural resources. These goals, objectives and guidelines set the direction for the Agency and its programs in the long term management of the watershed forest resources for the enhancement and protection of the water supply. As part of the 2011 Watershed Forest Management Plan, an assessment of the current forest conditions was completed which included a comprehensive forest inventory. The plan and inventory identified forest stands where silvicultural practices are required to be implemented to meet the desired forest conditions. The DEP Forest Management Program continues to implement these silvicultural practices through forest management projects. Updating forest inventories, implementing timber harvests, and reviewing forestry proposals from landowners who have sold conservation easements to NYC are core activities of the program in furtherance of the goals and objectives of the Forest Management Plan.

Wetlands

Wetlands improve water quality, attenuate storm flows, reduce flooding and erosion, maintain stream baseflow, and provide wildlife habitat, recreation and educational opportunities. The Wetlands Protection Program collects information about the characteristics, distribution and functions of wetlands to inform regulatory and partnership protection programs. Wetland permit applications and other land use proposals are reviewed to minimize potential impacts to wetlands to the extent practicable.

The Wetland Protection Strategy was first implemented in 1996 and most recently updated in 2012. The strategy includes research and mapping programs such as a pilot mapping project using LiDAR and reference wetland monitoring. Part of DEP's strategy is to protect wetlands through other programs such as regulatory reviews, land acquisition, and agricultural programs.

Invasive Species

The Invasive Species Program was formed to develop and implement a comprehensive strategy to identify, prioritize and address invasive species threats to the water supply and coordinate monitoring and management. Invasive species can cause direct harm to water supply infrastructure through clogging of intakes and pipes potentially costing millions of dollars of damage. Invasive species also can impact biodiversity and water quality potentially through degradation of the natural ecosystems that the water supply relies on.

Recognizing the threat that invasive species pose to water quality, water supply infrastructure, and ecosystems generally, the Invasive Species Program has been taking steps to comprehensively address the prevention, early detection, rapid response and management of the most damaging invasive species. Efforts are coordinated internally through the inter-disciplinary Invasive Species Working Group and with external partners through DEP's involvement with the Partnerships for Regional Invasive Species Management, the NYS Invasive Species Advisory Committee and other federal and state agencies.

The Invasive Species Management Strategy covers the topics of prevention and pathway risk mitigation, early detection and rapid response to new invasive species, control and management of existing invasive species where appropriate, mitigation of the impacts from species that can't be controlled, restoration of areas that have been heavily impacted by invasive species, intra-agency and external partnership collaborations to address these issues. These are all areas that have been and will continue to be critical to managing invasive species that may impact the watershed.

The goals of the Ecosystem Protection Program are as follows:

Forestry

The goal of the Forest Management Program is to protect water quality by increasing the diversity of species and age structure of City forest lands to enhance forest vigor and forest resiliency. Promoting these forest conditions increases nutrient retention in the forest and promotes a forest that effectively responds to catastrophic events to enhance the watershed protection functions of the forest, thus protecting the water supply.

The near term Forest Management Program goals will focus on implementing the comprehensive Watershed Forest Management Plan and will include the following:

- Continued implementation of silvicultural activities such as timber harvesting guided by the use of DEP's Conservation Practices and enhanced best management practices.
- Implementation of assessment strategies for lands acquired since the development of the Plan including forest inventories and assessment, and incorporation of newly acquired lands into the management regime.
- Assessment of forest/deer impacts and management strategies to promote forest regeneration. Deer browsing is one of the primary limiting factors for forest regeneration success.
- Maintain data collection and analysis for the Continuous Forest Inventory (CFI) project.

Wetlands

- Expand the pilot LiDAR wetland mapping and connectivity assessment to the entire watershed. Produce a National Wetland Inventory (NWI)-compliant GIS wetland layer for the entire watershed using LiDAR-derived data, high resolution aerial photography, and other ancillary data sources to improve the accuracy and completeness of wetland mapping and connectivity assessment.
- Enhance the Reference Wetland Monitoring Program based on the recommendations of the reference wetland standards report and strengthen the efficacy of this study.

Invasive Species

- Implementation of key aspects of the Invasive Species Management Strategy to promote sustainable native communities.

Table 2.30 Ecosystem Protection Program Planned Activities/Milestones

Activity	*Due Date*
Forestry	
• Implement the Watershed Forest Management Plan	Ongoing
• Update the Watershed Forest Management Plan	12/24/17
• Revise the Watershed Forest Management Plan	3/31/27
• Continue to conduct forest inventories on City-owned lands, including long-term CFI plots	Ongoing
• Continue to assess and mitigate deer impacts on forest regeneration on City-owned lands	Ongoing
Wetlands	
• Update Wetlands Protection Strategy	3/31/18
• Update the wetland GIS data for the watershed using LiDAR derived data and high resolution photography	3/31/22
• Continue reference wetland monitoring	Ongoing
• Review federal, state and local wetland permit applications	Ongoing
Invasive Species	
• Continue to implement the Invasive Species Management Strategy	Ongoing
• Engage watershed partners and residents to coordinate efforts in invasive species prevention and control	Ongoing

Table 2.31 Ecosystem Protection Program Reporting Milestones

Report Description	*Due Date*
Submit updated Watershed Forest Management Plan	12/24/17
Submit revised Watershed Forest Management Plan	3/31/27

Submit updated Wetlands Protection Strategy	3/31/18
Summary of wetland mapping and connectivity assessment results for the watershed	3/31/22
Submit updated Invasive Species Implementation Strategy	3/31/22
Report on program implementation in the FAD Annual report including: • Updates on forest inventories; • Forestry projects; • Wetland mapping; • Wetland permit reviews; • Wetland protection efforts; and • Invasive species activities.	Annually, 3/31

2.3.9 Nonpoint Source Pollution Strategy for East of Hudson Catskill/Delaware Basins

DEP developed a non-point source program for the West Branch, Boyd's Corner, Croton Falls and Cross River Reservoir basins. DEP addresses concerns in these East of Hudson watershed basins through the continued implementation of the Watershed Regulations, involvement in project reviews, inspection and maintenance of existing stormwater management facilities, a septic repair program, and through a program to reduce stormwater pollution through the construction of stormwater retrofits.

The near-term goals of the program are to continue the reduction of nonpoint source pollution to the four East of Hudson CAT/DEL reservoirs. The initiatives implemented to achieve that goal include:

- Operation and Maintenance – Regularly inspect the existing stormwater management facilities and identify maintenance needs in order to achieve the designed removal efficiencies.
- Reduce the Potential Pathogen Risk – Continue to implement the Septic Repair Reimbursement Program and conduct inspection of sanitary sewers to prevent possible discharges of wastewater.
- Reduce the Potential Pollutant Load – Reduce pollutant loads through a grant program to assist in funding the design and construction of new stormwater retrofits built in CAT/DEL basins located East of Hudson.

Table 2.32 East-of-Hudson Nonpoint Source Protection Program Planned Activities/Milestones

Activity	*Due Date*
Maintenance of EOH Stormwater Facilities	Ongoing
Stormwater Remediation Projects Complete construction of two stormwater retrofits. • Maple Avenue (Cross River); and • Drewville Road (Croton Falls).	12/31/19
EOH Stormwater Retrofit Grant Program DEP will support the design and construction of stormwater retrofits in the four CAT/DEL basins located East of Hudson by providing funding sufficient for the capital costs of retrofits mandated by NYSDEC to treat runoff from high density development within those basins. The ratio of funding to be provided by DEP to the total amount allocated for stormwater retrofits East of Hudson will be no greater than the ratio of the phosphorus reductions required in the CAT/DEL basins to the phosphorus reductions required in the entire East of Hudson watershed.	Approximately 18 months from date of FAD (Est. 12/31/18)
DEP will continue to make City lands available for stormwater retrofit projects constructed by EOH Watershed communities so long as DEP determines that the projects will not pose a threat to water quality or DEP operations related to the water supply.	Ongoing
East of Hudson Septic Repair Program (SRP) • Implement SRP in four CAT/DEL basins located East of Hudson in accordance with program plans • Continue to provide technical assistance in support of EOH septic management programs	Ongoing
Video Sanitary Sewer Inspection • Video Sanitary Sewer Inspection of four CAT/DEL basins located East of Hudson • Complete mapping of new sewer areas (if any) • Complete inspection of targeted areas • Identify potential defects	3/31/21

• Notify entities responsible for remediation of identified deficiencies.	

Table 2.33 East-of-Hudson Nonpoint Source Protection Program Reporting Milestones

Report Description	***Due Date***
Report on implementation of two EOH Stormwater Remediation Projects	Quarterly until completed (3/31, 6/30, 9/30, 12/31)
Report on program implementation in the FAD Annual Report • Maintenance of EOH Stormwater Facilities; • Stormwater Remediation Projects; • Stormwater Retrofit Grant Program; • East-of-Hudson Septic Repair Program; and • Video Sanitary Sewer Inspection.	Annually, 3/31

2.3.10 Kensico Water Quality Control and Related Programs

The Kensico Reservoir, located in Westchester County, is the terminal reservoir for the City's CAT/DEL water supply system. Because it provides the last impoundment of CAT/DEL water prior to entering the City's distribution system, protection of this reservoir is critically important to maintaining water quality for the City. The Kensico Water Quality Control Program reduces non-point source pollution in the Kensico Reservoir through various stormwater and wastewater projects.

The near-term goals of the program are to:

- Operation and Maintenance – DEP will continue regular inspections of the existing stormwater management facilities and identify maintenance needs to maximize their removal efficiency.
- Reduce the Potential Pathogen Risk – Continue to implement the Septic Repair Reimbursement Program, monitor the early warning sanitary sewer overflow protection system, and inspect targeted sanitary sewers in order to reduce possible discharges of wastewater.

- Reduce the Potential Risk of Turbidity at Effluent Chambers – Complete shoreline stabilization project at Shaft 18 and review timeline for assessing and/or dredging effluent chambers to prevent possible resuspension of sediment.

Table 2.34 Kensico Water Quality Control Program Planned Activities/Milestones

Activity	***Due Date***
Inspect and maintain non-point source management facilities within the Kensico Reservoir Basin: • Stormwater management facilities; • Turbidity curtain; and • Spill containment measures.	Ongoing
Complete Shaft 18 shoreline stabilization project	12/31/21
Oversee remote monitoring system at Westlake Sewer Extension	Ongoing
Implement Septic Repair Reimbursement Program	Ongoing
Video Sanitary Sewer Inspection Program: • Complete mapping of new sewer areas; • Complete reinspection of targeted areas; • Identify potential defects; and • Notify entities responsible for remediation of identified deficiencies.	3/31/21

Table 2.35 Kensico Water Quality Control Program Reporting Milestones

Report Description	***Due Date***
Report on program implementation in the FAD Annual Report, including: • O&M of non-point source management facilities; • Westlake sewer monitoring program; • Shaft 18 shoreline stabilization;	Annually, 3/31

• Septic Repair Program; • Video Sanitary Sewer Inspection; • Kensico Scat Sanitary Survey; and • Westchester County Airport, as needed.	

2.3.11 Catskill Turbidity Control

High turbidity levels are associated with high flow events, which can destabilize stream banks, mobilize streambeds, and suspend the glacial clays that underlie the streambed armor. The design of the Catskill System takes into account the local geology, and provides for settling within Schoharie Reservoir, Ashokan West Basin, Ashokan East Basin, and the upper reaches of Kensico Reservoir. Under most circumstances the extended detention time in these reservoirs is sufficient to allow the turbidity-causing clay solids to settle out, and the system easily meets the SWTR turbidity standards (5 NTU) at the Kensico effluent. However, occasionally after extreme rain/runoff events in the Catskill watershed, DEP has had to use the coagulant aluminum sulfate (alum) to enhance the settling rate of suspended solids to control high turbidity levels.

Since 2002, DEP has undertaken a number of studies and implemented significant changes to its operations to better control turbidity in the Catskill System. Many of these measures have been implemented pursuant to the 2002 and 2007 FADs and the Shandaken Tunnel and Catalum SPDES Permits. A comprehensive analysis, the Catskill Turbidity Control Study, was conducted by DEP in three phases between 2002 and 2009. Based on the results of this study, DEP selected several implementation alternatives, specifically: modifying operations, particularly at Ashokan Reservoir, to manage turbidity; a system-wide Operations Support Tool (OST) that allows DEP to optimize reservoir releases and diversions to balance water supply, water quality, and environmental objectives; an interconnection of the Catskill Aqueduct and the Delaware Aqueduct (CAT/DEL Interconnect, CDIC), to improve overall system flexibility; and structural improvements to the Catskill Aqueduct stop shutter facilities to minimize the amount of water diverted from Ashokan Reservoir to Kensico Reservoir during turbidity events while meeting the supply needs of wholesale customers with connections to the Catskill Aqueduct. DEP has now completed implementation of all these measures.

In addition to the structural and operational changes listed above, DEP's multi-tiered water quality modeling program provides support to the program to control turbidity in the Catskill system. Water quality models are an integral part of OST and provide valuable information to guide the operation of the water supply to minimize the impact of turbidity events while considering longer-term system operating requirements.

Catalum SPDES Permit and Environmental Review

The Catalum State Pollutant Discharge Elimination System (SPDES) Permit sets forth the conditions under which the City is allowed to treat Catskill Aqueduct water with alum prior to entering Kensico Reservoir. The City and NYSDEC agreed to an interim operating protocol for the Ashokan Release Channel in October 2011. A modified version of that protocol was incorporated into an Order on Consent (DEC Case No.: D007-0001-11)(CO) which was executed by the City and NYSDEC on October 4, 2013 in connection with the Catalum SPDES permit.

In June 2012, consistent with the Catalum consent order, DEP requested a modification to the Catalum SPDES Permit to incorporate measures to control turbidity in water diverted from Ashokan Reservoir and to postpone dredging of alum floc at Kensico Reservoir until completion of certain infrastructure projects. As part of the environmental review process for the permit modification request, for which NYSDEC is the lead agency, once NYSDEC issues a final scope of work for the Environmental Impact Statement (EIS), the City is required to prepare a draft of the Draft EIS (DEIS) and a draft of the final EIS (FEIS), which will analyze the potential environmental and socioeconomic impacts resulting from the proposed modifications to the Catalum SPDES permit.

The Catalum EIS will evaluate the potential for significant adverse environmental impacts to both the Ashokan Reservoir/lower Esopus Creek and Kensico Reservoir that may occur from implementation of the turbidity control measures proposed to be incorporated into the Catalum SPDES Permit as well as from the postponement of dredging of Kensico Reservoir. The EIS will evaluate a suite of alternatives at Ashokan Reservoir, along the Catskill Aqueduct and at Kensico Reservoir as well as implementation of DEP's turbidity control measures as a whole. Where potential adverse impacts are identified, reasonable and practicable measures that have the potential to avoid, mitigate, or minimize these impacts will be identified.

NRC Expert Panel Review

As required by the Revised 2007 FAD, DEP contracted with the National Research Council (NRC) to conduct an expert panel review of the City's use of OST. The NRC is in a unique position to bring together a group of experts with the breadth of experience and expertise needed to undertake this independent study and to ensure a comprehensive and scientifically objective product.

The goals of the Expert Panel are to:

- evaluate the effectiveness of the City's use of OST for water supply operations, and identify ways in which the City can more effectively use OST to manage turbidity;
- evaluate the performance measures/criteria that the City uses to assess the efficacy of Catskill Turbidity Control, and recommend additional performance measures, if necessary;

- review the City's proposed use of OST in evaluating the proposed modification to the Catalum SPDES Permit as well as the alternatives to be considered in the environmental review of those proposed modifications; and
- review DEP's existing studies of the potential effects of climate change on the City's water supply to help identify and enhance understanding of areas of potential future concern in regard to the use of OST.

The final report from the expert panel will be a public document which will be posted on both the NRC and DEP websites. The recommendations and results will be incorporated in the Catalum EIS as appropriate.

The timing of the work of the Expert Panel is intended to align with the environmental review. To the extent possible, the Expert Panel recommendations will be made available in time to inform the development of the draft of the DEIS which DEP will provide to NYSDEC in connection with the proposed modification of the Catalum SPDES Permit.

In the event that DEP determines, based on the conclusions of the FEIS, that modification of the Phase III Catskill Turbidity Control Implementation Plan is necessary, the City will be required to propose alternative measures for achieving turbidity control and a timeline for implementing those alternatives.

Table 2.36 Catskill Turbidity Control Planned Activities/Milestones

Activity	***Due Date***
Continue to utilize and update OST	Ongoing
Conduct the Expert Panel review of DEP's use of OST. • Upon request of the Expert Panel, provide any information necessary to assess the City's turbidity and water system modeling programs and to respond to the questions the Panel has been asked to address • Provide the final report to the regulators and the Watershed Inspector General (WIG) • Submit final revised performance measures/criteria for evaluating the efficacy of Catskill Turbidity Control measures, taking into consideration the Expert Panel recommendations, for review and approval by NYSDOH, USEPA and NYSDEC.	Ongoing When released by NRC 6 months after NRC Expert Panel report
Annually convene a progress meeting with NYSDOH, USEPA,	Annually, 10/31

NYSDEC and the WIG to provide a forum for discussion of the status of the Catskill Turbidity Control measures, management of turbidity events reported in the March Annual Report and subsequent events, use of performance measures to assess program efficacy, status/results of the DEIS and FEIS, and other matters related to turbidity control. In addition, DEP will facilitate discussion of the following items: • the Expert Panel Report. This discussion may occur at the next annual meeting after the Report is submitted or NYSDOH may, at its option, request that DEP convene a separate meeting to discuss the Expert Panel Report, in addition to the annual meetings. Consistent with NRC's procedures, the City will ask some or all members of the Expert Panel, and/or staff of the organization, to participate in this meeting; • the DEIS. This discussion may occur at the next annual meeting after the DEIS is issued by NYSDEC, or NYSDOH may, at its option, request that DEP convene a separate meeting to discuss the DEIS, in addition to the annual meetings; and • the Catskill Turbidity Control measures report that is due 3 months after issuance of the FEIS. This discussion may occur at the next annual meeting more than three months after issuance of the FEIS or NYSDOH may, at its option, request that DEP convene a separate meeting to discuss this report, in addition to the annual meetings.	

Table 2.37 Catskill Turbidity Control Reporting Milestones

Report Description	***Due Date***
Report on program implementation in the FAD Annual Report	Annually, 3/31
Provide the final report on NRC Expert Panel to the regulators and the Watershed Inspector General (WIG).	When released by NRC
Report on final revised performance measures/criteria for evaluating the efficacy of Catskill Turbidity Controls.	6 months after submission of Expert Panel report

Report on Catskill Turbidity Control Rondout West Branch Tunnel (RWBT) Shutdown Management Plan, including consideration of maintaining water quality during the RWBT repair and shutdown.	One year prior to the planned RWBT shutdown
Report on whether, based on the conclusions of the FEIS, the City intends to modify its use of turbidity control measures identified in the Phase III Catskill Turbidity Control Implementation Plan, and/or implement any other turbidity control measures. If so, the City shall submit a modification of the Phase III Plan, proposing alternative measures for achieving turbidity control and a timeline for implementing those alternative measures.	3 months after NYSDEC issuance of FEIS

2.4 Watershed Monitoring, Modeling, and GIS

2.4.1 Watershed Monitoring Program

DEP conducts extensive water quality monitoring throughout the watershed. The watershed monitoring conducted by the Water Quality Directorate (WQD) is defined in the 2016 Watershed Water Quality Monitoring Plan (WWQMP). The WWQMP is designed to produce the appropriate data for reports related to regulatory compliance, FAD Program evaluation, modeling, and surveillance. The WWQMP is amended through the use of addenda, to address and track changes in the monitoring program as they occur. Significant changes to the monitoring plan are reviewed and approved by NYSDOH in advance of implementation. Water quality results from the routine monitoring programs throughout the watershed are stored in a database, which includes data for reservoirs, streams, and aqueducts. If major changes in watershed activities are anticipated in the near future, DEP will review the monitoring plan and work with regulatory partners to make changes as appropriate.

The water quality database serves both short-term and long-term objectives. Daily results are used for regulatory compliance and operational guidance. Upon completion of a year of data collection, results are summarized in the Watershed Water Quality Annual Report. Over the longer term, a more comprehensive evaluation of the routine monitoring data is conducted to define water quality status and long-term trends, as well as demonstrate the effectiveness of ongoing watershed protection efforts. This evaluation is described in the Watershed Protection Program Summary and Assessment Report produced every five years by DEP. The water quality database is also essential to water quality modeling and long-term planning for climate change. In summary, monitoring data is essential to meet the many long- and short-term aspects of water supply operation, tracking landscape and water quality changes, and planning for the future.

The goals of DEP's Watershed Monitoring Program are as follows:

- Provide water quality results for keypoints (i.e., aqueduct locations), streams, reservoirs, and wastewater treatment facilities collected through routine programs to

guide operations, assess compliance, and provide comparisons with established benchmarks. Describe these results and ongoing research activities in Watershed Water Quality Annual Reports.

- Use water quality data to evaluate the source and fate of pollutants and assess the effectiveness of watershed protection efforts and water supply operations. Provide a comprehensive evaluation of watershed water quality status and trends, and other research activities, to support assessment of the effectiveness of watershed protection programs.
- Actively participate in forums (e.g., seminars, discussion groups) for the exchange of information between DEP and outside agencies regarding watershed research activities and pathogen investigative work.
- Coordinate a technical working group on pathogen studies to discuss the latest research on pathogen sources, transport and fate in the environment; effectiveness of management practices on reducing pathogen concentrations; and identifying additional monitoring and/or research needs.
- Provide after action reports on all non-routine chemical treatments and other significant or unusual events that have potential to impact water quality.

Table 2.38 Watershed Monitoring Program Planned Activities/Milestones

Activities	***Due Date***
Annual participation in educational seminars on watershed monitoring and management	Ongoing
Coordinate annual Pathogen Technical Working Group meeting	Annually, 5/31
Provide after action reports on all non-routine chemical treatments and other significant or unusual events that have the potential to impact water quality	Upon completion as specified for each action

Table 2.39 Watershed Monitoring Program Reporting Milestones

Report Description	***Due Date***
Submit Watershed Water Quality Annual Report, including comprehensive chapters on: • Kensico Reservoir water quality;	Annually, 7/31

• Pathogens; • Modeling; • Educational Seminars on watershed monitoring and management; and • Ongoing Research.	
Submit Watershed Protection Program Summary and Assessment Report	3/31/21

2.4.2 Multi-Tiered Water Quality Modeling Program

The models developed and applied by DEP's Water Quality Modeling Program fall into four general classes:

1. watershed models that simulate hydrology and stream water quality, including processes associated with agricultural, forested, and urban lands, and with water quality including turbidity, nutrients, organic carbon, and disinfection byproduct (DBP) precursors;
2. reservoir models that simulate the effects of watershed hydrology, nutrient inputs, and operations on reservoir nutrient and chlorophyll levels, the production and loss of organic carbon;
3. system operation models that simulate the demands, storage, transfer, and quality of water throughout the entire NYC reservoir system; and
4. stochastic weather generators, which generate synthetic time series of weather variables such as precipitation and air temperature; when combined with watershed, reservoir, and system models, allows evaluation of the impacts of climate change and extreme events on supply system operation and water quality.

These models encapsulate the key processes and interactions that control generation and transport of water, sediment, organic carbon and nutrients from the land surface, through the watersheds and reservoirs, and the supply system.

Research and development is an integral component of the Water Quality Modeling Section's mission, and leads to improvements to existing models, adaptation of new models and development of model applications. Results of these applications have been published in the peer reviewed literature and have distinguished DEP as a leader in the use of models to support water supply management by evaluating the impacts of changing management programs, climate, land use, population, and reservoir operations. For example, through its membership in the Water Utility Climate Alliance (WUCA), DEP was one of four U.S. water utilities that took a national leadership role by demonstrating the use of models to evaluate the impacts on climate change through the Piloting Utility Model Applications (PUMA) initiative. DEP will make published journal articles that are produced by the Water Quality Modeling Group available as a supplement to the Watershed Water Quality Annual Report.

DEP conducts this modeling work with in-house staff, and through the work of full-time post-doctoral researchers and affiliated part-time university experts working under contract. The combined scientific expertise of the DEP scientific staff and the post-doctoral and faculty experts allows state-of-the-art modeling approaches and technology to be combined with detailed system knowledge and supporting data.

The goals of the Water Quality Modeling Program are the development and application of models in the following areas:

- Prediction of turbidity transport in the Catskill system, and Kensico and Rondout Reservoirs, and to provide guidance for reservoir operations to minimize the impact of turbidity events;
- Integration of the Rondout turbidity model into the Operations Support Tool;
- Development and testing of turbidity models for other Delaware system reservoirs, beginning with Neversink;
- Evaluation of the effectiveness of watershed management programs implemented through the FAD/MOA on maintenance and improvement of water quality;
- Continue model development and application to forecast the effects of climate change on water supply quantity and quality;
- Development and testing of models to simulate watershed sources, and reservoir fate and transport, of organic carbon and disinfection byproduct precursors; and
- Allow evaluation of impacts of infrastructure improvements (both during and following), including the RWBT repair project.

Table 2.40 Multi-Tiered Modeling Program Planned Activities/Milestones

Activity	***Due Date***
Update and enhance data describing land use, watershed programs, meteorology, stream hydrology and water quality, reservoir quality and operations data to support modeling	Ongoing
Provide modeling and technical support for Catskill Turbidity Control measures including the applications of OST	Ongoing
Use reservoir turbidity models and OST to support operational decisions in response to episodes of elevated turbidity	Ongoing

Apply and test new models to support watershed management and long-term planning	Ongoing
Development and testing of fate and transport models for organic carbon and disinfection byproduct precursors in Cannonsville and Neversink Reservoirs	Ongoing
Develop future climate scenarios for use as inputs to DEP watershed and reservoir models; scenarios may be based on: (a) historic time series, and (b) synthetic weather generators	Ongoing
Develop model applications that simulate the impacts of future climate change on watershed hydrology, reservoir water quality, and water system operations	Ongoing
Hold an annual progress meeting with regulators to present and discuss modeling results	Annually, 11/30

Table 2.41 Multi-Tiered Modeling Program Reporting Milestones

Report Description	***Due Date***
Submit program Status Report, including updates on the modeling activities described above in the Watershed Water Quality Annual Report.	Annually, 7/31
Report on Modeling Analysis of FAD Programs in the Watershed Protection Program Summary and Assessment Report.	03/31/21

2.4.3 GIS Program

DEP's upstate Geographic Information System is used to manage the City's interests in the lands and facilities of the upstate water supply system, and to display and evaluate the potential efficacy of watershed protection programs through maps, queries, and spatial analyses. The GIS is also used to support watershed and reservoir modeling of water quantity and quality, as well as modeling of water supply system operations. GIS resources are utilized by staff at offices throughout the watershed, directly and via the Watershed Lands Information System (WaLIS).

WaLIS is a custom database application that manages information about the watershed lands and resources owned by DEP and its neighbors. It is a labor-saving system that uses GIS data analyses, relational database management, document management, workflow and reporting

capabilities to support the Watershed Protection Programs Directorate as well as other groups throughout DEP. GIS and WaLIS save users a significant amount of time by automating tasks previously done manually, such as analyzing data, creating maps, tracking/auditing information and generating reports.

Since 1997, the GIS Program has provided technical support and data development for a variety of protection programs and modeling applications in areas such as:

- SEQRA review and regulatory mapping;
- land acquisition prioritization;
- open space mapping;
- infrastructure mapping;
- forestry management;
- water quality compliance monitoring;
- reservoir morphometry (bathymetry);
- stream assessment;
- land cover and impervious surface mapping and tracking;
- modeling evaluation of watershed management programs;
- land use, soil, and meteorological inputs for modeling; and
- climate change impact assessment.

GIS staff routinely:

- acquire, update, or develop new GIS data and metadata;
- perform GIS analysis and research;
- produce maps and statistical reports;
- fulfill requests for Bureau-specific data from other agencies and watershed stakeholders;
- train and support other DEP staff, interns, and local government agents in the use of Global Positioning Systems (GPS) for project-specific data gathering efforts; and
- provide support in the acquisition, management, and analysis of remotely-sensed data such as aerial imagery for watershed-wide land use and topographical (terrain) mapping.

The Bureau's GIS will continue to be a useful tool in four primary areas:

- inventory and track water supply lands and facilities;

- perform analysis of land use and terrain to map development, agriculture, forest, and hydrography;
- provide estimation of the effects of watershed management programs on long-term water quality; and
- support watershed and reservoir modeling of water quantity and quality, and modeling of system operation.

Table 2.42 GIS Program Planned Activities/Milestones

Activity	***Due Date***
Continue to provide GIS technical support for protection programs, monitoring programs, and modeling applications	Ongoing
Continue to develop and update GIS data and metadata, including acquisition of high-resolution aerial data and their derived products as needed	Ongoing
Continue to improve and maintain GIS infrastructure to evolve with changing technology and growing database needs	Ongoing
Continue to fulfill requests for Bureau-specific GIS data from other agencies and watershed stakeholders	Ongoing

Table 2.43 GIS Program Reporting Milestones

Report Description	***Due Date***
Report on program implementation in the FAD Annual Report, including: • GIS technical support for protection programs, monitoring programs, and modeling applications; • Completion or acquisition of new GIS data layers and aerial products in the BWS GIS spatial data libraries; • GIS infrastructure improvement; and • GIS data dissemination summaries.	Annually, 3/31

2.5 Regulatory Program

2.5.1 Watershed Rules and Regulations and Other Enforcement/Project Review

DEP's Watershed Regulatory Program consists of Project Review and Regulatory Enforcement. DEP's Revised 2007 FAD required the City to administer and enforce applicable environmental regulations, which include the Watershed Regulations, including the regulations and standards incorporated by reference, the SPDES, and State Environmental Quality Review Act (SEQRA).

The program is coordinated through a Memorandum of Understanding (MOU) between NYSDEC and the City. The MOU established the Watershed Enforcement Coordination Committee (WECC), which meets quarterly to address non-compliance of Stormwater Pollution Prevention Plans through formal enforcement and/or compliance assistance under specific inter-agency protocols. The WECC process is designed to address instances of significant non-compliance in a timely and appropriate manner.

With completion of all required upgrades of WWTPs as part of the 2007 FAD WWTP Upgrade Program, the City, in accordance with Public Health Law § 1104 and the MOA, is obligated to pay for capital replacement of Watershed Equipment and Methods at all public WWTPs and all (public or non-public) WWTPs that existed or were under construction as of November 2, 1995 and that are required by the Watershed Regulations and not otherwise required by federal or state law. DEP, with the assistance of NYSEFC, will administer a program to fund required capital replacement needs. Replacement work conducted under these provisions will be reported in the FAD Annual Report.

DEP is working towards revising the Watershed Regulations to provide for greater consistency with the State's regulatory program for stormwater and wastewater, and also in response to concerns raised by West of Hudson stakeholders. Among other things, DEP is planning to amend the provisions relating to noncomplying regulated activities, subsurface sewage treatment systems, holding tanks, stormwater pollution prevention plans, and variances. DEP will continue to discuss the proposed revisions with stakeholders before beginning the rulemaking process.

The goals of the Watershed Rules and Regulations program are to continue to:

- Facilitate optional pre-application meeting requests, receive applications for approval of regulated activities, perform review of SEQRA notices, perform project reviews in accordance with the Watershed Regulations and monitor construction activity. The project history is recorded in a database to assist DEP in ensuring that projects undertaken within the NYC watershed have received necessary DEP approvals. Additionally, the database tracks DEP's efforts to meet its regulatory review timeframes and enables DEP to generate the FAD reports;

- Investigate possible violations of the Watershed Regulations, Environmental Conservation Law, and Clean Water Act. Document system failures, illicit discharges and construction site non-compliance; issue Notices of Violation as necessary, and review corrective action plans for all violations. Observe and document remediation efforts and perform close out actions. These activities are recorded in a database to track all Bureau enforcement actions. The Enforcement Activity FAD Report also includes DEP Police involvement and enforcement of environmental and public health requirements, including petroleum/chemical spills in the watershed, and hazardous and solid waste dumping in the watershed; and
- Continue DEP's commitment to pay for Capital Replacement of Watershed Equipment and Methods at eligible WWTPs.

Table 2.44 Watershed Rules and Regulations Planned Activities/Milestones

Activity	***Due Date***
Enforce the Watershed Regulations and other applicable regulations. Continue to promote compliance guidance to applicants seeking approval, through pre-application conferences and providing guidance documents	Ongoing
Work with NYSDEC, in accordance with Addendum S of the DEP/NYSDEC Memorandum of Understanding, to improve coordination of stormwater enforcement and compliance activities between agencies and with the State Attorney General's Office. Such enforcement and compliance coordination will apply, but not be limited to, all effective NYSDEC general permits for construction activity. Stormwater Watershed Enforcement Coordination Committee meetings with involved agencies will be held at least twice per year or more as needed	Ongoing
Develop and submit a timeline for completing proposed changes to the Watershed Regulations which includes meetings with stakeholders as appropriate and a target date for adoption by the City	2 months after 2017 FAD effective date
Update guidance documents affected by Watershed Regulation changes to assist applicants undertaking regulated activities in complying with the Watershed Regulations. Submit the updated guidance documents in accordance with the MOA.	18 months after Watershed Regulation's effective date

Table 2.45 Watershed Rules and Regulations Reporting Milestones

Report Description	*Due Date*
Submit reports consisting of: • Summary table, with corresponding maps, of new project activities that may affect water quality including variance activities and review of new/remediated septic systems in the Catskill/Delaware watershed basins as well as in the Croton Falls and Cross River basins east of the Hudson River; • Summary table (inventory) of all development projects proposed and their SEQRA status, with corresponding maps; and • Summary table of projects under construction, by basin, with corresponding maps.	Semi-annually, 4/30 and 10/31
Submit reports on the status of the City's regulatory enforcement actions in the Catskill/Delaware watershed basins, including the Croton Falls and Cross River basins	Semi-annually, 4/30 and 10/31
Submit an update annually on Capital Replacement of the Watershed Equipment and Methods at eligible WWTPs	Annually, 3/31
Report on the analyses used to determine the phosphorus-restricted and coliform-restricted status of each reservoir, as part of the Watershed Water Quality Annual Report	Annually, 7/31
Submit report on the progress of the proposed changes to the Watershed Regulations until adopted	Semi-annually, 4/30 and 10/31

2.5.2 WWTP Compliance and Inspection

The goal of the WWTP Compliance and Inspection Program is to prevent degradation of source waters from the threat of contamination from WWTPs discharging in the watershed. To ensure compliance with the Watershed Regulations and SPDES permits, the City through the WWTP Compliance and Inspection Group performs onsite inspections, conducts sample monitoring, provides compliance assistance, and takes enforcement actions when needed. The program is coordinated through a MOU between NYSDEC and the City. The MOU established the Watershed Enforcement Coordination Committee, which meets quarterly to address non-compliance through formal enforcement and/or compliance assistance under specific inter-agency protocols. The WECC process is designed to address instances of significant non-compliance in a timely and appropriate manner. In addition, the City's Water Quality sampling program regularly monitors the effluent of all treatment plants in the watershed and uses the

results of sampling to assist WWTP operators to meet compliance requirements or to initiate enforcement actions as necessary.

The general milestones set forth for the Revised 2007 FAD remain relevant and form the basis for program implementation within the 2017 FAD.

Table 2.46 Wastewater Treatment Plant Compliance and Inspection Program Planned Activities/Milestones

Activity	***Due Date***
Perform monitoring at all New York City-owned WWTPs in accordance with their SPDES permits, and grab sample monitoring monthly at all non-New York City-owned WWTPs discharging in the Catskill/Delaware watershed. At least once annually, for the non-City-owned WWTPs, samples shall be collected and analyzed in accordance with the monitoring requirements of each facility's SPDES permit. Continue to provide assistance to owner/operators of non-City-owned WWTPs as needed.	Ongoing
Continue to take timely and appropriate enforcement actions against non-City-owned WWTPs for noncompliance with the Watershed Regulations and SPDES discharge permit requirements, in accordance with the WECC enforcement coordination protocol of the NYSDEC/DEP MOU	Ongoing
Conduct at least four on-site inspections for year-round SPDES permitted facilities and at least two on-site inspections for seasonal SPDES permitted facilities per year at all WWTPs in the watershed	Ongoing

Table 2.47 Wastewater Treatment Plant Compliance and Inspection Program Reporting Milestones

Report Description	***Due Date***
Report on the Wastewater Treatment Plant Compliance and Inspection Program, including: • WWTP Inspection Summary Reports; and • Enforcement Actions.	Semi-annually, 3/31 (July 1 to Dec. 31) and 9/30 (Jan. 1 to June 30)

Report Description	*Due Date*
Submit WWTP Water Quality Sampling Monitoring Report	Semi-annually, 3/31 (July 1 to Dec. 31) and 9/30 (Jan. 1 to June 30)
Report by email to NYSDOH all sewage spills exceeding 500 gallons within 24 hours of the City becoming aware of the spill	Ongoing

2.6 Catskill/Delaware Filtration Plant Design

In 1993, USEPA issued a FAD for the Catskill/Delaware water supply that required the City to proceed with conceptual and preliminary design of a water filtration facility that could be built in the event that filtration was someday deemed necessary. The 1997 FAD added deliverables for Final Design and the completion of a FEIS, but included a provision for the City to seek relief from these deliverables if the remaining conditions of the FAD were being adequately addressed and the Catskill/Delaware water supply appeared likely to meet federal water quality standards for the foreseeable future. The City was able to demonstrate the efficacy of its long-term source water protection strategy and was given relief from preparing a Final Design and FEIS. Having addressed the milestones and conditions of the FAD, and given the long-term outlook for meeting water quality standards, the 2002 FAD, and subsequent FADs, required the City to update the preliminary filtration designs every two years.

While the City remains confident that source water protection is an effective and sustainable public health protection strategy, it is prudent to ensure that filtration plans are kept up to date in case it becomes necessary to construct a plant. Accordingly, DEP is proposing to contract for a comprehensive review and study of filtration technologies and pilot testing to support the creation of a new conceptual design. The existing Catskill/Delaware filtration conceptual design documents are largely based on work completed nearly 25 years ago. The City believes it is appropriate to refresh the design process to take advantage of advances in water treatment technology and knowledge since the original work was completed. The project is expected to include bench-scale and full-scale pilot studies and independent review and input from water treatment experts in the engineering community. A new study of filtration methods and technologies for the Catskill/Delaware filtration plant will ensure that the design concepts and documents are current and reflect current operational and technology needs. This will minimize the overall time to commence filtration in the event that DEP or the primacy agency later determines that filtration is necessary.

Table 2.48 Catskill/Delaware Filtration Plant Design Planned Activities/Milestones

Activity	*Due Date*
Advertise for Request for Proposals	12/31/16
Issue Notice to Proceed	3/31/18
Commence bench pilot studies	11/30/19
Complete pilot studies and submit report	6/30/24
Submit conceptual design	3/31/26

Table 2.49 Catskill/Delaware Filtration Plant Design Reporting Milestones

Report Description	*Due Date*
Report on status of design review	Annually, 3/31
Submit pilot studies report	6/30/24
Submit Final Report on conceptual design	3/31/26

2.7 Waterborne Disease Risk Assessment Program

In order to continue to operate under a Filtration Avoidance Determination, NYC must continue to demonstrate that water consumers served by the NYC water supply are adequately protected against waterborne disease (per SWTR 40 CFR §141.71 (b)(4)). Particularly NYC must be able to sufficiently demonstrate that there are no waterborne outbreaks of giardiasis or cryptosporidiosis.

Since the promulgation of the SWTR in 1989, and the initiation of a NYC Waterborne Disease Risk Assessment Program (WDRAP) in 1993, some significant changes in water quality regulation and water treatment have occurred. In NYC, the Catskill/Delaware UV plant was constructed and began operation in 2012 (also the Croton filtration plant began delivering water into distribution in 2015). With these treatment facilities now in operation, NYC has major additional protection against any risk of waterborne disease due to pathogens such as Cryptosporidium. Public health monitoring under WDRAP continues to serve in assessing and assuring the safety of the water supply.

Table 2.50 WDRAP Planned Activities/Milestones

Activity	*Due Date*
Continue to operate Waterborne Disease Risk Assessment Program	Ongoing
In relation to any water quality "event" involving the NYC water supply (e.g., increased turbidity levels, pathogen detection, disruption of operations), DEP will provide NYSDOH and USEPA with syndromic surveillance system information	Event based
Notify NYSDOH and USEPA whenever DEP is notified by the New York City Department of Health and Mental Hygiene of any signs of community gastrointestinal illness in which public drinking water supply appears to be the source of the illness.	Event based
Continue to implement the Turbidity Action Plan and annually update the contract information	Event based

Table 2.51 WDRAP Reporting Milestones

Report Description	*Due Date*
Submit Annual Report on program and program findings, implementation and analysis	Annually, 3/31

2.8 Administration

Beginning in the early 1990s, DEP hired hundreds of professionals in a variety of fields to support its comprehensive watershed protection program. The efforts of this dedicated staff allow the City to successfully implement the elements of the overall protection effort.

DEP is committed to maintaining the level of staffing, funding, and expertise necessary to support all elements of the City's Long-Term Watershed Protection Program and to meet all associated milestones. Upon request of NYSDOH, DEP will convene a meeting with CWC, Stream Management Program partners, WAC, and/or other FAD program partners, to discuss program administrative issues such as contracts and funding. Additionally, a new section has been added to the annual report to provide the status of key partnership contracts.

Table 2.52 Administration Program Planned Activities/Milestones

Activity	*Due Date*
DEP, in consultation with the New York City Office of Management and Budget, will make a presentation to the NYSDOH/USEPA/NYSDEC on the amount of money appropriated and spent for watershed protection programs and its adequacy to meet program objectives and FAD requirements.	Within 60 days of annual report

Table 2.53 Administration Program Reporting Milestones

Report Description	*Due Date*
Report annually on: • actual filled staff position levels versus available positions for each division and section involved in supporting the watershed protection program, and confirm that resource levels are adequate to ensure that all program goals/FAD requirements are met. Contractor support staff will be noted; • amount appropriated in the City budget for watershed protection programs for the upcoming fiscal year, specifically the amount (capital and expense) spent during the previous year, the amount appropriated for the current year, and the amount planned for the year thereafter. The amount spent, appropriated, and planned will be broken down by program, to the extent practicable. The report will also include costs for technical consultant contracts identified in the FAD; and • status of key partnership contracts including: contract issues (i.e., change orders, planning for successor contract) and funding projections.	Annually, 9/30

2.9 Education and Outreach

The Watershed Education and Outreach Program is a collaborative and comprehensive undertaking that involves DEP working with numerous partners in both the watershed and New York City to educate, inform, teach, train, promote, publicize, and generally raise awareness about the importance of the water supply system and the critical need to protect the source of this water supply for current and future generations. Certain elements of the Watershed Education and Outreach Program are achieved through individual watershed programs and partnerships that target a specific audience with a specific message on a specific topic, whereas other elements are achieved through direct stakeholder engagement or active participation in local community events where information can be disseminated easily and quickly to a broad public audience. The continued use of websites, press releases, newsletters, publications, and newer technology such as social media and e-news complements all these efforts.

Viewed in its entirety, the Watershed Education and Outreach Program embodies the classic example of "the whole is greater than the sum of its parts," in which a collection of individual efforts contributes their distinct accomplishments towards achieving the unified goal of increased knowledge, awareness and appreciation of the water supply system and the City's Long-Term Watershed Protection Strategy. Virtually every watershed protection program funded or supported by DEP accomplishes some degree of public education or outreach, which DEP attempts to track and quantify with a focus on characterizing the key target audiences reached. The primary watershed programs that focus on education and outreach include the CWC Public Education Grants Program, Watershed Agricultural Program, Watershed Forestry Program, Stream Management Program, and Land Management Program (Watershed Recreation).

The goals of the Public Education and Outreach Program are to:

- Continue to track and document the estimated numbers and types of audiences reached via targeted watershed education and/or training programs; and
- Continue to track and document the diverse range of community public outreach events that are sponsored or attended by DEP and its watershed partners.

Table 2.54 Education and Outreach Program Planned Activities/Milestones

Activity	***Due Date***
Continue to support the CWC Public Education Grants Program	Ongoing
Continue to support targeted education and professional training programs for specific adult audiences through the ongoing efforts of existing watershed protection programs	Ongoing
Continue to support school-based education programs for both	Ongoing

upstate and downstate audiences (teachers and students)	
Continue to support and/or participate in various watershed community outreach events and public meetings	Ongoing
Continue to utilize websites, press releases, newsletters, publications and social media to disseminate information about the water supply and watershed protection programs	Ongoing

Table 2.55 Education and Outreach Program Reporting Milestones

Report Description	***Due Date***
Report on program implementation in the FAD Annual Report, summarizing key activities and accomplishments such as: • CWC Public Education Grants Program; • Watershed Agricultural Program; • Watershed Forestry Program; • Stream Management Program; and • Watershed Recreation.	Annually, 3/31

2.10 Reporting

The proposed reporting milestones from the watershed protection programs are compiled below. Details on each report and program can be found in earlier sections of this Long Term Plan.

Table 2.56 List of Reoccurring Reports

Reporting Milestones	***Due Date***
Filtration Avoidance Criteria Report	Monthly
Trihalomethane Monitoring Report	Quarterly
Waterfowl Management Program	Annually, 10/31
Land Acquisition Program	Semi-annually, 3/31, 7/31
Stream Management Program – Action Plans	Annually, 5/31
Stream Management Program – Water Quality Monitoring Study, status reports	Biennially, commencing 3/31/19
EOH Stormwater Remediation Project status report	Quarterly until completed, 3/31, 6/30, 9/30, 12/31
Watershed Water Quality Annual Report	Annually, 7/31
Watershed Protection Program Summary and Assessment Report	3/31/21
WWTP Monitoring Report	Semi-annually, 3/31, 9/30
WWTP Inspection Report	Semi-annually, 3/31, 9/30
Watershed Regulations Project Review Report	Semi-annually, 4/30, 10/31
Watershed Regulations Enforcement Report	Semi-annually, 4/30, 10/31
Progress Report on Revisions to the Watershed Regulations	Semi-annually, 4/30, 10/31
Waterborne Disease Risk Assessment Program	Annually, 3/31
FAD Budget and Staffing Report	Annually, 9/30

FAD Annual Report, including status of the following programs: • SWTR Compliance; • FAD Expert Panel; • Septic Remediation and Replacement Program; • Small Business Septic Program; • Sewer Extension Program; • Community Wastewater Management Program; • Stormwater Program; • Stormwater Retrofit Program; • Land Acquisition Program; • Land Management Program; • Watershed Agricultural Program; • Watershed Forestry Program; • Stream Management Program; • Riparian Buffer Program; • Ecosystem Protection Program; • East of Hudson Nonpoint Source Program; • Kensico Programs; • Catskill Turbidity Controls; • Watershed Monitoring Program; • Watershed Modeling Program; • GIS Program; • Watershed Rules and Regulations; • WWTP Compliance and Inspection; • WWTP Capital Replacement Program; • Catskill/Delaware Filtration Plant Design status; • Waterborne Disease Surveillance Program; and • Education and Outreach Program.	Annually, 3/31

Table 2.57 List of Significant One-time Reports

Reporting Milestones	***Due Date***
Application for renewal of the Water Supply Permit.	6/30/22
Watershed Agricultural Program – Metrics Assessment and Recommendations Report	6/30/23
Watershed Forestry Program – Report on CAI evaluation results	12/31/21 12/31/26
Stream Management Program – basin specific reports	12 months after 2017 FAD effective date
Stream Management Program – brief report on CREP and CSBI partnership	12/31/17
Stream Management Program – CSBI/CREP progress report	6/30/21
Stream Management Program – Local Flood Hazard Mitigation Program evaluation	6/30/18 6/30/21
Stream Management Program – Water Quality Monitoring Study, initial findings report	11/30/22
Stream Management Program – Water Quality Monitoring Study, final report	11/30/27
Streamside Acquisition Program Evaluation	12/15/18
Updated Watershed Forest Management Plan	12/24/17
Revised Watershed Forest Management Plan	3/31/27
Updated Wetlands Protection Strategy	3/31/18
Summary Report on Wetland LiDAR Mapping	3/31/22
Updated Invasive Species Implementation Strategy	3/31/22
Final revised performance measures/criteria for Catskill Turbidity Controls	6 months after NRC Expert Panel Final

	Report
Catskill Turbidity Control RWBT Shutdown Management Plan	One year prior to the planned RWBT shutdown
Report on whether the City intends to modify its use of turbidity control measures	3 months after NYSDEC issuance of FEIS
Watershed Protection Program Summary and Assessment Report	3/31/21
Catskill/Delaware Filtration Plant – pilot studies report	6/30/24
Catskill/Delaware Filtration Plant – final conceptual design	3/31/26