Implementation of New York City's Watershed Protection Program and Compliance with the 2017 Filtration Avoidance Determination

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Contents

Acronyms

BMPs	Best Management Practices
BWS	Bureau of Water Supply
CATALUM	Catskill alum
CDUV	Catskill Delaware Ultraviolet Light Facility
CFR	Code of Federal Regulations
CFU	Colony Forming Units
CREP	Conservation Reserve Enhancement Program
CSBI	Catskill Streams Buffer Initiative
CWC	Catskill Watershed Corporation
CWMP	Community Wastewater Management Program
EFC	New York State Environmental Facilities Corporation
EIS	Environmental Impact Statement
EOH	East-of-Hudson
FAD	Filtration Avoidance Determination
FMP	Forest Management Plan
GCSWCD	Greene County Soil & Water Conservation District
GIS	Geographic Information System
LAP	Land Acquisition Program
LFA	Local Flood Analysis
MAP	Management Assistance Program
MOA	Memorandum of Agreement
NASEM	National Academies of Science, Engineering, and Medicine
NMC	Nutrient Management Credit
NOV	Notice of Violation
NTU	Nephelometric Turbidity Unit
NEIWPCC	New England Interstate Water Pollution Control Commission
NYCDEP	New York City Department of Environmental Protection
NYCDOHMH	New York City Department of Health and Mental Hygiene
NYCFFBO	New York City Funded Flood Buy-Out
NYCRR	State of New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OST	Operations Support Tool
PFM	Precision Feed Management
SEQRA	State Environmental Quality Review
SMP	Stream Management Program
SPDES	State Pollutant Discharge Elimination System
SWTR	Surface Water Treatment Rule
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UV	Ultraviolet Radiation
WAC	Watershed Agricultural Council
WAP	Watershed Agricultural Program
WDRAP	Waterborne Disease Risk Assessment Program
WFP	Whole Farm Plan
WIG	Watershed Inspector General
WOH	West-of-Hudson

WR&Rs	Watershed Rules and Regulations
WSP	Water Supply Permit
WWQMP	Watershed Water Quality Monitoring Plan
WWTP	Wastewater Treatment Plant

Background and Purpose

Since 1989, the federal Surface Water Treatment Rule (SWTR) has required public water systems using surface water to provide filtration. In rare circumstances, a system can be granted filtration avoidance if it can successfully implement a comprehensive plan to protect source water quality. New York City's Catskill/Delaware supply has operated under a series of Filtration Avoidance Determinations (FAD) since 1993, with each successive FAD based on an evolving suite of watershed protection programs. In December 2016, the New York City Department of Environmental Protection (NYCDEP) submitted the most recent plan for the long-term protection of the Catskill/Delaware water supply. Implementation of the plan, which was entitled *New York City Department of Environmental Protection 2016 Long-Term Watershed Protection Program* ("2016 Long-Term Plan"), would ensure effective watershed protection and compliance with filtration avoidance criteria for the Catskill/Delaware water supply. In December 2017, upon completion of review of the plan and in consultation with the United States Environmental Protection Agency (USEPA), the New York State Department of Health (NYSDOH) concluded that the City's plan would provide adequate watershed protection and consequently issued the 2017 Filtration Avoidance Determination (FAD), covering the period from 2017 to 2027. The 2017 FAD requires the City to implement the watershed protection plan outlined in its 2016 Long-Term Plan and includes certain additional requirements and clarifications. As a result, the City's commitments and obligations are defined by both the City's 2016 Long-Term Plan and the 2017 FAD.

The 2017 FAD requires that NYSDOH, in consultation with USEPA, conduct a review of the City's implementation of the 2016 Long-Term Plan and compliance with the requirements of the 2017 FAD, with a report on the findings of that assessment issued by July 31, 2021. This review, along with a number of other elements, will form the basis for any revisions to the 2017 FAD, scheduled for July 2022. Other key components of the overall FAD review process include:

- *2021 Watershed Protection Program Summary and Assessment* (March 2021) report by the City;
- National Academies of Sciences, Engineering, and Medicine *Review of the New York City Watershed Protection Program* (August 2020);
- Feedback from Watershed Stakeholders: Following the release of the NASEM report, NYSDOH and USEPA participated in a series of meetings organized by NYCDEP with various Watershed stakeholders to gather feedback on the NASEM recommendations and FAD program implementation;
- *2021 Long-Term Watershed Protection Program* (December 2021);
- Issuance of a draft Revised 2017 FAD;
- State Environmental Quality Review Act (SEQRA) assessment of the potential environmental impacts of implementation of the Revised 2017 FAD;
- A Public Comment Period in early 2022 to solicit comments on the draft Revised 2017 FAD; and
- Issuance of a final Revised 2017 FAD.

Although the 2017 FAD was issued for a period of ten years, at any time NYSDOH may make a determination that the City no longer provides adequate protection of its Catskill/Delaware water supply and may require the City to filter that supply.

The remainder of this evaluation will address the City's progress in implementing major programs under the 2017 FAD, as well as certain regulatory compliance requirements. Unless otherwise stated, for the purposes of this report, the City's compliance with the 2017 FAD requirements was assessed for the period from 2017 to 2020.

Summary

Overall, the City has satisfied the obligations specified in the 2017 FAD. There have been no violations of source water quality and no waterborne disease outbreaks in the City related to drinking water. For most programs, the City has met deadlines and achieved program goals. The completion of the National Academies of Science, Engineering, and Medicine expert panel review of the City's Watershed Protection Program is a noteworthy achievement during the assessment period. The panel reaffirmed the success of the City and its partners in protecting source water quality and made recommendations for improvements going forward. Other accomplishments have been achieved through the Catskill Watershed Corporation's (CWC) Environmental Infrastructure Programs including: the completion of community wastewater projects in Shandaken, Claryville, and West Conesville; and the remediation of 1,125 septic systems and pump out of 1,676 septic tanks in the West-of-Hudson (WOH) Watershed from 2017 to 2020. In addition, planning is underway for the future $48 million Shokan community wastewater project. Since inception, the suite of Land Acquisition Programs has allowed the City to protect 187,507 acres (as of March 2021). When combined with lands protected by other agencies and organizations, 39.7% of the City's watershed is permanently protected. The Watershed Agricultural Program continues to implement backlog Best Management Practices and is on track to fulfill the deliverable. Progress has been made in flood hazard mitigation programs through the CWC and the City's Stream Management Program (SMP) partners. The SMP awarded a total of $68.9 million to fund the existing five SMP partner contracts for an additional five-year period. These programs help remove potential water supply contaminants from areas vulnerable to flooding, while at the same time reducing the risks of flooding in Watershed communities. The SMP has been responsible for the remediation and stabilization of numerous stream channels and streambanks, reducing inputs of eroded sediments and increasing resiliency to future storms, and completed 119 projects rehabilitating approximately 12 miles of streams and riparian buffers. This included the design and construction of 10 Water Quality Stream Projects (full channel restoration or streambank stabilization) treating 2.2 miles of unstable stream reaches. The Catskill-Delaware Ultraviolet Light Facility was operational during the entire assessment period, helping to ensure the safety of the City's unfiltered drinking water supply.

Some FAD program elements have experienced delays in implementation, including several of the Watershed Agricultural Programs and the Septic Remediation and Replacement Program. In a number of cases, the COVID-19 global pandemic led to implementation delays outside of the City's control (such as government "stay-at-home" orders) or interfered with the timely processing of contracting invoices. For example, several community wastewater management projects have taken longer to complete than expected, due in large part to the extensive coordination needed between the City and the communities on both technical and administrative matters (such as easements). Funding for the Shokan community wastewater project required a contract amendment to increase the project budget from $25 million to over $48 million. NYSDOH has generally accepted the City's explanations and justifications in such cases. However, continuous program implementation has been put at risk by issues with the City's contracting processes. NYSDOH and USEPA encourage the City to investigate ways to address these issues to help ensure that FAD due dates are met and watershed protection is maintained.

NYSDOH, in consultation with USEPA, concludes that the City has a comprehensive and robust watershed protection program, which, overall, is being effectively implemented by the City and its watershed partners. The City continues to provide drinking water to NYC and upstate consumers that meets all requirements of the SWTR.

Regulatory Requirements and Structure of the 2017 FAD

The conditions that a public water system must satisfy in order to avoid filtration of a surface water supply are defined in the SWTR and its amendments, specifically 40 CFR §141.71, §141.171, and §141.712 of the federal code of regulations and 10 NYCRR Part 5, Subpart 5-1, Section 1.30(c) of the NY State Sanitary Code. The federal code separates the filtration avoidance requirements into two categories: source water quality conditions and site-specific conditions. Source water quality conditions include fecal or total coliform levels and turbidity levels measured immediately prior to the first point of disinfection. Site-specific conditions include disinfection, watershed control program, inspection, and distribution water quality requirements, as well as a requirement that the system must not be identified as a source of a waterborne disease outbreak.

The 2017 FAD summarizes the programs, along with activities and schedules, that the City and its partners have committed to as part of their watershed protection and filtration avoidance efforts. The FAD programs are grouped into the following broad categories, which cover both the source water quality and site-specific conditions defined by the SWTR:

- Program to monitor/document compliance with filtration avoidance criteria ("Objective Criteria") (FAD Section 2);
- Comprehensive environmental infrastructure programs to reduce pollution from sewage and stormwater (FAD Sections 3.1 – 3.5);
- Various protection and remediation programs, such as Land Acquisition, Stream Management Program and Catskill Turbidity Control, to protect and improve water quality (FAD Sections 4.1 – 4.11);
- Watershed monitoring, modeling and Geographic Information Systems (GIS) (FAD Sections 5.1 – 5.3);
- Regulatory programs to ensure compliance with Watershed Rules & Regulations (WR&Rs; FAD Sections 6.1 – 6.2);
- Construction of the CDUV Facility (FAD Section 7);
- In-City programs to assess risk of waterborne disease and prevent cross connections between the water distribution system and contaminant sources (FAD Sections 8.1 – 8.2);
- Administrative Program to ensure adequate staffing and funding for FAD programs (FAD Section 9); and
- Education and Outreach to enhance understanding of and strengthen collaboration in watershed protection efforts (FAD Section 10).

The inspection element of the SWTR's site-specific conditions, which is an on-site assessment of the adequacy of the water system's watershed control program and disinfection processes, is performed annually by NYSDOH.

Evaluations of all FAD programs are provided below.

Evaluation of the City's Compliance with the 2017 FAD by Program

Surface Water Treatment Rule Objective Criteria Compliance

FAD Section 2. SWTR Objective Criteria Compliance

2017 FAD Requirements

The SWTR Objective Criteria include numeric requirements for turbidity, fecal coliform bacteria, and disinfection byproducts, as well as requirements for system operations. The water system must provide adequate disinfection and must also have redundant disinfection system components. Under the 2017 FAD, the City must continue to meet all of the Objective Criteria in order to maintain its filtration avoidance status for the Catskill/Delaware system. The 2017 FAD also obligates the City to conduct a monitoring program and to report results in accordance with applicable State and federal regulations.

Evaluation of the City's Compliance

NYSDOH has evaluated the City's compliance with the Objective Criteria for maintaining filtration avoidance through review of the City's monthly monitoring reports and conducting annual inspections of water system infrastructure, treatment processes, and instrumentation. The SWTR specifies that compliance monitoring for source water quality shall be conducted immediately prior to the first or only point of disinfectant application. For the City's Catskill/Delaware water supply, under normal operating conditions, sampling of source water is performed at the Delaware Aqueduct Shaft 18 downtake. Before October 2012, another location known as the Catskill Lower Effluent Chamber was also used, but it has not been in operation due to the long-term shut down of the Catskill Aqueduct between Kensico Reservoir and the Catskill/Delaware Ultra Violet Light Disinfection (CDUV) Facility. As noted in Table 1, the City has satisfied the Objective Criteria's numeric requirements for coliform bacteria for the Catskill/Delaware system.

In addition, the City has not exceeded the maximum concentrations allowed for disinfection byproducts in the distribution system, which are 12-month system-wide running averages of 80 micrograms/liter (ug/L) for total trihalomethanes (TTHM) and 60 ug/L for haloacetic acids (HAA5). As shown in Table 2, the quarterly running annual averages for TTHM and HAA5 have ranged from 34 – 42 ug/L and 37 – 46 ug/L, respectively, during the assessment period. CT values, which are the product of disinfectant concentration and contact time, were adequate during the assessment period (i.e., the daily Inactivation Ratio, or IAR, was always greater than 1.0 during the period).

Table 1. Source Water Turbidity and Fecal Coliform Levels, 2017-2020.

Year	Catskill Lower Effluent Chamber[a]		Delaware Shaft 18 Downtake	
	Maximum 4-Hour Turbidity Measurement (NTU)[b]	Maximum Percent of Fecal Coliform Samples >20 CFU/100mL[c]	Maximum 4-Hour Turbidity Measurement (NTU)[b]	Maximum Percent of Fecal Coliform Samples >20 CFU/100mL[c]
2017	Offline		1.8	0.0%
2018	Offline		1.6	6.3%
2019	Offline		1.2	1.6%
2020	Offline		1.3	1.1%

Notes:
(a): The Catskill Lower Effluent Chamber was taken offline September 13, 2012.
(b): To maintain filtration avoidance status, turbidity level in a representative sample of the source water cannot exceed 5 Nephelometric Turbidity Units (NTU) unless it is determined that the turbidity was caused by an unusual and unpredictable event, and no more than two such events have occurred in the previous 12 months or five such events in the previous 120 months. An event is a series of consecutive days during which at least one turbidity measurement each day exceeds 5 NTU, *see* 40 CFR §141.71(a)(2) and 10 NYCRR 5, Subpart 5-1.30(c)(2).
(c): To maintain filtration avoidance status, at least 90% of water samples collected prior to disinfection must exhibit fecal coliform concentrations no greater than 20 Colony Forming Units/100 milliliters (CFU/100 mL) in the preceding six months of water service to the public, *see* 40 CFR §141.71(a)(1) and 10 NYCRR 5, Subpart 5-1.30(c)(1).

Table 2. Distribution System Disinfection Byproduct Concentrations, 2017 – 2020.

Year	TTHM Quarterly Running Annual Average[a] (ug/L), Range	HAA5 Quarterly Running Annual Average[a] (ug/L), Range
2017	36 – 41	37 – 38
2018	34 – 38	39 – 43
2019	38 – 41	38 – 46
2020	39 – 42	38 – 43

Note:
(a):Filtration avoidance systems serving a population of greater than 10,000 must meet Maximum Contaminant Levels (MCLs) for TTHM of 80 ug/L and HAA5 of 60 ug/L calculated as a running annual average of quarterly results in samples collected from selected points in the distribution system. *see* 40 CFR §141.71(b)(6) and 10 NYCRR5, Subpart 5-1.30(c)(9).

At the entry points to the distribution system, free chlorine residual concentrations were never less than 0.2 milligrams/liter (mg/L) for more than four hours.

In the distribution system, a free chlorine residual was maintained, or a heterotrophic plate count value was less than 500 CFU/mL, in all compliance samples.

The City has also satisfied the system operation requirements, including the operational status of the disinfection facilities at the Kensico and Hillview Reservoirs.

The Revised Total Coliform Rule, promulgated by USEPA in February 2013, established an MCL for *E. coli*, and uses *E. coli* and total coliforms to initiate a “find and fix” approach to address fecal contamination that could enter the distribution system. Based on a review of data submitted to the NYSDOH, the system met the monitoring requirements for total coliform and compliance with the MCL for *E. coli* in the assessment period. The percentage of total coliform positive samples in the distribution system during the assessment period was as follows: 2017: 0.3%; 2018: 0.3%; 2019: 0.2%; and 2020: 0.3%. There were two *E. coli*-positive compliance samples collected during the assessment period (September 3, 2017 at Site 31650 in Manhattan; and August 11,

2018 at Site 46150 in Queens). However, since the required repeat samples did not find total coliform or *E. coli*, there were no MCL violations.

The 2017 FAD included requirements for the City to contract with NASEM 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 the filtration avoidance criteria.

While the due date of January 31, 2018 to issue the "commence work" notice to NASEM was missed by less than two months, the overall project timeline was not affected. NASEM assembled a 17-member, multidisciplinary panel to undertake the assignment. The panel held seven multi-day meeting events from 2018 through 2020, with four of those events open to the public. On August 10, 2020, NASEM released the panel's report and held a public briefing to summarize the panel's recommendations.

The 2017 FAD required the City to convene a public meeting with the regulatory agencies and watershed stakeholders to discuss the panel's findings and recommendations. This meeting was held on December 10, 2020. To ensure that stakeholders had sufficient time to discuss specific program areas, additional meetings were held:

- January 14, 2021 (Land Acquisition Program; Economic Vitality)
- January 28, 2021 (Stream Management Program; Water quality/data analysis)
- February 11, 2021 (Watershed Agricultural Program; Natural Resources programs)
- February 25, 2021 (Environmental Infrastructure programs; Climate change)
- April 29, 2021 (Land Acquisition Program)

All other reporting requirements for this section were satisfied. Therefore, the City has met the objective criteria required to maintain filtration avoidance status for the Catskill/Delaware system.

During this review period, NYSDOH did not issue a Notice of Violation (NOV) to the City. In comparison, one NOV was issued during the previous assessment period (related to wind-induced turbidity in Kensico Reservoir during Hurricane Sandy in 2012), and seven NOVs (monitoring violations) during the period 2007 to 2011.

Any violations that NYSDOH issues to the City require the submission of Corrective Action Plans that document the steps taken to remedy the protocols, operations, and site conditions that led to the violations. The City continues to work collaboratively with NYSDOH to minimize future occurrences of violations.

Environmental Infrastructure Programs

FAD Section 3.1 Septic and Sewer Programs

2017 FAD Requirements

The identification and remediation of septic systems that are sub-standard, likely to fail, or failing is important in protecting public health and water quality for several reasons. First, an improperly working septic system does not protect against environmental exposure to pathogenic microorganisms and viruses that are present in sewage. This is not only a danger to the City's

water supply, but also to local residents who can be exposed to human waste. Second, a poorly functioning septic system can release nitrogen, phosphorus, and organic matter to waterways. These nutrients can lead to excessive growth of algae and increased eutrophication, potentially leading to water supply issues such as: harmful algae blooms; loss of deep-water oxygen; iron and manganese problems; and taste and odor issues. Furthermore, increased organic matter from algae, septic systems, and sewers, as well as from agricultural and natural watershed sources, can lead to elevated disinfection by-products when raw water is chlorinated.

The 2017 FAD requires the City to continue to implement a Septic and Sewer Program aimed at preventing the potential water quality impacts of improperly functioning septic systems. The City's West of Hudson (WOH) septic and sewer effort is comprised of the following programs: Septic Remediation and Replacement Program, Septic Maintenance Program, Small Business Septic Program (now the "Expanded Septic Program"), Cluster System Program, and Alternate Design Septic Program. The City works closely with the Catskill Watershed Corporation (CWC) to implement these programs in the WOH Watershed. The City's enforcement of its WR&Rs (in effect since May 1, 1997 and most recently revised in November 2019) is also an important component of these programs. The Sewer Extension Program is inactive, and all program requirements were completed prior to the issuance of the 2017 FAD.

The primary goal of the Septic Remediation and Replacement Program is to ensure funding is in place to remediate or replace approximately 300 failing or likely-to-fail septic systems per year. The Cluster System Program funds the planning, design, and construction of cluster septic systems in thirteen WOH communities. The Expanded Septic Program provides repair funding to small businesses, not-for-profit organizations, and governmental entities. Finally, the Alternate Design Septic Program funds the eligible incremental compliance costs of the septic provisions of the WR&Rs for new septic systems to the extent they exceed state and federal requirements.

Evaluation of the City's Compliance

The City, through CWC, has largely been successful in implementing the Septic Remediation and Replacement Program. This program provides inspections, pump-outs, and, where necessary, repair or replacement of systems for single- or two-family residences in the WOH watershed that are failing or likely to fail. At the time the 2017 FAD was issued, participation was available to residential properties within 700 feet of a watercourse or the 60-day time of travel. In July 2018, the program was opened to all residential properties in the WOH watershed. In 2019, the program was further expanded to include reimbursement for second time repairs, as some of the systems installed at the program's inception have reached their end of life. Between 2017 and 2020, the program managed or remediated 177 to 261 systems annually, bringing the total number of systems repaired to 5,913 since 1997.

In early 2019, due to delays in the registration of the $86 million Septic V contract and concerns about new funding availability, CWC closed the Septic Repair Program to new signups. Related to this issue, in April 2019, CWC moved all remaining funds out of the Alternate Design Septic Program (about $1.4 million) and into the Septic Remediation and Replacement Program to help address funding availability and the program backlog. As of July 2019, there were 468 participants signed into the program. CWC did not begin accepting new applicants into the program until August 5, 2019, when the initial Septic V contract funds were received. In late 2019, CWC began removing applicants from the backlog if they were approved for funding but had not actively made any improvements on their system. A two-year time frame was added to the Program Agreement for new applicants within which repairs to their system must be completed. These actions lowered the backlog to 333 systems by January 2020. CWC again closed the

program to new applicants in August 2020, due to concerns regarding the City's timely payment of contract invoices during the COVID-19 pandemic. The program was reopened for new applicants in April 2021.

As part of the 2017 FAD requirements, the Small Business Septic Program was expanded to include governmental entities and not-for-profit organizations, in addition to small businesses. It is now referred to as the Expanded Septic System Rehabilitation and Replacement Program. Businesses with 20 or fewer employees, not-for-profits with five or fewer locally based employees, and governmental entities are reimbursed by CWC for 100% of the cost of septic repairs. Businesses with 21 or more employees and not-for-profits with 6 or more locally based employees are eligible for reimbursement at a slightly reduced rate (75% of the repair cost up to $100,000 and 100% of the repair cost covered above $100,000). For the period between 2016 and 2020, eleven septic system remediations have been addressed with program funding, bringing the program's total to 29 since inception in 2008.

The 2017 FAD had two requirements under the Cluster System Program. The first requirement was for the City, by June 30, 2018, to work with CWC to determine if modifications to the program rules were needed to facilitate cluster system implementation. The City reported in 2018 that potential changes to the program rules were discussed with CWC. In April 2019, the CWC Board of Directors approved changes to the program rules. By June 30, 2019, the City was required to make an additional $1 million available to the program to cover the eligible operation and maintenance costs for communities that implement a cluster system project. The City missed this deadline by several weeks, as the contract registered July 23, 2019. To date, no communities have applied to participate in this program, although CWC conducts outreach to towns when an area of septic failures may be eligible for coverage under the program.

The Septic Maintenance Program is administered by the CWC. Residents who have participated in the Septic Repair Program or whose septic systems were constructed after 1997 can receive 50% cost reimbursement for septic tank pump-outs or maintenance. This program also provides educational information to homeowners on septic system use and the role of regular maintenance in avoiding expensive system failures and dangerous sewage releases. This program remains popular among watershed residents, and in 2019, eligibility was expanded to small businesses, not-for-profit organizations, and governmental entities. Since 2017, there have been 1,415 septic pump-outs covered by the program, with 504 of those occurring during 2020. A total of 3,127 homeowners have participated in the program since it started in 2004.

The Sewer Extension Program had previously funded the design and construction of wastewater sewer extensions connected to City-owned WWTPs discharging in the WOH Watershed, as an alternate means of addressing failing septic systems. Two sewer extension projects in the towns of Shandaken (connected to the Pine Hill WWTP) and Middletown (connected to the Margaretville WWTP) were completed in 2017 prior to the issuance of the FAD. No additional sewer extension projects were required by the 2017 FAD and none have since been proposed.

In summary, the City has maintained substantial ongoing progress in Septic and Sewer Programs. The Septic Remediation and Replacement Program is meeting its goals and has become accessible watershed-wide, though contracting issues between the City and CWC have interfered with program implementation and remain a contentious issue. The Septic Maintenance Program has seen increasing usage each year and is an important tool for keeping repaired septic systems functioning. The Expanded Septic Program protects water quality while also supporting the economic viability of the WOH watershed's small businesses and not-for-profit organizations. The work performed under these programs contributes directly to the protection of source water quality

in the WOH watershed, while also providing benefit to watershed residents and small businesses. However, lengthy contract approval timelines and recent delays in payments under those contracts have led to interruptions in program implementation. NYSDOH and USEPA encourage the City to work both internally and externally to resolve contracting and invoicing issues in a timely manner to ensure long-term program success.

FAD Section 3.3 Community Wastewater Management Program

2017 FAD Requirements

The Community Wastewater Management Program (CWMP) provides funding for the design and construction of community septic systems, including related sewage collection systems, and/or the creation of septic maintenance districts, including septic system replacement, rehabilitation, and upgrades as well as operation and maintenance of the district. This program is designed to improve water quality and protect public health by reducing the transport of pathogens, nutrients and organic matter into waterways. The City has participated with CWC to facilitate the administration of the program. The participating communities were identified in Paragraph 122 of the Memorandum of Agreement (MOA) of 1997. At the time the 2017 FAD was published ten projects had been completed: Bloomville, Boiceville, Hamden, DeLancey, Bovina, Ashland, Haines Falls, Trout Creek, Lexington, and South Kortright. The 2017 FAD included requirements for completion of design and construction for five additional projects in Shandaken, Claryville, West Conesville, Halcottsville, and New Kingston. In addition, requirements to contract with CWC for the implementation of the Shokan community wastewater system were also included.

Evaluation of the City's Compliance

At the end of 2020, two of the six remaining CWMP projects had been completed. The City issued block grants to CWC for the Claryville project in April 2017 ($8.655 million) and for the Shandaken project in May 2017 ($6.77 million). The Shandaken septic maintenance district includes 73 properties and was completed in September 2020. The Claryville project consists of septic maintenance districts serving 130 properties in the Towns of Denning and Neversink. Construction was completed on the Denning portion in January 2020 and on the Neversink portion in September 2020. These completion dates were in line with the estimated dates included in the 2017 FAD.

In October 2020, the City, in consultation with CWC, proposed updated timeframes for several project milestones which better reflected actual progress than the original dates estimated in the 2017 FAD. These revised milestones included design and construction completion dates for Halcottsville and New Kingston, and the construction completion date for West Conesville. NYSDOH agreed with these schedule changes.

The West Conesville project will connect 54 systems to a community septic system. The City approved the block grant to CWC in July 2017 ($8.411 million). Project design was completed in March 2020 (originally estimated for December 31, 2018). The 2017 FAD included an estimated construction completion date of December 31, 2020. The updated construction completion date has been adjusted to September 30, 2021, and the project is on track to meet that milestone. All underground piping and pump stations were completed by May 2021, and the project was considered substantially complete through June 2021.

The Halcottsville project is a sewer collection system for 53 hookups with a connection to the City-owned Margaretville WWTP. The City approved the block grant of $8.954 million in September 2017. The 95% drawings were completed in December 2020, and property needed for the pump station was acquired by the Town of Middletown. Final design drawings were submitted to the City in February 2021. The updated completion dates for design and construction were adjusted three years to March 2021 and March 2023, respectively. Pre-construction phase activities for this project remain ongoing.

The New Kingston project will be a community septic system for 28 hookups. The City issued a block grant to CWC for the project in October 2018 ($5.2 million). Complications have arisen for this project, as one of the properties needed for the project is subject to a Watershed Agricultural Council (WAC) agricultural easement, and in March 2020, WAC denied the subdivision request on the eased portion of the property. The Town of Middletown is in the process of acquiring the property required for the project through an eminent domain proceeding. As of March 2021, the 95% drawings were completed. CWC is acquiring easements on two properties for pump station construction. The updated completion dates for design and construction were adjusted two years to June 2021 and June 2023, respectively. Pre-construction phase activities for this project remain ongoing.

Preliminary work for the Shokan community wastewater project is underway, but behind the schedule estimated in the 2017 FAD. The contract between the City and CWC to provide funding to implement the Shokan project was due by December 31, 2018, but the contract was not registered by the City until June 6, 2019. The original contract amount for the project was $25 million. The plan originally encompassed approximately 470 connections in Shokan, but the scope was later expanded. The Preliminary Engineers Report was finalized in April 2020. The resulting recommendation from the preliminary engineering report was to construct a large diameter gravity sewer system in Shokan, with conveyance to a membrane bioreactor WWTP and combining the service area of Shokan with that of the Hamlet of Boiceville. This increased the project budget to over $48 million, but would allow for the eventual retirement of the existing Boiceville WWTP. In August 2020, the City approved an increase in the project block grant to $48,715,000. The CWC Board of Directors approved the contract change order in April 2021 increasing the total project agreement funding to $49,346,500. In May 2021, the Town of Olive passed a resolution to purchase the property to locate the wastewater treatment plant. In July 2021, CWC reported that negotiations on the sewer district were in progress. As noted above, the City proposed adjustments to project milestone dates, which added two years to the original estimates for design and construction completion, now expected complete by December 31, 2022 and December 31, 2024, respectively. NYSDOH and USEPA agreed with these changes. The Shokan project is currently in the design phase.

The Community Wastewater Management Program has been an effective tool for protecting the WOH Watershed from potential contamination due to failing septic systems in relatively densely populated areas. Although a number of these projects have faced challenges, including the COVID-19 pandemic, the water quality protections offered by the projects completed under this program, including for both pathogens and nutrient impacts, are critical to the long-term compliance with the SWTR. NYSDOH and USEPA stress the importance of completing the Shokan project without further delay, as septic system failures located in the Shokan/Boiceville service area are within the 60-day travel time to the Ashokan Reservoir, creating an adverse risk to water quality and public health.

FAD Section 3.5 Stormwater Programs

2017 FAD Requirements

The 2017 FAD requires the City to implement and fund the Stormwater Programs as described in the 2016 Long-Term Watershed Protection Program and meet several other activity and reporting requirements for these programs. The Stormwater Programs are comprised of the Stormwater Retrofit Program, the Future Stormwater Controls Program, and the Local Technical Assistance Program. The Retrofit Program, administered by the CWC and the City, provides grants to implement best management practices (BMPs) and improve water quality for pre-1997 stormwater structures. The Future Stormwater Controls Program, also administered by CWC and the City, funds the incremental costs required by the City's WR&Rs, which are in addition to federal and state requirements. The 2017 FAD requires the City to sign a contract by May 31, 2019 with CWC to replenish $4,720,869 in Future Stormwater Funds. The Local Technical Assistance Program, administered by the CWC and the City, provides grants to support watershed protection and enhance quality of life in watershed communities. In addition, the City is required to ensure adequate funding for an engineering position to assist applicants in complying with the City's WR&Rs.

Evaluation of the City's Compliance

During the period of 2016 to 2020, fourteen stormwater retrofit projects were funded and completed for a total of approximately $4.4 million, in addition to four planning and assessment projects. The funding focused on street drainage, stormwater separation, a vacuum truck, a street sweeper, and highway maintenance activities.

The Local Technical Assistance program completed two projects between 2016 and 2020, both concerning the Town of Roxbury. Additionally, CWC awarded Local Technical Assistance Program funds to two watershed townships, Lexington and Olive, to update local flood relocation studies. Both studies were completed in 2019. With funding from the City, CWC continued to employ a staff person who was available to assist applicants who needed to comply with the stormwater provisions of the WR&Rs.

The MOA 128 Program reimburses municipalities and large businesses 100% of additional compliance costs, and small businesses 50%, for costs incurred as a result of the City's WR&R, but not otherwise required by federal or State law. The City contracted with CWC to provide $4,720,869 to replenish the Future Stormwater Funds to be used in accordance with MOA Paragraph 128. This contract registered prior to the FAD due date, and payment was made on July 1, 2019.

The MOA 145 Program reimburses low income housing projects and single-family home owners 100% and small businesses 50% of eligible stormwater costs. In 2018, the City transferred administration of the MOA 145 Program to CWC and provided $2.5 million in initial funding to CWC.

NYSDOH and USEPA believe that the Stormwater Programs have been effective and are an important part of the City's watershed protection program.

Protection and Remediation Programs

FAD Section 4.1 Waterfowl Management Program

2017 FAD Requirements

The Waterfowl Management Program was developed to evaluate and mitigate pollutant impacts such as fecal coliform bacteria and phosphorus deposition from migratory and resident water birds. The program was initiated in 1993 in response to elevated levels of coliform bacteria at Kensico Reservoir. The program was later expanded to include West Branch, Rondout, Ashokan, Cross River, Croton Falls, and Hillview Reservoirs. Bird harassment and deterrence techniques are utilized to prevent waterfowl from inhabiting the reservoirs.

Bird deterrence methods include nest and egg depredation, overhead wires, bird netting on shaft buildings, meadow maintenance, and other methods. Bird dispersal methods include the use of pyrotechnics, motorboats, airboats, remote control boats, propane cannons, and other methods to physically chase or deter waterbirds from inhabiting the reservoirs.

Evaluation of the City's Compliance

The City has met all waterfowl management requirements for this program. Avian dispersal techniques were used on Kensico between August 1 and March 31 of each year and year-round on a daily basis on Hillview Reservoir. Bird dispersal was not required at West Branch, Rondout, Ashokan, Cross River, or Croton Falls Reservoirs during the assessment period. Bird deterrent measures were practiced as needed on all the reservoirs covered by this program. At Kensico Reservoir, the City also performs wildlife sanitary surveys in and around the Delaware Aqueduct Shaft 18 area prior to large precipitation events to prevent wildlife excrement from washing into the reservoir. The City also collected the common baitfish, alewife, from around the Catskill Influent Chamber due to being a food attractant for gulls and certain duck species. All required Summary of Waterfowl Management Program reports were submitted on time.

In addition, while not a FAD reporting requirement, the City submits monthly Hillview Reservoir Wildlife Management Activities reports to NYSDOH in accordance with the 2019 Hillview Consent Decree requirements. The Waterfowl Management Program is a critical component of the City's watershed protection plan, and remains an important element of source water protection from contamination by fecal coliform bacteria.

FAD Section 4.2 Land Acquisition Program

2017 FAD Requirements

The goal of the Land Acquisition Program (LAP) is to ensure that environmentally sensitive watershed lands remain permanently protected, either through fee simple purchase or

conservation easements in order to avoid future degradation in water quality. The terms and conditions of the LAP are defined by the City's Water Supply Permit (WSP), initially issued by NYSDEC in 1997 and renewed in 2010. The WSP was most recently modified in 2016 to reflect the City-Funded Flood Buy-Out program.

The 2017 FAD requires the City to adequately fund the LAP with funds totaling $69 million deposited into the land acquisition segregated account, and it commits the City to solicit to purchase, in fee simple or through conservation easement, at least 350,000 acres of land through 2024. Up to 20,000 acres per year of acres solicited for the Pilot Streamside Acquisition Program (SAP), City-Funded FBO (NYCFFBO), and Watershed Agricultural Council (WAC) Farm and Forest Easement programs are counted towards this solicitation goal.

Additional requirements for this program include biennial submission of the solicitation plan, modifications to the Long-Term Land Acquisition Plan based on stakeholder comments, providing local consultation funds to assists towns and villages in their review of parcels proposed for acquisition, executing a new agricultural easement contract with WAC, and funding for the Catskill Center to continue implementation of the SAP.

A number of reporting requirements were included in the 2017 FAD. These include program status reports on the NYCFFBO, SAP, and Pilot Forest Conservation Easement, as well as those on the potential need for a program focused on agricultural land that is at risk of foreclosure or farms with retiring farmers, participant incentives for SAP, and an evaluation of riparian buffer protection in the Kensico and EOH FAD Basins.

Evaluation of the City's Compliance

The LAP continues to be a successful program and has met most goals set forth in the 2017 FAD. Solicitation goals have been met, the City has successfully developed re-solicitation strategies for specific landowner and property types, and the protected status of high priority sub-basins is steadily increasing. As of March 2021, the City owns or controls 187,507 acres in total, which represents 18.1% of the watershed. Since 2017, the City and its partners have added 12,730 acres to these holdings. Of the total acreage, 45,345 acres are considered riparian, which is the area within 300 feet of a watercourse. Together with lands protected by other agencies and organizations, 39.7% of the City's watershed is permanently protected.

The 2017 FAD requires funding for LAP in the amount of $23 million to be deposited on three occasions into the land acquisition segregated account. These deposits occurred in 2018 and 2020, and the next installment is due by July 1, 2022.

The FAD requires the City to submit plans for each two-year period to solicit 350,000 acres through 2024. The City reports that core LAP solicited 90,782 acres from 2017 through 2020, WAC solicited 118,484 acres, SAP solicited 3705 acres, and FBO solicited 56 acres. Due to the COVID-19 pandemic, less solicitation occurred in 2020.

As the LAP continues to mature, property acquisitions have become more tailored toward protecting lands with a more direct connection to water quality protection. During stakeholder meetings in 2016 and 2017 as the FAD was being developed, the City updated the town-level assessments from the 2010 Final Environmental Impact Statement (FEIS) for 21 towns. This work was done in part to understand the potential impact of LAP on the remaining developable land in the watershed. In April 2018, as required by the FAD, the City proposed modifications to the 2012-2022 Long-Term Land Acquisition Plan which increased the Surface Water Criteria

(SWC) used for property solicitation in Priority Areas 2, 3, and 4, along with other changes to solicitation. For example, the SWC was increased from 7% to 15% for properties not adjoining City lands, and outgoing solicitations were eliminated in towns where the City had, since 2010, acquired 4000 acres or met 100% of the 2010 FEIS projections. Core LAP fee simple parcels between 20-100 acres acquired since 2018 have an average SWC of 41%.

Under the NYCFFBO, the City has closed on 17 properties covering 90 acres since the program began in late 2016. The first evaluation report was submitted in June 2018 as required, and its general findings were that the program was successful but did identify several areas of concern (such as relocation of commercial businesses and critical facilities, and municipal opt-in for proposing eligible parcels). The second evaluation report was submitted in June 2021.

The 2017 FAD required the City to continue implementation of the Pilot SAP in the Schoharie basin. The program is operated through contract with the Catskill Center for Conservation and Development. From 2017 through 2020, SAP has acquired 208 acres through 27 purchase contracts. As the program has developed, an effort has been made to subdivide properties as needed to maintain developable land, while protecting the riparian acreage. The City also convened a stakeholder workgroup to explore payment approaches or monetary incentives to increase landowner participation, while balancing the principles of fair market value and willing seller/willing buyer. This effort culminated in a FAD deliverable due March 31, 2019 which described several financial and non-financial approaches. These included incentives such as an additional $2,000 to sellers with properties over 85% SWC and an additional $3,000 for properties valued under $40,000. A new purchase contract that includes an option agreement is also being developed, with a focus on streamside landowners with contiguous properties. Discussions have continued on third-party ownership of SAP parcels and potential local subdivision ordinance revisions to assist with SAP implementation.

An additional requirement had the City provide an additional $3 million to the Catskill Center to implement the SAP through at least 2022. The City fulfilled this requirement, although the deadline of June 30, 2019 was missed by several weeks. An evaluation report on the program was submitted as required in December 2020.

Expansion of SAP from the Schoharie basin to the entire WOH watershed will require a written determination from NYSDEC (in consultation with NYSDOH, the City, other agencies or local governments) as it is required by the 2010 WSP. The City would then be required to provide an additional $8 million to the Catskill Center to fund the program through the end of the 2017 FAD. If NYSDOH determines the program expansion requires additional funds, the City is allowed to use funds from the core LAP segregated account.

Under the Enhanced Land Trust Program, the City and watershed stakeholders developed a program whereby certain large properties with habitable dwellings may be pursued by land trusts for eventual acquisition of the vacant land portions by the City. Five WOH towns opted into the program, which included six eligible properties. To date, none of these have been acquired and the City does not anticipate any transactions will develop. The City continues to support the Land Trust Alliance with assistance for alliance programming and scholarships to help staff of watershed-based land trusts attend its annual meeting.

Under the Farm Easement Program, WAC executed and closed on 11 contracts to purchase 1,939 acres of farm easements from 2017 through 2020. The City was required to execute and register a contract or contract amendment with WAC to provide $11 million to continue the

program for the remainder of the 2017 FAD. Registration of this contract was delayed in part to allow time for the City's financial audit of WAC to be completed.

The Pilot Forest Easement Program executed and closed on nine contracts covering 2980 acres during the review period. The 2017 FAD included a requirement for the City to issue a status report by December 2020, but at the City's request, NYSDOH agreed to receipt of the report in December 2019. The status report recommended that the program should be continued for the remainder of the 2017 FAD, with further refinement to property selection criteria and preparations for increased stewardship activities as the program matures. In February 2020, NYSDEC solicited stakeholder input regarding the continuation of the program. Should NYSDEC determine that the WAC FCE Program will continue, the 2017 FAD requires the City, within 18 months of that determination, to provide WAC with a minimum of $8 million to continue the program for the remainder of the 2017 FAD.

The City was required by June 30, 2018 to execute and register a contract with CWC to increase the cap on funding for the Local Consultation Funds Program to $40,000 per incorporated town or village. This program assists towns and villages in their review of proposed parcels to be acquired by the City. In addition, the City was required to provide $5000 per municipality to review the updated Town Level Assessments. These contract changes were registered on February 15, 2018.

As part of the stakeholder discussions leading up to the 2017 FAD, one discussion topic related to demographic trends among watershed farmers and the need to keep those farms with working lands in production. These "transitioning farms" were defined as agricultural land that is at risk of foreclosure or farms with retiring farmers. A workgroup was convened to explore the feasibility of a program that would protect the majority of each transitioning farm by securing a conservation easement on the majority of the farm. A report on the findings of this workgroup was submitted as required by June 30, 2018, which recommended that no new programs to assist transitioning farms be developed at that time, due to little or no consensus on program need or direction. Related to this, the Delaware County Board of Supervisors adopted a resolution on June 27, 2018, which stated that the Board did not support "Farm Rescue" as a stand-alone funded program, but did support continued efforts to evaluate the issue. The report recommendations were discussed with NYSDOH, EPA, and NYSDEC in July 2018. NYSDOH made the determination in April 2019 that it had not been demonstrated that a farm transition program would be feasible, compatible with community goals, nor beneficial to watershed protection, therefore the City would not be required to propose a plan to implement such a program.

The City was required to submit a report that evaluated the need, opportunities, and options for enhancing riparian buffer protection efforts in the Kensico and EOH FAD basins, including but not limited to, establishing a riparian acquisition program for these basins, and metrics for evaluating these options. This report was timely submitted in September 2018. It concluded that vegetated riparian buffers are the predominant land cover on privately-owned EOH lands, with 83% of buffer acres vegetated and only 8% of classified as lawn/soil; strong town and county regulations enhance existing federal, State, and City regulations protective of buffers; and voluntary programs are available to landowners interesting in maintaining or enhancing buffers on their properties. Combined with long-term water quality data trends, additional City-funded efforts toward riparian protection in these basins suggest little to no benefit for water quality and public health protection.

During the West of Hudson stakeholder meetings leading up to the 2017 FAD, the concept of land swaps was discussed. This would entail the use of certain potentially developable LAP-acquired parcels with lower water quality protection value to facilitate relocation of development out of

floodplains, thereby providing a benefit to both parties. The concept is allowed under certain scenarios described in Special Condition 21 of the WSP. The 2017 FAD required the City to participate in a stakeholder-convened workgroup to explore this concept, and then submit a progress report on the workgroup's activities by June 2018. While this workgroup was not convened as anticipated, the City has stated its willingness to remain engaged on the topic and proposed a meeting in Summer 2021.

NYSDOH finds that the City has generally met the 2017 FAD requirements for the LAP. As this program continues to mature, it remains important to consider the 1997 Memorandum of Agreement which recognized that the goals of drinking water protection and economic vitality are not inconsistent, and that the goals for the LAP would ensure availability of sufficient developable land to accommodate growth without negative water quality impacts. The 2020 NASEM report recommended that the structure and objectives of LAP be updated, so that the focus is on acquiring the best lands for water quality protection and at the same time recognizing that there are legitimate concerns for community development. The report also recommended a shift in program emphasis and funding toward SAP and NYCFFBO and away from the traditional "core" acquisition program. While recognizing the City's LAP has historically been an important tool for watershed protection, NYSDOH also generally agrees with the 2020 NASEM recommendations to transition the program's overall focus toward protection of floodplains, wetlands, and riparian areas, while balancing community vitality.

FAD Section 4.3 Land Management

2017 FAD Requirements

As significant resources have been invested in securing water supply lands and conservation easements, continual efforts must be made to ensure they are properly monitored, managed, and secured. Reservoir water quality is largely dictated by human activities and the nature of the lands in the Watershed. Therefore, it is important to foster stewardship among recreational users and regulate activities that could negatively impact water quality. Effective and routine monitoring of lands and easements is vital to discovering encroachments, timber trespass, and overuse of lands the City has purchased, as well as potential violations of easements. Various levels of active management are frequently required to foster healthy forests and other natural resources, control invasive species, and allow recreational opportunities.

The 2017 FAD requires the City to monitor water supply lands, provide community benefits through compatible recreation and agricultural uses, enforce the conditions of conservation easements, continually assess and implement strategies to ensure water supply lands are utilized recreationally by the public, perform outreach and events to engage recreational users of City land, and steward non-eased lands.

Evaluation of the City's Compliance

City-owned lands are classified as being High or Standard priority, with inspections taking place annually and at least every five years, respectively. High priority lands consist of places with an elevated security concern (e.g., intakes), areas with existing or future high intensity recreational uses, and properties with a history of trespass or encroachment. Easements are inspected twice each year. Properties are posted within 90 days of closing, and boundaries maintained during site visits and inspections. It is also important for the City and WAC to maintain good relationships

with land owners with conservation easements, particularly when these properties are sold to new owners who may not understand the terms of the easement and/or lack a similar conservation ethic as the previous owner. Along with monitoring, these positive relationships likely contribute to the rarity of easement violations in the Watershed and help the City in its outreach to procure new lands for purchase and easements.

The City manages its land portfolio through a spatial database known as the Watershed Land Information System. The database stores locationally-referenced site inspections, maps, photographs, land use permits, and correspondence.

The City and its partners are successfully increasing low impact recreational opportunities in the Watershed, and have opened more than 142,538 acres for this purpose so far under the 2017 FAD. Abundant outdoor recreational opportunities play an important role in maintaining and improving community vitality. The City has developed an interactive map of the Watershed Recreation Areas (http://www.nyc.gov/html/dep/html/recreation/index.shtml) to allow users to find City-owned properties and the types of permitted recreation in each area. The City performs a variety of outreach and educational activities that promote recreational opportunities, such as the recently completed Catskill Recreation Plan. In 2017, DEP developed a trail policy that helps guide the prudent development of new designated hiking trails. The City also fully opened the Ashokan Rail Trail on the northern side of the Ashokan Reservoir in March 2020.

Managing forestry lands is particularly important in protecting water quality, and one way the City accomplishes this is through the use of conservation easements for agricultural and forest properties. Landowners who have eased lands have to submit certain requests dependent on the work they want to be accomplished. The City has reported that timber harvesting is an activity most requested and averages six requests per year. To encourage forest regeneration due to deer over-browsing, the City supplies deer hunting permits for City land and collaborates with NYSDEC to plan for deer management.

Fishing and boating on City-owned reservoirs are also popular recreational activities. Boats for fishing must steam cleaned, affixed with a free DEP registration tag, and stored in their designated locations, The City also operates a seasonal and day use recreational boating program on Cannonsville, Pepacton, Neversink, and Schoharie reservoirs that allows boaters to use steam cleaned and tagged vessels such as kayaks and canoes. In 2019, DEP extended the recreational boating season by approximately 35 days, and discontinued the four-year Cannonsville Trolling Motor Pilot due to water quality concerns and lack of interest from users. Many boat storage areas are at or near capacity, particularly EOH. DEP is working to expand and improve storage areas and has addressed problems in its revised 2019 recreation rules. There have been no reported significant water quality concerns associated with recreational boating and fishing to date during the 2017 FAD.

In addition to recreation, the City allows use of some of their land holdings for the direct economic benefit of watershed residents. This includes: timber harvesting, maple sap collection, and some agriculture, primarily on land that was actively farmed at the time of purchase. The City reviews all proposed activities and take other measures to protect water quality such as maintaining large buffer strips near streams and not allowing manure spreading during the winter.

Interest in outdoor recreation has increased nationally in recent years, particularly during the COVID-19 pandemic, and increased usage can lead to increases in litter and other environmental degradation. The City and its partners have expanded their outreach and other management activities during the 2017 FAD to promote recreation and minimize its potential environmental

impacts. NYSDOH considers watershed recreation as a net benefit to the sustained protection and vitality of the NYC watershed, and recreational opportunities should continue to grow as the City continues to acquire more land.

Managing City land is an important activity that protects water quality and the City's investment in these lands. NYSDOH recognizes the value of these activities and notes that this program will continue to grow as the City acquires more land.

FAD Section 4.4 Watershed Agricultural Program

2017 FAD Requirements

The Watershed Agricultural Program (WAP) is a voluntary program that represents a successful longstanding partnership between the City and the Watershed Agricultural Council (WAC). The main goal of the program is to reduce pollution associated with agricultural land use and to protect source water quality. Through this voluntary program the WAC, in cooperation with its partners, develops and implements Whole Farm Plans (WFPs). These are compilations of multiple site-specific agricultural Best Management Practices (BMPs) intended to reduce environmental risks and mitigate source water quality impacts associated with farming. The planning process includes identification, prioritization, and mitigation of environmental issues on each participating farm, along with establishment of riparian buffers, when warranted, through the federal Conservation Reserve Enhancement Program (CREP).

The 2017 FAD requires the City to manage the portfolio of active WFPs and conduct annual status reviews on at least 90% of active WFPs.

In order to address a backlog of BMPs which need to be implemented, repaired, or replaced, the City is required by the end of December 2022 to: design, encumber, and schedule for implementation at least 50% of certain new BMPs identified by WAC as of January 2017; and design, encumber, and schedule for implementation at least 50% of all BMPs needing repair or replacement that were identified by WAC as of January 2017. These BMPs will then need to be implemented, repaired, or replaced by the end of calendar 2024.

The City must also: develop and update nutrient management plans on 90% of all active participating large farms that require one; continue to make available the Nutrient Management Credit (NMC) Program to all eligible farms; and implement the Precision Feed Management (PFM) Program on up to 60 eligible farms. The City is also required to develop new, and re-enroll expiring, CREP contracts, and to implement the Farmer Education and Economic Viability Programs. Additionally, the City, in consultation with WAC, is required to assess the adequacy of the current WAP metrics and submit a report on this assessment by June 30, 2023.

Evaluation of the City's Compliance

The City's *2021 Watershed Protection Program Summary and Assessment* indicates that WAC was the first local partnership expected to provide a long-term solution for preventing water pollution associated with farming. In addition, the City intended to support sustainable farming traditions in the Watershed by implementing the WAP. Since WAP's inception in 1993, the City has invested more than $250 million in its contractual obligations, mainly to support development and implementation of WFPs/BMPs on participating farms, stimulate long-term farm land

preservation through the CE program, encourage owners of forested lands to implement forest management plans (FMPs), and provide technical assistance and education on effective water quality protection techniques.

The continued success of the WAP is accomplished through effective partnerships between the farmers and the WAC, as well as Cornell Cooperative Extension, Delaware County Soil and Water Conservation District, and the US Department of Agriculture's Natural Resources Conservation Service and Farm Service Agency. During 2020, both the WAC Executive Director and Board Chair resigned. Currently WAC is actively engaged in addressing fiscal management challenges, with help from the City and a third-party auditor. A final audit report is expected in late 2021, which will help WAC enhance its fiscal controls in support of future program activities. These circumstances, combined with the COVID-19 pandemic, have impacted some aspects of program implementation.

The City reported that during the assessment period, WAP developed six new WFPs on WOH farms and three on EOH farms. The WAP also completed 427 WFP revisions on 59 EOH farms and 368 WOH farms.

Annual status reviews on farms have become an integral part of the WFP process. The 2017 FAD requires the City to conduct annual status reviews of WFPs on at least 90% of all active farms. This requirement was met and exceeded. During the assessment period, the reported average annual completion rate was 95%. The WAP is continuing to manage the current active WFPs and reported that there were a total of 326 active WFPs at the end of 2020. There are 259 WOH WFPs and 67 EOH WFPs, though 32 of the WOH WFPs are for farms that no longer have at least five animal units and 30 farms no longer meet the annual revenue eligibility requirement. The WAP determined in March 2020 that new prospective applicants meet the NYS requirements for agricultural tax exemption.

The City reports that during 2016-2021 WAP has maintained nutrient management plans on an average of 95% of all participating large farms, exceeding the goal included in the 2017 FAD.

During the assessment period, making the NMC program available to watershed farmers resulted in 142 active farms participating which is an 18% increase since the end of 2016.

The WAP continues to meet the metric of up to 60 eligible farms involved with the PFM program, with 44 active farms currently enrolled in PFM. NYSDOH acknowledges that the number of dairy farms in the WOH watershed is decreasing, and that WAP has revised the program to allow for beef farms to fill the remaining capacity in the program.

The 2017 FAD requires the City to design, encumber, and schedule for implementation within two years of being encumbered at least 50% of all BMPs within pollutant categories I-VI, as well as 50% of all BMPs needing repair or replacement, that were identified as of January 1, 2017. The City is on track to meet these deliverables. During the assessment period, the WAP implemented 514 backlog BMPs. This included 283 in pollutant categories I-VI (reducing the backlog in that category by 20%) and 231 repair/replacement BMPs (reducing that backlog by 67%). The official BMP backlog list as of December 31, 2020 includes 780 remaining BMPs in pollutant categories I-VI and 78 in the repair/replacement category.

The City is required, on an ongoing basis, to enroll new, and re-enroll expiring, CREP contracts. The City reported that as of December 2020, a total of 1,687.4 acres of riparian buffers were enrolled in 172 active CREP contracts. Due to a recent reduction in the US Department of

Agriculture (USDA) rental payment rates, WAC is unsure of how new enrollments and re-enrollments into the program will be impacted.

The 2017 FAD requires that a Farmer Education Program be implemented. During the assessment period, WAC conducted 137 events for the Farmer Education Program that were actively attended. WAC continues to implement the Economic Viability Program and has reached 50,000 people annually with the printing of the Pure Catskills guide. WAC promoted local agricultural and forestry products through 102 events and distributed micro-grants funded by the City to farm and forest businesses.

Reporting requirements for the WAP included in the 2017 FAD were met. The City submitted annual reports with all specified reporting information to NYSDOH and USEPA by March 31 each year.

In summary, NYSDOH acknowledges that the City has successfully met all metrics for WAP included in the 2017 FAD. The WAP continues to be an important element of the City's watershed protection program. As with most other programs, the City and its partners have encountered implementation delays in 2020 and early 2021 due to the COVID-19 pandemic, but in general program goals are being met.

FAD Section 4.5 Watershed Forestry Program

2017 FAD Requirements

The Watershed Forestry Program is a longstanding partnership between the City, the WAC, and the USDA 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. The primary focus of the Watershed Forestry Program is to promote good forest stewardship over the long-term for both water quality and economic viability purposes. A secondary focus is to educate students along with the general public in the importance of working forests. To achieve its objectives, the Watershed Forestry Program supports the development of forest management plans (FMPs) and acres of forest land enrolled in New York's forest Tax abatement program (480-a); Management Assistance Program (MAP) projects; the implementation of best management practices during timber harvests; professional training of foresters and loggers; educational programs for landowners; teacher training and educational materials; and watershed model forests that demonstrate working forest principles and to educate both forest landowners and urban residents.

The Watershed Forestry Program provides cost sharing, technical assistance and other incentives to landowners, loggers, and professional foresters to encourage the use of portable skidder bridges and erosion control measures, and the maintenance of forest buffers. The Watershed Forestry Program now puts greater emphasis on encouraging landowners with more than 50 acres of forest to enroll in the NYS Forest Tax Law 480-a tax abatement program which requires a ten-year stewardship commitment. Since 2015, an interactive website for landowners (MyWoodlot.com) has been an educational tool for landowners who do not have a certified forest management plan.

The 2017 FAD requires the City to enroll landowners in New York's 480-a Forest Tax Law and/or develop FMPs through the MAP, with a goal of completing at least 60 projects per year. The City

is also required to provide fund at least 6 Trees for Tribs projects each year, and to coordinate and maintain four existing model forests. Other requirements include training and education for loggers, foresters, landowners, and schools.

Evaluation of the City's Compliance

In compliance with the 2017 FAD, during the assessment period the Watershed Forestry Program continued to aid in enrolling landowners seeking to improve their stewardship of their properties into the 480-a Forest Tax Law, and FMPs, enrolling 40 first-time properties and re-enrolling 202 properties during the assessment period; provided funding to support implementation of 189 MAP projects; and funded 243 forestry BMPs. The program exceeded its goal of completing 6 Trees for Tributaries projects/year; a total of 35 projects were completed during 2016-2020. During the current assessment period, the Watershed Forestry Program continued to implement a wide range of forestry education and professional training programs for landowners, loggers, foresters, school groups, teachers, and other target audiences. Finally, the Watershed Forestry Program continued to maintain for educational purposes four model forests located in Delaware, Ulster, Greene, and Putnam Counties.

The City and WAC completed the second Conservation Awareness Index (CAI) survey in 2020, with this survey being sent to landowners that own more than 10 acres of forest. This survey is a FAD deliverable and aids in determining how informed landowners are regarding conservation decisions about their forests. Results are still being determined.

NYSDOH recognizes the valuable services and contributions to water quality protection provided by the Watershed Forestry Program and supports the City and WAC's efforts to most effectively encourage forest landowners to be good stewards of their lands.

FAD Section 4.6 Stream Management Program

2017 FAD Requirements

The Stream Management Program (SMP) seeks to improve water quality through the protection and restoration of stream stability and ecological integrity for WOH Watershed streams and floodplains. This is accomplished using stream management plans, stream restoration demonstration projects, and locally-led implementation of plan recommendations. The result is long-term stream stewardship, guided by a strong network of partnering agencies and community participation, which seek to improve water quality. The City partners with the Soil and Water Conservation Districts (SWCD) in Delaware, Greene, Sullivan, and Ulster Counties, along with Cornell Cooperative Extension of Ulster County (CCEUC).

Requirements for the SMP are described in the 2016 Long-Term Plan and the 2017 FAD. These include: completing the remainder of Ashokan basin stream restoration projects (a requirement of the Revised 2007 FAD); providing total funding of at least $90 million to the SMP partner organizations for the 10-year period of the FAD; conducting six stream feature inventories to identify water quality threats and support project site prioritization; revegetating at least 5 streambank miles; and submitting biennial action plans for implementation of stream management plan recommendations

The 2017 FAD also requires the City to design and construct at least 24 stream projects that have a principal benefit of water quality protection or improvement, with at least 3 of these in the Stony Clove basin and a total of 8 in the Ashokan basin.

Another requirement is to explore coordination between the Catskill Stream Buffers Initiative and the Conservation Reserve Enhancement Program to pilot the combined efforts of these programs on fallow agricultural lands.

As part of the Local Flood Hazard Mitigation Program, NYCDEP was required to complete the Local Flood Analyses (LFA) and provide funding for LFA-recommended projects through both the SMP partners and CWC. Additionally, the City was tasked with evaluating the LFHMP for its contribution toward water quality protection and to recommend program enhancements, if necessary.

Evaluation of the City's Compliance

The City and its partners continue to successfully implement the SMP. Program implementation contracts with the five SMP partners have been executed and registered, with funding of $68.9 million toward the minimum $90 million requirement for this 10-year FAD period. However, NYSDOH notes that the City's contract with Delaware County SWCD (DCSWCD) lapsed on June 30, 2020 without the successor contract in place. The contract was registered by the City on August 21, 2020 and backdated to ensure continuity with the previous contract.

The City completed the remainder of the required seven stream projects in the Ashokan basin (carried over from the Revised 2007 FAD), constructing two full channel restoration projects on the Beaverkill at Van Hoagland Road, one full channel restoration on Woodland Creek at the Woodland Valley Landowners Association, and a streambank stabilization on the Stony Clove Creek at Wright Road (which followed on a channel restoration and realignment completed there in 2015).

The City submits new Water Quality Stream Projects (WQSPs) for NYSDOH approval each November to be counted toward the program goal of at least 24 projects. During the assessment period, the City completed four WQSPs. Full channel restoration projects were constructed on the Batavia Kill at the Kastanis site and on the Bush Kill at Watson Hollow, and streambank stabilization projects were constructed on the East Kill at Colgate Lake Road and on the West Branch Neversink River at Clothes Pool. The City has recently included the use of Unmanned Aerial Systems (i.e. drones) to increase the accuracy and efficiency of site assessment, project design, and post-construction monitoring. In addition, two-dimensional hydraulic modeling is now used by engineers when designing all WQSPs.

The activities of the Catskill Streams Buffer Initiative are included as requirements under the SMP as well as FAD Section 4.7, *Riparian Buffer Protection Program*. Since 2016, CSBI has planted nearly 43 acres of buffer during 68 projects, covering 5.4 miles of stream length.

During the stakeholder meetings held while the 2017 FAD was being developed, WAC and DCSWCD proposed a pilot program to combine the efforts of CREP and CSBI to focus on fallow agricultural land, with a goal of increasing planted riparian buffers. The resulting FAD requirement had the City fund a pilot, as well as establish program metrics and submit a progress report with recommendations on the future of this partnership. WAC and DCSWCD implemented the pilot in Delaware County, while the GCSWCD and UCSWCD handled the Schoharie and Ashokan basins. The City implemented it in the remainder of the WOH watershed. In consultation with

NYSDOH and USEPA, the City and its partners developed metrics to guide the pilot implementation and evaluation. The metrics were submitted in November 2018 as a FAD deliverable. Following the two-year pilot period, DEP submitted an evaluation report in November 2019 recommending extension of the pilot program for another two years. NYSDOH agreed with the recommendations and approved extension of the program in 2020. Four CSBI projects were completed in Delaware County with 12 of the 19.6 acres of buffer planted enrolled in CREP. The four projects covered 1.5 miles of stream length. No CREP/CSBI projects advanced in Greene, Ulster, and Schoharie counties due to lack of interest from landowners.

The City has met annually with program partners to review SMP priorities and develop rolling two-year "action plans" to prioritize and implement stream management plan recommendations within each WOH reservoir basin. The action plans include descriptions of community-driven projects funded under the Stream Management Implementation Program (SMIP). During the assessment period, a total of 115 SMIP project awards were funded through the SMP partners. Projects funded fell into various categories including education and outreach, planning and research, and design and construction. Overall, of the 275 SMIP projects funded since 2009, 86% have been finalized while 14% are either in design or in the process of implementation.

The 2017 FAD requires the City to submit several deliverables related to water quality monitoring studies. The first is a report discussing the water quality basis for stream project site selection in each basin during the FAD period and a prioritization of streams for inventories. This was submitted in June 2019. In addition, beginning in 2019, the City has reported biennially on the status of the Esopus Creek Watershed Turbidity/Suspended Sediment Study.

The Local Flood Hazard Mitigation Implementation Program was funded with a $17 million contract with the City and CWC, as part of the Revised 2007 FAD. This program supports stream projects to reduce flood impacts, secures sources of pollution (like fuel storage tanks), assists qualifying residents relocating under the Flood Buyout Program, and extends the post-flood debris cleanup program. It also makes funding available to communities to explore LFA-recommended projects. Major activities completed by CWC during this reporting period include: conducting 31 feasibility studies; removing the Mount Pleasant bridge over the Esopus Creek in Mount Tremper; anchoring 64 fuel tanks; acquiring the Breakey Motors property for a floodplain restoration project; managing demolition and site restoration of 9 structures sites acquired under the buyout programs; and efforts to relocate 9 critical facilities and businesses out of the floodplain.

Under the LFA process, the SMP works with area flood commissions on engineering studies using hydraulic models to evaluate areas of WOH population centers at risk for flooding, and then evaluate potential mitigation options. Through 2020, 22 LFAs have been completed or substantially completed, covering 34 population centers. As part of the SMP partner contracts, the 2017 FAD requires the City to make $15 million available to support a minimum of 50-LFA generated projects. During the assessment period, a total of 13 LFA-recommended projects were funded through 20 SMP grants totaling $4.58 million.

The City submitted the first evaluation of the LFHMP as required by June 30, 2020. The evaluation concluded that the program was successful, but also offered recommendations for practices and procedures that could assist in refining program focus, increase program participation, and streamlining implementation. A second program evaluation report is due in 2023.

The CatskillStreams.org website is used as a repository for stream management plans, project information, local flood analyses, watershed stewardship initiatives, research, and as an outreach tool for interested community members. Other outreach and education included mentoring 24

interns, conducting 36 educational and outreach projects, providing information for 21 flood commissions, and presenting at 10 basin-related conferences and symposia.

The 2017 FAD set forth the Watershed Emergency Stream Response and Recovery Plan which requires DEP to participate in a workgroup convened by NYSDEC with stakeholders, to develop a coordinated plan for in-stream and riparian emergency recovery in response to flooding events. This workgroup was not convened during the assessment period.

Finally, semi-annual progress meetings for NYSDOH, USEPA, and NYSDEC have been convened twice per year (one office-based, one field based) as required by the 2017 FAD.

NYSDOH finds the SMP to be an effective tool for restoring, protecting, and enhancing stream stability, thereby reducing sediment contributions from banks and beds to watershed streams. The relationships that the City has fostered with its SMP partners has created a strong platform for implementing this program, which has provided a model for stream management and restoration work throughout New York State.

FAD Section 4.7 Riparian Buffer Protection Program

2017 FAD Requirements

The Riparian Buffer Protection Program focuses on protecting, managing, and restoring riparian buffers along publicly- and privately-owned streamside areas. These efforts are coordinated through the other programs, such as Land Acquisition, Watershed Agricultural, Stream Management, and Forestry Programs. Technical assistance, education, and training are also important components of the Riparian Buffer Protection Program, offering assistance to riparian landowners on various relevant topics, including proper streamside management and riparian plantings.

The program goals for the 2017 FAD require the City to continue the existing programs that are protective of riparian buffers, including implementation of the CREP and the Catskill Streams Buffer Initiative (CSBI), facilitating the supply of native plant materials, and revegetation of at least five miles of streambank throughout WOH watershed by November 30, 2027. The City is also required to continue implementation of the Pilot Streamside Acquisition Program (described earlier under Section 4.2) and explore options for synergies between CREP and CSBI to increase riparian buffers on fallow agricultural lands (described earlier under Section 4.6). The City is also required to continue to seek enhanced management agreements (voluntary 10-year or purchased perpetual) for all current and future stream restoration projects, convene an annual meeting of the Riparian Buffer Working Group, and support the Croton Trees for Tribs Program.

Evaluation of the City's Compliance

During the assessment period, the City continued its efforts on riparian buffer protection throughout the Watershed and made substantial progress on successful implementation of the program. Activities under the Pilot Streamside Acquisition Program were discussed under Section 4.2.

As reported in the *2021 Watershed Protection Program Summary and Assessment*, between 2016 and 2020, the City protected 24,205 acres of buffers under fee simple acquisition and 6,450

acres under conservation easements. An additional 7,385 acres of buffers were protected under the farm easements program through WAC. Through 2020, the City has acquired 18.3% of riparian buffers in the Watershed, which is an increase of 4.7% since the previous NYSDOH compliance assessment period.

The 2017 FAD requires the City to continue implementation of CREP, which is a federal program that compensates farmers for taking riparian lands out of farm production and is implemented in conjunction with Whole Farm Planning under the WAP. This requirement was met.

During the assessment period, 14 new contracts engaging 85.3 acres of riparian buffers were enrolled in CREP. At the end of this enrollment period, a total of 1687.4 acres of riparian buffers representing 153 landowners and 172 active CREP contracts were enrolled. In 2020, the USDA realized that there had been overpayments in rental contracts and proposed the landowners either receive reduced rental payments, end contracts without penalty or appeal the decision with the FSA. A total of 84 landowners representing 111 contracts (1155.91 acres) got re-enrolled with reduced payments, while a total of 37 landowners representing 45 contracts (352.64 acres) chose not to re-enroll. A total of 12 landowners representing 165.1 acres chose to appeal.

During the assessment period, the City completed 33 Riparian Corridor Management Plans for individual landowners, conducted public activities (such as volunteer planting and riparian workshops), developed program marketing and reference materials, and maintained the CSBI website (http://www.catskillstreams.org/catskill-streams-buffer-initiative/). Between 2016 and 2020, the CSBI program completed 68 riparian restoration activities, such as plant installations and bioengineering practices. CSBI partners coordinate contracts to provide local plant stock and seed, which provided 23,000 trees and shrubs for CSBI and CREP-CSBI planting projects.

The 2017 FAD includes a requirement for the City to support the Croton Trees for Tribs program in the EOH watershed, with a goal of six projects per year. Through the WAC Forestry Program, 35 Croton Trees for Tribs projects were completed during 2016-2020, covering 3.6 acres. This program includes an educational component as well, as students are taught how to plant trees in riparian areas.

NYSDOH notes that the Riparian Buffer Protection Program is an integral part of the City's overall watershed protection program and has been effectively implemented by the City. NYSDOH commends the City for the accomplishments of this program.

FAD Section 4.8 Ecosystem Protection Program

2017 FAD Requirements

Well-functioning, intact natural ecosystems are critical for maintaining and enhancing water quality. The Ecosystem Protection Program combines goals and activities from three principle areas: forestry, wetlands, and invasive species. The City provides multi-faceted programming for the protection of wetlands and fisheries along with stewardship of forests and management of invasive species through a combination of research, inventories, assessment, and outreach programs. Silvicultural activities are used to increase the diversity of species and age structure to promote forest resiliency.

Wetland and their surrounding areas are recognized for the important role they play in maintaining and improving water quality, attenuating peak storm water runoff, and contributing to the base flow of streams. The program has collected data on vegetation, soils, and hydrologic information on various types of wetlands in the Catskill/Delaware Watershed for over a decade. This program requires the City to monitor reference wetlands, analyze reference wetlands data, and develop reference standards. One of the primary goals of establishing reference wetlands is to provide metrics to guide the design and assessment of wetland restoration, construction, and enhancement efforts. The information is used to mitigate projects that the City undertakes on its lands, and also those projects that the City reviews throughout the Catskill/ Delaware Watershed in its regulatory programs.

FAD deliverables involve multiple activities including: implementing the Watershed Forest Management Plan; conducting forest inventories on City-owned lands; assessing deer browse impacts and mitigation; updating wetland GIS data using LiDAR derived data and other photography; monitoring reference wetlands; reviewing local, State and federal wetland permit applications; implementing Invasive Species Management Strategy; and engaging local residents and Watershed partners for invasive species control and prevention.

The City was also required to submit an updated Wetland Protection Strategy by March 31, 2018.

Evaluation of the City's Compliance

The City continues to implement the Watershed Forest Management Plan, which aids in planning forest projects to preserve natural resources that co-exist such as riparian areas, endangered and threatened species, and wetlands. During the reporting period City-owned watershed lands increased from 135,000 to 181,000 acres. The amount of acreage under conservation easements increased from 23,700 to 26,150 acres. DEP hired 7 new foresters from 2016-2018 and a new program manager in 2019. During the assessment period, DEP delineated a total of 173 wetlands equaling 100.5 acres associated with 27 forestry projects. On four forest management projects, DEP surveyed for bog turtle habitat to ensure the habitat is not impacted by timber harvests. The bog turtle is a federally threatened and state endangered species.

During the reporting period, 115 new Continuous Forest Inventory (CFI) plots located on recently acquired LAP lands were established in the EOH and WOH watersheds. DEP reports that corrections were made as needed to datasets for CFI plots from 2002 – 2018, and CFI data for the Pepacton, Schoharie and Cannonsville basins were completed in 2019.

Deer continue to impact forest regeneration on City-owned lands. EOH foresters developed a stewardship contract to aid in addressing forest health surrounding the reservoirs and included protection from deer browse. While the initial phase focused on the Croton system, later phases will include FAD basins. The City reports this remains a forest management priority.

During the assessment period, the City submitted an updated Wetland Protection Strategy by March 31, 2018, fulfilling the deliverable.

Following the successful completion of the enhanced wetland mapping pilot study in 2015, the City developed a contract to expand the methodology to the entire watershed. This contract was awarded in February 2020 and work began in May 2020. Activities included review and improvement of the automated mapping rules and protocols for manual editing and classification of wetland polygons when needed. DEP expects the project to be completed September 2021. This project will allow for updated maps to aid in trend analysis and regulatory review.

The City continues to monitor reference wetlands and uses the data to aid in evaluating any wetland condition trends and potential monitoring needs. In 2016 and 2017, DEP resampled 99 vegetation plots in 18 reference wetlands. DEP updated their plot sampling strategy and collaborated with the New York Natural Heritage Program. Together, they were awarded a USEPA Wetland Program Development Grant in 2019. In 2020, DEP sampled seven wetlands in EOH and WOH using tools to aid in evaluating the condition of the surrounding landscape with the aid of rapid assessment methodology, and sampled vegetation and pollinators.

From 2016 to 2020, DEP reviewed 142 wetland permit applications, of which 29 were in FAD basins. Of those applications in FAD basins, 84% were for activities that would not result in a reduction in wetland area. These activities included invasive species management and pond dredging. DEP continues to comment on federal wetland jurisdiction issues and NYSDEC General Permits.

The Invasive Species Management Strategy was submitted as a FAD deliverable in 2016 and DEP staff formed an Interdisciplinary Invasive Species Working Group (ISWG). In 2018 a subgroup of the ISWG formed a sub-committee to discuss the use of reservoirs and City lands by fire departments. A policy is currently being developed to reduce the risk of invasive species introduction by firefighting equipment.

While not required by the 2017 FAD, the City has been responding to the presence of *Hydrilla* (*Hydrilla verticillata*) in the New Croton Reservoir and completed treatment with fluridone-based herbicides in small plots between 2018 and 2020. To date, *Hydrilla* has not been found in any of the Catskill/Delaware system reservoirs.

In partnership with SUNY Ulster, student interns conducted manual removal projects from City lands for invasive species such as burning bush (*Euonymus alatus*), Japanese barberry (*Berberis thunbergii*) and purple loosestrife *(Lythrum salicaria*). They also worked to remove new invasive species of concern including pale swallow-wort (*Vincetoxicum rossicum*), and mile-a-minute vine (*Persicaria perfoliata*).

Due to the invasive emerald ash borer (*Agrilus planipennis*), DEP has been identifying remaining ash trees since 2018. DEP reports there are five ash mortality plots in the WOH watershed being monitored. This is part of the Monitoring and Managing Ash (MaMA) project associated with the Ecological Research Institute and U.S. Forest Service.

The City continues to monitor for zebra mussels (*Dreissena polymorphia*) and found no zebra mussel veligers in the Catskill/Delaware reservoirs, although veligers were found in two Croton system reservoirs. Monitoring for zebra mussels was suspended in 2020 due to COVID-19 restrictions. There are no established zebra mussel populations present currently in the EOH or WOH watersheds.

Watershed partners and residents are regularly engaged through outreach events the City participates in and collaborates with other organizations. The ISWG has partnered with the New York State Invasive Species Advisory Committee, Catskill Regional Invasive Species Partnership, and Lower Hudson Partnership for Regional Invasive Species Management (PRISM). These groups allow for coordinated efforts to survey and monitor the presence of invasive species.

The Ecosystem Protection Program continues to be an important component of the City's overall watershed protection program.

FAD Section 4.9 East-of-Hudson Nonpoint Source Pollution Control Program

2017 FAD Requirements

The East-of-Hudson (EOH) Nonpoint Source Pollution Control Program has been developed to reduce inputs of pathogens and nutrients from sanitary sewers, septic systems, and stormwater to the EOH FAD Basins (Boyd Corner's, West Branch, Cross River, and Croton Falls Reservoirs). This is addressed through continued implementation of the WR&Rs, involvement in project reviews, and inspection and maintenance of existing stormwater management facilities.

Under the EOH Stormwater Retrofit Grant Program, the City is required to provide $22 million to the EOH Watershed Corporation to support the design and construction of retrofits in the EOH FAD basins and upstream of the Croton Falls Reservoir. Under the EOH Community Wastewater Planning Assistance Grants Program, the City is required to provide $3 million for preliminary planning for community wastewater solutions in areas of the EOH FAD basins where poorly functioning septic systems have the potential to impact water quality. The City is also required to implement the EOH Septic Repair Program, with funding sufficient to support the repair, replacement, or connection to a WWTP for at least 35 systems per year. Other relevant activities under the FAD require the City to: maintain its EOH stormwater facilities; make City land available for stormwater retrofit projects; complete the construction of two specific stormwater projects (Maple Avenue and Drewville Road); and conduct video sanitary sewer inspections.

Evaluation of the City's Compliance

The City has completed construction of the two required stormwater retrofit projects (at Maple Avenue and Drewville Road). These projects have incurred significant delays over the years as the City navigated the local project approval process, and the City has missed associated deadlines going back to the 2007 FAD. The Maple Avenue project was designed to intercept suspended solids from deposition into the Cross River Reservoir. The Drewville Road project was designed to intercept sediment from deposition in Croton Falls Reservoir and mitigate drainage ditch erosion. Design and permitting for both projects began in 2016, and the orders to commence work were issued in November 2018. NYSDOH and USEPA conducted a site visit of the project locations in 2020 and confirmed that the retrofit projects are functionally complete.

The EOH Septic Repair Program, administered by EFC on behalf of the City, reimburses homeowners 50% of the cost of septic repair or connection to a sewer system in the EOH FAD basins, including Lake Gleneida. Homeowners with a demonstrated financial hardship may qualify for an additional 25% reimbursement. Since 2016, the program has issued 31 reimbursements for septic repairs; 23 of these were in the West Branch and Boyd Corners basins. The City has made efforts to increase participation, including annual direct mailings to all eligible residents, posting flyers at town halls and libraries, and conducting outreach to local town and health department staff. In 2019, the City met the 2017 FAD requirement to expand program eligibility for septic systems in basins upstream of, or hydrologically connected to, Croton Falls Reservoir. The EOH Stormwater Retrofit program is intended to support the design and construction of stormwater projects in EOH FAD basins and areas that impact the Croton Falls Reservoir. The City is required by the 2017 FAD to provide the East of Hudson Watershed Corporation (EOHWC)

with $7 million to support stormwater retrofits in the EOH FAD basins and $15 million to support stormwater retrofits in basins hydrologically connected to the Croton Falls Reservoir by September 30, 2019. The initial payment of $15 million dollars was provided in August 2019. Since inception, the program has eliminated 379.3 kg per year from the targeted areas through projects such as detention basins, channel stabilization projects, and pocket wetlands among others. Through the Stormwater Facility and Maintenance Program, the City is able to provide annual maintenance and inspections of existing Stormwater facilities beyond the one-year warranty period after construction to ensure the projects remain functioning as intended.

The 2017 FAD highlighted eight areas in the EOH watershed where poorly functioning septic systems could be impacting water quality. Based on preliminary NYSDEC studies, those areas were identified as surrounding Lake Waccabuc, Lake Truesdale, and Lake Kitchawan in the Cross River Reservoir basin; and Palmer Lake, Lake Gilead, Lake Casse, Lake View Road, and Mud Pond Brook in the Croton Falls Reservoir basin. The 2017 FAD required the City to develop and administer a $3 million grant program to provide funding to municipalities for preliminary planning and engineering studies of potential community wastewater solutions in those areas. In 2018, DEP entered a $3.3 million contract with NEIWPCC to administrate the EOH Community Wastewater Planning Assistance Program. These funds are intended to be used to finance local municipalities to pursue engineering studies and reports on evaluating infrastructure to mitigate water quality impacts. These studies would then be used for the municipality to apply for State or Federal funding to construct these projects. As of 2020, the City reports that all the identified municipalities have contracted with their selected engineering firm to perform the wastewater studies, and the studies are expected to be completed by December 2021.

To highlight defects and areas in need of remediation sanitary sewers in the EOH FAD basins, the 2017 FAD requires the city to conduct video inspections of new and targeted areas in four basins by March 31, 2021, expanding and updating existing maps of the sewer system in the local township. This deadline was missed by the City. Although the contract was awarded in June 2020 to National Water Main and registered in December 2020, work has not commenced. It is expected that the 6- to 8-week project will begin in the summer 2021.

NYSDOH finds the EOH Non-Point Source Pollution Control Program to be a critical suite of protection measures targeting potential sources of water quality impairment in the EOH FAD basins, and the City is generally in compliance with the program requirements.

FAD Section 4.10 Kensico Water Quality Control Program

2017 FAD Requirements

Under normal operating conditions, the Kensico Reservoir is the terminal reservoir for the City's Catskill/Delaware water supply, as it serves as the last impoundment of water prior to chemical treatment. High water quality in this reservoir is critically important for meeting the SWTR objective criteria. The primary goal of this program is to reduce non-point source pollution in the reservoir though the implementation of stormwater and wastewater projects, thereby protecting the waters of the Kensico Reservoir from degradation.

Since its inception in 1997, this program has aggressively addressed overall watershed protection, as well as prevention of water quality degradation in Kensico Reservoir. Over the years many protective and remedial projects have been successfully implemented in the Kensico

basin. The most recent measures have targeted pollution prevention associated with stormwater and wastewater inputs.

The 2017 FAD directs the City to continue and enhance effective protection of water quality in Kensico Reservoir. On an ongoing basis, the City is required to inspect and maintain nonpoint source management facilities within Kensico basin (i.e. stormwater management facilities, turbidity curtains, and spill containment measures) and perform wildlife scat surveys as needed. By December 31, 2022, the City must complete the shoreline stabilization project at Kensico Shaft 18. Other requirements include reviewing the timeline for dredging at the effluent chambers, overseeing the remote monitoring system at Westlake sewer extension, conducting video sanitary sewer inspections, and reviewing water quality control activities at Westchester County Airport. The City is also required to continue to implement the Septic Repair Reimbursement Program in the Kensico Basin.

Evaluation of the City's Compliance

As the terminal reservoir, certain federal water quality standards (i.e., coliform and turbidity levels) apply to Kensico. To comply with these standards, the City has implemented a rigorous water quality control and protection program. Intense study efforts of the Kensico basin have led to implementation of various projects to specifically address localized threats to water quality.

During the assessment period the City has met the requirements of the 2017 FAD. The turbidity curtains (the primary and the back-up) were routinely inspected to ensure designed efficiency. A 200-foot-long section of the back-up curtain required replacement. No other deficiencies were located, and the turbidity curtains were functioning as intended. Spill containment measures are in place around the reservoir and are regularly inspected. During the assessment period, four minor spill events that did not require deployment of booms were reported (December 2018, March 2019, August 2020, and September 2020).

In accordance with the Operation and Maintenance Guidelines, DEP conducted regular inspections and maintenance of all 47 stormwater and erosion abatement facilities installed by the City throughout the Kensico watershed. Maintenance activities include grass mowing, vegetation removal, fence repair, and debris removal. The City reports that all BMPs are functioning as designed.

The 2017 FAD requires the City to complete the shoreline stabilization project at Delaware Shaft 18 by December 31, 2022. This project is a corrective action required in response to the raw water turbidity exceedance during Hurricane Sandy in 2012. When completed, the project will stabilize and protect approximately 700 linear feet on the western shoreline and approximately 475 linear feet on the cove area. Work on the initial phase of the project (design, permitting, and solicitation of construction bids) was completed in 2018. The commence work order was issued in June 2018. The contractor began site preparation in the summer of 2020 and commenced construction activities on the cove area in July 2020 and the west shore in December 2020. It is anticipated that future shoreline stabilization activities associated with the Kensico-Eastview Connection project will occur near the Catskill Upper Effluent Chamber and will tie in with the cove area stabilization from the current project. The area around the Upper Effluent Chamber remains under evaluation for potential future dredging. As part of this evaluation, diving work was completed in November 2020, and a sediment model is under development. Completion of the evaluation report is anticipated during the second half of 2021.

To prevent risks of water quality degradation caused by failing septic systems in Kensico basin, the City implements the septic reimbursement program through a contract with the New York State Environmental Facilities Corporation (NYSEFC). This project provides a 50% reimbursement of the rehabilitation cost for failing septic systems in Kensico basin, or covers the cost to connect them to an existing sewage collection system. All residential systems in the Kensico basin are eligible, which is over 700 properties. The City reported that since the inception of the program in 2008, a total of 27 septic systems have participated in the program totaling up to $275,000 reimbursed. Nine of those repairs have occurred since 2016 ($93,000 reimbursed). The City annually mails letters directly to local residents to remind them about this important program and provide NYSEFC contact information.

The City works closely with the Westchester County Department of Environmental Facilities (WCDEF) to monitor the West Lake Sewer Trunk Line. This line collects and conveys untreated sewage in close proximity to the reservoir. To detect any malfunction, the City installed a Smart Cover Technology sanitary sewer remote monitoring system for this trunk line. This allows for remote monitoring of deficiencies such as leaks, system breaks, and overflows. WCDEF provides operational and maintenance support as needed. The City also conducts annual visual inspections of the line to assess problems with above ground infrastructure such as manholes. The most recent annual full inspection of the line was conducted in October 2020. The City reported no abnormalities for the trunk line during the assessment period.

The 2017 FAD requirement for the Video Sanitary Sewer Inspection Program includes the Kensico basin. Compliance with this requirement was discussed in Section 4.9.

Westchester County Airport is located in the Kensico drainage basin, in close proximity to Rye Lake. Due to its location, the City reviews all proposed development and remediation activities at and around the airport for potential water quality impacts. During the assessment period, this included review of the Airport Master Plan, a nearby parking garage, and a small uncapped landfill on airport property. The City submitted formal comments to NYSDEC on a site characterization workplan to assess potential groundwater contamination at the site.

NYSDOH has determined that the Kensico Water Quality Control Program is critical in protecting the City's terminal reservoir from spills, stormwater runoff, and sewage inputs. NYSDOH looks forward to the completion of the shoreline stabilization project and the resumption of normal operational activities at Kensico Reservoir.

FAD Section 4.11 Catskill Turbidity Control Program

2017 FAD Requirements

Elevated turbidity events have long been associated with the Catskill System and may represent the greatest risk to the City maintaining its filtration avoidance. The majority of turbidity comes during short-term major flow events that result in excessively high turbidity levels in the upper Esopus Creek. This turbidity is primarily generated within the stream itself, rather than the surrounding landscape, and this impact of the underlying geology on water quality was considered when the Catskill System was designed. For example, when the turbidity of Schoharie Reservoir is elevated, this water can be isolated from the Catskill water supply by shutting down the Shandaken Tunnel. In addition, the dual-basin design of the Ashokan Reservoir gives turbidity another opportunity to settle in the West Basin and again in the East Basin before it moves down

the Catskill Aqueduct and into Kensico Reservoir. Once in Kensico, there is additional time to allow turbidity to settle as water flows through the reservoir to the Kensico effluent chamber. While there is normally enough time to have turbidity settle, the system was built with the capacity to add alum above Kensico Reservoir during extreme turbidity events to coagulate and rapidly settle the turbidity. The existing Ashokan Reservoir Release Channel has been used periodically since 2011 to halt or reduce the movement of post-storm turbid waters into the East Basin and down to Kensico Reservoir. The interconnection of the Catskill Aqueduct and the Delaware Aqueduct at Shaft 4, completed in August 2017, allows the City to supplement Catskill water with Delaware water, improving water quality and maximizing flow.

Under previous FADs, the City conducted the Catskill Turbidity Control Study, which explored options to mitigate turbidity impacts on water quality in the Catskill System, thereby reducing the potential need for alum use. The Catskill Turbidity Control Study was conducted in three phases. Phases I and II were completed under the 2002 and 2007 FADs. The 2007 FAD required the City to conduct a Phase III study to evaluate engineering and structural alternatives at the Ashokan Reservoir to reduce the level of turbidity entering the Catskill Aqueduct, then develop a plan to implement the findings of the Phase III study. The Phase III plan led the City to start modifying reservoir operations using the Operations Support Tool (OST) developed under Phase II, making improvements to the Catskill Aqueduct stop shutters, and constructing the Shaft 4 interconnection. OST has been used to predict Kensico turbidity levels under different operating scenarios and to assist the City in making operating decisions. The Shaft 4 interconnection allows the City to supplement the Catskill Aqueduct with Delaware Aqueduct water, maintaining flows during high turbidity periods.

While these water system operations are very effective in controlling Kensico turbidity and reducing the need for alum treatments, they can result in large, and often sustained, flows of turbid water to the lower Esopus Creek causing environmental and economic impacts. 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. The Catalum SPDES permit regulates alum use in the Catskill Aqueduct prior to entering Kensico Reservoir. Furthermore, the City submitted an application to NYSDEC to modify the Catalum SPDES permit. As part of the environmental review process for the permit modification request, for which NYSDEC is the lead agency, the City prepared a draft of the Draft Environmental Impact Statement (DEIS) and a draft of the final EIS, to analyze the potential environmental and socioeconomic impacts resulting from the proposed modifications to the Catalum SPDES permit. The 2017 FAD requires the City to meet with NYSDOH, EPA, NYSDEC, and the Watershed Inspector General (WIG) to discuss the findings of the draft and final EIS, and submit a report on whether, based on the conclusions of the FEIS, the city intends to modify its use of turbidity control measures.

The Revised 2007 FAD required the City to contract with the National Academies of Sciences, Engineering, and Medicine (NASEM Expert Panel) to review the City's use of OST for water supply operations, and to evaluate the proposed modifications to the Catalum SPDES permit and alternatives to be considered in the environmental review. The 2017 FAD required that, six months after the final OST NASEM Expert Panel report is released, the City must submit final revised performance measures and criteria for evaluating the efficacy of the Catskill Turbidity Control measures.

One year prior to the Rondout-West Branch Tunnel (RWBT) shutdown, the 2017 FAD requires the City to submit a Catskill Turbidity Control management plan for when Kensico Reservoir is

only fed by the Catskill Aqueduct. Currently, the shutdown is planned for late Fall 2022 through late Winter 2023. NYSDOH expects the City to provide the report sometime in the Fall of 2021.

Evaluation of the City's Compliance

All deliverables with due dates within the time period of the 2017 FAD have been met, and deliverables with future due dates are underway. All reports required by this program have been submitted on time as of December 2020.

The NASEM Expert Panel report on OST was submitted in September 2018. The panel met six times, with three of these meetings being open to the public. The public could submit comments electronically throughout the process. Overall, the panel strongly supported the use of the OST for managing water supply operations and future planning. DEP and the regulators found this review to be very helpful, and most of the recommendations have been acted upon to improve the OST.

As required in the 2017 FAD, DEP submitted the Report on Final Revised Performance Measures/Criteria for Evaluating the Efficacy of Catskill Turbidity Controls in March 2019. This study indicated that the operational Catskill turbidity controls could have eliminated approximately 96% of the historical alum usage, and similar reductions are expected for the future. The largest reductions are associated with the use of the Croton Filtration Plant, and the Shaft 4 interconnection, with Conditional Seasonal Storage Objective providing some additional benefit. It is important to note that during the RWBT shutdown alum will be used when the aqueduct turbidities exceed 2-3 NTU in order to maintain low baseline turbidities in Kensico Reservoir during this critical period. Work on the Catalum SPDES permit is progressing. The Final Scope was issued on March 22, 2017 and the draft DEIS was submitted to DEC on May 30, 2019. The DEC released the DEIS for public comment on December 16, 2020, and comments were taken until June 16, 2021. The most recent Catskill Turbidity Control annual progress meeting with NYSDOH, USEPA, NYSDEC and the WIG was held remotely on October 22, 2020.

Watershed Monitoring, Modeling, and GIS

FAD Section 5.1 Watershed Monitoring Program

2017 FAD Requirements

Section 5.1 of the 2017 FAD requires that the City conduct a watershed-wide monitoring program in accordance with Section 2.4.1 of its Long-Term Watershed Protection Program and the milestones therein. The monitoring framework is defined by the Watershed Water Quality Monitoring Plan (WWQMP), which describes the City's hydrology, limnology, and pathogen monitoring and surveillance programs, and supports trend analysis, modeling efforts, reservoir operations, and regulatory requirements. The WWQMP was last updated in 2018.

The 2017 FAD requires the City to participate in educational seminars on watershed monitoring, and coordinate annual technical meetings for the Pathogen Working Group. In addition, pathogen reports summarizing monitoring results at the Kensico Reservoir and the WOH Reservoirs are provided annually. Annual updates on ongoing research activities are also provided. The City also submits a monthly water quality report, which describes its compliance with the objective

regulatory requirements for filtration avoidance, such as turbidity and coliform bacteria levels in source water, and disinfection.

The City commits to continuing a comprehensive evaluation of water quality status, water quality trends, and the overall effectiveness of its watershed protection program. The data generated through the City's monitoring program, in conjunction with other defensible scientific findings, is used to conduct the City's periodic assessment of the effectiveness of the watershed protection program.

In addition, the City is required to provide after-action reports on all chemical treatment activities that are not part of their standard daily operations, as well as other significant or unusual events.

Evaluation of the City's Compliance

The *2021 Watershed Protection Program Summary and Assessment* report was submitted as required by the 2017 FAD, and serves as a reference for this FAD compliance assessment. It covers activities in the watershed protection programs during the assessment period through 2020, and examines watershed trends over the last twenty years. It also includes information on the City's modeling programs and how they are used both to evaluate the watershed protection programs and as support tools for making operational decisions. During the assessment period, the City submitted after-action reporting on one incident involving an unexpected decrease in chlorination at the Kensico Reservoir disinfection facilities. This occurred in 2020.

In accordance with the 2017 FAD, the City has participated in educational seminars on watershed monitoring. During the assessment period, the City, along with other partners, has sponsored an annual watershed conference each September that allows scientists and technical experts to present research findings and technical data related to water quality and watershed protection. This conference was held online in 2020 due to the COVID-19 pandemic.

The City has also participated in the Ashokan Watershed Conference, Schoharie Watershed Summit, and the Catskills Environmental Research & Monitoring Conference. The Pathogen Technical Working Group has convened and discussed pathogen research and detection methods annually since 2008. While these activities continued during the assessment period, due to COVID-19 several of these conferences and meetings were held remotely or postponed until 2021.

All reporting requirements for this program have been met. All Watershed Water Quality Annual Reports were submitted. These reports summarize water quality, water quantity, pathogens, watershed management, model development, and research. Special studies have included source tracking of elevated levels of *Giardia* in the Rondout basin. This study found that elevated *Giardia* within the Rondout watershed were likely from multiple sources, and due to unseasonably higher levels of precipitation happening prior to observed increase in 2018. Other special investigations have focused sampling at stream sites suspected of contributing pathogen loadings to Kensico Reservoir and method projects for improved identification of microorganisms.

The City has an extensive and robust monitoring program, which provides the data necessary to confirm that water quality criteria required to maintain filtration avoidance are met, helps to assess the efficacy of the City's watershed protection programs, and helps to detect water quality impairments. As reported in after-action reports, the City has been extremely responsive to unusual water quality or treatment events, addressing the sources of these events in a timely manner and implementing procedures to prevent such events from recurring.

Due to the COVID-19 pandemic, it became necessary for the City to reduce some operational monitoring due to COVID-19. The City first notified the NYSDOH and NYCDOHMH of their intentions in March 2020, and their first report outlining their reduced monitoring strategy was submitted on March 20, 2020 with the basic premise of maintaining compliance and emergency sampling, with additional priority sampling programs resuming as COVID-related restrictions eased and more resources became available. NYSDOH and NYCDOHMH approved this monitoring reduced monitoring program and all subsequent requests for extensions to date. This has not affected compliance data. NYSDOH is satisfied in the progress the City has made in restoring the planned monitoring.

FAD Section 5.2 Multi-Tiered Water Quality Modeling Program

2017 FAD Requirements

The Multi-Tiered Water Quality Modeling Program uses integrated reservoir and terrestrial models to evaluate watershed management programs and reservoir operations, as well as long-term water supply planning. This involves using watershed land cover characteristics, weather data, and climate models to simulate the quantity and quality of water entering the City's reservoirs. There are several objectives, including: improving overall turbidity control by integrating the Rondout turbidity model into OST and developing turbidity models for the other Delaware System reservoirs; guiding reservoir operations, particularly as related to new infrastructure improvements; assisting in evaluating the effectiveness of FAD/MOA-related programs; developing models to predict and evaluate allochthonous and autochthonous sources, reservoir fate and transport of organic carbon, and other metrics for disinfection by-product precursors, and continuing to work to better understand the effects of climate change on water quality and overall water system reliability.

Evaluation of the City's Compliance

All reporting requirements from the 2017 FAD were satisfied during the assessment period and exceptional progress has been made in this program. The City's modeling program investigated a variety of water quality questions, such as how channel processes affect the retention and release of phosphorus in streams, and how ice cover on reservoirs affects turbidity attenuation and phytoplankton succession. Work was conducted on a predictive model of disinfection by-products precursors in source waters and the resulting trihalomethanes in the City's distribution system. Modifications were made to OST to update the hydrologic and meteorological data sets, add real-time data capabilities, and implement improved loading predictions for the Esopus Creek. The 2016 US Geological Survey high-resolution reservoir bathymetry surveys were incorporated into OST. A number of improvements were made to OST and its associated inputs and tools to allow overall better optimize, plan, and evaluate the overall operation of the water system while maintaining community and other required out of system water releases. New OST baseline run rules and software visualization products were developed to aid operational decisions during water system infrastructure project and other critical periods. Time series input flow data were expanded to September 2017 to improve planning under changing hydrologic regimes. DEP improved coordination with the National Weather Service, and a new diagnostic tool was developed to allow for quality control and revision of input weather forecasts along with other improvements such as the development of a statistical model to estimate the spatial variation of precipitation throughout the West of Hudson watersheds.

Over this assessment period the City has used modeling to better understand and plan for the potential impacts of climate change on water quantity and quality as well as the evaluation of the effectiveness of watershed protection and remediation programs. The use of the Soil Water Assessment Tool (SWAT) and SWAT-Hill Slope (SWAT-HS) models were extended to all WOH reservoirs, the General Lake Model (GLM) linked with the Aquatic Eco-Dynamic (AED) water quality model was applied to Cannonsville Reservoir to evaluate thermal structure and nutrient fluxes, a disinfection byproduct fate and transport model is being developed for Cannonsville, and the turbidity model for Pepacton Reservoir is being refined. Historic stream flows were reconstructed using paleoclimatic data to better understand the frequency and return periods of major hydroclimatic events, and progress was made in the development of climate change indices and metrics along with improvements to processes to downscale the most recent global climate models. The effectiveness of point and non-point source control programs were quantified and compared within the Cannonsville Watershed. Taken together and with better coupling with other watershed programs, these modeling efforts will prove useful in future program planning.

The City has maintained a contract with the Research Foundation of the City University of New York, which provides support to the City's water quality modeling efforts using post-doctoral research scientists. The City also participated in numerous conferences and interagency to international workgroups, and published a substantial number of research papers.

NYSDOH believes that the Multi-Tiered Water Quality Modeling Program has been effective, and is a critical component of the City's watershed protection program. NYSDOH commends the City for its involvement with national and international organizations and initiatives, which helps keep the City current on data collection, modeling, and climate change issues and provides an opportunity for sharing ideas and collaborating with other experts in these fields.

FAD Section 5.3 Geographic Information System

2017 FAD Requirements

The City utilizes an extensive GIS in its watershed protection efforts and water supply operations. In addition to creating maps and illustrating environmental data, GIS is also used in data gathering and management, regulatory programs, satellite imagery analysis, and complex environmental modeling. A few of the key areas where GIS plays a vital role include: land acquisition and management, Streamside Acquisition Program, water quality modeling, watershed protection evaluation, water system operations for system reliability and maximizing water quality, and long-term planning. There are many FAD programs where GIS is an important tool.

The 2017 FAD requires the City to continue to maintain and update its GIS capabilities, and to report on use of GIS, GIS updates, and dissemination of GIS data to stakeholders as needed.

Evaluation of the City's Compliance

The City continues to have a robust and active GIS program and has made the updates and improvements necessary to effectively use this technology. Acquisition of higher resolution LiDAR and orthoimagery allowed important updates to watershed hydrography, floodplains, reservoir basins and watersheds, and reservoir bathymetry updates are currently underway. The City continues to maintain its GIS infrastructure such as backing up databases, ensuring users

have the proper security clearance, updating ArcGIS Desktop software, and giving GIS staff new GIS-grade workstations in 2019. In addition to serving as an important in-house resource to research and many programs, the GIS group also shares non-sensitive data with partners, stakeholders, watershed communities, state/federal agencies, consultants, universities, non-governmental organizations, and other interested parties. All deliverables have been addressed, and GIS has been and will remain a critical tool in FAD implementation, SWTR compliance, and other aspects of watershed management and water system operations.

FAD Section 6.1 Watershed Rules and Regulations and Other Enforcement/Project Review

2017 FAD Requirements

The Regulatory and Engineering Programs Division within the NYCDEP Bureau of Water Supply (BWS) works on wastewater treatment performance, sewer systems, and construction plans. They review subsurface sewage treatment systems alteration and construction plans, stormwater runoff control, impervious surfaces, nonpoint source discharges, and wetland protection. The City is an Involved Agency on most major projects during the SEQRA process and can issue comments to the Lead Agency regarding activities that may impact water quality in the Watershed.

The BWS also implements the City's Watershed Rules and Regulations (WR&Rs). The WR&Rs identify activities that are prohibited in the Watershed or require the City's review and approval. Following the approval of proposed regulated activities, the BWS monitors to assure compliance with the conditions of approval. The BWS also conducts inspections throughout the Watershed to identify violations of applicable laws and responds to citizen complaints. The NYCDEP Police are responsible for protection of the City's water supply infrastructure along with protection of the environment and people living in the Watershed.

The 2017 FAD requires that the City enforce its WR&Rs; provide conferences with applicants for regulated activities and guidance documents; work with NYSDEC to coordinate enforcement of stormwater regulations; and report on project activities in the Watershed, enforcement actions, and work done to replace equipment at WWTPs that is required by the City's WR&Rs.

The 2017 FAD also requires the City to submit the proposed changes to the WR&Rs and a timeline for completion of the rulemaking process, as well as update the guidance documents affected by the changes to the WR&Rs.

Evaluation of the City's Compliance

As is required by the 2017 FAD, the City has submitted semi-annual reports on activities in the Watershed that require review under the City's WR&Rs and on enforcement actions. The enforcement action reports illustrate the City's diligence in identifying violations, communicating with relevant parties, and following up as necessary to ensure violations are corrected. The City meets quarterly with NYSDEC, NYSDOH, EPA, and the NYS Office of the Attorney General to coordinate enforcement of stormwater regulations in the Watershed.

In 2015, the City funded and executed a capital replacement agreement with NYS Environmental Facilities Corporation (EFC) to replace failing equipment that was installed a part of the Upgrade Program. In 2018, EFC elected to no longer administer the Capital Replacement Program on behalf of the City. In 2019, the City entered a new agreement with the New England Interstate Water Pollution Control Commission (NEIWPCC) to manage the capital replacement program. During the assessment period, capital replacement funds were not requested from eligible WWTPs from either EFC or NEIWPCC, although the City has continued to fund the replacement of minor equipment (like pumps and filter cartridges) under established operation and maintenance agreements with each WWTP.

The City's WR&Rs are a critical component of the City's watershed protection program. The City continues to actively enforce its WR&Rs, working in coordination with other regulatory agencies, to maximize effectiveness of this important protection tool. As part of the stakeholder meetings held during the development of the 2017 FAD, changes were proposed to the City's WR&Rs. These changes included updates to reflect changes in federal or State law, clarification of existing rule language, revisions to the process for determining when a dormant septic system can be brought back into service, and standards for the use of holding tanks and portable toilets. The City submitted the timeline for adopting the proposed changes in February 2018. Throughout 2018, the City completed the processes for State Environmental Quality Review and City Environmental Quality Review, and engaged in the City Administrative Procedure Act (CAPA) process. Four public hearing were held in late 2018, and the amended regulations were formally submitted to NYSDOH in December 2018. NYSDOH granted approval in August 2019, and after the City satisfied the Public Health Law requirements, the amended regulations became effective November 29, 2019.

NYSDOH is currently engaged in the process of updating 10 NYCRR Part 128 to reflect the City's amended regulations.

FAD Section 6.2 Wastewater Treatment Plant Inspection Program

2017 FAD Requirements

The main goal of the WWTP Inspection Program is to prevent degradation of water quality associated with discharges from WWTPs in the NYC watershed. This is accomplished through ensuring compliance with the WR&Rs and State Pollutant Discharge Elimination System (SPDES) permits. With the assistance of NYSDEC, the City administers the WWTP Inspection Program, which is comprised of on-site inspections, monitoring of and assistance with SPDES compliance, and necessary enforcement actions associated with noncompliance.

The 2017 FAD requires that all WWTPs discharging in the Catskill/Delaware watershed are monitored to ensure compliance with their SPDES permits, and that grab samples are collected and analyzed monthly for all non-City-owned WWTPs. The City is also expected to annually conduct at least four on-site inspections for all 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. When necessary, the City shall provide technical assistance to owner/operators of non-City-owned WWTPs as needed. When noncompliance with either WR&Rs and/or SPDES permits is identified, enforcement actions are taken in accordance with the protocol delineated in the NYCDEP/NYSDEC Memorandum of Understanding (MOU).

Semi-annually, the city is required to submit a summary of WWTP Inspection Reports, Enforcement Activities, and the WWTP Water Quality Sampling Monitoring Report. Any sewage spills exceeding 500 gallons must be reported to NYSDOH within 24 hours of the City becoming aware of the incident.

Evaluation of the City's Compliance

During the assessment period the City has been successfully implementing the program. All reporting requirements of the 2017 FAD have been met.

In the *2021 Watershed Protection Program Summary and Assessment*, the City reports that the 30 active WWTPs in the WOH and 9 WWTPs in the EOH FAD basins are inspected on a regular schedule, as is required by the 2017 FAD. The WWTP Compliance and Inspection program reports have been submitted to NYSDOH and USEPA on time. The reports provide valuable information regarding comprehensive monitoring of the complying WWTPs and demonstrate effective enforcement actions, along with technical and professional assistance, in the event of noncompliance.

Enforcement activities are coordinated with NYSDEC through their quarterly Watershed Enforcement Coordination Committee meetings, where the status of watershed WWTPs is discussed, and actions are taken to restore compliance. Staff from NYSDOH, USEPA, and the Office of the Attorney General participate in these collaborative efforts to ensure compliance with regulatory requirements and validate the City's transparency in operations.

NYSDOH concludes that during the assessment period, the City has effectively implemented this program, complied with all requirements of the 2017 FAD, and has continued to maintain productive relationships with both NYSDEC and NYSDOH. The WWTP Inspection Program remains a vital component for protection of the City's unfiltered water supply.

Catskill/Delaware Filtration Facilities

FAD Section 7 Catskill/Delaware Filtration Plant Design

2017 FAD Requirements

The 1997 FAD required the City to produce a Final Design and Final Environmental Impact Statement for filtration facilities for the Catskill/Delaware water supply. The determination at that time settled on the use of ozone and direct filtration as the best treatment option. Successive FADs included a requirement to provide biennial updates to that preliminary design. In recognition that the work supporting those preliminary plans was decades old, the 2017 FAD requires the City to contract for a comprehensive review of filtration methods and technologies, resulting in the development of a new conceptual design for a filtration facility or facilities. The expectation is that the design review process will include: bench studies and modeling; larger-scale pilot studies; independent review from water treatment experts; and a conceptual design that incorporates the latest filtration methods and technologies. A report on pilot studies is due in 2024 and the final report on conceptual design is required by the end of 2026.

Evaluation of the City's Compliance

The City has met the requirements of this FAD program. The requirement for Notice to Proceed was completed on January 24, 2018, and issued to Hazen and Sawyer with a contract amount of $15.8 million. The Task 1 Bench Scale Testing Final Report was submitted in May 2020, prior to the due date. It included a review of water quality and current regulations, a comprehensive

technology evaluation, and bench-scale testing. Various treatment components were evaluated including ozone, microfiltration/ultrafiltration, dissolved air flotation (DAF), and ion-exchange resins. A recommendation was made to move forward with testing four treatment trains, all involving the use of ozone as a pre-oxidant. These trains will include an evaluation of the original direct filtration plan, one involving DAF followed by filtration, and two membrane filtration trains, one with an ion exchange resin. The City is on schedule to meet the December 31, 2021 due date to commence conceptual design and larger-scale pilot studies.

In-City Programs

FAD Section 8.1 Waterborne Disease Risk Assessment Program

2017 FAD Requirements

Maintaining filtration avoidance requires the City to continually demonstrate that water consumers served by the Catskill/Delaware system are adequately protected against waterborne disease. The Waterborne Disease Risk Assessment Program (WDRAP) was initiated with the goal of helping the City comply with the FAD criterion that the NYC water supply is not the source of a waterborne disease outbreak and that water consumers are adequately protected against waterborne disease.

Since its inception in 1993, the program has been modified and enhanced to better track the incidence of, and gather epidemiological data on, waterborne diseases, in particular giardiasis and cryptosporidiosis. This is accomplished through: 1) monitoring rates of giardiasis and cryptosporidiosis in NYC, with demographic and risk factors data collection; 2) providing a system that tracks diarrheal illnesses to ensure rapid detection of any outbreaks; and 3) conducting risk assessment to identify potential association, or lack of thereof, between an outbreak and tap water consumption.

The 2017 FAD requires the City to maintain the WDRAP as an effective tool that will help detect the presence of waterborne disease outbreaks and report any evidence of such an outbreak to NYSDOH and USEPA in a timely manner. The FAD further requires that, should a water quality "event" occur (e.g. increased turbidity, pathogen detection, disruption in operation, etc.), the City, in coordination with the NYC Department of Health and Mental Hygiene (NYCDOHMH), will provide syndromic surveillance system information to NYSDOH and USEPA.

Upon notification by the NYCDOHMH of any significant signs of community gastrointestinal illness, in which the public drinking water supply appears to be the source of illness, the City is required to inform NYSDOH and EPA.

In addition, the 2017 FAD requires the City to submit annual WDRAP reports, which will describe programmatic accomplishments, implementation status, and data interpretation.

Evaluation of the City's Compliance

During the assessment period, the WDRAP has met all requirements of the 2017 FAD. Over the years, this program continues to enhance its core components (i.e. disease and syndromic surveillances) in various ways including incorporating some education and outreach activities. Four main tools are used for syndromic surveillance: hospital emergency department monitoring;

anti-diarrheal medication monitoring; clinical laboratory monitoring; and nursing home sentinel surveillance. Special projects undertaken during the reporting period include publication of a manuscript on the epidemiology of cryptosporidiosis in NYC, and a survey of other similar cities in order to obtain information that can aid NYC's public health surveillance efforts relevant to detection of potentially waterborne diseases.

The City has submitted its annual WDRAP report by March 31 of each year as required by the 2017 FAD. These reports are well-organized, incorporate valuable data regarding comprehensive surveillance, and, based on analysis of available data, have each concluded that there was no evidence of a drinking water-related outbreak in NYC during the reporting period. None of the WDRAP surveillance tools were interrupted due to the COVID-19 pandemic. In fact, data from 2020 found a decrease in both cryptosporidiosis and giardiasis incidences among City residents, suggesting a relationship to State and City government "stay at home" orders due to COVID-19.

Since its inception, the WDRAP has continued to effectively implement the program and maintain compliance with the requirements. NYSDOH believes that this program is critical to assessing that the City's water is not a source of a waterborne disease outbreak, as required by the SWTR for filtration avoidance.

FAD Section 8.2 Cross Connection Control Program

2017 FAD Requirements

While it is no longer a required component of the FAD, the Cross Connection Control Program is required by 10 NYCRR Section 5-1.31 and Title 15, Chapter 20 of the Rules of the City of New York. A cross connection is a physical connection in a drinking water distribution system through which the water supply can become contaminated. The City's Cross Connection Control Program inspects potential sources of cross connections and enforces the installation of backflow prevention devices where necessary. Under New York City Local Law 76/09, the Program reports semi-annually to the New York City Council on: the number of facilities for which one or more backflow devices were installed since the last report; the number of facilities that have been newly notified of the need to install devices; and the number of violations issued for failure to install devices. The City also provides this information to NYSDOH and USEPA, and in addition to its public website at: https://www1.nyc.gov/site/dep/about/cross-connection-controls.page. (Note that the website shown on page 95 of the 2017 FAD is no longer active.)

Administration

FAD Section 9. Administration

2017 FAD Requirements

The 2017 FAD requires the City to maintain staffing, funding, and expertise necessary to support all elements of the City's Long-Term Watershed Protection Plan and all activities detailed in the FAD. Specifically, the 2017 FAD annually requires the City to identify 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. In addition, the City is required to report annually on the amount (capital and expense) spent in the previous year, the amount appropriated for the current year, and the amount planned for the year thereafter, for watershed protection programs. This reporting also must include the status of key partnership contracts, such as those with CWC, SWCDs, and WAC.

In addition to adequate staffing and funding, the City and its WOH Watershed partners recognized that the establishment of a physical office in the WOH Watershed would improve implementation of the City's source water protection programs. The 2017 FAD includes requirements for the City to sign a binding commitment to lease office space in the new CWC building in Arkville, as well as due dates for assigning City staff to that office building.

Evaluation of the City's Compliance

The FAD requirements for this program have been met. The City's September 2020 report on budget and staffing identified 1294 budgeted positions for the Bureau of Water Supply, of which 1188 were filled (91.8%). These figures have been relatively consistent over the assessment period, with generally 92% of budgeted positions filled. In general, NYSDOH agrees that the City continues to adequately support the watershed protection programs with funding and staff.

However, during the assessment period, there have been several instances where delays related to City contracts either missed FAD deadlines or resulted in a gap in funding availability for program implementation. For example, CWC reported that delays in the registration of the Septic V contract impacted their ability to implement the Septic Remediation and Replacement Program in 2018 and early 2019. DCSWCD reported that their SMP funding contract lapsed on June 30, 2020 with the successor contract not in place until August 21, 2020, although the City was able to backdate the effective start to ensure continuity. NYSDOH reminds the City that lapses in contract funding for program implementation can put the City in a state of non-compliance with the terms of the 2017 FAD. While it is understandable that some delays in the contracting and payment process may have been due to effects of COVID-19 pandemic, NYSDOH expects that there will be no further delays in the remaining term of the 2017 FAD.

The 2017 FAD requirements have been met for the co-location of City staff with CWC at the Arkville office building. The City signed a binding commitment to lease office space in 2019 and had assigned at least 26 positions to the building by the end of calendar 2020. A total of 40 staff are required to be assigned to the building by the end of calendar 2026.

Education and Outreach

FAD Section 10. Education and Outreach

2017 FAD Requirements

The purpose of the Education and Outreach Program is to raise awareness about the importance of the New York City water supply system and the critical need to protect its sources for current and future generations. Through this collaborative program, the City works with numerous partners in both the watershed and New York City to educate upstate residents and downstate consumers about the importance of source water protection and to promote the water quality benefits of environmental stewardship.

The goals for the Education and Outreach Program include promoting environmental stewardship as a means of water quality and public health protection, as well as tracking and documenting the numbers and types of community public outreach events sponsored by the City or its partners, including audiences reached through watershed education or training programs.

The City is also required to continue its support of the school-based education and training programs for both the upstate and the downstate communities.

Reporting is documented each year by March 31 in the FAD Annual Report.

Evaluation of the City's Compliance

NYSDOH acknowledges that during the assessment period all programmatic requirements specified in the 2017 FAD have been met. The program continues to be an effective tool for educating targeted audiences on the topics related to FAD requirements.

Annually in March, as is required by the 2017 FAD, the City compiled and submitted its education and outreach report, where the overall status of the program and specific accomplishments had been described. Additional information and program summary have been provided by the City in the *2021 Watershed Protection Program Summary and Assessment* report. The report confirms that one of the most effective tools for reaching large audiences continues to be their website, which provides a broad spectrum of information including the annual drinking water Consumer Confidence Report, press releases, FAD reports, educational materials, regulatory documents, and recreational maps. The City continues to utilize various social media platforms including Twitter, Facebook, Flickr, Instagram, and YouTube to showcase its programs to a broader audience.

The City works closely with many watershed partners to advance the education and outreach program to a broad, diverse audience. Outreach by the City and its partners with watershed communities relevant to real property acquisitions, conservation easements, and flood buyouts are important components of the program.

With the exception of 2020 (due to COVID-19), a steady yearly increase in the number of unique organized events and expansion in attendance have been achieved. The City estimates that tens of thousands of people in specific target audiences were educated or trained every year through outreach activities, including classroom visits, guided tours and field trips. In addition, there have been many available learning opportunities for educators and other professionals.

Another important program component is the Public Education Grants Program, administered by the CWC. During the assessment period, the CWC awarded $912,000 for 159 grants to schools and organizations in NYC and the watershed. CWC, with financial support provided by the City also sponsored various workshops geared towards homeowners, municipal officials and local professionals on topics such as septic system maintenance, land use planning, wastewater, and stormwater. CWC continues to keep watershed residents up to date with its current programs and activities using various methods including postings on its main website, press releases and newsletters.

The support and expansion of environmental stewardship remains an integral and important part of the program. In its *2021 Watershed Protection Program Summary and Assessment* report, the City identifies the Watershed Recreational Program as one of the most notable ways the City has managed to promote active stewardships in City-owned lands among down state consumers and local residents. Notable activities conducted by this program include volunteer reservoir clean-up events and family fishing events. Some Watershed Recreational Events were cancelled in 2020 due to COVID-19 restrictions, but it is likely these events will return in future years. A major milestone of the watershed recreational program was the completion of the 11.5-mile-long Ashokan Rail Trail in Ulster County in 2019. NYSDOH notes this accomplishment and congratulates the City on its effective promotion of the watershed recreation program.

In conclusion, NYSDOH believes that the Education and Outreach Program continues to be very successful and remains a valuable component of the City's overall watershed protection program.

Conclusions

Overall, the City has successfully satisfied the obligations specified in the 2017 FAD. For most programs, the City has met FAD due dates. However, some FAD program elements have experienced delays in implementation. In a number of cases, these delays were due to circumstances outside of the City's control, including the COVID-19 global pandemic. In other cases, delays in contracting and funding processes or disagreements with watershed partners have put continuous program implementation at risk. While the City has been able to manage these situations to continue program activities, ensuring gaps in program activities do not occur is critical to the effective functioning of these programs and meeting the requirements of the FAD. NYSDOH encourages the City to work with its partners to seek ways to address contracting issues in order to mitigate barriers to successful program implementation.

In March 2020, the spread of the COVID-19 was declared a global pandemic by the World Health Organization. As a result, restrictions were put in place in New York State regarding social distancing, office building occupancy, and travel. The pandemic affected the processing of contract invoices for WAC and CWC, resulting in implementation delays. There were also less land solicitations under LAP and some ongoing projects were halted. While more people took advantage of the City's recreation land, family fishing events and reservoir clean ups had to be cancelled. NYSDOH commends the City and partner staff who, due to the COVID-19 pandemic, shifted to telecommuting and successfully re-focused their projects. While the COVID-19 pandemic challenged implementation of various FAD programs, at the time of this report's issuance, the City has resumed pre-COVID activity levels in the majority of programs.

The successful implementation of the Environmental Infrastructure Programs has protected waterbodies from contamination at the source while having direct economic benefits for watershed communities. Potential impacts on water quality from wastewater inputs into the WOH Watershed have been minimized through comprehensive Septic, Community Wastewater, and Stormwater programs. Furthermore, the EOH Non-point Source Pollution Control Program has provided funding for beneficial wastewater projects in the West Branch, Boyd's Corner, Croton Falls and Cross River reservoirs. Efforts through the Kensico Water Quality Control Program continue to protect the City's water at its last vulnerable point before chemical treatment. In addition, activities under the Catskill Turbidity Control Program have supplemented the City's ability to engineer around the Catskill System's natural periods of high turbidity.

The City's LAP has been highly successful in permanently protecting watershed lands. Together with lands protected by other agencies and organizations, 39.7% of the City's watershed is permanently protected. However, a balance must be maintained between watershed protection and community vitality, so the focus of LAP is gradually shifting toward parcels with more surface water, wetlands, and riparian areas. As the program transitions toward the potential expansion of the Streamside Acquisition Program and Forest Conservation Easement Program, efforts to acquire lands with a direct water quality benefit and subdivide developable land from acquisition parcels should continue where applicable.

The NYCFFBO has helped relieve the burden for owners of flood damaged properties and returns the floodplain to a condition more protective of water quality. The City also worked with regulators and stakeholders to evaluate the need to assist the transition of farm land between owners and creating mechanisms for enhancing riparian buffer protection in the Kensico basin, but it was agreed neither effort would significantly improve water quality protection or be supported by stakeholders. Also, while preliminary discussions have occurred regarding the potential for

moving residential and commercial development out of the floodplains onto suitable City-owned lands, it is a challenging process. The City has agreed to cooperate with stakeholders in furthering this effort.

The WAP continues to be an important program to promote economic vitality and protect water quality, but several organizational challenges may impede the timeliness of future deliverables. The combined efforts of the Forestry Program, Land Management Program, and Ecosystem Protection Programs will ensure watershed lands continue to act as a natural water filter by promoting a healthy ecosystem.

The Stream Management and Riparian Buffer Programs continue to be effective programs for helping the City meet goals for turbidity reduction in the WOH watershed streams and floodplains, with additional benefits of property and infrastructure protection. Partnerships between the City and local partners remain strong and provide models for other similar programs throughout the country.

NYSDOH, in consultation with USEPA, finds that the City has a comprehensive and robust watershed protection program, which, overall, is being effectively implemented by the City and its partners. The City continues to provide drinking water to NYC consumers that meets all requirements of the Surface Water Treatment Rule. For the remainder of the 2017 FAD, NYSDOH urges the City to make all efforts to complete deliverables on the agreed schedule, especially as it relates to implementation of contracts and provision of program funding. Additionally, the City should work with program partners to improve communications on contracting and invoicing issues, ensure timely payment of all properly documented invoices, and eliminate any delays in watershed protection program implementation.