



New York City Department of Environmental Protection

Filtration Avoidance Annual Report

For the period January 1 through December 31, 2023

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List of Acronyms

APHIS	Animal and Plant Health Inspection Service
ATU	advanced treatment unit
AUV	autonomous underwater vehicle
AWSMP	Ashokan Watershed Stream Management Program
BMP	best management practice
BWS	Bureau of Water Supply
C&D	construction and demolition
CAT/DEL	Catskill/Delaware
CATUEC	Catskill Upper Effluent Chamber
CC	compliance conference
CCD	Croton Consent Decree
CCE	Cornell Cooperative Extension
CCEUC	Cornell Cooperative Extension of Ulster County
CDUV	Catskill/Delaware Ultraviolet Disinfection Facility
CE	conservation easement
CMC	Catskill Mountain Club
CP	Forest Management Plan Conservation Practices
CREP	Conservation Reserve Enhancement Program
CRISP	Catskill Regional Invasive Species Partnership
CRP	Conservation Reserve Program
CSBI	Catskill Streams Buffer Initiative
CT	contact time
CUNY	City University of New York
CWC	Catskill Watershed Corporation
CWMP	Community Wastewater Management Program
DCPD	Delaware County Planning Department
DCSWCD	Delaware County Soil and Water Conservation District
DEIS	Draft Environmental Impact Statement
DEM	Digital Elevation Model
DEP	New York City Department of Environmental Protection
DFIRM	digital flood insurance rate map
DMAP	Deer Management Assistance Permit
DOE	New York City Department of Education
DOHMH	New York City Department of Health and Mental Hygiene
DPR	New York City Department of Parks and Recreation
DSEIS	Draft Supplemental Environmental Impact Statement

DUA	Day Use Area
EAB	emerald ash borer
EAF	Environmental Assessment Form
ECLRS	Electronic Clinical Laboratory Reporting System
ED/RR	Early Detection and Rapid Response Plan
EFC	New York State Environmental Facilities Corporation
EIS	environmental impact statement
ELTP	Enhanced Land Trust Program
EOH	East of Hudson
EOHWC	East of Hudson Watershed Corporation
EWP	Emergency Watershed Protection
FAD	Filtration Avoidance Determination
FDNY	New York City Fire Department
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHMP	Flood Hazard Mitigation Program
FITT	Forestry Interdisciplinary Technical Team
FMP	New York City Forest Management Plan
GCSWCD	Greene County Soil and Water Conservation District
GI	gastrointestinal illness
GIS	Geographic Information System
GPS	Global Positioning System
GWLF	Generalized Watershed Loading Function
HAA5	haloacetic acid five
HEC-RAS	Hydrologic Engineering Centers River Analysis System
HEFS	Hydrologic Ensemble Forecast Service
HEV	human enteric virus
HHC	New York City Health and Hospitals Corporation
HMGP	Hazard Mitigation Grant Program
HPC	Heterotrophic Plate Count
IAR	inactivation ratio
IRSP	individual residential stormwater permit
ISAC	Invasive Species Advisory Committee
ISC	New York State Invasive Species Council
ISWG	Invasive Species Working Group
JV	Joint Venture
LAP	Land Acquisition Program
LFA	Local Flood Analysis
LFHMIP	Local Flood Hazard Mitigation Implementation Program
LiDAR	Light Detection and Ranging

LIMS	Laboratory Information Management System
MAP	Management Assistance Program
MFO	Master Forest Owner
MCL	Maximum Contaminant Level
MGD	million gallons per day
MMI	Milone & MacBroom, Inc.
MOA	New York City Memorandum of Agreement
MRO	Modification of Reservoir Operations
MSM	Men who have sex with men
MST	Microbial Source Tracking
NAS	National Academies of Science
NASEM	National Academy of Sciences, Engineering and Medicine
NHD	National Hydrography Dataset
NMP	nutrient management plan
NOV	Notice of Violation
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
NWI	National Wetlands Inventory
NYC	New York City
NYCFFBO	New York City-Funded Flood Buyout Program
NYNJTC	New York-New Jersey Trail Conference
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
O&M	Operation and maintenance
OIT	Office of Information Technology
OST	Operations Support Tool
PAA	Public Access Area
PCR	polymerase chain reaction
PFM	precision feed management
PRISM	Partnership for Regional Invasive Species Management
RBAP	Riparian Buffer Acquisition Program
RCMP	Riparian Corridor Management Plan
REP	Regulatory and Engineering Programs
RFP	Request for Proposals
RNSP	Rondout/Neversink Stream Program
ROV	remote operated vehicle
RTCR	Revised Total Coliform Rule
RWBT	Rondout-West Branch Tunnel

SAFARI	Shandaken Area Flood Assessment and Remediation Initiative
SAP	Streamside Acquisition Program
SBR	sequential batch reactor
SCSWCD	Sullivan County Soil and Water Conservation District
SDE	Spatial Database Engine
SDEIS	Supplemental Draft Environmental Impact Statement
SEIS	Supplemental Environmental Impact Statement
SEQRA	State Environmental Quality Review Act
SFI	Stream Feature Inventory
SMIP	Stream Management Implementation Program
SMP	Stream Management Program
SPDES	State Pollutant Discharge Elimination System
SSMP	Septic System Management Program
SSTS	subsurface sewage treatment system
SUNY	State University of New York
SWAC	Schoharie Watershed Advisory Committee
SWAT-HS	Soil Water Assessment Tool – Hillslope
SWCD	Soil and Water Conservation District
SWPPP	stormwater pollution prevention plan
SWTR	Surface Water Treatment Rule
TCR	Total Coliform Rule
TFS	Team Foundation Server
THM	trihalomethane
TKN	total kjeldahl nitrogen
TSI	timber stand improvement
TTHM	Total trihalomethane
UCSWCD	Ulster County Soil and Water Conservation District
UFI	Upstate Freshwater Institute
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
WAC	Watershed Agricultural Council
WaLIS	Watershed Lands Information System
WAP	Watershed Agricultural Program
WCDEF	Westchester County Department of Environmental Facilities
WDRAP	Waterborne Disease Risk Assessment Program
WECC	Watershed Enforcement Coordination Committee
WFMP	Watershed Forest Management Plan

WFP	whole farm plan
WOH	West of Hudson
WQSP	Water quality stream projects
WRF	Water Research Foundation
WR&R	New York City Watershed Rules and Regulations
WSP	Water Supply Permit
WSPS	Water and Sewer Permitting System
WWQMP	Watershed Water Quality Monitoring Plan
WWTP	wastewater treatment plant
WWTPCI	Wastewater Treatment Plant Compliance and Inspection

1. Introduction

In the early 1990s, New York City embarked on an ambitious program designed to protect and enhance the quality of the City's drinking water supply. The City's approach was based on a simple premise: it is better to keep water clean at the source than allow it to get contaminated and clean it up later. Over the past 30 years, New York City's programs have been recognized as an international model for source water protection.

Promulgated in 1989, the federal Surface Water Treatment Rule (SWTR) requires all public surface water systems in the United States to filter their water for the protection of public health. Water suppliers could apply for a waiver from the filtration requirements, but only if they could meet stringent water quality, disinfection and source protection criteria. The New York City Department of Environmental Protection (DEP), which operates and protects the City's water supply, believed that the Catskill/Delaware portion of the City's system qualified for a filtration waiver. Following an initial application, DEP received the first Filtration Avoidance Determination (FAD) in January 1993, and has maintained a filtration waiver continually since that time. In January 2023, DEP marked the 30th anniversary of the first FAD. DEP has spent or committed more than \$2.9 billion to implement an array of programs that target both existing and potential sources of contamination. The result is that New York City consumers continue to enjoy affordable, high quality water.

Essential to the success of these efforts are the strong relationships developed between DEP and key water supply stakeholders including the watershed communities; locally-based organizations; environmental groups; and federal, state, and local government agencies. DEP's investments are designed to meet the twin goals of water quality protection and preservation of the economic vitality of watershed communities. DEP employs the largest workforce in the watershed and scores of additional jobs are created through direct and indirect employment from DEP's contracts. Project funding and tax payments account for nearly \$300 million annually. Projects completed enhance the quality of life for local residents in many ways, for example by providing reliable and inexpensive wastewater treatment or increasing resiliency from floods. In addition, DEP's reservoirs and land holdings are a valuable resource for local tourism economy.

The cornerstone of DEP's source water protection program is extensive research by DEP scientists into existing and potential sources of water contamination, and the detailed characterization of land use and land cover in the watershed. As part of DEP's source water monitoring program, tens of thousands of samples are collected annually throughout the watershed. Each year DEP performs hundreds of thousands of laboratory analyses. Based on the information collected through its monitoring and research efforts, DEP has crafted a watershed protection strategy that focuses on implementing initiatives that address current potential pollution sources and prevents the creation of new sources.

In December 2022, the New York State Department of Health (NYSDOH), in consultation with United States Environmental Protection Agency (EPA), issued mid-course update to the 10-year FAD issued in 2017. The Revised 2017 FAD calls for continuation of major program elements, with targeted enhancements and adjustments where needed. DEP protection strategies have continued to evolve over the past 30 years, based on program success; changes in watershed conditions; climate change impacts and projections; and improved monitoring and science. The Revised 2017 FAD continues these trends and positions DEP's source water programs for continued success.

This annual report covers the period January 1, 2022, through December 31, 2022, and is compiled to satisfy the requirements of the 2017 FAD. Material in this report is organized to parallel the sections of the FAD. Figures Figure 1.1 and Figure 1.2 and depict the impressive level of accomplishment over the past thirty years. The programs, each designed to target specific pollution sources, have touched nearly every corner of the City's vast catchment.

While the report focuses primarily on the efforts of New York City, it is important to recognize that DEP works in partnership with many agencies, organizations, and communities throughout the region to achieve its goals. These partnerships are vital to the continued success of the source water protection program and recognize the need to strike a balance between protecting water quality and the fact that the watershed is home to tens of thousands of people. The contributions of many of these groups are acknowledged throughout this report. The other private, governmental, community, academic, and non-profit entities that share a role in this complex effort are too numerous to list. However, DEP gratefully acknowledges their ongoing help and support.

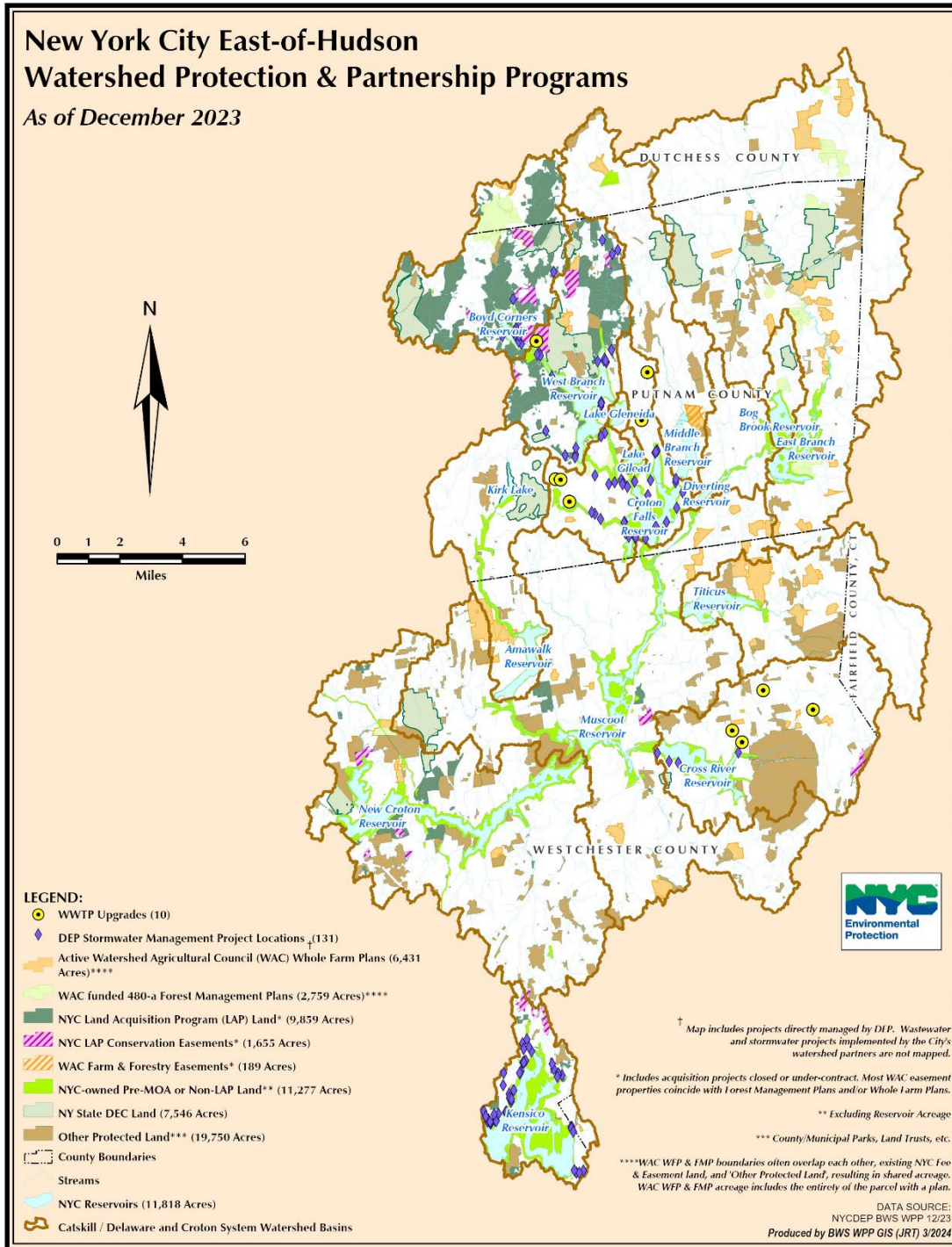


Figure 1.1 New York City East-of-Hudson watershed protection and partnership programs as of December 2023

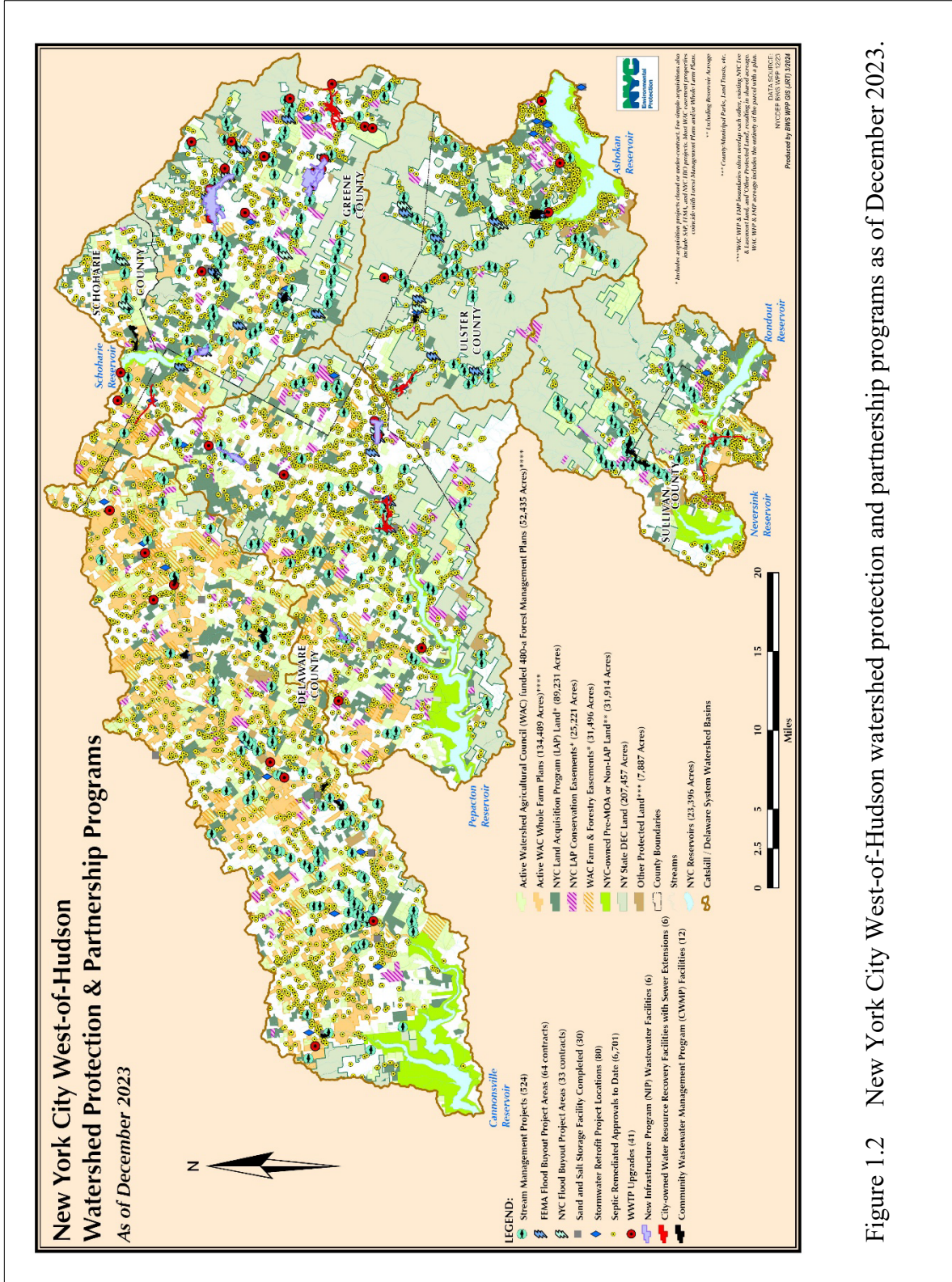


Figure 1.2 New York City West-of-Hudson watershed protection and partnership programs as of December 2023.

2. Federal and State Objective Water Quality Compliance

During 2023, DEP continued its comprehensive water quality monitoring efforts. New York City's sampling program is far more extensive than is required by federal or state law. Each year, the City collects tens of thousands of samples in the watershed and in the distribution system. In 2023, DEP collected approximately 44,800 samples and conducted 589,500 analyses. Of these, 31,600 samples were collected and 357,700 analyses were performed within the City. Once again, the results were notable: the City complied with the objective criteria of the Surface Water Treatment Rule (SWTR) (USEPA 1989).

By the tenth of every month, DEP provides both the U.S. Environmental Protection Agency (USEPA) and the New York State Department of Health (NYSDOH) with the results of its extensive monitoring program via the monthly Water Quality Report, which is issued in compliance with the requirements of the SWTR and other federal regulations in effect since 1991. The City, as an unfiltered surface drinking water supplier, must meet the SWTR specified objective criteria and demonstrate this in the monthly Water Quality Report. The information provided below summarizes compliance monitoring conducted during 2023.

2.1 Surface Water Treatment Rule Monitoring and Reporting

SWTR monitoring includes raw water monitoring for fecal coliform concentrations, turbidity, and disinfection/contact time (CT) values; entry point monitoring for chlorine residuals; distribution system monitoring for chlorine residuals and coliform bacteria levels; and quarterly monitoring in the distribution system for total trihalomethanes and haloacetic acids (HAA5). In 2023, all monitoring samples complied with thresholds defined by the SWTR.

2.1.1 Raw Water Fecal Coliform Concentrations (40 CFR Section 141.71 (a)(1))

In 2023, the Catskill Aqueduct between Kensico Reservoir and the Catskill/Delaware Ultraviolet Light Disinfection Facility (CDUV) was offline. Therefore, no Catskill Aqueduct effluent fecal coliform samples were collected for the year. The Delaware Aqueduct effluent from Kensico Reservoir exhibited fecal coliform concentrations in water prior to disinfection at levels less than or equal to 20 fecal coliforms 100/ml in at least 90% of the samples collected during the year, as calculated by six-month running percentages.

As shown in Figure 2.1, in 2023 the highest six-month running percentage of positive raw water fecal coliform samples at the Delaware Aqueduct effluent from Kensico Reservoir was 0.55%, well below the maximum percentage of positive samples allowed under the SWTR.

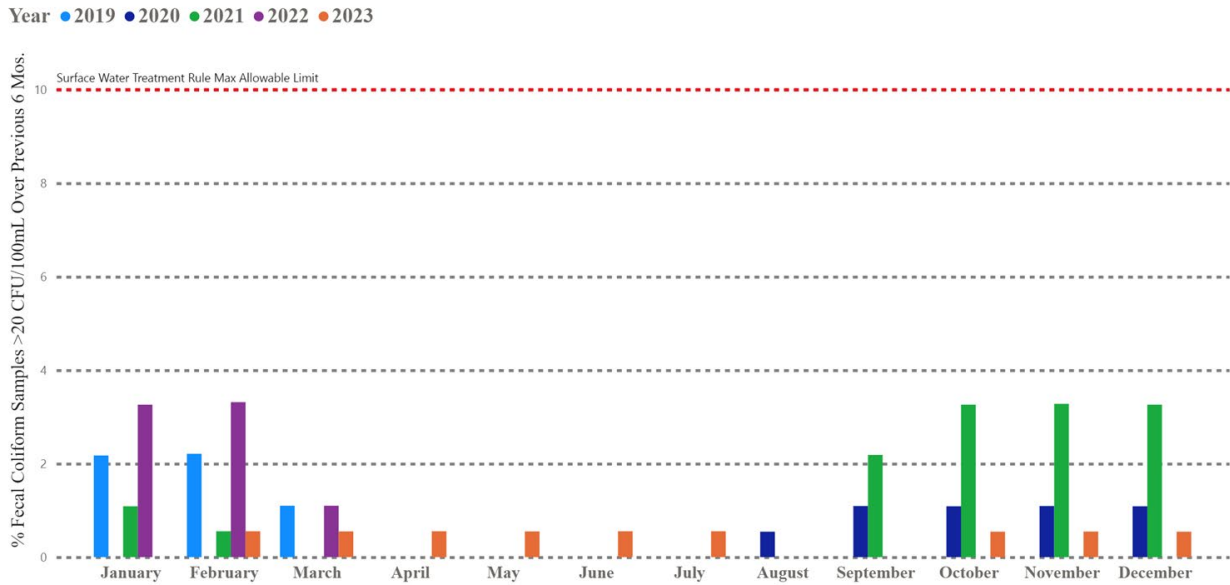


Figure 2.1 Percent fecal coliform samples >20 CFU/100mL over the previous six months, Catskill-Delaware System, 2019-2023.

2.1.2 Raw Water Turbidity (40 CFR Section 141.71(a)(2))

The Delaware Aqueduct effluent from Kensico Reservoir exhibited turbidity levels less than or equal to 5 NTU in water prior to disinfection for the entire 2023 calendar year (Figure 2.2). No samples were collected from the Catskill Aqueduct in 2023 because the Catskill Aqueduct south of Kensico Reservoir was offline.

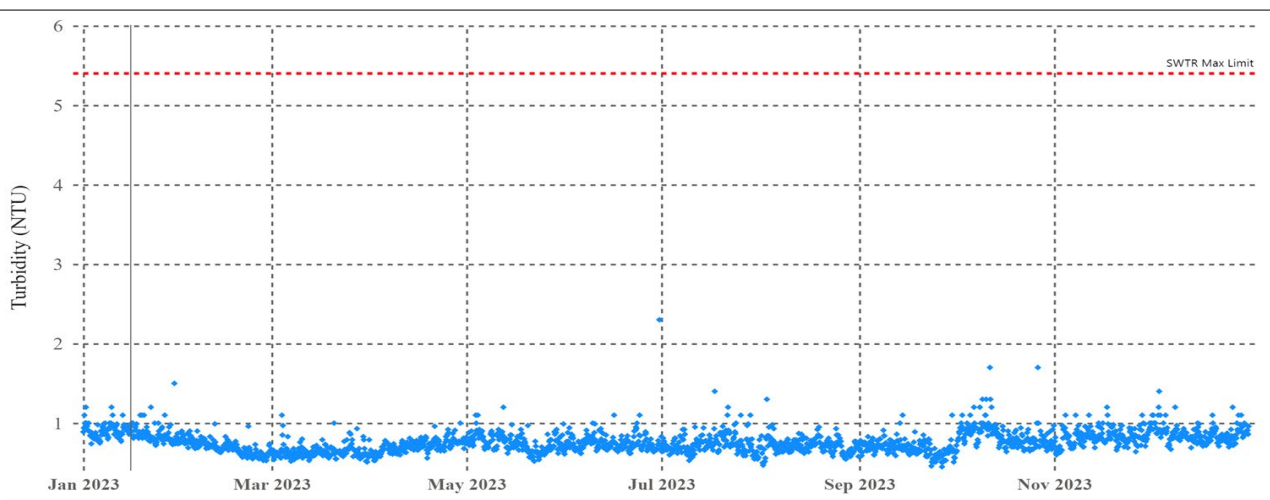


Figure 2.2 Catskill-Delaware source water turbidity, January 1, 2023-December 31, 2023.

2.1.3 Raw Water Disinfection/CT Values (40 CFR Sections 141.71(b)(1)(i) and 141.72(a)(1))

CT values recorded each day during the year for the Catskill and Delaware systems produced net inactivation ratios (IAR) greater than or equal to 1.0. CT was achieved using both UV and chlorine. For *Cryptosporidium*, 2-log inactivation was achieved with UV with a minimum log inactivation of 2.00. For *Giardia*, the required 3-log inactivation was achieved with 2-log using UV plus 1-log using chlorine other than from July 19, 2023 to July 20, 2023, when all 3-log was achieved with UV. The minimum log inactivation from UV for *Giardia* was 2.09.

The net IAR using chlorine for 1-log *Giardia* inactivation when it was needed was calculated adding the IAR from two segments. The first segment of the Delaware Aqueduct from Kensico to Shaft 19 at the Catskill/Delaware Ultraviolet Light Disinfection Facility (CDUV) was used for both aqueducts because the first segment of the Catskill Aqueduct was offline from Kensico to Eastview and was added to each aqueduct's second segment IARs from CDUV to Hillview. The actual lowest net IAR for 1-log *Giardia* using chlorine in 2023 was 1.1 for the Catskill Aqueduct and 1.2 for the Delaware Aqueduct.

2.1.4 Entry Point Chlorine Residual (40 CFR Sections 141.71(b)(1)(iii) and 141.72(a)(3))

As required, continuous monitoring for free chlorine residual was maintained at the distribution entry points throughout 2023, and at no time did the concentration fall below 0.2 mg/L for more than four hours.

2.1.5 Distribution System Disinfection Residuals (40 CFR Sections 141.71(b)(1)(iv) and 141.72(a)(4))

Of the 15,217 samples measured for residual chlorine within the distribution system during 2023, all were greater than or equal to 0.01 mg/L, except for 9 samples that equaled 0.00 mg/L.

2.1.6 Trihalomethane Monitoring (40 CFR Section 141.71(b)(6)) and HAA5 Monitoring (40 CFR Section 141.171)

The analysis for trihalomethanes in 2023, performed on a quarterly basis, resulted in a maximum total trihalomethane (TTHM) value of 77 µg/L. The analysis for haloacetic acids, also performed on a quarterly basis, resulted in a maximum haloacetic acid five (HAA5) value of 63 µg/L.

The highest TTHM quarterly running annual average during 2023, recorded during the first and second quarters, was 42 µg/L, a level below the regulated level of 80 µg/L. The highest HAA5 quarterly running annual average, recorded during the first quarter, was 45 µg/L, a level below the regulated level of 60 µg/L.

2.2 Total Coliform Monitoring

2.2.1 Monthly Coliform Monitoring (40 CFR Section 141.71(b)(5))

Within the distribution system, coliform monitoring indicated monthly levels of total coliforms below 0.5% for all 12 months of 2023 (Figure 2.3). The number of compliance samples analyzed in 2023 for total coliforms was 9,650, of which 76 were total coliform positive, and none were *E. coli* positive. The annual percentage of compliance samples that were total coliform positive was 0.8%. Since 1994, DEP has collected 307,335 coliform compliance samples, and only 17 of them have tested positive for *E. coli*.

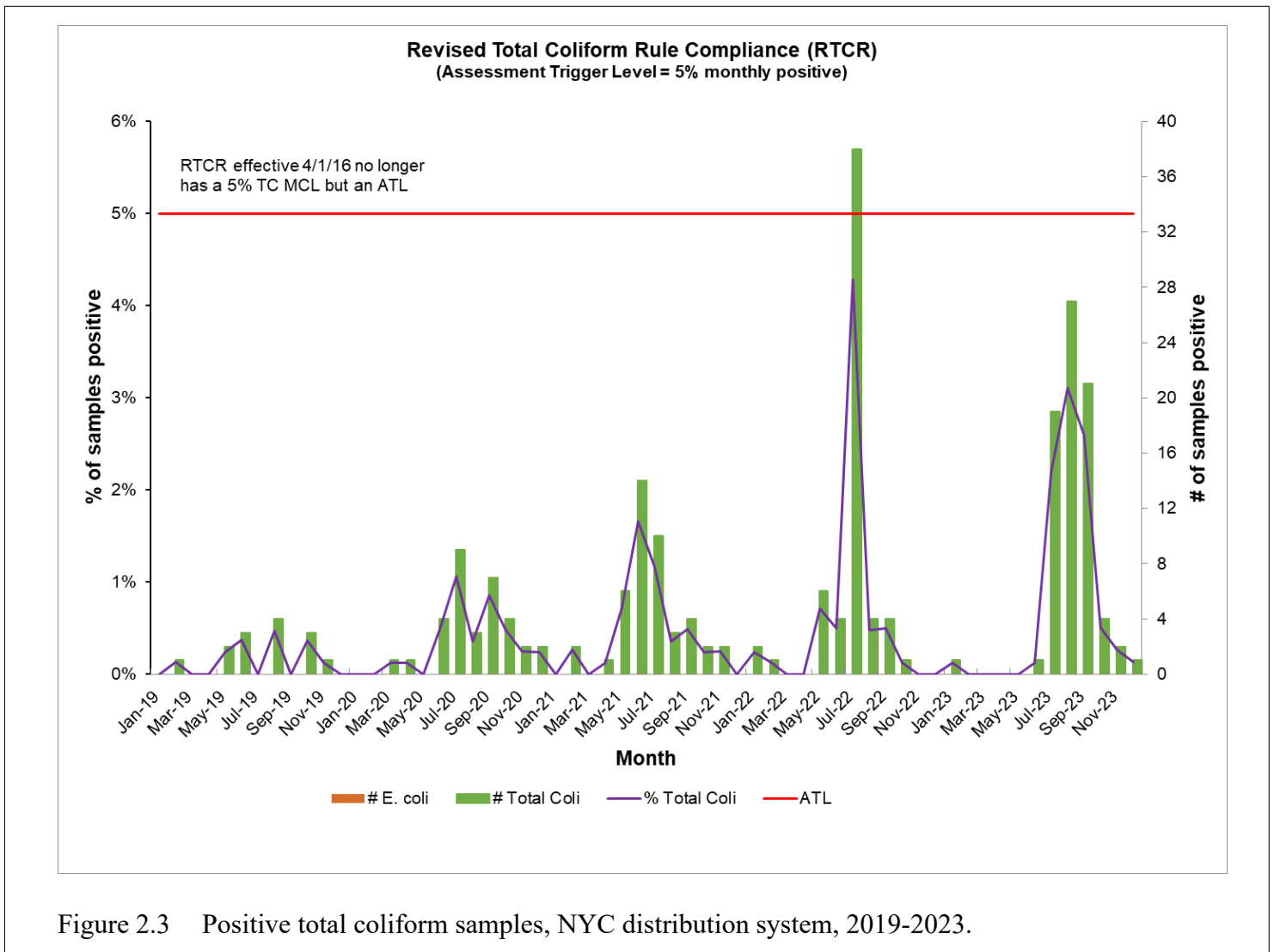


Figure 2.3 Positive total coliform samples, NYC distribution system, 2019-2023.

Heterotrophic plate counts (HPC) were all ≤ 500 CFU/mL, equivalent to a measurable free chlorine residual in 2023. Zero percent of the samples had an undetectable free chlorine residual or HPC > 500 CFU/mL. This meets the requirements that a free chlorine residual be maintained at representative points in the distribution system, and that no more than 5% of the free chlorine residual samples be undetectable in any two months.

2.2.2 Chlorine Residual Maintenance in the Distribution System

During 2023, DEP continued to ensure adequate levels of chlorine throughout the distribution system, by maintaining chlorination levels at the distribution system's entry points, conducting spot flushing when necessary, and operating two permanent chlorination booster stations to improve the chlorine residual levels for the Fort Tilden, Roxbury, and Breezy Point areas (Rockaway Peninsula) in Queens, and for Staten Island. As a result of these steps, detectable chlorine residuals were maintained throughout the distribution system in 2023.

3. Environmental Infrastructure

3.1 Septic Programs

Since 1997, DEP has committed over \$190 million to rehabilitate, replace, and maintain septic systems in the West of Hudson (WOH) watershed through several programs managed by the Catskill Watershed Corporation (CWC) as described below.

The Septic Rehabilitation and Replacement Program funds the repair and replacement of septic systems serving single- or two-family residences. In 2023, CWC reimbursed 291 residential septic repairs, including 27 second time repairs. To date, the program has funded more than 6,670 residential septic repairs throughout the WOH watershed.

The Septic Maintenance Program is intended to reduce septic system failures through the subsidizing of regular septic tank pump-outs and maintenance. In 2023, CWC subsidized 680 septic tank pump-outs, for a cumulative total of over 5,000 pump-outs since program inception.

The Expanded Septic System Rehabilitation and Replacement Program (formerly the Small Business Septic Program) funds the repair or replacement of failed septic systems serving eligible governmental entities, not-for-profit organizations, and small business owners in the WOH watershed. In 2023, CWC funded the remediation of 21 septic systems under the Expanded Septic Program, for a cumulative total of 81 repairs since program inception.

The Cluster Septic System Program funds the planning, design, and construction of cluster systems in 13 WOH watershed communities; operation and maintenance funding is also available. No communities opted to participate in this program during 2023.

3.2 Community Wastewater Management Program

Administered by CWC, the Community Wastewater Management Program (CWMP) supports the design and construction of community wastewater management solutions. To date, the CWMP has completed 12 projects in Bovina, DeLancey, Bloomville, Hamden, Boiceville, Ashland, Trout Creek, Lexington, South Kortright, Claryville, Shandaken, and West Conesville. For the remaining three CWMP projects still in progress, highlights for 2023 include:

- Halcottsville – DEP approved a block grant of \$11.454 million to connect this community to the City-owned Margaretville Water Resource Recovery Facility (WRRF). Construction commenced in July 2022. In 2023, the Town’s contractor completed construction of the collection system (e.g., force mains, pre-cast units) within the hamlet and installation of the force main along State Route 30 to the connection point of the Margaretville WRRF collection system. Testing of the force mains and pump stations will be completed over the winter. Substantial completion is expected to occur in 2024.

- New Kingston – DEP approved a block grant of \$7.7 million for a sewer collection system and community septic system. Construction on the project commenced in September 2022. In 2023, the town’s contractor installed and tested most of the sewer piping and pre-cast units, completed the wastewater treatment facility building, installed the onsite well and connected the generator. Substantial completion is expected to occur in 2024.
- Shokan – DEP approved a block grant of \$48.7 million for a WRRF serving the hamlets of Boiceville and Shokan in the Town of Olive in August 2020. The project is in the pre-construction phase. DEP provided comments on the 65% collection system and the Boiceville-to-Shokan force main in 2022. In 2023, DEP received the 65% Boiceville Conversion Facility Plan plans and the WWTP Facility Plan. The town anticipates obtaining collection system easements and completing the pre-construction phase in 2024.

3.3 Stormwater Program

3.3.1 Stormwater Cost-Sharing Programs

DEP pays for incremental costs associated with stormwater measures required solely by the City’s Watershed Rules and Regulations (WR&R) to the extent they exceed the costs of complying with state and federal requirements. Pursuant to the 1997 MOA, CWC administers two separate programs to offset eligible WR&R compliance costs related to the design, construction, and maintenance of stormwater pollution prevention plans and individual residential stormwater plans: the WOH Future Stormwater Controls Program (MOA-128) and the Future Stormwater Controls Paid for by the City Program (MOA-145).

The MOA-128 Program reimburses municipalities and large businesses 100% and small businesses 50% for eligible WR&R costs. DEP has provided over \$36.4 million to CWC for the MOA-128 Program, of which CWC has reimbursed over \$12.7 million to program applicants and transferred approximately \$17.6 million to other eligible programs.

The MOA-145 Program reimburses low-income housing projects and single-family homeowners 100% and small businesses 50% for eligible WR&R costs. Through 2023, CWC has reimbursed over \$1.7 million to MOA-145 Program applicants.

Table 3.1 summarizes projects approved for funding under both programs in 2023.

Table 3.1 WOH future stormwater controls projects approved for funding in 2023.

Applicant	Project	CWC Funding
Basset Brook LLC	Solar Power Utility	\$ 10,975.00
Catskill Holdings Windham LLC	Subdivision	\$303,396.06
Catskill Mountain Little League	Sports Complex	\$126,200.00
Cortina Mountain Estate LLC	Subdivision	\$195,512.13
CSS Real Holdings LLC	Subdivision	\$369,133.46
Floyd Dart	Subdivision	\$11,743.04
Four Goats LLC	Gas Station	\$70,000.00
Haines Falls Fire District	Parking Garage	\$13,053.00
James McDonald	Residential	\$5,674.82
Joseph Baglio	Residential	\$40,116.25
Lisa Zocchia Wage	Residential	\$6,165.00
Macollo LLC (Hotel Dylan)	Parking Lot	\$14,520.45
Montana Contracting Corporation	Subdivision	\$7,612.46
Nigol Koulajian	Residential	\$34,350.00
Onteora Club	Subdivision	\$16,533.12
Peter Sluiter	Residential	\$56,063.00
Rexmere Lakes LLC	Solar Power Utility	\$10,975.00
Windham – Ambulance Facility	Parking Area	\$133,900.48
Van Furman	Parking Area	\$68,453.75

3.3.2 Stormwater Retrofit Program

Jointly administered by DEP and CWC, the Stormwater Retrofit Program provides funding for the design, permitting, construction, and maintenance of best management practices to address existing stormwater retrofit runoff in concentrated areas of impervious surfaces.

Through 2023, the program has completed 19 planning and assessment projects and undertaken 80 stormwater retrofit projects. Among the projects undertaken, CWC funded various project phases that may include design, construction, or equipment. In 2023, the Village of Fleischmanns completed construction for the Lake Street stormwater retrofit project with an approximate cost of \$350,000. Also in 2023, CWC and DEP approved projects to initiate the assessment and conceptual design at the Olive Free Library and the Village of Margaretville. In addition to these two projects, there is one open retrofit project assessing a possible stormwater collection, conveyance, and treatment system for the Town of Jewett town hall and highway garage. Finally in 2023, DEP and CWC attended site visits in Pine Hill, The Red Barn in the Town of Hunter, and the Chicken Run Restaurant in the Town of Windham. On-site evaluations at these three locations determined that preliminary design work may be useful in assessing the extent to which the sites are suitable for future stormwater retrofit projects. To date, applications for those assessments have not been received.

4. Protection and Remediation Programs

4.1 Waterfowl Management Program

Implementation of the Waterfowl Management Program continued without interruption during 2023. The Waterfowl Management Program Annual Report, submitted on October 31, 2023, summarizes the program's activity from August 1, 2022, through July 31, 2023. The period from August 1 through December 31, 2023, will be summarized in the program's annual report to be submitted on October 31, 2024. Reports are also available on the DEP website (<https://www1.nyc.gov/site/dep/about/filtration-avoidance-determination.page>).

4.2 Land Acquisition

DEP's Land Acquisition Program (LAP) permanently protects high priority sensitive lands in the Catskill/Delaware watershed through acquisition of conservation easements (CEs) and land in fee simple, both directly by the City and in partnership with the Watershed Agricultural Council (WAC Farm and Forest CE Programs), Catskill Center for Conservation and Development (Streamside Acquisition Program, or SAP), and local municipalities through the New York City-Funded Flood Buyout Program (NYCFFBO).

In 1997, the City owned 3.4% of the land area in the Catskill/Delaware watershed, while an additional 21.3% was owned by New York State and other public entities for a total protected status of 24.7%. As of December 31, 2023, 39.8% of the Catskill/Delaware watershed land area has been permanently protected by the City, state, and others. Table 4.1 describes natural resources and features on City-protected lands and CEs acquired pursuant to the FAD. The acreage shown in Table 4.1 includes reservoir acres and is based on a GIS analysis rather than surveyed acres.

DEP now owns or controls more miles of stream, and roughly the same acreage of buffer land within 300 feet of watercourses and 1,000 feet of reservoirs, than are protected in the entire Catskill/Delaware watershed by all other entities combined including New York State. In total, 36% of stream length and stream buffers are under some type of permanent protected status, along with 73% of wetlands and deepwater habitats, 65% of floodplains and 44% of forest cover. Overall, the proportion of protected water features in the watershed roughly equals or exceeds the proportion of acres protected.

Table 4.1 Streams, stream buffers, wetlands and deepwater habitats, floodplains and forest cover on lands protected pursuant to the FAD

Land Protection Category	Total in CAT/DEL Watershed incl. Reservoirs (acres) ¹	% Total CAT/DEL Watershed Area	CAT/DEL Stream Length (miles) ²	% total CAT/DEL Stream Miles	CAT/DEL 300 ft. Riparian Buffer (acres) ³	% Total CAT/DEL Riparian Buffers	CAT/DEL Wetlands (acres) ⁴	% Total CAT/DEL Wetlands	CAT/DEL Forest Cover (acres) ⁵	% Total CAT/DEL Forest Cover	CAT/DEL Floodplain (acres) ⁶	% Total CAT/DEL Floodplain
<u>Publicly-Owned or Controlled lands⁷</u>												
NYC-owned Non-LAP Property (Pre-1997 or facility-related)	61,330	5.80%	105	2.70%	6,875	2.70%	27,013	62.10%	31,763	3.80%	29,921	55.30%
NYC-owned LAP Property (Post-1997, Fee Simple)	95,370	9.10%	381	10.00%	24,459	9.80%	2,363	5.40%	82,257	9.90%	2,061	3.80%
Land Protected by SAP Fee Simple	283	0.00%	4	0.10%	200	0.10%	32	0.10%	240	0.00%	45	0.10%
Land Protected by LAP NYC Conservation Easement	26,276	2.50%	107	2.80%	6,707	2.70%	444	1.00%	22,775	2.70%	490	0.90%
Land Protected by WAC Farm Easement	28,199	2.70%	120	3.10%	7,458	3.00%	406	0.90%	15,045	1.80%	1,368	2.50%
Land Protected by WAC Forest Easement	3,078	0.30%	5	0.10%	430	0.20%	18	0.00%	2,880	0.30%	42	0.10%
NYCFFBO - NYC-owned	53	0.00%	1	0.00%	17	0.00%	5	0.00%	37	0.00%	39	0.10%
FEMA FBO – NYC-owned	52	0.00%	1	0.00%	30	0.00%	7	0.00%	32	0.00%	42	0.10%
Subtotal NYC Lands and Easements	214,642	20.50%	725	18.90%	46,176	18.50%	30,288	69.60%	155,028	18.60%	34,007	62.90%
NY State-owned Land	210,079	20.00%	625	16.30%	42,562	17.00%	1,268	2.90%	207,825	24.90%	981	1.80%
Other in Protected Status	8,825	0.80%	45	1.20%	2,694	1.10%	358	0.80%	7,459	0.90%	480	0.90%
NYCFFBO - Municipally-owned	19	0.00%	0.5	0.00%	45	0.00%	1	0.00%	12	0.00%	17	0.00%
FEMA FBO – Municipally-owned	40	0.00%	1	0.00%	40	0.00%	2	0.00%	15	0.00%	36	0.10%
Total CAT/DEL Public Land:	433,605	41.30%	1,396	36.40%	91,517	36.60%	31,917	73.30%	370,340	44.40%	35,522	65.70%

Protection and Remediation Programs

Land Protection Category	Total in CAT/DEL Watershed incl. Reservoirs (acres) ¹	% Total CAT/DEL Watershed Area	CAT/DEL Stream Length (miles) ²	% total CAT/DEL Stream Miles	CAT/DEL 300 ft. Riparian Buffer (acres) ³	% Total CAT/DEL Riparian Buffers	CAT/DEL Wetlands (acres) ⁴	% Total CAT/DEL Wetlands	CAT/DEL Forest Cover (acres) ⁵	% Total CAT/DEL Forest Cover	CAT/DEL Floodplain (acres) ⁶	% Total CAT/DEL Floodplain
<u>Private Watershed Lands</u>												
Private Land	615,055	58.70%	2,435	63.60%	158,667	63.40%	11,609	26.70%	463,768	55.60%	18,558	34.30%
Total CAT/DEL Privately-owned Land:	615,055	58.70%	2,435	63.60%	158,667	63.40%	11,609	26.70%	463,768	55.60%	18,558	34.30%
Grand Total Land in CAT/DEL:												
	1,048,660	100.00%	3,830	100.00%	250,184	100.00%	43,526	100.00%	834,108	100.00%	54,080	100.00%

1. GIS Data Source: NYCDEP BWS, 12/2022. Land ownership acreage categories are calculated directly from areas of GIS polygons and therefore may not match exactly other survey-based acreage totals submitted by DEP. GIS data are clipped to the NYC watershed boundary. CAT/DEL includes all WOH basins plus West Branch, Boyd Corners, and Kensico. Reservoir basin boundaries derived from 1m LiDAR in 2014. Water features are from local-resolution National Hydrography Dataset (NHD) originally derived from 1m LiDAR in 2013 and last updated by DEP GIS staff in 2020.
2. Includes streams and river centerlines only as a linear measurement, wherever they intersect with the specified land category.
3. Riparian buffers are calculated as a 300-foot area on both sides of watercourses (streams and rivers only, excludes ponds, lakes, and reservoirs). Any water features within these buffers were excluded from buffer acreages.
4. Includes wetlands plus deepwater habitats. Acres of both are calculated from a combined GIS layer of NWI and DEC-mapped polygons and summarized by categories specified by DEP Wetlands Scientists, already used for FAD annual reporting purposes. Categories considered "deepwater habitats" include reservoirs or large lakes (L1), unconsolidated bottom (L2UB), riverbeds (RUB & RRB) or streambeds (RSB). Categories considered "wetlands" include palustrine systems and exclude the deepwater habitats classes as well as all upland (U), and unconsolidated shore (L2US). These definitions are distinct from the definition of an NFC-qualified wetland under the WSP.
5. Forest features are from landcover classes derived from LiDAR, leaf-off and leaf-on imagery that was acquired by DEP in 2009. Specific classes included are deciduous and coniferous trees from the landcover dataset, using the query "Landcover IN(1, 4)"
6. "Floodplains" are defined as 100-year floodplain, areas with a 1% annual chance of flooding. The query used "FLD_ZONE IN ('AO', 'AH', 'AE', 'A', 'VE')", is extracted from published FEMA DFIRM data. Some wetlands, floodplains, and riparian buffers overlap with each other, so these acreages cannot be added together for a "total water feature" figure.
7. All LAP properties are "Under Contract" or "Closed". "Other in Protected Status" means the land is believed to be under some form of permanent ownership by a land trust or municipal government.

Figure 4.1 depicts protected lands by basin, illustrating that in several high priority reservoir basins the City’s land holdings have increased dramatically compared with pre-MOA ownership. In the Rondout, West Branch/Boyd Corners, and Schoharie basins, for example, the City has raised the number of protected acres by almost 700%, 1,500%, and 3,000% respectively. Through 2023, the City owned or controlled a total of 188,587 acres of land in the Catskill/Delaware watershed, or 18.5% of the land area (excluding acreage under reservoirs).

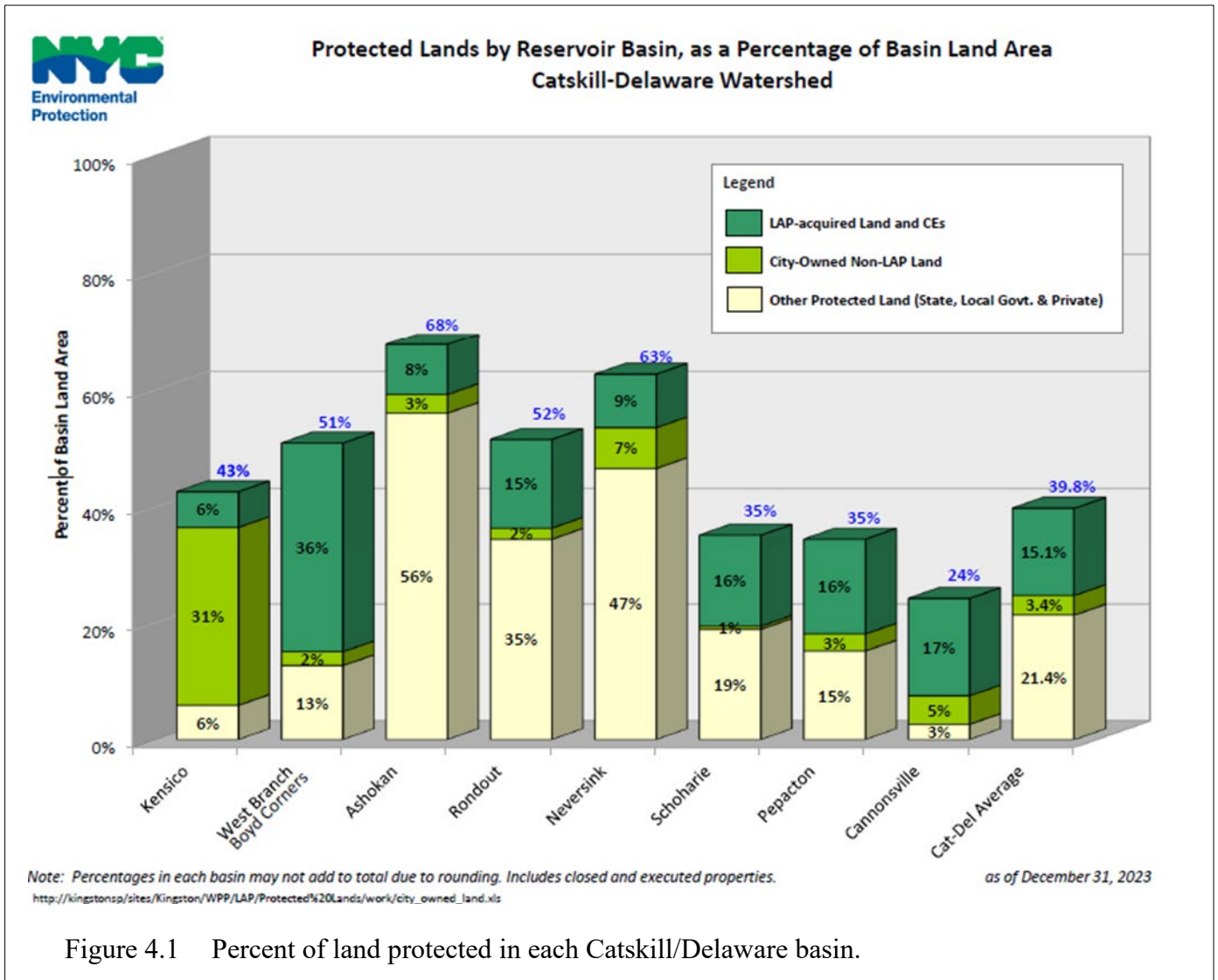


Figure 4.1 Percent of land protected in each Catskill/Delaware basin.

4.2.1 Solicitation Goals

The Revised 2017 FAD requires the LAP to solicit 200,000 acres over the seven-year period 2018-2024. This metric was reduced from 350,000 acres in the original 2017 FAD based in part on community concerns, negotiations with watershed stakeholders, and recommendations from the National Academies of Sciences, Engineering and Medicine.

In 2023, DEP and its LAP partners solicited 41,105 acres, with DEP responsible for 14,614 acres and the remainder representing the credit available per the FAD: the sum of 1,066 acres solicited through the SAP, one acre solicited through the NYCFFBO, and 21,156 acres solicited through the WAC Farm and Forest CE Programs. Acreage solicited through SAP and NYCFFBO are multiplied by five to yield a total solicitation credit of 26,490 acres for WAC, SAP and NYCFFBO.

Combined with acres solicited since 2018, the LAP and its partner programs have thus far solicited 191,494 acres (96%) toward the 200,000-acre FAD goal. Since 1997, the LAP has solicited over 480,000 total acres, with most landowner contacts now represented by re-solicitations of previously solicited properties. This figure is a current snapshot of total unique acres solicited at a one-to-one ratio across all programs. For closed properties, surveyed acres are used for calculations; for all other properties, the most recent solicited acreage field is used for calculation. The solicited acreage field changes over time due to adjustments in project configuration and/or routine tax parcel updates; it is not as accurate as a final survey.

Overall outcomes of LAP solicitations by basin and county since 1997 are listed in Table 4.2 and Table 4.3, respectively. Relatively high levels of positive responses (measured by contracts executed or under negotiation) are seen among solicited landowners in EOH basins: 41% in Kensico and 69% in West Branch/Boyd Corners; positive landowner responses in two WOH basins (Ashokan and Schoharie) are also at or above 30%. Similar findings exist at the county level, with solicitations in Dutchess, Greene, Putnam and Westchester counties resulting in positive landowner responses above 30%.

Since 2019, all core LAP solicitations have adhered to NYSDOH-approved modifications that increased Surface Water Criteria (SWC) requirements in relation to other property characteristics and prohibited outgoing solicitations in certain towns upon reaching specified acquisition thresholds. As depicted in Appendix A Table 1, the LAP cannot undertake outgoing solicitations in the towns of Andes, Walton, and Delhi, while Shandaken remains unavailable for solicitation under Special Condition 10(c) of the 2010 Water Supply Permit (WSP).

Table 4.2 Solicitation outcomes by basin since 1997.

Kensico Basin			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of Basin Acres</u>
Signed/Closed	20	405	41%
Offer Refused	9	86	9%
No Response	2	112	11%
Not Interested	6	357	36%
Other*	5	39	4%
Kensico Basin Sub-Totals:	42	999	
West Branch / Boyd Corners Basin			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of Basin Acres</u>
Signed/Closed	209	9,451	64%
Active, Under Negotiation	3	754	5%
Offer Refused	39	331	2%
No Response	43	803	5%
Not Interested	49	3,051	21%
Other*	29	286	2%
West Branch / Boyd Corners Basin Sub-Totals:	372	14,676	
Ashokan Basin			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of Basin Acres</u>
Signed/Closed	243	13,030	31%
Active, Under Negotiation	6	167	0%
Offer Refused	76	4,741	11%
No Response	165	9,583	23%
Not Interested	170	10,881	26%
Other*	65	3,937	9%
Ashokan Basin Sub-Totals:	725	42,339	
Cannonsville Basin			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of Basin Acres</u>
Signed/Closed	277	27,487	21%
Active, Under Negotiation	7	810	1%
Offer Refused	73	6,640	5%
No Response	520	44,554	33%
Not Interested	446	46,779	35%
Other*	99	7,727	6%
Cannonsville Basin Sub-Totals:	1,422	133,997	

Protection and Remediation Programs

Neversink Basin

<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of Basin Acres</u>
Signed/Closed	30	4,804	21%
Offer Refused	9	1,188	5%
No Response	44	4,675	21%
Not Interested	52	10,174	45%
Other*	7	1,703	8%
Neversink Basin Sub-Totals:	142	22,545	

Pepacton Basin

<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of Basin Acres</u>
Signed/Closed	335	32,005	28%
Active, Under Negotiation	6	402	0%
Offer Refused	54	6,433	6%
No Response	273	23,883	21%
Not Interested	337	46,645	41%
Other*	74	3,797	3%
Pepacton Basin Sub-Totals:	1,079	113,165	

Rondout Basin

<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of Basin Acres</u>
Signed/Closed	152	8,328	29%
Active, Under Negotiation	3	75	0%
Offer Refused	24	903	3%
No Response	93	5,591	20%
Not Interested	154	12,987	45%
Other*	13	780	3%
Rondout Basin Sub-Totals:	439	28,664	

Schoharie Basin

<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of Basin Acres</u>
Signed/Closed	391	29,158	32%
Active, Under Negotiation	16	1,428	2%
Offer Refused	83	5,434	6%
No Response	415	17,335	19%
Not Interested	349	25,015	27%
Other*	187	12,691	14%
Schoharie Basin Sub-Totals:	1,441	91,061	
Grand Totals:	5,662	447,445	

* "Other" includes properties solicited but now developed / ineligible, resolicitation under way (awaiting response), and contract rescinded. "Project acres" are used for projects that are Signed/Closed, otherwise "solicited acres" are used. Includes all programs except WAC. Does not include inactive projects.

Table 4.3 Solicitation outcomes by county.

Dutchess County			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of County Acres</u>
Signed/Closed	26	1,058	47%
Active, Under Negotiation	1	15	1%
Offer Refused	6	39	2%
No Response	7	102	5%
Not Interested	12	1,028	45%
Other*	3	18	1%
Dutchess County Sub-Totals:	55	2,261	
Putnam County			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of County Acres</u>
Signed/Closed	183	8,393	68%
Active, Under Negotiation	2	739	6%
Offer Refused	33	292	2%
No Response	36	701	6%
Not Interested	37	2,022	16%
Other*	26	269	2%
Putnam County Sub-Totals:	317	12,415	
Westchester County			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of County Acres</u>
Signed/Closed	20	405	41%
Offer Refused	9	86	9%
No Response	2	112	11%
Not Interested	6	357	36%
Other*	5	39	4%
Westchester County Sub-Totals:	42	999	
Delaware County			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of County Acres</u>
Signed/Closed	621	58,362	25%
Active, Under Negotiation	15	1,348	1%
Offer Refused	130	12,762	5%
No Response	794	68,581	29%
Not Interested	769	80,632	35%
Other*	174	12,007	5%
Delaware County Sub-Totals:	2,503	233,691	

Protection and Remediation Programs

Greene County			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of County Acres</u>
Signed/Closed	315	25,471	33%
Active, Under Negotiation	12	293	0%
Offer Refused	58	4,337	6%
No Response	332	15,374	20%
Not Interested	284	22,346	29%
Other*	156	10,494	13%
Greene County Sub-Totals:	1,157	78,314	
Schoharie County			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of County Acres</u>
Signed/Closed	70	4,630	27%
Active, Under Negotiation	2	999	6%
Offer Refused	22	1,240	7%
No Response	104	3,765	22%
Not Interested	81	4,686	27%
Other*	31	2,079	12%
Schoharie County Sub-Totals:	310	17,398	
Sullivan County			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of County Acres</u>
Signed/Closed	71	5,738	23%
Active, Under Negotiation	1	18	0%
Offer Refused	18	1,211	5%
No Response	71	6,630	26%
Not Interested	119	9,626	38%
Other*	11	2,120	8%
Sullivan County Sub-Totals:	291	25,343	
Ulster County			
<u>Current LAP Status</u>	<u>Number of Projects</u>	<u>Acres</u>	<u>% of County Acres</u>
Signed/Closed	351	20,611	27%
Active, Under Negotiation	8	223	0%
Offer Refused	91	5,790	8%
No Response	209	11,270	15%
Not Interested	255	35,193	46%
Other*	73	3,937	5%
Ulster County Sub-Totals:	987	77,024	
Total:		447,445	

Table 4.4 Watershed-Wide Outcomes

	Number of Projects	Acres	Pct. Of Watershed, Acres
Signed/Closed	1,657	124,667	28%
Active, under negotiation	41	3,635	1%
Offer refused	367	25,755	6%
No response	1,555	106,536	24%
Not interested	1,563	155,890	35%
Other	479	30,962	7%
Total	5,662	447,445	100%

4.2.2 Purchase Contracts

As depicted in Appendix A Table 2 and Appendix A Table 3, the core LAP and its partner programs executed 21 purchase contracts in 2023 comprising 1,196 acres at a fair market value of \$5.33 million. The average SWC is 46% for these properties, considerably higher than the cumulative average of 28% across all programs since inception. To date, DEP and its LAP partners have signed 1,861 purchase contracts comprising 156,247 acres at a fair market value of \$514.8 million (excluding partner operating costs to administer the SAP and WAC CE programs). DEP has spent an additional \$43.9 million on LAP soft costs such as appraisals and surveys.

Figure 4.2 depicts acreage signed to contract annually under core LAP and partner programs since 1995. The low numbers of purchase contracts and acres acquired during the past few years are attributable to a pandemic-induced hiatus in operations that DEP lifted in 2021, the effects of the pandemic on the real estate market, and refinements of criteria for program eligibility. Project designs now involve more frequent subdivisions to increase the amount of SWC that the City seeks to acquire while leaving more developable land in private ownership.

As depicted in Appendix A Table 4, DEP and its LAP partners closed on 16 purchase contracts comprising 347 acres in 2023. The average SWC is 67% for these properties, considerably higher than the average of 28% across all programs since inception. Appendix A Table 5. shows that projects closed in 2023 were valued at \$2.2 million while Appendix A Table 6. provides tax lot details for these acquisitions. Appendix A Table 7. summarizes these newly acquired watershed lands by LAP Priority Area. These totals exclude purchase contracts that have been rescinded and include 586 acres that are outside the City’s watershed but were acquired as part of 57 separate transactions, where it was difficult or impossible to subdivide tax lots that spanned the watershed boundary. “Total cost” reflects final values for all closed projects but appraised values for properties under contract and not yet closed.

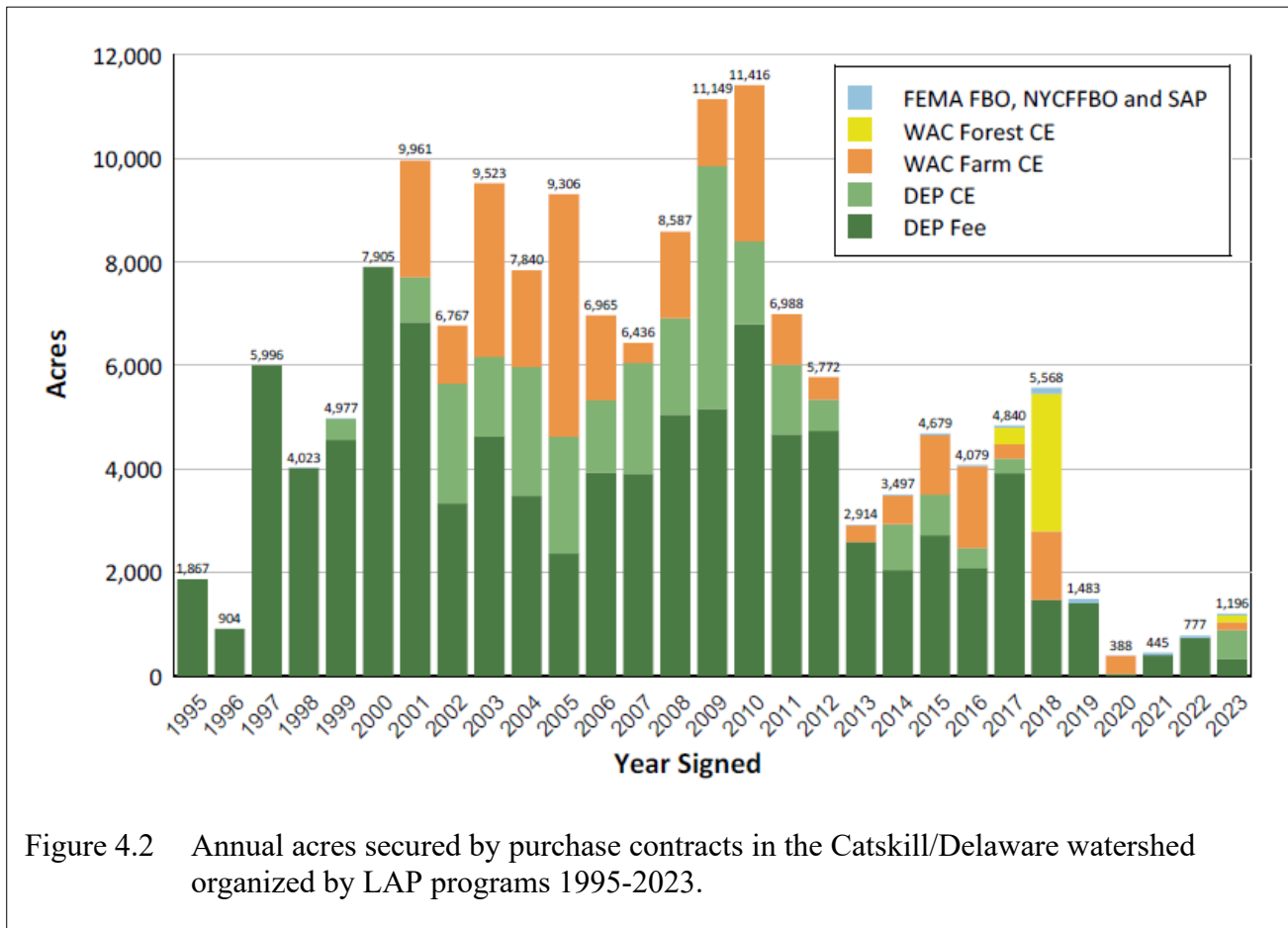


Figure 4.2 Annual acres secured by purchase contracts in the Catskill/Delaware watershed organized by LAP programs 1995-2023.

4.2.3 Transfer of Conservation Easements to New York State

DEP is required to convey CE to New York State on all watershed lands acquired in fee simple. During 2023, DEP participated in stakeholder meetings to explore potential changes to the model CE granted to the state to allow for certain new land uses, including public utilities and renewable energy infrastructure, pursuant to the Revised 2017 FAD. Considering these discussions, DEP did not convey any new CE to the state in 2023. Two CE (covering 19 properties) that DEP previously submitted to the state but have not been recorded due to the need for minor corrections are also being held in abeyance until new model CE language is completed. As of December 31, 2023, watershed wide, DEP has submitted and NYSDEC has recorded 83 CE on 1,093 properties (72,835 acres).

4.2.4 New York City-Funded Flood Buyout Program

The NYCFFBO was very active in 2023, with one new appraisal and three appraisal updates ordered, seven contracts executed, and four properties closed. DEP has appraised 46 properties to date through this program, with 26 projects closed (12 owned by the City and 14 owned by municipalities), seven now under contract, and four offers accepted or under review.

4.2.5 Streamside Acquisition Program

DEP administers the pilot SAP through an \$8 million contract with the Catskill Center for Conservation and Development (CCCD). In 2023, CCCD ordered seven appraisals totaling 54 acres, executed four purchase contracts on 17 acres, and closed on seven projects totaling 46 acres. To date, the SAP has ordered 81 appraisals (including updates for time) on 75 properties, which has resulted in 37 signed contracts on 290 acres. As shown in Appendix A Table 2, SAP acquisitions average 76% SWC. To date, the SAP has closed on 33 contracts protecting 273 acres. Figure 4.4 depicts a recently closed SAP project in the Town of Hunter.

As of the end of 2023, CCCD had expended \$41,000 worth of incentive payments that were developed in collaboration with watershed stakeholders to increase landowner participation in the SAP. This includes \$18,000 in total for nine landowners whose properties contain at least 85% or greater SWC and a total of \$21,000 for seven landowners whose properties appraised at or below \$40,000; two of the latter landowners also received an additional incentive payment of \$1,000 toward subdivision costs. Since late 2019, when all SAP incentives (financial and non-financial) were put in place, 15 out of 21 SAP transactions (71%) have involved incentive payments.

As required by the Revised 2017 FAD, during 2023 DEP convened stakeholder workgroup meetings to explore issues related to the expansion of the SAP beyond the Schoharie basin, including an evaluation of the proposed Delaware County riparian buffer license pilot program. In December, DEP submitted a FAD deliverable to NYSDOH which provided details of this effort. In the near term, DEP is in the process of extending CCCD’s current SAP contract through December 2027 to align with the term of the current FAD which requires the City to continue implementing the SAP in accordance with the 2010 WSP

4.2.6 Farm and Forest Easement Programs

DEP funds the Farm and Forest CE Programs through a contract with WAC that has been extended through early 2025. During 2023, WAC restarted its solicitation and contacted the owners of 21,156 acres. WAC appraised six properties in 2023 totaling 898 acres and has signed contracts on one Forest CE (130 acres) and two Farm CEs totaling 155 acres.

As summarized in Appendix A Table 4 and Appendix A Table 5, WAC has closed on a total of 157 farm CEs protecting 28,229 acres and nine forest CEs protecting 2,982 acres within the Catskill/Delaware watershed (note that over time, two Farm CEs have been reduced by a total of roughly 30 acres by local eminent domain proceedings). The average WAC Farm CE includes 29% SWC and the average WAC Forest CE includes 15% SWC.

4.2.7 Water Supply Permit

The 2010 WSP authorizes the LAP to acquire up to 106,712 acres of land in the Catskill/Delaware watershed through 2025, beyond the 102,287 acres that had been acquired as of January 1, 2010. Between January 1, 2010, and December 31, 2023, DEP and its LAP partners signed contracts on 54,042 acres, leaving a balance of 52,670 acres for potential acquisition.

Throughout 2023, DEP engaged with watershed stakeholders and regulators to discuss the future of core LAP and SAP expansion as a precursor to completing the City’s application for a successor 2025 Water Withdrawal Permit in late 2024.

4.2.8 Use of LAP-Acquired Land by Local Communities

The 2017 FAD requires DEP to participate in a workgroup convened to assess opportunities to use LAP-acquired lands to relocate development outside of floodplains. In 2023, DEP continued to engage in preliminary discussions with one watershed town that submitted a proposal in 2022, with conversations expected to continue in 2024.

4.3 Land Management

As the City continues to make significant investments acquiring fee simple water supply lands and conservation easements (CEs), DEP continues to focus on the management and stewardship of City-owned water supply lands while supporting and promoting beneficial uses such as watershed recreation.

4.3.1 Fee Simple Lands

As of December 31, 2023, DEP owns and manages 175,337 acres of City-owned fee simple watershed lands and reservoirs; this includes pre-MOA lands, reservoirs, and properties acquired through the Land Acquisition Program (LAP) under the 1997 MOA. The average sized parcel acquired under the MOA is 43 acres. The largest assemblage of City-owned lands acquired under the MOA totals 2,921 acres. As the City acquires new, smaller properties under the Flood Buyout Program and Streamside Acquisition Program, these properties are often isolated from other City-owned parcels and typically involve active neighbors; both factors can present an array of property management challenges.

Property Inspections

DEP inspects all City-owned water supply lands pursuant to its monitoring policy, which outlines procedures and frequencies for property inspections and boundary maintenance. All City-owned lands are posted with signage as appropriate, and all properties receive a boundary inspection at least once every five years. These inspections are the most comprehensive and include traversing all property boundary lines as well as the interior of the property to ensure proper survey monumentation and maintenance of boundary lines over the long term. DEP records all inspections and site visits, along with journal notes, photos, encroachments, and observations, in its Watershed Lands Information System (WaLIS).

Annually, DEP prioritizes ground inspections of properties into two categories based on location, number of adjacent properties, uses conducted on the property, and history of trespass or encroachments. “High Priority” properties generally have active recreational use, a history of encroachments or trespass, multiple adjacent landowners, or an active DEP permit/project. “Standard Priority” properties are those where minimal or no trespass or encroachments have been observed, or public use and/or road frontage are limited. DEP performs focused inspections

on all high priority properties, while site visits are conducted on standard priority properties. Focused inspections are significantly more involved than site visits. DEP can change a property’s inspection priority at any time depending on the circumstances, such as the discovery of an encroachment.

Encroachments

DEP strives to cure encroachments when they are discovered on City-owned lands, often during routine property inspections or through other land management activities. Once an encroachment is identified and categorized either as administrative (minor or major) or criminal under NYS Environmental Conservation Law, DEP coordinates the appropriate actions to pursue resolution with the Bureau of Police and Security, Bureau of Legal Affairs, or the City Law Department if the encroachment cannot be resolved through administrative actions.

In 2023, DEP identified 132 new encroachments on City-owned watershed lands, the majority of which were categorized as minor. In 2023, DEP successfully cured 18 encroachments, while resolutions for other encroachments remain ongoing.

Land-Use Permits

DEP issues land use permits (LUPs) to qualified entities seeking opportunities for use of City-owned lands where no appropriate alternatives exist. LUPs have a term of five years and may be renewed with DEP approval. LUPs include conditions that are intended to protect water quality and City-owned property, assets and infrastructure. During 2023, DEP issued 33 new LUPs and renewed 108 existing LUPs; these include three amendments to existing LUPs. DEP currently manages 1,188 active LUPs on City-owned water supply lands.

Agricultural Use

DEP allows for a range of agricultural uses on certain City-owned properties by offering agricultural licenses to watershed farmers, which include terms and conditions to protect water quality. The most common agricultural use on City land is the harvesting of hay. Other common uses include planting and harvesting of row crops, and pasturing livestock. Most farmers using City lands are enrolled in the Watershed Agricultural Program (WAP) and use best management practices (BMPs) adapted for use on City-owned lands. Over the years, DEP has allowed for the implementation of certain low-impact BMPs on City lands, including nutrient management plans, planting of cover crops, and the installation of fencing and watering systems to support rotational grazing of livestock.

In 2023 DEP renewed 19 agricultural licenses. DEP currently manages 127 agricultural licenses covering 2,879 acres.

4.3.2 Conservation Easements

DEP holds 177 conservation easements(CEs) on properties totaling over 26,000 acres in the Catskill, Delaware, and Croton watersheds. DEP conducts two annual inspections of all CE properties pursuant to MOA requirements, including one ground inspection and one aerial

inspection by helicopter. The latter is highly efficient for larger properties and allows DEP to inspect over 10,000 acres in one day. Violations that could pose serious water quality impacts are clearly visible from the air. If problems are observed through aerial monitoring, ground inspections are scheduled to further document any violations.

During DEP's 2023 aerial inspections, no new CE violations were identified. DEP resolved three pre-existing CE violations in 2023, including two timber harvest violations. Additionally, DEP approved seven new landowner requests to engage in CE-conditioned activities, including three timber harvests and the installation of an accessory structure. DEP also completed an amendment that merged two CEs into one.

The Watershed Agricultural Council (WAC) performed all MOA-required farm and forest CE monitoring inspections in 2023, which included both aerial and ground monitoring inspections for each property. WAC reported six easement violations, five of which were resolved.

4.3.3 Watershed Recreation

One of DEP's land management priorities is to allow and enhance low-impact recreational uses and opportunities at 19 reservoirs, two controlled lakes, and thousands of acres of City-owned lands throughout the Catskill, Delaware, and Croton watersheds. DEP continues to expand public access to City-owned recreational lands while supporting local economies through eco-tourism.

In 2023, DEP posted an additional 181 acres of watershed lands for recreational use, bringing the total lands and reservoirs available for public use to 154,951 acres. This includes 79,867 of Public Access Areas (PAAs), 29,654 acres of Access Permit Areas (APAs), 135 acres of Day Use Areas (DUAs), 35,086 acres of reservoirs, and 10,209 acres of pre-MOA reservoir shoreline. PAAs allow for hunting, hiking, fishing, or trapping without a DEP access permit. APAs allow for fishing and hunting, and select areas for hiking, with a valid DEP access permit. DUAs allow for certain day uses including walking and picnicking without a DEP access permit. Most shoreline areas require an APA permit for fishing, while reservoir use requires a DEP boat permit.

Figure 4.3 provides a breakdown of City-owned lands and reservoir acres opened for recreation since 2003, by recreational use categories.

In 2023, DEP continued to coordinate with Ulster County to manage the Ashokan Rail Trail, where DEP tracks recreational use with trail counters installed at each of the three trailheads. Over 140,000 pedestrians and bikers utilized the trail in 2023. Through a partnership with the Woodstock Land Conservancy and NY/NJ Trail Conference, volunteer trail stewards monitor the Ashokan Rail Trail during peak times, assist with enforcing trail rules, and educate recreational users about source water protection.

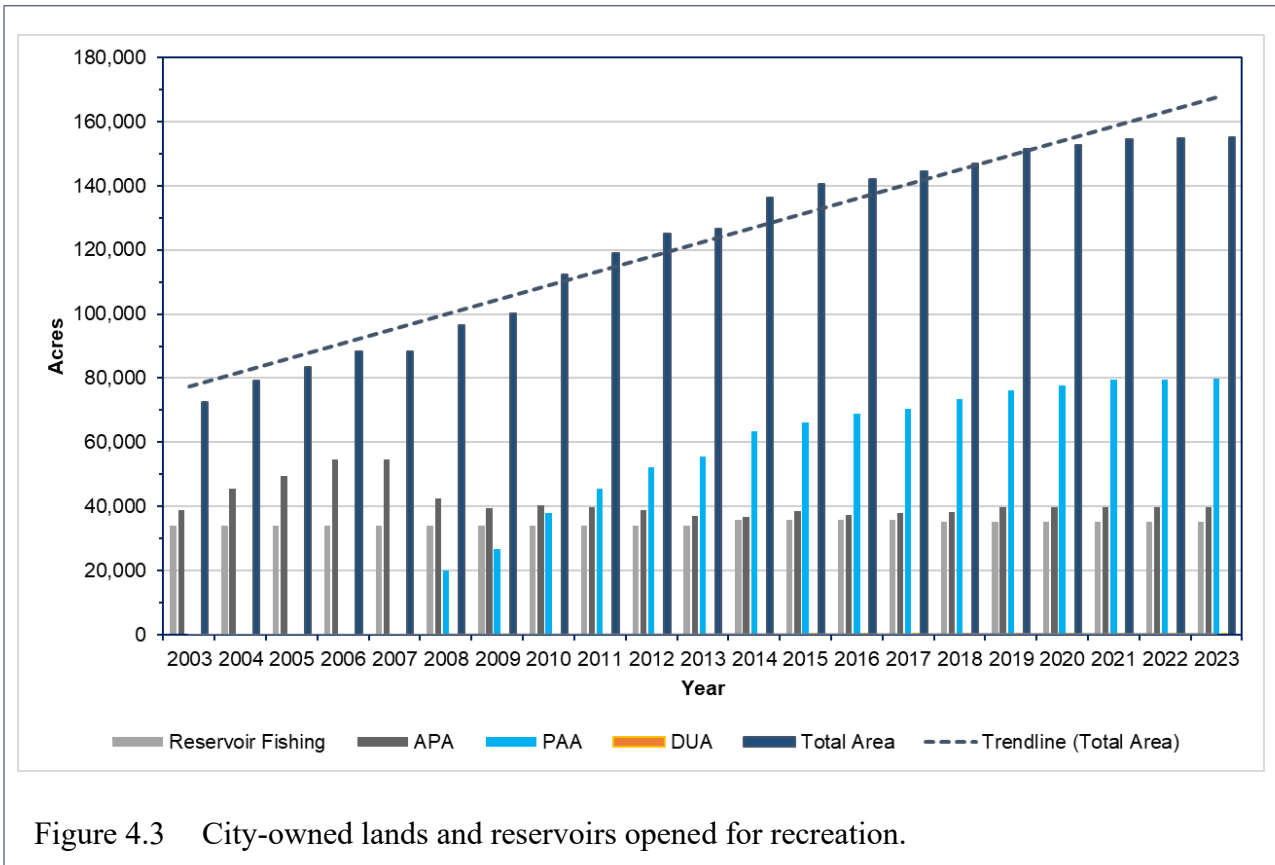


Figure 4.3 City-owned lands and reservoirs opened for recreation.

In partnership with the Hunter Area Trail Coalition, DEP oversaw the opening of a section of the Hunter Branch Rail Trail, with accompanying pedestrian bridge, in April 2023. DEP also continued to work with the Catskill Mountain Club, NY/NJ Trail Conference, Finger Lakes Trail Conference, and watershed communities to support the ongoing use of 17 hiking trails spanning approximately 67 miles of City-owned watershed lands. In 2023, DEP issued six new permits to state-licensed guides, allowing commercial guides to bring clients onto City-owned lands and reservoirs for recreational activities. DEP currently maintains 59 active guide permits.

DEP allows the use of fishing boats on water supply reservoirs for individuals who register their boats and obtain a DEP boat tag. All boats must be steam cleaned before storage, and they must remain on their assigned reservoir and within a specific boat storage area. Boat owners must renew their registration every four years, with DEP limiting the number of allowable boats per reservoir. In 2023, DEP issued 539 new fishing boat tags and renewed 1,564 expiring boat tags. DEP currently permits more than 13,532 fishing boats that are stored at Catskill, Delaware, and Croton reservoirs.

DEP’s recreational boating program on the Cannonsville, Pepacton, Neversink, and Schoharie reservoirs opened for the expanded season on May 1, 2023, and ran through October 31, 2023. In cooperation with the Catskill Watershed Corporation (CWC), DEP allows certified

vendors to rent canoes and kayaks for recreational use on City-owned reservoirs. In 2023, a total of 1,233 canoes and kayaks were registered with DEP for the season or rented for day use from qualified local businesses.

Since 2022, DEP also allows for low-impact recreational uses on City-owned lands by organizations, schools, and stakeholder groups through a letter of permission authorized under DEP's Recreational Rules. In 2023, DEP approved nine letters of permission for recreational uses of City-owned lands, including group educational activities, group hunting programs, and archeological or natural resource investigatory activities. These letters of permission improve DEP's responsiveness to ongoing requests for expanded recreational activities.

4.3.4 Deer Management

Healthy forests are a cornerstone of DEP's watershed protection efforts, including strategies to promote forest regeneration by reducing impacts from deer herbivory on City-owned lands. DEP continues to coordinate with NYSDEC, regional sporting groups, and members of the hunting community to improve deer harvesting opportunities on City-owned watershed lands. In 2023, DEP again participated in NYSDEC's Deer Management Assistance Program (DMAP) by issuing 441 DMAP permits to local hunters that resulted in 60 harvested deer (14% success rate). Since 2012, DEP has issued 3,940 DMAP permits that resulted in 685 harvested deer over the past 12 years (17% cumulative success rate).

4.4 Watershed Agricultural Program

The Watershed Agricultural Council (WAC) administers the Watershed Agricultural Program (WAP) using DEP contract funds and technical assistance provided by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), Delaware County Soil and Water Conservation District and Cornell Cooperative Extension (CCE). The USDA Farm Service Agency provides technical and financial assistance for the federal Conservation Reserve Enhancement Program (CREP). The WAP reduces the risk of agricultural pollution through the development of Whole Farm Plans (WFPs) and the implementation of best management practices (BMPs), along with the establishment of riparian buffers through CREP.

To date, the WAP has developed 460 WFPs on 377 West of Hudson (WOH) farms and 83 East of Hudson (EOH) farms. At the end of 2023, WAC reports that 276 WFPs (60%) remained active, including 210 WOH farms and 66 EOH farms. Of the 210 active WOH farms, 20 are classified as "active, ineligible" because they do not meet the WAP's current eligibility requirements of at least five animal units.

During 2023, the WAP approved two new WFPs on WOH farms; no new WFPs were approved on EOH farms. Four WOH farms went from a status of "active" or "active- ineligible" to "inactive", one WOH "active" farm became "active-ineligible", and 15 WOH "inactive" farms were "retired" from the program. The WAP anticipates developing up to two new WFP within the next 12 months. For the 307 active WFPs reported by WAC at the end of 2022, the WAP

conducted 301 annual status reviews (228 WOH, 73 EOH) during 2023, exceeding the 90% FAD metric. The WAP also completed 82 WFP revisions on 63 WOH farms and 19 EOH farms.

In 2023, the WAP implemented 335 BMPs on all participating farms at a total cost of \$4,458,775. These figures include 209 structural BMPs (of which 45 were repair or replacement BMPs on WOH farms totaling \$628,844), 76 nutrient management plans, and 6 no-cost management BMPs on EOH farms. To date, the WAP has implemented approximately 9,177 BMPs on all watershed farms at a cost exceeding \$79 million; these figures include 8,377 BMPs on WOH farms (\$72 million) and 800 BMPs on EOH farms (\$7 million). In 2024, the WAP anticipates implementing approximately 200 BMPs on WOH farms at an estimated cost of \$3.5 million and approximately 35 BMPs on EOH farms at an estimated cost of \$1,000,000.

The Revised 2017 FAD requires the WAP to achieve several BMP design and implementation metrics intended to reduce by 50% an existing backlog of BMPs identified in WOH WFPs prior to January 1, 2017, while limiting the creation of a new backlog of BMPs identified after January 1, 2017. The 50% backlog reduction metric applies to “new” BMPs identified but not yet implemented in WFP pollutant categories I-VI, as well as previously implemented BMPs regardless of pollutant category, in need of repair or replacement.

To serve as a baseline for the FAD metric, DEP and WAC adopted an official BMP backlog list dated January 1, 2017, that is comprised of 1,754 BMPs estimated to cost \$35.8 million, including 1,410 priority “new” BMPs not yet implemented in WFP pollutant categories I-VI (\$28.1 million) and 344 repair or replacement BMPs (\$7.7 million). At the request of WAC, DEP approved accepting component BMPs toward the goal of 50% backlog reduction metric (196 component “new” BMPs, 28 component repair and replacement BMPs).

As of June 30, 2023, WAC has successfully completed the design, and scheduled for implementation within three years, 50% of the “new” backlog BMPs. WAC had previously completed implementation of at least 50% of backlog BMPs needing repair and replacement before December 31, 2022. The Revised 2017 FAD requires WAC to repair or replace all viable BMPs that were designed and scheduled through calendar year 2022 by December 31, 2024.

Between January 1, 2017, and December 31, 2023, the WAP implemented 644 backlog BMPs at a total cost of \$9.1 million, including 397 “new” BMPs in pollutant categories I-VI (\$5.2 million) and 247 repair or replacement BMPs (\$3.9 million). During this same period, the WAP completed designs on 867 “new” backlog BMPs including 451 completed designs implemented (383 backlog, 68 component) and 416 completed designs not yet implemented (288 backlog, 128 component). The WAP also completed designs for 298 repair or replacement backlog BMPs (259 implemented and 39 completed designs not yet implemented).

Of the total 164 structural BMPs implemented in 2023, 83 were backlog BMPs (73 “new” and 10 repair or replacement) costing \$2,000,544 (\$1,390,731 for “new” BMPs and \$609,813 for repair or replacement BMPs). During 2023, the WAP anticipates designing approximately 275 “new” backlog BMPs for implementation.

Between January 1, 2017, and December 31, 2023, the WAP deleted 418 BMPs (24%) from the backlog list (384 “new” BMPs and 34 repair or replacement BMPs) due to farms becoming inactive, changes in farm operations or practices, or internal data reporting discrepancies. As of December 31, 2023, the WAP’s official BMP backlog list included 418 total remaining BMPs, comprised of 374 “new” BMPs and 44 repair or replacement BMPs.

Since January 1, 2017, the WAP has planned or identified an additional 2,002 non-backlog BMPs (including new and repair or replacement BMPs) on active WFPs estimated at \$22.3 million. Out of these 2,002 newly identified BMPs, the WAP has implemented 555 new (non-backlog) BMPs and 202 non-backlog repair or replacement BMPs totaling \$5.6 million. The non-backlog BMP portfolio, more accurately described as a new backlog of BMPs, is being generated primarily through extensive ongoing revisions to existing WFPs and the planning of new agronomic BMPs such as liming and cover crops. This growing new backlog of BMPs is contrary to the dual goals of the 2017 FAD metric. Since many of these BMPs will not be implemented for years, it is likely that a high percentage will be deleted in the future due to changes in farming operations or farms becoming inactive. DEP, in consultation with WAC, will look to assess these metrics and make recommendations for improvements via the Revised 2017 FAD required report due June 30, 2024.

During 2023, the WAP completed 76 new or updated nutrient management plans (NMPs) on 70 active WOH farms and six active EOH farms. In the WOH watershed, 199 participating farms are following NMPs, of which 193 (97%) are current (developed within the last three years). Additionally, 134 WOH farms participated in the Nutrient Management Credit (NMC) Program in 2023. Five farms left the NMC program, eight new farms were added (a decrease of one participant who left voluntarily). The WAP also implemented its eighth year of the Precision Feed Management (PFM) Program, completing 11 new or revised feed management plans in 2023. The PFM Program now has 57 active participants, including 36 dairy farms (23 in the Cannonsville basin, eight in the Pepacton and five in the Schoharie basin) and 21 beef farms (15 in the Cannonsville basin, four in the Pepacton basin, one in Schoharie basin and one in the Rondout basin).

In 2023, the WAP enrolled three new contracts totaling 14.11 acres in the Delaware County CREP/Catskill Stream Buffer Initiative (CSBI) pilot program, while one CREP contract was re-enrolled covering 20.52 acres of riparian forest buffers. Two contracts were either terminated or canceled. CREP implements riparian buffers on agricultural lands; CREP/CSBI implements riparian forest buffers on historical agricultural lands that are no longer actively farmed. As of December 31, 2023, there were 126 CREP contracts containing 1,245 acres of riparian forest buffers in the WOH watershed.

The WAP conducted 29 farmer education programs in 2023 attended by 824 total participants, of which 367 were watershed farmers. At least 77 individual WAP participants attended at least one farmer education program during 2023, with highlights including the

Catskill Regional Agricultural Conference, Delaware County Dairy Tour, the annual WAC Farm Tour, and the Beginning Shepherds Discussion Group.

Finally, the WAC Economic Viability Program reaches thousands of people through its Pure Catskills print guide, e-newsletters, marketing website (Pure Catskills), and support of regional events that promote the sale and marketing of locally sourced watershed products. There are currently 364 Pure Catskill members. The Economic Viability Program awarded 11 micro grants in 2023 totaling \$31,322.

4.5 Watershed Forestry Program

The Watershed Agricultural Council (WAC) Forestry Program is a partnership between DEP, WAC, and the United States Forest Service (USFS) that promotes well managed, working forests as a beneficial land use for watershed protection. The WAC Forestry Program combines core DEP contract funds with USFS grant funding to support the development of forest management plans, the implementation of forest stewardship activities through the Management Assistance Program (MAP), the implementation of BMPs on active timber harvest projects, professional training for loggers and foresters, and educational programs for landowners and school-based audiences.

In 2023, WAC funded the development of 25 forest management plans covering 3,300 acres. Five of these plans resulted in the new enrollment of 408 acres in the NYS Forest Tax Law (480-a tax abatement program), while the remaining 20 plans (2,892 acres) represented re-enrolled properties. A total of 60,108 watershed acres are enrolled in 480-a forest management plans funded by WAC. Landowners who enroll in this tax abatement program agree to restrict development, limit subdivision, and commit to a rolling 10-year schedule of forest stewardship activities that help prevent conversion of forestland to other less protective uses.

WAC also funded the completion of 57 MAP projects: 12 timber stand improvement projects, 16 wildlife improvement projects, two invasive plant control projects, two tree planting projects, no riparian improvement projects, and 25 landowner site visits. To date, the program has funded 941 MAP projects on 7,280 acres of forestland, with timber stand improvement and wildlife improvement representing 57% of all completed projects. The Revised 2017 FAD requires DEP, in consultation with WAC, to assess and report on by December 31, 2025, the effectiveness of the MAP in supporting the implementation of forest management plans. This will include a summary of any modifications made to the MAP or additional improvements that may be needed to promote good forest stewardship.

In 2023, WAC funded the completion of 44 road BMP projects, which included 14 stream crossing projects on active timber harvest sites. WAC also loaned out six portable bridges and distributed 28 free BMP samples. Additionally, WAC completed 14 Croton Trees for Tribes projects that planted 187 trees and shrubs along 1,070 linear feet of streams.

WAC continues to maintain the interactive [MyWoodlot.com](https://www.mywoodlot.com) website that educates forest landowners through online modules and helps them develop customized goals and management

activities for their properties. The website contains 60 goals, 249 activities, 841 pieces of “how-to” information, and 363 blogs and feature stories. In 2023, 19 landowners created MyWoodlot profiles, for 452 profiles to date; 26 of these profiles (6%) belong to WAC staff, WAC committee members and partners. WAC reports that 27,756 unique users visited MyWoodlot.com during 2023. The Revised 2017 FAD requires DEP, in consultation with WAC, to assess and report on the status and effectiveness of MyWoodlot.com by December 31, 2024.

In collaboration with the NYS Trained Logger Certification Program and Cornell Cooperative Extension, WAC sponsored 10 professional logger-training workshops during 2023 attended by 102 participants. Approximately 31 loggers working in the Catskill/Lower Hudson region were “Trained Logger Certified” during 2023.

WAC and its partners sponsored numerous forest landowner education programs in 2023, including 29 workshops attended by 878 participants. The Cornell Master Forest Owners (MFO) Program conducted 74 landowner visits while 45 MFOs were available to assist forest landowners in the watershed, primarily the Catskill region.

The Watershed Forestry Program implemented the following virtual and in-person school-based education programs in 2023: Green Connections School Partnership Program, Watershed Forestry Institute for Teachers, and the Watershed Forestry Bus Tour Grants Program. Green Connections engaged 173 students during the 2022-2023 school year, while 20 teachers attended the Watershed Forestry Institute. WAC sponsored 30 in-person bus tours and one virtual bus tours attended by 1,966 participants, primarily New York City students.

Additionally, the four watershed model forests hosted 51 educational programs and outreach events for 2,088 participants including youth, forest landowners, loggers, and water consumers. The Frost Valley Model Forest attracted 48 visitors. The Siuslaw Model Forest hosted 1,277 youth and adult through their programs, Lennox Model Forest attracted 60 visitors, while the Clearpool Model Forest reached 703 visitors from East of Hudson and New York City.

4.6 Stream Management Program

The Stream Management Program (SMP) contracts with local partners to restore and protect stream system stability and ecological integrity by promoting the long-term stewardship of streams and floodplains. While SMP projects serve multiple objectives, each project is identified through a prioritization process based on stream assessment and has a principal goal that is associated with a core SMP funding category. The core SMP project categories include Water Quality Stream Projects (WQSPs), Flood Hazard Mitigation/Local Flood Analysis (LFA),

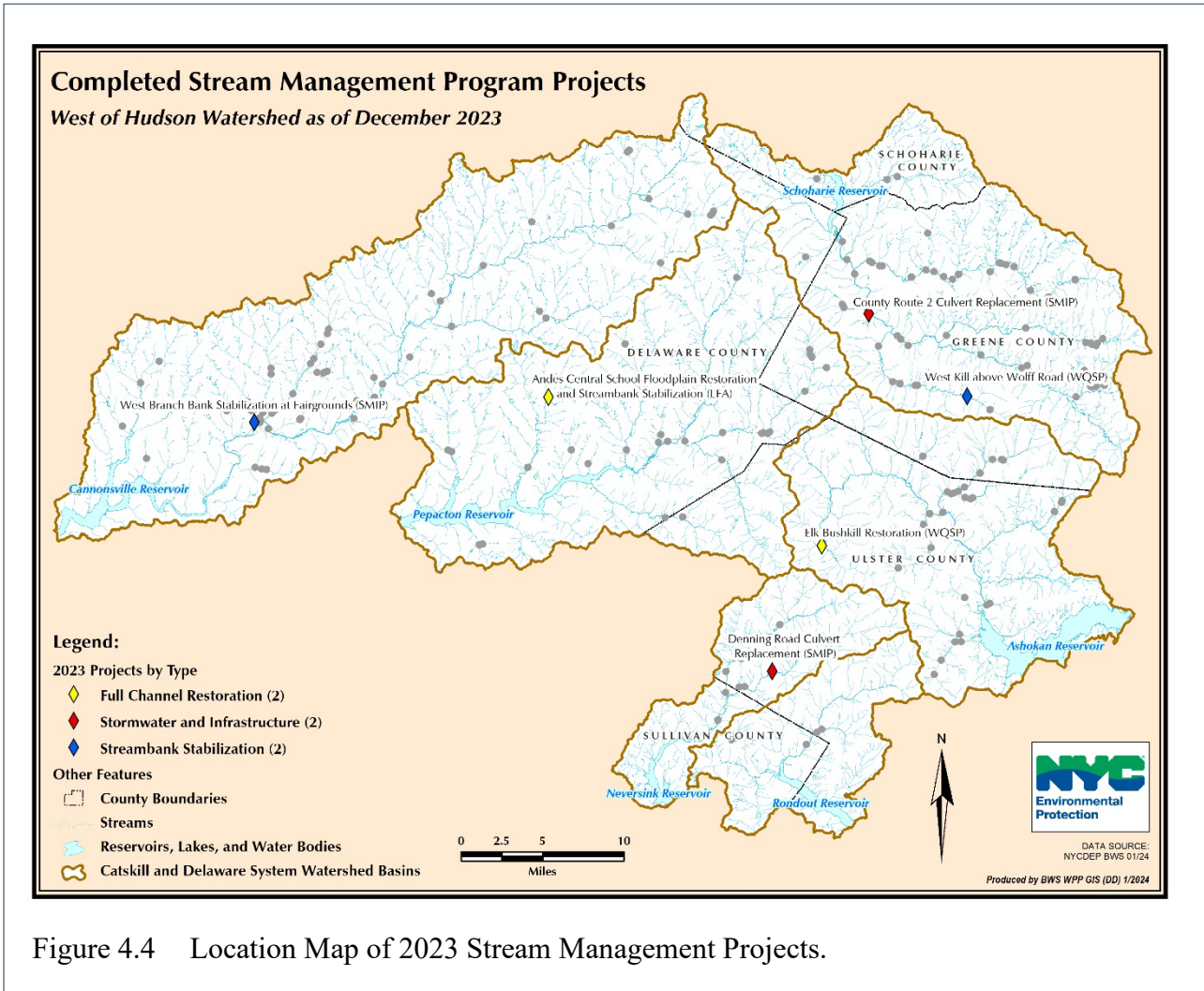


Figure 4.4 Location Map of 2023 Stream Management Projects.

Stream Management Implementation Program (SMIP), and the Catskill Streams Buffer Initiative (CSBI) which is described in Section 4.7.

In 2023, the SMP completed six additional stream projects (Figure 4.4), which taken together with 11 CSBI projects, resulted in 524 total completed projects treating 57.8 miles of stream since program inception. Six stream projects and 33 CSBI projects received annual repairs and maintenance. In 2023, the SMP completed an additional 9.5 miles of Stream Feature Inventories (SFIs) in support of the Upper Esopus Creek Watershed Turbidity/Suspended Sediment Monitoring Study, bringing the total SFI length completed under the Revised 2017 FAD to more than 153.5 miles. Throughout 2023, the SMP continued to deliver a broad base of educational programming, professional engineering services, and technical assistance. DEP also substantially advanced negotiations with the five SMP partners for successor basin program contracts.

4.6.1 Water Quality Stream Projects

The 2017 FAD requires the completion of 24 WQSPs, at least eight of which shall be in the Ashokan watershed and three shall be in the Stony Clove basin to support the Upper Esopus Creek Watershed Turbidity/Suspended Sediment Monitoring Study. Each November, DEP nominates WQSPs for NYSDOH approval under the FAD. In 2023, NYSDOH approved the Batavia Kill at Red Falls Project Site 4 in Prattsville and the Hollow Tree Brook Stream Restoration Project in Hunter. The SMP constructed two previously approved projects: West Kill above Wolff Road in Lexington and Elk Bushkill Stream Restoration in Shandaken. The third project planned for 2023 construction, Batavia Kill at Red Falls Project 3, was partially completed because of persistent high streamflow throughout the construction season.

In the Ashokan watershed, DEP has now completed six of the required eight WQSPs and all three WQSPs in the Stony Clove basin. In 2023, DEP proposed and NYSDOH approved the withdrawal of one previously approved WQSP, the Hillslope Stabilization at Bull Run, located in the Pepacton watershed. For the remaining 19 WQSPs with NYSDOH approval, 13 have been completed toward the FAD goal of 24 projects. Table 4.5 summarizes the status of WQSPs at the close of 2023.

Table 4.5 Status of WQSPs toward fulfillment of the Revised 2017 FAD requirement.

Project Name	Status	Length (feet)*	Basin
Batavia Kill at Kastanis	Completed	3,800	Schoharie
Bush Kill at Watson Hollow	Completed	250	Ashokan
Batavia Kill at Red Falls Project 1	Completed	1,606	Schoharie
Batavia Kill at Red Falls Project 2	Completed	830	Schoharie
West Branch Neversink River at Clothes Pool	Completed	850	Neversink
Hillslope Stabilization at Bull Run	Withdrawn	300	Pepacton
East Kill at Colgate Lake Road	Completed	700	Schoharie
Warner Creek Site 1	Completed	540	Ashokan
Warner Creek Site 2	Completed	560	Ashokan
Stony Clove Above Jansen Road	Completed	1,600	Ashokan
West Kill Above Wolff Road	Completed	750	Schoharie
East Branch Neversink River at Ladleton	Completed	1,360	Neversink
West Branch Delaware River at Riverhaven Farm	Approved	2,350	Cannonsville
West Branch Delaware River at Birdsong Farm	Approved	2,000	Cannonsville
Panther Kill Restoration	Completed	450	Ashokan
Batavia Kill at Red Falls Project 3	In process	1,800	Schoharie
East Branch Neversink River at Riley Brook	Approved	2,200	Neversink
Elk Bushkill Restoration	Completed	1,300	Ashokan
Batavia Kill at Red Falls Project 4	Approved	2,000	Schoharie
Hollow Tree Brook Stream Restoration	Approved	1,080	Ashokan

*Lengths for approved projects are estimated; lengths for completed projects are final.

West Kill above Wolff Road

The West Kill above Wolff Road Stream Restoration Project was first identified in 2004 during an SFI, at which time bank erosion monitoring and assessment began. Stream flows generated by Tropical Storm Irene in 2011 destabilized remaining bank protection in this reach and created incision into the channel bed and erosion into the banks, both comprised of clay-rich glacial till. A second SFI in 2018 revealed exacerbated hydraulic erosion at the toe and mass wasting of the hillslope. The project has modified the channel alignment, installed grade control over the reach, and constructed a stable floodplain bench along the failing hillslope. Riparian restoration involved bioengineering and plantings, including native potted plants (565 containerized trees and shrubs, 37 balled and burlap trees), 3,043 willow stakes and 1,775 linear feet of willow fascines) and seed mixes. The total project cost was \$754,754. Figure 4.5 illustrates the West Kill above Wolff Road project before and after restoration.

Elk Bushkill Stream Restoration

Located along a tributary to the Esopus Creek, the Elk Bush Kill Stream Restoration Project included the successful treatment of 1,300 feet of over-widened and unstable stream channel eroding into a terrace comprised of clay-rich lacustrine sediment across two acres. The restoration goal was to disconnect the channel from the lacustrine sediment, correct unstable channel planform and hydraulic geometry dimensions, and mitigate the risk of failure from an adjacent septic system. The lower reach was especially vulnerable to incision into lacustrine sediment necessitating grade control to restrict future incision. The project has modified the channel alignment and installed five grade control structures and 28 boulder clusters. The project also installed 868 linear feet of stacked rock with live willow brush layering, 6,400 willow and dogwood stakes, 131 trees, and 335 shrubs at a total cost to date of \$1,273,958. Figure 4.6 illustrates the Elk Bushkill Stream Restoration Project before and after restoration.

Batavia Kill at Red Falls

The Batavia Kill at Red Falls contains the largest and most complex stream segments to be addressed by the SMP to date. It is approximately 6,000 feet in length and includes multiple large hillslope failures where mass wasting and excessive erosion into glacial lacustrine clay and till deposits were causing significant water quality impacts. The SMP completed Project 1 in two phases during 2020-2021 at a cost of \$2.1 million. In 2022, the SMP completed Project 2 at a cost of \$1.1 million, including 830 linear feet of stream and floodplain restoration and hillslope stabilization. Project 3 will restore 1,800 linear feet of stream extending upstream of Project 2. Persistent high streamflow throughout summer 2023 has delayed completion of Project 3 until



Figure 4.5 West Kill above Wolff Road project before and after restoration.



Figure 4.6 Elk Bushkill project before and after restoration.

2024, with approximately 60% of work already complete. Project 3 requires construction of a new dewatering bypass, the establishment of streambed grade controls using boulder riffles and/or cross rock vanes, streambank stabilization via rootwad and log revetment, and floodplain grading and revegetation. The engineer's estimate for Project 3 is approximately \$1.9 million.

4.6.2 Flood Hazard Mitigation Program

The SMP supports the development of LFAs, which identify flood hazards in WOH population centers through hydraulic models and engineering analyses. Pursuant to the Revised 2017 FAD, City funding is available to implement LFA-recommended projects through the SMP, CWC's Local Flood Hazard Mitigation Implementation Program (LFHMIP), or the NYCFFBO. Several projects have also utilized state or federal funding sources.

The Revised 2017 FAD requires the SMP to commit \$15 million to fund the implementation of 50 LFA-recommended projects, of which DEP committed an initial \$7.1 million in five currently active SMP partner contracts. The Revised 2017 FAD also requires the City to assess the use of \$10.1 million in flood hazard mitigation funding that was previously committed to older SMP partner contracts. Of the original \$10.1 million that DEP committed to prior SMP contracts, nearly \$6.9 million was committed to projects and \$6.2 million of that amount was expended prior to those contracts being closed out during 2019-2020. Of the \$7.1 million that DEP committed to current SMP contracts, over \$5.5 million has been committed to projects and more than \$3.5 million has been expended. The SMP is currently negotiating successor contracts with basin program partners to provide an additional \$7.9 million, thereby fulfilling the \$15 million funding requirement in the Revised 2017 FAD.

In 2023, DEP submitted the second evaluation of the Local Flood Hazard Mitigation Program as required by the Revised 2017 FAD. The evaluation acknowledged the tremendous work accomplished by local partners since the program's inception nearly a decade ago and it recommended five program enhancements to meet the changing needs of watershed communities as well as a changing climate. Two noteworthy recommendations include the need to update existing LFAs to account for new data, new site conditions, and shifting local priorities, and the need to potentially develop new LFAs for additional flood-prone locations that were not originally identified during program development. DEP is currently working with local partners to advance and implement the recommendations included in the second evaluation.

SMP Local Flood Analyses (LFAs) and Recommended Projects

In 2023, the SMP commenced new LFAs in the Village of Margaretville, Delaware County, and the hamlet of Lanesville in the Town of Hunter, Greene County. To date, DEP has committed just over \$2.2 million to the development of LFAs, with 25 LFAs completed for 43 WOH population centers. Figure 4.7 depicts the locations and status of LFAs. A full list of completed LFAs can be found [here](#).

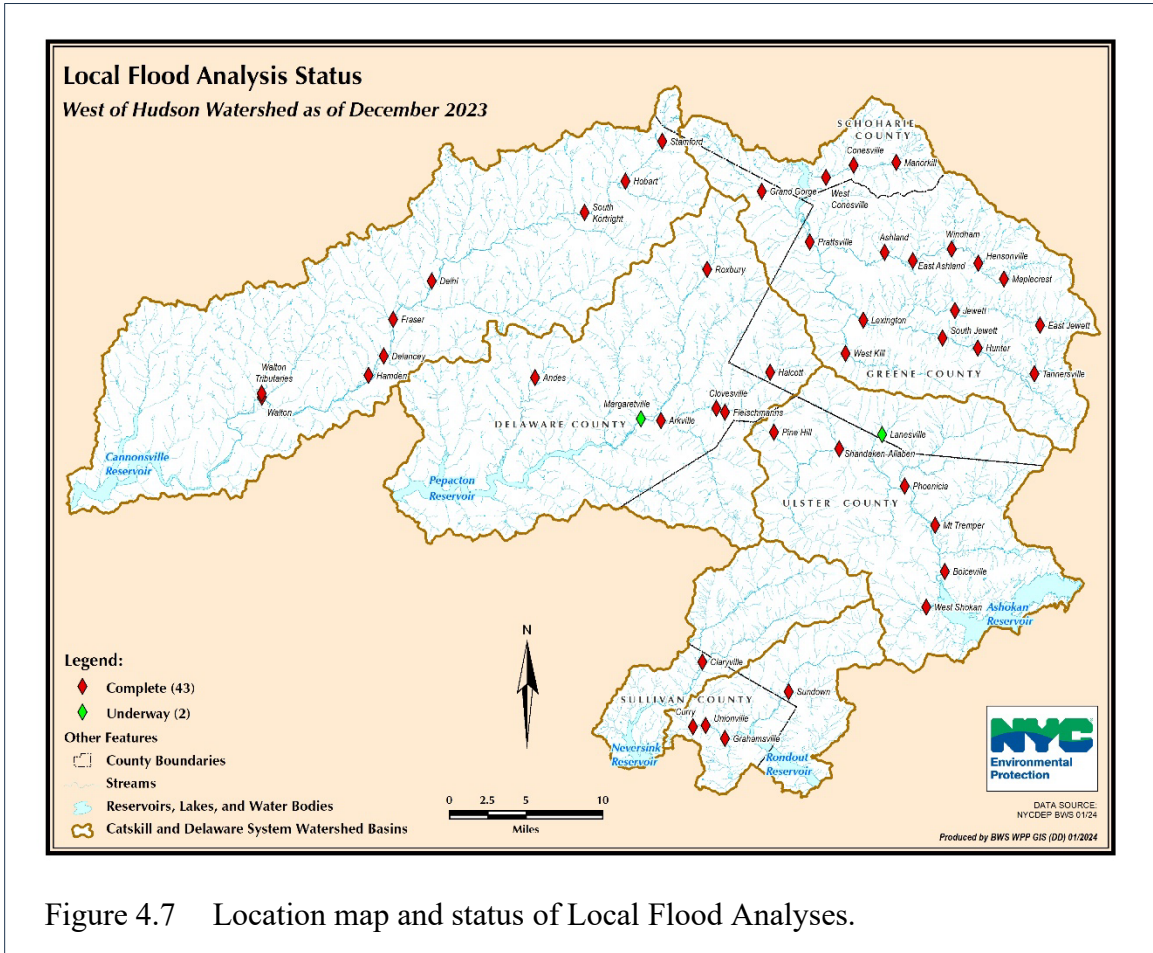


Figure 4.7 Location map and status of Local Flood Analyses.

In 2023, local SMP partners awarded six grants totaling \$839,790 to support the implementation of LFA-recommended projects, of which one grant for \$156,900 was subsequently withdrawn by the applicant. The five new grants will support the design of the Slater Road replacement culvert in Neversink, the design of the Route 23C replacement culvert in Jewett, the design for the Price Chopper berm removal in Delhi, and the design and construction of the Buntline Drive replacement culvert in Stamford. To date, the SMP has awarded 36 grants supporting 24 distinct LFA projects. Two substantial LFA-recommended projects constructed in 2023 are discussed below, each highlighting the successful collaboration between local SMP partners and CWC’s LFHMIP.

Railroad Avenue Streambank Stabilization Project

The Railroad Avenue Streambank Stabilization Project addressed a failing hillslope threatening to contribute to stream channel blockage and instability while stabilizing a critical road in the heart of Tannersville. In 2021, the Village of Tannersville was awarded \$1.2 million in construction funding through CWC’s LFHMIP to address an unstable portion of the Sawmill Creek. The Greene County Soil and Water Conservation District (GCSWCD) completed design



Figure 4.8 Railroad Avenue project before and after construction.

in 2022 at a cost of \$180,000. Project construction, funded and overseen by CWC, was substantially completed in 2023. Multiple high-flow events late in the construction season adjusted several of the newly installed grade control features, and portions of the mulch and seeding were washed away. Minor repair work will proceed in 2024, along with the completion of riparian vegetative plantings. To date, the total project cost is \$1.25 million with an anticipated final project cost of approximately \$1.38 million. Nearly 40% of the funding for this project (\$545,775) will come from the federal Water Resources Development Act (WRDA), thereby leveraging City funds to advance other valuable flood mitigation projects in the watershed. Figure 4.8 depicts the Railroad Avenue project before and after construction.

Andes Central School Floodplain Restoration and Streambank Stabilization Project

The Andes LFA identified a project to reduce the impacts from flooding in the hamlet of Andes by restoring floodplains and stabilizing streambanks along the Liddle Brook and Tremper Kill which come together at the Andes Central School. Streambed incision had led to the collapse of stacked rock walls, in turn threatening public and private property and infrastructure, and exacerbating potential flood hazards. To achieve project goals, Delaware County Soil and Water Conservation District (DCSWCD) prepared a design including widening of Liddle Brook with creation of a new floodplain, replacing failing retaining walls, and adding step pools and toe rock to provide grade control and bank protection thereby stabilizing the reach. A similar solution was prescribed for the Tremper Kill, where DCSWCD increased the floodplain, removed inadequate retaining walls, established step pools and toe rock, and armored the left streambank. The project also replaced an undersized school pedestrian access bridge over the Liddle Brook and provided a new sanitary sewer system.

This 4.5-acre project restored 910 linear feet of stream by re-establishing a significant floodplain area to enhance flow dynamics and floodwater conveyance. The project is designed to improve sediment transport and capacity and in-stream and riparian habitat while providing water quality protection. The project cost to date is approximately \$2.14 million, with the SMP contributing \$921,000 through DCSWCD and CWC funding \$1.22 million. In spring 2024, a permanent safety fence and additional riparian vegetation will be installed to fully complete the project. The anticipated total project cost is expected to be approximately \$2.22 million. Figure 4.9 illustrates the before and after restoration of Liddle Brook and Figure 4.10 illustrates the aerial view of the completed project



Figure 4.9 Little Brook project before and after restoration.



Figure 4.10 Aerial view of the completed Liddle Brook project.

CWC Local Flood Hazard Mitigation Implementation Program

In 2023, CWC funded nine property protection feasibility studies for potential elevation or floodproofing of flood-prone structures. CWC also approved funding a feasibility study for the relocation of the Shandaken Town Hall and Highway Garage, increasing the total number of feasibility studies approved to date to 68. Of these, CWC received six completed studies in 2023 bringing the total number completed to 62. CWC also funded the design of two property protection projects including a commercial building in Windham and a residence in Phoenicia, bringing the total property protection design approvals to 19.

In addition, CWC funded a public infrastructure feasibility study for a vulnerable location along Peekamoose Road in the hamlet of Sundown, as well as the purchase of a relocation parcel in the Village of Hunter for a future relocation of a fire station.

CWC approved three additional fuel tank anchoring projects in 2023. To date, CWC has approved 59 applications and funded the anchoring of 58 propane tanks (20,300 gallons) and 22 fuel oil tanks (5,880 gallons).

CWC and other local partners continue to make progress in leveraging City dollars with state, federal, or local funding sources to implement large-scale flood hazard mitigation projects. In addition to the Railroad Avenue Streambank Stabilization Project, the new Boiceville firehouse was constructed outside of the floodplain using approximately \$2 million from non-City sources and just over \$1 million provided by CWC, thereby accomplishing the first relocation of a critical community facility under the LFHMIP. With the new firehouse now fully operational, the former firehouse is being acquired through the NYCFFBO. After the structure is demolished, the floodplain will be restored to publicly accessible open space. Figure 4.11 shows the eastern side entrance of the completed Boiceville firehouse in November 2023.

The Village of Hunter is also making progress to relocate its flood-prone firehouse. After receiving CWC funding in 2022 to complete a relocation feasibility study, in 2023 the village was awarded \$178,600 in additional CWC funding to purchase a suitable parcel for relocation. These funds will match a \$1.97 million design and construction grant the village has been awarded through NYSDEC's Climate Smart Community Grant Program.



Figure 4.11 Eastern side entrance of the completed Boiceville firehouse in November 2023.

New York City-Funded Flood Buyout Program

DEP works with CWC through the LFHMIP to fund the removal of structures on floodplain properties acquired through the NYCFFBO. In 2023, five demolitions were completed: two in Shandaken and one each in Boiceville, Hunter, and Tannersville. Twenty-two flood-prone parcels have been mitigated since 2017. DEP closed on four additional NYCFFBO properties in 2023, all of which are on track for demolition by CWC in 2024.

4.6.3 Stream Management Implementation Program

In 2023, SMP partners continued to meet with their local advisory councils and working groups to deliver comprehensive basin-scale programming and to implement recommendations made in stream management plans, primarily through the Stream Management Implementation Program (SMIP) that supports locally driven projects.

Table 4.6 summarizes the total number of SMIP grants awarded in 2023 and to date. Since program inception in 2009, 330 SMIP grants have been awarded. Of this number, 275 grants are complete, 28 are in process, one is in the design phase, and 26 have been withdrawn. In 2023, SMP partners committed \$295,344 to six new SMIP projects (Table 4.6). The SMP partners completed 13 previously approved SMIP projects including three construction related projects (Table 4.7). Additional information on all SMIP projects can be found [here](#).

Table 4.6 Number of SMIP awards by category for 2023 and totals to date.

SMIP Category	2023	Total ¹
Education and Outreach	1	88
Recreation and Habitat Improvements	0	28
Stormwater and Infrastructure, Critical Area Seeding	1	77
Landowner Assistance/Streambank Restoration	0	50
Planning and Research	4	58
Flood Hazard Mitigation ²	0	29
Total	6	330

¹ Includes 22 projects awarded but later withdrawn.

² Since 2018, flood hazard mitigation projects are tracked separately as LFA-recommended projects to be consistent with the Revised 2017 FAD.

Table 4.7 Summary of SMIP construction-related projects completed in 2023.

Basin	Type of Project	Name of Project	Length (feet)
Schoharie	Infrastructure/Stormwater	County Route 2 Culvert	37
Neversink	Infrastructure/Stormwater	Denning Culvert Replacement	83
Cannonsville	Infrastructure/Stormwater	West Branch at Fairgrounds	200

4.6.4 Stream Studies

The SMP conducts scientific investigations to support stream management strategies and implementation. Priorities include (1) advancing and documenting the status of the 10-year collaborative research with USGS to investigate turbidity dynamics and reduction efforts in the upper Esopus Creek watershed, (2) revising the Catskill bankfull discharge and channel geometry regional regression relationships currently used by DEP and SMP partners, and (3) working with SMP partners on research and assessment initiatives.

In 2023, the Upper Esopus Creek Watershed Turbidity/Suspended Sediment Monitoring Study completed the seventh water year of the 10-year monitoring period. USGS conducted ongoing measurements at 29 monitoring stations and completed statistical analyses for future reporting. With support from SLR Engineering, DEP continued geomorphic and geologic investigations in the Stony Clove, Woodland Valley, and Broadstreet Hollow basins to support turbidity source characterization. This work entailed (1) advancing the Stony Clove bank erosion monitoring study (BEMS) through completion of topographic monitoring at the 11 BEMS sites, (2) sampling streambed depositional features at 27 locations to help quantify the percentage of fine sediment stored in streambed alluvium, (3) conducting SFI mapping along 8.5 miles of Broadstreet Hollow and one mile of Hollow Tree Brook, and (4) providing technical support to an independent turbidity production investigation in Woodland Creek by University of Vermont researchers.

Also in 2023, DEP amended its current agreement with USGS to include additional scientific investigations in support of the Esopus Turbidity Study. The amendment enables USGS to develop sediment budgets and sediment connectivity models for Stony Clove and Woodland Valley basins, conduct geophysical investigations to map potential future connectivity with glacial legacy sediment in Stony Clove and Woodland Valley basins, and prepare a final Scientific investigation report to support DEP's FAD reporting in November 2027.

4.6.5 Watershed Emergency Stream Response and Recovery Plan

Per the Revised 2017 FAD, the SMP is required to coordinate with NYSDEC regarding the State Programmatic General Permit for emergency response post-storm recovery activities. DEP continues to maintain communication with NYSDEC regarding the status of this permit. Upon issuance, DEP and the SMP partners will initiate outreach and training around the permit with a goal of preventing stream destabilization and associated water quality degradation.

4.7 Riparian Buffer Protection Program

DEP protects and manages riparian buffers as an essential component of its overall watershed protection program. DEP's Land Acquisition Program (LAP) acquires buffers that become publicly owned, while privately owned buffers are managed and protected through the Catskill Streams Buffer Initiative (CSBI), federal Conservation Reserve Enhancement Program (CREP), and other watershed programs.

4.7.1 Activities on City-owned or Controlled Land

DEP’s LAP includes 300-foot buffers on either side of a watercourse as a principal eligibility requirement under the “natural features criteria” set forth in the MOA. Within the Catskill/Delaware watershed, 36.6% (91,517 acres) of all stream buffers are protected by fee simple public ownership or conservation easements held by the City, state, Watershed Agricultural Council (WAC), local municipalities, or land trusts. This includes lands protected by the Streamside Acquisition Program (SAP). DEP now owns or controls more stream length (725 miles) and roughly the same amount of land within stream buffers (46,176 acres) as are protected in the Catskill/Delaware watershed by all other entities combined.

DEP carefully considers the presence or absence of riparian buffers when reviewing requests for projects on City-owned lands. For example, when issuing agricultural use licenses, DEP requires a minimum 35-foot buffer between farming activities and the stream. Proposals maintaining a larger buffer receive extra points in their rating. DEP reviews all land use permits and proposed projects for potential impacts to riparian buffers, imposing permit conditions as needed to avoid or mitigate these impacts. DEP secures stream crossing permits as required by NYSDEC and takes extra measures during forestry operations to select BMPs, such as temporary bridges or arch culverts, to minimize impacts on streams and buffers.

4.7.2 Catskill Stream Buffer Initiative

The CSBI is a component of DEP’s Stream Management Program (SMP) that strives to enhance the extent and functionality of WOH riparian buffers through vegetation mapping, riparian corridor planning, buffer restoration, maintenance and monitoring, invasive plant removal, and extensive education and outreach. DEP works with CSBI coordinators in four county soil and water conservation districts who develop riparian corridor management plans (RCMPs) for participating landowners and guide project design. Since 2009, county CSBI coordinators have completed 198 RCMPs, including 16 new RCMPs in 2023.

One unique aspect of the CSBI is the propagation of local genotypes of Catskill native species. Since 2009, the SMP has contracted with nurseries, including the Greenbelt Native Plant Center and One Nature, LLC, to grow over 73,646 gallon-sized trees and shrubs from locally collected seed. In 2023, the One Nature contract closed with final delivery of 3,943 gallon- sized trees and shrubs to local SMP partners. Greenbelt’s stock transitioned to a newly expanded and refurbished plant materials center established at the Greene County Soil and Water Conservation District’s (GCSWCD) Big Hollow campus in Maplecrest, NY. GCSWCD began the intake of 4,259 tubelings from Greenbelt for grow out and distribution to the SMP partners.

Table 4.8 lists the 11 CSBI planting projects completed in 2023; one new planting was completed through the CREP/CSBI pilot project. The SMP completed CSBI buffer restoration on 12.45 acres of streamside property that span nearly 1.4 miles of stream length. These projects installed 3,271 native Catskill trees and shrubs and 2,071 willow stakes.

Table 4.8 Summary of CSBI projects completed in 2023.

Basin	Name of Project	Stream Length (feet)	Area (acres)
Schoharie	Bilash MFRB	460	0.85
Schoharie	DEP Manor Kill	400	0.77
Schoharie	DEP Bear Kill	1,350	1.04
Schoharie	DOT Pollinator @ RM 1018	650	0.61
Schoharie	DOT Pollinator @ RM 1031	655	0.67
Schoharie	Maplecrest MFRB	1,635	1.77
Neversink	DEC Fishing Access	80	0.02
Neversink	Schoenburg Upstream	25	0.004
Pepacton	Palen CREP/CSBI	1,515	5.77
Cannonsville	SUNY Delhi #7	225	0.45
Cannonsville	BOCES @ Trout Creek	350	0.50
Total		7,345	12.45

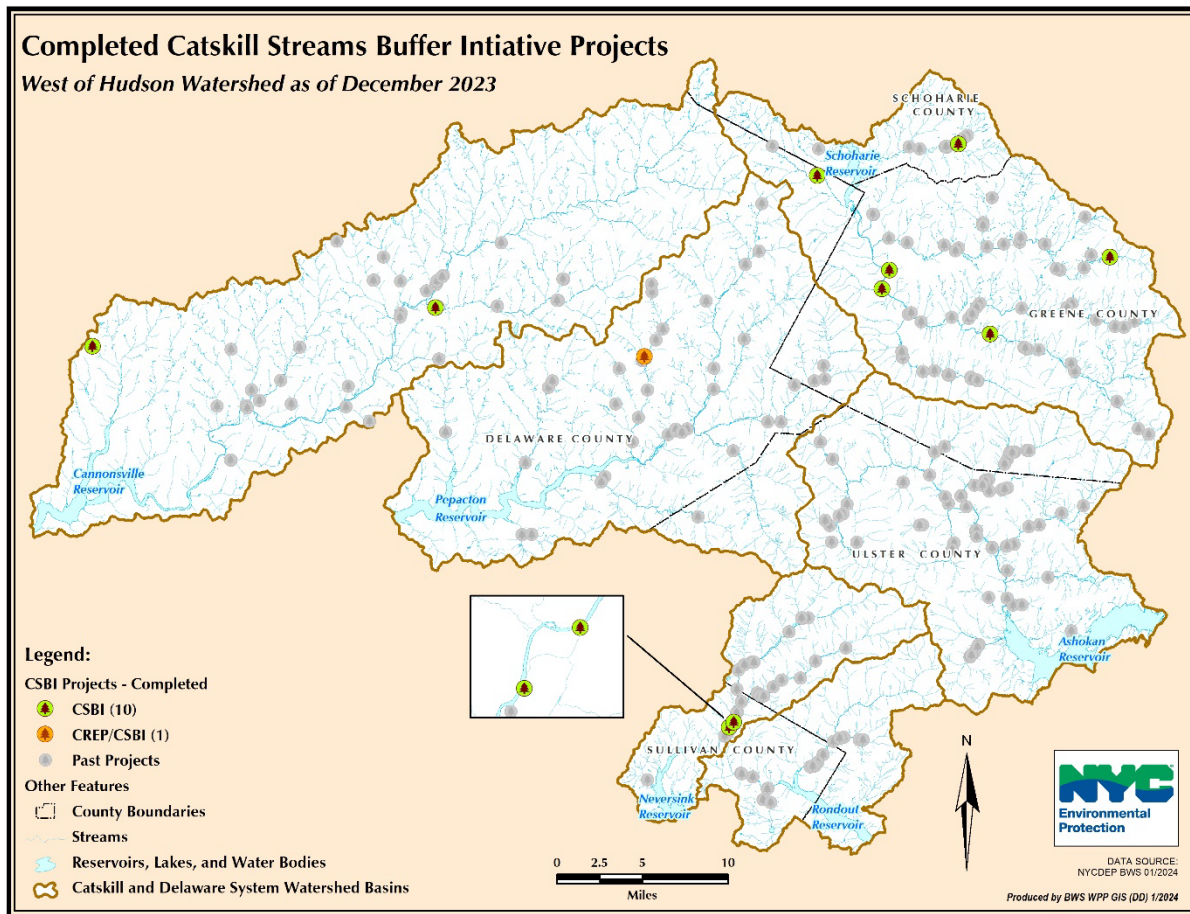


Figure 4.12 Location map of completed CSBI projects.

Since 2009, the CSBI has completed 300 total projects spanning more than 207.4 riparian acres and nearly 27 miles of stream length. These projects installed nearly 110,161 gallon-sized trees and shrubs, in addition to plugs, tubelings, and cuttings from willow and dogwood species (all native Catskill species). Figure 4.12 depicts the locations of completed CSBI projects. The Revised 2017 FAD requires the CSBI to revegetate a minimum of 10 streambank miles during 2018-2027. Through 2023, the CSBI has revegetated 9.9 miles.

To understand the factors affecting project success and design follow-up maintenance interventions, CSBI coordinators monitor projects for five years following installation to document browse pressure, plant survival and growth rates, and to assess the effectiveness of installation techniques. In 2023, 69 sites were monitored and 33 sites were maintained.

Bilash Multi-functional Riparian Buffer Restoration Project

In 2023, the Bilash Multifunctional Riparian Buffer Restoration Project along Schoharie Creek in Jewett, NY was completed. Goals of this project include supporting stream ecological health and water quality by reducing water temperature by providing shade, contributing organic matter for habitat and food, strengthen streambanks with dense root networks to reduce erosion and create pollinator and wildlife habitat. The Bilash project enhanced 0.85 acres of buffer over 460 linear feet of stream and included the planting of 370 trees and shrubs and 250 willow stakes. GCSWCD installed a temporary 8-foot-tall deer fence to allow native plants to grow in a 0.4 acre protected area without excessive browsing. Figure 4.13 illustrates the before and after planting of the Bilash Multi-functional Riparian Buffer Restoration Project.

Delaware County CREP/CSBI Pilot Program

A CREP/CSBI pilot program is underway to assess the potential for implementing greater numbers of riparian buffer planting projects that combine the benefits of both programs, including federal incentive payments from CREP and enhanced planting resources from CSBI. To date, seven projects have planted 2.65 miles of stream length and revegetated nearly 43 acres.

In 2023, the Palen CREP/CSBI planting project was completed in the hamlet of New Kingston within the Pepacton watershed. A total of 5.77 acres were planted, including 4.5 acres under CREP and 1.25 acres under CSBI. This project is unique in that within the project boundaries, there are three tributaries to the Platte Kill that converge, enabling 1,515 linear feet of buffer to be planted within a relatively small area. This landowner became interested in the CREP/CSBI pilot program after seeing the completion of the Wagner planting in 2021 that is just upstream of this site, illustrating the demonstration value of all projects. The Palen and Wagner projects, taken together, have revegetated 0.8 miles of stream. Figure 4.14 depicts the Palen CREP/CSBI project before and after planting.



Figure 4.13 Bilash multi-functional riparian buffer project before and after restoration.

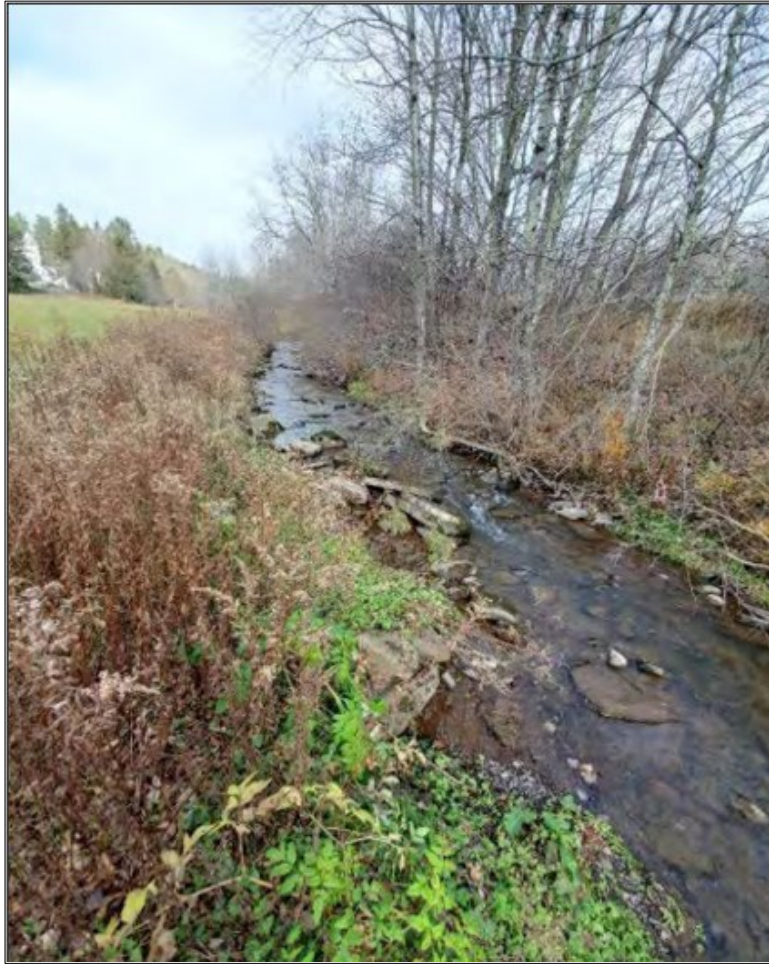


Figure 4.14 Palen CREP/CSBI project before and after planting.

4.8 Ecosystem Protection Program

4.8.1 Wetlands Protection Program

DEP protects wetlands through regulatory means, land acquisition, and multiple stewardship programs. Wetland mapping and monitoring programs provide baseline information to support these protection efforts.

Regulatory Review

DEP receives notification of applications filed in the watershed under Article 24 of the New York State Environmental Conservation Law, Section 404 of the Clean Water Act, and Connecticut state wetland regulations (Conn. Gen. Stat. Sec. 22a-42f). A subset of New York towns within the EOH watershed voluntarily forward wetland permit applications to DEP for review. DEP reviews these submittals and provides comment when alternatives that would avoid, minimize, or mitigate wetland and water quality impacts are identified. DEP's comments often lead to project plan modifications resulting in less overall impact and/or improved wetland mitigation than originally proposed.

In 2023, DEP reviewed 11 wetland permit applications for activities in FAD basins including nine NYS Article 24 wetland permit applications and two town permit applications. This includes DEP reviewed one permit in the Neversink basin and two in the Schoharie basin. Permanent wetland encroachments were minimal and limited to five of the applications, totaling 0.2 acres, with the highest at 0.11 acre. Most of the permanent impacts to wetlands and their adjacent areas were associated with road and culvert replacement and/or maintenance along with stormwater management. Four applications included adjacent area disturbance totaling 3.4 acres. Four applications included no permanent disturbance to wetlands or their adjacent areas for activities such as aquatic nuisance species management, septic repairs, and other ancillary improvements. DEP also reviewed one Section 401 water quality certification that was also an U.S. Army Corp of Engineers (USACE) pre-construction notification, for which a complete application is still pending.

DEP reviewed an additional 19 wetland permit applications in the Croton System, including 14 NYS Article 24 and five town wetland permit applications (Figure 4.15). Only two applications included permanent wetland disturbance, totaling 0.055 acres associated with a wetland crossing for a small subdivision and a single-family residence. The remainder of the applications did not involve permanent wetland loss as they were for adjacent area impacts and aquatic nuisance species treatments.

Land Acquisition

According to the National Wetlands Inventory (NWI) and New York State Department of Environmental Conservation (NYSDEC) freshwater wetland maps, there are approximately

15,190 acres of wetlands in the Catskill/Delaware (CAT/DEL) watershed. Since 1997, DEP has protected 3,074 acres or 20.2% of these wetlands through its Land Acquisition Program

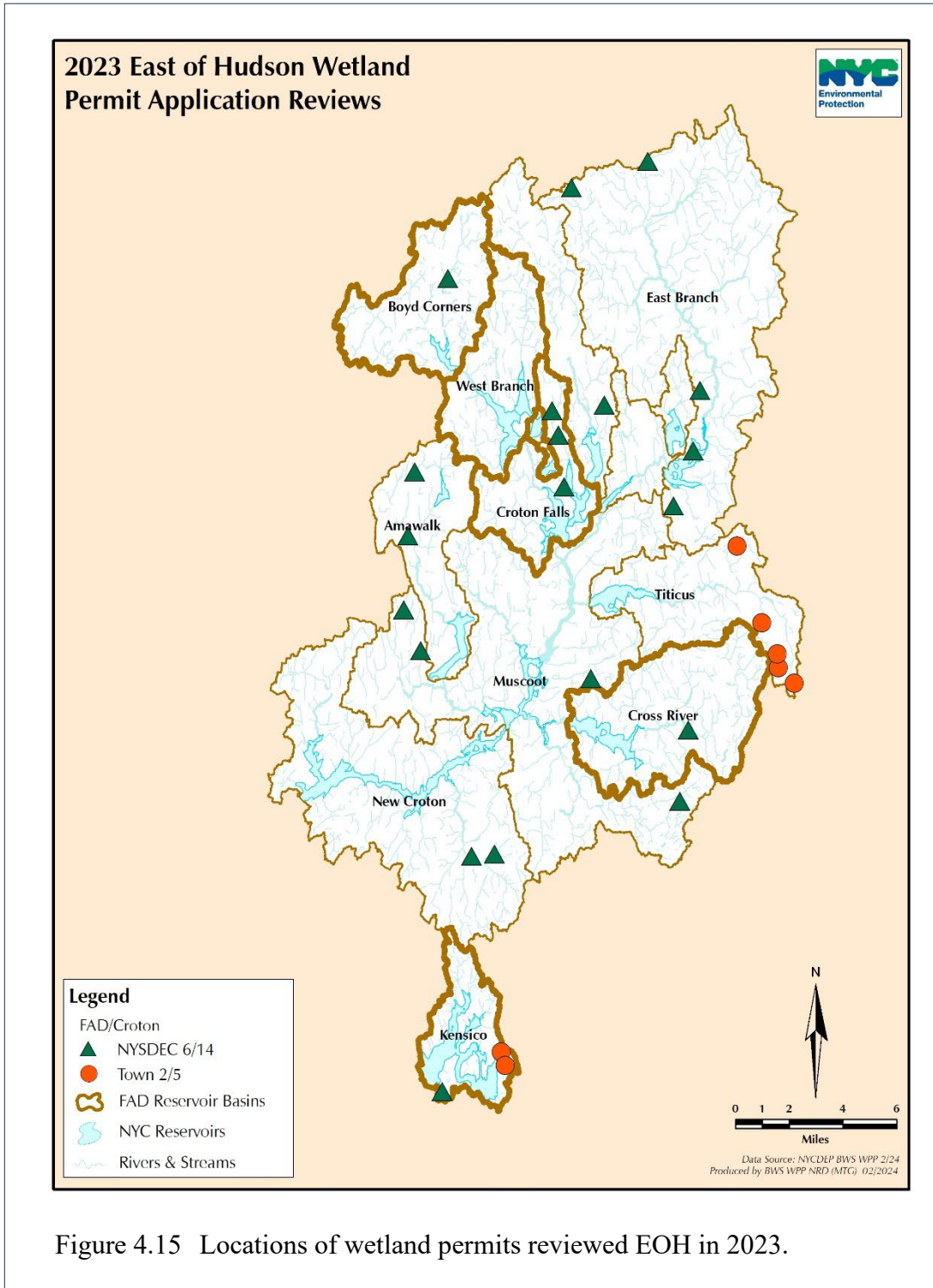


Figure 4.15 Locations of wetland permits reviewed EOH in 2023.

Protection and Remediation Programs

Table 4.9 Wetlands acquired or protected by the NYC Land Acquisition Program in the Catskill/Delaware and Croton systems as of December 31, 2023.

<i>Description</i>	<i>Acres</i>	<i>% of Total Watershed Acreage</i>	<i>% of Total Land Acquired</i>	<i>% of Total Wetlands or Deepwater Habitats in System</i>
For Catskill/Delaware (Ashokan, Schoharie, Rondout, Neversink, Pepacton, Cannonsville, West Branch, Boyd Corners, Kensico basins):				
Total Acreage of Entire Watershed	1,048,660			
Total Acreage of Wetlands (both NWI and DEC-regulated) in Entire Watershed (excluding Deepwater Habitats**)	15,190	1.45%		
Total Acreage of Deepwater Habitats in Entire Watershed	28,335	2.70%		
Total Acreage of Wetlands and Deepwater Habitats in Entire Watershed	43,526	4.15%		
Total Lands Under Contract or Closed by NYCDEP as of 12/31/23†*:	153,312	14.62%		
<i>Within those total lands under contract or closed:</i>				
Total Acreage of Wetlands (both NWI and DEC-regulated, excluding Deepwater Habitats**)	3,074		2.01%	20.24%
Total Acreage of Deepwater Habitats**	201		0.13%	0.71%
Total Acreage of Wetlands and Deepwater Habitats**	3,275		2.14%	7.52%
For Croton:				
Total Acreage of Entire Watershed	212,700			
Total Acreage of Wetlands (both NWI and DEC-regulated) in Entire Watershed (excluding Deepwater Habitats**)	20,025	9.41%		
Total Acreage of Deepwater Habitats in Entire Watershed	10,808	5.08%		
Total Acreage of Wetlands and Deepwater Habitats in Entire Watershed	30,834	14.50%		
Total lands under contract or closed by NYCDEP as of 12/31/23†*:	1,984	0.93%		
<i>Within those total lands under contract or closed:</i>				
Total Acreage of Wetlands (both NWI and DEC-regulated, excluding Deepwater Habitats**)	97.1		4.89%	0.48%
Total Acreage of Deepwater Habitats**	1.6		0.08%	0.02%
Total Acreage of Wetlands and Deepwater Habitats**	98.7		4.97%	0.32%

* Source: WLCP GIS, December 31, 2023. Note: Acres are calculated directly from areas of GIS polygons and therefore may not match exactly other acreage totals submitted by DEP. Watershed statistics calculated from LiDAR-derived 1m basin boundaries updated in 2014.

** Categories considered "Deepwater Habitats" include reservoirs or large lakes (L1), unconsolidated bottom (L2UB), riverbeds (RUB & RRB) or streambeds (RSB). Categories considered wetlands include Palustrine Systems and exclude the Deepwater Habitats classes as well as all upland (U), and unconsolidated shore (L2US).

† Includes fee, conservation easements, and farm easements. Excludes non-LAP and pre-MOA land.

Statistics produced by J. Tuscanes, BWS WPP GIS, 1/25/2024

(See Section 4.2 for details of the Land Acquisition Program). In the CAT/DEL watershed, pre-MOA DEP lands contain an additional 969 acres (6.4%) of wetlands, with an additional 1,316 acres (8.7%) of wetlands located on state or other protected lands. This amounts to roughly 35% of wetlands in the CAT/DEL watershed being located on protected lands.

Table 4.9 summarizes the acreage of wetlands protected through acquisition for both the CAT/DEL and Croton watersheds.

Wetland Monitoring

DEP gains information on the characteristics and functions of watershed wetlands through its wetland monitoring program. DEP has collected vegetation, soils, and long-term hydrologic data from numerous wetlands and seasonal pools throughout the CAT/DEL watershed for over a decade (Figure 4.16). These data provide benchmarks to guide wetland protection and management efforts and identify ecological trends from factors such as surrounding land use, climate change, or invasive species.

In 2023, DEP added five seasonal pool wetlands to the monitoring program, bringing total pools in the program to 46. Water quality data (pH, dissolved oxygen, temperature, and specific conductivity) were collected from seasonal pool sites throughout the growing season. Spring adult breeding amphibian and invertebrate surveys, and amphibian egg mass counts were also conducted at seasonal pool sites. DEP also conducted a kinematic survey on one seasonal pool wetland in the Ashokan Reservoir watershed. The survey was done to obtain true bottom elevation and horizontal profiling to provide information on water storage capacity to assess cumulative hydrologic functions of these important, yet largely unmapped and unregulated, systems.

DEP continued monitoring 25 vegetated reference wetlands in the West of Hudson watershed. Soil temperature, water table elevation, and plant cover data were collected at reference wetlands and seasonal pools throughout spring, summer, and autumn 2023.

In 2023, DEP continued its partnership with New York Natural Heritage Program (NYNHP) to help develop statewide wetland assessment methodology (www.nynhp.org/epa-wetland-condition). To date, DEP has evaluated 14 wetlands using this methodology. In 2023, three wetlands, one in the EOH watershed and two in the WOH watershed, were assessed using NYNHP standardized methods. This partnership supports DEP’s watershed wetland assessment goals while contributing to NYNHP’s efforts to develop tools to guide wetland protection and stewardship. Conditional and functional assessment tools can help prioritize wetlands for enhanced protection, identify restoration opportunities and performance targets, and provide benchmarks for evaluating trends.

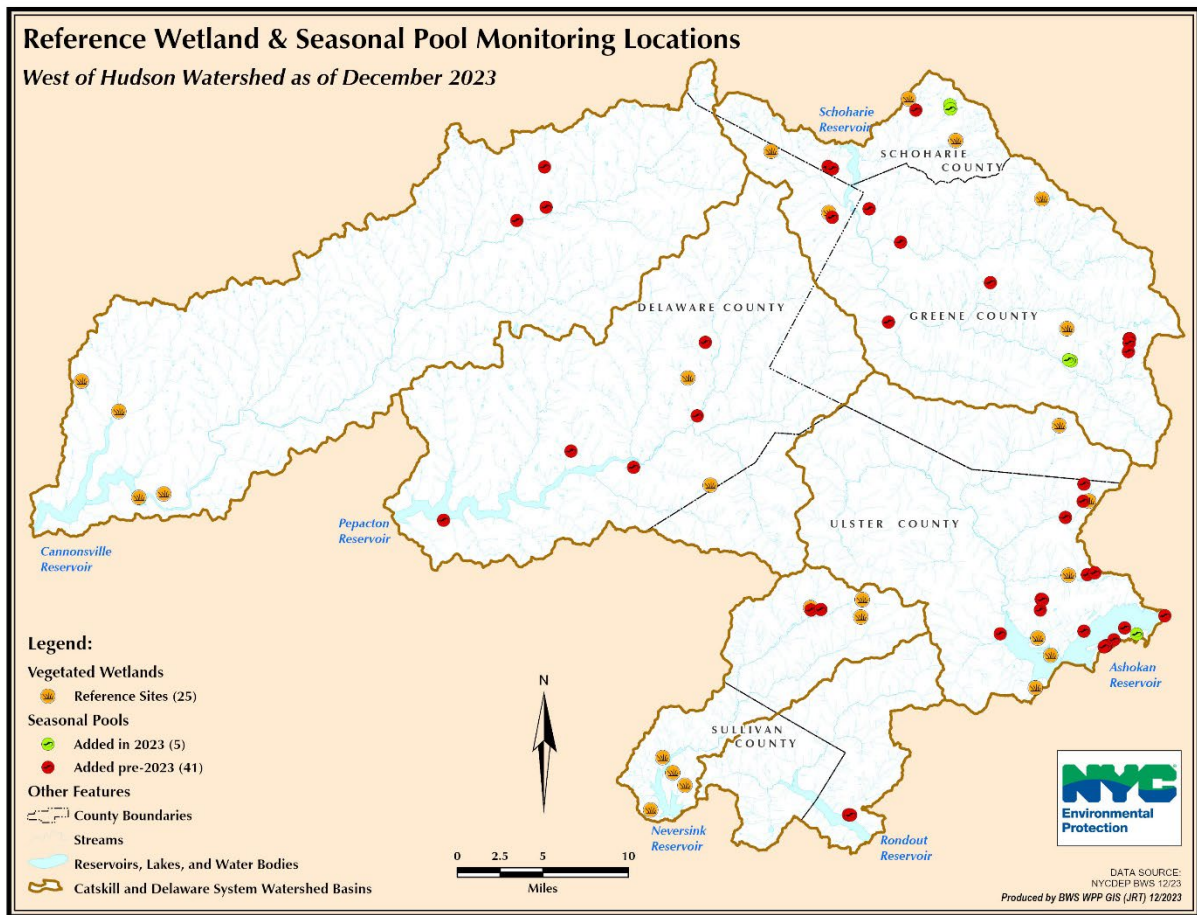


Figure 4.16 Reference wetland and seasonal pool monitoring sites in the CAT/DEL watersheds.

Wetland Mapping

Work was completed on the contract to expand the 2015 light detection and ranging (LiDAR) wetland mapping pilot study to the entire watershed in 2022. DEP developed protocols for a watershed-wide accuracy assessment to inform additional editing needs. The accuracy assessment is currently underway.

DEP Forest Management Program

DEP conducts an interdisciplinary review of its proposed forest management projects to ensure long-term responsible stewardship of natural and cultural resources on City lands. As part of this review, DEP wetland scientists delineate on-site wetlands, which are treated as exclusion zones in which no disturbance is permitted under normal circumstances. Moreover, the 100-foot-wide area surrounding wetlands is considered a special management zone, within which tree removal and equipment operation are limited. In 2023, DEP delineated 15 wetlands comprising 6.8 acres at three proposed forest management projects on City lands. These delineations also provide DEP with field-scale data on the characteristics of wetlands on City lands and inform remote wetland mapping efforts.

Education and Outreach

In 2023, DEP staff led education programs for the public at three separate events. To celebrate American Wetland Awareness month in May, DEP greeted recreational users along the Ashokan Reservoir and educated them on the importance of wetlands. DEP participated in the Mountain Top Arboretum BioBlitz and environmental education event in Hunter, New York. DEP also led SUNY Ulster field ecology students through a wetland mitigation site near the Ashokan Reservoir to teach them about wetland plants and soils.

4.8.2 Forest Management

DEP implements its Watershed Forest Management Plan (WFMP) to maintain a healthy, resilient forest on NYC watershed lands that will continue to protect water quality. Much of this work is achieved through commercial timber harvests that are publicly bid and overseen by project foresters. Considerable planning goes into the selection, development, and review of these forest management projects (FMPs) which includes drawing on in-house expertise through DEP's Forestry Interdisciplinary Technical Team (FITT).

The Forestry Program bid out four new FMPs in 2023. The extremely wet summer of 2023 resulted in significant delays to several active and planned projects, so four FMPs that were scheduled for award in 2023 will now be awarded in early 2024.

Table 4.10 lists these together with additional projects that are planned to be bid out in 2024.

In addition to planning and bidding out new FMPs, Forestry Program staff spent significant time overseeing 10 FMPs that were active during all or a portion of 2023. These projects involved over 1,700 acres of forest land straddling all three West of Hudson forestry regions (Ashokan/Schoharie, Neversink/Rondout, Cannonsville/Pepacton). The active projects ranged from a 55-acre ash salvage and thinning in the Town of Neversink on a property that was acquired in 2000, to a 327-acre ash and hemlock patch cut near the Pepacton Reservoir in the Town of Andes, and a 157-acre commercial firewood harvest and thinning on the south shore of the Ashokan Reservoir in the Town of Hurley.

During phases of active management on City FMPs, DEP foresters are in regular contact with contractors and make frequent site visits to ensure compliance with best management practices (BMPs) incorporated in the harvest plan. The exceptionally wet summer of 2023 and saturated site conditions repeatedly forced DEP foresters to halt harvesting on sensitive sites. One project that was particularly impacted by the summer downpours was the Southslope FMP in the Town of Conesville, located within the headwaters of the Manor Kill sub-basin of the Schoharie Reservoir. The approximately 270-acre harvest area straddles four adjoining properties that were acquired between 2002 and 2010 within the Manor Kill Land Management Unit.

Table 4.10 Forest Management Plans awarded in 2023 and planned for award in 2024.

Award Year	Project Name	FMP #	Basin	Acres
2023	Wright Brook	5209	Cannonsville	108
2023	Hollow Brook	5177	Neversink	327
2023	Bradley	5181	Neversink	171
2023	Quarried Coves	5206	Ashokan	157
			Total	763
2024	Highland	5221	Ashokan	215
2024	Little Bear	5222	Schoharie	64
2024	Tonche Gap	5207	Ashokan	122
2024	EOH Stewardship Contracts	5082	New Croton	121
2024	Bungalow Brook	5208	Neversink	61
2024	Myers Road	5210	Neversink	142
2024	Old Sholam	5211	Rondout	131
2024	Rocky Knob	5054	Pepacton	70
2024	Carpenter’s Eddy – Phase 1	5202	Cannonsville	99
			Total	1025

Utilizing the forest inventory data together with field assessments, Forestry Program staff characterized the Southslope forest as variable in age and species composition. Exceptional forest variability on this property is due to multiple past ownerships, past agricultural practices and abandonment, forest succession, and previous timber harvesting. Stands vary from open, patchy, early successional forest, to semi-open, sparse (likely previously grazed) woodland savannah, and very dense overstocked forest.

Planned management areas include a diversity of stand types, condition, and ages. Types can generally be characterized as hemlock-hardwood, mixed conifer-hardwood (various proportions of white pine, Norway spruce, northern hardwood, and oaks), northern hardwood, and oak-northern hardwood. One planted Norway spruce plantation is in the central southernmost portion of the property. The primary goals of forest management for this property are to maintain the mosaic of age and species diversity while also assuring a healthy, vigorously growing, and naturally regenerating forest. The forest will benefit from thinning for health and vigor, while phased regeneration harvests will maintain the diverse mosaic of age classes and species composition.

The Southslope FMP Project Plan (Figure 4.17 Southslope forest management project map. Figure 4.17) shows the limits of the forest management work, together with the location of skid trails, log landings, and BMPs. The hatched area in the northernmost section of the project represents an approximately 13-acre ‘patch cut’, a silvicultural tool to increase species and age diversity, which is a primary goal under the

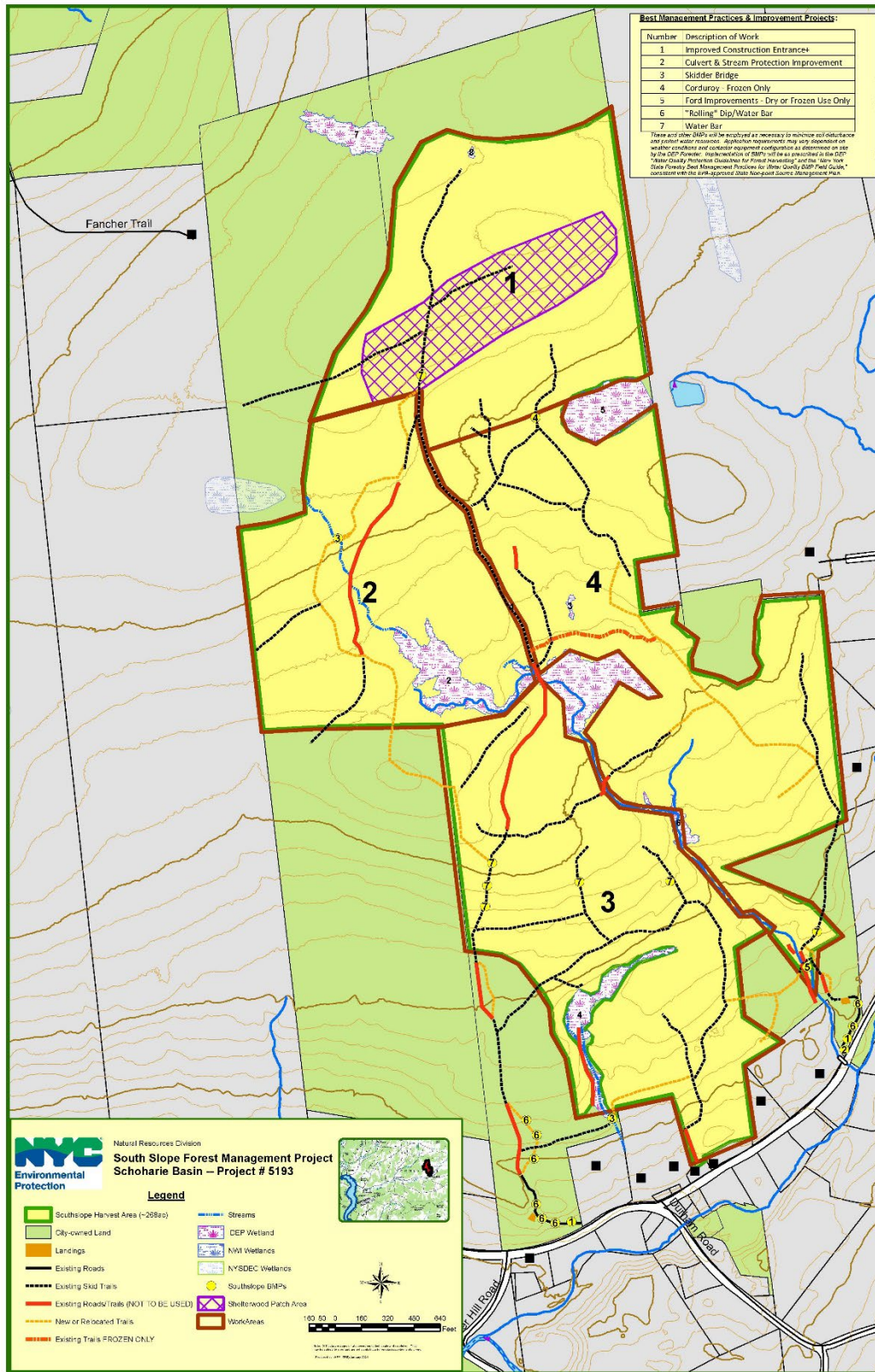


Figure 4.17 Southslope forest management project map.



Figure 4.18 Hardened entrance of the Southslope Forest Management Plan.

Watershed Forest Management Plan. Figure 4.18 demonstrates the use of geotextile as a BMP to harden sections of the project entrance to prevent erosion.

Forest Inventory and Planning

In 2023, DEP continued to make progress on its revision of the 2011 Watershed Forest Management Plan (WFMP), a FAD deliverable due in 2027. The 2011 WFMP characterizes City-owned forest lands at watershed and reservoir basin scales based on inventory data collected by the US Forest Service, and then augmented with a contract (LandVest) that inventoried lands acquired between 2011 and 2017. More recently, Forestry Program staff have developed and implemented a rapid assessment protocol to characterize the approximately

10,000 acres acquired since 2017, and in 2023 an additional 1,529 acres across 13 parcels were characterized through this process.

While these large-scale inventories provide a broad overview of forest condition at the watershed and reservoir basin levels, higher-resolution forest stand data is required to systematically prioritize and plan individual forest management projects. This need has been identified in both 2011 WFMP and in the National Academies of Sciences, Engineering, and Medicine’s Review of the New York City Watershed Program (2020) which states that “Traditional timber inventory data... should be augmented with ...stand-level indices and attributes in order to evaluate forest regeneration potential, model stand development trajectories, assess risks, and set priorities.” In 2023, DEP foresters developed a planning approach for the 2027 WFMP that will enable data-driven, prioritized outyear planning, pursuant to these recommendations. The revised WFMP will employ an approach in which reservoir basins will be broken into individual planning units, or compartments. Stand-level inventory data will be collected within compartments, and these data will be evaluated to prioritize forest management and resource allocation needs. Development of an integrated, multi-level forest inventory program is planned for the upcoming year to support the compartment planning goals for the revised WFMP.

4.8.3 Invasive Species

In 2023, DEP continued to implement the Invasive Species Management Strategy, originally submitted as a FAD deliverable in 2016 and updated in 2022. The strategy outlines actions to prevent new introductions of invasive species; to detect new infestations early and respond to them rapidly; to control and manage existing populations to support specific projects; to mitigate the impacts of species that cannot be otherwise managed; and to restore sites to prevent further impacts. This work is predominantly accomplished through intra-agency collaboration and external partnerships.

Intra-Agency Collaboration

The Invasive Species Working Group (ISWG) was formed within DEP in 2008 to develop and implement a science-based, comprehensive plan to identify, prioritize, and address invasive species threats to the water supply. The ISWG met three times in 2023 to discuss ongoing projects and updates and collaboration on the development of an invasive plant material composting facility.

Partnerships

New York State Invasive Species Advisory Committee

DEP has a seat on the New York State Invasive Species Advisory Committee (ISAC), created through state legislation in 2007 to provide information, advice, and guidance to the New York State Invasive Species Council (ISC) on invasive species impacts, prevention, regulation, detection, and management. In 2023, ISAC covered such topics as the development of a New

York State economic assessment of invasive species impacts, updates to the prohibited and regulated invasive species lists, and new programs that are being developed throughout the state to address climate change. DEP attended four ISAC meetings in 2023.

Catskill Regional Invasive Species Partnership

DEP continued to work regionally with partners on invasive species management in the Catskill region. In 2023, DEP continued work with the Catskill Regional Invasive Species Partnership (CRISP) to run a volunteer program to manage invasive species along the Ashokan Rail Trail and added the installation of boot brush stations at trail heads and restoration planting to the program. DEP participated in CRISP quarterly meetings and served as chair on the steering committee.

Lower Hudson Partnership for Regional Invasive Species Management (PRISM)

DEP continued to partner with the Lower Hudson PRISM and NYSDEC to survey for giant hogweed (*Heracleum mantegazzianum*) within the watershed. Due to the risk of serious injury and blindness, the state has been working to eradicate giant hogweed since 2008. No plants were found for the sixth consecutive year on or around previously treated City lands in the Croton Falls Reservoir basin in the Town of Carmel. These sites will continue to be monitored periodically moving forward but are now considered eradicated. DEP also serves on the steering committee for the PRISM.

Early Detection and Rapid Response

In addition to partnering with the Lower Hudson PRISM on giant hogweed, DEP initiated several other rapid response efforts to eradicate early detection species.

In 2023, DEP completed the third year of full-scale treatment of the *Hydrilla verticillata* infestation in New Croton Reservoir. Contractors with Solitude Lake Management treated 250 acres of nearshore area with granular fluridone herbicide (Sonar H4C and Sonar One). Unlike the dramatic reductions observed in 2022, post-treatment surveys in 2023 showed a large increase in plant density. This was due to challenges in maintaining target herbicide levels under significantly higher precipitation and associated flows and underscores the importance of long-term management efforts to keep this population in check through variable annual conditions.

For the sixth consecutive year, DEP attempted to control a small infestation of water chestnut (*Trapa natans*) in New Croton Reservoir just below the Muscoot Dam. Multiple large rain events over the course of the growing season dislodged large mats of water chestnut from Muscoot Reservoir and distributed the plants along the shoreline of New Croton Reservoir. Multiple days of efforts by Ulster County Community College interns, with support from DEP staff, were not sufficient to get these populations in check and larger-scale efforts will be required in 2024.

The spotted lanternfly (*Lycorma delicatula*) was found commonly throughout the EOH watershed in 2023. This invasive plant pest poses a threat to many hardwood species. DEP

participated for the third year in a spotted lanternfly multi-agency coordination task force and treatment work group. However, much of the focus of the group has shifted toward outlying populations in the western part of NY as part of the national strategy to slow the spread of this plant pest. DEP treated three trap trees to reduce the population at Hillview Reservoir and developed a facility guidance document for reducing populations in and around watershed facilities.

Control and Management

DEP continued to manage priority invasive species on City lands through manual and mechanical removal, herbicide applications, and biological control in 2023. Species were targeted based on the threat they pose to specific project areas and include mile-a-minute weed (*Persicaria perfoliata*), Japanese knotweed (*Reynoutria japonica*), Asiatic bittersweet (*Celastrus orbiculatus*), and common reed (*Phragmites australis*). DEP also contracted with Cornell University to assess and improve the viability of biological control agents for hemlock woolly adelgid. Cornell released silver flies (*Leucopis* spp.) in the Neversink basin in 2023. Further population monitoring and a final report are expected in 2024. DEP will continue working toward an integrated pest management approach to managing the impacts of the hemlock woolly adelgid on the eastern hemlock (*Tsuga canadensis*) forests in the watershed in 2024.

Mitigation of Impacts

DEP continued to participate in a Monitoring and Managing Ash (MaMA) project to identify lingering ash trees in 2023. DEP staff and Ulster County Community College interns monitored four ash mortality plots throughout the WOH watershed. More information about the MaMA project is available at <https://www.monitoringash.org/>.

Zebra mussels (*Dreissena polymorpha*) are another species that can have a significant negative impact on the water supply. Zebra mussels were first reported in Lake Mahopac in 2015, and settled adults were found in Amawalk and New Croton Reservoirs in 2021 and 2022, respectively. In 2023, DEP worked with the Water Research Foundation to convene an expert panel to review the potential impacts of zebra mussels to the Croton system. The panel provided a suite of recommendations including continued monitoring of the populations. DEP deployed artificial substrate samplers and collected plankton samples at locations throughout the New Croton Reservoir to monitor settlement and track larval concentrations (Figure 4.19). DEP is collaborating across directorates to track this infestation, prevent its spread, and prepare for and respond to infrastructure impacts. Infestation risk of CAT/DEL reservoirs by zebra mussels is considered low as their water chemistry, especially calcium and alkalinity, is limiting for larval and adult survival.

The Forest Ecosystem Monitoring Cooperative funded a collaboration between DEP and the Harvard Forest to develop a tool that remotely monitors forest canopy cover and health in the WOH and EOH watersheds in 2022. Throughout 2023, DEP's restoration ecologist entered DEP forest data to further the development of the tool and integrated feedback from DEP programs to



Figure 4.19 Adult zebra mussels on a substrate sampling plate in the New Croton Reservoir.

improve the design. The tool, which is anticipated to be available in spring 2024, will enable DEP staff to view a map that highlights areas in which the forest canopy is “less green” than normal, indicating declines in forest canopy due to pests, stress, clearing, blowdowns, or human disturbances, identifying potential impact mitigation needs.

Restoration

DEP continued to implement its restoration plan for the former lakebed exposed following DEP’s 2021 removal of the Chia Lin Dam, located in the Boyd Corners Reservoir basin. A contracted licensed pesticide applicator treated the common reed present on the site for

a second time in 2023 to facilitate the establishment of a native plant community, which will be augmented with native plantings in 2024/2025.

In 2023, DEP also worked with partners to apply for funding from the United States Forest Service to implement enrichment plantings to restore stands in the Neversink Basin that are damaged from hemlock woolly adelgid. If funded, work will begin in 2024.

4.9 East of Hudson Non-Point Source Pollution Control Program

The EOH Nonpoint Source Pollution Control Program supplements DEP's existing regulatory efforts and other initiatives to address nonpoint pollutant sources in the four EOH FAD basins: West Branch, Croton Falls, Cross River, and Boyd Corners. Wastewater Programs

4.9.1 Wastewater Programs

Septic Programs East of Hudson

DEP supports Westchester and Putnam counties in their efforts to reduce the potential impacts of improperly functioning or maintained septic systems. Westchester County, Putnam County, and their respective municipalities continue to implement the septic requirements of the NYSDEC MS4 General Permit, which obligates municipalities and counties to implement programs for the inspection, maintenance, and rehabilitation of septic systems.

DEP previously partnered with the New York State Environmental Facilities Corporation (EFC) to implement the Septic System Rehabilitation Reimbursement Program in priority areas of the EOH Catskill/Delaware watershed and basins hydrologically connected to the Croton Falls Reservoir (i.e. Bog Brook, Diverting, East Branch, and Middle Branch). Starting in 2023, DEP now manages this program in-house. In 2023, DEP completed the annual direct mailings to eligible residents to promote the program. In 2023, DEP issued reimbursements for eight septic repairs; four were completed in the West Branch and Boyd Corners basins with the remaining four in the Cross River, Croton Falls, and upstream, hydrologically connected basins.

EOH Community Wastewater Planning Grant Program

Pursuant to the 2017 FAD, DEP developed a grant program, administered by NEIWPC, to provide funding to EOH watershed municipalities for preliminary planning of community wastewater solutions for eight areas where septic systems may impact water quality. This grant program was completed in 2021, with the eight resulting wastewater studies providing a roadmap for municipalities to seek implementation funding. DEP completed the summary report in 2022.

Video Sanitary Sewer Inspections

DEP implements an inspection program for targeted portions of the sanitary sewer system located within the West Branch and Croton Falls basins. DEP completed the Comprehensive Summary Report of these selected areas and notified the Town of Carmel of the inspection results in 2022.

4.9.2 Stormwater Facility Inspection and Maintenance

The Facility Inspection and Maintenance Program ensures that previously constructed stormwater remediation facilities continue to function as designed through routine inspections. Maintenance is completed under the warranty in each facility’s construction contract during the first year and thereafter under DEP’s maintenance program contract. Inspection and maintenance follow procedures contained in the maintenance contract. During 2023, DEP inspected all facilities, with 60 facilities requiring vegetation removal, 40 requiring sediment and debris removal, eight requiring stone riprap repairs, six requiring tree removal, and three requiring seed and mulch. All stormwater facilities are functioning as designed.

4.9.3 Stormwater Retrofit Grant Program

DEP funds a grant program through the EOH Watershed Corporation (EOHWC) for eligible municipalities to construct the stormwater retrofits needed to satisfy municipal permit obligations under Section IX.A.5.b of the NYSDEC MS4 General Permit. The MS4 Permit mandates that EOH watershed municipalities achieve nonpoint source phosphorous reductions through the construction of stormwater retrofits. As required by the 2017 FAD, DEP contracted with the EOHWC to provide an additional \$22 million to support the design and construction of stormwater retrofits in the EOH FAD basins and those basins upstream of the Croton Falls Reservoir. Through 2023, EOHWC expended or committed approximately \$6 million of the initial payment for retrofit projects in the West Branch, Boyd Corners, Cross River, Croton Falls, and upstream hydrologically connected basins. Since inception, EOHWC’s retrofit program has removed an estimated 450 kg P/yr. from these basins.

4.10 Kensico Water Quality Control Program

Kensico Reservoir in Westchester County is a terminal reservoir that provides the last impoundment of Catskill/Delaware water prior to entering the City’s distribution system. As such, DEP prioritizes water quality protection efforts in the Kensico basin.

4.10.1 Septic Reimbursement Program

DEP previously implemented the Kensico Septic System Rehabilitation Reimbursement Program through a contract with New York State Environmental Facilities Corporation (EFC). Starting in 2023, DEP now directly reimburses eligible homeowners for repairing failing septic systems or connecting those systems to an existing sewage collection system. The program is voluntary, with the goal of encouraging property owners to inspect their septic systems and, if failing, rehabilitate them. During 2023, DEP mailed the annual program reminder letter to all eligible residents and issued one septic reimbursement.

4.10.2 West Lake Sewer

The West Lake sewer trunk line, owned and maintained by Westchester County, conveys untreated wastewater to treatment facilities located elsewhere in the county. DEP previously funded the installation of a sanitary sewer remote monitoring system for the trunk line to provide real-time detection of problems such as leaks, system breaks, overflows, and blockages. To date, there have been no overflows or concerns and the units appear to be working well. In 2023, DEP

conducted an annual visual inspection of the trunk line to assess the condition of exposed infrastructure. DEP also conducted routine partial inspections throughout the year related to ongoing maintenance of Kensico stormwater BMPs near the line. DEP noted no defects or abnormalities.

4.10.3 Video Sanitary Sewer Inspection

DEP implements an inspection program for targeted portions of the sanitary sewer system located within the Kensico basin. DEP's contractor completed the Comprehensive Summary Report of selected areas and notified the Town of Mount Pleasant of the inspection results in 2022.

4.10.4 Stormwater BMPs

DEP has constructed stormwater management and erosion abatement facilities throughout the Kensico basin to reduce pollutant loads to the reservoir. DEP and its contractor inspected and maintained these facilities throughout 2023, according to the O&M guidelines (Figure 4.20). Maintenance consisted of grass mowing, seeding and mulching, vegetation removal, fallen tree removal, fence repair, swale repair, and sediment and debris removal. All BMPs are performing as designed.

4.10.5 Wildlife Sanitary Surveys

DEP conducts sanitary surveys at the Kensico Reservoir as a proactive measure to identify and remove wildlife excrement before it washes into the water supply and potentially elevate fecal coliform levels. In February 2023, DEP increased the survey routine from 24 to 48 hours prior to significant precipitation events to a weekly survey. In 2023, DEP's contractor conducted 46 wildlife sanitary surveys at Kensico Reservoir (Table 4.11). Of the 8,521 fecal samples collected, 71% were attributed to Canada geese, 24% to passerine birds, 4% to white-tailed deer, and the remaining 2% to rabbits, bobcat, mink, raccoons, coyote, and unknown mammals. Of the 8,521 excrement samples collected 99.7% were confirmed to species level. All samples were removed from the property following collections.

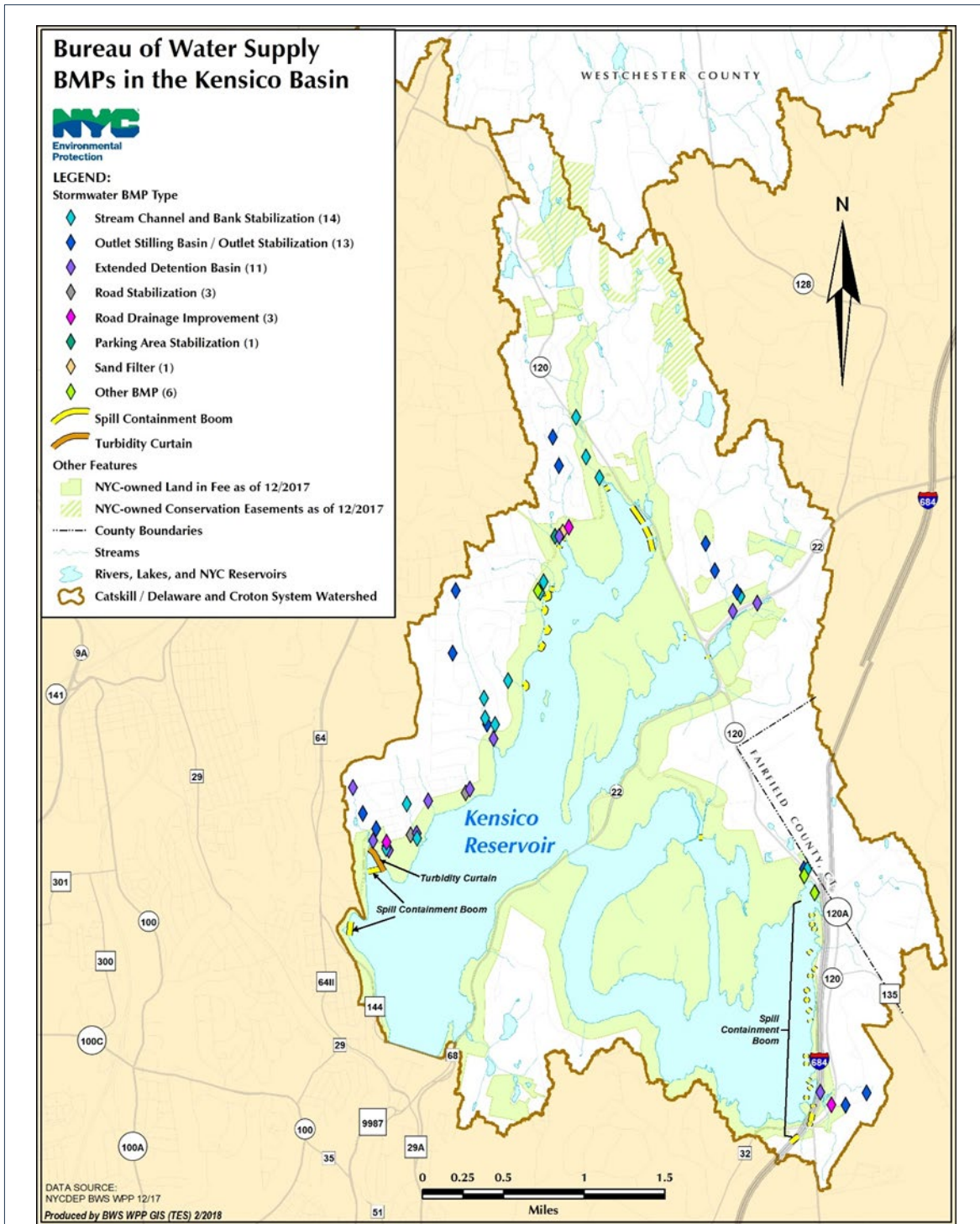


Figure 4.20 BMPs within the Kensico Reservoir Basin

Protection and Remediation Programs

Table 4.11 Kensico Reservoir 2023 wildlife sanitary surveys.

Date of Survey	White-tail Deer	Raccoon	Rabbit	Canada Goose	Coyote	Bobcat	Fox	Passerine (birds)	Other/ Unknown Mammal (Mink)	Total
1/18/23	34	0	0	0	8	0	0	0	0	42
1/25/23	25	0	0	0	0	0	0	0	1	26
2/14/23	2	0	3	2	0	0	0	0	1	8
2/21/23	10	0	1	0	0	6	0	0	10	27
3/2/23	3	2	0	0	2	0	0	0	1	8
3/13/23	27	0	8	0	0	0	0	0	2	37
3/29/23	5	0	0	3	2	0	0	0	0	10
4/4/23	3	0	0	0	0	0	0	0	1	4
4/11/23	0	0	0	393	0	0	0	46	1	440
4/18/23	0	0	0	671	1	0	0	3	0	675
4/25/23	0	0	0	31	0	0	0	2	0	33
5/2/23	0	0	0	52	2	0	0	0	0	54
5/9/23	2	0	0	23	1	0	0	0	0	26
5/16/23	2	0	0	110	0	0	0	31	0	143
5/23/23	0	0	0	410	0	0	0	15	0	425
5/30/23	5	0	0	908	0	0	0	35	0	948
6/6/23	5	0	0	1,261	1	0	0	0	0	1,267
6/13/23	1	0	0	1,024	0	0	0	77	3	1,105
6/20/23	6	0	0	377	0	0	0	35	0	418
6/27/23	15	0	1	802	0	0	0	9	1	828
7/5/23	9	0	0	1	0	0	0	1	0	11
7/11/23	11	0	1	16	0	0	0	49	0	77
7/18/23	23	0	0	0	0	0	0	0	0	23
7/25/23	33	0	0	0	0	0	1	0	0	34
8/1/23	19	0	0	0	0	0	0	34	0	53
8/8/23	16	0	0	0	2	0	0	182	0	200
8/14/23	8	0	0	0	1	0	0	7	0	16
8/22/23	8	0	0	0	0	0	0	1	0	9
8/28/23	6	0	4	0	0	0	0	1,408	2	1,420
9/4/23	1	1	0	0	0	0	0	0	1	3
9/12/23	5	0	0	0	0	0	0	9	1	15
9/19/23	2	0	0	0	0	0	0	0	2	4
9/28/23	4	0	0	0	0	0	0	0	0	4

Date of Survey	White-tail Deer	Raccoon	Rabbit	Canada Goose	Coyote	Bobcat	Fox	Passerine (birds)	Other/ Unknown Mammal (Mink)	Total
10/4/23	0	0	1	0	1	0	0	31	1	34
10/10/23	3	0	0	0	0	0	0	15	1	19
10/20/23	2	0	0	0	2	0	0	5	2	11
10/28/23	1	0	0	0	0	0	0	0	0	1
11/3/23	2	0	1	0	0	0	0	4	1	8
11/9/23	2	0	0	0	1	0	0	2	1	6
11/17/23	2	0	4	0	0	2	0	5	0	13
11/25/23	0	0	0	0	2	0	0	12	0	14
12/1/23	2	0	2	0	0	0	0	3	0	7
12/6/23	1	0	0	0	1	0	0	0	0	2
12/15/23	3	0	0	0	0	0	0	1	0	4
12/20/23	1	0	0	0	0	0	0	0	0	1
12/26/23	7	0	0	0	0	0	0	1	0	8
Total	316	3	26	6,084	27	8	1	2,023	33	8,521

4.10.6 Spill Containment Facilities

DEP maintains spill containment facilities in and around Kensico Reservoir to improve spill response and recovery. In 2023, DEP conducted routine maintenance at the spill boom sites to ensure they are available in the event of a spill. One minor event occurred in the Kensico basin on January 11, 2023, when 15-20 gallons of ethylene glycol was accidentally released within the City’s Delaware Aqueduct Shaft 17 facility. DEP performed the necessary cleanup within the building and there were no water quality impacts. No spills impacted the reservoir or required the deployment of the spill containment booms.

4.10.7 Shoreline Stabilization

Shaft 18

Since the Catskill/Delaware Ultraviolet Light Disinfection Facility. began operating, all Kensico water flows through the Delaware Effluent Chamber at Shaft 18 on the reservoir’s southeast shore. DEP completed shoreline stabilization near the effluent chamber in 2022 to maintain turbidity levels in compliance with state and federal water quality standards.

UEC

As part of the Kensico-Eastview Connection project and reconstruction of the Upper Effluent Chamber (UEC), DEP will stabilize the shoreline near the UEC, replace the existing

Malcolm Brook turbidity curtain, and remove sediment near the UEC intake channel. In 2023, DEP's engineering consultant continued design of the shoreline stabilization project. Construction of the project is anticipated to commence in 2025 and conclude in 2031.

4.10.8 Other Activities

Turbidity Curtain

In 2023, DEP continued to monitor and inspect the extended primary curtain and the backup turbidity curtain that are designed to direct flows from Malcolm Brook and Young Brook farther out to the main body of Kensico Reservoir. Based on the most recent inspection, no repair work was required. The curtains appear to be functioning as intended.

Sewer Connection Prioritization

The Revised 2017 FAD requires DEP to perform an evaluation of unsewered areas of the Kensico drainage basin to prioritize parcel locations for connection to an existing centralized sewage collection system. In 2023, DEP completed this evaluation using available septic repair data, water quality data, site conditions, and regulatory information. DEP found no apparent septic hotspots within the basin but did identify 285 parcels in three areas that are believed to be serviced by septic systems and warrant further investigation in the upcoming FAD-mandated feasibility study due in 2026.

Westchester County Airport

DEP continues to review activities proposed at or in relation to the Westchester County Airport due to its proximity to Kensico Reservoir.

In November 2023, Westchester County initiated SEQR environmental review for the Westchester County Airport snow equipment storage building. DEP issued comments to the county on November 28, 2023. Although the project does not require DEP approval of a stormwater pollution prevention plan (SWPPP), DEP did request an opportunity to review the project report and plans to ensure no adverse impacts to Kensico Reservoir.

In 2022, Westchester County relaunched a public engagement program on the airport master plan and held two public meetings in September. The supplement to the airport master plan is moving forward, though there is currently no deadline for completion and no new information concerning the plan was made available to the public in 2023.

The Rye Lake Filtration Plant is proposed by Westchester Joint Water Works on airport property in the Town of Harrison. DEP issued an approval of the SWPPP in May 2023, but awaits formal submission of an application for sewer extension approval.

Park Place at Westchester is a private 980-space parking garage proposed in the Town of North Castle. DEP previously commented on the project through the SEQRA process and awaits resubmission of final plans prior to issuing SWPPP approval under the City's WR&R.

In accordance with a 2019 NYSDEC consent order, Westchester County prepared a site characterization work plan to assess PFOS, PFOA, and other groundwater contaminants at and near the airport, which was accepted into the NYSDEC Brownfield Cleanup Program. NYSDEC released a draft remedial investigation work plan in October 2022. DEP reviewed and commented on this plan in 2022; the plan remains under review by NYSDEC.

Since identifying an uncapped landfill at the airport in 2015, Westchester County has performed sampling and laboratory analysis of groundwater, surface water, landfill soils, and accumulated iron flocculent. Results of soil samples collected from eight test pits indicate exceedances for certain metals and mercury. The landfill/soil mound is expected to be addressed through Westchester County's participation in the NYSDEC Brownfield Cleanup Program. The landfill is still under investigation and has been incorporated into the remedial investigation work plan mentioned above.

On January 19, 2023, a single-engine plane crashed into a wooded area on City-owned water supply lands in the Town of North Castle. There were no chemical or fuel spills associated with the crash and no water quality impacts to Kensico Reservoir.

4.11 Catskill Turbidity Control

Due to the nature of the underlying geology, the Catskill watershed is prone to elevated levels of turbidity in streams and reservoirs. High turbidity levels are associated with high flow events, which can destabilize stream banks, mobilize streambeds, and suspend the glacial clays beneath the streambed armor. The design of the Catskill System considers local geology and provides for settling within Schoharie Reservoir, Ashokan West Basin, Ashokan East Basin, and the upper reaches of Kensico Reservoir. Under normal circumstances, the extended detention time in these reservoirs is sufficient to allow the turbidity-causing clay solids to settle out and the system easily meets the SWTR turbidity standards (5 NTU) at the Kensico effluent. Occasionally after extreme rain/runoff events in the Catskill watershed, DEP has used aluminum sulfate (alum) as chemical treatment to control high turbidity levels.

Since 2002, DEP has undertaken several studies and implemented significant changes to its operations to better control turbidity in the Catskill System. DEP has implemented many of these measures pursuant to the 2002 and 2007 FADs and the Shandaken Tunnel and Catalum State Pollutant Discharge Elimination System (SPDES) permits. A comprehensive analysis, the Catskill Turbidity Control Study, was conducted by DEP with the Gannett-Fleming-Hazen and Sawyer JV in three phases between 2002 and 2009. DEP implemented several alternatives based on the results of this study: a system-wide Operations Support Tool (OST) that allows DEP to optimize reservoir releases and diversions to balance water supply, water quality, and environmental objectives; an interconnection of the Catskill Aqueduct at the Delaware Aqueduct Shaft 4 to improve overall system dependability; and structural improvements to the Catskill Aqueduct stop-shutter facilities. The Catskill-Delaware Interconnection and the Catskill Aqueduct stop-shutter facilities projects achieved functional completion in 2016.

Catalum Consent Order and Environmental Review

Rain events in October and December 2010 caused elevated turbidity levels in the Ashokan Reservoir. In addition to alum at Kensico, DEP also utilized the Ashokan Release Channel as part of a strategy previously approved by NYSDOH and EPA to ensure all drinking water standards were met. Using the channel raised concerns from communities along the Esopus Creek downstream of the reservoir.

In February 2011, NYSDEC commenced an administrative enforcement action against the City for alleged violations of the Catskill Aqueduct Intake Chamber Catalum SPDES Permit (NY0264652) regarding operation of the Ashokan Release Channel and alum addition. NYSDEC and DEP negotiated a consent order to resolve the alleged violations, which took effect in October 2013. The consent order included penalties, environmental benefit projects, a schedule of compliance, and an Interim Release Protocol for the channel's operation.

Consistent with the consent order, DEP requested a modification to the Catalum SPDES Permit in 2012 to incorporate turbidity control measures in water diverted from Ashokan Reservoir and to postpone dredging of alum floc at Kensico Reservoir until completion of certain infrastructure projects. The proposed modification is subject to environmental review under the State Environmental Quality Review Act (SEQRA), for which NYSDEC is lead agency. Below is a timeline for the Catalum environmental impact statement (EIS) development:

NYSDEC released a draft scope for the Catalum EIS for public comment from April 9, 2014, to August 29, 2014. More than 550 commenters submitted more than 900 comments.

- The final scope was issued on March 22, 2017, and it took into consideration feedback from the public review process and includes responses to the comments received.
- A draft DEIS was submitted to NYSDEC on May 30, 2019.
- NYSDEC released the DEIS for public comment on December 16, 2020.
- DEIS public hearings were held on February 4, 2021 and March 3, 2021.
- The public comment period for the DEIS closed on June 16, 2021. Over 1,300 comments were received.
- On January 10, 2022, NYSDEC issued a “Scope for the Supplemental Environmental Impact Statement for the Catalum SPDES Permit Modification.” This requires DEP, as the project sponsor, to prepare a Supplemental Draft Environmental Impact Statement (SDEIS) that is limited to analyzing the specific adverse environmental impacts that were not addressed or inadequately addressed in the DEIS. (https://www.dec.ny.gov/docs/permits_ej_operations_pdf/catalumsuppeisscope.pdf)
- On February 9, 2022, NYSDEC issued a “Combined Notice of Intent to Prepare a Supplemental Draft Environmental Impact Statement (SDEIS) and Notice of Acceptance of Scope”. The combined notice was published in the Environmental

Notice Bulletin and reflected the January 10, 2022 Scope document. (ENB Region 3 Notices 2/9/2022 - NYS Dept. of Environmental Conservation

- During 2023, DEP and NYSDEC continued reviewing comments submitted in response to the DEIS and discussing the scope of the SDEIS.
- On October 5, 2022, DEC announced a draft modification to the Interim Release Protocol for review and comment by the Ashokan Release Working Group. Comments received in late 2022 and early 2023 as well as potential responses were under consideration by NYSDEC as of December 31, 2023.

5. Watershed Monitoring, Modeling, and GIS

5.1 Watershed Monitoring Program

5.1.1 Routine Water Quality Monitoring

To ensure the delivery of high-quality drinking water, DEP conducts extensive water quality monitoring encompassing all areas of the watershed, including sites at aqueducts and water supply intakes (keypoints); streams; reservoirs; and water resource recovery facilities (WRRFs). DEP's monitoring objectives are documented in the Watershed Water Quality Monitoring Plan (WWQMP) (DEP 2018) and its associated addenda, which are designed to meet the broad range of DEP's regulatory and operational requirements. The overall goal is to maintain an objective-based water quality monitoring network providing scientifically defensible information to protect and manage the New York City water supply.

The plan's objectives have been defined by DEP management and program administrators, regulators, and other external agencies. The plan prescribes monitoring to achieve compliance with all federal, state, and local regulations; meet the terms of the Revised 2017 FAD (NYSDOH 2022); support water supply operation and modeling efforts; and ensure delivery of the best water quality to consumers through ongoing surveillance. Many specific objectives fall within each of these major areas.

Compliance

The compliance objectives are focused on meeting the regulatory monitoring requirements for the New York City watershed. This includes the Surface Water Treatment Rule (SWTR) (USEPA 1989) and its subsequent enhancements, the New York City Watershed Rules and Regulations (WR&R) (DEP 2019), administrative orders, and State Pollutant Discharge Elimination System (SPDES) permits. The sampling sites, analytes, and frequencies are defined in each objective according to each permit, rule, or regulation.

FAD program evaluation

The USEPA specified many requirements in the 2007 FAD (USEPA 2007) meant to protect public health and NYSDOH continued to specify requirements in the Revised 2017 FAD. These requirements form the basis for the City's ongoing assessment of watershed conditions, changes in water quality, and any modifications to the strategies, management, and policies of the Long-Term Watershed Protection Plan (DEP 2021). The City also conducts a periodic assessment of the program's effectiveness using DEP's water quality monitoring data. Program effects on water quality are reported in the Watershed Protection Program Summary and Assessment reports (e.g., DEP 2021), which are produced every five years.

Modeling support

Modeling data are used to meet the long-term goals for water supply policy and protection and to provide guidance for short-term operational strategies including reservoir

balancing, establishing release rates, and managing unusual water quality events. These objectives are achieved through implementation of watershed and reservoir model improvements based on ongoing data analyses and research results; ongoing testing of those models; updating of data necessary for the models’ development; and development of data analysis tools to support modeling projects.

Stream, reservoir, aqueduct, and meteorological data are all needed to develop, calibrate, and validate models. Data acquired through stream monitoring include both flow and water quality data. Aqueduct monitoring provides flow and reservoir operations data to support reservoir water balance calculations. The water balance and reservoir water quality data are needed to test, apply, and further develop DEP’s one- and two-dimensional models. The meteorological data collection provides critical input necessary to meet both watershed and reservoir modeling goals. The modeling program’s 2023 activities are summarized in the Watershed Water Quality Annual Report.

Surveillance monitoring

The surveillance monitoring chapter of the WWQMP contains several objectives that focus on aqueduct monitoring to guide the short-term operation of the water supply system. Other objectives relate to maintaining a baseline understanding of potential and emerging contaminants (e.g., trace metals, organic compounds), water quality status and long-term trends for reservoirs and streams in the Croton System.

DEP operates an extensive Robotic Water Quality Monitoring Network (RoboMon) as part of its routine monitoring program. The network provides high-frequency data which are used for water supply management during routine operations as well as water quality events (e.g., storms). The network is critical for providing an early warning of water quality conditions to inform DEP management in making effective operational decisions and supporting operational models. The network includes fixed-depth buoys (including two under-ice buoys), profiling buoys, and several stream installations. The RoboMon network made over 2.4 million measurements in the watershed in 2023.

5.1.2 Additional Water Quality Monitoring

In addition to routine monitoring, events or incidents may occur that necessitate additional water quality monitoring. These special investigations (SIs) include monitoring related to the activation of the Croton Filtration Plant; taste and odor monitoring; implementation of an invasive species (Hydrilla) control project; pump station monitoring; copper sulfate treatment within the Croton System and other smaller, less intensive monitoring events. The major 2023 SI efforts are outlined below.

Special Investigation: Croton Taste and Odor Monitoring

In 2023, a total of 764 samples were collected for Geosmin (GSM) and 2-methylisoborneol (MIB) at a total of 40 sites. The number of samples collected were in support of three major monitoring objectives: Croton Water Filtration Plant support, copper sulfate

treatment monitoring, and upstream taste and odor surveillance monitoring. There were no taste and odor events in 2023. After several years of monitoring various locations throughout the watershed, there is a general understanding of the spatial and temporal trends in the areas studied, and therefore reductions to monitoring will be implemented in 2024 to focus on operational support.

Special Investigation: Invasive Species Control

DEP conducted a special investigation to continue to evaluate the fate and transport of an applied chemical herbicide in New Croton Reservoir for the treatment of the aquatic invasive plant, Hydrilla. A contractor applied fluridone (trade names, SONAR H4C and SONAR ONE) in two forms (i.e., pellet and liquid) at a select treatment area in the reservoir from June through September 2023. Samples were collected in New Croton Reservoir and at keypoint sites to quantify the presence and extent of fluridone transport in the reservoir before, during, and after application. DEP collected grab samples at all sites weekly and shipped them to a contract laboratory for fluridone analysis. Monitoring continued through October.

Special Investigation: Pump Station Monitoring

In preparation for the RWBT shutdown operation, both the Croton Falls and Cross River pump stations were utilized during a March 2023 RWBT dewatering exercise. The pump stations were used to augment Ashokan Reservoir diversions into Kensico Reservoir. Enhanced monitoring was initiated to satisfy the Section 5.1 of the Revised 2017 New York City Filtration Avoidance Determination (FAD). The enhanced monitoring was in accordance with the February 2023 Water Quality Monitoring Plan for Croton Falls and Cross River Pump Station Operations. Enhanced monitoring began February 13, 2023, prior to any pumping, as required. Data were submitted to NYSDOH according to the monitoring plan. There were no water quality issues during the exercise. Details of the enhanced monitoring were provided to NYSDOH via an after-action report published in March 2023.

A second RWBT dewatering exercise was executed in October of 2023 to further support the RWBT shutdown operation. Once again, the Croton Falls and Cross River pump stations were utilized to support the exercise and augment Ashokan Reservoir diversions to Kensico Reservoir. Enhanced monitoring was initiated to satisfy the Section 5.1 of the Revised 2017 New York City Filtration Avoidance Determination (FAD). The enhanced monitoring was in accordance with the February 2023 Water Quality Monitoring Plan for Croton Falls and Cross River Pump Station Operations. Enhanced monitoring began September 25, 2023, prior to any pumping, as required. DEP implemented bird dispersal activities at Croton Falls Reservoir to mitigate elevated fecal coliform counts seen prior to Croton Falls Pump Station initiation. The initiation of the Cross River Pump Station was delayed until coliform counts decreased. Data were submitted to NYSDOH according to the monitoring plan. Details of the enhanced monitoring were provided to NYSDOH via an after-action report published in November 2023.

Special Investigation: Copper Sulfate Treatment in the Croton System

In preparation for the RWBT shutdown, DEP expanded copper sulfate treatments in 2023 to control algal populations that could be releasing taste and odor compounds into the water column. In 2023, copper sulfate treatments were applied at four reservoirs: Croton Falls, Cross River, Muscoot, and New Croton. Water quality monitoring was utilized to guide treatment dates and locations at each of the four reservoirs. Water quality monitoring was conducted before and after treatment and included dissolved copper, photosynthetic production, phytoplankton presence and abundance, and MIB and GSM concentrations.

Copper sulfate was applied via boat using an on-board tank and calibrated pump system to disperse the copper sulfate at 0.3 mg/L. In total, there were three treatments each at Croton Falls, Cross River, and Muscoot reservoirs and four treatments at New Croton Reservoir. All treatment applications were successful in depressing algal growth within the portion of the water column that was treated. Further details of the treatment applications can be found in the after-action reports that was circulated during 2023.

Special Investigation: Hunter Highlands WWTP

In August 2023, a special request by West of Hudson Wastewater Treatment Program staff was made to continue to evaluate plant function for the Hunter Highlands WWTP in consideration of a proposed increase in plant flow. Monthly sampling was initiated in November 2023, and will conclude in April 2024. The plant was sampled in November for Giardia and Cryptosporidium and was negative for Cryptosporidium oocysts, and Giardia cysts. Composite samples were collected monthly to evaluate plant performance and compliance with SPDES permit limits.

5.1.3 Water Quality Reports

DEP produces a Watershed Water Quality Annual Report (WWQAR). This is submitted annually each July to NYSDOH and USEPA. This document covers water quantity; water quality of streams and reservoirs; Kensico Reservoir water quality; and a summary of the year’s major water quality modeling activities. For 2023, DEP’s watershed monitoring effort consisted of 318 sampling sites, resulting in 13,200 samples and approximately 231,800 analyses.

In 2023, to move away from manual interpretation of metrics, Data & Technology staff developed a PowerBi dashboard for metrics and analyses reporting. During this process inconsistencies in the above metrics that were reported in the 2021 and 2022 FAD annual reports were discovered. The errors related to variations in interpretations of what samples should be included in the overall summary of samples and analyses. Moving forward, PowerBi will be used to generate these metrics with a standard set of rules enabled to ensure consistent and accurate reporting. Table 5.1 shows the metrics that were included in those reports and the corrected numbers generated from PowerBi.

Table 5.1 Samples and analyses, 2021 - 2023

Report	Region	Sites Reported	Sites Corrected	Samples Reported	Samples Corrected	Analyses Reported	Analyses Corrected
2021	Watershed and Distribution	-	-	44,300	47,300	556,100	598,000
2021	Watershed Only	409	343	11,000	14,400	92,500	206,000
2022	Watershed and Distribution	-	-	43,900	45,700	577,000	580,300
2022	Watershed Only	470	320	11,600	13,400	200,600	203,600

5.2 Multi-Tiered Water Quality Modeling Program

DEP’s Water Quality Modeling Program uses models to quantify the impact of climate change, changes in land use, individual and grouped components of the watershed protection program, operation of the water supply system, and water demand on the quantity and quality of water delivered to the City. A detailed description of water quality modeling progress and activities in 2023 will be included in the Watershed Water Quality Annual Report, which will be completed on July 31, 2024. A summary of these activities is given here.

Developing an index of climate indicators: In 2023, DEP continued the development of climate change indicators and associated extreme climate index. The purpose of the index is to describe the degree of extreme conditions for a given year relative to the reference period of 1970-2000. This reference period is used to calculate 10th and 90th percentiles for each indicator, with any indicator outside these values tagged as ‘extreme’. Counts of these extreme values are summed for each year to generate the climate change index timeseries. In addition to the annual computation of all climate trends using the existing software, work this year has begun on planning for a dashboard to disseminate the trend and index results. As part of the Del-444 contract, consultants have been provided with all data and codes, and are working with DEP staff to build the dashboard and conduct additional statistical analyses on the climate trends. This work will proceed into 2024.

Developing extreme climate scenarios: During 2023, we continued our efforts to develop improved multiyear hydrological extreme scenarios for NYC Water Supply System resiliency studies. Our 2022 results focused on one WOH basin and one set of downscaled model results (referred to as MACA) from Phase 5 of the Coupled Model Intercomparison Project (CMIP5). During 2023, we have extended the analysis significantly to include all six WOH basins, and results from four different sets of modeling results. The four sets of results include: (1) MACA (CMIP5); (2) NASA Global Daily Downscaled Projections from CMIP6; (3) Localized Constructed Analogues (LOCA) downscaled precipitation results from CMIP6; and (4) High-resolution global climate model results from Princeton University and derived from NOAA’s Seamless System for Prediction and Earth System Research (SPEAR-HI). These four results encompass the range of state-of-the-art high-resolution climate model results that are required for local and regional studies of the impacts of climate change such as our study. We have analyzed results from all these models, found a consistent underestimation of the magnitude of extreme

precipitation scenarios in our region, and are currently in the process of applying appropriate corrections (based on the work of Frei et al. 2022) for all WOH basins.

Watershed modeling: Watershed modeling efforts in NYC watersheds is focused on two main areas and include: 1) assessment of climate change impacts on streamflow and water quality, and 2) evaluation of watershed protection programs. In 2023, the Soil and Water Assessment Tool (SWAT) was used to simulate the impact of climate change on dissolved organic carbon (DOC) exported from the Neversink watershed. Preliminary results indicate ~1% increase in DOC flux every 5 years in response to projected changes in streamflow under future climate. During 2023, we also initiated a research project to evaluate the impact of DEP’s land acquisition program on water quality. Tremper Kill sub-basin of Pepacton watershed and Manor Kill sub-basin of Schoharie watershed were chosen for this study. The goal of this project is to assess the potential improvements in water quality due to land acquisition, using data and the SWAT watershed model. The Generalized Watershed Loading Function (GWLF) model was used for streamflow simulations in a climate change study on developing decadal scale drought and pluvial scenarios. In 2023, the GWLF model was also used in streamflow simulations under future climate scenarios based on CMIP6 projections, at major stream sites in WOH and EOH watersheds. Ongoing work includes the application of the SWAT model for estimating watershed nutrient loads under new climate projections.

SWAT modeling for EOH watersheds: In 2023, the EOH watersheds modeling tasks began with the development of a SWAT model for Amawalk watershed, which is characterized by the highest percentage of urban land (46.8%) among EOH watersheds with natural inflow. The model was set up for the watershed outlet on Muscoot River at Baldwin Place USGS monitoring station. This segment of the watershed encompasses 3,225 septic systems (non-point source pollution) and four wastewater treatment plants (point source pollution) discharging into the river system. Calibration and validation of the model for streamflow yielded satisfactory results, with NSE > 0.5 and PBIAS < ±2. The SWAT model estimated the contribution of the point and non-point sources of nutrient pollution to the total load of nitrogen and phosphorus. The findings indicated that each failing septic unit in the vicinity of the stream network contributed an average of 76 kg/year of nitrate (NO₃) load and 0.14 kg/year of total dissolved phosphorus (TDP). Furthermore, the contribution of wastewater treatment plants to nutrient loads exhibited a decrease from 34% (NO₃) and 10.3% (TDP) to 9.7% (NO₃) and 1% (TDP) following plant upgrades.

In 2024, we plan to further develop Amawalk SWAT model by including fertilizer calculations, conducting water quality calibration and validation, and refining nutrient load estimations. Additionally, we will develop a SWAT model for Boyd Corners — the watershed distinguished by having the lowest number of septic systems and no wastewater treatment plants — allowing for a direct comparison of nutrient loading from the Amawalk watershed.

DOC modeling in WOH streams: Some portion of organic matter (OM) derived from NYC watersheds is also a precursor to disinfection byproducts (DBPs). Effective management of

OM in watersheds requires monitoring and understanding OM sources, seasonal dynamics, and transport patterns. During 2023, we analyzed observations of dissolved organic carbon (DOC), an operational proxy of OM, from the six major inflow streams to WOH reservoirs. These streams were West Branch Delaware River (inflow to Cannonsville Reservoir), East Branch Delaware River (inflow to Pepacton Reservoir), Neversink River (inflow to Neversink Reservoir), Rondout Creek (inflow to Rondout Reservoir), Schoharie Creek (inflow to Schoharie Reservoir), and Esopus Creek (inflow to Ashokan Reservoir). The analyses included: (1) developing empirical models to predict DOC from other commonly measured environmental variables such as flow and turbidity, (2) calculating fluxes (i.e., loading of DOC into reservoirs), and (3) analyzing for long-term trends.

The six empirical models evaluated in the study were: linear regression model (LM), dynamic linear model (DLM), LOAD ESTimator model (LOADEST), Weighted Regressions on Time, Discharge, and Season (WRTDS) model, multiple linear regression model (MLR), and general additive model (GAM). We found that GAMs produced consistently the most robust results, with the optimal predictors being flow, TP, turbidity, Julian day (representing seasonality) and antecedent dry days (represent watershed conditions). The exact combination of these predictors in the final models varied among the study sites. The average (2003-2022) amount of DOC fluxes in the decreasing order were estimated as follows: 6.74 kg d⁻¹ km² (Neversink), 5.82 kg d⁻¹ km² (Schoharie), 5.10 kg d⁻¹ km² (Ashokan), 4.60 kg d⁻¹ km² (Cannonsville), 4.23 kg d⁻¹ km² (Rondout), and 3.96 kg d⁻¹ km² (Pepacton). Long-term trend analysis showed absence of clear monotonic trend at all sites in the recent 20 years.

DBP studies: DEP is continuing to work on a multi-year project to develop DBP formation potential models for source water streams, fate and transport models for DBP precursors in reservoirs, and DBP model for the City's distribution system. In 2023, DEP in collaboration with University of Massachusetts, Amherst, continued a special study of DBP precursor compounds in Neversink watershed. The study included monitoring of UVA spectral scan, DOC, TN, THMs, HAAs, HANs, HKs, CP, lignin, and amino acids.

Data Analysis: We continued evaluating relative contributions of turbidity loading from Shandaken Tunnel and Esopus Creek watershed into the West Basin of Ashokan Reservoir. In 2022, Shandaken Tunnel contributed 3.9% of the Esopus Creek watershed turbidity loading.

Exploration of Machine Learning Models: Environmental systems are often complex and interconnected, involving numerous variables and intricate relationships. Machine learning (ML) can effectively handle large and diverse datasets, allowing for the analysis of complex environmental processes that may be challenging for traditional methods. In 2023, we began preliminary testing of ML models for predicting total phosphorus (TP) and total dissolved phosphorus (TDP) at the primary inflow monitoring location CBS, Cannonsville Reservoir. Six models of varying complexity were evaluated. All models were available as Python language software packages. All models used a wide range of spatio-temporal predictor variables (sometimes also called features). In this study, we considered 28 geological, meteorological,

hydrological, and water quality variables as potential predictors. Among the six models, ET-XGB was found to perform the best in predicting both TP and TDP, with $R^2 = 0.95$ and 0.91 , respectively for the training period (1997-2016), and 0.78 and 0.51 , respectively for the testing period (2017-2022). Other models did not perform well ($R^2 < 0.8$ for TP and $R^2 < 0.5$ for TDP, for both testing and training periods).

OST-W2 runs: A major storm on Dec 18, 2023, impacted water quality of Catskill System (E16i; Esopus Creek peak instantaneous flow = 21,800 CFS; turbidity = 1250 NTU). After the storm, we conducted several OST runs to guide operations of the Catskill Aqueduct and manage water quality.

Many of these results were presented in detail at the annual progress meeting with regulators, which was held on October 26, 2023. Representatives of the New York State Department of Health, the U.S. Environmental Protection Agency, and the New York State Department of Environmental Conservation attended this meeting.

5.3 Geographic Information System

DEP uses its Geographic Information System (GIS) for multiple purposes: to support numerous FAD and MOA programs; to manage the City’s interests in water supply lands and facilities; to display and evaluate the efficacy of watershed protection through maps, queries, and analyses; and to support watershed, reservoir, and operational modeling efforts. Primary GIS resources include a centralized geodatabase (the GIS library), the Watershed Lands Information System (WaLIS), and Global Positioning System (GPS) technology. This report summarizes GIS technical support for programs and modeling applications; the completion or acquisition of new GIS data layers; improvements to GIS infrastructure; and dissemination of GIS data.

5.3.1 GIS Technical Support

In 2023, DEP continued to use its GIS to perform technical support and data development, including GPS fieldwork, for a variety of watershed protection programs and modeling applications. A core function of the GIS is to create customized statistical reports and maps depicting land ownership, land cover extent, hydrographic and topographic features, riparian and flood zones, water supply facilities, or program implementation status over particular basins or political boundaries. Such analyses were used for program design and planning, engineering screening, regulatory jurisdiction determination, emergency response, water supply operations, and recreational outreach.

GIS staff worked with Land Acquisition Program (LAP) and Streamside Acquisition Program (SAP) staff to implement a new solicitation approach. This new approach uses forest cover data, Stream Preservation Areas, and SMP project locations to target land purchases in areas the City would like to pursue stream restoration projects. This helped the SAP work in closer coordination with the Stream Management Program to identify collaborative projects.

Staff continued deploying DEP GIS layers into DEP Police helicopters at Hudson Valley Regional Airport in Dutchess County. The layers are used for real-time navigation to DEP facilities and property boundaries. Figure 5.1 shows a screenshot of the navigation system in the helicopter. The background image is from the helicopters live camera showing the landscape in real time. The blue boundary is a loaded GIS layer of a City fee property. DEP easement and Watershed Agricultural Council (WAC) easement boundaries have also been loaded, for DEP and WAC staff to conduct easement inspections.

5.3.2 GIS Data Management

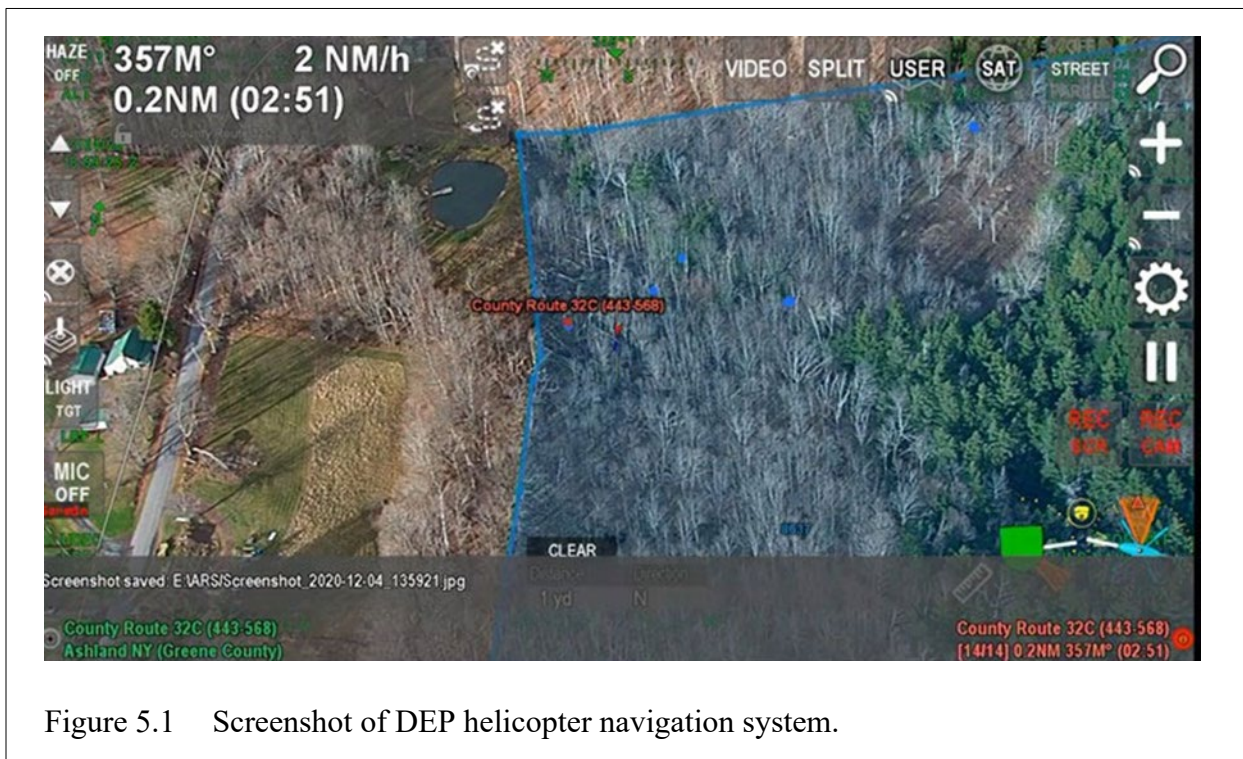


Figure 5.1 Screenshot of DEP helicopter navigation system.

In addition to procuring and maintaining GPS hardware and software year-round, GIS staff process and upload field-collected GPS data into GIS layers that are incorporated into the GIS Library. In the 2023 summer field season, numerous GPS datasets were collected, corrected, QA-ed, and processed into GIS layers related to wildlife and wetland studies, forestry, property management, and land acquisition.

GIS staff continued their participation in the BWS Data Governance committee, completed policy documents, and completed the GIS data catalog with over 200 spatial data entries.

As part of ongoing annual GIS data maintenance, DEP regularly updated or overhauled several existing feature classes. These included mission-critical data for various DEP programs,

such as countywide digital tax parcels, City-owned land or interests, state-owned land, water supply facilities, stream restoration projects, septic repairs, and engineering project locations. Annual updates on locations of sensitive, threatened, or endangered species on City-owned lands were received from the New York Natural Heritage Program (NYNHP) to supplement data collected by the DEP Wildlife Studies Program. DEP obtained the latest version of SSURGO2 soils data from USDA and numerous other updates from the NYS GIS Clearinghouse, including NYSDOT transportation features and NYSDEC layers.

5.3.3 GIS Infrastructure Improvement

During 2023, DEP continued to maintain its GIS infrastructure by upgrading ArcGIS Desktop software; diagnosing database performance issues; updating schemas and servers to improve database speed; building and testing new geodatabase scripts; evaluating and refining user security levels on servers for different databases; and backing up all databases. DEP maintained GPS units used by various programs by replacing aging units, updating data dictionaries, updating software, and tracking inventory for all GPS hardware and software.

GIS staff continued to work with DEP’s Bureau of Information Technology (BIT) on an initiative to implement best practices and upgrade GIS architecture throughout all DEP bureaus in collaboration with the GIS software vendor ESRI. The WPP GIS Section collaborated with BIT and ESRI on ESRI enterprise licensing, harnessing the ArcGIS Enterprise development environment inside the Hawthorne Data Center, and initiated plans for fully utilizing ArcGIS Online to share GIS data to ensure redundancy and backups offsite, for better resilience.

DEP also continued to upgrade and maintain WaLIS, which currently operates on approximately 200 DEP user workstations. DEP’s developers provided routine WaLIS support throughout 2023 by creating custom server reports, customizing the WaLIS interface to resolve mapping or data entry issues, or facilitating and enhancing workflow. Staff continued to modify workflow assignments along with 2 WaLIS software updates to improve efficiency, fix bugs, and to provide new enhancements to reflect the changes in process for encroachments and observations.

5.3.4 Data Dissemination to Stakeholders

Using established in-house data sharing policies, DEP continued to review all outside requests for GIS data and provide these data to watershed partners and interested parties as required. DEP provided over 51 stakeholders and communities with semi-annual data updates in January and July for newly acquired and existing City-owned lands. DEP shared updated watershed recreation data with Ulster County, WAC, and the Catskill Center for their recreation website mapping applications, and to the NYC Open Data Portal. Throughout 2023, DEP responded to data sharing requests from Ulster County Community College, Ulster County SWCD, NYSDOH, NYSDEC, SUNY Buffalo, NYS Office of the Attorney General, Hudsonia, WAC, CWC, Catskill Center, and various counties, towns, and consultants working on DEP-related watershed projects.

GIS staff developed a plan in late 2023 to disseminate DEP's most requested "shareable/public" watershed GIS data layers by establishing an online GIS data sharing platform using ESRI's ArcGIS Online (AGOL). This will improve quality control by preventing out-of-date data from being used by the public and will reduce overhead on staff for individual data requests. Staff plan to implement the platform sometime in 2024.

6. Regulatory Programs

A primary component of DEP’s overall watershed protection strategy is the enforcement of applicable environmental regulations, which include, but are not limited to the New York City Watershed Rules and Regulations (WR&R), the NYSDOH Appendix 75-A Wastewater Treatment Standards, the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity, and the New York State Environmental Quality Review Act (SEQRA). Of these, the primary mechanism for protection of the water supply is via administration of the WR&R.

DEP’s regulatory efforts are focused on three primary functions: review and approval of land development projects within the watershed; inspection of the following: wastewater treatment plants, new subsurface sewage treatment systems and active construction sites; and pursuit and resolution of violations of the WR&R.

6.1 Project Review

Land development projects in the City’s watershed, including those sponsored by DEP, are reviewed to ensure compliance with the WR&R. Activities that typically require DEP review and approval include new and modified wastewater treatment plants (WWTP), sewer collection systems, subsurface sewage treatment systems (SSTS), projects requiring the preparation of stormwater pollution prevention plans (SWPPP), and the construction of impervious surfaces. In addition, DEP issues individual residential stormwater permits (IRSP), and stream crossing, piping or diversion permits (CPDP) for other stormwater-related activities. DEP also ensures that during construction, erosion control measures are properly installed and maintained and that for the post-construction condition, projects that require SWPPPs or IRSPs have properly constructed necessary long-term best management practices. In addition, DEP reviews and offers comments on permit applications that have been submitted to NYSDEC for activities such as mining operations, timber harvesting, industrial activities, landfill closures, stream disturbance and wetland incursions. DEP’s input is sought by NYSDEC in accordance with the DEP/NYSDEC Memorandum of Understanding and via the SEQRA process.

Lists of the new projects received during the previous calendar year in both the select East of Hudson reservoir basins and all West of Hudson basins are included in the Semi-Annual FAD report. The semi-annual Project Activities report also includes brief summaries and maps reflecting project locations. In 2023, there were 20 new commercial subsurface sewage treatment system applications, six sewer collection system applications, 23 SWPPP applications, and five variance applications. Additionally, there were seven stream disturbance permit reviews, four private timber harvest reviews, five NYSDOT reviews, one “Other” type project, and 10 NYC Land Use Permit applications in the Catskill and Delaware watersheds in 2023.

6.1.1 SEQRA Coordination

DEP reviews and provides detailed comments on all SEQRA notices received for land development projects and activities in the City's watershed. DEP's SEQRA Coordination Section processes all applications, maintains a database of new and amended notices, tracks development trends in the watershed, and coordinates with local and state entities and authorities that regularly act as Lead Agency pursuant to SEQRA Law.

The semi-annual report includes a summary and mapping of all SEQRA reviews processed by DEP during the previous calendar year. There were 57 new SEQRA applications received in the Catskill and Delaware watersheds in 2023.

6.1.2 Delegation Agreements

The Westchester and Putnam county health departments perform reviews of new, modified, and repaired SSTs in accordance with their respective delegation agreements with DEP. The Ulster County Health Department performs reviews of new and modified SSTs and certain intermediate repairs in accordance with its delegation agreement with DEP.

During the calendar year 2023, DEP received documentation relative to 41 delegated SSTs in FAD basins; 30 of these reviews are attributed to septic systems in the WOH watersheds with the remaining 11 delegated SSTS applications located in the select EOH FAD reservoir basins.

6.2 Enforcement Activities

DEP investigates, documents and issues Notices of Violation (NOV) for a wide variety of errant activities including failing SSTs, non-compliant SWPPPs, projects that commence construction without prior DEP approval, and any activity that results in a pollutant-laden discharge in the watershed. Enforcement actions are prepared with input from attorneys from DEP's Bureau of Legal Affairs and the City Law Department. In addition to coordinating with NYSDEC, county health departments, municipal code enforcement officers, and the Catskill Watershed Corporation, DEP routinely refers water quality violations to partner agencies where DEP's authority under the WR&R relative to the activity is limited or non-existent. Examples of violations that DEP fully documents and refers to NYSDEC's regional offices are discharges from sites covered by industrial SPDES permits, such as concrete or asphalt manufacturing facilities. In 2023, DEP opened 6 new NOVs and closed 9 existing NOVs. Additional detail regarding these violations is included in the semi-annual reports.

The primary function of the DEP Police with respect to enforcement is regular, daily patrol of the watershed documenting a wide range of potential water quality incursions. Police employees receive over 300 hours of training in environmental law and regulations, provided in part by DEP watershed protection staff, as well as 170 hours of practical field training in water supply infrastructure protection. The DEP police have the authority to issue summonses and notices of warning/violation of the New York State Environmental Conservation Law, the WR&R, as well as other state and local codes. DEP regulatory staff work cooperatively with the

DEP Police to ensure that citizen complaints regarding potential illicit environmental activity are investigated and addressed in a timely manner.

6.3 Wastewater Treatment Plant Compliance and Inspection Program

DEP’s Wastewater Treatment Plant Compliance and Inspection (WWTCPI) Program conducts quarterly compliance inspections at each surface discharging WWTP that operates on a year-round basis. A minimum of two compliance inspections per year are conducted during the operating season at seasonal surface-discharging facilities. Similarly, at least two compliance inspections per year are conducted at non-contact cooling water discharges to surface waters, groundwater remediation systems, landfills, and oil/water separators. Treated industrial waste discharges to groundwater, via ground surface application, are inspected four times per year. This does not preclude DEP from performing inspections with greater frequency. DEP may also conduct unannounced facility inspections to manage instances of non-compliance, respond to abnormal or emergency operating conditions, react to mistakes or problems with self-monitoring data or record keeping, discuss special DEP laboratory sampling results, oversee modifications or expansions to a facility, and fulfill special requests by internal agency management.

When violations are identified at WWTPs, DEP coordinates enforcement activities with NYSDEC, USEPA, NYSDOH, and the New York State Attorney General’s Office through the quarterly Watershed Enforcement Coordination Committee (WECC) meetings. At these meetings, the operational status of watershed WWTPs is discussed, and steps are taken to ensure adequate enforcement activities are pursued to achieve compliance.

6.3.1 Facility Compliance in the Catskill/Delaware Watershed

Thirty-one WOH WWTPs were inspected by DEP on a regular schedule in 2023. Of these, 26 are permitted for year-round discharge and five for seasonal discharge. Three of the 31 are wastewater treatment facilities permitted to discharge to groundwater. These are the hamlet of Chichester, Mountainside Farms, and Hanah Country Club. Three other facilities are classified as industrial non-contact cooling water discharges. These are Friesland Campina- DOMO, Kraft Dairy and Saputo Foods. Altogether, DEP conducted 172 scheduled compliance and emergency response inspections in the Catskill/Delaware watersheds in 2023.

Compliance with State Pollution Discharge Elimination System (SPDES) permits continued to improve among WWTPs in the Catskill/Delaware watersheds in 2023, due in large part to the WWTCPI Program.

As reported previously, NYSDEC issued a Notice of Violation (NOV) on February 6, 2019 for collection system overflows and late reporting relative to the Hunter Highlands Wastewater Treatment Plant. On October 28, 2021 EPA, issued a significant non-compliance letter to the facility for total suspended solids violations in February and June 2021.

A NYSDEC Order on Consent, including a Schedule of Compliance, was fully executed on November 9, 2022. In January 2023, the initial list of compliance items in the schedule was completed, including restoring internet service, SCADA, call out functions, and effluent turbidity continuous monitoring and recording. Additionally, alarms are now fully operational, and the eyewash station is in good working order.

A WWTP Evaluation Engineer's Report including unit process analysis and a Collection System Operations and Maintenance (O&M) Plan were prepared by the engineer and submitted to NYSDEC in February 2023 as required by the schedule. NYSDEC and DEP issued comments February 2023 and revised documents were received in May 2023.

Revisions to the WWTP O&M Manual were submitted in March 2023, as required by the schedule. NYSDEC and DEP reviewed and issued comments in May 2023. The revised submittal was due on November 9, 2023, and has not yet been received. Specifically, the submittal needs to include a detailed plan and implementation schedule to address ammonia removal in activated sludge tanks. The collection system repairs specified in the Collection System Corrective Actions Completion Schedule, to be completed by September 30, 2023, has been extended by NYSDEC to March 31, 2024. Additionally, by November 2024, Hunter Highlands must submit a report detailing the results of inspection and cleaning of the entire sewer collection system.

DEP and NYSDEC will continue to work cooperatively to seek solutions to other issues at the facility that are not specifically cited in the schedule. These improvements include repairs to an inoperative dual sand tertiary filtration system train, infrastructure repairs in CBUD building, completion of SCADA upgrade, and repairs to the equalization lagoon.

Mountainside Farms Dairy (MFD) has exceeded their SPDES permitted limits for daily maximum flow and daily average flow every month during 2023. MFD has a current SPDES flow limit of 51,000 GPD daily avg and 64,000 GPD daily max. The facility has a pending Industrial SPDES permit renewal application with a request to modify flow limits and change the reporting location to effluent flow. MFD had an initial flow increase request for 64,000 GPD daily avg and 78,000 GPD daily max. However, in May 2023 MFD indicated they are planning on requesting higher flow limits of 100,000 GPD daily average and 125,000 GPD daily max.

In addition to flow concerns stated above, MFD experienced two documented overflows in the past few years. The NYSDEC issued a Notice of Violation (NOV) on November 3, 2021, for the June 3, 2021, overflow of the main pump station. More recently, the NYSDEC issued an NOV on May 26, 2023, for a January 22, 2023, overflow of the lower pump station. NYSDEC requested that the facility relocate the lower pump station further away from the stream.

The NYSDEC requested an engineering report to evaluate how much flow the WWTP can effectively treat along with the required reserve capacity and to evaluate the condition of the dissolved air flotation unit and any other questionable components along with any modifications or upgrades that will be required to meet the proposed flow limits.

MFD’s engineer provided a report on September 20, 2023, which included the assessment and improvement report for both pump stations, totaling approximately \$100,000.00. MFD proposes to increase the storage capacities for both pump stations, install new duplex controls and back-up pumps, install dial-up alarm, replace the auto transfer switch, and connect both stations to the back-up generator. The NYSDEC is currently drafting an Order on Consent to primarily address the SPDES permitted flow and past exceedances and pump station overflows.

DEP participates in Compliance Conferences (CC) with those facilities that continue to violate their SPDES permit limits and/or monitoring requirements. CCs are usually conducted after repeated attempts by DEP to remediate the problem with the facility owner and/or operator have failed. DEP, in conjunction with NYSDEC and local regulatory authorities, issues an NOV prior to calling for a CC. DEP did not participate in any CCs in 2023. Many problematic and outdated facilities, which used to exceed their permits on a regular basis, have been either consolidated and connected to another upgraded facility, upgraded as a standalone facility, converted to subsurface discharge, or totally abandoned. As a result, the number of problematic WWTPs has greatly decreased.

6.3.2 Facility Compliance in the East of Hudson Watershed

The West Branch, Boyd Corners, Croton Falls, Cross River, and Kensico reservoir basins are of special interest because they contribute to waters of the Delaware System. The following is a summary of the WWTPs and collection systems inspected within the West Branch, Croton Falls, and Cross River basins. There are no WWTPs in the Kensico and Boyd Corners basins, but DEP does perform inspections of the collection system/pump stations maintained by Westchester County and the Towns of North Castle and Harrison within the Kensico basin. In 2023, DEP conducted 88 scheduled compliance and emergency response inspections for the WWTPs in the EOH FAD basins. Additionally, during fall operation of the Cross River and Croton Falls pump stations, REP staff performed weekly reconnaissance inspections of eight plants in the respective reservoir basins. Throughout the operational period, no abnormal conditions were observed.

There are nine WWTPs in the West Branch, Croton Falls, and Cross River basins. All were in substantial compliance with their SPDES permit discharge limitations in 2023.

DEP performed compliance inspections of the Town of North Castle (Old Route 22, Cooney Hill Road, Route 120/Loudens Cove, New King Street, Old Orchard Street) and the Harrison (Park Lane) pump stations and collection system throughout the 2023 monitoring period. The inspections revealed no abnormal conditions.

For monitoring of the Westlake Sewer Trunk Line, see FAD Section 4.10.1.

6.3.3 Sampling of WWTP Effluents

Wastewater treatment plant (WWTP) and water resource recovery facilities (WRRF) effluent results are reported to NYSDOH and USEPA semiannually in the Wastewater Treatment Plant Compliance and Inspection (WWTPCI) report as required by the Revised 2017 FAD.

Sampling data are also provided to DEP's WWTP regulatory inspection staff to provide information about plant performance.

Sampling and analysis of surface-discharging WWTP effluents was conducted by DEP's state-approved laboratories throughout the year. In 2023, composite samples were collected once during the year at non-City owned plants that have composite sample monitoring requirements in their State Pollutant Discharge Elimination System (SPDES) permits. City-owned WRRFs were also sampled in accordance with SPDES permit requirements. Results were reported to the New York State Department of Environmental Conservation (NYSDEC) in SPDES discharge monitoring reports.

In the Catskill and Delaware systems there were 29 WWTP and WRRF facilities with active SPDES permits. Of these plants, five are City-owned and 24 are non-City-owned. The 24 non-City-owned facilities are monitored on as-needed basis as per an addendum to the Watershed Water Quality Monitoring Plan (effective date May 1, 2023).

In the EOH system there were nine WWTP and WRRF facilities with active SPDES permits (one City-owned and eight non-City-owned) in FAD basins. Mahopac is the only EOH plant with composite sampling. Eight WWTPs are located within the Cross River and Croton Falls basins, and one is located in the West Branch Reservoir watershed.

In 2023, 1,981 analyses were performed (by DEP and contract lab) on 621 influent and effluent samples from WWTPs and WRRFs in the Catskill, Delaware and EOH systems. Of the 621 samples, 557 were collected from City plants and 64 were collected at non-City-owned plants.

Cross River and Croton Falls reservoirs are not routinely considered FAD basins; however, they become part of the FAD system when their Delaware Aqueduct pumps are in operation. During these times, WWTP and WRRF samples are required to be collected from eight plants in these basins including Mahopac, which is monitored monthly regardless of pump station operation. The pump stations were activated between October 16, 2023, and November 5, 2023.

6.4 Capital Replacement Program

The City is obligated to pay for capital replacement of watershed equipment and methods at eligible WWTPs required by the WR&R and not otherwise required by federal or state law. DEP provides funding to replace minor equipment (e.g., filter cartridges, membranes, pumps, meters) as needed to ensure the facility functions properly and in accordance with the WR&R. DEP can directly fund the replacement of equipment under established O&M agreements with each WWTP owner. In 2023, NEIWPC, DEP's contract partner, made no payments to WWTPs located in FAD basins for replacement of major watershed equipment.

7. In-City Programs

7.1 Waterborne Disease Risk Assessment Program

EPA’s Surface Water Treatment Rule and DEP’s Waterborne Disease Risk Assessment Program (WDRAP) share a common goal: public health protection. The objectives of the WDRAP help provide assurance that this goal is met. Components of WDRAP have evolved over time; but the essential purpose and the core organizational structure have remained consistent over the years. WDRAP is a joint agency program involving the NYC Department of Health and Mental Hygiene (DOHMH) and DEP. Established in 1993, the program has continued under a series of intra-city agreements (ICAs) between these two city agencies. The WDRAP ICA lays out each agency’s roles and responsibilities. In 2022, DEP and DOHMH renewed their collaboration by finalizing a new ICA which took effect July 1, 2022, and will continue through June 30, 2027.

WDRAP has two major ongoing functions:

- To obtain data on the rates of giardiasis and cryptosporidiosis in the City, along with demographic and risk factor information on cases and patients.
- To provide a system to track gastrointestinal illness (as indicated by diarrhea or vomiting) to ensure rapid detection of any outbreaks.

Active City surveillance has been ongoing since 1993 for giardiasis and 1994 for cryptosporidiosis. Electronic reporting of cases began in 2011. DOHMH public health epidemiologists follow up on confirmed reported cases of cryptosporidiosis to collect additional information. The epidemiologists verify the data provided in the case reports, collect additional demographic and clinical information, and identify possible sources of oocyst exposure. Giardiasis cases receive similar attention if the patient works in a high-risk setting (e.g., food handler, health care worker, childcare worker) or attends, or is thought to attend, daycare.

A shift in recent years toward the use of syndromic multiplex panels (SMP) has had a notable impact on both giardiasis and cryptosporidiosis surveillance in NYC and across the United States. An increase in the number of documented cryptosporidiosis cases in NYC first noted by WDRAP staff in late 2015 has continued through subsequent years. In 2023, there were approximately 37 laboratories using an SMP test in the City. The proportion of giardiasis patients diagnosed exclusively by an SMP test at a hospital or commercial laboratory has grown from 5% in 2015 to 52.5% in 2023 (Figure 7.1). Similarly, the proportion of cryptosporidiosis patients diagnosed exclusively by an SMP test at a hospital or commercial laboratory has grown from 20% in 2015 to 85.3% in 2023.

All data from 2023 are preliminary as of this writing and are subject to change pending the results of confirmatory laboratory testing and any other needed adjustments. In 2023, there were 1348 cases of giardiasis and 410 cases of cryptosporidiosis reported to DOHMH (as of

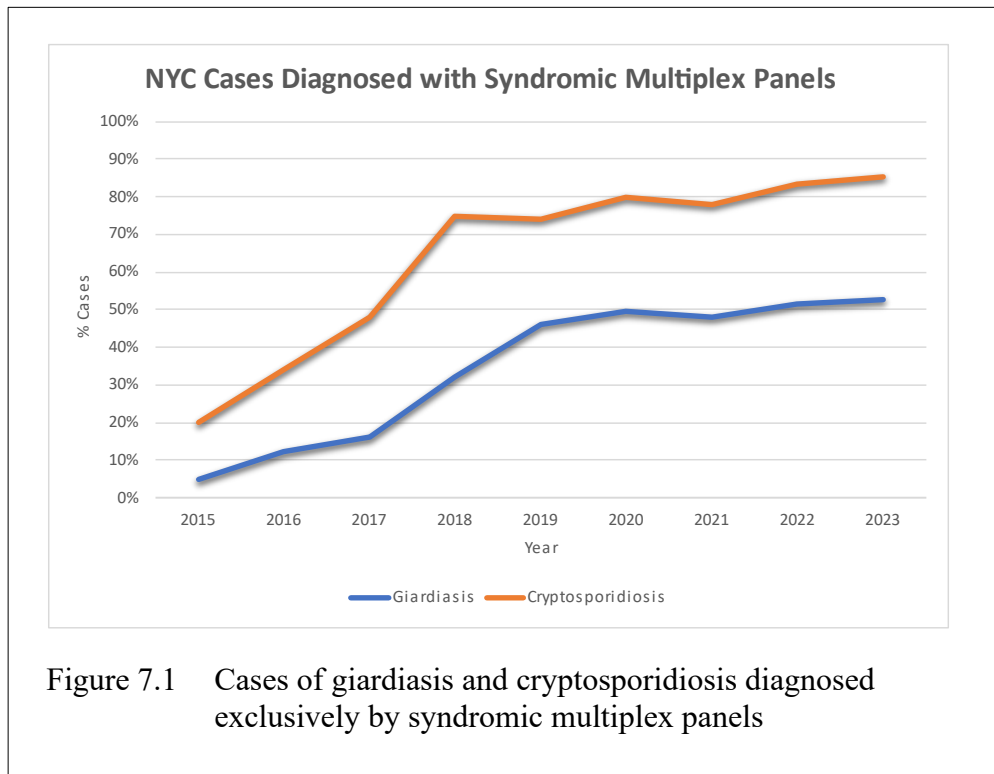


Figure 7.1 Cases of giardiasis and cryptosporidiosis diagnosed exclusively by syndromic multiplex panels

January 2024). This is a 40% and 18% increase from 2022 for giardiasis and cryptosporidiosis, respectively. Epidemiologists completed 70 giardiasis patient interviews of patients in high transmission risk groups, and conducted 263 cryptosporidiosis patient interviews in 2023.

While the case counts increased for both cryptosporidiosis and giardiasis in 2023, they closely follow the increasing trend seen in years prior to the COVID-19 pandemic (from 2015-2019) believed to be a result of the increased SMP testing. As reported previously, the drop in cases in 2020 was likely due to changes in healthcare-seeking behaviors during the pandemic, with subsequent case numbers gradually increasing in 2021 and 2022 as the pandemic waned. Further exploration of laboratory data is necessary to determine the cause of the increase in 2023. Potential reasons could include: 1) an increase in laboratories who use SMP diagnostic testing, 2) an influx of asylum seekers from other countries who were infected prior to arriving in NYC, 3) an increase in disease transmission, or 4) some combination of all three factors.

In addition to tracking reported cases of giardiasis and cryptosporidiosis, New York City has four syndromic surveillance systems in place to detect outbreaks of gastrointestinal illness:

- Hospital emergency department logs are tracked electronically for chief complaint data (including gastrointestinal illness symptoms). Data from 53 hospitals is received and analyzed daily.

- Sales of over-the-counter or non-prescription anti-diarrheal medications at major pharmacies are monitored electronically. Data from approximately 400 drug stores is received and analyzed daily.
- The number of stool specimens submitted to a large clinical laboratory for microbiological testing is tracked.
- Several sentinel nursing homes across the City are monitored for gastrointestinal disease outbreaks.

The above systems are not specifically designed to detect outbreaks of giardiasis, cryptosporidiosis, or waterborne disease, rather they are designed to broadly detect an increase in gastrointestinal illness regardless of the cause. These systems are useful for rapid and sensitive detection of gastrointestinal illness outbreaks, and alerts from these systems could trigger rapid investigation of potential sources. All four syndromic surveillance systems continued to be operational in NYC in 2023, and there was no evidence of a drinking water-related outbreak, consistent with findings of prior years.

Each year a WDRAP annual report is prepared which provides much more detail than is provided here. The annual reports include more complete findings from disease surveillance and case follow-up (including demographic data, and case interview results), summary results from syndromic surveillance programs, and WDRAP program implementation information. The WDRAP annual reports are a FAD requirement, and are submitted annually in March to USEPA, NYSDOH, and others as required. These reports are also posted on DEP's website:

- WDRAP Annual Reports (1997–2023) are available at:
<https://www.nyc.gov/site/dep/water/waterborne-disease-risk-assessment.page>.

In terms of additional WDRAP-related activities, NYC's Hillview Reservoir Cryptosporidium and Giardia Action Plan was updated for 2024, as required by the Hillview Consent Decree, and is located at: <https://www1.nyc.gov/assets/dep/downloads/pdf/water/water-monitoring/hillview-cryptosporidium-giardia-action-plan.pdf>.

8. Education and Outreach

DEP collaborates with the Catskill Watershed Corporation (CWC), Watershed Agricultural Council (WAC), Cornell Cooperative Extension, Soil and Water Conservation Districts, Catskill Center, the Catskill Regional Invasive Species Partnership, the Lower Hudson Partnership for Invasive Species Management, Trout Unlimited, and other partners to increase knowledge and awareness among key audiences about source water protection, land conservation and stewardship, stream corridor protection, stormwater and wastewater, flood response and preparedness, invasive species, watershed recreation, riparian buffers, and other topics.

DEP disseminates information to a broad public audience through its [website](#), [press releases](#), and social media platforms. By the end of 2023, DEP was reaching over 13,000 followers on [NYC Water Facebook](#), over 6,100 followers on [NYC Watershed Facebook](#), 23,600 followers on [NYC Water Twitter](#), and 8,108 followers on [NYC Water Instagram](#). DEP's [NYC Water Flickr Page](#) has 265 followers and contains over 10,520 photos and archival images.

Recreation and stewardship of City-owned lands are popular ways that DEP engages with certain audiences, including over 100,000 subscribers to the Watershed Recreation e-newsletter. In 2023, although DEP did not organize any in-person events on City lands, DEP continued to utilize a new expedited recreational permitting process for allowing organizations, schools, and other groups permission to use City-owned lands for low-impact outreach and recreation activities. DEP also collaborated with Ulster County to continue managing and maintaining the [Ashokan Rail Trail](#), which attracted approximately 141,400 visitors throughout 2023.

[DEP's Education Office](#) reached more than 40,000 students, educators, and other professionals in 2023 by conducting 400 environmental education programs and distributing over 15,000 resource materials. These programs included virtual and in-person field trips and professional learning opportunities, [new digital resources](#), classroom visits, and guided tours at the [Visitor Center at Newtown Creek](#). DEP's 2023 [Water Resources Art & Poetry Contest](#) engaged more than 1,700 students from over 100 schools in the watershed and New York City; contest winners were again featured in a watershed exhibit at the [Catskill Water Discovery Center](#). [Trout in the Classroom](#) engaged over 18,500 students and teachers from approximately 150 schools statewide. DEP sponsored an in-person performance of the "[City That Drinks the Mountain Sky](#)" and collaborated with the Fashion Institute of Technology to develop and distribute 10,000 copies of a new interactive coloring book about our water resources called [Drippy's Water Adventure](#). DEP also collaborated with WAC to host a Watershed Forestry Bus Tour for over 50 non-formal educators from New York City. For the 175th anniversary of the High Bridge, DEP partnered with the Bronx Children's Museum to print and distribute 2,500 children's books, called *The Lowdown on the High Bridge*, at a celebratory event with author Sonia Manzano.

The [CWC Public Education Program](#) awarded 31 grants totaling \$200,000 to schools and organizations in the watershed and New York City; the estimated direct audience for these

programs is 16,600 people. To date, CWC has awarded 727 educational grants totaling just under \$4 million, including 61 grants for public audiences and 666 grants for school-based audiences. CWC maintains a [networking website for watershed educators](#) and routinely posts press releases and program announcements on its main [organizational website](#).

The Watershed Agricultural Program conducted 29 farmer education programs attended by 824 total participants via both virtual and in-person events. Highlights included the Catskill Regional Agricultural Conference; two annual WAC Farm Tours; a series of on-farm workshops and tours; and the annual Delaware County Clean Sweep Chemical Disposal Day. WAC routinely posts program announcements on its [organizational website](#) in addition to promoting local farm and forestry products through the [Pure Catskills Campaign](#) and posting informational videos on the [WAC YouTube channel](#).

The WAC Forestry Program utilized the interactive [MyWoodlot](#) website to educate forest landowners and engage them in stewardship activities, while the [watershed model forests](#) continued to host educational events for all audiences. MyWoodlot also offers a [virtual model forest Storymap tour](#). In 2023, WAC sponsored 10 logger training workshops for 102 participants and conducted 30 in-person tours and one virtual bus tour for 1,966 participants, primarily New York City students. Twenty teachers attended the annual [Watershed Forestry Teachers Institute](#) and 173 students participated in the 2022-2023 [Green Connections School Partnership Program](#).

The Stream Management Program offered a mix of educational events targeted to streamside landowners, municipal officials, watershed professionals, school-based audiences, and other stakeholders. Highlights include the Ashokan Watershed Conference, Schoharie Watershed Month/Summit; Certified Floodplain Manager exam training; post-flood emergency stream intervention training; sediment and erosion control training; a citizen science-based BioBlitz; youth programs such as the Stream Adventures Program, Watershed Detectives Club Afterschool Program and career day events; and recreation-based programs designed to improve appreciation and understanding of stream ecology such as stream snorkeling, kayaking, and guided stream and forest walks. The [CatskillStreams.org](#) website continues to serve as a resource for streamside landowners and local officials, as well as a repository for all stream management plans and local flood analyses completed to date. In 2023, Delaware County SWCD launched a new [website](#) for its stream management program in the Cannonsville and Pepacton basins.

Finally, DEP and its partners attend community events where staff communicate with the public and distribute information. In 2023, the following events were among those attended by DEP or watershed partners: Bovina Farm Day, Catskill Mountain Fall Festival, Delaware County Fair, Delaware County Farm Tour, Delhi Harvest Festival, Deposit Lumberjack Festival, Family Farm Day, Grahamsville Little World's Fair, Margaretville Cauliflower Festival, Meredith Dairy Fest, New York City Watershed Science and Technical Conference, New York State Floodplain and Stormwater Manager's Association Annual Conference, New York Woodman's Field Days,

Olive Day, Shandaken Tunnel SPDES Permit Outreach Meeting, Ulster County Fair, and the Westchester County Regional Envirothon.

9. Miscellaneous Reporting Provisions

9.1 Water Conservation/Demand Management

Despite a steady increase in population since the 1980s, New York City’s average daily demand has decreased over the past several decades, with daily demand below the 1960s drought-of-record (1,405 MGD) since 2009 (Figure 9.1). Several factors are responsible for this decrease, such as increased efficiency and awareness of water conservation, as well as the implementation of DEP’s Water Demand Management Program.

In 2013, DEP implemented a comprehensive Water Demand Management Program, as part of the Water for the Future Program, with the goal of reducing consumption by 50 MGD by 2022. After several years of continued declines in demand and based on the progress, the goal was revised to 20 MGD. In 2023, DEP surpassed this goal with 22.7 MGD of water savings. The initial driver of the Demand Management Plan was to reduce demand through conservation to offset the effects of the Delaware Aqueduct closure and ensure an adequate water supply for the City. The Demand Management Program has proven to be a cost-effective approach towards conserving water that has also created exciting opportunities and partnerships with multiple industries throughout New York City. This program has continued to provide benefits to the City, along with continued efforts to reduce nonrevenue water, optimize metering infrastructure, and reduce losses in the distribution system with continuous improvement and monitoring efforts.

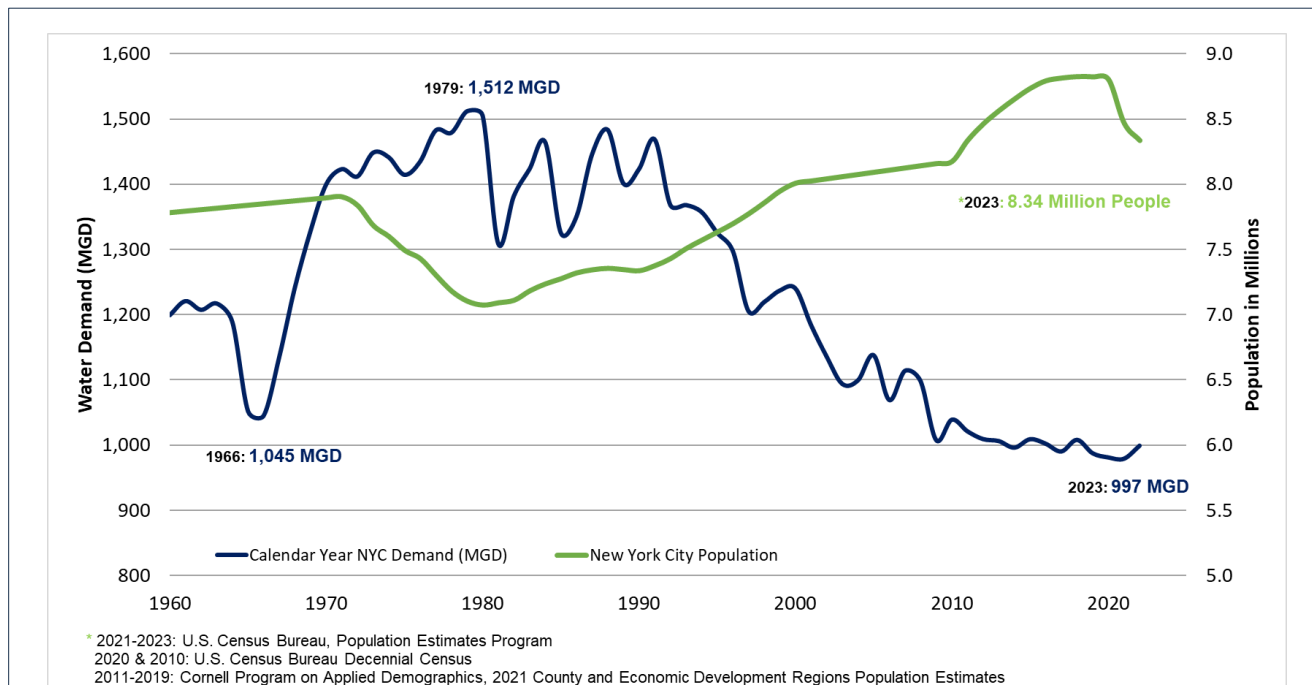


Figure 9.1 Historic water demand and population

9.1.1 Water Demand Management Plan

As described in the 2018 Water Demand Management Plan and subsequent annual updates (<https://www1.nyc.gov/site/dep/water/water-conservation.page>), DEP evaluated various options and developed a cost-effective program with a focus on water demand management through conservation to ensure an adequate supply of water. The most cost-effective options became the top demand management strategies. The plan sets forth six major strategies:

- **Municipal Water Efficiency Program:** Involves retrofits of city-owned properties.
- **Residential Water Efficiency Program:** Focuses primarily on the Toilet Replacement Program for multi-family buildings.
- **Non-Residential Water Efficiency Program:** Collaboration with private sector organizations including restaurants, hotels, hospitals, and universities.
- **Water Distribution System Optimization:** Entails system repairs and upgrades, managing water pressure, and refining water meter accuracy and leak detection.
- **Water Supply Shortage Management:** Encompasses the review and revision of plans to prepare for a drought and other water shortages.
- **Wholesale Customers Water Demand Management Program:** Targets demand management planning, and implementation for wholesale customers north of the City.

The following is a summary of DEP's recent progress in implementing these strategies.

Municipal Water Efficiency Program

DEP established partnerships and completed several projects with key municipal agencies and entities to support water efficiency measures in their facilities. Partners include the New York City Department of Education (DOE), the New York City Department of Parks and Recreation (DPR), the New York City Fire Department (FDNY), the City University of New York (CUNY), New York City Health and Hospitals Corporation (HHC), New York City Department of Citywide Administrative Services (DCAS), and New York City Department of Cultural Affairs – Cultural Institutions Group (CIG).

Beginning in 2013, DEP's partnership with DOE has funded the replacement of over 40,000 new and efficient fixtures in over 500 school facilities across all five boroughs to date. DEP completed the partnership in 2023 and in total, DOE retrofits saved 3.8 MGD.

DEP's partnership with CUNY included over 1,000 fixture upgrades at City College for a demand savings of 0.04 MGD. DEP and CUNY extended their partnership and executed an interagency agreement to replace inefficient fixtures at Queens College. In total, DEP and CUNY plan on replacing over 1,000 fixtures across four campus buildings at Queens College for an estimated savings of 0.03 MGD. These upgrades are currently underway and are expected to be completed in 2024.

In 2023, DEP continued its partnership with DPR and the Central Park Conservancy and Prospect Park Alliance. In Central Park, the North End Recirculation Project will include a pumping and filtration system to recirculate water in the Park's northern waterbodies and reduce flow to the City's combined sewer system. This project is currently in design and is anticipated to save 0.48 MGD. In Prospect Park, DEP continued coordinating with Prospect Park Alliance to replace a valve on the make-up water line for the park's lake system. In 2022, Prospect Park Alliance completed the design; once completed, the project is expected to save 0.80 MGD.

In January 2023, DEP launched its sixth Water Challenge to all 14 of the City's water resource recovery facilities (WRRFs) in the five boroughs. Like the previous year, all facilities are being encouraged to reduce demand by 10% over a two-year baseline average from calendar year 2021 and 2022. The WRRF Water Challenges help raise continued awareness of the importance of water conservation and provide the opportunity for cross-agency collaboration.

DEP is also continuing to partner with HHC to complete an additional HHC retrofit project at Bellevue Hospital. Funding was transferred to HHC to replace six vacuum pumps that serve two medical vacuum systems. These pumps have far exceeded their useful life and are outdated, inefficient, and use a constant stream of water to create a vacuum seal within the pump. These retrofits are expected to greatly improve efficiency and result in significant water savings. This project is currently underway and expected to be completed in 2025.

Residential Water Efficiency Program

In June 2019, DEP concluded the Toilet Replacement Program after five years of successful implementation. The program retrofitted approximately 13,300 toilets citywide for a savings of 0.63 MGD.

DEP worked with Honeywell to provide building owners with complimentary household water conservation surveys to help identify opportunities for water savings and detecting leaks leading up to .4 MGD of water savings. In total, DEP has achieved a demand savings of 1.03 MGD through these two initiatives.

Non-Residential Water Efficiency Program

The DEP Water Conservation and Reuse Grant Pilot Program incentivizes commercial and residential water conservation projects that achieve a minimum water savings of 2,740 gallons per day (1 million gallons per year). DEP has offered grant funding to one applicant and is currently in the process of confirming their funding and legal agreements. The project includes a 400,000 gallon per day water reuse system that contributes not only water conservation benefits, but also combined sewer overflow reductions. Overall, the pilot program is anticipated to save 0.2 MGD by 2023.

DEP has successfully completed several Water Challenges to different commercial sectors: hotels, restaurants, hospitals, and universities. Participants are encouraged to reduce their annual water consumption by at least 5% from their baseline year (measured as the 12-month period prior to the beginning of the Challenge). DEP prepares monthly reports to help

participants track their consumption and their performance against the other participants. DEP also hosts quarterly workshops to help participants learn how to make their facilities more water efficient.

DEP's latest challenge, a two-year Water Challenge to Universities, was completed in August 2020. Collectively, the six participants—Fordham University: Lincoln Center Campus, The New School, Long Island University: Brooklyn Campus, Pace University, St. John's University, and Weill Cornell Medicine—reduced their monthly average water consumption by 11%, surpassing the 5% Water Challenge goal, for a total savings of 0.12 MGD.

Water Distribution System Optimization

Water distribution system optimization includes system repairs and upgrades, water pressure management, refining water meter accuracy, and leak detection. In 2023, DEP surveyed a total of 669.46 miles of water mains. As a result of leaks proactively found and repaired, DEP estimates that 11,049,880 gallons of water per day were saved.

Leaking and/or vandalized fire hydrants can result in significant water waste; an illegally opened fire hydrant can release more than 1,000 gallons per minute. In 2023, DEP repaired 7,574 hydrants, replaced 834, and provided other maintenance services to 10,487 additional hydrants.

DEP continually works to improve maintenance of the pressure zones within the City's water distribution system. In 2023, DEP completed 4,465 preventive maintenance inspections/calibrations on pressure regulating valves. DEP also overhauled one of the 457 pressure regulating valves in use citywide. In 2023, the number of breaks per 100 miles was 4.97, below the City's 10-year average of 6.43, and well below the accepted industry average of 25 breaks per 100 miles annually.

DEP's efforts to achieve universal metering of all DEP water and sewer accounts is motivated by the need to reduce non-revenue water and promote conservation among water users by providing accurate consumption information. The universal metering initiative is also critical to measuring the success of many other demand management strategies. Accurate consumption data enables DEP to determine whether target consumer groups have achieved projected consumption reductions or how demand management strategies may be adapted to improve their effectiveness. In 2023, DEP replaced 831 large meters.

To date, approximately 477,898 customers have signed up for My DEP to view their bills, water usage, and payment history online. This service also allows customers to pay their bills online and sign up for automatic billing (eBills). Approximately 150,000 customers have signed up for eBills. To date, over 699,000 customers have signed up for leak alerts.

Water Supply Shortage Management

In May 2022, amendments to DEP's "Drought Emergency Rules" (15 RCNY Chapter 21) were formally adopted and promulgated. As amended, the rules are now titled the "Water Shortage Emergency Rules."

New York City’s rulemaking process is governed by the procedure set forth in the City Administrative Procedure Act (CAPA). DEP first initiated the process of amending the Drought Emergency rules in July 2013. In January 2022, the Mayor’s Office of Operations and the New York City Law Department certified DEP’s final draft amendments to the “Drought Emergency Rules” (“Water Shortage Emergency Rules” as proposed by the amendments), and DEP subsequently noticed them for public review and comments and held a public hearing on the draft amendments in February 2022 as required under CAPA. The amendments to the rules were deemed final and effective as of May 13, 2022. The revisions to the rules expand their scope and applicability to include water shortages caused not only by hydrological droughts, but also other types of events such as planned and unplanned infrastructure outages.

The revisions also add, remove, and change certain water use prohibitions during the different stages of a water shortage emergency, to provide more clarity and better reflect DEP’s understanding of City water use. Although this action does not apply to routine residential water use such as drinking, bathing, or dishwashing, DEP expects that public awareness of the restrictions would lead to decreased residential water use during a declared water shortage emergency.

Wholesale Customers Water Demand Management Program

The Wholesale Customer Water Demand Management Program assisted DEP’s seven upstate wholesale customers (utility partners) in developing demand management plans for their systems, with a target 5% reduction in consumption. All seven utility partners developed demand management plans under this program, with a total two-year sustained water demand savings of 5.21 MGD (a 9% decrease from their 2013 baseline). Due to unforeseen circumstances brought on by the COVID-19 pandemic, much of the anticipated funding for implementation of this program was reallocated. However, in January 2023, DEP was able to reinstate a partnership with the City of Yonkers, NYC’s largest wholesale customer, to implement a combination of tailored demand management strategies. This project is expected to achieve an additional estimated savings of 1.3 MGD.

9.2 Updates to Drought Management Plan

In 2023, monthly average precipitation was above normal for 58% of the year (based on historical average for the period 1993-2022). The NYC Delaware Basin Reservoir System storage stayed above the “Normal” storage level for the entire year. It was not necessary to invoke the City’s Drought Management Plan, as the probability of refill did not fall below 50% for the Catskill or Delaware systems.

The Drought Management Plan has three phases — Drought Watch, Drought Warning, and Drought Emergency — that are invoked sequentially as conditions dictate. The Drought Emergency phase is further subdivided into four stages with increasingly severe mandated use restrictions. Guidelines have been established to identify when a Drought Watch, Warning, or Emergency should be declared and when the appropriate responses should be implemented.

These guidelines are based on prevalent hydrological and meteorological conditions, certain operational considerations, and other factors. In some cases, other circumstances may influence the timing of drought declarations.

- Drought Watch - Drought Watch is declared when there is less than a 50% probability that reservoirs in either of the two largest systems, the Delaware (Cannonsville, Neversink, Pepacton, and Rondout reservoirs) or the Catskill (Ashokan and Schoharie reservoirs), will fill by June 1, the start of the water year.
- Drought Warning - A Drought Warning is declared when there is less than a 33% probability that reservoirs in either the Catskill or Delaware System will fill by June 1.
- Drought Emergency - A Drought Emergency is declared when there is a reasonable probability that, without the implementation of stringent measures to reduce consumption, a protracted dry period would cause the City's reservoirs to be drained. This probability is estimated during dry periods in consultation with the New York State Drought Management Task Force and the New York State Disaster Preparedness Commission. The estimation is based on analyses of the historical record, the pattern of the dry period months, water quality, subsystem storage balances, delivery system status, system construction, maintenance operations, snow cover, precipitation patterns, use forecasts, and other factors. Because no two droughts have identical characteristics, no single probability profile can be identified in advance that would generally apply to the declaration of a Drought Emergency.

The Drought Management Plan was last revised in 2012 and DEP is currently working to update and revise the plan. DEP continues to encourage consumers to conserve water and to observe the City's year-round water use restrictions, which remain in effect. These restrictions include a prohibition on watering sidewalks and lawns between November 1 and March 31 and illegally opening fire hydrants.

9.3 Delaware Aqueduct Leak

DEP efforts to repair the Delaware Aqueduct continued in 2023 and included the following major activities:

- Completion of two partial dewatering exercises of the RWBT. The first was conducted in March 2023, and the second in October 2023. The tunnel was out-of-service for approximately 30 days during these operations.
- Repairs and upgrades to the Shaft 6 pump station based on lessons learned during the RWBT partial dewatering exercises.
- Design of upgrades to the Shaft 6B drainage tunnel pump station that will be used during the RWBT shutdown connection dewatering. Pump station upgrades will

increase the design capacity of the pump station from 20 million gallons per day to 30 million gallons per day.

Tunnel Dewatering Preparation

The 50 million gallons per day pumping station, which can dewater the RWBT under the expected conditions, is ready to operate. Pump station exercises are conducted monthly with comprehensive testing of the pump station conducted annually.

RWBT Bypass and Repair—Site and Shafts (BT-1) and Bypass Tunnel (BT-2)

The bypass tunnel contract, BT-2, continues to make progress. The final concrete lining of the tunnel was completed in October 2021. Final lining of the access shafts was completed in July 2022, and construction of the access chamber superstructures is significantly completed. The Shaft 6B drainage tunnel pump station installation was completed and tested in June 2022, and upgrades are underway and scheduled to be completed in summer 2024.

The shutdown of the RWBT for connection of the bypass to the existing RWBT will commence in autumn 2024. During the execution of the connection, workers will grout the leaks in the Wawarsing area of the tunnel from within the dewatered tunnel. DEP expects the bypass project to be completed by May 2025.

Hydraulic Investigations of the RWBT

Investigations of the RWBT help DEP assess the nature and degree of leakage stemming from the aqueduct. Efforts to study the nature of the leak are described below.

- The Tunnel Monitoring Program under DEP’s DEL-LTA contract has ended. The program’s purpose was to determine if tunnel conditions are changing. The monitoring efforts under this contract resulted in a determination of no substantial change during 2021.
- DEP in conjunction with our BPES and EISCOM contracts have since taken over tunnel leakage monitoring as part of the 2023 partial dewatering exercises. These contracts gathered data on tunnel leakage and surface expressions during the 2023 partial dewatering exercises.
- Data and analysis from the 2023 partial dewatering exercises noted that tunnel leakage rates have increased above the levels noted from leakage testing in 2008-2010. The increased leakage levels are within the current capacity of the Shaft 6B drainage tunnel pump station, however upgrades to the pump station will further solidify the pump station’s ability to handle infiltration dewatering during the RWBT connection.

Catskill Aqueduct Repair and Rehabilitation

The CATRR project focuses on the section of the aqueduct between Ashokan Reservoir in Ulster County and Kensico Reservoir in Westchester County. The project's scope focuses on inspection of the entire aqueduct, repairing deficiencies (including concrete and mechanical components), and removing a biofilm layer on the interior walls to improve the hydraulic characteristics of the tunnel and restore tunnel capacity. CAT-RR construction commenced in August 2018. The fourth and final shutdown was carried out between October and mid-December 2021 with significant scope achieved, including the stabilization of the Catskill Influent Weir at Kensico Reservoir, biofilm removal, valve replacement and repair of several steel pipe siphon locations, and wall and invert repairs in the Reynolds Grade Tunnel.

Two related projects include building chemical addition facilities at the Ashokan Screen Chamber (CAT-213E) and the Pleasantville Alum Plant (CAT-213F) to deliver chlorination and dechlorination chemicals and alum, respectively. CAT-213E reached substantial completion in October 2021. Substantial completion of CAT-213F was reached in March 2023.

9.4 Catskill/Delaware Filtration Plant

The 1997 Filtration Avoidance Determination first required the City to produce a preliminary design for filtration facilities for the Catskill/Delaware water supply. The 2002 FAD required the City to provide biennial updates to the preliminary plant design for the Catskill/Delaware (CAT/DEL) system (in addition to constructing an ultraviolet light disinfection facility that began fully operating in October 2012). The 2007 FAD continued to require the City to provide a biennial report updating the preliminary design for filtration facilities. In 2013 and 2015, the City and NYSDOH agreed no design changes to the 2009 preliminary plans for the CAT/DEL filtration facilities were necessary. In recognition that the work supporting the existing preliminary plans was over 25 years old, the 2017 FAD required the City to contract for a comprehensive review of filtration methods and technologies, resulting in a new conceptual design for a filtration facility or facilities.

DEP completed the initial phase of the design project, which included bench scale studies, in 2020. Following evaluation of the results, DEP initiated phase two of the project in 2021. The second phase includes the design, construction, and operation of large-scale pilot plants; completion of pilot studies and a report; and completion of a full-scale conceptual design. The 2023 work included installing a Catskill Aqueduct connection needed to supply the pilot facilities, developing pilot testing protocols, preparing permit applications, and working with the general contractor to advance the fabrication and installation of components of the pilot system.

9.5 Arkville office

DEP has committed to locate staff in a new office recently constructed in Arkville, N.Y. by the Catskill Watershed Corporation. The goal of sharing space is to further improve coordination on joint programs and to enhance accessibility for watershed communities. The FAD requires DEP to assign specific numbers of staff to the new facility in the coming years.

Construction of the new building in Arkville was substantially complete in the spring of 2020, and DEP staff began to take occupancy of the building later that year. As of the end of 2023, DEP had 29 full-time employees working in the building. DEP has allocated additional vacant positions to be based in Arkville; those positions will be filled as allowed by the City's hiring process.

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Appendices

Appendix Table 1 Status of Acquisitions since January 1 2010 by town.

West-of-Hudson

Delaware County	City Acres	WAC Acres	Total Executed	EIS Projections thru 2022	% of EIS Projection	Acres to No Out-Going Solicitation	Acres to 1/2 mile = 50%	Acres Exceeded	60% of Cap or 2k Max
Andes	5,861	2,029	7,890	7,690	103%			200	4,614
Walton	2,956	2,036	4,992	0	0%			0	2,000
Delhi	3,173	1,397	4,570	3,951	116%			619	2,371
Roxbury	2,818	487	3,305	0	0%	695		0	2,000
Middletown	2,380	839	3,218	4,983	65%	1,765		0	2,990
Bovina	2,063	402	2,466	2,785	89%	319		0	1,671
Kortright	986	1,401	2,387	0	0%	1,613		0	2,000
Stamford	1,366	886	2,252	4,539	50%	2,287	472	0	2,723
Hamden	934	1,093	2,027	3,640	56%	1,613	157	0	2,184
Meredith	835	438	1,273	0	0%	2,727	727	0	2,000
Tompkins	521	177	699	0	0%	3,301	1,301	0	2,000
Colchester	400	110	510	0	0%	3,490	1,490	0	2,000
Franklin	286	182	469	0	0%	3,531	1,531	0	2,000
Masonville	355	0	355	0	0%	3,645	1,645	0	2,000
Harpersfield	20	184	204	0	0%	3,796	1,796	0	2,000
Total	24,955	11,661	36,615						

Greene County	City Acres	WAC Acres	Total Executed	EIS Projections thru 2022	% of EIS Projection	Acres to No Out-Going Solicitation	Acres to 1/2 mile = 50%	Acres Exceeded	60% of Cap or 2k Max
Windham	1,634	555	2,189	2,207	99%	18		0	1,324
Lexington	1,760	155	1,915	3,771	51%	1,856	347	0	2,263
Jewett	1,560	0	1,560	2,794	56%	1,234	117	0	1,676
Prattsville	1,224	99	1,323	2,346	56%	1,023	85	0	1,408
Hunter	1,214	0	1,214	2,726	45%	1,512	422	0	1,636
Ashland	974	0	974	1,948	50%	974	195	0	1,169
Halcott	558	61	619	1,571	39%	952	324	0	943
Total	8,922	871	9,793						

Schoharie County	City Acres	WAC Acres	Total Executed	EIS Projections thru 2022	% of EIS Projection	Acres to No Out-Going Solicitation	Acres to 1/2 mile = 50%	Acres Exceeded	60% of Cap or 2k Max
Conesville	420	405	825	2,400	34%	1,575	615	0	1,440
Gilboa	409	0	409	0	0%	3,591	1,591	0	2,000
Jefferson	85	0	85	0	0%	3,915	1,915	0	2,000
Total	914	405	1,319						
Sullivan County	City Acres	WAC Acres	Total Executed	EIS Projections thru 2022	% of EIS Projection	Acres to No Out-Going Solicitation	Acres to 1/2 mile = 50%	Acres Exceeded	60% of Cap or 2k Max
Neversink	1,745	0	1,745	4,472	39%	2,727	939	0	2,683
Total	1,745	0	1,745						
Ulster County	City Acres	WAC Acres	Total Executed	EIS Projections thru 2022	% of EIS Projection	Acres to No Out-Going Solicitation	Acres to 1/2 mile = 50%	Acres Exceeded	60% of Cap or 2k Max
Olive	929	0	929	1,899	49%	970	210	0	1,139
Denning	710	130	840	5,046	17%	4,206	2,187	0	3,028
Woodstock	528	0	528	2,593	20%	2,065	1,028	0	1,556
Wawarsing	486	0	486	0	0%	3,514	1,514	0	2,000
Shandaken	473	0	473	1,450	33%	397	397	0	870
Hardenburgh	84	164	249	3,641	7%	3,392	1,936	0	2,185
Total	3,211	294	3,505						
WOH District Sub-Totals:	39,746	13,231	52,977	105,043	50%	52,066			

East-of-Hudson

Putnam County	City Acres	WAC Acres	Total Executed	EIS Projections thru 2022	% of EIS Projection	Acres to No Out-Going Solicitation	Acres to 1/2 mile = 50%	Acres Exceeded	60% of Cap or 2k Max
Kent	718	0	718	0	0%	3,282	1,282	0	2,000
Carmel	169	0	169	0	0%	3,831	1,831	0	2,000
Total	887	0	887						
Westchester County	City Acres	WAC Acres	Total Executed	EIS Projections thru 2022	% of EIS Projection	Acres to No Out-Going Solicitation	Acres to 1/2 mile = 50%	Acres Exceeded	60% of Cap or 2k Max
North Castle	109	0	109	0	0%	3,891	1,891	0	2,000
Mount Pleasant	49	0	49	0	0%	3,951	1,951	0	2,000
New Castle	12	0	12	0	0%	3,988	1,988	0	2,000
Total	170	0	170						
EOH District Sub-Totals:	1,057	0	1,057						
Watershed Totals:	40,803	13,231	54,034						

Out-Going Solicitation is prohibited in Shandaken per the 2010 Water Supply Permit.

SWC = Surface Water Criteria

"60% of Cap or 2k Max" refers to whether the LAP is limited to 60% of the town cap or 2,000 acres before solicitation constraints must be implemented.

Acquisition within 1/2 mile of designated areas is per 2018 LAP Solicitation Modifications.

Figures in blue highlights remaining acres under 1,000.

This report uses DEP Acres so each parcel is counted within its respective town.

Difference between Project Acres and DEP Acres:

Project Acres - Acres for a project. Are originally set to the sum of the acres from the parcel data. These fields are editable by the closing staff or real estate staff.

DEP Acres - Acres for each parcel. Are originally set to the acres field from the parcel data. This field is adjusted if the partial flag (on a parcel) is set or if we find out that the parcel data acreage is off. One project can be comprised of multiple parcels, therefore these numbers do not always match for a given project.

Appendix Table 2 Contracts signed in the Cat-Del System by reporting period and natural features criteria.

Reporting Period: 1995 to 2022

R.E. Type	# of Contracts	Total Acres	Avg. Size of Project (ac)	SWC (ac)	Avg. % SWC	Slope (ac)	Avg. % Slope
City CE	170	25,933	153	7,158	28%	16,495	64%
City FBO	26	64	2	62	97%	23	36%
City Fee	1,381	97,496	71	27,699	28%	58,331	60%
FEMA	64	74	1	65	87%	16	21%
SAP	33	273	8	207	76%	127	46%
WAC CE	157	28,229	180	8,167	29%	15,084	53%
WAC FE	9	2,982	331	452	15%	2,213	74%
subtotal	1,840	155,051	84	43,811	28%	92,289	60%

Reporting Period: 2023

R.E. Type	# of Contracts	Total Acres	Avg. Size of Project (ac)	SWC (ac)	Avg. % SWC	Slope (ac)	Avg. % Slope
City CE	1	555	555	254	46%	279	50%
City FBO	7	8	1	8	95%	2	24%
City Fee	6	331	55	132	40%	198	60%
SAP	4	17	4	14	82%	8	50%
WAC CE	2	155	78	106	68%	41	27%
WAC FE	1	130	130	34	26%	29	22%
subtotal	21	1,196	57	548	46%	557	47%

Program-to-date Sub-Totals

R.E. Type	# of Contracts	Total Acres	Avg. Size of Project (ac)	SWC (ac)	Avg. % SWC	Slope (ac)	Avg. % Slope
City CE	171	26,488	155	7,412	28%	16,773	63%
City FBO	33	72	2	70	97%	25	35%
City Fee	1,387	97,827	71	27,832	28%	58,529	60%
FEMA	64	74	1	65	87%	16	21%
SAP	37	290	8	221	76%	135	47%
WAC CE	159	28,384	179	8,273	29%	15,125	53%
WAC FE	10	3,112	311	486	16%	2,242	72%
Grand Totals:	1,861	156,247	84	44,359	28%	92,846	59%

Notes:

Survey acres are used to calculate project acres for closed properties. SWC (Surface Water Criteria) acres are based on GIS and tax parcel acres and may not be as accurate.

Pursuant to the 1997 Memorandum of Agreement, SWC includes acreage that is within (a) 300 feet of a watercourse, (b) 1,000 feet of reservoirs, (c) areas designated as 1% return interval flood (100 year base flood), and/or (d) wetlands (defined as federal jurisdiction wetlands larger than five acres, or designated by NYSDEC).

Slope: Acres that are at or greater than 15% grade.

In some cases SWC acres may appear to be greater than project acres, this is because SWC acres are GIS based and project acres are survey based. Therefore, they do not always align.

Appendix Table 3 Contracts signed in the Cat-Del System by reporting period with costs.

Reporting Period: 1995 to 2022

R.E. Type	# of Contracts	Total Acres	Average Size	Purchase Price
City CE	170	25,933	153	\$72,229,273
City FBO	26	64	2	\$4,421,069
City Fee	1,381	97,496	71	\$386,114,934
FEMA	64	74	1	\$453,575
SAP	33	273	8	\$1,852,502
WAC Farm CEs	157	28,229	180	\$41,539,880
WAC Forest CEs	9	2,982	331	\$2,891,334
Subtotals:	1,840	155,051	84	\$509,502,568

Reporting Period: 2023

R.E. Type	# of Contracts	Total Acres	Average Size	Purchase Price
City CE	1	555	555	\$554,500
City FBO	7	8	1	\$2,572,000
City Fee	6	331	55	\$1,327,904
SAP	4	17	4	\$268,490
WAC Farm CEs	2	155	78	\$438,486
WAC Forest CEs	1	130	130	\$169,000
Subtotals:	21	1,196	57	\$5,330,380

Program-to-date Sub-Totals

R.E. Type	# of Contracts	Total Acres	Average Size	Purchase Price
City CE	171	26,488	155	\$72,783,773
City FBO	33	72	2	\$6,993,069
City Fee	1,387	97,827	71	\$387,442,838
FEMA	64	74	1	\$453,575
SAP	37	290	8	\$2,120,992
WAC Farm CEs	159	28,384	179	\$41,978,366
WAC Forest CEs	10	3,112	311	\$3,060,334
Grand Total:	1,861	156,247	84	\$514,832,948

Notes:

Survey acres are used to calculate project acres for closed properties. SWC (Surface Water Criteria) acres are based on GIS and tax parcel acres and may not be as accurate.

Pursuant to the 1997 Memorandum of Agreement, SWC includes acreage that is within (a) 300 feet of a watercourse, (b) 1,000 feet of reservoirs, (c) areas designated as 1% return interval flood (100 year base flood), and/or (d) wetlands (defined as federal jurisdiction wetlands larger than five acres, or designated by NYSDEC).

Slope: Acres that are at or greater than 15% grade.

In some cases SWC acres may appear to be greater than project acres, this is because SWC acres are GIS based and project acres are survey based. Therefore, they do not always align.

Appendix Table 4 Contracts closed in the Cat-Del System by reporting period and natural features criteria.

Reporting Period: 1995 to 2022

R.E. Type	# of Contracts	Total Acres	Avg. Size of Project (ac)	SWC (ac)	Avg. % SWC	Slope (ac)	Avg. % Slope
City CE	170	25,933	153	7,158	28%	16,495	64%
City FBO	22	47	2	47	99%	18	39%
City Fee	1,361	96,185	71	27,133	28%	57,606	60%
FEMA	64	74	1	65	87%	16	21%
SAP	26	227	9	167	73%	103	45%
WAC CE	157	28,229	180	8,167	29%	15,084	53%
WAC FE	9	2,982	331	452	15%	2,213	74%
subtotal	1,809	153,677	85	43,188	28%	91,535	60%

Reporting Period: 2023

R.E. Type	# of Contracts	Total Acres	Avg. Size of Project (ac)	SWC (ac)	Avg. % SWC	Slope (ac)	Avg. % Slope
City FBO	4	17	4	16	94%	4	27%
City Fee	5	284	57	176	62%	176	62%
SAP	7	46	7	40	88%	24	53%
subtotal	16	347	22	232	67%	205	59%

Program-to-date Sub-Totals

R.E. Type	# of Contracts	Total Acres	Avg. Size of Project (ac)	SWC (ac)	Avg. % SWC	Slope (ac)	Avg. % Slope
City CE	170	25,933	153	7,158	28%	16,495	64%
City FBO	26	64	2	62	97%	23	36%
City Fee	1,366	96,469	71	27,309	28%	57,782	60%
FEMA	64	74	1	65	87%	16	21%
SAP	33	273	8	207	76%	127	46%
WAC CE	157	28,229	180	8,167	29%	15,084	53%
WAC FE	9	2,982	331	452	15%	2,213	74%
Grand Totals:	1,825	154,024	84	43,420	28%	91,740	60%

Notes:

Survey acres are used to calculate project acres for closed properties. SWC (Surface Water Criteria) acres are based on GIS and tax parcel acres and may not be as accurate.

Pursuant to the 1997 Memorandum of Agreement, SWC includes acreage that is within (a) 300 feet of a watercourse, (b) 1,000 feet of reservoirs, (c) areas designated as 1% return interval flood (100 year base flood), and/or (d) wetlands (defined as federal jurisdiction wetlands larger than five acres, or designated by NYSDEC).

Slope: Acres that are at or greater than 15% grade.

In some cases SWC acres may appear to be greater than project acres, this is because SWC acres are GIS based and project acres are survey based. Therefore, they do not always align.

Appendix Table 5 Contracts closed in the Cat-Del System by reporting period with costs.

Reporting Period: 1995 to 2022

R.E. Type	# of Contracts	Total Acres	Average Size	Purchase Price
City CE	170	25,933	153	\$72,229,273
City FBO	22	47	2	\$3,510,069
City Fee	1,361	96,185	71	\$367,867,249
FEMA	64	74	1	\$453,575
SAP	26	227	9	\$1,455,035
WAC Farm CEs	157	28,229	180	\$41,539,880
WAC Forest CEs	9	2,982	331	\$2,891,334
Subtotals:	1,809	153,677	85	\$489,946,416

Reporting Period: 2023

R.E. Type	# of Contracts	Total Acres	Average Size	Purchase Price
City FBO	4	17	4	\$911,000
City Fee	5	284	57	\$882,620
SAP	7	46	7	\$397,467
Subtotals:	16	347	22	\$2,191,087

Program-to-date Sub-Totals

R.E. Type	# of Contracts	Total Acres	Average Size	Purchase Price
City CE	170	25,933	153	\$72,229,273
City FBO	26	64	2	\$4,421,069
City Fee	1,366	96,469	71	\$368,749,869
FEMA	64	74	1	\$453,575
SAP	33	273	8	\$1,852,502
WAC Farm CEs	157	28,229	180	\$41,539,880
WAC Forest CEs	9	2,982	331	\$2,891,334
Grand Total:	1.825	154.024	84	\$492.137.503

Appendix Table 6 Parcels eased or acquired in 2023 with tax parcel detail.

Project ID	County	Town	Location	Basin	Priority Area	Tax Map Number	R.E. Type	Acres	Closing Date
5841	Delaware	Kortright	Scotch Hill Rd	Cannonsville	4	105.-2-3.4	Fee (City Fee)	16.9	06/29/2023
4175	Delaware	Middletown	Route 28	Pepacton	4	307.1-1-54.2	Fee (City Fee)	24.5	06/29/2023
8195	Delaware	Stamford	Footo Hol Rd	Cannonsville	4	88.-1-12.3	Fee (City Fee)	17.2	08/11/2023
9617	Delaware	Walton	2829 County Hwy 22	Cannonsville	4	231.-1-12.2	Fee (City Fee)	183.6	02/23/2023
9257	Greene	Hunter	off Terns Rd	Schoharie	4	182.07-4-20	Fee (SAP)	6.7	12/21/2023
9265	Greene	Jewett	Olander Drive	Schoharie	4	132.00-1-13	Fee (SAP)	5.6	04/20/2023
9663	Greene	Jewett	Route 23A	Schoharie	4	163.00-2-7	Fee (SAP)	1.7	12/21/2023
9663	Greene	Jewett	Route 23A	Schoharie	4	163.00-2-8	Fee (SAP)	0.8	12/21/2023
9114	Greene	Prattsville	Route 23	Schoharie	3	75.00-5-2	Fee (SAP)	3.3	03/15/2023
9344	Greene	Prattsville	Cozy Hollow Rd	Schoharie	3	75.00-1-22	Fee (SAP)	18.8	06/29/2023
9704	Greene	Prattsville	off Etta Post Rd	Schoharie	4	57.00-3-40	Fee (SAP)	3.5	01/19/2023
265	Putnam	Kent	Route 301	West Branch	1B	20.-1-4	Fee (City Fee)	43.1	10/19/2023
9714	Schoharie	Conesville	Martha Rock Rd	Schoharie	3	194.-1-2	Fee (SAP)	6.1	01/19/2023
9551	Ulster	Shandaken	Route 28	Ashokan	2	25.10-1-10	Fee (City FBO)	2.0	04/24/2023
9551	Ulster	Shandaken	Route 28	Ashokan	2	25.10-1-13.100	Fee (City FBO)	10.1	04/24/2023
9665	Ulster	Shandaken	off Route 28	Ashokan	2	25.10-4-24.100	Fee (City FBO)	3.4	04/27/2023
9809	Ulster	Shandaken	620 Oliverrea Road	Ashokan	2	12.18-1-13	Fee (City FBO)	0.1	12/14/2023
9830	Ulster	Shandaken	609 Oliverrea Road	Ashokan	2	12.18-1-8	Fee (City FBO)	1.0	08/08/2023
Totals:						18		348.4	

Appendix Table 7 Summary of LAP signed contract to date by priority area.

Reporting Period: 1997 to 2022

Priority Area	# of Contracts	Total Acres	Purchase Price (millions)
1A	138	5,261	\$47.1
1B	341	18,850	\$135.9
2	206	11,758	\$38.6
3	432	43,235	\$97.5
4	723	75,947	\$190.3
Total	1,840	155,051	\$509.5

Reporting Period: 2023

Priority Area	# of Contracts	Total Acres	Purchase Price (millions)
1A	0	0	\$0.0
1B	0	0	\$0.0
2	3	118	\$1.3
3	1	23	\$0.1
4	17	1,055	\$3.9
Total	21	1,196	\$5.3

Program-to-date Totals

Priority Area	# of Contracts	Total Acres	Purchase Price (millions)
1A	138	5,261	\$47.1
1B	341	18,850	\$135.9
2	209	11,875	\$39.9
3	433	43,258	\$97.6
4	740	77,002	\$194.2
Total	1,861	156,247	\$514.8

Appendix Table 8 NYCFFBO purchase contracts by county.

County / Municipality	Project ID	Owner is (or Will Be)	Acres	Step	Step Date	FBO Category	Price
Delaware County							
Village of Fleischmanns	9316	City	0.2	Closed	12/30/20	1 - LFA	\$110,000
Subtotals	1		0.2				\$110,000
Greene County							
Village of Hunter	9586	Village	0.1	Closed	6/30/21	1 - LFA	\$200,500
Village of Hunter	9621	Village	0.1	Contract Executed	1/6/23	1 - LFA	\$75,000
Village of Hunter	9622	Village	0.2	Contract Executed	1/6/23	1 - LFA	\$185,000
Village of Hunter	9623	Village	0.2	Contract Executed	1/6/23	1 - LFA	\$152,000
Village of Tannersville	8934	Village	0.5	Closed	12/30/20	1 - LFA	\$165,000
Village of Tannersville	9486	Village	0.5	Closed	12/30/20	5 - Inundatio	\$24,000
Village of Tannersville	9487	Village	0.5	Closed	8/30/21	1 - LFA	\$155,000
Town of Hunter	8847	NYC	21.5	Closed	2/21/20	4 - Erosion	\$344,000
Town of Hunter	9243	NYC	1.2	Closed	3/20/19	4 - Erosion	\$231,000
Town of Hunter	9831	NYC	2.5	Contract Executed	12/6/23	4 - Erosion	\$885,000
Town of Jewett	8883	NYC	4.8	Closed	9/7/17	4 - Erosion	\$167,000
Town of Lexington	8629	NYC	1.0	Contract Executed	6/30/23	1 - LFA	\$215,000
Town of Windham	9573	Town	0.3	Closed	5/27/21	1 - LFA	\$164,000
Subtotals	13		33.4				\$2,962,500
Schoharie County							
Town of Conesville	8884	NYC	0.6	Closed	10/10/17	3 - Stream	\$86,000
Town of Conesville	9306	NYC	2.8	Closed	3/5/20	1 - LFA	\$118,000
Town of Conesville	8963	Town	0.6	Closed	7/26/19	3 - Stream	\$9,100
Subtotals	3		4.0				\$213,100
Ulster County							
Town of Olive	9374	NYC	1.2	Closed	9/27/19	1 - LFA	\$240,000
Town of Olive	9381	NYC	0.9	Closed	10/23/19	1 - LFA	\$189,000
Town of Olive	9309	Town	1.3	Closed	9/30/19	1 - LFA	\$380,000
Town of Olive	9311	Town	1.6	Closed	10/29/21	1 - LFA	\$525,000
Town of Olive	9315	Town	0.3	Closed	12/30/19	1 - LFA	\$205,000
Town of Olive	8202	Town	2.7	Contract Executed	11/5/23	1 - LFA	\$710,000
Town of Olive	9780	Town	1.5	Contract Executed	2/17/23	1 - LFA	\$350,000
Town of Shandaken	9809	Town	0.3	Closed	12/14/23	5 - Inundatio	\$253,000
Town of Shandaken	9830	Town	1.0	Closed	8/8/23	5 - Inundatio	\$311,000
Town of Shandaken	9665	NYC	3.4	Closed	4/27/23	1 - LFA	\$85,000
Town of Shandaken	4988	NYC	4.4	Closed	12/17/21	3 - Stream	\$41,000
Town of Shandaken	9393	NYC	1.6	Closed	3/24/20	1 - LFA	\$28,000
Town of Shandaken	9406	Town	0.5	Closed	9/23/19	1 - LFA	\$13,500
Town of Shandaken	9408	Town	0.5	Closed	10/4/19	1 - LFA	\$15,000
Town of Shandaken	9419	NYC	1.2	Closed	10/30/20	1 - LFA	\$154,000
Town of Shandaken	9551	Town	12.1	Closed	4/24/23	1 - LFA	\$262,000
Subtotals	16		34.5				\$3,761,500
Grand Totals	33		72.1				\$7,047,100