

**New York City
Department of Environmental Protection**

**Filtration Avoidance Annual Report
For the period January 1 through December 31, 2001**

March 29, 2002

*Prepared in accordance with condition 901a of the May 1997 EPA Filtration Avoidance
Determination*



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1. Introduction

In 2001, New York City's comprehensive watershed protection program continued to make significant strides to protect and improve the quality of the Catskill/Delaware water supply. The City, primarily through the New York City Department of Environmental Protection (DEP), and its partner agencies and organizations continued to advance the many programs that target present and possible future sources of pollution in the Catskill/Delaware watershed.

Since embarking on an aggressive watershed protection program in the early 1990s, the City has made great progress in assessing the potential sources of water contamination and has designed and implemented programs to address these sources. As part of DEP's source water monitoring program, samples are collected and tests are conducted throughout the watershed. Each year, DEP collects more than 35,000 samples from 300 sites and performs more than 300,000 laboratory analyses. Based upon the information collected through its monitoring and research efforts, DEP designed a comprehensive watershed protection strategy, which focused on implementing both protective (antidegradation) and remedial (specific actions taken to reduce pollution generation from identified sources) initiatives. DEP's assessment efforts pointed to several key potential sources of pollutants: waterfowl on the reservoirs; wastewater treatment plants discharging into watershed streams; failing septic systems; the approximately 350 farms located throughout the watershed; and stormwater runoff from development. DEP has crafted a protection strategy to target those primary pollution sources and a host of secondary ones.

In the context of this long-term commitment, 2001 is yet another year of significant achievements. The City continues to advance efforts in key program areas: land acquisition; regulatory enforcement; implementation of key environmental partnership programs; upgrades of non-City-owned wastewater treatment plants; and water quality monitoring and research. As a result of the breadth, depth and complexity of the City's protection efforts, one simple fact often gets overlooked: water from the Catskill and Delaware watershed continues to meet the highest quality standards. There have been no violations of the objective criteria of the Surface Water Treatment Rule.

1.1 Land Acquisition

DEP met the 2001 goals for solicitation of owners of watershed lands set forth in the 1997 Filtration Avoidance Determination (FAD) and the Watershed Memorandum of Agreement (MOA). Specifically, in the program year that concluded January 21, 2002, DEP solicited owners of 55,265 acres of watershed lands in designated priority areas. In the first five years of the program, New York City solicited owners of more than 258,679 acres of Catskill and Delaware land.

Through December 2001, DEP had 34,180 acres either acquired or under purchase contract. A number of key parcels are among the acquisitions to date, including:

- A total of six projects comprising approximately 150 acres were signed to contract in Kensico 1A and 1B. Of the 1,038 acres eligible in the basin, the total number of acres acquired or under contract stands at 167 acres, or 16%.
- Of the 4,830 acres eligible in Rondout 1A, the total number of acres acquired or under contract was raised to 2,021 acres (42%).
- Of the 12,645 acres eligible in West Branch 1A and 1B, the total number of acres acquired or under contract was raised to 6,632 acres (56%).

1.2 Environmental and Economic Partnership Programs

West of the Hudson River, many of the partnership programs are being administered by the Catskill Watershed Corporation (CWC), a non-profit corporation formed specifically for that purpose. Together, CWC and DEP continued to implement programs that remediated more than 150 failing septic systems in the Catskill and Delaware watersheds in 2001, and funded another round of projects to install stormwater control retrofits.

DEP, in cooperation with the Watershed Agricultural Council (WAC), has helped make the Farm Program into a national model. The Farm Program has a solid history of achievement: 320 farms have signed up to participate (versus a FAD goal of 297); 225 farms have commenced implementation of Whole Farm Plans; and \$12.9 million has been spent to date on structural Best Management Practices (BMPs). In addition to continuing to install Best Management Practices on participating farms, WAC has made great strides in forest management, initiating a small farms program, and implementing an expansive research strategy. In addition, the Conservation Reserve Enhancement Program (CREP) continues to be successful at removing environmentally sensitive lands from agricultural production and treating those lands with conservation practices. To date, more than 635 acres of riparian buffer lands have been enrolled in CREP, which represents a dramatic increase over traditional rates of enrollment in the Conservation Reserve Program in the watershed region.

When coupled with DEP's own efforts in the areas of stream management, sewer extensions, new infrastructure and land management, 2001 was a year of tremendous activity and water quality protection.

1.3 Wastewater Treatment Plant Upgrades

There are 34 non-City-owned surface-discharging WWTPs in the Catskill/Delaware watershed, which account for approximately 60% of the WWTP flow in the west of Hudson watershed. In 2001, upgrade designs proceeded quickly and construction began at facilities that account for approximately 83% of non-City-owned Catskill/Delaware WWTP flow. In addition,

DEP has completed the upgrades of the six City- owned wastewater treatment facilities that account for 40% of the WWTP flow in the west of Hudson watershed, at a cost of more than \$240 million. These upgraded facilities continue to operate well, and effluent quality has improved markedly since completion of the upgrades.

1.4 Water Quality Monitoring

During 2001, DEP continued its comprehensive water quality monitoring efforts. Both in the City distribution system and in the watershed, DEP collects literally thousands of samples each year and conducts millions of analyses. The City's sampling program continues to be much more extensive than is required by federal or State law. More than 40,000 samples were collected in the City and approximately 750,000 analyses were completed. Once again, the results are impressive. The City complied with the Objective Criteria of the Surface Water Treatment Rule. Of the 11,114 in-City Compliance samples collected pursuant to the Total Coliform Rule in 2001, a mere 0.24% were total coliform positive. All resamples were negative for total coliform. Since November 1994, DEP has collected approximately 76,000 Compliance samples and only three of those samples have tested positive for *E. coli*.

1.5 Watershed Protection Program Assessment and Long-term Plan

On December 17, 2001, DEP submitted *New York City's 2001 Watershed Protection Program Summary, Assessment and Long-term Plan*. This document serves two purposes: first, it satisfies the New York City Watershed Memorandum of Agreement (MOA) requirement that the City provide a written evaluation of its performance in implementing the MOA, with recommendations for needed improvements, by January 21, 2002. Second, it constitutes the City's long-term plan for watershed protection and application for an extension of the filtration waiver issued by the United States Environmental Protection Agency (EPA), pursuant to the May 1997 New York City Filtration Avoidance Determination (FAD).

The report is the single most comprehensive evaluation of the City's watershed protection efforts to date. The report details the significant achievements made by DEP and its partners in designing and implementing the overall watershed protection program. Further, it uses information from DEP's comprehensive water quality monitoring and modeling programs to confirm that the quality of Catskill/Delaware remains high and that specific watershed protections programs are beginning to yield benefits. As noted above, the City continues to easily meet all the objective water quality criteria of the Surface Water Treatment Rule. In addition, specific efforts – waterfowl management, Kensico stormwater controls, wastewater treatment plant upgrades and inspections – are showing quantifiable improvements in localized water quality.

Based on the analysis of programs, the City crafted a proposal to extend the watershed protection efforts and secure another filtration waiver. This proposal commits the City to continue, and in some cases significantly expand, certain ongoing programs that target key potential

pollution sources. Included are the Land Acquisition Program; the Watershed Agricultural Program; the Waterfowl Management Program; the Septic Remediation and Replacement Program, and the Stormwater Retrofit Program; the New Infrastructure Program for the first seven identified communities; the Wastewater Treatment Plant Upgrade Program; the Stream Management Program; and the programs designed to protect the Kensico Reservoir.

In addition, the City will undertake a number of new initiatives. Among these are the Community Wastewater Management Program, to address wastewater problems in certain identified smaller hamlets and villages; a Septic Operation and Maintenance Program, that will support proper operation and maintenance of septic systems west of Hudson; a house-to-house septic survey in the West Branch and Boyds Corner Reservoir basins to identify failing septic systems; funding for CWC and county staff throughout the watershed to undertake comprehensive watershed planning efforts and to identify and prioritize community stormwater needs; a study to evaluate engineering options for reducing levels of turbidity leaving the Schoharie Reservoir; certain efforts to control nonpoint source pollution in east of Hudson Catskill/Delaware basins; and a commitment to design and construct an enhanced disinfection facility for Catskill/Delaware water if such a facility is deemed feasible by EPA.

This comprehensive report can be found on DEP's website at www.nyc.gov/dep

1.6 Relief from Catskill/Delaware Filtration Deliverables Granted by EPA

By letter dated November 29, 2001, EPA Region II Acting Regional Administrator William Muszynski informed DEP Commissioner Joel A. Miele Sr., P.E., that EPA approved DEP's request for relief from certain filtration avoidance deliverables related to the design of a Catskill/Delaware filtration plant. In 2000, DEP petitioned EPA for the relief, based on the track record of success demonstrated by the City's comprehensive watershed protection program. With EPA's approval, the City will now be able to avoid entering into a final design process for a Catskill/Delaware filtration facility. The relief is conditioned upon City compliance with certain milestones, primarily related to the completion of upgrades of upstate wastewater treatment plants and design and construction of a ultraviolet disinfection facility for Catskill/Delaware water. In granting relief, DEP believes that EPA has made a strong statement in support of the City's watershed protection efforts.

1.7 Water Supply Security

In the wake of the events of September 11, New York City took a number of steps to enhance the security of the water supply system. Steps taken included increased surveillance at critical facilities upstate and in the City, enhanced water quality monitoring and initiation of a contract to install surveillance and access control measures at key locations. The City continues to place the highest priority on protection of the water supply.

1.8 2001 Annual Report

This report covers the period January 1, 2001, through December 31, 2001, and is compiled to satisfy condition 901a of the May 1997 FAD, which requires DEP to submit a comprehensive annual report on the status of the watershed protection program. While this report provides a thorough overview of those programs that are directly connected to watershed protection or water quality preservation and enhancement in the City's Catskill and Delaware water supply systems, there is a wide variety of additional information that is compiled and available in other formats. Under the filtration avoidance waivers that have been in effect since January 1993, DEP produces and provides an extensive schedule of other reports, data and documents to EPA and the New York State Department of Health (DOH). Further information on the programs discussed here can be found in the reports submitted pursuant to the May 1997 Filtration Avoidance Determination.

In addition, the DEP web site provides a host of information on watershed protection programs, including recent press releases, reservoir storage status and up-to-date water quality data. Please visit the web site at www.nyc.gov/dep, and click on the "About DEP" link. Also, DEP has recently completed an informational CD-ROM with descriptions of the watershed and water supply system, program updates and interactive, GIS-based maps that allow the user to create custom maps of the watershed and key features of the landscape. To obtain a free copy of the CD-ROM, please call 914-742-2086 or send an e-mail to levinen@water.dep.nyc.ny.us.

While this report focuses, of necessity, on the efforts of New York City, it is important to note that DEP works in partnership with dozens of agencies and organizations throughout the region to achieve the common goal of water quality protection. Many of those organizations are acknowledged in the body of this report. The other private, governmental and non-profit entities that share a role in this complex effort are too numerous to list. However, DEP gratefully acknowledges their help and support.

2. Federal and State Objective Water Quality Criteria

On the tenth of every month, DEP provides both EPA and DOH with the results of its enhanced monitoring program, developed to comply with the requirements of the Surface Water Treatment Rule (SWTR), the Total Coliform Rule and other federal regulations that went into effect in 1991. The City, as an unfiltered surface drinking water supplier, must meet these objective criteria. The information provided below demonstrates compliance with all pertinent standards.

2.1 SWTR Monitoring and Reporting

Monthly raw water and entry point monitoring for coliform concentrations, turbidity, disinfection and chlorine residuals complied with all federal water quality requirements, as did quarterly monitoring for trihalomethanes. These results indicate the continued maintenance of a high quality water supply.

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

Both the Catskill and Delaware Aqueduct effluent from Kensico Reservoir exhibited fecal coliform concentrations, in water prior to disinfection, at levels less than or equal to 20 CFU/100 mL in at least 90% of the samples collected during the year, for six month running percentages. In fact, the running percentages of samples for the Catskill and Delaware systems never dipped below 97.83% and 98.35%, respectively.

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

Both the Catskill and Delaware Aqueduct effluent from Kensico Reservoir exhibited turbidity levels less than or equal to 5 Nephelometric Turbidity Units (NTU), in water prior to disinfection, on an ongoing basis. Continuous monitoring of source water turbidity was maintained during the year. At no time did turbidity values exceed 3.1 NTU for the Catskill System and 2.9 NTU for the Delaware System.

2.1.3 Raw Water Disinfection/CT Values (40 CFR Section 141.71(b)(1)(I))

CT values recorded each day during the year for the Catskill and Delaware Systems produced net inactivation ratios greater than or equal to 1.0 at all times. The actual lowest net inactivation ratio for both the Catskill and Delaware Systems was 1.2.

2.1.4 Entry Point Chlorine Residual (40 CFR Section 141.71(b)(1)(iii))

Chlorine residuals were maintained at concentrations at or above 0.20 mg/l at all entry points during the year. The lowest chlorine residual measured at an entry point was 0.26 mg/l.

2.1.5 Distribution System Disinfection Residuals (40 CFR Section 141.72(a)(4))

All chlorine residuals for Compliance samples, measured within the distribution system during the year, were measurable/detectable (the lowest being 0.02 mg/l), with the exception of one (1) Compliance sample with a 0.0 mg/l free chlorine residual. This sample, however, had a heterotrophic plate count (HPC) of <500 CFU/mL (actual count was 2 CFU/mL) and by rule is deemed to have a measurable/detectable disinfectant residual for purposes of determining compliance with this requirement of the SWTR.

Three (3) Surveillance samples had 0.0 mg/l free chlorine residuals: one sample with a HPC of <1 CFU/mL, one sample with a HPC of 36 CFU/mL (sampled from an inactive main), and one sample where the HPC test was not performed but which was total coliform negative. Surveillance sites are located on mains that do not have direct service connections to consumers and are not used for compliance purposes. Surveillance samples supplement Compliance sites and are collected to gather additional water quality data in the distribution system. Surveillance samples make it possible to optimize process control, assess water quality, facilitate water quality management and to determine the source and extent of physical and/or biological quality changes, such as high turbidity, color or coliform occurrences.

2.1.6 Trihalomethane Monitoring (40 CFR Section 141.71(b)(6))

The results of analysis for total trihalomethanes, performed on a quarterly basis, were less than or equal to 100 ug/l for every sample taken. The highest total trihalomethane result was 54 ug/l.

2.2 Total Coliform Monitoring

2.2.1 Monthly Coliform Monitoring

Within the distribution system, coliform monitoring indicated monthly levels below the 5% maximum of the Total Coliform Rule. The number of Compliance samples collected for total coliform analysis was 11,114. Of the Compliance samples collected, 27 samples were total coliform positive. No *E. coli* were detected. All resamples were total coliform negative. The actual percentage of Compliance samples that were total coliform positive was 0.24%.

2.2.2 Chlorine Residual Maintenance in the Distribution System

During the year DEP has continued a number of programs to ensure adequate levels of chlorine throughout the distribution system. These have included: 1) maintaining chlorination levels at the distribution system's four entry points, 2) conducting spot flushing when necessary, and 3) providing local chlorination booster stations at remote locations. Three permanent local chlorination booster stations have been continuously operating to improve the chlorine residual levels at the Fort Tilden, Roxbury and Breezy Point areas (Rockaway Peninsula in Queens), City Island in the Bronx and Floyd Bennett Field in Brooklyn.

As a result of these steps taken by DEP, chlorine residuals have been continuously maintained throughout the distribution system. In 2001, in over 11,000 Compliance samples, only one (1) sample had a 0.0 mg/l chlorine residual, and that sample had a HPC of <500 CFU/mL (actual count was 2 CFU/mL) and by rule is deemed to have a measurable/detectable disinfectant residual for purposes of determining compliance the SWTR.

Table 2.1. Monthly Average Free Residual Chlorine at System Entry Points

Month	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
City Tunnel No.1 at BX4/154/15450/10250													
JAN	0.61	0.59	0.63	0.69	0.94	1.03	0.95	1.18	0.80	0.73	0.94	0.70	0.71
FEB	0.57	0.56	0.65	0.65	0.80	1.05	0.88	0.90	0.78	0.73	0.88	0.68	0.67
MAR	0.58	0.62	0.63	0.68	0.93	1.00	0.92	1.00	0.67	0.72	0.79	0.67	0.64
APR	0.48	0.56	0.57	0.66	1.00	0.97	1.07	1.04	0.70	0.77	0.85	0.62	0.69
MAY	0.55	0.60	0.60	0.69	0.91	0.93	1.00	0.89	0.74	0.75	0.78	0.70	0.68
JUN	0.54	0.64	0.64	0.68	0.90	0.89	1.01	0.83	0.81	0.81	0.86	0.73	0.72
JUL	0.52	0.63	0.59	0.82	0.94	1.14	1.01	0.95	0.87	0.98	1.01	0.74	0.69
AUG	0.56	0.57	0.65	0.79	0.99	1.02	1.06	1.14	0.95	1.29	0.96	0.75	0.71
SEP	0.51	0.63	0.69	0.87	1.14	1.18	1.14	1.16	1.03	1.20	0.88	0.76	0.71
OCT	0.52	0.61	0.81	0.89	1.16	1.08	1.07	1.02	1.04	1.19	0.83	0.72	0.72
NOV	0.61	0.58	0.70	0.87	1.16	1.14	1.15	0.90	0.92	1.22	0.78	0.78	0.82
DEC	0.61	0.74	0.70	0.93	1.12	1.04	1.05	0.87	0.83	1.03	0.80	0.74	0.91
City Tunnel No.2 at BX5/121/12150													
Month	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
JAN	0.50	0.59	0.64	0.74	0.97	0.99	1.03	1.14	0.89	0.79	0.88	0.83	0.83
FEB	0.46	0.55	0.66	0.68	0.85	1.11	1.02	0.97	0.80	0.74	0.81	0.76	0.84
MAR	0.45	0.58	0.65	0.66	0.95	1.10	0.95	1.13	0.74	0.80	0.78	0.77	0.78
APR	0.50	0.54	0.55	0.68	1.01	1.02	1.04	1.08	0.76	0.87	0.88	0.70	0.83
MAY	0.73	0.59	0.58	0.71	1.03	1.12	1.01	0.94	0.83	0.95	0.91	0.71	0.82
JUN	0.65	0.66	0.64	0.69	1.13	1.25	1.05	0.97	1.02	1.00	0.97	0.76	0.79
JUL	0.69	0.69	0.69	0.83	1.10	1.19	1.06	1.01	1.08	1.13	1.02	0.89	0.82
AUG	0.75	0.64	0.71	0.87	1.24	1.17	1.11	1.14	1.16	1.25	1.07	0.96	0.92
SEP	0.68	0.67	0.75	1.02	1.24	1.36	1.16	1.20	1.24	1.28	1.10	0.95	0.93
OCT	0.62	0.68	0.91	0.91	1.24	1.30	1.09	1.05	1.19	1.23	1.02	0.94	0.94
NOV	0.61	0.66	0.76	0.88	1.13	1.22	1.15	0.93	0.99	1.14	1.02	0.88	0.98
DEC	0.63	0.75	0.69	0.94	1.19	1.18	1.12	0.94	0.85	1.01	0.90	0.83	1.05
City Tunnel No.3 at 15450													
Month	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
JAN											1.11	0.69	0.70
FEB											0.94	0.70	0.70
MAR											0.76	0.69	0.67

Table 2.1. Monthly Average Free Residual Chlorine at System Entry Points

Month	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
APR											0.68	0.65	0.69
MAY											0.70	0.70	0.74
JUN											0.79	0.72	0.70
JUL										1.15	0.90	0.74	0.68
AUG										0.89	0.94	0.74	0.69
SEP										0.89	0.85	0.77	0.70
OCT										0.92	0.82	0.74	0.69
NOV										1.06	0.78	0.79	0.79
DEC										1.12	0.78	0.74	0.91

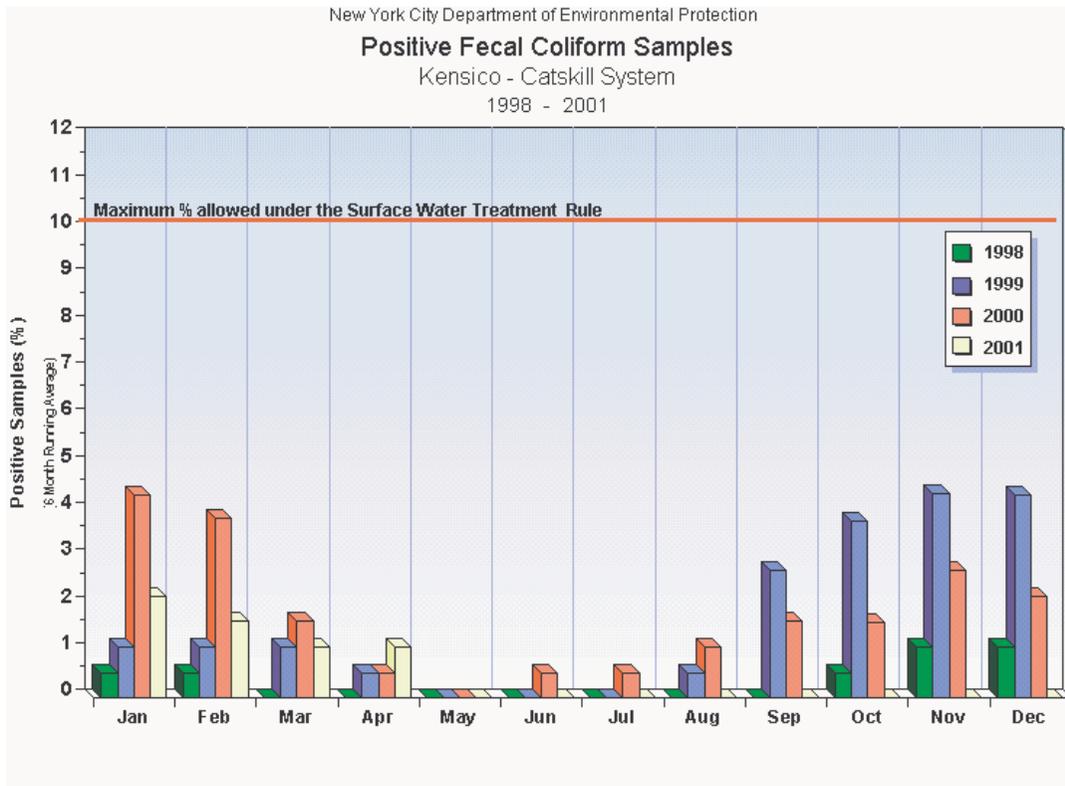


Figure 2.1. Positive fecal coliform samples, Kensico-Catskill System, 1998-2001.

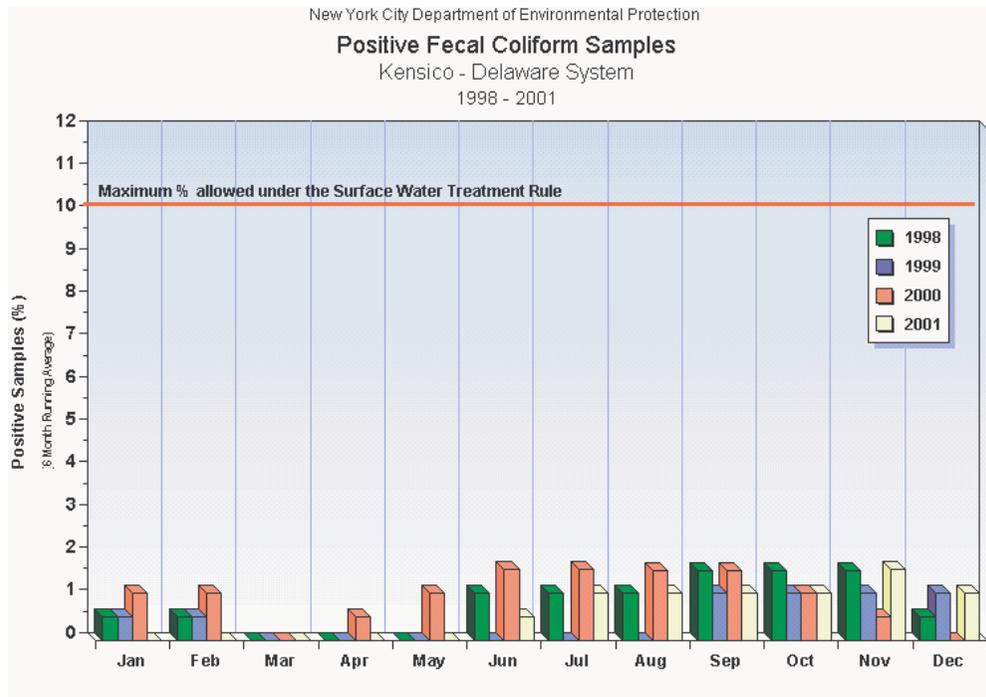


Figure 2.2. Positive fecal coliform samples, Kensico-Delaware System, 1998-2001

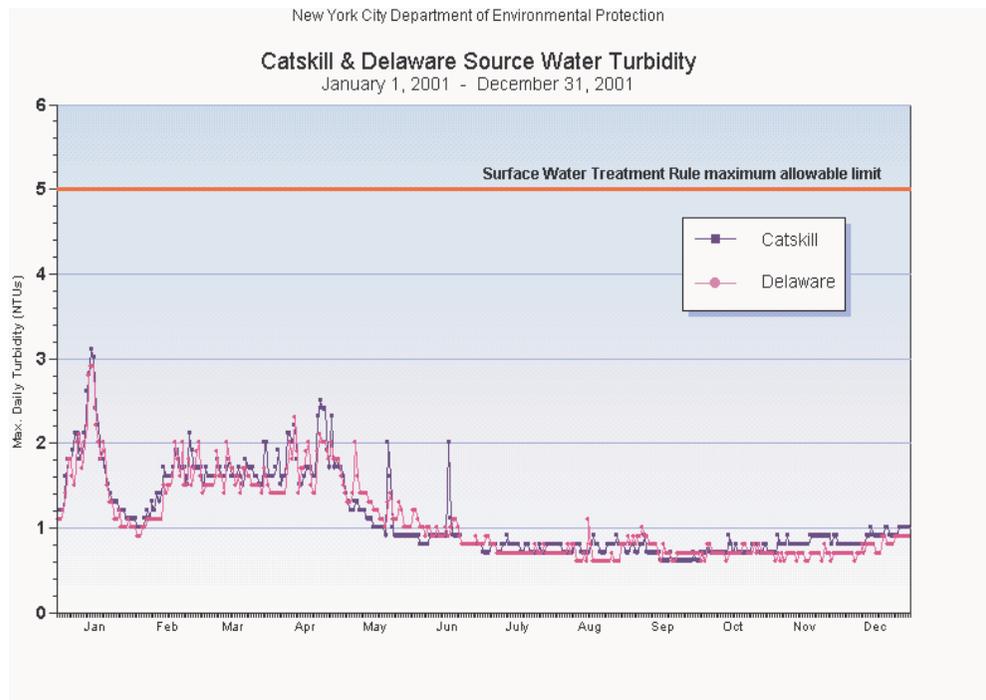


Figure 2.3. Catskill and Delaware source water turbidity, 1/1/2001-12/31/2001.

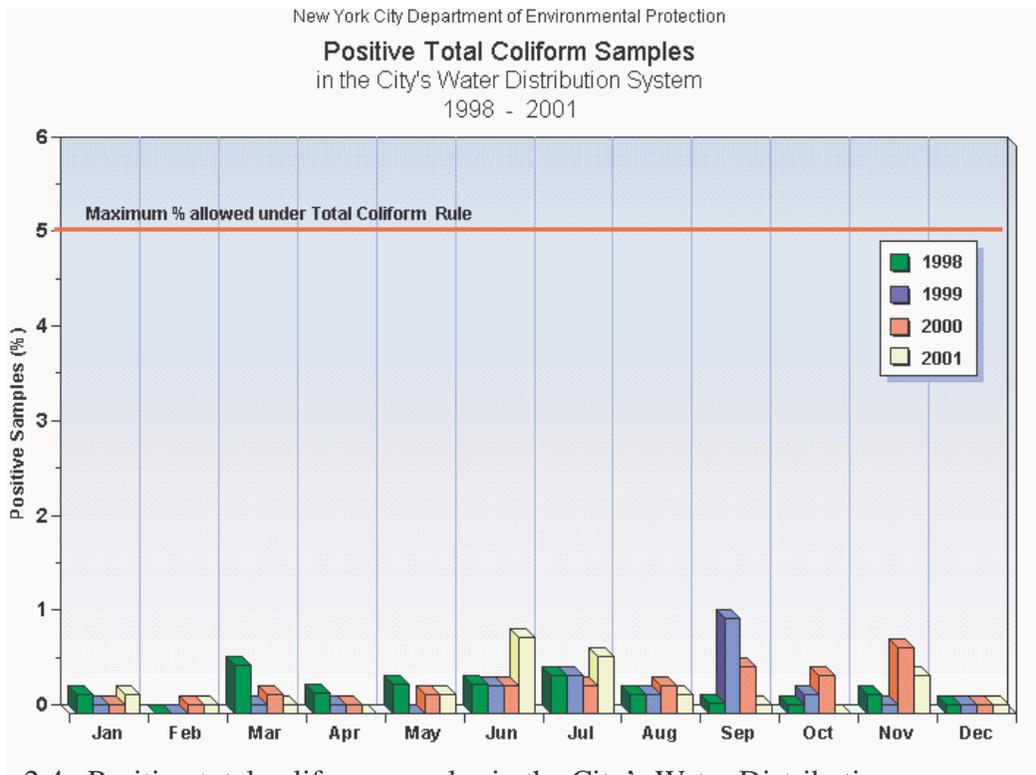


Figure 2.4. Positive total coliform samples in the City's Water Distribution System, 1998-2001.

3. Kensico Reservoir Programs

Kensico Reservoir plays a key role in the Catskill/Delaware water supply system: it acts as a final settling and detention basin before water is sent south to the distribution system. Ninety-eight percent of the water that passes through Kensico comes from the Catskill and Delaware Aqueducts. DEP believes that no single basin in the world has been studied more intensively than Kensico. DEP has mapped the watershed; sampled the streams and groundwater; located every inch of sewer and every septic system in the basin; counted and recounted the birds on the reservoir; and conducted literally dozens of other studies to identify every possible threat to water quality in the basin. Out of these studies has grown what is perhaps the most comprehensive management plan for any basin anywhere.

3.1 Waterfowl Management

A discussion of the DEP waterfowl management program at Kensico Reservoir can be found in the Pathogen Research section of this report.

3.2 Stormwater Management

The end of 2001 marked the close of the first full year of monitoring the extended detention/created wetland that DEP constructed in Malcolm Brook, and the stream channel and stormwater outfall stabilization practices implemented elsewhere in the Kensico watershed. Throughout the year the monitored practices, including those designed to treat stormwater and those that actually eliminate sources of reservoir pollution, proved to be successful by all accounts.

By January 2001, DEP had successfully brought 40 of the 44 stormwater management practices that make up the Kensico Stormwater Management Plan on line. Since then, DEP's efforts have focused on completing the last four partially constructed practices, and on monitoring and maintaining the facilities that have been completed.

DEP's 2001 design, construction, operation, inspection and monitoring accomplishments relative to the stormwater management practices are described below.

3.2.1 Design and Construction

Shortly after mobilizing for construction of detention basin 75, on a reservoir stem of the Rye Lake portion of Kensico Reservoir, work was halted when an unmapped fiber optic cable was discovered on the site. Following a series of discussions with the owner of the cable (Verizon), DEP redesigned the facility to avoid encroaching on the cable and submitted the revised designs to regulatory authorities, Verizon, and DEP budgetary staff for approval. The design changes were estimated to increase construction costs from \$400,000 to \$1 million. In August 2001, City legal counsel denied the request for additional funding on the basis that a City code requires all

utilities be relocated outside of construction zones, or the utility owner assume any additional costs associated with DEP's redesigned facility. DEP reopened negotiations with the Verizon and was able to persuade its representatives to relocate the cable outside of the work zone.

As a result of the Verizon's willingness to relocate the cable, DEP withdrew its request to construct the modified facility. Verizon began relocating the cable upon receipt of permit approvals from the New York State Department of Transportation (DOT) in January 2002. Construction of the basin will begin when the relocation is completed in the spring of 2002.

In response to requests from the Town of Mount Pleasant, DEP redesigned road drainage improvements (facilities 58 and 59) needed to direct additional runoff to facility 57 (an existing sand filter). The new design, made necessary by road repaving, added two catch basins, 240 linear feet of drainage pipe, 1,200 linear feet of concrete curbing and the repair of a badly eroded section of public road. After several iterations, the Town, and telephone, electric and gas utility companies, approved the design revisions in April 2001. The revisions increased construction costs from \$140,000 to \$400,000 but will improve road conditions, safety and performance of the sand filter. Initial approvals from DEP's contracting unit were secured in the fall 2001. As the potential for hazardous winter conditions precluded traffic detours and road closings at the site, DEP postponed construction until the spring 2002. Refer to the Hazardous Materials Section that follows for a discussion of DEP's advancement of the spill containment facilities during 2001.

DEP also modified the designs of facilities 2, 2A, 8, 12, 13, 19, 23, 25, 28, 31, 37, 5A, 44, and 66 in response to operational defects, field testing results and maintenance needs, and municipal and private property owner requests. Each of the enhancements was based upon lengthy negotiations that DEP believed were necessary to maintain its relationship with abutting property owners and the towns. DEP has planted over 100 large trees and shrubs, which were not included in the original design contract, but improve aesthetics. In 2001, fences at three detention basins (23, 66, and 67) were relocated in accordance with private negotiations and permit approvals.

The following table lists the dates the facilities were completed and post construction maintenance measures were completed by DEP. It also describes the additional enhancements and maintenance work DEP completed in 2001. DEP has scheduled its construction contractor to complete the remaining four facilities in the spring 2002.

Table 3.1. Kensico Stormwater Facility Construction and Completion Schedules, Post Construction Enhancements and Maintenance Activities

<i>Basin</i>	<i>Facility Number</i>	<i>Construction Start and Completion Dates¹</i>	<i>Post-Construction Design and Aesthetic Enhancements</i>	<i>Maintenance Activities</i>
Malcolm Brook	2 ²	6/17/00 11/21/00	Planted 16 10' Blue Spruce and Norway Spruce Trees, 25 5' Forsythia, 7 Viburnum (shrub), topdressed dam embankment with topsoil and grass, installed gate operator lock mechanism, inflow monitoring weirs, stocked basin with mosquito larvae- eating fathead minnows	Sediment removed from forebay. Dead and damaged trees removed from facility. Security fence repaired and pond drain cleared of debris.
Malcolm Brook	4	8/31/99 9/13/99		
Malcolm Brook	8	6/14/99 8/20/99	Planted 1 Blue Spruce, modified velocity dissipation box to eliminate potential mosquito larvae habitat	
Malcolm Brook	12	4/12/99 11/5/99	Planted 4 White Pine, 7 Blue Spruce, 2 Maple, stocked forebay and main basin with mosquito larvae eating fish, installed 2 gate operator locking mechanisms, manufactured and installed new trash shield over weir slot to prevent clogging	Removed dead and damaged trees. Repaired fence. Removed sediment from forebay and cleared pond drain of debris, upstream from monitoring weir, and sampling pool at basin outlet, removed debris from main basin. Mowed embankment.
Young Brook	13	3/29/99 11/5/99	Installed gate operator locking mechanism	Removed dead and damaged trees. Repaired fence. Removed sediment and debris from basin.
Young Brook	14	3/29/99 11/5/99		
Young Brook	15	3/29/99 11/5/99		
N2	16	10/27/99 10/27/99		

Table 3.1. Kensico Stormwater Facility Construction and Completion Schedules, Post Construction Enhancements and Maintenance Activities

<i>Basin</i>	<i>Facility Number</i>	<i>Construction Start and Completion Dates¹</i>	<i>Post-Construction Design and Aesthetic Enhancements</i>	<i>Maintenance Activities</i>
N2	18, 19, 20	9/28/99 9/14/00	Installed gate operator locking mechanism, stabilized access road	Repaired erosion on access road immediately adjacent to and upstream from the basin.
N3	2A	10/12/99 9/14/00	Planted 2 cherry trees, to be replaced with evergreens in 2002, planted 11 evergreen and 10 deciduous trees, converted portion of access road to seeded area, installed gate operator locking mechanism, and designed curtain drain - scheduled for 2002 installation	Stabilized eroding accessway.
N4	23, 24	12/22/99 9/14/00	Planted 8 10' Blue Spruce and installed new section of chain link fence and gate operator locking mechanism	
N5	37, 39, 40 (Note 1)	3/27/00 9/14/00	Constructed wall of fieldstone along top of bank, repair watershed wall, complete preconstruction rodent/pest inspection, stocked basin with mosquito larvae-eating fish, and installed 2 gate operator locking mechanisms and new stormwater culvert under adjacent roadway.	Repaired crack in weir wall, repaired leak in box culvert, repaired erosion damage to dam (caused by upslope road runoff), removed accumulated sediment from forebay B, located source of erosion in rip rap channel and repaired, and removed debris from main basin.
N5	35	5/24/00 5/25/00		
N5	34	5/23/00 5/23/00		
N5	31	10/25/99 11/22/99		Installed erosion control mat downstream from facility bounds.
N5	28	10/25/99 10/25/99	Planted 3 6' White Pine, 1 12' Maple 10 shrubs (<i>Viburnum</i>), placed large field stone in channel to eliminate erosion	Repaired and replaced rip rap and filter fabric, removed accumulated sediment, installed erosion control mat downstream of facility, and removed 2 dead trees.

Table 3.1. Kensico Stormwater Facility Construction and Completion Schedules, Post Construction Enhancements and Maintenance Activities

<i>Basin</i>	<i>Facility Number</i>	<i>Construction Start and Completion Dates¹</i>	<i>Post-Construction Design and Aesthetic Enhancements</i>	<i>Maintenance Activities</i>
N5	25	10/25/99 11/12/99	Seeded and created a stable staging area adjacent to facility on access road turn-around.	Removed accumulated sediment.
N5	5A	3/27/00 4/25/00	Modified trash rack to prevent clogging	
N6	41	12/8/99 12/28/99		
Bear Gutter	66	4/24/00 9/14/00	Planted 3 10' White Pine, 2 10' Norway Spruce, installed gate operator locking mechanism	
Bear Gutter	67	6/7/00 11/8/00		Repaired fence (ice damage), erosion damage and damaged coconut roll.
Bear Gutter	65	5/27/00 5/27/00		
Bear Gutter	8A	4/18/00 4/20/00		
Bear Gutter	64	5/26/00 5/26/00		Removed accumulated sediment.
Bear Gutter	63	4/5/00 4/5/00		
N8	43	12/3/99 4/3/00		Reseeded eroded areas.
N9	44	4/18/00 4/18/00	Planted 4 12' Blue Spruce	
N12	47	11/17/99 11/18/99		Removed accumulated sediment and debris.
N12	7A	11/16/99 11/17/99		Removed accumulated sediment and debris.
N12	57, 58, 59	1/11/00 57 done 12/15/00 58 and 59, see note 1		Removed debris from culvert under Nanny Hagen Road.
Whippoorwill	60	12/1/99 12/3/99		Removed accumulated sediment.
Whippoorwill	61	11/29/99 12/3/99		
E11	74	11/6/00 Note 1		

Table 3.1. Kensico Stormwater Facility Construction and Completion Schedules, Post Construction Enhancements and Maintenance Activities

<i>Basin</i>	<i>Facility Number</i>	<i>Construction Start and Completion Dates¹</i>	<i>Post-Construction Design and Aesthetic Enhancements</i>	<i>Maintenance Activities</i>
E11	75	11/6/00 Note 1		
E11	70	4/6/00 4/7/00		
E11	71	4/7/00 4/7/00		Cleared clogged culvert of sediment.
E9	68	4/10/00 4/10/00		

Footnote 1: Construction completion date identifies the date construction of the stormwater practice(s) was complete and the practice became fully operational. Final stabilization, landscaping or ancillary improvements may have taken place after construction was complete.

Footnote 2: Following more than two years of negotiations, PepsiCo Inc. granted DEP approval to construct facility 2, an extended detention basin on the company's property at the headwaters of Malcolm Brook.

Note 1: Redesign required by property owner (basin 37/39/40), by the Town of Mount Pleasant (sand filter drainage improvements 57 and 58) and by phone utility (basin 74/75).

3.2.2 Operation, Inspection and Monitoring

With 40 of the stormwater management facilities completed by 2001, DEP dedicated the staff and financial resources necessary to implement its facility operation, inspection, monitoring and maintenance programs, as specified in DEP's Kensico Stormwater Management Facilities Operation and Maintenance Manual. During the past year, DEP executed each of these programs, and based upon its experience, developed specifications for a long term contract to engage a firm to perform the maintenance services. Inspections were generally conducted weekly, and after significant storm events, while the assessment of the effectiveness of the facilities (practice #12 in Malcolm Brook) is conducted in accordance with an EPA approved Quality Assurance Project Plan, as described below.

Seventeen of the facilities required maintenance in accordance with DEP's Operations and Maintenance Manual, as noted in the table above. DEP expects to advertise the specifications for a maintenance services contract in early 2002. Meanwhile, DEP and its construction contractors perform all required maintenance and will continue to do so until a maintenance contract is in place.

Eighteen of the stormwater facilities are located adjacent to an unpaved Con Ed Access Road, under the power lines paralleling the western shore of the Kensico Reservoir. Prior to construction, the road was in serious disrepair, eroding and discharging sediments toward the reservoir. Lengthy sections of the road near several of the stormwater facilities were improved and stabilized by DEP during 2001. Following negotiations, Con Edison, the only permitted user of the road, has agreed to repair sections of the accessway and assume responsibility for a portion of

the roadway's maintenance as a condition of a DEP Revocable Permit. DEP prepared, and provided Con Edison with, engineering plans for road drainage improvements and erosion stabilization in 2001. City, DEP and Con Edison lawyers and technical representatives continued negotiating the terms of a lease agreement that would allow Con Ed to continue using the road, but requires the company to implement stormwater management practices. DEP anticipates that the negotiations will be concluded early in 2002, and that the new agreement will include DEP's recommendations for additional road maintenance.

As noted in the previous table, DEP made aesthetic enhancements, altered landscaping and modified designs based upon requests from municipalities and private property owners, and hydrologic conditions and field tests of installed structures. For example, all detention basin valves were fitted with locking systems to prevent vandalism and unwanted adjustments in flow and retention capacity. A curtain drain system was also designed for one area of the access road around the reservoir to ensure road stabilization and to redirect road runoff away from the basin's steep slope.

DEP's five-year stormwater practices monitoring plan to determine the pollutant removal effectiveness of the detention basins was submitted to EPA in January 2000. As prescribed in the Quality Assurance portion of the Stormwater Facility Monitoring Plan, monitoring of turbidity, suspended solids, fecal coliform bacteria and total and dissolved phosphorus at detention basin 12, on Malcolm Brook, was conducted between March 2000 and November 2001. The results document the stormwater practices' pollutant removal capacity. Using the Regression of Loads technique to calculate the basin's pollutant removal rate, the estimated turbidity, fecal coliform bacteria and total suspended solids load reductions are 51, 41 and 72 percent respectively. The basin further reduces stormwater pollutant loads delivered to the reservoir by reducing the average peak discharge of turbidity, fecal coliform bacteria and flow by 70, 50 and 30 percent, respectively. Note that DEP included phosphorus in its monitoring program to assist the agency in developing similar programs that target phosphorus, not because of elevated levels of phosphorus in the reservoir.

In 2001, DEP significantly revised and nearly completed designing additional inflow and outflow monitoring structures needed to fully execute the Monitoring Plan. Design work for the structures could not be fully commenced until the basins were constructed, operational and field-tested. Upon completion of the weir designs (needed to measure flow and calculate loads) and construction specifications, DEP will request review and approval from DEP's contracting and legal units, and advertise the construction contract after incorporating any necessary modifications. Construction funding for the monitoring was secured in January 2001.

The success of the program's first "operational" year confirmed the legitimacy of DEP's watershed assessment and stormwater retrofit approach, which was based upon modeled and sampled pollutant load reductions, field observations and modeling of stream flows (storm and base) observed erosion and sedimentation and community relations.

3.3 Turbidity Curtain

Since its installation in 1995, the turbidity curtain installed in the reservoir between the Catskill Upper Effluent Chamber (CUE) and Malcolm and Young Brooks has effectively deflected discharges from the two watercourses away from the effluent chamber. To confirm the effectiveness of the structure, DEP conducted several special water quality monitoring studies, evaluated routine stream and reservoir water quality data, and routinely inspected the curtain. All maintenance needs identified during inspections were promptly completed. The amount of maintenance required in 2001 was minimal and included only replacing floats damaged by waterfowl, restitching sections of curtain together, and securing steel anchoring cables. During the year, DEP made arrangements for a diving contractor to conduct the second subsurface inspection of the curtain since its installation. The divers, who completed the inspection and routine maintenance work immediately following the close of the reporting period, also surveyed the reservoir bottom between the curtain and the two brooks. The reservoir floor was very stable, as evidenced by a vegetated buffer approximately 5 feet wide along the length of the curtain, and by the size and shape of minor accumulations of sediment at the mouths of the brooks, which have not changed since the dredging operation was completed. The findings are not surprising given that DEP stabilized eroded sections of both brooks that previously contributed sediment to the reservoir, and constructed three detention basins that retain suspended solids and reduce erosive stormwater velocities.

To provide an additional safeguard for the quality of water entering the effluent chambers, DEP will replace the curtain before it reaches the end of its design life span. The existing curtain will remain in place until the replacement curtain is installed. DEP prepared plans and specifications for the replacement and disposal of the existing curtain in 2000, and submitted a funding request in spring 2001. To expedite the replacement of the curtain, and installation of the Interstate 684 Spill Containment Facilities, DEP combined the two projects and submitted one funding request. In 2001, funding for the replacement curtain was approved. In addition, comments concerning the plans and specifications for the curtain's replacement were received, and satisfactorily responded to, in August 2001. With the specifications approved, solicitations for contract bids were advertised in February 2002. The new curtain, depicted below, is scheduled for installation in 2002.

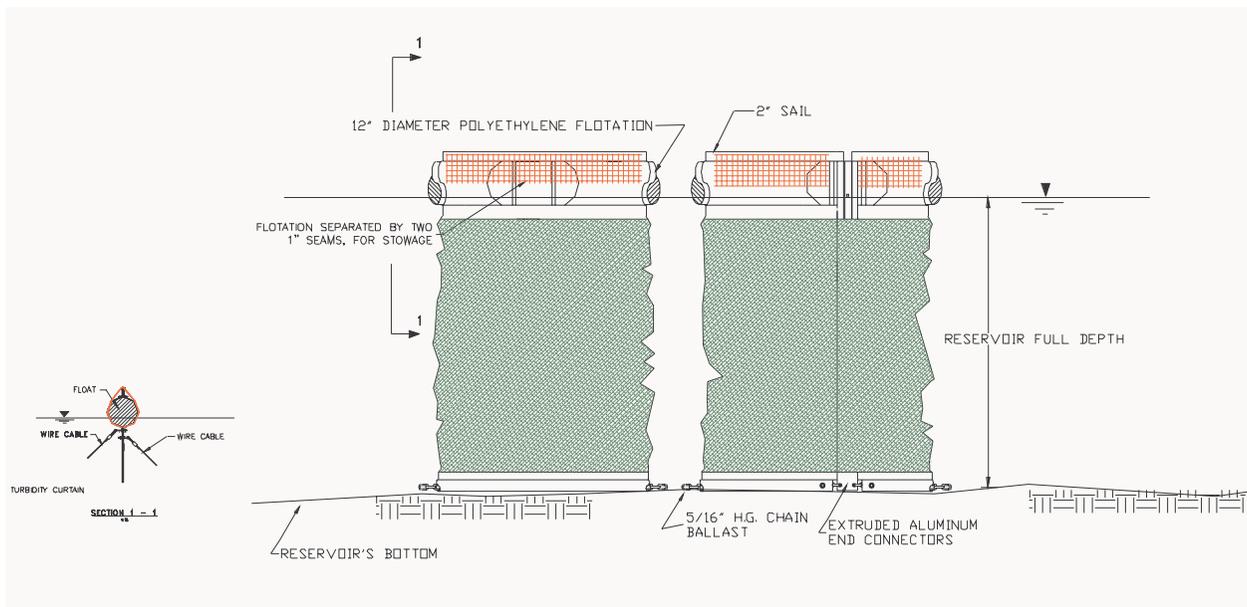


Figure 3.1. Replacement turbidity curtain with waterfowl deterrent floats

3.4 Maintenance Dredging

When sediment dredging was completed at the CUE and Shaft 18 in May 1999, some 2,000 cubic yards of sediment, twice the volume estimated by the diving firm engaged by DEP to estimate the volume of sediment that should be dredged, had been removed from the reservoir. During 2001, DEP continued to routinely monitor the mouths of Malcolm and Young Brooks for signs of sediment accumulation. In the same year, DEP developed criteria it will use to determine the need for maintenance dredging in the future.

DEP's criterion for determining the need for future dredging is based upon underwater investigations to be conducted in 2006. DEP proposes to contract a diving firm to survey the reservoir bottom and measure the volume of fine-grained sediment present in the intake channels leading to the two effluent chambers, and at points where Malcolm and Young Brooks enter the reservoir. If such resuspendable sediment has accumulated in these areas, DEP will apply for regulatory approvals to remove the sediment and engage a dredging contractor to complete the work in accordance with federal, State and municipal requirements and permits.

Based upon diving inspections conducted at the mouths of Malcolm and Young Brooks, water quality analyses, stream modeling, and sediment sampling, DEP determined that dredging was not warranted in 2001.

3.5 Repair Of Sewer Leaks

As part of its Kensico Sewer Inspection Program, DEP video inspected approximately 55,000 of the 95,000 linear feet of sanitary sewer line in the Kensico watershed in 1998. The purpose of the inspections was to identify, and repair, defects in County and municipally owned sewer lines that may result in exfiltration of wastewater into the reservoir. That program identified some 39 sections of defective sewer that DEP repaired by grouting, relining, or excavating and replacing.

During 2001, DEP continued discussions with Westchester County concerning a joint Operations and Maintenance Agreement to ensure that County owned sewers susceptible to failure in the Kensico watershed, as well as those in the West Branch, Boyds Corner, Cross River, and Croton Falls watersheds, are inspected and maintained as necessary to prevent exfiltration.

3.6 Failing Septic Systems/Illicit Sewer Connections

In 2001, DEP reevaluated and supplemented its program to identify and remediate failing septic systems in the Kensico watershed. To update the data collected during the first such survey in 1991, DEP began a second survey of approximately 795 homes in the four watershed towns (New Castle, Mount Pleasant, Harrison and North Castle) in the watershed. DEP eliminated the remaining homes in the watershed from the survey after confirming, by examining municipal records and 1991 survey data, that they are served by sanitary sewers. The house-to-house septic system survey involves mailing a letter explaining program's purpose to residents, requesting their participation by returning a survey form (enclosed with the letter) and allowing DEP to inspect their systems.

The survey requests confirmation that the residence is served by a septic system and asks for the approximate dates of construction and the last inspection, and whether the system was functioning properly at that time. In the event the system wasn't working properly, the resident is asked to identify the malfunction and remedy taken (if any). Since DEP enjoys excellent relationships with the supervisors of North Castle and Mount Pleasant, where the vast majority of the systems are located, the two supervisors signed and mailed the introductory letter and survey to their constituents. Mailing of the Harrison and New Castle letters was not scheduled until February 2002, to allow DEP time to complete the survey process in Mount Pleasant and North Castle. Since DEP attempts to speak with all residents with septic systems, (whether or not a survey was returned) and inspect the systems, the process is a time consuming one.

In 2001, approximately 90 North Castle surveys were returned and 75 systems were inspected. Of the total of more than 139 systems inspected in the watershed, no new failing septic systems were identified. The survey is expected to be completed by September 30, 2002.

3.7 Hazardous Materials

In order to protect the Kensico Reservoir from hazardous spills, DEP is integrating its Interstate 684 Spill Containment Plan with an enhanced Spill and Emergency Response Protocol, and an enhanced spill containment project that addresses the threat that spills on additional roads around the reservoir pose to water quality. The I-684 plan includes the deployment of twenty-five spill containment booms at the stormwater outfalls from the highway, while the enhanced protocol includes updated notification procedures, improved preparedness, and updated material cleanup, transportation and disposal procedures.

The integrated Kensico Spill Containment Plan will not only increase the locations where any spilled materials will be contained, but will also improve the response time and effectiveness of State, County, City and municipal spill response units.

The figure on the following page depicts the locations of the I-684 stormwater outfalls and the spill containment booms. The containment system, detailed below, is designed to ensure material spilled on a road, and discharged in the form of sheet flow, or through a stormwater drainage system, is sufficiently contained to allow for simplified recovery. This will prevent migration of the material through the reservoir, minimizing water quality impacts. Furthermore, the system has been specially designed to preclude waterfowl roosting through the use of deterrents on the tops of the boom buoys.

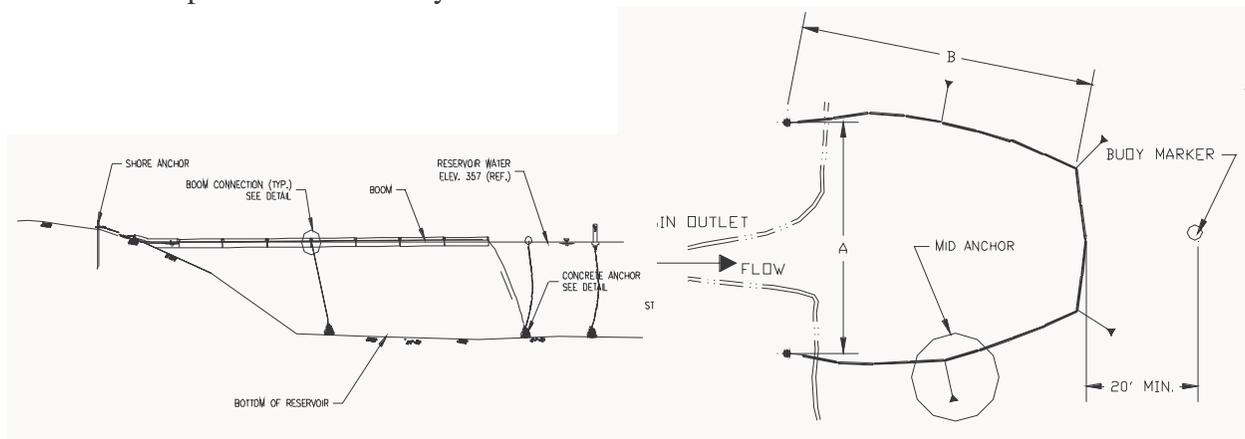


Figure 3.2. Spill containment boom - plan and cross sectional views

Funding for the revised contract plans and specifications for the 25 containment booms at the I-684 storm drain outfalls, and the turbidity curtain at Malcolm Brook, was requested in spring 2001. Funding for the amended contract plans was approved in January 2002. To expedite installation, maintenance, and response, DEP manufactured and installed identification signs at each of the 25 outfalls in 2001.

Finally, during the reporting period, DEP staff began preliminary designs for enhancements to the spill containment plan to be implemented at the other roads around the reservoir, including Routes 120 and 22, and Nannyhagen Road in the Towns of North Castle and Mount Pleasant. Storm drain systems have been located and digitally mapped, and preliminary estimates of stormwater flows from the existing outfalls, upon which the dimensions of the containment booms will be based, have been calculated. The data is being used to site and design containment booms for each outfalls' specific hydraulic load. DEP will complete specifications to accompany the completed designs in the summer of 2002.



Figure 3.3. Spill containment facility sites: catch basins and storm drain outfall locations in the Kensico Reservoir.

3.8 Route 120/22

During 2001, DOT released a Draft Final Environmental Impact Statement for the Route 120/22 project in the Kensico watershed. Although DOT has significantly reduced the scope of the preferred project alternative, DEP continues discussions with DOT and watershed stakeholders.

DEP met with DOT, and other governmental agencies and environmental organizations, during 2001 to discuss stormwater management options to protect reservoir water quality from stormwater generated by the amended highway plan and from portions of the existing highways that drain into the reservoir. While DOT sought endorsement of its technical approaches to managing stormwater from the project, insufficient detail was provided to determine the adequacy of the various approaches.

At DOT's request, DEP also participated in an October 2001 tour of the Route 120/22 project corridor to identify wetlands that would be impacted by DOT's proposed highway modifications, and the areas where wetlands would be created, and/or, restored to mitigate the impacts on wetlands. Since the proposal was first announced, DEP has insisted that DOT thoroughly examine road configuration alternatives that would eliminate any wetland loss. Representatives of EPA, DOT, the New York State Department of Environmental Conservation (DEC), Westchester County, Riverkeeper, the Croton Clean Water Coalition, Sierra Club and NRDC also participated in the tour.

The Route 120/22 project, and accompanying stormwater management facilities, remained under scrutiny by a committee established in 2001 to further evaluate stormwater management options. Various governmental officials, and environmental and public advocacy groups, participate on the committee.

3.9 Kensico Watershed Improvement Committee

At the Town of North Castle Supervisor's request, the five largest corporations on Route 120 (King Street) and the town, established the Kensico Watershed Improvement Committee (KWIC) in 1996, to assess land management practices being employed by the Town and the corporations, to identify potential sources of reservoir pollution from municipal and corporate facilities, and to formulate a plan to reduce the threat to the reservoir from those sources of pollution. The King Street Corridor Management Plan (Plan) sets forth sound environmental practices for the corporations and the Town to manage their facilities in ways that prevent contamination of the Kensico Reservoir. By the fall 2000, KWIC had completed a plan that gained the full support of the five corporations and the Town. The corporations pledged to minimize water quality threats by voluntarily implementing the pollution prevention and remediation practices contained in the plan and periodically reevaluating and updating the Plan.

The Committee unveiled its plan to the public at a reception in May 2001. Throughout the year, members continued to voluntarily implement the plan, which was heralded by many as a state of the art approach to reservoir watershed protection. The Committee agreed to meet periodically to discuss implementation difficulties and successes, and refine the plan, as necessary. DEP will actively support KWIC by participating in periodic meetings, continuing to provide technical support, tracking and ensuring compliance with the plan, initiating 2 and 5 year reviews of the plan and its implementation, and based upon review results, refining the plan with the committee's members.

DEP also met with the North Castle Supervisor and the KWIC chairs in 2001, to discuss the expansion of KWIC. The Supervisor enthusiastically supported expansion and offered to assume a lead role. Based upon these discussions, DEP inventoried potential members of KWIC in the other three communities in the Kensico watershed, and developed an expansion strategy that was endorsed by the North Castle Supervisor and KWIC chairs. The Supervisor has agreed to mail an introductory letter explaining the program to all businesses in the watershed and encouraging them to participate in the program.

3.10 Westchester County Airport

During 2001, DEP continued to closely monitor activity at the Westchester County Airport and maintained ongoing discussions with airport management. Based upon the number of water quality related issues facing the airport, and its proximity to the reservoir, airport representatives and DEP agreed to take a proactive approach to protecting the reservoir by meeting quarterly to address water quality protection and remediation topics before they reach a critical stage. The first such meeting will be held in March 2002.

3.10.1 Groundwater Investigation

Past land uses, spills, and improper storage and handling of hazardous materials at the airport raised concerns over the potential for contamination of the Kensico Reservoir from pollutants conveyed by groundwater to the reservoir. Accordingly, DEP engaged in discussions with the County concerning the need for a comprehensive evaluation of the quality of groundwater underlying the airport and the direction in which it flows. DEP, the New York State Attorney General staff, DEC, and several citizen groups urged Westchester County to develop and implement a program to determine the direction of groundwater flow from the airport, and the quality of the groundwater migrating toward the Kensico Reservoir. In response, the County engaged a consulting firm in 1999, to conduct a groundwater flow/quality study. With the consultants engaged, DEP met with the County to discuss the scope of the study.

Following several meetings between DEP and Westchester County staff, the County completed a *Westchester County Airport Draft Groundwater Flow Evaluation and Sampling Plan* in March 2000. DEP, representatives of the State Attorney General's Office, DEC, and several environmental organizations reviewed the draft. DEP (and other entities independently) met with

Westchester County representatives in April 2000, to discuss errors and omissions in the draft study. DEP issued formal comments addressing the draft groundwater report, which DEP concluded did little to assess the quality of groundwater on the site, or the potential for sub-surface migration of any contaminants from the airport to the Kensico Reservoir.

DEP's comments cited specific deficiencies in the report and the need for additional analysis to fully evaluate existing conditions, and the potential impacts on the City's drinking water supply from any groundwater contaminated by airport operations. DEP and County staff met again to discuss DEP's comments and a schedule for advancing the study. Subsequent to that meeting, the County released a revised report, which addressed the errors and deficiencies in the first version of the report and provided the data upon which conclusion reached in the first report were based. The revised report, which was generally accepted by the reviewing parties, established the basis for future groundwater monitoring by the County and DEP.

Soon after the release of the revised report, DEP and the County executed a formal groundwater sampling agreement that established a schedule and protocol for joint collection and analysis of groundwater samples. In August 2001, DEP and the airport received the analyses of the first samples taken in June 2001. The analysis provided no indication that contaminated groundwater was migrating toward the reservoir. DEP and the County will continue to collect split samples, in accordance with the agreement, indefinitely.

3.10.2 Airport Expansion/Master Plan Revision

In the spring 2000, DEP attended a public informational session conducted by Westchester County. The purpose of the session, which was conducted pursuant to SEQRA, was to inform the public and involved agencies about modifications Westchester County is considering making to the Airport Layout Plan component of the Airport Master Plan which the County adopted in 1987. DEP also attended a SEQRA Scoping Session held by the County and subsequently issued written comments identifying water supply issues that must be analyzed the FEIS that the County will prepare once it reaches a decisions on preferred development alternatives.

In November 2000, DEP received notification from Westchester County that, based upon comments it received in response to the *Draft Supplemental Environmental Assessment and Supplemental Environmental Impact Statement for the Proposed Water Quality Buffer and the Reuse of the Former Air National Guard Site*, the County completed a Final Scoping Document.

The proposed actions subject to the SEQRA analysis include the creation of an undisturbed forested buffer between a portion of the airport and the Kensico Reservoir, new measures to improve aircraft deicing practices at the airport and several options for the use of the portion of the airport formerly occupied by the Air National Guard. DEP submitted extensive comments to the County concerning potential impacts on the Kensico Reservoir that were anticipated from the proposal and reviewed the final version of the Scoping Document to ensure that issues DEP raised had been satisfactorily addressed.

As of the end of 2001, the County had not issued a decision concerning the Master Plan.

3.10.3 Taxiway Expansion/Perimeter Road

At the request of Westchester County, DEP conducted a January 2000 on-site assessment of the airport's proposal to construct an additional taxiway, to stockpile fill, and to construct a perimeter road all of which were partially in the Kensico Reservoir watershed. DEP located watercourses on the site to ensure that impervious surface components of the project avoided encroachment on the 100-foot limiting distance established in the Watershed Rules and Regulations (WR&R), and determined that the County would be required to prepare an SPPP for the project.

Following several requests for additional information, and modifications of the airport's SPPP, DEP approved the plan in October 2001. The plan details how stormwater runoff from the portion of the perimeter road in the watershed will be protected from erosion during construction and runoff from the road treated by on-site infiltration practices. Runoff from the expanded taxiway will be discharged into an existing drainage system outside of the Kensico watershed.

3.11 Kensico Environmental Enhancement Program

The Kensico Environmental Enhancement Program (KEEP) is a joint effort between DEP and Kensico Reservoir watershed communities to protect and enhance water quality in the Kensico Reservoir. KEEP involves coordinated surveillance of the reservoir, community education and outreach on issues related to the reservoir and its watershed, and environmental education programs for children. Joint efforts of DEP and the community to promote watershed protection provide opportunities for watershed residents to learn how they or their community can prevent nonpoint source pollution.

Many new people from the community were drawn to KEEP events. All events began with an introduction about KEEP and its mission. The KEEP Executive Board held monthly meetings during the past year and made significant progress on several projects. An intern from Pace University Environmental Education Program worked with DEP representatives on many educational activities. They were invited to visit schools that surround the Kensico Reservoir and conduct workshops for students and teachers. KEEP held a very successful Kensico Reservoir Watershed Water Conservation & Water Quality Preservation Art & Poetry Contest Award Ceremony at Pace University. The award ceremony was a culmination of classroom lessons which focused on the history and present day New York City water supply system, the roll that the Kensico watershed plays in the overall system, water quality, the value of water and water conservation. Over 85 sixth and seventh grade students attending schools surrounding the Kensico watershed participated in the contest. Through their artwork and poetry the students were able to express their understanding and appreciation of our water supply system as well as the need to protect this vital resource.

A permanent education display for the Kensico Dam Plaza was unveiled in 2001. DEP Commissioner Miele, local elected officials and representatives from the KEEP Board and Westchester Parks Dept were on hand to celebrate the installation of the display. A performance of “City that Drinks The Mountain Sky” by Arm-of-the-Sea Theatre took place at Kensico Dam Plaza. It was co-sponsored by KEEP and Westchester Parks Department.

The KEEP web page continues to be posted on DEP’s Internet site. The site can be visited directly at www.nyc.gov/dep/html/news/keep.html. The site includes information about KEEP’s mission and activities.

4. Pollution Prevention

4.1 Watershed Agricultural Program

The Watershed Agricultural Program is a comprehensive effort to develop and implement pollution prevention plans on 85% of the commercial farms in the City's Catskill and Delaware watersheds. The program is a voluntary partnership between the City and farmers in the watershed to manage nonpoint sources of agricultural pollution, with particular emphasis on waterborne pathogens, nutrients and sediment. In addition, the program incorporates the economic and business concerns of each farm into the development of its Whole Farm Plan in order to fully establish the principles and goals of pollution prevention into the farm operation.

The Watershed Agricultural Program strives to maintain and protect the existing high quality of the water supply system from agricultural nonpoint source pollution through the planning and implementation of Best Management Practices (BMPs) on farms. When possible, the Program uses traditional BMPs that are proven to protect and enhance source water quality, and, if necessary, to employ and evaluate innovative BMPs to increase the number of alternatives available to farmers to address "non-traditional" agricultural water pollution concerns, especially waterborne pathogens.

Fully funded by the City, the Program is administered by the not-for-profit Watershed Agricultural Council (WAC), whose board consists of farmers, agri-business representatives and the DEP Commissioner. Over time, the City and WAC have been able to leverage generous financial support from other sources to enhance the Program, particularly the US Department of Agriculture, EPA, and Army Corps of Engineers. Local, State and federal agricultural assistance agencies provide planning, technical, educational, engineering, scientific and administrative support for the program under subcontractual agreements with the Council.

4.1.1 Summary of Progress Reaching FAD Goals and Milestones

The following table describes the progress of the Watershed Agricultural Program (WAP) in meeting its various Filtration Avoidance Determination milestones for 2001. The program has met or exceeded its goals, including those for executing Whole Farm Plan (WFP) implementation agreements, commencing implementation of WFPs, completing WFPs, and annual follow-up on farms that have completed implementation.

Table 4.1. The progress of the Watershed Agricultural Program (WAP) in meeting its various Filtration Avoidance Determination milestones for 2001.

<i>Filtration Avoidance Determination Milestone</i>	<i>Goal 12/31/01</i>	<i>Achieved 12/31/01</i>
Farms Signed Up	297	320

Table 4.1. The progress of the Watershed Agricultural Program (WAP) in meeting its various Filtration Avoidance Determination milestones for 2001.

<i>Filtration Avoidance Determination Milestone</i>	<i>Goal</i>	<i>Achieved</i>
	<i>12/31/01</i>	<i>12/31/01</i>
Whole Farm Plans (WFPs) Approved	273	275
WFPs Commenced Implementation	212	225
Whole Farm Plans Complete	105	107
Annual Follow Up	73	139

4.1.2 Land Area and Animals Treated

The following tables provide a comparison of approximate acreage of agricultural land in approved WFPs at the end of 1997, 1999 and 2001, and a census of livestock covered under Whole Farm Plans for the same period.

Table 4.2. Acreage of agricultural land in approved WFPs.

<i>Agricultural Land</i>	<i>1997</i>	<i>1999</i>	<i>2001</i>
Rotated Cropland Owned	7,507	8,271	8,630
Rotated Cropland Rented	4,500	12,284	4,931
Permanent Hayland Owned	4,002	5,766	7,957
Permanent Hayland Rented	3,838	5,646	9,190
Pasture Owned	9,578	11,970	13,943
Pasture Rented	5,713	4,580	5,045
Woodland Owned	17,694	21,306	21,128
Woodland Rented	2,727	3,301	3,799
<i>Total Acres</i>	55,551	73,124	74,623

Table 4.3. Animal census farms participating in WAP as of 12/31/01.

<i>Animal Type</i>	<i>Number of Animals</i>		
	<i>1997</i>	<i>1999</i>	<i>2001</i>
Mature Dairy	12,636	10,625	12,160
Dairy Heifers	8,758	7,494	8,779
Veal	790	630	951
Beef	1,566	1,214	2,268
Sheep	569	425	862
Goats	78	63	306

Table 4.3. Animal census farms participating in WAP as of 12/31/01.

<i>Animal Type</i>	<i>Number of Animals</i>		
	<i>1997</i>	<i>1999</i>	<i>2001</i>
Pigs	68	185	209
Horses	565	475	762
Chickens	2,655	2,606	4,895
Pheasants	250	300	300
Rabbits	25	100	110
Emu	0	7	12
Ostrich	18	15	35
Llama	55	74	89
Deer	375	380	404

4.1.3 BMP Implementation

The following table summarizes all the BMPs that were implemented during 2000 and 2001. Table 4 summarizes all the BMPs that were implemented in the years prior to 2000. Practices with Natural Resource Conservation Service code numbers are fully described on the New York NRCS web site (<http://www.ny.nrcs.usda.gov/standards>).

Table 4.4. BMP implementation, 2000 – 2001.

<i>NRCS / WAC Code #</i>	<i>Best Management Practice Name</i>	<i>No. of Best Management Practices</i>
313	Manure Storage Structure	7
314	Brush Management	6
328	Conservation Cropping Sequence	8
340	Cover and Green Manure Crop	4
342	Critical Area Planting	3
362	Diversion	10
382	Fencing	80
391a	Riparian Forest Buffer	16
393	Filter Strip	11
468	Lined Waterway or Outlet	2
500	Obstruction Removal	4
512	Pasture and Hayland Planting	9
516	Pipeline	5
528	Prescribed Grazing	4
558	Roof Runoff Management System	4
560	Access Road Improvement	17

Table 4.4. BMP implementation, 2000 – 2001.

<i>NRCS / WAC Code #</i>	<i>Best Management Practice Name</i>	<i>No. of Best Management Practices</i>
561	Heavy Use Area Protection	17
574	Spring Development	47
575	Stock Trails and Walkways	25
580	Streambank Stabilization	4
586	Stripcropping - Field	1
590	Nutrient Management Plan	122
606	Subsurface Drain	6
612	Riparian - Tree and Shrub Planting	52
614	Trough or Tank	3
620	Underground Outlet	5
633	Waste Utilization	100
707	Barnyard Water Management System	41
NY748	Recording Keeping	85
3110	Calf Greenhouse	10
3120	Calf Hutches	1
3130	Barn Ventilation	5
3310	Farm Fueling Facility - Above Ground	9
3340	Farm Fueling Facility - Closure	2
3410	Manure Spreader	6
3420	Loader	3
3430	Manure Truck	1
3440	Manure Scraping System	2
3450	Manure/Sump Pumps	2
3460	Anaerobic Fixed Film Digester	1
3520	Farm Dump Closure	1
3810	Sewer Connection Yearly Fees	1
4000	Watering Systems	1
	Total No. of Best Management Practices	799
	Total Cost	\$4,647,400.00

4.1.4 Conservation Reserve Enhancement Program

Federal Fiscal Year 2001 was the third full year of the New York City Conservation Reserve Enhancement Program (CREP) Memorandum of Agreement between New York City, New York State and the US Department of Agriculture. There were 332.3 acres under contract at the end of FY 00 and 634.7 acres at the end of FY 01. Clearly, after a period of start up and outreach, CREP has over the past two years taken root as one of the most important aspects of the Watershed Agricultural Program. The enthusiasm with which farmers are now establishing riparian buffers and stream fencing is encouraging, especially when one considers how vehemently such measures were rejected when proposed as requirements under the City's 1990 Discussion Draft Watershed Regulations.

4.1.5 Eklund Farm Update

A private engineering firm was contracted to develop engineering designs for two concrete-lined manure storage structures at the Delair Farm where the farm's 300 dry cows are housed. These projects will be partially funded by Watershed Environmental Assistance Program (WEAP) funds. The designs have been submitted to the Army Corps of Engineers for their approval. It is anticipated that both structures will be built in the summer of 2002. In addition, the Eklund Farm has enrolled 219 acres into the Conservation Reserve Enhancement Program.

4.1.6 Small Farms Program

Six pilot "small" whole farm plans have been developed and approved by WAC. Initial BMP implementation and design work has begun on several of the approved plans. The WAC Small Farm Advisory committee reviewed a list of 69 farms that have completed Tier II AEM surveys and selected 16 farms (8 of which had once been signed up for the large farm program) with the highest environmental issues and the greatest number of animal units to be the next group of farms to be planned after the planning of the pilot farms is completed.

4.1.7 BMP Implementation Prioritization

In its 1997 mid-course review of the Filtration Avoidance Determination for the Catskill/Delaware watershed EPA recommended "NYCDEP and WAC develop an effective mechanism for prioritizing implementation, both among farms and within an individual Whole Farm Plan." The following is a description of the Watershed Agricultural Program's strategy of setting priorities for BMP implementation.

WAP Strategy For Setting BMP Implementation Priorities Both Among Farms and Within an Individual Whole Farm Plan

Setting priorities for BMP implementation both among farms and within individual Whole Farm Plans has been a desired goal of WAP since the beginning of Phase II of the program in 1994. The Environmental Review/Problem Diagnosis (ER/PD) tool was developed early on to identify water quality concerns on a farm and provide a framework to prioritize those concerns

during the development of a Whole Farm Plans (WFP). There are 11 pollutant categories addressed in each WFP with pollutant category I being the highest priority and pollutant category XI being the lowest priority:

- I. Parasites and Phosphorous – Animal Waste Management
- II. Pesticides – Storage Facilities, Mixing/Loading Areas
- III. Phosphorous – Fertilizer Storage
- IV. Parasites – Animal and Manure Management
- V. Nutrient Management
- VI. Nutrients – Concentrated Sources
- VII. Sediment – Diffuse
- VIII. Sediment – Concentrated
- XI. Pesticides – Field
- X. Fuel Storage
- XI. Other Materials

In General, Categories I – III address concerns about storage of manure, pesticides and fertilizers, where catastrophic failure can cause major water quality impairment; Categories IV – V address concerns about land application of manure; Category VI addresses accumulation and runoff of milkhouse waste, silage leachate, and manure from barnyards and other areas where livestock congregate; Category VII addresses soil erosion and nutrient runoff from cropland; Category VIII addresses erosion of riparian areas, especially where cattle have access; Category IX addresses field application of pesticides; Category X addresses farm fuel tank siting and containment; and Category XI addresses other issues not addressed in the 10 categories above.

WAP BMP implementation strategy on individual farms is to implement all BMPs whenever practical according to the pollutant category priority in the WFP. However, experience has shown that adhering to priorities can be complicated by the unique personal and business concerns on individual farms.

Variability in this strategy occurs for the following reasons:

1. The inability of farmers to make timely necessary management changes on the farm to support the practice due to uncertainty about future farm plans (i.e., retirement, selling farm etc.) and financial hardships related to fluctuating commodity (esp. milk) prices.
2. Since 1998, the Conservation Reserve Enhancement Program (CREP) has given the program the ability to aggressively add riparian forest buffers to WFPs. This has allowed the program to address the third “stream edge barrier” in a much more effective manner. However, accommodating the federal requirement that all BMPs in the CREP contract be installed within one year has caused the program to diverge from the prioritization strategy.

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3. In some cases planned BMPs on a given farm may be in excess of their Phase II cost guideline and priorities may have to fit within budgetary constraints.
 4. Practicalities of contracting for BMP implementation sometimes require a need to adjust priorities. For example, a fencing contractor may be contracted to implement high priority streambank fencing and lower priority pasture management fencing at one time, as opposed to dividing the work into two separate contracts.
 5. An ongoing shortage of contractors to bid and implement BMPs has also impacted WAP's BMP implementation strategy from time to time.

WAP also has a policy and protocol to address urgent threats to water quality quickly, which allows BMP implementation on farms even before the Whole Farm Plan is completed. The protocol includes notifying DEP immediately to set up a site visit when these urgent threats are identified, so that correct remedial actions can be taken and DOH and EPA can also be informed. In addition, whenever significant pathogen issues are identified they have been and will continue to be given the highest priority for BMP implementation.

Basin Priorities

The program investigated the possibility of setting priorities between subbasins using a Geographic Information System (GIS) in the USDA River Basin Study; however, due to the fact that the water quality is generally excellent throughout the Catskill/Delaware watershed, ranking subbasins was difficult. In addition, WAP, since its inception, has intentionally tried to maintain a broad geographical distribution of BMP implementation to maintain program credibility and support with the agricultural community. Role model farmers were chosen to be the first to have their plans developed and implemented so that they could become strong advocates for the program and encourage other farmers to participate. This strategy has been successful and is one of the reasons the program has been able to attract participation by more than 90% of the commercial farms in the watershed.

Developing BMP Implementation Priorities for the 2002 Construction Season

As a result of the analysis of BMP implementation priorities, WAC requested in 2001 that its sub-contracting agencies develop priorities for BMP implementation for the coming year. The following considerations were used:

1. Pollutant category (from ER/PD)
2. Urgency of the project (failure of existing structure or practice)
3. Site of the farm and potential for pollution
4. CREP BMPs that have a signed contract with USDA Farm Service Agency
5. Proximity to water body
6. Completeness of preliminary design work
7. Firmness of landowner's decision on selected BMP
8. Farm stability and long-term goals (retirement, bankruptcy)
9. FAD Goals

10. Funding Availability

Planning teams developed an initial list of BMPs based upon the above criteria that they anticipate implementing this year. A project planning group consisting of WAC, DEP and other senior program staff reviewed these lists to ensure that the highest priority BMPs are implemented, and that all FAD and contractual milestones will be met.

4.1.8 Scientific Support and Evaluation

Over the past two years numerous projects were continued or initiated to evaluate the impact of the Watershed Agricultural Program on water quality, particularly phosphorous and parasite loadings.

An Evaluation of Best Management Practices Installed in the Cannonsville Reservoir Watershed

The Cannonsville Reservoir has been designated as phosphorus (P)-restricted as a result of elevated P loadings from the surrounding region, much of which is confined-dairy agriculture. Efforts at reducing P loads to the Cannonsville Reservoir have involved an on-farm approach, with BMPs being implemented on a farm-by-farm basis to address this problem. However, current interest regarding P loss from agriculture relates to the effectiveness of BMP strategies at the watershed scale. This study establishes a method of evaluating the effectiveness of BMPs by applying the Generalized Watershed Loading Function (GWLF) model to the Cannonsville Reservoir watershed. GWLF is a simple, lumped model that does not require a large dataset, and therefore is useful where rapid and/or large-scale assessments are required. It simulates daily values of stream flow, erosion, sediment yield and nutrients. However, the model is not configured to assess the effects of BMPs directly – modification of GWLF to incorporate BMPs is the primary purpose of this study.

The first step in modifying the model involves categorizing the BMPs of concern as to their mechanisms of operation and pollutant(s) affected. Also, the effectiveness of each BMP must be quantified based on literature values. Subsequently, those portions of the pollutant generation and transport system influenced by each BMP must be determined for representation in the simple structure of GWLF, and the changes necessary in model structure and/or data input to allow it to represent each particular BMP must be made. After incorporating these changes, we first present model simulations of flows and P concentrations at the watershed outlet representing current levels of BMPs installed. Additional simulations are then presented representing various post-BMP scenarios consistent with the current approach to BMP implementation on the watershed. Differences between the various approaches to BMP implementation are highlighted and discussed.

This study has integrated a literature study with a modeling approach to show the potential effects of BMPs on a watershed scale. From the large number of existing BMP studies, it is possible to estimate the expected effectiveness of several BMPs. One can appreciate the difficulty in

establishing BMP effectiveness, especially considering the large number of BMPs that are in use and the long experimentation periods that are sometimes required in order to fully assess effectiveness. In recent times, researchers have tended to turn to modeling as a means of assessing BMPs. While models simplify the natural system (Novotny and Olem, 1994), they may be the only means of extrapolating local results to the watershed scale.

DEP Mapping and Modeling Staff worked with Pennsylvania State University to use the methodology described above to estimate the potential impact of implementing all the phosphorus reducing BMPs in WFPs approved by WAC in the Cannonsville watershed. This analysis determined that the dissolved phosphorus loadings and the particulate phosphorus loading from agricultural runoff would be reduced by 23.5% and 42.8% respectively after the implementation of the BMPs. This analysis is fully described in *New York City's 2001 Watershed Protection Program Summary, Assessment and Long-term Plan*, Section 5.1.3 and Appendix F.

Town Brook Sub-basin Research

Under the leadership of the Watershed Agricultural Council, the Town Brook Sub-basin Research project has progressed considerably over the past two years, with additional funding committed by EPA through Congressional Safe Drinking Water Act appropriations. The Town Brook research project was divided into two companion approaches: initial BMP specific evaluations commenced in 1999; and broader BMP implementation and evaluation projects initiated in 2000. Both efforts were described fully in a quality assurance plan that was submitted to EPA and DEC in January 2002. The focus of the Town Brook Research Project so far has been on management of phosphorous. There are a number of different components of this research effort.

PSA effectiveness as a BMP – This task assesses the potential for a number of readily available phosphorus-sorbing amendments (PSAs; i.e., wollastonite, iron carbonate, water treatment sludge, gypsum, fly ash, anthracite, and steel processing sludge) to reduce soil and manure phosphorus (P) levels. Soil and dairy manure samples representative of Town Brook watershed (TBW) conditions were incubated with these PSAs to quantify degree of P reduction. All lab incubations, sample analyses, and analysis of results are complete. A summary report will be submitted to the Watershed Agricultural Council (WAC) in spring 2002, upon approval of the Quality Assurance Project Plan (QAPP).

Streambank fencing and riparian buffer strip effectiveness – This task assesses the potential benefits of streambank fencing in limiting direct transfer of nutrients to the stream by cattle as well as improving stream health. An observational study was conducted within the TBW in which the grazing behavior of cattle was periodically monitored to determine the frequency with which they urinate and defecate directly in the stream. Four observations have been conducted. The data have been analyzed and are presented by comparing direct P inputs to the stream from cattle to P losses expected from typical agricultural land uses. Additionally, ecological assessments of the stream segments through the pasture areas were made. Because of similar physical

settings and scientific questions, a decision was made to combine the buffer strip effectiveness concern of this task with a milkhouse waste vegetative filter strip (VFS) study (following task). Part of the purpose of this initial effort is to provide a protocol for future filter/buffer strip sampling and analysis. A summary report documenting all phases of work associated with this task will be submitted to the WAC in spring 2002, upon approval of the QAPP.

Barnyard-related BMP effectiveness – This task involves: 1) initiation of a multi-year assessment of the effectiveness of barnyard improvements, and 2) assessment of milkhouse waste VFSs in reducing P from that particular waste stream. The Town Brook Research Group (TBRG) met with the whole-farm planners in April 2000, to consider establishment of a pre-installation monitoring scheme on a site at which barnyard improvements were to be installed, likely in 2002. We were to meet with the farmer in May 2001, to present our monitoring plans. However, this meeting was delayed by a variety of circumstances. We still hope to use that particular farm for the experiment because of its physical setting, but the planning process is on hold until some problems involving the whole-farm planning process are resolved. If acceptable to the farmer, pre-BMP installation flow and water quality instrumentation will be installed in early 2002. Existing milkhouse waste filters on two farms within the TBW were sampled throughout 2000 and 2001 to establish variability and patterns of flow and P, and apparent efficacy of the filters in reducing P in the milkhouse waste stream. All sample and data analyses have been completed, and results are available that will: 1) become the basis for developing a filter/buffer strip sampling protocol by which to expand the effort and make the results more scientifically defensible, and 2) provide an initial assessment of the efficacy of conventionally installed milkhouse waste VFSs. A report describing these findings and documenting the need for continuing work will be submitted to the WAC in spring, 2002, upon approval of the QAPP.

Preliminary testing of subsurface phosphorus transport – This task assesses the potential for subsurface transport of P under TBW conditions. Nine monolith cores were taken from selected TBW sites for lab studies to evaluate subsurface (leaching) transport of P under artificial rainfall regimes. All phases of the study have been completed and initial findings indicate that, in general, large amounts of P can move under fully saturated conditions, but there is limited to no movement under unsaturated conditions. A summary report will be submitted to the WAC in spring 2002, upon approval of the QAPP.

Prepare QA Project Plan; FY 1999 and 2000 SDWA grants – A substantial amount of water quality sampling and analyses were completed related to the FY 1999 research before the Town Brook Research Team and WAC realized the QAPP document should have been prepared prior to the sampling. However, the three agencies involved in field sampling within the overall study had each provided P analyses of soil and water samples from the project's onset, and routinely conducted inter-lab comparisons and followed standard QA/QC procedures throughout. Consequently, the Research Team proposed development and approval of a single comprehensive,

partly retrospective, QAPP document to cover the two grant projects. This proposal was accepted, and the document was submitted to DEC and EPA for final approval on January 7, 2002, after two initial rounds of review.

Update of the Paired Watershed Research and Monitoring Study

Since June 1993, DEC has conducted an intensive water monitoring study on behalf of DEP and WAC to evaluate the effectiveness of the Watershed Agricultural Program at the farm scale.

The project incorporates a modified paired watershed monitoring design, with the R. Farm as the treatment watershed and a forested watershed as the control. Monitoring includes measurement of stream flow, precipitation, nutrients, organic carbon, suspended sediment, pathogens and macroinvertebrates. In addition, records of farm activities before and after BMP implementation are being kept.

The farm and control sites were monitored for two years from June 1993, through May 1995, prior to BMP implementation at the farm in 1995-1996. Monitoring resumed in late 1996 and was originally scheduled to continue for 5 years. Another two years is being added to the evaluation period for a total of seven years. Currently, the project is in the fifth year of post-implementation monitoring.

The Paired Watershed Research and Monitoring Study has demonstrated the Program's ability to reduce pollutant loadings and increase stream health at the farm scale. Additional BMPs are being implemented at the R Farm under the Conservation Reserve Enhancement Program, which are anticipated to cause even greater reductions in dissolved phosphorous loadings from the farm.

*Evaluation of the Effectiveness of Solar Calf Housing in Reducing the Off-Farm Transport of *Cryptosporidium parvum**

Although solar calf houses form an integral part in many farm plans to reduce the prevalence of waterborne pathogens, questions have been raised about their effectiveness. In response, WAC entered into a contract with Cornell University researchers in early 2001 to conduct a study to evaluate the effectiveness of solar calf housing in reducing the off-farm transport of *cryptosporidium parvum* (*C. parvum*). Three aspects of this question are being investigated: the degree of infection of calves on farms that have implemented solar calf housing; the survivability of *C. parvum* on selected farmsteads; the transport of *C. parvum* off selected farmsteads. Comparisons will be made between farms with and without solar calf houses.

Early on, the study was delayed because of bio-security concerns resulting from the outbreak of Hoof and Mouth Disease in Europe. By the end of the summer 2001, Cornell developed a protocol for on-farm research, and animal sampling was allowed to commence. This project is now ongoing, and it is anticipated that initial conclusions will be reported by the end of 2002.

4.2 Watershed Forestry Program

The Watershed Forestry Program (WFP) is administered through a contract between DEP and WAC using core program funding from New York City and matching project grants from the USDA Forest Service (USFS). Specific programs and projects are implemented by WAC in partnership with SUNY College of Environmental Science and Forestry (ESF), Catskill Forest Association (CFA), New York Logger Training, Inc. (NYLT), and other agencies and organizations. The WFP continues to accomplish significant progress in the following major program areas.

4.2.1 Forest Management Planning

The WFP provides cost-sharing to private landowners to develop 10-year forest management plans written by qualified foresters trained by WAC. This year, the forestry plan specifications were revised to include an improved focus on water quality BMP recommendations as well as the USFS standards for delineating and managing forested riparian areas. WAC sponsored three training workshops for the 52 previously approved foresters, of which 37 foresters participated and remain qualified. To encourage foresters to identify riparian areas with specific forest management recommendations, the WFP developed a pilot riparian delineation cost-sharing program, which is currently underway for ten forestry plans approved this year. The WFP also developed a cost-sharing program this year to upgrade non-WAC forestry plans at least five years old to watershed specifications. In support of these new initiatives and to promote forest management planning in general, this year WAC published its first informational newsletter for watershed landowners and mailed more than 20,000 copies to forest landowners in both the Catskill/Delaware and Croton watersheds. This newsletter proved to be very successful in generating requests for information and cost-sharing applications. The WFP will continue expanding landowner information dissemination efforts next year while further evaluating and improving plan implementation opportunities.

Table 4.5. Forest Management Planning accomplishments.

<i>Accomplishments - Forest Management Planning</i>	<i>2001</i>	<i>To Date</i>
Number of landowner applications approved for cost-sharing*	111	277
Number of forest management plans completed	86	184
Number of completed plans that delineate riparian areas	6	6
Riparian acreage delineated in a completed management plan	60	60
Forested acreage included under a completed management plan	9,586	28,532
Total acreage included under a completed management plan	13,229	36,428

* Includes three applications approved for plan updates.

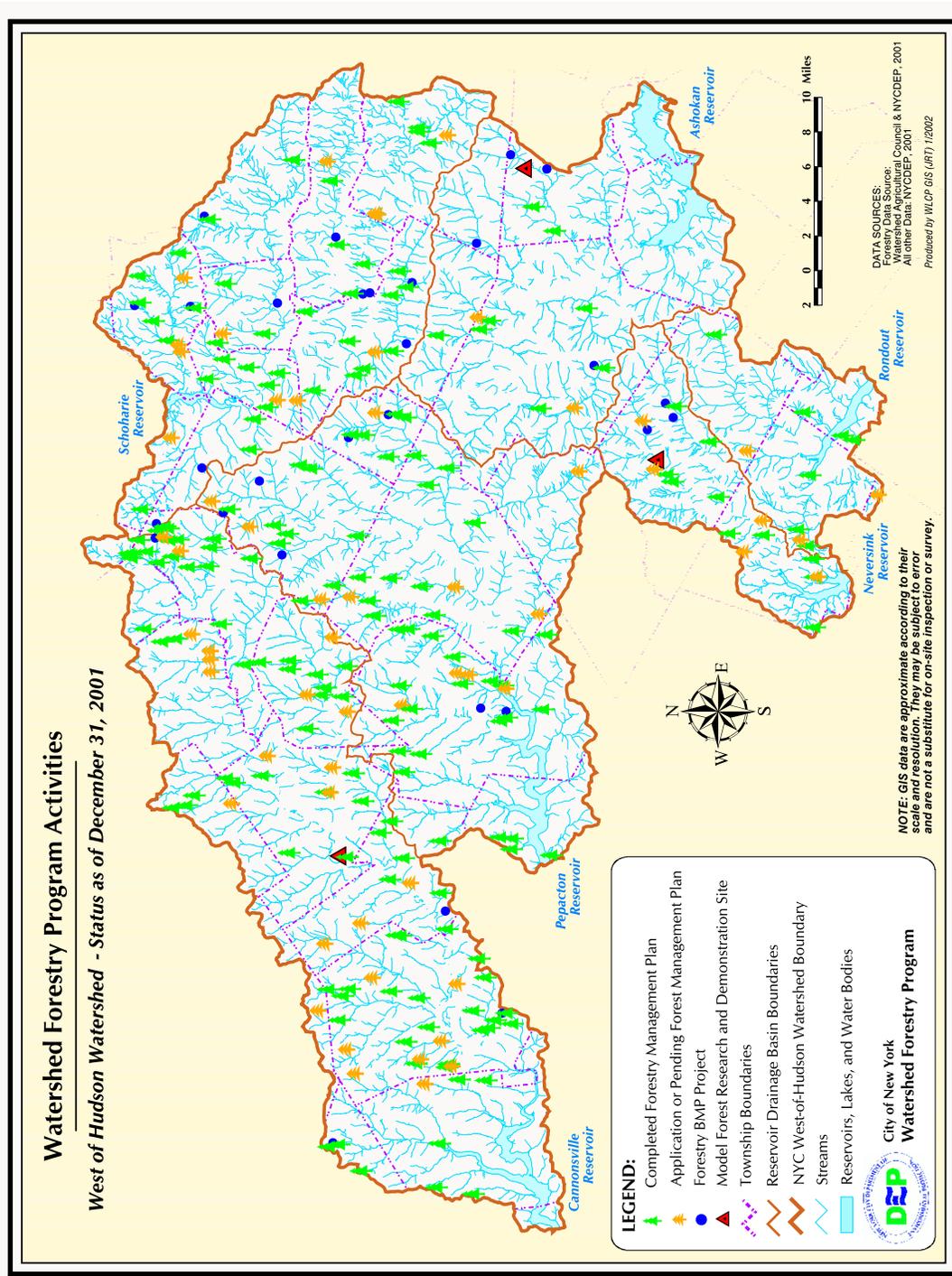


Figure 4.1. Watershed Forestry Program activities, West of Hudson Watershed, status as of December 31, 2001.

4.2.2 BMP Implementation

The WFP offers cost-sharing incentives and technical assistance to loggers and landowners for implementing certain forestry BMPs. This year, in addition to already cost-sharing the construction of short-span skidder bridges and the rental of long-span haul bridges by watershed

loggers, the WFP expanded its existing portable bridge loan program to include four short-span skidder bridges and one long-span (30') haul bridge. The WFP also expanded its existing BMP free sample program to include the following erosion control technologies: geotextile road fabric, open-topped pipe culverts, silt fencing, rubber-topped water deflectors, traditional pipe culverts, rubber tire land bridge mats, and organic (non-petroleum based) bar and chain oil. Also this year, the WFP evaluated and expanded its cost-sharing program for the proper design and layout of new timber harvest roads, in addition to developing a pilot cost-sharing program for the remediation of 15 logging roads having existing erosion and sedimentation problems. Finally, this year WAC purchased an additional 1,000 copies of the "New York State Forestry BMPs for Water Quality" field guide for continued distribution to loggers, landowners and foresters during workshops, site visits and outreach events. Next year, the WFP will evaluate and expand the road remediation program while increasing dissemination of new BMP samples to watershed loggers and continuing implementation of forest management plan recommendations.

Table 4.6. BMP implementation accomplishments

<i>Accomplishments – BMP Implementation</i>	<i>2001</i>	<i>To Date</i>
Number of portable bridges constructed or rented by watershed loggers and cost-shared by WAC*	3	12
Number of watershed logging sites where a portable bridge owned by WAC was loaned and installed*	10	14
Number of timber harvest road BMP projects completed	11	17
Miles of timber harvest roads properly designed and installed	24	35
Number of forest road remediation pilot projects completed	14	14
Miles of forest roads remediated and properly closed	23	23
Number of water bars installed on all road BMP projects	939	1,296
Number of broad-based dips installed on all road BMP projects	94	115
Number of culverts installed on all road BMP projects	31	34
Acres of harvest site stabilized on all road BMP projects	11	19

** According to WAC surveys and logger feedback, portable bridges have been used and/or installed on more than 50 individual logging sites throughout the watershed.*

4.2.3 Logger Training

The WFP offers cost-sharing to watershed loggers for voluntarily participating in the State-wide Trained Logger Certification Program administered by NYLT, as well as other continuing education or water quality BMP workshops sponsored by WAC. To promote logger training and increase BMP implementation, the WFP continues to support and participate in the Deposit and Andes Lumberjack Festivals and the New York State Woodsmen Field Days. WAC maintains a list of 149 "watershed qualified" timber harvesters representing more than 100 individual loggers and/or logging companies working in the watershed.

Table 4.7. Logger training accomplishments.

<i>Accomplishments – Logger Training</i>	<i>2001</i>	<i>To Date</i>
Number of training workshops sponsored for watershed loggers*	24	108
Total number of loggers and foresters attending workshops	222	987

** Includes NYLT workshops sponsored directly by WAC, as well as other continuing education or NYLT workshops sponsored throughout the watershed region by CFA and SUNY-ESF.*

4.2.4 Research and Demonstration

Under the leadership of SUNY-ESF, the WFP coordinates four model forests throughout the watershed that integrate forestry and water quality research, BMP and silvicultural demonstrations, public outreach and interpretive education. This year, the Lennox Memorial Forest was fully completed when more than 20 interpretive signs were installed along the two-mile demonstration road. At both the Ninham Mountain and Frost Valley Model Forests, this year SUNY-ESF completed the pre-harvest forest inventory by installing another 194 continuous forest inventory (CFI) and permanent forest health monitoring (FHM) plots, in addition to installing a USGS research weir and gathering bi-weekly stream samples at both sites. SUNY-ESF also installed another 44 CFI plots at the Mink Hollow Model Forest, where a USGS stream monitoring gauge gathers baseline water quality data from the undisturbed forest. Three of the four model forests are now actively supporting long-term water quality research. Next year, the WFP is planning to construct the demonstration road and possibly begin silvicultural treatments at Frost Valley, complete the pre-harvest inventory at Mink Hollow, and continue designing the demonstration road and silvicultural treatments at Ninham Mountain.

Table 4.8. Model Forest summary.

<i>Summary - Model Forests</i>	<i>Acreage*</i>	<i>CFI Plots</i>	<i>FHM Plots</i>	<i>Status</i>
Lennox, Delaware County	70	167	14	complete
Frost Valley, Ulster County	240	570	13	underway
Ninham Mtn., Putnam County	150	272	0	underway
Mink Hollow, Ulster County	250	202	0	planned

** Includes only the area of each model forest that is planned for silvicultural treatment and active forestry demonstration. Total acreage for each property is greater.*

4.2.5 Education and Outreach

The WFP conducts, sponsors and supports a variety of educational programs and outreach events targeted primarily to forest landowners, water consumers and the environmental community. This year, three major landowner workshops and a follow-up site visit were conducted for more than 200 upstate/downstate residents owning forestland in the Catskill/Delaware and Croton

watersheds. In addition, a one-day forest science symposium was sponsored for more than 125 professional foresters, watershed land stewards and natural resource managers. The third annual Watershed Forestry Teacher's Institute was held in July while the "Green Connections" youth education pilot program was completed, independently evaluated by two New York University graduate students, and determined to be a successful educational partnership involving four upstate/downstate schools. The WFP is expanding the scope of its education program, including both "Green Connections" and the Teacher's Institute, to reach a broader audience of upstate/downstate forest landowners and current/future watershed stewards. Finally, for the second consecutive year, WAC and DEP participated in the annual two-day conference and field meeting of the Northeast Association of Watershed Forest Managers, which featured tours of the WFP's timber harvest road BMP projects in the Croton watershed and also an exchange of program ideas and information with Connecticut's BHC Company watershed.

Table 4.9. Forest Education Program accomplishments.

<i>Accomplishments – Forestry Education Program</i>	<i>2001</i>	<i>To Date</i>
Number of forestry educational programs conducted and/or sponsored directly by the WFP*	5	17
Total number of participants in forestry educational programs*	330+	1,000+
Number of upstate/downstate teachers participating in the annual Watershed Forestry Teacher's Institute	16	43
Number of upstate/downstate students participating in the "Green Connections" youth education program	115	115

** Includes landowner workshops, forestry site visits and watershed bus tours organized and/or paid for using DEP program funds or USFS matching grants. Excludes forestry outreach events, logger training workshops, staff presentations and speaking engagements.*

4.2.6 Economic Development

This year, the WFP developed an Economic Action Program to disburse \$1.2 million in USFS "Rural Development Through Forestry" matching funds to Catskill-based wood products businesses via competitive grants. The purpose of this program is to provide an economic basis for maintaining the privately owned forested landscape of the watersheds. WAC hired a program administrator who meets quarterly with an expert grant committee to review applications and award competitive grants for projects such as developing and marketing a new furniture line, supporting an apprenticeship program, purchasing new woodworking equipment, upgrading computer technology, preparing long-term business plans, researching new kiln-drying methods, and expanding or improving manufacturing facilities.

Table 4.10. Economic development accomplishments.

<i>Accomplishments – Economic Development</i>	<i>2001</i>	<i>To Date</i>
Number of grant applications reviewed by WAC	47	47
Number of projects awarded a USFS grant	22	22
Total amount of USFS grant funding awarded for projects	\$965,055	\$965,055

4.2.7 Riparian Forest Buffers

This year, WAC completed its riparian buffer pilot project funded by the USFS and implemented in conjunction with the Conservation Reserve Enhancement Program (CREP). DEC helped WAC develop a preliminary GIS buffer assessment tool for identifying priority stream corridors in the Catskill/Delaware watershed for riparian buffer plantings, and this tool was presented to the Watershed Agricultural Program CREP Team in April. The WFP also developed a tree nursery pilot project this year to encourage local production of containerized buffer stock by three nurseries in support of fall CREP planting efforts. These nurseries produced 6,550 seedlings representing 20 different native species that were used to plant 24.4 acres of riparian forest buffers on eight CREP projects this fall. WAC and DEP are currently evaluating options for continuing the riparian forest buffer program so that it better supports ongoing streamside protection efforts.

Table 4.11. Riparian forest buffer accomplishments.

<i>Accomplishments – Riparian Forest Buffers</i>	<i>2001</i>	<i>To Date</i>
Number of riparian planting projects completed*	17	19
Number of acres planted with riparian buffer stock*	39.5	47
Total riparian buffer acreage established by planting projects*	81.8	91.8

** Includes six riparian buffer demonstration sites established in partnership with various local outdoor education centers and ten projects implemented in conjunction with CREP.*

4.3 Wastewater Treatment Plant Upgrades

4.3.1 Upgrades of Non-City-owned Wastewater Treatment Plants

As part of the MOA, the City agreed to fund the upgrades of all non-City-owned wastewater treatment plants (WWTPs) in the watershed. (As reported in previous annual reports, upgrades of City-owned WWTPs, which account for more than a third of WWTP flow in Catskill/Delaware watershed, proceeded on a separate track and were completed in 1999.) The task of coordinating these complex projects with the 34 different owners in the Catskill/Delaware watershed is enormous. Many of the WWTP owners are restaurateurs, hoteliers, camp operators, school administrators and managers of recreational facilities; not professional WWTP operators and construction specialists. DEP has proceeded diligently with this vast undertaking and provided step-by-step guidance on a host of engineering, contracting and regulatory issues.

Currently and as in previous years of the Program, the New York State Environmental Facilities Corporation (EFC) works with DEP to assist in the administration of these programs. DEP and EFC have continued to provide technical and program guidance to each of the owners and their engineers to assist them through the process of upgrading each unique facility.

An additional \$185 million was added to the Regulatory Upgrade Program in 2001. This together with a \$7.8 million Change Order enacted in 2000, brings the total current Regulatory Upgrade funding to \$272 million. Also in 2001, an additional \$2.47 million of SPDES funds were allocated to various West of Hudson (WOH) WWTPs; \$300,000 of this was from the Inflow and Infiltration (I & I) portion of the SPDES Program.

During 2001, important Program milestones continued to be reached as construction activities commenced on the upgrades for seven WWTPs representing 83.5% of the total WOH SPDES flow. Draft Operation and Maintenance (O&M) Agreements were also developed during 2001 and are expected to be finalized during 2002.

The upgrade of non-City-owned WWTPs is divided into two distinct programs: Regulatory Upgrades and SPDES Upgrades (West of Hudson only). Although two separate programs, the Upgrade Agreement between EFC and the WWTP owner encompasses both programs.

DEP has entered into a contract with EFC that identifies a wide range of tasks to be performed by both DEP and EFC to ensure comprehensive management of the overall WWTP Upgrade Program. DEP's and EFC's tasks have included, but are not limited to: program start-up, establishing contracts with each WWTP owner, providing technical assistance to each WWTP owner and their consulting engineer, change order administration, construction oversight, funds management (including invoice review and reconciliation) and extensive project management.

The Regulatory Upgrade Program is designed to assist the subject WWTPs in meeting the requirements of the WR&R. Treatment technologies required by the Regulatory Upgrade Program include, but are not limited to: phosphorus removal, sand filtration with redundancy, back up power, back up disinfection, tertiary treatment via microfiltration (or DEP-approved equivalent), effluent flow metering and alarm telemetering.

The SPDES Upgrade Program is designed to assist each WWTP in meeting the conditions of its current SPDES permit. Equipment that is unreliable or reaching the end of its useful life is eligible for replacement under this program. Additionally, SPDES improvements conducted at a facility after November 2, 1995 are also eligible for reimbursement under this program.

There are currently 34 West of Hudson WWTPs in the Regulatory and SPDES Upgrade Programs. During 2001, 10 new WWTPs were identified and are scheduled to sign Upgrade Agreements in 2002.

4.3.2 2001 Accomplishments

Construction activities began on the upgrades for seven WWTPs representing 83.5% of the total WOH SPDES flow. Three WWTPs (75% of flow) began construction by August 2001. These WWTPs are the municipal plants of the Villages of Delhi, Stamford and Walton. Construction began on the SPDES Upgrade at the Village of Hobart in September 2001. By December of 2001 bonus incentives were offered to the contractors selected to do the construction at Hunter Highlands, Mountainside Dairy and the Village of Hobart. These contractors, along with the contractor for Allen Residential Center, began preparations for construction as the year 2001 came to an end. These seven WWTPs are expected to be functionally complete by June 30, 2002.

Of the remaining 16.5% of flow, nearly 6% will be addressed by incorporation into the New Infrastructure Program (NIP), while the remainder (10.7% of flow) is in various stages of design.

Draft O&M Agreements were developed during 2001, and are expected to be finalized during 2002. Among other things, these draft agreements detail the method that the WWTP owners and DEP will use to calculate the O&M costs that DEP will pay for under the terms of the MOA. Payment schedules and the duration of the agreement are included.

Through EFC, DEP contracted with four consulting engineering firms to assist in the review and approval of upgrade design plans. These consulting firms also performed other appropriate tasks as needed by the Upgrade Program.

During 2001, DEP addressed the reality that certain privately-owned WWTPs, intended to be connected to municipal WWTPs being constructed under the NIP, will not be able to connect to such municipal facilities prior to May 2001. Through EFC, DEP hired a consultant engineer to identify and recommend interim treatment measures that could be used to provide a higher level of treatment until the private WWTPs are taken off line. The results of the study determined that the addition of UV Disinfection would be the most effective and economical means of providing enhanced treatment. Subsequently, DEP scheduled a meeting with representatives of the EPA, DEC and DOH to discuss the study and proposed schedule for the implementation of Interim UV Disinfection for the private WWTPs that will be tied into NIP. Based on the results of this meeting, DEP will direct the WWTP owners and their consulting engineers to proceed with design and installation of the equipment per the study report with an expected target completion milestone date of June 30, 2003.

During 2001, DEP continued its implementation of the Fast Track Action Plan. The Plan encouraged increased communication with owners and engineers in order to provide assistance and clarify DEP's expectations. During 2001, DEP was very proactive in reaching out to WWTP owners, their engineers and attorneys. Significant progress continued to be made by employing this approach.

In 2001, as an addition to the Fast Track Action Plan, DEP developed a model pre-purchase specification, which was developed in order to shorten the time to complete construction. This specification was issued by DEP as *Information Bulletin No. 9*. This process was used by the Villages of Walton, Delhi, Stamford and Hobart and has significantly shortened the construction schedule. Other information bulletins issued by DEP in 2001 were: *Information Bulletin 11 – Bidding Process Guidelines* to provide assistance with the bidding and procurement process and with the preparation of construction contract documents; and *Information Bulletin 12 – Procedures for Approval of Engineering Personnel*. These information bulletins were mailed to all WWTP owners, engineers and attorneys.

Based upon a re-survey of the Catskill/Delaware watershed area, 10 new WWTPs were identified. They are: Batavia Kill Recreational Area, Bread Alone, Cortina Valley Ski, KJ Western Playground, Latvian American Disabled Veterans, Palace Hotel, Sportsman's Diner, White Birches Campsite, Windham Mountain Village, and Windham Ridge Club. In 2001, initial outreach meetings describing the Upgrade Program took place with the owners of Bataviakill Recreational Area and Windham Ridge Club. Additional meetings with the remaining owners will occur no later than March 31, 2002. These new WWTPs are expected to be upgraded by March 31, 2005. (Two of these facilities, Palace Hotel and Windham Mountain Village are within the service areas for New Infrastructure Program WWTPs and may be removed from the Upgrade Program in the future.)

4.3.3 Upgrades of City-owned Wastewater Treatment Plants

As reported in previous annual reports, New York City owns and operates six wastewater treatment facilities in the Catskill/Delaware watershed. The six facilities include five WWTPs – Tannersville, Grand Gorge, Margaretville, Pine Hill and Grahamsville – and one community septic system, in Chichester.

Construction to upgrade all facilities began in 1995 and 1996. The work required at the Chichester facility was relatively simple and was completed in June 1996. Work on the other five facilities was completed in 1997, 1998 and 1999, all in accordance with mandated schedules.

Since the upgrade of these facilities, DEP sampling has shown a clear improvement in effluent quality, demonstrating a high level of treatment of an expanded and more stringent list of SPDES parameters. Significant improvement in BOD removal, total suspended solids, phosphorus levels and fecal coliform levels have been achieved at all facilities. DEP is pleased with the improvement in effluent quality from City-owned facilities and optimistic that similar effluent quality will be achieved when upgrades of the non-City-owned WWTPs are completed.

4.4 Implementation of Wetlands Protection Program

In 1996, DEP developed and began implementation of an interdisciplinary Wetlands Protection Strategy consisting of regulatory and non-regulatory elements designed to protect and preserve the water quality function of wetlands in the watershed. In September 2001, DEP completed an enhanced Wetland Protection Strategy that, like the previous strategy, includes regulatory and non-regulatory components. However, the September 2001 strategy includes important additions to DEP's approach to protecting wetlands in the watershed, and their water quality protection and improvement functions.

The enhanced wetlands protection strategy includes, among other things, provisions to review land use and development proposals before federal, State and municipal agencies that regulate wetlands. Further, the strategy includes administration of the WR&R, the review of federal, State and municipal legislation that may affect wetlands in the watershed, and inter-agency coordination of enforcement, science, research and mapping programs of value to DEP in implementing the regulatory component of the strategy. Data collected in the non-regulatory programs will assist DEP in assessing the potential impacts on the water quality functions of wetlands anticipated from proposed land use and development projects and by helping to substantiate conclusions DEP draws in those assessments.

4.4.1 Regulatory Programs

Project Reviews

A key component of DEP's regulatory wetland protection program is the review of applications to conduct activities governed by federal, State and municipal regulations, as well as those regulated by the WR&R. Since the jurisdictions of these regulatory authorities vary, reviewing applications before all of the noted agencies is necessary to help ensure that all activities that threaten the water quality functions of wetlands in the watershed are carefully reviewed by DEP. Reviewing proposals before federal, State, City and municipal wetland agencies allows DEP to assess a proposal's compliance with applicable wetland regulations, and its potential impact on federal, State and municipally designated wetlands, and to identify measures to avoid, minimize and mitigate impacts on the water quality function of wetlands.

In 2001, DEP continued its active role reviewing wetland permit applications pending before the United States Army Corps of Engineers (ACOE), DEC, and the watershed towns and villages in the East of Hudson District that have adopted wetland legislation.

To better coordinate the review of wetland permit application reviews, enforcement activities, and other regulatory components of the program, a unit of DEP's Engineering Section Valhalla office has assumed responsibility for overseeing the program. This approach allows DEP

staff that hold professional certifications in wetlands science and have extensive wetlands management experience to implement and track the regulatory program in a more efficient and effective manner.

To assist DEP in reviewing federal, State and municipal wetland permit applications, DEP completed a regulatory guide in 2001 that includes a compilation of ACOE, DEC, and the municipal regulations in effect in the West Branch, Boyds Corner, Kensico, Cross River, and Croton Falls Reservoir watersheds. The guide, which also includes an extensive database of wetland literature and technical memoranda exploring a variety of wetland issues, assists DEP in evaluating land use proposals affecting the water quality functions of wetlands.

United States Army Corps of Engineers Applications – In the early 1990s, the ACOE began forwarding certain Pre-construction Notifications (PCNs), Individual Permit Applications, and other notices for projects in the watershed to DEP for review and comment. DEP reviews PCNs (that notify the ACOE that a project sponsor believes the project is authorized by a Nationwide Permit and that an Individual Permit will not be sought before the project begins) to confirm that the proposed activity complies with the recently amended federal wetland regulations and that the activity will not have an adverse impact on federally designated wetlands or water quality in the watershed. DEP's strategy also includes the review Individual Permit Applications to assess a project's compliance with the ACOE's Regulations and EPA's guidance for the review of Individual Permit applications.

If, based on review of a PCN, DEP concludes that a project will adversely impact a wetland, or water quality in the watershed, DEP will request that the ACOE require an Individual Permit Application to allow for thorough review of the proposal. In those instances, DEP will encourage the ACOE to require an alternative project design, or location, that will avoid adverse impacts. If this is not entirely achievable, DEP will pursue opportunities with the ACOE to minimize impacts, also through modification of the project design and, or, its location. Finally, if opportunities to avoid or minimize impacts do not exist, DEP assesses mitigation options that would compensate for any wetland impacts that result from the project. In these cases, DEP applies federal mitigation standards to assess the location and design of the proposed mitigation, as well as alternatives that might better replicate any water quality function(s) of the impacted wetland. During the reporting period DEP staff continued to review proposals under consideration by the ACOE.

To maximize the effectiveness of the federal application review program, in 2001 DEP formally requested that the ACOE forward all PCNs and Individual Permit Applications for projects in the City's watershed to DEP's regulatory wetland unit for review. The ACOE granted DEP's request. DEP has incorporated a policy of requesting the ACOE require an Individual Permit application, rather than a PCN, for projects in the watershed that may have a significant adverse impact on water quality, into its project review protocol.

New York State Department of Environmental Conservation Wetland Permit Applications

– Through a Memorandum of Understanding (MOU) with DEC, DEC forwards “Major” stream disturbance permit applications, meeting certain criteria, to DEP for review. In 2001, DEC continued to forward them to DEP, which reviewed these applications to ensure compliance with New York’s Protection of Waters Regulations, and that the proposal does not threaten water quality. During the past year, DEP issued comments to DEC Region 3 and 4 concerning a number of proposals with potential wetland impacts. The comments identified instances of noncompliance, potential impacts on water quality, and measures that could be incorporated into a proposal to avoid, minimize and mitigate the water quality impacts anticipated from the activity.

During the reporting period DEP also reviewed certain DEC Freshwater Wetland Permit Applications subject to the State’s Wetlands Regulations. Although not formalized in an MOU, DEP’s review of freshwater wetland permit application is similar to the review of Protection of Waters Permit Applications to assess the proposal’s impact on wetlands and identify measures to mitigate those impacts. Once DEP becomes aware of permit application through DEC’s Environmental Notice Bulletin, discussions with DEC, or other means, DEP reviews the permit applications. Comments issued by DEP identify omissions in the applications, inconsistencies between a proposal and DEC’s Freshwater Wetland Regulations, and measures that should be incorporated into a proposal, or included as a condition of approval, to protect a wetland, its water quality function, or water quality. DEC and DEP meet bi annually to discuss, among other things, the stream disturbance and wetland application review process.

In 2001, DEP and DEC met twice to discuss, among other things, wetland permitting and enforcement activity in the watershed and to exchange information to assist each agency in administering their wetland programs. Following the September 2001 meeting, DEP provided DEC with a “One-Stop-Shopping” matrix that identifies a broad range of permits required in the watershed, under what circumstances they are required, and the agency(ies) from which the regulatory approvals must be secured. DEP has also formalized its review of DEC wetland applications by formally requesting that DEC’s two regions in the watershed forward wetland applications to DEP’s regulatory wetland unit for review.

In response to DEP’s request, DEC will forward both the stream disturbance and, “Major” freshwater wetland permit applications, to DEP’s Valhalla office. Upon receipt of DEC wetland permit applications at DEP’s regulatory wetlands review unit, DEP enters the pertinent information into its recently created spatial database, and conducts a technical team review of the review of the proposal. When deemed appropriate, DEP forwards comments concerning the proposal to DEC for its consideration.

In addition to DEP’s reviewing applications forwarded by DEC, the two agencies maintain an ongoing dialogue concerning federal, State and City wetland programs.

State Wetland Mapping

DEP is authorized under the WR&R to regulate certain activities that are within limiting distances, or otherwise affect, wetlands that have been mapped by the State. During 2001, DEC concluded the fieldwork, and initiated the administrative process, to add an additional fifteen wetlands identified by DEP to the State wetland maps. Once mapped, these wetlands will be afforded the additional level of protection that the WR&R provide.

In 2001, DEC also initiated a re-mapping program in the East of Hudson (EOH) watershed that involves evaluating another 55 potential wetlands. As part of this process, DEC agreed to map Wetlands of Unusual Local Importance (ULIs), in this case wetlands that are contiguous to the City's reservoirs EOH. DEP will delineate these ULIs in 2002 to assist in the mapping process.

401 Water Quality Certifications

DEP met with DEC on several occasions in 2001 to discuss options to further protect the water quality function of wetlands and water quality in the watershed. As a result of those meetings, DEC agreed to forward 401 Water Quality Certification requests for projects in the watershed to DEP for review. In order for certain projects to proceed, DEC must issue a 401 Water Quality Certification that indicates the State's water quality standards will not be contravened by the proposal action. The 401 certifications provide DEP, and the public, with an opportunity to evaluate a proposal's potential impact on the quality of the City's drinking water supply, and constitutes an important enhancement of DEP's Wetlands Protection Strategy.

To expedite DEP's review of applications for certifications, DEP developed a standard review form in 2001 that is founded in the State's criteria for issuance of the 401 certifications. The form will allow DEP to gauge the project's compliance with the State standards for issuance of the certification. Depending on the scope of the project for which the certification is sought, the request will be reviewed by one or more members of a Wetlands Review Panel created by DEP in 2001.

State Environmental Quality Review Act (SEQRA)

In its role as an "Involved Agency," as defined by SEQRA, DEP seeks become involved in State and municipal reviews of projects that may impact wetlands at the earliest stages of a projects possible development. During SEQRA scoping stage DEP exercises its latitude to address a broad range potential wetlands impacts that must be addressed if a positive declaration is issued and an Environmental Impact Statement is to be prepared. If no formal scoping is conducted, or no EIS prepared, DEP identifies potential impacts on the water quality functions of wetlands, that a project may have, and project alternatives that would avoid, minimize, or mitigate the potential impacts in response to a SEQRA Environmental Assessment Form.

Municipal Wetland Permit Applications

In addition to its role in SEQRA, DEP reviews proposals before municipal regulatory bodies, in the EOH watershed, concentrating on a proposal's compliance with the municipal wetland regulations and the threat that a proposal poses to a wetland, its water quality function and water quality.

During the reporting period, DEP continued its dialogue with the five municipal agencies in the Catskill/Delaware watershed EOH (no municipalities West of Hudson have adopted wetland protection legislation) that administer wetlands regulations. Citing the importance of protecting the water quality functions of wetlands and water quality, DEP may advocate denial of a wetlands permit application under consideration at the municipal level, or modification of the project to avoid, minimize or mitigate the impacts.

New York City Watershed Rules and Regulations

With the adoption of the WR&R in 1997, came another level of wetland protection through project review. DEP now reviews applications to conduct regulated activities to ensure that the prohibitions on certain activities within limiting distances to DEC-mapped wetlands established in the WR&R are complied with, and that other activities that may adversely impact wetlands, such as discharges of stormwater and wastewater from new developments, are conducted in compliance with the WR&R.

The WR&R provide an important level of wetland protection by prohibiting certain activities within limiting distances to wetlands that have been mapped by DEC. The regulations also require stormwater pollution prevention plans for certain projects to prevent the discharge of untreated stormwater from new developments into watercourses and DEC mapped wetlands. See the WR&R section of this report for more information on DEP's project review activities during 2001.

DEP Wetland Tracking System

To better understand the distribution and magnitude of wetland impacts resulting from various land use and development projects, DEP enhanced its permit tracking system in 2001, by creating a spatial database that allows DEP to monitor extensive wetland permit application, and violation activity. Originally developed as a database that would record information such as the type of wetland impacted by the proposed activity and the area of wetland impacted, DEP's enhanced system significantly broadens its data management capabilities. This spatial database now allows staff to quickly view a wetland in a GIS format and determine whether it is likely to provide an important water quality function, if it has been impacted in the past, and its position in the watershed. These data will assist DEP in developing comments to regulating agencies, and in determining the extent to which DEP will involve itself in the review of a permit application or regulatory violation.

The enhanced spatial database also enables DEP to track wetland disturbance and loss, and manage other information associated with wetlands related activities in the watershed. Input data includes a description of a proposed activity, the project or site location(s) and the level of permitting required. Fields in the database also include: the agency(ies) with regulatory jurisdiction (ACOE, State, or municipally designated wetlands); wetland permits required (ACOE, State, municipal); project acreages (total acres of the project); total acres of site disturbance; total acres of on-site wetlands and on-site wetland acreage disturbed, and any regulated buffer area disturbed.

DEP Legislative Reviews

The extent to which wetlands in the watershed are protected is, in large part, a function of the wetland regulations, and other land use regulations, in effect and the manner in which they are administered and enforced. DEP's wetland strategy includes the review of new regulations, or amendments to existing regulations, that may influence the level of protection afforded to wetlands in the watershed.

During 2001, DEP continued its legislative review function by tracking and evaluating changes in federal, State, and municipal legislation that may affect wetland protection in the City's watershed. In 2001, DEP reviewed changes to the ACOE Nationwide Permitting Program, New York State's proposed General Permit for Stormwater Discharges from Construction Activities, municipal Master Plan and Zoning Regulation amendments, and EPA's Phase II Stormwater Regulations.

Regulatory Enforcement

During the reporting period, DEP continued its active role in the detection and restoration of wetlands subjected to unauthorized disturbances. In addition to enforcing the provisions of the WR&R relating to wetlands, which involves responding to numerous violation referrals in 2001, the regulatory component of the wetlands strategy includes providing technical assistance to other regulatory agencies with common wetland protection goals.

In 2001, DEP continued to assist the Watershed Inspector General in resolving a violation of the State's Wetlands Regulations committed in the Great Swamp in Patterson, Putnam County. At the State's request, DEP reviewed a Wetlands Restoration Plan proposed by the property owners as mitigation for the offense. DEP conveyed its comments to DEC which approved a modified plan. DEP also coordinated enforcement activities involving the filling of a wetland in the Town of Southeast with EPA's wetland section. DEP conducted on-site inspections of the filled wetlands and forwarded photographs and other data to EPA, which is still pursuing the matter.

In 2001, DEC provided DEP with the State's standard wetland violation referral form, with which DEP will notify DEC of potential violations of the State wetland regulations. DEP distributed the form to its field staff with a protocol for documenting and reporting suspected wet-

land violations to DEP's regulatory wetland management unit. DEP will pursue similar arrangements with the ACOE, and with the municipalities that occupy portions of the Catskill/Delaware watershed East of Hudson.

Beginning in December 2001, DEP began cataloguing wetland violations in its spatial database, which has fields that identifies the property owner, the party committing the offense, the municipality in which a violation occurs and the UTM coordinates of the site, recommended action(s), and final disposition. Violation coordination remains a topic of discussion during semi-annual watershed coordination meetings between DEC and DEP.

4.4.2 Wetland Mapping and Research

DEP continued to implement and expand its Wetland Mapping and Research Programs. Plans were begun to update the west of Hudson National Wetlands Inventory Maps (NWI) and to continue analysis of East of Hudson wetlands trends. Progress was also made in expanding the wetland monitoring and functional assessment programs to the entire watershed. These wetland mapping and research projects are designed to support both the regulatory and non-regulatory aspects of the Wetlands Protection Strategy.

National Wetland Inventory (NWI) Map Update

An agreement with the United States Fish and Wildlife Service (USFWS) was drafted to update the NWI GIS coverages for the west of Hudson watersheds. The project will revise the original NWI coverages, which were completed in 1995 and were based on mid-1980s aerial photography. The updated coverages will be based on new, color infrared (CIR) photography and will reflect recent pond construction as well as wetland changes that have occurred since the mid-1980s.

Wetland Trends Analysis

A plan to continue the mapping and analysis of EOH wetland trends was developed. The project will rely on the new aerial CIR photography that will be acquired as part of the NWI map update. The 1999 EOH wetland trends mapping project documented wetland trends for a 26-year period (1968-1984, 1984-1994). The proposed work would extend the analysis from 1994 to 2002.

Wetland Functional Assessment

DEP's Functional Assessment Program combines the USFWS Watershed-based Wetland Characterization and Preliminary Assessment of Wetland Functions (W-PAWF) with a monitoring program in order determine reference characteristics and water quality functions of watershed wetlands. For the Wetland Characterization, the USFWS assigns hydrogeomorphic (HGM) descriptors to each NWI wetland to support watershed-scale preliminary assessment of wetland

functions. To date, a pilot scale W-PAWF and reference wetlands monitoring program have been implemented in the West Branch and Boyds Corner basins. In 2001, DEP advanced in its efforts to expand the wetland functional assessment program to the entire watershed.

An intergovernmental agreement with the USFWS to conduct a W-PAWF for the Cannonsville and Neversink Reservoir Basins was initiated in 2000. In late 2000, DEP received and field-checked draft wetland characterization maps for these basins. In 2001, DEP provided the USFWS with comments on the hydrogeomorphic classifications of nearly 300 individual wetlands and with general recommendations for improving classification methodology for Catskill wetland types. During the 2001 growing season, DEP conducted fieldwork with USFWS staff to further evaluate the draft wetland characterizations and DEP's recommendations. Based on this work, the USFWS will finalize the draft maps and complete the preliminary functional assessments in 2002.

DEP completed an intergovernmental agreement with the USFWS to conduct a W-PAWF for the remainder of the watershed, both east and west of the Hudson. This two-year project is scheduled to commence in March 2002, and will rely on methodology developed through previous DEP/USFWS joint efforts in Cannonsville/Neversink and West Branch/Boyds Corner projects.

In 2001, DEP collected a second year of water quality data at the reference wetlands established in 1999, as part of the West Branch/Boyds Corner pilot functional assessment program. Biweekly monitoring of total and dissolved organic carbon, total and dissolved phosphorus, total suspended solids, and color has been conducted at the outflows of terrene and at the inflows and outflows of lotic reference wetlands since April 2000, and is scheduled to continue through April 2002. DEP also collected a second growing season's worth of weekly monitoring data from water table wells located throughout the pilot reference wetlands.

In addition to maintaining the monitoring program in the pilot study area, DEP initiated site selection and developed a preliminary work plan for a reference wetlands monitoring program West of Hudson. Through Safe Drinking Water Act funds, DEP plans to monitor water quality, vegetation, and soils at 22 wetlands occupying terrene and lotic landscape positions throughout the Catskill and Delaware watersheds. GIS-rendered maps were produced for the entire West of Hudson to locate potential reference wetlands. Field surveys for final site selection and monitoring will commence when funding and contracts are in place.

The reference wetlands monitoring program was implemented in conjunction with the W-PAWF to verify wetland classifications and preliminary assessments, to measure the effects of different wetland types on the quality of surface waters, and to determine reference conditions for wetlands among various hydrogeomorphic settings. DEP will continue to analyze data collected from reference wetlands to assess the distribution, composition, and functions of watershed wetlands.

Wetland Scientific Support

In addition to conducting the above wetland mapping and research projects, wetland scientists provided technical support to other divisions of DEP. Scientists reviewed and commented on Environmental Impact Statements, and ACOE, DEC and municipal wetland permit applications. Wetland scientists also provided field and GIS support for the DEC wetland remapping project and continued to participate in the meetings of the New York State Interagency Wetlands Group.

4.4.3 Land Acquisition and Stewardship: Acquisition of Wetlands

DEP's Land Acquisition and Stewardship Program (LASP) seeks to protect future water quality by purchasing vacant land in environmentally sensitive areas within the watershed, thereby precluding development which could potentially harm water quality. Vacant parcels that contain whole or part of a wetland greater than 5 acres identified by the 1996 National Wetlands Inventory (NWI) are one of several criteria used by DEP to target sensitive areas for acquisition.

The following table indicates that more than 900 acres of NWI and DEC-regulated (non-inundated) wetlands were either under contract or closed by DEP in both East and West of Hudson as of November 8, 2001. In addition, more than 1,500 acres of wetlands are located within a 1,000-foot buffer of total acreage acquired by DEP at that time.

4.4.4 Watershed Agricultural Program

Whole Farm Plans

Through the Whole Farm Planning process, wetlands on participating farms are identified and mapped. An effort is made to guide agricultural activities away from wet areas and apply BMPs. These BMPs include, for example, fencing livestock out of stream crossings to protect riparian vegetation and improved barnyard management.

The Conservation Reserve Enhancement Program

The Conservation Reserve Enhancement Program (CREP) allows watershed farmers to retire environmentally-sensitive cropland from production and helps establish streamside buffers by providing cost-sharing as compensation. Buffers range from 35 feet to 180 feet. These riparian buffers are fenced to keep out neighboring cows and other wildlife; trees and shrubs are planted to restore vegetation. As of the end of 2001, approximately 32.4 acres of NWI wetlands were protected within 173.6 linear miles of riparian forest buffer contracted under CREP in all WOH counties.

Forest Management Planning

The WAC Forestry Program provides funding to watershed landowners for developing forest management plans written by professional foresters trained and approved by WAC. Required training workshops for certified foresters include forestry plan specifications with a focus on water quality protection and riparian area delineation. To date, forest management plans have been completed on more than 20,000 acres.

4.5 Pilot Phosphorus Offset Program

The WR&R prohibit the construction of new, or expanded, WWTPs with surface discharges in Phosphorous Restricted reservoir basins of the City's watershed. However, the Pilot Phosphorous Offset Program, as set forth in the WR&R and MOA, allows the construction of up to three new, or expanded, WWTPs with a combined surface discharge of no more than 150,000 gallons per day (gpd) East of Hudson. West of Hudson, the program allows up to three new, or expanded, plants with a total surface discharge no greater than 100,000 gpd. New or expanded WWTPs allowed under the Program must comply with the condition that for every kilogram of phosphorous discharged from the WWTP, and nonpoint sources associated with the projects the WWTP serves, three kilograms of phosphorous will be removed, through a DEP- offset mechanism, from the same in which the WWTP is sited.

4.5.1 East of Hudson

Kent Manor

There were no developments in the status of the Kent Manor proposal since DEP revoked Kent Manor's approval to participate in the program on July 2, 1999, because of the applicant's inability to secure the required approval letter from the County or Town.

Campus at Field Corners

During the reporting period, Campus continued to redesign its development based upon the 68,000-gpd wastewater discharge allocated in the offset program and to pursue regulatory approvals for the redesigned project from the Town of Southeast. At the close of the reporting period, Campus had not gained the necessary approvals from the Town.

Emgee Highlands

By the winter of 2001, Phases I and II of the Highlands project had been completed, with the WWTP becoming fully operational on December 28, 2001. The first phase included initial excavation, and construction of a stormwater sampling station at the point where stormwater discharges from the site. Phase II included the construction of the water quality treatment basins that serve as the offset mechanism. During the year, DEP also issued its final approval of the Contingency Plan and Quality Assurance and Project Plan (QAPP), and was notified by Highlands that its offset monitoring program had begun.

To satisfy one of the conditions of DEP's approval allowing Highlands to participate in the program, Highland provided DEP with baseline water quality data from 1999. However, the laboratory analysis of the only post-construction samples collected at the site (at three of the four stormwater treatment basins) during the only three storm events that were of sufficient magnitude to trigger the automatic sampling devices have yet to be returned to Highlands. Upon Highlands' receipt of the water quality data, DEP will begin to evaluate the effectiveness of Highlands' offset program.

4.5.2 West of Hudson

There were no developments in the WOH program during 2001.

4.6 Stormwater Programs

4.6.1 Stormwater Retrofit Program

The Stormwater Retrofit Program is a \$7.625 million program to fund the design, permitting, construction, implementation and maintenance of stormwater BMPs to address existing stormwater runoff in concentrated areas of impervious surfaces in the WOH watershed to the extent such stormwater BMPs are necessary to correct or reduce existing erosion and/or pollutant loading. CWC manages the Stormwater Retrofit Program in consultation with DEP.

Throughout 2001, CWC and DEP solicited for program applications, conducted site inspections, completed project evaluations and administered previously funded projects.

Five applications were received and identified for further review and inspection as a result of the Project solicitation that took place June 1, 2001, through September 3, 2001. Upon completion of the evaluation process, three projects met minimum requirements for funding consideration based upon their “Site Factor” score. Project ranking is based upon a combined “Site Factor/Pollutant Removal” score. Projected pollutant removal is calculated using the Simple Method.

All project evaluations, ranking and suggested funding limits were presented to the CWC Wastewater Committee on January 8, 2002, and then forwarded to the CWC Board for adoption. Projected capital funding for Round 3 is projected to be \$307,450. The table below provides information on each Round 3 project.

Table 4.13. Stormwater Retrofit Program projects.

<i>Applicant</i>	<i>Project Area</i>	<i>Project Description</i>	<i>CWC Award</i>
Village of Stamford	Railroad Avenue	Installation of separated stormwater mains and laterals	\$196,000
Town of Windham	Hickory Hill Road	Installation of erosion control devices, conveyance and sedimentation devices	\$73,950
Town of Hunter	NYS Rt.23 R.O.W.	Installation of erosion control devices, conveyance and sedimentation devices	\$37,500

4.6.2 Stormwater BMP Cost Sharing Programs

The West of Hudson Future Stormwater Controls Program is a \$31.7 million program to fund the design, construction, implementation and maintenance of new stormwater measures pursuant to SPPPs and IRSPs required by the WR&R but not otherwise required by federal and/or State law for WOH projects constructed after the effective date of the WR&R. The program is managed by CWC in consultation with DEP.

In 2001, CWC processed funding applications for seven (7) projects. Applicants, projects, authorizing resolutions, and funding levels are shown in the following table.

Table 4.14. Applications for future stormwater control funding.

<i>Applicant</i>	<i>Project</i>	<i>Approval Date</i>	<i>CWC Funding</i>
Town of Middletown	Town Offices	3/27/01	\$39,842.00
Ulster County	Sundown Sand & Salt Facility	8/28/01	\$22,100.00
Camp Loyaltown	Swimming Pool	9/25/01	\$54,852.20
Walton Central School	High School Running Track	9/25/01	\$146,155.00
		11/27/01	\$75,745.00
Clark Management, Inc.	Betty Brook Subdivision	9/25/01	\$9,712.50
Hamil	Water Business Expansion	11/27/01	\$1,991.99
Village of Hunter	Dolan Park Project	11/27/01	\$33,898.50

In 2001, DEP paid out \$3,170,000.04 to CWC for the Future Stormwater Controls Program, and has paid a total of \$14,793,333.52 since 1997.

As a result of the segregation of one million dollars for Future Stormwater Operation and Maintenance in October 1999 (CWC Resolution #309), earnings accrued to date total approximately \$113,165.54. These earnings are restricted to the funding of approved operation and maintenance costs resulting from eligible stormwater projects. The account is reviewed semi-annually by the CWC Wastewater and Finance Committees to determine its adequacy.

4.6.3 Future Stormwater Controls Paid for by the City

Paragraph 145 of the MOA (Future Stormwater Controls Paid for by the City: Single Family Homes, Small Businesses, and Low income Housing) establishes a fund to pay certain incremental costs of stormwater management measures required by the WR&R, and that are not otherwise required by State and/or federal law, regulation, or enforceable standard.

Prior to the promulgation of the WR&R, DEP developed an application form (included in the Applicant's Guides to Stormwater Pollution Prevention Plans and Individual Residential Stormwater Permits) that when accompanied by invoices for the design and implementation of the stormwater controls, provides DEP with the bulk of information necessary to reimburse an eligible applicant. DEP also prepared a manual that includes specifications for the components of various stormwater controls and their unit prices. DEP uses the manual to calculate the costs of the stormwater controls required by the WR&R. Finally, DEP developed a contact template to be used for all contacts between DEP and the stormwater reimbursement applicants and a flow chart that allows each entity in the permitting, contracting, and payment process to understand the steps involved in the payment process.

Since the adoption of the WR&R in May 1997, DEP has received eleven applications for funding (ten West of Hudson and one East of Hudson) that have qualified for reimbursement. One payment was associated with a low-income housing project, eight payments were for the stormwater controls required for construction of small businesses and two payments were associated with costs for stormwater controls required for single-family houses. Two applications for funding relating to single family houses East of Hudson were pending as the time this report was released. Since 1997, a more than \$330,000 has been disbursed under the Future Stormwater Controls Program.

On April 25, 2001, DEP received a Stormwater Pollution Prevention Plan (SPPP) Application from Jerry Hamil, the owner of a small plumbing business. Mr. Hamil proposed to construct a 24-foot by 26-foot garage, to house his truck and equipment. The structure is located within 100 feet of an intermittent watercourse. Considering the small size of the building, a SPPP for Minor Activities was prepared. Subsurface infiltration was the permanent best management practice implemented for this project, along with temporary sediment and erosion control measures during construction. Seamless aluminum gutters convey roof runoff to a subsurface absorption bed with dimensions of 50 feet by 15 feet.

The construction of the building has been completed, and the infiltration system has been installed. Estimates for materials and labor total \$4,200.00, of which DEP is responsible for 50%. The reimbursement payment is being processed.

4.6.4 Other Stormwater Programs

Water Resources Development Act/Safe Drinking Water Act Stormwater Retrofit Program

Upon receiving notification that DEP's Stormwater Retrofit/Monitoring Grant(s) had been approved, DEP prepared a project outline and implementation schedule and forwarded them to the ACOE and DEC for review. While these documents were being reviewed in 2001, DEP selected two stormwater retrofit sites, one in the West Branch Reservoir watershed and one in the Croton Falls Reservoir watershed. During the reporting period, DEP also developed a draft Quality Assurance/Monitoring Plan that will, when implemented, quantify the success of the retrofitted structures in reducing pollutant loads to the two reservoirs.

New York State Department of Transportation (DOT) Programs

Memorandum of Agreement – During 2001, DEP and DOT continued to implement the 1998 Memorandum of Agreement. In addition to reviewing more than 40 transportation projects in the City's watershed, DEP and DOT met to review the agreement and make any adjustments deemed necessary by either agency. No changes were deemed necessary.

Watershed Stormwater Practices Manual – DEP and DOT held discussions aimed at completing DOT's Stormwater Management Practices Manual for DOT projects in the watershed. The manual, developed by DOT, DEC, Westchester County, the Sierra Club, and DEP includes acceptable designs for DOT projects in the City's watershed.

New York State Route 6 Widening and Bridge Restoration – DOT and DEP met for a third time in 2001, to discuss the Route 6 project scheduled to begin in the spring 2002. The bridge spans the West Branch Croton River, which flows from the West Branch Reservoir, under Route 6, to the Croton Falls Reservoir. Properly controlling stormwater during and after construction is particularly important because the river discharges directly into the Croton Falls Reservoir and because it is revered by recreational fisherman throughout the watershed as one of the few trout streams that supports a native population of naturally reproducing trout.

Turkey Mountain Watershed Study/Stormwater Practices Management Study – Having assisted in the development of the scope of work for the DOT funded Turkey Mountain Watershed Study and Stormwater Management Practices Study, DEP continued its discussions during the reporting period with DOT concerning implementation of the projects in 2001. Both projects received additional funding that was determined to be necessary. DOT expects both projects to begin in early 2002.

Pre-Bid Meetings – At DOT's request, DEP participated in a pre bid meeting with potential bidders on the Putnam Bikeway Project. The purpose for DEP's participation was to explain to the contractors the requirements of the Stormwater Pollution Prevention Plan DEP approved for the project. This would allow the bidders to consider the costs of stormwater control, during and after construction, thereby avoiding delays in the implementation of the controls.

DEC General Permit for Stormwater Discharges

In 2002, DEC released a Draft General Permit for Stormwater Discharges, which would replace its 1993 permit and a new revised version of the State's stormwater facility design manual, upon which the State's General Permit for Stormwater Discharges from Construction Activities relies. DEP reviewed the documents and identified numerous issues with the two drafts. DEP will pursue the issues during the public comment process.

Stormwater Outreach

DEP presented its regulatory and non-regulatory stormwater management programs at several stormwater symposia during the reporting period. In addition to discussing its stormwater programs at two EPA-sponsored meetings that examined federal, State and City programs, DEP presented its programs at the New York Water Environment's 3rd Annual Conference on Watershed Protection, at the annual meeting of the Westchester/Putnam Chapter of the New York State Society of Professional Engineers.

Police and Staff Training and Development of Field Guide

During 2001, DEP conducted two training sessions for DEP Police and Project Review and Enforcement personnel. The training was designed to familiarize staff with the stormwater provisions of the WR&R and site conditions that constitute violations of DEP Stormwater Pollution Prevention Plans or the other provisions of federal, State and City regulations. To supplement the training, DEP completed a draft field manual, for use by DEP staff, that depicts a wide variety of erosion and sediment control practices and specifies, in plan and narrative form, the proper installation and maintenance of the measures. The manual is scheduled for release in the summer of 2002, and includes a coordination protocol to avoid duplication in DEP's enforcement efforts.

4.7 New Sewage Treatment Infrastructure Program

The New Sewage Treatment Infrastructure Program (NIP) is described in Paragraph 122 of the MOA. There are 22 communities identified, listed in order of priority, that are eligible to receive funds for the study, design and construction/implementation of wastewater collection, treatment and disposal options. The Program is funded for \$75,000,000. The top seven communities have completed extensive studies assessing wastewater needs, service areas, estimates of associated wastewater flows and identifying/proposing the appropriate wastewater collection, treatment, and disposal options. After the extensive studies at each of the top seven communities, allocations of "block-grants" to complete design and construction, based upon highly scrutinized cost estimates, were agreed upon for the top five communities.

In 2001, the top five communities signed design/construction amendments to existing contracts and initiated the one-year design period. In three of these communities – Hunter, Windham and Fleischmanns – a number of existing privately-owned wastewater facilities eligible for funding under the Regulatory Upgrade Program will be connected to the planned Municipal WWTP to be built under the NIP. In Hunter, WWTPs at Colonel's Chair, Forester Motor Lodge and Camp Loyaltown are planned for consolidation. In Windham, Ski America, Thompson House and Frog House are planned for consolidation. In Fleischmanns, the Regis Hotel is planned to connect to the municipal plant.

Once construction contracts are let following the construction bid period, communities are committed to advance projects. The following table identifies milestones for these five communities. Additional information on Program development and components is included in previous Annual Reports.

Table 4.15. New Infrastructure Program design and construction milestone.

<i>Municipality</i>	<i>Design/Construction Amendment Execution Date</i>	<i>Design Complete Date</i>	<i>Construction Bids Complete Date</i>	<i>Functional Completion Date</i>
Andes	March 2001	March 2002	September 2002	September 2004
Roxbury	March 2001	March 2002	September 2002	September 2004
Windham	May 2001	May 2002	November 2002	November 2004
Fleischmanns	August 2001	August 2002	February 2003	February 2005
Hunter	September 2001	September 2002	March 2003	March 2005

4.8 Sewer Extension Program

DEP made great strides in advancing the implementation of the Sewer Extension Program during the past year in the following areas: developing bid specification/procurement documents for planned sewer extensions in communities where DEP is responsible for the design and construction of extensions being funded through the Program; drafting new and revised agreements necessary for advancing the implementation of the Program in specific communities; and preparing revised draft model Sewer Use Laws for municipalities participating in the Program.

DEP prepared three separate bid procurement documents for communities where DEP is managing the design and construction of planned extensions being funded through the Program. Two of the bid procurement documents are for a planned sewer extension along NYS Rt. 23 near the Hamlet of Grand Gorge in the Town of Roxbury. One document is for conducting an archeological resources investigation to ascertain whether there are any significant archeological resources within the extension's planned service area; the other procurement is for the purpose of conducting an environmental site assessment of two specific locations along the extension to determine if any hazardous materials are present that would pose health and safety issues.

The other procurement document is for obtaining a certified list of owners of record (for easement purposes) for all of the properties affected by the planned extensions and associated laterals in the Town of Shandaken in Ulster County and the Towns of Roxbury and Middletown, and the Village of Margaretville, in Delaware County.

DEP also prepared new and revised draft municipal agreements during the past year, which must be signed by each of the involved communities before the Program can be fully implemented in their community.

DEP also prepared and distributed a revised Model Sewer Use Law in October 2001, to each of the participating municipalities that hadn't as yet submitted either a revised draft law or comments to DEP.

To advance the selected projects, DEP sent out letters to all of the municipalities where extensions are planned (with the exception of the Town of Hunter, which already signed an agreement with DEP) that provides a deadline date of April 1, 2002 for them to sign an agreement with DEP. DEP is hopeful that all of the involved communities will execute agreements by April 1, 2002.

4.9 Septic System Rehabilitation and Replacement Program

The Septic Rehabilitation Program is a \$13.6 million program to rehabilitate failing septic systems serving single family or two-family homes in the WOH watershed. During 2001, program coordinators continued to implement design and construction of repairs and replacements to septic systems identified as failing by DEP prior to January 1, 1999. To finish work on outstanding septic systems, CWC extended contracts with septic program coordinators in November 2001.

Septic system failures identified between January 1, 1999 and July 1, 1999, are eligible for CWC funding, but are the responsibility of the homeowner to remediate and are not eligible for inclusion in the Coordinator Program.

Beginning July 1, 1999, revised rules redirected program eligibility to properties in the 60-day travel time areas.

Through 2001, CWC has sent out letters to all homeowners in Priority Area 1A (sub-basins within 60-day travel time to distribution that are near intakes) soliciting participation in the program. Homeowners were solicited in three stages, those with systems located: a) within 100 feet of a water course (48 systems); b) between 100 and 300 feet of a watercourse (76 systems); and, c) greater than 300 feet from a watercourse (381 systems). CWC staff conducted initial site/system inspections for participating homeowners; where warranted, a more detailed inspection was performed. Systems found to be failing or substandard and likely to fail are being remediated. CWC pays one hundred percent of eligible septic remediation costs for primary residences and sixty percent of eligible costs for secondary residences. Through November 2001, CWC has identified 56 failing or likely to fail septic systems in the 1A area. Of these, 17 have completed repairs and the remainder are in the site investigation/design process. The graph on the following page shows all septic remediations since 1997.

During 2001, approximately 150 septic system remediations in the WOH watershed were eligible for CWC funding.

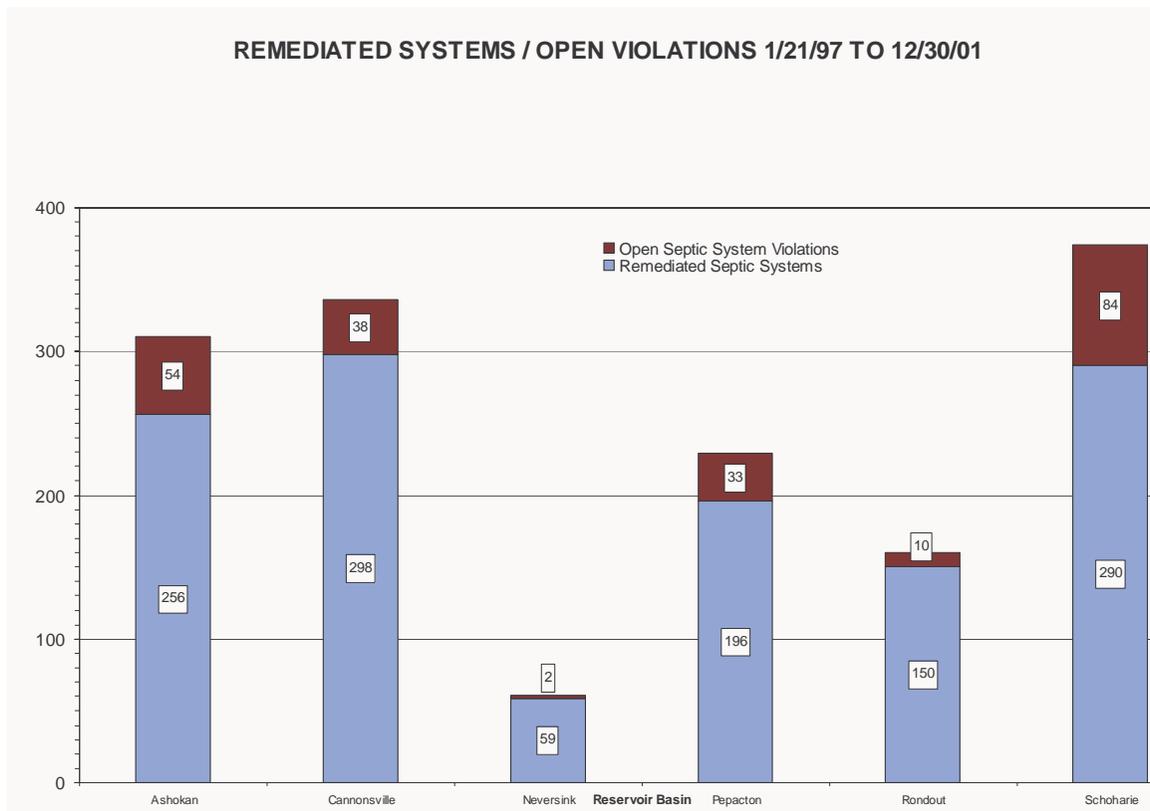


Figure 4.2. Remediated systems/open violations 1/21/97-12/30/01.

4.10 Alternate Design Septic Systems Program

The Alternate Design Septic Systems Program is a \$3 million program to pay for the importation of fill material and/or pumping apparatus for the construction of septic where required solely by DEP or its delegatee in order to comply with the Watershed Regulations.

CWC, in consultation with DEP, drafted program rules and standards, which were adopted by the CWC Board on February 1, 2000.

During 2001, CWC approved the first application for funding in this program. CWC staff determined that the applicant was eligible and that a portion of the request was reasonable and justified for reimbursement under program guidelines. The applicant appealed the amount disapproved. The appeal process was ongoing at year's end.

At its September meeting, the CWC Board resolved to transfer \$334,000 from this program to the Septic Program to act as a cost share to a WRDA/WEAP grant to the Septic Program.

4.11 Sand and Salt Storage Facilities Program

As of December 31, 2001, all of the sand and salt storage facilities funded during the first round (sites located within the WOH watershed) have been constructed. DEP has reviewed and approved site plans (as well as applicable permits) for each of these facilities. The map on the following page shows the location of all constructed facilities.

CWC has entered into Round 2 contracts to construct new storage facilities with nine municipalities, including Delaware and Schoharie Counties, which have sand and salt storage sites outside of the WOH watershed that serve five or more miles of roads within the watershed. Since these sites are located outside of the WOH watershed and are not subject to the Watershed Regulations, DEP is not involved in the review and approval of project plans for these facilities.

As of the end of 2001, all but two of these Round 2 facilities have been completed. It is anticipated that the remaining facilities in the Towns of Colchester in Delaware County and Woodstock in Ulster County will be constructed during the 2002 construction season.

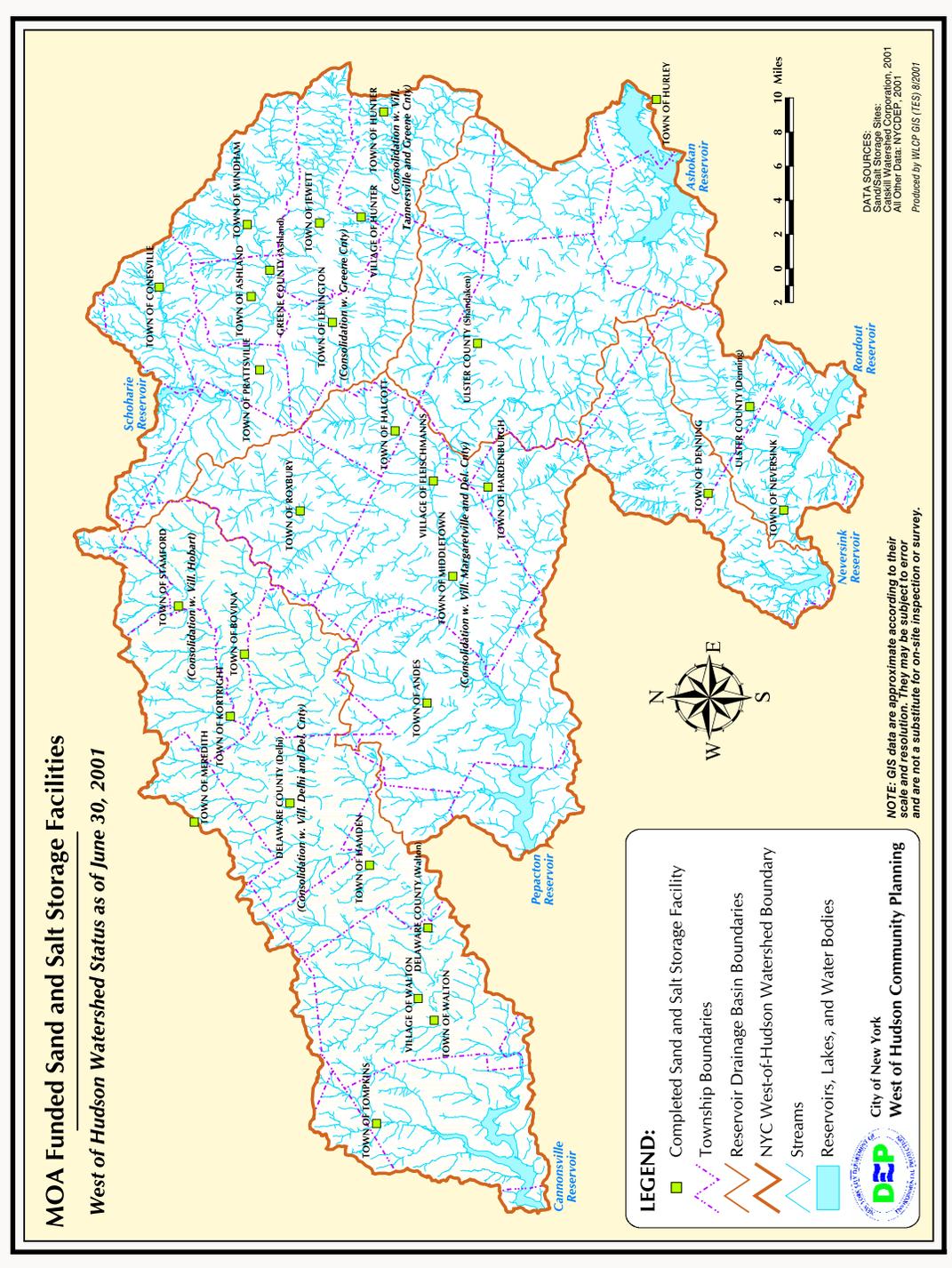


Figure 4.3. MOA funded sand and salt storage facilities, West of Hudson Watershed, status as of June 30, 2001.

4.12 Stream Management Program

The Stream Management Program (SMP) works in partnership with WOH watershed communities to address chronic and pervasive problems associated with streams in a mountainous region: streambank and bed erosion, significant loadings of total suspended sediment that cause turbidity and contribute to nutrient loadings, flood hazard risk, and fisheries habitat protection and improvement. The SMP's extensive progress in the year 2001 is reflected in the following accomplishments made toward three principal programmatic goals:

- Goal 1: Create a framework for stream management and develop an informed constituency of stream managers and community participants
- Goal 2: Develop databases to support stream management decisions, stream design specifications and program evaluation strategy
- Goal 3: Develop and implement stream management plans in priority sub-basins and construct stream stability restoration demonstration projects

Goal 1: Create a Framework for Stream Management and Develop an Informed Constituency of Stream Managers and Community Participants

The ability of the SMP to meet its overarching mission – the establishment of long-term stream management plans and strategies for priority WOH sub-basins to protect and improve raw water quality – depends on its ability to create an informed constituency of stream managers who share a common management approach based on applied fluvial geomorphology. SMP continued to provide education, training and outreach through a variety of forums in 2001:

Workshops

Designing the Stream Management Plan: a Facilitated Workshop – In March 2001, SMP hosted a two-day workshop to promote public input and organize participants to the recently launched stream management planning efforts in four sub-basins. Over 90 participants, working in three sub-basin groups, helped to develop a localized strategy to identify their stakeholders and maximize public participation in the planning process. The groups also discussed the concept and potential content of a stream management plan.

Participants included Stream project staff from each county Soil and Water Conservation District (SWCD), county departments of public works (DPW), NYS Department of Transportation (DOT), DEC permitting, fisheries biology, and flood management divisions, town planning boards and supervisors, the Watershed Agricultural Council (WAC), United States Geological Survey (USGS), New York State Environmental Management Office (SEMO), and the Federal Emergency Management Agency (FEMA). DEP intends to host a Planning Session annually to foster coordination among the four project teams, to share accomplishments and pitfalls, and set future goals.

Public Education

SMP coordinated two riparian planting projects with upstate and watershed high schools, and the Council on the Environment of NYC funded by CWC, in partnership with the Greene County SWCD. In May, over 70 students from NYC's High School for Environmental Studies, Margaretville and South Kortright High Schools received an orientation to the New York City watershed and then participated in hands-on bioengineering that is critical to re-establishing channel stability after construction. They planted several hundred bare root willow, dogwood, poplar, and green ash stock at Farber Farm on the East Kill.

In November, DEP cosponsored a major volunteer riparian planting weekend with GCSWCD and Trout Unlimited on the Batavia Kill at Big Hollow. The weekend drew over 80 volunteers, including DEP, GCSWCD, and DEC staff, school environmental clubs, Trout Unlimited members from multiple chapters and a Boy Scout troop from the Bronx. Over 10,000 bare root seedlings were planted, as well as 2,500 feet of live fascines and over 500 live stakes. For more detailed information on the conservation planting days, see www.gcswcd.com.

Conferences/Presentations

SMP delivered the keynote presentation, "*Managing Streams as Systems*," at the Stream and Floodplain Restoration Workshop sponsored by the Association of State Floodplain Managers and EPA Office of Wetlands and Watersheds in September 2001 in Albany, NY.

SMP presented its research on "*Bankfull Discharge and Hydraulic Geometry Relationships for the Catskill Region*" at the March 2001 meeting of the NYS Non Point Source Coordinating Committee's (NYS NPSCC) Hydrologic and Habitat Modification Working Group. The research demonstrates a statistically significant relationship between drainage area and bankfull discharge in the Catskill Region.

Strategic Planning and Advisory Board

The SMP conducted an intensive 5-year strategic planning and budgeting process. The SMP is establishing an Advisory Board to guide the Program in evaluating its effectiveness in meeting its stated goals. The Advisory Board will be comprised of approximately fifteen professionals with recognized expertise in hydrology, fluvial geomorphology, aquatic and riparian ecology, hydraulic engineering, community-based natural resource planning and related natural resource fields, and will offer consultative review of the SMP's methods, practices and program initiatives. Cornell Cooperative Extension of Ulster County (CCE) has agreed in principle to act as an administrator of the SMP's Advisory Board and a draft contract was prepared to enable CCE to coordinate the meetings and provide for transportation and lodging arrangements. At the close of the year, the Advisory Board participants had been identified and a mission statement and letter of invitation had been prepared.

Goal 2: Develop Databases to Support Stream Management Decisions, Stream Design Specifications and Program Evaluation Strategy

The SMP has been engaged in an ongoing data collection and research effort since 1996. These data are needed to support development of stream management plans and restoration projects, and assess the effectiveness of the SMP. DEP entered into a contract with USGS for their professional services to help complete major portions of the research program. The four-year research contract commenced in October 2001.

SMP continued negotiations with researchers at Pennsylvania State University (PSU) on a contract to conduct an Erosion and Scour study. The study will attempt to correlate streambank and bed erosion and scour rates to variables derivable through watershed geomorphic assessments, and to establish the ranges of conditions that distinguish "stable" vs. "unstable" settings. The SMP continued to identify sites for this study; many of these sites will also be used for other components of the SDWA research. Contract registration is expected during the second quarter of 2002.

Regional Curve Study

The regional curve study is an ongoing effort to document the range of bankfull discharge values and associated channel dimensions in stable/unstable streams in the Catskill Mountains. Successful stream restoration by natural channel design requires knowledge of the bankfull discharge conditions in the region where work is occurring. In 2001, SMP prepared a draft report documenting the identification of regional relationships for bankfull discharge and hydraulic geometry at 14 USGS gauge sites in the Catskill Mountains. The draft report was distributed to several practitioners in the field of applied fluvial geomorphology and hydrology for professional peer review. The draft report was revised in the fourth quarter of 2001, incorporating peer review comments. An interim, provisional report has been distributed to county SWCD staff so that they can apply the information to identifying bankfull discharge in the field for their watershed reconnaissance work in stream management plan sub-basins.

Our preliminary findings suggest that rather than developing a single regional curve for the Catskill Mountains, we can stratify the bankfull data by the mean annual runoff in the gauged basin and create at least two sets of curves for use in the WOH watershed. One regional relationship is derived for the high peaks region of Ulster and Greene Counties which have high mean annual runoff yielding higher bankfull parameter values, and another regional relationship is derived for the areas away from these high peaks which are characterized by lower mean annual runoff and correspondingly lower bankfull parameter values.

DEP and USGS staff performed additional work on the regional curve study by 1) identifying 5 inactive USGS gauges for reactivation in 2002, and subsequent bankfull discharge calibration surveys, 2) identifying 5 additional active USGS gauges for bankfull calibration surveys

in 2002, and 3) with additional work performed by DCSWCD staff, conducted bankfull discharge calibration surveys for 3 USGS gauges in hydrologic region 5. At least 13 gauges will be added to the regional curve study to further refine the regional relationships documented in the current interim report.

Reference Reach Database and BMP Effectiveness Monitoring Studies

SMP continued to work closely with USGS to develop Quality Assurance Project Plans (QAPPs) and protocols for these two studies. Most of the work performed was in developing a protocol for assessing trout habitat in wadeable streams for use in the Program evaluation. Fieldwork to test and refine the protocol was conducted with USGS and student interns from Ulster County Community College in the summer 2001, and initial data analysis was completed by USGS and DEP by the close of 2001. Additional sampling protocols and QAPPs are under development by DEP and USGS and will be completed prior to the coming field season.

Watershed-Scale Stream Assessment Protocol

A significant accomplishment of the Program in 2001 was the joint development, field testing and refinement of a 'Watershed Assessment Protocol' for use by the SWCDs in their stream assessments for stream management planning in small to medium sized sub-basins. The protocol will be subject to continuing refinement and adjustments based on drainage area size, and availability of funding and staffing resources.

Goal 3: Develop and Implement Stream Management Plans In Priority Sub-Basins and Construct Stream Stability Restoration/Demonstration Projects

Contracts for stream management plans and restoration/demonstration projects are currently in place with the Greene, Ulster, Sullivan, and Delaware County Soil and Water Conservation Districts for the Batavia Kill in the Schoharie basin, Broadstreet Hollow and Stony Clove Creeks in the Ashokan Basin, the Chestnut Creek in the Rondout Basin, and the West Branch Delaware River in the Cannonsville Basin, respectively.

A full description of the stream management planning process and a sample contractual scope of work can be found in *New York City's 2001 Watershed Protection Program Summary, Assessment, and Long Term Plan*, Appendix K.

All planning projects involve a partnership between SMP and the local SWCD. The table below summarizes the partnerships, the planning period, funding by source, drainage area and riparian landowners affected. Existing stream management planning contracts address 31% of the WOH Watershed area and offer the potential to reach 3,455 riparian landowners.

Table 4.16. Summary of ongoing stream management planning projects.

<i>Sub-basin/basin</i>	<i>Local SWCD</i>	<i>Budget, DEP Contribution</i>		<i>Period</i>	<i>Basin Area (Sq. Mi.)</i>	<i>Riparian Landowners</i>
Batavia Kill/Schoharie	Greene County	\$2,051,000	100%	1996-2002	73	677
		\$4,486,269	100%	2002-2005		
Broadstreet Hollow/Ashokan	Ulster & Greene County	\$576,010	25%	2000-2002	9	70
Stony Clove /Ashokan	Greene County	\$730,250	25%	2001-2003	32	249
WB Delaware/ Cannonsville	Delaware County	\$1,841,243	25%	2001-2004	353	2,229
Chestnut Creek/ Rondout	Sullivan	\$558,000	25%	2001-2003	20	230

Batavia Kill Stream Management Pilot Project

In 2001, the City allocated \$4.48 million for the design and construction of stabilization projects for an additional approximately 6 miles of stream channel in five major sections of the Batavia Kill. In addition, funding will be allocated to implement the several programmatic initiatives recommended by the Stream Management Plan, including expanded education and training for highway officials, realtors, builders, and development of a Japanese knotweed management strategy.

In 2001, GCSWCD drafted substantial components of its Stream Management Plan for the Batavia Kill, including reach-by-reach summaries of stream condition; a description of regional setting including demographics, physiography, geology, hydrology, land use, aquatic resources, and infrastructure; a summary of existing studies or reports (flood and fisheries, for example); and recommendations for future management of the Batavia Kill.

Late in 2001, a public outreach strategy designed to raise public awareness about, and to secure public input into, the Plan was developed. GCSWCD drafted a landowner brochure and opinion survey. These will be mailed to each landowner along the Batavia Kill and its major tributaries. GCSWCD also hired a limnologist to assist in analysis of the turbidity and TSS data collected by DEP on the Batavia Kill.

Big Hollow Stream Restoration Project

This nearly one mile reach of the Batavia Kill, located in the headwaters of the sub-basin, was restored to stable channel dimensions during 2001. Prior to suspending work for the winter, over 75% of the total channel length was completed and 44 of 62 rock vanes had been completed, as well as 9 of 11 cross vanes. Channel construction activities were halted in mid- September in order to enable sufficient time for thorough bioengineering of the completed section, which is essential to the long-term stability of the project. This monumental effort included the installation of over 4,000 feet of live fascines, 950 live posts, 1,900 live stakes and over 3,250 linear feet of

brush layering by the contractor. All completed work was hydro-seeded (15.5 acres). The site was then secured for the winter and completion is planned for the 2002 field season. Please refer to the figure on the following page for a photographic summary of the Big Hollow stream channel restoration project.

Stony Clove, Chestnut Creek, West Branch Delaware, and Broadstreet Hollow Stream Management Planning Projects

This section presents a summary of the funding, administration, and stream assessment efforts common to the four “WRDA” contracts overseen by SMP. The section following this details the status and major accomplishments of each of the four projects in 2001.

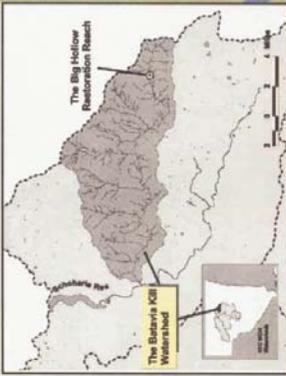
Funding – Funding for the Stony Clove, Chestnut Creek, and West Branch Delaware plans was secured through the Watershed Environmental Assistance Program (WEAP) of the Watershed Resources Development Act (WRDA), administered by the NY District Army Corps of Engineers (ACOE). The Broadstreet Hollow Stream Project is also partially supported by the WEAP. DEC has contributed funds through the Environmental Bond Act. A breakdown of the funding contributions of the various partners can be found in Chapter 2 of New York City's 2001 Watershed Protection Summary, Assessment, and Long Term Plan.

Substantial progress was made between DEP and ACOE to establish the necessary contracts to enable DEP to be reimbursed for project costs on the stream management plans during 2001. The Project Management Plan (PMP) and Project Cooperation Agreement (PCA) between DEP and the ACOE for each of these three projects was finalized and DEP legal review and a letter of concurrence indicating DEP's intention to sign the final contract was finalized and sent to the NY District ACOE. The ACOE will sign these contracts in 2002.

Administration – 2001 was an extremely busy and productive year for each Project. Prior to the first field season, each District:

- Hired and trained Project Coordinators and field technicians,
- Procured and received training in the use of the necessary equipment,
- Arranged necessary sub-contracts,
- Held planning meetings with DEP,
- Formed and met with their Project Advisory Committees,
- Held initial public meetings to introduce the stream management planning effort, and
- Initiated the requisite office portion of the stream classification process.

Stream Restoration at Big Hollow



The Big Hollow Restoration Project

The 72 square mile Batavia Kill watershed in Greene County is a demonstration watershed for natural channel design and multi-objective stream management. This tributary of the Schoharie Creek flows 21 miles through the northern Catskill towns of Windham, Ashland, and Prattsville into the Schoharie Reservoir. Since 1999, more than two miles of the Batavia Kill have been reshaped to stable channel dimensions, and densely planted with riparian vegetation on the banks and floodplain.



Restoration of the Big Hollow reach

In Fall 2001, nearly a mile of stream was restored at Big Hollow. Restoration efforts involved re-aligning a severely eroded channel to a natural meander pattern, and re-grading its slope to restore the shallow riffles and deeper pools that provide trout habitat. This restoration is part of the Batavia Kill Stream Management Pilot project, a partnership between DEP and the Greene County Soil and Water Conservation District (GCSWCD).



Design and construct a new stream alignment

Greene County Soil and Water designed and supervised the construction of the restoration project. The red dotted line represents the new stream channel alignment, including the first 6 of 19 the meanders constructed.



Rock Vane Construction

In mid-August the stream was temporarily diverted around the site. Earthmoving equipment was used to regrade and realign the channel. Rock vanes composed of large boulders that are quarried to size and shape specifications were installed to maintain the position of the new alignment.



Produced by the Stream Management Program
Division of Watershed Lands and Community Planning



Re-establish Grass and Herbaceous Riparian Vegetation

By early September, the first portion of the project was hydro-seeded using conservation seed mix and cellulose mulch. Hydro-seeding provides a fast and effective method for establishing stabilizing vegetation. Note the shape of the new stream channel.



Re-establish Woody Vegetation

The volunteers assembled and installed 2500' of live willow fascines - bundles of branches that are placed in shallow trenches along the bank- and planted willow stakes, thousands of rooted alder, hybrid poplar, and dogwood seedlings on four acres of the floodplain along a 1/2 mile stretch of the Batavia Kill Stream.

Figure 4.4. Stream restoration at Big Hollow

Stream Assessment – Throughout the 2001 field season, SMP and District staff conducted watershed-scale assessments of stream stability conditions on the Stony Clove, the Broadstreet Hollow and the Chestnut Creeks. A preliminary assessment was conducted on the West Branch (see below). The process will result in a thorough understanding of the condition of the stream system, and identification of problem areas that will be prioritized for future restoration or management.

Table 4.17. Watershed assessment progress for stream management planning sub-basins, 2001.

<i>Reservoir/ Basin</i>	<i>Sub-basin</i>	<i>Level I</i>	<i>Level II</i>	<i>GPS Network</i>	<i>Cross Sections Surveyed</i>	<i>BEHI</i>	<i>GIS Analysis/ Maps</i>
Ashokan/ Esopus	Stony Clove	Entire sub-basin	7 mile mainstem	Mainstem, Silver Hollow trib	199	26 banks surveyed	Initially complete, 2001
Ashokan/ Esopus	Broadstreet Hollow	Entire sub-basin	3.2 miles mainstem	3.2 mile mainstem	185	29 banks surveyed	Ongoing 2001-2
Schoharie/ Schoharie	Batavia Kill	>6 mi., mainstem & trib locations	>6 mi., mainstem	Selected sites, mainstem & tribs	114	12 general surveyed	Partially complete, 2001
Cannonsville/ W. Br. Delaware	W. Br. Delaware Mainstem	Entire mainstem	2 USGS gauge sites, 1 project site	Planned: 2002- 4	Planned: 2002-4	Planned: 2002-4	Planned: 2002-4
Rondout/ Chestnut	Chestnut Creek	Entire sub-basin	4.85 miles mainstem/ 1200ft Pepacton Hollow trib	4.85 miles mainstem	190	12 banks surveyed	Ongoing 2001-2

Fieldwork was largely completed during 2001 in the Broadstreet Hollow, Stony Clove and Chestnut Creek sub-basins.

Stony Clove Creek Stream Management Plan

A newsletter introducing the project, describing the upcoming summer field surveys, and providing SWCD and DEP contact information was sent to all streamside landowners in the spring. The newsletter was followed by two meetings of the PAC, one held at the Shandaken Town Hall, and one at the Hunter Town Hall, to apprise municipal officials and provide them the ability to respond to potential questions from their constituents.

These meetings were then followed by two public meetings—one in Chichester and one in Phoenicia—to announce the project and the summer fieldwork to the public, and to relay to them the results of the landowner survey. Streamside landowners brought their personal photographs and other archival material to document historical stream conditions for the stream assessment and the management plan.

The project team has worked to facilitate the development of a riparian landowner association. It is the hope of the SWCD, DEP and the PAC that the association will serve as an avenue for educational programming on various stream stewardship issues. The first activity of the association was choosing representatives to the PAC for the Stony Clove Project, to ensure a landowner voice and support for the recommendations that will be included in the plan.

The stream assessment was conducted from June through November, and covered the mainstem and, with a less-intensive protocol, the major tributaries.

Chestnut Creek Stream Management Plan

Two public presentations were held in Grahamsville – one at the Town Hall and one at the Methodist Church as part of the Daniel Pierce Library Lecture Series. These introduced the project to the community, described the upcoming stream assessment, and directly solicited information from landowners about their concerns. A PAC meeting was attended by 13 local, State and federal agency representatives.

A spring 2001 mailing to all mainstem riparian landowners sought permission for stream access for the stream assessment, and provided SWCD and DEP contact information.

The stream assessment was conducted from June through November, and covered the mainstem and a major tributary. Data processing and analysis are ongoing.

In December 2001, a request for proposals was prepared and issued by the SCSWCD to solicit consulting services with experience in fluvial geomorphology and hydraulic engineering to assist the Project Team with analysis and interpretation of their stream data and the identification of an appropriate demonstration project. Several proposals were received and reviewed, with final selection and contracting to take place in the first quarter of 2002.

West Branch Delaware River Stream Management Plan

Candidates for the Project Advisory Committee were identified by DCSWCD and invited to a presentation about the project in January. Key PAC members actively participated in the Stakeholder Facilitated Planning Workshop in April. Due to its prioritization of field activities, DCSWCD did not hold a formal PAC meeting or other public meetings during the reporting period.

A time series of aerial photography (1938, 1963, 1971, 1983) was scanned and georeferenced to serve as a data source for mapping the historic changes in channel alignments on the main stem of the West Branch. This data has enabled the project staff to identify critical areas of continuing instability.

The initial GIS-based assessment contributed to the definition of a Level I Rosgen stream type for much of the West Branch main stem and Town Brook watershed. DCSWCD performed an initial reconnaissance of the West Branch main stem between South Kortright and Hamden (approximately 17 miles). The intent of this reconnaissance was to look for a stable reference reach for use in developing regional hydraulic geometry parameters and provide some verification of the Level I Rosgen classification. The process also provided the team with perspective on the nature of the problems to be found on the river system.

To prepare a design for the restoration demonstration project site at the Octagon farm in Hamden and the restoration of sites near in the Village of Walton, DCSWCD calibrated bankfull flow at three local USGS stream gauges and identified and surveyed a design reference reach on Schenevus Creek near Maryland, N.Y. Data from these surveys was shared with DEP and the project geomorphic consultant for review and verification of findings. Topographic and Level II survey work continued on the Hamden Farm project site and was completed in October.

Upper Delaware Basin Study – The Philadelphia District of the US Army Corps of Engineers (ACOE) has authorization for a study of the Upper Delaware River Basin, which includes the West Branch Delaware River above the Cannonsville Reservoir. Three meetings were held with the Philadelphia District ACOE, DEC, DEP and the SWCD during the report period to discuss this funding.

DEC has allocated \$1.25 million as a local match to update floodplain maps for the West Branch and tributaries above the Cannonsville Reservoir. It is anticipated that this funding will be used to leverage ACOE funding for preparing flood hazard mitigation plans and construction designs for additional stream restoration projects. DEC is the lead local sponsor and will work with DCSWCD and the DEP in providing local direction to this effort.

Broadstreet Hollow Stream Management Plan

Two PAC meetings were held to strategize public outreach for the project. An initial public meeting was a general information session to introduce the public to the project, and was attended by over twenty of the seventy local residents. This was followed by a meeting in which streamside landowners brought their personal photographs and other archival material to document historical stream conditions for the stream management plan. The second meeting provided informal discussion with landowners about their concerns and questions.

Complete stream assessment field data were collected for over 3 miles of the mainstem, and substantial progress was made toward analyzing the information for developing the management plan. Potential project site prioritization and summary statistics are among the parameters that will be included in the management plan. 1:12,000 aerial photography was flown over the watershed by 3Di Technologies according to USGS specifications for professional aerial photogrammetric standards.

During 2001, further construction refinements were undertaken at the demonstration restoration site, with additional funding provided by ACOE and matched by in kind contributions from GCSWCD. Completed project surveys and reports have been submitted by GCSWCD, and final site inspection is planned for the coming field season. DEP wrote an Operation and Maintenance/Monitoring Plan and Agreement. This plan includes landowner guidance for project success. This was transmitted to the Ulster County SWCD for their signature in December 2001. Upon signing in 2002, the Plan will be forwarded to the ACOE for their review and approval.

The restoration site was monitored during the field season as part of ongoing assessments of project effectiveness. This effort is a cooperative monitoring program including geomorphic surveys, fisheries and aquatic habitat assessment, and fisheries population sampling conducted by DEP, USGS, GCSWCD and Trout Unlimited. Monitoring was conducted at the project reach, the reference reach used in design, and a control reach with similar disturbed characteristics to those found in the project reach prior to construction. Data analysis and interpretation will be incorporated as part of the management plan, and be updated as monitoring continues.

Other Partnership Projects

In addition to the aforementioned Stream Management Planning projects, SMP is providing technical assistance and playing a partnership role in the following projects in restoring stability to a failing bank on the Esopus Creek and in restoring floodplain function on the Schoharie Creek in Prattsville.

Esopus Creek Restoration Demonstration Project - Throughout 2001, SMP worked with its partners to develop a plan for restoring reach stability to address a severely eroding streambank at the confluence of the Woodland Valley stream and the Esopus Creek in Shandaken. The project has received \$250,000 in funding from the WEAP. Contingent upon agreement around a geomorphic design, DEP will match the WEAP funds.

During the latter part of 2001, DEP continued to negotiate the design of this restoration project with the Natural Resources Conservation Service (NRCS), the UCSWCD and Fisch Engineering. Additional hydraulic analyses were performed by Fisch Engineering to refine estimates of shear stresses along the eroding stream bank to in turn refine the mix of rock riprap and bioengineering along the face of the bank. By the close of the year, the NRCS and DEP had reached agreement on the majority of the design, including the primary geomorphic components, which include moving the stream to the other side of the valley and including a series of rock vanes and cross vanes. However, the parties had not agreed upon the final design by the close of the reporting period.

Prattsville Floodplain Restoration Project – This project was undertaken as a cooperative effort by the Town of Prattsville, GCSWCD, DEC, ACOE, a riparian landowner, and DEP, and was identified as one of three for initial funding by the ACOE under the WEAP to address ice

jamming and associated water quality problems in the Hamlet and the Schoharie Reservoir. A Design Project Cooperative Agreement was signed in 2001. Field surveys and design work were conducted by Lamont Engineers, Inc., with assistance from DEP and GCSWCD staff, to identify potential reference reach locations, compile known information on the USGS gauging station on the project reach, and to compile other stream geometry data for direct use or reference in completing the design process for the project area. The conceptual design will be completed and submitted in Spring 2002, for initial review by DEP and GCSWCD, and subsequently the remaining project partners.

5. Research, Mapping & Modeling

5.1 Comprehensive Watershed Monitoring

5.1.1 Specific Efforts to Address NRC & ILSI Recommendations

The International Life Sciences Institute (ILSI) issued a report (April 1998) entitled *Comprehensive Watershed Monitoring: A Framework for the New York City Reservoirs*. The ILSI report recommended the development and use of an integrated approach to watershed monitoring, which draws on modeling, risk-based planning and analysis, statistical sampling and design, and basic compliance monitoring. Similarly, in September 1999, the National Research Council (NRC) issued a report entitled “Watershed Management for a Potable Water Supply: Assessing New York City’s Approach.” The NRC report, like the ILSI report, contained a number of water quality monitoring recommendations, which the authors felt would further enhance the City’s existing program. For the most part, these recommendations have been fundamental components of the City’s drinking water quality monitoring program since its restructuring began fifteen years ago. The recent advances for 2001 that address the recommendations of ILSI and the NRC are described below.

Integrated Monitoring Program Development

In 2001, DEP commenced a comprehensive review of its watershed monitoring networks (responsible for Hydrology, Limnology, and Pathogen sampling) that have been established over the last decade to ensure that they meet all current long-term and short-term objectives. The impetus for this review was the expanding scope of DEP’s mandates, in terms of the need i) to meet new regulations, ii) to fulfill data requirements for watershed and reservoir models, and iii) to use the historical database to guide efficient sampling design. The monitoring program is integrated through its objectives; several collection networks (eg., stream and reservoir sampling) may contribute to a single objective (eg., providing the input data for model runs.) Therefore, the definition of objectives was the starting point for this comprehensive review, and they ultimately define the temporal, spatial, and analytical requirements of the monitoring program. Statistical features of the historical database were used, where possible, to guide sampling design for the monitoring networks and to give insight into the 'period of record' needed for trend detection. A draft document that provides the details of the sampling sites, frequencies, and analytical methods is currently under review. Through this process of conducting a critical review of the sampling networks, DEP is confident that its monitoring programs meet the current and future objectives of DEP - for operational and regulatory compliance, as well as the long-term evaluation of MOA programs. The document that describes the objectives and monitoring networks will be made available to EPA upon its completion in April of 2002.

Expand Storm Event Monitoring

During 2000, DEP initiated monitoring of storm events to assess the effectiveness of the newly constructed BMPs on streams draining into Kensico Reservoir. The BMPs, which are part of DEP's Kensico Reservoir Water Quality Control Program, were designed to improve stormwater quality by reducing loads of suspended solids and coliform bacteria, as well as levels of turbidity, in the streams discharging into Kensico Reservoir. The first of the BMPs constructed was Facility 12 (an extended detention basin) located at the mouth of Malcolm Brook at West Lake Drive. The construction of this BMP was completed during the fall 1999. During January and February 2000, monitoring stations were constructed and installed at the outlet of Facility 12, and at the two main inlets to Facility 12. Storm event monitoring began during March.

During 2000, several storm events were monitored, with sufficient data collected to calculate fecal coliform and total suspended solids loads entering and exiting the basin during six events, as well as sufficient data to calculate turbidity quasi-loads during seven events. In addition to the reductions in analyte loads discharged to Kensico Reservoir from Malcolm Brook, the BMP was also effective at reducing the peak rate of runoff that discharged to Kensico Reservoir, as well as the peak concentrations of fecal coliform and peak levels of turbidity.

In 2001, storm event sampling at BMP Facility 12 on Malcolm Brook continued in an effort to assess the effectiveness of the BMPs to remove pollutants. Samples were collected so that storm event loads into and out of the BMP could be calculated for 8 storm events. Data from monitoring Facility 12 were presented at the AWRA Annual Conference in November 2001.

DEP also initiated high runoff event monitoring on three catchments within the New Croton Reservoir watershed in 2000. The goal of this project is to document water quality changes in runoff before and after changes in land use. Two of the monitoring sites are located downstream from currently undeveloped areas where land use changes are expected to occur within the next two years. The third site is located downstream from an undeveloped area that is expected to remain undeveloped. Data from the third site will be used as a control to compare data obtained from the other two sites. The project will compare loads of total phosphorus, total dissolved phosphorus, nitrate-nitrite, dissolved organic carbon and total suspended solids calculated from storm event monitoring at the three sites before, during and following the land use change. Monitoring is expected to continue over the next ten years.

In 2001, storm event monitoring continued at the three catchments within the New Croton Reservoir watershed. Sufficient data were collected to calculate storm event loads and event mean concentrations during 7 storm events from these catchments. A summary report on monitoring the New Croton catchment sites is in preparation.

Expand Microbial Studies

DEP increased the number of quality control samples for the source waters (sites DEL18, CATLEFF and CROGH) to more frequently determine recovery of (oo)cysts. Recovery is determined by collecting a 50 liter sample rotating between the CATLEFF, DEL18 and CROGH sites every week. These samples are subsequently spiked with live (oo) cysts to determine precision and recovery of the analytical method in these matrices. In addition, a duplicated 50 liter sample is collected monthly. High volume, in-line spiking methods are also currently being developed by the laboratory staff.

DEP conducted comparative studies of the ICR and 1623 (50 L) methods at the source water influents and effluents. These studies concluded that the 1623 (50 L) method had higher detections of (oo)cysts. Starting October 15, 2001, DEP formally changed the source water method to 1623 (50L). Preliminary data has shown an increase in the frequency of detection of both *Giardia* cysts and *Cryptosporidium* oocysts.

Enhanced microbiological techniques have also been applied to DEP samples, when warranted, in the fields of serology, Ribotyping, F-specific RNA coliphage typing, and Small-Subunit ribosomal-RNA-Based Diagnostic Genotyping. Any of these methods alone can assist DEP in categorizing sources of potential contamination of the water supply. However, by using two or more of these techniques in concert with each other, the confidence in source identification is greatly enhanced.

DEP also enhanced microbial monitoring this year in response to the terrorist attack in NYC. The microbiology laboratories in each district are performing a screening of HPC plates for a bacteria that may resemble the colonial morphology of *Bacillus anthracis*. Any colonies fitting that description have been further tested and confirmed not to be *B. anthracis*.

Enhance Data Analysis, Interpretation, and Dissemination

Enhanced data analysis, interpretation, and dissemination consists of several major efforts that are currently taking place simultaneously at the DEP. This includes an improved Intranet and Internet system, implementation of a laboratory information management system (LIMS), and conducting an extensive SDWA project focussed on the production of several reports designed to summarize and interpret the findings from DEP's extensive monitoring programs.

DEP is currently in the process of designing and installing a laboratory information management system (LIMS) at the Kensico and Central Laboratories. At the Kensico Laboratory a detailed design document was produced by the vendor in collaboration with the Kensico LIMS team, and customized software based on the design has been installed. This software is very close to the production version. The design and testing of key reports were completed and testing of

login, result entry, and data review modules is about to begin. The Central Laboratory is still in the design stage. A draft design document has been written; however, recent changes in requirements may require revisions to the design.

DEP's capability to share data and run analyses via the Intra- and Internet is in the process of enhancement through the ParTech contract entitled "NYC Watershed Data Management and Software Tool Development." This is a three-year contract funded by SDWA and is in progress. Through this contract, DEP has obtained important imagery and developed specialized analytical software that will enhance watershed management. Another accomplishment is the beginning of the database conversion to Oracle to facilitate its link to the GIS. This link will be done through an application that is described below as the Water Quality Information System (WQIS.)

EPA approved funding to DEP through the Safe Drinking Water Act (SDWA) for a project on "Communication of Water Quality Data Analyses and Model Applications." The objective of the project is to enhance production of data analyses and reports to support watershed management decisions, and to communicate findings to other agencies and the public.

The SDWA project is composed of five sub-tasks as follows:

- Automation of DEP's Routine Water Quality Reports that will include the purchase of software and hardware, and the design of proprietary software to generate graphics for two related reports: an annual watershed report and a long-term trend report that will be produced at five year intervals.
- Condensed Version of the December 2001 report entitled *New York City's 2001 Watershed Protection Program Summary, Assessment and Long-term Plan* that will include: a comparison of current water quality to benchmarks (regulatory limits), an evaluation of long-term trends, a description of program implementation since the signing of the MOA and quantification of effects to date, and the projection of future effects of programs.
- Bureau-wide, Long-term Development and Project Management of DEP's Intra/Internet including the implementation of a web application for database publishing that will allow the access of water quality and other databases through the use of browsers (e.g., Netscape or Internet Explorer). The same web application would enable reports to be generated dynamically directly to the Internet or Intranet. This would greatly automate the data sharing process; as long as data users know how to use a browser, they will be able to access and analyze data.
- Media Conversion of Historical Water Quality Data from microfiche copies of original handwritten lab books to data in digital format. More accessible historical water quality data is essential for analysis of long-term trends.
- Implementation of the Water Quality Information System (WQIS) for Enhanced Data Organization that will include a centrally managed database with current and historic data. The key component of the WQIS system management will be a hybrid of the GIS/Intranet software and an ORACLE database.

A contract to conduct the above tasks was signed by DEP and DEC and work on these tasks will begin in March of 2002.

5.2 Total Maximum Daily Loads

DEP continues to work with the DEC to develop Total Maximum Daily Loads (TMDLs) of total phosphorus. Under the Clean Water Act, DEC is required to develop and implement TMDLs for waterbodies listed on the State's 303(d) list. DEP agreed to assist the State in developing TMDLs for the watershed, which primarily consists of phosphorus modeling, data analysis and preliminary TMDL calculations. The TMDL program is being conducted in two phases, so that pollution reduction strategies can be implemented as soon as possible in the reservoirs exceeding their TMDLs. Phase I consisted of the application of basic models utilizing available data; Phase II consists of model refinement and additional data. Phase I TMDLs were approved by EPA in April 1997. DEP released a series of Phase II TMDL technical reports in March 1999; DEC submitted the Phase II TMDL package to EPA in June 2000; and EPA approved the Phase II TMDLs in October 2000.

The MOA requires two reports describing the impacts of existing City and State programs on nonpoint source loads of phosphorus and potential nonpoint source management practices that could be implemented in order to achieve the Phase II TMDLs in the watershed. The first report, coauthored by DEP and DEC, was released on April 30, 2001. The report described the impacts of existing City and State programs on nonpoint source loads of phosphorus and potential nonpoint source management practices that could be implemented and provided some additional watershed analyses to assist stakeholders in allocating phosphorus reductions. The second report, authored by DEC with input by DEP, is anticipated in early 2002.

5.3 Terrestrial and Reservoir Modeling

5.3.1 Terrestrial Modeling

DEP continued to develop and apply GWLF models for simulating stream flows, and nutrient and sediment loading, in the Catskill/Delaware watershed. Data to support GWLF modeling were acquired, updated and/or developed. Calibration and verification of GWLF hydrology sub-models were conducted for all Catskill/Delaware watersheds and GWLF water quality sub-models were calibrated for all Catskill/Delaware watersheds. The ability to evaluate BMPs was added to the GWLF model, so that management scenarios could be generated.

GWLF was functionally linked to the reservoir model and to supporting GIS and time-series databases, to permit the models to be run in an integrated application. The integrated modeling system was used in a preliminary evaluation of the effectiveness of MOA programs in Cannonsville and Pepacton reservoir watersheds.

Model Data Acquisition and Development

DEP continued to acquire and develop data to support terrestrial model development, testing, and applications. Land use, SCS Runoff Curve Number and USLE Erosion Potential grids were developed or updated to provide inputs for GWLF model calibration, testing and applications. Time series of stream flow at USGS stream gauges and water quality at DEP water quality monitoring sites were updated with more recent data to support model testing.

An updated and improved land use/land cover map of the Catskill/Delaware watershed for use in terrestrial modeling is being created as part of task 1 of the SDWA project with PAR Government Systems Corporation (PAR) on Watershed Data Management and Software Tool Development (PAR SDWA project). The updated land use/land cover map will be based on recent satellite imagery with ground-truthing, and will incorporate ancillary data including tax parcel data. See the GIS section of the annual report for more details.

An evaluation of additional water quality monitoring data needs to support completion of GWLF model calibration and verification of the Catskill/Delaware watershed was performed. For each reservoir watershed, the frequency and duration of additional water quality monitoring, including storm event monitoring, required for completion of model calibration and verification, was estimated. These estimates are being used in the planning of future DEP water quality monitoring, to be reported in April 2002.

Calibration and Verification of GWLF Models

DEP continued to calibrate and verify GWLF models for the Catskill/Delaware watershed. GWLF hydrology sub-models were calibrated and verified for Schoharie, Ashokan, and West Branch Reservoir watersheds. GWLF water quality sub-models were calibrated for these three reservoir watersheds. With the completion of these reservoir watersheds, the calibration and verification of GWLF hydrology sub-models for all Catskill/Delaware watersheds is complete.

Incorporation of BMPs into GWLF

The ability to evaluate the effects of non-point source management practices on nutrient loading within the GWLF modeling framework was developed, tested and applied in a preliminary evaluation of watershed management in Cannonsville and Pepacton watersheds. Methods were developed to: quantify BMP implementation by watershed programs; estimate BMP nutrient reduction efficiencies by literature review and data analysis; and apply BMP efficiencies and implementation rates to source-specific GWLF loading estimates. Incorporation of BMPs into GWLF was supported by USDA Agricultural Research Service (ARS), as part of the Town Brook Research Program. The ARS developed a database of agricultural BMPs and associated nutrient removal efficiencies and helped develop the methodology for applying these data within the modeling framework.

GWLF Applications to Support Watershed Management

The GWLF model was applied to estimate the effects of watershed management programs on nutrient loads to the Cannonsville and Pepacton Reservoirs. Four management programs were evaluated: WWTP Upgrades; Watershed Agricultural Program; Urban Stormwater Program and Regulations; and Septic System Rehabilitation Program. Calibrated GWLF models for Cannonsville and Pepacton watersheds were used to estimate nutrient loads from different watershed sources under baseline, pre-management conditions (no BMP or WWTP upgrades effects). Nutrient reductions due to each watershed management program were estimated from BMP nutrient removal and implementation data. These reductions were then applied to the baseline results to obtain a management scenario. Loading estimates for the management scenario were compared with the baseline GWLF model loads to estimate the effects of the four watershed management programs on nutrient loading.

Estimated phosphorus loading reductions due to implementation of the four watershed management programs were substantial. Loading reductions exceeded 25% for both dissolved and particulate phosphorus in Cannonsville watershed and exceeded 10% for both dissolved and particulate phosphorus in Pepacton watershed. Point source WWTP upgrades and the implementation of agricultural BMPs by the Watershed Agricultural Program provided most of the loading reductions, followed by septic system remediation. Urban stormwater management provided insignificant reductions in both dissolved and particulate phosphorus, due to the limited nutrient contributions from the small amount of urban land use under baseline conditions.

5.3.2 Reservoir Modeling

Cannonsville Reservoir Modeling

The *Cannonsville Management Model*, completed in 1999, has served as the template for development of similar models for the remaining six Catskill/Delaware reservoirs. The *Cannonsville Management Model* has been incorporated into a linked, one-dimensional framework. These models (*Catskill/Delaware Management Models*) have received long-term baseline loading simulations, using the lumped parameter model, GWLF, and serve as the primary tool to evaluate watershed best management practices as they relate to reservoir water quality with respect to eutrophication.

GWLF loads have been simulated for a multiple year period (30+ years), using current land use and average point source conditions, along with precipitation conditions over that time period. These loads have been used to develop and test the software for the linked management model. Despite some problems with the water balance once the watershed and reservoir models are linked, the model is performing well. Further refinements are anticipated.

Catskill/Delaware Reservoir Modeling

Completed reservoir models for each of the Catskill/Delaware reservoirs were delivered in February 2001. Hydrothermal one- and two-dimensional models have been calibrated and verified for several years for each reservoir. Water quality models that simulate the influence of external loading of nutrients on in-reservoir conditions have also been calibrated and verified to support nutrient management programs specified under FAD and MOA mandates, such as the phosphorus TMDL program. Upstate Freshwater Institute (UFI) has performed the work, under contract, to develop and test the models. A user-friendly graphical user interface has been developed for the one-dimensional models. Throughout the contract period, in-house reservoir modeling staff has collaborated with UFI on all technical matters and has received training on all aspects of model use. Work has also continued for Kensico Reservoir models; a two-dimensional hydrothermal model was calibrated for that reservoir that can be used for tracer studies. Future plans include adding Kensico Reservoir to the linked reservoir models so that system-wide predictions can be made.

Ongoing Research

Ongoing water quality modeling initiatives have established that the reservoirs of the Catskill/Delaware system have unusually high levels of inanimate particles (tripton) relative to concentrations of phytoplankton. Much of this material is clay minerals received from highly erodible watersheds of these reservoirs. Tripton has important water quality implications for these reservoirs, as it increases turbidity and the attenuation of light, influences the cycling of a number of constituents such as phosphorus, and interferes with the application of the widely used indicator of trophic state - total phosphorus (TP). While ultimately received from the watershed, tripton is also delivered to the water column of these reservoirs through a sediment resuspension process. Modeling analyses have demonstrated that it is critical to accommodate the effects of tripton and resuspension processes in the current nutrient-phytoplankton water quality models. A detailed research project began in the 2001 sampling season. Process study and monitoring needs were conducted and will continue through the next sampling season (2002). Once the data requirements are completed, the Cannonsville model will be upgraded to include a credible tool to predict TP that comes from processes other than external loading from watersheds. While this research is specific to Cannonsville Reservoir, the findings will have utility for other reservoirs as well.

Model Application and Future Planning

The new models will provide tools for managers to be able to evaluate the impacts of watershed practices for each reservoir, as well as the impact one reservoir may have on another. This feature is especially relevant to the City's Catskill/Delaware system. By running various operational scenarios (i.e., withdrawal depths, release quantities, timing of release) the models will assist in making water diversion decisions that will optimize quantity and quality of water within the water supply.

The reservoir modeling group has continued to develop an extensive database of all data needed for model input and testing. These data come from DEP's water quality and engineering groups, as well as other agencies. Terrestrial and reservoir modeling staff have worked together to develop a monitoring needs list for continued modeling support into the future. This list will include water quality monitoring of reservoirs, streams and aqueducts, plus necessary forcing data for model input of additional years. All data are organized, checked, and analyzed by reservoir modeling staff as time and resources permit. Future plans for the reservoir modeling group include continued model testing, evaluation and management of all necessary data, upgrade of the graphical user interfaces to meet new needs, and working with DEP's scientists and engineers in performing model runs for specified requests. Modeling staff will also work closely with policy and regulatory groups to ensure that the models and their graphical user interfaces can accommodate the requirements of these activities. All data will continue to be reviewed by in-house modeling staff to ensure their accuracy and completeness with respect to model requirements.

5.4 Geographic Information System

DEP continued to develop the upstate Geographic Information System (GIS) and to use it in support of FAD and MOA programs. The GIS was used for hardcopy mapping, geographic analyses, spatial data development, visualization and analysis of remotely sensed imagery and water quality modeling.

The system includes networked UNIX and Windows workstations at DEP GIS laboratories in Kingston and Valhalla and on individual desktops. Users access spatial data stored in data libraries on central servers. ESRI (ArcInfo, Arcview, ArcGIS) and ERDAS (Imagine) are the GIS software packages of choice. The Grahamsville and Shokan sites have a Windows workstation for on-site GIS work. Global Positioning System (GPS) technology is used for field data collection.

5.4.1 GIS System Development

Hardware and software upgrades were initiated to maintain an enterprise GIS of the highest caliber, one providing essential support for the diverse requirements of DEP watershed management programs.

ESRI's release of ArcGIS 8, a software package that integrates ArcInfo and Arcview functionality into three graphical desktop applications (ArcCatalog, ArcMap and ArcToolbox), significantly influenced the direction of evolution for the GIS. ArcGIS 8 was released in conjunction with the new ESRI geodatabase model, a third-generation, object-oriented data model for representing geographic information, one that replaces second-generation coverage and shapefile formats. DEP decided to implement the geodatabase within a relational database (Oracle) using ArcSDE, an ESRI software product that serves as a gateway for managing spatial data in a data-

base management system. Among its strengths, this configuration allows for representation of relationships between data sets and for increased complexity as one queries associated attribute information.

DEP's decision to proceed with an ArcGIS/ArcSDE/Oracle implementation required additional staff support, provided by way of Safe Drinking Water Act (SDWA) funding and contractual arrangements with DEC and PAR Government Systems Corporation (PAR) of Rome, NY. An Oracle database administrator implemented a prototype geodatabase in Oracle on a networked SUN workstation; he will support a full conversion of existing GIS libraries to the geodatabase model. A UNIX system administrator has provided technical assistance at each site; he will install, configure, and administer new SUN data servers due to arrive in 2002. The SUN (UNIX) servers will be networked to UNIX and Windows clients at each site. The geodatabase implemented at Kingston will be mirrored to the Valhalla site.

Associated with acquisition of ArcGIS 8 were actions to upgrade Windows hardware at each site. New COMPAQ application servers installed at Kingston and Valhalla serve ArcGIS 8 to client PCs in the GIS labs and on individual desktops. The Valhalla site acquired 10 Dell workstations, the majority for use in a reconfigured GIS lab. A similar order is underway for Kingston. The Ashokan workstation was upgraded and configured to access Valhalla GIS data by way of the T1 line.

As GIS staff become more familiar with the functionality of the new software and its extensions (Spatial Analyst, 3D Analyst, GeoStatistical Analyst) it will play a larger role in daily workflow. ArcInfo Workstation and Arcview 3 software remain available on UNIX and Windows machines, providing a robust tool set for GIS mapping and analyses.

Acquisition of tabloid-size color printers (HP8550CM) and large-format plotters (HP1055CM) at the two labs allowed the Bureau to retire older equipment and to enhance map output capability. Valhalla staff upgraded the GPS base station at Shaft 18 in the East of Hudson watershed from a Community Base Station to a Trimble Reference System. Two Trimble Geo-Explorer 3 GPS units were purchased to supplement previously acquired survey-grade units. GPS enhancements enabled DEP to collect a variety of project field data.

5.4.2 GIS Database Development

Recognizing the importance of a high quality spatial data library as a fundamental component of the GIS, DEP continued to upgrade, create and obtain data products. Library data developed in-house were submitted for QA/QC review. Designated GIS staff at each site collaborated to manage and update the libraries. These efforts promoted use of a common foundation of up-to-date and accurate spatial data for GIS activity.

In part, DEP data development work during the year focused on using tax parcel data available for most of the EOH and WOH watersheds to refine existing thematic layers or develop new ones at a scale of 1:4,800. These layers included municipal boundaries (town, village), designated priority areas as per the 1997 MOA, NYS-owned land, and pre-MOA NYC-owned land. Similar work continues; the parcel data is primary source material for creating a coverage of “protected open space.” DEP updated existing library data layers, including several monitoring site files, a coverage of newly acquired lands (post-MOA) and proposed septic maintenance service areas, among others.

In addition to in-house development work, DEP staff acquired watershed-relevant data from other organizations. Recently completed land use/land cover data were obtained from Dutchess County. The data were used to upgrade an interim EOH land use/land cover data layer and for terrestrial modeling of nutrient loadings from the landscape. DEP acquired a draft version of DEC stream classification hydrography for the watershed. Monitoring site files (flow, water quality) were downloaded from USGS web sites. The efforts of a DEP summer intern from Ulster County Community College resulted in the addition of another series of watershed-wide imagery to the library; a color-balanced version of leaf-off ortho imagery in MrSid (compressed) format for all quads comprising the watershed was downloaded from the NYS Clearinghouse.

PAR began work on additional data products for the upstate GIS. LIDAR elevation data were collected and are being used to refine shoreline mapping of reservoir extents as defined by spillway elevations. One-foot CIR EMERGE and LANDSAT ETM imagery were obtained and are being used to develop up-to-date watershed land cover and land use data products. The EMERGE imagery is being used to map impervious surface in the EOH watershed. Thermal imagery has been collected for the Town Brook (Cannonsville) and Biscuit Brook (Neversink) sub-basins and may prove useful for refining hydrography information. These PAR data development efforts are ongoing.

Finally, DEP preserved and utilized historical information by scanning maps, georeferencing the images when appropriate, and in some cases, digitizing features from the scanned data. In particular, “Topographical Maps of the Croton Watershed” from 1889 that contain valuable information about areas prior to reservoir construction were scanned and image processed using Adobe Photoshop. Cannonsville historical data (roads, houses) were derived from USGS 15-minute quadrangles (1901 to 1926) and from Army Map Service and USGS 15- and 7.5-minute quadrangles produced in the 1950’s. Work began on scanning and georeferencing approximately 100 maps of a 1983 Fairchild aerial survey series, a planimetric depiction of the entire EOH watershed.

5.4.3 Training and Professional Meetings

Upstate GIS staff furthered their professional growth by attending conferences and training events, and by participating in GIS user groups. Staff helped other DEP employees improve their GIS skills by offering formal software instruction and informal technical support.

DEP staff presented a paper at the 2001 ESRI International User Conference in San Diego, CA, titled "Using Airborne LIDAR DEMs to Delineate NYC Reservoir Boundaries According to Spillway Elevation Contours." Several DEP GIS users were involved in ESRI-sponsored workshops about ArcGIS 8 and the geodatabase data model.

In addition, a GPS training seminar was provided for Engineering and other DEP staff. The seminar concentrated on fundamental GPS concepts and utilization of the technology, including data acquisition with newly acquired dataloggers and data processing with the latest version of Pathfinder Office software.

DEP GIS staff attended a yearly meeting of the Capital District GIS Users Group and quarterly meetings of the Catskill GIS Users Group. The most recent was held at Sullivan County Community College, Loch Sheldrake, NY in conjunction with the international recognition of GIS Day. These forums foster collaboration among GIS users in the eight counties that comprise the NYC watershed. They also serve as information clearinghouses that allow DEP staff to stay abreast of system and data development efforts of other organizations.

5.4.4 Project Status

Semi-annual progress reports to EPA from DEP in July 2001, and January 2002, detailed the scope of FAD and MOA projects in which the BWS upstate GIS was utilized. These documents provided detailed lists of the numerous maps that were produced, along with brief descriptions of individual projects.

Hundreds of maps were produced in 2001, to support the programmatic needs of groups throughout the Bureau. Maps were created for and/or by the Land Acquisition Program (basin status, community review, gap analysis), the Reservoir and Terrestrial Modeling Groups (monitoring sites, drainage basins, Town Brook research), Limnology and Hydrology Groups (sampling sites, turbidity, fish kill), the DEP Public Affairs Office (system overview), the DEP police (routine patrol work, post 9/11 surveillance team, siting communication antennae), the Stewardship Program (recreational use, conservation easements, forest inventory), the Pathogen Group (drainage basins, landscape characteristics), the Wildlife Studies Group (waterfowl management, reservoir survey, bird observation), the Water Quality Impacts Assessment Group (toxic contaminants, biomonitoring), the Stream Management Program (flood plains, stream classification), the Natural Resources Group (wetland tracking, state regulatory wetland map revision), and the Division of Operations and Engineering (salt storage facilities, regulatory review of stormwater/wastewater/watercourse disturbance projects, individual septic system replacements, Kensico flow monitoring, wetland/other project locations, stream classification), among others.

Maps not only assisted Bureau staff with routine watershed monitoring and management tasks but also contributed to emergency response and planning efforts. Map products were presented to other agencies in satisfaction of regulatory requirements, for information and review. GIS staff continued to refine interactive software routines that automated recurring mapping tasks performed by real estate specialists and stewardship program specialists.

In conjunction with these mapping efforts the GIS was used extensively to provide technical support, query and analysis for DEP projects. These projects included Kensico Stormwater Management; Residential Survey and Identification of Failing Septic Systems in the West Branch/Boyd's Corner/Kensico reservoir basins; Wetlands Tracking; Designated Main Streets; Nonpoint Source Pollution Management Plan for the EOH Cat/Del Basins; Stormwater and Erosion Remediation; Impervious Surface Cover Threshold Evaluation; Project Site Constraints; Intermediate Sized Sewage Treatment Systems; Baseline Documentation of Conservation Easements; Inventory of Newly Acquired Lands; Forest Management Plans; Stream Management; Sewer Extension; Whole Farm Easements; Out-Basin Planning for Land Acquisition; Town Brook Research; Pesticide and Toxic Compound Monitoring; and water quality Special Investigations, among others.

Generally, as the GIS has evolved to include more detailed and watershed-wide data layers, and as a greater number of users are able to access the system through graphical interfaces, the GIS has played a larger role as a resource for programs of watershed management. It was used not only to develop criteria for implementation of FAD and MOA programs, particularly land acquisition, but also to identify constraints to implementation. It was used to establish baseline documentation of City-owned properties and initial conditions for a variety of other projects.

The GIS was used in planning new, extended, or upgraded infrastructure for water supply, wastewater treatment and stormwater management facilities. The GIS was used as a tool to assist in either planning for or responding to an emergency, whether the threat of terrorist attack or accidental spill. The GIS continued to play an instrumental role in supporting ongoing research into sources and processes of water quality degradation; it was used to plan for and to evaluate BMPs and other remediation activities. The reader is referred to the above mentioned status reports for more thorough description of 2001 project activities that utilized GIS.

5.5 Pathogen Research

5.5.1 Wildlife Studies

During 2001, DEP's Pathogen Program Wildlife Studies continued to monitor impacts from wildlife and domestic animals throughout the watershed. Investigational studies, through the collection and analysis of baseline data on populations and field samples, continue to implicate wildlife, particularly waterbirds (waterfowl and gulls), as the most important contributor of seasonal fecal coliform bacteria (FCB) to the upstate reservoirs. The implementation of a Waterfowl Management Program to manage bird populations has thus far been DEP's most successful

mitigative measure that has significantly reduced fecal coliform bacteria levels in its upstate reservoir system. A Pathogens Wildlife Sampling Program, developed in 1996 to identify prevalence and relative contribution of *Giardia* spp. and *Cryptosporidium* spp., has continued into 2001 to include impact analysis from domestic animals (pets).

Waterfowl Management Program

The Wildlife Studies Waterfowl Management Program was developed by DEP to identify and mitigate waterbirds as a source of fecal coliform bacteria to the New York City reservoir system. The objectives of the program include: 1) record year-around waterbird populations on select reservoirs; 2) assess seasonality and species-specific impact; and 3) develop waterfowl management strategies to deter bird activity that negatively impacts water quality.

To accomplish these objectives, routine monitoring was conducted for all avian species inhabiting five upstate reservoirs within the New York City water supply system. Reservoir monitoring was selected according to each water body's relative importance to Kensico Reservoir and distribution. Weekly bird surveillance monitoring was conducted at Kensico, West Branch and Ashokan Reservoirs. Bi-weekly monitoring was conducted at Rondout Reservoir, upstream of West Branch and Kensico and at Jerome Park Reservoir. Weekly monitoring is also conducted at Hillview Reservoir, which receives treated water from Kensico.

As part of the Waterfowl Management Program, the bird deterrent and harassment component continued to significantly reduce daily waterfowl and gulls numbers. The reduction in bird numbers has had a direct effect on New York City's compliance with the Surface Water Treatment Rule in significantly reducing fecal coliform bacteria levels. Since the fall of 1993, DEP's bird deterrent and harassment program has successfully eliminated any seasonal increases of waterfowl and gull populations roosting at both Kensico and Hillview Reservoirs, resulting in the abatement of seasonal FCB elevations.

The yearly bird harassment activities begin each August and operate daily from pre-dawn to post-dusk hours through March. Harassment activities, conducted through a DEP contract, were temporarily suspended following the terrorist actions of September 11th but were immediately re-instituted. This program was designed to deter all resident and migratory bird activity of waterfowl and gull species from the surface water and adjacent upland areas. Through the use of motorboats, hovercraft, noisemakers (bird bangers and screamers), and bird distress tapes, this nonlethal program displaces birds from Kensico to other regional and local waters and properties. DEP temporarily suspended the use of noisemakers following September 11th and redeployed the technique in early January 2002. Local breeding populations of Canada geese (*Branta canadensis*) were also monitored and managed to eliminate local breeding activity. This was conducted through an egg-depredation program (USFWS permit # MB789947-1 and DEC permit #

DWP01-039) at Kensico, West Branch, Rondout, Ashokan, Hillview and Jerome Park Reservoirs. Additional monitoring through the use of identification bands, neck collars, and auxiliary leg bands is also conducted yearly.

Reservoirs upstream of Kensico Reservoir continue to be monitored to determine if a bird deterrent program is necessary at these more remote locations. To date, DEP has implemented various bird deterrent methods at the Rondout Reservoir, Ashokan and Jerome Park Reservoirs on an as needed basis.

Pathogen Wildlife Program

The Pathogen Wildlife Program was developed by DEP to investigate the prevalence and concentration of pathogens (*Giardia* spp. and *Cryptosporidium* spp.) in individual species of wildlife and their impacts on reservoir water quality. DEP has been actively sampling terrestrial and avian species of wildlife for the presence of pathogens. A pathogen sampling program was initiated through a contract with Cornell University's Veterinary College, Parasitology Section, to identify pathogen concentration in domestic animals (pets) and all wildlife species that potentially contribute *Giardia* spp. and *Cryptosporidium* spp. in two upstate watershed subbasins (Malcolm Brook, Kensico Reservoir and Ashokan Brook, Ashokan Reservoir). Through this contract, DEP will be able to better determine the relative contribution of *Giardia* and *Cryptosporidium* from domestic animals and a variety wildlife species. The final report is expected to be completed in 2002.

5.5.2 Monitoring for Source Water

DEP conducts weekly sampling for (oo)cysts and viruses at the inflows, [CATALUM, DEL17] and outflows, [CATLEFF, DEL18] of Kensico Reservoir, the discharge of Malcolm Brook, [MB1] and the outflow of the New Croton Reservoir, [CROGH]. Sampling also occurs weekly at the release of the Croton Falls Reservoir [CROFALLSR] when water from this reservoir is pumped into the Delaware Aqueduct. From June 1992 to May 1999, routine source water protozoan samples were collected and analyzed following Protocol P229 (ASTM 1992). Increased recovery of *Giardia* cysts was observed during DEP's participation in the Information Collection Rule (ICR) from July 15, 1997 to December 8, 1998. This finding led DEP to collect over 100 additional samples using both methods (ASTM and ICR) to determine whether a method change was warranted. DEP decided to switch to the ICR method for the source water keypoints [CATLEFF, DEL18, CROGH] on May 4, 1999. To fully evaluate the sources of the (oo)cyst detection at the effluents of Kensico Reservoir, the method used for the samples collected at the Kensico influents was also changed to the ICR method on March 13, 2000. Results from the routine sampling using the ICR method continued to indicate more frequent detection of *Giardia* cysts. EPA published the most current method (Method 1623) for (oo)cysts with the intent that it will be used for the upcoming Enhanced Surface Water Treatment Rule Long Term 2 (LT2ESWTR) regulations. In preparation for switching to this new method, DEP conducted two comparative studies, one 13-week study at the Kensico influents and an 8-week study at Kensico

effluents. Beginning July 30, 2001, samples at Kensico influents were collected and analyzed using EPA method 1623 (50L HV filter). Similarly, the method used to analyze source water key-point samples was switched to the new method beginning October 15, 2001. The ASTM method continued to be used to collect and analyze samples from Malcolm Brook [MB1].

Figures 5.1 through 5.6 provide temporal plots for the entire duration of DEP pathogen monitoring (June 1992 through December 2001) of the monthly averages of *Giardia* and *Cryptosporidium* (oo)cysts concentrations for the aqueduct keypoints for the source water reservoirs. Site CROFALLSR has little data available (n=19) over the 1992-2001 period since monitoring is conducted only when waters from this site are pumped into the Delaware aqueduct. To be consistent with the proposed LT2 regulations, the concentrations are presented in the plots as (oo)cysts per liter and non-detection results are treated as equal to zero. The data is partitioned into time frame blocks distinguishing different lab analysis methods. Because method changes often occurred in the middle of a month, a mean of all data collected (regardless of method) was used to represent the monthly averages for these months. The figures indicate fairly similar average concentrations during the early part of the monitoring program (1992-1994, ASTM method) with the more recent ICR and 1623 (1999-present) results. A marked absence of *Giardia* and *Cryptosporidium* was noticed for the intervening period 1995-1999. It is unknown whether these changes are of environmental consequence or an indication of improved method recoveries and increasing analyst proficiency.

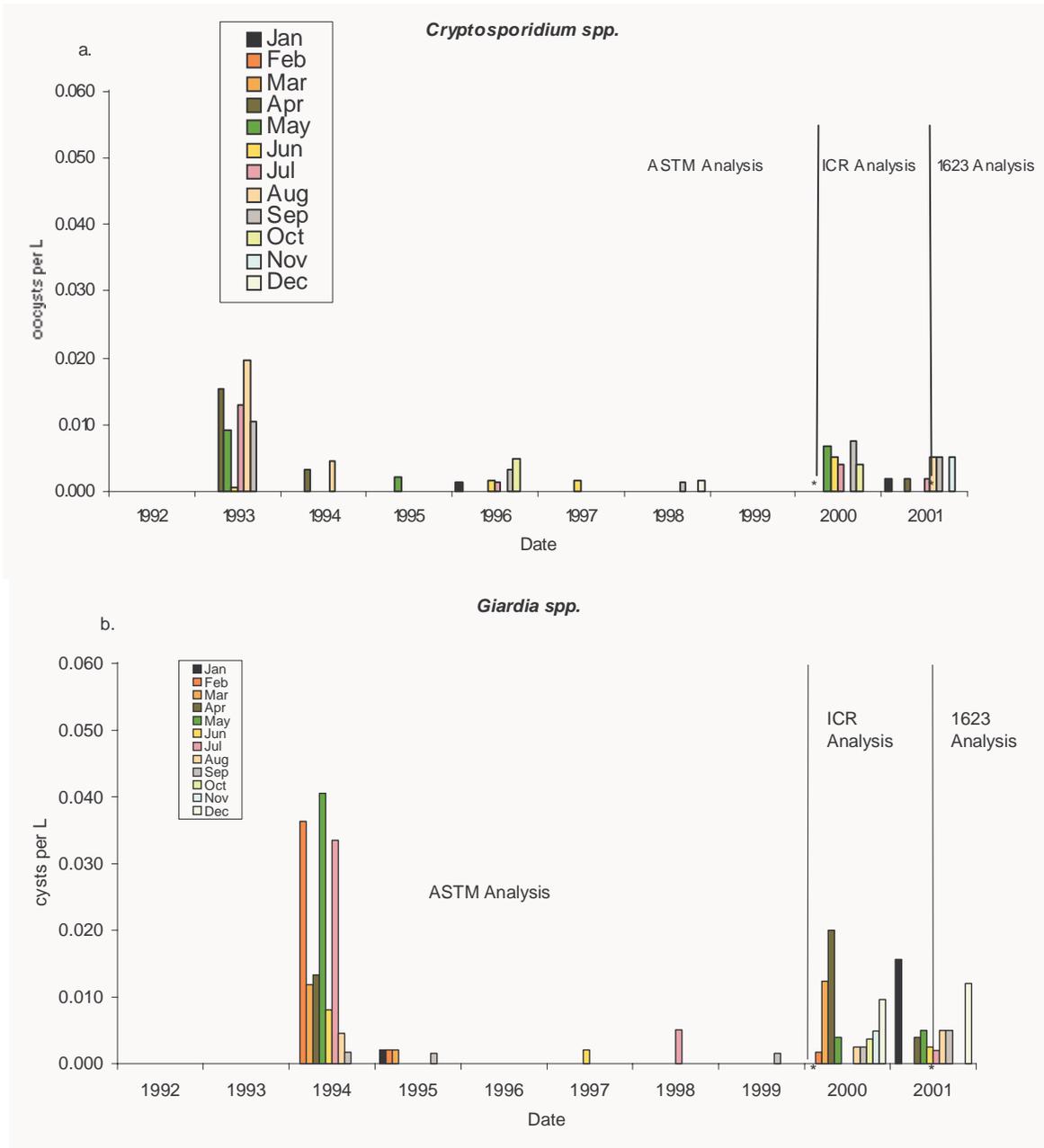


Figure 5.1. Monthly average of routine sample data for entire duration of DEP pathogen monitoring at Kensico Reservoir influent site CATALUM. Non-detects set to zero for calculation of arithmetic mean.

*Change in analysis method occurred during month.

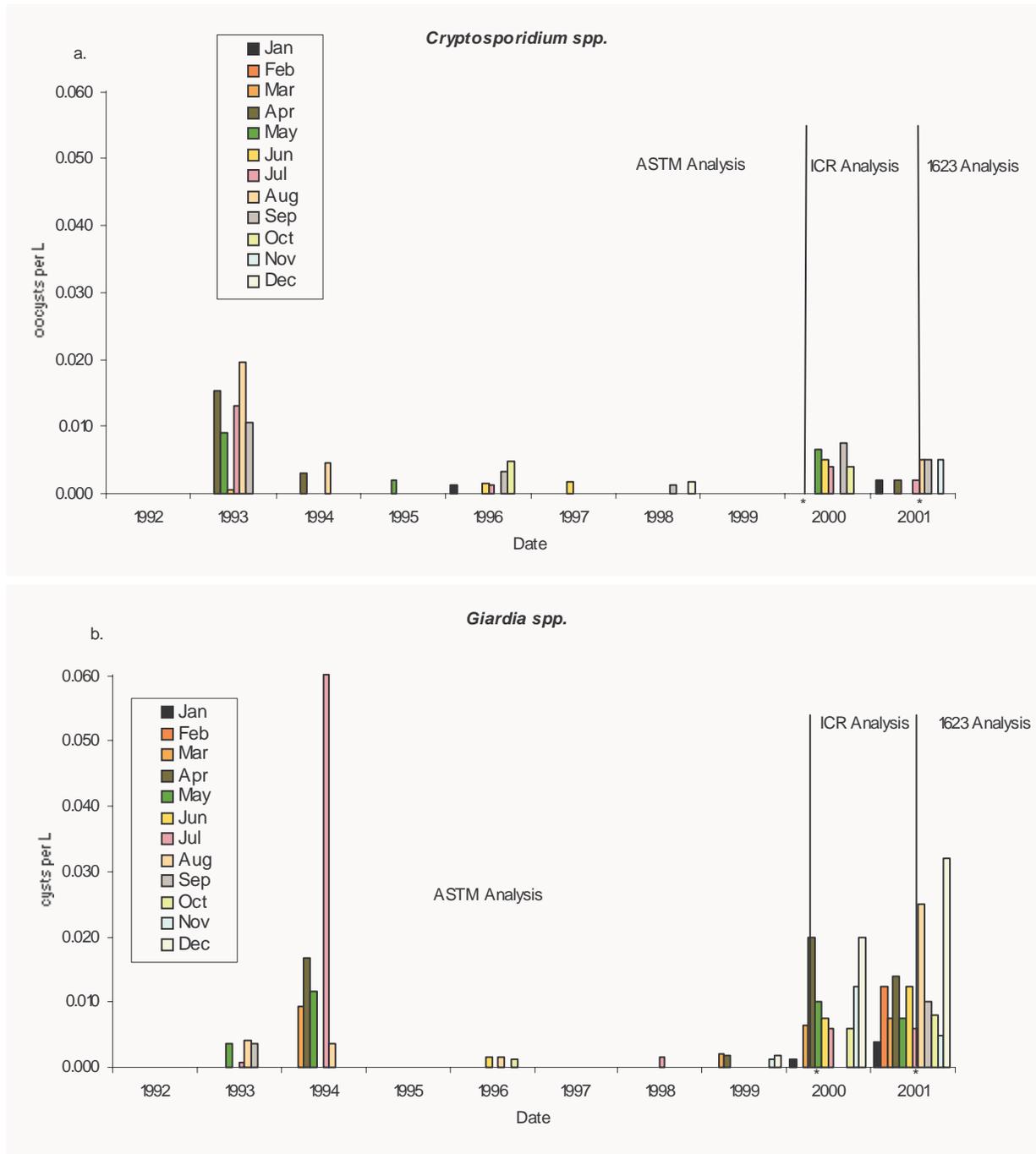


Figure 5.2. Monthly average of routine sample data for entire duration of DEP pathogen monitoring at Kensico Reservoir influent site DEL17. Non-detects set to zero for calculation of arithmetic mean

*Change in analysis method occurred during month.

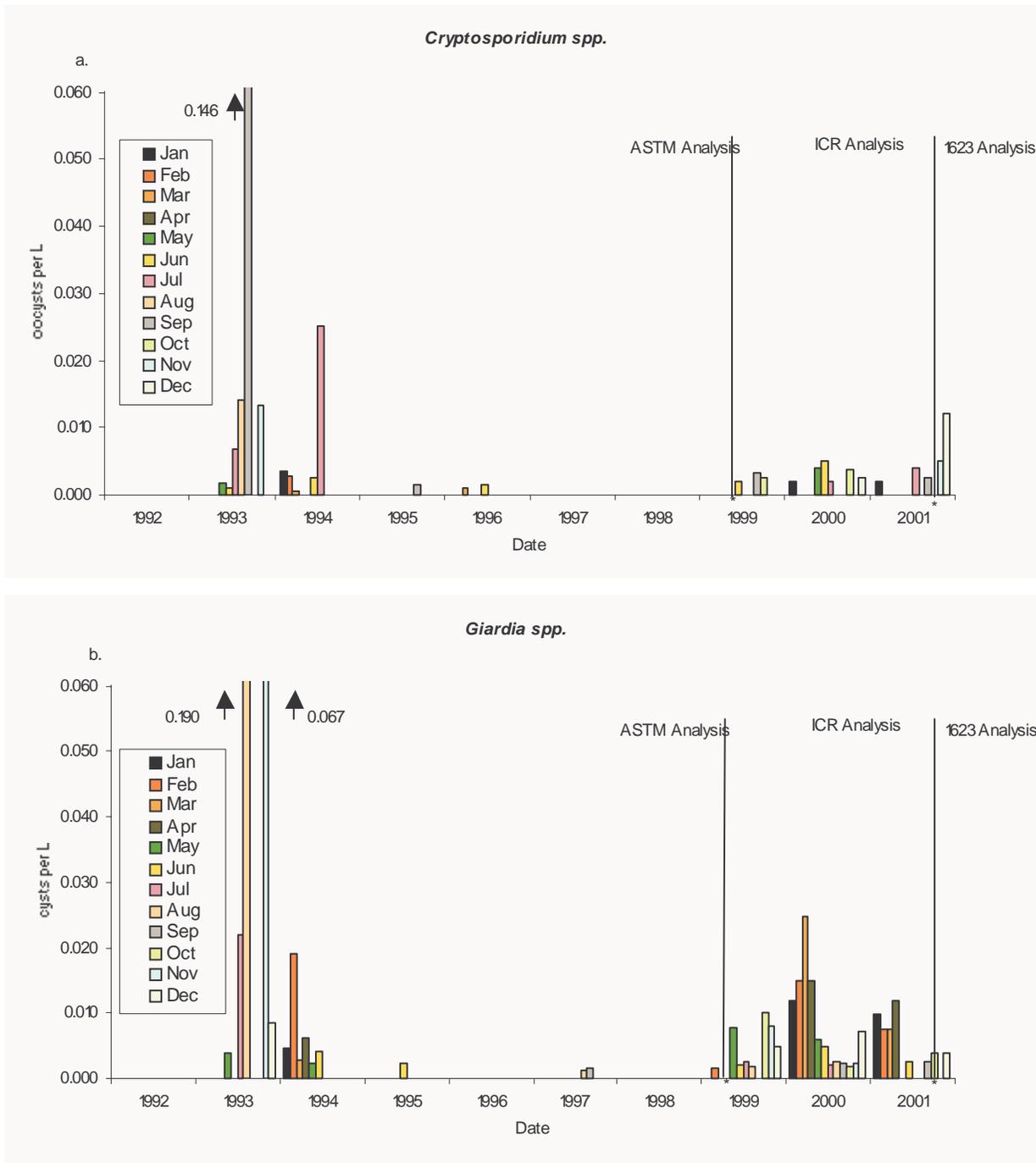


Figure 5.3. Monthly average of routine sample data for entire duration of DEP pathogen monitoring at New Croton Reservoir effluent site CROGH. Non-detects set to zero for calculation of arithmetic mean

*Change in analysis method occurred during month.

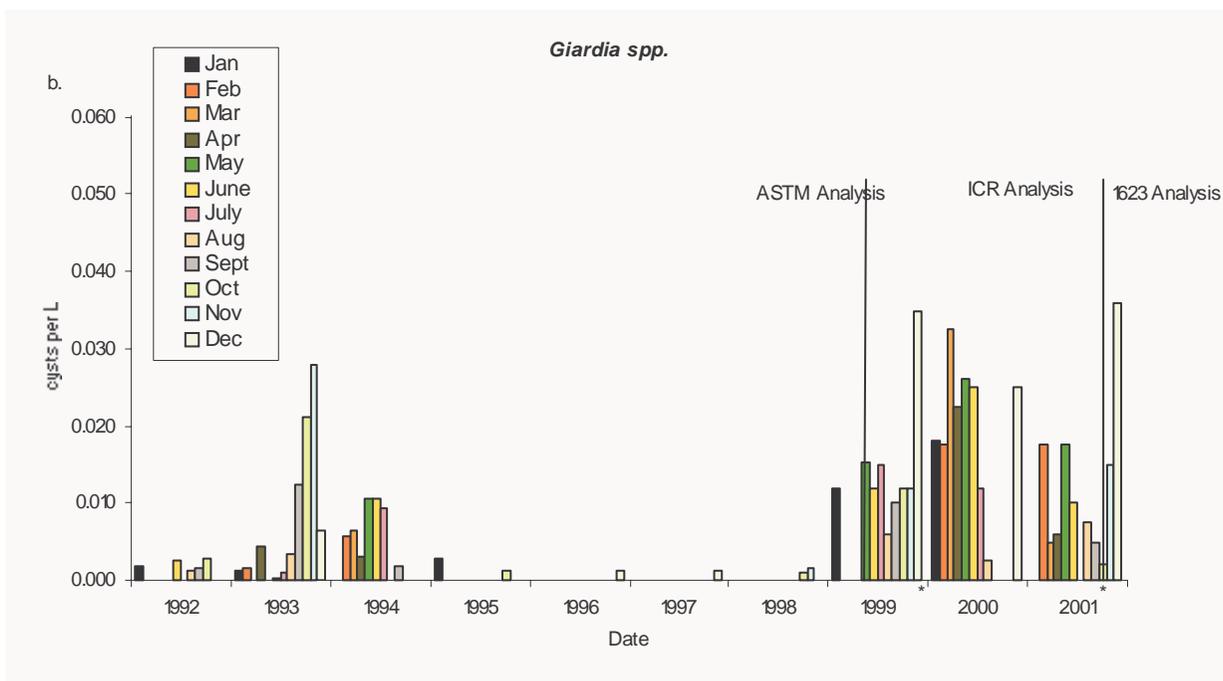
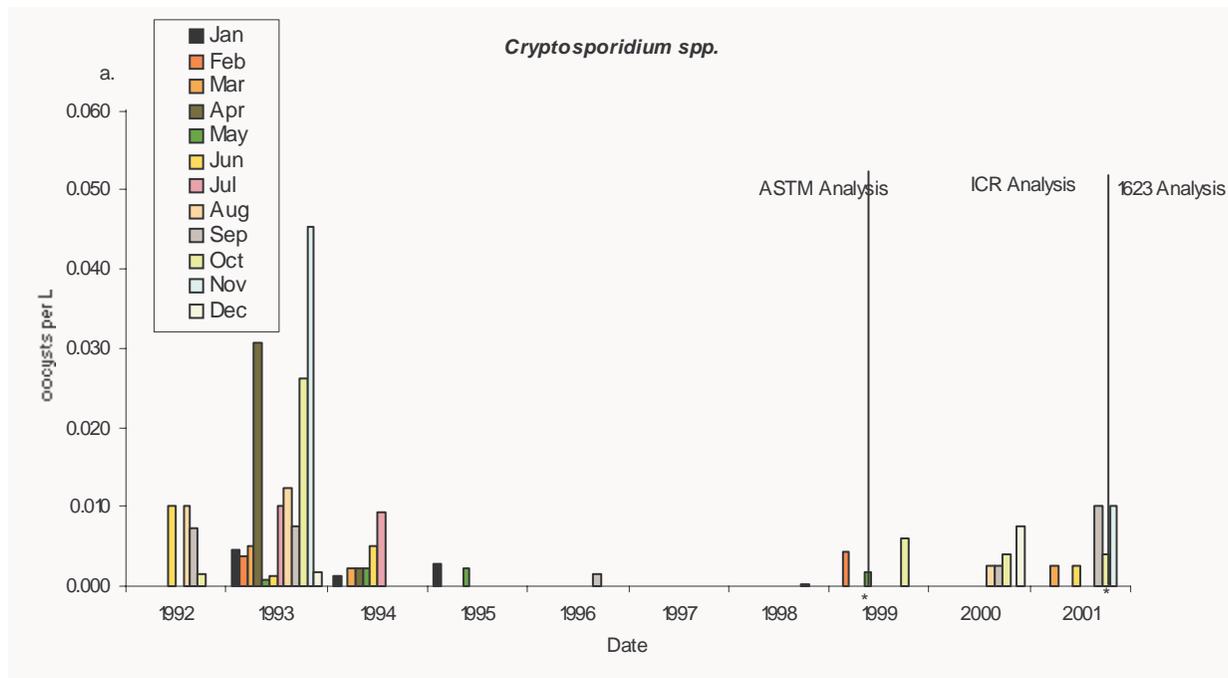


Figure 5.4. Monthly average of routine sample data for entire duration of DEP pathogen monitoring at Kensico Reservoir release site CATLEFF. Non-detects set to zero for calculation of arithmetic mean

*Change in analysis method occurred during month.

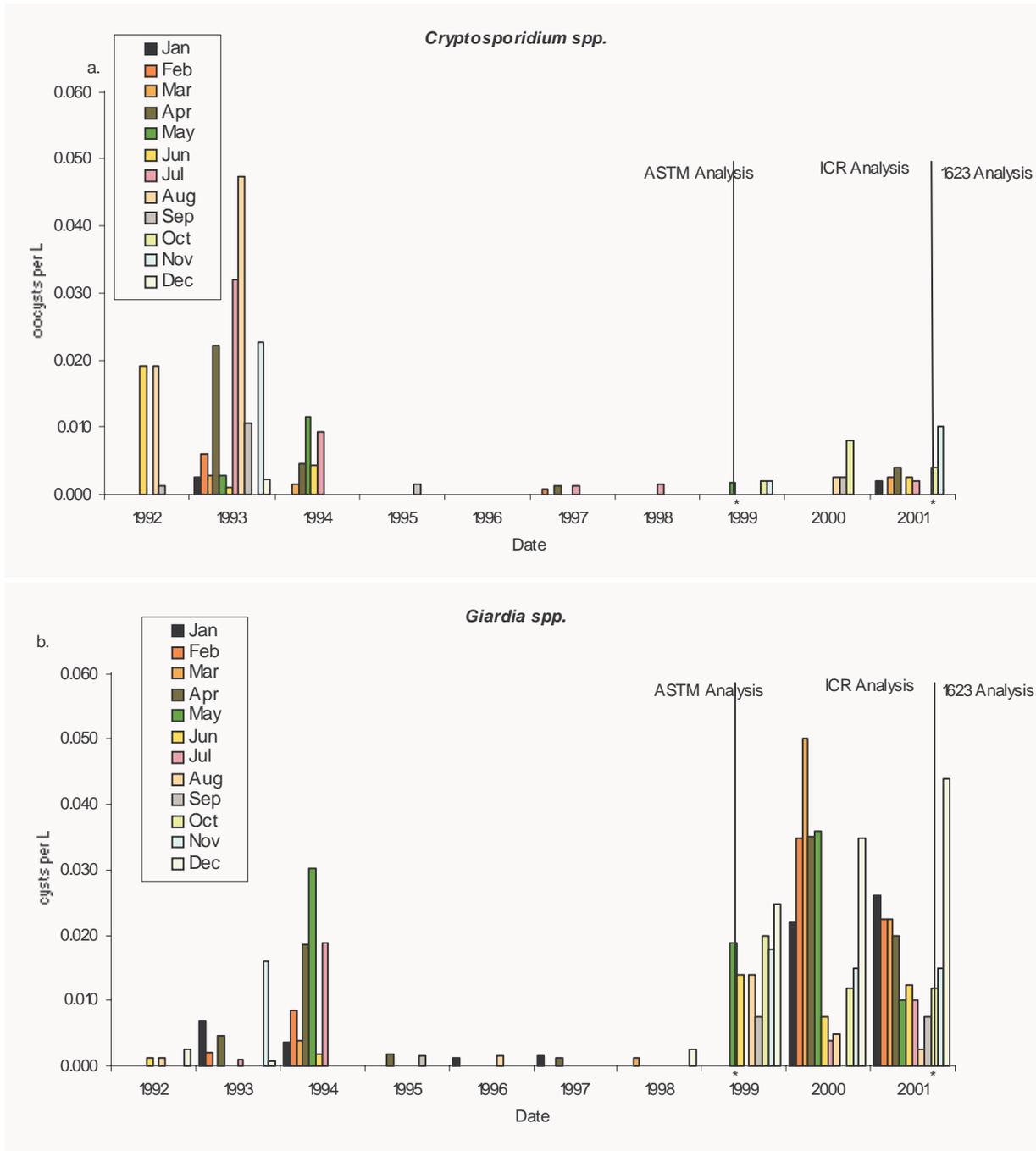


Figure 5.5. Monthly average of routine sample data for entire duration of DEP pathogen monitoring at Kensico Reservoir release site DEL18. Non-detects set to zero for calculation of arithmetic mean

*Change in analysis method occurred during month.

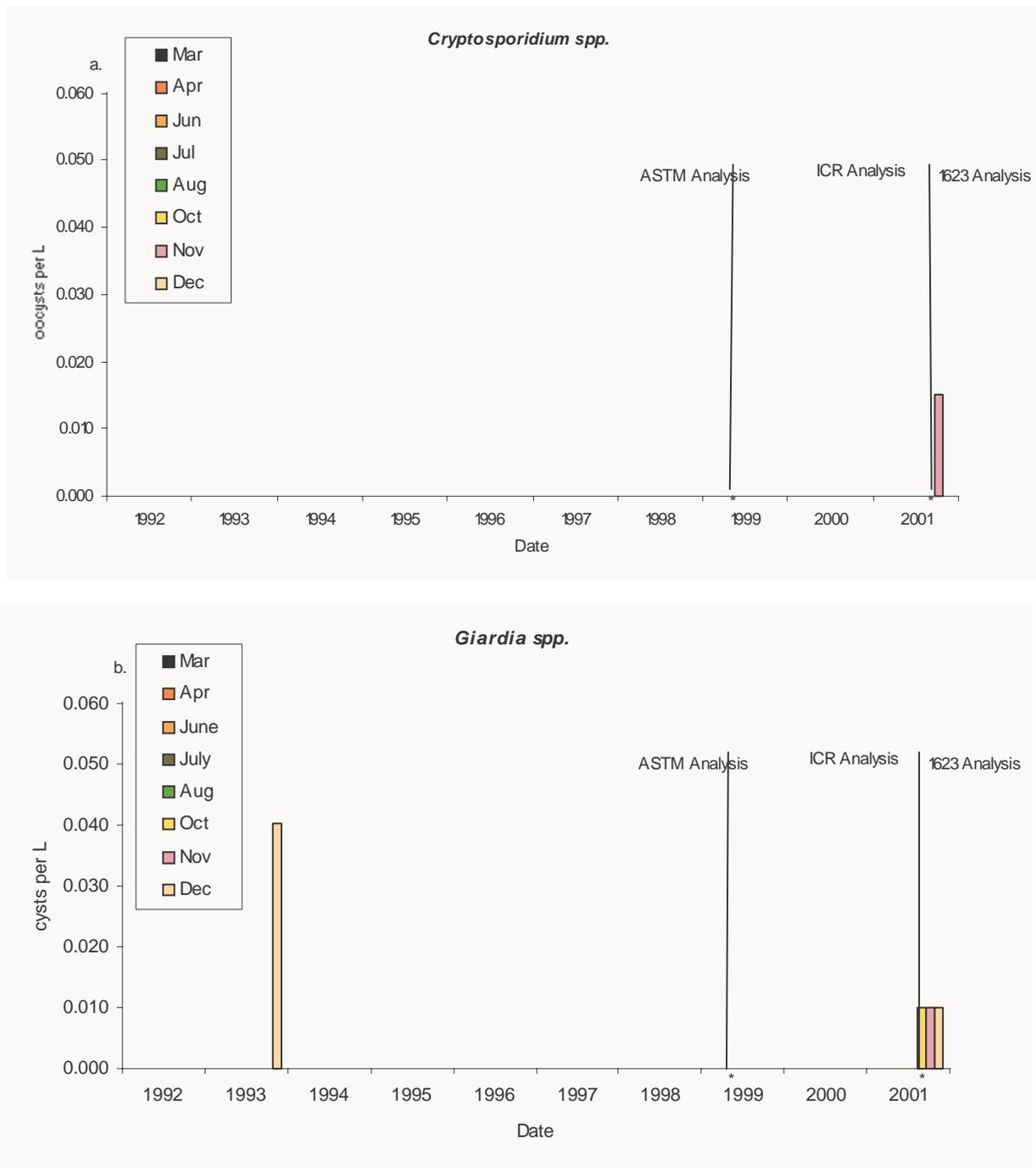


Figure 5.6. Monthly average of routine sample data for entire duration of DEP pathogen monitoring at Croton Reservoir release site CROFALLSR. Non detects set to zero for calculation of arithmetic mean

*Change in analysis method occurred during month.

As mentioned above Pathogen monitoring at the source water effluents and Kensico Reservoir influents has undergone three method changes since the program's inception in 1992. The table below presents *Giardia* spp. cyst occurrence and average concentration results for each method during its period of use. These results were computed using only weekly fixed frequency data, excluding special sampling events such as turbidity alerts or alum treatment sampling. Average concentrations were computed using an arithmetic mean and zero values for samples where no pathogens were detected. Generally there was a higher level of cysts detected with the ICR and 1623 methods than the ASTM method.

Table 5.1. *Giardia* spp. summary results of the different methods used at DEP reservoir keypoint sampling sites. Sampling is weekly at all sites except CROFALLSR which is variable.

	<i>ASTM</i>			<i>ICR</i>			<i>1623</i>		
	<i>n</i>	%detect	cysts L ⁻¹	<i>n</i>	%detect	cysts L ⁻¹	<i>n</i>	%detect	cysts L ⁻¹
CATLEFF	335	14%	0.0017	130	62%	0.0127	12	58%	0.0200
DEL18	334	13%	0.0017	128	68%	0.0174	12	67%	0.0267
CROGH	258	11%	0.0054	128	41%	0.0060	12	17%	0.0033
CATALUM	281	10%	0.0024	72	29%	0.0053	23	13%	0.0043
DEL17	294	9.2%	0.0015	69	45%	0.0091	23	52%	0.0157
CROFALLSR	9	11%	0.0045				10	50%	0.0100

The following table presents *Cryptosporidium* spp. oocyst occurrence and average concentration results for each method during its period of use. Summary results were computed following the same procedure as in the preceding table. Changes in occurrence and average concentration did not change appreciably between ASTM and ICR methods. However, oocysts have been generally detected about twice as frequently in the limited number of samples analyzed with method 1623.

Table 5.2. *Cryptosporidium* spp. summary results of the different methods used at DEP reservoir keypoint sampling sites. Sampling is weekly at all sites except CROFALLSR which is variable.

	<i>ASTM</i>			<i>ICR</i>			<i>1623</i>		
	<i>n</i>	%detect	cysts L ⁻¹	<i>n</i>	%detect	cysts L ⁻¹	<i>n</i>	%detect	cysts L ⁻¹
CATLEFF	335	14%	0.0024	130	8.5%	0.0013	12	25%	0.0050
DEL18	334	15%	0.0027	128	11%	0.0011	12	25%	0.0050
CROGH	258	8.9%	0.0017	128	12%	0.0012	12	33%	0.0067
CATALUM	281	8.5%	0.0009	72	17%	0.0018	23	22%	0.0043
DEL17	294	9.2%	0.0011	69	16%	0.0020	23	13%	0.0026
CROFALLSR	9	0%	0.00000				10	20%	0.0060

A presentation of the status of New York City's source water relative to the proposed LT2SWTR is provided in the figure below. The proposed LT2SWTR requires large unfiltered utilities to conduct monthly sampling for *Cryptosporidium* spp. oocysts to calculate a two-year average concentration for the purposes of determining the level of treatment required for compliance. Utilities with a monthly average less than 0.01 oocysts L⁻¹ will be required to install treatment to achieve a two-log removal (99%), those greater than 0.01 oocysts L⁻¹ would be required to achieve three-log removal (99.9%) with treatment. Caution should be maintained until the LT2ESWTR is finalized and promulgated since these action levels may change.

The figure below presents an average *Cryptosporidium* concentration for each of the methods (ASTM, ICR, 1623). The first average uses worst case ASTM data from the first two years of source water monitoring (6/16/1992-6/14/1994). We chose this as a worst-case since this data has the highest concentration seen at the Kensico effluents [CATLEFF, DEL18] for all methods. The second average is from the last two years of ICR monitoring data 10/04/99-10/09/01), chosen for method comparison. The last and most applicable average is the current record of method 1623 data (10/15/01-12/31/01). While this is not a two-year record, it is the best indication of how New York City's source water compares with the proposed standard because it is based on the method required under the proposed LT2 regulations (i.e., EPA method 1623).

Overall, average concentrations of *Cryptosporidium* spp. oocysts with any of the three methods used since 1992 were low relative to the average of 0.034 oocysts L⁻¹ found for unfiltered water supplies during the ICR (EPA, 2001). In addition, the average *Cryptosporidium* spp. concentrations of the Kensico effluents fall below the 0.01 oocyst L⁻¹ level proposed in the LT2ESWTR.

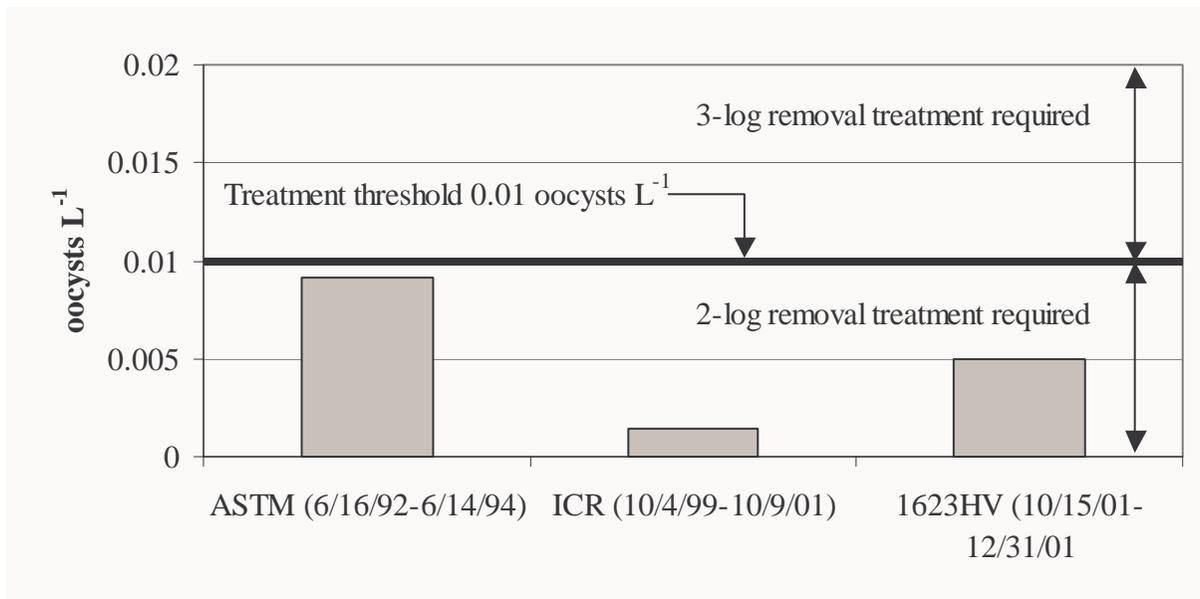


Figure 5.7. Average concentration of *Cryptosporidium* spp. oocysts found at the Kensico Reservoir effluents [CATLEFF, DEL18] utilizing different methods in relation to proposed LT2ESWTR treatment threshold.

5.5.3 Watershed Monitoring

Watershed monitoring refers to a sampling program designed to characterize the occurrence and density of pathogens found at a variety of sites in the watershed. Sites in the program were chosen to represent collecting reservoir inflows, point sources and watersheds having different land types. Most sites in the program have about eight years of monthly pathogen data. This fixed frequency sampling was discontinued in October 2001, for program review.

One objective of the watershed monitoring program is to discern relationships between land types and pathogen occurrence and density. The table on the next page presents (oo)cyst occurrence and average concentration along with summary information on land cover and land use. Pathogen sampling sites that were not included in this analysis include reservoir keypoints and wastewater treatment plant outfalls. Using GIS data, watersheds of 23 sampling sites were analyzed for land cover (land cover refers to physical features of the landscape such as vegetation, water, wetlands and impervious surface coverage). Land use data were also assembled for 17 of the 23 sites (land use refers to data regarding the cultural aspects of the landscape). Tax parcel classifications were identified as a generalization of land use. This information was only available for sites West of the Hudson River. It is important to note that the land use and land cover classifications are limited by the accuracy of the GIS data layers and the assumption that the orientation of the specific covers or uses within a watershed is not important.

The results indicate that forest cover is dominant (> 50% land cover) at all of the sites except Third Brook (CTB) and site TRTIT. Grasses and crops were dominant at Third Brook while no single cover was dominant at TRTIT. Grasses and crops are generally the second-most common cover type. This cover can act as an indicator of agricultural areas. However, interpretation is not straightforward since the cover also includes residential lawns and abandoned/fallow fields, which are not in active agriculture. Impervious surfaces generally were less than 10% of watershed areas with sites along Malcolm Brook (MB1-14%, MB4-19%, MB8-33%) being the exception. Oddly, site MB3 differed greatly from the other Malcolm Brook sites with 95% forest cover. Presumably this mature suburban community had a dense tree canopy, which may have obscured the many homes and lawns from accurate land cover analysis. Although not a complete surprise, the great extent of forest cover (43.9-99.9%, median =79.4%) complicated differentiation of many sites by their land cover.

The table presents the sampling sites sorted in order of highest average Total *Cryptosporidium* oocysts concentration (oocysts L⁻¹) to lowest. Average pathogen concentrations were calculated by arithmetic means (treating samples without detection as zero). The averages encompass the period of record for each site omitting samples that were not part of the fixed frequency schedule (i.e., storms, special samples). Additional data on watershed area, number of samples collected, land cover rank, and highest land use percentages are also presented. The land cover profile summarizes the data by abbreviating the cover type and placing it in order of percent cover. For example site BBD is ranked as FAWMI which, indicates that (F)orest cover was highest followed by gasses and crops (A is for agriculture), (W)ater, Wetland (M for marsh) and lastly (I)mpervious surface. Sites in the ranking had an average of 108 samples (min 28, max 438) collected over 8 years (min 2.3 max 8.9). Watershed areas range from about 20 to 20,000 acres.

Table 5.3. Pathogen site ranking based on average *Cryptosporidium* spp. concentration. Averages were determined using arithmetic means and a value of zero for samples where no oocysts were detected.

<i>Site</i>	<i>Size (ac)</i>	<i>n</i>	<i>TC Occur</i> ¹	<i>TC Avg</i> ²	<i>TG Occur</i> ³	<i>TG Avg</i> ⁴	<i>Land Cover Profile</i> ⁵	<i>Highest Landuse</i> ⁶
RF	383	126	34.92%	0.0339	41.27%	0.0320	FAWMI ⁶	Agr (87%)
SHR1	250	116	39.66%	0.0304	49.14%	0.0457	FAWIM	Res (59%)
CTB	3,437	131	31.30%	0.0191	36.64%	0.0181	AFIWM	Agr (61%)
TRTIT	109	68	25.00%	0.0149	35.29%	0.0119	FAIMW	n.a.
MB3	23	75	24.00%	0.0094	36.00%	0.0102	FAIWM	n.a.
MB4	80	71	21.13%	0.0084	23.94%	0.0082	FIAMW	n.a.
HH7	6,101	82	34.15%	0.0084	36.59%	0.0139	FMAIW	n.a.
MB1	131	438	27.17%	0.0081	18.95%	0.0049	FIMWA	n.a.
FB4	3,263	81	19.75%	0.0068	14.81%	0.0042	FAIMW	Agr (42%)

Table 5.3. Pathogen site ranking based on average *Cryptosporidium* spp. concentration. Averages were determined using arithmetic means and a value of zero for samples where no oocysts were detected.

Site	Size (ac)	n	TC Occur ¹	TC Avg ²	TG Occur ³	TG Avg ⁴	Land Cover Profile ⁵	Highest Landuse ⁶
WDBN	225,278	131	18.32%	0.0052	45.80%	0.0225	FAIWM	Agr (32%)
E13I	1163	74	32.43%	0.0051	36.49%	0.0203	FAMIW	Res (35%)
PMSB	105,313	85	20.00%	0.0046	55.29%	0.0257	FAIMW	Res (39%)
WD2	218,397	115	18.26%	0.0030	50.43%	0.0185	FAIWM	Agr (33%)
MB8	29	68	11.76%	0.0030	8.82%	0.0009	FIAWM	n.a.
WSPB	212,605	115	13.04%	0.0027	42.61%	0.0276	FAIWM	Agr (33%)
E16i	122,389	96	16.67%	0.0026	38.54%	0.0107	FAMIW	Wild (61%)
BBD	96	104	13.46%	0.0025	22.12%	0.0075	FWAIM	Com (100%)
S5I	151,286	79	11.39%	0.0019	46.84%	0.0140	FAIMW	Res (31%)
FFU	12,130	115	5.22%	0.0017	27.83%	0.0060	FAMWI	Wild (54%)
BBU	87	97	15.46%	0.0017	21.65%	0.0062	FWAIM	Com (100%)
FFD	13,389	119	6.72%	0.0010	27.73%	0.0053	FAMWI	Wild (50%)
NCG	42,604	75	8.00%	0.0010	48.00%	0.0175	FAWIM	Wild (69%)
E10i	12,385	28	14.29%	0.0009	17.86%	0.0027	FAIMW	Wild (70%)

1. Total *Cryptosporidium* occurrence (percent detection)

2. Total *Cryptosporidium* average concentration (oocysts L⁻¹)

3. Total *Giardia* occurrence (percent detection)

4. Total *Giardia* average concentration (cysts L⁻¹)

5. Land Profile is a coding system that orders percent land cover from highest to lowest. F-Forest, A-Grasses and Crops, W- Water, M- Wetland, I- Impervious surfaces

6. Highest land use is the tax classification with the highest percentage of area for a given site. Area in (). Agr- Agriculture, Res- Residential, n.a. not available, Wild- Wild Forest and public property, Com- Commercial

Several observations were apparent from this ranking.

- Concentrations of *Giardia* and *Cryptosporidium* (oo)cysts were low overall (average 0.0085 L⁻¹) but variable (stdev.053)
- *Cryptosporidium* occurrence (% detection) tended to correlate with concentration.
- ‘Wild Forest’ lands tended to have the lowest concentrations of *Cryptosporidium* oocysts.
- A mixture of Agricultural and Residential uses tended to have higher *Cryptosporidium* concentrations than forested areas.

5.5.4 Virus Occurrences

DEP monitors human enteric viruses to determine their occurrence and assess the sources transport and potential exposure from these organisms. Monitoring of viruses began in January 1993, and continues to present. Source water inflows and outflows, Ashokan and Rondout reservoir outflows, wastewater treatment plant inflows and outflows, as well as sites mandated by EPA are routinely monitored.

The method used in routine monitoring for viruses involves the use of a quantal cell-culture assay (e.g., EPA ICR method). The assay, with dependency on visible cytopathic effects on host cells requires a time frame of 28 – 42 days to produce accurate results. Of the 299 routine samples collected and analyzed over the past year, viruses were detected in 21. Twenty of the positive samples occurred at the wastewater treatment plants, 11 influents and 9 effluents. Removal of viruses through wastewater treatment is accomplished primarily through disinfection. An average taken for all plants show greater than 4-log removal rate. One sample taken at Malcolm Brook (MB1) detected positive for viruses.

In response to the 9/11/01 terrorist attacks in New York City, the Pathogen Program collected extra samples at the source water keypoints [DEL18, CATLEFF and CROGH] that were analyzed using an Integrated Cell-Culture-Polymerize Chain Reaction (ICC-PCR) procedure in addition to the cell-culture assay. The ICC-PCR based method produces rapid and highly sensitive detection of the RNA of specific enteroviruses in water samples. By this method, results from the 9/11 samples were known within 24 hours of the samples being analyzed. Results from the ICC-PCR analysis were negative except for samples taken at Croton Reservoir release site CROGH. Samples analyzed by ICC-PCR analysis showed presence of enterovirus while ICR analysis of the same sample detected no virus presence. While positive detection by ICC-PCR analysis indicate the presence of RNA for viruses that potentially threaten public health, the lack of detection with the ICR analysis indicates that the viruses were probably not present in large concentrations (At this time, the ICC-PCR analysis method does not enumerate the level of viruses in a sample.)

5.5.5 Pathogen Technical Working Group

Work has continued during the reporting period on implementing the Pathogen Technical Working Group's (PTWG) study titled "Evaluation of Two Pathogen Concentration Filters for Use With USEPA Method 1623 for *Giardia* spp. and *Cryptosporidium* spp. Analysis". The objective of this study is to develop improved sampling methodology. Over the past several months, DEP has been developing methods to allow for the finalization of the QAPP. Initial (oo)cyst spiking experiments have resulted in lower than expected recoveries. Further experiments are planned to resolve these issues. During the December 6, 2001 meeting, a presentation on the information provided by the statistical tools contract was provided by DEP.

5.6 Septic Siting Study

The final report of the Septic Siting Study was issued by DEP in January 2000. While the original purpose of the experiments was to confirm or deny the protectiveness of the 100-foot horizontal separation distance between a septic system's leaching field and surface waters, several of the study participants came to believe that standardization of the siting and design of septic systems was perhaps more crucial to controlling pollution from septic systems than simply increasing the horizontal separation distance from surface waters for all new systems. Subsequent review of the data also found an apparent relationship between virus mimic transport and vertical separation, or the distance between the bottom of the leaching field trench and bedrock or high groundwater. As a result of the experiments, recommendations on standardizing siting procedures and increasing the required vertical separation were forwarded to DOH in February 2000.

DOH requested and obtained all the data needed to duplicate DEP's correlation analysis of vertical separation and percentage detection of spiked microbes at downgradient wells. DEP and DOH held several meetings to discuss the findings of the study and next steps.

In September 2001, DOH wrote to DEP and indicated that, based their analysis of the study results, they did not believe that the study supported a finding of significant pathogen transport beyond 100 feet. In addition, DOH did not support DEP's primary recommendation from the study, that the vertical separation distance between the bottom of the septic trenches and groundwater or bedrock be increased to four feet throughout the watershed.

DEP continues to believe that the Septic Siting Study did identify potential deficiencies in septic systems that are constructed in accordance with Appendix 75-A. For that reason, DEP began developing guidance material to accompany the WR&R. That guidance material, which will be finalized in 2002, will incorporate many of the recommendations made by DEP as a result of the Septic Siting Study.

5.7 Galley Study

The Galley Study was a twenty-eight month study that correlated the treatment of septic systems using galleys to those using conventional trench systems. An Interim Report was issued in March 2000, with a Final Report issued in May 2000.

Under the FAD, DEP was required to present recommendations to DOH for possible changes to the WR&R, based on the findings of the Galley Study and the Septic Siting Study. Based on the findings of the Final Report, DEP determined that new galley systems should not be permitted in the New York City water supply watershed. A letter was sent to DOH to that effect, and revised language for inclusion in the WR&R was drafted. DOH reviewed the Final Report,

and forwarded a comment letter to DEP that posed several technical questions. A reply to that comment letter was sent to DOH that explained the reasons for DEP's decision. DEP received additional comments from DOH, and issued a reply in the form of a Supplemental Report.

On June 11, 2001, DEP received an official notice from DOH stating their concurrence with DEP's proposal to amend the WR&R to ban new galley systems from the watershed, and to include a new definition in the WR&R that defines galley systems as "...structural chambers in a horizontal or vertical arrangement for the storage of effluent until it can be absorbed into the soil...."

DEP is currently undertaking the actions necessary to promulgate the amendments in accordance with the requirements of SEQRA, the Public Health Law and the City Administrative Procedure Act.

5.8 Pesticide and Toxic Contaminant Monitoring

DEP has undertaken an effort to characterize the threat that toxic compounds (pesticides, organic chemicals, and heavy metals) pose in the watershed. Using GIS and a variety of federal, State and City data sources, maps depicting potential sources were created to prioritize sample sites and analytical methods. In the spring 2001, the first year of sampling for this 2-year enhanced monitoring effort began.

The compounds being investigated with this program have already been determined not to pose a critical water quality problem to consumers through past sampling of the distribution system and aqueduct keypoints. Given the sparse detections of those monitoring efforts, this program strives to achieve detections and thus provide the most conservative assessment of the threat of toxic compounds possible using standard EPA-approved analytical methods. Potential source areas are sampled during the season in which the potential pollutant is judged most likely to be detected. Analytes, matrices, and their corresponding sampling seasons are listed in the following table. If compounds are detected, follow up sampling and study will assist with identifying sources, the magnitude of the pollution and potential management options.

Table 5.4. Analytical methods used for the Pesticide and Toxic Compound Monitoring Program in 2001

Sampling Events	Sites	Analysis of Water							Analysis of Sediment		
		NP Pesticides EPA 507	CI Pesticides/PCBs EPA 508	CI Herbicides EPA 515	Carbamates EPA 531	SVOCs EPA 525	VOCs EPA 524	Metals EPA 200	SVOCs SW8270	CI Pesticides/PCBs SW8081	Metals SW6019
Spring Sediment Sampling	12								X	X	X
Spring Pesticide Sampling	52	X	X	X	X*						
Summer Sed/Tissue Sampling	0										
Fall Toxics Sampling	37					X	X	X			
Annual Keypoint Monitoring	10					X	X				

Spring sediment sampling conducted in March 2001, was confined to the East-of-Hudson source water watersheds of Kensico, New Croton/Muscoot and West Branch Reservoirs. Sediments collected from 12 stream locations were analyzed for 92 synthetic organic compounds and 23 metals. No pesticides, PCBs or semi-volatile organic compounds were detected. Three metals were detected in excess of DEC’s “severe effect level” for sediments screening at the Long Pond tributary of West Branch Reservoir and Kensico Reservoir Tributary E11, which drains the westernmost portions of the Westchester County Airport (see table on following page).

Spring water sampling was conducted in May 2001, to coincide with the start of the growing season when pesticide use is high and targeted primarily golf courses and residential developments. Water samples were collected from 32 West-of-Hudson watershed streams and from 7 streams in the Kensico and West Branch watersheds. None of the 65 different pesticides analyzed for were detected in any samples. However, poor laboratory quality control procedures discounted the reliability of these data.

Fall water quality monitoring for synthetic organic and other toxic compounds was conducted in October 2001, to coincide with seasonally low stream flows. Under the assumption that dilution of contaminants from chronic low-level sources would be at its least, stream sampling sites were located near landfills or areas with industrial or urban land uses. Stream water samples were analyzed for a total of 135 synthetic organic compounds and 17 metals. Only two sites contained detections out of seventeen West-of-Hudson watershed locations and 7 stream locations in the Kensico and West Branch watersheds. Analysis detected synthetic organic compounds and metals in an intermittent tributary receiving runoff from the Hurley Landfill in the Ashokan Reservoir watershed. Malcolm Brook in the Kensico watershed was found to contain detectable con-

centrations of PAHs, but only above the BMP at West Lake Drive. The sample taken downstream of the BMP was non-detect for all analytes, which suggests that the BMP is removing organic contaminants in addition to the contaminants it was designed for: sediment and coliform bacteria.

Annual monitoring of 10 aqueduct keypoints for VOCs and SVOCs to complement such monitoring in the distribution system has been incorporated into this program. In 2001, the key-point sample collected at the Croton Lake Gatehouse was found to contain Simazine, a herbicide.

Table 5.5. Detected contaminants from sampling events in 2001.

Sampling Event	Method	Samples Analyzed	Samples		Contaminant Detected
			with Detects		
Spring Sediment Sampling	SVOCs	12	0		
	CI Pesticides/PCBs	12	0		
	Metals	12	3		Pb, Mn, Zn
Spring Pesticide Sampling	SVOCs	39	0		
	CI Pesticides/PCBs	8	0		
	CI Herbicides	6	0		
	Carbamates	6	0		
Fall Synthetic Organic Sampling	SVOCs	24	1		PAHs, Isophrone and a phthalate
	VOCs	7	0		
	Metals	11	2		Cu, Pb, Mn
Annual Keypoint Monitoring	SVOCs	10	1		Simazine
	VOCs	10	0		

Data from this program thus far support the assumption that toxic compounds and pesticides are not a substantial health threat through consumption of the water supply. This intensive sampling program will continue for another year, after which ongoing sampling at fewer sites will target potential sources identified during this two-year intensive effort and include sampling of storm events.

5.9 Monitoring of Tributaries Draining Properties of the Proposed Resort on Belleayre Mountain

In late 1999, DEP was informed that a Catskill-area developer (Crossroads Ventures) plans to construct a resort on the top of Belleayre Mountain adjacent to the State-owned Belleayre Mountain Ski Center. This development, the Belleayre Resort at Catskill Park, will be located on a site straddling the watershed divide between the Ashokan and Pepacton Reservoirs near the Village of Pine Hill. The developer envisions two 18-hole golf courses, a 17 lot residential subdivision, 700 hotel units, associated clubhouses, and maintenance and staff buildings disturbing 573 of the site's 1,900 acres, making this one of the largest land development proposals in the Catskill Region in decades.

Soon after review of the Environmental Assessment Form for the proposal, DEP began developing a plan to monitor the water quality of tributaries in the vicinity of proposed development area. The study will be a 4-phase program with an anticipated duration of approximately 10 years. Phase I of the program involved the documentation of pre-development conditions at study and control sampling sites by sampling weekly for standard water quality parameters and storm-event sampling for turbidity and total suspended solids only. The figure on the next page illustrates the locations of sampling sites for this program. Phase II includes the development of stream discharge rating curves for all sample sites, the installation of automated monitoring equipment with pressure transducers and dataloggers to continuously monitor stream stage and the inclusion of nutrient analyses in storm-event samples. Phase III is the construction monitoring phase, and Phase IV is the post-construction monitoring period during which DEP expects water quality to stabilize so that longer-term changes (e.g., nutrient concentration increases) become apparent. The table on the following page lists the various water quality parameters being examined and their sampling frequency.

Currently this program is in Phase II. A review of data quality objectives determined that the weekly sampling conducted during Phase I could be scaled back to bi-weekly sampling without a meaningful loss of the ability to detect changes in nitrate concentrations (nitrate was selected for statistical analysis due to its nearly normal distribution in the data gathered so far). Preliminary comparisons of total suspended solids and turbidity data from Giggle Hollow found no statistically significant difference between samples collected during baseflow and samples collected during storm events. If the Belleayre Resort is eventually constructed, this monitoring regime will provide DEP with a detailed quantitative assessment of the project's overall impact to ambient water quality. Regardless, DEP will have gathered a considerable data base on the Catskill headwater streams located on Belleayre Mountain, data which could be useful for many research and impact assessment projects in the future.

Table 5.6. Analytes and sampling frequency of tributaries in the vicinity of the proposed Resort on Belleayre Mountain

<i>Analyte</i>	<i>Phase II Baseline Frequency</i>	<i>Phase II Stormwater Frequency</i>
ammonia nitrogen	1/ 2 weeks	5 storms at 6 sites
nitrate nitrogen	1/ 2 weeks	5 storms at 6 sites
nitrite nitrogen	1/ 2 weeks	5 storms at 6 sites
total phosphorus	1/ 2 weeks	5 storms at 6 sites
total suspended solids	1/ 2 weeks	5 storms at 6 sites
turbidity	1/ 2 weeks	5 storms at 6 sites
fecal coliform bacteria	1/ 2 weeks	none
Nitrogen/ Phosphorus Pesticides	annual	none
Chlorinated Pesticides	annual	none

Table 5.6. Analytes and sampling frequency of tributaries in the vicinity of the proposed Resort on Belleayre Mountain

<i>Analyte</i>	<i>Phase II Baseline Frequency</i>	<i>Phase II Stormwater Frequency</i>
Semi-volatile Organic Compounds	annual	none
Enteric Pathogens	annual	none
Macro-invertebrates	2/year	none

In addition to its monitoring of tributaries, DEP continues to be actively involved in the overall environmental review of this significant project. DEP provided DEC (which is acting as lead agency under SEQRA) with detailed comments on the proposed scope of the Environmental Impact Statement (EIS) being prepared for the project and, after the close of the reporting period, provided DEC with a detailed analysis identifying areas which the draft EIS, submitted by the project sponsor, was incomplete.

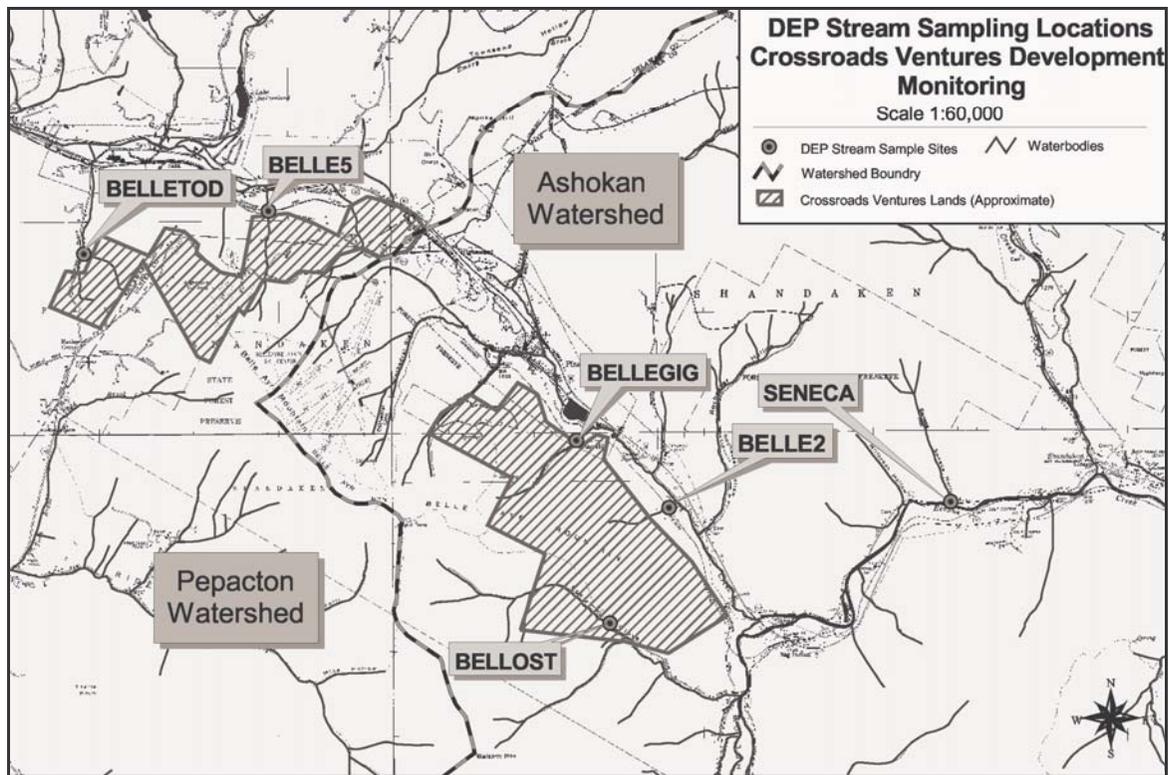


Figure 5.8. DEP stream sampling locations— Crossroads Ventures Development Monitoring.

5.10 Pesticide & Fertilizer Working Group

The MOA required DEC to convene a Pesticide and Fertilizer Technical Working Group (Working Group) to analyze the State's current regulations and standards on the storage, use and application of pesticides and fertilizers, and to recommend any changes to such regulations and standards to protect the City's water supply from potential contamination from pesticides or fertilizers, or to enhance the City's ability to monitor any impact from such storage, use or application.

The MOA required that the Working Group be composed of individuals from the EPA, the Watershed Agricultural Council, the New York State Department of Agriculture and Markets, DEP, a representative of the MOA Environmental Parties, a representative of a pesticide applicator organization, and representatives of the MOA Municipal Parties from both the West-of-Hudson and East-of-Hudson areas.

The Working Group first convened in 1997, and through 2000 met on twelve occasions to review scientific data and to hear expert opinions related to potential impacts of pesticides and fertilizers. The Working Group completed its preliminary review of the data on December 17, 1998; and, a Final Report of the Pesticide and Fertilizer Technical Working Group was issued by DEC on September 28, 2000. With respect to the existence of pesticides in watershed streams and the contribution of fertilizers to eutrophication in the watershed, the group found little data that might justify new regulations at the outset. Therefore, the Final Report focused primarily on non-regulatory approaches with a series of recommendations.

Some of the actions that DEC has indicated have been taken to follow through with some of the Working Group's recommendations include the following:

- 1). A Pilot homeowner pesticide use study was completed by Cornell University. The results of this pilot survey are still listed by DEC as being under review.
- 2). Several homeowner Integrated Pest Management (IPM) pamphlets have been developed by DEC.
- 3). Cornell University's Turf program has produced a homeowner IPM brochure for lawn care and DEC has advised that it is working with Cornell to make this available within the watershed.
- 4). DEC has hired one new pesticide specialist to handle and inspect aquatic permits in the watershed and is attempting to fill another similar position for the DEC's New Paltz Office.
- 5). DEC has indicated that at least one large fertilizer producer, "Tru-Green Chemlawn", has removed all phosphorus from their fertilizers in the watershed.
- 6). DEC has provided funds to Cornell University's Pesticide Management Education Program (PMEP) to update two pesticide applicator training manuals on protecting water quality. DEP has reviewed and commented on the first draft of one PMEPE work product.

- 7). There has been some staff level discussion between DEC and DEP concerning reassembling the Working Group to help review and disseminate the recommendations of the Working Group and to evaluate the follow-up activities.

5.11 Benthic Macroinvertebrate Biomonitoring

The primary objective of DEP's benthic macroinvertebrate biomonitoring program is to assess water quality for the purpose of supporting healthy biotic communities in watershed streams and rivers. To accomplish this purpose, riffle communities in these streams are sampled using the traveling kick method and analyzed with a series of four metrics: Species Richness, EPT Richness, Hilsenhoff Biotic Index and Percent Model Affinity. The values from these metrics, after being converted to a common scale, are averaged to produce a water quality score for each site corresponding to an overall assessment of non-impaired (7.5-10), slightly impaired (5-7.5), moderately impaired (2.5-5), or severely impaired (0-2.5).

Because processing of samples collected in 2001 was not complete at the time of writing, the following report summarizes developments in the benthic biomonitoring program that occurred during 2000. In that year, 40 sites in the West-of-Hudson watershed were sampled, 23 in the Catskill System and 17 in the Delaware System. Thirty-four of the sampled WOH sites were assessed as non-impaired, while the remaining 6 (3 in Catskill, 3 in Delaware) rated slightly impaired.

Final assessments for all sites are illustrated in the figures on the following pages. A map showing the locations of biomonitoring sites sampled in 2000 in the Catskill/Delaware watershed is also displayed.

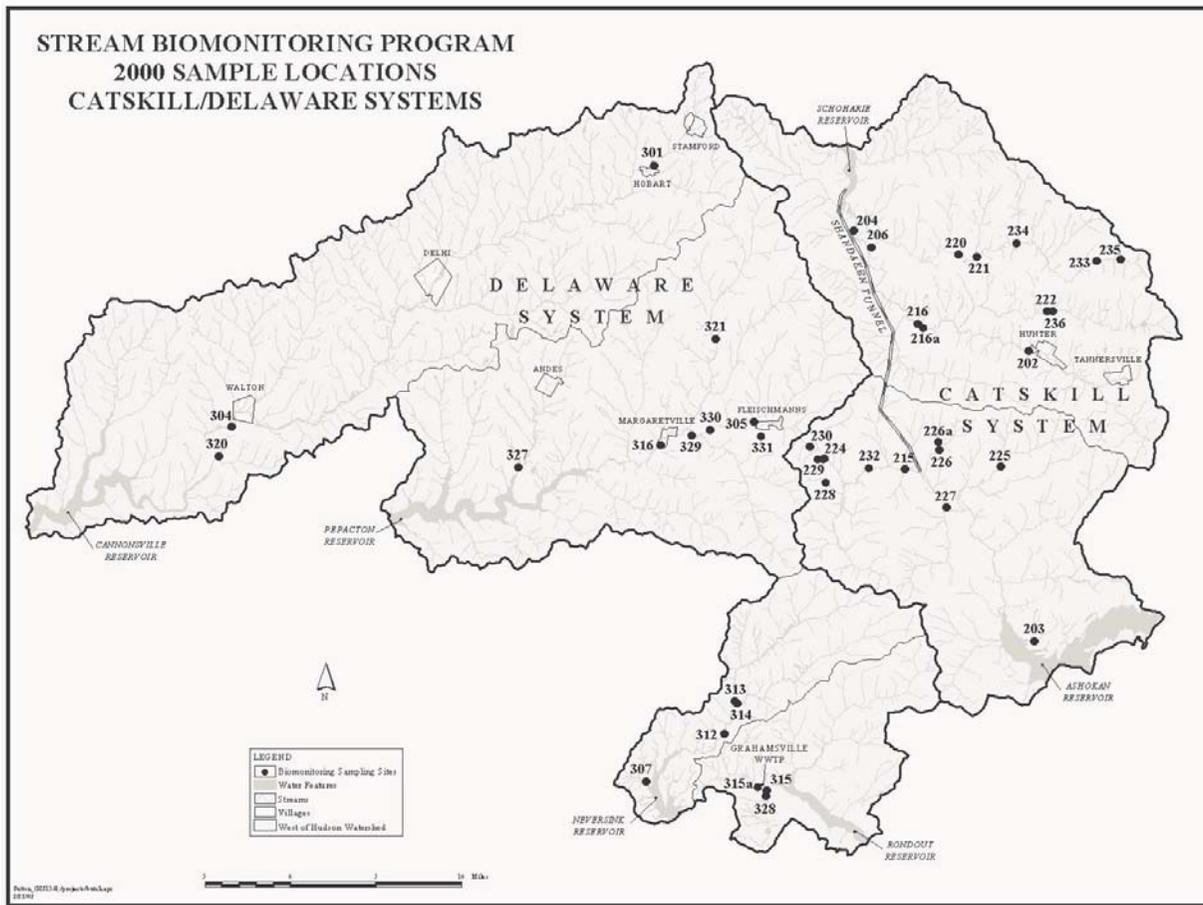


Figure 5.9. Stream Biomonitoring Program 2000 sampling locations—Catskill/Delaware Systems.

5.11.1 Catskill System

Twenty of the 23 sites sampled assessed as non-impaired. Twelve of the sampled sites were in the Schoharie Reservoir watershed (four on Schoharie Creek, six on Batavia Kill, two on the East Kill). The remaining 11 sites were located in the Ashokan Reservoir watershed, including the two sites on Esopus Creek established by DEP to monitor potential impacts to the creek from Shandaken Tunnel discharges. Twelve of the sites were associated with projects intended to stabilize eroding streambanks, including 5 of the 6 on the Batavia Kill. These are discussed in a separate section below, following a review of the other sites. An additional four sites were on streams draining the Crossroads Ventures development project on Belleayre Mountain and were chosen to monitor potential impacts from construction at that site.

Ashokan Reservoir Watershed

All of the Crossroads Ventures sites (228-230, 232); Butternut Creek, a tributary to Ashokan Reservoir (203); Birch Creek, a tributary to Esopus Creek (224); and both sites on Esopus Creek (215 and 227) assessed as non-impaired. Only one site in the watershed – on Stony Clove below the proposed BMP (225) – received a suboptimal rating.

Sampling at Butternut and Birch Creeks was undertaken to resolve equivocal assessments in previous years. The Butternut Creek site had been rated non-impaired in 1996 (score, 9.53) following a slightly impaired assessment in 1994, while Birch Creek had been rated non-impaired in 1998 and slightly impaired in 1999, each time with scores close to the 7.5 threshold. In 2000, both sites had scores solidly in the non-impaired range (Butternut Creek, 8.91; Birch Creek, 7.98). Site 215, the above-tunnel site on Esopus Creek, was rated non-impaired, as it has been every year since it was first sampled in 1996. Site 227, situated below the tunnel, was also rated non-impaired, but with a score only slightly above the non/slightly impaired threshold (7.57). This contrasts with the result in 1999, the first year the site was sampled, when it exhibited a score just below the threshold (7.42). DEP's continued monitoring of this site will seek to determine the extent of variation in its metric scores, which, together with results from Site 215, should provide a better picture of the effects of tunnel discharges on the stream's water quality.

Schoharie Reservoir Watershed

Nine of the 12 sites in the Schoharie Reservoir watershed were associated with stream-bank stabilization projects and are discussed below. Of the remaining three, two were situated on Schoharie Creek (Sites 202 and 204), and one was on the Batavia Kill (Site 206). Sampling has been performed at Site 202, below the Village of Hunter, since 1994, and at Sites 204, in Prattsville, and 206, on the Batavia Kill at its confluence with Schoharie Creek, since 1995. In all years, including 2000, Sites 202 and 206 have been assessed as non-impaired. Site 204, on the other hand, was assessed as slightly impaired in 2000, and has generally exhibited a much more variable history than the other two sites, alternating since 1996 between slightly impaired and non-impaired assessments. Preliminary data strongly suggest that this trend will continue in 2001, when a return to non-impaired status seems likely. The annual change in assessment status since 1996, appears to be largely driven by low taxa counts in years of slight impairment, but the factors responsible for this condition are unclear. Similar variability has also been recorded at the Lexington Bridge BMP site (216). To address these issues, DEP undertook a survey of the stream in 2001, from its headwaters at Elka Park above Tannersville to Prattsville. The survey, which consists of macrobenthic samples taken at seven stations along the Elka Park-Prattsville reach, is intended to yield data on longitudinal changes in community composition, which in turn may provide insights into the highly fluctuating metric results observed at these sites. The survey will be repeated in 2002.

5.11.2 Evaluation of streambank stabilization projects

DEP has been monitoring stream sites selected for streambank stabilization projects since 1996, when pre-construction sampling was first performed at Lexington Bridge on Schoharie Creek. In 1998, monitoring began at sites on the Batavia Kill and the East Kill, and in 1999 on Broadstreet Hollow and Stony Clove. In 2000, a total of 12 sites were sampled on these streams, 7 at the site of proposed or already constructed projects, 5 at upstream reference sites. All but two – at Stony Clove and the East Kill – received a non-impaired rating.

Batavia Kill

All sites sampled on the Batavia Kill were assessed as non-impaired. This includes the two farthest downstream BMP sites at Ashland (220 and 221), both of which have been sampled since 1998; a reference site for Sites 220 and 221 in Windham (234); another BMP site at Peck Road, in the stream's headwaters (233); and a reference site for Site 233 located above the Batavia Kill flood control dam (235). Sites 233-235 were sampled for the first time in 2000.

Site 220 has received a non-impaired water quality assessment in every year DEP has sampled it, with slightly higher scores being observed in 1999 and 2000 than in 1998. At Site 221, results have been more variable, shifting from a non-impaired assessment in 1998 to a slightly impaired one in 1999, followed by a return to non-impaired status in 2000. The limited sampling record makes it difficult to determine whether the overall increase in scores is related to construction of BMPs at these sites, which was completed in the summer of 1999. Indeed, at Site 220, sampling occurred no more than a few weeks after completion of the BMP, probably not enough time for discernible changes to have occurred in the benthic community. On the other hand, DEP has observed a steady increase in the number of sensitive mayflies at both sites since sampling began. Such a shift in community structure, if present, could signal an improvement in water quality. DEP will continue to assess these communities to determine if a change toward more sensitive organisms has in fact occurred.

Sampling at Site 233 was performed before construction of the BMP began. Although the site was rated non-impaired, preliminary results indicate that midges will represent approximately 80% of the sample in 2001, about twice the number in 2000. Because midges are a fairly tolerant group of organisms, the likely result will be a decline in the site's water quality assessment in 2001.

Schoharie Creek

On Schoharie Creek, both the streambank stabilization site at Lexington Bridge that DEP has been sampling since 1996 (216) and a new reference site (216a), established just upstream, were assessed as non-impaired. Assessments at Site 216 have alternated between non-impaired and slightly impaired in every year since the BMP was built (1997), making any evaluation of the effectiveness of the stabilization project problematic. This annual reversal in metric results is similar to the situation encountered at Site 204 farther downstream, as are the chronically low taxa

counts recorded in slightly impaired years. Site 216 is also characterized by episodic spikes in certain taxa counts, which, when they occur, have the effect of depressing the final water quality assessment. Specifically, in 1997, the percent of the sample comprised of mayflies rose to 86.4%, significantly lowering the percent model affinity metric (which assumes an optimal value of 40% mayflies), while in 1996, over 20% of the sample was represented by *Prostoma* sp., an uncommon but highly tolerant worm-like organism whose presence in such large numbers depressed the HBI metric. As stated earlier, the high degree of variability at Sites 216 and 204 has prompted DEP to undertake a longitudinal survey of Schoharie Creek to help it isolate some of the factors contributing to this condition.

East Kill

On the East Kill, Site 222, the BMP site DEP has been sampling since 1998, received a slightly impaired assessment, while the newly-established reference site located just upstream (236) was rated non-impaired. Site 222 has been assessed as slightly impaired in every year sampled, although scores were considerably higher in 1999 and 2000 than 1998, when the site's score barely surpassed the 5.0 moderately/slightly impaired threshold. DEP will return to this site annually to determine if scores continue to improve following completion of the BMP in July 2000.

Broadstreet Hollow and Stony Clove

The two sites on Broadstreet Hollow – the BMP site (226) and a newly-established reference site (226a) – both assessed as non-impaired. DEP now has two years of pre-construction data on this stream and is currently awaiting data from the first post-construction year (2001). The Stony Clove site (225), at which construction has not yet begun, was rated as slightly impaired, after assessing non-impaired in the previous year. The change was largely the result of a steep decline in total taxa and in the numbers of *Lepidostoma* sp., a sensitive caddisfly. It is unclear whether these data reflect a deterioration in conditions at the site or merely natural interannual variation.

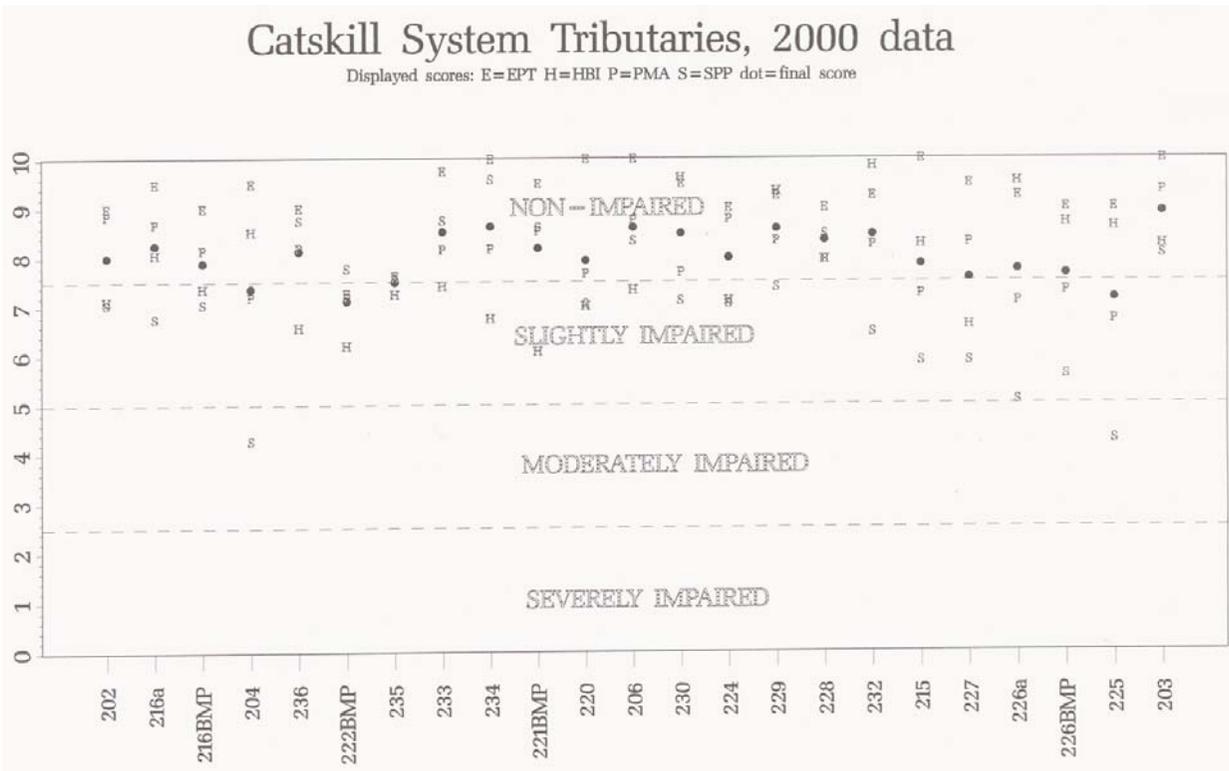


Figure 5.10. Catskill System tributaries, 2000 data.

5.11.3 Delaware System

Fourteen of the 17 sites sampled in the Delaware System were assessed as non-impaired. Three of these were in the Cannonsville Reservoir watershed (Sites 301, 304, 320, all on the West Branch Delaware), 6 were in the Pepacton Reservoir watershed (Sites 316 and 321 (East Branch Delaware), 327 (Tremper Kill), 329 (Dry Brook), 330 (Bush Kill), 331 (unnamed tributary to the Bush Kill)), 2 were in the Neversink Reservoir watershed (Sites 307 (Aden Brook), 312 (Neversink River)), and 3 were in the Rondout Reservoir watershed (Sites 315 and 315a (Chestnut Creek), 328 (Red Brook)). Of the three slightly impaired sites, one was on the Bush Kill (305) and two were on branches of the Neversink River (313, West Branch; 314, East Branch).

Six of the sites – 301, 304, 307, 316, 320, 321 – are sampled routinely by DEP and thus represent a long-term record of water quality in the Delaware System. Three of these sites – 304 (below the Walton WWTP), 316 (below the Margaretville WWTP), and 321 on the East Branch Delaware – have been assessed as non-impaired in every year of sampling (six, five, and five years, respectively). Sites 301 and 320, both on the West Branch Delaware, have been assessed as

non-impaired in all but one year of sampling (seven and five years, respectively), and Site 307 on Aden Brook has been assessed as non-impaired in five of seven years of sampling. These results suggest that water quality in Delaware streams remains very high overall.

DEP returned to Chestnut Creek (site 315) for the second year in a row in response to past concerns over the potential impact of thermal discharges from the Grahamsville WWTP on downstream water quality. The site had received a slightly impaired rating in 1996, the first year of sampling, but in 1999 it was assessed as non-impaired. In 2000, DEP sampled not only the historical site downstream of the treatment plant, but also a newly-established reference site upstream (315a). Both sites were assessed as non-impaired, with the downstream site actually scoring higher than the upstream one (8.8 vs. 7.8). These results, taken over two consecutive years, indicate that no impairment to Chestnut Creek has occurred as a result of discharges from the plant.

Sites 313 and 314, on the West and East Branches of the Neversink River, respectively, both received slightly impaired ratings for the second year in a row. While the low pH values typically encountered in the East Branch undoubtedly have a major downward impact on the benthic community at Site 314, the reasons for the suboptimal scores on the West Branch remain unclear. It should be noted that the Neversink mainstem has achieved non-impaired status in every year DEP has sampled it, including 1999 and 2000, when Sites 313 and 314 were slightly impaired. At Site 305 on the Bush Kill, which was also rated slightly impaired, DEP suspects that land use changes in the immediate vicinity of the site, including riprapping of the streambank after the flood of 1996, may have contributed to the suboptimal assessment. DEP plans to return to this site in 2002 to investigate this result further.

6. Catskill/Delaware Treatment

During 2001 the focus of Catskill/Delaware treatment moved from filtration to disinfection using ultraviolet light.

The year 2000 ended with the completion of two documents: a draft preliminary design of full scale filtration plant and a draft EIS for the full-scale filtration plant. These reports underwent Value Engineering and regulatory reviews and were updated accordingly by September 30, 2001.

Although the FAD cited future deliverables for the completion of final filtration designs and associated environmental impact assessments, provisions were included that would allow DEP to seek relief from such work. In conjunction with a request for relief, DE has agreed to implement a planning process for Ultraviolet (UV) Disinfection of Catskill/Delaware water leading to the operation of UV facilities by August 30, 2009. To maintain the time-neutral dual-track approach, DEP will perform biennial updates of the preliminary designs for filtration.

6.1 Preliminary Design Update

Following the release of the Draft Preliminary Design and the Preliminary Draft Environmental Impact Statement, DEP and their consultants, the Joint Venture of Hazen and Sawyer/Camp Dresser & McKee (H&S/CDM), have refined the preliminary designs.

In addition to review by EPA and DOH, the preliminary designs were the subject of a Value Engineering (VE) workshop and a meeting of the project's Technical Review Committee. In February, the City's Office of Management and Budget hosted a VE workshop on the preliminary designs of the facility. Representatives from EPA and DOH participated in the workshop, as did members of the project team. The VE process used to review this project is an organized, multi-disciplinary process designed to find alternative ways to achieve the project's necessary and desired functions with the lowest life cycle costs.

Following the workshop, the project team conducted a two-day Technical Review Committee session to review the recommendations from the VE workshop and to discuss other issues related to the effort to update the preliminary designs. Following these assessments, modified designs were prepared and issued in September 2001.

A preliminary report citing recommendations to improve the value of the project and a reconciliation meeting to determine which recommendations can and should be implemented also followed the VE workshop. The most notable of the VE recommendations – removal of the ozone contactors – was immediately incorporated into the facility design. The ozone feed system has been relocated to the head of the raw water conduits. Ozonation can be achieved in a smaller facility footprint. Another recommendation suggested less conservative treatment of the proposed secondary disinfectant. The ozone design criteria were revisited in light of the September

2000 Agreement in Principle for future Long Term -2 Enhanced Surface Water Treatment Rule. These regulations are expected to assign *Cryptosporidium* treatment requirements for filtered supplies based on pathogen concentration in source waters. Given the high-quality of the Catskill/Delaware source waters and the success of the DEP's watershed protection efforts, *Cryptosporidium* inactivation requirements are likely to be substantially lower than those anticipated for the development of the draft preliminary designs. As a result, the design criteria employed for the preliminary design update became governed by filtration enhancement goals rather than inactivation requirements. Lower ozone doses, necessary to achieve enhanced filtration performance and maintain high-rate filtration will provide some degree of *Cryptosporidium* inactivation by default. Many other VE items were set aside for "further study" in the event that the current designs are to be advanced to final design at some future time. Some of these items may be incorporated into future biennial preliminary designs updates.

H&S/CDM also made an effort to modify the draft preliminary designs to maximize and reserve usable site area to allow for the possibility of siting other DEP facilities, such as the Croton Filtration facility, at Eastview.

6.2 Aqueduct Inspections

To ensure that archival information accurately reflects the infrastructure and to ascertain the condition of these facilities DEP sought to conduct visual inspection of the Catskill Connection Chamber and Shaft 19 of the Delaware Aqueduct. An inspection of the Catskill Connection Chamber and a portion of the aqueduct downstream of the chamber was conducted on May 8, 2001. Minor spalling was identified in a portion of the aqueduct and recorded dimensions on the DEP records accurately reflect dimensions observed during the inspection. Due to potential interference with other projects and the prohibitive cost of conducting inspections of Shaft 19, visual assessment of the Delaware aqueduct facilities has been postponed. Inspection of the uptake and downtake facilities at Shaft 19 should be undertaken prior to final design. Findings from this inspection have been incorporated into the Updated Preliminary Designs.

6.3 Enhanced Disinfection Study

During 2001, the project team completed work on an enhanced disinfection study, assessing the effectiveness of chlorine, chlorine dioxide and ozone as disinfectants for the Catskill/Delaware supply. The primary objective of this enhanced study was to evaluate potential issues associated with increasing the level of pathogen inactivation using alternative disinfectants. The study was an outgrowth of the disinfection kinetics testing, completed in 1998, and included inactivation testing, regrowth potential characterization and disinfection by-product formation assessment. Seasonal variations in water quality were taken into account for this study.

As anticipated, ozone was the most effective disinfection method for inactivating oocysts. Though less effective, chlorine dioxide showed promise as a disinfection agent. Chlorine, which served as a baseline for the study, was ineffective for treating *Cryptosporidium*. Findings from the study suggest that none of the chemical disinfectants would be likely to increase distribution system regrowth, as long as an adequate chlorine residual is maintained. Likewise, no regulatory concerns related to disinfection by-product formation are anticipated with any of the disinfectants evaluated.

Unlike the chemical disinfectants in the Enhanced Disinfection Study, the project team decided to evaluate the feasibility of incorporating an Ultraviolet (UV) disinfection facility into the water supply system prior to establishing a scope for bench scale or pilot testing. A draft feasibility report was presented to DEP in April 2000. This report led to further evaluation of UV disinfection for Cat/Del.

Since DEP is presently pursuing the use of ultraviolet light disinfection for Cat/Del, no further work on chemical disinfection alternatives is anticipated.

6.4 Ultraviolet Disinfection

In anticipation of the promulgation of enhancements to the federal Safe Drinking Water Act, DEP began to assess Ultraviolet Disinfection (UV) for the Catskill/Delaware water supply in the event that relief from filtration planning process could be achieved. DEP and their consultant conducted a preliminary assessment of the engineering feasibility for UV disinfection of these supplies. Based on this work, DEP authorized H&S/CDM to proceed with bench-scale studies to assess the effectiveness of Ultraviolet light in rendering *Cryptosporidium* cysts inactive. Samples of water from Kensico Reservoir underwent inactivation studies and disinfection by-product assessments. This work has been conducted using low and medium pressure UV lamps.

Additional work is being conducted to further address the engineering feasibility of installing UV disinfection facilities at one of three City-owned sites (Kensico Reservoir, Eastview and Hillview Reservoir) and to refine economic and operational considerations. Efforts are also underway to identify manufacturers of equipment suitable for such an installation.

DEP summarized the findings of these investigations in a UV Feasibility Report issued on December 31, 2001. DEP will use this work to advance the designs of UV facilities and complete a conceptual design report and associated drawings for UV disinfection by May 31, 2002.

DEP and the JV continued to develop a scope of work for final design of Ultraviolet disinfection. At this time the project team is researching reactor validation methods for a system of this magnitude. Additional samples have been collected for bench scale inactivation studies reflecting a range of water quality characteristics.

On November 1, 2001, the project team hosted a workshop on Ultraviolet Disinfection at the offices of Hazen and Sawyer. The workshop agenda included project background, basics of UV Technology, regulatory issues, equipment options, modeling approaches for validation, site considerations and an open discussion. The information exchanged at the workshop and the questions raised during open discussion will better prepare the project team, DOH and EPA to proceed with the investigation of UV as an option for the Cat/Del supplies.

6.5 FAD Modifications

In a letter dated July 13, 2001, EPA stated its intention to modify the May 1987 Filtration Avoidance Determination for the Catskill and Delaware water supplies by substituting deliverables relating to Ultraviolet Disinfection of Cat/Del. This modification was conditioned upon a 30-day public comment period.

In a subsequent letter, dated November 29, 2001, EPA conditionally approved the request for relief and outlined modifications to the Filtration Avoidance Determination, substituting deliverables relating to Ultraviolet Disinfection for many of the remaining filtration-related deliverables. The modifications include provisions for biennial updates of the preliminary designs for filtration to maintain the time-neutral approach. The tasks and due dates established for Ultraviolet Disinfection of Cat/Del are shown below.

12/31/01	UV Feasibility Report Complete
5/31/02	UV Conceptual Design
8/31/02	Start Final Design *, **
5/31/04	Draft EIS prepared (if required)
11/30/04	Final EIS completed (if required)
5/31/05	Complete Final Design
8/31/09	UV in Operation

* *or within 3 months of EPA decision to proceed with UV, whichever is later*

** *due dates for subsequent deliverables will be adjusted accordingly*

7. Regulatory Review and Enforcement

7.1 Watershed Regulations

A primary component of DEP's overall watershed protection strategy is the enforcement of applicable environmental regulations, which include the revised WR&R, also promulgated as State law, the federal Clean Water Act, SEQRA and others. Of these, the primary mechanism for protection of the water supply is the WR&R. DEP's enforcement efforts are focused on three major areas: review and approval of projects within the watershed; regulatory compliance and inspection; and environmental enforcement.

7.1.1 Project Review

Because DEP has specific review and approval authority granted by State law, it is considered an "Involved Agency" under SEQRA for these projects where a DEP approval is required, and must review and issue findings statements regarding projects that have potential environmental impacts in the watershed. Comments or questions raised by DEP during the SEQRA process must be addressed by the project applicant to the satisfaction of both DEP and the lead agency.

Each project proposed in the watershed, including those designed or sponsored by DEP, is reviewed to ensure compliance with the WR&R, as well as federal, State and local laws. Projects that require DEP review and approval include all wastewater treatment facilities, including the installation and maintenance of subsurface sewage treatment systems (SSTS), preparation of SPPPs and the construction of certain impervious surfaces. In addition, DEP reviews and issues permits for IRSPs and for impervious surfaces associated with stream diversions or pipings. DEP also ensures that during and after construction, projects that require SPPPs or IRSPs have the necessary BMPs and that erosion controls are properly installed and maintained. In addition, DEP also reviews applications that have been sent to DEC for special permits involving mining operations, timber harvesting, stream crossings and wetland issues. These applications are forwarded to DEP for review and comment as provided for in the DEP/DEC MOU.

The table on the following page lists projects reviewed in the Boyds Corner, West Branch and Kensico Reservoir basins in 2001. The maps that follow show the location of these projects. Also in the past year, DEP received 58 applications for SSTS review and approval, and 1 application for SPPP review and approval in the Boyds Corner, West Branch and Kensico Reservoir basins.

Table 7.1. Boyds Corner, West Branch and Kensico New Projects

<i>Reservoir Basin</i>	<i>Project Name</i>	<i>Town</i>	<i>DEP Approval Required</i>	<i>Project Status</i>
West Branch	Porco Sedgewood-view Lot 1	Kent	Variance	New
West Branch	Ryder/Sedgewood Club	Kent	Variance	New
West Branch	Weigold/Cranewood Estates	Carmel	Variance	Complete
Kensico	Westchester County Airport	North Castle	Stormwater	Approved
Kensico	Mt. Pleasant Water Distribution System	Mt. Pleasant	Other	New
Boyds Corner	Charles Baione Lot	Kent	Variance	New

Table 7.2. Boyds Corner, West Branch and Kensico Individual SSTSs for 2001

<i>Reservoir Basin</i>	<i>Town</i>	<i># of New Septics</i>	<i># of Approvals*</i>
Boyds Corner	East Fishkill	3	2
Boyds Corner	Kent	9	6
Kensico	Harrison	1	2
Kensico	Mount Pleasant		1
Kensico	New Castle	4	2
Kensico	North Castle	3	3
West Branch	Carmel	5	4
West Branch	East Fishkill		2
West Branch	Kent	19	14

*Number of approvals of individual septic received in 2001.

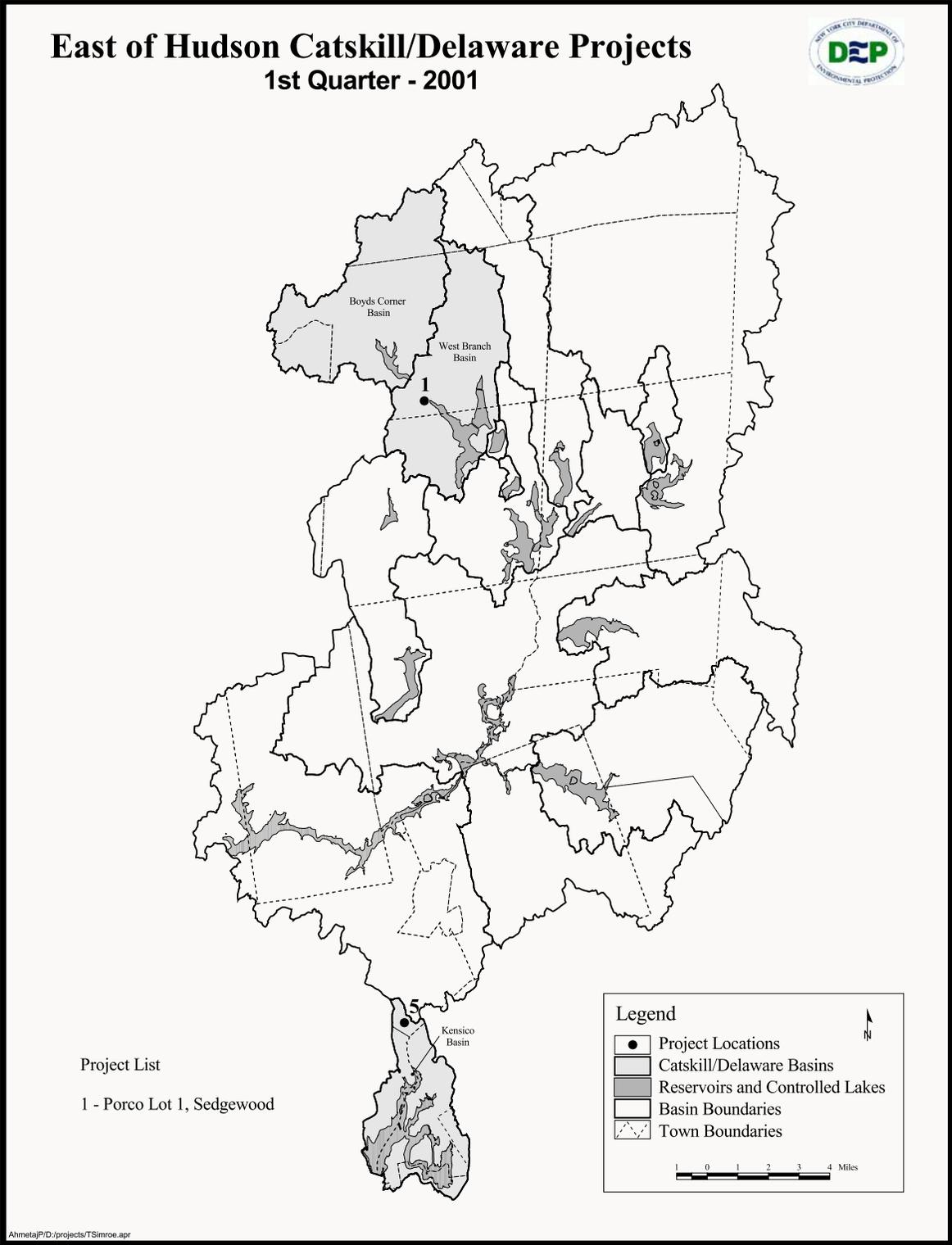


Figure 7.1. Map for East of Hudson Catskill/Delaware Projects 1st Quarter 2001.

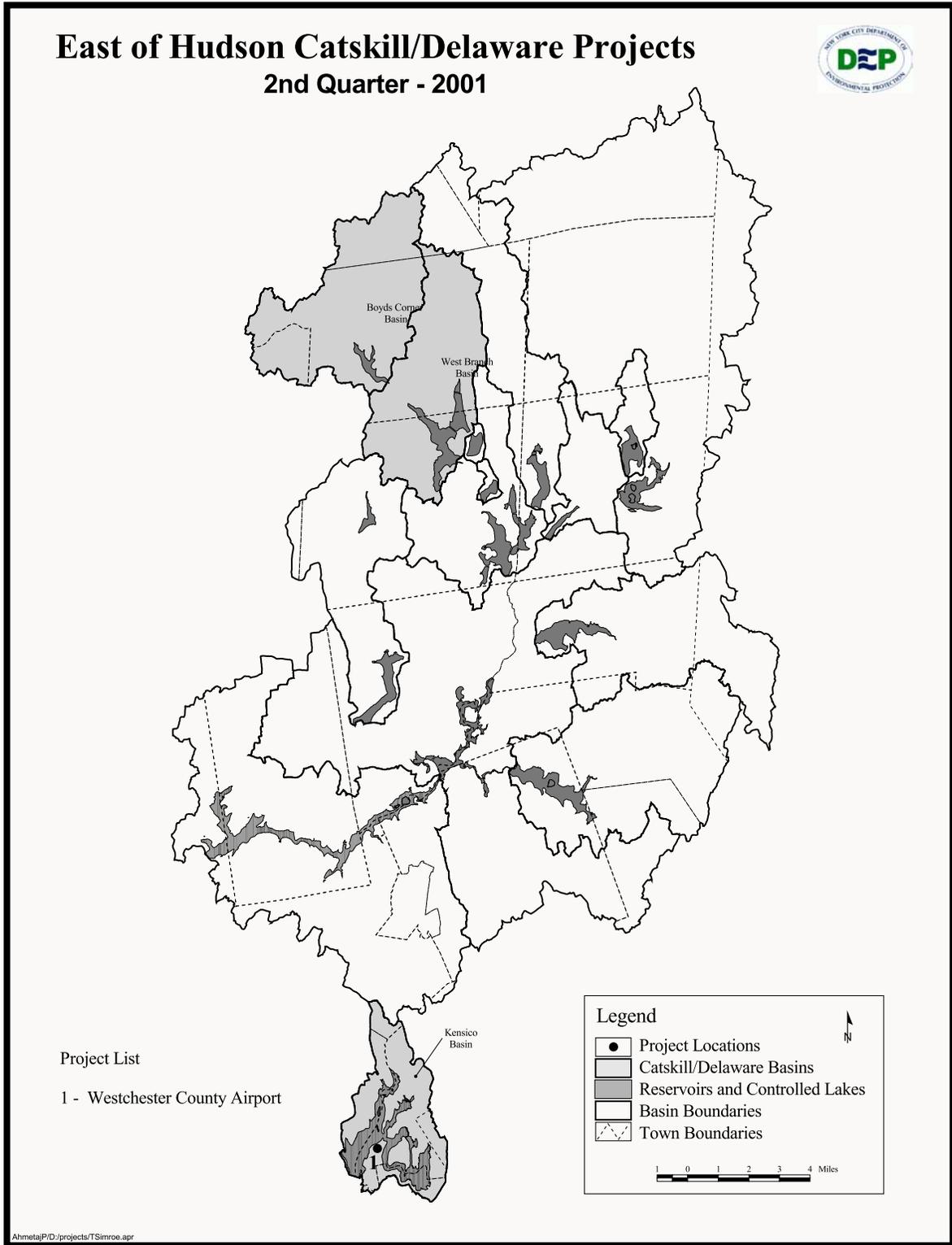
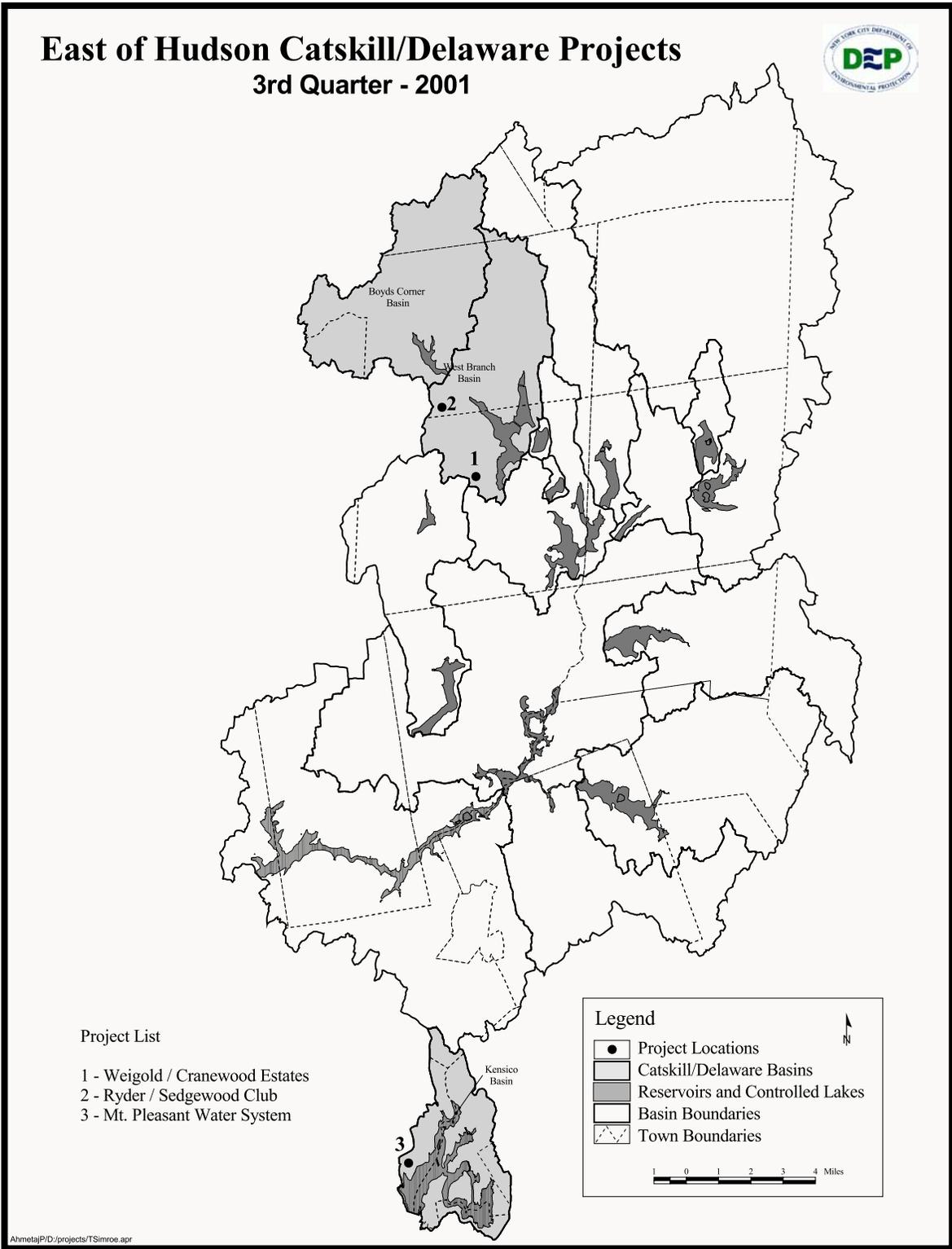


Figure 7.2. Map for East of Hudson Catskill/Delaware Projects 2nd Quarter 2001.

East of Hudson Catskill/Delaware Projects 3rd Quarter - 2001



Project List

- 1 - Weigold / Cranewood Estates
- 2 - Ryder / Sedgewood Club
- 3 - Mt. Pleasant Water System

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Figure 7.3. Map for East of Hudson Catskill/Delaware Projects 3rd Quarter 2001.

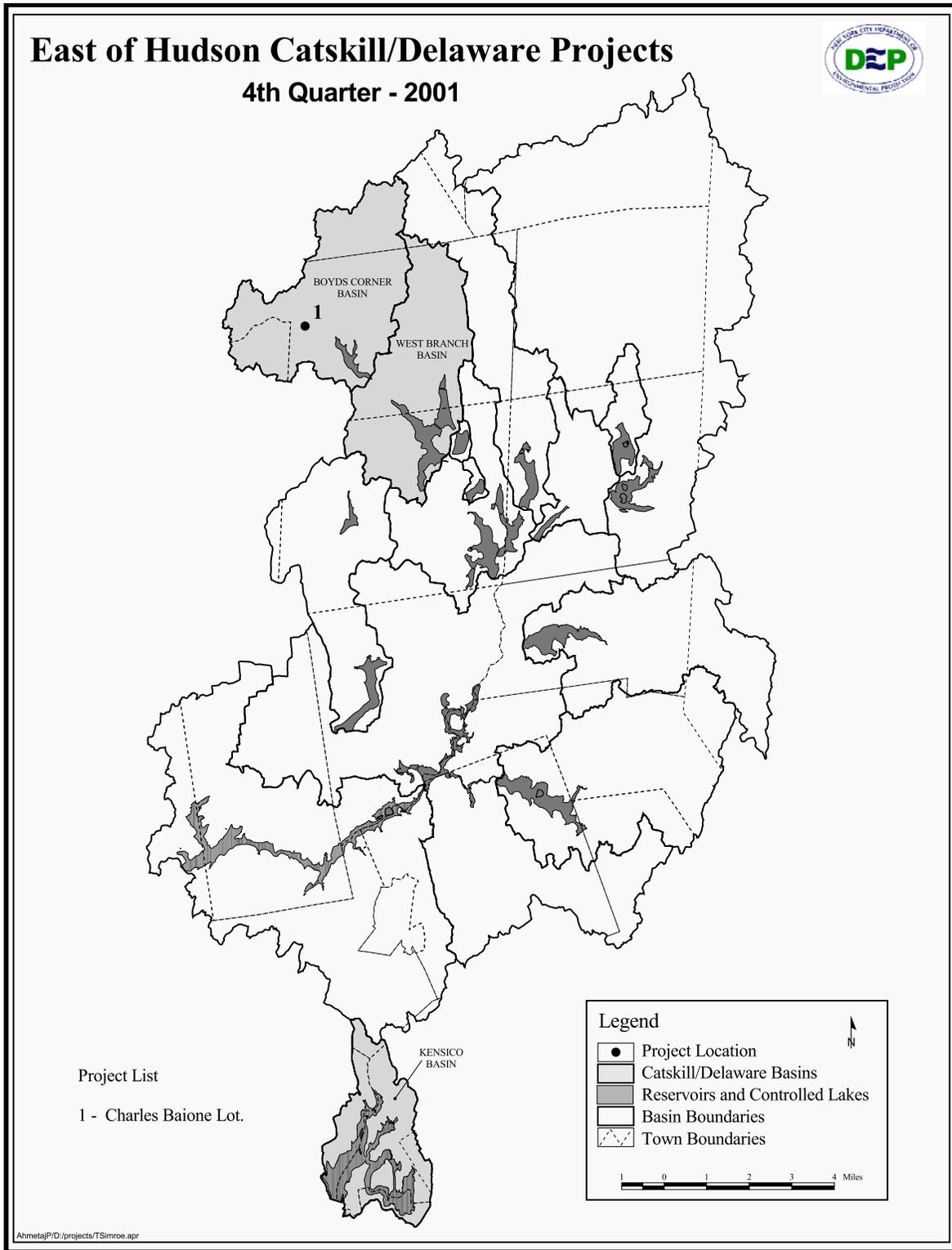


Figure 7.4. Map for East of Hudson Catskill/Delaware Projects 4th Quarter 2001.

In the WOH watershed DEP reviewed more than 400 applications for new or remediated commercial and residential septic systems, 13 stormwater pollution prevention plans and 65 other projects that proposed one or more regulated activities. The vast majority of these other projects were forwarded by DEC as stream disturbance permits, timber harvesting or mining applications. The tables below list all these projects listed by quarter of 2001. The new, delegated and remediated individual septic systems are listed separately on the last two tables. The maps on the pages following show the locations of the projects by quarter. The numbers on the maps refer to the project Map #.

Table 7.3. Catskill/Delaware New Projects – 1st Quarter 2001

<i>Reservoir Basin</i>	<i>Map #</i>	<i>Project Name</i>	<i>Town</i>	<i>DEP Approval Required</i>	<i>Project Status as of 12/31/01</i>
Ashokan	12	Alpine Osteria B & B	Shandaken	Septic Replacement	Approved
Ashokan	11	Pollack, Giselle Timber Harvest	Shandaken	Timber Harvest	Complete
Ashokan	19	Wittenberg Sportsmen's Club	Woodstock	Timber Harvest	Complete
Ashokan	10	Ashokan Kiosk Site	Olive	Other	Complete
Cannonsville	16	Country Meadow Mobile Home Park	Walton	Septic Replacement	Approved
Cannonsville	14	Doc Smith Quarry #1	Walton	Other	Complete
Cannonsville	15	Doc Smith Quarry #2	Walton	Other	Complete
Cannonsville	13	OWSL #4161	Walton	SEQRA Review	Complete
Cannonsville	4	CR 2 Over West Branch	Hamden	Stream Disturbance	Complete
Cannonsville	3	Kilanowski Property	Hamden	Stream Disturbance	Complete
Neversink	9	Neversink Kiosk Site	Neversink	Other	Complete
Pepacton	7	Middletown New Town Offices	Middletown	Stormwater	Approved
Pepacton	8	Kingdon Gould Stream Disturbance	Middletown	Stream Disturbance	Complete
Pepacton	1	Pepacton Kiosk Site	Andes	Other	Complete
Rondout	17	Bellanca Timber Harvest	Wawarsing	Timber Harvest	Complete
Rondout	18	Rondout Kiosk Site	Wawarsing	Other	Complete
Schoharie	6	Hunter Library	Hunter (V)	Stormwater	Approved
Schoharie	2	Schoharie Kiosk Site	Gilboa	Other	Complete
Schoharie	5	Diamond Notch Dry Hydrant	Hunter	Stream Disturbance	Complete

Table 7.4. Catskill/Delaware New Projects – 2nd Quarter 2001

<i>Reservoir Basin</i>	<i>Map #</i>	<i>Project Name</i>	<i>Town</i>	<i>DEP Approval Required</i>	<i>Project Status as of 12/31/01</i>
Ashokan	9	Laroux, Benjamin	Lanesville	Residential SPPP	Approved
Ashokan	10	Rose, James	Halcott	Residential SPPP	Approved
Ashokan	26	Asclepius Foundation	Shandaken	Septic Replacement	Approved
Ashokan	27	Full Moon Inn	Shandaken	Septic Replacement	Approved
Ashokan	28	Mack's Woodworking	Olive	New Septic	Incomplete
Ashokan	11	Catskill Mountain Railroad	Shandaken	Other	Incomplete
Ashokan	34	Rt. 212 Culvert & Retaining Wall	Woodstock	Other	Complete
Ashokan	33	Hessol Timber Harvest	Woodstock	Timber Harvest	Complete
Cannonsville	5	Engels Cabinetry Shop	Delhi	New Septic	Approved
Cannonsville	3	Pawlikowski, John	Delhi	New Septic	Approved
Cannonsville	4	Delaware County Public Safety Building	Delhi	Stormwater	Approved
Cannonsville	29	NYSE&G	Tompkins	Stormwater	Approved
Cannonsville	30	Walton High School Running Track	Walton	Stormwater	Approved
Cannonsville	15	Melloy Stream Disturbance	Meredith	Stream Disturbance	Complete
Neversink	22	Papa's B&B Service Center	Neversink	Septic Replacement	Approved
Neversink	21	OWSL #4168	Neversink	SEQRA Review	Complete
Neversink	19	Grahamsville Fairgrounds	Neversink	Sewer Connection	Approved
Neversink	18	Dean, Meigan	Neversink	Stormwater	Approved
Neversink	20	Daniel Pierce Library	Neversink	Stormwater	Incomplete
Pepacton	1	Misty Morning Farm, Inc.	Neversink	Septic Replacement	Approved
Pepacton	25	Mary's Cookin	Roxbury	New Septic	Approved
Pepacton	16	Hamil, Jerry (The Water Guy)	Margaretville	Stormwater	Approved
Pepacton	24	McArdle Stream Disturbance	Roxbury	Stream Disturbance	Complete
Pepacton	17	Little Red Kill Road Culvert	Middletown	Stream Disturbance	Complete
Pepacton	23	Grauert Property	Roxbury	Stream Disturbance	Complete
Pepacton	2	Grommeck Property	Andes	Stream Disturbance	Complete
Pepacton	7	Aquilina Property	Halcott	Stream Disturbance	Complete
Schoharie	31	Sblendorio, Anthony	Windham	Residential SPPP	Complete
Schoharie	6	Halcott Grange Hall	Halcott	Septic Replacement	Approved
Schoharie	8	Hunter Theater	Hunter	Septic Replacement	Approved
Schoharie	32	Windham Seafood Restaurant (Kallman)	Windham	Other	Approved
Schoharie	12	CR 23C Slide Repair	Jewett	Other	Complete
Schoharie	13	Vanucchi Stream Disturbance	Jewett	Stream Disturbance	Complete
Schoharie	14	Frederick King Property	Jewett	Stream Disturbance	Complete

Table 7.5. Catskill/Delaware New Projects – 3rd Quarter 2001

<i>Reservoir Basin</i>	<i>Map #</i>	<i>Project Name</i>	<i>Town</i>	<i>DEP Approval Required</i>	<i>Project Status as of 12/31/01</i>
Ashokan	14	Brody, Irene	Olive	New Septic	Approved
Ashokan	16	Gilbert, Gladys	Olive	New Septic	Incomplete
Ashokan	15	OWSL #4176	Olive	SEQRA Review	Complete
Ashokan	17	Gitter Stream Disturbance	Shandaken	Stream Disturbance	Complete
Ashokan	25	Manuso Timber Harvest	Woodstock	Timber Harvest	Complete
Ashokan	27	Bradford Timber Harvest	Woodstock	Timber Harvest	Complete
Ashokan	26	Oliver Timber Harvest	Woodstock	Timber Harvest	Complete
Cannonsville	18	OWSL #4177	Tompkins	SEQRA Review	Complete
Cannonsville	19	Napoli Stream Disturbance	Tompkins	Stream Disturbance	Complete
Cannonsville	6	Hutson Farm Stream Disturbance	Hamden	Stream Disturbance	Complete
Cannonsville	4	Kulaski Stream Disturbance	Bovina	Stream Disturbance	Complete
Cannonsville	20	Richardson Stream Disturbance	Walton	Stream Disturbance	Complete
N/A	2	OWSL #4178	Rockland	SEQRA Review	Complete
Pepacton	3	OWSL #4175N	Andes	SEQRA Review	Complete
Pepacton	1	Horton Brook	Colchester	SEQRA Review	Complete
Rondout	13	Neversink Town Hall	Neversink	Sewer Connection	Approved
Schoharie	12	Lexington Historical Society	Lexington	Septic Replacement	Approved
Schoharie	21	Davis, Linda	Windham	Septic Replacement	Incomplete
Schoharie	23	Ski Windham Snow Tubing Park	Windham	New Septic	Approved
Schoharie	9	Scribner Hollow Tele-Tower	Hunter	SEQRA Review	Complete
Schoharie	7	Dolans Lake Park	Hunter (V)	Stormwater	Approved
Schoharie	22	GCSWCD - Stream Disturbance	Windham	Stormwater	Approved
Schoharie	24	Cuomo, Nicholas & Terry	Windham	Crossing, Piping, Diversion	Approved
Schoharie	5	Buel Stream Disturbance	Conesville	Stream Disturbance	Complete
Schoharie	8	Grossman Stream Disturbance	Hunter	Stream Disturbance	Complete
Schoharie	11	Cerbone Stream Disturbance	Jewett	Stream Disturbance	Complete
Schoharie	10	Anson Stream Disturbance	Hunter	Stream Disturbance	Complete

Table 7.6. Catskill/Delaware New Projects – 4th Quarter 2001

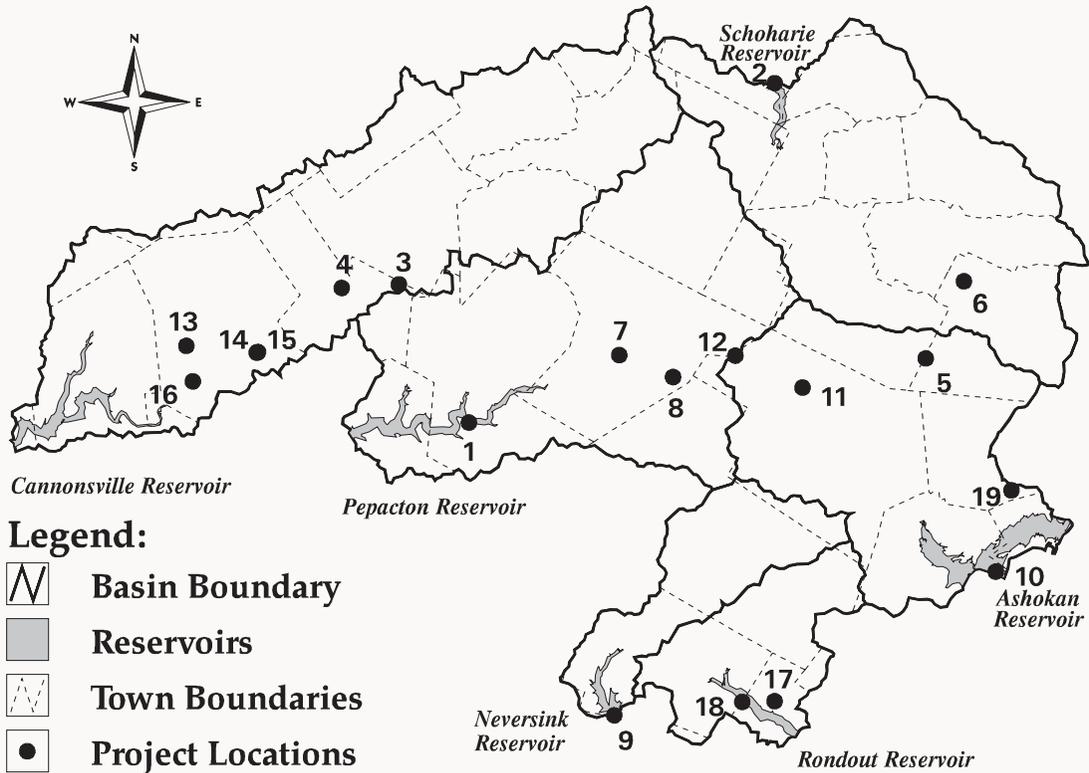
<i>Reservoir Basin</i>	<i>Map #</i>	<i>Project Name</i>	<i>Town</i>	<i>DEP Approval Required</i>	<i>Project Status as of 12/31/01</i>
Ashokan	16	Belleayre Hostel	Shandaken	Septic Replacement	Approved
Ashokan	13	OWSL #4181B	Olive	SEQRA Review	Complete
Ashokan	12	OWSL #4181	Olive	SEQRA Review	Complete
Cannonsville	18	OWSL #4187	Tompkins	SEQRA Review	Complete
Cannonsville	17	Weinmann Stream Disturbance	Stamford	Stream Disturbance	Complete
Cannonsville	1	Hamlet of Bovina Center	Bovina	WWTP	Incomplete
Cannonsville	14	Catskill Family Farms Co-op	Roxbury	Septic Replacement	Approved
Neversink	4	Denning Stormwater Retrofit	Denning	Other	New
Pepacton	9	LeSure Yoga Studio	Middletown	New Septic	Approved
Pepacton	6	Wadler Brothers, Inc.	Middletown	New Septic	Approved
Pepacton	5	Lake Switzerland	Fleischmanns	Other	New
Pepacton	2	OWSL #3864	Colchester	SEQRA Review	Complete
Rondout	10	Applewhite, John & Felecia	Neversink	Residential SPPP	Approved
Rondout	11	Tri-Valley CSD	Neversink	Stormwater	Incomplete
Rondout	19	McDole Timber Harvest	Wawarsing	Timber Harvest	Complete
Schoharie	20	Rallatos Auto Repair Garage	Windham	New Septic	Approved
Schoharie	7	Hunter Village Inn	Hunter	Septic Replacement	Approved
Schoharie	21	Pedrossa SSTS	Windham	Septic Replacement	Approved
Schoharie	3	Conesville Sand & Gravel	Conesville	Other	Complete
Schoharie	15	Grand Gorge Firehouse	Roxbury	SEQRA Review	Complete
Schoharie	8	OWSL #4182N	Lexington	SEQRA Review	Complete



City of New York
West of Hudson Engineering

West of Hudson Projects

1st Quarter - 2001



Legend:

- Basin Boundary
- Reservoirs
- Town Boundaries
- Project Locations

Project List

- | | |
|-------------------------------|---|
| 1 Pepacton Kiosk Site | 10 Ashokan Kiosk Site |
| 2 Schoharie Kiosk Site | 11 Pollack, Giselle |
| 3 Kilanowski Property | 12 Alpine Osteria B & B |
| 4 CR 2 Over West Branch | 13 OWSL Report #4161 |
| 5 Diamond Notch Dry Hydrant | 14 Doc Smith Quarry #1 |
| 6 Hunter Library | 15 Doc Smith Quarry #2 |
| 7 Middletown New Town Offices | 16 Country Meadow Mobile Home Park |
| 8 Kingdon Gould Streambank | 17 Bellanca Timber Harvest |
| 9 Neversink Kiosk Site | 18 Rondout Kiosk Site |
| | 19 Wittenberg Sportsmen's Club Timber Harvest |

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Figure 7.5. Map for West of Hudson projects 1st Quarter 2001.

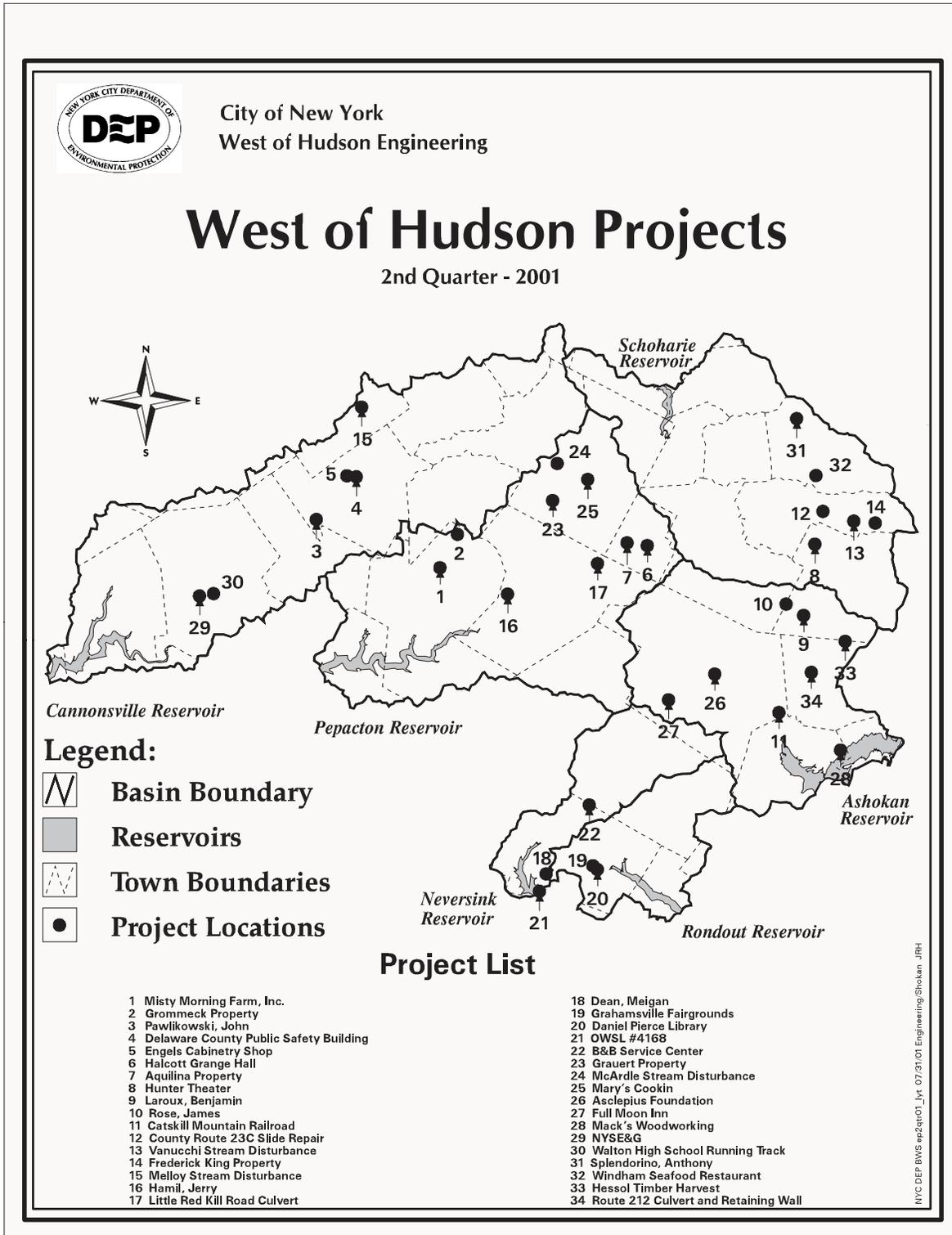


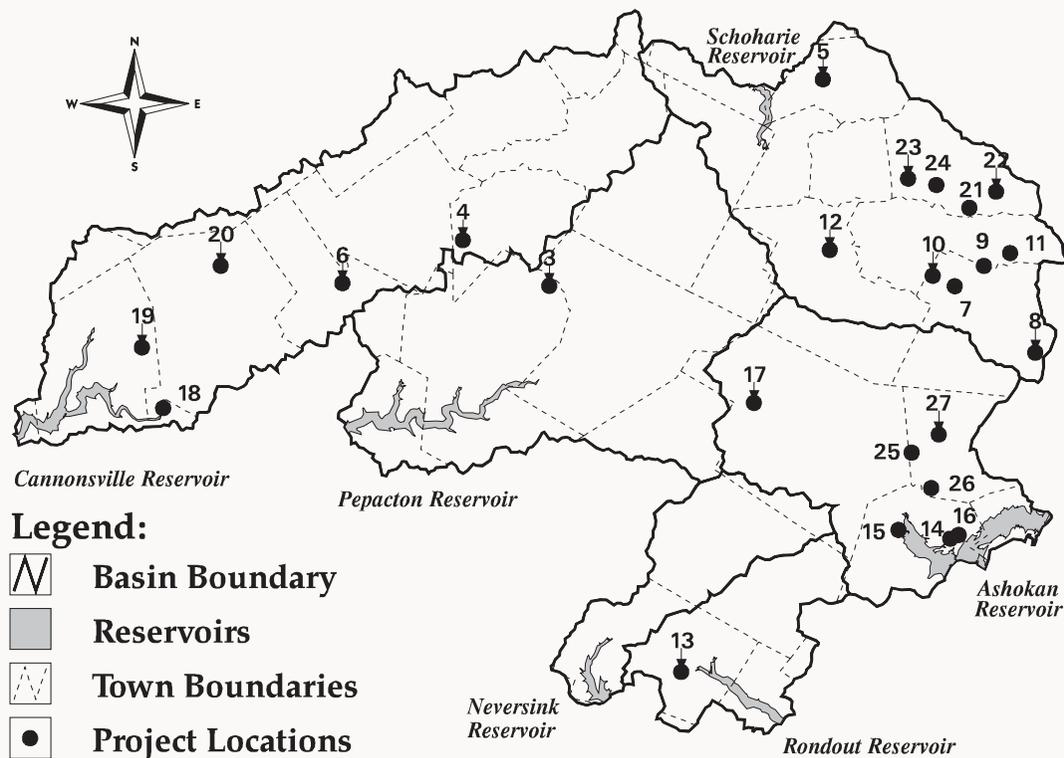
Figure 7.6. Map for West of Hudson projects 2nd Quarter 2001.



City of New York
West of Hudson Engineering

West of Hudson Projects

3rd Quarter - 2001



Legend:

- Basin Boundary
- Reservoirs
- Town Boundaries
- Project Locations

Project List

- | | |
|-------------------------------------|---|
| 1 Horton Brook (NOT PLOTTED) | 15 OWSL #4176 - Smith, John & Carol |
| 2 OWSL #4178, Verizon (NOT PLOTTED) | 16 Gilbert, Gladys |
| 3 OWSL #4175N, Weaver Hollow Road | 17 Glitter Stream Disturbance |
| 4 Kulaski Stream Disturbance | 18 OWSL #4177 - Bouman, Peter |
| 5 Buel Stream Disturbance | 19 Napoll Stream Disturbance |
| 6 Hutson Farm Stream Disturbance | 20 Richardson Stream Disturbance |
| 7 Dolan's Lake Park | 21 Davls, Linda |
| 8 Grossman Stream Disturbance | 22 GCSWCD Batavia Kill Stream Restoration, Big Hollow |
| 9 Scribner Hollow Tele-Tower | 23 Ski Windham Snow Tubing Park |
| 10 Anson Stream Disturbance | 24 Cuomo, Nicholas & Terry |
| 11 Cerbone Stream Disturbance | 25 Manuso Timber Harvest |
| 12 Lexington Historical Society | 26 Oliver Timber Harvest |
| 13 Neversink Town Hall | 27 Bradford Timber Harvest |
| 14 Brody, Irene | |

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Figure 7.7. Map for West of Hudson projects 3rd Quarter 2001

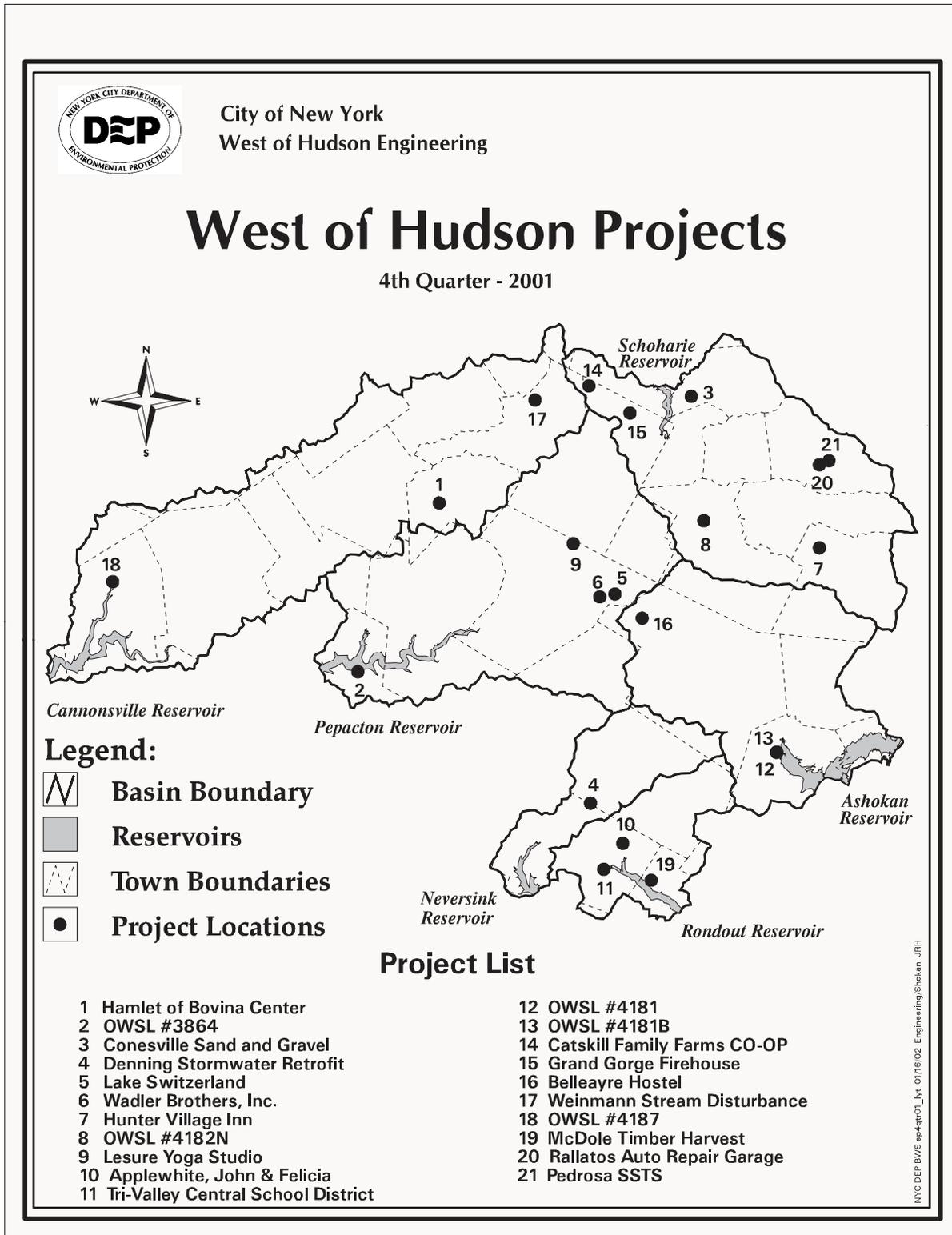


Figure 7.8. Map for West of Hudson projects 4th Quarter 2001.

Table 7.7. Catskill Watershed – Individual SSTs for 2001

<i>Reservoir</i>	<i>Town</i>	<i># of Delegated Septics</i>	<i># of New Septics</i>	<i># of Septic Repairs</i>	<i># of Approvals</i>	<i># of Constructions</i>
Ashokan	Hunter	0	1	0	1	0
Ashokan	Hurley	5	N/A	3	5	13
Ashokan	Olive	17	N/A	26	39	26
Ashokan	Shandaken	15	N/A	10	16	22
Ashokan	Woodstock	10	N/A	3	8	13
Schoharie	Ashland	N/A	7	2	10	6
Schoharie	Conesville	N/A	3	1	4	2
Schoharie	Gilboa	N/A	1	0	1	1
Schoharie	Hunter	N/A	12	6	20	20
Schoharie	Hunter (V)	N/A	1	0	1	0
Schoharie	Jewett	N/A	14	9	25	21
Schoharie	Lexington	N/A	11	3	16	13
Schoharie	Prattsville	N/A	2	2	3	5
Schoharie	Roxbury	N/A	1	0	2	3
Schoharie	Windham	N/A	17	12	26	26
Totals		47	70	77	177	171

Table 7.8. Delaware Watershed - Individual SSTSs for 2001

<i>Reservoir</i>	<i>Town</i>	<i># of Delegated Septics</i>	<i># of New Septics</i>	<i># of Septic Repairs</i>	<i># of Approvals</i>	<i># of Constructions</i>
Cannonsville	Bovina	N/A	2	2	5	5
Cannonsville	Delhi	N/A	7	2	10	17
Cannonsville	Franklin	N/A	3	0	2	2
Cannonsville	Hamden	N/A	6	5	12	14
Cannonsville	Harpersfield	N/A	1	0	1	1
Cannonsville	Jefferson	N/A	0	0	0	1
Cannonsville	Kortright	N/A	8	9	10	8
Cannonsville	Masonville	N/A	0	0	1	3
Cannonsville	Meredith	N/A	6	1	7	8
Cannonsville	Sidney	N/A	0	0	0	0
Cannonsville	Stamford	N/A	1	0	2	5
Cannonsville	Stamford (V)	N/A	4	0	4	4
Cannonsville	Tompkins	N/A	5	1	6	13
Cannonsville	Walton	N/A	11	9	19	20
Neversink	Denning		2	0	3	3
Neversink	Hardenburgh		0	0	0	
Neversink	Neversink		0	6	10	11
Pepacton	Andes	N/A	10	7	15	24
Pepacton	Bovina	N/A	1	0	2	3
Pepacton	Colchester	N/A	3	2	5	7
Pepacton	Halcott	N/A	6	0	6	7
Pepacton	Hamden	N/A	1	0	1	2
Pepacton	Hardenburgh		1	0	2	1
Pepacton	Margaretville (V)	N/A	0	1	1	0
Pepacton	Middletown	N/A	16	6	22	32
Pepacton	Roxbury	N/A	4	5	10	16
Pepacton	Wawarsing	0	0	0	0	0
Rondout	Denning		2	0	3	3
Rondout	Fallsburg		0	1	1	1
Rondout	Hardenburg		1	0	1	1
Rondout	Neversink		0	10	15	18
Rondout	Wawarsing		0	3	3	2
Totals		6	105	70	179	232

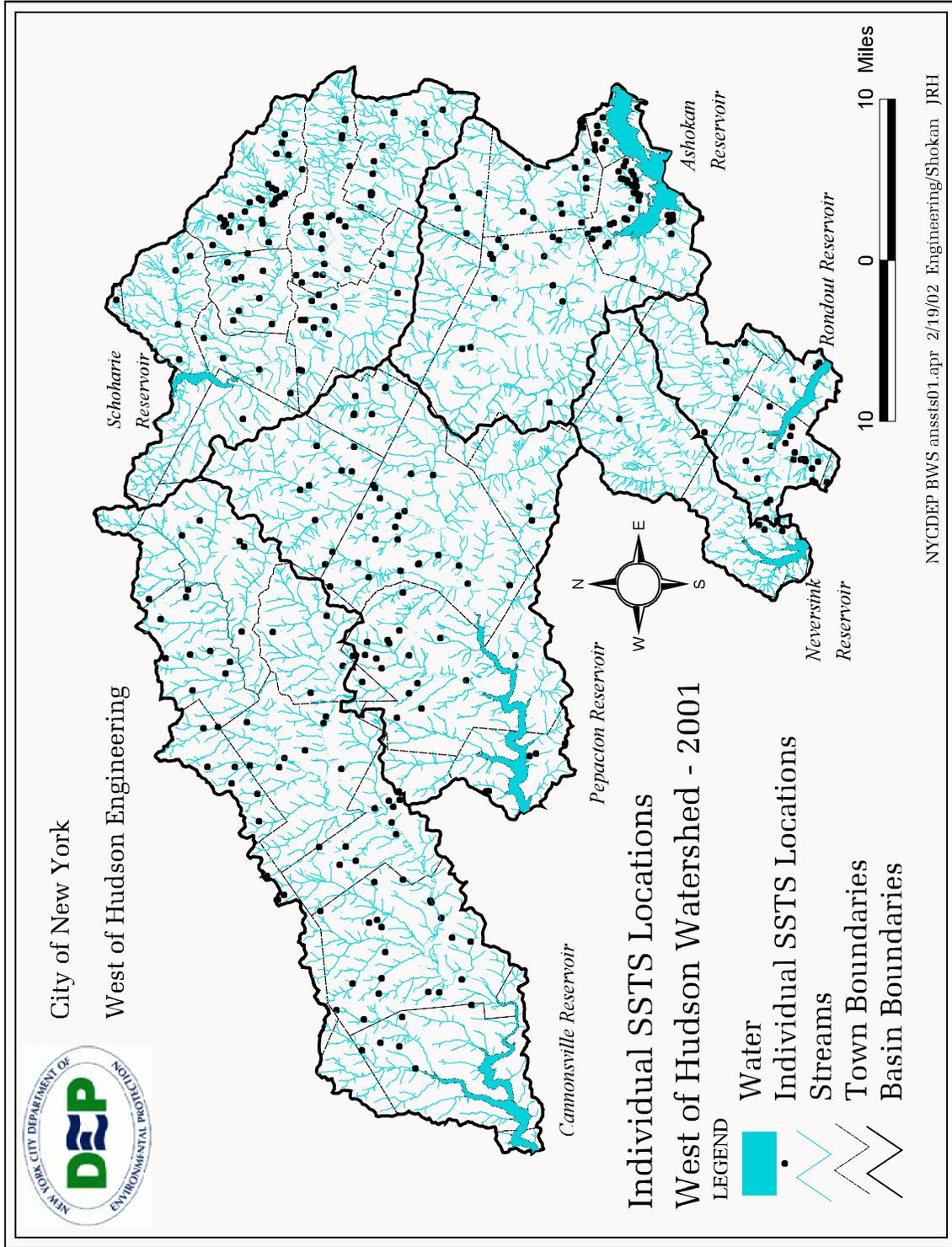


Figure 7.9. Map for West of Hudson Watershed individual SSTS locations 2001

7.2 Wastewater Treatment Facility Compliance Inspection Program

Wastewater treatment plants in the Catskill and Delaware watersheds continue to show improvement in compliance with their State Pollutant Discharge Elimination System (SPDES) permits over the past year, in large part due to DEP's Wastewater Treatment Facility Compliance Inspection Program. Facilities showing notable improvement in compliance records in 2001 include Camp L'Man Achai, Hunter Highlands, Camp Nubar, Camp Timberlake and Ski Windham. One facility, Mountainside Restaurant, has failed to consistently maintain its required effluent limits even after corrective work was performed, and has been referred to DEC for enforcement actions. DEC is the primary agency for this facility under inter-agency agreement.

Another facility, Regis Hotel, was subject to pump-outs during part of the year, due to the work of inspection program staff. Because these pump-outs did not positively affect effluent quality, DEP and the facility are working on an agreement for a revised operating procedure during the 2002 season. Structural measures will be required prior to the Hotel opening. Latvian Church Camp, which is permitted for a surface discharge, continued to be subject to restricted subsurface discharge to avoid non-compliant surface discharges.

Camp L'Man Achai was also subject to a "no surface discharge" requirement for its entire 2001 operating season. As a result, the camp had to hold and haul its entire WWTP flow. No violations occurred during the 2001 season. The camp will again be required to operate under the hold and haul requirement for the 2002 operating season.

Notification by the inspection program staff, and in one case directly by DEP sampling staff, caused several facilities to take immediate corrective action during specific incidents of acute operational or equipment failures. This resulted in avoidance or elimination of non-compliant discharges. These facilities included Thompson House, Ski Windham, Mountain View Estates, Liftside, Village of Delhi, Village of Stamford and Village of Hobart WWTPs.

At each surface discharging wastewater facility that operates on a year-round basis, DEP conducts four inspections, one for each calendar quarter. At seasonal surface discharging facilities, a minimum of two inspections per year are conducted during the facility's operating season. Similarly, at least two inspections per year are conducted at cooling water and oil and water separator discharges to surface waters. Treated industrial waste discharges to groundwater, via ground surface application, are inspected four times per year.

A total of 41 WOH wastewater treatment facilities were inspected on a regular schedule. Of those, 30 facilities are permitted for year-round discharge and eleven are permitted for seasonal discharge. Of this overall total, three are wastewater treatment facilities permitted to discharge to groundwater. Two other discharges are industrial cooling water discharges, and one is an oil and water separator with potential discharge to the ground surface. The total number of regularly scheduled inspections of WWTPs in the Catskill/Delaware watershed in 2001 was 160.

In addition to regular inspections, DEP conducts follow-up inspections when necessary. If it is determined at the initial inspection that non-complying conditions exist and corrective action is necessary, a follow-up inspection is scheduled to ensure that corrective actions are implemented and that an effort is being made to return the facility to compliance or to correct operational deficiencies. Also, following an enforcement initiative, staff may periodically conduct a follow-up unannounced visit to ensure that the facility is continuing in its efforts to remain in compliance. Approximately 40 follow-up inspections were made at various facilities throughout the year.

Several facilities had construction remediation or improvements made in response to compliance actions initiated by DEP. During and after construction work on any facility, DEP will visit the facility to observe the work and to ensure the construction is in accordance with approved plans. Approximately 36 construction inspections were performed in 2001.

This past year, upgrade construction activities commenced at 7 facilities. These facilities are Village of Delhi, Village of Walton, Village of Stamford, Village of Hobart, Hunter Highlands, Allen Residential Center and Mountain Side Farms WWTPs.

DEP also visits facilities to meet with owners and/or operators to address special problems and to offer operating suggestions. In addition, DEP labs conduct special analyses to help identify reasons for actual or potential violations by determining if the collection of special samples in the treatment process train is needed. DEP conducted approximately 20 such visits in 2001.

In 2001, seven Compliance Assistance Conferences were held between DEP and facility owners. There was one NOV issued. There were two 60-day Notices of Intent to Sue delivered to treatment facility owners. There were seven referrals to DEC for enforcement actions.

In addition, DEP coordinates enforcement activities with DEC through the quarterly Watershed Enforcement Coordination Committee (WECC) meetings. At these meetings the status of watershed WWTPs is discussed and steps are taken to ensure that adequate enforcement activities are pursued. Staff from EPA and DOH also participate in the WECC meetings.

7.3 Sampling of Wastewater Treatment Plant Effluents

Sampling of wastewater treatment plant (WWTP) effluents is conducted by DEP's District Laboratories: Grahamsville Lab in the Delaware District and Ben Nesin Lab in the Catskill District. Non-City-owned surface-discharging WWTPs are sampled twice monthly and City-owned WWTPs are sampled at least weekly. Details regarding the location, sampling frequency, and list of analytes for each WWTP can be found in DEP's "Water Quality Surveillance Monitoring" report (revised November 1997). Sampling data are shared regularly with DEP's Facilities Compliance Section for the purpose of tracking compliance with SPDES-permitted effluent limits.

The City-owned WWTPs are sampled in accordance with the monitoring requirements of their SPDES permits, and grab-samples are taken at non-City-owned facilities. Once a year, a composite sample is collected from those non-City-owned WWTPs that have composite sampling monitoring requirements in their permits. In the Catskill District in 2001, composite samples were collected from Snowtime, Hunter Highlands, Liftside, Onteora Central School, and Colonel's Chair Estates, and from the City-owned WWTPs at Tannersville, Grand Gorge, and Pine Hill. In the Delaware District, composite samples were collected from Village of Walton, Village of Stamford, Allen Residential Center, Village of Hobart, Ultradairy and Village of Delhi, from the City-owned WWTPs at Margaretville and Grahamsville, and from the non-contact cooling water discharges at Kraft and Ultra Dairy. Effluent total phosphorus concentration data are collected from all facilities regardless of whether or not this parameter is permitted so that the data can be used to develop point-source phosphorus loads. In 2001, the Ben Nesin Laboratory conducted 4,210 analyses on 826 effluent samples and the Grahamsville Laboratory conducted 5,036 analyses on 527 effluent samples from WWTPs (and non-contact cooling water discharges) discharging within the water-supply watershed only.

To monitor the effluent quality of WWTPs that receive high weekend usage during the ski season, samples were collected on the holiday weekends of Martin Luther King Day, Washington's Birthday, Christmas, and New Years, at Whistle Tree, Snowtime, Mountain View Estates, Mountain View Homeowners Association, Liftside, Hunter Highlands, and Forester Motor Lodge. In general, these samples contained slightly more exceedances of SPDES-permitted parameters than standard weekday samples collected during the ski season.

Final upgrades, including phosphorus removal and microfiltration, were completed at the City-owned WWTPs in the Catskill/Delaware watershed in 1999. T-test analyses of water quality data collected above and below the City-owned plants using the protocols specified in Addendum E of the DEC/DEP MOU found the Tannersville and Grand Gorge WWTPs to be significant contributors of total phosphorus to the receiving streams prior to their upgrades. After their upgrades and throughout 2001, no City-owned facility was found to be a significant source of phosphorus to stream sites exceeding the total phosphorus guidance value for streams. This evidence continues to suggest that the upgrade program will successfully reduce nutrient loads from point sources.

7.4 2001 Protection Activities

The Protection Section performs routine patrols of City-owned reservoirs, aqueducts, and watershed area; performs discovery and confirmation, issues Notices of Violation, and pursues enforcement actions on failed subsurface sewage treatment systems; reviews residential building sites from the testing phase through the completion of construction for subsurface sewage treatment systems; refers other potential WR&R violations to the Engineering Section; refers criminal activity to the DEP Police; performs supplemental SPPP inspections; issues Fishing and Boating

Permits and enforces Fishing and Boating Regulations; documents and pursues removal of encroachments on water supply lands; and performs numerous other activities to protect the water supply. Additionally, these activities are coordinated with DEP and Corporation Counsels, local County Health Departments, local building inspectors, and the Catskill Watershed Corporation in the MOA program areas. Protection staff also performed a house-to-house survey of the Kensico watershed.

In 2001, Protection accomplished the following (the East of Hudson figures are watershed wide, and include both the Boyds Corner/West Branch, Kensico, and all Croton System Reservoirs, aqueducts, and watershed areas):

Table 7.9. 2001 workload items accomplished.

	<i>East of Hudson</i>	<i>Catskill</i>	<i>Delaware</i>
WORKLOAD ITEM DESCRIPTION			
New Onsite SSTS's Construction Approved	0	64	120
New Onsite SSTSs Design Approved	0	4	11
Onsite SSTSs Remediated or Replaced	0	113	120
Fishing Permits Checked	2,179	455	798
Boating Permits Checked	290	63	120
Sectors Patrolled	1,14.5	50	102
Aqueduct Patrols	44.5	38.25	59
Individuals Removed from City Property	2,104	731	467
Police Referrals	0	0	2
Complaints Received	6	7	7
Spills Responded To	1	4	7
NOVs/NOFs Issued	6	44	18
FISHING AND BOATING PERMITS			
Fishing Permits Issued/Renewed	3,034	1,661	2,830
Boat Permits Issued/Renewed	549	415	730
Boat Permits Validated	3,751	1,281	1,938
Boats Steam Cleaned	782	172	262
OTHER REPORTED ITEMS			
Miles Traveled	210,632	155,026	318,722
Onsite SSTSs Pending Construction		203	109

7.5 DEP Police Activities

DEP Police are responsible for the security of water supply facilities and enforcement of environmental laws. DEP Police patrol the City's watershed on a daily basis in the vicinity of critical water supply structures such as chambers, dams and aqueducts. Officers help track new developments, construction, or other activities that may affect the watershed and refer all relevant information to the appropriate group within DEP for follow-up.

Since the events of September 11, the DEP Police have increased their focus on protection of critical water supply facilities. In addition, DEP is working with ACOE to assess facilities and design and install certain access control and surveillance measures

The following table summarizes the enforcement activity of the DEP Police in 2001.

Table 7.10. 2001 DEP Police activity.

<i>Description</i>	<i>Summons/Arrest</i>			<i>Notice of Warning</i>		
	<i>Patrol</i>	<i>EEU</i>	<i>Total</i>	<i>Patrol</i>	<i>EEU</i>	<i>Total</i>
1 Penal Law Trespass	371	50	421	113	6	113
2 Environmental Conservation Trespass	2	1	3	0	0	0
3 Hazardous Material Release	0	0	0	0	0	0
4 Hazardous Material Spill	0	0	0	0	0	0
5 Discharge to Stream	0	1	1	0	1	0
6 Dumping	5	5	10	0	0	0
7 Solid Waste to Environment	0	4	4	0	1	0
8 Turbidity/Contravention	0	4	4	0	0	0
9 Working in stream without permit	0	3	3	0	0	0
10 Fishing without license	31	6	37	0	0	0
11 Failure to carry a license	2	0	2	0	0	0
12 Depositing Noisome Substance	12	11	23	0	1	0
13 Fishing Other than Angling/Fishing	1	0	1	0	0	0
14 Failure to Contain Waste	0	0	0	0	0	0
15 Hazardous Substance to River	0	0	0	0	0	0
16 Hunting with Artificial Light	0	0	0	0	0	0
17 Taking Game from Highway	0	0	0	0	0	0
18 Taking Undersize Fish	0	1	1	0	0	0
19 Taking Fish Out of Season	0	0	0	0	0	0
20 Penal Law (Other than Trespass)	47	0	47	1	1	1
21 V& T	475	64	539	4	0	4

Table 7.10. 2001 DEP Police activity.

<i>Description</i>	<i>Summons/Arrest</i>			<i>Notice of Warning</i>		
	<i>Patrol</i>	<i>EEU</i>	<i>Total</i>	<i>Patrol</i>	<i>EEU</i>	<i>Total</i>
22 All Other	22	3	25	8	0	8
23 No Covering Device	0	1	1	1	1	1
24 Removal of Trees	0	0	0	0	0	0
25 Unattended poles	0	0	0	0	0	0
26 Improper Tagging	0	0	0	0	0	0
27 Firearm in Vehicle	0	0	0	0	0	0
28 Unclassified ECL	6	0	6	0	0	0
29 Failure to Report	0	2	2	0	0	0
TOTAL	974	156	1130	127	11	138

7.6 Delegation Agreements

Westchester, Putnam and Ulster County Health Departments continued to perform reviews of septic systems in accordance with the Delegation Agreements. We have received documentation concerning the review of 352 delegated systems during the calendar year 2001.

8. Land Acquisition and Stewardship Program

8.1 Program Summary

Between January 22nd 2001 and January 21st 2002, DEP met the Year 5 solicitation deliverable set forth in the 1997 FAD and the 1997 MOA. Specifically, 55,265 acres were solicited during this period, bringing the total acres solicited during the first five years of the program to 258,679 in the Catskill and Delaware watersheds.

Between January 21, 1997 and January 21, 2002, a total of 486 purchase contracts comprising 34,180 acres were secured by the program (signed to purchase contract or closed). Of these, 293 projects totaling 19,259 acres have been acquired, with the remaining 193 projects totaling 14,921 acres remaining under purchase contract. During year 2001, 88 projects comprising 5,928 acres were closed and 119 projects accounting for 7,521 acres were signed to purchase contract. Among the significant accomplishments during 2001:

- A total of six projects comprising approximately 150 acres were signed to contract in Kensico 1A and 1B. Of the 1,038 acres eligible in the basin, the total number of acres acquired or under contract stands at 167 acres, or 16%.
- Of the 4,830 acres eligible in Rondout 1A, the total number of acres acquired or under contract was raised to 2,021 acres (42%).
- Of the 12,645 acres eligible in West Branch 1A and 1B, the total number of acres acquired or under contract was raised to 6,632 acres (56%).

8.2 Land Acquisition

During 2001 (roughly equivalent to Year 5 of the MOA), DEP met Year 5 goals for solicitation of owners of watershed lands set forth in the 1997 FAD and the MOA. Specifically, during December 2001, DEP completed solicitation of 55,265 acres of watershed lands. Thus during the first five years of the program, the City solicited owners in excess of 258,679 acres of land in the Catskill and Delaware systems.

During the past five years the City has secured roughly the same number of non-reservoir (above water) acres (34,180) as those owned by the City prior to program implementation (36,046). In the West Branch/Boyd's Corner basins, the City has secured more than ten times the number of acres above water than it owned prior to 1997, while these figures range variously from 30% to 400% in Ashokan, Rondout and Schoharie. The City now controls over 35% of all above-water lands in Kensico, 30% of such lands in West Branch/Boyd's, and 7% (on average) in each of the six west-of-Hudson basins.

8.2.1 Conservation Easement Program

During previous years, considerable staff resources were dedicated to refining the conservation easement program and related documents. This effort has resulted in tangible progress this year: three projects totaling 408 acres were acquired, representing the City's first ever acquisition of conservation easements, and a total of 13 additional easements representing 1,694 acres are signed to contract. As required by the MOA and FAD, the City will monitor easements at least twice annually.

8.2.2 Whole Farm Easement Program

Following appraisals on ten farms during 2000, all six verbal acceptances reported in last year's Annual Report were successfully converted into signed purchase contracts representing 2,279 acres in 2001. The first two of these farm easements, totaling 770 acres, were acquired during 2001. Negotiations have continued during the year on an additional ten farms, six of which were appraised during early 2002, with purchase offers to follow soon thereafter.

8.2.3 Croton Acquisition Programs

During 2001, the City entered into 3 purchase contracts to acquire 137 acres in the western part of Priority A New Croton Reservoir, including two conservation easements. The City closed on three parcels totaling 311 acres, including a 178-acre parcel on the south side of the reservoir, which alone satisfied the \$1.5 million Croton Land Acquisition Supplemental Environmental Project (SEP) embodied in the Croton Filtration Consent Decree. During this year we were notified that the DEC signed two projects totaling 339 acres. Efforts continue to transfer DEC's previously acquired 215-acre parcel to the City, after which a conservation easement will be granted back to DEC along with easements on other City-acquired fee simple projects.

8.2.4 Stewardship Programs

Forestry

During the reporting period, DEP continued to monitor forestry projects being implemented by landowners of certain properties that were under purchase contracts to New York City. These landowners are required to use DEP's *Water Quality Protection Guidelines for Forest Harvesting* for all such resource extractions. The guidelines address such activities as pre-harvest planning, road construction and maintenance, stream crossings, watercourse and wetland protection, soil stabilization of disturbed areas, and general pollution prevention. There was one harvest or planned harvest (on three parcels covering 524 acres of land under contract) that was overseen by DEP staff during the reporting period.

Recreational Use

Public access to City-owned watershed lands were suspended following the September 11, 2001 attacks. It is expected that recreational use will be re-opened in 2002 with a revised Public Access Permit system providing additional means of security and control. Planning continues for an enhanced recreational use registration system, which will require users to obtain permits and educational materials regarding pollution prevention before entering City-owned watershed lands.

During 2001, the third year of public access to newly acquired lands, a total of 7,023 acres were opened to hiking and fishing. No significant violations or water quality impacts were seen on newly acquired lands as a result of this public access program. Local consultation continued, with 121 information packages totaling 7,849 acres submitted to four sets of partners (31 separate towns, Sporting Advisory Committees (SACs), DEC and EPA). The WOH SAC held one meeting during 2001, while the EOH SAC held three meetings.

Transfer of Conservation Easements on Fee Acquisitions to NYS

During 2001, final agreement was reached on terms of the model easement, a transfer process (involving City disposition and State acquisition of real property interests) was outlined and agreed to, and the first easement transfer packages were prepared. Unfortunately those packages were destroyed in the events of September 11th, and new packages are now being prepared to effectuate the first transfers. Once the transfer process has been established as operational and efficient – both within and between the two agencies (DEP and DEC) – rafts of easements will be processed on a routine basis.

Monitoring and Cleanup

On occasion, DEP encounters opportunities to remedy existing pollution problems (in addition to preventing future pollution impacts by acquiring land). DEP continued to coordinate with landowners for the clean-up of debris on parcels under contract to be acquired. During the reporting period, 103 parcels totaling 8,636 acres were checked and cleared of over 400 instances of solid waste, or other debris. Debris removed ranged widely in size and scope, including two outhouses, an encroaching failed septic system, a 275-gallon oil tank in stream, an abandoned camp trailer, an abandoned school bus, a dump site with 20 cubic yards of appliances, several deteriorating barns and silos, one underground fuel storage tank, construction debris and metal drums, a cabin in poor condition, and a collapsed garage.

DEP land stewards made 1,642 inspection and monitoring visits to City-owned parcels during the reporting period. Progress was enhanced due to the above-normal temperatures in the spring and at the end of the year. A total of 85 debris sites were cleaned up, including non-hazardous material collection. Staff monitored 808 miles of boundary line and posted over 180 of those miles with boundary signs. Thirty-nine (39) woods road entrances were blocked, gated, or otherwise secured from illegal entry and dumping during the reporting period.

The total number of linear miles of perimeter around City-owned land has increased 60% in the past five years, from 1,272 to 2,040, and is expected to total over 3,000 miles by 2008.

9. Disease Surveillance

New York City's Waterborne Disease Risk Assessment Program (WDRAP) was developed and implemented to:

- obtain data on the rates of giardiasis and cryptosporidiosis, along with demographic and risk factor information on case patients;
- provide a system to track diarrheal illness to assure rapid detection of any outbreaks; and
- determine the contribution (if any) of tap water consumption to gastrointestinal disease.

Two City agencies are involved in this effort: the Department of Health (NYCDOH) and DEP. In addition to participation by staff from both agencies, an inter-agency unit, the Parasitic Disease Surveillance Unit, was established to implement major components of this program.

Below is a summary of program highlights and preliminary case numbers and case rates for giardiasis and cryptosporidiosis for the year 2001. More complete and finalized data will be provided in the WDRAP Annual Report, which will be issued in May 2002. In addition, quarterly reports containing additional data from 2001 were issued in April, July, and October 2001, and January 2002. Variations in data between this report and previous reports may be due to several factors, including disease reporting delays, correction of errors, and refinements in data processing – for example the removal of duplicate disease reports. In addition, case rates from prior years have been adjusted in this report to reflect 2000 U.S. Census data (utilizing intercensal estimates for years 1994-1999).

9.1 Active Disease Surveillance

9.1.1 Giardiasis

Active laboratory surveillance of giardiasis to insure complete reporting of cases by laboratories continued in 2001. Also, telephone calls continued to be made to physicians, laboratories, and/or patients to obtain missing basic demographic information from case reports. Case rates and basic demographic findings were compiled and reported on a quarterly basis.

The number of cases and the case rate presented here for 2001 are preliminary. During 2001, a total of 1,498 cases were reported to NYCDOH and the annual case rate was 18.7 per 100,000. Data for the year 2001, as of March 1, 2002, indicate that the number of cases and the case rate decreased relative to prior years since 1994 (see table below).

Table 9.1. Number of Cases and Case Rates* for Giardiasis, Active Disease Surveillance, New York City 1994 - 2001

<i>Year</i>	<i>Number of Cases</i>	<i>Case Rate per 100,000</i>
1994	2,513	33.1
1995	2,523	32.9
1996	2,287	29.6
1997	1,786	22.9
1998	1,960	24.9
1999	1,896	23.9
2000	1,770	22.1
2001	1,498**	18.7**

* For 1994-1999, rates were calculated using intercensal estimates. For 2000-2001, 2000 Census data were used.

** Preliminary data for 2001 (as of March 1, 2002).

9.1.2 Cryptosporidiosis

Active disease surveillance for cryptosporidiosis (including regular laboratory visits or telephone contact) and case interviews continued during 2001. Case rates and basic demographic findings continued to be compiled and reported on a quarterly basis. The number of cases and the case rate presented here for 2001 are preliminary. During 2001, a total of 125 cases were reported to NYCDOH and the annual case rate was 1.6 per 100,000. The number of cases and the case rate in 2001 decreased relative to prior years (see table below).

Table 9.2. Number of Cases and Case Rates* for Cryptosporidiosis, Active Disease Surveillance, New York City 1994 – 2001.

<i>Year</i>	<i>Number of Cases</i>	<i>Case Rate per 100,000</i>
1994	297**	3.9**
1995	472	6.2
1996	335	4.3
1997	172	2.2
1998	208	2.6
1999	261	3.3
2000	172	2.1
2001	125***	1.6***

* For 1994-1999, rates were calculated using intercensal estimates. For 2000-2001, 2000 Census data were used.

** Active disease surveillance began in November 1994.

*** Preliminary data for 2001 (as of March 1, 2002).

Again, more complete and final data will be presented in the WDRAP Annual Program Report. This will include demographic data for giardiasis and cryptosporidiosis, and potential risk exposure data for cryptosporidiosis.

9.2 Diarrheal Disease Monitoring (Outbreak Detection Program)

Over the past several years, the City has established and maintained three independent and complementary systems to monitor for outbreaks using sentinel populations or surrogate indicators. Operation of all three systems continued in 2001, with some enhancement of the anti-diarrheal medication tracking program. Also in 2001, a new surveillance system was added utilizing hospital Emergency Department illness reports. In addition, an evaluation of the outbreak detection program has been completed and a report is in progress. This evaluation is being conducted under contract with the New York Academy of Medicine.

9.2.1 Anti-Diarrheal Medication Monitoring

The monitoring of sales of anti-diarrheal medication (ADM) can be a useful source of information about the level of diarrheal illness in the community. In New York City's program, volume-of-sales information of non-prescription ADMs, is obtained on a weekly basis from a major drug store chain. A second program which utilized data from a regional distributor for independent pharmacies was discontinued due to insufficient data, as explained in last year's annual report. In 2001, efforts were made to add additional pharmacy chain(s) to the city's suite of surveillance programs for outbreak detection. The latest effort was undertaken as part of a broader syndromic surveillance initiative, under the city's bioterrorism preparedness work. An agreement has been reached with an additional chain, and data on prescription medications has started coming in. Establishment of a data management system for this new data set is underway.

9.2.2 Clinical Laboratory Monitoring

The number of stool specimens submitted to clinical laboratories for bacterial and parasitic testing also provides information on the incidence of gastrointestinal illness in the population. Participation of three clinical laboratories (including the largest laboratory in the metropolitan area) continued during 2001. Daily data is transmitted by fax (by two labs) and by telephone report (by one lab) to NYC's Parasitic Disease Surveillance Unit on the number of stool specimens examined for: 1) bacterial culture and sensitivity, 2) ova and parasites, and 3) *Cryptosporidium parvum*. (In 2001, all three labs provided *Cryptosporidium* data, in addition to C&S and O&P data)

9.2.3 Nursing Home Monitoring

Nursing home surveillance continued during 2001. The nine currently-participating nursing homes are representative of:

- four of five City boroughs (a Staten Island home declined continued participation in April 2000);

- different resident populations (HIV/AIDs, non-AIDs, and mixed);
- different sources of city water supply (the Croton, Catskill/Delaware, and groundwater systems)

Each nursing home provides, by fax, the daily number of new cases of gastrointestinal disease among residents on each ward.

9.2.4 Hospital Emergency Department Monitoring

During 2001, as a result of the events of September 11th, a new system of syndromic surveillance involving hospital emergency departments was implemented. The program was originally established and run by NYC (DOH and DEP) and federal (CDC) staff; however since October, the program has been manned entirely by NYCDOH/DEP representatives and hospital staff. Each morning, 7 days/week, 32 hospitals throughout NYC electronically transmit to the NYCDOH the chief complaint of all patients seen in their emergency department in the previous 24 hours. While chief complaints of different types are reported, of most relevance to WDRAP are reports of diarrhea and vomiting. The data is analyzed for spatial and temporal clusters on a daily basis to determine whether an unusual rate of illness is reported, which could indicate a possible GI outbreak.

9.3 Additional Data Gathering Efforts

9.3.1 New York City DOH Public Health Laboratories – Stool Testing

Active disease surveillance is an effective tool for capturing all laboratory-diagnosed cases of a disease. However, it is believed that cryptosporidiosis is significantly under-diagnosed. As part of our efforts to better assess cryptosporidiosis incidence in the general population, NYCDOH has been conducting stool tests for *Cryptosporidium* on specimens submitted by Child Health Clinics and the School Health Program. The *Cryptosporidium* analysis is conducted by the Health Department's Public Health Laboratories (PHLs). This program continued during 2001. However, due to a change in the organization of Child Health Clinics, most of the stool specimens no longer go the PHLs. Therefore the number of specimens available for testing has been significantly reduced. Note that while the clinics' population is not representative of the overall New York City population, results provide some indication of the prevalence of *Cryptosporidium* in this age group. Data will be included in the WDRAP Annual Report.

9.4 Information Sharing and Education

Information continues to be available on both the DEP and NYCDOH websites, including results from the City's source water protozoa monitoring program.

10. Other Programs

10.1 Staff Enhancements & Training

The staffing level for all Filtration Avoidance programs was adequately maintained during 2001, through aggressive recruitment efforts. DEP will continue efforts to ensure effective coordination and staffing levels to meet the many Filtration Avoidance deadlines.

Throughout the year, DEP continued to provide training for staff to ensure that the level of professional expertise in the watershed remains high. A training summary for 2001 is Appendix A to this document.

Appendix

Annual Report On Staff Training For Period: January 1 Through December 31, 2001

Note: Note: In addition to the specialized professional training and conferences detailed below, DEP staff attended numerous sessions on computer programs and techniques; management and supervisory skills; City procurement and contracting policies and procedures; and basic work-place safety.

Drinking Water Quality Control

- March 4-10, 2001 – The Director of the Ben Nesin Lab attended the “Pittcon” conference in New Orleans, LA. “Pittcon” is a yearly conference that presents the latest advances in analytical methodologies and instrumentation. It is the largest conference of this type in the United States.
- April 2-8, 2001 – One Biologist attended the “Arctic Goose” conference in Quebec, Canada. The conference provided a forum for discussion of current research in Canadian Geese, one of the primary species negatively impacting water quality throughout the upstate reservoirs.
- April 5-6, 2001 – A Research Assistant attended a three-day “International Conference on West Nile Virus” in White Plains, NY, sponsored by the New York (NY) Academy of Sciences. The conference reviewed issues associated with the emergence of West Nile Virus in the NY metropolitan area, and addressed detection, control, treatment, management and other issues.
- April 8-11, 2001 – The Project Manager of Capital Programs attended the American Water Works Association (AWWA) “Information Management and Technology” conference in Atlanta, GA. The conference is of particular importance to New York City because a large number of information management programs and projects are currently being developed which relate to the City’s drinking water quality control system. Some topics included: Utilizing Low Cost; Web Based Technologies for Improved Reporting; Developing Water Utility Information Management Systems; and Infrastructure Protection and Computer Network Strategy.
- April 24, 2001 – Eight staff members attended a one-day, in-house “Hazardous Materials Certification for DOT 49CFR” training session at the Kingston office, given by the Environmental Resource Center. The purpose of this one-day training class was to supply staff with the knowledge and skills necessary to provide a safe and healthy work environment.
- April 30-May 2, 2001 – The Supervisor of DWQC’s Modeling Unit attended the American Water Resources Association (AWRA) “Water Quality Monitoring and Modeling” conference in San Antonio, TX. Technical sessions focused on: Current & Anticipated Monitoring/Modeling Needs; Sources of Water Quality Related Information & Tools for Synthesis; The Relationship Between Current Data Collection Efforts & Anticipated Water Quality Modeling; and Presentations of State-of-the-Art Monitoring/Modeling Approaches.
- April 30-May 3, 2001 – The Section Chief for DWQC’s Field Operations attended the “Cary Conference: Understanding the Ecosystem” in Millbrook, NY. This biennial conference has become an important forum for discussion of issues in ecology and ecosystem science. Topics discussed are directly related to DEP on-going programs.
- May 14-18, 2001 – Thirteen staff members from various units attended a forty-hour in-house,

“Hazwoper” training session at DEP’s Croton Lake Gate House. The purpose of the training is to supply employees with the knowledge and skills necessary to recognize and understand the dangers of responding to or cleaning up hazardous substances and how to protect themselves while putting an emergency response plan into action.

- June 4-8, 2001 – A Supervisor from DWQC attended a week long “Water Quality Modeling Workshop” at Manhattan College in Riverdale, NY. The training focused upon the fundamental concepts of water and sediment quality modeling and provided attendees with hands-on experience running state-of-the-art models for calculating Total Maximum Daily Loads (TMDL).
- June 12-13, 2001 – A Scientist Water Ecologist attended a two-day “Environmental Stewardship of Utility Rights-of-Way” conference in Albany, NY. The conference focused upon educating and informing attendees of what the utility industry, state regulatory agencies and university researchers have been doing to better maintain electric transmission line rights-of-way through the development and implementation of Integrated Pest Management Techniques.
- June 14-16, 2001 – The Research and Analysis Section Chief attended the “International Congress on Ultraviolet Technologies” in Washington, DC. The symposium included presentations on ultraviolet (UV) disinfection, design and full-scale experiences for UV disinfection, as well as the regulatory approval process forum for UV systems.
- June 17-21, 2001 – The Chief of Drinking Water Quality Planning, and the Chief of Research and Analysis, attended the “AWWA Annual Conference” in Washington, DC. The conference agenda addressed some of the most pressing issues in drinking water, including disinfection by-product and surface water treatment rules, groundwater and alternative disinfection techniques, new treatment technologies, pathogens, and surface source water issues which are all vital to DEP’s ongoing efforts.
- June 23-27, 2001 – A Research Assistant attended the “North American Forest Ecology Workshop” in Duluth, MN. Several topics relevant to forest management as it relates to water quality protection were addressed. The ability to develop relationships with scientist from other organizations expands the Department’s ability to stay abreast of current research regarding forest ecosystems as they relate to water quality.
- June 26-27, 2001 – Four staff members attended a two-day, in-house, “Environmental Regulations Course” at DEP’s Sutton Park location, which was given by the Environmental Resource Center. Topics included: Training And Record Keeping; Activities That Require Permits; Procedures For Attaining And Maintaining Compliance; and How To Determine Which Laws Apply To Your Facility.
- June 26-July 1, 2001 – The Deputy Chief of DWQC and a Research Scientist attended the “Decision Support Systems for Water Resources Management” conference in Snowbird, UT, sponsored by AWRA. Several plenary sessions were directly related to DEP’s ongoing activities for the Croton Watershed Management Strategy Contract. Several assessment tools used nationally and internationally to identify and assess watershed management options were addressed as well.
- July 7-13, 2001 – A Geographic Information Systems (GIS) Coordinator attended the “Environmental Systems Research Institute (ESRI) Users Conference” in San Diego, CA. ESRI produces DEP’s primary GIS software. The conference is an annual event, which highlights the most recent advancements in ARCINFO and ARCVIEW software development and is attended by many GIS staff in national, state and local governments. Various sessions

included applications, problem-solving techniques, technical info, plus many other topics related to DEP's role and policy in disseminating and using GIS data.

- August 5-7, 2001 – The Quality Assurance/Quality Control Officer and his Assistant attended the “NY Association of Approved Environmental Labs Annual Convention” in Wilkes-Barre, PA. The convention focused upon: Field Sampling Issues, Data Integrity, Samples, and Laboratory Ethics.
- August 27-30, 2001 – An Assistant Hydrologist attended “Monitoring & Modeling Nonpoint Source Pollution in Agricultural Landscapes” workshop in Indianapolis, IN. The workshop will bring together land managers and water quality specialists to share information on the effectiveness of Best Management Practices (BMPs) in improving water quality, effective monitoring techniques and statistical analyses of watershed data.
- August 27-29, 2001 – The Supervisor of the Water Quality Impact Assessment Group attended “SAS Applying Data Mining Techniques” training in New York City. Data mining explores techniques to define large data sets for patterns and clusters, and to develop productive models.
- October 29-30, 2001 – A Geographic Information Systems (GIS) Specialist and a Supervisor attended the “NYS GIS Conference” in Albany, NY. Since the Bureau actively utilizes GIS technologies to support projects requiring the creation, storage, manipulation and visualization of spatially referenced watershed data, it is necessary to be kept up-to-date on the latest advances and technologies in the field.
- November 11-13, 2001 – A Research Scientist attended the Annual Conference of the Society of Environmental Toxicology and Chemistry, entitled “Early Warning Monitoring Systems & Biomonitoring” in Baltimore, MD. Several sessions focused upon drinking water, which is extremely relevant to the City's response to terrorist attacks. Several public and private agencies including water suppliers presented their evaluations of Early Warning Monitoring Systems currently in use.
- November 11-16, 2001 – A District Hydrologist attended the “AWRA Annual Conference” in Albuquerque, NM, and presented an abstract entitled: *Storm Load Reductions for an Extended Detention Basin*. Among other topics, the conference brought together water quality specialists nationwide to share information on the effectiveness of BMPs in improving water quality, effective monitoring techniques and statistical analysis of watershed data.
- December 1-6, 2001 – The Acting Chief of DWQC attended the “Risk Analysis in an Interconnected World” symposium in Seattle, WA. Several sessions focused upon microbial risk assessment, a critical issue for DEP's filtration avoidance effort and most recently an important new development given City-wide concerns about Anthrax.
- December 3-4/01 – One Research Scientist attended the “Water Security Summit” sponsored by AWWA and the U.S. Environmental Protection Agency in Hartford, CT. Several sessions focused upon: early warning monitoring systems; biological/chemical agents of concern; and threats to a water supply system. This information is vital in order to identify possible terrorist attacks to the water supply.

Management Information Systems

- April 17-23, 2001 – A Senior Advisor and the Bureau MIS Director attended the “Public Technology: Transforming Government Through Technology” conference in Atlanta, GA. The annual conference provided a forum for professionals to share research and experiences in government applications of new technology.

Operations and Engineering

- January 22-26, 2001 – Fifteen staff members from the Protection Unit attended training to the level of “Hazardous Materials Technician” and thirteen were trained to the level of “Hazardous Materials Specialists”. The training was given at DEP’s Kingston location by Miller Environmental Group and complies with all current Occupational Safety and Health Standards (OSHA) guidelines for emergency response personnel.
- January 30-31, 2001 – Seventeen staff members involved with inspections, enforcement, laws and regulations attended an in-house, “OSHA Compliance” training session at DEP’s Sutton Park location, given by The Environmental Resource Center
- February 21, 2001 – Eighteen staff members from various districts attended a one-day, “Disinfection” training class offered by DEC at Ulster County Community College in Stone Ridge, NY. Training is vital for Wastewater Treatment Plant Inspectors who are required to have an understanding of disinfection when inspecting plants.
- February 27-28, 2001 – One Associate City Planner and one Project Manager from the WOH District attended a two-day “Computer Models for Stormwater Evaluation” training session at Syracuse University in Syracuse, NY. This training session and the skills and expertise gained is critical to the proper assessment and design of stormwater management projects within the watershed.
- March 2, 2001 – Seven certified Wastewater Treatment Plant Operators from the Delaware District, eight Operators from the Catskill District, and two staff members from the Engineering Division, attended a one-day, “RBC Trickling Filter Workshop” sponsored by DEC at the Ulster County Community College in Stone Ridge, NY. The workshop covered topics pertinent to the daily operations of wastewater treatment plants.
- March 11-14, 2001 – An Associate City Planner attended the “National Symposium on Individual and Small Community Sewage System” in Fort Worth, TX. On-site wastewater treatment and dispersal technology has made tremendous strides in recent years.
- March 19-20, 2001 – An Associate Project Manager from the WOH Engineering Division attended the “Design and Selection of Stormwater Quality Management Practices” training at Syracuse University. The skills and expertise that will result from this training session is critical to the proper assessment and design of stormwater management projects within the watershed.
- March 20, 2001 – Fifteen staff members from the Delaware District attended a one-day, in-house, “Jerome Mercury Vapor Analyzer” training class at the Grahamsville District Office, given by Arizona Instruments, Inc. The purpose of this training is to give the staff the knowledge and skills necessary to properly operate, calibrate and maintain the Jerome Mercury Vapor Analyzer equipment on site.
- March 20-21, 2001 – Two Supervisors from the EOH District attended a two-day, “Wet Weather Operations” training class at SUNY, Morrisville. Training was designed to assist plant operators in developing strategies for use at wastewater treatment plants when dealing with wet weather conditions.

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- April 2-3, 2001 – Two Project Managers from the Engineering Division attended a two-day “Rural Wastewater Solutions” conference in Oneonta, NY, sponsored by the NY On-Site Wastewater Association and included presentations by experts from across the country on technology and management of on-site and small community wastewater treatment systems.
 - April 3-4, 2001 – Nineteen staff members from various districts attended a two-day, in-house, “Environmental Regulations” training course given by The Environmental Resource Center at DEP’s Sutton Park location. The course focused upon the role of employees in training and record keeping, activities that require permits, procedures for attaining and maintaining compliance and how to determine which environmental and safety laws apply to them.
 - April 5-6, 2001 – The Deputy Director and three Supervisors from Ops & Eng attended the “3rd Annual Conference on Watershed Protection” in Kingston, NY. The conference focused upon strategies involved with the WOH watershed. Topics included: Objectives of Watershed Protection; Watershed Planning and Management; Stormwater Management; Wastewater Treatment Plant Upgrades; and A Tour of Water Treatment Plants.
 - April 9-10, 2001 – A Project Manager working in EOH Engineering Design Review, the group attended a two-day, “Planning Your Site for Erosion & Sediment Control” training session at Syracuse University’s Lubin House in NYC. The information presented is specific to the review of stormwater pollution prevention plans and includes the most up-to-date information on the design and implementation of practices used.
 - April 24, 2001 – Ten staff members from various districts attended a one-day, in-house, “Hazardous Materials Certification for DOT 49CRF” training session at the Kingston location, given by The Environmental Resource Center.
 - April 24-27, 2001 – The Catskill District Engineer and a Civil Engineer attended the three-day NY Section, AWWA conference, “Making a World of Difference” in Kerhonkson, NY. Technology in the water industry, safety issues and watershed activities were focused upon, and attendees were given a chance to interact with their peers from other governmental agencies and the private sector as well.
 - April 25, 2001 – Forty staff members from various districts attended another one-day, in-house, “Hazardous Materials Certification for DOT 49CFR” training session at DEP’s Croton Lake Gate House, given by The Environmental Resource Center.
 - May 14-18, 2001 – Seven staff members from various districts attended a forty hour, in-house, “Hazwoper” training session at DEP’s Croton Lake Gate House.
 - May 22, 2001 – Four Chief Operators from Margaretville, Grahamsville, Downsville and Mahopac, attended a one-day “Using ORP for Process Control” training class in New Haven, CT, sponsored by the New England Interstate Water Pollution Control Commission. The training covered applications for oxidation reduction potential (ORP) in process control.
 - May 29-30, 2001 – Two Associate Project Managers from the Engineering Design Review Group, attended the “Design and Selection of Stormwater Quality Management Practices” sponsored by NYSDEC at Syracuse University’s Lubin House, in NYC. The information presented in this class is specific to the review of stormwater pollution plans and both attendees will be able to share this information with others in their group.
 - June 12-14, 2001 – A Civil Engineer attended “Land Development Desktop Fundamentals” training in Liverpool, NY. As part of the Project Management Group in Ops & Eng, it is vital to be trained with the AutoCAD, the engineering design software used to prepare the designs for stormwater management facilities in the Kensico Reservoir Watershed.
 - June 13-14, 2001 – Two Associate Project Managers attended the “Southeast NY Stormwa-

ter” conference in Fishkill, NY. Topics addressed: Phase II of the Stormwater Regulations; Enforcement of Local Regs; Stormwater Quality and Quantity; Watershed Approach to Stormwater Management; and Stormwater Design.

- June 26-27, 2001 – Ten staff members attended a two-day, in-house, “Environmental Regulations” course at DEP’s Sutton Park location, given by The Environmental Resource Center. Topics included: Training And Record Keeping; Activities That Require Permits; Procedures For Attaining And Maintaining Compliance; and How To Determine Which Laws Apply To Your Facility.
- July 8-13, 2001 – A Watershed Maintainer and Stationery Engineer Electric, from the Delaware District, attended a five-day, “Basic Supervision” training course at SUNY, Morrisville. DEC requires that a person in responsible charge of a wastewater treatment plant, whether having overall or delegated responsibility during a shift, be certified at the appropriate level for the plant. Successful completion of the course is a prerequisite for a Grade 3 Operator.
- July 16-20, 2001 – Twenty staff members from various divisions within Ops & Eng attended an in-house, forty-hour, “Hazwoper Training” session at the Croton Lake Gate House, given by the Environmental Resource Center.
- July 18-20, 2001 – Three Project Managers from the Engineering Design Review Group, East and West of Hudson, attended a three-day “Freshwater Wetland Construction training course at the State College of PA. All attendees are involved in administering DEP’s Watershed Regulations (*Stormwater Impervious Surfaces*) through stormwater permitting of new residential, commercial and industrial land development projects.
- July 24, 2001 – Ten certified Wastewater Treatment Plant Operators and Regulatory Staff from the Catskill, Delaware, and East of Hudson districts, attended a one-day, “Anaerobic Digestion & Gravity Thickeners” course at SUNY, Delhi. Training covered topics pertinent to the daily operations of wastewater treatment plants and focused upon: Anaerobic Digestion, Biochemistry; Factors Affecting Digestion; Troubleshooting, Gravity Thickening, and Case Studies.
- July 31, 2001 – Fifteen staff members from various districts attended an in-house, “Jerome Mercury Vapor Analyzer” training session at the Grahamsville district office, given by Arizona Instruments Inc.
- August 6-7, 2001 – A Supervisor and a Watershed Maintainer from the EOH district attended a two-day, “OSHA Comprehensive Essentials of Safety” training in East Elmhurst, NY. The purpose of this training is to give employees the knowledge and skills to properly interpret OSHA standards. It is important that staff be fully aware of OSHA standards and accurately comprehend the Federal Code of Regulations.
- August 6-10, 2001 – A Civil Engineer Intern from the Delaware district attended “Basic Laboratory” training at SUNY, Morrisville. The course is required for all persons intending to become certified as a wastewater treatment plant operator in New York State. Topics included: Laboratory Safety; Basic Chemistry; pH Meter; Alkalinity; Chlorine; Dissolved Oxygen; and BOD and Solids Determinators. The course meets DEC certification requirements.
- September 10-21, 2001 – Two Watershed Maintainers from the Grahamsville and East of Hudson districts attended “Basic Operations” training at SUNY, Morrisville. This two-week course was designed to meet prerequisite requirements for NYS certification. It addresses all aspects of treatment processes as well as basic concepts of maintenance operation of the associated plant equipment.

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- September 23-25, 2001 – Two Project Managers from the Engineering Section attended the “Stream and Flood Plain Restoration” workshop in Albany, NY. The workshop emphasized stream restoration as a strategy to meet traditional concerns of professionals who address floods, water quality, and erosion concerns associated with streams and floodplains.
 - September 23-28, 2001 – Two Supervisors and four Watershed Maintainers from the Grahamsville, EOH, and WOH districts, attended a week long “Troubleshooting O&M Problems at Fixed Film WWTP’s” in Windham, NY. The course was sponsored by DEC and will assist personnel who are responsible for reviewing and approving the treatment methods and technologies for wastewater treatment.
 - October 1-5, 2001 – Seventeen employees from the Delaware and Catskill district attended a forty hour “Hazardous Waste Training” course given by the Environmental Resource Center, at DEP’s Grahamsville shop.
 - October 15, 2001 – Ten staff members from the East and West of Hudson Engineering Design Review Group, the Regulatory Compliance, and the Project Review Group, attended a one-day “Nonpoint Source Technology Transfer” workshop in West Point, NY. The workshop provided staff the opportunity to learn successful nonpoint source pollution assessment techniques, controls and management strategies, and the role these strategies play in watershed protection.
 - October 18, 2001 – An Associate Project Manager from the Regulatory Compliance Group attended a one-day “Activated Sludge Wastewater Biology” course at Penn State University’s Hartford, CT location. Several critical areas of the activated sludge treatment process were focused upon such as: floc formation; nutrients, phosphorus, and nitrogen; heavy metals, nitrification and denitrification; and bioaugmentation. This training is necessary for staff involved with inspecting and enforcing regulations at the wastewater treatment facilities.
 - October 22-24, 2001 – A Supervisor Watershed Maintainer, attended the “Grade 4 Management” reformatted Advanced Operations course, at SUNY, Morrisville. This training offers required contact hours needed to renew an operator's certificate.
 - November 13-14, 2001 – Three staff members from the Engineering Section, Catskill and Delaware Districts, attended the “Train the Trainer for Environmental Professionals” in Kingston, NY. Staff members are often asked to assist in developing presentations for workshops, and this training will better prepare them for these presentations. The course meets the training requirement to become a DEC approved trainer.
 - December 11, 2001 – Eleven staff members from the Delaware District attended an in-house “Jerome Mercury Vapor Analyzer Training” at the Grahamsville location.
 - December 7,10,19, 2001 – Fifty four staff members from the Protection Units, attended a one-hour “Zebra Mussel Training” session at DEP’s Kingston and Sutton Park location. Staff was briefed on the history, migration, North American infestation, impacts on ecosystems and utilities, identification, sampling programs, and prevention of zebra mussels.

Systems Operations

- January 1-31, 2001 - Three Watershed Maintainers completed their training to obtain their IIB Water Treatment Licenses.
- January 1-31, 2001 – All Watershed Maintainers have completed their “Quarterly Training” sessions. Training includes review of self-contained breathing apparatus, Solvay Kits, respirators and each facility’s “Emergency Response Plan.”

- February 19, 2001 – All Systems Operations personnel attended a briefing with local Emergency Response Agencies in order to plan for a “Simulated Evacuation Exercise” to be conducted.
- March 19, 2001 – All Systems Operations personnel attended another briefing with local Emergency Response Agencies in order to continue planning the “Simulated Evacuation” which will be conducted.
- April 1-30, 2001 – One Supervisor received training on the newly purchased computerized respirator fit-testing equipment.
- April 3-4, 2001 – One Supervisor attended a two-day, in-house, “Environmental Regulations” training course given by The Environmental Resource Center at DEP’s Sutton Park location.
- April 22, 2001 – Conducted a “Simulated Chlorine Evacuation” exercise with local Emergency Response Agencies at Shaft 18.
- April 25, 2001 – All Supervisors and Watershed Maintainers assigned to Systems Operations attended a “DOT Hazardous Materials” training class at DEP’s Croton Lake Gate House, given by The Environmental Resource Center.
- May 9, 2001 – All Supervisors assigned to Systems Operations attended a one-day, in-house, “Hazmat Specialist Refresher” training class given by “McIlvain Protection International, at DEP’s Croton Lake Gate House. This required OSHA training is for hazardous material response employees who respond to or witness an emergency, and is based on “levels”. Specialists are responders who must have sufficient experience to demonstrate competency in an emergency situation.
- June 26-27, 2001 – An Assistant Civil Engineer attended a two-day, in-house, “Environmental Regulations” course at DEP’s Sutton Park location, given by The Environmental Resource Center.
- July 1-31, 2001 – All Watershed Maintainers received their required Quarterly Training, which included: utilization of self-contained breathing apparatus and respirators, an overview of each facility’s Emergency Response Procedures and each employee was tested for proper respirator fit.
- July 16-20, 2001 – Four Watershed Maintainers attended an in-house, forty-hour “Hazwoper Training” session at the Croton Lake Gate House, given by the Environmental Resource Center.
- July 31, 2001 – Two Supervisors attended an in-house, “Jerome Mercury Vapor Analyzer” training session at the Grahamsville district office, given by Arizona Instruments Inc.
- August 1-31, 2001 – One new Watershed Maintainer started on his IIB Water Treatment Licensing Course. Training will continue over a period of time.
- August 6-7, 2001 – One Supervisor attended a two-day “OSHA Comprehensive Essentials of Safety” training in East Elmhurst, NY.
- September 1-30, 2001 – One new Watershed Maintainer received his required Risk Management Training.

DEP Police

- January 15-May 18, 2001 – Nine Officers from the DEP Police attended a training course entitled “Basic Police Recruit Training” at the Westchester Police Academy in Valhalla, NY. The course is designed for newly appointed Police Officers. New York State General Municipal and Executive Laws mandates that all Police Officers, within one year of appointment attend an approved basic course.
- January 22-June 27, 2001 – Four Officers attended “Basic Recruit Training” at the Zone 5 Regional Law Enforcement Training Center in Troy, NY.
- January 24-25, 2001 – One Detective and two Police Officers attended a two-day, “Train the Trainer” at the Westchester Police Academy. This training course certified them to teach the use of pepper spray to other Police Officers.
- February 5-June 22, 2001 – One Officer attended “Basic Recruit School” at the Rockland County Police Academy.
- March 5-23, 2001 – One Sergeant attended “Police Supervisory Training” at the Kingston Police Academy. Training is mandated within one year of appointment.
- March 19-23, 2001 – Four Detectives attended “HIDA Analytical Investigative Techniques” at the Rockland County Academy. The course focused on analytical investigative techniques used to solve crimes.
- March 19-30, 2001 – Two Detectives attended “Evidence Technician School” at the Zone 5 Regional Law Enforcement Academy in Troy, NY. Proper methods used to collect evidence at the crime scene and the preparation of information needed for admission to court was reviewed in length.
- March 26-30, 2001 – Two Detectives and five Officers attended the “Field Training” course at the Kingston Police Academy. All officers must attend a field-training program upon completion of a Basic Recruit Course. Training ensures that the Officers are ready to work on their own, and in the case of more experienced Officers, they are trained to administer this course to new recruit Officers.
- April 4, 2001 – Eight Police Officers attended an in-house “OC” training class given by DEP Police Officers. All were briefed on the proper handling and use of pepper spray.
- April 10, 2001 – One Detective and ten Police Officers attended another in-house, “OC” training class given by DEP Police.
- April 23-27, 2001 – One Lieutenant from the DEP Police attended a “Technical Surveillance Operations” training class sponsored by the Putnam County Sheriff’s office. Scheduled training topics addressed were: Basic Electronics and Equipment Maintenance; Operational Techniques; and Laws Related to Surveillance Operations.
- April 30-May 11, 2001 – Two Detectives attended a “Crime Scene Evidence Specialist” course at the Poughkeepsie Police Department. The Detectives were trained on the proper way to collect evidence, preserve crime scenes, and how to prepare all the information for submission to the courts.
- May 7-11, 2001 – Two Police Officers attended a “Juvenile Officers Course” given by the NYS Juveniles Officers Association. All were properly trained on the many NYS regulations specifically geared to juveniles who have committed crimes.
- May 21-23, 2001 – Two clerical associates attended a three-day, “Law Enforcement Dispatch” course at the Carmel Police Department. Basic dispatcher skills were focused upon.
- May 31-June 3, 2001 – One Officer from the DEP Police attended the “Critical Incident Stress

- Management for Law Enforcement” training in Albany, NY.
- June 4-15, 2001 – Two Detectives from the DEP Police attended a two-week “Firearms Instructor” training course in Troy, NY. Upon completion of the training, both detectives will be certified by NYS to provide firearms training to other officers.
- June 4-15, 2001 – One Sergeant attended an “Instructor Development” course at the Kingston Police Department. Completion of this training will certify him to instruct other Police Officers.
- June 18-29, 2001 – Four Police Officers attended another “Instructor Development” course in Dutchess County. After completion, they also will be certified to instruct other Officers.
- July 9-12, 2001 – One Officer attended a “Breath Test Operators” course at the Zone 5 Law Enforcement Academy in Troy, NY. Upon completion the Officer will be certified to operate breath test equipment on persons arrested for driving while intoxicated.
- July 16-19, 2001 – Four Police Officers attended a “Radar” class at the Zone 5 Law Enforcement Academy in Troy, NY. Upon completion the Officers will be certified in the use of Radar Equipment, in accordance with NYS law, to detect persons speeding.
- July 30-November 30, 2001 – Three DEP Police Officers attended “Basic Recruit” training in Kingston, NY. Training is mandated within one year of appointment.
- August 8-15, 2001 – One Police Officer attended an “AED Instructor” course at the American Red Cross. Upon completion the Officer will be able to teach other Officers the proper use of automatic defibrillators.
- August 13-December 14, 2001 – Two Police Officers attended “Basic Recruit” training at the Westchester Police Academy. Training is mandated within one year of appointment.
- August 16-17, 2001 – The Assistant Chief of the DEP Police, Two Lieutenants and one Sergeant attended an “Investigation & Surveillance Technology for Administrators” course. This two-day course was geared towards supervisors on the various types of technology available for use in investigations and surveillance.
- August 20-24, 2001 – Four Detectives and one Sergeant attended a “Basic Investigation & Surveillance Technology” training course. All were instructed in the proper use of the various types of technology available for use in cases, which involve investigations and surveillance.

Regulatory Compliance

- June 26-27, 2001 – Two staff members from the newly formed Division of Regulatory Compliance attended a two-day, in-house, “Environmental Regulations” training course at DEP’s Sutton Park location, given by The Environmental Resource Center.

Water Systems Planning

- November 12, 2001 – The Chief of the Project Management Section and the Chief of the Construction Management Section attended a one-day “Electrical Control Circuits” training in White Plains, NY. Some topics included: Diagrams; OSHA Safety Rules; Troubleshooting; Symbols; and Overload Protection.

Watershed Lands And Community Planning

- April 10-12, 2001 – A City Planner with the Stream Management Program attended the

“Annual NYS Wetlands Forum” in Albany, NY. The forum provided timely and accurate information about wetlands policy and programs in NYS and was attended by program managers and officials from various state and federal agencies.

- May 4-6, 2001 – An Associate Project Manager with the EOH Community Planning section attended the “NYS Lake Association Conference: Partnerships in Lake Management” in Hamilton, NY. Key issues of concern to Upstate Lake Associations were focused upon and the information acquired will assist in creating an outreach program to encourage Lake Management techniques.
- June 23-27, 2001 – A Manager with the Stewardship Program attended the “North American Forest Ecology Workshop” in Duluth, MN. The workshop focused upon many topics relevant to forestry, ecology and management regarding the linkages between the process of managing both large and small-scale forestry projects.
- June 27-30, 2001 – The Director of WL&CP attended the “National Watershed Forum” conference in Arlington, VA. The conference focused upon shaping policies and motivating actions to sustain watersheds into the next century. Senior decision-makers from government and the private sector were present to develop strategies.
- July 7-13, 2001 – The GIS Coordinator from WL&CP, attended the “ESRI Users Conference” in San Diego, CA. ESRI produces DEP’s primary GIS software. The conference is an annual event, which highlights the most recent advancements in ARCINFO and ARCVIEW software development, and is attended by many GIS staff in national, state and local governments. Various sessions included applications, problem solving, techniques, technical info, plus many other topics related to DEP’s role and policy in disseminating and using GIS data.
- August 27-31, 2001 – Three Foresters with the Land Acquisition and Stewardship Program attended “Silvicultural” training in Warren, PA. Training covered the development of mixed-hardwood stands, intermediate culture, harvest regeneration in the context of underlying ecology, and forest biology which provides the scientific basis for a series of practical guidelines that offer systematic and measurable means for making decisions about forest stands. Training will enable staff to eliminate paperwork and begin using the field data computers and Silva Software, which was recently purchased.

