New York City
Department of Environmental Protection

Filtration Avoidance Annual Report
For the period January 1 through December 31, 2004

March 2005

Prepared in accordance with the November 2002 EPA Filtration Avoidance Determination

Michael A. Principe, Ph.D.
Deputy Commissioner
Bureau of Water Supply

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1. Introduction

For New York City, 2004 marked another year of extraordinary progress in its efforts to protect and improve the quality of the Catskill/Delaware water supply through the implementation of its aggressive watershed protection program. The City, primarily through its Department of Environmental Protection (DEP), the agency responsible for the management and operation of the Water Supply System; and its partner agencies and organizations continued to work together to advance the wide range of programs that address both current and potential sources of pollution in the Catskill/Delaware watershed.

Launched 13 years ago, the City's multi-faceted watershed protection program is based on exhaustive research by DEP scientists into existing and prospective sources of water contamination. 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 33,000 samples from 300 sites and performs more than 400,000 laboratory analyses. Based upon the information collected through its monitoring and research efforts, DEP crafted a comprehensive watershed protection strategy, which focuses on implementing both protective (antidegradation) and remedial (specific actions taken to reduce pollution generated 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; farms located throughout the watershed; and stormwater runoff from development. DEP's protection strategy targets these primary pollution sources as well as a number of secondary ones.

In 2004, New York City continued to make especially significant advances in these 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.

1.1 Land Acquisition

In 2004, DEP completed the solicitation of watershed lands specified in the the 2002 Filtration Avoidance Determination (FAD) and the Watershed Memorandum of Agreement (MOA). DEP also continued an aggressive campaign to resolicit owners in key priority areas who had previously not responded or had declined to sell land to the City. DEP anticipates that resolicitation will continue to be a key element of the Land Acquisition Program in the future. By the end of 2004, DEP and its partners had protected more than 60,000 acres of land either through fee acquisition or conservation easement. Easements and agricultural easement have become an increasingly important tool to the program and a significant portion of the land protected in 2004 was protected via easement. Key parcels continue to be protected in top priority areas.

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 1,925 failing septics in the Catskill/Delaware watershed since 1997. In addition, DEP and CWC continues a program to pay homeowners to maintain their septic systems through regular pump outs.

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: more than 90% or large farms in the watershed have signed up to participate; 272 farms have commenced implementation of Whole Farm Plans; and 179 farms have substantially completed installation of 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 1,620 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, and land management, 2004 was a year of tremendous activity and water quality protection.

1.3 Wastewater Treatment

There are 34 non-City-owned surface-discharging Wastewater Treatment Plants (WWTPs) in the Catskill/Delaware watershed, which account for approximately 60% of the WWTP flow in the west of Hudson watershed. By the end of 2004, upgrades were complete at facilities that account for more than 95% of non-City-owned Catskill/Delaware WWTP flow. In addition, at a cost of more than $240 million, 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. These upgraded facilities continue to operate well, and effluent quality has improved markedly since completion of the upgrades.

Under the New Infrastructure Program, seven new WWTPs will be built west of Hudson in communities with demonstrated wastewater problems. Of the five projects initiated under the 1997 FAD, one, Andes, has achieved functional completion. Three others are under construction and are expected to be completed in 2005. Construction contracts were awarded and construction was initiated in the fifth community, Fleischmanns. Wastewater projects in Phoenicia and Prattsville are being advanced.

1.4 Water Quality Monitoring

During 2004, 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 33,000 samples were collected in the City and approximately 430,000 analyses were completed. Once again, the results are impressive. The City complied with the Objective Criteria of the Surface Water Treatment Rule. Of the 11,074 in-City Compliance samples collected pursuant to the Total Coliform Rule in 2004, a mere 0.2% were total coliform positive. All resamples, except one, were negative for total coliform. Since November 1994, DEP has collected approximately 111,000 Compliance samples and only eleven of those samples have tested positive for *E. coli.*

1.5 2004 Annual Report

This report covers the period January 1, 2004, through December 31, 2004, and is compiled to satisfy requirements of the November 2002 FAD, which requires DEP to submit a comprehensive annual report on the status of the watershed protection program. Material in this report is organized to parallel the sections of the November 2002 FAD, which is somewhat different from previous FAD annual reports.

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/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 December 27, 1991, 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 and November 2002 FADs.

In addition, in 2004, DEP mainted a portion of its website devoted to the watershed protection program. The new site contains 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 website at http://www.nyc.gov/watershed.

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. SWTR Objective Criteria Compliance

2.1 Federal and State Objective Water Quality Criteria

During 2004, DEP continued its comprehensive water quality monitoring efforts. In 2004, DEP conducted almost 622,000 analyses on the thousands of samples collected both in the City distribution system and in the watershed. DEP's sampling program continues to be much more extensive than is required by federal or State law. Almost 33,600 samples were collected in the City and approximately 430,600 analyses were completed. Once again, the results are impressive. Of the 11,074 in-City Compliance samples collected pursuant to the Total Coliform Rule in 2004, a mere 0.2% were total coliform positive, of which four samples were also *E. coli* positive. All resamples, except one, were negative for total coliform. Since November 1994, DEP has collected more than 111,000 Compliance samples and only eleven of those samples have tested positive for *E. coli.*

On the tenth of every month, DEP provides both EPA and State 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 summarizes Compliance monitoring conducted during the year.

DEP achieved compliance with all federal water quality requirements for raw water monitoring for fecal coliform concentrations and disinfection/CT values, entry point monitoring for chlorine residuals, distribution system monitoring for chlorine residuals and coliform bacteria levels, and quarterly monitoring in the distribution system for trihalomethanes and haloacetic acids. Raw water monitoring for turbidity resulted in a missed sampling in December, resulting in a Tier 3 violation.

2.2 SWTR Monitoring and Reporting

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

Prior to disinfection, both the Catskill and Delaware Aqueduct effluent from Kensico Reservoir exhibited fecal coliform concentrations 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 98.31% and 96.72%, respectively.

2.2.2 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. Turbidity values did not exceed 4.2 NTU for the Catskill System and 3.6 NTU for the Delaware System.

It should be noted however, that there were several interruptions in continuous monitoring of source water turbidity. On October 5 at 12 p.m., a reading was unavailable because of a sample pump shutdown. Similarly, a reading was unavailable at 12 p.m. October13, due to the forebay pump failure. On October 5 at 11:40 a.m., a meter turbidity reading of 1.1 NTU and a grab turbidity reading of 1.2 NTU were noted. On October 13 at 12 pm, a grab turbidity reading of 0.9 NTU was noted. All of the aforementioned incidents occurred within the Delaware System.

Concerning the Catskill System, on December 14 at 4 a.m., the continuous monitoring data was not available due to a power failure. No grab sample was taken in lieu of the continuous monitoring data, resulting in a Tier 3 violation. Turbidity levels noted four hours before and four hours after the 4 a.m. period were 0.9 and 0.8 NTU, respectively.

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

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

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

Chlorine residuals were maintained at concentrations at or above 0.20 mg/l at all Catskill/Delaware entry points during the year. The lowest chlorine residual measured at an entry point was 0.30 mg/l.

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

All chlorine residuals for Compliance samples measured within the distribution system during the year were measurable/detectable (the lowest being 0.01 mg/l), with the exception of four (4) Compliance samples in the Catskill/Delaware Distribution Area and five (5) Compliance samples in the Groundwater Distribution Area, each having 0.0 mg/l free chlorine residuals. In the Catskill/Delaware Distribution Area, two (2) of the samples had a heterotrophic plate count (HPC) resulting in <1 CFU/ml and 1 CFU/ml. HPC was not performed on the other two (2) samples, but they were total coliform negative, and resamples collected from the same sites were also total coliform negative with an HPC of <1 CFU/ml. In the Groundwater Distribution Area, four (4) of the samples had a HPC resulting in <1 CFU/ml. HPC was not performed on the other sample but it was total coliform negative, and a resample collected from the same site was also total

coliform negative with an HPC of <1 CFU/ml. Samples with an HPC less than or equal to 500 CFU/ml would be deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement.

Several surveillance samples also had 0.0 mg/l free chlorine residuals. 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.

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

The analysis for trihalomethanes, performed on a quarterly basis, resulted in a maximum total trihalomethane (TTHM) level of 55 ug/l in the Catskill/Delaware Distribution Area. The analysis for haloacetic acids, also performed on a quarterly basis, resulted in a maximum haloacetic acid five (HAA5) level of 84 ug/l in the Catskill/Delaware Distribution Area.

The highest TTHM Quarterly Running Average during the year was recorded during the third quarter at 41 ug/l for the Catskill/Delaware Distribution Area, well below the regulated level of 80 ug/l. The highest HAA5 Quarterly Running Average during the year was recorded during the second and third quarters at 51 ug/l for the Catskill/Delaware Distribution Area; this quantity was below the regulated level of 60 ug/l.

2.3 Total Coliform Monitoring

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

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 11,074. Of the Compliance samples collected, 23 samples were total coliform positive of which four (4) samples were also *E. coli* positive. All resamples, except one, were negative for total coliform. The actual percentage of Compliance samples that were total coliform positive was 0.2%.

2.3.2 Chlorine Residual Maintenance in the Distribution System

During the year DEP continued a number of programs to ensure adequate levels of chlorine throughout the distribution system. These include: 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 with few exceptions. In 2004, in over 11,000 Compliance samples all but four (4) Compliance samples in the Catskill/Delaware Distribution Area had measureable/detectable chlorine residuals upon collection and, in consideration of HPC values, two (2) of those samples would be viewed as having a measureable/detectable chlorine residual.

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**	**2002**	**2003**	**2004**
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	0.92	0.94	0.72
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	0.92	0.91	0.68
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	0.96	0.87	0.75
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	0.92	0.91	0.71
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	0.93	0.83	0.81
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	0.93	0.83	0.79
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	0.92	0.78	0.80
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	0.96	0.85	0.82
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	0.87	0.88	0.78
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	0.92	0.84	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	0.95	0.89	0.72
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	0.94	0.81	0.72
City Tunnel No.2 at BX5/121/12150																
Month	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
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	1.15	1.06	0.81
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	1.17	1.03	0.83
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	1.19	1.01	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	1.22	1.00	0.79
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	1.14	0.95	0.80
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	1.15	0.92	0.85
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	1.15	0.94	0.88
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	1.18	0.92	0.87
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	1.16	0.96	0.77
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	1.11	0.91	0.81
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	1.01	0.93	0.79
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	1.04	0.84	0.78

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	2002	2003	2004
City Tunnel No.3 at 15450																
JAN											1.11	0.69	0.70	1.00	0.97	0.73
FEB											0.94	0.70	0.70	0.97	0.94	0.70
MAR											0.76	0.69	0.67	0.92	0.99	0.67
APR											0.68	0.65	0.69	0.94	0.93	0.68
MAY											0.70	0.70	0.74	0.84	0.83	0.67
JUN											0.79	0.72	0.70	0.80	0.75	0.72
JUL										1.15	0.90	0.74	0.68	0.83	0.78	0.73
AUG										0.89	0.94	0.74	0.69	0.84	0.91	0.66
SEP										0.89	0.85	0.77	0.70	0.86	0.93	0.65
OCT										0.92	0.82	0.74	0.69	0.87	0.96	0.77
NOV										1.06	0.78	0.79	0.79	0.88	0.92	0.73
DEC										1.12	0.78	0.74	0.91	0.96	0.88	0.73

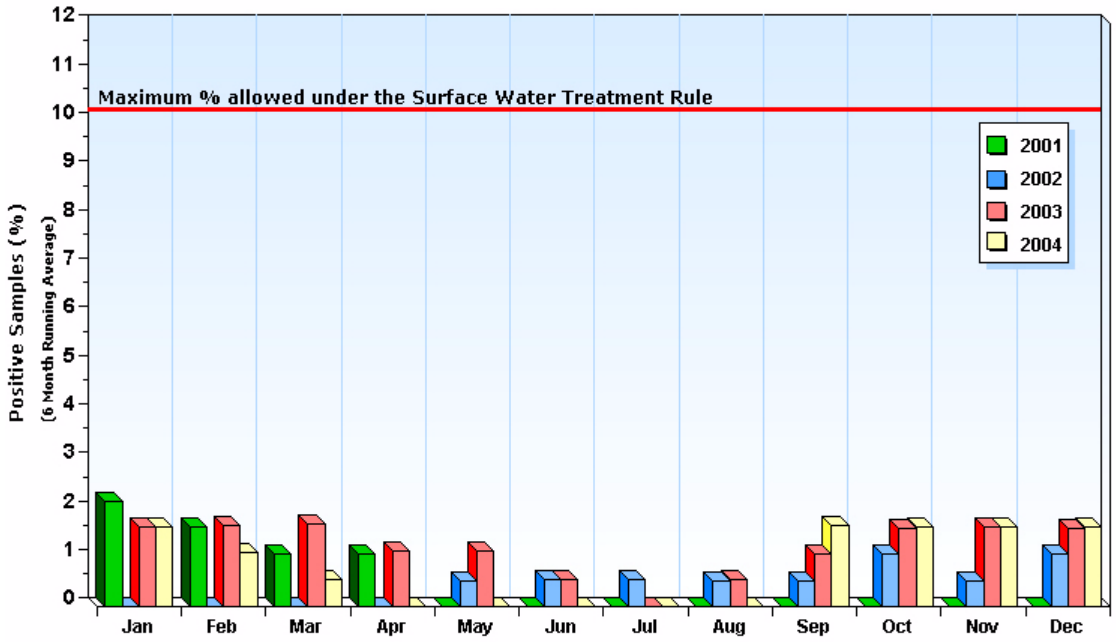


Figure 2.1. Positive fecal coliform samples, Kensico Reservoir, Catskill System, 2001 - 2004.

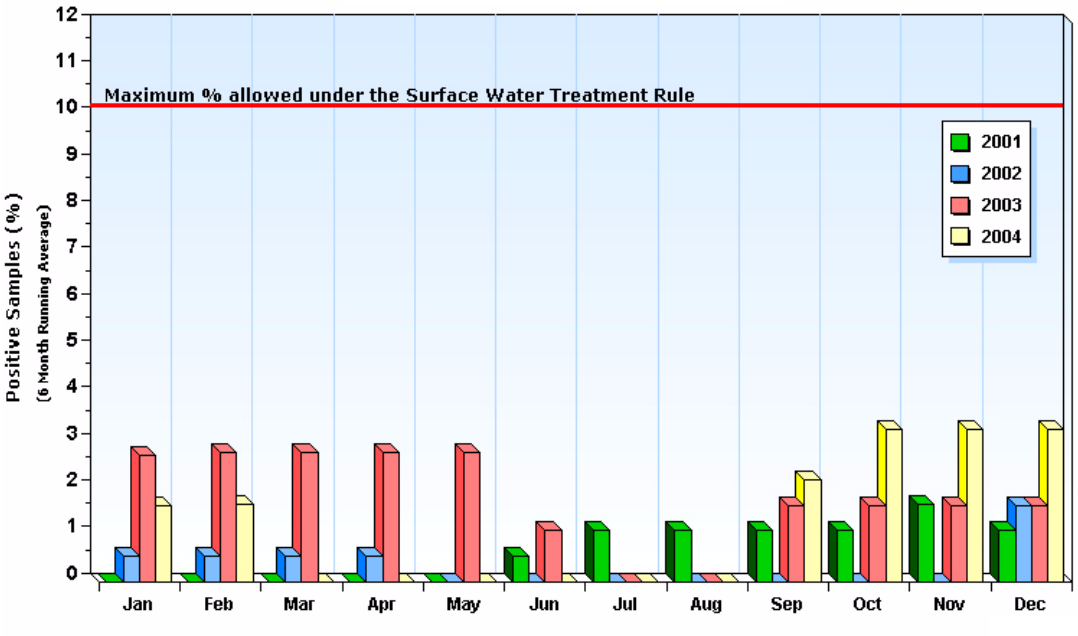
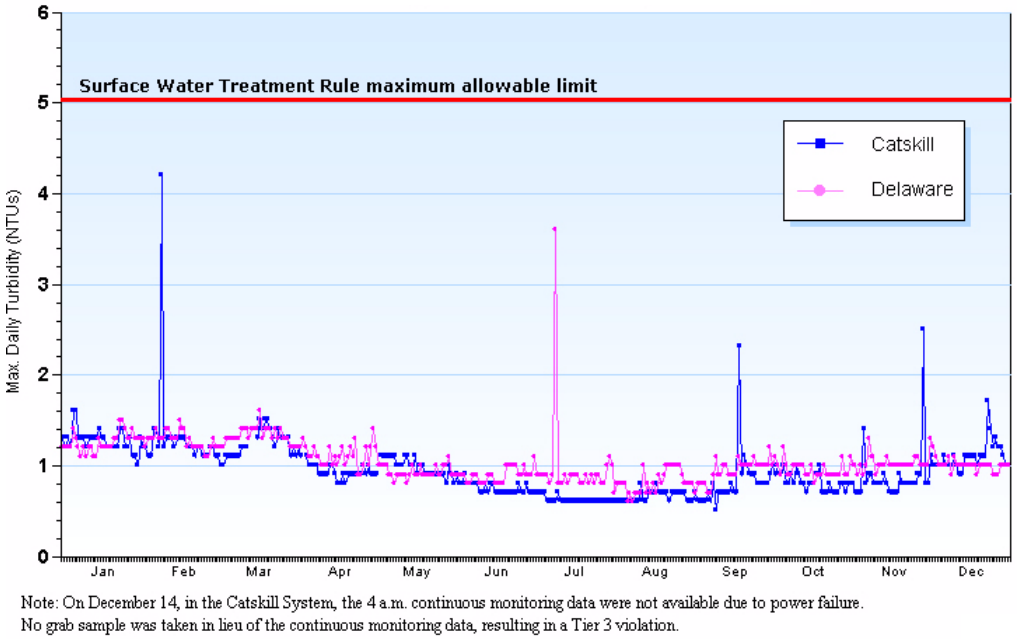


Figure 2.2. Positive fecal coliform samples, Kensico Reservoir, Delaware System, 2001 - 2004.



Note: On December 14, in the Catskill System, the 4 a.m. continuous monitoring data were not available due to power failure. No grab sample was taken in lieu of the continuous monitoring data, resulting in a Tier 3 violation.

Figure 2.3. Catskill and Delaware source water turbidity, 1/1/04 - 12/31/04.

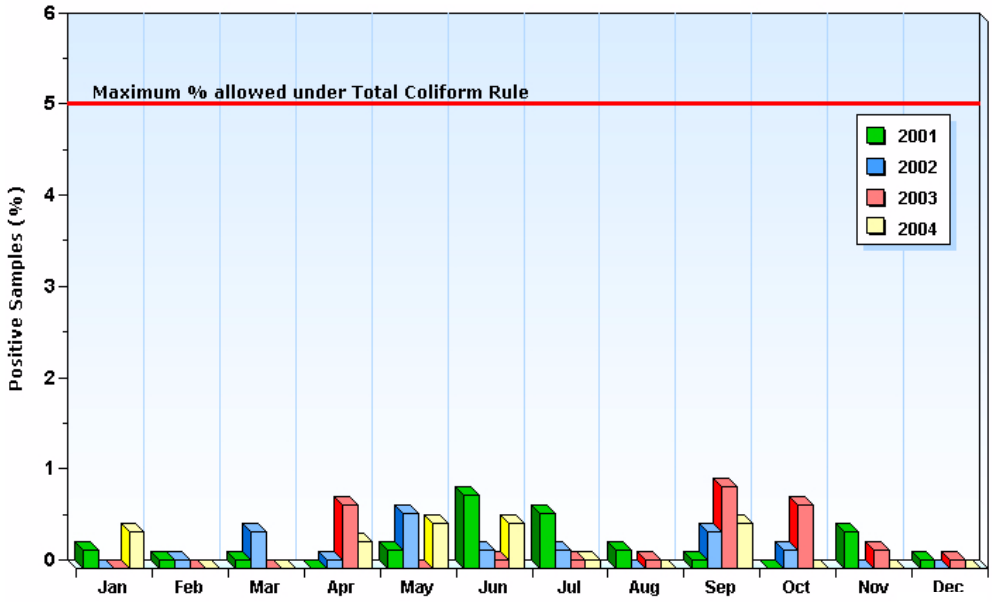


Figure 2.4. Positive total coliform samples in the City's Water Distribution System, 2000 - 2003.

3. Environmental Infrastructure

3.1 Septic and Sewer Programs

3.1.1 Septic System Rehabilitation and Replacement Program

Since 1997, New York City has committed $28.6 million in funding to rehabilitate, replace, and upgrade septic systems serving single or two-family homes in the City's West of Hudson watersheds. The Septic System Rehabilitation and Replacement Program is managed by the Catskill Watershed Corporation (CWC), a local not-for-profit organization created to manage Watershed Partnership and Protection Programs. CWC is made up of elected officials from within the WOH watershed, as well as a State representative and a New York City representative.

The CWC Septic System Rehabilitation and Replacement Program consists of the following sub-programs: the Priority Area Program, the Hardship Program, the SDWA-Septic Monitoring Program, and the Reimbursement Program.

The Priority Area Program is an inspection and repair program implemented geographically based upon the proximity of septic systems to reservoirs and watercourses. The Priority Area Program was implemented by CWC in July 1999, in the 60-Day Travel Time Area and has since expanded sequentially to include first septic systems located within 50 feet of a watercourse and/or 300 feet of a reservoir or reservoir stem and then septic systems located between 50 and 100 feet of a watercourse. The procedural steps involved in the Priority Area Program are:

- CWC solicits homeowner interest in the Priority Area Program in the area where the program is being implemented.
- CWC meets with the homeowner to explain the program and to sign the homeowner to a Homeowner-CWC Agreement.
- Once the Homeowner-CWC Agreement is signed, CWC and the homeowner schedule a time to have the septic tank pumped.
- CWC inspects the septic tank after it is pumped and dye tests the system to identify/confirm a failure.
- CWC notifies DEP of identified failures (generally within 24 to 36 hours).
- If a system is identified as failing or likely to fail, the homeowner retains an engineer to design the septic remediation.
- DEP is notified in advance to witness soils testing for the design of septic remediation.
- DEP reviews design and if/when approvable issues a Design Approval letter.
- The homeowner obtains a construction quote on a CWC bid form. If the proposed work exceeds $20,000, the CWC Board needs to approve the scope of work and cost of the system.
- The remediation is constructed by a contractor retained by the homeowner.
- The Engineer who designed the system issues a letter certifying that construction was in accordance with the design.
- DEP issues a Construction Acceptance letter.
- Upon receipt of the DEP Construction Acceptance letter, CWC reimburses the homeowner (100% reimbursement for primary residence; 60% reimbursement for second home).

The CWC Hardship Program funds septic repairs outside of the Priority Area Program for applicants who meet certain income eligibility criteria. A total of $300,000 has been earmarked to date for hardship funding. In 2004, CWC identified 15 homeowners as being eligible for funding under the Hardship Program.

The purpose of the SDWA-Septic Monitoring Program is to provide information about the effectiveness of alternative onsite wastewater treatment technologies under local conditions to help designers and regulators select appropriate, cost-effective systems in the WOH watershed. Four different septic system designs are being installed under this program: Aerobic Treatment Units (ATUs), sand filters with leach fields, peat filters with leach fields, and conventional systems. Through 2004, 20 septic systems have been substantially constructed with 15 of those having received final post-construction approval by DEP, 16 are in various stages of design and/or are awaiting construction.

Under the Reimbursement Program, homeowners can be reimbursed by CWC for septic remediations which occur outside of the Priority Area Program depending upon funding availability. Presently, homeowners who fixed failing septic systems between July 1, 1999 and November 30, 2004, are eligible for reimbursement.

CWC funded the repair or replacement of 129 septic systems in the West of Hudson watershed in 2004. Since program inception, the total number of septic systems repaired, replaced or managed under all CWC Septic Programs is 1,925.

3.1.2 Septic Maintenance Program

The Septic Maintenance Program is funded for $1.5 million. It is a voluntary program intended to reduce the occurrence of septic system failures through regular pump-outs and maintenance. CWC pays 50% of eligible costs for pump-outs and maintenance. Implementation was originally on a pilot program basis, but was expanded watershed-wide in 2004.

CWC sent out approximately 1,100 program solicitation letters in 2004, targeting homeowners who repaired or replaced septic systems at least three years ago under the CWC Septic Program.

CWC subsidized a total of 64 septic tank pump-outs in 2004**.**

3.1.3 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 systems where siting required by DEP's Watershed Regulations requires additional fill or pumping.

No applications for eligible Alternate Design Septic System projects were submitted in 2004.

In March 2004, CWC transferred $200,000 in Alternate Design Septic Systems Program funding to the Septic Program for the Hamden Community Wastewater Management Pilot Project. In August 2004, CWC transferred $200,000 in Alternate Design Septic Systems Program funding to the Septic Hardship Program.

3.1.4 Sewer Extension Program

DEP has continued working closely with each of the participating municipalities to advance the Program's implementation. The following provides a summary of the activities taken in implementing the Program in each of the communities during the past year:

Town of Hunter (Tannersville Wastewater Treatment Plant):

In 2004, the Town completed construction of all of the new sewer mains and pump stations for each of the planned sewer extensions selected for funding. DEP staff played a key role in organizing construction update meetings and in resolving a number of issues that came up during construction.

The Town is planning on letting bids for the construction of the laterals in late-winter 2005. Once all of the necessary easements are signed by the affected landowners and by the City, and filed with the County Clerk's office, construction of the laterals will be able to commence. Construction of laterals should be completed by the end of the 2005 construction season.

Town of Roxbury (Grand Gorge Wastewater Treatment Plant):

DEP has continued to advance planning and design activities for the planned sewer extension near the Hamlet of Grand Gorge. Project design plans and specifications have been revised and enhanced in response to comments received from the New York State Department of Environmental Conservation (DEC). Approval for plans and specifications is expected in early 2005. DEP is also in the process of filing easements (signed by landowners along the planned extension and by the City) with the Delaware County Clerk's Office.

Construction of the planned extension is now expected to commence in spring 2006.

Town of Neversink (Grahamsville Wastewater Treatment Plant):

The Town made great progress in implementing the Program in 2004.

The Town signed an Agreement with DEP in March 2004, which became effective on May 3, 2004. The Town has since worked diligently in advancing the planning and design of the proposed extensions in consultation with DEP.

Construction of the planned extensions should occur during the 2006 construction season.

Village of Margaretville/Town of Middletown (Margaretville Wastewater Treatment Plant):

During the past year, DEP has worked closely with the Village and Town in resolving the few remaining outstanding issues associated with the draft Agreement for implementing the Program. The Village and Town are expected to sign the Agreement in the Spring of 2005.

DEP now anticipateS construction to commence on the planned extensions during the 2006 construction season.

3.2 New Sewage Treatment Infrastructure Program

The New Sewage Treatment Infrastructure Program (NIP) funds the study, design and construction of new wastewater projects in seven communities: Andes, Roxbury, Hunter, Windham, Fleischmanns, Phoenicia, and Prattsville.

Construction of the Andes WWTP and collection system was completed and accepted by DEP in 2004. The Functional Completion Certificate for the Wastewater Treatment Plant and Sanitary Sewers was issued on August 10, 2004. The O&M Agreement between the Town and the City was executed on September 8, 2004. Lateral connections have begun and the plant is processing wastewater.

Construction of the Force Main from Roxbury to the Grand Gorge WWTP was completed in 2004. Functional Completion Certification was issued on November 22, 2004. The O&M Agreement between the Town and the City was executed on September 8, 2004. Lateral connections will occur in 2005.

In Hunter, the WWTP was near completion at the end of 2004. (In January 2005, DEP authorized startup and performance testing at the WWTP and the acceptance of sewage from Liftside at Hunter Mountain). Remaining construction of the sewer collection system and lateral hook-ups will occur in 2005.

The Windham WWTP was completed in 2004. Remaining construction of the sewer collection system and lateral hook-ups will occur in 2005.

The Fleischmanns 100% WWTP and collection system designs were approved by DEP in November 2004. Construction contracts were awarded in 2004 and construction has commenced.

In October 2003, DEP executed a Change Order to the New Infrastructure Program that included the funding necessary for the design and construction phases of wastewater projects in Prattsville and Phoenicia (Town of Shandaken).

Prattsville signed the design/construction contract with New York State Environmental Facilities Corporation in January 2004. During 2004, Prattsville issued updated SEQRA Findings and submitted 65% Design plans for the WWTP and collection system to DEP. Final Design approval and the commencement of construction are anticipated to occur in 2005.

The Town of Shandaken secured a purchase option on the parcel where the Phoenicia WWTP is planned, with an anticipated closing in April 2005. The Town prepared an RFP for engineering services and solicited proposals in 2004. The Town plans to retain an engineering firm and execute the Design/Construction contract with the New York State Environmental Facilities Corporation during the first quarter of 2005. The Town will proceed with WWTP and collection system design in 2005.

3.3 Community Wastewater Management Program

The Community Wastewater Management Program (CWMP) provides funding for the design and construction of community septic systems, including related sewerage collection systems, and/or the creation of septic maintenance districts, including septic system replacement, rehabilitation and upgrades, and operation and maintenance of the district, in up to five (5) identified communities.

The CWC Board of Directors approved the Community Wastewater Management Program Rules at its February 2004 meeting. CWC sent out Community Wastewater Management Program solicitation letters to the first five Identified Communities (Bloomville, Boiceville, Hamden, Delancey, and Bovina Center) in early April 2004. All five communities responded in the affirmative regarding their participation in the program. (Bovina Center and Hamden had already begun community wastewater projects with grant funding secured from other sources and from the CWMP).

CWC sent out a Request for Proposals for Professional Consulting Services for the Community Wastewater Management Program on June 4, 2004. A pre-bid meeting was held on June 15, 2004.

CWC awarded the CWMP Consultant Contract to Lamont Engineers. Lamont Engineers is the firm already retained by Bovina and Hamden, so continuity and coordination will be maximized.

During the fourth quarter of 2004, CWC and DEP finalized the draft Participating Community Agreement. Participating Community Agreements were sent for signature to Bloomville, Boiceville, Hamden and DeLancey. The Participating Community Agreement for Bovina still needs to be amended so as to be a three-way agreement including Delaware County (as indicated

above, the Bovina project is already underway with alternate funding). In 2004, CWC received signed agreements back from the Town of Olive (Boiceville) and the Towns of Stamford and Kortright (Bloomville).

Construction of the Bovina CWMP project began in September, 2004. By the end of 2004, all 12 leach fields were installed and the main pump station was installed. Construction, including the collection system throughout Bovina Center, is anticipated to be complete by autumn 2005.

During 2004, Lamont Engineers began work on the Study Phase in Hamden. Work is progressing on the Hamden Guidance Document, which will be an advisory document that details the municipality's responsibilities in developing a municipal wastewater project. Lamont Engineering intends to use this document for the projects in Bloomville, Boiceville and DeLancey.

3.4 Stormwater Programs

3.4.1 Stormwater Retrofits Program

Throughout 2004, CWC and DEP conducted site inspections, and administered previously funded projects with the goal of closing-out open construction grant projects. Evaluation of new Stormwater Retrofit construction grant applications was temporarily suspended in 2004, to assess the extent of current financial obligations to complete open projects at a time of escalating construction costs.

In 2004, CWC modified its policy to institute an open application time-frame for construction grant project applications, evaluating each application as it is submitted and giving funding preference to construction grant project applications where a municipal stormwater planning and assessment study has already been successfully completed or where a New Infrastructure Program project or Community Wastewater Management Program project is in progress. Applications for the Infrastructure Assessment Program are due in November.

A standard maintenance contract for all stormwater retrofits funded by the Stormwater Retrofit Program on private and municipal properties was reviewed and approved in 2004. The maintenance contract incorporates provisions for ownership, entry for inspection, maintenance, maintenance records, and reimbursement of costs. Once the property owner signs a maintenance contract with CWC, the owner is eligible to receive a maintenance fund disbursement.

In cooperation with CWC, in 2004 DEP implemented a Stormwater Retrofit Sampling Partnership Program to assess the pollutant removal efficiency of several WOH stormwater BMP retrofit projects. DEP's Water Quality Impact Assessment unit drafted a Quality Assurance Project Plan (QAPP) for this sampling project and in March 2004 the QAPP was approved by DEP, CWC and DEC. One of the ultimate goals of this project is to provide data to the National Stormwater Database. Funding for laboratory analysis work for this project will be provided

through the Retrofit Program in the amount of $60,000 over three years. DEP will provide for all other aspects of the project, including staff and equipment for field sample collection and data analysis.

In 2004, automated monitoring equipment was installed at four project sites. Rainfall data along with BMP influent and effluent flows were recorded at all sites. Unanticipated difficulties with measuring flow volumes for automated flow-weighted sample collection prevented actual sample collection and analysis in 2004. DEP has purchased new equipment to improve flow measurement abilities, and sampling for this project will begin in the spring of 2005

3.4.2 West of Hudson Future Stormwater Controls Program - MOA ¶ 128

In 2004, CWC finalized funding applications for three (3) projects. Applicants, projects, authorizing resolutions, and funding levels are shown in the following table.

Table 3.1. Applications for Future Stormwater Control Funding.

Applicant	Project	Approval Date	CWC Funding	NYC 50%
Delaware County	Public Safety and Office Building	10/26/04	$45,976	N/A
Tannersville (V)	Bike path final payment	12/12/04	$212,542	N/A
Tannersville (V)	Bike path remediation (not to exceed)	12/12/04	$11,402	N/A

The CWC Board of Directors transferred funds from the Future Stormwater Program to the Septic Program to provide additional funding for the implementation of the Bovina Community Septic project. A total amount of $1,585,000 was approved for transfer (February 24, 2004). An additional $120,000 of Future Stormwater Controls Funds was approved for transfer to fund a sanitary lateral reimbursement program in Bovina (September 28, 2004).

CWC's Board of Directors previously earmarked earnings of $1,000,000 of Future Stormwater Controls Fund for funding operation and maintenance costs resulting from eligible stormwater projects. Earnings accrued to date total approximately $167,378.85.

3.4.3 Future Stormwater Controls Paid for by the City Program

West of Hudson

In 2004, the City received WOH applications for funding the design and implementation of stormwater controls pursuant to paragraph 145 of the Watershed Memorandum of Agreement. The following summarizes the applications for funding the City received during the reporting period, and the disposition of those applications:

- The City received an application to cover 100% of the cost of designing and implementing an

Individual Residential Stormwater Permit (IRSP) associated with the construction of a single-family residence. The WR&Rs required that an IRSP be prepared because the dwelling was within a limiting distance to a watercourse specified in the WR&Rs. The applicant did not submit breakdown costs for the construction by the close of 2004. *(T) Windham*

- The City received an application to cover 50% of the cost of designing and implementing a Stormwater Pollution Prevention Plan (SPPP) associated with a less than 25% expansion of an existing commercial facility (small business) within 100 feet of a watercourse specified in the WR&Rs. The application was still being reviewed for validity of cost estimates at the close of 2004. *(T) Lexington*
- The City received an application to cover 50% of the cost of designing and implementing a SPPP associated with the construction of a gas station within the watershed. The applicant submitted breakdown costs, which were incomplete by the close of the 2004. The review will continue when additional information requested by the City is received. *(T) Neversink*
- The City received an application to cover 50% of the cost of designing and implementing mitigation measures associated with the construction of impervious surface within 100 feet of a watercourse. The proposal included a commercial addition to an existing residence. A variance was required in order for the project to be approved for construction. The project was under review at the close of the year. *(T) Hunter*
- The City received an application to cover 50% of the costs associated with designing and implementing a SPPP associated with a less than 25% expansion of an existing impervious surface at a commercial facility (small business) located within 100 feet of a watercourse. The City has requested supporting documentation, which was not received by the close of 2004. *(T) Woodstock*
- The City received an application to cover 50% of the costs associated with designing and implementing a SPPP associated with expansion of impervious surface within 100 feet of a watercourse at an existing commercial facility (small business). The City requested supporting documentation including an approved SPPP, which was not received by the close of 2004. *(T) Hunter*
- The City received an application to cover 50% of the costs associated with designing and implementing a SPPP associated with disturbance greater than 2 acres on a 15% or more slope. The application was under review at the close of 2004. *(T) Hunter*
- The City paid $29,611.83 to a small business to cover 50% of the costs associated with the design and implementation of a SPPP required for construction of an impervious surface within 100 feet of a watercourse, within a designated Hamlet. *(T) Neversink*

3.5 WWTP Upgrade Program

As part of the MOA, the City agreed to fund the upgrades of all existing 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 the Catskill/Delaware watershed, proceeded on a separate track and were completed in 1999.) The upgrades will provide highly advanced treatment of wastewater treatment plant (WWTP) effluent. The task of coordinating these complex projects with the WWTP owners in the Catskill/Delaware watershed is enormous. Many of the 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, operating, contracting and regulatory issues.

DEP has entered into a contract with the New York State Environmental Facilities Corporation (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. 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.

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.

The Regulatory Upgrade Program is designed to assist WWTPs in meeting requirements imposed solely by 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 certain WWTPs in meeting the conditions of their current SPDES permits. Equipment that is unreliable or reaching the end of its useful life is eligible for replacement under this program. Additionally, certain SPDES improvements conducted at a facility after November 2, 1995, are also eligible for reimbursement under this program.

In 2004, the focus was completing upgrades for the remaining WWTPs, as well as implementing Start Up and Performance Testing (SPT) and negotiating Operations and Maintenance (O&M) agreements. By the end of 2004, WWTPs accounting for 97% of the total West of Hudson (WOH) flow had either achieved Functional Completion or were in the construction stage of the program. 95% of the flow had achieved Functional Completion. WWTPs accounting for the remaining 3% of the flow were finalizing their upgrade design.

In this period, almost 300 disbursements were made to WOH WWTP owners, valued at some $10 million. Of this amount, some $6.5 million was disbursed for construction costs, $1.8 million was for engineering, the bulk of which were design costs, $187,000 was for SPT and the

balance was for miscellaneous charges that included legal and administration activities. In addition to the $10 million, an additional $2.8 million was spent on O&M. O&M agreements were successfully negotiated with four additional WWTP owners.

During 2004, DEP, upon careful review of the 11 new, small WWTPs added to the Upgrade Program in 2002, determined that nine of these facilities were in fact not WWTPs. These nine were accordingly dropped from the list of those WWTPs that were required to meet New York City's WR&R. The two remaining WWTPs continued to move ahead in the Upgrade Program.

Upgraded WWTPs scheduled to connect to New Infrastructure Program (NIP) facilities all made excellent progress. Consistent with EPA's direction, these facilities had been directed to design and install interim UV disinfection systems, pending connection to the NIP facilities. By the end of 2004, all seven of these WWTPs had completed the construction and installation of the interim UV disinfection systems and were all in operation.

4. Protection and Remediation Programs

4.1 Waterfowl Management Program

Pursuant to the November 2002 FAD, the Waterfowl Management Program will submit a separate annual report on July 31, 2004.

4.2 Land Acquisition

During 2004, there were both formal solicitation goals to meet as well as "resolicitation" goals, as required under the 2002 Filtration Avoidance Determination (FAD). During December 2004, DEP completed solicitation of 47,800 acres, the final solicitation goal required by both the FAD and the 1997 MOA and Water Supply Permit. This brings total acres solicited to 385,762, substantially beyond the eight-year requirement of 355,050. In addition, DEP's interval annual goal of resoliciting owners of 89,000 acres (that had already been contacted) was surpassed by 10,000 acres. The results of all re/solicitation activity to date indicate that continued outreach produces results, whether or not someone has been contacted before.

By the end of calendar year 2004, DEP had secured a total of 700 purchase contracts comprising 51,454 acres throughout the Catskill/Delaware system at a cost of $141 million (excluding "soft" costs of roughly $14 million). Of these, 590 projects totaling 41,349 acres have been acquired (closed), with the remaining 110 projects totaling 10,105 acres under purchase contract. During 2004, 94 projects comprising 5,798 acres were closed and 62 projects accounting for 5,976 acres were signed to purchase contract. Among the significant accomplishments during 2004:

- An additional 1,318 acres of land were signed to contract in Ashokan 1B and 2, including one 881-acre conservation easement covering most of the north and south flanks of Tonshi Mountain.
- Watershed-wide, another 674 acres were acquired across the highest priority (1A) areas.
- Of the 15,400 estimated eligible acres in West Branch/Boyd's 1A and 1B, the total number of acres acquired or under contract was raised to 8,219 acres (53%).

DEP's acquisitions (including contracts yet to close) surpassed 50,000 acres, which when added to WAC's farm easements brings total lands protected more than 60,000 acres since 1997. Prior to 1997, DEP's total holding of buffer land in the Catskill/Delaware system was 36,047.

4.2.1 Solicitation

During 2004 , DEP solicited 47,800 acres, the final annual solicitation goal required by the FAD as well as the 1997 MOA and Water Supply Permit. This brings the total acreage solicited to 385,762 during the 8-year period since January 21, 1997. In addition, DEP committed to re-contact owners of 89,000 acres of lands previously solicited (a process also termed 'resolicitation'),

and also reached this goal. Thus, during the first eight years of the program, the City solicited owners of over 385,000 acres in the Catskill/Delaware system and has re-contacted owners in excess of 176,000 of those acres to date. Response rates demonstrate that re-contact efforts are worthwhile.

During the last eight years, the City has increased its land holdings dramatically. In Rondout, a high priority basin, the City has multiplied its buffer lands by five times. In West Branch/Boyd's Corners, another critical basin, buffer lands have been multiplied by 12, while in Schoharie there has been more than a 9-fold increase; in Ashokan, City-owned buffer lands have almost been tripled.

Resolicitation Plan

As previously reported and detailed further below and in Table 4.1, the resolicitation plan is being implemented and has yielded good results to date. Those landowners contacted by the program are divided into two categories:

"Same Owners" Resolicited: This category includes landowners who were previously solicited and either did not respond, said they were uninterested, or rejected our purchase offer(s). Since 2003, 159,000 acres were solicited in this group, of which 60,000 acres (38%) expressed interest following resolicitation, 29,000 (18%) have been appraised, and 3,117 acres have signed sales contracts to date.

"New Owners" Resolicited: This category includes landowners who recently acquired property from owners we previously solicited. Since 2003, 23,000 acres were "resolicited", of which 6,500 acres (28%) have expressed interest, 3,500 acres (15%) were appraised, and 16 acres have signed sales contracts to date.

These results, expected to climb further over time, demonstrate that re-contacting landowners who have previously indicated disinterest is a worthwhile endeavor. It is not clear that the effort to contact new owners appears to be worthwhile, but since there can be significant time delays in seeing results from a given real estate outreach effort, we plan to continue this process through several cycles and to thereafter review success rates.

Table 4.1. 2003-2004 Re-solicitation Activity

	Acres Re-Solicited			Interested		Appraised		Signed Contract	
Category	2003	2004	Total	Acres	% of Total	Acres	% of Total	Acres	% of Total
Same Owner									
Dormant No Response, Same Owner	46,478	58,536	105,014	24,411	23%	6,151	6%	625	1%
Owner Not interested - Same Owner	8,571	6,366	14,937	4,991	33%	1,909	13%	358	2%

Table 4.1. 2003-2004 Re-solicitation Activity

Category	Acres Re-Solicited			Interested		Appraised		Signed Contract	
	2003	2004	Total	Acres	% of Total	Acres	% of Total	Acres	% of Total
Offer Refused - Same Owner	18,527	20,541	39,068	30,676	79%	21,190	54%	2,134	5%
Total - Same Owner	73,576	85,443	159,019	60,078	38%	29,250	18%	3,117	2%
New Owner									
Dormant No Response - New Owner	7,107	5,197	12,304	2,725	22%	1,467	12%	16	0%
Owner Not interested - New Owner	2,942	2,720	5,662	1,988	35%	601	11%	0	0%
Offer Refused - New Owner	2,853	2,488	5,341	1,719	32%	1,484	28%	0	0%
Total - New Owner	12,902	10,405	23,307	6,432	28%	3,552	15%	16	0%
TOTAL FOR 2003 - 2004	86,478	95,848	182,326	66,510	36%	32,802	18%	3,133	2%

4.2.2 Acquisition

During 2004, throughout the Catskill/Delaware system, 6,249 acres in 76 purchase contracts were signed, [while 99 projects comprising 8,536 acres were closed (surpassing last year's record closings).] As of the end of 2004, a total of 700 purchase contracts comprising 51,454 acres were secured by DEP program-wide (signed to purchase contract or closed). Of these, 590 projects totaling 41,349 acres have been acquired, with the remaining 110 projects totaling 10,105 acres under purchase contract.

Program Improvements

The Land Acquisition Program continued to make advances, albeit with lower acres and deals signed than in recent years; this is perhaps because due to the dual forces of a heightened real estate market and the probability that landowners who were predisposed to sell have largely done so. During 2004, the City continued to improve and revise program documents and policies to maximize program competitiveness within the confines of the MOA, FAD, WSP, and City code. Staff retention has been excellent and we continue to operate with a full complement of program staff in all areas. Significant advancements were made with regard to technical support (Land Acquisition Tracking System and Watershed Land Information System) to allow for enhanced project management and tracking of solicitations.

4.2.3 Conservation Easement Program

During 2004, 14 easements totaling 2,584 acres were signed to purchase contract by DEP and 10 easements totaling 1,342 acres were closed. This brings DEP's easement program to 53 easements totaling 8,245 acres closed or under contract.

Whole Farm Easement Program

As of the end of 2004, the Watershed Agricultural Council (WAC) held Farm Easements on 32 farms totaling 6,202 acres, with executed contracts remaining on another 16 farms totaling 2,392 acres. The success of the program to date has convinced DEP, in consultation with EPA, to add $7 million in new funding (which will not impact current DEP Land Acquisition Programs) to this program.

Table 4.2. Purchase contracts executed between 1/1/04 and 12/31/04, Catskill/Delaware system.

Reservoir Basin	Priority	# of Parcels	Acres	Appraised Value
Ashokan	1B	2	123.20	$622,129
Ashokan	2	6	1,194.51	$3,134,530
Cannonsville	1B	1	145.55	$103,333
Cannonsville	3	5	393.21	$812,457
Cannonsville	4	10	670.81	$1,214,649
Neversink	4	5	780.24	$883,834
Pepacton	1B	1	3.10	$15,000
Pepacton	3	1	461.47	$306,878
Pepacton	4	8	968.92	$1,757,354
Rondout	1A	1	2.00	$25,000
Rondout	1B	3	346.05	$675,619
Schoharie	3	4	414.02	$800,174
Schoharie	4	4	266.00	$592,960
West Branch	1A	1	6.27	$453,059
West Branch	1B	10	200.51	$3,071,006
Program Totals:		**62**	**5,975.86**	**$14,467,983**

Table 4.3. Summary of executed landowner agreements by basin through 12/31/2004 (excludes WAC CE's).

Reservoir Basin	# of Parcels	Total Acres	Average Acres	Value
Ashokan	136	8,950	66	$18,215,520
Cannonsville	75	5,908	79	$6,411,513
Kensico	10	215	21	$16,348,183
Neversink	15	2,577	172	$2,376,887
Pepacton	120	10,618	88	$12,069,207
Rondout	90	5,237	58	$6,587,036
Schoharie	94	9,731	104	$13,048,384
West Branch	160	8,213	51	$65,549,275
Totals	**700**	**51,448**	**73**	**$140,606,004**

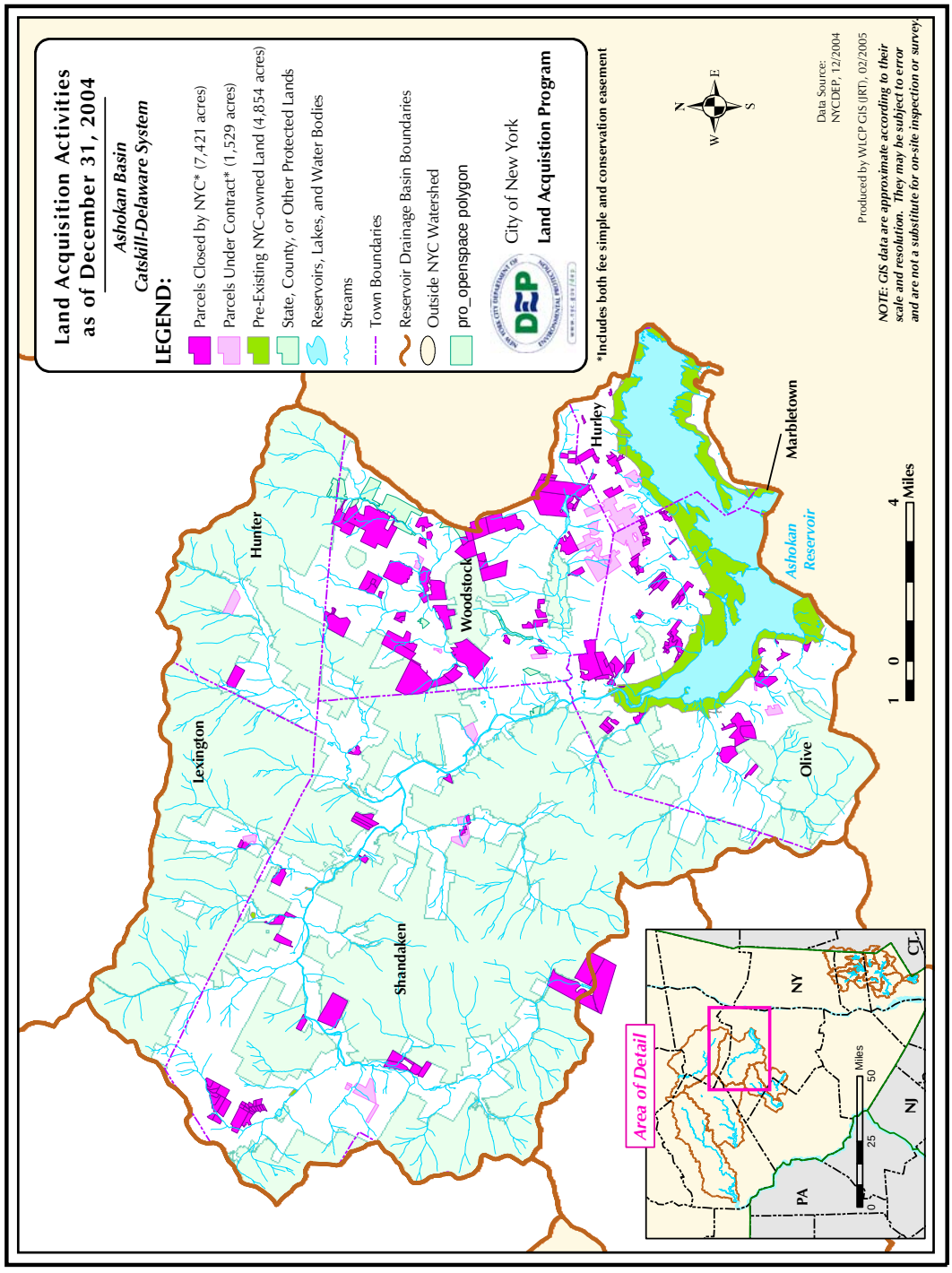


Figure 4.1. Land acquisition activities in the Ashokan Basin as of December 31, 2004.

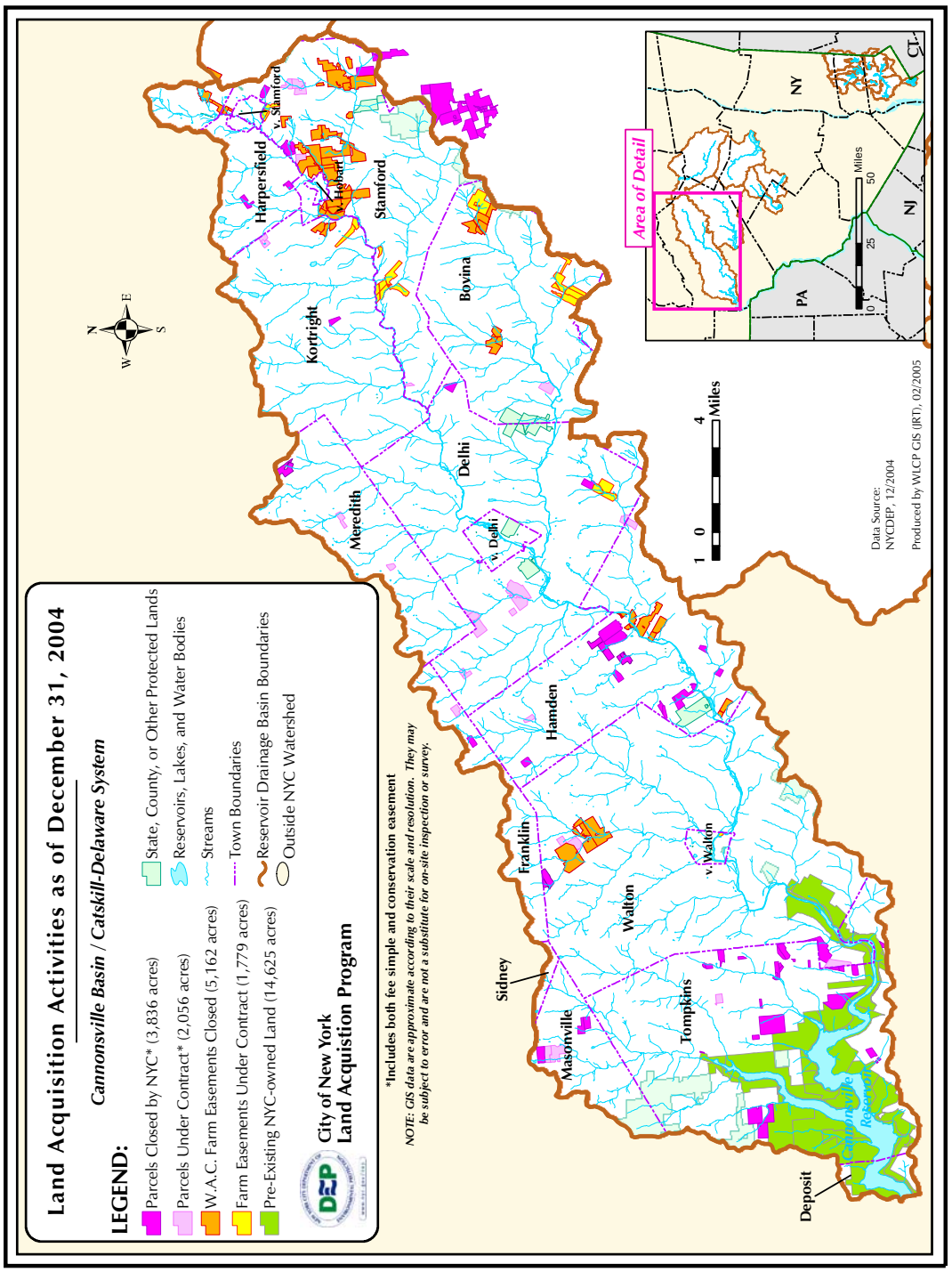


Figure 4.2. Land acquisition activities in the Cannonsville Basin as of December 31, 2004.

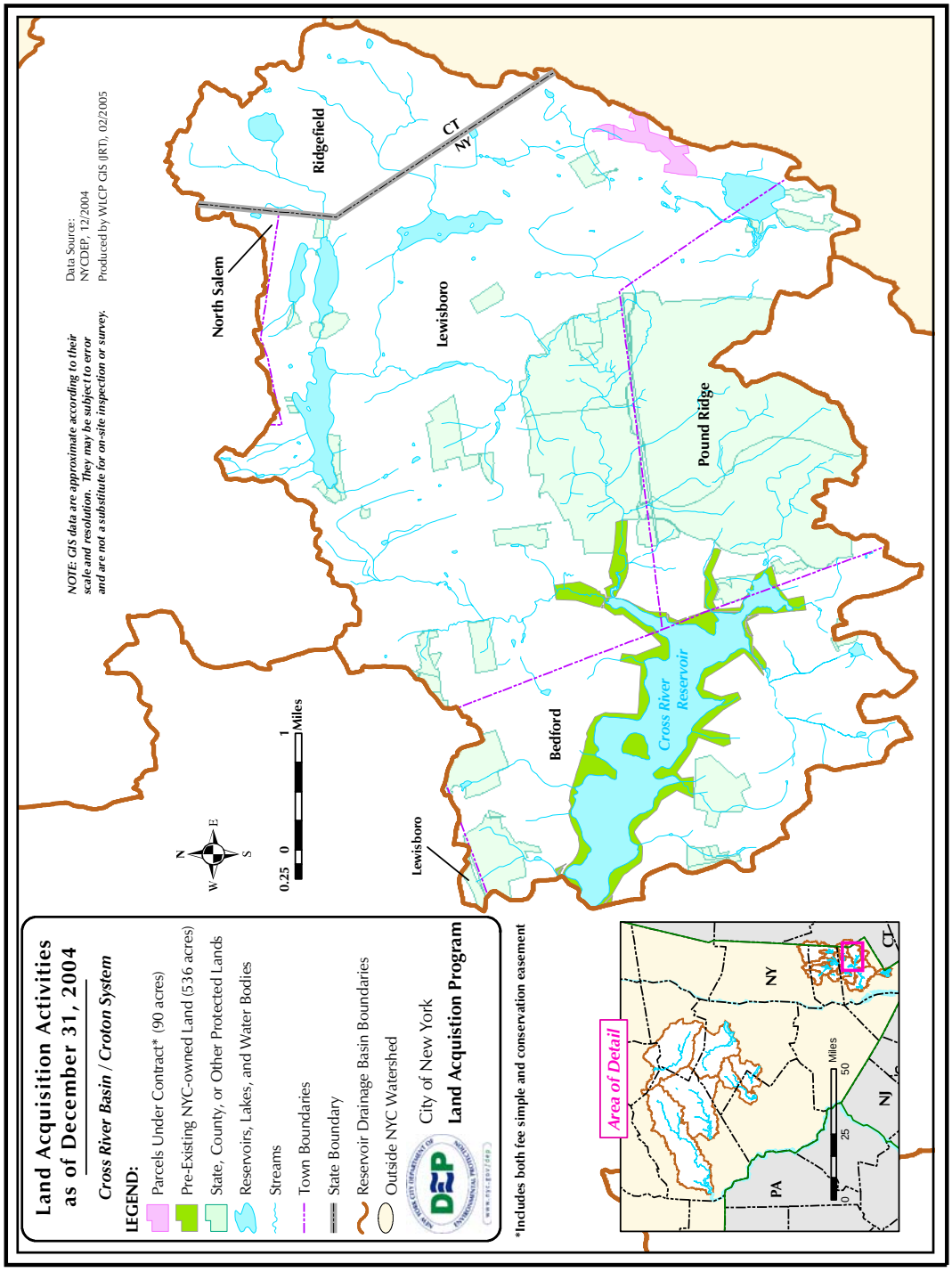


Figure 4.3. Land acquisition activities in the Cross River Basin as of December 31, 2004.

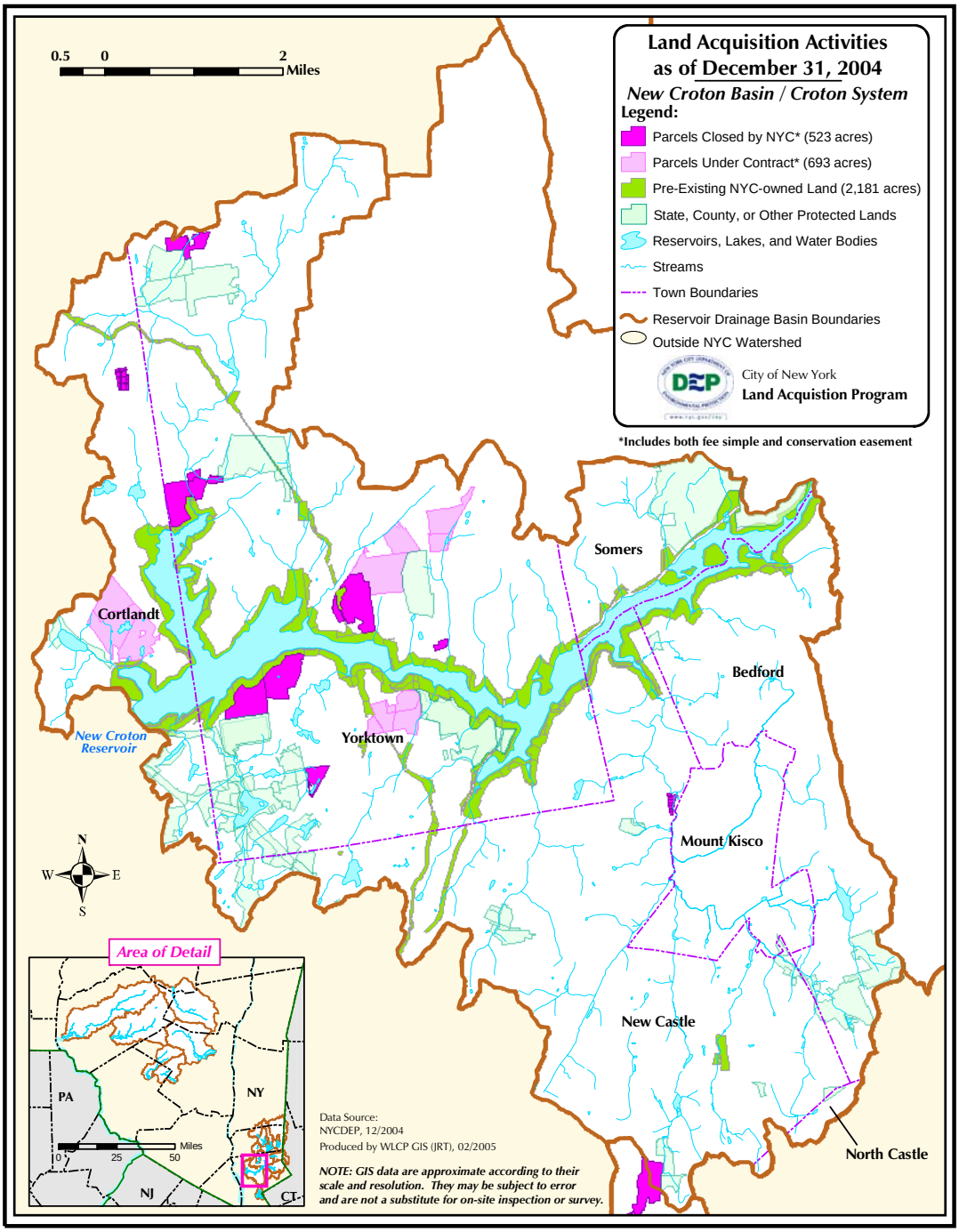


Figure 4.4. Land acquisition activities in the New Croton Basin as of December 31, 2004.

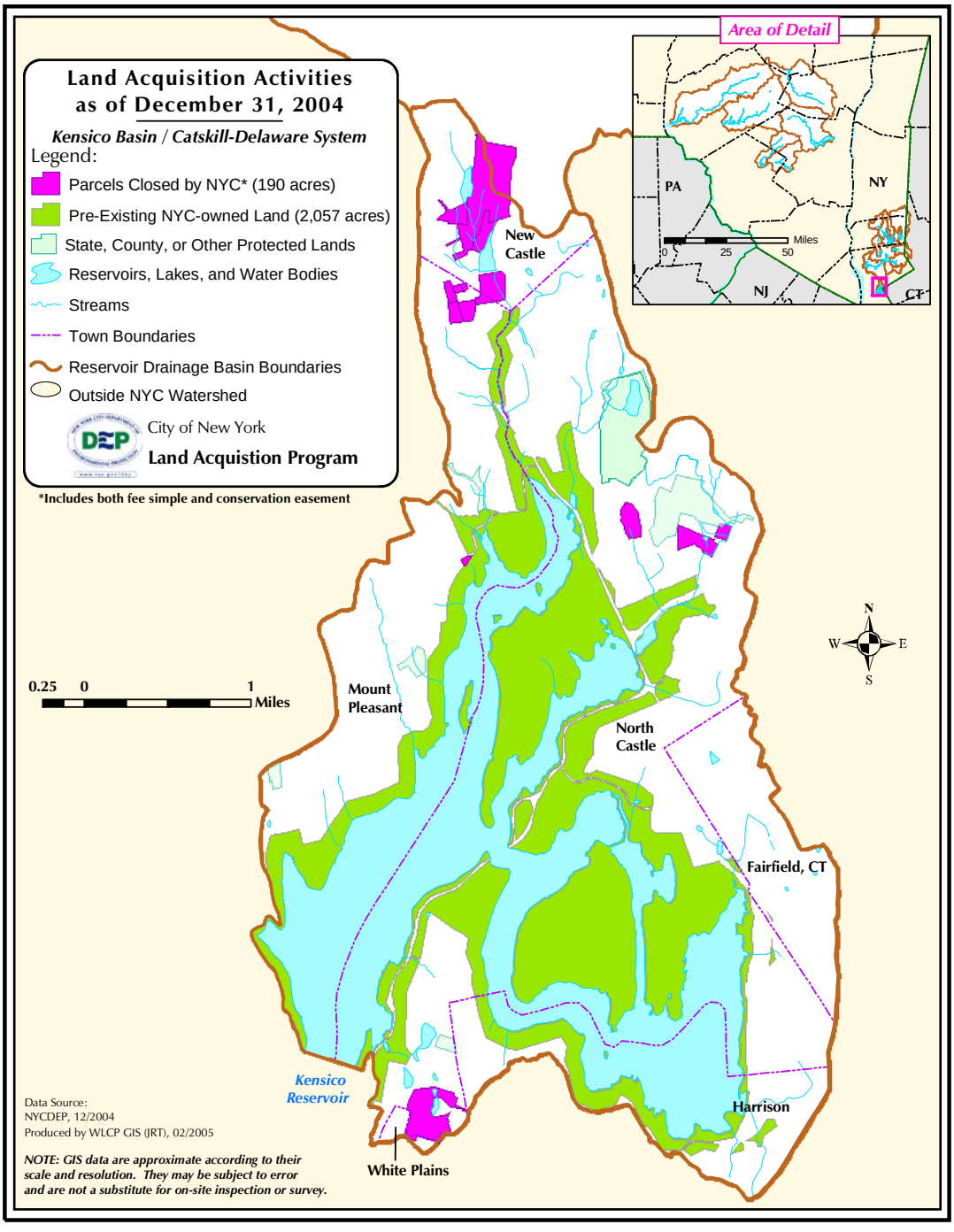


Figure 4.5. Land acquisition activities in the Kensico Basin as of December 31, 2004.

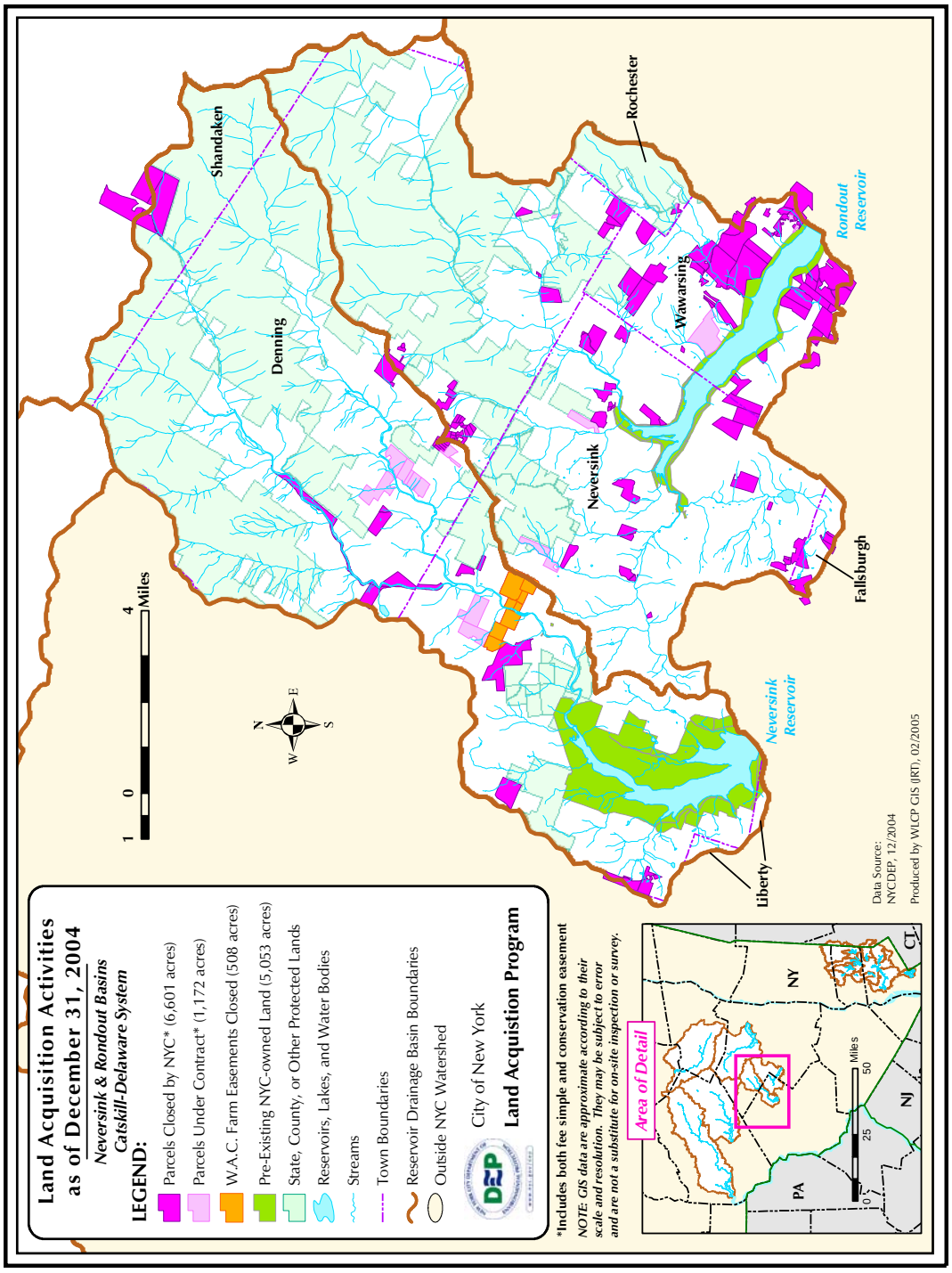


Figure 4.6. Land acquisition activities in the Neversink and Rondout Basins as of December 31, 2004.

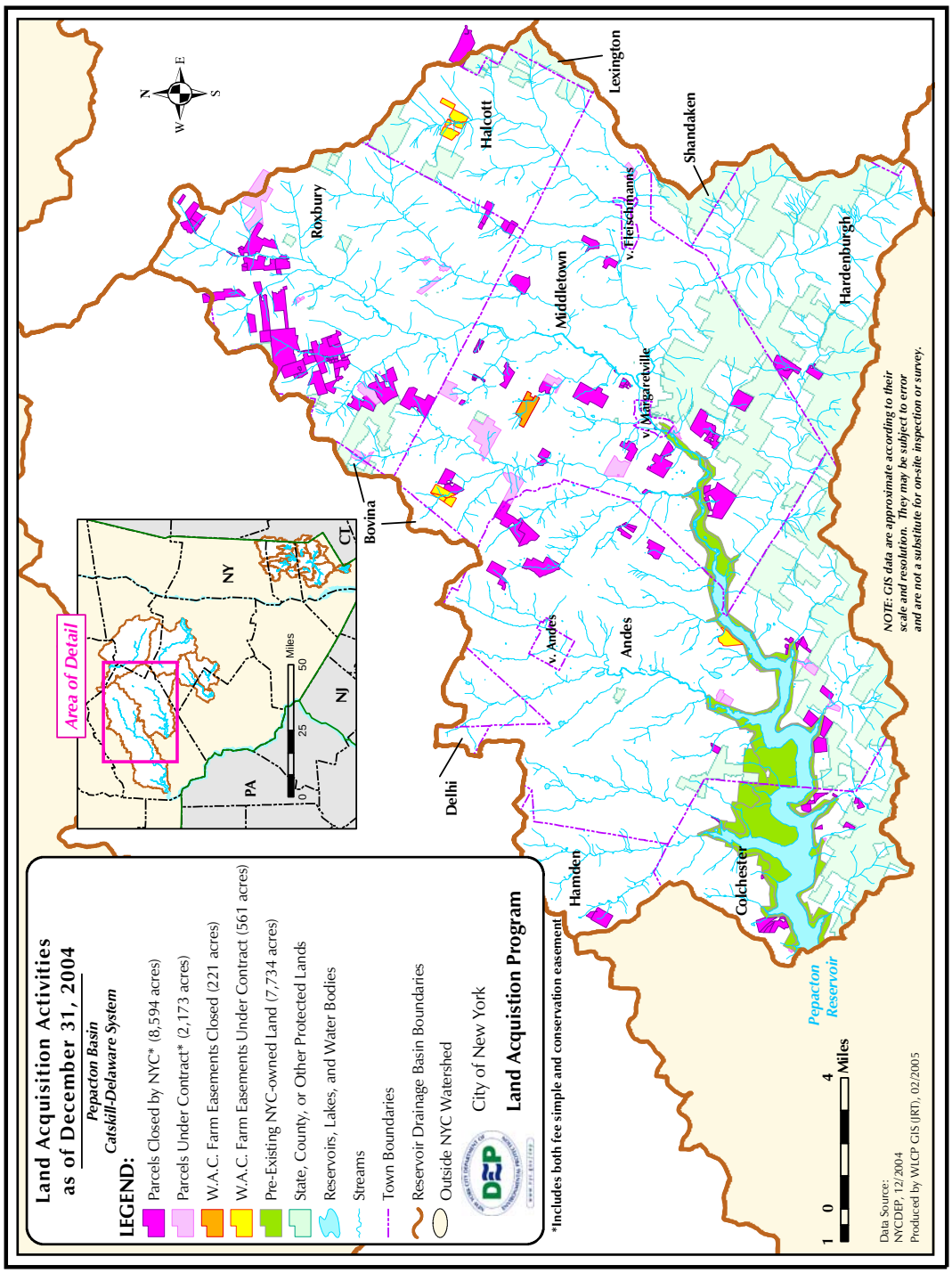


Figure 4.7. Land acquisition activities in the Pepacton Basin as of December 31, 2004.

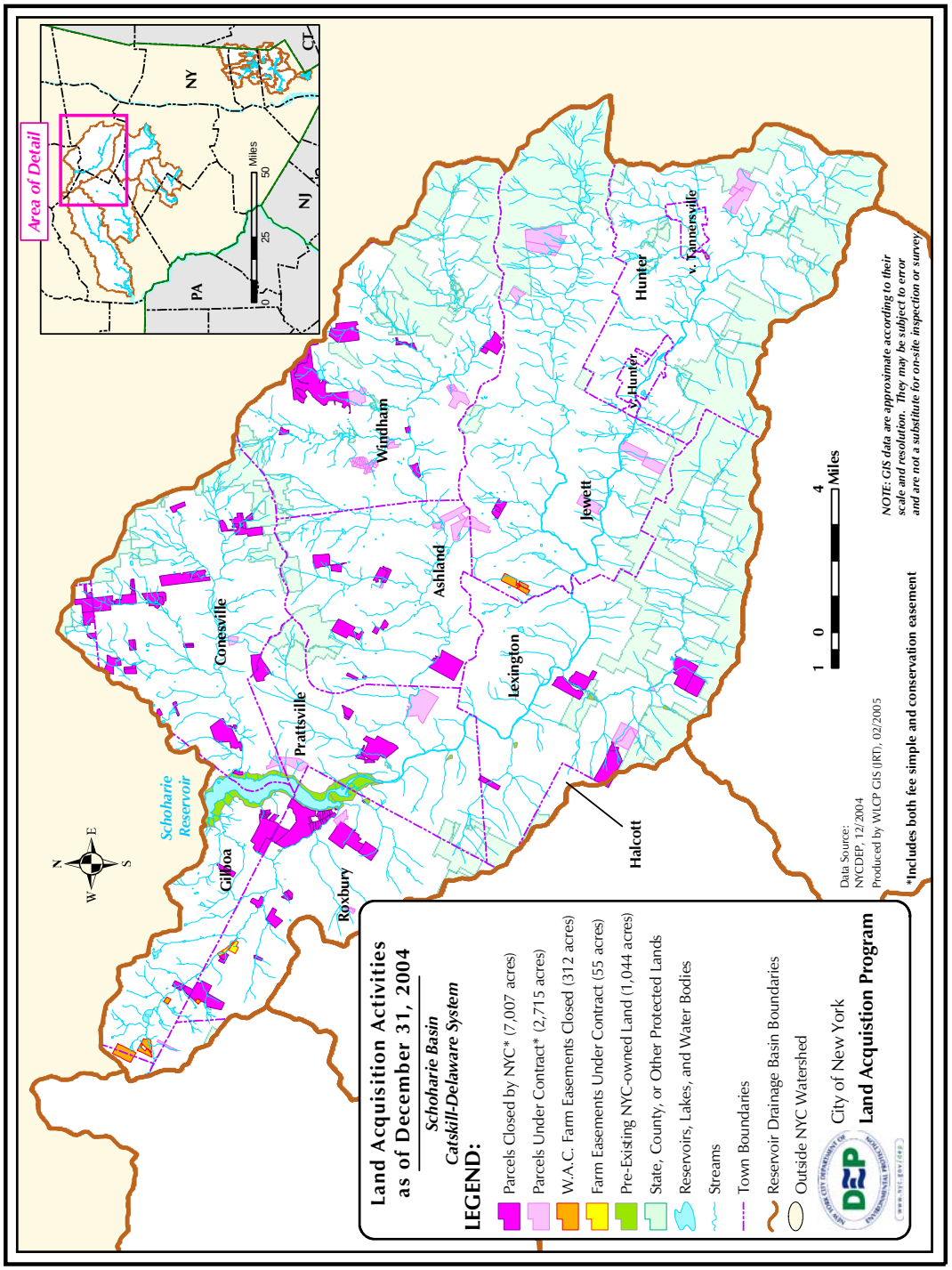


Figure 4.8. Land acquisition activities in the Schoharie Basin as of December 31, 2004.

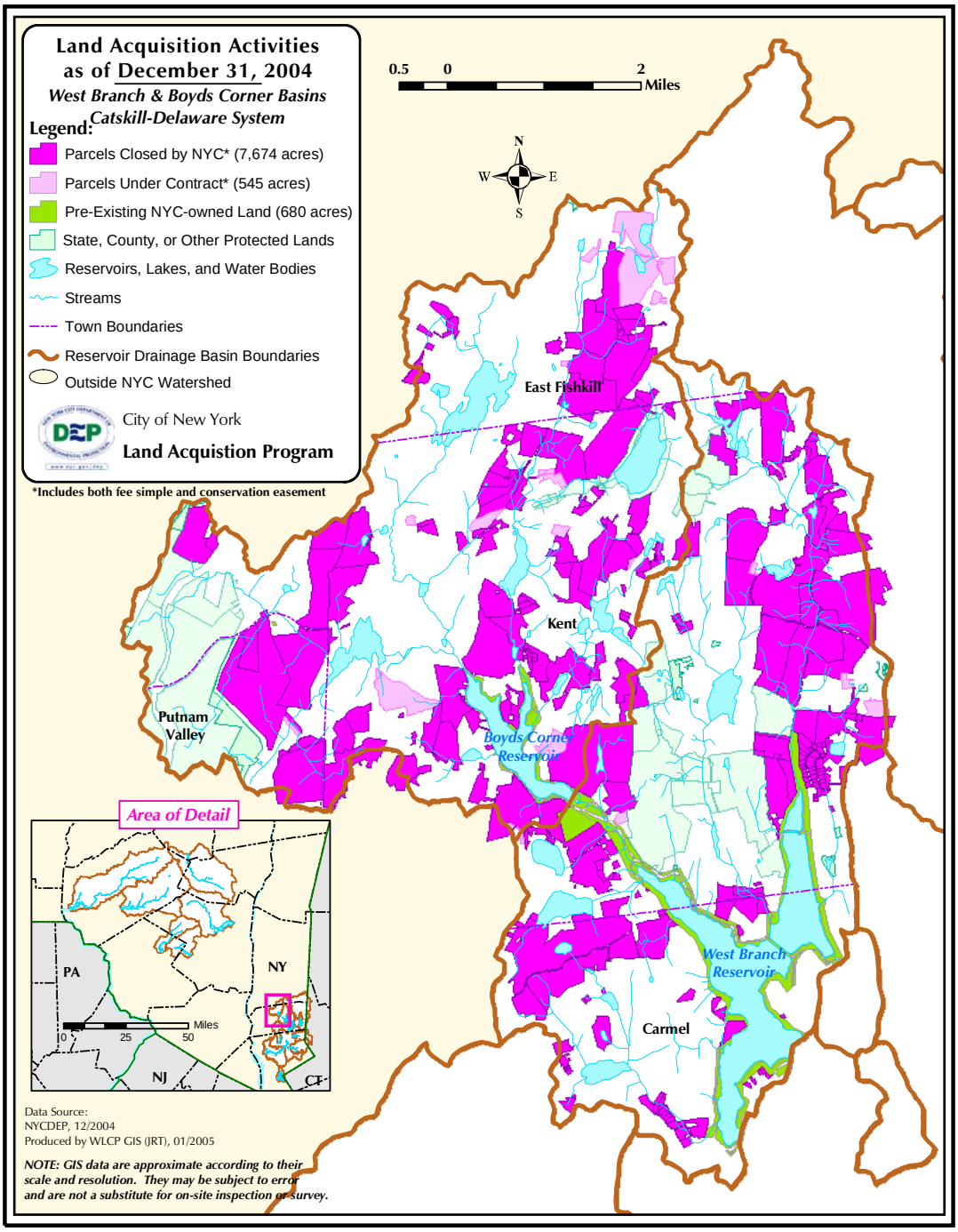


Figure 4.9. Land acquisition activities in the West Branch and Boyd Corners Basin as of December 31, 2004.

4.3 Watershed Agricultural Program

The Watershed Agricultural Program is a comprehensive effort to develop and implement pollution prevention plans on 85% of the commercial farms[1] in the City's Catskill/Delaware watershed. 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 NYC 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.

Largely 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 sub-contractual agreements with the Council.

4.3.1 FAD Program Goals

The chart below summarizes the accomplishments to date of the Watershed Agricultural Program (WAP) towards meeting the goals and milestones of the November 2002 FAD. (See attached WAP activity map to see the extent of the programs accomplishments including: WFPs approved, commenced plan implementation, farms substantially implemented and plans that had follow-up visits in 2004)

1. "Commercial Farm" is defined as earning greater than $10,000 in annual gross farm income.

Table 4.4. Accomplishments to date of the Watershed Agricultural Program

Task	Farms	Sub-Farms	Total Farms	FAD Goal 12/31/04
Original Farm Sign-ups	329	-	329*	Monitor
Estimated Number of Watershed Farms	260	41	301	
Current Eligible Sign-ups* (% Of Total Farms)	247	41	288 (95.3%)	Monitor
New Sign-ups	2	0	2	
WFP Implementation Agreements (% Of Total Farms)	243	41	284 (94%)	All Participating Farms
WFPs Commenced Implementation				
Active	181	36	216	All
Under Revision	15	4	19	Participating
Inactive	35	1	36	Farms
Total	231	41	272	
WFPs Substantially Implemented				
Active	109	8	117	
Under Revision	15	4	19	
Inactive	42	1	43	
Total	166	13	179	219
WFP Annual Follow-up	118	33	151	181

*Note: 82 farms that have signed up are no longer eligible for the program due to a change in the farm operation (i.e. farm is out-of-business, all animals were sold etc.)

There are three milestones that Watershed Agricultural Program did not meet this year even though it continued to maintain an aggressive rate of implementation.

1. Commenced Implementation: The goal for 2004 was for 288 (or all participating) farms to have commenced implementation. The number achieved was 272 farms (in addition, there are 7 farms that went out of business before any implementation occurred). This leaves six approved WFPs that have no documented implementation. One of these farm's WFPs was just approved in 2004; two others had BMPs contracted in 2004 that were not completed, but should be in early 2005. Another farmer decided he wanted to revise his barnyard project after it had been designed and put out to bid this spring. The WAC engineering staff is working with this last farmer to revise the plan and hope to have his barnyard implemented in 2005. The two remaining farms have been difficult to contact. Planners

have recently contacted these two farmers and plan to revise their WFPs this year and schedule implementation for 2005. Figure 4.10 tracks the program accomplishments for this milestone from 1999 through 2004.

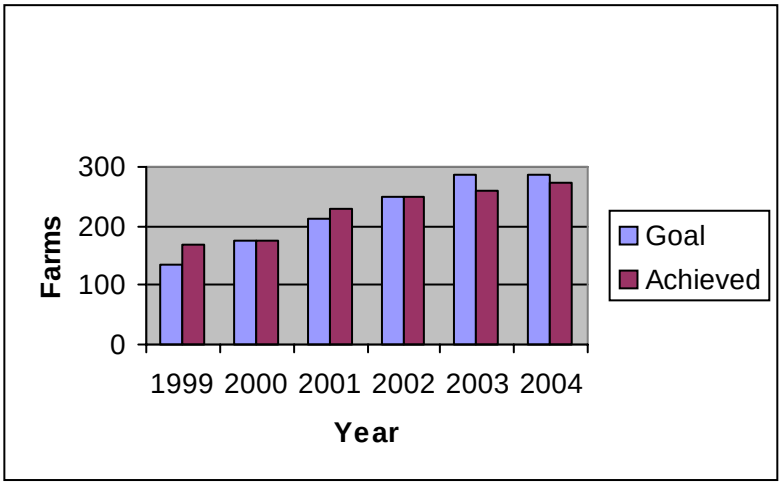


Figure 4.10. Farms with commenced implementation.

2. Farms Substantially Implemented: There are now 179 farms substantially implemented, forty short of the FAD milestone of 219. Figure 4.11 tracks the accomplishments made towards achieving this milestone. Recently, DEP and WAC staff met with each Planner to review all the WFPs to determine what would be needed to achieve substantial implementation. This analysis showed that there are approximately 15 farms that have BMPs in their WFPs that are no longer needed. Once these BMPs are removed from the plans, these plans would become substantially implemented. Presently, the only mechanism to remove BMPs is through the WFP revision process. In the past the planners did not place a high priority on revising plans on farms that have recently sold their dairy cows or other livestock, because a significant portion of the environmental issues are removed when the animals are no longer on the farms. WAC has asked the planners to give the highest priority to revising plans in 2005, which will result in substantial implementation.

A second impediment to reaching this milestone is the addition of new BMPs through WFP revisions. WAC has approved 101 plan revisions over the last two years, which included 344 new practices at a potential cost of $2.6 million. These new BMPs often delay WFPs from meeting the definition of "Substantially Implemented." WAC is developing program guidance that will limit new BMPs that are presented in plan revisions from being funded in the current DEP-WAC contract term. This will allow WAC to concentrate on implementing BMPs currently in approved WFPs.

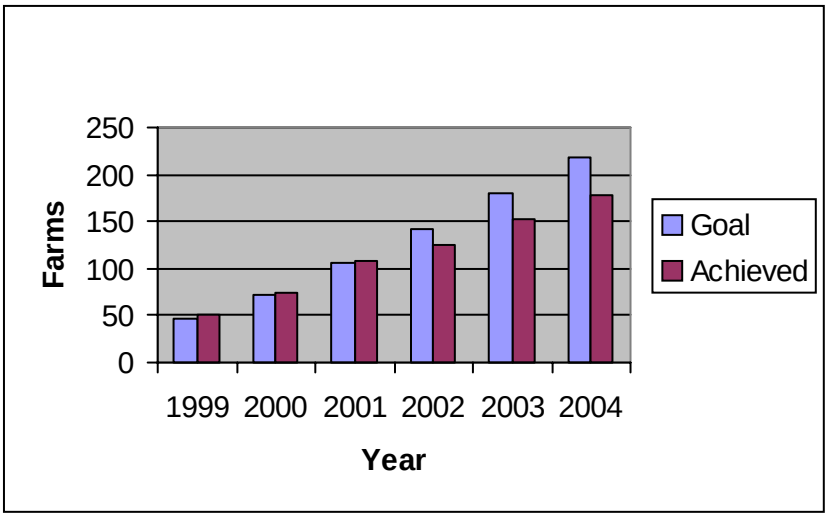


Figure 4.11. Farms substantially implemented.

3. WFP Annual Follow-ups: There were 151 farms (including 33 sub farms) that had an annual follow-up in 2004; the milestone was 181. It should be noted that 28 farms that are known to be inactive did not have an annual follow-up because the farm status is unchanged. The planners have also piloted a Comprehensive Annual Status Review on 25 farms in 2004. The comprehensive review includes an on-site inspection of all BMPs and a review with the farmer of operation and maintenance requirements for each BMP. There is a substantial amount of additional time required to complete the comprehensive review compared to what was done in the past. It is expected that a comprehensive review could be completed on each farm once every three years. An analysis of the first 25 pilot comprehensive reviews will be presented to WAC for discussion in March 2005.

4.3.2 Status of Farm Numbers in the Watershed

As of December 31, 2004, there were 284 farms (including 41 "sub-farms") with WFP agreements, representing 94% of commercial farms in the watershed. There were two new farms that signed up (one previously not identified and the second was a new farming operation) to participate in the program in 2004, and program staff developed WFPs for these two farms. There are four other farms that have signed up but still do not have a plan. One plan is scheduled to be presented to the Council for approval in February and another should be completed in 2005. The two remaining farms have been unable to come to agreement on a final plan. WAC staff will be asked by DEP to continue to work with these landowners to see if a plan can be agreed upon that is acceptable to both WAC and the farmer.

There are currently 288 (including 41 sub-farms) commercial farms signed up for the program out of a possible 301 farms. This represents 95.7 percent participation rate. The original FAD goal was to have 85% participation.

4.3.3 BMP Implementation

Over the past twelve years (1992-2004) WAP has implemented 2,863 BMPs at a cost of $22.1 million on over 231 commercial farms. This past year alone 329 BMPs were implemented at a cost of $3.4 million. The majority of the design and implementation oversight of BMPs is accomplished with WAP staff.

4.3.4 Conservation Reserve Enhancement Program (CREP)

There are now under contract a total of 1,623.8 acres of riparian buffers. In addition, there are more than 150 acres of riparian buffers that have been approved by the Council that are in the CREP contract development pipeline. There are a total of 145 contracts of which 114 are complete and have all the associated BMPs implemented. The location of these contracts can be seen on the attached CREP Activities Map.

In past reports the number of stream miles protected by CREP buffers was included. However, DEP has recently determined that the USDA conversion factor that was used to estimate the stream miles may have overestimated the length of the buffers and consequently underestimated their width. Based upon GIS data analysis conducted by Delaware County SWCD staff, the estimated stream miles protected is approximately 150.

4.3.5 Farmer Education Program

WAP has continued its Farmer Education Program that provides educational opportunities for watershed farmers in the following areas related to pathogen and nutrient management:

- New York State Cattle Health Assurance Program (NYSCHAPS): 36 farms are participating in NYSCHAPS, which is a State sponsored program that brings a farmer and his veterinarian together with State veterinarians to develop a herd health plan that is specific to the individual farm.
- Precision Feed and Forage Management: The second 2-day course entitled, “Precision for Profit, Cow Health and the Environment”, was held in four locations (Delhi, Hobart, Liberty and Walton) in February and March. A total of 19 farmers (13 watershed and 6 non-watershed farmers) participated in the course. In addition, five agri-service dairy nutritionists attended the workshop, which is important since the private sector does most of the dairy ration balancing for farms in the Catskills.

  The workshop was hands-on and featured a full size bovine digestive tract and over 25 bags of feed ingredients from cotton seeds to wheat mids. Topics covered included, cattle nutritional requirements, rumen physiology and biology, nutritive qualities of feed ingredients, ration balancing, feeding systems and the importance of not over feeding phosphorus. During the course each farmer completed a tactical plan to improve his or her forage and feeding system.

- Calf Assess: A series of three workshops were held in Trout Creek, Delhi and Bovina to teach behavioral and management changes on farms to maximize calf health. These classes were attended by 19 watershed farmers as well as several from outside the watershed.
- Cow Assess: CCE of Delaware County also developed this course on transition cow care. This

course focused on preparing the cow for freshening and ensuring a healthy calf and colostrum, as well as managing and preventing herd health issues. Fourteen watershed farmers participated.

- The Precision Feeding for Profit, Cow Health and the Environment Tour was held on August 4th. The focus of the tour was to visit farms that are successfully feeding high-forage rations and producing high quality forage. There were 30 farmers and agri-service representatives who participated in the tour.
- Small Farm Program Participant Education: The "Smart Choices for Small Farms" workshop was held at three different locations throughout the watershed this fall to educate small farm operators who have completed either a Tier I or Tier II Agricultural Environment Survey about the various programs offered by WAC. Forty-one people attended and a fourth meeting is being considered for the Grahamsville area.

4.3.6 Small Farm Program

WAC has approved 37 Small Farm Whole Farm Plans (WFPs). Ten of these farms had originally signed up for the "large farm" program, but due to a change in their operation were no longer eligible as such. To date, 27 of the 37 approved WFPs have commenced BMP implementation. In 2004, 44 BMPS have been installed at a cost of $260,724.00.

4.3.7 Croton Agricultural Program

WAC has approved to date 22 WFPs on farms in the EOH watersheds and commenced implementation on 12 farms. There were 29 BMPs implemented in 2004, at a cost of $371,193.00. Seven WFPs are substantially implemented.

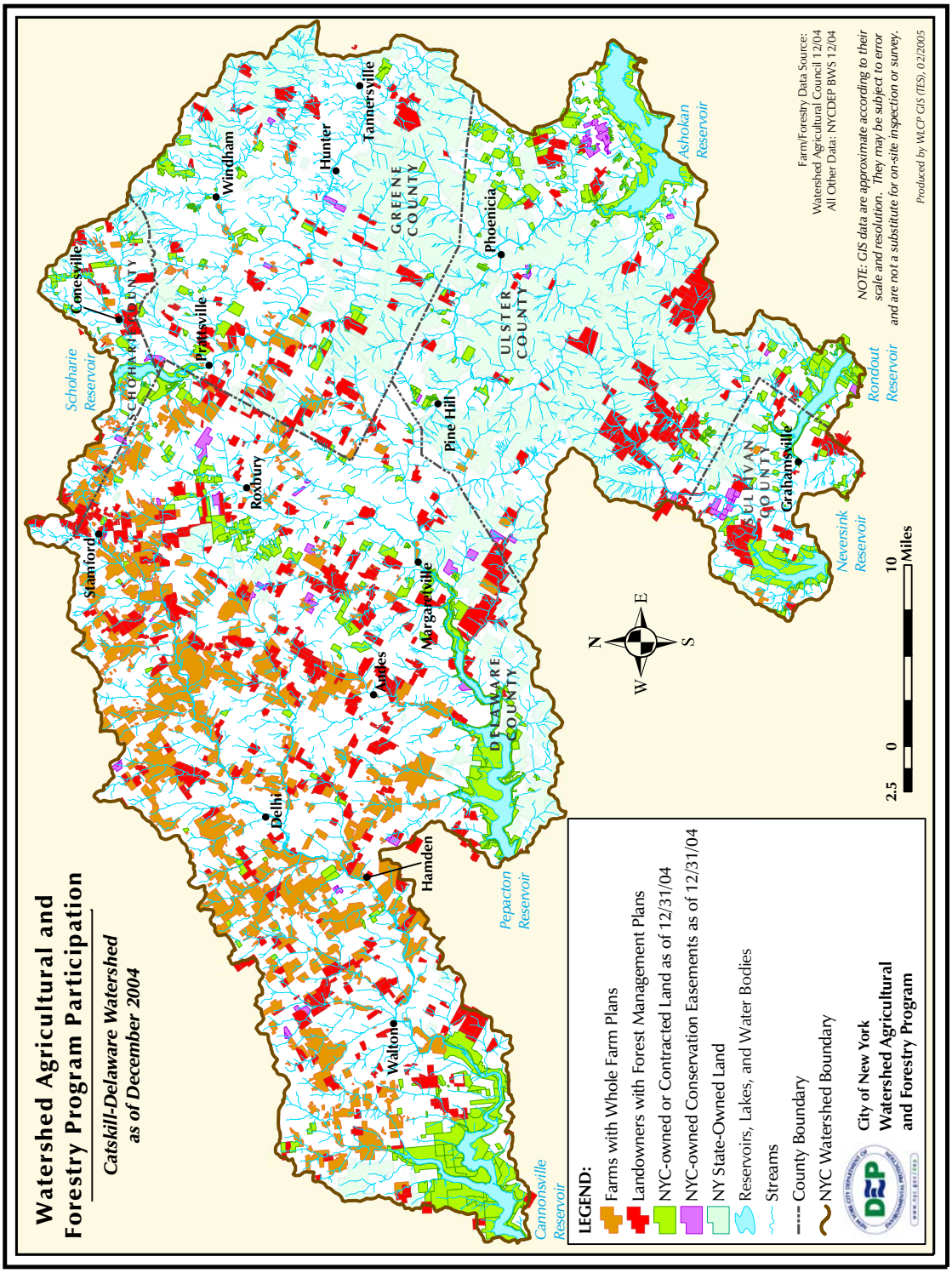


Figure 4.12. Watershed Agricultural and Forestry Program Participation, Catskill-Delaware watershed as of December 2004.

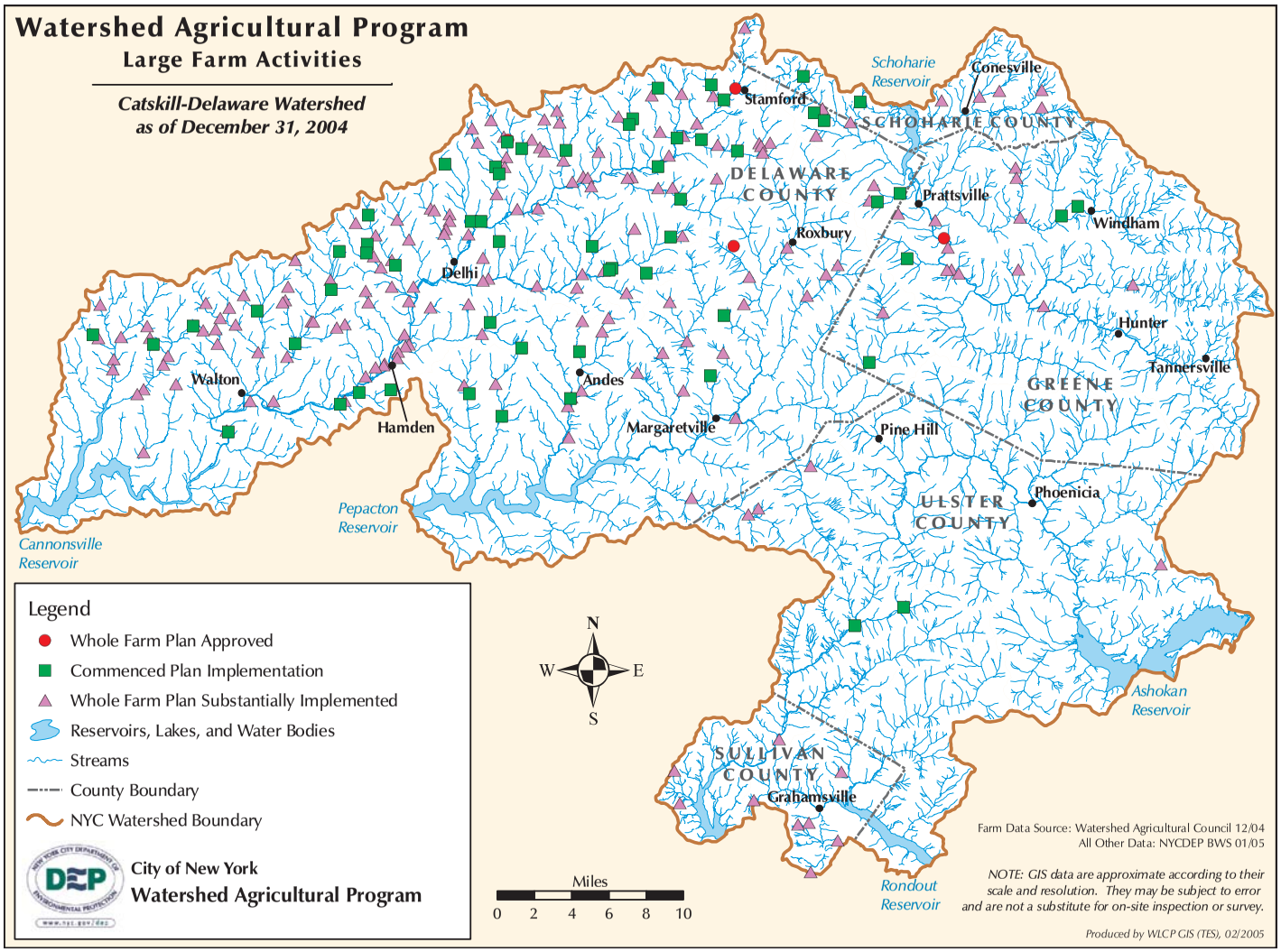


Figure 4.13. Watershed Agricultural Program. Large Farm Activities. Catskill-Delaware watershed as of December 31, 2004.

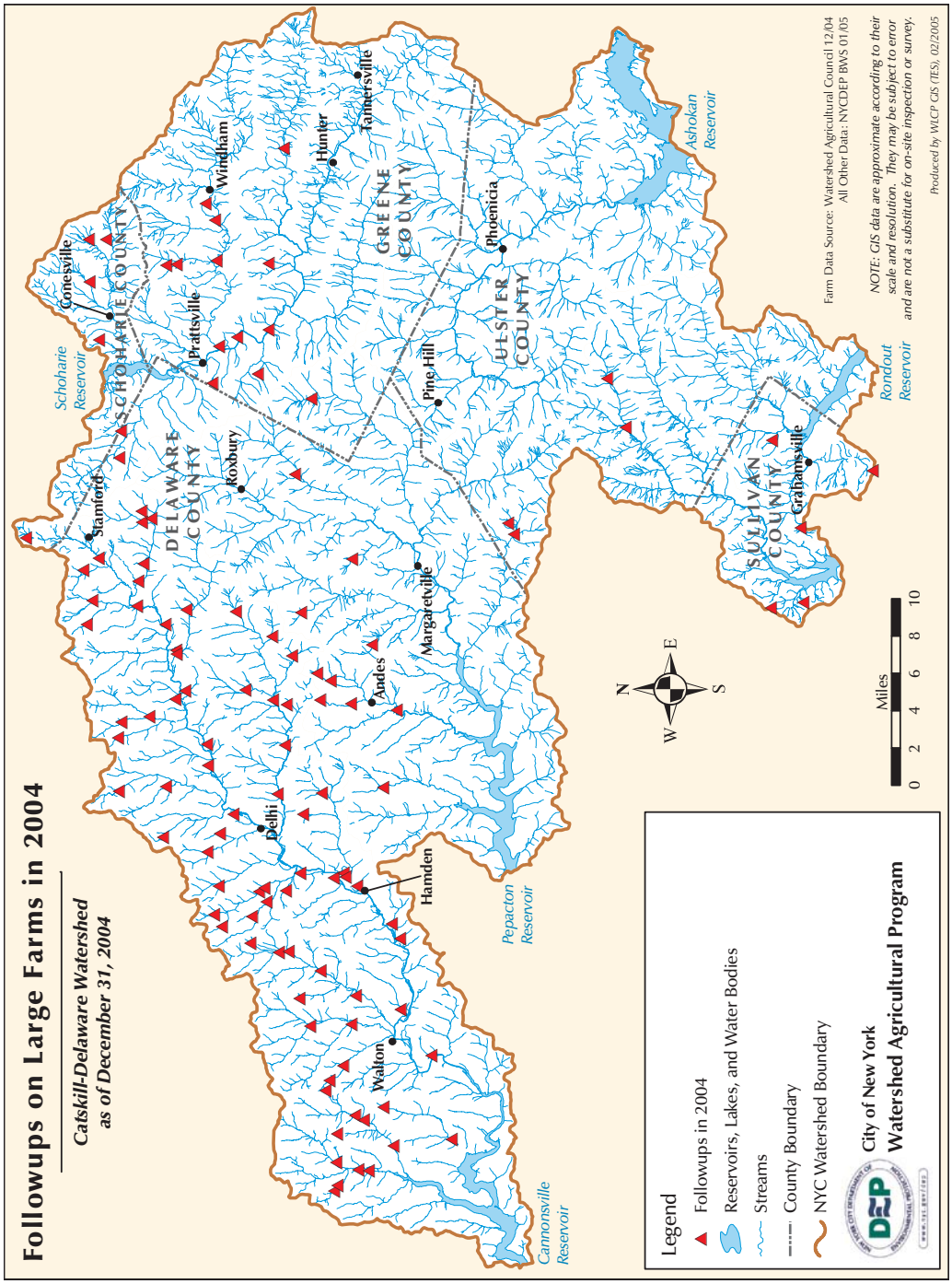


Figure 4.14. Followups on Large Farms in 2004. Catskill-Delaware watershed as of December 31, 2004.

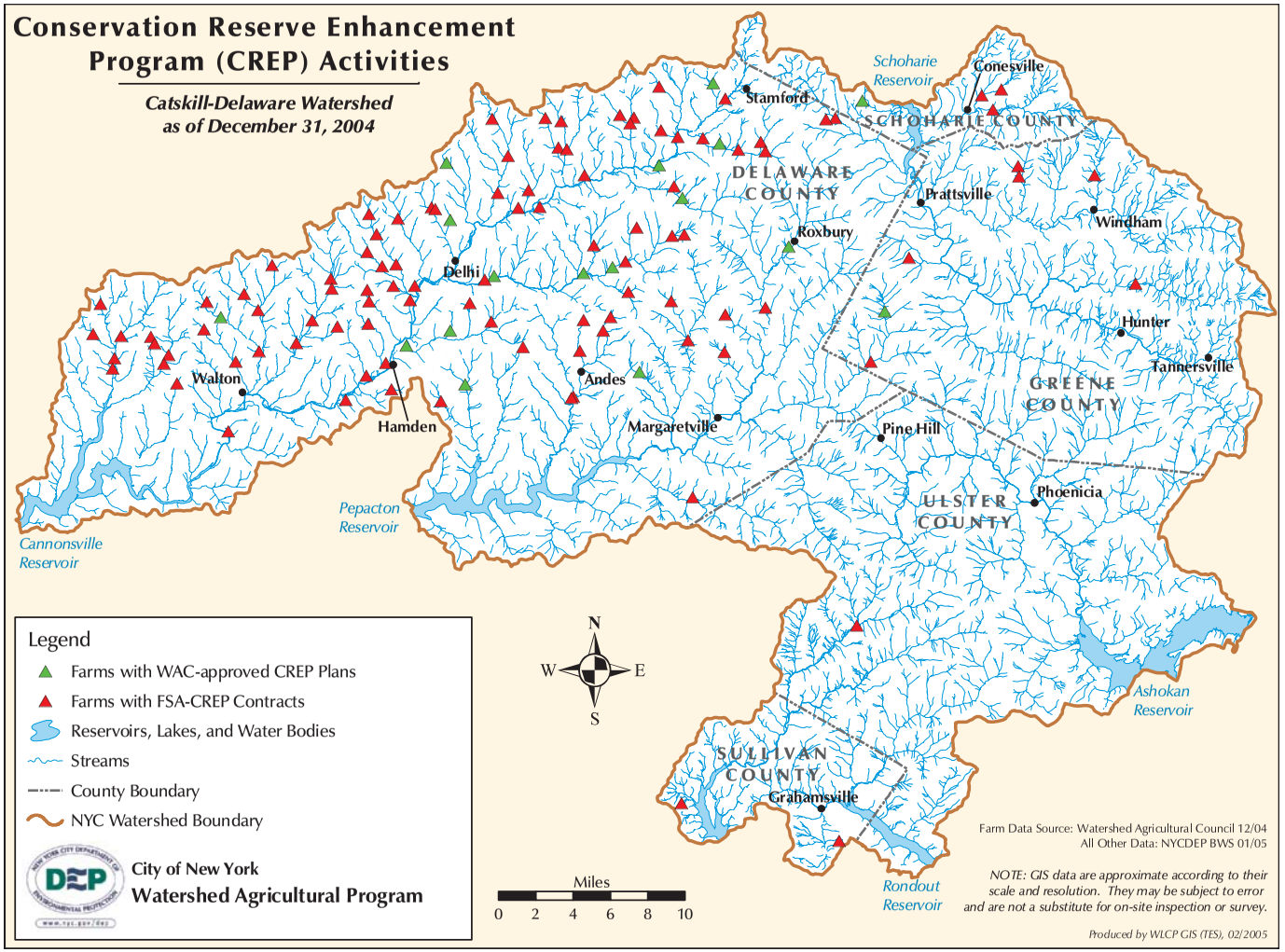


Figure 4.15. Conservation Reserve Enhancement Program (CREP) Activities, Catskill-Delaware watershed as of December 31, 2004.

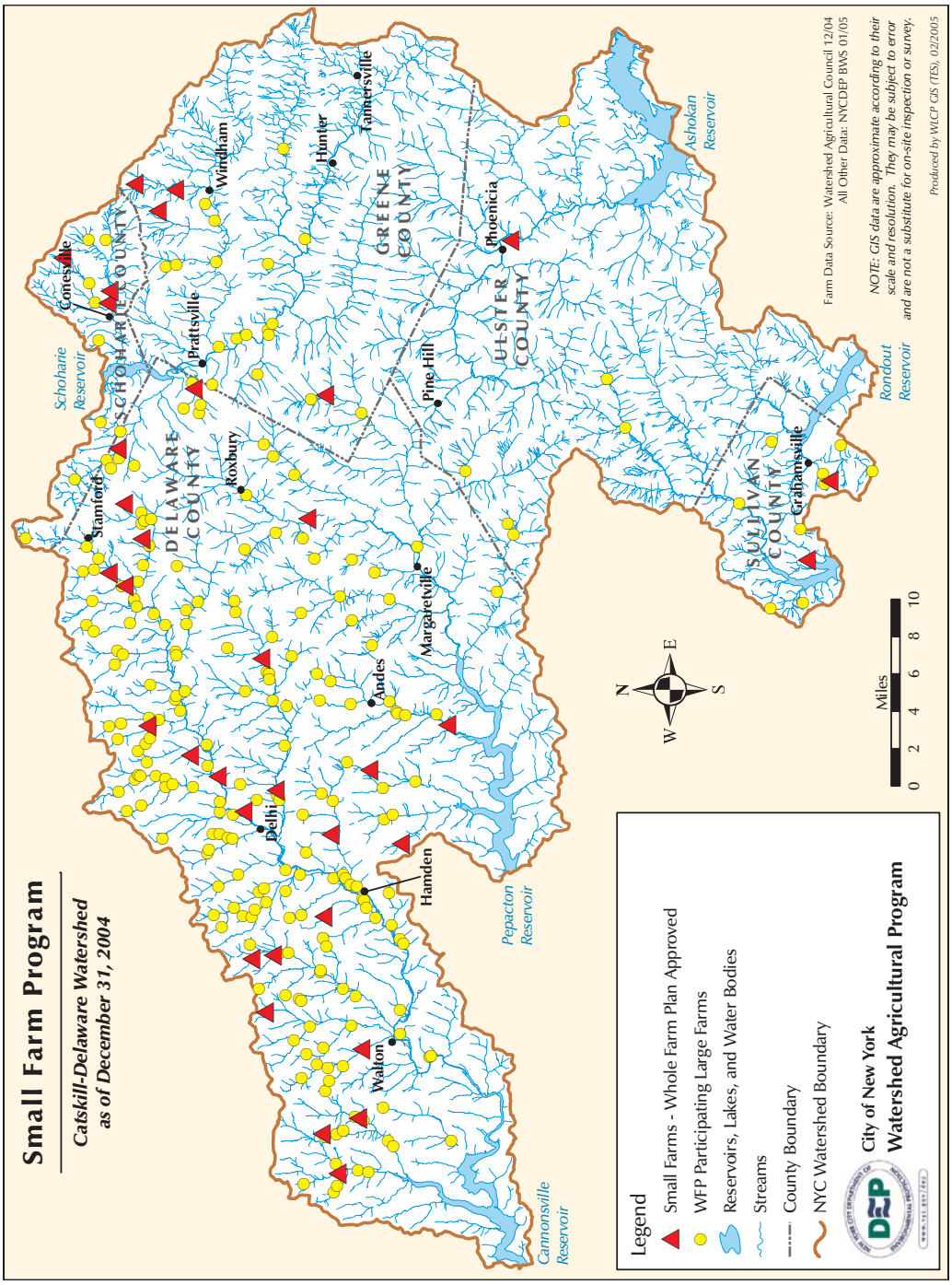


Figure 4.16. Small Farm Program. Catskill-Delaware watershed as of December 31, 2004.

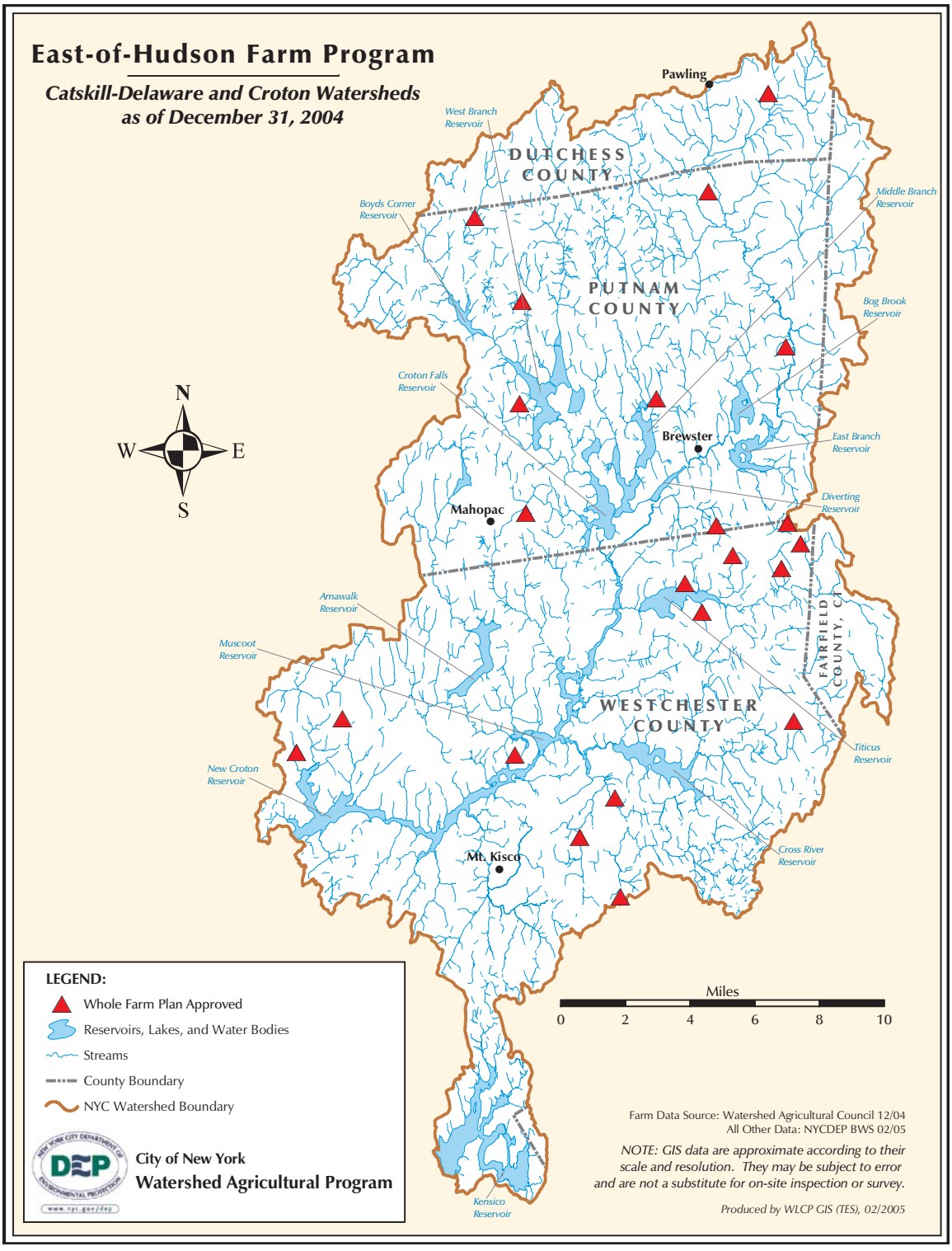


Figure 4.17. East of Hudson Farm Program. Catskill-Delaware and Croton watersheds as of December 31, 2004.

4.4 Forestry Program

The Watershed Forestry Program is a partnership that supports well-managed working forests as a beneficial land use for watershed protection. Since 1997, DEP has contracted with the Watershed Agricultural Council (WAC) to administer and implement four core program tasks: (1) forest management planning; (2) BMP implementation; (3) logger training; and (4) research, demonstration and education. Through WAC, the Forestry Program also receives matching grants from the USDA Forest Service (USFS) to strengthen the economic viability of the wood products industry and to promote forest stewardship through education and outreach.

During 2004, the Watershed Forestry Program underwent a two-day strategic planning exercise as part of WAC's broader long-term strategic planning effort covering all of its core programs. As a result of this process, the Forestry Program developed a new set of operational guidelines that clarifies programmatic policies, updates and revises certain participant eligibility requirements, and increases certain WAC cost-sharing rates to reflect current program priorities and emerging audience needs (especially in the East of Hudson watershed). Specific highlights of these programmatic policy changes will be discussed throughout this report.

Also during 2004, the Watershed Forestry Program worked with the USFS and New York Forest Owners Association (NYFOA) to hire a second WAC forester to be located East of Hudson and dedicated entirely to working in the New York portion of the Hudson Highlands region. The new Hudson Highlands forester position will be funded entirely through the USFS beginning in winter 2005. In addition, WAC hired a forestry intern during the second half of 2004, who assisted DEP with its 5-year plan evaluation report and also worked with both WAC foresters to conduct BMP monitoring and other field work. The internship was considered by WAC and DEP to be highly successful and is planned for replication in 2005.

4.4.1 Forest Management Planning

The Watershed Forestry Program provides training to foresters and funding to landowners to encourage their development of WAC forest management plans. During 2004, WAC's Forest Management Planning Program was expanded to incorporate several new policies, including higher cost-sharing rates for East of Hudson plans, revised cost-sharing rates for West of Hudson plans, expanded eligibility requirements that allow villages or towns (including their school districts) to apply for management plan funding, and new riparian planning requirements for all WAC Forest Management Plans completed after January 2005. This latter requirement also applies to all WAC upgrades of pre-existing stewardship plans (not originally developed through WAC) and all 5-year WAC updates of pre-existing WAC plans.

Figures 4.18a and b summarize the annual accomplishments of the WAC Forest Management Planning Program. A total of 438 plans have been completed to date covering 81,381 total acres, of which 63,275 acres are forested. These figures include 3 plan upgrades completed in 2002, 7 plan upgrades completed in 2003, and 11 plan upgrades completed in 2004. These figures

do not include six plan updates that were completed for the first time during 2004 for landowners having a pre-existing WAC plan at least five years old. These six WAC plan updates represent 1,331 total acres and 952 forested acres.

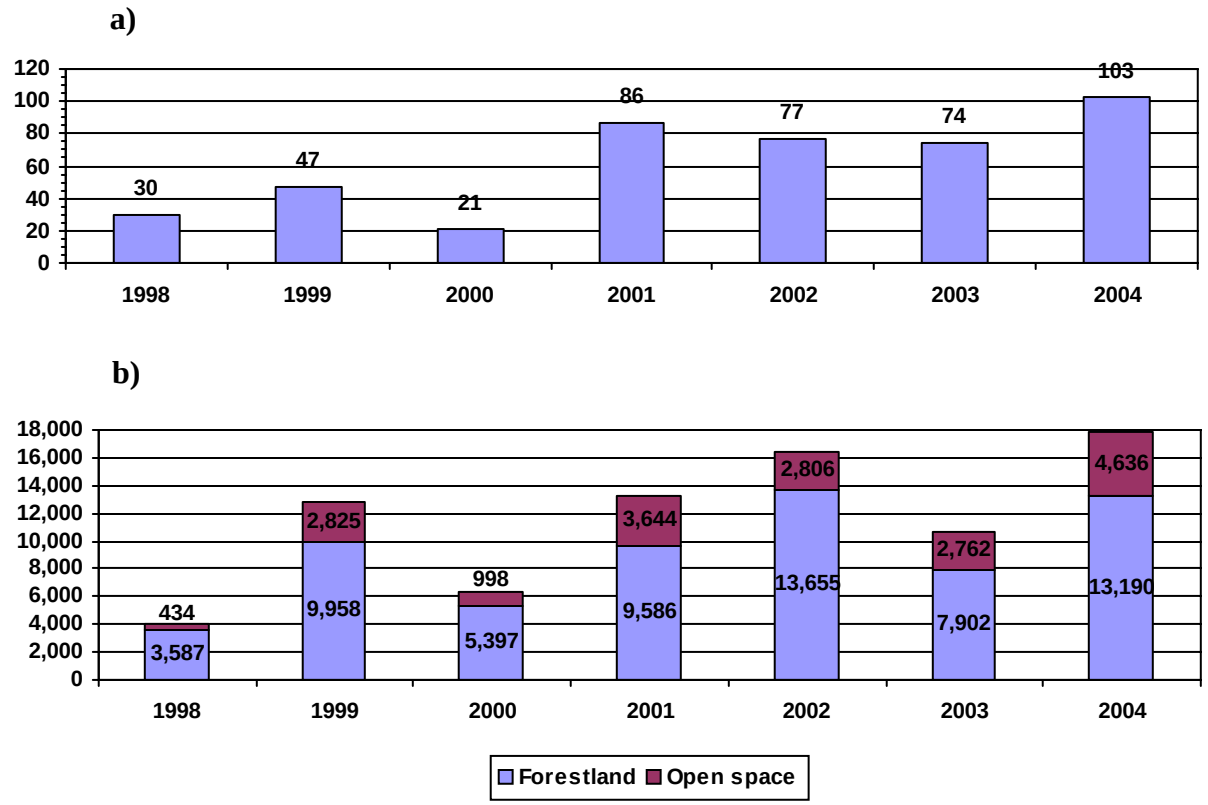


Figure 4.18. a) Number of WAC forest management plans completed during 1998-2004, b) Acreage enrolled in WAC forest management plans during 1998-2004

Forester Training

Figure 4.19 summarizes the annual forester training accomplishments of the Forestry Program to date. During 2004, WAC sponsored four training workshops (including one riparian training workshop) that were attended by 36 participants. A total of 35 foresters are currently trained to write WAC forestry plans. Twenty-three of these foresters are trained to write riparian plans and at least 9 foresters provide services to East of the Hudson landowners.

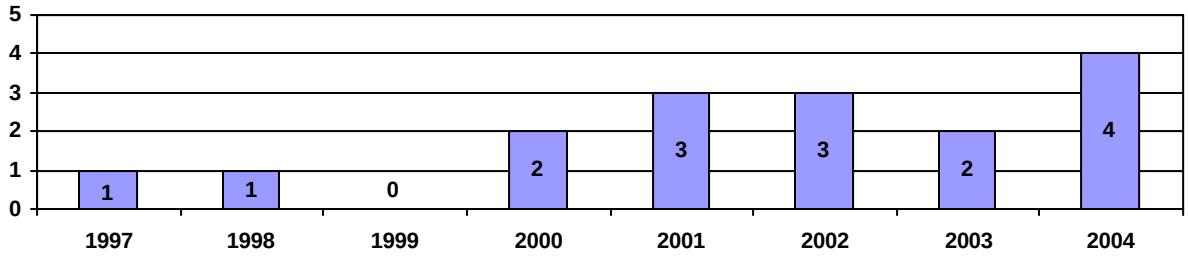


Figure 4.19. Number of watershed forester training workshops held during 1997-2004.

Riparian Planning

Figures 4.20a and b summarize the annual riparian planning accomplishments of the Forestry Program since WAC began cost-sharing these plans in 2001. During 2004, 14 riparian plans were completed covering 329 riparian acres. To date, 27 riparian plans have been completed covering 1,839 riparian acres. It is worth emphasizing that riparian planning will become a standard requirement of all WAC forest management plans beginning in 2005.

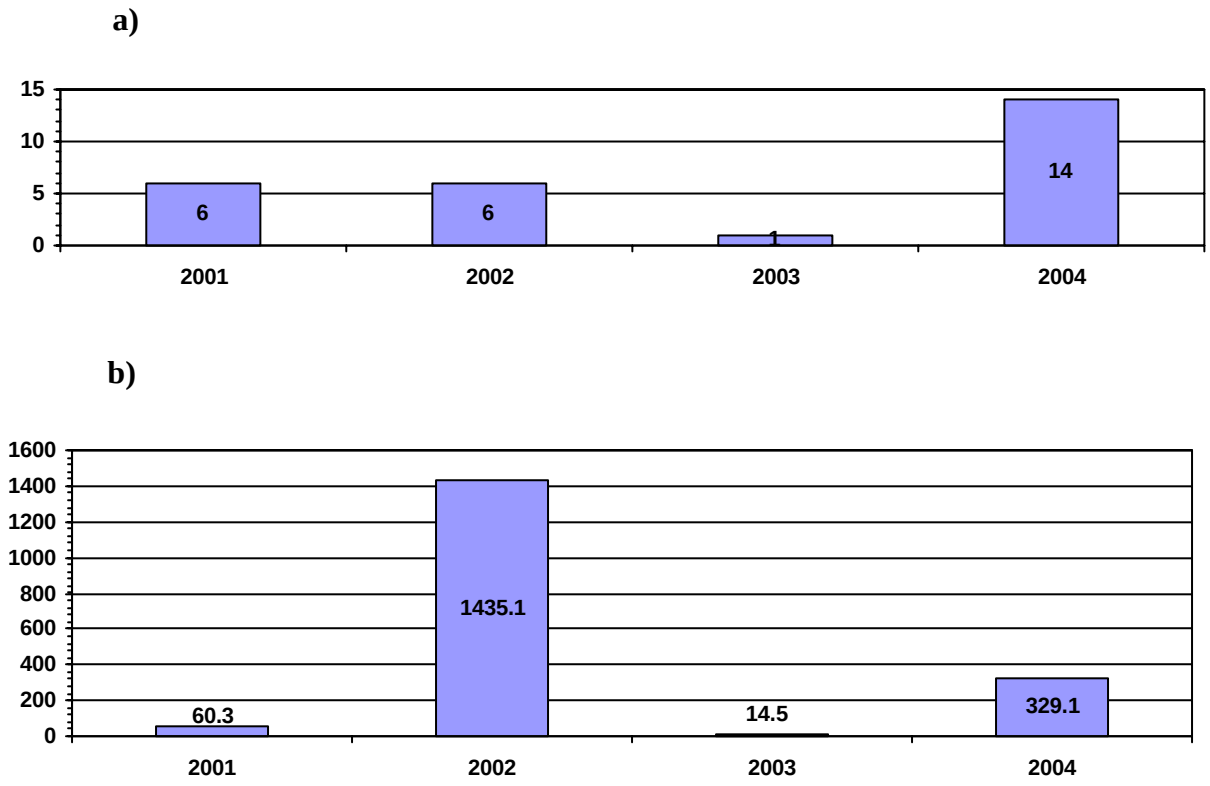


Figure 4.20. a) Number of WAC riparian plans completed during 2001-2004, b) Acreage enrolled in WAC riparian plans during 2001-2004.

5-Year Plan Evaluation

During 2004, DEP and WAC evaluated the 5-year implementation status of 47 WAC plans developed during 1999. The evaluation found that two landowners (4%) have entered into permanent land conservation easements through WAC's Agricultural Easement Program, two landowners (4%) are currently negotiating property transactions (one fee simple and one easement) with DEP's Land Acquisition Program, two landowners (4%) have received federal cost-sharing through the Forest Land Enhancement Program (FLEP) to implement forest stand improvement work on their properties, four landowners (9%) have received WAC cost-sharing to update their 5-year old plans, and seven landowners (15%) have participated in a WAC road BMP cost-sharing program representing eight different projects (four timber harvest road projects and four road remediation projects). In addition, 20 of the 40 landowners (50%) who were eligible for the New York State Forest Tax Law (480-a) actually enrolled their WAC plans in this property tax relief program.

4.4.2 Best Management Practice (BMP) Implementation

The Watershed Forestry Program offers cost sharing, technical assistance and other incentives to loggers and landowners for implementing forestry BMPs such as portable bridges, geotextile road fabric, silt fencing, pipe culverts, open-topped culverts, non-petroleum chainsaw oil, rubber tire land mats, and rubber belt water deflectors. Through WAC, the Forestry Program also supports the construction of new timber harvest roads, the remediation of existing forest roads having erosion problems, and the planting of riparian buffers on stream restoration projects throughout the watershed. During 2004's strategic planning process, WAC's forestry BMP programs were modified to incorporate new preferential cost-sharing rates and eligibility requirements for watershed loggers who are fully certified under the state-wide Trained Logger Certification Program. These modifications are intended to provide increased incentives for those loggers who voluntarily complete the Trained Logger Certification program.

Portable Bridges

Figure 4.21 summarizes the annual portable bridge accomplishments to date. During 2004, WAC loaned out 9 portable bridges (6 short-span and 3 long-span) and cost-shared 3 portable bridges on logging sites throughout the watershed.

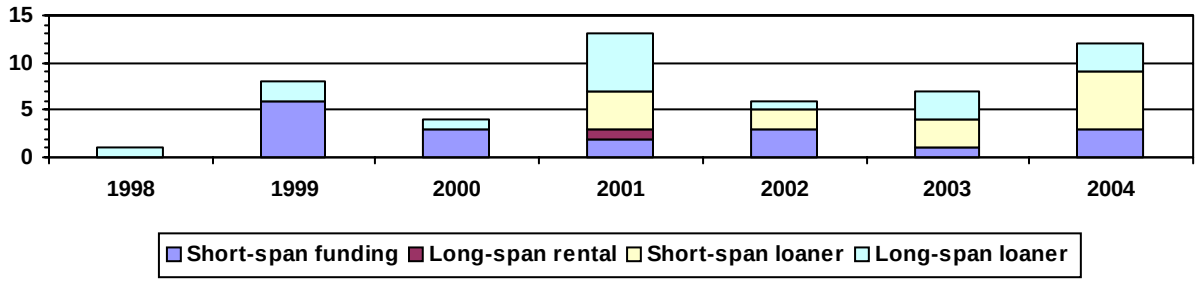


Figure 4.21. Number of portable bridge projects implemented during 1998-2004.

Road BMP Projects

Figure 4.22 summarizes the annual road BMP accomplishments to date. During 2004, 16 road projects were completed representing 20.7 miles of properly installed or repaired forest access roads containing 822 water bars, 77 broad-based dips, and 970 linear feet of geotextile fabric, silt fencing and pipe culverts. These 16 projects also stabilized 10 acres of land surrounding the roads. To date, 75 road projects have been completed representing 110.6 miles of properly installed or repaired forest access roads containing 3,382 water bars, 286 broad-based dips, and 6,840 linear feet (1.3 miles) of geotextile road fabric, silt fencing and pipe culverts. These 75 projects stabilized 44 acres of land surrounding the roads.

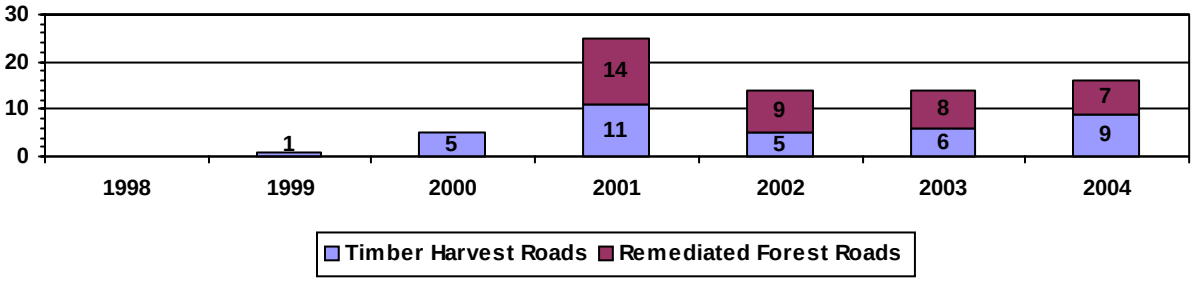


Figure 4.22. Number of road BMP projects completed during 1998-2004.

Riparian Buffer Grants

In 2003, the Forestry Program awarded grants to Greene County and Sullivan County Soil and Water Conservation Districts (SWCDs) to implement riparian buffer stream restoration projects in the Batavia Kill, West Kill, Brandywine, Stony Clove and Chestnut Creek watersheds. Sullivan County completed their Chestnut Creek grant during 2004, whereas Greene County will be continuing project implementation throughout 2005.

4.4.3 Logger Training

The Forestry Program partners with the Catskill Forest Association (CFA) and New York Logger Training (NYLT) to promote and support voluntary logger participation in the state-wide Trained Logger Certification Program. To become fully certified, loggers must complete three courses: Forest Ecology & Silviculture (FES), First Aid & CPR, and Chainsaw Safety/Game of Logging (GOL). Figure 4.23 summarizes the logger training accomplishments of the Forestry Program to date. During 2004, CFA conducted two FES workshops, one CPR workshop, and 7 GOL workshops (Levels 1-4) that were attended by nearly 100 participants. In addition, WAC and NYLT sponsored a Logger Rescue workshop on DEP property that was attended by 24 participants. According to NYLT, there are 26 individuals working in the Catskill/Lower Hudson region who are fully certified as of December 31, 2004. These numbers represent 12% of the 220+ loggers who are estimated to work in the watershed at least a portion of the year.

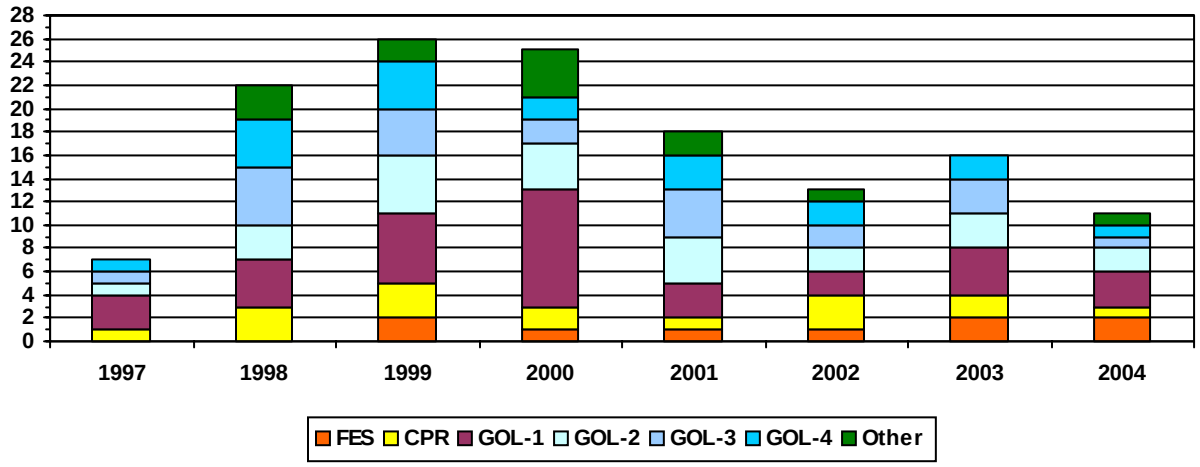


Figure 4.23. Number of watershed logger training workshops held during 1997-2004.

4.4.4 Research, Demonstration and Education

The Forestry Program partners with SUNY College of Environmental Science and Forestry (ESF), Catskill Center for Conservation and Development, Cornell Cooperative Extension, CFA, Frost Valley YMCA, Empire State Forest Products Association (ESFPA), US Geological Survey and the US Army Corps of Engineers to implement a variety of research, demonstration and upstate/downstate education programs throughout the watershed and within New York City.

Model Forests (Research and Demonstration)

During 2004, SUNY-ESF completed forest inventory field work and a 360-degree photo point project at both the Lennox and Frost Valley Model Forests. In addition, the Frost Valley YMCA conducted a number of timber harvests in several of their model forest treatment blocks where SUNY-ESF and USGS have begun researching the effectiveness of applying wood chips

on the forest floor as a potential BMP to sequester nitrate following a timber harvest. At the Nimham Model Forest in Putnam County, the State DEC is currently supporting the operation and maintenance of the SUNY-ESF water quality monitoring station while the remainder of the project has remained on hold for the past year. The Mink Hollow Model Forest project was also placed on hold during 2004.

BMP Monitoring

In 2004, WAC initiated a watershed forestry BMP monitoring project funded through the USFS as part of its national effort to develop a standardized BMP monitoring protocol that is measurable and comparable among states. Of the 10 states participating in the Northeast, WAC is the sole provider of data for New York and the only participant that is not a state agency. With DEP and DEC input, WAC's foresters have gathered data from 42 sampling sites on private, State and City lands where timber harvesting has occurred during the past two years and there was also a stream crossing present. This data was field checked for accuracy with foresters from Massachusetts in preparation for sampling 40 watershed sites in 2005.

Education and Outreach

Figure 4.24 summarizes the major education and outreach accomplishments of the Forestry Program to date. During 2004, the Forestry Program was directly involved with at least 14 workshops, 12 bus tours, 9 outreach events and 3 presentations. Workshops comprise classroom instruction and field-based education for landowners and other upstate/downstate audiences. Examples include landowner workshops, kiln drying classes, interpretive woodswalks, county environmental field days, and the annual Watershed Forestry Institute for Teachers and Green Connections school program. Bus tours primarily include watershed forestry field trips for downstate recipients of a WAC bus tour grant, in addition to other organized tours for interested groups and visiting professionals. Outreach events include promotional and informational events where the Forestry Program is represented as a sponsor or participant. Examples include the Delaware County Fair, Deposit Lumberjack Festival, NYS Forestry Awareness Day, model forest ribbon cutting ceremonies, and various regional or national Woodworking Expos. Presentations include regional, state and national conferences where the Forestry Program is represented as a case study or staff speaking engagement.

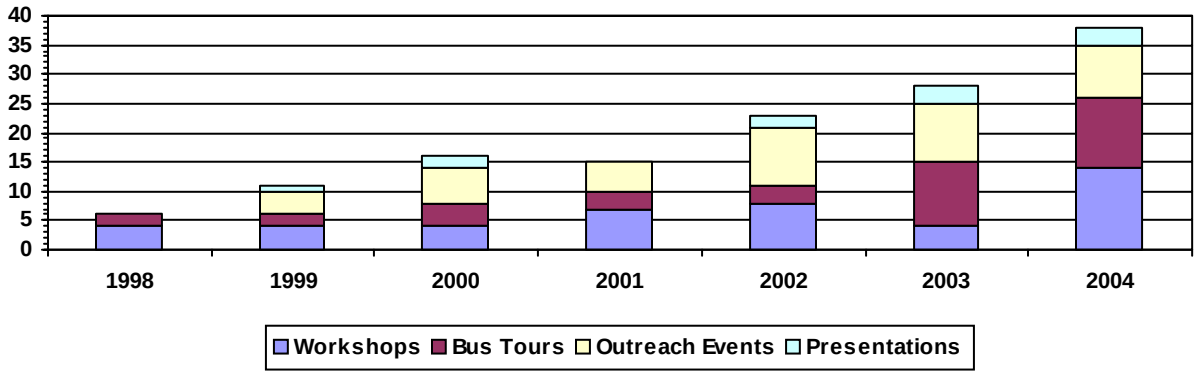


Figure 4.24. Number of forestry education and outreach programs held during 1998-2004.

Forestry Economic Action Grants

The Forestry Program continues to support an Economic Action/Rural Development Through Forestry Grants Program funded by the USFS to improve the economic viability of local wood-using businesses. During 2004, 13 grants were awarded totaling $327,500 and 11 grants were completed. To date, 66 grants have been awarded totaling $2.08 million, of which more than $1.8 million has been delivered to recipients and $2.6 million has been matched locally. Forty-seven grants have been fully completed to date. It is worth noting that USFS funding for the Economic Action Program is being phased out across the country due to shifting federal priorities. As a result, WAC will likely be awarding the last of its economic development grants during 2005. Approximately $236,000 remains available.

Taxation Policy

During 2004, DEP and WAC contributed to the successful efforts of a state-wide coalition to provide one-time reimbursement to local municipalities adversely impacted by the NYS Forest Tax Law (480-a). Of the $3.3 million authorized by the State Legislature as "Small Government Assistance" for local reimbursement, $1,415,000 was provided to the City of Schenectady and $1,885,000 was provided to 26 school districts and 66 towns throughout New York State. Of this latter amount, $100,200 (5%) was provided to 3 watershed school districts (Franklin, Walton and Tri-Valley) and 10 watershed towns (Bovina, Denning, Franklin, Halcott, Hamden, Hardenburgh, Meredith, Tompkins and Walton).

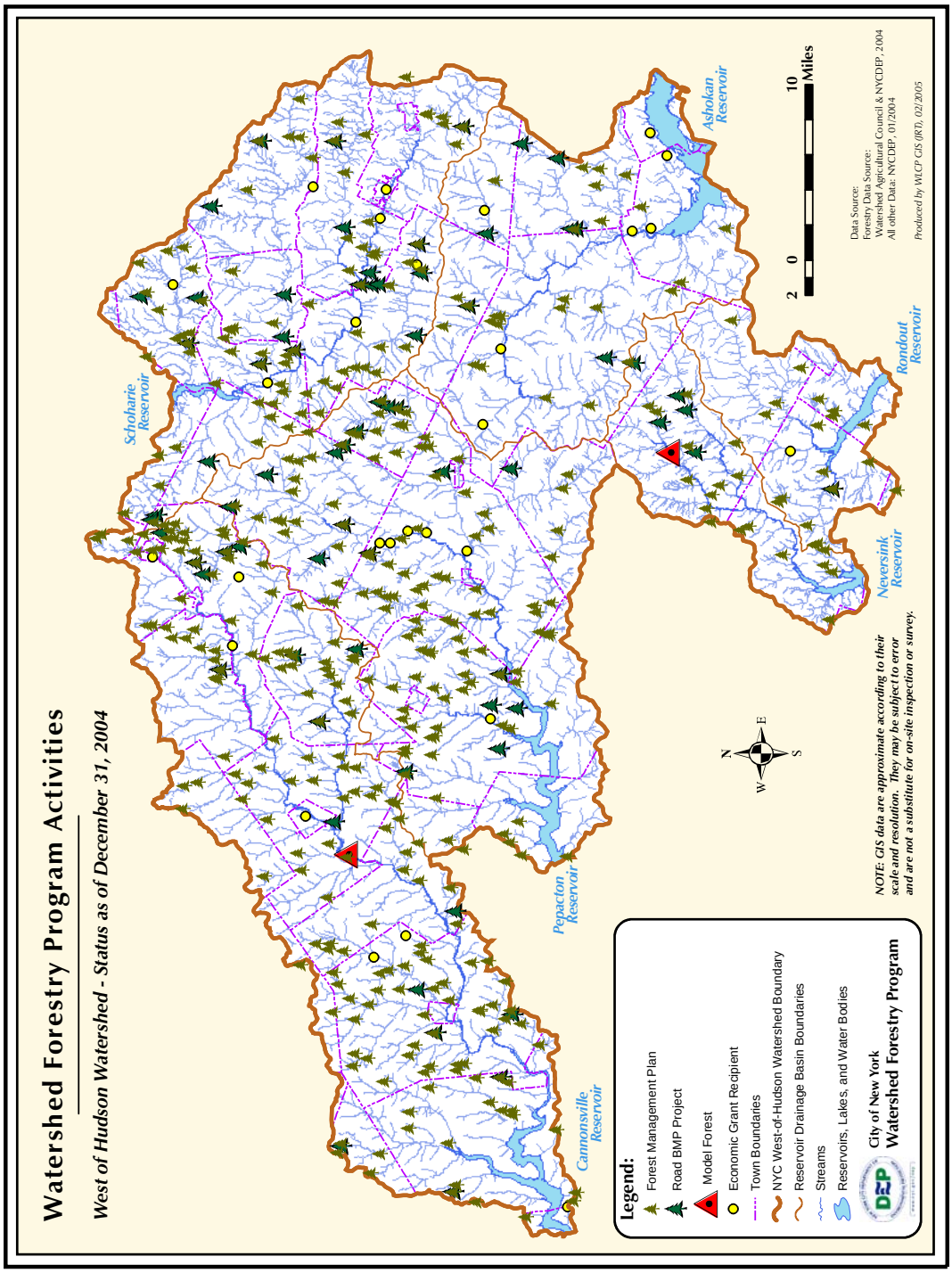


Figure 4.25. Watershed Forestry Program Activities, West of Hudson watershed - Status as of December 31, 2004.

4.5 Stream Management Program

The Stream Management Program (SMP) made substantial progress in 2004 towards accomplishing its extensive set of FAD-mandated stream management plans and demonstration restoration projects. In 2004, management plans were completed in three additional sub-basins, bringing the total to five and extending the geographic area covered by a plan from 5 percent to 31 percent of the Catskill/Delaware watershed. The SMP is on target for completing a total of nine management plans encompassing 65% of the West of Hudson watershed by April 2007. Despite a second extremely wet field season that seriously strained the ability to complete construction of two demonstration projects, the SMP and its Soil and Water Conservation District (SWCD) partners are still on-target to complete the entire set of 13 demonstration projects by December 2007. Six of the 13 are completed at this time.

This report addresses broad themes of progress in 2004. This report does not specifically address the extensive education and outreach component of the SMP. Detailed accomplishments for each stream management planning basin including education and outreach can be found in semi-annual reports to EPA. Detailed descriptions of SMP goals, objectives and program elements are described most recently in the 2003 Biennial Report (December 2003) and the Five Year Plan (December 2001). A more reflective review of progress towards its mission and progress toward five specific program goals is included in the April 2004 Program Evaluation Report.

4.5.1 Stream Management Plans

Stream Management Plans are intended to provide a framework for local long term stewardship of stream-related problems that impact water quality, transportation infrastructure, private property loss and aquatic and riparian integrity. Each plan presents a comprehensive set of recommendations that provides a hierarchy of programmatic, policy and action-related priorities, giving DEP and its partners a road map for accomplishing long term stewardship objectives.

In 2004, management plans were completed by DEP and its SWCD partners for the Stony Clove (Ashokan Basin), the Chestnut Creek (Rondout Basin), and the expansive West Branch Delaware River (Cannonsville Basin). After submission of each plan, DEP evaluated significant findings and recommendations and prioritized those with the greatest promise for protecting or improving water quality. DEP has submitted these summary reports to EPA for the Chestnut Creek and the Stony Clove Creek (September 2004) and will do so for the West Branch Delaware River in July 2005.

The physical setting of each stream within its valley, taken together with land use, is somewhat unique and poses different threats to water quality, requiring unique recommendations. In the Stony Clove, streambed incision into glacio-lacustrine clays caused by extensive channel hardening was considered the greatest threat to water quality. This, combined with weakened

riparian buffers in some areas, led to recommendations to strengthen the nascent Stony Clove Landowners Association, encourage riparian protection, pilot riparian plantings and structural bioengineering in key reaches, and to discourage activities that further exacerbate streambed incision. In the Chestnut Creek, the stream was considered to be in very good condition. Water quality threats were few, but stormwater and enhanced riparian management – via education about invasives and eradication of knotweed – were recommended. In the West Branch Delaware River, the highest priority recommendation is to bring the Conservation Reserve Enhancement Program (CREP) to the remaining farmers in the WBDR's main stem valley areas. To do so, the SWCD and DEP must work together to stabilize streambanks on those farms in order to ensure they are eligible for CREP. These recommendations set the stage for initial implementation of these plans in 2004, described generally below.

Most significantly, a "Phase II," contract was registered with Greene County Soil and Water Conservation District (GCSWCD) for the Stony Clove. This three-year, $316,000 agreement will enable 1) completion of the Lanesville demonstration project, and 2) implementation of priority recommendations in the Stony Clove. Priority recommendations advanced in 2004 included developing a set of specifications for riparian plantings and structural bioengineering in five reaches identified in the stream management plan (the Streamside Planting Project). Plans to plant these sites were held up by delays in DEP's contract registration and then compounded when required Article 15 (DEC) permits were delayed as well. However, this additional time enabled GCSWCD and DEP to improve the planting specifications and prepare a bid package and a comprehensive list of vendors, including landscapers in the region. Planting is planned for 2005.

Also, the Stony Clove team hosted numerous Project Advisory Committee and public review meetings with its draft Plan. The Plan has been very well received with public and agency comment, and the Plan is being finalized at this time.

In the Chestnut Creek sub-basin, implementation of priority recommendations did not require a new Phase II contract, but rather a simple extension of the existing agreement because substantial funding remained. DEP and SCSWCD quickly accomplished this task early in 2004 and itemized an implementation strategy for efforts through 2005. However, in November 2004, and for a second time, the SCSWCD Project Coordinator moved on to a new professional position. SCSWCD has decided against rehiring a new project coordinator to advance this project. This discouraging setback has caused DEP and the SCSWCD to scale back efforts to what can be accomplished with existing staff in 2005. The highest priority actions include monitoring and maintenance of the demonstration project at the Town Hall site and working to eradicate small stands of Japanese knotweed at its few locations along Chestnut Creek's mainstem.

During 2004, the SMP successfully negotiated a scope of work and budget for a Phase II West Branch Delaware River contract. During its assessment of the WBDR corridor, the DCSWCD found that 40% of the main stem riparian zone is in agricultural land use. The report also provides a rough assessment of the buffer condition and found that nearly 44% of the 10 miles of buffer described as inadequate along the river's mainstem is associated with agricultural land uses. These findings support the Phase II allocation of monies to enable the DCSWCD to design the necessary streambank stabilization measures to make up to 8 farms in the valley eligible for participation in the Conservation Reserve Enhancement Program. DCSWCD had already begun the design process for two farms at the close of 2004.

Where plans are not yet complete, DEP is working to establish new effective partnerships and further cultivate existing partnerships to provide a firm foundation for developing stream management plans. The Esopus Creek Project is offered as an example for this report. In the Esopus Creek watershed, a stream management plan is scheduled for completion in December 2006. Towards that goal, DEP worked in 2004 to negotiate and register a contract with the Cornell Cooperative Extension of Ulster County (CCE). DEP also began working with CCE and Consensus Building Institute in early 2004 to convene a focus group of stakeholders to strategize and outline the overall process of creating a stream corridor protection plan. The focus group comprised of Town officials and representatives of DEC, UCSWCD, CCE, DEP, Trout Unlimited (TU), Catskill Center for Conservation and Development, local business, and streamside landowners met four times in six months and produced an introductory brochure that outlines the scope and intent of the plan.

A visible level of activity by the SMP in the Esopus Creek watershed has maintained fertile ground for the upcoming planning effort. The DEP has developed credibility due to the success of the restoration demonstration project at the Woodland Valley confluence in 2003, and worked to maintain that credibility during 2004. During 2004, DEP and UCSWCD monitored the project closely throughout the high water events of the unusually wet season. TU and adjacent landowners volunteered during supplemental plantings of the project site.

2004 brought a newly-elected Supervisor and Town Board, ,which posed a considerable challenge to DEP for the upcoming Esopus Creek planning effort and for the ongoing work to gain adoption & implementation of plans in the Broadstreet Hollow and the Stony Clove. DEP met this challenge by meeting with the newly elected officials to present and discuss the multi-objective approach to stream management exemplified in the Broadstreet Hollow and Stony Clove management plans, and the natural channel design approach to restoration used at the Broadstreet Hollow and the Woodland Valley/Esopus Creek demonstration projects. A flash flood on May 13, 2004 caused extensive damage to Birch Creek (in the headwater area of Esopus Creek), resulting in property damage and significant suspended sediment loading. This crisis focused the officials even more closely on stream management and opened up regular dialogue between them and the SMP. DEP mapped and photo-documented the damage and met Town offi-

cials and local landowners at the various sites to discuss the relative merit of various responses. DEP was asked to present its findings surrounding Birch Creek to Trout Unlimited's local chapter.

During 2004, the Towns of Shandaken and Olive hosted meetings with DEP, DEC and the Federal Emergency Management Agency (FEMA) to discuss the adequacy of existing floodplain maps and to delineate areas for more detailed mapping in the future. This is part of DEP's efforts to upgrade floodplain maps throughout the West of Hudson watershed (see below). Shandaken is eager to receive these maps (anticipated between 2007 and 2008) and put them to use.

In May 2004, DEP performed a first phase watershed assessment of the Esopus Creek corridor. The documented research will be used as a foundation for further refined investigation to evaluate the condition of the stream's geomorphic and riparian health, to identify areas of concern, and to propose recommended BMPs to address those concerns. This work will be carried out in 2005 and 2006, through a contract with the US Army Corp of Engineers (ACOE) Research and Development Center's Environmental Laboratory under the guidance of Dr. Craig Fischenich, a renowned expert in applied fluvial geomorphology.

Plans remain to be completed in the East Branch Delaware River (December 2007) and the Schoharie Creek (April 2007). During 2004, SMP successfully completed negotiation of scope of work and budget for the East Branch Delaware River with the DCSWCD, and work is expected to commence this spring or early summer 2005. This contract expands the staffing capacity of the District and works to strengthen the planning capacity and education and outreach capacity of the District as it moves into its second major project.

4.5.2 Floodplain Mapping

SMP and DEC continued to define the scope of work and terms of a contract to fund the revision of flood studies and creation of floodplain maps for all areas within the WOH watersheds. Using the latest in flood mapping technologies, this effort will vastly improve the public knowledge of the region's floodplains and flood hazard areas. Once complete, these maps will help communities and resource managers to identify and mitigate flood threats, plan for secure future development, and further understand how their rivers and streams function. As a tool for protecting water quality, these maps will help communities reduce pollution and contamination associated with major flood events. DEC and DEP are expected to begin the mapping effort on the Catskill system followed by areas on the Delaware system. DEP expects its floodplain mapping contract with DEC to be registered and work commenced during 2005.

4.5.3 Stream Restoration Demonstration Projects

Figure 4.26 depicts the status of DEP- sponsored restoration projects and non-DEP sponsored projects at the close of 2004. The SMP is tasked with thirteen (DEP-sponsored) stream restoration demonstration projects during 2003 – 2007. To date, five of these thirteen projects are

completed and a sixth is almost complete. While scheduled dates of completion have been modified with EPA's approval, during the term of this FAD, all are expected to be completed by December 2007. Four additional projects were completed prior to the initiation of this FAD, and as a result the total number of DEP-sponsored restoration projects completed in the WOH watershed to date is nine.

Both 2003 and 2004 were record setting wet years in the West of Hudson watershed region. Two demonstration projects were hit hardest by this wet weather and remain incomplete: the West Kill at Shoemaker and the Stony Clove at Lanesville, both designed and constructed by the GCSWCD. Streamflows in these valleys remained well above pumpable capacity (20cubic feet per second) for the majority of the 2004 construction season. Despite this condition, the GCSWCD was able to take advantage of drier weather in September and October to achieve approximately 65% completion of the West Kill at Shoemaker, including extensive bioengineering with native species for the project length. GCSWCD completed a detailed report on this bioengineering effort.

A first Delaware County demonstration project was completed by the DCSWCD in 2004, at the Dave Post Farm on the Town Brook. This 1,200-foot project was selected because cattle access to the stream and the lack of a functional riparian buffer was exacerbating stream bank erosion and headcuts throughout the reach. DCSWCD worked with the WAC Whole Farm Plan team for site inclusion in CREP and the incorporation of a cattle crossing in the project reach. Despite delays due to several storm events, the project was constructed on time and on budget.

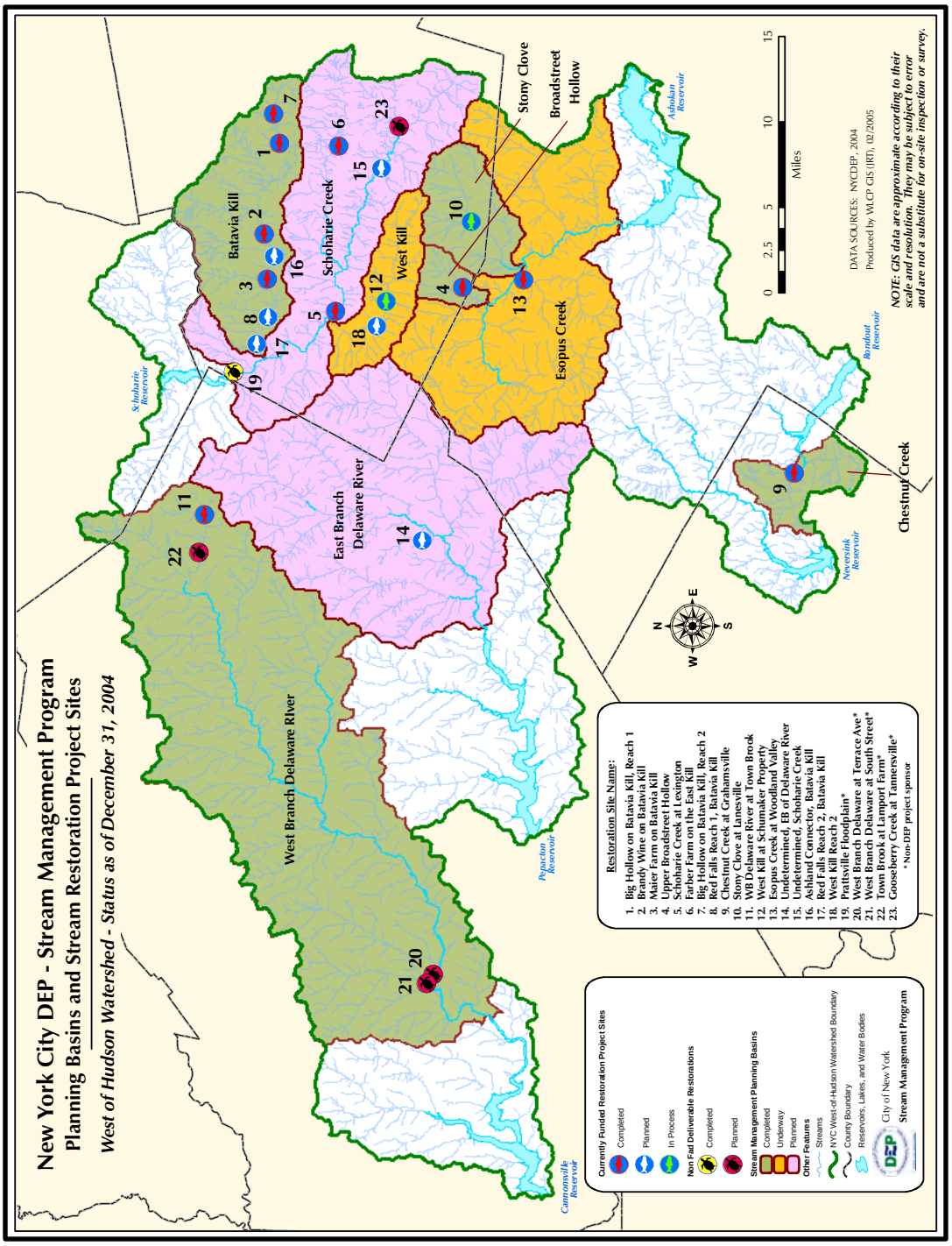


Figure 4.26. Planning basins and stream restoration project sites, West of Hudson watershed - Status as of December 31, 2004

In Sullivan County, the SCSWCD worked closely with the Town of Neversink Highway Department to replace a problem culvert on the Pepacton Hollow, a tributary to the Chestnut Creek. The replacement of this culvert was considered a high priority in the Chestnut Creek Stream Management Plan for its contribution to flooding along a long stretch of the Pepacton Hollow Road. At times, access to the upper road limits was cut off as a result of this flooding. In a partnership effort, the SCSWCD team subcontracted Integrated River Solutions to design the capacity and specifications for the replacement culvert. DEP funded the cost of the culvert and associated construction materials, and the Town Highway Department performed the installation.

Also completed in 2004 was the long-awaited Prattsville Floodplain Restoration Project, a project sponsored by the Village of Prattsville, designed and constructed by the GCSWCD and funded by the ACOE. This project restores the ability of the Schoharie Creek floodplain to receive ice flow and floodwaters during spring thaw and seeks to reduce upstream flooding associated with ice jams that periodically occur on the river. Other non-DEP-sponsored projects, including Terrace Avenue and South Street in the West Branch Delaware River Basin, and the Gooseberry Creek in the Schoharie Basin, are insufficiently funded at this point to be advanced by their project sponsors. The Town Brook at Lamport Farm project is on hold as the WAC determines the future agricultural land use of this site and its eligibility for CREP.

All stream restoration projects that have been constructed require ongoing monitoring as part of DEP's BMP Project Evaluation (see below) and to determine the need for maintenance. Throughout 2004, monitoring was performed on the Brandywine, Maier Farm and Big Hollow Projects (Batavia Kill, GCSWCD), the Esopus Creek at Woodland Valley (UCSWCD), the Chestnut Creek at Town Hall (SCSWCD) and the Broadstreet Hollow (GCSWCD). No major maintenance activities were undertaken.

4.5.4 Stream Data Management

Through the creation of stream management plans, design and construction of stream restoration projects, and the research into stream processes and project performance (described below), SMP and its project partners have collected significant quantities of information about Catskill streams. To ensure this information is available and useful to all stream managers and partners for the long term, SMP has embarked on a project to develop a geospatial database of stream information for the West of Hudson watershed. This GIS database will house information from stream assessments, reference reach and design surveys, monitoring efforts and other associated studies and enable managers to review conditions across the watersheds where surveys have been completed. DEC has allocated Safe Drinking Water Act (SDWA) funds to PAR Government Systems Corporation (PAR) for the design and implementation of the database. In 2004, after producing the needs assessment, requirements analysis and work plan for the project, PAR began designing the database and creating a common GPS data collection database. PAR's team is guided by the stream managers who meet regularly to discuss the design and functional capability of the database, as well as the adoption of consistent stream data management protocols.

4.5.5 Stream Process Research

Throughout 2004, SMP continued its multi-year effort to develop regional stream morphology databases. These projects include the development of 1) regional relationships relating bankfull discharge and hydraulic geometry to drainage area (the 'regional curves'), 2) a stable reference reach database, 3) a monitoring study on the effectiveness of our BMP projects, and 4) a monitoring study of rates of streambank erosion and stream bed scour at up to 11 stream reaches in support of projects 2 and 3.

Initially scoped as a set of multi-year projects, a number of these efforts are nearing completion. Development of regional curves for the Catskills is now largely complete. The latest version of the regional curves has been distributed to various project partners for use in their project review of Article 15, ACOE, and stormwater permits. SMP continues to promote the use of these curves internally and externally in project review, watershed assessment, BMP evaluation and stream channel classification and assessment. The final revision to the regional curves is expected in late 2005.

Substantial progress was made toward completion of development of the Catskill stream reference reach database. To date, nine reaches have been identified for inclusion in the study, and five of these have undergone intensive survey and data collection. This project is largely dependent on the frequency of bed-mobilizing flow conditions. Originally scoped as a 5-year study, data collection was scheduled to conclude in 2006. Monumenting and initial instrumentation (site setup) in 2003 was delayed due to wet weather, and the initial instrumentation on a key site did not occur until the 2004 field season, effectively delaying data collection, analysis and final reporting. Nonetheless, all required field work was completed during the 2004 season, and data entry and analysis is ongoing as planned. DEP expects to be able to report preliminary findings on this project by the close of 2006

Substantial progress was also made toward completion of monitoring the effectiveness of stream restoration demonstration projects installed on three unstable stream reaches, and to monitor six control sites (three stable and three unstable sites), over a five year period. This project entails one to two years pre-construction monitoring and three to four years post- construction monitoring. Both construction and monitoring are weather dependent, and high water in 2003 and 2004 caused delays in project construction and subsequent monitoring. In 2004, scheduled field work was able to be completed during the season, and data entry and analysis is ongoing as planned for data collected since the beginning of the project. Additional field work originally scoped for 2003 and 2004 will take place during 2005 and 2006, with additional monitoring scoped to continue through 2007. Preliminary reports of findings will be produced following 2005 and 2006 field seasons, with final findings reported in 2007.

Stream bed and bank erosion and pilot measurements of stream bed scour in support of reference reach and BMP reach studies also proceeded as planned for the 2004 field season, with all planned field work completed. Data entry and data analysis are also in progress. Scour and bed mobility assessment requires five or more bed mobilizing events. Sites monitored have experienced one to four such events, so monitoring is scheduled to continue until the required number of events has been monitored.

4.6 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 Watershed Rules and Regulations (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.

4.6.1 Regulatory Programs

A main component of DEP's Wetland Protection Strategy is the review and comment on applications for federal, State, and municipal wetlands permits, as well as proposals subject to environmental review under the State Environmental Quality Review Act (SEQRA). During 2004, DEP continued to review applications for permits for activities on regulated wetlands. Furthermore, DEP enhanced its regulatory review program by broadening the scope of responsibilities of the DEP unit responsible for overseeing the review of the activities on regulated wetlands.

As the level of protection afforded to wetlands varies widely among regulatory authorities, reviewing applications for activities that are subject to the authority of multiple agencies helps to ensure activities that threaten the water quality functions of wetlands in the watershed are considered to the fullest extent possible. All wetland proposals are assessed for compliance with appli-

cable wetland regulations and for threats to the potential water quality protection functions of wetlands. Please refer to the tables in the following sections for a summary of various regulatory reviews conducted by DEP during the past year.

United States Army Corps of Engineers

DEP met with the ACOE in 2004 to request a reassessment of the Corps Wetland delineation on a portion of the Cross Roads Ventures site in addition to a number of other issues including DEP's review of Pre-Construction Notification (PCNs), individual Permit Applications, and other notices for projects affecting wetlands in the watershed. Following this meeting, DEP reaffirmed by letter to the ACOE its ongoing request to forward all permit Notices of coverage under the Corps' recently amended Nationwide Permits and PCNs to DEP. During the year, ACOE diligently complied with DEP's request.

During 2004, DEP continued to review PCNs, which notify ACOE that a project sponsor believes his or her project is authorized by a Nationwide Permit and that an Individual Permit will not be sought before the project begins. DEP reviews the PCNs to confirm that the proposed activity complies with the amended federal wetland regulations, and that the activity will not have an adverse impact on federally designated wetlands or water quality in the watershed.

If, based on its review of a PCN, DEP concludes that a project will adversely impact a wetland or water quality in the watershed, DEP will request that ACOE require an Individual Permit Application to allow for thorough review of the proposal. In those instances, DEP will encourage ACOE to require an alternative project design or location that will prevent adverse impacts. If this is not entirely achievable, DEP will pursue opportunities to minimize impacts, also through modification of the project design/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 2004, DEP staff continued to review proposals under consideration by ACOE.

The regulatory component of DEP's Wetland Protection Strategy also includes the review of Individual Permit Applications to assess a project's compliance with the ACOE Regulations and EPA's guidance for the review of Individual Permit applications.

Table 4.5. ACOE proposals reviewed by DEP.

Project Number	Project Name	Notification/Permit	Wetlands Losses (acres)	Wetlands Gains (acres)	Activity
1 EOH	Draft Compensatory Mitigation Guidelines	ACOE Special Public Notice	---	---	Regulatory Guidelines
4 EOH	WC DPW Muscoot River Lasdon Park/ Muscoot Park, Somers	ACOE Public Notice	0.07	0	Excavation, Discharge of Fill
6 EOH	Columbia Company	ACOE Public Notice	---	---	Not Applicable

Table 4.5. ACOE proposals reviewed by DEP.

Project Number	Project Name	Notification/Permit	Wetlands Losses (acres)	Wetlands Gains (acres)	Activity
7 EOH	Kingston-Ulster Airport	ACOE Public Notice	---	---	Not Applicable
9 EOH	Nancy K. Simpkins, 120 Mill River Road, South Salem, NY	ACOE PCN	---	---	Not Applicable
10 EOH	American Sugar Refining, Inc., 1 Federal Street, Yonkers, NY	ACOE PCN	---	---	Not Applicable
11 EOH	Shelter Cove Estates, 600 Clarence Avenue, Bronx, NY	ACOE PCN	---	---	Not Applicable
13 WOH	Bull Run Creek Lining, Margaretville, NY	ACOE Permit	615 LF	---	Stream Disturbance
Total			0.07 acres, 615 LF		

New York State Department of Environmental Conservation Wetland Permit Applications

Article 15 Protection of Water Permit Reviews

In 2004, DEP continued to receive and review DEC stream disturbance permit applications. DEP issues comments to DEC Regions 3 and 4 concerning proposals with potential wetland impacts. The comments identify 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 2004, DEP reviewed and commented on the 11 DEC Article 15 Protection of Waters Permits represented in the table below.

Table 4.6. DEC Article 15 Protection of Waters Permits reviewed by DEP in 2004.

Project Number	Project Name	Notification/Permit	Wetlands Losses (acres)	Wetlands Gains (acres)	Activity
1 WOH	Birch Creek at SR 28 and Rose Mtn. Road, Shandaken, NY	DEC Article 15	190 LF		Stream Disturbance
2 WOH	Post Property, Town Brook Road, Stamford, NY	DEC Article 15	1,200 LF		Stream Disturbance
4 WOH	Galliduani Property, Mountain Road, Middletown, NY	DEC Article 15	75 LF		Stream Disturbance
5 WOH	Stark Property, Little Red Kill Road, Middletown, NY	DEC Article 15			Stream Disturbance
6 WOH	Pine Island Subdivision, Blue Berry Street, Gilboa, NY	DEC Article 15	0		
7 WOH	Grabinski/Moreno Property, Vining Heights Dr, Windham, NY	DEC Article 15	NA		Within Wetland Buffer
8 WOH	Clark & Lawrence Properties	DEC Article 15	0.117		
9 WOH	CR 83 Bridge Over Schoharie Creek, CR 83, Hunter, NY	DEC Article 15			Stream Disturbance
10 WOH	Stony Clove Creek at Jansen Road - Bono Property, Hunter, NY	DEC Article 15	469 LF		Stream Disturbance

Table 4.6. DEC Article 15 Protection of Waters Permits reviewed by DEP in 2004.

Project Number	Project Name	Notification/Permit	Wetlands Losses (acres)	Wetlands Gains (acres)	Activity
11 WOH	Stony Clove Creek at Jansen Road - Lepuil Property, Hunter, NY	DEC Article 15	87 LF		Stream Disturbance
12 WOH	Stony Clove Creek at SR 214 - Thomson Property, Hunter, NY	DEC Article 15	210 LF		Stream Disturbance
Total			0.117 ac, 2,231 LF		

Table 4.7. Article 24 Freshwater Wetland Permit Applications.

Project Number	Project Name	NYC Reservoir Basin	Notification/Permit	Wetlands Losses (acres)	Wetlands Gains (acres)	Activity
6 WOH	Pine Island Subdivision, Blue Berry Street, Gilboa, NY	Schoharie	DEC Article 24	0	---	

401 Water Quality Certifications

DEP did not receive any requests for DEC 401 Water Quality Certifications during 2004.

2004 DEC Wetland Violations

As part of the Wetland Protection Strategy, DEP identifies violations of federal, State and municipal wetland regulations, refers the violations to the appropriate agency and assists in resolving the violations. During the reporting period, DEP participated in the violations identified in the table that follows.

Table 4.8. 2004 wetlands violations.

Project Number	Project Name	NYC Reservoir Basin	Notification/Permit	Wetlands Losses (acres)	Wetlands Gains (acres)	Activity
2 EOH	Kim-Wald Property, 395 Blinn Road, Croton-on-Hudson, NY	New Croton	Town of Yorktown	0.17	0.17	Pond Creation - Mitigation Plan
3 WOH	Smolen Wetland Restoration Plan, Turkey Hill Rd, Middletown, NY	Pepacton	None	---	---	Enforcement Action
Total				0.17	0.17	

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

2004 Connecticut Reviews

During the reporting period, DEP reviewed the proposals, identified in the table that follows, that are located in Connecticut municipalities occupied by portions of the watershed.

Table 4.9. Proposals reviewed by DEP that are located in Connecticut municipalities occupied by portions of the watershed.

Project Number	Project Name	NYC Reservoir Basin	Notification/Permit	Wetlands Losses (acres)	Wetlands Gains (acres)	Activity
5 EOH	Ridgefield Golf Course, Ridgefield, CT	Titicus	State of Connecticut Diversion of Water Permit	0	0	Diversion of Water For Irrigation
12 EOH	Thomas W. and Virginia R. Dawes, 845 No. Salem Road, Ridgefield, CT	Titicus	Town of Ridgefield	0.003	0	Stream Crossing
13 EOH	Rockwood Lane, Danbury CT	East Branch	City of Danbury	0.06	0	Stream Crossing
14 EOH	4 Hardscrabble Road, Sherman/New Fairfield CT	East Branch	Town of New Fairfield	0	0	Within Wetland Buffer
16 EOH	Deer Haven Estates, 161 & 165 Ball Pond Road, New Fairfield, CT	East Branch	Town of New Fairfield	0	0	No Wetlands
18 EOH	124 Ridgebury Road, Ridgefield, CT	Titicus	Town of Ridgefield	0	0	No Wetlands
19 EOH	31 Catoonah Street, Ridgefield, CT	Titicus	Town of Ridgefield variance	0	0	No Wetlands
20 EOH	Artuso, 42 Bryon Avenue, Ridgefield, CT	Titicus	Town of Ridgefield variance	0	0	No Wetlands
Total				0.063		

In addition to reviewing applications for wetlands permits before federal, State and municipal agencies, DEP reviews all applications under the City's WR&R to ensure compliance with the wetland protection provisions of those regulations. Further information on DEP's project review activities is found in Chapter 6 of this report

The following two maps depict the locations of proposed activities requiring wetland that were reviewed by DEP in both the East and West of Hudson Districts in 2004.

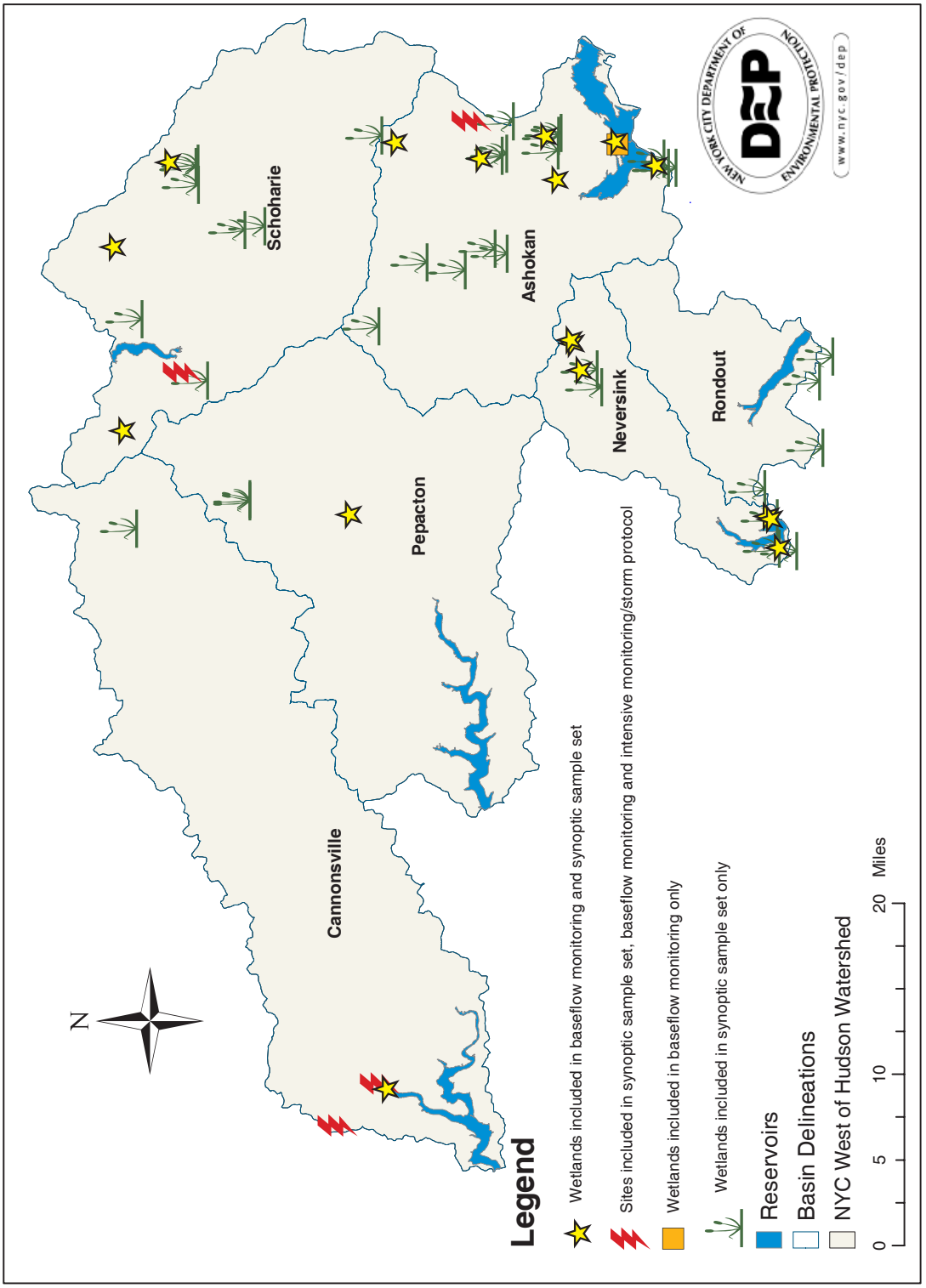


Figure 4.27. WOH Reference Wetland Program monitoring locations.

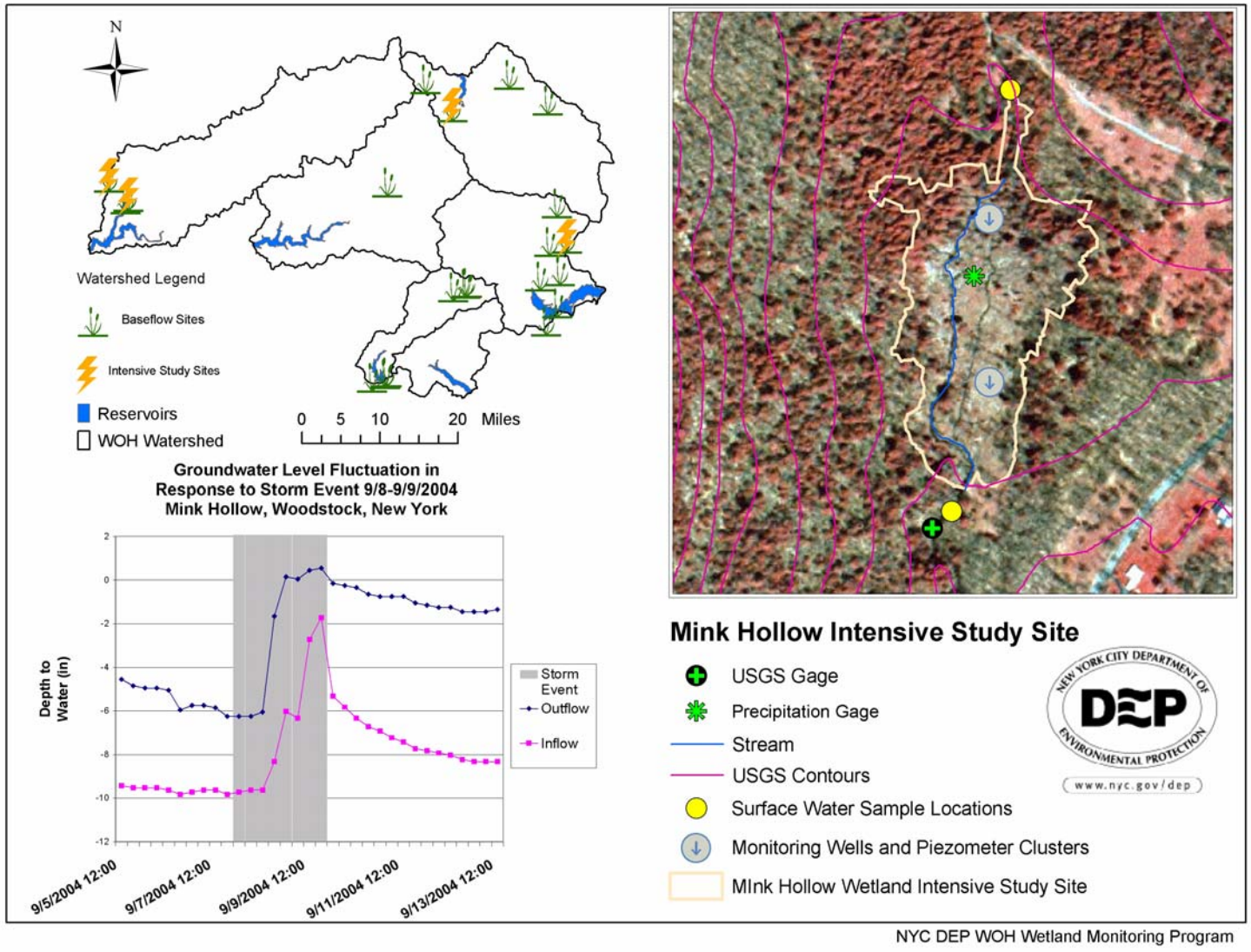


Figure 4.28. WOH Reference Wetland Program intensive site example.

4.6.2 Non- Regulatory Programs

Acquisition of Wetlands

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

Table 4.10 indicates wetlands either under contract or closed by DEP as of December 31, 2004, as well as wetlands located within a 1,000 foot buffer of total lands acquired by DEP. These include wetlands identified by the USFWS 1996 National Wetlands Inventory and DEC mapped wetlands.

NYS Freshwater Maps

At DEP's request, DEC examined existing data sources and, in conjunction with DEP, conducted fieldwork to revise the NYS Freshwater Maps for the East-of-Hudson (EOH) watersheds. Specifically, DEC verified the boundaries of existing regulated wetlands, located additional wetlands that meet the regulatory threshold of 12.4 acres, and identified smaller wetlands of Unusual Local Importance (ULIs) that are adjacent to the reservoirs. The wetlands identified on the State maps are subject to both DEC regulations as well as DEP Watershed Rules and Regulations.

DEC completed revisions of the NYS Freshwater Wetland Maps for the Croton and Kensico watersheds and the additional lands were adopted in November 2004. Fieldwork for this effort in the portions of the watershed located in Westchester County, including the Kensico Reservoir Basin, was completed in 2002 and a public hearing on the proposed changes was held on December 3, 2003. 71.3 acres of wetlands were added to the NYS regulatory maps in the Kensico Reservoir basin, raising the total of state-regulated wetlands in the Kensico Basin from 65.5 to 136.8 acres. These additional lands offer increased protection of previously documented wetlands and their associated water quality functions under New York State Freshwater Wetlands Law.

DEC's field work for the Putnam County map revisions was completed in 2004, with the exception of a couple of wetlands that were discovered after the main field work had been completed. These wetlands may warrant other considerations and possible follow-up field visits. Currently, DEC estimates having a public hearing over the revisions in late June-July 2005, and a filing of a final amendment possibly in December 2005.

Table 4.10. Wetlands acquired or protected by NYCDEP in the Catskill/Delaware and Croton Systems as of December 31, 2004*

Description	Acres	% of Total Watershed Acreage	% of Total Land Acquired
For West-of-hudson (All Basins):			
Total acreage of entire watershed	1,013,954		
Total acreage of wetlands (both NWI And DEC-regulated) in entire watershed (excluding deepwater habitats**)	11,448	1.13%	
Total acreage of deepwater habitats in entire watershed	24,521	2.42%	
Total acreage of wetlands and deepwater habitats in entire watershed	35,969	3.55%	
Total lands under contract or closed by NYCDEP as of 12/31/04†*:	51,735	5.10%	
Within those total lands under contract or closed:			
Total Acreage Of Wetlands (both NWI and DEC-regulated, excluding deepwater habitats**)	752		1.45%
Total acreage of deepwater habitats**	119		0.23%
total acreage of wetlands and deepwater habitats**	871		1.68%
For East-of-hudson (All Basins):			
Total acreage of entire watershed	248,102		
Total acreage of wetlands (both NWI and DEC-regulated) in entire watershed (excluding deepwater habitats**)	18,889	7.61%	
Total acreage of deepwater habitats in entire watershed	14,679	5.92%	
Total acreage of wetlands and deepwater habitats in entire watershed	33,568	13.53%	
Total lands under contract or closed by NYCDEP as of 12/31/04†*:	9,869	3.98%	
Within Those Total Lands Under Contract or Closed:			
Total Acreage of wetlands (both NWI and DEC-regulated, excluding deepwater habitats**)	743		7.53%
Total acreage of deepwater habitats**	3		0.03%
Total acreage of wetlands and deepwater habitats**	746		7.56%

* Source: WLCP GIS, January, 2005. Note: Acres are calculated directly from areas of GIS polygons and therefore may not match exactly other acreage totals submitted by DEP. NWI Wetlands acreages exclude all upland (U), unconsolidated shore (L2US), and streambeds (RSB) categories

** Categories considered "deepwater habitats" from NWI wetlands include reservoirs or large lakes (L1), unconsolidated shoreline (L2US), riverbeds (RUB) or streambeds (RSB), but not ponds or small lakes.

† Includes fee, conservation easements, and farm easements.
Statistics produced by T. Spies, WLCP, 2/28/05

4.6.3 Wetland Mapping and Research

In 2004, DEP continued to implement and expand its Wetland Mapping and Research Programs. Work has begun to update the West-of-Hudson (WOH) 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 include the entire watershed. These wetland mapping and research projects are designed to support both the regulatory and non-regulatory aspects of the DEP's Wetlands Protection Strategy (DEP, 2001).

National Wetland Inventory (NWI) Map and EOH Trends Update

The first NWI was completed in the mid-1990s, and was based on the best existing aerial photography (1982-1987, 1:58,000 scale CIR). The first EOH wetland trend analysis, completed in 1999, summarized trends in wetland loss and change for the periods from 1968 to 1984 and 1984 to1994. As part of the overall Wetland Protection Strategy, updates of the NWI wetland maps for the East and West of Hudson watersheds are currently under way, and the extension of the EOH wetland trend analysis for the period from 1994 to 2004 has begun.

The NWI update for WOH, based on spring 2003 aerial photography (1:40,000 scale CIR), is being finalized. Draft WOH GIS data have gone through two reviews for quality and completeness. Wetland field checks were performed in 2004, as part of the quality assessment of the draft WOH NWI update maps. The assessment used GIS, 2001 CIR digital orthoimagery, and field-collected information (2004 data from the WOH Reference Monitoring Program), plus additional October 2004 field observations to evaluate NWI wetland omissions and discrepancies in aerial extent and wetland type.

Progress has been made in updating the EOH NWI wetlands and extending the wetland trend analysis from 1994 to 2004. As noted in the 2003 FAD Annual Report (DEP 2004), the spring 2003 EOH photography was rejected for failing to meet technical specifications. In the spring of 2004, 1:40,000 scale CIR photography was reflown, reviewed and accepted. Analysis of the photography for the NWI update and trend analysis is under way. Draft NWI update maps for EOH and the wetland trend analysis report are due in May 2005. Delivery of the final maps and report is expected in May 2005.

Wetland Functional Assessment

DEP's Wetland Functional Assessment Program combines the USFWS Watershed-based Wetland Characterization and Preliminary Assessment of Wetland Functions (W-PAWF) with a reference wetlands monitoring program to determine baseline characteristics and water quality functions of wetlands among various hydrogeomorphic settings. For the W-PAWF, the USFWS attaches hydrogeomorphic modifiers to each wetland polygon in the NWI database to support preliminary, basin-wide assessments of eight wetland functions. DEP is conducting a monitoring program to verify the hydrogeomorphic classifications and preliminary functional assessments and to provide additional measures of ecological and water quality conditions for reference wetlands.

The W-PAWF for the entire Catskill, Croton, and Delaware watersheds was completed in December 2004 and was submitted as a FAD deliverable. Three main descriptors (landscape position, landform, and water flow path) were applied to each NWI wetland by interpreting map information and, when necessary, consulting aerial photos. Other modifiers were added to depict features such as headwater, drainage-divide, and human-impacted wetlands. Methodological improvements gained from work in Cannonsville and Neversink (completed in 2002), as well as from previous work in the Boyds Corners and West Branch basins (completed in 1999), greatly benefited the project, as did extensive reviews by DEP staff.

Upon completion of the database, several analyses were performed to produce a preliminary assessment of wetland functions for the watershed. The following functions were evaluated using the database:

1) surface water detention,
2) streamflow maintenance,
3) nutrient transformation,
4) sediment retention,
5) shoreline stabilization,
6) provision of fish habitat,
7) provision of waterfowl and waterbird habitat, and
8) provision of other wildlife habitat.

A series of 13 maps for each reservoir basin was prepared to highlight wetland types that may perform these functions at significant levels (high or moderate).

It is important to emphasize that the functional assessment is a preliminary evaluation based on wetland characteristics interpreted through remote sensing and best professional judgment. The classification is useful for general natural resource planning, as an initial screening for considering prioritization of wetlands (for acquisition or strengthened protection), as an educational tool (e.g., helping the public and non-wetland specialists better understand the functions of wetlands and the relationships between wetland characteristics and performance of individual functions), and for characterizing the differences among wetlands in terms of both form and func-

tion within a watershed. This type of assessment does not eliminate the need for site-specific field investigations, which is the focus of the Reference Wetland Monitoring Program (described below).

WOH Reference Wetland Monitoring Program

The WOH Reference Wetland Monitoring Program is a two-year project that will sample water quality, vegetation, and soils at 22 reference wetlands located throughout the Catskill/Delaware watershed. The project officially started in September 2003 as the SDWA grant got underway and two new wetland staff were hired. Water quality monitoring for this project will be conducted through a contract with State University of New York College of Environmental Science and Forestry (SUNY ESF). This contract was registered on September 3, 2003, with a work commencement date of October 15, 2003. Vegetation, soil, and water table monitoring will be conducted by DEP.

Results of this monitoring program will enable DEP to determine baseline conditions and water quality functions of a number of wetland types. The data will be evaluated based on the hydrogeomorphic classification in order to characterize the distribution, composition, and functions of watershed wetlands. This approach will provide a means of identifying wetlands for strengthened protection based on their landscape positions and associated water quality functions and will benefit the development of both regulatory and non-regulatory wetland protection as well as non-point source programs.

Site Selection

The study sites were selected based on the following criteria:

- located on State-, County-, or DEP-owned lands,
- contiguous with watercourses (terrene outflow and lotic),
- representative of common wetland vegetation classes in the study area,
- minimally disturbed in the drainage areas, and
- accessible to routine sampling.

Over 100 sites were investigated for possible inclusion in the study. Detailed field reconnaissance was conducted at approximately 80 sites, including assessments of hydrology, vegetation, and soils. The final 22 sites selected represent a range of wetland types located in five out of the six WOH reservoir basins. All of the study site wetlands have been mapped and the boundaries established using Global Positioning System technology (Figure 4.27).

Water Quality Monitoring

A Quality Assurance Project Plan covering the water quality monitoring was developed and approved by DEP, EPA and DEC in January 2004. DEP is providing rigorous oversight and conducting data validation of the water quality data generated by the laboratories.

Water quality samples are collected once a month for "base-flow" sampling from the 22 wetland study sites. Sample sites are located at the inflow and outflow of the lotic wetlands, and the outflow of terrene wetlands for a total of 34 sample locations per sample event. The water samples are analyzed for: dissolved major cations (Ca, Mg, Na, K, Si, and Fe); total alkalinity, sulfate (SO4), chloride (Cl), total nitrogen (TN), nitrate-nitrite (NO3NO2), ammonium (NH4), total phosphorus (TP), total dissolved phosphorus (TDP), dissolved organic carbon (DOC), fluorescence, strontium isotopes, oxygen isotopes, carbon isotopes and tritium. In addition, field measurements of dissolved oxygen, pH and specific conductance are collected at each site when water samples are taken. Monitoring of the study sites started in June 2004. By the end of the year, seven monthly sample runs were completed resulting in over 5,000 lab analyses.

In addition to the monthly base-flow sampling, a synoptic sampling event was conducted over a two day period in August 2004. Over 65 wetlands surface water samples were collected across the watershed. This synoptic sampling allows us to see if the results from the 22 sites are representative of wetlands in the Catskill/Delaware watershed and provides a larger database to compare the water quality with the wetland classifications (Figure 4.27).

Storm and groundwater sampling are conducted at a subset of four of the study sites ("intensive sites") in order to develop rudimentary mass balances. SUNY Cortland has installed ISCO storm samplers, capacitance rods, piezometer clusters and rain gages at each of these sites. In addition to the routine baseflow sampling, groundwater monitoring and field measurements are conducted at each site. Storm event samples have been collected at each intensive site between one and three times during 2004, with samples. Samples are chosen to represent the rising limb, peak and falling limb of the storm and are analyzed for the same parameters as the baseflow samples. Together, the capacitance rods data and piezometer measurements provide insight into the discharge and recharge characteristics of each wetland. Discharge measurements have been performed at least 10 times at each intensive site. Preliminary rating curves (discharge vs. stage) have been developed. Precipitation is measured in 0.01 inch intervals at each site and this data will be combined with regional precipitation chemistry published by USGS to infer the chemical contribution of precipitation to the chemical characters of the sites. Specific hydrologic and associated chemical trends will be investigated for each of the four intensive sites (Figure 4.28).

DEP installed a total of 34 groundwater wells with data loggers at each of the study sites in the dominant vegetation community for each wetland. Lotic sites are equipped with data loggers near the inflows and outflows, while the terrene sites have had wells installed at the outflows. These data loggers record depth to groundwater level at 6-hour intervals and the data is downloaded on an approximate biweekly basis. A second set of wells with wider diameters and removable caps were also installed in close proximity to the data loggers to allow for measurements of physical parameters (dissolved oxygen, oxidation reduction potential, pH, specific conductance, and temperature). Routine well monitoring began in July 2004.

Soil and Vegetation Sampling

Soil cores were collected at each of the 34 well pair locations. These cores have been separated into horizons and described for texture and color. DEP has contracted with Cornell Nutrient Analysis Laboratories to perform analyses for Soil Fertility: soil pH, exchangeable acidity, organic matter, Morgan extractable P, K, Ca, Zn, Mg, Al, Mn, and nitrate, Total Elemental Analysis, Cation Exchange Capacity, Total Carbon and Nitrogen, Organic Carbon, and Metals. Seventy-two of the soil samples have been shipped to the Cornell Soils Laboratory for analysis in December 2004. Thirty three additional layers will be selected from the remaining samples, prepared and shipped to the lab in early 2005. The results will be used to investigate correlations among chemistries of soil and water, plant communities and hydrogeomorphic classes.

Vegetation sampling grids for the study sites are being constructed using GIS. A baseline is established along the long axis of each wetland sampled. Perpendicular transects are then established at 50 meter intervals along the baseline, with the location of the first transect established with a random number generator. Plots are then located at 50 m intervals along each transect for a random grid design. The resulting vegetation plot locations can then be located using GPS in the field. This allows more staff time allocated for vegetation identification and sample collection rather than the time intensive task of surveying plot locations.

4.7 East of Hudson Non-Point Source Management Plan

DEP's Nonpoint Management Plan (NPS Plan) for the Catskill/Delaware reservoir watersheds East of Hudson was designed to identify a variety of potential sources of nonpoint pollution in the four Cat/Del Basins and develop means to reduce or eliminate those sources. Turbidity and fecal coliform bacteria are the priority pollutants targeted in the NPS plan.

During 2004, DEP completed extensive assessment and remediation efforts in the four target reservoir basins, which include: Boyds Corner, Cross River, Croton Falls and West Branch.

Program accomplishments during the reporting period include:

Stormwater

- Video inspecting and digitally mapping the stormwater infrastructure in critical management areas;
- Identifying and eliminating illicit connections identified in the stormwater infrastructure inspection program;
- Expanding the stormwater infrastructure video inspection and digital mapping program to encompass the entire Cross River and Croton Falls watersheds;
- Redesigning and initiating construction of three large stormwater management/nonpoint abatement projects, including Washington Road, Meadowlark Drive and Pennebrook Lane;
- Repairing ten small severely eroding sites, identifying 30 additional sites in need of repair, and preparing a contract to repair the additional sites.

Hazardous Materials, Pesticides, and Turf Management

- Conducting site audits with property owners and developing and overseeing implementation of remediation plans.

Wastewater

- Developing a wastewater infrastructure mapping and inspection plan and securing contractual approval for the project to commence.

Spill Containment

- Completion of a Spill Containment Plan for the four reservoir watersheds and development of a contract to implement the plan.

The following sections detail advances in each component of the NPS Plan in 2004.

4.7.1 Stormwater

One of the most important elements of the NPS Plan is reducing nonpoint pollutants generated or conveyed by stormwater. The NPS Plan addresses numerous ways potential pollutants enter the City's drinking way supply; these include runoff from roads and other impervious surfaces, surface flow through drainage swales and infrastructure, and storm flows from watercourses with eroding channels. The NPS Plan addresses existing sources of improperly managed stormwater and incidences of accelerated erosion and sedimentation.

Stormwater Infrastructure Mapping and Inspection

DEP's contractor, Tectonic Engineering, was engaged in the fall 2003 to digitally map and inspect the stormwater infrastructure in critical areas of the Croton Falls, Cross River, West Branch and Boyds Corner reservoir basins. The target inspection areas were identified in the Croton Watershed Strategy, Draft Croton Plan, and by DEP staff as critical stormwater management areas, septic focus areas and wastewater treatment plant service areas. The mapping and inspection program was designed to identify illicit connections to the stormwater infrastructure, identify where stormwater management and erosion abatement might reduce pollutant loading to surface waters, and comprehensively map the infrastructure for use in potential future stormwater management programs.

In 2004, the City elected to expand the program to include mapping and inspection of the entire stormwater infrastructure in the Cross River and Croton Falls Reservoir watersheds. The additional work that began during the reporting period is proceeding as weather permits and is scheduled to be completed in December 2005. DEP decided to include these entire basins to further ensure the absence of illicit connections and, in part, to provide additional information for the evaluation of impervious surface thresholds and to provide data for the design of planned stormwater remediation facilities.

During the 2004 inspection program, pertinent data such as sewer pipe size, estimated age, composition, and precise location, as well as outfall and catch basin location, was collected and digitally mapped. Comprehensive digital mapping of the infrastructure ensures that all of the system's components are located, which is essential for future inspection and maintenance.

Tectonic submitted its final report that contains maps of the digital mapping and inspection data in late September 2004. To date, the ongoing inspection effort evaluated 246,700 linear feet of pipe and 3,827 outlets and catch basins and revealed no sites in need of stormwater management, erosion control measures, or other stormwater treatment measures. An additional 2,383 structures (outlets and culverts) were mapped. The September 2004 report identified six areas of concern in the form of unauthorized discharges, as described in the table below.

Three of the six areas of concern identified by the contractor in 2004 were determined to be illicit discharges: a residence at Robin Drive, Arms Acres, and Carmel Bowl, all in Carmel. The residence at Robin Drive had installed a pipe from a dog kennel to the infrastructure in Robin Drive allowing dog waste to be discharged directly to the stormwater system and into the West Branch Reservoir. The pipe was permanently sealed.

At Carmel Bowl, DEP noted an area of sewage material (toilet paper and other debris) surrounding a sewer cleanout drain on-site. According to the property owner, the sewer line was previously cleaned with an "electric snake" and the discharge occurred at that time. The material was cleaned within one week of DEP's initial site inspection and the sewer cleanout was capped.

At Arms Acres, a clogged kitchen grease trap led to the unauthorized discharge of kitchen grease from an on-site cafeteria directly into the stormdrain system. DEP referred the site to the Putnam County Department of Health (PCDOH). According to PCDOH, the property owner has contracted a local contractor to remove grease from the trap on a regular basis. PCDOH indicated that the site has been remediated to their satisfaction and that they require no further action on the site. The other three sites identified were investigated and determined not to be illicit discharges.

DEP continues to review routine project progress and inspection reports with the contractor monthly. Further, DEP's contractor notifies DEP immediately when any potential illicit connections or other potential sources of nonpoint pollution are identified. DEP promptly initiates an investigation and takes further action when any potential remediation needs are deemed necessary.

Stormwater Remediation Plan Implementation

Work under a Stormwater Remediation Site Design contract began during the reporting period. That contract requires the contractor to prepare designs and specifications to remediate five large sites that are contributing significant volumes of sediment to the water supply (Table 4.11).

Table 4.11. Large stormwater remediation projects being designed.

Site Name and Pollutant	Reservoir Basin	Town	Location and Description of Remediation
WB-1 Sediment	West Branch	Kent	Joseph Court: Repair severely eroded 200' length of channel on steep slope. The drainage channel discharges directly to the West Branch Reservoir.
CR-1 Sediment	Cross River	Bedford	Maple Road, a 0.9 mile length of unpaved road with unpaved shoulders adjacent to the Cross River Reservoir: Stormwater drainage improvements, culvert repair, embankment stabilization, and landscape improvements along length of unpaved road.
CF-1 Sediment	Croton Falls	Carmel	Stoneleigh Avenue: Stream channel stabilization for length of eroded stream channel (Michael's Brook) between Hughson and Kelly Roads.
BC-1 Sediment	Boyds Corner	Kent Cliffs	Richardsville Road, a stream channel spanning from a pond, through a small cottage residential community to an eroded outfall on a steep slope: install new drainage culvert, embankment stabilization, riprap channel, head and endwalls, and forebay.
WB-2 Sediment	West Branch	Carmel	Unpaved parking lot in Sycamore Park off Long Pond and Crane Roads: embankment stabilization, grass pavers to stabilize parking area and drainage improvements including forebays.

Stormwater Retrofit and Remediation Program

DEP's Retrofit and Remediation Program includes all remedial measures associated with stormwater, and the application of the site and facility selection criteria.

Washington Road

Washington Road is an unpaved road adjacent to the West Branch Reservoir. The road is characterized by the lack of stormwater infrastructure and accelerated erosion of the road's surface, shoulders and existing conveyance channels. DEP designed a stormwater remediation and erosion abatement plan for the road and side slopes as well as contract plans and specifications for the repairs. Work commenced in August 2004. At the end of the reporting period, 85% of the work to eliminate ongoing discharges of sediment into the West Branch Reservoir from the road

and its inadequate drainage system was complete. The contract will be closed in the spring 2005, after the final three sections of severely eroded slopes have been stabilized, the landscaping plan has been implemented, and the several damaged sections of the road have been repaired

Meadowlark Drive and Pennebrook Lane

DEP designed retrofits, to be partially funded by monies secured through a Water Resources Development Act (WRDA) grant, for two poorly functioning stormwater basins in the West Branch Reservoir watershed. The basins are being restored to capture and attenuate the first flush, treat contaminant-laden runoff, and control peak rates of stormwater discharges. Federal, State and municipal permits and approvals were secured and site work began at the Meadowlark Basin retrofit site in 2004. At the close of the reporting period, 80% of the work necessary to transform the existing detention basin into a stormwater treatment basin/created wetland was complete.

During 2004 DEP's contractor also mobilized and began construction of the stormwater management facility on Pennebrook Road, also funded in part with monies from the WRDA grant.

Small Stormwater Remediation Sites

The small remediation projects program was established to repair incidences of erosion and sedimentation in the Catskill/Delaware basins EOH. Projects in this program cannot be candidates for any other federal, City, State or municipal initiative. Examples of remediation sites include eroding stormwater discharges at the outfalls from existing infrastructure, eroding stream channels, and failing slopes adjacent to reservoirs, wetlands and watercourses.

Repair of ten small erosion sites in 2004 was completed by the close of the reporting period. To expedite future small site repairs, during 2004 DEP developed a three-year contract to repair 10 sites each in 2005, 2006, and 2007, and identified the specific sites in need of repair.

Table 4.12. Location of Small Stormwater Remediation Projects remediated in 2004.

Site No.	Reservoir Basin	Town	Location and Repair Description
WB1	West Branch	Carmel	Stream north of Washington Road: stabilize stream bank, head and endwall repair and stabilize outlet.
BC1	Boyds Corner	Kent	Stream from Seven Hills Lake: culvert under Ninham Road, stabilize stream bank, head and endwall repair and stabilize outlet.
BC2	Boyds Corner	Kent	Stream from Ninham Lake: repair culvert under East Boyd's Road, stabilize stream bank, head and endwall repair and stabilize outlet.
BC3	Boyds Corner	Kent	Culvert under East Boyd's Road: culvert repair and channel stabilization.

Table 4.12. Location of Small Stormwater Remediation Projects remediated in 2004.

Site No.	Reservoir Basin	Town	Location and Repair Description
BC4	Boyds Corner	Kent	Culvert under East Boyd's Road: culvert repair and channel stabilization.
BC5	Boyds Corner	Kent	Culvert under East Boyd's Road: culvert repair and channel stabilization.
BC6	Boyds Corner	Kent	Culvert under East Boyd's Road: culvert repair and channel stabilization.
BC7	Boyds Corner	Kent	Culvert under East Boyd's Road: culvert repair and channel stabilization.
BC8	Boyds Corner	Kent	Culvert under East Boyd's Road: culvert repair and channel stabilization.
BC9	Boyds Corner	Kent	Culvert under East Boyd's Road: culvert repair and channel stabilization.

4.7.2 Spill Containment Plan

DEP completed the design of a spill containment plan for the East of Hudson Catskill/Delaware Reservoir watersheds in January 2004. The plan, modeled after the integrated Kensico Spill Containment Plan, is designed to ensure that 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 expedited and simplified recovery. This will prevent migration of the material through the reservoir, minimizing the impact to water quality.

The plan includes the installation of spill containment booms at stream inlets and other critical points in four East of Hudson Catskill/Delaware Reservoirs, boat access ramps at strategic locations along the reservoirs' shorelines, and a containment facility labeling system to facilitate the identification of spill locations. The project will be completed in two phases, with Phase I focusing on the West Branch and Boyds Corner basins and Phase II focusing on the Croton Falls and Cross River Reservoirs.

DEP's NPS Plan includes the installation of spill containment facilities at the stormwater infrastructure outfalls from heavily traveled secondary roads with the potential to convey hazardous spills into the four reservoirs. The containment facilities are floating booms, anchored to the reservoir shore. An important function of the containment facilities is to allow for recovery and clean up of the spilled substances. The NPS Plan also includes installation of storage buildings that will house emergency booms and spill response materials, as well as floating boat docks that provide boat access for clean up and recovery.

At the close of the reporting period, the contract to execute the plan was awaiting registration by the Comptroller. Once the contract is registered, DEP will issue an Order to Commence Work and work on the project will begin.

4.7.3 Maintenance Implementation and Tracking

Stormwater Facilities Construction, Operations, and Maintenance Tracking

The various specifications DEP developed to maintain all of the stormwater management facilities and erosion controls constructed in the Kensico watershed will be applied to the facilities installed and constructed under the NPS Plan. During the reporting period, DEP prepared specifications for a 3-year contract to maintain all of the nonpoint source facilities, including stormwater retrofits, erosion controls, spill containment facilities, and turbidity curtains. During the reporting period, maintenance was conducted under an existing contract DEP has with a qualified firm.

During 2004, DEP and its contractors continued development of full scale Computer Assisted Facilities Management (CAFM) system to track nonpoint source management measure implementation, operation, inspection, monitoring and maintenance efforts. The program will track all program activities, including construction, operation, maintenance, and monitoring. Its most unique and useful function is to provide pop up reminders on computer calendars to complete routine and non-routine program activities such as:

- routine and weather-event triggered post construction inspection and monitoring,
- maintenance schedules and emergency requisition requirements and deadlines,
- construction schedule compliance requirements, and
- program schedule compliance reminders including reporting deadlines.

These capabilities, plus the field data logging function of the program, make the CAFM system an important addition to the long term success of DEP's nonpoint reduction measures.

4.7.4 Hazardous Materials/Stormwater Audits

In 2004, DEP completed an inventory of facilities that potentially contain hazardous materials. DEP also conducted field investigations to verify site locations and operational status, digitally mapped sites using GIS software, and developed a preliminary protocol to be used during site inspections.

Sites were initially identified using information contained in the Croton Watershed Strategy, which includes facilities listed on various State and federal regulatory databases, as well as New York State Office of Real Property Services (NYS ORPS) land use classifications contained in DEP tax parcel databases. Once a preliminary listing of sites was developed, field investigations were conducted to verify site location and operational status. Based on the field investigation, a total of 80 sites were selected for inclusion in the audit program.

The majority of sites were found to be clustered in three focused areas along major roadways in the watershed basins: Route 52 in the Town of Kent, Route 6 in the Hamlet of Mahopac, and Route 6/Old Route 6 in the Town of Carmel. The majority of facilities identified were petro-

leum bulk storage or RCRA-waste generating facilities associated with automobile filling and repair stations. Other sites included dry cleaners, municipal facilities, light industrial operations, and a hospital.

Field visits included inspections of the facility by DEP staff to identify potential threats to water quality. DEP then developed recommendations for property owners based on the results of site inspection. Participation in the audit program was voluntary.

In 2004, DEP contacted 64 of the 80 sites identified for inclusion in the program. Property owners granted DEP access to 42 of these 64 sites. A list of sites contacted is as follows:

Conditions identified at five facilities warrant additional investigation and/or remediation. These sites, associated areas of concern, and status are listed in the table below.

Table 4.13. Sites identified that warrant additional investigation, remediation, and/or evaluation.

SITE/ STREET/ TOWN	BASIN	ISSUE	POSSIBLE SOLUTION	STATUS
Shade & Sun Nursery/ Shady Ln/ East Fishkill	Boyds Corner	Signs of erosion along unpaved roadways on-site. Sedimentation of stormwater basin near entrance of facility. Uncovered soil stockpiles possibly eroding from rear work area.	Stormwater infrastructure improvements along unpaved driveways to reduce erosion. Cleaning of stormwater basin on-site. Erosion and sediment control measures for soil stockpiles (e.g. covering, silt fences, seeding).	Letter sent to facility in September 2004 requesting that the owner install erosion and sediment control measures and consider developing a stormwater management plan for the facility. Follow-up to be conducted in 2005.
Near Sunoco Service Station/Route 35/ Cross River	Cross River	General drainage problems along Rt. 35 cause flooding of gasoline refueling area and service bays on-site. Minor erosion galley identified along eastern portion of property flowing toward stormdrain.	Stormwater infrastructure improvements along Rt. 35 to direct stormwater away from facility.	Specific remedial measures being developed.

Table 4.13. Sites identified that warrant additional investigation, remediation, and/or evaluation.

SITE/ STREET/ TOWN	BASIN	ISSUE	POSSIBLE SOLUTION	STATUS
Mahopac Railroad Tie Corp./Route 6/ Mahopac	Croton Falls	Improper storage of used oil and automobile batteries in the southern portion of the site. Storage of out-of-service AST's on-site. Junk automobiles and scrap metals on-site are exposed to stormwater.	Proper storage and disposal of used oil and auto batteries. Removal of out-of-service AST's and junk automobiles from the property. General housekeeping improvements by property owner in the future.	Property owner initiated cleanup of site in December 2004. DEP Legal Dept., NYS Attorney General's Office and DEC Region 3 Solid and Hazardous Waste Engineer notified of the site. DEP to inspect site upon completion of site cleanup.
Williams Shell Service Center/Route 6/ Carmel	Croton Falls	Floor drain identified in service bay. Discharge point of drain unknown. Staining noted around drain. Storage of oils and other auto-related materials noted in vicinity of drain.	Investigate discharge point of drain to determine if Class V Underground Injection Well.	Referred to DEC Water Division in August 2004 as possible Class V well under the EPA UIC Program. Drain plugged with impervious material by property owner in November 2004. Consultant for property owner contacted DEC in December 2004 to request closure. DEP is awaiting response from DEC.
Near Matra & Every Citgo/ Route 6/ Carmel	Croton Falls	General drainage problems along Rt. 6 cause periodic flooding of facility. Sediment noted near stormdrain in front of property along Rt. 6.	Stormwater infrastructure improvements along Rt. 6 to direct stormwater away from the facility.	Specific remedial measures being developed

Minor housekeeping issues were recommended at eleven facilities. Housekeeping concerns largely involved storage of chemical containers, used batteries, used auto parts, and/or wrecked vehicles in uncovered, outdoor areas where they were directly exposed to stormwater. These materials, when stored in this manner, represent a nonpoint source of pollution.

Property owners were advised of the areas of concern at the time of inspection and in formal correspondence. DEP also distributed guidance materials to property owners advising them on proper storage and handling practices for hazardous materials and petroleum products and initiated follow up contact to ensure these areas of concern were addressed. Sites such as these will also be targeted for future education, outreach, and awareness efforts.

DEP will complete audits of the remaining 16 sites, and prepare a summary report of major findings from the audit program and recommendations for future activities during the next reporting period. It is anticipated that recommendations will include a schedule for re-inspection of certain facilities, follow-up on previously recommended remedial activities, and the development of education, outreach, and awareness activities.

4.7.5 Turf and Pesticide Management

In 2004, DEP continued to work with the Interagency Fertilizer Workgroup (the Workgroup) to educate the public on proper lawn care practices, the potential water quality impacts associated with fertilizer use, and promote the use of low/no-phosphorous fertilizer products in the New York City watershed. The Workgroup consists of individuals from various organizations including the NYS Attorney General's Office, EPA, NYSDOH, DEC, DEP, Westchester County Department of Planning, Cornell Cooperative Extension of Westchester County, New York State Turf and Landscape Association, and the GAIA Institute, among others.

The Workgroup created and distributed educational brochures to local residents that discussed potential water quality impacts of fertilizer use and promoted soil testing prior to fertilizer application. The Workgroup also developed a series of short presentations aimed at educating local garden clubs and lawn care professional on proper lawn care practices, the potential water quality impacts of fertilizer misapplication, and the water quality benefits of soil testing and low/no-phosphorous fertilizers. Members of the Workgroup also initiated contact with retailers to make low/no-phosphorous fertilizers available in local stores in watershed areas.

In addition to these ongoing efforts, DEP also awarded a $50,000 contract to Westchester Cornell Cooperative Extension (CCE), working in conjunction with Putnam County CCE, to develop and implement a survey of residential lawn care practices in the East of Hudson watershed basins. The goal of the survey is to characterize current lawn care practices on residential properties and will be distributed to both residents and commercial landscape professionals. Survey documents will be finalized by February 2005, and administered between March and June 2005.

4.7.6 Map, Analyze and Track Impervious Cover

After developing a scope of work in 2004 for additional analysis of the relationship between the percentage of impervious surface in a watershed basin and water quality, DEP is awaiting a revised scope of work from the contractor who is engaged to perform these services. This revised scope will utilize data from the Croton Process Studies and the Croton Watershed Study to conduct a paired watershed assessment at the subwatershed scale to better quantify the water quality and biological impacts of impervious cover. The currently contemplated scope includes utilizing data from two subwatersheds within the Cross River and Croton Falls watersheds where intensive water quality and biological monitoring data exist, and where land use intensity is very different. A tributary to Cross River Reservoir (e.g., Michaels Brook) that has an extensive network of enclosed drainage and impervious cover will be compared to a similarly-sized, relatively undeveloped subwatershed in the Croton Falls watershed. The basic approach will be to collect and analyze specific watershed land cover characteristics of each subwatershed, such as total impervious cover, directly connected impervious (also frequently referred to as effective impervious cover), total forested cover, total wetland acreage, total number of stream/roadway crossings, total length of enclosed drainage network, etc. and correlate these metrics with water quality and biological monitoring data. The data will help support previous impervious cover analyses projects as a definitive case study and will allow investigators to critically evaluate the input data for anomalies that can impact statistical assessments of this nature.

4.7.7 Wastewater Infrastructure Mapping, Inspection, and Remediation

The four Catskill/Delaware EOH watersheds are rural in character and primarily served by septic systems. DEP's Nonpoint Plan addresses the potential for wastewater to enter the water supply in several ways. First a contractor is being engaged to map the entire wastewater infrastructure system in the four target watersheds and to video inspect the certain sections of the infrastructure that are most likely to be defective and, as such, allow for the exfiltration of wastewater into the water supply.

To categorically determine that no threat from defective wastewater infrastructure exists in the four reservoir watersheds, DEP's contract specifications require the mapping and video inspection of the wastewater infrastructure. To accomplish that task, the contractor must first conduct a thorough investigation to identify the locations of all sanitary infrastructure. This, and the other information generated during the mapping and inspection program will be used to formulate a Wastewater Infrastructure Remediation Plan. DEP will implement the Remediation Plan in cooperation with infrastructure owners and operators and will fund and oversee the repair of all defects that may result in nonpoint discharges of wastewater into the water supply. Illicit connections to the infrastructure will also be identified under this program and addressed by appropriate enforcement authorities. DEP will attempt to expedite any necessary repairs through inter-municipal agreements, as it has in the past.

In 2003, DEP prepared specifications for the mapping and video inspection of the wastewater infrastructure in the four EOH Cat/Del Basins. In 2004, DEP elected to expedite the contracting process, and incorporate the sanitary infrastructure video inspection and mapping work into the ongoing stormwater infrastructure inspection contract. The contracting approvals were obtained in 2004. The sewers will be inspected and mapped beginning in the spring of 2005. To expedite preparation of the Wastewater Remediation Plan, DEP has requested that it be informed by the contractor of any potential defects that may lead to exfiltration of effluent when they are found.

All of the sanitary infrastructure in the four East of Hudson basins will be inspected to comprehensively identify and assess potential sources of wastewater from the sanitary sewer system. During the inspection program, pertinent data such as size, estimated age, composition, and precise location of sewer pipes and manholes will be collected and digitally mapped. Collecting digital data of the system's components is essential for future inspection and maintenance. All defects that might lead to exfiltration of wastewater into the water supply will be identified.

Wastewater Infrastructure Remediation Plan

DEP will utilize the results of the Wastewater Inspection Program to develop a Wastewater Infrastructure Remediation Plan. The plan will repair any defects in the wastewater infrastructure that may lead to exfiltration of wastewater. To expedite implementation of the Remediation Plan, DEP contacted the infrastructure owners in 2004, and will obtain and evaluate information about all potential defects when the defect is found, rather than waiting for the entirety of the infrastructure to be inspected to review the results. DEP can then address illicit connections as they are found, by further investigation and forwarding all information to the appropriate regulatory agencies for enforcement action. The information found during the additional investigation will be incorporated into the template specifications mentioned above and used to refine and finalize intermunicipal agreements to complete the repairs.

4.8 Kensico Water Quality Control Program

Protecting the Kensico Reservoir, its watershed and surface water quality has been a long standing priority for DEP. Program elements include aggressive stormwater management, waterfowl management, installation and maintenance of a turbidity curtain and spill containment facilities, and maintenance dredging. In 2004, DEP continued to diligently implement planned programs, and expand and refine Kensico watershed management initiatives.

4.8.1 Stormwater Management

Stormwater Management Facilities 75 and 68A

In 1998, DEP embarked on a program to install 45 stormwater management and erosion abatement facilities in the Kensico Reservoir watershed to reduce loads of turbidity and coliform bacteria delivered by stormwater to the Kensico Reservoir. The last erosion abatement facility, channel stabilization on Stream E9 near Route 120 (68A), was completed in 2004. Construction included stream bank stabilization, access road stabilization and drainage improvements, as well as monitoring equipment installation.

Construction of detention basin 75, on Stream E11, between Route 120 and Interstate 684 was also completed in 2004. This basin, the last of the ten designed as part of the stormwater management component of the Kensico Water Quality Control Plan, had been redesigned to avoid a buried fiber optic cable that serves the northeast corridor.

4.8.2 Stormwater Facility Maintenance

To ensure that all of the stormwater facilities in the Kensico watershed continue to function as intended, DEP provides for routine facility inspections and maintenance at each site. DEP staff complete the facility inspections, while maintenance is performed by either DEP staff, or DEP's maintenance contractor. In 2004, DEP developed a three-year maintenance contract that will become effective at the close of the existing maintenance contract.

Facility inspections conducted during the reporting period found few instances of required immediate maintenance and none that appeared to compromise the effectiveness of the stormwater facilities. One access improvement was completed for the monitoring crew at Whippoorwill stream. What maintenance that was required was completed without delay. Maintenance performed included:

- clearing fallen dead trees
- repair of storm damage around Whippoorwill Stream (BMP 61)
- repairing security fencing around a detention basins
- replacing eroded rip rap at three facilities
- repairing several eroded slopes
- removing invasive vegetation from several facilities
- mowing detention basin slopes and embankments
- removing accumulated sediment from outlet stilling basins

At the end of 2004, DEP conducted thorough inspections of all stormwater facilities in the Kensico watershed and developed a comprehensive schedule of maintenance activities that will be implemented as soon as weather permits in the spring 2005. These activities include:

- removal of accumulated sediment, debris, and unwanted vegetation from detention basin forebays, outlet stilling basins and stabilized stream channels
- extension of maintenance road access and guide rail at detention basin 67/State Route 22 (permits have been secured), installation of gate in fence, and removal of debris pile at northern end of basin
- cleaning out rip rap stream channel at BMP 28 and repositioning eroded rip rap
- mowing and weed whacking all detention basins and BMP 44
- installation of access paths for monitoring crews at detention basins 12 and 37
- installation of access improvement (turn around) at detention basin 75
- installation of impervious liner in micropool B at detention basin 75
- reparation of spill containment facilities as needed (replace missing buoys, flotation, anchors and cables) and removal of any floating debris

Stormwater Facility Monitoring

DEP's Kensico stormwater management facilities monitoring program revealed that the stormwater remediation and erosion abatement facilities continued to effectively eliminate sources of sediment, and reduce other nonpoint pollutants during 2004. Nonpoint reductions in loads of suspended sediments delivered to the reservoir are realized where stabilized stream banks and channels, and stormwater outfalls prevent sediment from entering surface waters and the reservoir during base and storm flows. DEP confirms the stability of the repaired banks and channels at erosion abatement facilities during regular inspections. DEP monitoring found the following nonpoint removal rates at one detention basin:

- total phosphorus 61%
- fecal coliform 33%
- turbidity 77%
- total suspended solids 81%

4.8.3 Enhanced Spill Containment

DEP anticipates that the components of the Enhanced Spill Containment Plan implemented in 2004 will not only enhance containment, but also decrease response time in the event of a release. Furthermore, the containment structures have been specifically designed to preclude waterfowl roosting through the use of deterrents on the tops of the boom buoys, which will reduce the likelihood of pathogen contamination.

During 2004, additional spill containment facilities were installed at existing stormwater outfalls in the Kensico Reservoir (see Figure 4.29) in accordance during the reporting period. Additional work, including safety improvements at the Kensico dock and other boat access improvements will be installed under an active contract in accordance with spill response protocol. The spill containment facilities will be maintained under the 3-year maintenance contract.

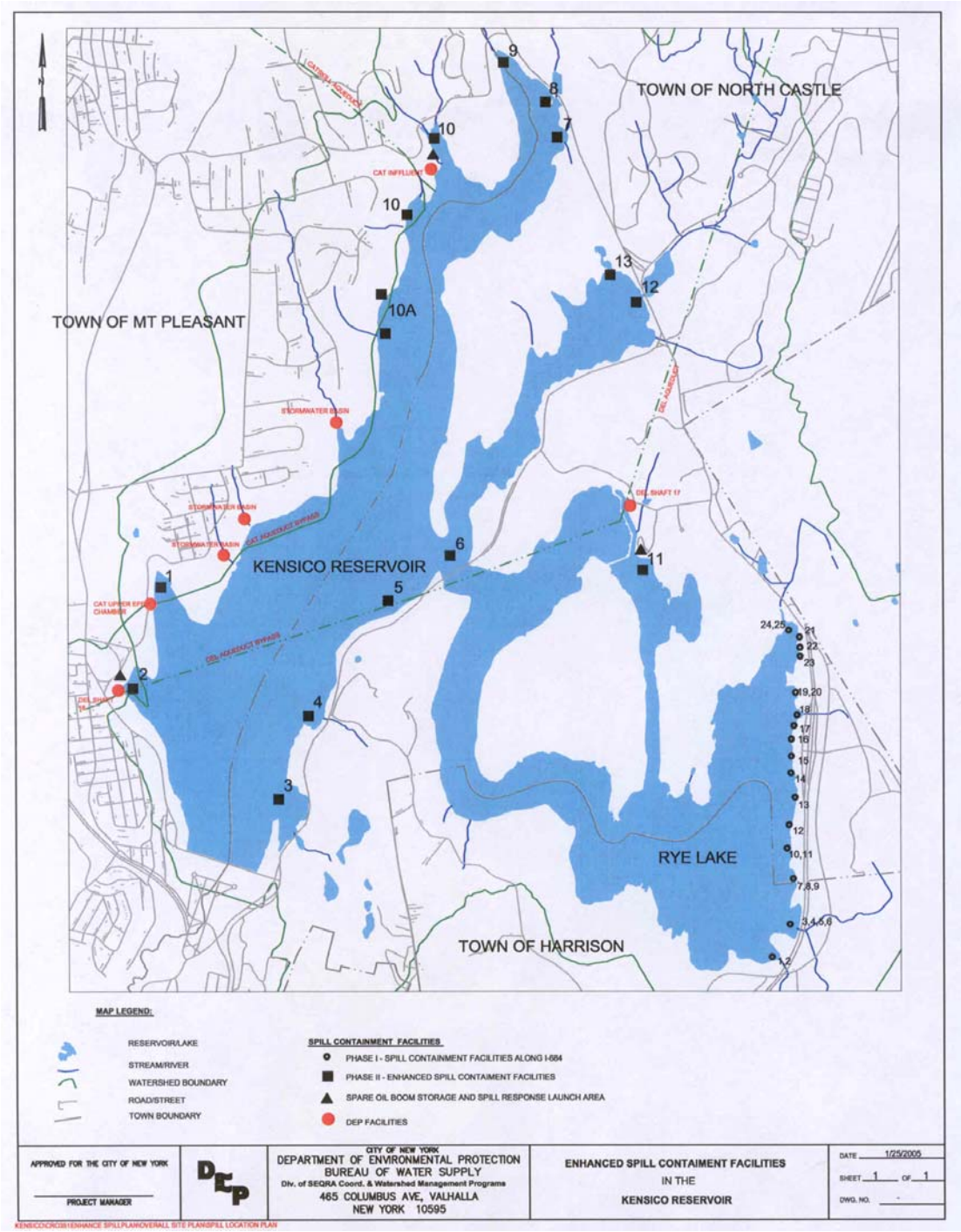


Figure 4.29. Kensico Reservoir Spill Containment Facilities Installed in 2004.

4.8.4 Reservoir Dredging

In 2004, DEP continued to monitor the accumulation of sediment in the reservoir, specifically at the mouths of Malcolm and Young Brooks, in accordance with the dredging criteria DEP developed in 2003. Because the stormwater management facilities in Malcolm and Young Brooks prevent the migration of sediment into the reservoir, no significant accumulations of sediment were observed in either location. Sediment accumulation in the stormwater facilities upstream from the key areas of potential accumulation, were also closely monitored. Sediment was removed from two of three facilities during the reporting period, preventing accumulation in the reservoir.

4.8.5 Wastewater Infrastructure Inspection and Mapping

DEP's contract to video inspect and digitally map certain sections of the sanitary sewer infrastructure in the Kensico Reservoir watershed experienced processing delays. The contract was advertised in August 2004, and a low bidder selected in September. DEP expects the contract will be awarded and registered in early 2005. DEP's contractor is ready to mobilize upon receipt of the Notice Commence Work. The mapping and inspection will supplement DEP's previous program in which some 50,000 linear feet of sewer were mapped and inspected. This new contract is expected to map and inspect all of the remaining sanitary infrastructure in the watershed, estimated to be some 40,000 feet (see Figure 4.30).

4.8.6 Giardia Control

Animals living in stormwater infrastructure can contribute to fecal loads in the surface water system. To prevent animals from entering and inhabiting the storm drain infrastructure in the Malcolm Brook subbasin, grates were installed at the outlets of four storm drains in October 2004. The grates are designed to prevent clogging by swinging open in the event of a debris backup during high flows, and to prevent animals from lifting and entering the pipe during dry periods. During the 2002 stormwater infrastructure inspection program, video cameras filmed images of a raccoon in the storm drain.

4.8.7 Turbidity Curtain

In 2003, DEP replaced in the almost 10-year old turbidity curtain that was installed to deflect flows from Malcolm and Young Brooks away from the Catskill Upper Effluent Chamber. In 2004, DEP extended the existing turbidity curtain by 300 feet to direct flows from Malcolm and Young Brooks further out to the body of the reservoir and to provide enhanced protection of the water entering the Catskill Upper Effluent Chamber. This work was performed in accordance with the Giardia Control Plan DEP prepared for EPA.

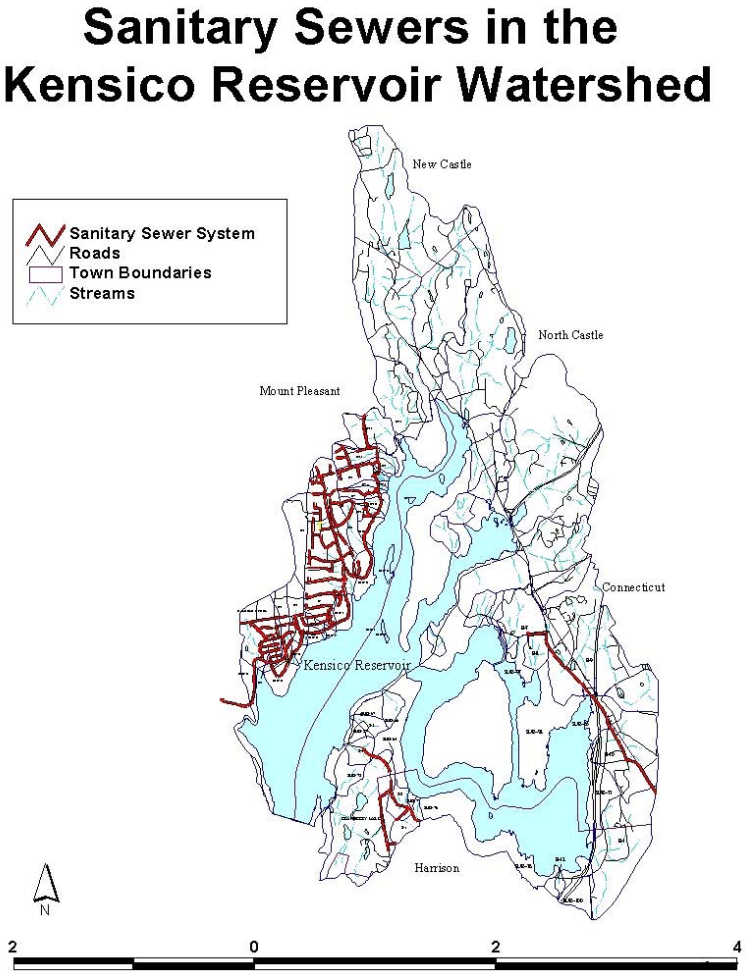


Figure 4.30. Sanitary sewers in the Kensico Reservoir watershed.

4.8.8 KEEP

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 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.

KEEP participated in many events throughout the year. They took part in the Pace University Environmental Center's Annual Harvest fair by providing educational materials highlighting KEEP's mission. KEEP sponsored a Trout in the Classroom Program at Westlake Middle School

in Mt. Pleasant. In May, KEEP held very successful Kensico Reservoir Watershed Water Conservation & Water Quality Preservation Art & Poetry Contest involving schools surrounding the Kensico Reservoir. The Art and Poetry contest was a culmination of classroom lessons, which focused on the history and present day New York City water supply system, the role that the Kensico watershed plays in the overall system, water quality, and the value of water and water conservation. KEEP co-sponsored a performance of “City that Drinks the Mountain Sky” the story of NYC's water supply told in the elemental beauty of Puppet Theater. KEEP co-sponsored its annual Take a Child Fishing Day in which parents and children are invited to learn about and fish in the Kensico Reservoir.

4.9 Catskill Turbidity Control

Due to the nature of the underlying geology, the Catskill watershed is prone to elevated levels of turbidity in streams and reservoirs. High turbidity levels are associated with high flow events, which can destabilize stream banks and also mobilize the streambeds suspending the glacial clays that underlie the streambed armor. The design of the Catskill system accounts for the local geology, and provides for settling within Schoharie, Ashokan West Basin, Ashokan East Basin and the upper reaches of Kensico Reservoir. Under normal circumstances the extended detention time in these reservoirs is sufficient to allow the turbidity-causing clay solids to settle out, and the system easily meets turbidity standards at the Kensico effluents. Periodically, however, the City has had to use chemical treatment to control high turbidities.

DEP is engaged in numerous projects and studies designed to reduce turbidity in the waters of the Catskill system. A summary of the major projects and studies that are underway is provided below. In addition, certain other turbidity control efforts are discussed elsewhere in this report.

Analysis of Engineering Alternatives

DEP is undertaking a comprehensive analysis of engineering and structural alternatives to reduce turbidity levels in the Catskill System. DEP has engaged the Hazen and Sawyer–Gannett Fleming Joint Venture to conduct the engineering analyses. In addition, DEP has hired the Upstate Freshwater Institute (UFI) to enhance the existing Schoharie Reservoir model to allow for full assessment of the effectiveness of potential engineering alternatives in reducing turbidity. UFI has been working closely with the Joint Venture.

The "Phase I Final Report, Catskill Turbidity Control Study" was submitted to EPA and NYSDOH per the FAD requirements. The Study involved a review of historical water quality and physical data for the Schoharie Reservoir and Shandaken Tunnel discharge, review of State and federal regulatory programs affecting these water supply facilities, and evaluation of six alternatives for potentially improving water quality. These alternatives included:

- Alternative 1 - Multi-Level Intake, to allow selective withdrawal of water from strata with

desired turbidity levels;
- Alternative 2 - Turbidity Curtain, to filter out silt and clay particles;
- Alternative 3 - In-Reservoir Baffle, to reduce short-circuiting of Schoharie Creek inflows and improve settling;
- Alternative 4 - Modification of Reservoir Operations, to reduce discharge turbidity while meeting water demands;
- Alternative 5 - Engineered Treatment Facilities, including coagulation, flocculation, and settling; and
- Alternative 6 - Ashokan Reservoir Modifications, to increase overall turbidity removal capacity in the Catskill System.

Summary of findings for each alternative follow:

Alternative 1: Multi-Level Intake

Results of a two-dimensional modeling effort conducted by UFI indicated that selective withdrawal capability through a multi-level intake could help reduce turbidity export from Schoharie Reservoir and provide additional control over discharge temperature. Further modeling over longer simulation periods will be conducted in Phase II to accurately quantify the long-term performance of selective withdrawal structures under a wider range of demand and climactic conditions.

Four potential sites for a new intake with selective withdrawal capability were evaluated. Of these, three sites were recommended for further evaluation in Phase II. Water quality differences between these three sites will be assessed further, following completion of Phase II modeling efforts.

In addition to new multi-level intake structures, modification to provide selective withdrawal capability at the existing Shandaken Tunnel Intake was also recommended for evaluation in Phase II. Such modifications could provide benefits associated with selective withdrawal capability, but in a more cost-effective manner.

Alternative 2: Turbidity Curtain

A comprehensive turbidity curtain study was conducted, including bench-testing, in-reservoir pilot testing, and conceptual design of a full-scale system. In-reservoir pilot testing indicated that a permeable turbidity curtain showed some potential for reducing turbidity export from Schoharie Reservoir. However, the ability of a full-scale system to provide consistent turbidity control performance is questionable. Factors contributing to this assessment include the inconsistent performance exhibited in the majority of bench and pilot tests and the potential negative impact of the air cleaning process on the overall particle removal provided by the curtain system.

In addition, a turbidity curtain at Schoharie Reservoir would constitute a large-scale implementation of a novel, complex technology in a challenging physical environment. Based on performance and reliability concerns this alternative was not recommended for further development in Phase II, either as an interim or a long-term measure.

Alternative 3: In-Reservoir Baffle

Preliminary three-dimensional modeling conducted by UFI indicated that an impermeable baffle structure around the existing intake would reduce the short-circuiting of Schoharie Creek inflows into the intake, thus increasing mixing, dilution of inflows, and settling time. These factors have the potential to reduce turbidity export from Schoharie Reservoir. Further modeling of turbidity/particle transport over longer simulation periods will be performed in Phase II, to accurately quantify the turbidity reduction benefits of baffle structures under a wider range of demand, drawdown, and climate conditions.

A baffle structure at the Schoharie intake could be constructed using either a floating, anchored impermeable membrane material, or a more conventional concrete barrier. The impermeable membrane curtain would have a significantly lower life cycle cost than the concrete barrier, and was recommended for further evaluation in Phase II.

Alternative 4: Modification of Reservoir Operations

This alternative involves modifying the operation of Schoharie and Ashokan Reservoirs to reduce the turbidity of discharges to Esopus Creek and to the Catskill Aqueduct. These alternative management strategies could also provide improved control over peak summer temperatures in water discharged to Esopus Creek. However, water quality-driven changes in the timing of withdrawals must be considered in the context of overall water supply needs.

To further assess the feasibility of modifying reservoir operations to meet water quality objectives while still meeting supply constraints, a linked water quality/quantity modeling tool was proposed, using the GWLF watershed models operated by DEP, the two-dimensional CE-QUAL-W2 reservoir water quality models established by UFI for the West of Hudson reservoirs, and the OASIS reservoir operations model developed by HydroLogics for the DEP reservoir system. This modeling tool would be developed incrementally. Stage 1 (a proof-of-concept model) will begin development during Phase II of the Catskill Turbidity Control Study, in two stages. Stage 1a will focus on Schoharie Reservoir, while Stage 1b will extend the model linkage to include Ashokan and Kensico Reservoirs. The Stage 1a work is expected to yield an evaluation (by the end of Phase II) of the possibility of modifying Schoharie Reservoir operations to address turbidity and temperature concerns.

Alternative 5: Engineered Treatment Facilities

Various engineered treatment and settling facilities were evaluated under Alternative 5. Several of the sub-alternatives considered (including ballasted flocculation, or coagulation, flocculation and clarification using inclined plate settlers) could reduce turbidity export from Schoharie Reservoir and could reliably reduce the turbidity of Shandaken Tunnel discharges to low levels. However, due to the very high cost of such large capacity treatment facilities, as well as the significant environmental, permitting, and public acceptance issues involved in their implementation, none of the engineered treatment facilities evaluated under Alternative 5 were recommended for further evaluation in Phase II.

Alternative 6: Ashokan Reservoir Modifications

Under this alternative, five Ashokan Reservoir modifications that could potentially reduce the turbidity of water entering the Catskill Aqueduct were evaluated. These modifications included providing capacity to discharge turbid West Basin water downstream, increasing West Basin storage capacity to allow longer detention time of turbid inflows, providing selective transfer capacity between West and East Basins, installing a baffle wall in the East Basin to reduce short-circuiting, and installing permeable turbidity curtain(s) around the Catskill Aqueduct intake(s). Three of these five alternatives were found to be potentially feasible and effective and were recommended for further evaluation in Phase II. These include: increasing West Basin storage; providing waste discharge capacity in the West Basin; and installing a baffle wall in the East Basin.

Phase II work will include further development and evaluation of the surviving alternatives identified above. This evaluation will include an assessment of the effectiveness and cost-effectiveness of selected combined alternatives. Core Phase II tasks will include refinement of conceptual designs, additional modeling to quantify turbidity control performance, detailed cost estimation, cost-benefit analysis, and further assessment of potential environmental issues and permitting requirements. The Phase II final report, due September 2006, will include preliminary designs, performance evaluations, and detailed cost information to support final decision-making.

Upstate Freshwater Institute Monitoring and Modeling

Monitoring

In 2004, the Upstate Freshwater Institute (UFI) continued a comprehensive monitoring program of Schoharie Creek, Schoharie Reservoir, and Esopus Creek, that featured elements of robotic monitoring technology, as well as manual efforts. The monitoring effort is a key component of the initiative to develop mathematical models of temperature, transport, and water quality to support related rehabilitation initiatives for these systems.

1. Robotic monitoring

Reservoir Remote Underwater Sampling Station (RUSS) units—RUSS units have been placed on Schoharie reservoir to allow for continuous data collection at key locations. A single RUSS unit was tested in 2002 near the intake. Two additional units were deployed in May 2003, one near the dam and one approximately mid-way between the intake and the dam. These robotic deployments continued in 2004 (April-November).

Stream robotic sampling units (Robohuts) - Specially fabricated for this effort, Robohuts have been placed along streams to collect continuous stream data for several key parameters. A Robohut was placed on Schoharie Creek in March 2003. A second Robohut was installed near the mouth of Esopus Creek in July 2003. These two units provided data during 2004. An additional Robohut was installed on Esopus Creek, above the Shandaken Tunnel outfall, in late 2003. Operation of this unit, delayed because of permitting issues, will commence in early 2005. Plans to install another Robohut downstream of the outfall have been discontinued, because it would not add substantively to the integrated monitoring/modeling initiative.

2. Non-robotic monitoring

UFI continues to conduct manual monitoring on these systems to provide groundtruth information for the robots and augment spatial characterization of water quality, particularly following runoff events, in support of model development and testing. This effort features the use of modern rapid profiling instrumentation in the reservoir, and the deployment of a number of recording thermistors in Esopus Creek. UFI has collaborated with NYCDEP staff in morphometric characterization of Esopus Creek, necessary to support development of models for that stream.

<u>Modeling</u>

Mathematical models of transport and water quality (particularly temperature and turbidity) were being developed, preliminarily tested, and preliminarily applied by UFI in 2004. These quantitative tools will provide credible predictive capabilities to support deliberations by the Joint Venture and NYCDEP managers concerning rehabilitation alternatives for the system, and will eventually support design efforts by the Joint Venture for engineered solutions.

Preliminary testing of the following models was completed by UFI in 2004:

- two-dimensional hydrothermal transport model for temperature for Schoharie Reservoir.
- three-dimensional hydrodynamic/transport model for Schoharie Reservoir.
- two-dimensional interim turbidity model for Schoharie Reservoir.
- temperature model for Esopus Creek.

Models (1) and (3) were applied to support Joint Venture evaluations of Alternative 1 (described above). Model (2) was applied to support Joint Venture evaluations of Alternative 3 (described above). Model (4) will be applied to evaluate the interplay between the Shandaken Tunnel discharge and the temperature of Esopus Creek, and relates to the SPDES permit (described below).

State Pollutant Discharge Elimination System (SPDES) permit for the Shandaken Tunnel Discharge to the Esopus Creek

Following the decision of Judge Scullin on February 6, 2003, requiring the City to diligently pursue a SPDES permit for the water releases from the Shandaken Tunnel into the Esopus Creek, and directing the State to make a determination about the required SPDES permit for the discharge, a first Draft permit was noticed for public comment by DEC in the Environmental Notice Bulletin on February 18, 2004. DEP responded to DEC on March 19 with a letter of comments. Based on comments received from a number of parties, DEC withdrew the initial Draft Permit.

A second Draft Permit was noticed for public comment by DEC in the Environmental Notice Bulletin on August 4, 2004. DEC received a number of comments including a lengthy submission from DEP.

A legislative hearing and issues conference has been scheduled for April 12, 2005, to determine whether the comments received by DEC warrant an administrative hearing. Following that hearing, which seems likely, the administrative law judge will issue a decision as to whether the permit should be issued as a Final Permit in its present form, or whether modifications to the Draft should be made in the Final Permit. A final determination will not be issued for several months.

5. Watershed Monitoring, Modeling and GIS

5.1 Watershed Monitoring Program

An "Integrated Monitoring Report" was delivered to EPA and DOH in October 2002. This report presented reviews of DEP's three key upstate water quality monitoring programs: Hydrology, Limnology, and Pathogens. These reviews were designed to meet the expanding scope of DEP's data uses including requirements for watershed and reservoir models, mandates, and regulations, as well as fulfilling data needs to ensure that management requirements are adequately addressed. The programs are designed to meet the current and future data requirements of DEP including the long-term evaluation of watershed protection programs.

The overall goal of the framework is to establish an objective-based water quality monitoring network, which provides scientifically defensible information regarding the understanding, protection, and management of the New York City water supply. The information needs required to achieve this goal are compiled as objectives, each of which is clearly defined (in statistical terms if possible). The list of objectives for each program was derived by compiling the information needs of existing and prospective DEP programs, and the review of legally binding mandates, agreements, and/or documents which pertain to New York City's Watershed Water Quality Monitoring Program. The definition of objectives was the starting point for this comprehensive review because, ultimately, the objectives define the temporal, spatial, and analytical requirements of the programs. Statistical features of the historical database were used to guide the sampling design.

To ensure the most efficient gathering of data, the monitoring programs are integrated with each other through common data requirements. Several data collection programs (e.g., Hydrology and Limnology) may contribute to a single objective (e.g., Reservoir Modeling) so it is essential that data from each collection program be coordinated.

Minor changes to any of these monitoring programs are being formally documented and maintained as an annual addendum to the Integrated Monitoring Report (IMR). After a 5-year period, a new version of the IMR will be issued that incorporates the changes reported in the annual addenda. Major modifications in these monitoring programs will be submitted to appropriate agencies for prior review and approval, as appropriate. These will be documented in the annual addenda and revised IMR.

Pursuant to the City's Long-Term Watershed Protection Program, DEP now produces a Watershed Water Quality Annual Report which is submitted to EPA in July of each year. This document contains chapters discussing issues, including: water quantity (e.g., the effects of droughts during the reporting period); water quality of streams and reservoirs; watershed management; and water quality models (terrestrial and reservoir). For the 2004 report (due July 31, 2005), the limnology and hydrology components of the document will draw largely on information

obtained from approximately 225 routinely-sampled reservoir and stream sites resulting in about 7,000 samples and over 99,000 analyses. For the pathogens component, a total of 1,895 samples were analyzed for *Cryptosporidium* and *Giardia* (oo)cysts (3,790 analytes) at 206 sampling sites (including keypoints), and 331 samples were collected for human enteric virus examination.

With regard to protozoan pathogens, the following reports were issued in 2004: monthly Filtration Avoidance Report, monthly Croton Consent Decree Report, Semi-Annual Reports of "DEP Pathogen Studies of *Giardia* spp. and *Cryptosporidium* spp. and Human Enteric Viruses". In addition, contributions to the Research Objectives Report, Kensico Reservoir Report, and Watershed Water Quality Annual Report were issued. Additionally, results from weekly *Cryptosporidium* and *Giardia* sampling at the three source waters are posted on DEP's web site.

DEP submits a semi-annual "Kensico Watershed Management Report" to EPA in January and July. The report's January submission presents, discusses, and analyzes monitoring data from the Kensico watershed. This report contains information such as fecal coliform bacteria and turbidity results obtained at various keypoint, stream, and reservoir locations. Additionally, the document reports observations from assessment of Kensico's BMPs, groundwater, toxic substances, as well as from employment of the Kensico water quality model.

5.2 Multi-Tiered Water Quality Modeling Program

DEP's Multi-Tiered Water Quality Modeling Program is an integrated set of watershed and reservoir modeling tools to support both long-term watershed management and short-term operational strategies for maintaining high-quality NYC drinking water. The Program has four major elements:

- Data Acquisition and Organization
- Model Development and Improvement
- Model Integration and Software Development
- Applications for Watershed/Reservoir Management

Progress was made in 2004 in these areas, as described below.

5.2.1 Data Acquisition and Organization

Watershed modeling data includes meteorological data to drive the models; stream flow and water chemistry data for watershed model calibration and testing; and spatial GIS data that characterize watershed land use and physiography. GIS data is organized in a GIS library. Time-series data for modeling is organized in a Modeling Time-Series Data Library. In 2004, modeling time series data were updated as new data became available. DEP now has the following time series data for watershed modeling applications in its Data Library:

- Meteorology data from Northeast Regional Climate Center (daily precipitation and min/max air temperature) – Pre. 1960-2003
- Stream flow data from USGS (daily) - Pre. 1960-2003
- Stream chemistry data from NYCDEP (routine and storm events) - 1987-2003
- Stream chemistry data from DEC (W. Br. Delaware River) - 1992-2002
- Waste Water Treatment Plant data from NYCDEP (monthly nutrient loads) - 1990-2003

GIS data for watershed soils, topography, and land use were updated or improved in 2004. SSURGO 2 (version 2 format) soils data were acquired where available (Cannonsville, part of Pepacton, and East of Hudson watersheds). GIS layers of water table depth and depth to bedrock were created to support model applications. A 10-meter resolution digital elevation model (DEM) of the watersheds was used to create flow direction, flow accumulation, and TOPMODEL topographic index maps for the GWLF-VSA model. Two new GIS layers were created for DEP by PAR. A point coverage of buildings in the WOH watersheds was developed to provide improved estimates of the locations of septic systems. A new land use/land cover (lu/lc) data set based on 2001 remote sensing data provides more current lu/lc data with a higher class resolution. These data will be used in future modeling applications.

Reservoir modeling data includes reservoir morphometry GIS data, a daily time-series of meteorology, and reservoir inputs and reservoir outputs. The input data include stream flows and nutrient loading either estimated directly from measurements of stream discharge and chemistry, or taken from the output of the GWLF model. To calculate the outputs, information on reservoir operations is needed, such as aqueduct flows, reservoir discharge, spillage, and water level (stage). To verify and calibrate the models, water column measurements of temperature, chemistry and phytoplankton biomass are needed.

Data to run the two dimensional reservoir water quality model (CE-QUAL-W2) for the Schoharie Reservoir were acquired as part of the work being done in the Catskill Turbidity Control Study (Gannett Fleming, Hazen and Sawyer, 2004). Following this acquisition, DEP now has model data for a 14 year period (1989-2003). These data, needed to drive the model, include:

- hourly meteorological data,
- daily water flow measurements of reservoir input (streams) and outputs (aqueduct discharge, dam releases, and spill)
- daily stream and aqueduct temperature data
- daily stream and aqueduct turbidity data

5.2.2 Model Development and Improvement

Watershed Models

A major improvement in the GWLF watershed model was made in 2004, by incorporating variable source areas (VSAs) into the model (DEP 2005b). This important modification was made to address the growing body of evidence that the predominant mechanism for runoff gener-

ation in the NYC watersheds is saturation-excess on Variable Source Areas (VSAs), as opposed to an infiltration-excess runoff generating mechanism upon which the standard GWLF is based. Similar to the standard GWLF model, the revised GWLF model simulates runoff volumes using the SCS Curve Number (CN) Method, but spatially-distributes the runoff response according to a soil wetness index. The spatial distribution of runoff by soil wetness index provides a more realistic identification of runoff generating areas in the NYC watersheds, with important consequences for simulation of pollutants that are typically transported by runoff. The revised GWLF model with VSAs will be used in future model development and applications.

Other GWLF model improvements were made in 2004 (DEP 2004a, DEP 2005b). A runoff Curve Number parameter calibration procedure was developed, applied and tested on 31 USDA-gaged WOH watersheds. Calibration of CN parameters greatly improved accuracy of simulated runoff when compared to baseflow-separated runoff data. An alternative formulation of the CN algorithm that is used in the SWAT model was also tested, and incorporated into DEP's GWLF model. This alternative algorithm was found to produce good runoff results and is more compatible with the method used to incorporate VSAs into GWLF. Additional GWLF improvements in 2004 included algorithms for evapo-transpiration from saturated areas, and lagging of surface runoff by travel time through the stream network. An investigation of seasonal patterns in dissolved phosphorus concentrations in runoff was begun in 2004. Results of these investigations will be used to incorporate seasonal variability of nutrient concentrations in a future version of GWLF, as needed.

Progress was made toward improving the calibration of water quality model parameters for the Catskill/Delaware watershed GWLF models. Further calibration and verification of GWLF models, scheduled in the 2002 FAD for January 31, 2006 (Pepacton, Ashokan and West Branch) and January 31, 2007 (Neversink, Rondout, and Schoharie), will be based on additional storm event monitoring being collected by DEP. As these additional data are made available they are processed by calculating loads and statistics at different time scales. In 2004 additional storm event monitoring data for Pepacton, Ashokan and West Branch basins were processed in preparation for GWLF calibration and testing.

Reservoir Models

During this year two new modeling tools, LINKRES and Toolset2D, developed by the Upstate Freshwater Institute (UFI) under a contract from PAR, were evaluated, accepted, and put into use.

LINKRES is an enhanced user interface that runs two dimensional hydrodynamic and water quality models developed for Kensico reservoir and the reservoirs comprising the WOH system, in a linked configuration for a chosen set of interconnected reservoirs. In linked configu-

ration, the aqueduct output from one model simulation, becomes the input to a downstream reservoir. The purpose of LINKRES is to allow for simulations of the movement of several types of substances through differing reservoir networks. The substances can be grouped as:

- Conservative substances (tracer)
- Settling particles
- Decaying particles

The underlying models are based on the hydrodynamic framework of CE-QUAL-W2 (Version 2.0; Cole and Buchak 1995). These models were calibrated and verified for a number of years (UFI 1999, 2000, 2001) except for the Kensico Reservoir, which was calibrated and verified by JEEAI (2001).

A series of LINKRES simulations of the Catskill system were made, which demonstrated the ability of LINKRES to simulate the transport of total suspended solids (TSS) with a constant sinking rate though the Catskill system and Kensico reservoirs (DEP 2004). DEP found LINKRES to be a powerful and useful tool, which allowed detailed simulations of the influence of sources and sinks of TSS on Catskill reservoir water quality, and particularly on the water quality in the Kensico reservoir. A number of important principles regarding the attenuation and movement of TSS were demonstrated. LINKRES proved to be capable of successfully simulating complex patterns of inflow, outflow and reservoir TSS concentrations, permitting evaluation of the factors influencing these patterns.

Toolset2D is used to create the files containing physical forcing data needed to run DEP's 2-D reservoir models and files containing observed measurement data needed for model verification. Toolset2D takes data files already developed for DEP's 1-D reservoir models and converts them to a form that can be used with the 2-D models. DEP tested Toolset2D and found it to correctly reformat data needed for the 2-D reservoir models, and that the 2-D models run correctly using these data. Most DEP 1-D data sets were converted to be compatible with the 2-D models using Toolset2D. Consequently, DEP now has compatible data allowing both 1-D and 2-D reservoir models to be run in parallel.

5.2.3 Model Integration and Software Development

In 2004, DEP completed incorporation of modeling integration tools into DEP's Nutrient Management Eutrophication Modeling System (NMEMS). Modeling integration tools were developed by the SDWA-funded contractor PAR and through work performed in-house by DEP personnel. The combined set of modeling tools was incorporated into NMEMS to provide comprehensive integration of models and data (DEP 2005b).

The modeling toolset includes tools for data analysis and formatting, watershed model application and testing, and reservoir-watershed model integration. The data analysis and formatting tools are for developing time series model inputs (precipitation, min/max air temperature,

point source loads); data for model calibration and verification (stream flow and chemistry time series data); and model parameters (GIS-based model constants, septic system statistics, and BMP implementation data). Watershed model application and testing functionality is provided by the Vensim modeling software tools for model simulation, calibration, output visualization, and result reporting. Reservoir-watershed model integration is achieved through a command line interface to the reservoir model that was developed to provide a seamless data stream between the watershed and reservoir model. These modeling system tools can be operated separately or combined to achieve a flexible system for model development, testing and application.

5.2.4 Applications for Watershed/Reservoir Management

Model applications to support watershed and reservoir management conducted during 2004 included an assessment of phosphorus TMDLs, and TSS/turbidity modeling using DEP's two dimensional modeling tools (LINKRES) and CE-QUAL-W2. The TMDL assessment was submitted to EPA (DEP2004b) in accordance with section 5.2 of the 2002 FAD. TSS/turbidity modeling was done to support management of primary reservoirs (Kensico, Ashokan, and Rondout Reservoirs), in response to specific events that occurred in 2004. Simulations were made in response to a number of events, and DEP also began work on more general simulations to examine the broader patterns of turbidity transport through a number of reservoirs.

TMDL Evaluation

In 2004 DEP utilized the NMEMS to Assess Phase II TMDL's for Ashokan, Neversink, Pepacton, Rondout, Schoharie, and West Branch watersheds and reservoirs (DEP 2004b). The effects of increasing non-point source loads by a ratio of TMDL load allocation to current load on reservoir eutrophication were investigated. Results of these analyses suggested that these increased loads will produce median growing season chlorophyll-*a* levels below critical thresholds. However, the assessment is preliminary because the GWLF models for these watersheds are based on initials calibrations to limited data. Further analyses of the TMDLs will be undertaken once the models are fully calibrated. DEP is proposing no changes to the current TMDLs at this time.

Kensico Reservoir Studies

A study of particle transport through Kensico Reservoir under a range of conditions and aqueduct flow rates was carried out using the CE-QUAL-W2 model (Echelman, 2004 DEP 2005a). The effects of varying TSS sources, reservoir thermal structure, and settling rates on TSS concentrations leaving Kensico reservoir were studied. TSS was input from either the Delaware or Catskill aqueducts as a large pulse during both stratified and isothermal conditions. This study revealed three important findings:

1. The highest Kensico Reservoir effluent concentrations relative to loadings were found during stratified conditions, irrespective of the source of TSS. Transport of TSS as a plume restricted to a vertical layer above the thermocline, is much more effective than transport under isother-

mal conditions. Consequently, TSS inputs occurring during stratified conditions have a greater potential to negatively impact effluent water quality.

2. Elevations of TSS concentrations in Kensico Reservoir effluent during stratified conditions were greater when the source of the TSS load is the Catskill aqueduct vs. the Delaware aqueduct. Settling along the Rye Lake Reservoir Branch can lead to a significant reduction in effluent TSS concentrations derived from the Delaware aqueduct. Under stratified conditions, the effluent response to an input from the Delaware aqueduct was found to be a factor of 3 less than when the simulated TSS input comes from the Catskill aqueduct. This is a result of particle trapping in the Rye Lake Branch.
3. During isothermal conditions TSS loading from the Delaware aqueduct led to greater effluent concentrations, despite particle trapping in the Rye Lake Branch. Under isothermal mixing, particle dilution is the most important factor influencing effluent concentrations and the greater volume of water in Kensico's main branch led to lower effluent response when inputs came from the Catskill aqueduct.

These preliminary results provide valuable information that may be used in Kensico reservoir operational decisions for aqueduct input control.

Rondout Reservoir Studies

The Rondout reservoir simulations were performed in response to a large runoff event that occurred on July 22-23, 2004, which caused the discharge of turbid water into the reservoir from Rondout Creek (DEP 2005b). Such an event can potentially lead to supply-wide water quality problems, particularly if they were to occur at the same time as Catskill system turbidity events. The July 2004 event did not lead to water quality problems since Catskill system water was of good quality and the Rondout turbidities never strongly influenced the Delaware aqueduct water quality. Nevertheless, simulations associated with this event provided an opportunity to test a model of Rondout Reservoir turbidity and added to the existing knowledge of processes related to forecasting turbidity transport. The analysis required development of a 2-D CE-QUAL-W2 model setup to approximate the July storm event that resulted in elevated Rondout Reservoir turbidities (45 NTU at the dam). The 2-D model reproduced observed vertical variations in beam attenuation, which demonstrates the value of the model for simulating the transport and vertical distribution of turbidity, both integral factors in predicting effects on aqueduct withdrawals. Further research will continue to refine these simulations and the Rondout model setup associated with the above simulations will serve as a starting point for future simulations.

Ashokan Reservoir Modeling

The Ashokan reservoir 2-D modeling work involved linking West and East basins in an attempt to assess alternative Dividing Weir operating strategies and their implications on Catskill aqueduct turbidity (DEP 2005b). In these simulations predictions of dividing weir flow from the West Basin model were used as input to the East Basin model, assuming a 2-D model segmenta-

tion scheme. The project developed a two-dimensional LINKRES setup to simulate a storm event occurring on September 18, 2004, which elevated Ashokan reservoir West Basin turbidity levels to approximately 100 NTU.

Three scenarios were developed to assess the implications of using the Catskill aqueduct East Basin intake under conditions where flows were either primarily spilling over the Dividing Weir or moving through the gate structures, which are approximately 12 meters below the weir crest. These scenarios were:

1. "Passive Gate", where the gate transfer flow rates are kept at a relatively low and constant rate and are not actively increased to reduce the transfer of water over the Dividing Weir. This scenario simulated the greatest transfer of water over the dividing weir.
2. "As Operated Gate", where the gate transfer flow rates are actively increased to reduce the flow over the Dividing Weir. This scenario is based on the operating policy that was used during the September turbidity event.
3. "Preemptive Gate", where the gate transfer flow rates were increased beyond the normal "as operated" policy to minimize the transfer of water over the Dividing Weir.

The results of running these scenarios suggested that during this event, the "as operated" strategy favoring gate flows led to acceptable turbidity levels that were well below the maximum level in the turbidity plume. However, the simulations also suggest that at this time an aggressive policy of limiting flows thought the gate ("passive gate" scenario) could have led to somewhat better water quality.

These results are preliminary, but do illustrate the ability of the 2-D models to aid in the monitoring of an ongoing turbidity event to simulate the time of travel through the West Basin and to evaluate reservoir operation strategies to mitigate the detrimental effects of a turbidity plume. The results obtained here are dependent on the magnitude of the Esopus Creek discharge and turbidity levels, as well as the nature and structure of thermal stratification in the reservoir. This work illustrates the use of models to better understand the dynamics of turbidity mixing and transport, and suggests that simulations can be used examine standard reservoir operating procedures.

5.3 WWTP Monitoring

5.3.1 Pathogen Sampling

The purpose of the WWTP monitoring program is to demonstrate that microfiltration and technologies deemed equivalent continue to perform well with respect to pathogen removal from effluent. DEP monitors ten waste water treatment plants quarterly since July 2002, as described in the Integrated Monitoring Report. The following wastewater treatment plants are sampled: Hunter Highland (HHE), Delhi (DTP), Pine Hill (EPE), Hobart (HTP), Margaretville (MSC), Grahamsville (RGC), Grand Gorge (SGE), Tannersville (STE), Stamford (STP) and Walton (WSP) (Figure 5.1).

All plants were sampled four times in 2004, with the exception of Pine Hill and Hunter Highland which were each sampled three times. The fourth samples were postponed due to weather related issues. Both of these samples were missed in the fourth quarter of 2004 and were sampled in early January 2005. Additionally, two virus results are not available for 2004. The Pine Hill virus sample for January 26, 2004 was not able to be collected due to weather and the Tannersville virus result for June 8, 2004 is missing as a result of the shipping company losing the filter.

Seven of the ten plants were negative for *Cryptosporidium* in 2004 (Table 5.1). There were three occasions when *Cryptosporidium* oocysts were recovered and each time it was from a different plant. Hunter Highland, Hobart and Margaretville plants each had one occurrence ranging from 1 to 3 oocysts per 50L. Eight of the ten wastewater treatment plants were negative for *Giardia* cysts during 2004. Stamford had one occurrence of cysts in January 2004 (1/50L), whereas the Grahamsville plant was positive for *Giardia* cysts each of the four times it was sampled with results ranging from 2 to 39 cysts/50L.

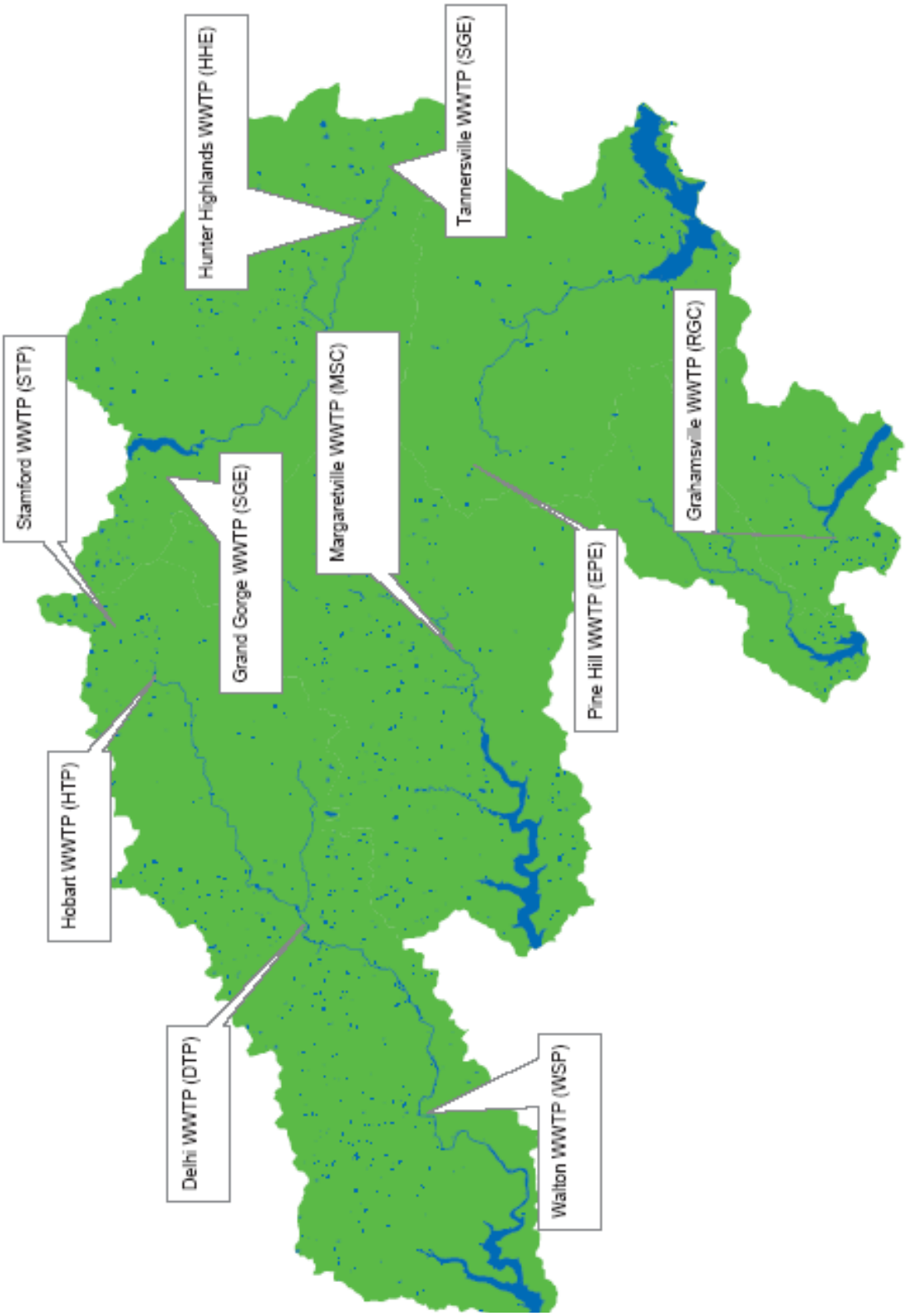


Figure 5.1. Locations for Wastewater Treatment Plant pathogen monitoring, NYC DEP 2004

Table 5.1. Protozoan and human enteric virus results for the 2004 WWTP Monitoring Program.

Site	Date	HEV (100L)	*Giardia* (50L)	*Cryptosporidium* (50L)
DTP	1/5/04	NI (<1.0)	0	0
DTP	4/27/04	NI (<1.0)	0	0
DTP	8/9/04	NI (<1.0)	0	0
DTP	11/8/04	NI (<1.0)	0	0
EPE	1/26/04	No sample	0	0
EPE	6/21/04	NI (<1.0)	0	0
EPE	7/19/04	NI (<1.0)	0	0
HHE	2/17/04	NI (<1.0)	0	3
HHE	7/13/04	NI (<1.0)	0	0
HHE	8/24/04	NI (<1.0)	0	0
HTP	1/20/04	NI (<1.0)	0	1
HTP	5/19/04	NI (<1.0)	0	0
HTP	8/23/04	NI (<1.0)	0	0
HTP	11/1/04	NI (<1.0)	0	0
MSC	3/1/04	NI (<1.0)	0	0
MSC	6/21/04	NI (<1.0)	0	0
MSC	7/19/04	NI (<1.0)	0	2
MSC	10/18/04	NI (<1.0)	0	0
RGC	2/9/04	NI (<1.0)	39	0
RGC	6/23/04	NI (<1.0)	10	0
RGC	9/27/04	NI (<1.0)	9	0
RGC	11/22/04	NI (<1.0)	2	0
SGE	2/23/04	NI (<1.0)	0	0
SGE	5/17/04	NI (<1.0)	0	0
SGE	9/13/04	NI (<1.0)	0	0
SGE	10/4/04	NI (<1.0)	0	0
STE	2/17/04	NI (<1.0)	0	0
STE	6/8/04	Filter lost	0	0
STE	7/12/04	NI (<1.0)	0	0
STE	10/4/04	NI (<1.0)	0	0
STP	1/20/04	NI (<1.0)	1	0
STP	5/19/04	1.03	0	0
STP	8/23/04	NI (<1.0)	0	0
STP	11/1/04	NI (<1.0)	0	0
WSP	1/5/04	NI (<1.0)	0	0

Table 5.1. Protozoan and human enteric virus results for the 2004 WWTP Monitoring Program.

Site	Date	HEV (100L)	*Giardia* (50L)	*Cryptosporidium* (50L)
WSP	4/27/04	NI (<1.0)	0	0
WSP	8/9/04	NI (<1.0)	0	0
WSP	11/8/04	NI (<1.0)	0	0

All samples collected at the plants were negative for human enteric viruses in 2004, with the exception of one sample collected at Stamford on May 5, 2004, where the result was 1.03/ 100L.

Due to the repeated occurrence of *Giardia* at the Grahamsville site, a special investigation was designed and implemented by DEP. Operations at the Grahamsville wastewater treatment plant were reviewed to investigate a possible failure of the membrane filtration units or a source of contamination downstream of the membrane filtration units. Nothing remarkable about the plant operation was noted from this review; however, discussions with plant operators indicated that the outdoor location of the chlorine contact tank made it possible for roosting birds and small mammals to potentially contaminate the effluent site. A preliminary Project Plan was drafted and a Quality Assurance Project Plan (QAPP) was subsequently developed outlining an investigation that would determine if a difference existed between the *Giardia* levels immediately post filtration (RGMF) compared to the routine pathogen sampling site (RGC) which is located after the open chlorine tank. The RGC site was originally selected as the sample site for pathogens since it was already designated the plant effluent site by the plant's SPDES permit. The QAPP outlined four sampling runs. The first run was conducted on December 16, 2004, and three additional runs were scheduled with the fourth concluding on February 10, 2005 (Table 5.2). Sampling was planned coinciding with school sessions since the school district is a major contributor to the plant's influent. Although most of these data surpass the time period covered by this report, they are included here as a follow up to occurrences in 2004.

Table 5.2. Grahamsville Wastewater Treatment Plant *Cryptosporidium* and *Giardia* results at the effluent of the Membrane Filtration Unit (RGMF) and the Routine Effluent Manhole (RGC) [(oo)cysts/50L]

Date	RGMF *Crypto*	RGC *Crypto*	RGMF *Giardia*	RGC *Giardia*
12/16/04	0	0	0	1
01/20/05	0	0	0	4
02/03/05	0	0	0	0
02/10/05	0	0	1	0

There were no *Cryptosporidium* oocysts recovered in any of the samples collected at the effluent of the membrane filtration units (RGMF - indoor sampling point), nor at the routine outdoor sampling location (RGC). As for *Giardia*, there were positive detections of cysts in two out

of four samples collected at the routine outdoor sampling site (RGC), and the most recent survey detected one cyst at the effluent of the membrane filter unit. A scheduled plant upgrade to replace the open chlorine contact tank with ultraviolet (UV) treatment is expected to reduce the impact of potential contamination of the effluent by wildlife.

5.4 Geographic Information System

In 2004, DEP staff continued to develop the upstate Geographic Information System (GIS) and use it to support watershed protection programs. GIS was used for hardcopy mapping, geographic analysis, spatial data development, visualization and analysis of remotely sensed imagery, and water quality modeling.

The upstate GIS includes networked Windows and Unix workstations at laboratories in Kingston and Valhalla, and on individual desktops. Each lab has hardware capabilities for scanning documents, digitizing data, and producing hardcopy maps on a variety of small- and large-format output devices. Users access spatial data stored in data libraries on central servers. ESRI (ArcGIS) and ERDAS (Imagine) are the GIS software vendors of choice. There are workstations for on-site GIS work at Shokan and Grahamsville. Global Positioning System (GPS) technology is used for field data collection.

5.4.1 Utilizing GIS for Watershed Management Applications

Semi-annual progress reports to EPA in July 2004 and January 2005 indicated the broad extent to which GIS was used to support FAD and MOA programs. Numerous map products were produced and a diversity of projects utilized GIS technologies.

Digital and hardcopy maps supported program activity throughout the Bureau. GIS maps represented the implementation status of such DEP programs as Land Acquisition, Land Management, Sewer Extension, Whole Farm Planning, Forest Management, and Septic Remediation. Others GIS maps were used to plan enhancements to monitoring programs, improve security protocols, upgrade watershed communications, undertake wetland change analysis, plan for stormwater management, and stream restoration projects. Maps were used in reports and presentations, project reviews and special investigations, regulatory compliance, and judicial hearings.

Of the hundreds of maps created, several were used in DEP's review of the Draft Environmental Impact Statement (DEIS) for the proposed Bellayre Resort, portraying impervious footprints, topography, surface hydrology, and State Pollutant Discharge Elimination System (SPDES) outfalls. An atlas of the watershed and aqueduct regions was produced for the Bureau's Hazardous Materials Response Unit; it also was included as reference material in applications for Safe Drinking Water Act funding. Other maps were used in project planning for the Catskill/Delaware Ultraviolet Plant, Shandaken Tunnel Dredging, and Kensico Stormwater Management.

The semi-annual progress reports also described the many Bureau projects in which GIS analysis was important. Those mentioned below are examples; a more complete description is found in the semi-annual reports.

DEP used GIS in projects related to wetlands mapping (National Wetlands Inventory update, trend analysis, functional assessment) and project site assessment. The Water Quality Impacts Assessment group prepared Special Investigation reports and developed a survey of East of Hudson (EOH) lawn care practices. The Hydrology group analyzed and adjusted its snow monitoring program. The Watershed Modeling group derived additional spatial inputs (soil parameters, wetness index) necessary for modeling nutrient loads to reservoirs.

DEP also used GIS to maintain a database of project and septic system locations. Information generated from GIS data helped staff evaluate potential development site constraints and limitations on new development. Information on hydrography, soils, watercourse limiting distances, steep slopes and other potentially sensitive features was utilized in the preparation of project reviews and comment letters. GIS was also used to determine political and property boundaries and to assist in evaluating stream instability and erosion problems.

Staff of the newly-formed Division of SEQRA Coordination used GIS to develop a pilot application to track facility inspection and maintenance requirements of the Kensico Watershed Management programs. The pilot is being expanded to encompass the EOH Non-Point Source (NPS) Management Plan programs and the four Catskill/Delaware reservoir basins. In the context of the NPS Management Plan and in conjunction with data from the Croton Watershed Strategy, staff used the GIS to identify sites that treat, store, dispose of, or generate hazardous materials and petroleum products in the EOH and Catskill/Delaware basins. GIS was used to identify initial site locations for spill containment facilities installed in the Kensico Reservoir at the outlets of storm drains.

The Stream Management Program completed the first phase of a geomorphic assessment of the Esopus Creek corridor, undertook a riparian vegetation classification, and continued work on a geographically referenced database integrating USGS hydrologic data and stream survey data. The Land Acquisition Program used GIS analysis to design its Re-solicitation Program. Development continued on the Watershed Land Information System (WaLIS) and the Land Acquisition Tracking System (LATS); both use tax parcel data as a key integration with GIS. The Land Management Program delineated Field Office Management Areas and defined Whole Farm and Conservation easements. GIS analysis was used in review of the DEIS for the proposed Bellayre Resort, focusing on soils, slopes, impervious surfaces, as well as water quality monitoring locations and SPDES outfall locations as determined by GPS.

5.4.2 GIS Data Development, Management, and Dissemination

Recognizing the importance of a high-quality spatial data library as a fundamental component of GIS, staff continued to upgrade, create, and obtain data products.

One-foot grids of impervious surface in the EOH and West of Hudson (WOH) watersheds were developed under contract with PAR. PAR also created a 2001 Anderson Level 4 land use/ land cover classification for the EOH and WOH watersheds and a WOH point coverage that approximates the location of buildings with septic systems. DEP GIS staff provided substantial guidance and review throughout these data development efforts.

Additional spatial layers for terrestrial modeling were developed. These included delineations of drainage areas above USGS stream gages, thiessen polygons for weighting precipitation model inputs, Soil Survey Geographic (SSURGO) soil attributes (unsaturated depth, % clay, hydraulic conductivity), hydrologic derivatives from 10-meter WOH Digital Elevation Models, and soil delineations and attribute data in the SSURGO 2 format, now available for four counties of the watershed.

Work continued on improving links between GIS and Modeling. The ArcView 3 Inputs Tool for GWLF was improved to derive additional soil and elevation parameters, and to provide a revised output format for the Constants Input (CIN) file. The AVSWAT2000 modeling extension for ArcView 3 was used to derive drainage basin parameters.

Several layers in the library were updated during the reporting period. These included monitoring sites (keypoint, snow, stream, meteorological stations), aqueducts/tunnels, and land ownership (NYC pre-MOA, NYC post-MOA, NYS). Updates to the coverage library were incorporated into the geodatabase. Metadata were revised, as necessary.

The semi-annual reports detailed the extent to which data were shared with stakeholders and the public according to data sharing policies developed in cooperation with DEP Legal. In lieu of not having a data dissemination internet site due to security concerns, staff reviewed outside requests for spatial data, forwarded requests for data deemed “sensitive” to management for approval, and wrote approved GIS data to CD-ROM for distribution. Data were shared with contractors, research institutions, local/county/state/federal agencies, environmental groups, and regulators.

5.4.3 GIS Infrastructure

Work continued throughout the reporting period on deploying and maintaining the geodatabase, utilizing ArcSDE as a gateway for the storage of attributed spatial data in an Oracle relational database management system. In 2004, ArcSDE and Oracle were installed on a UNIX server at Valhalla, making it possible to not only replicate the coverage library from Kingston to Valhalla nightly, but also the geodatabase. The coverage library is also replicated to workstations at Grahamsville and Shokan. This implementation strategy promotes use of a common database by users at distant locations. Significantly, 2001 1-foot resolution orthoimagery for the entire watershed was added to the data libraries.

In 2004, six additional 18Gb hard drives for workstations used by the Watershed Modeling Group were purchased and installed. Several Uninterruptible Power Supply (UPS) batteries and a UPS power module were replaced after failure during a power outage. Six 400Gb mass storage removable hard drives were acquired for use in backing up servers and transferring large data sets. Four dual-Xeon processor workstations were acquired to replace outdated or problematic machines used by GIS and Modeling staff.

DEP began the process of upgrading software to ArcGIS 9, ArcSDE 9, and Oracle 10i. The ESRI DataReviewer extension for ArcGIS was acquired and used to evaluate data developed by PAR. A five-user license was obtained for SAS Bridge for ESRI, a tool enabling bi-directional linking of SAS analytical intelligence with the mapping capabilities of ArcGIS. Two workstations at Kingston were upgraded to version 8.7 of ERDAS Imagine image processing software.

Training opportunities were provided for staff. WLCP GIS staff at Kingston worked with Waypoint Technology (Albany, NY) to provide a two-day session of GPS training, with nine participants. GIS and MIS staff at Valhalla worked with ESRI to provide three two-day sessions, "Introduction to ArcGIS I," with 34 participants. Several people viewed monthly ESRI on-line seminars that dealt with ArcGIS, ArcSDE, and geodatabase issues.

Three DEP employees attended the NYS GIS Conference (October, Kerhonkson, NY). One co-presented a paper entitled "Integrating Multi-Resolution Data Sources to Update and Improve Land Cover and Land Use Classification for NYC's 2,000 Square Mile Watershed"; another submitted a map for critique in the cartography workshop. One staff member attended the Northeast Arc Users Group Conference (September, Lake Placid, NY). The Bureau was also represented at "GIS Day" at Sullivan County Community College and meetings of the Catskill GIS Users Group. One person completed an ESRI Virtual Campus course, "Introduction to Visual Basic," and attended a week-long ESRI course at SUNY-Albany, "Introduction to Programming ArcObjects with VBA." This training provided an introduction to customizing in the ArcGIS environment.

6. Regulatory Programs

6.1 Watershed Rules and Regulations and Other Enforcement/Project Review

6.1.1 Regulatory Review and Enforcement

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, NPDES and SEQRA, as well as local ordinances. 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 of wastewater treatment plants; and environmental law enforcement.

Project Review

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 systems, including wastewater treatment plants (WWTPs), the installation of subsurface sewage treatment systems (SSTSs), the preparation of Stormwater Pollution Prevention Plans (SPPPs), and the construction of certain impervious surfaces. In addition, DEP reviews and issues permits for Individual Residential Stormwater Plans (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 installed, and that erosion controls are properly sited 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.

Tables 6.1 and 6.2 list project applications received in the Boyds Corner, West Branch, Croton Falls, Cross River and Kensico Reservoir basins for the 1st, 2nd and 3rd quarters of 2004. There were no new project applications received in these basins for the fourth quarter of 2004. The project locations are depicted on Figures 6.1 through 6.3.

Table 6.1. Boyds Corner, West Branch, Croton Falls, Cross River and Kensico Reservoirs new projects for 2004.

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/04
Boyds Corner	South Sagamore Estates	Kent	SPPP	Incomplete
Boyds Corner	Vargas Subdivision	East Fishkill	SEQRA	No Application
Croton Falls	Hillcrest Commons	Carmel	SEQRA	No Application
Croton Falls	Somers Hills Subdivision Lot #26/KTT Builders	Carmel	CPDP	Closed
Croton Falls	Somers Hills Subdivision, Lot 27/KTT Builders	Carmel	CPDP	Incomplete
Croton Falls	Springside Residential Development	Carmel	Sewer Connection	Approved
Croton Falls	Watson Laboratories Expansion	Carmel	SPPP/SEQRA	Incomplete
Croton Falls	Hillcrest Commons	Carmel	SEQRA	No Application
Croton Falls	Somers Hills Subdivision Lot #26/KTT Builders	Carmel	CPDP	Closed
Kensico	Badagliacca Residence	Mount Pleasant	CPDP	Approved
Kensico	MT. Pleasant Central School District/Westlake	Mount Pleasant	SPPP	Approved
Kensico	Westchester County Airport DPW Staging Area	North Castle	SPPP	Complete
West Branch	Daffodill Hill Lot 8, Adams	Kent	Ind. Residential SPPP	Approved
West Branch	Long Pond Est. Lot 47/Earl Mark	Carmel	Variance	Incomplete
West Branch	Orr Subdivision Lot 6/Jerry Vallen	Kent	Variance	Incomplete
West Branch	Reconstruction of Shats 9,10 and 17	Various	SPPP	Approved

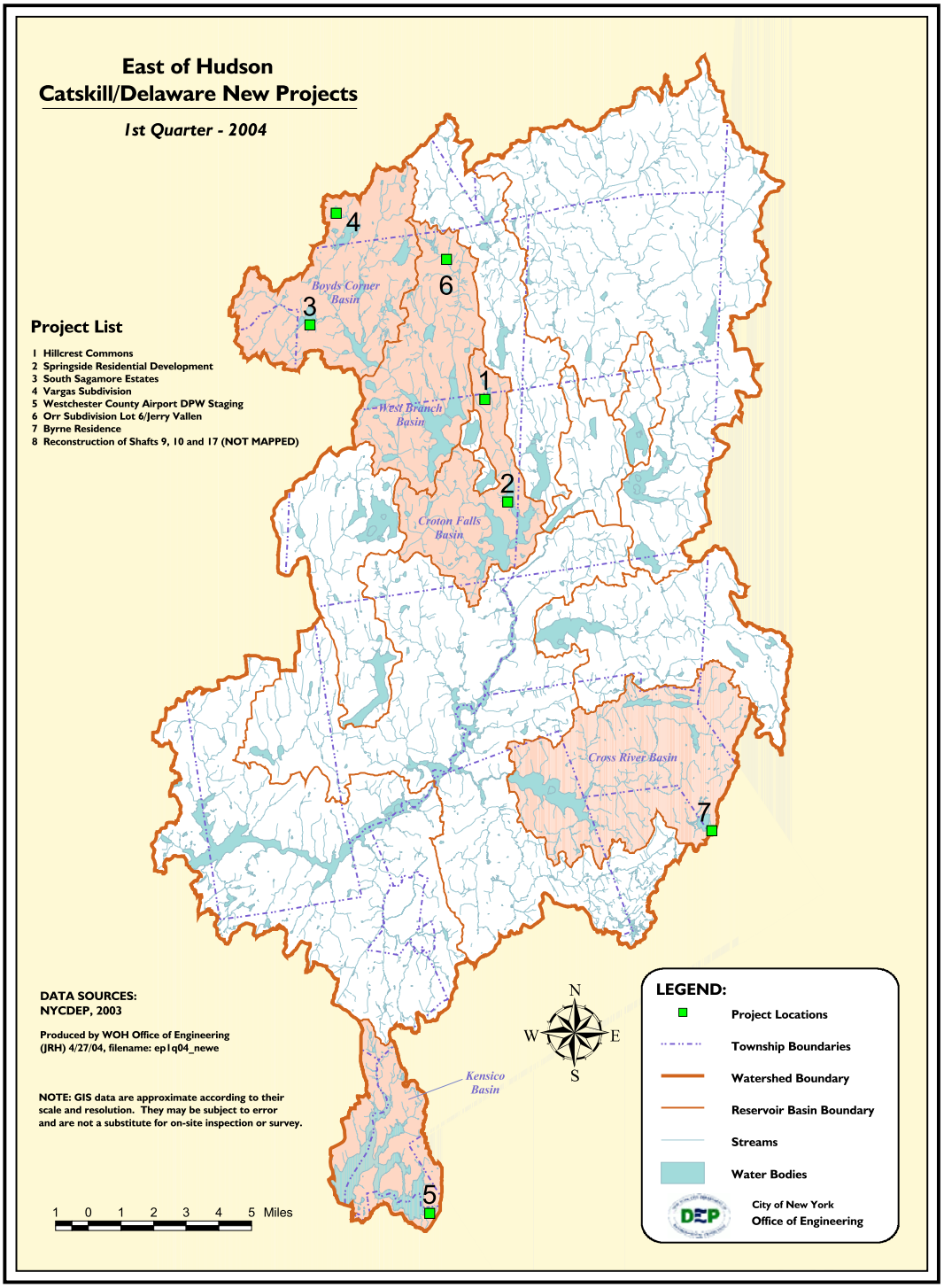


Figure 6.1. East of Hudson Catskill/Delaware new projects - 1st quarter.

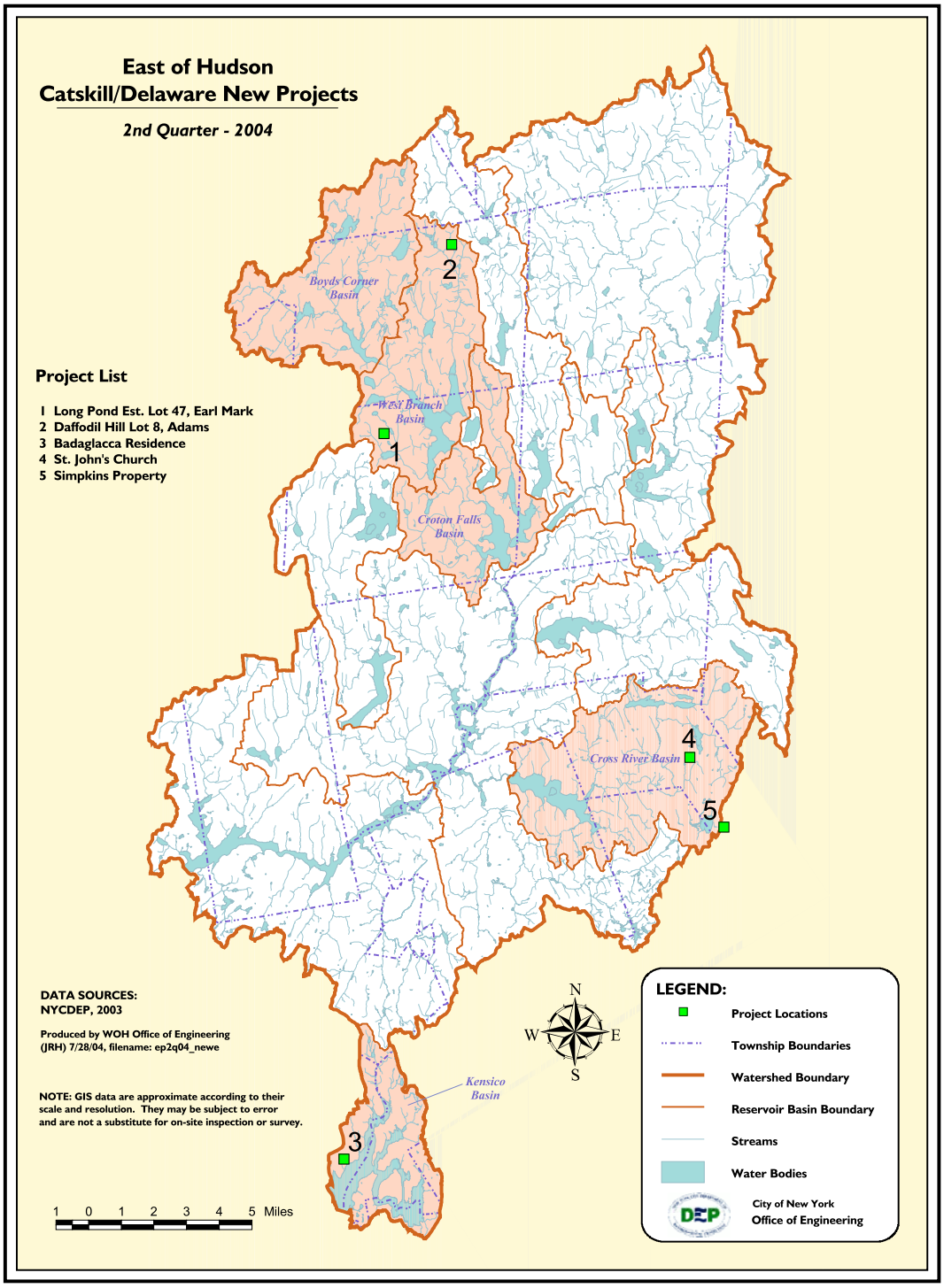


Figure 6.2. East of Hudson Catskill/Delaware new projects - 2nd quarter.

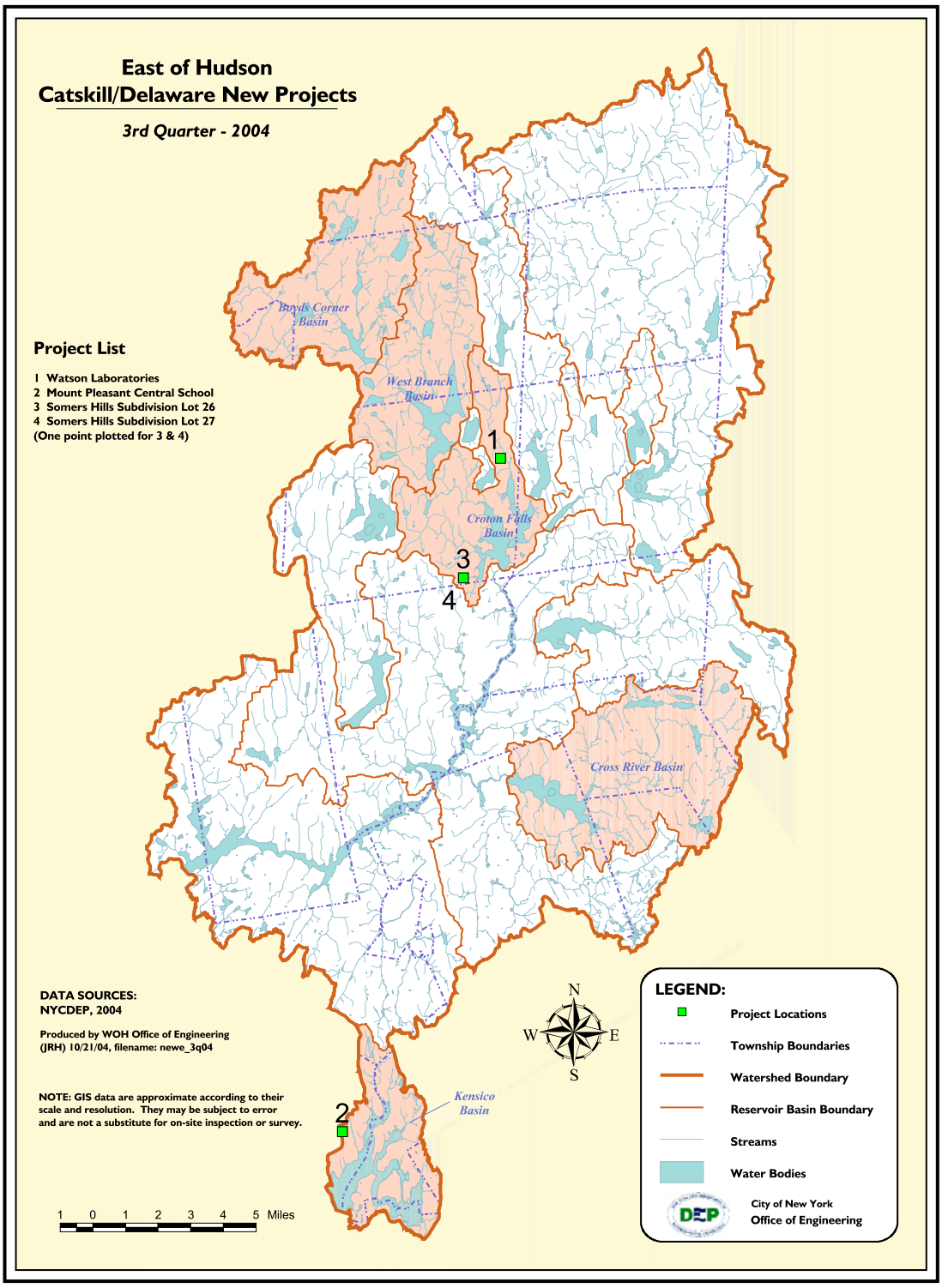


Figure 6.3. East of Hudson Catskill/Delaware new projects - 3rd quarter.

All new individual septic system applications in Kensico, West Branch, Boyds Corners, Croton Falls and Cross River basins are subject to delegated review by the Putnam and Westchester County Health Departments.

Table 6.2. Boyds Corner, West Branch, Croton Falls, Cross River and Kensico Reservoirs individual SSTSs for 2004

Reservoir	Town	# of Delegated Septics	# of New Septics	# of Septic Repairs	# of Approvals	# of Constructions
Boyds Corners	East Fishkill	0	4	0	3	0
Boyds Corners	Kent	0	6	0	2	1
Boyds Corners	Putnam Valley	0	0	0	0	0
Cross River	Bedford	0	1	0	2	0
Cross River	Lewisboro	7	7	1	14	0
Cross River	Pound Ridge	0	0	0	0	0
Croton Falls	Carmel	3	3	0	5	3
Croton Falls	Kent	1	0	0	2	0
Croton Falls	Southeast	0	0	0	1	0
Croton Falls	Somers	0	0	0	0	0
Kensico	Mt. Pleasant	0	0	0	0	0
Kensico	New Castle	0	0	0	0	0
Kensico	North Castle	0	6	0	3	0
Kensico	Harrison	0	0	0	0	0
Kensico	Greenwich Ct.	0	0	0	0	0
West Branch	Carmel	0	2	2	0	0
West Branch	East Fishkill	0	3	0	0	1
West Branch	Kent	1	5	1	6	0
West Branch	Putnam Valley	0	0	0	0	0
Totals		**12**	**37**	**3**	**38**	**5**

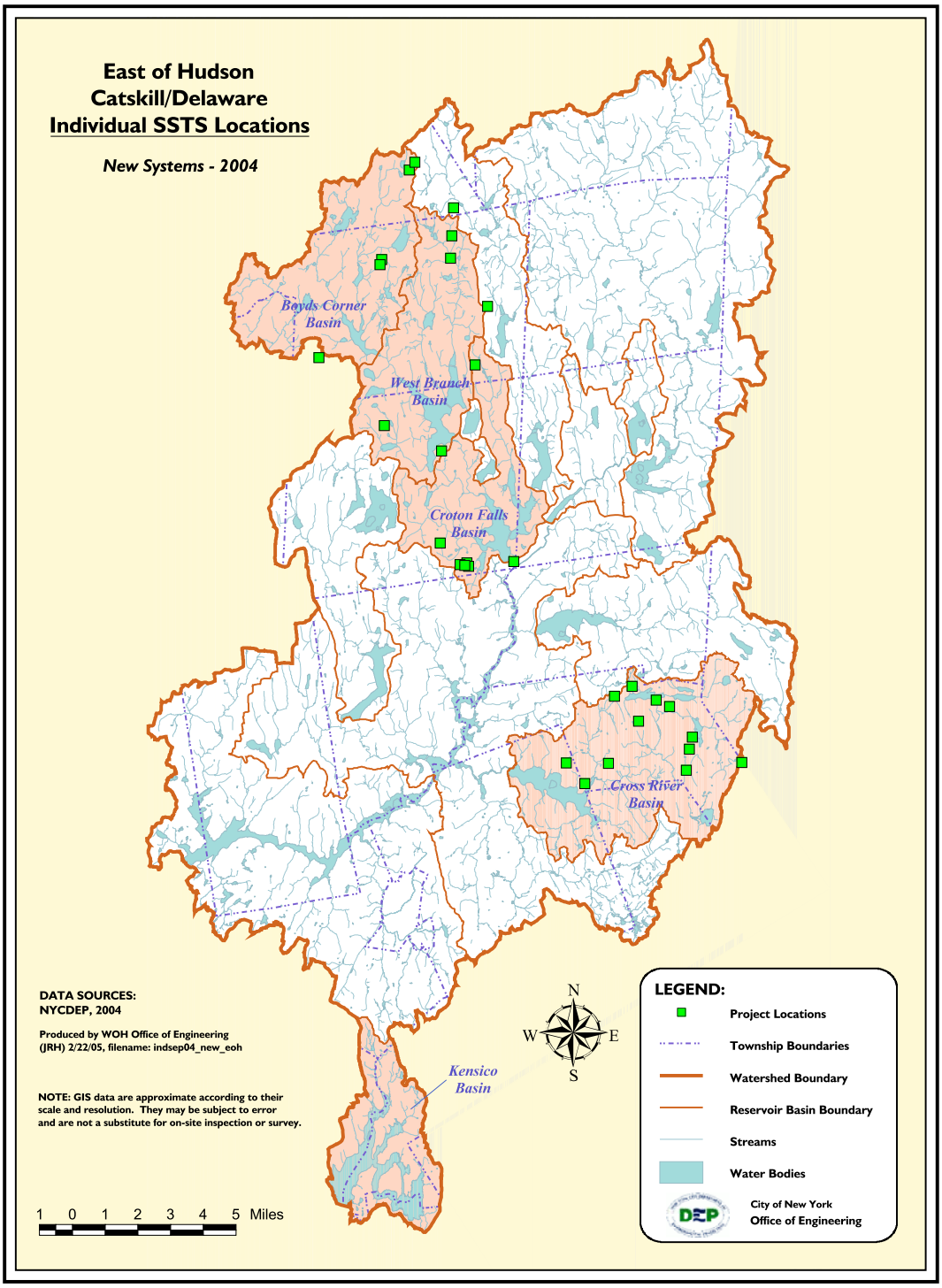


Figure 6.4. East of Hudson Catskill/Delaware individual SSTS locations.

Table 6.3 lists all projects received in 2004 in the Cannonsville, Pepacton, Rondout, Neversink, Schoharie and Ashokan basins in the Delaware and Catskill systems. The "Other" projects consist of DOT projects, wetland and stream disturbances, mining applications from DEC, timber harvesting and Stormwater Retrofit projects. The projects listed below are new or repaired commercial, institutional and multi-family septics, or individual advanced aerobic treatment units (ATU). The new, delegated and remediated individual septic systems are listed in Tables 6.4 and 6.5. Figures 6.4 through 6.9 show the locations of these projects.

Table 6.3. Ashokan, Cannonsville, Neversink, Pepacton, Rondout, Schoharie Reservoirs new projects for 2004.

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/04
Out	LM-4255 - Not Mapped	Rockland	SEQRA	Closed
Ashokan	Chinese Take-out @ Shokan Square	Olive	Comm. SSTS Repl.	Approved
Ashokan	Eckstein, Shimon (Twin Creeks, Inc)	Shandaken	CPDP	Approved
Ashokan	Frawley, Kevin (Silver Creek Cabins)	Shandaken	SSTS/SEQRA	Approved
Ashokan	Living Word Chapel	Hurley	Comm. SSTS Repl.	Closed
Ashokan	Matalon, Vivian	Hurley	CPDP	New
Ashokan	Pine Hill Water District Water Main	Shandaken	SPPP/Other	No Application
Ashokan	Pine View Bakery	Olive	Other	No Application
Ashokan	Realignment & Reconstruction of Rt. 28A - CAT-244	Olive	Other	Complete
Ashokan	Reconstruction of 9 Ashokan Bridges	Olive	Other	Complete
Ashokan	Shokan Bend	Olive	Other	No Application
Cannonsville	DCDPW - Not Mapped	Walton	Other	Closed
Cannonsville	Catskill Scenic Trail	Stamford (V)	Stream Disturbance	No Application
Cannonsville	Cochrane, George H., Jr.	Meredith	SSTS/SEQRA	Approved
Cannonsville	DCSWMF - 2nd Quarter 2004 - Not Mapped	Walton	Other	No Application
Cannonsville	DOT Bridge Cleaning	Various	Other	New
Cannonsville	Ed Kutner Property	Stamford (V)	Stream Disturbance	Closed
Cannonsville	Hamden Hill Ridge Riders	Hamden	SEQRA	Closed
Cannonsville	Meadow Hill @ Bovina	Bovina	SSTS/SPPP/SEQRA	Approved
Cannonsville	Miller, Larry	Stamford (V)	Comm. SSTS Repl.	Incomplete
Cannonsville	New York State Electric & Gas (NYSEG), Report No 4252N - Not Mapped	Masonville	SEQRA	No Application
Cannonsville	NYS Bear Spring Headquarters	Walton	SSTS/SEQRA	Approved
Cannonsville	Octagon Motor Lodge	Hamden	SSTS/SEQRA	Approved
Cannonsville	OWSL #4251N	Stamford (V)	SEQRA	Closed

Table 6.3. Ashokan, Cannonsville, Neversink, Pepacton, Rondout, Schoharie Reservoirs new projects for 2004.

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/04
Cannonsville	Post Property	Stamford (V)	Stream Dist./ SPPP/ SEQRA	Closed
Cannonsville	Reconstruction of Trout Creek, Downstream Dam & Murphy Hill Culvert/Bridges- DEL-149-Not Mapped	Tompkins	Other	No Application
Cannonsville	Redstone Investments (Ames Plaza Expansion)	Delhi	SPPP/SEQRA	Incomplete
Cannonsville	River Edge Builders	Bovina	SSTS/SEQRA	Approved
Cannonsville	T/Tompkins Town Hall	Tompkins	New Comm. SSTS	Approved
Cannonsville	Trelease, William, Jr.	Delhi	SSTS/Other/SEQRA	Approved
Cannonsville	V/Stamford SW Retrofit	Stamford (V)	Other	Closed
Cannonsville	NYSDOT General Bridge Repairs	Multiple	Other	
Neversink	Den, Doug & Wendy	Neversink	SPPP/SSTS	Approved
Neversink	Frost Valley – Pigeon Brook	Denning	Comm. SSTS Repl.	Approved
Neversink	Frost Valley - Thomas Lodge	Denning	SSTS/SEQRA	Approved
Pepacton	Athanasakes, Irene	Middletown	Other	No Application
Pepacton	Brannen Property	Andes	Stream Disturbance	No Application
Pepacton	Chambers, William	Andes	Comm. SSTS Repl.	Approved
Pepacton	Cherry Ridge-Campbell Mountain Wild Forest UMP	Colchester	Other	No Application
Pepacton	Donovan, Tom	Middletown	SSTS/Variance	Approved
Pepacton	Fairhaven Ministries	Andes	SSTS/SPPP	New
Pepacton	Farley, Donald	Bovina	SSTS/Variance	Approved
Pepacton	Farley, Donald	Bovina	SSTS/Variance	Approved
Pepacton	Frame, Deborah	Middletown	SSTS/SEQRA	Approved
Pepacton	Galliduani Property	Middletown	Stream Disturbance	Closed
Pepacton	Keller, Robert	Middletown	New Comm. SSTS	Approved
Pepacton	Maggie's Market	Middletown	Sewer Conn./ SPPP/ SEQRA	Approved
Pepacton	Mountain Flame, Inc.	Middletown	Sewer Connection	Approved
Pepacton	Mountain Vista	Andes	Other	No Application
Pepacton	New York State Electric & Gas (NYSEG), Report No. 4253N (PID3420)	Middletown	SEQRA	No Application
Pepacton	NYS Route 28 Curve Flattening	Middletown	Other	Closed
Pepacton	NYS Rt. 28 Roadside Drainage	Middletown	Other	New
Pepacton	O'Connor, Ed & Laura	Andes	SEQRA	Closed
Pepacton	Smolen Wetland Restoration Plan	Margaretville (V)	Other	No Application

Table 6.3. Ashokan, Cannonsville, Neversink, Pepacton, Rondout, Schoharie Reservoirs new projects for 2004.

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/04
Pepacton	Stark Property	Middletown	Stream Disturbance	Closed
Pepacton	Starlight Forests, LLC, Report No 4256N, PID 2108	Andes	SEQRA	No Application
Pepacton	Teeple, Laura	Middletown	SEQRA	Closed
Pepacton	V/Margaretville Stormwater Retrofit Project	Margaretville (V)	Other	No Application
Schoharie	Ashland SW Retrofit/ Assesment	Ashland	Other	Closed
Schoharie	Atkinson Property	Hunter	Stream Disturbance	Closed
Schoharie	Batavia Kill Enterprises (Howard Drum)	Ashland	SSTS/SEQRA	Approved
Schoharie	Batavia Kill Recreation Area	Windham	WWTP	Closed
Schoharie	Bolz, Michael	Jewett	SSTS/SEQRA	Approved
Schoharie	Boulder Ridge Country Homes	Windham	SSTS/SEQRA	Approved
Schoharie	Brown, David	Jewett	SSTS/Other/SEQRA	Approved
Schoharie	Cacici, Joseph	Prattsville	SSTS/Variance	Denied
Schoharie	Catskill Development Corp. - Townhouses	Hunter	SEQRA	No Application
Schoharie	Catskill Mountain Lodging, LLC.(Yakov Bletnisky)	Hunter	SSTS/Variance	Incomplete
Schoharie	Clark & Lawrence Properties	Ashland	Stream Disturbance	Closed
Schoharie	Conesville Fire District	Gilboa	SSTS/SEQRA	Approved
Schoharie	CR 83 Bridge Over Schoharie Creek	Hunter	Stream Dist./ SEQRA	No Application
Schoharie	Darmanin, Josephine	Conesville	SSTS/SEQRA	Approved
Schoharie	DiBenedetto, Ralph	Roxbury	Comm. SSTS Repl.	Approved
Schoharie	Edward P. Newburg Living Trust	Windham	SEQRA	Closed
Schoharie	Eso, Gregory	Roxbury	CPDP	Approved
Schoharie	Glover, James	Windham	New Comm. SSTS	Approved
Schoharie	Good Drink Inc. (Agosto, Angelo)	Hunter	Sewer Connection	Approved
Schoharie	Grand Gorge Stormwater Retrofit	Roxbury	Other	Closed
Schoharie	Greene County Street Sweeping SW Retrofit	Hunter	Other	Closed
Schoharie	Grinnell, John	Lexington	SSTS/SEQRA	Approved
Schoharie	Highlands Pollution Control SW Retrofit	Hunter	Other	Closed
Schoharie	Hunter Estates (Klein, Shane)	Hunter	SSTS/SEQRA	Closed
Schoharie	Hunter Transfer Station SW Retrofit	Hunter	Other	Closed
Schoharie	Hunter Village Square	Hunter	Comm. SSTS Repl.	Approved

Table 6.3. Ashokan, Cannonsville, Neversink, Pepacton, Rondout, Schoharie Reservoirs new projects for 2004.

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/04
Schoharie	Koehler, Patricia	Jewett	Interm SSTS (IS)	Complete
Schoharie	Lake in the Sky Subdivision	Gilboa	SSTS/SPPP/SEQRA	Closed
Schoharie	LaSasso, Dean	Prattsville	SSTS/Variance	Approved
Schoharie	Loftus, John	Lexington	Comm. SSTS Repl.	Approved
Schoharie	Manor Kill Mine	Conesville	Other	Closed
Schoharie	Maynard, John	Ashland	Comm. SSTS Repl.	Complete
Schoharie	Okonski, Adam	Jewett	New Comm. SSTS	Approved
Schoharie	Oliver, Henry	Prattsville	SSTS/Variance	New
Schoharie	O'Neill, Caroline Kelly	Hunter	SSTS/SEQRA	Closed
Schoharie	OWSL #4250	Gilboa	SEQRA	Closed
Schoharie	Pine Island Subdivision	Gilboa	SPPP/SEQRA	Incomplete
Schoharie	Prattsville SW Retrofit/ Assesment	Prattsville	Other	Closed
Schoharie	Reconstruction of Schoharie Roads	Conesville	Other	New
Schoharie	Schoharie Reservoir Dredging	Roxbury	Other	No Application
Schoharie	Spanhake, Wade	Jewett	Comm. SSTS Repl.	Complete
Schoharie	Stony Clove Creek at Jansen Road - Bono Property	Hunter	Stream Disturbance	Closed
Schoharie	Stony Clove Creek at Jansen Road - Lepuil Property	Hunter	Stream Disturbance	Closed
Schoharie	Stony Clove Creek at SR 214 - Thomson Property	Hunter	Stream Disturbance	No Application
Schoharie	Sugar Maples - Maple Crest	Windham	Comm. SSTS Repl.	Approved
Schoharie	Tannersville Sewer Main Stream Disturbance	Tannersville (V)	Stream Disturbance	Closed
Schoharie	The Yacht Club	Tannersville (V)	SPPP/SEQRA	Closed
Schoharie	Tsuyuko Verona - Windham Country Store	Windham	SPPP/SEQRA	Approved
Schoharie	V/Hunter SW Retrofit/ Assesment	Hunter	Other	Closed
Schoharie	V/Tannersville SW Retrofit/ Assesment	Tannersville (V)	Other	Closed
Schoharie	Vatra Lodge (Frank Ciollo)	Hunter	Comm. SSTS Repl.	No Application
Schoharie	Von Aweyden & Co., Inc.	Jewett	SSTS/SEQRA	Approved
Schoharie	Warda, Victor	Jewett	New Comm. SSTS	Complete
Schoharie	Windham Grocery Store, (Mastrantonakis, Michael)	Windham	Other	Closed
Schoharie	Windham Mountain SW Retrofit	Windham	Other	Closed
Schoharie	Windham Operating Corporation Trailside Subdivision	Windham	Sewer Collection	Approved

Table 6.3. Ashokan, Cannonsville, Neversink, Pepacton, Rondout, Schoharie Reservoirs new projects for 2004.

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/04
Schoharie	Windham SW Retrofit	Windham	Other	Closed
Schoharie	Windham Willows Senior Apts.	Windham	SSTS/SPPP	Incomplete
Schoharie	Yandresitz, Renee; Slope Failure Repair	Hunter	Stream Disturbance	Closed
Schoharie	Zarelli, Rod	Jewett	SSTS/SEQRA	Complete

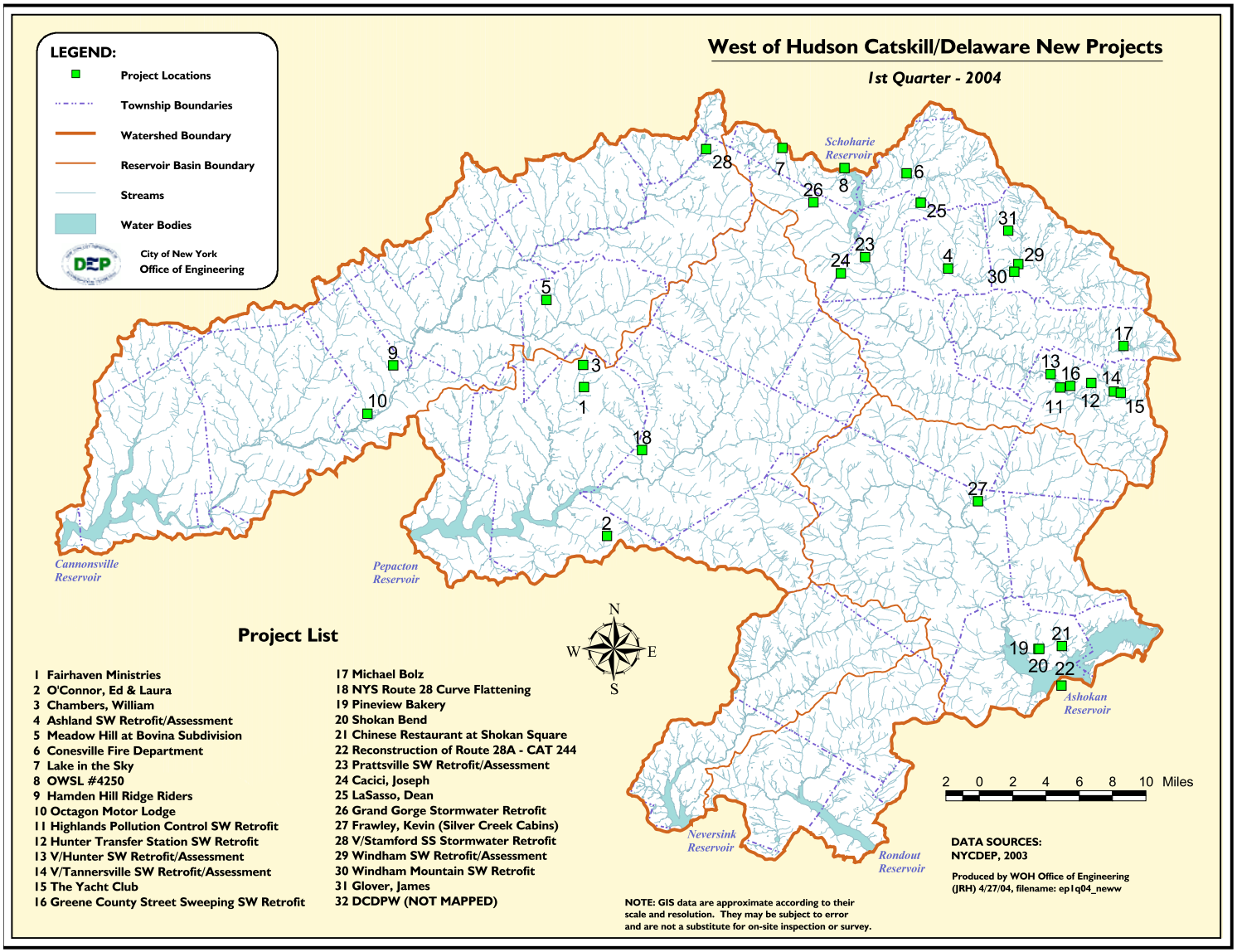


Figure 6.5. West of Hudson Catskill/Delaware new projects - 1st quarter.

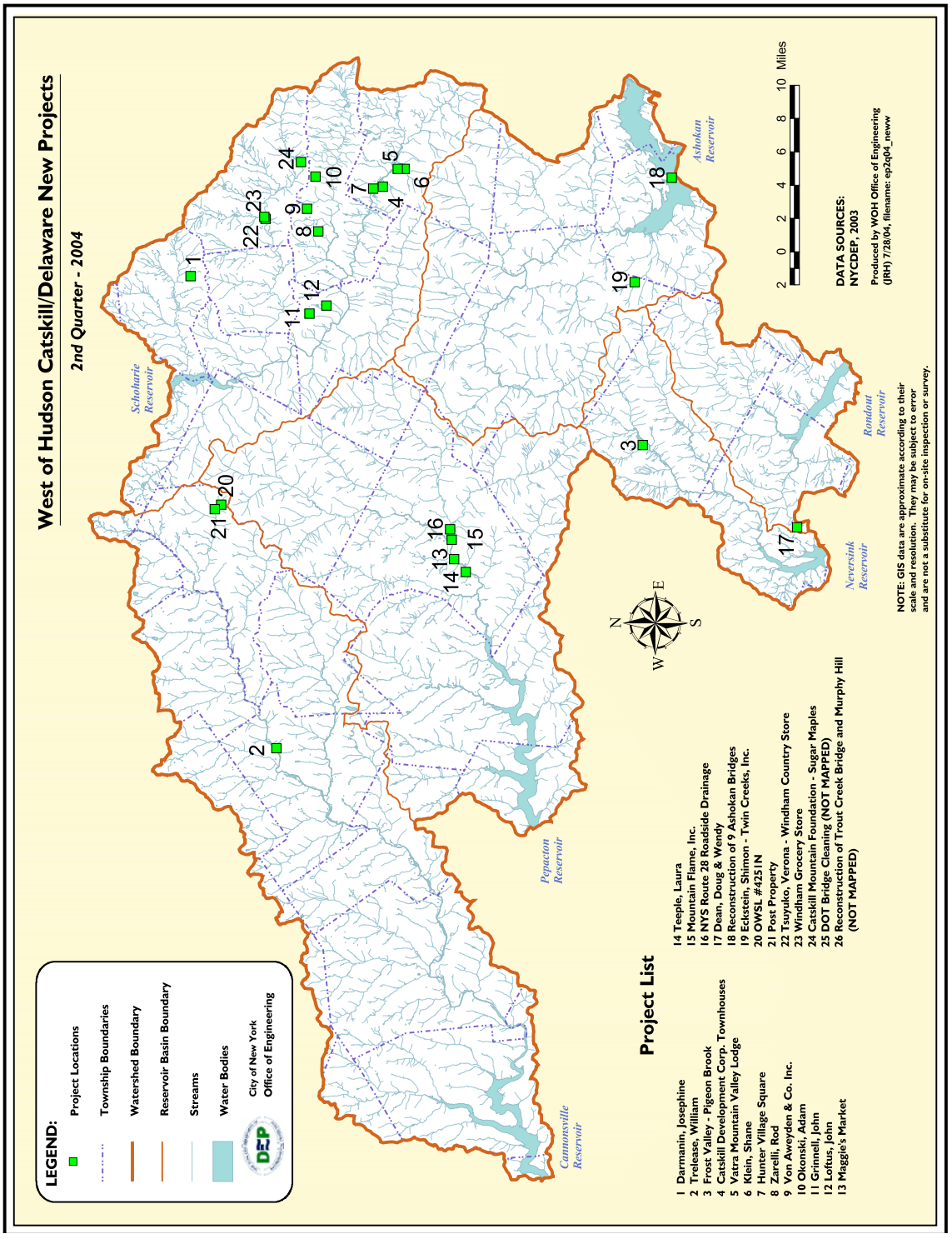


Figure 6.6. West of Hudson Catskill/Delaware new projects - 2nd quarter.

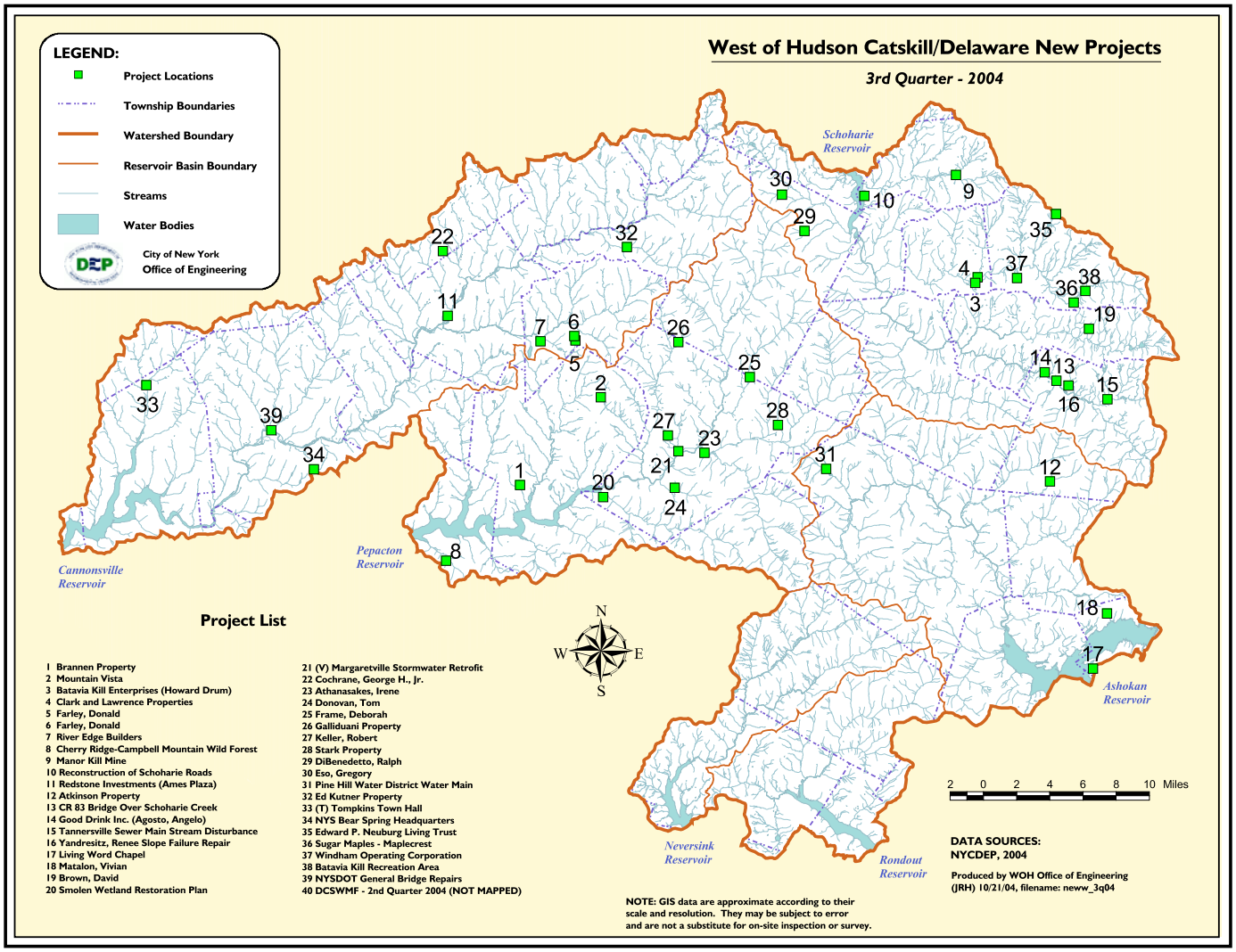


Figure 6.7. West of Hudson Catskill/Delaware new projects - 3rd quarter.

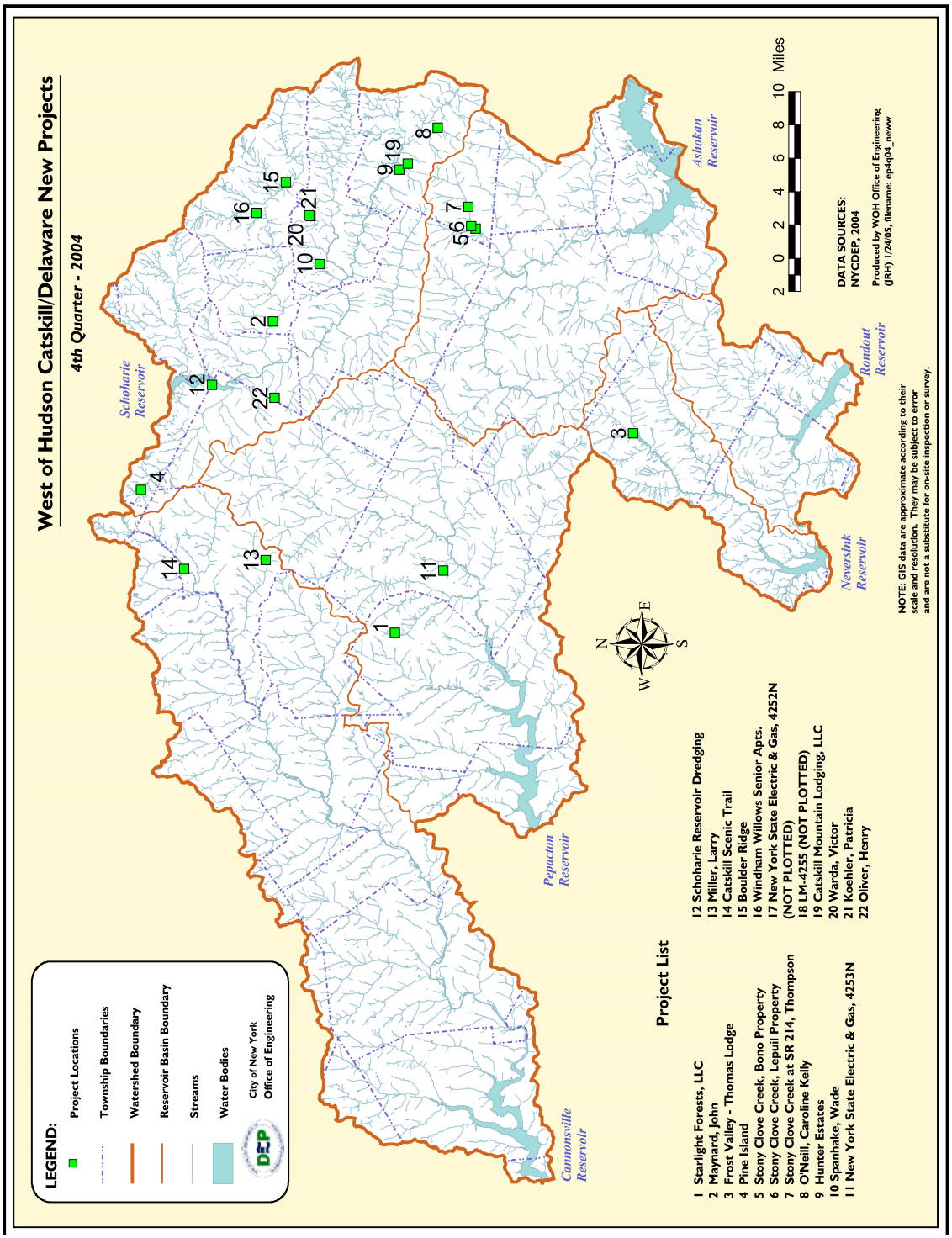


Figure 6.8. West of Hudson Catskill/Delaware new projects - 4th quarter.

Table 6.4. Ashokan and Schoharie Reservoirs individual SSTSs for 2004.

Reservoir	Town	# of Delegated Septics	# of New Septics	# of Septic Repairs	# of Approvals	# of Constructions
Ashokan	Hurley	4	N/A	5	5	7
Ashokan	Olive	14	N/A	26	35	42
Ashokan	Shandaken	11	N/A	24	30	29
Ashokan	Woodstock	10	N/A	5	5	6
Schoharie	Ashland	N/A	21	2	22	8
Schoharie	Conesville	N/A	4	1	8	2
Schoharie	Gilboa	N/A	4	1	8	2
Schoharie	Halcott	N/A	2	0	2	2
Schoharie	Hunter	N/A	9	4	14	11
Schoharie	Hunter (V)	N/A	0	0	0	0
Schoharie	Jewett	N/A	26	5	26	14
Schoharie	Lexington	N/A	14	3	17	13
Schoharie	Prattsville	N/A	14	1	16	12
Schoharie	Roxbury	N/A	0	0	2	0
Schoharie	Stamford	N/A	0	0	3	0
Schoharie	Tannersville (V)	N/A	0	0	1	1
Schoharie	Windham	N/A	41	5	56	30
Totals		**39**	**135**	**82**	**250**	**179**

Table 6.5. Cannonsville, Pepacton, Rondout, Neversink Reservoirs individual SSTSs for 2004.

Reservoir	Town	# of Delegated Septics	# of New Septics	# of Septic Repairs	# of Approvals	# of Constructions
Cannonsville	Bovina	N/A	13	3	16	7
Cannonsville	Delhi	N/A	5	5	15	11
Cannonsville	Franklin	N/A	0	0	0	0
Cannonsville	Hamden	N/A	7	7	19	10
Cannonsville	Harpersfield	N/A	1	1	2	2
Cannonsville	Hobart (V)	N/A	0	0	0	0
Cannonsville	Jefferson	N/A	0	0	0	1
Cannonsville	Kortright	N/A	8	6	13	4
Cannonsville	Masonville	N/A	0	0	1	0
Cannonsville	Meredith	N/A	8	1	9	3
Cannonsville	Sidney	N/A	1	0	1	1

Table 6.5. Cannonsville, Pepacton, Rondout, Neversink Reservoirs individual SSTSs for 2004.

Reservoir	Town	# of Delegated Septics	# of New Septics	# of Septic Repairs	# of Approvals	# of Constructions
Cannonsville	Stamford	N/A	7	3	8	6
Cannonsville	Tompkins	N/A	3	3	6	5
Cannonsville	Walton	N/A	12	15	28	11
Neversink	Denning	2	N/A	2	3	5
Neversink	Hardenburgh	2	N/A	0	0	2
Neversink	Neversink	N/A	6	3	10	10
Pepacton	Andes	N/A	17	8	24	17
Pepacton	Bovina	N/A	0	1	2	1
Pepacton	Colchester	N/A	5	7	7	0
Pepacton	Fleischmanns	N/A	0	0	0	0
Pepacton	Halcott	N/A	3	3	6	3
Pepacton	Hamden	N/A	1	0	1	0
Pepacton	Hardenburgh	N/A	1	2	3	0
Pepacton	Middletown	N/A	36	16	50	17
Pepacton	Roxbury	N/A	22	6	26	10
Pepacton	Wawarsing	N/A	0	2	3	1
Rondout	Denning	0	N/A	3	3	1
Rondout	Fallsburg	N/A	0	0	0	0
Rondout	Hardenburgh	0	N/A	0	0	0
Rondout	Neversink	N/A	3	7	11	10
Rondout	Rochester	0	N/A	0	0	0
Rondout	Wawarsing	1	N/A	3	2	1
Totals		**5**	**159**	**107**	**269**	**139**

* DEP has an agreement with Ulster County to review new individual SSTS applications

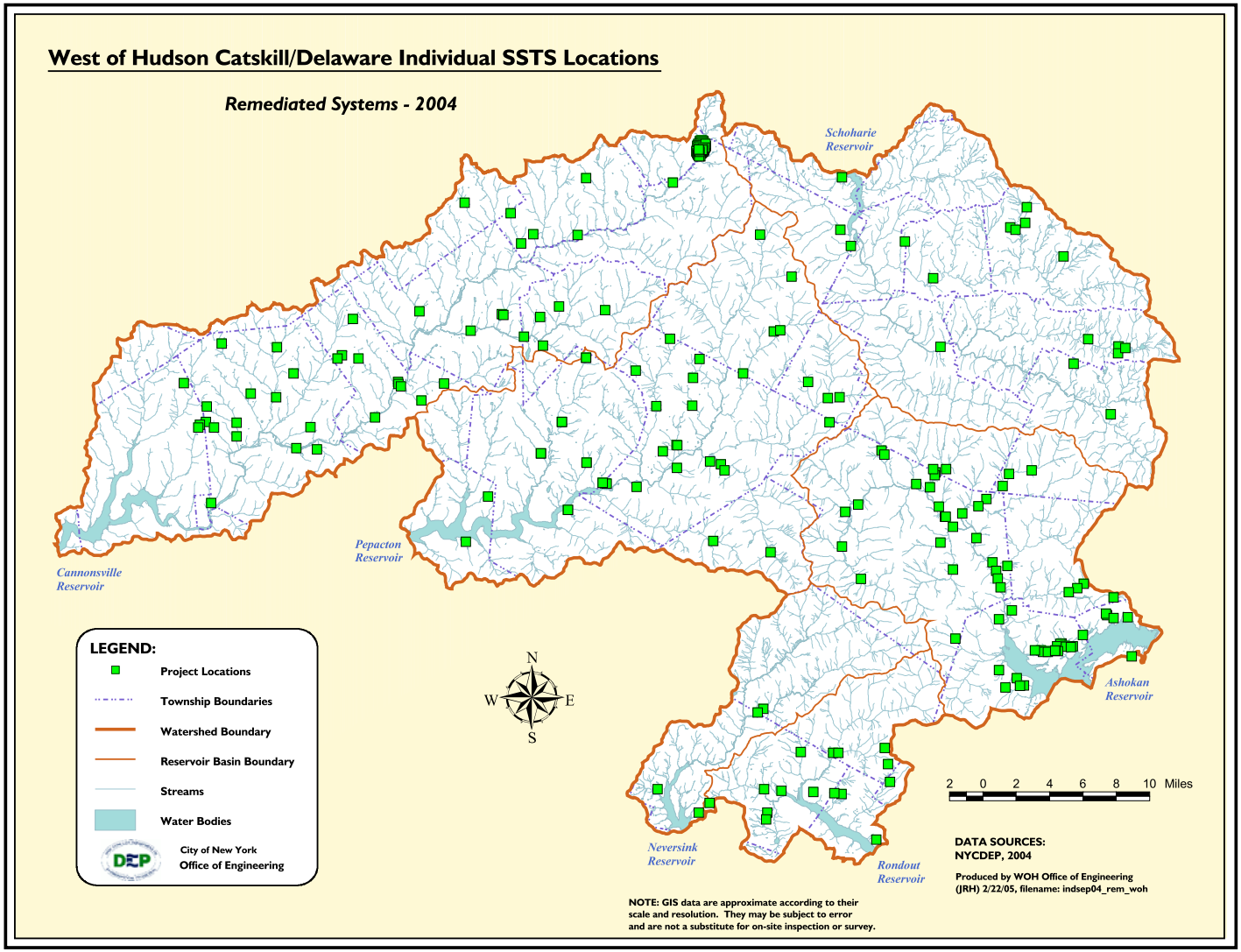


Figure 6.9. West of Hudson Catskill/Delaware individual SSTS locations.

6.1.2 Enforcement Activities

DEP continues to monitor activities in the watershed to ensure water supply protection. As part of that effort focuses on the management and protection of City-owned water supply lands. As of December 2004, these lands totaled approximately 120,256 acres. DEP inspects and maintains boundary limits on all City lands and conservation easements; prepares properties for purchase by the City; issues public access and boating permits; and refers violations to DEP Police.

The Engineering Division is responsible for reviewing applications, conducting site visits, witnessing soil tests and inspecting construction of all new individual septic systems in the Catskill and Delaware districts. On a limited basis, this Section also performs discovery and confirmation of septic failures, issues Notices of Violation (NOV), pursues enforcement actions on failed Subsurface Sewage Treatment Systems, and refers potential criminal activity to the DEP Police. Additionally, these activities are coordinated with DEP Legal and Corporation Counsel, local County Health Departments, local building inspectors, and the Catskill Watershed Corporation if the activity is in a MOA program area.

The DEP Police have taken a larger role in patrolling for and detecting violations of the WR&R. In recent years, DEP has expanded the Police force from approximately 75 officers to a current force of 170 officers. Police officers are specially trained to enforce federal, State and local laws. The Police Division's Environmental Police Academy trains environmental police officers for the unique mission of DEP. The Environmental Police Academy is accredited by the New York State Division of Criminal Justice Services and offers not only the required 510 hours of mandatory state police training, but also offers 320 hours of training in environmental law and sciences, as well as 170 hours of practical field training in environmental and infrastructure protection. The Environmental Police Academy also conducts, coordinates and documents in service training for veteran environmental police officers to train and update members in state of the art techniques and technologies. The DEP Police coordinate closely with other DEP divisions to be aware of ongoing construction projects in the watershed, and to ensure that areas of special concern are closely monitored.

In 2004, the DEP Police:

- Completed 18,177 hours of training;
- Conducted 3,714 preliminary investigations;
- Conducted 149 long-term investigations related to pollution crime or terrorism;
- Conducted 100 suspicious incident investigations related to terrorism;
- Patrolled 2,078,504 miles; and
- Conducted 217,109 physical security inspections.

Also in 2004, the DEP Police made 275 arrests, issued 893 summonses and served 122 Notices of Warning for violations of the New York State Penal Law, New York State Environmental Conservation Law, New York State Vehicle & Traffic Law, the WR&R and various other State and local statutes.

Table 6.6. 2004 Land Management Activities.

	East of Hudson	Catskill	Delaware
Properties fully inspected (acres)	6,528	24,681	22,906
Properties partially inspected (#)	256	197	62
Miles of boundary painted	80	84	36
Miles of boundary posted	66	136	27
Site visits (#)	72	179	846
Pre-closing site inspections (acres)	404	4,394	956
Debris/hazards identified (#)	58	18	63
Debris/hazard cleaned/resolved	43	75	27
Encroachments identified	29	15	12
Encroachments referred (#)	7	5	3
Encroachments resolved	16	5	7
Road/access areas secured (#)	6	0	14
Contacts with NYC neighbors (#)	398	148	107
Contacts with NYC Recreational users (#)	1,197	2,006	421
Number of non-compliant boats removed (#)	1,294	180	72
Number of boats steam-cleaned (#)	697	191	188

The 2004 Engineering activities for the East of Hudson are specific for the following basins: Boyds Corner, West Branch, Croton Falls, Cross River and Kensico:

Table 6.7. 2004 Engineering Activities.

	East of Hudson	Catskill	Delaware
New or Delegated Onsite SSTSs Design Approved	34	164	171
Remediated Onsite SSTSs Design Approved	0	100	112
SSTSs Construction Approved (New, Remediated or Delegated)	35	187	145
SPPP, IRSP and CPDP Approvals	7	9	10
WWTP or Sewer Connection, Sewer Extension Approved	1	9	5
NOVs/NOFs for SSTS	2	3	1
NOVs/NOFs for SPPP	6	4	1
Other Application Received (Non Regulated)	4	22	23

6.1.3 Delegation Agreements

In 2004, Westchester, Putnam and Ulster County Health Departments continued to perform reviews of septic systems in accordance with the Delegation Agreements. DEP received documentation concerning the review of 206 delegated systems during the calendar year.

Of the total 206 delegated septic systems, a total of 56 systems were reviewed by the county health departments in the Catskill and Delaware systems.

6.1.4 Winter Road Deicer Policy and Protection Development

DEP maintains a laboratory analysis contract specifically for de-icers should samples be received to compare total phosphorus concentrations to the ranges listed in the advisory posted on the website of the Watershed Inspector General (http://www.oag.state.ny.us/environment/deicer.html). In 2004, one Town Department of Public Works requested analysis of three liquid de-icing products they were considering for purchase. Based on laboratory analysis and comparison with the advisory guidelines, one product was removed from consideration.

DEP also presented a poster on the inter-agency work of comparing total phosphorus concentrations in de-icers, and in December 2004, developed criteria for a conference titled "Rising Salt Concentrations in Tributaries of the Hudson River Estuary".

6.2 Wastewater Treatment Facility Compliance Inspection Program

At each surface discharging wastewater facility that operates on a year-round basis, the DEP's Wastewater Treatment Facility Regulatory Compliance Inspection (RCI) Sections conducts inspections, one for each calendar quarter. At seasonal surface discharging facilities, two inspections per year at minimum are conducted during the operating season. Similarly, at least two inspections per year are conducted at non-contact cooling water discharges to surface waters groundwater remediation systems, landfills, oil/water separators and wastewater collection systems. Treated industrial waste discharges to groundwater, via ground surface application, and is inspected four times per year.

DEP also visits facilities to meet with owners and/or operators to address special problems and to offer operating suggestions. In addition, DEP laboratories conduct special analyses to help avoid or address violations. RCI staff help guide and inform such efforts and introduce samplers to new WWTP sample sites.

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 are discussed and steps are taken to ensure that adequate enforcement activities are pursued to achieve compliance. Staff from EPA, DOH, and the Attorney General's Office also participates in the WECC.

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. 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.

In 2004, five Compliance Assistance Conferences were held between DEP and facility owner(s). Five DEC Order of Consent was initiated with fines. No NOVs were issued by DEP. There were six referrals to other agencies for assistance in implementing enforcement actions.

Facility Compliance in Catskill/ Delaware Watershed

Not including the new but unfinished New Infrastructure Program (NIP) WWTPs, a total of 44 West of Hudson wastewater treatment facilities were inspected on a regular schedule. Of those, 34 facilities are permitted for year-round discharge, and 10 are permitted for seasonal discharge. Of this overall total, four are wastewater treatment facilities permitted to discharge to groundwater. These are the Hamlet of Chichester, Frog House Restaurant, Mountainside Farms, and Hanah Country Club. Three other dischargers are industrial non-contact cooling water discharges. These include Ultra Dairy, DMR, and Kraft Non-Contact Cooling Water discharges. Of the inspections conducted in 2004, approximately 104 were follow-up inspections, which were made at various facilities throughout the year. In addition, there were 354 site inspections related to DEP's Upgrade Program construction work.

Wastewater treatment plants in the Catskill/Delaware watershed continue to show improvement in compliance with their State Pollutant Discharge Elimination System (SPDES) Permits. This is due in large part to DEP's Wastewater Treatment Facility Compliance Inspection Program. Several facilities showed improvements in compliance in 2004, including Golden Acre Farms (GAF), Liftside at Hunter WWTP, and Regis Hotel. At GAF and Regis Hotel, program intervention increased operator attention and education, improving the quality of effluent. At Liftside, program intervention resulted in the construction of a holding lagoon and other steps that reduced untreated discharges and overflows.

Construction related to the new Village of Hunter WWTP collection system interfered with the existing piping at the Colonel's Chair WWTP, which caused an unacceptable discharge for a short period of time. DEP staff insured that this temporary upset was quickly and reasonably mitigated by owners, operators and construction personnel until final connection can be made to the new WWTP in 2005.

Notification by the inspection personnel required several facilities to take immediate corrective actions during specific instances of acute operational or equipment failures. This resulted in reduction, avoidance, or elimination of non-compliant discharges. These facilities included:

Mountainside Restaurant, Onteora High School, Snowtime/Ski Windham, Thompson House, and the new Village of Andes WWTP. Several facilities made construction remediations or improvements to their wastewater treatment facilities to reduce risks of non-compliant discharges. These were initiated by DEP through the inspection program and/or by DEC in cooperation with DEP. These included Delhi, Hobart and Mountainside Farms. Crystal Pond, a non-discharger, installed an alarm on the wastewater storage tank.

RCI personnel reviewed and oversaw implementation of enhanced UV disinfection at seven facilities awaiting connection to NIP wastewater treatment plants. These facilities were Camp Loyaltown, Colonel's Chair, Forester Motor Lodge, Liftside at Hunter, Regis Hotel, Snowtime/Ski Windham and Thompson House.

RCI personnel were also instrumental in the progress made in DEP's Upgrade program. During 2004, more stringent SPDES limits were almost immediately met at wastewater treatment plants that participated in the Upgrade Program, including Camp L'Man A'Chai, Delaware-Chenango BOCES, and Roxbury Run. DEP's RCI staff performed construction inspections, start-up surveillance and review of operating manuals.

In 2004, under the NIP, one completely new wastewater plant in the Village of Andes replaced many antiquated individual septic systems, including some known to be failing. As a direct result of inspections and construction monitoring, the Andes WWTP met its more stringent SPDES limits almost immediately.

However, improvements demanded by DEP and the DEC watershed and regional staff were unsuccessful in improving the effluent from the existing wastewater treatment at Timberlake Camp. In response, DEP accelerated its review and approval of the upgrade plans and commencement of the upgrade construction. Construction began in 2004 and completion is expected to prevent non-complying discharges before the 2005 camp season begins.

Facility Compliance in East of Hudson Watershed

The EOH RCI Section ensures that adequate measures are taken to enforce compliance with the SPDES permits issued to the seventy-two (72) WWTPs that discharge into the EOH watershed. The RCI Section conducted 590 quarterly compliance, emergency response and WWTP upgrade construction inspections in 2004. Several reservoirs areas are of special interest because West Branch, Boyds Corner, Croton Falls, Cross River and Kensico Reservoir basins in the East of Hudson System could contribute to waters of the Delaware system.

The following is a summary of the WWTPs and collection systems inspected within the West Branch, Croton Falls and Cross River basins. There are nine WWTPs that discharge effluent into these basins. There are no WWTPs in the Kensico and Boyds Corner basins, but DEP does perform inspections of the collection/pump stations maintained by the Towns of North Castle and Harrison within the Kensico basin.

Of the nine WWTPs that discharge in the West Branch, Croton Falls and Cross River basins, seven continued to show improvement in the quality of the effluent discharged. The Fairways at Hill and Dale, Waccabuc Country Club, City owned Mahopac plant, Lewisboro Elementary School, Lake Plaza, Fulmar Road Elementary School and the Meadows at Cross River WWTPs were all operating satisfactorily during 2004. Mechanical updates and minor problems, such as low pH readings or low chlorine residuals, were immediately corrected after recommendations made by the RCI staff.

Of the remaining two wastewater treatment facilities, Clear Pool Camp experienced four exceedances for chlorine residual and one fecal coliform exceedance during the 2004 monitoring period. DEP recommended that the operator properly clean the chlorine contact tank and the effluent discharge line to improve the disinfection process. These recommendations did improve the facility's performance. Construction at this facility under the Upgrade Program was completed during the third quarter of 2004, and Start-up and Performance Testing was conducted during the fourth quarter of 2004. Initial testing indicated that the facility was meeting its SPDES parameters, and it is anticipated that this facility will be operating well within its SPDES limits during the 2005 season.

Carmel Sewer District #2 WWTP experienced numerous problems in 2004. There were four (4) serious sewer overflows in 2004, one from the sewer line located on Stoneleigh Avenue that was caused by a hole being drilled through the sewer line by a private contractor conducting a soil boring. Another overflow was reported from a manhole located between Route 6 and Route 52 adjacent to Lake Gleneida. A third overflow occurred at the Belden Road Pump Station, and a fourth overflow occurred at a pump station at Hughson Road. These overflows, combined with in-house overflows and violations of the SPDES permit limits for phosphorous and ammonia, led to a compliance conference held at the DEC regional office. The ammonia violations were caused by a combination of mechanical failure of the sludge pumps and the acceptance of up to 6,000 gallons of septage per day. DEC drafted an Order on Consent for the violations and the sewage overflows. There were tasks indicated within the schedule of compliance that include a submittal of an Emergency/Spill Response protocol and a Corrective Actions Report. A copy of the draft consent order was submitted to RCI for review.

RCI performed compliance inspections of the Town of North Castle and Harrison pump stations and collection system throughout the 2004 monitoring period. On January 29, 2004, the North Castle Water and Sewer Department reported a sewage overflow from the pump station on Cooney Hill Road. The cause of the overflow was a grease blockage in the line that connects from the Swiss-Re office complex. DEP and the Town conducted meetings with representatives of the Swiss-Re office complex about this recurring problem in the collection system. A Report of Non-Compliance Event was submitted to the DEC reporting the overflow. The Town of North Castle increased the frequency of their sewer manhole inspections in response to this event.

6.2.1 Sampling of Wastewater Treatment Plant Effluents

Sampling of WWTP effluent is conducted by DEP's District Laboratories at the Grahamsville Lab, the Ben Nesin Lab, and the Brewster Lab. Non-City-owned surface-discharging WWTPs are sampled twice monthly. West-of-Hudson City-owned WWTPs are sampled at least weekly, exceeding the SPDES monitoring requirements. Sampling data are shared regularly with DEP's Wastewater Treatment Facility Compliance Inspection Section for the purpose of tracking compliance with SPDES-permitted effluent limits.

At City-owned plants, DEP laboratories collect compliance samples, including grab and composite samples, for reporting on Discharge Monitoring Reports. At non-City-owned facilities, grab samples are taken, and in addition a composite sample is collected once a year from those plants that have composite sample monitoring requirements on their permits. In the Catskill district in 2004, composite samples were collected from Snowtime, Hunter Highlands, and Liftside. In the Delaware district, composite samples were collected from the Village of Walton, Village of Stamford, Village of Hobart, Village of Delhi, and Mountainside Farms, and from the non-contact cooling water discharge at Kraft. 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 2004, the Ben Nesin Laboratory conducted 3,581 analyses on 589 effluent samples and the Grahamsville Laboratory conducted 3,491 analyses on 432 effluent samples from WWTPs (and non-contact cooling water discharges) discharging within the watershed. For plants in the East-of-Hudson basins (West Branch, Cross River, and Croton Falls), the Brewster Laboratory collected 173 effluent samples and conducted 1,610 analyses.

To monitor the effluent quality of WWTPs that receive periodic high usage during the ski season, special efforts were made to collect and analyze samples from these facilities. The following facilities were visited during the Christmas-New Year week: Colonel's Chair, Forester Motor Lodge, Hunter Highlands, Liftside, Mountain View Estates, Mountain View Homeowners Association, Snowtime, and Whistle Tree. Samples from three of these eight sites contained more exceedances of SPDES-permitted parameters than standard weekday samples collected during the ski season.

6.3 SEQRA Coordination

To better coordinate SEQRA activity in the watershed, DEP created the Division of SEQRA Coordination and Watershed Management Programs in January 2004. The Division is charged, in addition to other things, with successfully executing the duties outlined below.

Division staff ensure timely, thorough, and effective SEQRA environmental reviews in the watershed. To manage these often large and often complex projects, and the accompanying SEQRA environmental reviews, DEP tracks all SEQRA projects in the watershed; maintains a database of new projects and development trends in the watershed; interacts with local, State and

federal officials and other interested parties on DEP's involvement in SEQRA environmental reviews; and makes certain that the appropriate levels of DEP management are kept apprised of the presence, and status, of potentially controversial SEQRA reviews.

Table 6.8. SEQRA actions 2004.

Received	Reviewed	Comment Letters Issued	Ongoing Reviews	SEQRA Process Closed
151	151	84	85	66

Notes:
1) SEQRA Actions include:
Notices of Intent to Act as Lead Agency
Determinations of Action Types
Environmental Assessment Forms
Scoping Documents
Draft Environmental Impact Statements
Final Environmental Impact Statements
Supplemental Environmental Impact Statements
Findings to Approve or Deny
2) Ongoing reviews and process closures include certain actions that DEP received prior to the beginning of the reporting period.

The following summaries provide a brief overview of the nature and status of several of the most significant, privately sponsored, SEQRA Type I actions that are currently undergoing, or have undergone, SEQRA environmental reviews during the reporting period.

Gateway Summit/Fairway, Town of Carmel

At the direction of the Town Planning Board, the sponsors of two proposals on adjacent properties have merged them into one to eliminate the SEQRA segmentation issue. The proposal, Gateway Summit/Fairway, includes the construction of a hotel, a YMCA facility, two (2) office buildings, a restaurant and nearly 300 attached senior housing units on approximately 190 acres in an area served by public water and sewer. The Carmel Planning Board designated itself Lead Agency two years ago and conducted a formal scoping process in which DEP participated. The Generic DEIS has been completed in accordance with the final scoping document and was submitted to the Lead Agency and all Involved Agencies early in 2005. SC&WMP staff attended Public Hearing on February 2, 2005. The comment period for the Draft GDEIS was extended 30 days until March 2, 2005.

Crossroads Ventures, LLC, Town of Shandaken

The Crossroads project is divided into two related but geographically distinct developments with a total of 400 hotel rooms, 351 additional hotel and housing units, a 21 lot single family residential subdivision, two (18) hole golf courses, and two WWTPs. The project was

circulated in December of 1999, with Town of Shandaken Planning Board as Lead Agency. In February 2000, DEC Region 3 requested of DEC Commissioner that it hold Lead Agency status of co-Lead Agency with the Town of Shandaken; however, in March 2000, DEC Commissioner named DEC as Lead Agency for the project. In April 2004, DEP commented on the DEIS which it found to be fundamentally flawed and incomplete because it failed to satisfy SEQRA. DEP had concerns regarding the failure of the DEIS to adequately identify and describe effective mitigation for potential impacts of the construction and operation of the proposed resort.

7. Catskill/Delaware Filtration/UV Disinfection Facilities

For 2004, the primary focus of the Catskill/Delaware water treatment projects continued to be the development of designs for an Ultraviolet (UV) light disinfection facility. Two deliverables, a Draft Environmental Impact Statement (DEIS) and a Final Environmental Impact Statement (FEIS), were completed this year. DEP and their engineering design consultants, the Joint Venture of Hazen and Sawyer/CDM (the JV), made significant progress toward meeting future UV related deliverables. These efforts resulted in the inspection of the Catskill Aqueduct between Kensico Reservoir and the Catskill Connection Chamber at Eastview; expansion of a full-scale UV equipment validation facility in Johnstown, NY; advancement of computer based modeling for UV disinfection equipment; identification of a construction management contractor; and initiation of pre-bid activities for UV system suppliers (UVSS) and site preparation contractors. A Value Engineering Workshop was conducted in September.

To maintain the time-neutral dual-track approach for meeting the goals of the Surface Water Treatment Rule, the City has agreed to complete biennial updates of the preliminary designs for a water filtration facility. The last update was completed in September 2003. A similar update will be completed in 2005.

7.1 Equipment Validation

In 2003, DEP decided to proceed with a Low-Pressure High Output (LPHO) UV Disinfection system and identified a testing facility that could be modified for full-scale validation of high-capacity UV equipment. In response to a Request for Expressions of Interest released by the JV in late 2003, three potential UV system suppliers were identified to develop custom designs for LPHO UV disinfection chambers. Each vendor was afforded an opportunity to submit shop drawings and fabrication credentials for LPHO UV units. Candidate UVSSs that successfully meet the project specifications and time lines will then have an opportunity to provide UV equipment for full-scale validation testing in 2005. In advance of validation, each vendor will be expected to enter into a memorandum of understanding regarding the provision of 55 more units. The three vendors currently involved in the selection process are Trojan, Ultratech and Wedeco.

In conjunction with the New York State Energy Research and Development Authority (NYSERDA) and a Joint Venture subcontract with Hydroqual, the City expanded the recently developed UV Validation & Research Center of New York located at the Johnstown/Gloversville Joint Wastewater Treatment Facility in Johnstown, NY. Since this facility is located near the head of a distribution system leading from the local (drinking) water treatment facility, a suitable supply of source water is available for validation testing under a wide envelope of water quality conditions. The infrastructure to deliver, spike, treat, test and dispose of the water used in testing at a flow rate up to 60 MGD has been installed by Hydroqual.

In addition to creating the infrastructure necessary for testing, the testing protocol has been under development throughout the year A workshop was held in October 2004, to discuss the protocol with representatives from a peer review group, EPA and DOH. The project team has investigated potential challenge microbes to determine their suitability as surrogates for cryptosporidium and the availability of the number of organisms necessary to support evaluation of a wide matrix of influent characteristics and operating conditions. Two challenge organisms, MS-2 and Q-Beta, will be employed during the full-scale validation testing. To achieve or simulate a range of UV transmittance conditions lignin sulfonate will be used in the validation test runs. The first unit to be tested is scheduled to be on site in March 2005.

Using data collected during biodosimetry validation of the UV equipment (Wedeco K3000,K143, K143 HP and Trojan UV Swift 4L12(b) & 8L24) and corresponding computer based light intensity and fluid dynamic models, the Joint Venture developed and blind-tested a means to predict the performance of the 40 mgd disinfection units that will be installed in the Catskill/Delaware UV Facility.

By integrating aspects of light intensity distribution (LID) models and computational fluid dynamic (CFD) models the radiation and hydrodynamic characteristics of the UV disinfection equipment can be predicted. Use of these models, hereafter referenced as CFDi models, will be incorporated into the full-scale validation program and will later serve as a tool to assess future operating conditions. CFDi models will be developed for the test units, the validation facility test stand, the piping network at the UV facility and the disinfection chambers that will be installed there. These models will be used to establish fluence distributions within the UV units which will be used to develop Reduction Equivalent Dose (RED) bias to ensure cryptosporidium inactivation.

A flow chart (Figure 7.1) has been developed to illustrate how CFDi modeling will be integrated with full-scale validation testing to develop operating control strategies for the UV facility. While the design team will use the validation results to finalize the structural, mechanical and electrical designs for the facility, CFDi modeling will be done on the selected UV chamber as it will be installed in the piping network and the need for a hydraulic safety factor will be evaluated. The bioassay validation results will also be used to determine the values of the expanded uncertainties and RED bias factors which will be used to define the intended dose for the UV disinfection facility.

A presentation and subsequent status report will be delivered to EPA and DOH in 2005.

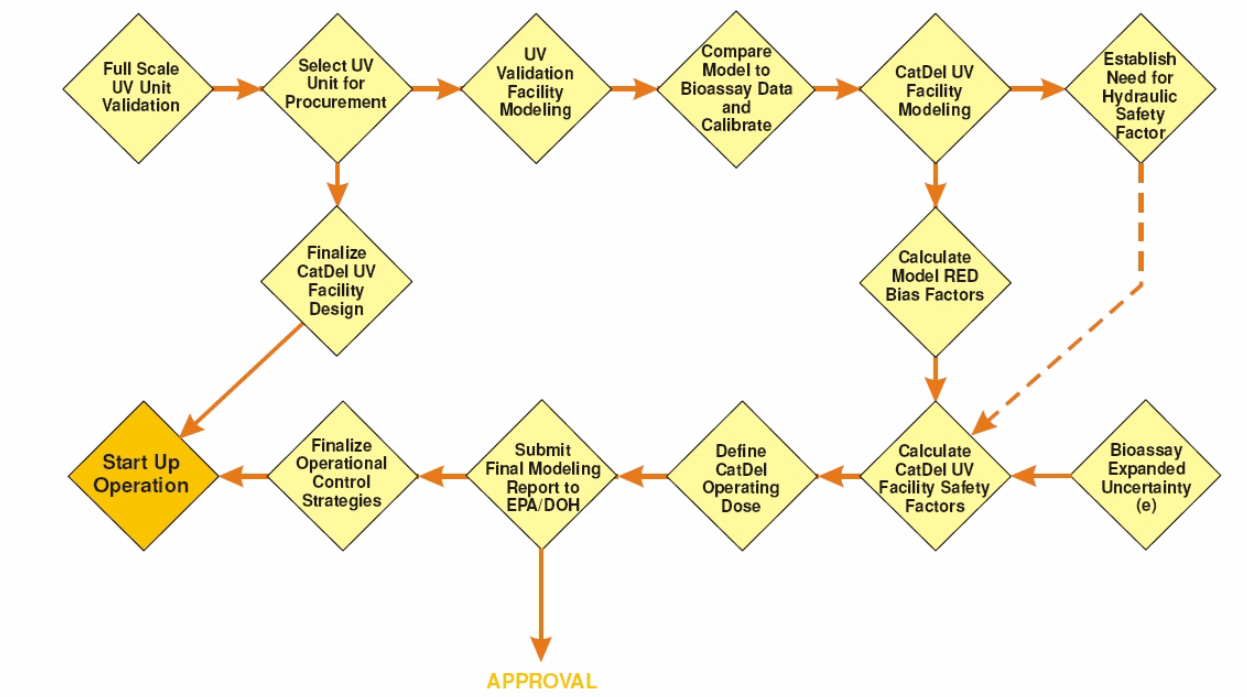


Figure 7.1. Illustration showing how CFDi modeling will be integrated with full-scale validation testing to develop operating control strategies for the UV facility.

7.2 Value Engineering Workshop

During the week of September 20, 2005, the second of two Value Engineering (VE) workshops was conducted by the City's Office of Management and Budget. A team of industry professionals was gathered to review and assess the preliminary level designs for the UV facility at the Eastview site. The Value Engineering workshop is a structured forum that begins with a presentation by the design team and a review of the project goals. The next phases of the workshop include an analysis of the specific functions of the proposed facility and a brainstorming session to identify modifications to the design that address specific facility needs. These suggestions are then ranked and reviewed with DEP to ensure that suggested alterations to the project would not be prohibited. Top ranked suggestions are then developed and their implementation costs or related costs savings are calculated. A closing session is conducted to share the recommendations of the VE team with the design team.

At the conclusion of the workshop, DEP and the Joint Venture were presented with a written report of the VE team's recommendations. Early in 2005, DEP will issue a response to the report, indicating which proposals the project team believes should be implemented, studied fur-

ther, or rejected. An implementation meeting will be held in spring 2005 to discuss these responses. Each of the adopted changes will be fully reflected in the final designs for the UV facility.

7.3 Environmental Assessment and EIS Preparation

Following the October 11, 2003 release of the Draft Scope of Work for the Environmental Impact Statement and a positive declaration, DEP's assumption of the role of Lead Agent was challenged. By the close of 2003, the Town of Mount Pleasant agreed that DEP would serve as Lead Agent and a public hearing to address the Scope of Work for the Environmental Impact Statement (EIS) was rescheduled for February 2004. A final scope of work was issued in April 2004.

AKRF, a JV subcontractor assisted in the development of the DEIS which was released on May 31, 2004. The DEIS (a two volume document) presented a detailed description of the project and identified the federal, State, local and City discretionary approvals or actions that will be required for the project. The potentially significant adverse impacts that could arise during construction or operation of the UV facility were also discussed. Proposed mitigation measures for these impacts were outlined. Following public review and additional study, the FEIS was released on November 30, 2004. A Findings Statement was issued on December 29, 2004. Efforts to obtain the various approvals necessary for construction are underway.

7.4 Fouling Study

To better understand the operation and maintenance of the UV disinfection equipment, DEP intends to conduct a pilot study focused on lamp-sleeve fouling. As currently conceived, the pilot will allow for parallel testing of LPHO and MP lamp units. For each type of lamp being tested, two units will be installed so that side-by-side runs to assess varying operating conditions can be performed. The effect of upstream chlorine addition will be evaluated in the study.

The research plan will also incorporate an assessment of the potential impact of the visible light emitted by UV lamps on algae growth as well as any impacts to taste and odor that may result from UV disinfection. Mechanical and chemical cleaning methods will both be used during this study. Information that may be helpful to future operators will be noted and incorporated in the training and documentation delivered during start-up of the Catskill/Delaware UV Disinfection facilities.

To accommodate an infrastructure remediation project at Delaware Shaft 17 and avoid complications from on-site blasting, the proposed site for the fouling study was revised. The fouling study is now to be conducted at the downstream side of Kensico Reservoir at Shaft 18 of the Delaware Aqueduct. The City has been engaged in an ongoing effort to acquire site plan approval

to construct a temporary pilot facility at the site and a special use permit to operate the pilot. Though these efforts were not completed in the 2004 calendar year, the project team expects to be on site by mid-summer 2005.

7.5 Catskill Aqueduct Inspection Program

As currently operated, the Catskill Aqueduct delivers water from Kensico Reservoir to the Eastview site at an operating head which is too low to meet the hydraulic gradeline of the proposed UV disinfection facilities. To meet the design flow of the proposed UV facilities and address DEP's concerns for redundancy and reliability, DEP is planning to pressurize the Catskill Aqueduct between Kensico Reservoir and Eastview.

With the assistance of Jenny Engineering, a JV sub-contractor, DEP and the JV conducted a series of seven short term aqueduct shut-downs (see Figure 7.2) that allowed personnel to enter the 12,500 foot long segment of aqueduct between the Upper Effluent Chamber at Kensico Reservoir and the Catskill Connection Chamber at Eastview. This allowed for visual inspections and integrity tests as well as sample collection from the floor and walls of the conduit. Findings from these inspections will serve as the basis for the design of the modifications necessary to pressurize the aqueduct.

Summary of Aqueduct Inspections

CATSKILL AQUEDUCT

Shutdown	Date	Type of Inspection	Areas
1	March 13	Initial, Visual	Kensico C&C; Kensico Grade between Venturi Meter and North Siphon Chamber; Fluoridation Pit between LEC and Screen Chamber
2	March 15	Initial, Visual	Eastview Grade Tunnel
3	March 27	Final, Testing	Eastview Grade Tunnel
4	March 29	Final, Testing	Eastview Grade Tunnel
5	March 31	Final, Testing	Kensico C&C; Kensico Grade between Venturi Meter and North Siphon Chamber; Fluoridation Pit between LEC and Screen Chamber Siphon Chamber; Fluoridation Pit between LEC and Screen Chamber
6	April 3	Final, Testing	Steel Siphon; Kensico C&C between Screen Chamber and Venturi Meter
7	April 5	Initial, Final, Testing	Dike Grade Tunnel

Figure 7.2. Summary of aqueduct inspections.

In addition to conducting visual inspections, sonic and ultrasonic testing was conducted and ground penetrating radar was used to assess the thickness of the tunnel lining and locate voids in the vicinity of the aqueduct. Windsor probes were used in the vicinity of core sample collection points. Information from these tests will provide insight into the aqueduct's ability to withstand pressurization. Where groundwater intrusion was encountered, water samples were collected. These samples were tested to assess the likelihood of corrosion of any materials to be used in the aqueduct.

7.6 Site Preparation and Facility Construction

The project team has accelerated the start of construction by segregating the site preparation work from the general construction contracts. The Site Preparation contract was released for bidding on December 9, 2004. Bids were to be delivered in mid-March and an Order to Commence Work is expected by mid-year.

7.7 Publications and Presentations

As the design team working on the world's largest UV water disinfection facility, DEP and Joint Venture staff are routinely called upon to present their work at Technical Conferences and Seminars. During the year the following technology transfer presentations were made by members of the project team.

- April 2004 – Florida Water Resources Conference
  "The Challenges of Designing the World's Largest UV Disinfection Facility"

  The purpose of this paper was to report on the feasibility of UV disinfection for large utilities and the unique set of design challenges that must be addressed. The design of a UV disinfection facility for New York City's Catskill and Delaware supplies poses several unique design challenges due to the scale of the facility (2,020 mgd), the unfiltered state of the water being treated and the relative infancy of UV technology. Challenges that have been encountered include the need to provide a facility that: meets the required design goals under all operating conditions and raw water qualities, is highly reliable, and maintains the present operational flexibility of the system.

- May 2004 - IUVA Northeast Seminar
  "CFD Modeling of the 2 Billion Gallon per day UV System for NYC" and
  " UV Facility Planning and Status Update for NYC"

These presentations offered the audience at the Northeast Regional Seminar of the International UV Association an update on the progress of the NYC UV Disinfection project.

- June 2004 - AWWA ACE2004

  "UV System Validation – From City to Nation to State", similar to the presentation made in April 2004 at FWRC.

  "CFD Modeling of the Two Billion Gallons per Day UV Reactor System for New York" A general overview of modeling for Cat/Del focusing generally on the UV unit modeling with some info on the hydraulic modeling of the plant.

  and a Poster on the "Selection of LPHO vs. MP UV Systems"

- September 2004 - IUVA Karlsruhe

  "UV Disinfection System Validation: The Plan for New York City's Catskill and Delaware UV Disinfection Facility"

- November 2004 - WQTC

  "UV Disinfection System Validation: The Plan for New York City's Catskill and Delaware UV Disinfection Facility"

This presentation was similar to the one offered in September 2004 at the International Ultraviolet Association meeting in Karlsruhe.

7.8 Filtration Planning Design Update

In accordance with the modifications to the FAD that introduced the UV Disinfection Facility deliverables and provided relief from certain filtration related deliverables, DEP submitted the first biennial update of the preliminary designs for the Catskill/Delaware filtration facility. Since the designs were first completed in September 2001, DEP has considered siting several additional facilities at Eastview. In addition to being the proposed site for a DEP police precinct and shafts for the future Kensico-NYC Tunnel, the Eastview site is a back-up site for the Croton Filtration Facility. In response to internal security discussions, DEP is also evaluating the possibility of incorporating laboratory and operations facilities onto the Eastview site. In the event that these projects are deemed appropriate for the site, details of the facilities will be included in future design updates for the Catskill/Delaware water filtration facility.

7.9 American Water Works Research Foundation (AWWARF) Activities

7.9.1 Optimization of UV Reactor Validation

In October 2002, DEP agreed to champion a proposal for an AWWARF Tailored Collaboration project entitled "Optimization of UV Reactor Validation". Carollo Engineers, Clancy Environmental, Inc. and the Optical Laboratory of the Institute of Medical Physics and Biostatistics of the University of Veterinary Medicine of Vienna, Austria developed the research plan for this study. The cities of Phoenix, Arizona and Tacoma, Washington have agreed to co-sponsor this work.

This work is intended to address three primary issues associated with UV equipment validation. The study is intended to optimize reactor validation methods, limit the uncertainties in design and ultimately reduce the costs of implementation for full-scale UV installations.

The American Water Works Association Research Foundation awarded funding for this research. To date, the study has evaluated several bacteriophages and found that some available surrogate organisms, such as T7 and SP8, while providing closer matches to the UV dose response curves than MS2 do not titer in significant concentrations. Q-Beta has a dose response characteristic that could reduce RED bias by approximately 25% and has been identified as the best alternative to MS2. Work will continue on other phages.

Findings indicate that lignin sulfonate and coffee are still most the feasible agents for establishing an array of UV absorbance conditions during validation. Although a number of UV absorbing compounds were evaluated to more closely simulate operating conditions during validation, limited availability of the products tested hinder their widespread application. This work is more applicable to the polychromatic light applied in Medium Pressure UV systems.

A third component of the research focuses on the effects of lamp aging on dose delivery. As expected, output from aged lamps appears to be less uniform at the ends of the lamps than at the middle of the lamps. As a result the placement of sensors at different points along the lamps will be critical as results from various segments of the lamp will predict in a wide array of germicidal effects -- some over-estimated and others underestimated.

7.9.2 Membrane Filtration of Filter Backwash Water

This project is to be conducted at the pilot testing facilities DEP is planning to use for the UV lamp fouling study. As a result of the relocation of the testing site, there is no progress to report this year.

7.9.3 Integrating UV Disinfection Into Existing Water Treatment Plants

The objective of this project was to provide guidance to utilities in evaluating the implementation of UV disinfection into existing water treatment plants (WWTPs). The research team developed two interactive decision tools to help utilities evaluate their existing treatment strategy and retrofit issues associated with UV disinfection, which were released through AWWARF at the end of 2004. The Multi-Barrier Assessment Tool (MBAT) and UV Disinfection Implementation Tool (UVDIT) are intended to assist utilities with conceptual planning and preliminary assessments of disinfection options and UV disinfection implementation issues. These tools were developed by Malcolm Pirnie, Inc. and Hazen and Sawyer as part of AWWARF Project 2861 with in-kind services provided through the Catskill/Delaware UV project.

The MBAT evaluates a utility's water quality goals, source water quality, and existing treatment processes to determine whether enhanced disinfection may be necessary to meet future regulations and water quality goals, based on risk reduction and overall costs. If increased disinfection is needed, the potential technologies, including UV disinfection, will be compared based on risk reduction and costs.

Should the MBAT determine that UV disinfection is a recommended treatment option, the UVDIT is used to evaluate existing infrastructure, hydraulic limitations, water quality variability, flow variability, power source limitations, and lamp breakage issues. Once those constraints are determined, the UVDIT will answer questions such as 1) where are the feasible retrofit locations for UV disinfection, 2) what are the risks of UV disinfection at each retrofit location, 3) how are these risks mitigated, and 4) how much does each retrofit option cost?

8. In-City Programs

8.1 Waterborne Disease Risk Assessment Program

New York City's Waterborne Disease Risk Assessment Program (WDRAP) is a joint agency program involving the Department of Health and Mental Hygiene (DOHMH) and DEP. WDRAP was developed and implemented in order 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.

In 2004, active surveillance for giardiasis and cryptosporidiosis continued as in prior years. Fifty clinical laboratories located in New York City currently performing parasitology examinations for *Giardia lamblia* and *Cryptosporidium*, as well as eight laboratories in the NYC vicinity are contacted on a regular basis to solicit case reports on all positive specimens. For all cryptosporidiosis cases, and as needed for giardiasis cases, public health epidemiologists contact clients to verify the data collected on the case report, to collect additional demographic and clinical information, and to identify possible sources of exposure. At the time of this writing, the 2004 *preliminary* count of cases reported to the DOHMH among NYC residents indicates 1,086 cases of giardiasis, and 138 cases of cryptosporidiosis.

With regard to outbreak detection systems, New York City currently has four types of systems in operation, each one tracking a different indicator of gastrointestinal illness (GI) in the community (Note: these systems are not specific to giardiasis or cryptosporidiosis, nor are they specific to waterborne illness). One system involves the tracking of chief complaints from hospital emergency department logs; under another system DOHMH monitors and assists in the investigation of GI outbreaks in sentinel nursing homes; and a third system tracks the number of stool specimens submitted to clinical laboratories for microbiological testing. With regard to the Clinical Laboratory Monitoring System, two program changes occurred in 2004: (1) one of the three participating laboratories discontinued business operations in March 2004, and (2) beginning in August 2004, DOHMH implemented a computer model to establish statistical cut-offs for significant increases in clinical laboratory submissions. The fourth type of outbreak detection system includes monitoring of sales of anti-diarrheal medications (ADMs). The City's ADM monitoring activities include three components: one in which the *weekly* volume of sales of non-prescription ADMs at a major drug store chain are monitored; a second, involving another major drug store chain, in which *daily* sales of non-prescription medications are monitored; and a third in which DOHMH receives data from a national retail data source.

Additional results and program information can be found in the WDRAP semi-annual and annual reports.

8.2 Cross Connection Control Program

The Cross Connection Control Program has as its primary objective the avoidance of any potential for backflow from within premises to the public water supply system. To accomplish this objective, property owners are required to install backflow prevention containment devices in water service lines for premises that pose a potential hazard. After installation, backflow prevention containment devices are required to be tested by a certified tester at least once a year. Installation of containment devices, or a review leading to an exemption from installation of such a device, is initiated due to one of the following reasons:

- Complaints to DEP indicating that there may be a potential for a backflow to the public water supply system.
- Construction of new premises or renovation of existing premises which require installation of a tap or wet connection in a size two (2) inches or larger.
- Premises that appear to be at "high hazard" for contamination of the public water supply in the event of a backflow.

Construction of new premises and/or renovation of existing premises that involves installation of a two inch tap or a larger connection frequently involves a potentially hazardous occupancy. Such construction/renovation requires a mandatory cross connection control review. This review may result in installation of a containment device as part of the construction/renovation, or an exemption from installation of such a device.

During 2004, DEP was able to greatly improve regulatory compliance by enforcing remediation deadlines. All property owners participating in the Cross Connection Control Program received letters informing them of their obligation to test cross connection control devices at least once a year. These notifications also indicated that Notices of Violation would be issued for non-compliance with the annual testing requirement. Enforcement of the annual testing requirement will allow DEP to issue Notices of Violation in 2005 to property owners who failed to submit a test report during 2004.

DEP also created a list of "super high risk" premises as a sub-category of the previously established list of "high hazard" premises. Review of the compliance status of "super high risk" premises indicates that approximately 20% of such premises have either achieved complete compliance or are currently in the process of doing so. Information regarding the compliance status of "high hazard" premises is expected to become available sometime during 2005.

As in 2003, significant increases were seen in the installation and testing of backflow preventers, with only minimal staffing increases. Additionally, in 2004 only one water service termination was necessary due to failure to comply with cross connection control requirements.

9. Education and Outreach

Public education and outreach efforts have been a component of the City's watershed protection strategy since the expansion of the protection program in the early 1990s. DEP's activities are built on the principle that an informed base of watershed residents and water consumers facilitate development and implementation of protection strategies. An effective outreach program enhances consumer confidence in the safety and quality of the water supply, while teaching watershed residents and consumers alike the importance of watershed protection.

DEP's efforts have included, and will continue to include, both program-specific education efforts and broad-based outreach. In many cases, program-specific outreach efforts are conducted in coordination with DEP partner agencies and organizations – the Catskill Watershed Corporation, the Watershed Agricultural Council, KEEP and the watershed counties, to name a few. It is important to acknowledge the contributions of these locally-based groups in spreading the word about the links between land use activities and water quality.

9.1 Program-specific Education Efforts

Many of the individual watershed protection programs have incorporated outreach since their inception. In many cases, that outreach is designed to reach a target group of involved or interested parties. For instance, the Farm Program focuses efforts on reaching farmers and the Stream Program has held a number of training sessions for agencies and contractors who work in streams. In addition, these programs have a more general educational component to disseminate basic information to a wider audience.

DEP has collaborated with WAC, CWC and other partner organizations on a variety of programs, including the Farm Program, the Forestry Program, the Stream Management Program, Partnership Programs run by CWC and Croton Planning.

9.2 WOPA Education Program

Through the Watershed Office of Public Affairs *(WOPA),* DEP takes a comprehensive approach to watershed education. DEP visits schools in New York City and watershed counties and offers students an educational, action-oriented, multi-disciplinary curriculum. DEP programs promote investigation, allowing students to analyze factors, past and present, human and non-human, which affect the entire watershed. DEP also organizes staff development for teachers, providing them with an opportunity to meet and work with DEP scientists, engineers, and environmental educators.

In 2004, *Trout in the Classroom* continued to be one of the most effective and popular classroom programs. DEP environmental educators visited over 40 schools in both East and West of Hudson watersheds. This program teaches stewardship and science through the rearing of

brown trout. Classes receive hatchery-bred eggs in the fall and students monitor the life cycle of the fish and the water quality until the end of the school year when the fish are then released into an appropriate stream. Through the aquaculture of brown trout, students discover the connections between aquatic systems, life cycles, water quality and drinking water.

DEP's watershed education program includes participation in major events in the region, especially county fairs. DEP's education staff provides visitors of these events with valuable information; offers workshops and demonstrations; and explains the role of DEP as a cooperative partner with its upstate neighbors and environmental groups. A variety of materials are distributed to the public including booklets, pamphlets and fact sheets about the water supply system, drinking water quality, the Whole Farm Program, wetlands, land acquisition and conservation easements, as well as other related materials. During the summer months, thousands of watershed residents visit the DEP education display booth, where they are presented with materials that explain the agency and its programs. In 2004, DEP participated in more than 50 events throughout the watershed.

9.3 CWC Education Program

With support from the DEP Commissioner, the proposed Watershed Museum received a $30,000 grant from the New York Community Trust to assist their fund raising and strategic planning activities. Despite the fact that no City MOA funding is being committed to the project, the City continued to work with the Catskill Watershed Museum on their efforts. Following meetings with DEP and other watershed organizations, the Museum altered their plans to broaden the museum scope. The proposed Catskill Watershed Discovery Center would not only tell the story of the development of the New York City water supply and its watershed, but would also focus on the natural, social and cultural history and resources of the broader Catskill region.

In 2004, CWC budgeted $25,000 for "Special Project" requests and $100,000 for round seven of their competitive grants program (K-12 audiences). Following the recommendation of CWC's Public Education Advisory Group, twenty three competitive projects were approved totaling $97,294. In addition, two "special projects" were approved.

9.4 Publications

The Bureau's publications program continued to produce materials in 2004 that describe, support and explain watershed protection programs for a general, rather than technical, audience.

In 2004, DEP introduced *Around the Watershed*, an 8-page newsletter mailed to the 80,000 property owners in the City's watershed and distributed at fairs and other community events. This publication offers stories about DEP's various water quality protection programs

with an emphasis on their connection to the community and to residents' involvement. It will be produced twice a year and is also available online at DEP's special watershed protection Web site, www.nyc.gov/watershed, as are all other Bureau of Water Supply printed materials.

As part of the ongoing series of brochures about special watershed programs, new versions of the Land Acquisition and Conservation Easement brochures were produced in 2004.

In support of the Recreation & Stewardship Program, Spring and Fall editions of the *Watershed Recreation* newsletter were produced and mailed to the more than 50,000 DEP Access Permit holders and distributed at fairs and public events. In addition, a 64-page Hunting Guide, which included the Interim Conditions for Hunting on City-Owned Lands as well as maps of all the City-owned parcels open for hunting in the 2004 season, was prepared for mailing to the Access Permit holders who also received Hunting Tags.

9.5 Lawn Fertilizer Reduction

Watershed Nutrient Workgroup

In effort to reduce the amount of nutrients, particularly phosphorus, entering the water supply reservoirs East of Hudson, DEP is working cooperatively on an education program to reduce the amount fertilizer applied to residential lawns. DEP participates in the Watershed Nutrient Workgroup along with the Environmental Protection Bureau of the NYS Office of the Attorney General, Putnam and Westchester County Cornell Cooperative Extension (CCE), Putnam County Planning, Westchester County Planning, NYS DOH, DEC, NYS Turf Grass Association, Chem Lawn and EPA.

The principal result of this joint public-private effort in 2004 was the generation of a brochure that effectively presents the link between residential lawn practices and the potential impact on water quality. Through the brochure, residents are urged to complete a soil test prior to fertilizing and use non-phosphorus fertilizers whenever possible. DEP procured 50,000 copies of the brochure for distribution to watershed residents via CCE, lake associations, and town and county officials.

Lake Association Pilot Test

In effort to reduce the amount of phosphorus entering the watershed through improper application of fertilizers, DEP is working cooperatively on an education program with the Lake Carmel Lake Association. DEP, through Putnam County Cornell Cooperative Extension (CCE), works to inform residents of the impact of phosphorus fertilizer on their lake and ultimately the watershed.

DEP and Putnam CCE performed over thirty free soil tests for residents within the Lake Carmel basin. DEP and CCE also distributed to the Lake Carmel Lake Association 1) information on techniques to reduce the water quality impact of managed lawns and 2) the results of the soil tests showing that over 80% of the soils tested had adequate levels of soil phosphorus and did not need additional phosphorus fertilizer.

10. Miscellaneous Reporting Provisions

10.1 Water Conservation

Water demand in the City of New York had been increasing at a rate of more than 1% per year through the 1950s, 1960s, 1970s and early 1980s. Since the late 1960s the City's water consumption has been beyond the "dependable yield" of the reservoir system. Three drought warnings or emergencies occurred during the 1980s. At the same time, wastewater flows to the Wards Island, Newtown Creek, North River and Coney Island wastewater treatment plants either exceeded or approached permit levels. Avoiding the capital cost of expanding the water supply and wastewater treatment infrastructure and the costs incurred by droughts led New York City to develop a lower cost plan for providing water/sewer services.

The best proof of the success of these programs is the drop in New York City's water consumption. From an average of 1450-1500 million gallons per day (MGD) in 1990-1991, consumption has dropped continuously in the 1990s to under 1250 MGD since 1996 and under 1200 MGD for 2001through 2004, even through some of the hottest summers on record. Wastewater flows have been decreasing consistently every year since the early 1990s.

Highlights of DEP's ongoing water efficiency program include:

Leak Detection

DEP has undertaken an aggressive sonar leak detection program, which surveys approximately 1 million linear feet of water mains each year. One-third of the city's water mains are scanned for leaks every nine months while the remainder are scanned at least once every three years. Leak reduction also includes regular inspection of system blow-off valves and hydrant locks. The ultrasonic leak detection program is estimated to have significantly reduced supply systems losses since the mid-1980s, with system-wide savings of at least 30-50 MGD in the early years and 5-20,000 gpd in recent years.

DEP will continue a program of leak detection and street repairs. DEP estimates that the largest benefits of this program accrued in the early years. Going forward, DEP anticipates that the program will maintain equilibrium, rather than yield significant further reductions in leakage.

Water Metering

New York has completed its Universal Metering Program. A metered rate structure provides customers with a long-term incentive for leak repair and efficient use. Quarterly billing for metered customers began regularly in 1995. Some multifamily buildings are being offered the option to continue to be billed on a per-apartment fixed charge if they meter and undertake a number of water efficiency measures. The City is now almost 96% metered.

Expanded Use of Non-Potable Water for Non-Potable End Uses

DEP has begun discussion with the New York City Department of Buildings (DOB) and NYCDOH about the development of standard code requirements for "greywater" and rainwater harvesting systems as part of DOB's revision of the New York City Building Code. Several new buildings have been constructed which recycle part or all of their wastewater for use in toilet flushing and other non-potable end uses. Con Edison's headquarters building has used steam condensate for toilet flushing since the 1980's. The Department of Parks and Recreation's Green-Thumb Program, along with Council on the Environment of New York City has installed rainwater harvesting systems at 20 community gardens.

There is a great potential for reducing water demands, wastewater and stormwater flows by using rainwater and greywater to meet non-potable end uses. The development of formal building and health code requirements and procedures will help realize this potential. DEP will also consider providing incentives for the incorporation of such systems in future construction. In 2004 the New York City Water Board enacted the Comprehensive Water Recycling Program that provides a discount on water and wastewater charges for buildings that construct "blackwater" systems to recycle both sanitary sewage and stormwater.

Water Efficiency in City-Owned Buildings

Mayor Bloomberg created a Mayor's Task Force on Sustainability in 2004 and as part of that effort, DEP will be awarding an engineering survey contract in early 2005 to perform surveys of a sample of city-owned buildings (offices, schools, hospitals, etc.) to develop a list of generic cost-effective water efficiency upgrade projects as a future efficiency program.

General Water Use and Drought Regulations

DEP enforces standard regulations prohibiting certain outdoor water uses during peak hours of the day, requirements for evaporative cooling towers for all but the smallest air conditioning and refrigeration units, and penalties for significant leak and waste violations. During drought periods the City can implement a three-stage series of increasing restrictions on water use including outdoor water use, air conditioning and commercial water use, increased hydrant patrols and other measures.

Federal Clothes Washer Efficiency Standards

Beginning in 2004, the Department of Energy will implement minimum efficiency standards for new clothes washers, which will, over 15 years or so, provide significant savings as people replace their old washers. The standard becomes a bit tighter in 2007.

A specific savings estimate for New York City has not been completed, but a very conservative one would look only at one- and two-family homes. There are approximately 775,000 one- or two-family homes in the City. Assuming there are two people per property, DEP estimates a saving of about 9 gallons per person per day, or about 14 MGD.

The one- and two-family home analysis excludes a NYSERDA program which is providing incentives to "route operators" to replace the machines in apartment building laundry rooms and our agreement with NYCHA wherein they will be replacing the machines in theirs. Perhaps 20-25% of apartment buildings will be required to replace older equipment with newer, more efficient units.

DEP estimates that these programs will lead to a total savings of up to 10-20 MGD in the next five years and another 30-55 MGD over the following 15 years as the existing stock of clothes washers is replaced.

Future Efficiency Programs

DEP has begun a wide-ranging review of system dependability that will lead to a plan of supply and demand-side projects with a goal of increasing system dependability. DEP will be evaluating a variety of water efficiency projects as part of this project.

10.2 Drought Management Plan

In 2004, it was not necessary to invoke any of the components of the City's Drought Management Plan, as precipitation, runoff and storage levels all remained high.

The Drought Management Plan has three phases - Drought Watch, Drought Warning and Drought Emergency - that are invoked sequentially as conditions dictate. The Drought Emergency phase is further subdivided into four stages with increasingly severe mandated use restrictions. Guidelines have been established to identify when a Drought Watch, Warning or Emergency should be declared and when the appropriate responses should be implemented. These guidelines are based on factors such as prevalent hydrological and meteorological conditions, as well as certain operational considerations. In some cases, other circumstances may influence the timing of drought declarations.

- Drought Watch – Drought Watch is declared when there is less than a 50% probability that either of the two largest reservoir systems, the Delaware (Cannonsville, Neversink, Pepacton, and Rondout Reservoirs) or the Catskill (Ashokan, and Schoharie Reservoirs), will fill by June 1 - the start of the water-year.
- Drought Warning – A Drought Warning is declared when there is less than a 33% probability that either the Catskill or Delaware Systems will fill by June 1.
- Drought Emergency – A Drought Emergency is declared when there is a reasonable probability that, without the implementation of stringent measures to reduce consumption, a protracted dry period would cause the City's reservoirs to be drained. This probability is estimated during dry periods in consultation with the New York State Drought Management Task Force and the New York State Disaster Preparedness Commission. The estimation is based on analyses of the historical record, the pattern of the dry period months, water quality, subsystem storage balances, delivery system status, system construction, maintenance operations, snow cover,

precipitation patterns, use forecasts, and other factors. Because no two droughts have identical characteristics, no single probability profile can be identified in advance that would generally apply to the declaration of a drought emergency.

DEP continues to encourage consumers to conserve water and to observe the City's year-round water use restrictions, which remain in effect. These restrictions include prohibition on watering sidewalks and lawns between November 1st and March 31st and illegally opening fire hydrants.

10.3 Delaware Aqueduct Leak

Efforts to evaluate the condition of, and to develop unwatering and repair plans for the Rondout-West Branch Tunnel (RWBT) continued in 2004 and involved consideration of hydraulic investigation of the RWBT; RWBT repair planning; and water supply dependability analysis. Below is a description of the activities surrounding these components.

Leak Monitoring and Assessment

Efforts to monitor and quantify the leak continued in 2004. Flow data from the effluent chamber (Rondout) and from the influent chamber (West Branch), along with Hydraulic Grade Line data and measurements of the surface expressions at Roseton are continuously gathered. No discernable increase in leakage has been observed to date.

As part of the leakage monitoring program, DEP has conducted dye and hydrostatic tests to assess the leakage rate. Dye tests involve injecting an approved dye into the tunnel during full flow conditions and monitoring the time for the dye to travel a set distance. This data can be used to determine an average flow rate along the tunnel and then compared with the discrete flow measurement at Rondout Reservoir for calculation of the leakage rate. To date, there has been no clear indication of increasing leakage, and the tunnel leakage has been determined to be stable under full flow conditions.

A hydrostatic test is performed during no flow conditions, which means the tunnel was shutdown and isolated from the upstream and downstream reservoirs. As the tunnel is allowed to drain (through the leaks) the water surface elevation is noted every five minutes. The leakage rate is then calculated using the known volume-elevation profile of the tunnel. The data gathered by these test shows there has been no indication of an increasing leakage and that the tunnel leakage has been determined to be stable under no flow conditions.

Autonomous Underwater Vehicle (AUV) Inspection of the RWBT

The AUV inspection of the tunnel was completed in 2003, and analysis of the data collected during that inspection continued in 2004. The data from the AUV were compared to other known features of the tunnel that were recorded during the tunnel's construction (geology, water

inflows, and construction techniques). While there was no partial collapse or large indication of a substantial leak, extensive areas of cracked concrete were observed and mapped. Several areas of interest for follow-up investigations were noted for future AUV and ROV inspections.

Remote Operated Vehicle (ROV) Inspection of the RWBT

An ROV program is being developed for detailed inspection of discrete portions of the tunnel identified by the AUV program. Use of an ROV will allow capture of real time data, and provide the ability to perform detailed, close-up investigations of these areas of interest.

Risk Analysis Program

A risk analysis of Tunnel failure was developed in 2001 based on existing information such as original contract drawings, prior tunnel inspection logs and interviews with former personnel. In 2004, the Risk Analysis was updated, incorporating the results of the leak monitoring program, directional drilling, and AUV inspection. This updated risk analysis concluded the risk of tunnel failure is "low to very low" over the next five years. However, this risk is higher than ideal for a tunnel of its importance. The risk analysis will be updated every two years or when significant new data on the tunnel is gathered.

Repair Preparations for the RWBT

In 2004, DEP completed facility plans for the unwatering of the RWBT tunnel. To perform a planned tunnel repair, it is necessary to unwater the tunnel. Several pumping configurations and shaft modifications have been evaluated with the goal of unwatering the tunnel as reliably and quickly as possible. Design is now proceeding for the selected unwatering scheme.

Designs are also being prepared for a suite of tunnel repairs, including grouting, carbon fiber wrap installation, steel liner, and other repair methods. Tunnel access designs were also prepared for the available shafts along the tunnel.

Surface Pressure Grouting

In 2004, DEP continued to investigate and develop a facility plan for a surface pressure grouting operation. This grouting would involve drilling holes from the surface to the vicinity of the tunnel, and injecting cement based materials or other compounds into the voids in the ground that conduct water to the surface. This may be able to decrease the leakage from the tunnel as well as strengthen the surrounding rock mass and extend the time frame in which the tunnel has to be repaired from within.

Shaft 6A

In 2004, a facility plan was developed to evaluate the feasibility of construction a new unwatering shaft for the tunnel near the Hudson River, on the existing Shaft 6 site. A new shaft at this location could provide a more suitable and effective unwatering system.

Water Supply Dependability Analysis

In 2004, DEP continued its evaluation of the dependability needs for the water supply system. The RWBT was identified as a critical element of the System needed to meet the City's annual average demand and water needs for portions of the upstate community.

Several projects were identified that, individually or in combination, could enable the System to meet demand during a planned or emergency repair of the RWBT. These projects include: alternative means of increasing system conveyance and storage; providing additional supply through expansion of existing sources, or development of other sources; and implementing demand management and reduction measures. The feasibility of these potential projects has been considered based on a preliminary analysis of their effectiveness and implementability. The projects will be further investigated and developed in 2005, with additional consideration to their degree of dependability. Alternative combinations of projects will be evaluated that could provide the water supply dependability needed during repair of the RWBT.

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