West Branch of the Delaware River
Stream Corridor Management Plan

Draft

December 2004

Prepared by:
Delaware County Soil and Water Conservation District

In cooperation with:
New York City Department of Environmental Protection
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FOREWARD

The Board of Directors of the Delaware County Soil and Water Conservation District is pleased to present this ***Draft Stream Corridor Management Plan*** for the West Branch Delaware River above the Cannonsville Reservoir. We cordially invite all stakeholders to review and provide comments on the contents of the Plan.

To quote David Osborne, author of Re-Inventing Government, "Entrepreneurial government pushes control of policies out of the bureaucracy and into the community to empower people rather than to simply serve them."

We sincerely hope that this Plan will serve as a foundation that empowers and inspires all stakeholders to enhance the comprehensive management of this valuable resource. We welcome all to adopt this plan, not as a definitive action plan to resolve all issues and concerns of the river, but as a starting document that recognizes the opportunities to develop a true partnership in the spirit of cooperation.

Richard A. Weidenbach,
Executive Director

Delaware County Stream Corridor Management Plan
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LIST OF ACRONYMS

Acronyms	Definition
BFE	Base Flood Elevation
BMP	Best Management Practices
CCE	Cornell Cooperative Extension
CREP	Conservation Reserve Enhancement Program
CRS	Community Rating System
CWC	Catskill Watershed Corporation
DCAP	Delaware County Action Plan
DCDES	Delaware County Department of Emergency Services
DCDPW	Delaware County Department of Public Works
DCPD	Delaware County Planning Department
DCSWCD	Delaware County Soil and Water Conservation District
DFIRMs	Digital Flood Insurance Rate Maps
DRIPP	Delaware River Invasive Plant Partnership
ECL	Environmental Conservation Law
FAD	Filtration Avoidance Determination
FEMA	Federal Emergency Management Agency
FIRMs	Flood Insurance Rate Maps
FPA	Fisherman-Parking Area
GCSWCD	Greene County Soil and Water Conservation District
GIS	Geographic Information System
GPS	Global Positioning System
HMGP	Hazard Mitigation Grant Program
MES	Munro Ecological Services
MOU	Memorandum of Understanding
NFIP	National Flood Insurance Program
NRCS	Natural Resources Conservation Service
NYCDEP	New York City Department of Environmental Protection
NYCRR	New York Code of Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
NYSEG	New York State Electric and Gas
PAC	Project Advisory Committee
PFR	Public Fishing Rights
SBA	Small Business Administration
SCMP	Stream Corridor Management Plan
SCMPr	Stream Corridor Management Program
SDWA	Safe Drinking Water Act
SEMO	State Emergency Management Office
SMP	Stream Management Program
SPDES	State Pollutant Discharge Elimination System
SPPP	Stormwater Pollution Prevention Plan

SWTR	Surface Water Treatment Rule
USACOE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WAC	Watershed Agricultural Council
WAP	Watershed Agricultural Program
WFP	Whole Farm Plans
WRDA	Water Resources Development Act
WRI	Water Resources Institute

1. Executive Summary

This draft Stream Corridor Management Plan provides a foundation for local residents, municipalities, interested organizations and cooperating agencies to enhance stewardship of the West Branch Delaware River and its tributaries. Funded by the New York City Department of Environmental Protection and the U. S. Army Corps of Engineers, this Plan is a culmination of four years of study and assessment in coordination with the Delaware County Action Plan (DCAP). Guided by a local Project Advisory Committee, this Stream Corridor Management Plan is representative of how both upstate and downstate stakeholders can work in partnership to protect and enhance a mutually beneficial resource.

The West Branch Delaware River and its tributaries are the source waters for the Cannonsville Reservoir, part of the Catskill/Delaware drinking water supply system for New York City. The watershed above the Cannonsville Reservoir encompasses an area of 353 square miles with approximately 662 linear miles of rivers and streams. This predominantly forested and agricultural watershed represents a sizeable and challenging resource to comprehensively manage. Stream walkover observations and assessments (presented in **Section 6**) suggest that the West Branch Delaware River has a tendency to become shallower and wider that is desirable due to increased sediment supply from excessive bank and bed erosion in the main river and its tributaries. While erosion and deposition are natural processes, many management activities can significantly increase erosion rates that in turn contribute to increases in sediment supply. These conditions demonstrate the need for comprehensive management and stewardship by all stakeholders.

This Plan was written in plain English to the extent possible. Clear understanding and involvement in the management of this resource by all stakeholders is crucial to its overall health. Although the entire document is lengthy, the reader will find that most sections provide informative reading. We encourage you at this time to review the Plan's Recommendations in **Section 2**, which we believe, provide a starting point for the long term stewardship of the West Branch Delaware River, its tributaries and associated riparian corridors.

Section 2 - Stream Corridor Plan Recommendations January 12, 2005

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2. Stream Corridor Management Plan Recommendations

Introduction

"The traditional engineering approach to river development has failed to incorporate the practical, physical, aesthetic and financial advantages of approaching river management as maintenance of natural tendencies in river channel behavior." Luna Leopold

Traditional stream management practices typically focus on single objectives such as bank stabilization or flood threat reduction. While dumped stone, riprap and other hard armoring techniques may achieve the goal of localized bank *stability* or protection, the application of these techniques generally do not consider potential causes or effects downstream or outside the immediate project area. Additionally, other stream functions such as stream and *floodplain* ecology, *sediment* transport and water quality are rarely considered. In many instances, ongoing evolutionary changes in stream form are interrupted by localized stabilization techniques. These interruptions may cause stream *instability* to shift upstream or downstream. Work undertaken to address one form of instability may create a domino effect of instability elsewhere.

It is a goal of this management plan to create a better understanding of stream processes and encourage *riparian* landowners and managers to try and understand the potential causes of a particular problem, consider the potential effects of mitigation, and to seek technical guidance when needed. The following recommendations are suggested guidelines to help and improve stream management in the West Branch basin.

Recommendations

RECOMMENDATION #1

Integration of the Watershed Agricultural Program and Stream Corridor Management Program

The Stream Corridor Management Program (SCMPr), Watershed Agricultural Council and New York City Department of Environmental Protection should develop and implement mechanisms to comprehensively integrate stream corridor management and stewardship into the Whole Farm Planning process.

The Watershed Agricultural Council (WAC) was formed in 1992 to assist the NYCDEP in the development and implementation of voluntary watershed protection programs that include agriculture and forestry, with the overall objective of safeguarding and improving source water quality in the New York City watershed.

The Watershed Agricultural Program (WAP) is a contractual partnership between WAC and the following agencies: Delaware County Soil & Water Conservation District (DCSWCD), USDA Natural Resources Conservation Service (NRCS) and Cornell Cooperative Extension (CCE). These partner agencies develop and implement Whole

Farm Plans (WFP) that address goals documented in the United States Environmental Protection Agency's Filtration Avoidance Determination (see **Section 4.2**) and the WAC contract with New York City. WAP program staff consists of NRCS planners, agronomists and engineers, DCSWCD civil engineering technicians and technicians, CCE crop, livestock, and nutrient management specialists. WAP teams work collectively to plan and implement agricultural Best Management Practices (BMPs) as an integrated system on each participating farm. BMP's are designed and constructed to NRCS standards and specifications. Other practices not covered by NRCS standards are designed and implemented by a team of WAC engineers and technicians.

Research not mentioned elsewhere in this plan indicates that approximately 62 percent of the land parcels in the West Branch watershed greater than 1 acre in size are under agricultural production[1]. With 662 miles of streams in the basin, it is obvious that many of these streams wind their way through agricultural land. Stream management issues exist on many of these farms. The SCMPr staff, on its own, does not have time to assess all of these sites. WAP resource staff who develop Whole Farm Plans could be trained to identify and assess stream related issues on farms during the Whole Farm Planning process and work with SCMPr staff to develop solutions to the problems.

This training could be designed to assist WAP staff to:

- Identify problem stream reaches during the Environmental Review/Problem Diagnosis step of the Whole Farm Planning process.
- Describe and/or identify the problem and its possible causes.
- Develop a "Stream Stewardship Plan" that outlines inexpensive measures for farmers to maintain stream stability.

WAP staff and SCMPr staff could then cooperate on identified issues such as riparian buffer enhancement, stream bank erosion, cattle access problems, debris jams or the need to consider other stream restoration measures.

Comprehensive integration of these programs will significantly enhance stream corridor management in the West Branch Delaware River watershed. The SCMPr, Watershed Agricultural Council and New York City Department of Environmental Protection should meet on a timely basis to develop and formulate the integration of these programs.

[1] Contract Task II-4 – Basin Demographics & Land Use. Report compiled by DCSWCD, 2003.

RECOMMENDATION #2

Expand Technical Support to the USDA Conservation Reserve Enhancement Program (CREP)

The Stream Corridor Management Program (SCMPr) should expand efforts to provide technical and design assistance for stream bank stabilization projects at potential CREP sites. The goal of this assistance is to stabilize stream banks that are currently unstable so that they are eligible for CREP participation.

From the results of the walkover assessment and the vegetation mapping exercise conducted during the planning effort, the SCMPr staff found that protection and enhancement of the riparian forest buffer should be one of highest priorities for the future protection of the river's main stem, its tributaries and the lands adjacent to these streams.

Locally, vegetation and the streambanks at established CREP sites in the West Branch watershed have begun to recover. This initial recovery is due in large part to the exclusion of livestock from the stream, resulting in a reduction of hoof shear stress on the banks. Decreased erosion and the opportunity for vegetative growth on the streambanks reduce nutrient and pathogen-laden runoff from reaching streams, and improved stream health throughout the basin.

As mentioned in **Section 6.3.2**, the United States Department of Agriculture (USDA) administers CREP. CREP authorization is currently scheduled to expire on September 30, 2007. It is also mentioned that CREP cannot be implemented on unstable streambanks. **Section 6.3.1** indicates that nearly 30% of riparian land is cropland and pasture, 44% of which has inadequate buffers.

Therefore, SCMPr staff should prioritize and expand efforts to provide technical and design assistance to USDA and Watershed Agricultural Program staff for implementation of streambank stabilization projects at potential CREP sites.

In addition, SCMPr staff should work with USDA, Watershed Agricultural Council, and New York City Department of Environmental Protection staff to seek congressional re-authorization of the New York City watershed CREP beyond 2007.

RECOMMENDATION #3

Participation with the Catskill Watershed Corporation

The Stream Corridor Management Program (SCMPr) should cooperate with the Catskill Watershed Corporation (CWC) to explore the enhancement of existing CWC programs and explore the development of new CWC funding programs that address stream related stormwater issues, stream stewardship, public education and outreach, and stream stability issues.

The CWC, a local not-for-profit development corporation has a dual goal to protect the water resources of the New York City watershed west of the Hudson River while preserving and strengthening communities located within the region. CWC is a logical choice to fund stream corridor management projects and programs identified in each county's Stream Corridor Management Plan, thereby reducing the need to set up new funding mechanisms and governing boards.

The SCMPr and CWC, in cooperation with New York City Department of Environmental Protection should:

1. Explore opportunities to enhance existing CWC stormwater programs to include the following:
   - Cooperative public outreach efforts to educate businesses, municipalities and residents regarding stormwater impacts on streams.
   - Enhanced public outreach efforts to include funding for stream management education and stream stewardship training for landowners.
   - Funding for retrofitting selected culverts that pose stormwater and fish passage issues.
   - Funding for storm flow solutions at bridges with problematic stormflows.

2. Explore new programs for stream/stormwater management to include the following:
   - To fund a culvert sizing and design program for municipalities (see **Recommendation #6**).
   - To fund stream stewardship activities which may include selective berm and/or debris removal.
   - To fund future mitigation projects related to stream channel and streambank stability.

Figure 2.1 Poorly designed culvert outfall along NYS Route 10 upstream of Bloomville. Note direct discharge into river with lack of energy dissipation and sediment control measures. This site could benefit from a stormwater retrofit.

See **Section 4.7** for further information on the Catskill Watershed Corporation.

RECOMMENDATION #4

Stream Corridor Management Plans for Non-Agricultural Riparian Landowner Stewardship

The Stream Corridor Management Program (SCMPr) should seek funds to develop a program to provide non-agricultural riparian landowners with their own site specific Stream Corridor Management Plans.

The development of an individual Whole Farm Plan for agricultural production and a Forestry Plan for forest landowners has been essential to improving and maintaining water quality in the West Branch watershed. These plans inventory and assess soil, water and forest resources and provide a clear plan of action by recommending both structural and managerial Best Management Practices which meet both landowner and water quality objectives.

A significant amount of riparian property is non-agricultural land. As with agricultural and forestry practices, certain activities by riparian landowners may contribute to stream and riparian buffer degradation. Therefore, the SCMPr recommends development of a program to provide non-agricultural riparian landowners with an individual Stream Corridor Management Plan. This Plan would be provided at the request of the landowner free of charge. The Plan would address floodplain function, stream processes (including streambank and stream channel maintenance), invasive species control, and the importance of desirable native riparian vegetation and its function.

Figure 2.2 Example of site that could benefit from individual landowner stewardship.

Riparian landowner stewardship is essential to proper stream corridor management. Efforts by individual riparian landowners to improve and maintain proper stream process and riparian buffers can be very significant, especially with the control of invasive species and the management of desirable native vegetation. Well informed and educated riparian landowners can also be instrumental in maintaining floodplain function and stream channel and streambank functions. Many times streambank and stream channel unraveling begins as small problems that could have been mitigated or corrected by a well educated riparian landowner without public funding assistance.

The preparation of individual Stream Corridor Management Plans will also provide SCMPr staff opportunities to proactively monitor stream health, identify emerging issues and/or problems in the watershed, and develop greater rapport with riparian landowners.

RECOMMENDATION #5

Streamline Stream Work Permitting

The Stream Corridor Management Program (SCMPr) proposes that the permitting process for stream work be simplified and streamlined. It is proposed that an interagency working group composed of representatives from the New York State Department of Environmental Conservation, U. S. Army Corps of Engineers, Delaware County Soil & Water Conservation District (DCSWCD), New York City Department of Environmental Protection, and neighboring Soil & Water Conservation Districts, identify ways to simplify and streamline the permitting process for the benefit of all agencies and stakeholders.

The purpose of this recommendation is to improve the permitting process so that necessary stream stabilization efforts may be made in a timely and efficient manner. As described in **Section 5.13,** the permitting process for stream disturbance is involved and lengthy, particularly for larger projects. Permitting can also be very costly. For example, administrative costs for SCMPr staff alone to prepare permit applications for the Town Brook demonstration project were nearly $2,850. The permitting process for emergency stream work in the aftermath of floods should also be reviewed.

One goal could be the enhancement of existing permitting authority to the DCSWCD for implementation of approved stream management practices under its current General Permit.

RECOMMENDATION #6

Assist Municipalities with Culvert Sizing and Design

The Stream Corridor Management Program (SCMPr), in cooperation with the Catskill Watershed (CWC) and Delaware County Department of Public Works (DCDPW), should develop a program to provide technical assistance to Town Highway Superintendents for culvert sizing, placement and design.

Culverts are frequently used for highways crossing tributaries to the West Branch Delaware River, particularly in headwater areas where the tributaries are smaller and bridges are not required or economically practical. Culverts are also used under

highways to drain roadside ditches, many of which create their own outfall watercourse to streams or wetlands.

Figure 2.3 Culvert installation that could benefit from improved alignment, fish passage, outfall dissipation, headwall installation and top cover.

While performing the walkover assessments in the watershed, SCMPr personnel observed that road culverts often caused increased erosion both below and above the crossing. Typically these problems relate to the size or shape of the culvert selected or the installation of the culvert. Improper orientation, the lack of energy dissipation, and numerous other problems related to culvert installation reduce the culvert's efficiency, and impact stream channel and streambank stability. Additionally, incorrect culvert design/installation may have significant impacts on fish passage. The number of culverts in the watershed is quite large and therefore the total deleterious effect of improperly installed culverts could be significant.

The SCMPr should work in cooperation with other interested parties such as the CWC and DCDPW to develop a protocol for the assessment of existing culverts, prioritization of culverts for replacement and the designs for retrofitting existing culverts.

RECOMMENDATION #7

Participation with the Delaware County Action Plan (DCAP)

The Stream Corridor Management Program will continue to work closely with all DCAP participants to integrate the West Branch Delaware River Stream Corridor Management Plan and its recommendations into all relevant components of the Delaware County Action Plan.

DCAP is a local initiative that comprehensively evaluates water quality issues and coordinates and facilitates local, state and federal initiatives to improve water quality in Delaware County (see **Section 4.6**). Integration of the Stream Corridor Management Plan and its recommendations into existing DCAP programs will ensure water quality benefits are maximized and/or enhanced.

RECOMMENDATION #8

Expand Public Education and Outreach Efforts

The Stream Corridor Management Program (SCMPr) should expand public education and outreach efforts to better inform and educate all stakeholders, including municipalities, regarding stream stewardship, the importance of floodplain function, stream processes and the importance of riparian vegetation. These efforts should be developed and implemented in cooperation with the Project Advisory Committee and the Catskill Watershed Corporation.

Earlier outreach efforts by the SCMPr were largely limited to those that facilitated field work or helped formulate and direct the development of this Stream Corridor Management Plan. However, much more needs to be done. We must keep in mind that government programs, including this SCMPr, cannot take the place of stewardship by the general public and individual riparian landowners. Stream stewardship is the responsibility of everyone who lives in a watershed and participation from all stakeholders is the preferred objective.

To accomplish this objective, all stakeholders need to more fully understand stream processes such as stream bank erosion and sediment transport and the function of stream features such as riparian forest buffers, floodplains, and riparian wetlands. This understanding will guide stakeholders as they adopt practices that will protect the stream and improve its overall stability. Likewise, stream managers need to understand and account for the perspective and priorities of the stakeholders as they develop future stream management efforts.

Education and outreach efforts should be expanded to include, but not be limited to the following:

- Develop a dialog with stakeholders on stream processes and the best management of stream features such as floodplains and riparian buffers.
- Promote action by new and existing watershed associations, stream management public interest groups and other groups and organizations interested in stream corridor management.
- Educate the public and municipalities regarding the importance of controlling invasive species, especially Japanese knotweed.
- Facilitate public and municipal involvement in Flood Hazard Mitigation efforts (see **Section 5.14**).
- Support landowners interested in furthering their understanding of streams through stream management education efforts such as field days and workshops.
- Develop brochures, presentations, exhibits, press releases and other educational materials for the public and stakeholder groups.

RECOMMENDATION #9

Geomorphic Assessments at Bridges and Culverts

The Stream Corridor Management Program (SCMPr) should develop a protocol and program to perform a full geomorphic assessment at prioritized bridges and large culverts. This program should be developed in cooperation with the New York City Department of Environmental Protection, Delaware County Department of Public Works, Town Highway Superintendents and New York State Department of Transportation.

Stream assessment observations by SCMPr staff show that the West Branch main stem and a significant number of tributary crossings near their confluences with the river commonly exhibit signs of stress, such as gravel deposition near bridges and large culverts. These gravel deposits are generally a result of the inability of the stream to transport sediment during lower flows and can lead to decreased storm flow capacity through the structure and bank erosion and/or bed scour near the structure.

Geomorphic assessments at identified and prioritized structures would result in a description of stream related issues at each site for incorporation into a set of initial recommendations for consideration in future maintenance, rehabilitation or replacement. As an example, considerations could include maintenance of low flow channels through structures and/or floodplain relief structures at elevated bridge approaches.

Figure 2.4 Gravel deposit under McMurdy Brook bridge on NYS Route 10 near Hobart. Note restriction of the waterway.

RECOMMENDATION #10

Flood Hazard Mitigation and Flood Recovery

Work with Delaware County Planning Department (DCPD) and Emergency Services to develop a county-wide Hazard Mitigation Plan. Continue to work with the Delaware County Board of Supervisors, New York City Department of Environmental Protection (NYCDEP) and New York State Department of Environmental Conservation (NYSDEC) to revise the Federal Emergency Management Agency (FEMA) flood study and floodplain maps.

Hazard Mitigation is any sustained action that reduces or eliminates long-term risk to people and property from natural hazards and their effects. Flood recovery is federal and state assistance available through FEMA and the State Emergency Management Office (SEMO) after a Presidential declared flood disaster. FEMA and SEMO are the federal and state agencies that administer their respective hazard mitigation programs and provide recovery assistance for Presidential declared flood disasters. Flood Studies and Flood Insurance Rate Maps (FIRMs), provide vital information to communities considering flood hazard mitigation and stream management options.

The DCPD has initiated the preparation of a county-wide Hazard Mitigation Plan which will enable communities to apply for funding through hazard mitigation programs. Plans are also under way in cooperation with the Delaware County Board of Supervisors, NYCDEP and NYSDEC to update current floodplain maps. Stream Corridor Management Program staff will continue to participate with and support both efforts.

See **Section 5.14** for more information.

RECOMMENDATION #11

Continuation of Geomorphic Research/Assessments

The Stream Corridor Management Program (SCMPr) and New York City Department of Environmental Protection, in consultation with the Project Advisory Committee, should continue Rosgen Level II assessments and perform Rosgen Level III and Level IV assessments at prioritized locations throughout the West Branch Delaware River watershed.

To more fully understand the problems facing the West Branch of the Delaware River basin, further investigation of the main stem and tributaries will be required. The original contract for the SCMPr outlined a process where Rosgen Level I through Level III assessments would be performed on the West Branch main stem, with Rosgen Level IV to be performed in restoration project reaches. Due to the size of the watershed and staffing issues with respect to time required to adequately perform necessary assessments

to compile a complete data set of watershed conditions, their causes, and potential effects of current and proposed management practices, these assessments will be necessary to reinforce preliminary determinations and validate assumptions.

Efforts should be made to seek funds and staff necessary to complete this work.

RECOMMENDATION #12

Seek Funds Necessary for Construction of Walton Streambank Stabilization Projects

The Stream Corridor Management Program (SCMPr) will continue to seek all funds necessary to implement two streambank stabilization projects located at Terrace Avenue and South Street in the Village of Walton.

Figure 2.5 View of relocated shed along severely eroding bank at the Terrace Avenue site. Note area near center of photo where upstream edge of shed was located. (December, 2004)

In early 1999, two sites in the Village of Walton, approximately 5 miles upstream of the Cannonsville Reservoir were identified for mitigation of severely eroding streambanks. Erosion at these two locations has been steadily increasing since the January 1996 flood resulting in significant risks to water quality, private property, public infrastructure and aquatic habitat. The upstream site is located at the eastern limit of the village adjacent to Terrace Avenue, and consists of an actively-eroding streambank along the edge of a sandy terrace. The eroded section is approximately 600 feet in length and 30 feet high. Erosion has recently accelerated at this site due to the extremely wet conditions during 2003 and 2004. It is estimated that 10-12 lateral feet of embankment (approximately 7000 tons) has sloughed into the river during this period. The downstream site is located adjacent to Stockton Avenue and consists of a 25-foot-high bank that is eroded at its toe, and intermittent shallow translational failures of the upper bank for approximately 500 feet.

In August, 1999, the Delaware County Soil and Water Conservation District applied for $369,000 (75% of the orginial project cost estimate of $469,000) in state funding through

the Clean Water/Clean Air Bond Act for State Fiscal Year 1999/2000. The New York State Department of Environmental Conservation (NYSDEC) awarded a Performance Partnership Grant (PPG) in November 2000 in the amount of $246,800 and a contract was executed for the work in September, 2001. Construction was originally planned for 2003.

Between the time of grant application and time of award, site conditions have worsened; it then became apparent that the project needed to be increased in scope and magnitude. New cost estimates were projected and in May, 2002, a Letter of Interest was submitted to NYSDEC requesting additional funds through the Watershed Environmental Assistance Program. Additional funds from this program are not expected. In April 2003, Fisch Engineering of Vicksburg, Mississippi was awarded a contract to develop a conceptual design for these sites with multiple alternatives considered. New cost estimates for the preferred alternatives at both sites total $1,222,000. To date has all funds necessary to complete the projects have not become available. NYSDEC has issued a final contract extension for expenditure of the $246,800 in PPG grant funds through December 31, 2007, at which time the projects must be completed. An additional $975,200 is currently needed to complete these projects.

Closer view of the unstable embankment at the Terrace Avenue site (December, 2004).

South Street location showing condition of embankment (December, 2000).

SCMPr is working within the following schedule to complete these projects:

2005 – procure required funding
2006 – project survey, design and permitting
2007 – project implementation

RECOMMENDATION #13

Prioritization of Identified Stream Intervention Projects

The Stream Corridor Management Program, working with the Project Advisory Committee and New York City Department of Environmental Protection, will prioritize potential restoration reaches relative to the type and level of intervention needed.

Stream reaches in need of restoration or mitigation vary both in the magnitude of the problem and level of intervention that may be needed. Water quality, property and aquatic habitat protection will be priorities for all reaches prioritized for intervention. Other intervention levels to be considered will include:

Preservation – This intervention level should be considered when stream and surrounding floodplain are in excellent condition with low flooding and erosion threats, good water quality, and sustainable functioning aquatic and terrestrial habitat. These sections should be identified as valuable anchor points for stable stream morphology and good habitat, as well as helping to preserve and/or enhance water quality and flood dynamics.

Passive – Passive intervention should be considered when a stream reach and surrounding floodplain are in generally good condition, exhibiting apparent stability and sustainable function without further needs for any intensive management or changes. These reaches may not be in the most stable condition but may recover unassisted over time. Some visual monitoring or inspection of certain features or areas may be warranted, but generally no active management is recommended.

Assisted Recovery – Partial intervention, or "assisted recovery", involves direct management intervention on a small scale. Assisted recovery must be done carefully and with a good understanding of the stream type and setting to avoid further instability. Assisted recovery may be as simple as planting riparian vegetation to maintain bank stability, or as complicated as designing comprehensive stormwater management retrofits or reconstructing sections of streambank.

Full Geomorphic Restoration – This intervention level requires the most intensive management and should be reserved for the most severe locations of stream instability with the greatest impact to management goals. This level of management requires much greater time and financial resources and technical expertise to ensure stability restoration is consistent with both management goals and the stream type and setting that will ensure project success and longevity.

RECOMMENDATION #14

Develop a Process for Updating the West Branch Delaware River Stream Corridor Management Plan

In cooperation with the Project Advisory Committee and New York City Department of Environmental Protection, the Stream Corridor Management Program shall develop a process for updating the West Branch Delaware River Stream Corridor Management Plan.

It is expected that as this plan and its recommendations are implemented, additional information and data will be created, and other management issues identified. In order to keep the plan a "living document" it should be updated on a periodic basis as needed. The updates would track the implementation of the plan's recommendations, consider post-project monitoring, and compile and analyze new data, information, and management issues.

Section 3 – Introduction and Purpose

January 10, 2005

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3. Introduction and Purpose

3.1. Introduction

"The rivers are our brothers. They quench our thirst. They carry our canoes and feed our children. You must give to the rivers the kindness you would give to any brother." Chief Seattle

Why develop a Stream Corridor Management Plan for the West Branch of the Delaware River? Stream management is an emerging discipline that recognizes the importance of our local streams to our overall quality of life, and seeks to coordinate decision-making around common goals we collectively identify for the stream.

Many generations of families have managed streams in the West Branch of the Delaware River *watershed*. Over the past several centuries we have used streams for transportation, learned to harness them for power, and used them for a source of food, recreation and water supply for both animals and humans. We have also installed *berms*, *rip rap* and various other types of *revetments* along their banks, altered their courses of flow, removed streamside vegetation, excavated un-wanted *gravel* deposits from their beds, and periodically stocked them with fish. These are all stream management activities.

Our past management activities have been relatively uncoordinated. Landowners have managed their own streambanks and *floodplains*, highway departments and railroads have managed road *embankments* and bridges, and *runoff* has at times been concentrated and given a more direct route to a stream. When there was major storm damage, state and federal agencies assisted to address immediate local needs. Those involved had their own objectives, areas of knowledge and expertise, and own ideas of what needed to be done to keep a stream healthy and protect property and infrastructure. Though all of our past efforts were well intentioned, there remain areas in the watershed that continue to unravel or seem to need continuous maintenance.

During the past few years efforts have started to focus on the management of the watershed as a whole. Through these efforts, we are trying to better understand stream function, the causes of *instability*, and the effects of management practices. This stream corridor management plan was created cooperatively through the efforts of local residents, local leaders and agency representatives involved in different aspects of stream management. It identifies management issues, common, shared and competing goals, and provides a "road map" for coordination among the many "stakeholders" (those who rely on, work with, or live by streams in the West Branch watershed). These stakeholders include local landowners, county, state and local highway departments, local agencies, anglers, canoeists, and the City of New York, whose residents drink some of these waters.

This plan also provides a description of stream function and dynamics, results of our continuing research, input from local residents, and management recommendations. Recommendations are tailored to specific sites and to generalized types of conditions.

Finally, the plan provides contact information for a variety of individuals, organizations and agencies involved in the various aspects of stream management, plus sources of technical and financial help for those seeking to implement plan recommendations.

3.2. Purpose

The West Branch of the Delaware River watershed is a major drainage area in the headwaters of the Delaware River system. Its streams impact how we live, providing both benefits and challenges. Increasingly, we are aware of the impacts that we have on the stream deriving from the way we live. From its headwater source in the Towns of Stamford and Harpersfield to the Cannonsville Reservoir (a source of water supply for New York City), the West Branch watershed encompasses an area of 353.5 square miles that contain 662.4 miles of stream.. The main stem of the West Branch is fed nineteen identified major tributaries. Land use is largely agricultural, and the West Branch watershed is home to approximately 2230 year round and seasonal residents. The Cannonsville Reservoir contributes nearly 25% of the drinking water to approximately 9 million people in the New York City metropolitan area.

Interest in developing a coordinated management strategy for the West Branch of the Delaware River emerged after the catastrophic January 19, 1996 flood event. After this flood, the dramatic stream and infrastructure damages that resulted, and subsequent emergency repair work, it was apparent that stream related activities in certain areas, although well-intentioned, had set the stage for excess damages during a flood. As a result, the condition of the West Branch significantly changed in many areas of the watershed. Small instability and *erosion* problems worsened, small eroding banks became larger failures and some stream courses were significantly altered.

This condition was noticed by *riparian* (streamside) landowners, anglers, resource agencies, and by the New York City Department of Environmental Protection (NYCDEP), who had been mandated by the United States Environmental Protection Agency (USEPA) to develop a strategy for stream management in its Catskill and Delaware watersheds that would address stream and riparian corridor-related water quality concerns. The NYCDEP Stream Management Program was charged with this responsibility and noted that local and City concerns dovetailed: local infrastructure and private property losses attributable to excessive rates of erosion were a concern to both, but to NYCDEP for water quality reasons. Excess streambank erosion can create "*turbidity*" in the Cannonsville Reservoir and contribute pollutants such as phosphorus as well. Excessive erosion can also degrade fisheries habitat and overall ecological health of the West Branch. Both the Delaware County Soil & Water Conservation District (DCSWCD) and NYCDEP acknowledge that biological health is an indicator of good water quality. This mutual interest in addressing stream instability laid the groundwork for a productive partnership between DCSWCD and NYCDEP.

Recognizing this, the NYCDEP initiated a voluntary planning effort with DCSWCD and the U. S. Army Corps of Engineers (USACOE). These core agencies agreed to work

together to fund and coordinate the development of this management plan, and to construct a stream restoration *demonstration project*.

These agencies recognized the importance of local leadership for development of an effective management strategy for the West Branch of the Delaware River. As a result, the DCSWCD and NYCDEP convened local stakeholders living and working along the stream and formed a Project Advisory Committee (PAC) to develop, guide and implement the goals and objectives of the management plan.

This planning process has helped foster stronger partnerships among local, state, city and federal agencies, and landowners in the West Branch watershed. The plan is intended to facilitate cooperation and communication between the involved parties, build community relationships, aid in managing resources in the watershed, and support for stewardship of the stream as a vital natural resource.

3.3. Goals and Objectives

The scope of this project's goals and objectives are limited to the study areas ─ the main stem of the West Branch of the Delaware River and one of its headwater tributaries, the Town Brook sub-watershed. There are four primary goals for this management plan, each of which is described in more detail below. Note: Current progress towards each of these goals and objectives is at a varying state of completion

1) Document issues and local concerns and outline a plan to reduce damage to private property and public infrastructure (roads and bridges) from stream erosion and floodwaters;

2) Summarize known information and outline a plan to protect and improve water quality;

3) Document current conditions and outline a plan to protect and enhance the integrity of stream and floodplain ecosystems;

4) Provide a strategy for coordination of management activities among the various stakeholders, to ensure that no one of the above goals is achieved at the expense of another. Document partnerships with other water quality programs in the watershed.

3.3.1. Flooding and Erosion Threats

The risks associated with floods and their powerful erosive forces can affect an individual landowner or an entire community. To help reduce these risks, this plan has the following objectives:

1) Conduct a watershed-wide survey of landowners to assess the history of flood damages, concerns and interests in the stream;

2) Conduct a physical survey and analysis of the West Branch of the Delaware River and Town Brook main channels and their floodplains in order to better understand how each stream is likely to behave in future flood events, as indicated by its physical form (*stream morphology*);

3) Identify sites of bank erosion, monument and survey selected sites (for ongoing *monitoring*) prioritize sites in need of further assessment, and make prioritized recommendations for their treatment;

4) Identify those locations where developed or residential areas may be threatened by bank erosion, and make prioritized recommendations for their treatment;

5) Identify sites where bank conditions or bank location could exacerbate bank erosion problems, leading to high water quality risks, and make prioritized recommendations for their treatment;

6) Identify and assess bridge or *culvert* crossings that may be at risk from erosion of stream banks or streambeds, or otherwise *unstable* or threatened, and make prioritized recommendations for their treatment to the Town Highway Superintendents and County DPW; and

7) Provide this information to the Delaware County Hazard Mitigation Planning Grant administrator. .

Water Quality

1) Potential impairments to water quality can come from both point sources (such as the outfall of a sewage treatment plant) and non-point sources (such as urban runoff, failing septic systems, etc.). Various methods are used to evaluate water quality, and many reputable studies have occurred and continue to monitor water quality in the West Branch basin. These studies are summarized in **Section 5.12**. Erosion threats and their stream-related causes and effects are described in some detail in the Findings (**Section 6**).

2)

3.3.2. Ecological Health

The health of our stream and floodplain ecosystems is increasingly recognized as a key element in our quality of life. Healthy streams support a diversity of fish and insect species, and healthy floodplains support a variety of tree, shrub and grass species, as well as wildlife that can only thrive along healthy streams. Healthy streams provide higher recreation value, and increase property values for the individual landowner and the community as a whole. To achieve the goal of optimizing stream and floodplain ecosystem integrity, this plan has the following objectives:

1) Characterize the status of the stream ecosystem in general terms for the West Branch of the Delaware River main stem as a whole, using existing fish and insect population data as available;

2) Survey local resident's experience with the West Branch fishery, to determine perceived trends and document its management by local angling groups and the NYSDEC;

3) Monitor the response of fish community structure to *stream stability restoration* practices implemented during the course of the development and implementation of the management plan

4) Characterize current floodplain and riparian forest management practices on the West Branch and Town Brook main stems, and make prioritized recommendations for changes that can improve ecosystem integrity;

5) Conduct field surveys of selected riparian vegetation; make prioritized recommendations for further study and management of the riparian zone.

3.3.3. Coordination

Streams are currently "managed" by many different individuals, agencies and organizations. Each of these groups has its own perspective of the stream, including their specific goals and management practices they consider desirable. Sometimes the goals and practices of one group can be at cross-purposes with others, but through better communication and coordination, and by coming to agreement on a common strategy, these potential conflicts can be minimized or avoided. To promote the goal of effective coordination among the many stakeholders, this plan has the following objectives:

1) Establish a Project Advisory Committee consisting of representatives of all significant stakeholder groups to coordinate the development and implementation of the management plan;

2) Conduct a survey of the West Branch basin residents to determine their concerns, interests and stewardship practices;

3) Conduct a survey of highway superintendents about their concerns, interests and current management practices and priorities, and make recommendations to address these concerns;

4) Survey the needs of local stakeholders for information needed to promote land use that is consistent with the long-term, collective goals of the West Branch community, and make recommendations for strategies to acquire that information;

5) Determine the needs of various stakeholder groups for technical assistance, information and education, and make recommendations for the development of programs to meet those needs;

3.4. Guide to this Stream Corridor Management Plan

3.4.1. Plan Organization

This Stream Corridor Management Plan has been arranged by broad categories including: general watershed description, specific stakeholder information, and watershed and stream-specific recommendations. A review of the Table of Contents provides the best overview of how this material is organized. The plan is written in relatively easy-to-read format, because it would be of little use if people could not read and understand it. While modern stream studies do include some scientific jargon, concepts are explained as simply as possible, and a glossary is provided to define terminology.

The Findings section of this study (**Section 6**) summarizes thousands of hours of field time and scientific assessments. The Recommendations section (**Section 2**) contains summary recommendations, plus a variety of useful links and other guidance to facilitate future action. This section also contains suggestions for keeping this management plan up-to-date, which is important to ensuring the plan remains a viable and useful resource. The Appendix contains selected reference materials and other supporting documents. Additional material, much of which is in electronic format, is currently stored at the DCSWCD office.

3.4.2 Plan Application and Implementation

In summary, this Management Plan provides a framework for general stream management decision-making in the watershed. The plan provides documentation of current stream conditions along the West Branch and Town Brook main stems, private and public property issues, and a broad assessment of the condition of existing infrastructure. It will be useful when planning, permitting or providing advice and technical guidance to landowners and agencies within the West Branch watershed.

The plan also offers specific recommendations for expanding public outreach and prioritizing future assessments, work and maintenance activities in the watershed. The assessment data contained in the supporting documentation can aid projects and progress when state and federal agencies are assisting with flood emergencies. Highway departments can also use this information to help with the long-term maintenance of infrastructure projects.

A detailed, watershed wide assessment of fish populations and habitat quality was not undertaken as part of this effort. However, **Sections 5.11** and **5.15** provide useful and interesting reading about fish habitat.

The West Branch of the Delaware River watershed is a reasonably intact and healthy stream. However, the reader will find that some interesting trends were identified, existing and future issues pointed out, and in many cases these were mapped for the first time, as well. It is hoped that the plan's recommendations will serve as a guide for long-term stewardship for our river and its *tributary* streams.

Section 4 – Background

January 7, 2005

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4. Background

4.1. Introduction

"A science of land health needs, first of all, a base datum of normality, a picture of how healthy land maintains itself as an organism." Aldo Leopold, A Sand County Alamanac

The New York City water supply system consists of unfiltered surface water sources (1,969 square miles) that supply an average of 1.3 billion gallons per day of drinking water to more than nine million people in the New York City metropolitan area. The West Branch Delaware River and the Cannonsville Reservoir *watershed* covers 455 square miles and accounts for 28% of the Catskill/Delaware Watersheds. This area (**Figure 4.1**) supplies nearly 25% of the city's drinking water. The New York City Department of Environmental Protection (NYCDEP) is the City agency with primary responsibility for oversight of the operation, maintenance and management of the water supply infrastructure and the protection these watersheds.[1]

4.2. NYCDEP Filtration Avoidance Determination

The Safe Drinking Water Act (SDWA) amendments of 1986 required the United States Environmental Protection Agency (USEPA) to develop criteria under which filtration would be required for public surface drinking water supplies. In 1989, USEPA promulgated the Surface Water Treatment Rule (SWTR), which requires all public water supply systems supplied by unfiltered surface water sources to either provide filtration or meet a series of water quality, operational and watershed control criteria (filtration avoidance criteria).[2]

As a result, the NYCDEP filed for and received a conditional, renewable Filtration Avoidance Determination (FAD) in May 1997 (after a series of conditional waivers and a FAD beginning in 1993) under which the NYCDEP now operates its water supply system. The FAD is periodically reviewed and evaluated by the USEPA and the New York State Department of Health.

Central to maintaining the FAD are a series of partnership programs between New York City and the upstate communities, as well as a set of rules and regulations administered by the NYCDEP. As required in the FAD, this Stream Corridor Management Plan is being developed and implemented under the NYCDEP's Stream Management Program (SMP).

[1] New York City's 2001 Watershed Protection Program Summary, Assessment and Long-term Plan, December 2001. Section 1, pages 1-6. Also published on NYCDEP Website: http://www.ci.nyc.ny.us/html/dep/html/fadplan.html (Verified 8-26-04)

[2] Ibid. paraphrased.

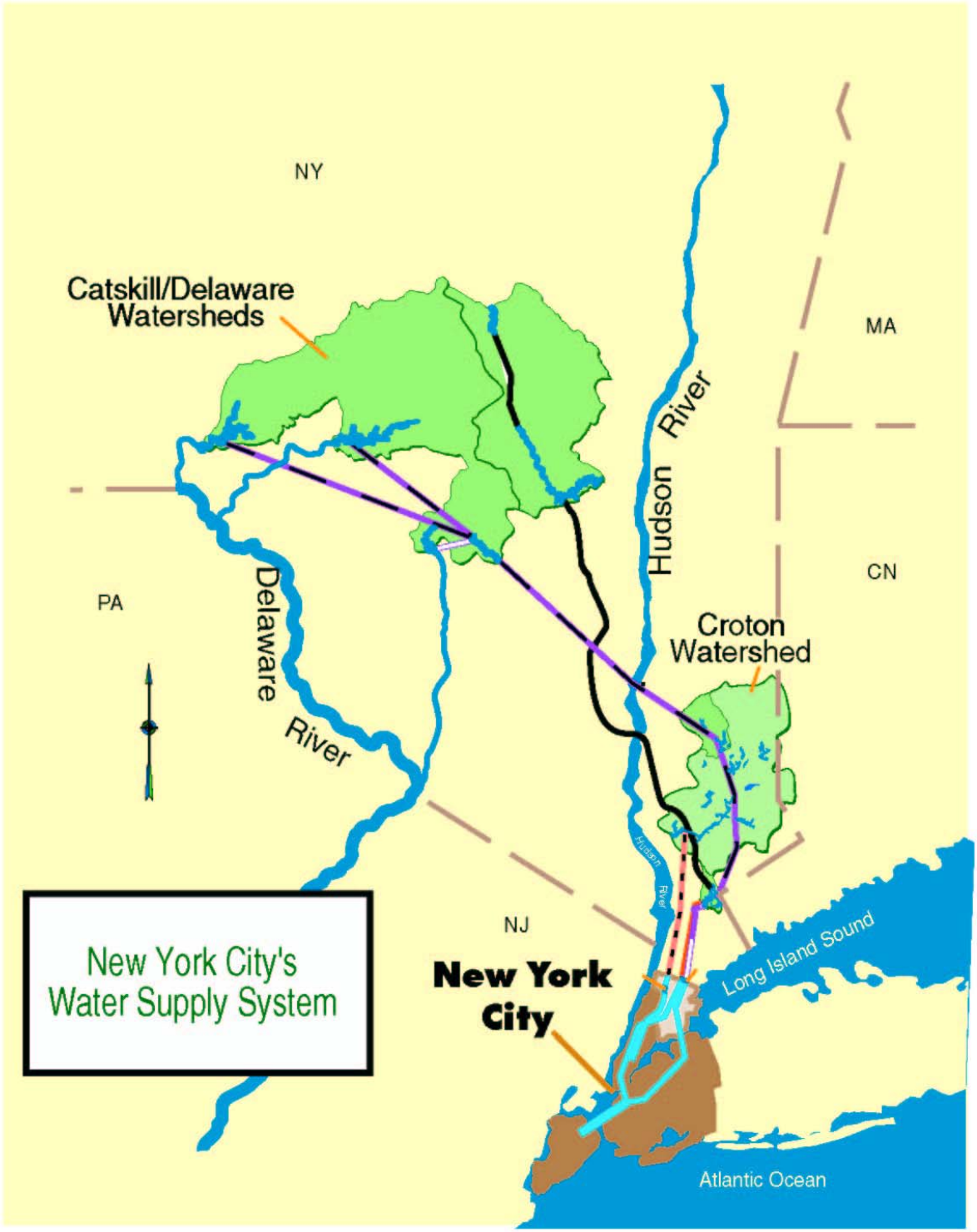

Figure 4.1 Catskill/Delaware Watersheds of New York City Water Supply System

4.3. Stream Corridor Management Program Contract Development

Following the January 1996 flood event, which produced significant stream and infrastructure damage throughout the Catskills, it was recognized that a program to repair isolated streambanks would not effectively address the systemic causes of stream channel *instability* that exacerbate streambank *erosion*, compromise water quality and degrade *aquatic habitat*. In consultation with its watershed partners, the City of New York developed a stream management strategy to be implemented by its Stream Management Program (SMP). Its overall mission is to restore stream *stability* and stream ecological integrity by facilitating the long-term stewardship of Catskill streams and *floodplains*. As described in **Section 3**, local concerns about excessive stream erosion and flooding complement NYCDEP's concerns about water quality, making the partnership between NYCDEP and the Delaware County Soil & Water Conservation District (DCSWCD) a natural choice.

The main stem and tributaries of the West Branch were considered of significant priority by NYCDEP to be included in a first tier of projects to develop a comprehensive Stream Corridor Management Plan (SCMP) and DCSWCD was the appropriate agency with the legal mandate and experience to undertake this task. From 1999—2000, DCSWCD negotiated with NYCDEP to develop a SCMP contract for the West Branch of the Delaware River and its tributaries.

The contract was executed on 7/19/00 and an Order to Commence Work was issued to the DCSWCD on 9/12/00. The contract period was from 10/6/00 to 10/5/04, with funding (not to exceed $1,218,433) supplied by the NYCDEP and the US Army Corps of Engineers (USACOE). The primary tasks were to assess conditions of the entire main stem of the West Branch, and use the information gathered to develop a plan for the long-term stewardship of the basin. Two hundred thousand dollars of the contract sum would be used for construction and leveraging outside funds for one or more demonstration restoration projects.

A contract was executed in July 2000 and work commenced in December 2000, with a project term of December 2000 to December 2004. Subsequently, the project was extended to December 2005.),

4.4. Project Partners

When planning around any shared resource there are many different points of view, concerns, practices and regulations. To accomplish the goals and objectives described in **Section 3**, a communication network (advisory committee) was developed among the landowners and agencies that live, work near, or otherwise enjoy the streams and rivers in the basin.

4.4.1. Project Advisory Committee

In January of 2001 DCSWCD held a project information meeting to introduce the Stream Corridor Management Program (SCMPr) to prospective members of a Project Advisory Committee (PAC). Formed in March 2001, the committee has gradually expanded, each member bringing their own unique experiences and historical perspectives to the group. The PAC has met several times to review and discuss information collected by the SMP and to advise SCMPr as needed.

Early in the program, the staff and PAC identified stakeholders among the approximately 2,230 *riparian* landowners in the West Branch basin. This stakeholders list includes project partners, various categories of landowners and businesses, special interest groups, agencies, local municipal boards and highway departments, regulators, schools, media, and others interested in stream management. The PAC and Stakeholder lists are included at the end of this section.

4.4.2. Initial Landowner Contact

Initial landowner contact included a letter mailed to the 692 riparian landowners along the main stem of the West Branch, in early summer 2001, that briefly described the project and requested their support. This was followed by another letter and a release form sent to main stem landowners in the Towns of Stamford, Harpersfield and Kortright, seeking their permission to perform river assessments along their property. In early 2002, similar letters and release forms went out to West Branch main stem residents in the Towns of Delhi, Hamden and Walton. Landowners were overwhelmingly receptive in allowing the work to be performed. SCMPr maintained close contact with local landowners wherever stream data collection was being performed.

4.4.3. Landowner Surveys

Landowner perception of stream management issues was considered crucial to the success of the SCMP. Past and current management practices, the reasons for these practices and their successes and failures was considered valuable information for use with planned assessments, and would play an important role in future management recommendations. Important information was also gained as to where landowners were trapped into never ending cycles of stream maintenance, which would assist in the development of future management priorities and public outreach.

In May 2002 and again in April 2003, a survey addressing the perceptions of riparian landowners about their stream and its possible management alternatives was performed along the West Branch main stem and the main stems of the major sub-basin tributaries (see **Map 5.2**). The Town's of Harpersfield, Kortright, Stamford and the Kidd Brook *tributary* in the Town of Delhi were surveyed in 2002; Hamden, Bovina, Walton, Meredith and the remainder of Delhi were surveyed in 2003. Using two survey areas facilitated the survey process and coincided with the areas of the watershed being assessed during the 2002 and 2003 field seasons. The survey form was slightly modified for the 2003 survey to facilitate data compilation. The results of both surveys were

combined and used to support efforts of the SCMPr, NYCDEP and the PAC to determine landowner concerns, target further research, and make plan recommendations.

Of 1037 surveys distributed, 230 were filled out and returned (a 22% return rate). Six land ownership classes were recognized for solicitation: permanent residence (44%), vacant/forested land (17%), agriculture (14% - representing 62% of the land base), seasonal residence (14%), business (7%), and government/public service (4%). Of the surveys returned, respondents were 50% permanent residents, 20% seasonal residents, 18% farmers, 6% businesses, 3% government/public servants, and 3% vacant/forested landowners. Of the permanent residents responding, 79% had lived in the basin 20 years or more, while 97% had 10 years or more of residency. 47% of the seasonal residents responding had lived here for 20 years or more, while 77% had 10 or more years of residency.

Of the agricultural respondents, 88% use their streams in their livelihood, and nearly 80% enjoy the stream view. Among all other residents, over 80% enjoy both their stream view and wildlife viewing. Nearly 70% felt that stream conditions are good to excellent. Respondents who enjoy fishing were about equally divided between those who felt stream conditions had improved, deteriorated or remained consistent over time. Their primary concern was with streambank erosion (over 60%). Moderate concerns include flooding of property and government regulation of private property rights (35% each). Minor concerns include the time required to obtain permits for stream-work, pollution from upstream, time and money required for proper stream care and washout of roads and bridges (20-26%). Over 40% indicated they had been affected by flooding multiple times, but only 27% indicated flooding as a frequent problem, while 44% thought flooding was a minor problem. 33% had never been affected by flooding. Some felt that *gravel* deposits need to be removed as a solution to flooding, while a few others felt that stream bank maintenance is necessary to maintain their streams. Over 30% felt that stream management decisions should be shared between landowners and local government, and 30% felt stream management decisions should rest with the local Soil & Water Conservation District. Survey forms, reports and summary tables are included in **Appendix 1**.

Example of streambank riprap above County Route 2 bridge in Delancey

The summary of responses listed above indicates that residents generally enjoy viewing their streams and stream conditions are good. Residents are genuinely concerned with erosion, and flooding is a moderate concern. Some residents feel that some sort of maintenance is necessary to protect property and some have indicated concerns with obtaining permits and money to perform stream related work.

Additionally, several landowners with a long family history of living on the West Branch were asked to further share their experiences with living and working along the river. Due to the agricultural nature of the basin, most of these landowners were 3rd to 8th generation farmers. Approximately 80% of these residents had experienced annual flooding with some indicating conditions have worsened since the January 1996 flood (see Section 3.8.3). 84% had been involved with maintenance practices generally consisting of *berms* and/or dumped stone or riprap. Generally, 30-40% had concerns with continuing erosion, widening of the river, increasing incidences of gravel bars, and difficulties with obtaining regulatory permits. An average of 36% appreciate the importance of floodplain function and natural river processes and have either natural or man-made buffers along at least some of their river frontage. Approximately 33% of the farmers prefer to mow or crop to the river's edge.

4.5. Watershed Agricultural Council

The Watershed Agricultural Council (WAC) was formed in 1992 to assist the NYCDEP in the development and implementation of voluntary watershed protection programs that include agriculture and forestry, with the overall objective of safeguarding and improving source water quality in the New York City watershed region through various conversation programs. Two programs pertinent to stream management are the Watershed Agricultural Program (WAP) and the Watershed Forestry Program, further described below. Further information is available on the WAC website: www.nycwatershed.org (Verified 12-07-04)

4.5.1. Watershed Agricultural Program

WAP is a contractual partnership between WAC and the following agencies: Delaware County Soil & Water Conservation District, USDA Natural Resources Conservation Service (NRCS) and Cornell Cooperative Extension (CCE). These partner agencies develop and implement Whole Farm Plans (WFP) that address goals documented in the United States Environmental Protection Agency's Filtration Avoidance Determination (see **Section 4.2**) and the WAC contract with New York City. WAP program staff consists of NRCS planners, agronomists and engineers, DCSWCD civil engineering technicians and technicians, and CCE crop, livestock, and nutrient management specialists.

WAP teams work collectively to plan and implement agricultural Best Management Practices (BMPs) as an integrated system on each participating farm in both large and small farm programs in the Catskill/Delaware Watersheds. These water quality BMPs are designed and constructed to NRCS standards and specifications and include: barnyard management systems, manure storage, roof runoff management, grazing systems, livestock water systems, livestock trails, comprehensive nutrient management, diversions, and crop rotation, to name a few. The Conservation Reserve Enhancement Program, implemented by USDA through WAP, is a very important riparian buffer program for land under agricultural production, further described in **Section 6.3.2**). Other practices not covered by NRCS standards are designed and implemented by a team of WAC engineers and technicians.

4.5.2. Watershed Forestry Program

WAC administers the Watershed Forestry Program with funding from the U. S. Forest Service and NYCDEP to address forestry needs within the Catskill/Delaware Watersheds. Community-based forestry groups and foresters provide technical support with the New York State Department of Environmental Conservation. The program encourages private forest landowners to actively manage their forests using sustainable best management practices and offers information and technical assistance to help them reach their goals, while observing practices that ensure the preservation of water quality.

The program offers training for consulting foresters and loggers and partners with the New York Logger Training's "Trained Logger Certification" program to help timber harvesters learn about a range of topics from safety and first aid to sustainable forestry to BMPs for water quality. The program also encourages forest land owners to develop and implement Forest Management Plans and provides technical assistance and some cost-sharing for implementation of forest management and riparian forest BMPs.

The Watershed Forestry Program also coordinates four model forests throughout the watershed that integrate research, demonstration, continuing education and public outreach. The Lennox Memorial Forest, the lone model forest in the Cannonsville basin, is a 140-acre site located south of Delhi and was completed in 2001. After viewing an educational kiosk that connects healthy forests to clean water, visitors travel a two-mile demonstration road with interpretive signs that highlight erosion control BMPs and fourteen silvicultural treatments. A number of deer "exclosures" are installed at the Lennox Forest to help research the effects of deer grazing on forest regeneration.

With funding from the USDA Forest Service Economic Action Program, eligible wood-based businesses in the NYC Watershed regions East and West of the Hudson River are awarded grants through the Forestry Grants Program to assist in a variety of projects ranging from web-site design and marketing to apprenticeship programs and new equipment. The results are improved safety and efficiency, cutting-edge wood technology and innovative marketing campaigns, all of which emphasize WAC's goal that forestry remain a viable enterprise to protect water and to bolster economic vitality in watershed communities.

4.6. Delaware County Action Plan

The Delaware County Action Plan (DCAP) was formulated in 1999 to address water quality issues in the New York City watershed. DCAP is a comprehensive strategy developed to meet the needs of Delaware County as a result of the Cannonsville basin being designated a phosphorus-restricted basin. DCAP coordinates with public and private agencies to develop water quality initiatives and seek funding for implementation.

DCAP lead agencies include the DCSWCD and the following Delaware County Governmental Departments: Planning, Public Works, Watershed Affairs and Economic Development, and the New York State Water Resources Institute (WRI). Other DCAP

participants include: Delaware County: Industrial Development Agency, Chamber of Commerce, and Cornell Cooperative Extension; Regional: Catskill Watershed Corporation, Watershed Agricultural Council and NYCDEP; New York State Departments: Environmental Conservation, Health, State, Agriculture and Markets, Soil and Water Conservation Committee, and Cornell University researchers. Federal Agencies: Environmental Protection Agency, Department of Agriculture, Natural Resources Conservation Service, and Army Corps of Engineers.

DCAP adopted a multiple barrier approach to address potential pollutants, particularly phosphorus. The barriers utilized are called the Initial Source Barrier, the Transport Barrier and the Stream Corridor Barrier. Current components of DCAP include management programs for stormwater and flooding, highway runoff, on-site septic systems, precision livestock feeding, forage management, SCMPr, and *monitoring* and modeling of best management practices to assess phosphorus reduction. By coordinating all water quality efforts under the DCAP umbrella, these programs are working together to collectively reduce pollutants entering watercourses and to improve overall water quality. The following categories demonstrate DCAP effectiveness to date:

Stream Corridor Management

The SCMPr has completed the following assessments:

- Rosgen Level II for the West Branch and Town Brook main stems.
- Evaluation of land use and riparian vegetation communities for the West Branch main stem.
- Cursory evaluation of stream conditions in proximity to road and bridge infrastructure.

The SCMPr has also implemented a full geomorphic demonstration restoration project to evaluate the effectiveness of natural stream channel design practices and principles. (see **Section 6, Findings** for a detailed description of the assessments and project)

This information is being integrated with other DCAP efforts, particularly the stormwater management and highway maintenance programs, to further enhance the effectiveness of these local water quality initiatives, further described below:

Stormwater Management

The Delaware County Planning Department (DCPD) has developed the following long term management programs:

- Inventory, Assessment and Evaluation of Stormwater Sources and Infrastructure

  Goal: to identify all point and non-point sources of stormwater in village and hamlet areas and manage them to reduce their impact on water quality.

  Work Completed:

  - A detailed evaluation of stormwater sources and conveyance systems has been completed in the Cannonsville basin using *GPS* to locate stormwater infrastructure and culvert outfalls. A *Geographic Information Systems*

(GIS) database has been created combining this information with soils, land use and topographic datasets.
    - Pilot projects of stormwater collection, conveyance and treatment methods have been implemented in the villages of Stamford, Delhi and Walton.

- Local Implementation and Municipal Plan Development

  Goals: to work with each municipality to develop local initiatives for water quality protection through stormwater management and demonstrate the role of water quality to community economic development; also, to develop Stormwater Management Plans consistent with the NYCDEP Watershed Regulations and Phase II EPA Stormwater Regulations.

  Work Completed:
    - Failing components of stormwater infrastructure in Bovina Center have been assessed and replaced.
    - Stormwater Management Plan finalized for the Village of Walton.
    - Stormwater Management Plan under way for the Village of Delhi.
    - Planning for source water protection.

Highway Management Activities

The Delaware County Department of Public Works (DCDPW) completed an assessment of highway stormwater impacts in 1999 and continues to maintain a comprehensive highway inventory and assessment program. All major drainage features have been inventoried using GPS and a GIS database has been developed. Efforts to minimize negative water quality impacts include ongoing management practices and capital construction projects.

Construction to date includes a stormwater management retrofit along County Route 6 in the Town of Bovina, and treatment of stormwater runoff from the parking lot at the Delaware County office building on Page Avenue in the Village of Delhi.

Ongoing management practices include: 1) Sediment removal from culverts and catch basins with a vacuum truck; made possible with a grant from the CWC 2) In-place road culvert stabilization, which includes slip lining failed culverts (when feasible) to minimize sedimentation caused by traditional excavation and replacement. 3) De-icing material control, which includes installation of modern control equipment on material spreaders to facilitate precise metering of de-icing materials.

DCDPW is extending its highway management program to the towns in order to inventory and assess town highways, identify priority stormwater management practices and assist with procurement of CWC funding.

Other activities include creation of *wetlands* towards the establishment of a mitigation bank on county-owned property in Walton, and research investigating the use of chipped passenger car tire chips as a medium to remove dissolved phosphorus from stormwater.

Additional information is available on the DCAP website:
http://www.co.delaware.ny.us/depts/h2o/dcap.htm (Verified 12-07-04)

4.7. Catskill Watershed Corporation

The Catskill Watershed Corporation (CWC) is a not-for-profit local development corporation with a dual goal: to protect the water resources of the New York City watershed west of the Hudson River, while preserving and strengthening communities located in the region. The CWC was formed in January 1997 with the signing of the New York City Memorandum of Agreement between City, State, federal, local and environmental entities. To help offset the costs and restrictions of increased regulations and land purchases by the city, CWC is charged with developing and implementing several city-funded programs including residential septic rehabilitation, replacement and maintenance, community wastewater management, planning and installation of stormwater controls, road salt storage, public education and economic development. CWC also consults on recreational uses of city lands, tax assessment issues, and wastewater treatment plants planned for several watershed communities. These programs are intended to protect the quality of the water which sustains 9 million residents of New York City and its suburbs, while at the same time preserving and strengthening the rural communities within the 5-county Catskill and Delaware Watersheds. Further information is available on the CWC website: www.cwconline.org (Verified 12-07-04).

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West Branch Stakeholders

Delaware County Departments
Emergency Services
Planning
Public Works
Watershed Affairs
DCSWCD

Local Organizations
Catskill Revitalization Corporation
Chambers of Commerce

Business Entities
Campgrounds
Contractors
Developers
Farmers
Hunting and Fishing Guides
Foresters
Golf courses
Realtors
Ski slopes
Other local businesses

Local Governing/Planning Boards and Highway Departments
Bovina, Town of
Delhi, Town of
Franklin, Town of
Hamden, Town of
Harpersfield, Town of
Hobart, Village of
Kortright, Town of
Meredith, Town of
Stamford, Town of
Stamford, Village of
Walton, Town of
Walton, Village of

Regional Entities
Catskill Watershed Corporation
Catskill Center for Conservation and Development
Cornell Cooperative Extension
Delaware River Basin Commission
New York City Department of Environmental Protection
New York Farm Bureau
Watershed Resource Institute

State Entities
New York Department of State
New York State Department of Environmental Conservation
New York State Department of Transportation
New York State Emergency Management Office
New York State Parks, Recreation, and Historic Preservation
New York State Soil and Water Conservation Committee
State University of New York at Delhi

Federal Entities
Federal Emergency Management Agency
National Oceanic and Atmospheric Administration
United States Department of Agriculture
Natural Resources Conservation Service

United States Forest Service
United States Army Corps of Engineers
United States Department of the Interior
United States Environmental Protection Agency
United States Fish and Wildlife Service
United States Geological Survey

Special Interest Groups
4-H clubs
Anglers
Canoers/boaters
Future Farmers of America groups
Scouting groups
Trout Unlimited

Other Interests
Allen Residential Center
Churches
Non-riparian landowners
Phoenix House
Public utilities
Riparian landowners
Schools
Seasonal riparian landowners
Water consumers (local, NYC)
Water recreation interests

Media
Catskill Mountain News
Country Folks
County Shopper
Delaware County Times
Deposit Courier
Hancock Herald
Local cable network – Delhi
Local cable network – Walton
Mirror Recorder
Mountain Eagle News
Stamfordword.com
The Daily Star
The Reporter Company
Tri-Town News
WBNG TV - Binghamton
WCDO Radio
WDHI Radio
WDLA Radio
WDOS Radio
WIYN Radio

WATERSHED DESCRIPTION--SECTION 5
FINDINGS--SECTION 6
STREAM SEGMENTS--SECTION 7
LANDOWNER SURVEY INFO--SECTION 8
REF & GLOSSARY-- SECTION 9 AND 10