



DELAWARE COUNTY STREAM CORRIDOR MANAGEMENT PROGRAM

A Cooperative Program
Delaware County Soil and Water Conservation District
New York City Department of Environmental Protection
Delaware County Planning Department



West and East Branch Delaware River Stream Corridor Management Plan Recommendations

The following pages are recommendations that were extracted from the West and East Branches of the Delaware River Stream Corridor Management Plans. A colored piece of paper separates the West Branch and the East Branch recommendations. An applicant may reference any of the 39 recommendations in their grant proposal from either the West Branch, East Branch, or both plans that best fits their proposals.

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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 does not consider potential causes or effects downstream, upstream or outside the immediate project area. Additionally, other stream processes such as channel and *floodplain* interaction and *sediment* transport 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.

One goal of this management plan is 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 aid and improve stream management in the West Branch basin.

Recommendations

RECOMMENDATION #1

Integration of the Stream Corridor Management Program and Watershed Agricultural Program

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

The Watershed Agricultural Council 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), United States Department of Agriculture (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. BMPs 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 indicates that approximately 62 percent of the land parcels in the West Branch watershed greater than one acre in size are under agricultural production¹. 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, but the SCMP staff, on its own, does not have time to assess all of these sites. WAP resource staff could be trained to identify and assess stream related issues on farms during the Whole Farm Planning process and work with SCMP staff to develop solutions to the problems.

This training could be designed to:

- Identify stream reach issues, including Japanese knotweed problems (see **Section 5.10.4**), during the Environmental Review/Problem Diagnosis step of the Whole Farm Planning process.
- Describe and/or identify the problems and possible causes.
- Develop a "Stream Stewardship Plan" that outlines inexpensive measures for farmers to maintain stream stability.

WAP staff and SCMP staff could then cooperate on identified issues such as riparian buffer enhancement, stream bank erosion, cattle access problems, debris jams, Japanese knotweed management 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 SCMP, 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

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

The Stream Corridor Management Program (SCMP) and the NYCDEP should continue to fund and provide technical and design assistance for stream bank stabilization projects at potential CREP sites. The goal of this assistance is to stabilize stream banks so they are eligible for CREP participation.

From the results of the walkover assessment and the vegetation mapping exercise conducted during the planning effort, SCMP 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, improving stream health throughout the basin.

Sixty-two percent of the parcels along the West Branch main stem are under agricultural production. Under federal rules, CREP cannot be implemented on unstable streambanks. SCMP 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. Funding sources for these projects should be explored and identified to facilitate CREP implementation.

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. SCMP 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

Enhance the Implementation of CREP on New York City Watershed Cropland and Explore Long-Term CREP Contracts

The Stream Corridor Management Program (SCMP) should work with the New York City Department of Environmental Protection, United States Department of Agriculture, US Environmental Protection Agency, Watershed Agricultural Council and other pertinent federal, state and local agencies and

organizations to enhance CREP implementation on cropland and explore long-term CREP contracts.

Cropland CREP

Currently, only 17% of CREP buffers implemented in Delaware County are on cropland demonstrating the need to enhance CREP participation on stream side cropland. Many producers do not opt for CREP buffers along cropland because:

- ◆ Quality cropland is in valley bottoms and available acreage is in short supply
- ◆ Crop values are significantly higher than CREP payments
- ◆ Necessitated enterprise changes make it too costly to produce crops on uplands

A review of LIDAR contour mapping and field verification reinforces that many runoff patterns are parallel to the stream. In these cases, *hydrologic delivery zones* should be identified where nutrients and sediments enter the stream. This may allow for narrower buffers along streams with parallel runoff patterns while shifting the main focus of a buffer in the hydrologic delivery zone areas or wider buffers with perpendicular runoff patterns.

An interagency Cropland Buffers Working Group should be established to:

- ◆ Assess cropland acres for CREP applicability under current program rules
- ◆ Develop a planning protocol to identify and address hydrologic delivery zones
- ◆ Develop applicable vegetation buffer standards for parallel runoff patterns
- ◆ Develop equitable incentive and payment protocols

Approximately 31 miles of cropland along the West Branch main stem are currently un-buffered, suggesting the need to review and enhance CREP rules on cropland.

Long-Term CREP

Under current program guidelines, CREP contracts are executed with either a ten or fifteen year life span. Landowners are required to follow an operation and maintenance plan during the life of the contract to ensure required plant survival rates and to protect the buffer area from destruction. Once the contract has expired, however, the commitment to maintaining the buffer will also expire.

There are documented improvements in stream health where CREP is currently implemented. The environmental benefits gained by extending existing CREP contracts and providing for longer-term future contracts would be an integral component of sound stream and land-use management.

RECOMMENDATION #4

Implement a Variable Width Riparian Buffer Pilot Program

The Delaware County Soil and Water Conservation District (DCSWCD) Stream Corridor Management Program (SCMP) should work with the New York City Department of Environmental Protection (NYCDEP), New York State Department of Environmental Conservation, Watershed Agricultural Council, Catskill Watershed Corporation, Cornell Cooperative Extension and other pertinent federal, state and local agencies and organizations to develop and implement a pilot program to establish variable width riparian buffers along unstable stream reaches and monitor their effectiveness.

Mitigating unstable streambanks to facilitate the implementation of the USDA Comprehensive Reserve Enhancement Program (CREP - see **Section 6.3.2**) can be cost prohibitive. It is also important to recognize that mitigation measures may carry a high risk of failure if implemented within an improperly functioning stream reach. This is the case with three sites identified for mitigation along the West Branch Delaware River. These sites are located in a 4.35 mile reach of the river that is not properly functioning. Sections of this reach have become straightened, most of the reach has over widened and excessive deposition is occurring. Evidence suggests that this section of the river will continue to adjust and deposit sediment.

A need exists to develop criteria to facilitate riparian buffer implementation on agricultural lands along certain unstable streambanks. Since meandering is a natural stream function, the meander pattern can be reasonably predicted for a given reach of stream. Therefore, buffer limits could be established to allow a stream to naturally adjust within established limits. Buffer width could vary depending on site specific situations. Rock armoring could be planned at critical locations along a future streambank. If future needs were determined rock could be placed in dry conditions with reduced construction costs and minimal to no dewatering costs. Vegetative planting sequences could be phased over time as stream adjustment progresses.



Figure 2.1 Example of rapid lateral migration near Hamden resulting from the April 3, 2005 storm. This section of stream is one of the 3 sites located in the 4.35 mile stream reach.

The SCMP and NYCDEP should work with all involved agencies and stakeholders to further advance the variable width riparian buffer concept, implement a pilot program to address identified needs and monitor program effectiveness.

RECOMMENDATION #5

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, including Japanese knotweed identification and management (see **Section 5.10.4**), for landowners, local planning boards and highway departments, contractors, schools, community groups and other interested stakeholders.
 - 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:
 - Fund a culvert sizing and design program for municipalities (see **Recommendation #9**).



Figure 2.2 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.

- Fund stream stewardship activities which may include selective berm and/or debris removal.
- Fund future mitigation projects related to stream channel and streambank stability.

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

RECOMMENDATION #6

Stream Corridor Management Plans for Non-Agricultural Riparian Landowner Stewardship

The Stream Corridor Management Program (SCMP_r) 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.

Although 62% of the parcels in the basin over one acre are under agricultural production (see **Recommendation #1**), there remains a significant amount of riparian property that 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 SCMP_r recommends



Figure 2.3 Example of site that could benefit from individual landowner stewardship.

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 with Japanese knotweed management as a primary focus (see **Section 5.10.4**), and the importance of desirable native riparian vegetation and its function.

Riparian landowner stewardship is essential to proper stream corridor management. Efforts by individual riparian landowners to improve and maintain proper stream processes 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 begin as small problems that could have been mitigated or corrected without public funding assistance by a well educated riparian landowners. The preparation of individual Stream Corridor Management Plans will also provide SCMP staff with opportunities to proactively monitor stream health, identify emerging issues and/or problems in the watershed, and develop greater rapport with riparian landowners.

RECOMMENDATION #7

Stream Gravel Deposition Issues

The Delaware County Soil and Water Conservation District (DCSWCD) Stream Corridor Management Program, New York City Department of Environmental Protection and Delaware County Department of Watershed Affairs will identify opportunities to work with the New York State Department of Environmental Conservation and U.S. Army Corps of Engineers for the purpose of identifying options pertaining to the management of deleterious gravel deposits within the West Branch of the Delaware River system.

Several members of the public and local government leaders have stated, throughout the public review process of this management plan, that they believe certain gravel deposits have had a deleterious effect on streambank stability and flooding over the years and have expressed their concern with current policies and regulations restricting their removal. The Stream Corridor Management Program has the responsibility to investigate these issues and respond to these concerns by advancing discussion with the appropriate regulatory agencies to identify what information is needed to determine if and where an appropriate level of response and intervention can or should be exercised. The DCSWCD wishes to create an informed dialog about gravel and stream processes in the West Branch Delaware River (WBDR) watershed, to improve both the professional manager's and general public's understanding of the mobilization, transport and deposition processes of both sediment and woody debris in the WBDR system. The DCSWCD recognizes that in order to successfully advocate a specific plan of action regarding gravel, it must both develop a science-based understanding of specific stream processes and secure the participation of the key regulatory agencies.

RECOMMENDATION #8

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, neighboring Soil & Water Conservation Districts, Delaware County Department of Public Works (DCDPW) and local community leaders identify ways to delegate, 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 should be to enhance delegated permitting authority to the DCSWCD by NYSDEC for implementation of approved stream management practices under its current General Permit.

RECOMMENDATION #9

Assist Municipalities with Culvert Sizing and Design

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

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.

While performing the walkover assessments in the watershed, SCMP staff observed that road culverts often caused increased erosion below, and many exhibited increased deposition 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 culvert 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.



Figure 2.4 Culvert installation that could benefit from improved alignment, fish passage, outfall dissipation, headwall installation and top cover.

The SCMP should work in cooperation with other interested parties such as the CWC and DCDPW to develop a protocol to expand assessments of existing culverts to include geomorphic assessments, and work collectively where necessary in the prioritization of culverts for replacement and on the designs for retrofitting existing culverts. This technical assistance could be provided through recommendations made during the development of individual Town Highway Management Plans (HMPs) currently being developed by the DCDPW and Delaware County Planning Department (DCPD) Special Flood Hazard Areas as identified on Flood Rate Insurance Maps should also be included in this protocol (see **Section 5.14**).

RECOMMENDATION #10

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 #11

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 with funding from 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, 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:

- Development of a dialog with stakeholders on stream processes and the best management of stream features such as floodplains and riparian buffers.
- Facilitation of enhanced stormwater management.
- Promotion of action by new and existing watershed associations, stream management public interest groups and other groups and organizations interested in stream corridor management.
- Education of the public and municipalities regarding the importance of controlling invasive species, especially Japanese knotweed (see **Section 5.10.4**).
- Facilitation of public and municipal involvement in Flood Hazard Mitigation efforts (see **Section 5.14**).
- Support of landowners interested in furthering their understanding of streams through stream management education efforts such as field days and workshops.
- Development of brochures, presentations, exhibits, press releases and other educational materials for the public and stakeholder groups.

The DCSWCD and DCPD should initiate education and outreach with the local planning boards. When a planning board conducts a subdivision review or a site plan evaluation, they should be aware of the concerns of the DCSWCD in regards to the impact on streams in light of additional growth and development. The planning boards could then be used as a local engine to distribute information hosting workshops for private property owners that are current stakeholders or adjoining property owners.

The formation of local watershed associations should also be encouraged. These local stakeholders can be a valuable asset by contributing both historical and current stream reach information, sponsoring community based projects, and assisting in the procurement of project funding. Local planning boards could serve as the facilitator of these associations.

RECOMMENDATION #12

Geomorphic Assessments at Bridges and Culverts

The Stream Corridor Management Program (SCMP) and NYCDEP 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, Delaware County Planning Department, Town and Village Highway Superintendents and New York State Department of Transportation.

Stream assessment observations by SCMP 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, in conjunction with available historic hydraulic data, 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



Figure 2.5 Gravel deposit under McMurdy Brook bridge on NYS Route 10 near Hobart. Note restriction of the waterway.

channels through structures and/or floodplain relief structures at elevated bridge approaches.

These assessments should be done as part of the environmental review process conducted during the design phase of a project in coordination with the municipality or agency having maintenance jurisdiction.

RECOMMENDATION #13

Flood Hazard Mitigation and Flood Recovery

Work with Delaware County Planning Department 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), New York State Department of Environmental Conservation (NYSDEC) and the State Emergency Management Office (SEMO) 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 SEMO, the agencies that administer their respective hazard mitigation programs 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 substantially completed 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 #14

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, additional time is required to adequately perform necessary assessments to compile a complete data set of watershed conditions, their causes, and the potential effects of current and proposed management practices. Additional 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 #15

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.

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 original 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.



Figure 2.6 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).

Between the time of grant application and time of award, site conditions have worsened; it 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 (WEAP). Additional funds from this program are not expected. In April 2003, Fisch



Figure 2.7 Closer view of the unstable embankment at the Terrace Avenue site (December, 2004).

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 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. At the time of the first draft of this document, an additional \$975,200 was currently needed for completion. On April 15, 2005, it was announced that \$916,500 in WRDA funds were earmarked for these sites. SCMP, the Village of Walton and the Delaware County Department of Watershed Affairs are working within the following schedule to complete these projects:

- 2005 – procure commitments for remainder of required funding
- 2006 – project survey, design and permitting
- 2007 – project implementation



Figure 2.8 South Street location showing condition of embankment (December, 2000).

RECOMMENDATION #16

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 management action vary both in the magnitude of the problem and level of intervention needed. Water quality, property and aquatic habitat protection will be priorities for all reaches prioritized for intervention. The level of intervention will be based on the current need and condition of the stream as well as the type of existing and future land uses. Properties surrounding streams which have the potential for development based on location, accessibility, size, soils and local land use controls will be deemed as more critical for intervention.

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 need for 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, very costly and requiring the most intensive management, 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 #17

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 addressed and implemented, additional information and data will be collected and other management issues identified. In order to keep the plan a “living document” it should be updated 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.

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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.

Our understanding of how healthy streams function is still growing. As the science of stream ecosystems and best management practices to protect and restore them continue to evolve, this improved understanding needs to be incorporated into our day-to-day stewardship and management activities. The NYCDEP is committed to using the DCSWCD as a technical advisor, information clearinghouse, and funding source for implementation of SCMP recommendations. The following recommendations are suggested guidelines to help and improve stream management in the East Branch basin.

RECOMMENDATION #1

Scientifically-Based Post-Flood Emergency Stream Intervention

The SCMP should work cooperatively with the NYCDEP and the Project Advisory Committee to improve immediate post-flood emergency intervention capabilities by demonstrating and training contractors and local municipalities in scientifically-based stream principles, procedures and methods.

Delaware County has had a number of floods in the last eleven years that have left varying degrees of damage in their aftermath, including loss of life. The June 2006 and June 2007 floods caused significant damage, both recurring and new. The June 2006 flood clearly demonstrated the need for improved flood response. It is clear and obvious that municipalities and contractors need to have scientifically-based knowledge including proper channel dimensions, floodplain function and the negative impact of berms. Much immediate post-flood mitigation performed to date has led to additional problems or left some areas vulnerable to recurring damage. In many areas post-flood work has unraveled stream systems more than any other non-flood work combined. Many streams are poised to further damage public and private property, put lives at risk, and impair water quality and aquatic habitat.

Municipalities, resource agencies, private contractors and landowners are overwhelmed with post-flood triage and obtaining necessary permits, and are significantly challenged with knowing

how to perform scientifically based mitigation. Regulatory agencies are equally overwhelmed with permit issuance. This will continue unless post-flood response can be enhanced.

DCSWCD has received Round 9 Water Quality Improvement Project, Non-agricultural Non-point Source Abatement and Control funding to begin to pro-actively address post-flood emergency intervention issues before the next flood happens. With this and matching funding the DCSWCD proposes a new and innovative approach for post-flood emergency intervention in preparation for future floods to:

- Scientifically and environmentally address stream channel avulsions (course changes) and compromised channel capacity
- Initiate a process whereby local contractors and highway superintendents obtain a knowledge base with training and certification in:
 - Use of DCSWCD Regional Hydraulic Relationship curves to properly size stream channels
 - Re-connecting floodplains
 - Natural stream restoration principles and techniques
 - Identification and prioritization of stream reaches for post-flood intervention
 - Best Management post-flood intervention techniques

Having a trained and knowledgeable contractor and highway superintendent base will significantly enhance future post-flood emergency intervention and efforts in the watershed.

RECOMMENDATION #2

Provide Technical Assistance To Local Highway Departments

The SCMP, in cooperation with the Delaware County Department of Public Works (DCDPW) and the NYCDEP, should enhance communication with local highway departments. These efforts should be developed and implemented in cooperation with the PAC and the DCPD, and utilize Catskill Watershed Corporation (CWC) program funds for stormwater retrofits and other practices as appropriate.

The SCMP follows the Delaware County Action Plan (DCAP) and works with the Delaware County Department of Public Works (DCDPW) to manage streams in proximity to county roads. The DCPD and DCDPW also work with town highway departments to develop Highway Management Plans (HMPs). The HMPs are intended to be a long term management tool for highway superintendents to prioritize projects and better estimate costs of repairs on an annual basis. In addition, the plans will encourage more comprehensive maintenance program incorporating similar design standards throughout the county. These practices will ensure local roads can meet the enhanced standards for road construction as well as the management of stormwater systems and flow of runoff associated with highway infrastructure. Opportunities exist to help local highway departments reduce maintenance costs by orienting and sizing culverts and bridges to better accommodate stream flow patterns.

The SCMP_r should work in cooperation with other interested parties such as the DCDPW and DCPD to enhance its technical assistance to local highway departments. This could include:

- A protocol to evaluate existing culverts and bridges following geomorphic principles, and work collectively to prioritize and design culverts for retrofitting or replacement where necessary
- Use DCSWCD Regional Hydraulic Relationship Curves (see **Volume 2, Section 3**) and Draft Stream Maintenance Protocol (on a pilot basis where applicable) to appropriately manage streams in proximity to local roads
- Work with local municipalities to assess areas in need of periodic stream maintenance around public infrastructure, following DCSWCD's Draft Stream Maintenance Protocol
- Work with local municipalities to procure funding for prescriptive measures

This technical assistance could be provided through recommendations in individual Highway Management Plans. The SCMP_r should also work in cooperation with the New York State Department of Transportation to assess, mitigate and maintain problem areas along state highways.

RECOMMENDATION #3

Implement the Streamside Assistance Program

The SCMP_r should implement the Streamside Assistance Program as defined in the 2007 Filtration Avoidance Determination. This effort should be developed and implemented in cooperation with the PAC.

The development of an individual Whole Farm Plan for agricultural producers and a Forestry Plan for forest landowners has been essential to improving and maintaining water quality in the East 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 that meet both landowner and water quality objectives.

As with agricultural and forestry practices, certain activities by streamside landowners may contribute to stream and streamside buffer degradation. Most streamside property (approximately 96.8%) in the East Branch watershed is non-agricultural land. In the West Branch Delaware River SCMP, the SCMP_r recommended development of a program to provide non-agricultural streamside landowners with an individual Stream Corridor Management Plan. The 2007 Filtration Avoidance Determination provides for such an initiative, entitled the Streamside Assistance Program.

An individual SCMP would be provided at the request of the landowner. This may require a small refundable deposit by the landowner but will ultimately be free of charge. The Plan would address floodplain function, stream processes (including streambank and stream channel maintenance), invasive species control with Japanese knotweed management as a primary focus (see **Section 5 of Volume 2**), and the importance of desirable native streamside vegetation and its function.

Streamside landowner stewardship is essential to proper stream corridor management. Efforts by individual streamside landowners to improve and maintain proper stream processes and streamside buffers can be substantial, especially with the control of invasive species and the management of desirable native vegetation. Well informed streamside landowners can also be instrumental in maintaining floodplain function in addition to stream channel and streambank functions. Many times, streambank erosion and stream channel degradation begin as small problems that could have been minimized or corrected—without public funding assistance—by well-informed streamside landowners. The preparation of individual Stream Corridor Management Plans will also provide SCMP staff with opportunities to proactively monitor stream health, identify emerging issues and/or problems in the watershed, and develop greater rapport with streamside landowners.

RECOMMENDATION #4

Continue with and Enhance Education and Outreach Efforts

The SCMP should cooperate with the NYCDEP and the PAC to better inform and educate all stakeholders regarding stream stewardship, the importance of floodplain function, stream processes, and the importance of streamside vegetation. Education and outreach efforts should be developed and implemented in cooperation with the PAC, with cooperation from the Catskill Watershed Corporation's (CWC) Education Program.

The success of any program is a function of its education and outreach efforts. Government programs such as the SCMP are no substitute for genuine stewardship by watershed residents and stakeholders. Stream stewardship should be every resident's responsibility, and participation by all stakeholders is the preferred objective. To accomplish this, all stakeholders need to better understand stream processes such as streambank erosion, sediment transport and the function of floodplains, streamside vegetation, and wetlands. Improved understanding will help guide stakeholders as they adopt practices to protect streams and improve overall stream stability. Likewise, stream managers need to understand and incorporate the perspectives and priorities of stakeholders as they direct future stewardship and management efforts.

Enhance education and outreach efforts to include:

- Streamside landowner rights
- Stream gravel management (See **Recommendation #9**)
- Stream, floodplain, and streamside vegetation functions
- Invasive species identification and management (See **Recommendation #16**)
- Highway management and its streamside effects (See **Recommendation #2**)
- Flood response/flood hazard mitigation (See **Recommendation #'s 1 & 17**)
 - Education and training for municipalities and contractors
 - Municipal education regarding the Delaware County Multi-jurisdictional All-Hazards Mitigation Plan
 - Improved correspondence regarding funding available to municipalities and individuals for declared flood events
- Formation and function of community groups

- Providing educational sessions for local planning boards
- Use of mass mailings
- Use of websites and links to others
- Collaboration of various organizations/municipalities/landowners for the development of a strategic plan for recreational and educational use of East Branch Delaware River (EBDR) corridor
- Collaboration with the Water Discovery Center of the Catskills

RECOMMENDATION #5

Provide Annual Floodplain Development Permit Training for Municipal Officials

The SCMP, in cooperation with the NYSDEC, NYCDEP, DCPD and PAC should work toward providing annual Floodplain Development Permit training for local municipal officials.

Floodplain development permits are required for any floodplain development in New York State as part of the National Flood Insurance Program (NFIP). Local laws authorize designated municipal officials to accept floodplain development applications, review their completeness, require hydrology studies, issue permits and issue compliance certificates. Compliance with the NFIP is what enables landowners to purchase flood insurance backed by the Federal government, and keeps rates reasonable as well.

These laws and requirements are in place to prevent structural damage and loss of life during major flood events. It is not a question of if another large flood will occur, but when. Better understanding of flood damage potential, stormwater implications, the NFIP, and use of Federal Insurance Rate Maps will empower local officials to make informed decisions, including local Comprehensive Plan implementation. Knowing how to properly manage our floodplains is crucial to our continued safety and economic sustainability. Further, demonstrating excellence in implementing the NFIP through the Community Rating System (CRS) can achieve reduced flood insurance rates for our communities.

RECOMMENDATION #6

Enhance Local Land Use Laws and Ordinances

The SCMP, in cooperation with the DCPD, NYCDEP, PAC and other interested stakeholders, should work toward including a stream management component in local Comprehensive Plans, local laws and local management practices as may be appropriate.

The Towns within Delaware County through participation in the Town Planning Advisory Service (TPAS) can work with the Delaware County Planning Department to develop a process to incorporate stream stewardship and maintenance into local planning initiatives. The continued revision and updating local plans and local laws can be a source to incorporate criteria for

protection as well as encourage development in areas that mitigate impacts to streams to the greatest extent possible.

Projects that municipal leaders may consider to meet the objectives of this goal could include the following:

- Update local Comprehensive Plans to reflect the importance of stream corridor management and the protection and preservation of the streams within the municipalities.
- Develop tools that can be used to support planning initiatives for stream rehabilitation projects such as Source Water Protection Plans and Open Space or Recreation Plans.
- Adopt and maintain local Highway Management Plans to address stormwater and infrastructure impacts associated with roads and bridges.
- Update local Floodplain Laws to include limits for floodplain development and protect stream banks from encroachment.
- Update local zoning laws and subdivision regulations to include best stream management practices.
- Support annual stream clean-up days.
 - Coordinate efforts with the Delaware County Solid Waste Coordinator to ensure proper disposal of debris (see **Recommendation #12**).
- Support local groups that wish to develop watershed associations that would work toward stream management practices and assist SWCD and NYCDEP monitor the health of individual stream reaches,

Local communities should also work with the Delaware County Soil and Water Conservation District and the Delaware County Planning Department to regularly update and manage the SCMP.

RECOMMENDATION #7

Adopt Principles of Stream Stewardship at the Municipal Level

Local legislative boards should incorporate principles of stream stewardship into the creation and/or revision of their town or village comprehensive plans and local land use regulations.

Scientifically-based stream management practices (see below) are essential to the long-term health and stability of all waterways flowing through the towns and villages of the East Branch Delaware River watershed. Following the principles of proper stream stewardship will not only ensure the preservation of stream health, aesthetics, recreational opportunities, water quality, and aquatic habitat, but will also reduce or prevent costly restoration and repairs stemming from damages caused by unstable stream systems.

If the principles of stream stewardship are incorporated into the goals and objectives of a local comprehensive plan, land use regulations such as subdivision, site plan review, and zoning laws may be created and/or revised to afford additional protection to waterways. From that point

forward, development activities within that municipality would be reviewed with an eye toward improved and enhanced stream stewardship.

STREAM STEWARDSHIP

Once one understands the basic principles of stable, healthy streams and how human activities affect those streams, the question of “What next?” usually arises. This section will outline some general principles of stream stewardship that can be adopted at the personal, municipal, or regional agency level.

- Work toward the protection and/or restoration of
 - the environmental services provided by streams and floodplains
 - the health of stream and floodplain ecosystems
 - the naturally effective channel form and function of streams
 - floodplains as part of the natural stream system
 - riparian buffers
- In the process of managing streams to protect public safety and infrastructure, avoid threatening
 - stream health upstream or downstream
 - the upland ecosystem through which the stream runs
 - the streambank stability of neighboring properties

RECOMMENDATION #8

Streamline Stream Work Permitting

The Stream Corridor Management Program (SCMP_r) 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 NYSDEC, U.S. Army Corps of Engineers, DCSWCD, NYCDEP, neighboring Soil & Water Conservation Districts, DCDPW, and local community leaders, identify ways to delegate, simplify and streamline the permitting process for the benefit of all agencies and stakeholders.

The purpose of this recommendation is to enhance the permitting process so that necessary stream stabilization efforts may be made in a timely and efficient manner.

The following goals are suggested:

- In sub-basins with approved watershed management plans, enhance delegated permitting authority to the DCSWCD by NYSDEC for implementation of approved stream management practices under its current General Permit
- Enhance the process for permitting federal flood response and recovery programs such as the USDA Emergency Watershed Program
- Work with United States Army Corps of Engineers (USACOE) to provide guidance documents for landowners
- Local planning board review of stream permits in economic development areas with the goal of working on future guidance documents

RECOMMENDATION #9

Selective Stream Gravel Management

The SCMP, NYCDEP, and the Delaware County Department of Watershed Affairs should work with the NYSDEC and U.S. Army Corps of Engineers to identify and fund an independent stream scientist or engineer to create a guidance document with recommendations on how, when and where to scientifically manage problematic gravel deposits within the East Branch Delaware River system . Such a document might require a study. In this interim, the Delaware County SCMP Draft Stream Maintenance Protocol would be employed.

Throughout the development of this management Plan, several members of the public and local government leaders stated their belief that certain gravel deposits have had a harmful effect on streambank stability and flooding over the years. Numerous concerns have been expressed regarding current policies and regulations restricting gravel removal. The Stream Corridor Management Program has the responsibility to investigate these issues and respond to these concerns by advancing discussion with the appropriate regulatory agencies.

The DCSWCD wishes to create an informed dialog among stakeholders about gravel and stream processes in the East Branch Delaware River (EBDR) watershed. This dialog would share perceptions of and explore common goals between stream managers and the general public regarding sediment and woody debris mobilization, transport, and deposition. The goal would be to identify the information required to determine if and when an appropriate level of response should be exercised. The DCSWCD recognizes that in order to successfully advocate a specific plan of action regarding scientific gravel management, it must involve key regulatory agencies while developing a science-based understanding of local stream processes.

The Draft Stream Maintenance Protocol is attached as Appendix A.

RECOMMENDATION #10

Provide Assistance to Community Watershed Groups/Associations and Government Entities

The SCMP, working with the PAC and NYCDEP, should provide technical assistance and general direction to community watershed groups/associations and government entities that are actively engaged in grassroots stream stewardship/management activities.

Jurisdictions adjacent to the EBDR watershed have met with success when local watershed associations have taken ownership of the stewardship/management of their particular sub-basin. These stakeholders play a significant role by providing historical information, assisting with data collection, and developing and implementing localized stream management plans. In so doing, stream health, streamside buffers, and upland and aquatic habitat are locally managed for the long-term.

The DCSWCD, in cooperation with the PAC and NYCDEP, can provide valuable guidance to community watershed groups/associations and government entities. The ultimate goal is to empower these groups to manage their streams in a manner that is consistent with their own visions for the future, proper principles of stream stewardship, and the EBDR SCMP. Guidance can range from that which is administrative in nature (suggesting watershed association structure and identifying funding sources) to the more technical (providing education on stream science and assisting with design/selection of mitigation and stewardship activities.)

RECOMMENDATION #11

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 East 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 efforts to improve water quality in Delaware County (see **Section 10 of Volume 2**). Integrating the Stream Corridor Management Plan and its recommendations into DCAP programs will maximize water quality benefits by ensuring multi-departmental review and county-wide awareness.

RECOMMENDATION #12

Debris Management

The SCMP should cooperate with the Project Advisory Committee, Delaware County Solid Waste Coordinator and NYCDEP to develop a protocol for inventorying floodplain debris and assist municipalities and communities with developing appropriate action plans for debris management.

Throughout many areas in the watershed, a plethora of debris can be found on floodplains in the form of uprooted trees, stumps, garbage dumpsters, propane and/or oil tanks, lumber, sheds, yard items or anything else that can float. During a flood, such debris can easily travel downstream and collectively has the potential to clog a bridge or culvert, often with devastating effects. It is also a threat to water quality.

The SCMP can assist this effort by:

1. Assisting with local efforts to ensure responsible floodplain management including maintenance and annual clean up efforts.
 - Developing a protocol for municipalities and communities to use to inventory floodplain debris and assist with annual clean-up efforts. This should be coordinated with the Delaware County Solid Waste Coordinator to ensure proper disposal of debris.

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- Helping interested municipalities and communities develop individual debris management action plans that may include clean-up efforts as well as policing efforts to ensure local areas known for illegal dumping are monitored and people are prosecuted for illegal dumping on private property in streams and along floodplains.
 - Holding a series of educational workshops on debris management for streamside stakeholders. This should be coordinated with the SWCD, Delaware County Solid Waste, NYS DEC and NYCDEP.
2. Working with the Delaware County Solid Waste Management Facility, NYC DEP, local communities and Delaware County Emergency Services to assist with debris removal and inventory after a catastrophic flood event.
- Assist with a plan for debris removal and management after a flood event to reduce impacts to the health and safety of flood victims and other residents of the communities. Actively participate in clean-up and debris removal efforts to reduce costs to county tax payers for removal after a flood event.
 - Participate during the operation of the Emergency Operations Center (EOC) to retrieve, sort and dispose of debris in an appropriate manner, including household waste, contaminated materials, woody debris, etc. This coordinated effort should be overseen by the Solid Waste Coordinator and the DPW Commissioner to ensure proper disposal of all forms of waste.
 - Coordinate with local transfer stations to properly sort and dispose of debris after a flood event.

RECOMMENDATION #13

Prioritization of Identified Stream Intervention Projects

The SCMP, working with the PAC and NYCDEP, should prioritize potential restoration reaches, including the type and level of intervention needed.

Stream reaches in need of management vary both in the magnitude of the problem and level of intervention needed. Water quality, property, and aquatic habitat protection will be the main concerns for all reaches prioritized for intervention. Level of intervention will be based on the current need and condition of the stream as well as the type of existing and future land uses. Streamside properties having development potential based on location, accessibility, size, soils, and local land use controls will be deemed as more critical for intervention. With all levels of intervention listed below, it is important to use native plant materials for the restoration and to continue to achieve the goal of a naturalistic look and character. Identified projects are listed in the DCSWCD two-year Action Plan.

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 and floodplain 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 need for 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 streamside 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, very costly and requiring the most intensive management, should be reserved for the most severe locations of stream instability with the greatest adverse impact on management goals. This level of management requires much greater time, financial resources, and technical expertise to ensure stability restoration is consistent with both management goals, stream type, and setting that will ensure project success and longevity.

RECOMMENDATION #14

Enhancement of East Branch Watershed Fisheries

The SCMP, in cooperation with the NYSDEC, the NYCDEP, and the PAC, should provide support to local grass-roots efforts, watershed associations, and fisheries organizations to enhance existing fisheries in the East Branch Delaware River watershed.

The East Branch Delaware River and its tributaries are noted for their trout fishery, with many reaches providing excellent habitat. However, there are some impacted reaches and good reaches that could be enhanced, particularly by increasing streamside vegetation. Suggestions for enhancing fisheries (and water quality) include:

- Working with landowners around Lake Wawaka (Halcottsville Pond) to reduce negative thermal effects on trout and to enhance trout migration in this reach of the East Branch Delaware River
- Continue to work with all stakeholders, the NYSDEC, and identified legislators to bring the No-Kill fishing proposal to fruition, extending from the Village of Margaretville to the New York City property line downstream of the village
- Work with the landowner to restore the reach of the Platte Kill avulsed during the June 2006 flood.
- As may be identified by **Recommendation #9**, consider the influence of certain gravel deposits on fish passage.

To address PAC concerns, and in cooperation with the PAC, the SCMP_r should assist the PAC in seeking qualified professionals and matching funds to research the following:

- Thermal effects on streams and suggest mitigation options
- Cumulative thermal effects of ponds and lakes on streams, their effects on local water tables, and suggest mitigation options
- Mitigation options for those pollutants identified by the USGS in their study (Part 3, 2004) of water quality in the Pepacton Reservoir basin
- Expand on mercury contaminant level research that is being conducted in the basin

RECOMMENDATION #15

Enhance Recreation Opportunities

The SCMP_r, in cooperation with the PAC and NYCDEP, should assist communities to enhance streamside recreational opportunities where possible. These efforts should be developed and implemented in cooperation with the PAC and with assistance with the DCPD.

Little public access exists along the main stem of the East Branch Delaware River and its major tributaries. This limits use of the waters for angling, canoeing and kayaking. These activities augment tourism and are relaxing means of recreation for all residents who choose to take part. Some areas could be revitalized or enhanced with streamside walkways to accommodate a greater cross-section of tourists and residents.

The SCMP_r, in cooperation with NYCDEP and the PAC, should:

- Work with DCPD and other appropriate organizations and agencies to facilitate recreation and revitalization plans. These plans could include:
 - Public access points for angling, canoeing and kayaking that do not compromise streambank integrity
 - Revitalization of existing public access points and streamside walkways
 - Creation of new streamside walkways to establish outdoor classrooms
- Collaborate with various organizations/municipalities/landowners for the development of a strategic plan for recreational and educational use of EBDR corridor

RECOMMENDATION #16

Invasive Species Management

The SCMP_r, in cooperation with NYCDEP, PAC, TNC, Catskill Region Invasive Species Partnership (CRISP), and other interested stakeholders, should continue its involvement with invasive species management, following and promoting all invasive plant programs in the East Branch watershed. These efforts should be developed and implemented in cooperation with the PAC.

Sometimes attempts to beautify a property with new and different plants will introduce a plant that aggressively spreads out of control. These “invasive” plants present a threat when they alter the ecology of the native plant community. Their impact may even alter the landscape should the invasive plant destabilize the geomorphology of the watershed (Malanson, 1993). Japanese knotweed, an invasive plant gaining a foothold in the East Branch basin, is an example of a plant capable of causing such disruption. Although others exist, other invasive plants of note along the East Branch corridor include common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and garlic mustard (*Alliaria petiolata*)¹. Current control efforts include a pilot Japanese knotweed management project in Halcott Center and stakeholder education.

The SCMP, in cooperation with NYCDEP, PAC should:

- Continue the Halcott Center Japanese knotweed management pilot project
- Expand Japanese knotweed management projects throughout the watershed
- Expand and enhance invasive species education efforts, particularly through websites
- Work with and promote all invasive plant programs in the East Branch watershed
- Assist communities with applying for CWC funds where appropriate
- Consider emphasis on native replacement vegetation

RECOMMENDATION #17

Flood Hazard Mitigation and Flood Response and Recovery

The SCMP should continue to work with the Delaware County Planning Department and Emergency Services to implement the county-wide, multi-jurisdictional, All-Hazards Mitigation Plan. The SCMP should continue to work with the Delaware County Board of Supervisors, the NYCDEP, the NYSDEC, and the State Emergency Management Office (SEMO) to revise the 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 SEMO, the agencies that administer their respective hazard mitigation programs for 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 completed preparation of a county-wide, multi-jurisdictional, All-Hazards Mitigation Plan that 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 support both efforts. These efforts could include but are not limited to:

¹ The Nature Conservancy, *Invasive Plant Species Inventory and Assessment of the Beaverkill Forest Matrix Block in the Catskill Mountains in Southeast New York*, January 2006, pages 14 & 17.

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- Implementation of early flood warning systems
- Development of community flood preparation and flood response action plans
 - Use of DCSWCD Regional Hydraulic Relationship Curves to restore flood-damaged channels
 - Assistance with trained personnel to assess post-flood stream conditions
 - Use of trained personnel to perform post-flood stream work
 - Engage the Delaware River Basin Commission
 - Engage Trout Unlimited
- For declared disasters
 - Outreach to communities with information regarding available funding to municipalities and individuals
 - Assist communities with FEMA/SEMO work orders
 - Cooperation with Trout Unlimited

RECOMMENDATION #18

Utilize Existing Funding Sources

The SCMP_r should cooperate with the NYCDEP to explore opportunities for existing funding sources to enable implementation of recommendations identified in this Stream Corridor Management Plan.

Proper stream stewardship and management is crucial to meet water quality goals and objectives. This Stream Corridor Management Plan provides a variety of recommendations, the implementation of which will require an equal variety of funding amounts. For example, enhanced management techniques may incur relatively few costs; by contrast, mitigation measures that seek to maintain water quality while ensuring economic sustainability may require substantial funding. It is important to take full advantage of funding opportunities through established, local, not-for-profit organizations like the CWC and the Watershed Agricultural Council (WAC). These development corporations have the dual goals of protecting water resources in the New York City watershed while preserving and strengthening communities within the region. Both corporations are logical choices to fund stream corridor management projects and programs identified in each West-of-Hudson County's stream management plans, thereby reducing the need to establish new funding mechanisms and governing boards. Opportunities exist to enhance their current programs and/or establish new programs to assist the SCMP_r in meeting stewardship and management needs.

The SCMP_r and CWC, in cooperation with NYCDEP, should:

1. Explore opportunities to enhance existing CWC **stormwater programs** through:
 - a. Cooperative public outreach efforts to educate businesses, municipalities and residents regarding stormwater impacts on streams.
 - b. Enhanced public outreach efforts to include funding for stream management education and stream stewardship training, such as invasive species identification and management for landowners, local planning boards and highway departments, contractors, schools, community groups, and other interested stakeholders.

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- c. Funding for retrofitting selected culverts that pose stormwater and fish passage issues.
 - d. Funding for solutions at bridges experiencing storm flow problems.
2. Investigate existing program opportunities while exploring new programs for **stream and stormwater management** to include funding for:
- a. Mitigation of stream alignment issues at roadways, bridges, and culverts
 - b. Stream maintenance according to the DCSWCD protocol
 - c. Debris inventories and local action plans
 - d. Invasive species management
 - e. Enhancement of recreational opportunities in the watershed, such as the creation of access and recreation use plans
 - f. Rehabilitation and establishment of educational streamside pathways
 - g. Local match for early flood warning systems and development of community flood response action plans
 - h. Assistance for the 2007 FAD Streamside Assistance Program
 - i. Stream contaminant research
 - j. Stream thermal impact research

The SCMP and WAC, in cooperation with NYCDEP, should:

1. Explore opportunities to **enhance the WAC's Watershed Agricultural and Forestry Programs** to include funding that:
 - a. Trains staff to identify stream issues and their possible causes during preliminary review processes.
 - b. Develops "Stream Stewardship Plans" that outline economical measures for farmers to maintain stream stability.
 - c. Locates matching funds to assist with stream and streambank stabilization measures on farms.

RECOMMENDATION #19

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

In cooperation with the PAC and the NYCDEP, the Stream Corridor Management Program should develop a process for updating the East Branch Delaware River Stream Corridor Management Plan.

It is expected that as this Plan and its recommendations are addressed and implemented, additional information and data will be collected and other management issues identified. In order to keep the Plan a "living document," it should be updated as needed using the biennial Action Plans as required by the 2007 Filtration Avoidance Determination (FAD). Action Plans outline SCMP implementation schedules, with a two-year plan being submitted each year. The DCSWCD, NYCDEP and the PAC will meet each year by April 1 to review the status of the Action Plans and make modifications as necessary. The SCMP will be updated accordingly. It is also recommended that the Action Plans be shared annually with the DCAP partners.