Poultney Mettowee Basin Plan

Prepared in Accordance with 10 V.S.A. § 1253(d), The Vermont Water Quality Standards, The Federal Clean Water Act and CFR 130.6

March, 2005

Vision for the Poultney Mettowee Basin by 2010

Within the next five years, the Poultney Mettowee basin will see an increase in the number of agricultural operators who enroll in federal cost share programs and/or conservation programs that will sustain the working landscape. Related to this will be an increase in the number of non-structural agricultural best management practices (BMPs) in the basin. To support this effort, the Poultney Mettowee Natural Resource Conservation District hopes to expand the Nutrient Management Program for agricultural operators in the basin. Livestock will be fenced out from surface waters on medium and large farm operations throughout the Poultney Mettowee basin by the year 2008. The Poultney Mettowee Watershed Partnership, herein will also be referred to as "the Partnership." It includes federal, state, and local agencies and organizations that make up the Board of Directors. It will increase the linear miles of riparian buffer planting and streambank stabilization practices that will conserve additional riparian areas along the Mettowee riparian corridor and Flower Brook, a tributary to the Mettowee. The Partnership will increase awareness of the benefits of buffers for riparian landowners during this time. The Partners will seek funds to implement the Conservation Reserve Enhancement Program (CREP and CRP) for basin landowners and sign up an additional 300 acres. In response to losses in the working landscape in the Poultney Mettowee basin, the agricultural community would also like to increase access of regional agriculture producers to regional markets. More effort will be made to ensure that old farms are made available to new farmers first through the Land Link Program.

To address the issue of river instability in the Poultney Mettowee basin, the Vermont Department of Environmental Conservation–Rivers Management Program, in close cooperation with the Partnership, will complete Phase 1 geomorphic assessments for each major river system and significant tributaries. Strategically located sites will be selected for restoration and protection based on Phase 1, 2, and 3 geomorphic assessment information. Once project stabilization sites have been identified and designed, project managers will install stable channel design treatments to reduce over-widened reaches of rivers (especially the Mettowee River); stabilize riverbanks; and restore cooler water temperature.

During the next five years, the Vermont Department of Environmental Conservation Rivers Management Program will assist with Phase 1, 2, and 3 geomorphic assessments in sub-basins throughout the watershed to identify conservation reaches and areas of restoration. This will allow river managers to assess fluvial and ecological responses to restoration efforts. Comparisons will then be made with reference and pre-treatment data to assess the success of restorations. Land along riparian corridors will be purchased by a land conservation organization or placed under a conservation easement for river corridor protection.

Implementation of the Poultney Mettowee Basin Plan will reduce nonpoint source pollution by several means, including education and outreach. Within 5 years, the Poultney Mettowee Watershed Partnership will host additional Better Backroads and Vtrans workshops with town highway managers and crews in each major river basin (Poultney, Castleton, Hubbardton, and Mettowee). Town road crews will conduct back road assessments using AOT/ANR Bridge and Culvert protocols. This will target bridges and culverts in need of replacement and/ or repair during the next 10 years.

Urban best management practice workshops will be held for municipal officials and residents in the watershed over the next five years. Towns will work with the Rutland Regional Planning Commission to expand the language in town plans or zoning that promotes increased protection of water resources in each town. Specifically, planners hope to strengthen riparian corridor protection language in town plans and zoning regulations for towns in the Poultney Mettowee Basin. The Partnership will create an outreach and education program for landowners, contractors, and municipalities that are about to embark on construction projects. These programs will cover erosion and sediment control plans, necessary permits, and technical assistance that is available for such projects. To assist towns with stormwater issues, the Department of Environmental Conservation Stormwater Program will assist 10 towns in the basin with development of Multi-Sector General Permit plans.

To improve public awareness regarding water quality conditions in the Poultney Mettowee basin, the Partnership, in cooperation with the University of Vermont's Watershed Alliance and the Vermont Department of Environmental Conservation, will establish a public web-based database of long-term water quality monitoring data on basin waters that provides accurate and timely information. To support this web-based resource, the Partnership will develop an ongoing protocol for processing and notification of water quality sampling results. Partners will increase the number of water quality improvement projects in the Poultney Mettowee Basin funded through Supplemental Environmental Project funds (VTDEC enforcement action and penalties). To promote water quality education and awareness in the Poultney Mettowee basin, the Poultney Mettowee Watershed Partnership will install additional new kiosk signs about water quality issues.

To address the issue of aquatic nuisance species in the basin, the Water Quality Division of the Vermont Department of Environmental Conservation will initiate Exotic Species Watch programs with or through major lake and pond associations.

In summary, the implementation of this Water Quality Management Plan will both protect high quality waters and improve those waters affected by pollution.

THE SPELLING OF METTOWEE VS. METTAWEE VS. METAWEE (SIC)

The Vermont Department of Libraries acknowledges that this debate is long-standing. According to their files, the last correspondence from 1974-75 inquires into the spelling of the name of the river and its valley. The USGS topography maps have listed the spelling with an "a" for more than a century. The fourth report of the US Board of Geographic Names issued in 1916 covering the time period 1890-1916, lists the decision and in parentheses says "(Not Mettowee)". At some time between 1893 and 1941, the US Board of Geographic Names issued a decision which confirmed the spelling with an "a" – Mettawee. At last check, the Vermont Department of Libraries was looking for an actual copy of this decision to see if it includes any source information.

According to USGS, it's spelled with an "a." Mettowee is listed as a variant. However, local knowledge would suggest otherwise. The Poultney Mettowee Watershed Partnership spells Mettowee with an "o;" the Poultney Mettowee Natural Resource Conservation District spells Mettowee with an "o;" and there are nurseries, health care centers, granges, and other businesses that spell it with an "o." In fact, if you drive down Route 30, you'd be hard-pressed to find a spelling with an "a." The Dictionary of American Naval Fighting Ships lists the USS Mettawee (AOG-17) as having been christened from an Indian-named river in Washington County, N.Y. It should be noted that it is very difficult to do exacting research on the origins of names, especially when translated from a Native American language. Due to its local usage, this plan uses the spelling "Mettowee."

Executive Summary

A basin plan provides an overview of the health of water quality and aquatic habitat in a watershed and a description of the ongoing process of basin or watershed planning. In the basin planning process, the Agency of Natural Resources (ANR) engages the public and other agencies in a collaborative effort to maintain and improve surface water quality in the basin.

The basin plan for the Poultney and Mettowee River watersheds addresses the prevalent concerns regarding certain priority surface waters. Local concerns were ranked and strategies developed to address them. In addition, projects were implemented during the planning process. The strategies in the plan will assist groups, agencies, and organizations in deciding where to focus their resources and where to find resources. The plan also includes a proposal for establishing management goals for surface waters.

Sediment and nutrient enrichment are the major causes of the habitat problems along the streams of the watershed (DEC, 1999). The major factors that create sedimentation and nutrient enrichment in the Poultney Mettowee basin include land runoff from several land uses (including agriculture, roadways, residential, and industrial uses), the loss of riparian vegetation, streambank erosion, and municipal wastewater facilities. Thermal modification (i.e., a direct consequence from the loss of riparian vegetation) and pathogens affect the third and fourth greatest number of miles. Streambank destabilization and loss of riparian vegetation are a consequence of historic channel and flood plain management practices to accommodate not only agricultural land use but land development and transportation infrastructure encroachments in riparian areas as well.

Basin planning is one means of addressing water quality and water resource problems. Its effectiveness depends on the willingness of the local community, landowners, and State and federal entities to undertake projects that will enhance or protect water quality. The potential successes are based on the assumption that if given the means, people will work together to resolve problems that they have identified. The planning process facilitates this collaborative effort.

The most prevalent concerns in the community and the strategies for their remediation are outlined in Chapter 4 of this basin plan. The concerns and strategies have been developed through extensive public input. The concerns are listed here in the order that they appear in Chapter 4 of this basin plan:

- Nonpoint Source Pollution
- Stream Channel Adjustment Processes
- Landfills and Salvage Yards
- Pathogens
- Thermal Modification
- Fisheries
- Aquatic Nuisance Species
- Flow and Water Level Fluctuation
- Nutrient Enrichment and Sedimentation
- Loss of the Working Landscape (farm and forestland)
- Public Outreach and Education
- Lakeshore Protection and Recreational Issues

The remediation strategies to address these concerns presented in Chapter 4 are based on work that is either currently underway or will be addressed through programs and projects developed by the Agency of Natural Resources, the Poultney Mettowee Watershed Partnership, and other federal, state, and local partners. Implementation of these strategies will address the greatest sources of impacts to water quality in the basin.

Chapter 5 lists specific waters that the Agency of Natural Resources has identified as having water quality problems. They are either clearly in violation of the Vermont Water Quality Standards or in need of further assessment to determine the degree of the problem. Through the basin planning process, strategies have been developed that leverage existing resources from State and federal agencies and the community to

improve or better understand water quality problems in these specific waters.

Chapter 6 describes the different processes of setting goals for the management of specific surface waters. Once the goals are established, the Agency of Natural Resources will conserve or restore water quality and uses to attain the management goals.

Processes for setting goals can include the designation of water quality classes and management types, warm or cold water fisheries, and Outstanding Resource Waters as well as the determination of existing uses. Once adopted, these goals become part of the Agency's review of activities regulated under State and federal law.

As part of the Agency of Natural Resources' obligations under the Vermont Water Quality Standards, Chapter 6 includes the Agency's proposal to establish new management goals through the reclassification of Class B waters. The Agency's proposal designates Class B waters into management types B1, B2 or B3. The map listed under Appendix C includes waters where goals for surrounding land use in town or government agency plans are compatible with goals for B1 waters. The Agency also proposes B2 designation for all the remaining Class B waters. There are no B3 water management types proposed for the Poultney Mettowee basin.

Within the next five years, the Agency of Natural Resources will focus its efforts on the implementation of this basin plan in collaboration with the community and other State or federal agencies. The next basin plan will document work completed and address any new issues that have emerged.

The "Mettowee" Valley Grange (#373) in Pawlet, Vermont

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An unvegetated stretch of the Mettowee River in Pawlet

WHAT IS A WATERSHED?

A watershed, or basin, is a distinct, topographically defined, land area that drains into a single river, river system, or standing body of water. Because rivers join to become larger rivers, many watersheds may be considered sub-watersheds of larger watersheds. As one would expect, the activities taking place in a watershed play a critical role in the quality of water draining from it. The watershed is a good ecological unit to address water quality management goals because it is based on topography instead of traditional political boundaries. However, it is also for this reason that it poses particular challenges for coordinating action at the local level. All of the water within the Poultney Mettowee Basin drains into Lake Champlain, making the entire basin a component of the larger Lake Champlain Basin. When referring to the state designated major river basin, the plan will refer to the Poultney Mettowee basin. When referring to a specific river and its tributaries, the plan will refer to the watershed, as in the Mettowee River Watershed.

Chapter 1 Introduction

1.1 The Purpose of the Basin Plan and the Basin Planning Process

The basin plan provides an overview of the watershed's health and a description of the ongoing steps to restore and protect waters. In the basin planning process, the Poultney Mettowee Watershed Partnership (PMWP) in cooperation with the Vermont Agency of Natural Resources (ANR) collaborates with the public and other agencies to maintain and improve surface water quality in the basin.

Basin planning is not new to the Poultney Mettowee Watershed. A Comprehensive Water Quality Management Plan was developed for the Poultney Mettowee Basin in 1975. In addition, the Poultney Mettowee Natural Resource Conservation District (PMNRCD) has been engaging in water quality protection activities in the basin since 1940. The Vermont Water Resources Board adopted a management plan for the Lower Poultney River following its designation as an Outstanding Resource Water in 1992. Recently, the Lake Champlain Basin Program's Opportunities for Action has identified water quality problems and developed strategies to address these problems for all priority sub-watersheds of the Lake Champlain Basin, including the Poultney Mettowee watershed. The Poultney Mettowee Basin Assessment Report (DEC, 1999) provides the baseline water quality and aquatic habitat information necessary for the development of this watershed management plan.

The Basin Plan for the Poultney Mettowee Watershed addresses the community's most prevalent concerns regarding surface waters. The basin planning process identifies local concerns regarding water quality, uses, and values. These local concerns were ranked and strategies were developed to assist groups in focusing available funding resources. In addition, projects are also implemented during the planning process.

The Basin Plan fulfills federal and state requirements and includes: a proposal for establishing management goals for surface waters and a public ranking process to identify and restore waters that are in violation, or may be in violation of Vermont Water Quality Standards (Vermont Water Resources Board, 2000). The basin planning process also seeks to identify and provide a framework for the protection of high quality waters.

1.2 Planning on a Watershed Level

The watershed of a river is the entire area that drains into the river either through channelized flow or surface runoff from the surrounding land. A watershed plan considers all contributing sources of surface water to any one waterbody in the watershed.

Collaborative planning to improve or maintain water quality has been conducted at a watershed level since the 1960s. The State has been divided into seventeen basins for this purpose (see Figure 1). Some of the basins include the watershed of more than one major body of water such as in Basin 2, which includes the Poultney and Mettowee River watersheds. In six of the basins, there is only one major river, such as Basin 9 (White River) and its tributaries. The Agency of Natural Resources, also referred to as the Agency, is responsible for preparing basin plans for each of the 17 major river basins and updating them every five years.

1.3 Identifying Water Quality Problems

In Vermont, when water quality contaminants reach unacceptable levels in particular surface waters, those waters no longer support uses that Vermonters understand to be beneficial. The Vermont Water Quality Standards are intended to protect and enhance the quality, character and usefulness of surface waters and to ensure public health in that context (10 V.S.A. § 1250). Beneficial uses range from drinking water and recreation to the support of aquatic biota. At times, with differing preservation efforts for surface waters, diverse multiple uses may be in conflict. The State and local cooperators must seek a balance among conflicting uses while sustaining each use in accordance with the Standards.

Figure 1. Map of 17 Major River Basins in Vermont

Impacts or threats to these protected uses are assessed by the Agency using chemical, physical, and biological data, and best professional judgement. The residents of a basin also provide helpful information to the Agency by identifying problems on individual water bodies or general concerns.

The water quality problems addressed in the basin planning process are based on information from ongoing Agency assessment and monitoring, and on local concerns that are identified during public forums.

1.4 The Planning Process as a Collaborative Effort

Basin planning is conducted with local communities, state and federal governments, and private organizations because Vermont's water quality problems are, for the most part, the result of diffuse runoff from dispersed activities on the land. Such runoff can be generalized and referred to as nonpoint source pollution.

Water quality protection cannot depend on State and Federal regulations to stem the innumerable pollutants. Clean water depends on the interest and voluntary involvement of all residents of the watershed. Vermont already has more than 65 watershed and river groups as well as many local and regional organizations (such as Conservation Districts and Regional Planning Commissions) that have been active in addressing water quality concerns. In the Poultney Mettowee watershed, there are hundreds of landowners working to manage their lands to conserve Vermont's waters. Basin planning can support their efforts by providing technical and financial assistance. Through documentation of community-voiced problems and solutions, funds can be leveraged and resources directed toward the priorities of local communities and landowners.

A fundamental benefit of a collaborative approach is the sharing of information among resource agencies, groups, and individual citizens. In addition, the involvement of the community in identifying problems and solutions increases public awareness of opportunities to promote and preserve water quality in the basin.

1.5 Partners in the Poultney Mettowee River Basin Planning Process

A collaborative process in the Poultney Mettowee Basin began with the work of the Poultney Mettowee Watershed Partnership. The Partnership was formed between the Poultney Mettowee Natural Resources Conservation District in Vermont and the Washington County Soil and Water Conservation District in New York with funding provided by the Lake Champlain Basin Program.

POULTNEY METTOWEE WATERSHED PARTNERSHIP

The Poultney Mettowee Watershed Partnership began in 1998 when the two conservation districts working in the watershed got together with respective planning organizations (the Rutland Regional Planning Commission in Vermont and the Lake George/ Lake Champlain Regional Planning Board in New York) to talk about working together. For years, both districts, while sharing similar goals, had worked independently on opposite sides of the two rivers, which in many places form the boundary between New York and Vermont. With some financial help from the planning commissions and the Lake Champlain Byways Program, some early mailings were sent to stakeholders in the watershed, public forums were conducted, and enough information was gathered to help the districts find common ground for joint projects. An application to the Lake Champlain Basin Program provided the first (and follow-up) year of funding for a watershed coordinator, and the Partnership actively began working as a bi-state program.

The Poultney Mettowee Watershed Partnership is a project of the Poultney Mettowee Natural Resources Conservation District in Vermont and the Washington County Soil and Water Conservation District in New York with funding provided by the Lake Champlain Basin Program. A steering committee, made up of individuals and representatives of many different stakeholder groups in the watershed, will make recommendations to the Conservation Districts for management priorities and on-the-ground project activities. In 2000, the Agency of Natural Resources located a Watershed Coordinator in the Poultney Mettowee Basin to

assist in the basin planning effort. At that time, additional effort was made to expand the Steering Committee to include other stakeholders to make the basin planning process as inclusive and representative as possible.

The mission of the Poultney Mettowee Watershed Partnership is to bring together the efforts of citizens and organizations that share the common vision of conserving, protecting, and enhancing the natural and cultural resources of the watershed.

For a complete list of collaborators in the Poultney Mettowee Watershed Planning Process, please see Appendix G.

The five goals of the Poultney Mettowee Watershed Partnership are:

- To improve water quality.
- To enhance and interpret wildlife populations and habitats and other natural resources.
- Maintain a healthy agricultural based economy while protecting, restoring, and conserving the soil and water resources of agricultural land.
- To educate youth, educators, adults, residents, and visitors about conservation practices and the environment around them.
- To maintain and enhance agriculture-related and nature-based recreation opportunities.

Poultney Mettowee Watershed Partnership

The work of organizations and partnerships such as the Natural Resources Conservation Service, the U.S. Fish and Wildlife Service, The Nature Conservancy and the Poultney Mettowee Watershed Partnership with private landowners should be encouraged and supported. The results of their work include, and will continue to include, stable streambanks, buffers of vegetation along rivers and streams, conservation of agricultural soils, agricultural waste and nutrient management, public education, and the necessary technical assistance and support of the farming community.

1.6 Use of this Plan

The Basin Plan has many uses including:

- It serves as a guidance document for collaborating partners, as well as any individual or group that works on watershed issues.
- It serves as a guide for the Vermont Agency of Natural Resources (and other state and federal agencies) in its effort to protect and improve State waters to the level required by the Vermont Water Quality Standards.
- It serves as the platform for a petition to the Vermont Water Resources Board to classify waters to establish water quality management goals.

Groups will be able to use information in the plan for the following purposes:

- To improve understanding of the watershed and water-based resources.
- To develop project ideas related to water quality or water resource improvements.
- To identify technical or financial resources.
- To identify the technical or financial need of potential partners.
- To support grant proposals.
- To provide guidance to local and regional planning and zoning processes.

Agency programs (described in Appendix B) will use the solutions or strategies in the plan to help guide decisions by the Agency regarding allotment of technical and financial resources. In addition, Agency review of permit applications for potential impacts to water resources is guided by the management goals for State surface waters adopted during the planning process.

It should be emphasized that although the basin planning process is governed by state and federal law and regulation, the process is foremost an organized effort for government agencies to work with local groups and individuals in the basin to restore impaired waters and protect waters of special importance. Together federal, state, and local governments and private organizations and citizens can solve problems, develop action plans, and forge partnerships to conserve and restore water resources in the basin.

Sharp bend in the Mettowee River in Pawlet

Chapter 2 Description of the Poultney Mettowee River Basin

2.1 Physical Description

General Description

The Poultney Mettowee Basin encompasses an area of 373 square miles in portions of Addison, Rutland and Bennington counties. The Poultney River originates in the town of Tinmouth and flows northwesterly into New York State. The Mettowee River originates in the town of Dorset and also flows northwesterly into New York State. Both rivers enter the New York Barge Canal near Whitehall, NY [1].

There are a total of 25 lakes and ponds that are 20 acres and greater within the Vermont portion of the Poultney Mettowee Basin totaling approximately 5,250 acres. The six largest bodies of water in the Poultney Mettowee basin include:

- Lake Bomoseen (2,360 acres)
- Lake St. Catherine (883 acres)
- Lake Hortonia (479 acres)
- Glen Lake (206 acres)
- Sunset Lake (202 acres)
- Little Pond (177 acres).

Poultney River Watershed

The Poultney River drains 236 square miles in Vermont (Figure 2) and is 40 miles long within and along the borders of Vermont. It originates in the town of Tinmouth in the valley between Tinmouth and Spoon Mountains. From its source, the Poultney River flows northerly for about four miles and enters the town of Middletown Springs, from which point it flows westerly to its confluence with South Brook 6.7 miles downstream from its origin.

The Lower Poultney River begins at the Poultney – Fair Haven town line and extends 22 miles to a headwater region of Lake Champlain, referred to as "the elbow. " From Poultney to U.S. Route 4, the river is a winding scenic corridor with undeveloped shorelands. At twenty-two miles in length, the Lower Poultney River has one of the longest segments of natural stream corridor of any stream in Vermont. Canoeing is excellent in this segment, and provides natural habitat for a diversity of plants and animals. Directly north of the Delaware and Hudson Railroad crossing, is an interesting geologic area known as the "Slide – swimming flume". This is a rock outcrop in the streambed, which has had recreational use over the years. It is also a historic area, having been used as a baptismal site by the Seventh Day Adventist Church, formed in 1831 by the prophet William Miller, whose church near the river is on the National Register of Historic Places.

Several other exceptional geological features are found downstream of the "Slide/swimming flume," including "Ranney's Rocks/Mud Turbidites/Boudinage Structure," "Layered Cliffs," "Poultney River Folds/Deep Sea Fan," "Carver Falls," and "Limestone Cliffs." Carver Falls, the highest major falls in Vermont, contain two falls at the head of a limestone gorge. The falls have been altered by hydropower development since 1894. For 100 years before that date, they were harnessed to drive mill operations. The river above the falls lies in a ravine 100 feet deep. Below the falls, the ravine is 200 feet deep. A cave in a limestone cliff above the ravine is located about one mile below the falls. Indian artifacts have been found in the cave, as well as in the vicinity of Carver Falls, and in a field near Hackadam Road. Sunken boats from the War of 1812 can be seen at certain times of the year at the "Elbow" – an area of the river that turns north toward Lake Champlain. These historical artifacts are on the National Register of Historic Places.

In 1991, the Lower Poultney River Committee successfully petitioned the Water Resources Board to designate the Lower Poultney River as an Outstanding Resource Water due to its exceptional natural, cultural and scenic values. Based on this designation, the Vermont Agency of Natural Resources developed a management plan for the Lower Poultney River that established the following goal: "For that portion of the Lower Poultney River within Vermont borders, the State will seek to manage certain activities affecting the water quality, flows, course, current, and cross-section of the Lower Poultney River to preserve and enhance the exceptional natural, cultural, scenic, and recreational values of the river and river corridor (refer to uses and values included in Section III of the *VANR Management Plan for The Lower Poultney River, A Vermont Outstanding Resource*)."[2]

Figure 2. The Poultney River Watershed in VT and NY

1 *Basin 2 Assessment Report,* VT Agency of Natural Resources, 1999

2 *The Lower Poultney River, A Vermont Outstanding Resource,* VT Agency of Natural Resources, 1992

Much of the land bordering the Poultney River is forested or wetlands. The river corridor has a diversity of flora and fauna. The watershed consists of many natural communities including floodplain forests, oak-hickory forest, rich northern hardwood forest, birch-beech-maple forest, emergent marsh, hardwood-cedar swamp, shrub swamp, calcareous outcrop and talus slope. A state-identified deeryard is adjacent to the Poultney River in West Haven. Extensive wetland complexes are adjacent to and are interdependent with the Poultney River in Fair Haven and West Haven: Steves Marsh, Blue Hole, Schoolhouse Marsh, Corroscaden Marsh, Billings and Reed Marshes, Coggman Pond and Cemetery Cedar Swamp. Cemetery Cedar Swamp drains to the Poultney in Fair Haven, between Routes 22A and 4. The Vermont Natural Heritage program lists Cemetery Cedar Swamp as one of the largest cedar wetlands in Vermont. It is an example of a forested-swamp type of wetland and adds many species of flora and fauna to that of the river proper.

The fishery in the Poultney River is diverse; fish surveys have found that two thirds of the fish species in Vermont are found in the Poultney River. The Poultney River is one tributary to Lake Champlain in Vermont that has a Walleye population large enough to be used as an egg source for the Lake Champlain Walleye and Fingerling Project." The lower Poultney River also supports the most diverse native mussel populations than anywhere else in the state.

The Vermont Institute of Natural Science uses the Elbow area for birding trips. Birds sighted here include some that are uncommon nesters in Vermont. The floodplain along the river in West Haven contains the best population of Blue Gray Gnatcatchers in Vermont.

A small gorge, cascades and a swimming hole are located in Lewis Brook in the Town of Poultney. This privately owned site is approximately three miles upstream from the confluence of the brook with the Poultney River, approximately two miles upstream of Cemetery Cedar Swamp.

A deep gorge with a waterfall and cascades at an old mill site in the center of the village of East Poultney has impressive cliffs but is not accessible for swimming. Just upstream of East Poultney, and continuing for approximately one mile, are a series of gorges, waterfalls, pools and cascades. Two or three of these are accessible for swimming. There is a pretty little cascade, waterfall and approximately 20-foot deep gorge in an unnamed tributary to the Poultney River just north of the village of East Poultney. A Vermont Youth Conservation Corps Crew spent a day during the summer of 2001 removing garbage from an illegal dumpsite that was sliding down into the gorge.

Middletown Springs, approximately six miles upstream of the village of East Poultney, is the site of historic mineral springs. The springs were in the middle of the village, at the intersection of the Poultney River and North Brook. A park was developed here at the turn of the century because the springs were popular with tourists. There is only one active spring today that draws an occasional curious tourist. The river is shallow here and only allows wading.

Below the Hubbardton River, the Poultney River flows westerly for 1.8 miles where it is joined by Coggman Creek, which enters from the north.

Coggman Creek is a slow meandering stream with a length of 7.5 miles and a drainage area of 13 square miles. Originating on the flat plateau southwest of the village of Benson in the town of Benson, Coggman Creek flows southwesterly into the town of West Haven, where it turns southerly for the last two miles on its course prior to joining the Poultney River.

Proceeding generally southerly for 6.1 miles, the Poultney River is joined by the Champlain Canal in New York, which enters from the south. From this point, the Poultney River flows northwesterly for two miles to its terminus in Lake Champlain, at South Bay.

Castleton River Watershed

The Castleton River is the largest and most important tributary of the Poultney River, with a length of 20 miles and a drainage area of 99 square miles. The Castleton River is generally a sluggish and meandering stream. The Vermont Natural Heritage Report (2002)

cites the Castleton River as one of the best examples of a moderately sized mountain stream anywhere in the state. It originates on the southeastern slopes of Biddie Knob in the town of Pittsford. It flows southerly through Whipple Hollow, entering the town of West Rutland and proceeds through a large marsh northwest of West Rutland Village. The Castleton River then turns west and flows into the town of Castleton, where at a point 11 miles from its source, it is joined by North Breton Brook from the north. Several other steep gradient, mountain tributaries, such as Gully Brook, join the Castleton River as it travels from east to west along the Route 4 corridor.

Breton Brook, a tributary to the Castleton River in the Town of Castleton, contains a small bathing pool approximately four feet deep below an old mill dam with a few ledges on either side; undeveloped but right next to the road.

The Castleton River proceeds westerly, passing to the north of Castleton Village and south of Castleton Corners and Hydeville. Downstream four miles from North Breton Brook, it is joined from the north by its principal tributary, the Lake Bomoseen outlet stream. Although the length of this stream is only 0.4 miles, it has a drainage area of about 40 square miles, being the terminus of several brooks draining the many lakes and ponds of this area of Rutland County. Below the Lake Bomoseen outlet brook, the Castleton River flows westerly for the final five miles of its course, entering the town of Fair Haven where it passes through Fair Haven Village and joins the Poultney River.

Sucker Brook cascade is a fascinating site located in the Town of Castleton on Sucker Brook. It is described by Jerry Jenkins: "Approaching the cascades from the upstream, there are first a few cascades between three and six feet in height. Then the stream separates into three narrow channels and falls three to four feet, and then these channels unite and there is a steep cascade about 12 feet. Then there is as steep-sided ravine approximately 20 feet deep and 150 feet long, with some nice pools." Below the ravine, the stream enters a swamp. "Before the land was posted, the cascade was a popular recreational area and was used for camping, swimming, picnicking, and parties." [3]

The Mettowee River

Giddings Brook, a stream that enters the northern portion of Lake Bomoseen in the Town of Hubbardton approximately three-quarters mile above the lake, contains pretty cascades, ledges and pots, and is used for swimming.

From its confluence with the Castleton River, the Poultney River flows northerly for three miles into the town of West Haven, to Carver Falls, where it cascades over a total drop of 126 feet. From this point, the Poultney River proceeds westerly for 2.4 miles, where it is joined by the Hubbardton River, which enters from the northeast.

Hubbardton River Watershed

The Hubbardton River has a length of 17 miles and a drainage area of 45 square miles. Flowing generally southerly and southwesterly for its entire course, the Hubbardton River begins at a wetland in the town of Orwell, passes through the town of Benson and into the town of West Haven, to its juncture with the Poultney River. A tributary from Lake Hortonia joins the Hubbardton River in Benson.

Mettowee River Watershed

The Mettowee River has a length of 17 miles within Vermont and has a drainage area within the state of 137 square miles (Figure 3). It originates on the southern slopes of Dorset Mountain near the northern boundary of the Town of Dorset. From its source, the small stream tumbles rapidly down the mountainside, flowing in a southerly direction through Dorset Hollow and westerly onto the valley floor, entering the town of Rupert in East Rupert. In East Rupert, the Mettowee River becomes a slower and more meandering stream. It flows northwesterly through the town of Rupert and into the town of Pawlet. At a point 9.5 miles from its source and adjacent to the village of Pawlet, it is joined by Flower Brook from the east.

Flower Brook is seven miles long and has a drainage area of 19 square miles. This brook begins on the southern slopes of Tinmouth Mountain in the Town of Tinmouth, and flows southerly into the Town of Danby. After passing between Mount Hoag and Dutch

3 The Waterfalls, Cascades, and Gorges of Vermont, VT *Agency of Natural Resources, 1988.*

Hill, Flower Brook flows southwesterly into the town of Pawlet to its confluence with the Mettowee River. Flower Brook is a flashy stream that has had a history of producing minor flooding.

Proceeding west then north from Pawlet Village, the Mettowee River forms a wide "S" loop at Butternut Bend and continues under Vermont Route 153. It passes through a rocky gorge and continues to the point where Wells Brook enters from the northeast, 6.9 miles downstream of Flower Brook.

Wells Brook is the largest tributary to the Mettowee River (Figure 4). This brook, generally flashy upstream of Wells Village, begins in the town of Tinmouth on the western slopes of Tinmouth Mountain. It flows southwesterly to the Wells town line, westerly past the village of Wells, and to a point nine miles from its source. Here it is joined by Mill Brook from the northeast.

Mill Brook is the outlet brook of the Lake St. Catherine chain of lakes. It is two miles long and has a drainage area of 26.5 square miles.

From its confluence with Mill Brook, Wells Brook proceeds southerly into the town of Pawlet, where one mile downstream of Mill Brook, it joins the Mettowee River. Wells Brook has a total length of ten miles and a drainage area (including Mill Brook) of 34 square miles.

Continuing westerly, the Mettowee River enters the State of New York at a point 0.6 mile below Wells Brook, and proceeds to its eventual union with the Champlain Canal south of Whitehall, New York.

Another tributary of the Mettowee River within Vermont is the Indian River, which joins the Mettowee at Granville, New York. The Indian River is generally a meandering stream seven miles long in Vermont. It drains 39 square miles of land within the state. This stream begins at the watershed divide just north of the village of Rupert and proceeds northerly into the town of Pawlet entering New York at West Pawlet Village.

The Mettowee River watershed in Vermont is a little more forested than the Poultney River watershed with 71% of the watershed either deciduous or coniferous forest. The land used for agricultural purposes is about the same –16% of the watershed area. Surface water covers 6% of the Mettowee watershed and wetlands cover 2%. Transportation and other developed land comprise 4%.

Figure 3. The Mettowee River Watershed

A fishing area is located on Mill Brook in Pawlet, at its juncture with the Mettowee River accessible from the Route 140 Bridge west of Blossoms Corners. Approximately one mile south of this juncture is Button Falls on the Mettowee River in Pawlet. The Jenkins Report describes it as a "wide gorge and superb swimming hole with a falls 15-20 feet high," on the south side of Button Falls Road. On the north side of the road, "there is a narrow limey gorge with some fine swimming pools and very handsome rocks." Jenkins rates it as "State significant", in a part of the state where cascades (i.e., waterfalls) are "rare". He also rates it as "significant for good swimming".

A small gorge and cascade is located on Flower Brook, a tributary to the Mettowee River, in the Village of Pawlet. The gorge is an old mill site, with a dam at the upper end, and is spanned by the village general store. The site is presently operated for hydroelectricity, and a penstock bypasses the gorge.

2.2 Land Use

Land use information has been generated through the Vermont Land Cover Classification Project and shows that the Poultney Mettowee basin is predominantly forested with 69% of the watershed area in either deciduous or evergreen forest. A significant portion of the basin land use, 16%, is agriculturally based. Surface water covers about 7% of the basin and wetlands comprise 3%. Transportation and other developed land covers about 5% of the basin.

Agricultural Land

When one thinks of the Poultney Mettowee Basin, one invariably thinks of broad green valleys rimmed with forested hillsides. This image is based on the rural landscape that has developed over decades of agricultural use.

Agriculture gives the watershed its character. It also gives it an economic base, a cultural identity and an environment that combines field, forest, pasture and village. Only 5% of the basin has been developed into roads, homes and businesses.

Of the 373 square miles that make up the Poultney Mettowee Basin, 16% or 38,533 acres, is in agricultural use.

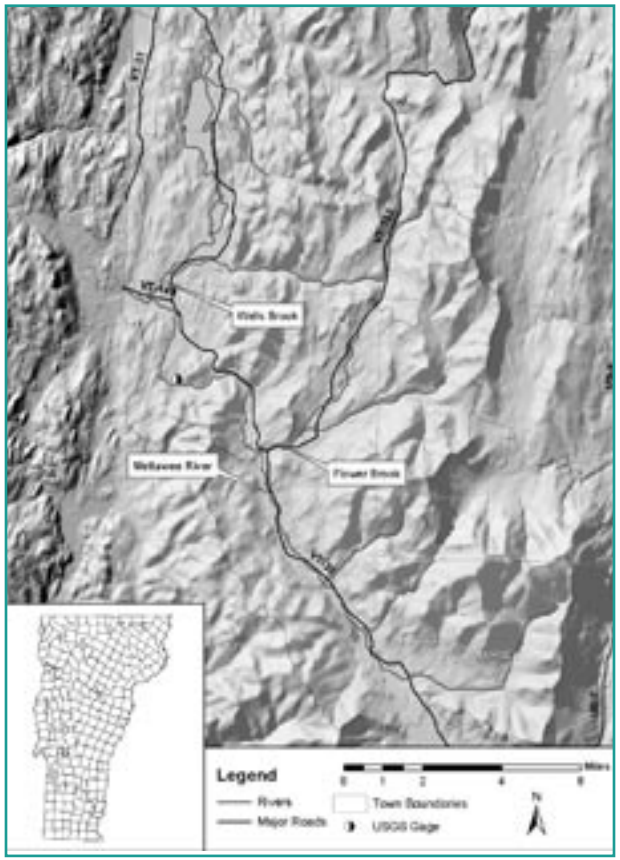

Figure 4. Principal Mettowee Tributaries

This is the second largest land use type in the watershed but is far below the 69% of the land that is in forest (Vermont DEC, 1999). Farms are producing milk and meat as well as apples, eggplant, wool and zucchini. Farm-owned forestland extends farm production into maple syrup and forest products. The most recent data available from 1997 shows a diversity of farm types ranging from dairy and horses to bees, cut flowers and raspberries.

Agriculture also has a large impact on the economy. Agricultural products produced in Rutland County have a market value of over $28 million dollars. Farms spend over $24 million a year, much of it locally, to support production and to pay property taxes.

Agriculture also has an impact on the environment. It is estimated that almost 60 miles of rivers and 80 acres of lake water are adversely affected by agricultural runoff. Excess nutrients, pathogens and sediments all can leave the farm when erosion control methods fail or heavy rains and floods inundate fields. Cropping practices that remove riparian vegetation along the banks leaves them susceptible to erosion leading to sedimentation and elevated stream temperatures.

Agriculture has been an active force in the valley for over 200 years. It is only within the past 30 years that nonpoint source pollution has begun to be addressed. It will take a great deal of time, work and investment on

Lewis Brook in Poultney

the part of Federal, State and local organizations, and farmers, to control the cumulative effects of agricultural practices over two centuries of impact.

Dairy operations and their associated crops are the primary agricultural use in the Poultney Mettowee Basin. Year 2001 Vermont Agency of Agriculture, Food & Markets data shows 153 dairy farms in the watershed, with 81 of these currently in operation. There are eight certified organic farms in the watershed. These farms have a total of 160 acres in hay, 227 acres in pasture, 34 acres

Table 1. Current Status of Agriculture in Rutland County

Rutland County Data	1982	1987	1992	1997
Total # Farms	561	516	493	530
Acres in Farms	166,855	140,177	132,674	125,770
Acres in Cropland	71,090	61,167	57,342	52,797
In # Farms	521	487	459	465
Acres in Pasture	22,501	17,535	15,040	13,041
In # Farms	290	301	272	274

** Data source: 1997 & 1987 Census of Agriculture, USDA*

Through the Vermont Land Trust, the Mettowee Valley Conservation Project has been very effective in conserving agricultural lands in the Poultney Mettowee basin. Very often, land conservation projects take imagination and time. Sometimes a lot of both are needed. In 1989 at the beginning of the Mettowee Valley Conservation Project, VLT purchased and conserved the former Moore Farm at the northwest end of this beautiful farm valley. Fred and Sandy Stone had been leasing the farm since 1972, and were later named "1994 Farmers of the Year" because of the quality of their operation. They wanted to purchase the farm, but because they also wanted to build a new freestall barn and increase their herd size, it was not economical to purchase all the land at once, even with the development rights removed. Therefore, in 1990, the Stones purchased 32 acres with the buildings on the west side of the highway where the new barn was to be built. VLT then entered into a long-term lease-option agreement for the 167 acres on the east side, which included 144 acres of prime agricultural soils. In March 2003 Shorty and Sandy completed their purchase of the additional land. Furthermore, the future affordability of the farm has been insured through an Option to Purchase at Agricultural Value (from the Vermont Land Trust).

It isn't always necessary to pull a farm apart to keep it in operation, but in the case of the Stone's "Stone Broke Farm," that was the best solution. Funding for the original acquisition was provided by the Vermont Housing and Conservation Board, the John Merck Fund, and local contributors. (Courtesy of Vermont Land Trust)

Recently, the Stones have enrolled in federal cost-share programs such as the Wildlife Habitat Enhancement Program and the Conservation Reserve Program to protect the Mettowee River riparian corridor and now have plans to engage in a river channel restoration project, with the assistance of the Poultney Mettowee Natural Resource Conservation District.

Conservation Practices in Place in the Watershed

Of the 81 dairy farms currently in operation in the Poultney Mettowee watershed, 23 have completed or are presently implementing 73 Best Management Practices. Each year between 2 and 8 farms are provided with cost-share funds for BMP implementation. Contributions of Federal and State dollars combine to decrease the cost for the farmer/landowner to as little as 15%.

Before 1996, many improvements were implemented by farmers on their own or with only Federal assistance prior to the State providing additional cost share funds. Since 1996, over $964,000 have been invested in nonpoint source pollution control on farms in the Poultney Mettowee basin. According to the Agency of Agriculture, Food, and Markets, this investment will reduce agriculture's contribution to phosphorus loading in surface waters by 1560 pounds per year once fully implemented throughout the basin. Additionally, these practices will reduce pathogens and assist farmers in better managing nutrients on the farm.

To date, three Federal programs have been used to conserve a total of 396 acres in the Poultney Mettowee Basin. Two USDA-NRCS programs include the Wetland Reserve Program, protecting 137 acres, and the Conservation Reserve Program, conserving 5 acres. The US Fish & Wildlife Service's Partners for Fish & Wildlife Program has fenced 254 acres of streamside land to prevent livestock from damaging streambanks. Another significant conservation program is through the Vermont Land Trust that seeks to provide long-term and perpetual easements on significant farmland. As of spring, 2004, the Vermont Land Trust has conserved approximately 11,000 acres, or 5% of the Poultney Mettowee basin.

Loss of the Working Landscape

While the total number of farms has decreased by 31 (5.5%) between 1982 and 1997, the number of farmed acres has decreased by 27,753 acres. This is a 30% decrease in the agricultural land of the county in only fifteen years. This loss of agricultural land has many implications. Loss of open space to development is evident along Route 30 in Castleton and many other areas.

Development has been shown to have a greater adverse impact on water quality per acre than does agricultural land. The increase in pavement and other impervious areas can increase runoff and carry toxic pollutants into waterways.

Despite these constraints the Poultney Mettowee watershed remains rich in prime agricultural land and maintains a vital agricultural industry. With the exception of Castleton and the lakes region, most areas face little urban development pressure. It is the economics of agriculture that will likely determine the future character of the valley.

Increased development means greater disturbance to soils, greater impact on resources and greater stress on existing farmland to both produce more on less land and to maintain the pastoral nature of the landscape. This becomes increasingly difficult with the concurrent increase in the cost of farming due to higher land costs and higher tax rates. Loss of Vermont's pastoral aesthetic may ultimately have an impact on the State's tourism revenue.

Projecting out another 15 years at the present rate of loss, there will be fewer than 40,000 acres in agriculture in all of Rutland County, which is only 6.7% of the land base of the county. This would dramatically change the cultural and environmental qualities of the valley.

The economic impact of agriculture in the basin is striking. Despite the dramatic decrease in farm acreage, the value of the agricultural products that are sold continues to increase. Dairy products make up 74% of the total value for the County. With total production expenses of $22,350,000, including $1,707,000 in property taxes, agriculture puts a significant amount of money into the local economy.

Trends for the Future

There are currently 81 operating dairy farms in the Poultney Mettowee Basin. Of these farms, 63 do not have waste management systems. At the current construction rate of three waste management systems per year and assuming all 63 farms require waste management systems, it will take approximately $2,087,040 and 21 years to complete implementation. The cost is based on a treatment cost of $320 per animal unit for waste management systems and a need to treat 6,522 animal units on dairy farms. Thirty-nine farms have not yet installed improved barnyards. In order to treat the remaining 3,860 animal units needing this treatment at an average cost of $90 per animal unit, it will cost $347,400.

Participation in these programs is voluntary and not all producers are willing or financially available to invest in BMPs so there may never be full participation. Manure runoff in the basin will never be 100% contained. Storage systems contain wastes produced during the winter spreading ban or when animals are confined. Pasture wastes and spread wastes will always be susceptible to runoff.

If current levels of funding for BMP installation continue, water quality should gradually improve until 2023 when all current operating dairy farms are treated. Levels of phosphorus and nitrogen in surface waters should decrease but might not be fully eliminated. Even greater improvement should come now that nutrient management is a requirement of participation in Federal agriculture programs. Further improvement could take place if the cost share funding programs are refocused on other types of farms and on annual practice implementation such as riparian treatments and buffer installation. An increase in support for these programs would decrease the amount of time it will take to reach maximum nutrient containment providing that each agricultural operation participates in the Nutrient Management Program.

Lack of riparian woody vegetation along streambanks has resulted in streambank failure

Through the Poultney Mettowee Natural Resources Conservation District, the Nutrient Management Program provides on-farm consultation, with the primary goal of working on individual nutrient management plan development while reducing nonpoint source pollution. Nutrient management plans are required on larger farms and on farms participating in Federal and State cost-share programs. A plan involves field and crop histories, soil tests and sampling results, and a detailed plan for use of all on-farm nutrients so as to maximize environmental and financial sustainability.

Forest Land

Rutland County is approximately 596,600 acres of which 82%[5] or 491,800 acres is forested. This is slightly higher than the statewide average of 78%[6] and an increase of 9% from 1983 when Rutland County was 73% forested. These figures represent a drastic change from the agricultural era of the mid 1800's when only 20% of Vermont was forested and our streams and rivers had little protection. Private landowners own 74% of the forestland with public land (federal, state, and municipal) comprising the remaining 26%[7]. In contrast the Poultney Mettowee Basin is approximately 238,720 acres of which 69% is forested. This is approximately 10% below the statewide average.

The three primary forest uses in Rutland County are recreation, wildlife habitat, and timber harvesting. Recreational values are becoming increasingly more important to residents both within and outside the county. Trail networks crisscross the landscape and are used by

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5 Frieswyk, Thomas and Richard Widmann. 2000. Forest Statistics for Vermont: 1983-1997. USDA, Forest Service, Resource Bulletin NE-145.

6 Frieswyk, Thomas and Anne M. Malley. 2000. Forest Statistics for Vermont: 1973-1983. USDA, Forest Service, Resource Bulletin NE-87.

7 A Landowners Guide: Wildlife Habitat Management for Vermont Woodlands. Vermont Department of Fish and Wildlife and Department of Forests, Parks, and Recreation. 1995. Project coordinators: Ronald J. Reagan, Department of Fish and Wildlife and Ginger Anderson, Department of Forest, Parks, and Recreation. 78 p.

"Compare the past with the actual condition of our (river basins) in question, and trace their conversion from forest-crowned hills, luxuriant pasture grounds, and abundant cornfields well watered by springs and fertilizing rivulets, to bald mountain ridges, rocky declivities, and steep earth banks furrowed by deep ravines with beds now dry, now filled by torrents of fluid mud and gravel hurrying down to spread themselves over the plain, and dooming to everlasting bareness the once productive fields. It is evidently a matter of the utmost importance that the public, and especially land owners, be roused to a sense of the dangers to which the indiscriminate clearing of the woods may expose not only future generations, but the very soil itself."

George Perkins Marsh, *Man and Nature; or, Physical Geography as modified by human action* (1864)

Or, more simply…

"The effects of clearing are already perceptible in the comparatively unviolated region of which I am speaking. The rivers which rise in it, flow with diminished currents in dry seasons, and with augmented volumes of water after heavy rains. They bring down much larger quantities of sediment, and the increasing obstructions to navigation."

George Perkins Marsh, *Man and Nature; or, Physical Geography as modified by human action* (1864).

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hikers, hunters, snowmobilers, skiers, horse enthusiasts, mountain bikers, and others. Water based recreation also abounds and benefits from the forested landscape through protection and aesthetics.

Many species of wildlife are found in Rutland County and all of them rely on the forest resource. Deeryards are one type of critical habitat that are identified for protection, along with large, undeveloped areas important for black bear. All species associated with the water resource rely on the forest for water purification, sedimentation control, temperature stability, and nutrient cycling. Several programs are offered through either the State or Federal government that encourage cost-share activities on private land to benefit wildlife and water resources. The discharge of sediment into waters of the State is often controlled through the implementation of the *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont*. Cost-share programs can also assist landowners in constructing proper stream crossings or fixing past destructive practices.

Timber harvesting has occurred on a majority of the land in Rutland County since the early 1700s. Several wood using industries are located in the county and rely on the timber resource that is important to Vermont's economy. Today approximately 20,000 acres is reserved from timber management due to statute or administrative designation. Many more acres are effectively unmanaged due to small size, location within urban areas, or lack of access. Approximately 100,000 acres of forest land in Rutland County is enrolled in the Use Value Appraisal program which give landowners a reduced per acre assessment for managing their forests according to sustainable forestry practices. These landowners are required to manage their land according to a plan that provides for timber harvesting, wildlife habitat, and protection of water quality.

The Vermont Backyard Forest Stewardship Program offers free stewardship assistance to private landowners in Rutland County and surrounding areas with 25 acres or less. It is a collective effort between the Backyard Forestry Program, the Rutland NRCD, and the Poultney Mettowee NRCD. The main objectives of the program are increasing the amount of stewardship on smaller parcels and restoring the connectivity of people and land.

Land fragmentation is an increasing concern in Rutland County. Vermont's Land Use and Development Law (10 VSA § 1973) previously mandated that state approved septic systems were required for any homes being built on ten acres or fewer. Developers subdivided properties into parcels just over ten acres in size to circumvent the permitting process and the expense of designing a septic system that met state guidelines. This, in combination with other factors including a decline in agriculture and the increase in second home construction has helped to create an overall landscape that is a mosaic of streets, homes, intensively managed lawns and gardens, and small fragments of forest around many town centers.

Forest fragmentation has an impact on the quality and quantity of wildlife habitat, reduces the opportunities for forest management, potentially degrades ecological functions including water quality, and reduces recreational opportunities. For example the average home range of a flock of wild turkeys may vary from 1000 to over 4000 acres. When this habitat occurs in an area that is extensively subdivided it can drastically limit the resources needed to continue to be effective turkey habitat. The Vermont Backyard Forest Stewardship Program is a grant-funded program that was started in Rutland County in 2001 to provide technical assistance to this growing number of small landowners in the Poultney Mettowee and Upper Otter Creek Watersheds. By educating landowners on the role that their small parcel plays within the overall landscape we can effectively protect and increase wildlife habitat, protect biodiversity, and increase the flow of sustainable forest resources harvested from small backyard forests. These small forest properties in conjunction with the properties around them are an integral part of the overall landscape. The management activities that occur on these small properties can have a profound impact on the natural communities that constitute the neighboring forests, meadows, streams, and lakes.

Developed Land

Initial economic development and agricultural settlement in the Poultney Mettowee Basin proceeded much as it had and would in western New England and northern New York State during the early 19th century. Rutland County took a leading regional role in the wool-growing industry as far as numbers of sheep raised. Most of the early valley towns in the basins were well suited for this industry. With specialization, farmers became increasingly involved in a cash economy and small commercial and mill villages developed along the major rivers, which served as a primary transportation route. The county, along with the rest of western Vermont, shared in the maximum impact of the Champlain and Erie canals on the state economy. By connecting both Vermont and the Great Lakes to the New York market, the canals lent impetus to the abandonment of wheat cultivation in favor of new agricultural specialties, realigned much county commerce, and allowed early development of the marble industry.[8]

The construction of railroads through the region accelerated the specialization and commercialization of agriculture. Railroads, together with steam-powered technology, spurred the rapid and lucrative exploitation of the stone and wood resources of the region. In the last two decades of the 19th century, the Rutland region became the preeminent industrial county in Vermont. During the 20th century, the Rutland County industrialization and urbanization reached its peak and the stone and wood industry went into decline, removing the underpinnings of related manufacturers and commerce in most of the industrial villages. During the last thirty years Vermont has seen an influx of manufacturing firms, growth in recreation—vacation home industry and significant immigration of people who have either retired or moved from the cities for a better living environment[9]. Growth in tourism has been an important factor in the region, however, an indirect consequence of this trend has been the conversion of smaller farms to residential housing to support the influx of people to the region. Ironically, this might detract from the basis of this growth in tourism.

Today there are several urbanized, or developed municipalities in the watershed that contribute stormwater runoff into surface waters due, in part, to the increase of impervious areas within municipal centers. The roads, houses and parking lots that make up the developed areas cover approximately 6% of the basin. Traditionally, municipal centers were developed adjacent to rivers and lakes, as these surface waters served as primary transportation routes. This is the case with several of municipalities in the Poultney Mettowee Basin. In the Poultney River Watershed, the towns of Castleton, Fair Haven, and Poultney each have developed municipal centers adjacent to the Poultney River. In the Mettowee Watershed, the towns of Dorset, Pawlet, and Granville, New York each have developed areas adjacent to the Mettowee River. The town of Whitehall, New York lies at the confluence of both the Poultney and Mettowee Rivers as they enter Lake Champlain (South Lake B). The developed area has led to reduced water quality when building resulted in the removal of vegetation along the stream corridor, the filling of floodplains and the disposal of untreated runoff from these areas in the river.

The high housing and population growth in some basin towns will alter water quality and aquatic habitat. Unless the rapidly growing towns have strong, clear protection goals and strategies in their town plans and zoning regulations, new development (with the accompanying land changes, soil exposure, encroachment on riparian areas, and increased impervious surfaces) will lead to more environmental threats and impacts. Currently, the plans of the most rapidly growing basin towns address water resource protection but the zoning or land conservation programs that would encourage protection are not yet in place.

2.3 Water-based Resources

The Poultney and Mettowee Rivers, their tributaries, and associated lakes, ponds, and wetlands support aquatic life and habitat and provide recreational opportunities through its fishery, swimming holes, boating, and aes-

8 Rutland Regional Plan. Rutland Regional Planning Commission, November 1999.

9 Rutland Regional Plan. Rutland Regional Planning Commission, November 1999.

thetics. In addition, the surface waters provide drinking water and irrigation supplies. The fundamental purpose of protecting water quality in Vermont is to protect these and other beneficial uses and values of the water. Characteristics of the Poultney Mettowee Basin that support many of these uses include the many different lakes and ponds and the boatable and swimmable sections of major rivers in the basin.

Lakes and Ponds

Of 5,410 lake and pond acres assessed for overall uses, 3,740 acres (69%) meet their designated uses, and 1,670 acres (31%) do not meet their designated uses, or are considered impaired (Table 2).

The majority of the threats and impairments to lakes and ponds in the basin are caused by non-native nuisance aquatic species. The major sources of the nuisance non-native species include boating and recreational activities, which cause their spread to other non-infested lakes.

Other causes of impacts to lakes and ponds include mercury contamination of fish (1,085 acres) and siltation, which threatens 232 acres. The source of mercury is atmospheric deposition, which has resulted in the need for fish consumption advisories. Siltation is from non-point sources, including silviculture, agriculture, land development, road run-off, and other land-disturbing activities.

Existing Uses

All surface waters in Vermont are protected to support uses valued by the public including swimming, boating, and fishing. The degree of protection afforded to these uses in most surface waters is based on the water's management type or class as described in Chapter 6 of the Plan. In particular surface waters, however, some uses are protected absolutely if the Agency of Natural Resources identifies them as existing uses (See Table 7) under the anti-degradation policy of the Vermont Water Quality Standards (VWQS). The continuing objective will be to encourage community involvement in identifying existing uses, Outstanding Resource Waters and proposing new classification and typing for waters in their community.

Table 2. Use Support Status of Basin 2 Lake Acres (as of 1999)

Use	Acres Fully Supporting Uses	Acres with Limited Uses	Acres Partially Supporting Uses	Acres Not Supporting Uses	Acres Not Assessed
Overall Uses	2467	1273	943	727	0
Aesthetics	2749	1910	24	727	0
Aquatic Life Use Support	2643	2016	24	727	0
Agricultural Water Supply	0	0	0	0	5410
Drinking Water Supply	85	0	0	0	0
Fish Consumption	4325	0	1085	0	0
Filtered Water Supply	0	0	0	0	5410
Industrial Water Supply	0	0	0	0	5410
Secondary Contact Uses	3441	1208	34	727	0

Table 2. Use Support Status of Basin 2 Expressed as Acres of Lakes

Lake St. Catherine outlet in Wells

Designated Uses

A designated use, according to Vermont Water Quality Standards (2000), "means any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water as set forth by the Water Resources Board.

Boating

The Poultney River is known for exceptional canoeing from a recreational and naturalist perspective. "The ledges of the upper segment provide challenge to experienced paddlers and the flat water of the lower segment invites paddlers of all skill levels. The boating experience of the entire Poultney River is outstanding due to the long season, visual interest, and exceptional wildness, privacy and naturalness of the river corridor (Jenkins, 1988). Other rivers in the basin, such as the Castleton, Hubbardton, and Mettowee, also provide good paddling and tubing when conditions allow for good flow.

Many of the lakes and ponds in the basin allow all types of boating to occur from Lake Bomoseen (the largest lake wholly contained within the state) that allows large power and sailboats to pristine to pristine ponds that only allow for car-top boats to be launched.

Swimming

Swimming holes are located throughout the Basin in rivers and streams, and there are abundant lakes and ponds

(hence the Lakes Region label). The mainstems of both the Poultney and Mettowee each have large swimming holes with jumping ledges, including Button Falls on the Mettowee and the swimming flume on the Poultney, just upstream of its confluence with the Castleton River. Along the Mettowee River, local residents also use quarry holes as public swimming holes.

The Vermont Department of Forest, Parks and Recreation maintains public beaches at State Parks located on local lakes. None of the other swimming holes or quarries are under any formal management oversight. Some landowners have concerns with liability, vandalism and garbage.

Fish Habitat and Fisheries

There is a wide variety of fish habitats found throughout the basin, from warm water fisheries located in lakes, ponds, and rivers, to cold water fisheries located in high mountain streams and where temperatures allow in valley surface waters. These fishery habitats range from high velocity riffles with cobble substrate to slow moving pools with sand substrate to seasonally flooded wetlands. The fish community of the lower Poultney River holds two thirds of the fish species found in Vermont. The following is by no means a comprehensive description of all fisheries in the basin, but rather a summary of fisheries in major waterbodies.

Poultney River – The headwaters are good habitat for Brook and Brown Trout, below the village of Poultney, which lacks spawning and nursery area. Sparse coverage exists for large fish. Lack of deep holes or riffle areas. Spawning and nursery areas are very good throughout the upper sections of the Poultney. All tributaries feeding into the Poultney above Fair Haven have excellent Brook and Brown Trout spawning and nursery areas. No species of trout have been stocked since 1972. (Note: 1999 Assessment Report notes over 55% of fish species known to Vermont found in the Poultney River). The following list provides a snapshot of fisheries conditions in the Poultney watershed:

- **Beebe Pond** – Supports a warm water fishery.
- **Lake Bomoseen** – Stocked with brown trout annually, supports a great bass fishery, also has northern pike and pan fish.
- **Burr Pond** – Supports a warm water fishery.
- **Glen Lake** – Supports a warm water fishery and is stocked with Rainbow Trout.
- **Lake Hortonia** – Supports largemouth bass, northern pike, and panfish.
- **Hubbardton River and Coggman Creek** – Supports a warm water fishery.
- **Castleton River** – Very good brown trout stream. Good spawning and nursery areas throughout the upper sections of the Castleton. The West Rutland Marsh provides good cover for larger trout. The lower reaches support brown trout while the upper reaches support brook trout.
- **Sunset Lake** – Supports lake and rainbow trout, northern pike and yellow perch.

Mettowee River – The mainstem of the Mettowee River and its tributaries generally support trout (brook, brown, and rainbow). The aquatic habitat and biota closer to the New York border becomes more marginal. The lower section of the river in Vermont runs through long stretches of open agricultural land. This has caused fish kills during periods of extreme high summer temperatures. Temperature data collection and modelling was conducted during the summers of 2000 and 2001 by VTDEC and VT Fish & Wildlife. The Mettowee has been classified as a wild trout stream with a "no-stocking" policy. Fish and Wildlife annual surveys have documented abundant natural reproduction. As of 2001, Vermont Fish & Wildlife has also targeted the Mettowee for special regulations regarding special protected slot limits and protected length limits for fish to be released. The protected size limit for the Mettowee is 10" to 14" with a two fish per day limit, which includes one fish that may be kept above the protected slot size. The following list provides a snapshot of fisheries conditions in the Mettowee watershed:

- **Indian River** – The Indian River experiences very low flow summers, and becomes a "losing stream" along certain reaches during the summer, meaning that the river bed runs dry during these conditions. Abundant natural reproduction occurs, so it has been removed from the stocking list.
- **Lake St. Catherine** – Supports both a cold water trout fishery (rainbow, brown and lake trout) and an excellent warm water fishery. In July of 1997, Vermont State Fisheries Biologists discovered alewives in Lake St. Catherine. State Biologists are concerned that the establishment of this exotic fish species in Vermont waters could prove to be a major threat to native forage and game fish populations.

A new baitfish regulation enacted by the Vermont Fish & Wildlife Board at the recommendation of the Vermont Fish & Wildlife Department is designed to protect native species and is now in effect in Vermont. The Vermont baitfish regulation establishes rules for collecting, importing, possessing, transporting, selling and using baitfish. This new regulation helps address the many risks to native species posed by the misuse of baitfish in Vermont (Vermont Fish and Wildlife, 2002). The movement of existing fish species from one body of water to another and the possibility of exotic fish species becoming established in Vermont are serious threats to high quality fisheries. The new regulation, developed with input from commercial bait dealers, also ensures that using baitfish in an appropriate manner will continue in the future.

Significant Natural Communities and Rare, Threatened and Endangered Species

Strongs Swamp in Benson

The Poultney Mettowee Basin contains a high diversity of natural areas and wildlife species. The river-wetland-forest complexes are abundant and provide extensive edge habitat supporting large numbers and diversity of birds (nesting habitat for some birds and migratory stop-over habitat for others), mammals, reptiles, amphibians, and plant communities. The East Bay floodplain forest along Lake Champlain in the town of West Haven and the Pawlet Sycamore Forest along the Mettowee River are two important examples of floodplain forest communities. Some of the finest wetlands in the state can be found in the Poultney Mettowee basin, including the Lake Bomoseen marshes (the largest aquatic bed marsh in the state), Dorset Marsh (one of three Class One wetlands in the state), West Rutland Marsh, Beaver Meadow, Little Pond in Wells, and Parsons Mill Pond.

The Poultney River watershed encompasses an impressive array of natural communities – floodplain forests, oak hickory forests, rich northern hardwood forest, birch-beech-maple forest, clayplain forest (Hubbardton River), emergent marsh, hardwood cedar swamp, shrub swamp, calcareous outcrop, talus slope and others. The variety of natural community types and level of species diversity in the Poultney River drainage is outstanding on a statewide basis.

Wetland and Water Dependent Wildlife

The Poultney Mettowee Basin supports an array of wildlife species, all of which are dependent on clean water to survive. Some live all or part of their lives near streams, rivers, lakes, and wetlands, using them for habitat, food sources, and travel and dispersal corridors. Wildlife and the landscape that supports them are vital parts of Vermont's rural culture and character. Throughout Vermont's history, plants and animals have provided food, clothing, tools, endless enjoyment, and a spiritual connection to our landscape. For many people, simply knowing that black bears roam the woods of Dorset Mountain in the Mettowee watershed and that bald eagles have been known to catch fish in Lake Bomoseen enhances their quality of life. In fact, results from a 2001 public opinion survey conducted by the U.S. Fish and Wildlife Service, show that Vermont ranked first in the nation as having the highest percentage of residents that actively viewed wildlife (60%). Today, over 240,000 Vermont residents engage in wildlife-associated activities including viewing, hunting, fishing and photography. That's 11% more than ski in Vermont. In 1996, residents and non-residents spent $341 million dollars in Vermont on wildlife-associated activities. A recent survey of Vermont residents found that the protection of fish and wildlife resources, habitats and lands as well as the opportunity to participate in wildlife-related recreation was important to nearly all (97%) of surveyed Vermont residents. This represents a significant contribution to the state's economy and illustrates the strong connection Vermont residents have to the land and its wild inhabitants. Maintaining high quality surface waters is critical to the continued survival and health of the Poultney Mettowee Basin's wildlife.

West Rutland Marsh

The Poultney Mettowee Basin provides a myriad of outstanding wildlife habitats and significant natural communities. The watershed drains some of the most productive uplands and riparian lands in the state. The calcium-enriched soils of the Taconic region provide outstanding agricultural land juxtaposed with a diverse mix of rich northern hardwoods, including significant amounts of high quality, mast-producing tree species. This resulting combination of habitat diversity consistently produces the highest harvests of white-tailed deer and wild turkeys in the state. Other game species such as black bears, grouse and squirrels abound. The Basin also provides extensive acreage of extremely productive wetland habitats, beginning in the uplands with the Class One Dorset Marsh, all the way downstream to the vast, dynamic wetlands complex along Lake Champlain to The Drowned Lands. These wetlands harbor abundant waterfowl, colonial bird species, shorebirds and raptors, along with a wide variety of furbearers, reptiles, amphibians and songbirds. An unusually large number of rare animal species is also found in the Basin, notably, the timber rattlesnake, 5-lined skinks, and numerous fresh water mussel species. The Poultney River is highly productive fishery and has been classed by the State of Vermont as an Outstanding Resource Water.

Irrigation and Animal Watering

Water from the Poultney Mettowee Basin is an important resource to the continuation of agriculture in the Basin. Surface water is used for irrigation and animal

Table 3. Water Withdrawals – in gallons per day

	Surface- water	% of Total	Ground-water	% of Total Acres Irrigated	
All Uses	12,570,000	100%	3,470,000	100%	----
Irrigation	290,000	2.3%	60,000	1.7%	290
Livestock Watering	180,000	1.4%	630,000	18.2%	----

(Lake George watershed area, including Poultney-Mettowee watershed - USGS 1990 Water Use for 0201000-Lake George Basin)

watering. Water withdrawals for these purposes total approximately 1,160,000 gallons per day. The fluctuation for irrigation needs often reflect current meteorologically trends. Potatoes, vegetables, orchards, berries, and nursery stock are all being supported by irrigation. Yet, combined surface water withdrawals for animal watering and irrigation account for only 3.7% of the total surface water withdrawals by all uses.

Between 1992 and 1997, the number of acres under irrigation and the number of farms using irrigation has remained nearly constant.

The Agency of Natural Resources determined that 2001 was the driest year in three decades and drought conditions continued through the summer of 2002. With many private wells and public water systems either out of water or with limited amounts of water, the Agency experienced a delicate balance of conflicting use. Rutland County farmers have solicited the federal Farm Service Agency in the past for financial help to tap water for wells, springs or irrigation. Across the State, 170 farmers had applied for drought relief during 2002. In response, the Farm Service Agency had secured federal funding to help farmers tap water for their herds and crops.

In addition to the 16 Rutland County farms that had applied for those funds in 2002, many more had inquired about assistance. In 1995, 1997 and 1999, Vermont experienced similar droughts. Each was worse than the last because groundwater supplies never had a chance to fully replenish after each dry spell.

State hydrologists indicated that Vermont experienced drought conditions for three consecutive years through 2002, which underscores the importance of water conservation practices. With many private wells and public water systems running out of water or with limited amounts of water during drought conditions, the Agency has sought to educate all Vermonters to use water wisely.

Drinking Water Supplies – Farm*A*Syst and municipal Source Water Assessment Programs

Source Protection Plans are an important part of managing and protecting public ground and surface water supply sources. A Source Protection Plan (SPP) identifies the potential sources of contamination in a specific area, assesses the risks of these potential sources of contamination, describes how to manage the risk from the potential sources of contamination, and discusses how to handle emergencies. In the Poultney Mettowee basin, there are 16 active public water systems, community and non-community, for which Source Water Protection Plans have been developed.

In order to provide for better protection of public health, every public community water system, like municipalities and mobile home parks, is required to have an approved Source Protection Plan under state law. Since 1985, the delineation of Public Water Source Protection Areas (SPA) has been required for all proposed new sources for public community water systems. Since 1992, a water system must have an approved Source Protection Plan (SPP) in order to receive an Operating Permit. Non-transient, non-community public water systems, like schools and factories with their own source of water, are also required to have a Source Protection Plan.

The Source Water Assessment Program (SWAP), a federal requirement, requires the identification of Potential Sources of Contamination and an identification of their risks to Transient, Non-community Public Water Systems (i.e., motels and restaurants with their own source of water), Public Community Water Systems, and Non-transient, Non-Community Public Water Systems. If a Public Water System has an approved Source Protection Plan, the requirements of the Source Water Assessment Program are met. A Water Protection Committee has been formed in the town of Castleton to update the Source Water Protection Plan due to ongoing concerns regarding stormwater contamination of the Source Protection Area (Dewey Field, North Street).

The only designated surface water used for a public drinking water supply in the Poultney Mettowee watershed is Inman Pond in Fair Haven. The number of surface waters used for private drinking water supplies is unknown. Traditionally, many of the seasonal camps located on lakes and ponds withdrew water for drinking, however, this is now the exception, rather than the norm.

Farm-A-Syst is a free, voluntary drinking water protection program offered throughout Vermont by the conservation districts. This program is to help agricultural producers protect their drinking water supplies. In-depth assessments are done of farm wells, operations and site geologic conditions. Water is also sampled and tested for nitrates, herbicides and bacteria. The Farm-A-Syst specialists then work with farm operators to recognize which practices are protecting water quality and which may pose a risk to drinking water. Once areas of concern are addressed, the district specialist works with the landowners to obtain the necessary technical and financial resources to correct problems.

Wetlands

Wetlands protection is gaining momentum in southwestern Vermont. The Lake Bomoseen Marsh that lies within the Poultney River watershed, was recently designated as one of four Class One wetlands (Vermont defini-

tion) in the state.One of the four Class One wetlands (Vermont definition) in Vermont occurs in the Poultney River watershed. The Dorset Marsh, one of the other four Class One wetlands provides the drainage between the Battenkill and Mettowee River watersheds. Wetlands are usually associated with riparian areas and forested areas. Other wetland conservation efforts are underway in the West Rutland Marsh and Loves Marsh in the Poultney Mettowee Basin.

Farming wetlands or draining wetlands for agriculture is not a significant problem in Bennington and Rutland counties. Drainage, filling, and fragmentation are more of an issue associated with development and road construction.

There is still a general lack of understanding by the public of the important functions and values of wetlands. The wildlife habitat values of wetlands are better understood and appreciated than others. Education and outreach conducted by conservation districts and other partners would educate citizens as to the value of wetlands to reduce flooding, filter nutrients, and recharge ground water. Several federal programs are available for landowners use to enhance or protect wetlands including: WRP (Wetlands Reserve Program), WHIP (Wildlife Habitat Incentives Program), CRP (Conservation Reserve Program), and Partners for Fish and Wildlife Program. The Vermont Land Trust, a nonprofit conservation organization, has also been very successful at protecting wetlands in Vermont, and specifically for the Mettowee Valley Conservation Project.

Canoeists on the Lower Poultney River

Chapter 3 Water Quality Conditions and Initiatives in the Basin

3.1 General Water Quality Conditions in the Poultney Mettowee Basin

The following assessments and reports were used for the development of this water quality management plan for the Poultney Mettowee watershed:

- Poultney Mettowee Watershed Partnership Public Attitudes Survey (Packer, 2002)
- Poultney Mettawee Watershed Water Quality and Aquatic Habitat Assessment Report (VTDEC, 1999)
- A Classification of the Aquatic Communities of Vermont (VTDEC, 1998)
- Vermont's Natural Heritage: Conserving Biological Diversity (Thompson, 2002)
- Poultney River Riparian Habitat and Geomorphic Assessment (TNC, 2001)
- Hubbardton River Restoration Project – (EPA Freshwater Initiative, 2001)
- Mettowee River and Flower Brook Geomorphic Assessment (Field, 2002)
- Lake Champlain Phosphorus TMDL (VTDEC, 2002)
- "Opportunities for Action", Lake Champlain Basin Program (2002)

Surface water conditions in the Poultney Mettowee Basin are generally good. In fact, the Vermont Natural Heritage Report (Thompson, 2002) identifies the Castleton River, Hubbardton River, the Lower Poultney River, Flower Brook, and a few lakes and ponds in the basin as priorities for conservation, because they represent a best existing example of the various class types for a particular region of state (Thompson, 2002).

The two greatest causes of impairments and threats to rivers and streams in the Poultney Mettowee Basin are nutrients and sediments from nonpoint source pollution according to the Poultney Mettowee Watershed Water Quality and Aquatic Habitat Assessment Report (1999). Temperature increases, pathogens, and metals are also having an impact on watershed rivers and streams. The sources of these pollutants include agricultural activities, streambank destabilization, riparian vegetation removal, municipal wastewater treatment facilities, land development and landfills.

The Poultney and Mettowee River watersheds still have a relatively high percentage (16% each) of land in agriculture. In some areas, where agricultural activities have occurred in close proximity to rivers and streams, there has been a loss of riparian vegetation and nutrients and other pollutants are more likely to reach the waters with storm runoff. Streambank destabilization and loss of riparian vegetation are a consequence of agricultural land use, transportation infrastructure, and land development encroaching on riparian areas. Along many streambanks adjacent to crop and pasture land, however, buffers are being left to grow or are actively being replanted. In the future, as more farmers implement Best Management Practices (BMPs) and participate in programs sponsored by the Natural Resources Conservation Service and U. S. Fish and Wildlife (Partners for Fish and Wildlife), more buffers will be established. As riparian vegetation grows and matures, assessments will likely find there to be less of a threat to waters related to agricultural activities.

Atmospheric transport and deposition of mercury and the incorporation of mercury into the food chain is an issue in this basin as in other basins in Vermont. This is especially problematic in the lakes' food webs but is also an issue affecting walleye taken from the lower reaches of the Poultney. The issue unfortunately cannot be addressed solely on the state level. Vermont did enact legislation requiring the labeling of all mercury-containing products as well as recycling of mercury in those products by the manufacturers, however, portions of this legislation are currently being challenged in court. Serious reduction of mercury releases and eventually mercury impacts, however, will require the influence and involvement of the federal agencies.

Nonpoint Source Pollution

Similar to other areas of Vermont, nonpoint source pollution is the major source of water use impairment to surface waters in the Poultney and Mettowee river basins. Unlike point source pollution, such as a direct discharge or outfall pipe, nonpoint source pollution is more diffuse, harder to quantify and more difficult to control. Examples of these are runoff from parking lots, back roads, fertilized lawns, and runoff from agricultural fields. It has been well documented that urban and suburban nonpoint sources contribute more phosphorus and sediment per acre than runoff from the working landscape. Urban land covers only a small portion of the Champlain Basin, yet it produces approximately 37% of the average annual nonpoint source phosphorus load to Lake Champlain – much more phosphorus per unit area than either agricultural or forested land (Hegman et al., 1999). To a large extent, nonpoint source pollution control and nonpoint source pollution prevention focuses on the watershed approach, land use and land management.

Portions of the Poultney and Mettowee Rivers and their tributaries have been listed as "impaired" due to agricultural nonpoint source pollution. Agricultural waste (manure) runoff is the largest overall contributor to water quality impairment, contributing approximately

Undersized bridge constricts water and sediment conveyance

55% of the nonpoint source pollution phosphorus loads to Lake Champlain (Lake Champlain Basin Program, Opportunities for Action, Draft, October 2001). The Lake Champlain Basin Program (2000) estimates that there are approximately 323 miles of streams bordered by agricultural land in the Vermont portion of the Lake Champlain Basin that are in need of riparian buffer installation and/ or streambank repair.

It is clear through this study and other sources that addressing nonpoint sources of pollution is critical to future watershed restoration efforts in these impaired waters.

Fluvial Geomorphology and Stream Channel Adjustment Processes

Fluvial (water) geo (earth) morphology (land shape) explains the physical processes and describes the shape and form of the river system within a particular landscape setting. There are several reasons for conducting geomorphic assessments of rivers. Three primary assessment objectives are the identification of stream condition (as compared to a reference stream of the same type); the stage of adjustment process, or physical change (if any) underway in the channel; and the sensitivity of the valley, floodplain, and channel to human or natural changes. The term "in adjustment" is used to describe a river that is undergoing change in its channel form outside the range of natural variability. The Vermont Department of Environmental Conservation, Rivers Management Program has developed fluvial geomorphic assessment protocols for conducting assessments of rivers and streams in Vermont.

A geomorphically "stable" or balanced river channel is one that maintains a predictable form over time. This balanced form is governed by the watershed inputs of water and sediment, climate, and the physical attributes of the watershed and valley setting including soils, hydrology, land use, and valley confinement. Flooding is a natural phenomenon that in many areas greatly conflicts with human land use. For this reason, rivers and flood plains have been extensively modified in an attempt to reduce such conflicts thereby forcing the fluvial system to be out of balance. Flood and erosion damages have been exacerbated as the fluvial systems seek to re-establish a geomorphically balanced condition.

The fluvial geomorphic adjustments that occur in response to disturbance are part of a predictable process that often results in conflicts with human investments along riparian corridors such as roads, bridges and culverts, railroads, agricultural lands, and residential and commercial structures. As these conflicts build, traditional channel management activities contribute to a vicious cycle of ever-increasing conflict and instability. Similarly, existing flood plain management mechanisms inadequately protect against encroachments that directly or indirectly lead to greater channel instability and increased magnitude of sediment discharge.

Thermal Modification

Thermal modification occurs when a wooded riparian buffer is lost or removed and the associated shade which allows the sun to increase water temperatures. Temperature is a primary regulator of biological activi-

Table 4. The six most prevalent sources of surface water quality problems in Basin 2

Water Quality Concern	Sources (Randomly listed)	High Impact (miles)	Moderate or Slight Impacts (mi.)	Total Impacts (miles)	Potential Threats (miles)
Sedimentation	Streambank de-stabilization, Road maintenance and runoff, Agriculture, Channelization, Dredging, and Land development	0.5	14.0	14.5	53.2
Nutrients	Streambank de-stabilization, Agriculture, Land development	—	15.4	15.4	46.0
Temperature	Loss of riparian vegetation, Streambank de-stabilization, Road maintenance, Agricultural land use, Channelization, and Land development	8.2	5.2	13.4	35.3
Pathogens	Developed land use, Agriculture, Waste water treatment plants	2.0	5.8	7.8	24.5
Metals	Landfill leachate, Urban (stormwater) runoff, Atmospheric deposition	10.6	—	10.6	—
Flow alteration	Impoundments (dams, hydro facilities), water withdrawals	—	10.4	10.4	—

ties and an increase in the temperature regime of small streams may have an adverse impact on fish populations by increasing their rate of metabolism while, at the same time, reducing the amount of dissolved oxygen in the water. Elevated water temperatures may, therefore, reduce the vigor of cold-water species and make them more susceptible to disease or parasites, such as whirling disease that affects trout populations in the Mettowee. Small headwater streams are most likely to be affected by the clearing of streamside vegetation.

Riparian cover is recognized as an essential component of trout habitat (VT Fish & Wildlife, 2001). It is defined as areas where fish can find shelter to rest and seek refuge from predators. In steams, cover can take many forms, including water depth, surface turbulence, coarse substrate (i.e., cobble and boulders), undercut streambanks, aquatic and overhanging riparian vegetation, woody debris (i.e., log snags and roots), and any other structures that provide fish with a secure place to evade threats or conserve energy. A stream or river lacking adequate cover, even though all other habitat requirements (water quality, temperature, food, and spawning areas) are met, is a poor place for trout to live over the long term and usually will be reflected by lower population densities. Adult Brown Trout are very dependent on the presence of cover and are largely confined to it unless spawning or feeding (VT Fish & Wildlife, 2001).

Temperature is one of the most important factors in limiting trout abundance. Directly related to temperature is dissolved oxygen. As temperature increases, dissolved oxygen levels decrease. Because trout require high oxygen levels, they require low temperatures. Once temperatures have reached the low 70s F, the amount of dissolved oxygen is low enough to drive trout out of marginal waters and into coldwater refuges, such as deep holes or groundwater seeps. They may stay in these protected enclaves as long as water temperatures remain high. Over prolonged periods, fish kills can occur.

Water temperatures may increase during certain stages of an adjustment process, when widening of the active channel occurs. Water temperatures may also be elevated along channelized reaches within which there exists little, if any, diversity of bed features. The channel may be primarily described as a continuous riffle or plane bed; lacking the deep runs and pools that contribute to a lower temperature regime. This scenario is evident along several mainstem reaches of the Mettowee River.

Pathogens

Pathogens are any disease-causing organism, including bacteria, viruses, and protozoa. The pathogens that are of concern in Vermont surface waters are those that come from fecal matter of humans and other warm-blooded animals. These pathogens cause gastrointestinal problems and become a more serious health risk to people who have weakened immune systems. Surface waters containing this waste pose a risk to human health when ingested through drinking water or inadvertent ingestion through contact recreation.

In surface waters, the most likely source of human waste or sewage is from a malfunctioning wastewater treatment plant or septic system. Sources of animal waste are highest in urban and agricultural areas. Wildlife that resides in the water, such as beaver and waterfowl, can also contribute pathogens.

The primary indicator of fecal material in water used in most freshwater monitoring efforts is *Escherichia coli (E. coli)*. The presence of *E. coli* indicates that there may be pathogens in the water that may make humans sick, but it is not an actual measurement of those pathogens. Vermont has adopted a water quality standard for *E. coli* bacteria for Class B waters that is more restrictive than EPA's standard. Vermont's Class B standard is 77 *E. coli*/100 ml in a single sample. For a variety of reasons, the restrictive nature of Vermont's present standard may be ineffective for assessing the actual risks to swimmers and determining where bacterial pollution is a real issue.

Fisheries

Aquatic Habitat

It is expected that by addressing the sedimentation and thermal pollution problems in the Mettowee, cold-water fisheries habitat will be improved. Fisheries habitat, especially walleye spawning areas, will be improved in the lower Poultney River, just above its mouth at Lake Champlain, by reducing sedimentation in the Hubbardton River. In addition, there should be a corresponding increase in wildlife, which uses forested riparian zones. USDA-NRCS and US Fish and Wildlife Service, Partners for Fish and Wildlife Program have considerable data on the most impaired reaches and also have prepared preliminary designs for planting and fencing. These agencies have also begun working with farmers in the Hubbardton River basin on barnyard improvements.

Whirling Disease

Earlier in 2003, the state of New York discovered whirling disease in its portion of the Batten Kill, a river long famous for its high quality trout fishing. Vermont Fish & Wildlife Department staff recently conducted preliminary tests that revealed the presence of whirling disease in Vermont's section of the Batten Kill. This is of special concern to anglers in the Mettowee River basin given the proximity of the Batten Kill to the Mettowee River.

Whirling disease is a potentially fatal disease affecting trout that is caused by a microscopic parasite. The parasite has a two-host life cycle involving trout and a common bottom-dwelling tubifex worm. The spore stage of the whirling disease parasite is extremely persistent and easily spread.

Whirling disease has led to major declines in several western states' trout populations. Symptoms of the disease are skeletal deformities and a blackening coloration of the tail area of the fish. Some infected fish exhibit a whirling motion when swimming, caused by damage to their cartilage and central nervous system. Young rainbow trout are at greatest risk, and other trout species can also suffer effects from the disease. Once trout reach three to four inches in length, cartilage forms into bone and the fish may carry the parasite, not showing any visible symptoms, but still be capable of passing it on when they die.

The disease is spread from one area to another mainly through the movement of infected fish or fish parts. Mud containing whirling disease spores may also be a vector. Fish-eating birds are suspected of spreading the parasite causing the disease through their feces. People also have the potential to spread the parasite when moving infected equipment such as boats, boat trailers, fishing tackle and waders from one body of water to another.

Alewives

Lake St. Catherine supports a coldwater trout fishery (Rainbow, Brown and Lake Trout) and an excellent warm water fishery. In July of 1997, Vermont State Fisheries Biologists discovered alewives in the lake. State Biologists are concerned that the establishment of this exotic fish species in Vermont waters could prove to be a major threat to native forage and game fish populations. The threats posed by the alewives are not limited to Lake St. Catherine. Water from Lake St. Catherine flows into Little Pond and over a dam into Mill Brook. Mill Brook enters the Mettowee River, which empties into the Barge Canal and then southern Lake Champlain. The implications of alewives becoming established in Lake Champlain are serious. The multi-million dollar Salmonid Restoration Program run by Vermont, New York, and the U.S. Fish & Wildlife Service could be in jeopardy. Direct competition from alewives could negatively impact native fish communities including smelt, yellow perch, and other important forage fish that game fish populations such as trout, salmon, and bass depend on. An investigational report on potential alternatives to managing alewives is anticipated from the Vermont Department of Fish and Wildlife (Spring 2004).

The Vermont Department of Fish and Wildlife is currently considering various management alternatives to deal with the alewife issue in Lake St. Catherine. The objectives of these alternatives are to minimize or eliminate the risk of spread of the alewife from Lake St. Catherine to other Vermont waters. It must be understood that a final decision on one specific management alternative will not be made until the Vermont Department of Fish and Wildlife has undergone a series of public scoping meetings to gather public opinion and comment. The Department will then seriously consider these opinions and comments before a final decision is made and actions are initiated to deal with the problem. With that, the potential management actions are:

- No Action.

This alternative would result in the Department of Fish and Wildlife taking no steps to prevent the spread of alewives from Lake St. Catherine to other Vermont waters.

- Population Reduction.

The risk of alewives spreading from Lake St. Catherine could be somewhat minimized by reducing their abundance in the lake. This might be accomplished by several methods. First, a predator fish such as brown trout, that would feed predominately on alewives, could be stocked into Lake St. Catherine. The predation pressure might keep the alewife population low enough that the risk of spread is minimal. Second, an aggressive netting project by the Department of Fish and Wildlife at specific times of the year when alewives are more vulnerable might have the same result.

- Alewife Containment.

The risk of alewives spreading downstream over the dam on Little Pond and eventually reaching Lake Champlain could be minimized by the construction of some kind of containment barrier on the channel leading from Little Pond to the dam. The barrier could be one of 3 different types: acoustic, electrical, or physical. Essentially, these barriers would block the movement of alewives downstream from the lake, reducing the chances that they would escape and spread to Lake Champlain.

- Reclamation.

Reclamation is a commonly used practice in North America to eliminate the threat that unwanted fish species pose to native aquatic ecosystems. When a lake is "reclaimed," it is chemically treated with a piscicide (a chemical that targets fish, much like herbicides target weeds and insecticides target insects) that kills all fish

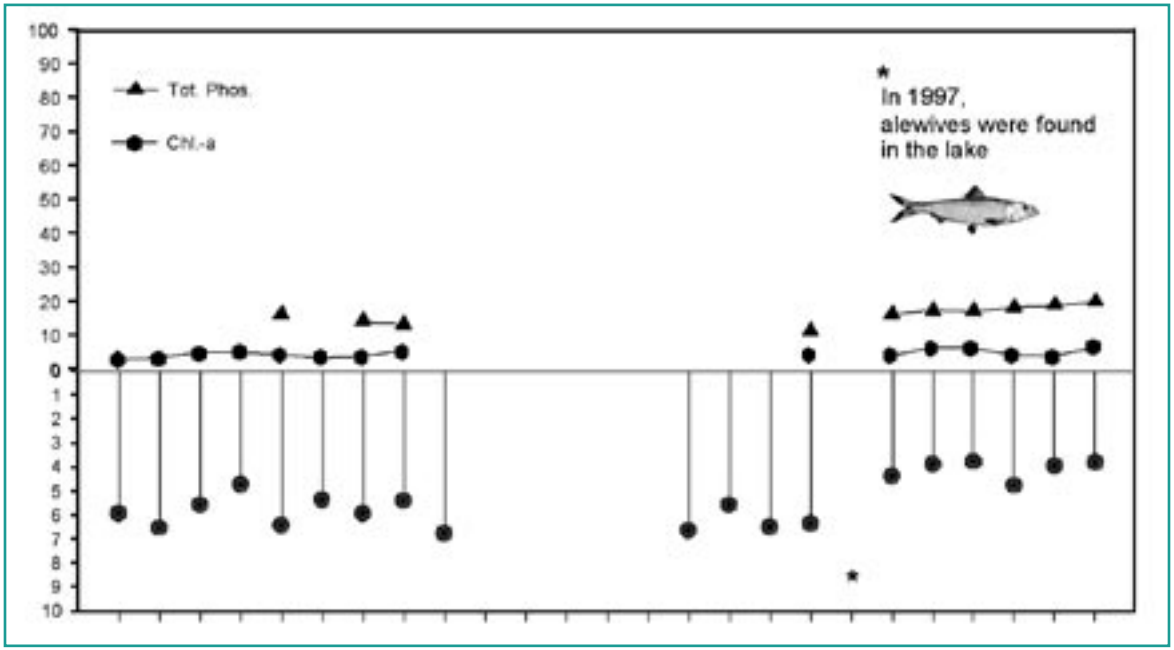

Figure 5. Lake St. Catherine Lay Monitoring Graph

species within a lake. If this option was chosen, all species of fish in Lake St. Catherine, including alewives, would be killed off. Shortly after this, the native fish species would be restocked using individuals from nearby lakes.

Mercury Contamination

In the atmosphere, mercury undergoes a wide variety of chemical transformations, eventually settling to the landscape as mercury attached to particulate matter such as soot. Once on the ground, mercury migrates through watersheds, arriving eventually into receiving waters (e.g. wetlands and lakes). Mercury that is moving through watersheds is subject to myriad chemical transformations, and these are often biologically mediated. The most important of these biological transformations is the generation of methyl-mercury (meHg). MeHg is a highly toxic form of mercury, which is easily assimilated into tiny planktonic organisms at the base of aquatic food chains. Through the processes of biomagnification, minute concentrations of meHg are passed up food chains, increasing to levels which pose a significant threat to those organisms which feed at the top of the aquatic food web. Organisms which are at risk of meHg exposure include top-level carnivorous fish such as walleye, fish-eating birds such as eagles and loons, and, of course, humans. It is noteworthy that some fish species are better at getting rid of their meHg burden than others, which is why the DOH advisories are species-specific. In addition, certain lakes appear to have conditions that result in more efficient transfer of methylmercury up the food chains. This is why the DOH advisories identify a select few waterbodies as having particularly elevated fish-tissue mercury concentrations, and where eating resident fish therefore carries a greater level of risk. Based on research that DEC has just recently completed, the DOH advisories are being modified to become more lake specific. DEC has identified the following factors as being associated with increased tissue mercury levels: lake acidity (natural or otherwise) and the levels of tannins in the water; presence of nearshore and upstream wetlands; water level fluctuation; and the rate at which the lake is flushed on an annual basis.

Mercury is the fourth largest cause of impairment to basin waters. The source is atmospheric transport of mercury from coal power plants in the midwestern United States into surface waters where it gets into the aquatic food chain. There is a fish consumption advisory for walleye in the lower part of the Poultney River due to the amount of mercury in the fish tissue. This advisory suggests no consumption for women of child-bearing age and children age 6 and under. There is also a statewide advisory restricting the number of meals per month that applies to "all other fish" (other than the six species with specific advisories) due to mercury (VTDEC, 1999).

Aquatic Nuisance Species

The majority of the threats and impairments to lakes and ponds in the basin are caused by non-native nuisance aquatic species. The Poultney and Mettowee Basin has the highest concentration of lakes with dense populations of Eurasian watermilfoil statewide. Lakes St. Catherine and Hortonia as well as Burr Pond have the most use-limiting and difficult milfoil infestations of any in Vermont. A chemical herbicide has been applied to Lake Hortonia, Burr Pond, and now Beebe Lake to control milfoil. A permit to apply herbicides to Lake St. Catherine has now been issued to the Lake St. Catherine Association (as of Spring 2004). However, there are many other methods used for controlling Eurasian watermilfoil on lakes and ponds in the Poultney Mettowee basin, including hand-pulling, the use of bottom barriers, mechanical harvesting, and biological controls. Adequate resources are a significant limiting factor to Eurasian watermilfoil management within the basin and elsewhere in the state as recreational activities continue to spread it. These aquatic species have an impact on a total of 1,332 acres in the basin, and include:

Table 5. Waters appearing below are waters altered by exotic species. These are priority waters for management action. This reflects the status as

Waterbody ID	Segment Name/ Description	Use(s) Affected	Surface Water Quality Problem	Current Status/Management or Control Activity
VT02-01	Discrete areas of lower Poultney	Aesthetics (AES), Aquatic Life Support (ALS), Contact Recreation (CR), Secondary Contact Recreation (2CR)	Water chestnut infestation	Handpulling (1998-01) BY TNC
VT02-01L01	Coggman Pond (West Haven)	AES, ALS, CR, 2CR AES, ALS, CR, 2CR	Locally abundant Eurasian watermilfoil growth Locally abundant water chestnut growth	No control activities Confirmed population in 1998; VTDEC/TNC Handpulling (1998-2001)
VT02-02L06	Black Pond (Hubbardton)	AES, ALS, CR, 2CR	Locally abundant Eurasian watermilfoil growth	weevil present; weevil augmentation (1997-2000)
VT02-02L07	Mill Pond (Parsons Mill Pond) (Benson)	AES, ALS, CR, 2CR	Locally abundant water chestnut and Eurasasian watermilfoil growth	VTDEC and TNC handpulling ongoing

Waterbody ID	Segment Name/ Description	Use(s) Impacted	Surface Water Quality Problem	Current Status/Management or Control Activity
VT02-03L02	Beebe Pond (Hubbardton)	AES, ALS, CR, 2CR	Locally abundant Eurasian watermilfoil growth	Weevil present; sonar permit application rec'd Fall 2001
VT02-03L05	Lake Bomoseen	AES, ALS, CR, 2CR	Dense Eurasian watermilfoil growth in most shoreline areas	Weevil present; weevil augmentation (93, 94,97 and 2001 milfoil declines of unknown cause
VT02-03L05	Lake Bomoseen	ALS, CR	Zebra mussel infestation	ZM population discovered in 19 99; population increasing; first water intake line clogged in 2001
VT02-03L06	Glen Lake (Castleton)	AES, ALS, CR, 2CR	Locally abundant Eurasian watermilfoil growth	Weevil present; noted natural milfoil decline 1992; wqd weevil harvest in 1999-2001
VT02-05L01	Lily Pond (Poultney)	AES, ALS, CR, 2CR	Locally abundant Eurasian watermilfoil growth	Weevil present; ongoing limited milfoil harv; sonar permit application received fall 2001
VT02-05L02	Little Pond (Wells)	AES, ALS, CR, 2CR	Dense Eurasian watermilfoil growth in most shoreline areas	Weevil present; ongoing milfoil harvest-sonar permit application received Fall 2001
VT02-05L03	Lake St. Catherine (Wells)	AES, ALS	Alewives	Alewives confirmed in 1997; VT Dept of Fish and Wildlife control alternatives report
VT02-05L03	Lake St Catherine (Wells)	AES, ALS, CR, 2CR	Dense Eurasian watermilfoil growth in most shoreline areas	Weevil present; ongoing milfoil harvest-sonar permit application received Fall 2001

Table 5: Waters altered by exotic species in the Poultney Mettowee Basin (2001)

Of most concern in the Poultney Mettowee basin, these aquatic nuisance species infest lakes and ponds:

- Eurasian watermilfoil – the most problematic. This infests the largest number of acres of lakes in the Poultney Mettowee Basin, and the largest number of lakes of any basin in the state. Lake Bomoseen, Beebe Pond, Burr Pond, Lake Hortonia, and the Lake St. Catherine chain have particularly severe infestations.
- Water chestnut – exists in several ponds and wetlands in the basin. The proximity of water chestnut infested areas of Lake Champlain makes this a continuous threat. Water chestnut has been found in Lake Bomoseen and removed.
- Zebra mussels – reproducing adults are now found in Lake Bomoseen and veligers have been discovered in Lake Hortonia.

The major cause of the spread of nuisance non-native species from one lake to another is by boats that have not been adequately cleaned.

Watermilfoil spread prevention is underway on several lakes and ponds in the basin. The Poultney Mettowee Watershed Partnership has assisted with education and outreach for spread prevention by the Burr Pond and Lake St. Catherine Associations. The Vermont Department of Environmental Conservation has provided technical assistance and grants-in-aid to the Lake Bomoseen Association, Beebe Lake Association, Lake Hortonia Association, Burr Pond Association, Sunrise-Sunset-Perch Property Owners Association, Lake St. Catherine Association as well as other smaller pond owners to control the spread of this aquatic nuisance species within the lake and to nearby waters.

In response to a request from the Burr Pond Association, the Poultney Mettowee Watershed Partnership has agreed to pursue education and outreach opportunities for the Burr Pond Association. Specifically, the Partnership will look into additional signage regarding invasive species that could be erected at the Fish and Wildlife access, as part of the Lake Champlain Byways project. The Aquatic Nuisance Species Program of VTDEC (2003) indicates that Eurasian watermilfoil density in Burr Pond is "heavy." The Burr Pond Association as well as the Lake Hortonia Association have recently submitted an application to re-treat Eurasian watermilfoil with Sonar A.S. The Lake St. Catherine Association is now permitted by the state

for the use of Sonar A.S. to treat watermilfoil once during the period between 2004 and 2006. The Beebe Lake Property Owners Association contracted to have Beebe Lake treated with Sonar A.S. during 2003.

Flow and Water-Level Regulation

Dams and hydroelectric operations change the physical, ecological and social characteristics of a river. Dams have multiple effects on rivers and riverine habitat. These changes range from a minor alteration of depth and velocity in the case of low-head, run-of-the-river dams, to a complete change from river to lake characteristics in the case of large dams. Dams can flood upstream habitat and act as barriers to upstream and downstream movement of aquatic organisms. Operations alter the natural flow regime in a way that can reduce downstream habitat quality and quantity. In addition to channel adjustments that may affect the structure of in-stream habitat, additional flow diversion from the bypassed reach of the stream can expose streambed substrates, effectively reducing the amount of habitat area available for aquatic organisms. In high-gradient streams, cobble and gravel substrates in riffles are exposed; in low-gradient streams, the decrease in water level exposes logs and snags and lowers the water away from the near-bank cover, thereby reducing available habitat.

The Carver Falls hydroelectric facility (Dam) on the Poultney River has gone to a run-of-river operation from a daily peaking operation under the New York State issued 401 and FERC license which should enhance the management efforts for the Lower Poultney River. Low or fluctuating flows below the Carvers Fall dam has been eliminated as a result. However, the recent switch to a "run of the river" operation could potentially accelerate erosion of the high banks. The owner, Central Vermont Power Service, is currently undergoing the FERC re-licensing process for Vermont.

One concern that continues to exist as a result of the daily peaking operation is the issue of aesthetics regarding the Carver Falls facility. A minimum level of support for aesthetics is desired continuously during the summer so that waters flowing through the bypass consistently exhibit good aesthetic values as described in Vermont Water Quality Standards (2000). In addition, the Vermont Fish and Wildlife Department have raised concerns regarding the potential adverse impacts associated with widely fluctuating flows in the bypass. Increased energy expended by aquatic biota moving in and out of the bypass as flows fluctuate could pose an undue risk to fisheries.

Public Outreach and Communication

The basin planning public process included a survey of residents to identify water quality concerns throughout the Poultney Mettowee Basin. A primary outcome of this project was that conservation districts were provided with an assessment of landowners' knowledge, attitudes, and behaviors with respect to water quality and land use. As a long-term benefit, the survey findings will serve as a benchmark for evaluation of progress. In addition, attendees of all meetings and public forums ranked issues, concerns, project areas, and future objectives for attention in basin planning.

Several major water quality problems, their sources, and impacts were identified from the many public meetings and focus group discussions held throughout the basin. The major concerns regarding water quality that were identified in this ranking process include:

- Health risks from pathogens in runoff from agriculture, urban sources, and overflow from wastewater treatment plants.
- Nutrient enrichment from agriculture, urban runoff, and eroding streambanks.
- Sedimentation from road runoff, agriculture, stream instability (erosion of stream banks stemming from channel adjustments that result from activities such as channelization and dredging), urban stormwater runoff, and other activities.
- Thermal impairment due to loss of riparian vegetation, streambank destabilization, back road erosion, and increasing impervious surfaces due to land development.
- Impaired waters from nonpoint source pollution

It is clear through the Public Attitudes Study conducted by the Partnership that public education and outreach are critical to future water quality efforts for residents in the watershed. Ultimately, a public that understands water quality and related resource management problems as well as possible solutions to those problems can best make informed choices about its long-term protection and restoration (LCBP, 2001). For public outreach to be effective, the messages must be clear, frequent, and identifiable. For that reason, the Partnership and District have focused on maintaining consistency throughout their public outreach efforts. The main goal in the beginning of the Partnership was to make its existence known, as well as that of the District. By promoting the organizations it was hoped that the public would be more aware of where to go for assistance, information and education.

Public relations efforts include:

- A website on which the Partnership listed every publication and much written information about the Partnership. It is updated monthly.
- Biannual publications have been released that are large, colorful, graphic newsletters about Partnership and District projects, both current and future. These are in addition to the regular quarterly newsletters of the District.
- A 15-week column in the local paper (which reaches every watershed resident free of charge) was secured during the summer of 2001. This Watershed News column also highlighted projects and specific events (especially opportunities for participation). The 5 week column series was repeated again in 2003 and 2004.
- Additional public relations methods such as radio and television pieces, public field days and festivals, and volunteer opportunities.
- Youth education opportunities, especially those that involve a hands-on educational experience. A survey conducted by the PMNRCD in 2000 showed a dramatic increase in retention of information after an educational event for students that involved a hands-

on experience versus a lecture or visual experience.

Conservation Districts have found a niche in education. They have been successful in educating citizens through various single topic workshops (pond ecology and construction, horse management, pasture management, watershed coalition building). A primary goal of the Conservation Districts has always been education about natural resources and water quality issues for residents of the watershed, agricultural producers, community leaders and youth. All projects convened by the Districts and Partnership are designed to include an educational component. For example, the Poultney River streambank project completed this past fall will include major press releases for public information, as well as inclusion on the Poultney Educational Trail map and brochure that publicizes the site as a demonstration project.

3.2 Important Local Water Quality Initiatives and Activities

- **Poultney Mettowee Watershed Partnership Goals and Related Water Quality Initiatives**

The Poultney-Mettowee Watershed Partnership is a project of the Poultney-Mettowee Natural Resources Conservation District in Vermont and the Washington County Soil and Water Conservation District in New York with funding provided by the Lake Champlain Basin Program. A steering committee, made up of individuals and representatives of many different stakeholder groups in the watershed, will make recommendations to the Conservation Districts for management priorities and on-the-ground project activities.

The mission of the Poultney-Mettowee Watershed Partnership is to bring together the efforts of citizens and organizations that share the common vision of conserving, protecting, and enhancing the natural and cultural resources of the watershed.

The Poultney-Mettowee Watershed Partnership has five primary goals:

- To improve water quality.
- To enhance and interpret wildlife populations and habitats and other natural resources.
- Maintain a healthy agricultural based economy while protecting restoring, and conserving the soil and water resources of agricultural land.
- To educate youth, educators, adults, residents, and visitors about conservation practices and the environment around them.
- To maintain and enhance agriculture-related and nature-based recreation opportunities.

The 5 goals of the Partnership have been identified to provide a framework for developing projects to enhance water quality conditions throughout the watershed. Since 1998, the Poultney Mettowee Watershed Partnership has pursued the goals of assessment, prioritization, and project completion to produce effective returns. Most of these projects have focused on education and outreach, such as the Poultney Educational Trail, the Public Attitudes Survey of residents on water quality, storm-drain stenciling, and the Watershed Festival of 2001. The Partnership members represent watershed interests from various backgrounds including farmers, foresters, loggers, business owners, municipal officials, anglers, local watershed organizations, environmental groups, teachers, utility companies, regional planners, and slate quarry operations. The Watershed Partnership is guiding the development of the watershed plan and assisting in the implementation of watershed restoration projects. The Watershed Partnership meets regularly to formulate a collaborative approach to resolving high priority water quality issues.

- **Local Water Quality Activities**

Poultney River Basin

Champlain Valley Clayplain Forest Restoration–Native Plant Nursery

Vermont's clayplain forests, now considered a rare natural community, were cleared more than 200 years ago and today cover only about 14 percent of the land in the Champlain Valley south of the Winooski River. The major limiting factor to restoration of the native clayplain and floodplain habitats has been a lack of plant material generated from local genetic stock. As a result, in 2002 the Nature Conservancy's Southern Lake Champlain Valley Program and the Poultney-Mettowee Watershed Partnership started a small native plant nursery called the Poultney Mettowee Restoration Nursery.

Seedlings are being grown from locally collected seeds. When grown to size, plants are being planted on riverbanks and floodplains located on Conservancy property and local farms that are enrolled in a federally funded cost-share programs, such as on local farms enrolled in the Partners for Fish and Wildlife Program, a federally funded stream bank protection program. In April 2003, the first seedlings grown in the Poultney Mettowee Restoration Nursery were planted onto riverbanks in Whitehall, NY and Benson, VT. The plantings fulfill two important goals: mitigating the impacts of agricultural practices on water quality and restoring clayplain and floodplain forest. Additional benefits of the plantings include expanding the river wildlife corridor system, stabilizing streambanks to decrease erosion and subsequent sedimentation that has an impact on native mussel and sand darter populations, and mitigating threats of invasive species by using native plant materials for restoration efforts.

The Hubbardton River and Lower Poultney River Restoration Initiative (TNC)

The Environmental Protection Agency-funded, *Wetland and Riparian Habitat Assessment of the Poultney River*

Watershed in NY and VT, completed in 2001, identified the Hubbardton River as a place where restoration would achieve multiple objectives. As an outgrowth of that assessment, a Hubbardton and Lower Poultney River Restoration Plan was completed in 2004 with local partners, landowners, agencies and scientists. The focus of the plan is the riparian and clayplain restoration in the Hubbardton and Lower Poultney River watershed.

The goal of the Hubbardton and Lower Poultney River Restoration Project is to mitigate the impacts of agricultural practices on water quality and to restore clayplain forests typical of the Lake Champlain area in the Poultney and Hubbardton River valleys. The restoration effort will also expand the wildlife corridor along rivers and streams, lessen the impact of invasive species, and stabilize riverbanks by decreasing erosion and sedimentation that has an impact on aquatic habitat and biota, including native fish nurseries.

Castleton River Watershed and Gully Brook in Castleton

A partnership has been developed between DEC, USDA-NRCS, USFW, PMNRCD, PMWP, and agricultural operators to form strategies to improve water quality in the Gully Brook and Castleton River due to stream channel adjustment processes. This recent project involves a geomorphic assessment of the Gully Brook and the development of a habitat restoration project. As of summer 2003, a geomorphic assessment is in progress to identify existing stream conditions at the watershed scale. Based on this assessment, a stream and floodplain restoration plan is being developed. The project will modify the current process to reverse the historic channelization project, that leads to severe aggradation in the Castleton River and subsequent flooding of adjacent farm operations. By allowing the Gully Brook to regain access to its historic floodplain above the confluence with the Castleton River, the delivery of sediment from the Brook to the Castleton River may be reduced. This project would embrace components of both active and passive geomorphic restoration, after construction of a floodplain at a lower elevation that can be accessed by the stream, Gully Brook will be left to redevelop its meanders and achieve equilibrium through adjustment processes that will lower water velocity and encourage sediment deposition upstream of the confluence with the Castleton. Bridge and culvert inventories will be conducted in the watershed to identify structures contributing to stream instability and hindering fish passage. These failing structures will be targeted for removal or repair.

Lower Poultney River Outstanding Resource Water

In 1991, the Water Resources Board designated the Lower Poultney River as a Vermont Outstanding Resource Water (ORW) due to its exceptional natural, cultural, and scenic values. According to the Lower Poultney River ORW Report, the state will seek to manage certain activities affecting the water quality, flows, course, current, and cross-section of the Lower Poultney River to preserve and enhance the exceptional natural, cultural, scenic, and recreational values of the river and river corridor. The upper reaches of the Poultney River and one of its major tributaries, the Castleton River, flows clear and fast out of the foothills of the Taconic Mountains in southwestern Vermont and generally support healthy cold-water fisheries. The Lower Poultney River and its other major tributary, the Hubbardton River, tend to run slower and muddy due the predominance of clay-rich soils underlying the clayplain valley and generally support a warm-water fishery.

The lower Poultney River has incised 16-20 feet below its historic floodplain into sand and gravel banks (Field, 2001). The sedimentology of the sand and gravel deposits and the presence of rooted tree stumps at the base of the deposit suggest that the deposits are the result of the deforestation that occurred with European settlement of the area (and subsequent deforestation). Reforestation during the past century or so has resulted in the river incising through these young deposits. Consequently, the degradation of the river should not be entirely ascribed to the Carver Falls Dam upstream, or nonpoint source pollution that may be contributing sediments. The river, although incised below a former floodplain, is in the process of restabilizing as evidenced by the presence of a new lower floodplain level (Field, 2001) and relatively stable non-eroding banks except at the outside bends of meanders. The pool spacing is consistent with stable stream channels (Field and Kline, 2001). The relatively high sinuosity of the channel probably results from the glacial lake clay at the base of the banks, which was the original bank material prior to the post-European settlement deposition (Field, 2001).

Vermont's Natural Heritage Report (Thompson, 2002) cites the Poultney River as one of the best examples of a moderate to large river directly entering Lake Champlain and forming a large freshwater estuary of Lake Champlain in East Bay. The aquatic communities in the Lower Poultney River contain species of bivalves and gastropods that originated from western glacial refugia and that are only found in Vermont below the "principal fall line", which is located near the 150 foot elevation contour. In fact, 43 species of fish and 12 species of freshwater mussels have been documented in the Poultney River including the eastern sand darter, the channel darter, black sandshell, giant floater, fragile papershell, pink heelsplitter, pocketbook, and other fluted mussels which are threatened or endangered in Vermont.

The Lower Poultney River is dominated by sand and gravel in midstream with silt-clay banks. The southern lake segment "B" of Lake Champlain has phosphorus concentrations that exceed Vermont Water Quality Standards and lower reaches of the Poultney River are among Vermont's "impaired" waters due to nutrient enrichment and pathogens from erosion and agricultural runoff (VTDEC, 2002).

Mettowee River Basin

Mettowee River Thermal Restoration Project

The Mettowee River, which is listed as a cold-water fishery, is approximately 30 miles long with a watershed that covers about 137 square miles. The river flows north northwesterly, originating near Dorset, Vermont and traversing into New York State before reentering Vermont to drain into the southern tip of Lake Champlain. At the northern end, it is predominantly forested.

From the headwaters north to the New York border, the watershed encompasses an expanse of agricultural fields and pastures where little or no shade is provided. In this area, the Vermont Department of Fish and Wildlife measured elevated water temperatures and observed periodic fish kills, leading to concern that the status of the river as a cold-water fishery may be impaired. Observations indicated that most problems occurred during periods of low flow associated with warm summer temperatures.

An 8.2 mile section of the Mettowee River in Vermont is listed on Vermont's 303(d) List of Impaired Waters (2002) for thermal pollution and another eleven miles are threatened by increased temperatures. Portions of Flower and Indian Brooks are also threatened by temperature increases. The primary reason for this thermal pollution is considered to be loss of riparian vegetation. The loss of shading results in increased solar radiation reaching the water and therefore a greater thermal load.

Theoretically, there is a point at which an increase in riparian shading would be sufficient to maintain adequate stream temperature. However, other factors that need improvement may significantly affect stream temperature, including channel morphology (sediment deposition and scour processes that lead to the development of clean riffles and deep pools) and ground water inputs.

Dr. John Field explains geomorphic assessment protocols to river assessment volunteers

In 2001, The VT Department of Environmental Conservation contracted with an environmental consulting firm (ENSR) to conduct a field survey and thermal modeling program. The summer 2001 field program served to quantify the nature and extent of the elevated water temperature problem in the Mettowee River through continuous recording of water temperatures throughout the study area for a 72-day period. The field program also included collection of meteorological, streamflow, channel geometry, and habitat assessment data required to support development of a water temperature model of the Mettowee River. The field program documented the presence of elevated water temperatures in the river. Temperature exceedances typically occurred for a period of a few hours during the late afternoon. The highest temperatures were observed in downstream reaches of the Mettowee, where riparian shading was minimal or non-existent and the channel was widest. Based on the summer 2001 ENSR data and the temperature modeling application, the following management actions were recommended to remove the temperature impairment from the Mettowee River:

1. Increase shading — Riparian planting will provide additional shading in critical areas to help lower water temperature.

2. Modify the channel — Deepening the river in the wide, shallow reaches is predicted to be effective in reducing maximum water temperatures. In addition, channel modification could provide deeper, cooler pools for fish to seek refuge during peak temperature events. (Note: Both active and passive management alternatives should be considered based on cost-benefit analysis and the current level of conflict between channel adjustment processes and landowner investments).

3. Reduce water temperatures entering from Flower Brook — The water temperature of Flower Brook is higher than that of the Mettowee. As plans to cool the waters of the Mettowee are implemented, the increased heat load contributed by this tributary will become significant. Therefore, management actions designed to reduce maximum water temperature in Flower Brook should be evaluated and implemented.

Figure 6. Erosion Sites on the Mettowee River and Flower Brook (VT) where Riparian Buffer is absent

After discovering that the Mettowee River was included on the impaired waters list, the Poultney Mettowee Watershed Partnership began to learn about and work on this issue. Efforts included securing grant funding for watershed education for landowners and the community, riparian planting, temperature monitoring, and settling basin construction on local gravel roads. *The Mettowee River Buffer Outreach and Education Project* as proposed would complement the Agency's goal of protecting and restoring riparian corridors as part of the state's long-term surface water quality, recreation, fisheries, and wildlife management.

A geomorphic assessment of the Mettowee River has highlighted specific sites along the Mettowee River and its tributaries where streambank instability and erosion is coupled with a lack of riparian vegetation (Field, 2002). Combining this information with riparian landowners who are willing to engage in an analysis of river management alternatives, geomorphic-based streambank stabilization projects and/or riparian buffer projects will most likely alleviate the thermal impairment while avoiding a regulatory approach to the problem.

3.3 Assessments Used for Identification and Ranking of Water Quality Conditions

- **Poultney Mettowee Watershed Partnership Public Attitudes Survey**

A reliable assessment of farmers' and other landowners' attitudes toward natural resource conservation was needed in order to develop a long-term plan for communication about, and the conservation of, the natural resources of the Poultney Mettowee Basin. Focus group research, conducted in 1998, lacked the richness and specificity necessary to effectively design and deliver a nonpoint source pollution prevention program on a large scale throughout the watershed. However, the input gathered through the focus groups, in addition to a review of the literature documenting similar research conducted in other regions of the country, provides a good starting point for the survey questions' design.

A telephone survey was conducted in October and November 2000 to provide a representative overview and assessment of watershed farmers' and other landowners' perceptions, attitudes, and behaviors toward natural resource conservation. The research objectives were to: (1) use survey techniques to bring landowners' perspectives to the watershed planning effort more quickly and with greater accuracy than often occurs in traditional public participation models, (2) use survey techniques as a communications medium to get word of the watershed program into the community, (3) provide an assessment of landowners' knowledge, attitudes, and behaviors with respect to natural resource conservation issues, and (4) generate data which will serve as a benchmark for later evaluation of the progress of watershed programs.

About 1100 households in the watershed were contacted in order to complete 290 surveys, which had a margin of error of 5-6% at the 95% level of confidence. Survey questions related to four central topics: (1) What knowledge of the Poultney Mettowee Basin and its related natural resources conservation and water quality issues do landowners and farmers residing within the watershed possess? (2) What are the attitudes and values of farmers and owners of variously sized land parcels within the Poultney Mettowee Basin regarding the quality of the water and other natural resources within the watershed and adjacent to their properties? (3) In what behaviors and management practices are landowners and farmers residing within the Poultney Mettowee Basin engaging that impact, or could potentially impact, water quality and other natural resources? And (4) how do landowners and farmers residing within the Poultney Mettowee Watershed prefer to receive information about water quality and other natural resources conservation practices; and what are the most trusted sources of this type of information?

Telephone survey methodology was chosen because of the time and cost savings compared with other methods, including face-to-face interviewing. Advance notice of the survey was published in the weekly community newspaper (Lakes Region Free Press) and local newspapers of general daily circulation (Rutland Herald and Glens Falls Post Star) in an effort to improve support for the project, and hence participation and completion rates. At the request of the district manager of the Washington County, NY Soil and Water Conservation District, farmers in New York state were also contacted in advance of the survey via direct mail to request their voluntary participation in the survey and to schedule a time for their data to be collected.

The length of the survey was kept to ten minutes in order to assure a high level of participant retention through the duration of the survey. Random number dialing was done within each of the two area codes for the Vermont and New York towns within the watershed in proportion to the overall population of each state's segment of the watershed. Proportionate numbers of farmers in each state were either randomly selected or self-selected for participation to assure a representative sample of this small, but critical, population within the larger region's general population.

Conclusions and Recommendations

The research objectives of the project were met. The use of survey techniques brought landowners' perspectives to the watershed planning effort. People who might not have had an opportunity to speak if traditional public participation models had been used were given that opportunity. The diversity in occupations and income levels, as well as the geographic distribution of the respondents is a good indicator of these successful measures.

The survey technique itself was used as a communications medium to get word of the watershed program into the community. The press coverage announcing the plans to conduct the survey, as well as the direct mail to the New York state farmers were additional mechanisms for raising the awareness of people in the watershed. At a minimum, 1100 people (the number of individual households contacted as part of the survey) received at least some part of the watershed conservation message when they answered their phones and heard the opening statement, "I'm calling to talk with you about the Poultney Mettowee Watershed." Obviously, those 290 individuals that completed the entire 10-minute survey had a much greater exposure to watershed concepts and time to contemplate their relationship to the watershed.

The primary outcome of this project was that conservation districts were provided with an assessment of landowners' knowledge, attitudes and behaviors with respect to natural resource conservation. In addition to the data reported here, the responses to each survey question have been entered into a database. As time and funding permits, these data can be analyzed as well. For example, if the conservation districts were contemplating a television public service message campaign, the questions about whether residents of the watershed

have televisions or ever watch the Champlain 2000 segment on the WPTZ-TV 5 news would be of interest. And likewise, information as to who prefers television as a communications channel could be used to tailor messages and images contained in the announcements to best reflect the demographics of that segment of the watershed's population.

Clearly, one of the long-term benefits of this research undertaking has been to generate data that can be used as a benchmark for later evaluation of the progress of watershed programs. As funding permits, it would be good to conduct another telephone survey of approximately 300 households to see what, if any, increase in awareness may have taken place, what communications channels were most effective, and which messages reached their target markets. More important would be a measurement of any behavior changes that may have resulted from the increased awareness brought on by conservation districts' communications tactics. Examples of expected changes might be more care on the part of landowners in their use and disposal of household chemicals or greater support by non-farmers for legislative initiatives that would provide financial and technical resources to farmers for addressing non-point source pollution problems.

- **Poultney Mettawee Watersheds Water Quality and Aquatic Habitat Assessment Report (VTDEC, 1999)**

Every five years, on a rotating basis, a Basin Assessment Report is developed for each major river basin in the state. The assessment is based on the results of water quality monitoring programs, and evaluations of the existing water quality in the basin and known threats to that water quality. The assessment process itself, for any given basin, takes about two years. The development of a Basin Plan will follow each Basin Assessment Report. The Poultney Mettawee Watersheds Water Quality & Assessment Report (VTDEC, 1999) serves as a reference guide for water quality conditions in the Poultney Mettowee Basin and has been used extensively in the creation of this basin plan. The following assessment and monitoring has been conducted

Table 6. Summary of Poultney Mettowee Basin Assessments

Assessment Title	Date	Lead Organization(s)	Waterway/Location	Protocols/Summary
Geomorphic/Physical Assessments				
Castleton River	Spring 2004	DEC, RRPC, PMNRCD	Entire Castleton River watershed	ANR Phase 1–Geomorphic Assessment Protocols
Gully Brook	Summer 2004	DEC, RRPC, PMNRCD	Gully Brook watershed	ANR Phase 1, 2 & 3 Geomorphic Assessment Protocols
Mettowee River	2001	GMC–Field	Mettowee River main stem	Buffington/ Montgomery/ Rosgen
Hubbardton River	2001	GMC–Field, GMC	Hubbardton River main stem	Buffington/ Montgomery/Rosgen
Temperature monitoring	2001–ongoing	PMWP, VTDEC	Mettowee River/ Flower Brook	EPA QAPP
Biomonitoring/Biological Assessments				
Macroinvertebrate & fisheries species diversity monitoring	5 year rotation	DEC BASS	Castleton, Hubbardton, Poultney, Mettowee, and Indian Rivers, and Flower Brook	Monitoring data is used in determining if waterways meet Vermont Water Quality Standard (impaired waters list)
Macroinvertebrate monitoring	On-going	Poultney Union H.S.	Poultney River main stem, Poultney	RiverWatch
Macroinvertebrate & chemical monitoring	On-going	CARP	Castleton River main stem, Castleton, Fair Haven	—
Water quality (TP, turb) and *E. coli* sampling	On-going	PMWP	Poultney River main stem	VTDEC - LaRosa Lab
Spring Phosphorus	On-going rotational	DEC–Lakes Section	Poultney Mettowee basin lakes & ponds Poultney River [TP] Monitoring for Lake Champlain TMDL	Phosphorus, dissolved oxygen, water clarity
Lake Assessments	On-going	DEC–Lakes Section	Lake Bomoseen, Lake St. Catherine, Lake Hortonia, Beebe Lake, Glen Lake Sunset Lake, Sunrise Lake, Burr Pond (Sudbury), Inman Pond, Hinkum Pond, Mudd Pond (Benson), Perch Pond, Black Pond, Austin Pond, Doughty Pond, Echo Pond (Hubbardton), Mill Pond	Substrate, access, shore line features, adjacent land use, pH, dissolved, oxygen, water clarity, algae, shoreline development & erosion, wilderness characteristics, natural communities, & non-native species

Key:

AAFM – Agency of Agriculture, Food, and Markets

DEC – Vermont Department of Environmental Conservation

DEC's BASS – Biomonitoring and Aquatic Studies Section Service

DFPR – Vermont Department of Forests, Parks, and Recreation

CARP – Castleton River Area Project, Fair Haven Grade School

GMC – Green Mountain College

NRCS – USDA Natural Resources Conservation Service

PMNRCD – Poultney Mettowee Natural Resource Conservation District

PMWP – Poultney Mettowee Watershed Partnership

RPCs – Rutland Regional Planning Commission

TNC – The Nature Conservancy

VNRC – Vermont Natural Resource Council

VT F&W – Vermont Department of Fish and Wildlife

VTDEC – WMD – Waste management Division

WWMD – Wastewater Management Division

Assessment Title	Date	Lead	Waterway/Location Organization(s)	Protocols/Summary
Lake Assessments (cont.)			(Benson), Perch Pond, Pine Pond, Root Pond, Old Marsh Pond, Roach Pond, Choate Pond, Half Moon Pond, and Breese Pond	
Lay Monitoring Program	On-going	VTDEC with volunteers	Lake Bomoseen, Lake St. Catherine, Beebe Lake, Sunrise Lake, Sunset Lake	Water clarity, Total Phosphorus, Chlorophyll-a, Temperature
Wetlands Assessments				
Significant Wetlands of the Poultney Mettowee Watershed	On-going	VTDEC–Wetlands Section, VTF&W, VNRC	Lake Bomoseen wetland, West Rutland Marsh, Ward Marsh	Qualitative assessment of the wetlands
Hazardous Waste, Landfill, & Wastewater Treatment Facility Monitoring				
Various DEC site monitoring database inventories	On-going	VTDEC–WMD and WWMD	Unnamed trib to the Mettowee River–West Pawlet, Castleton River–Fair Haven, unnamed trib to Wells Brook, Wells Sites are summarized in the Basin 2 Report.	Groundwater and surface water monitoring at hazardous waste sites, wastewater treatment facilities, and landfills
Chemical Assessments–Heavy metals	2002	VTDEC	Castleton, Hubbardton, and Poultney Rivers	VTDEC–LaRosa Lab
Agricultural Related Assessments				
Watershed Plan, Lower Poultney River, VT and NY		AAFM, NRCS, PMNRCD, TNC, PMWP, VTDEC	Lower Poultney River watershed–downstream of Carvers Falls needs (phosphorus) & cropland erosion.	Inventory and plan that addresses waste management system
Comprehensive Watershed Assessment Reports & Plans				
Basin 2- Poultney Mettowee Basin Assessment Report	1999 5-year rotation	DEC–Planning Section	Poultney Mettowee Basin	Comprehensive review of physical, chemical, & biological monitoring & assessments
Poultney Mettowee Basin Water Quality Management Plan	1975	DEC	Poultney Mettowee Watershed	Addresses municipal wastewater facility needs and to a lesser degree non-point source pollution & lake eutrophication

Table 6. Summary of Previous and On-going Physical, Chemical, and Biological Assessments of the Poultney Mettowee Basin

Castleton River in Fair Haven

- **A Classification of the Aquatic Communities of Vermont (VTDEC – Biomonitoring and Aquatic Studies Section, 1998)**

The Vermont Office of the Nature Conservancy initiated the Vermont Biodiversity Project in 1996. This endeavor involved the talents of individuals from many disciplines and institutions in Vermont. The general goal of the conservation plan included in the Vermont Biodiversity Project is "to maintain ecological integrity in a manner that insures the long-term viability of all native species and natural community types in Vermont within their natural ranges" (Vermont BDP, 1996). Among the many specific objectives associated with this goal is the classification of natural aquatic communities and the subsequent identification of priority conservation areas associated with each of the particular classes. The resulting classifications will be used to identify priority conservation areas as well as species and community distributions.

- **The Lower Poultney River Outstanding Resource Water Report, 1992**

In June 1991, the Water Resources Board designated the Lower Poultney River as a Vermont Outstanding Resource Water (ORW). The Agency of Natural Resources released the report on this designation to inform the public of those river values deemed exceptional by the Board. Section IV of the report has been adopted as the Agency management plan that articulates the Agency's regulatory responsibilities to preserve and enhance exceptional values of the Lower Poultney River.

- **Poultney River Riparian Habitat and Geomorphic Assessment**

The Nature Conservancy (TNC) has made the Poultney River watershed a national level priority, and has included the river among 50 waterways in North and South America to receive intensive freshwater conservation as part of TNC's Freshwater Initiative program. As part of its Freshwater Initiative on the Poultney, riparian and wetland habitats at lower elevations were assessed in summer 2000.

The major goals of the assessment were to (1) describe the range and diversity of natural wetland communities and river conditions in the study area, and (2) identify wetlands and river reaches that could be improved through restoration. The principle investigators combined their backgrounds in geomorphology, hydrology, plant ecology, and restoration to conduct a non-point source and stream channel condition visual assessment, a geomorphic stream assessment, and a wetland and riparian vegetation assessment. Digital map data on elevation, soil type, and land cover type were used to identify wetlands and areas that may have supported wetlands prior to land conversion, and were used to analyze river morphology in a Rosgen Level 1 assessment. Channel and bank conditions were mapped in a geographic information system (GIS) for the entire main stems of the Poultney and its two major tributaries, the Hubbardton and Castleton Rivers. Based on maps, aerial photographs, and preliminary inspection in the field, six areas were selected for the intensive geomorphic and vegetation assessments, representing a range of river conditions and vegetation. Each study area included reference wetlands as well as potential restoration sites. The study areas are (1) Middletown Springs on the upper Poultney River floodplain, (2) Green Mountain College and the Poultney River floodplain between Poultney and Fair Haven, (3) West Rutland marsh and swamp, (4) Harrison Sod Farm above the confluence of the Hubbardton and Poultney Rivers, (5) Trinity Farm and Clayplain on the Hubbardton River floodplain, and (6) Ward Marsh and East Bay near Lake Champlain. Rosgen Level 2 Assessments were made at a study site representative of the stream type at five of the study areas, and vegetation analysis was conducted using a Rapid Community Assessment at 33 field sites representing the range of wetland vegetation present in the six study areas.

- **Hubbardton River Restoration Initiative**

The Hubbardton River was identified in *the Poultney River Watershed Wetland and Riparian Habitat Assessment* (Field, Graves and Doyle 2001) as an area where lack of riparian vegetation, presence of eroding river banks, presence of a rare natural community, and presence of fine clay soils indicate that restoration would meet multiple restoration objectives. In addition, there are many landowners along the mainstem of the Hubbardton River that are willing to participate in restoration programs. The Poultney-Mettowee Watershed Partnership along with The Nature Conservancy, Rutland County NRCS, the Poultney-Mettowee NRCD, USFWS Partners for Fish and Wildlife, VT DEC Water Quality Division, and local landowners have begun to develop a restoration plan for the Hubbardton River. Green Mountain College has offered to be a consultant through the planning process.

The primary goal of this restoration project is to re-establish this unique, clayplain forest natural community along the mainstem of the Hubbardton River. The restoration project would also address a second goal of the Partnership, which is to reduce the high sediment load that characterizes the entire mainstem of the Hubbardton. The project will be used as a demonstration of effective stream corridor management practices for municipal officials, farmers, anglers, ecologists, business entities, and other landowners.

- **Mettowee River and Flower Brook Geomorphic Assessment**

During July 2001 a number of geomorphologic and physical features of the Mettowee River were mapped while walking and canoeing the entire 70 km (44 mile) length of the river, 37 km (23 miles) of which flows in Vermont. The mapped features included bank stability, bank composition, channel bottom morphology, location of wood and woody debris jams, and location of barriers to fish passage. All of these mapped features were input into a GIS (Geographic Information Systems) project along with information on riparian buffer width mapped from digital aerial photography. The significant tributaries of the Mettowee River were mapped in a similar fashion during June 2002. The significant findings of the geomorphologic mapping for the Vermont portion of the Mettowee River and Flower Brook are summarized in the tables contained in the full report (Field, 2002). More than 40 percent of the Mettowee River in Vermont is classified as either eroding, moderately eroding, or protected by riprap. Perhaps counter intuitively, there is actually a slightly lower likelihood for erosion to occur adjacent to where the riparian buffer is absent compared to other reaches of the river. Analysis of the data shows that only 26 percent of the eroding banks occur adjacent to areas without a riparian buffer although 34 percent of the river's length has no riparian buffer. Similarly, eroding banks on Flower Brook also have a slightly lower likelihood of occurring adjacent to where the riparian buffer is absent with 24 percent of the length of eroding bank occurring along the 27 percent of Flower Brook without riparian buffer. The reasons for why there does not appear to be a greater likelihood for erosion where the riparian buffer is absent is unclear but may indicate that other variables are more important controls on streambank erosion such as soil type, bank height, presence of riprap, and channel morphology (i.e., channel adjustment processes and stage of channel evolution).

- **Lake Champlain Basin Program "Opportunities for Action: An Evolving Plan for the Lake Champlain Basin"**

The Lake Champlain Basin Program's "Opportunities for Action" Plan is a pollution prevention, control, and restoration plan. The governors of New York and Vermont and the regional administrators of the USEPA endorsed the Plan in October 1996. The 1996 Plan called for periodic updates and 2001 marks the first revision of the Plan. The main goals of the plan continue to be: improving water quality throughout the Lake Champlain basin; protecting the basin's living natural resources; and preserving and enhancing the region's rich cultural and recreational resources. Three priorities were identified to protect and restore ecological and cultural resources of the Basin while maintaining a vital economy for the region:

- Reduce phosphorus in priority sub basins (such as the Poultney Mettowee basin) of Lake Champlain
- Prevent and control persistent toxic contaminants
- Develop and implement a comprehensive program to manage nuisance nonnative aquatic species

The Plan also suggests building capacity for local-level implementation. Local capabilities for watershed planning vary greatly throughout the Champlain Basin in both New York and Vermont. In some areas, municipalities have already developed watershed plans and instituted aggressive water quality protection measures. Municipalities in these areas typically benefit from ongoing technical support from the Department of Environmental Conservation, watershed associations, regional planning commissions, and county planning offices or conservation districts.

- **Lake Champlain Phosphorus TMDL– VTDEC, 2002**

The Lake Champlain Management Conference identified phosphorus reduction as one of the top management priorities for the lake in the 1996 basin plan *Opportunities for Action*. On a basin-wide level, the States of Vermont and New York, the province of Quebec, and many other cooperating groups and agencies have committed to participate in the Lake Champlain Basin planning process. The basin plan defined phosphorus loading targets for each lake segment watershed in Vermont and New York and made preliminary allocations to point and nonpoint sources within each watershed. The Lake Champlain Phosphorus TMDL is the next step in the refinement of the phosphorus reduction plan for the lake.

A TMDL (Total Maximum Daily Load) is the maximum amount (load) of a single pollutant from all contributing point and nonpoint sources that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. The Federal Clean Water Act, Section 303, establishes the water quality standards and TMDL programs. A TMDL is required for Lake Champlain because phosphorus concentrations in many segments of the lake are higher than the levels allowed in the Vermont Water Quality Standards.

The Lake Champlain Phosphorus TMDL sets target load reductions for each Lake Champlain lake segment, of which the Poultney River flows into "South Lake B". The nonpoint phosphorus load to the lake in 1991 was 24.8 metric tons/year (total load was 28 metric/year). Under the Lake Champlain Long-term Water Quality and Biological Monitoring Project, VT DEC will be able to determine, over the long term, whether the phosphorus loads at the mouth of the Poultney River as well as the concentrations in the South Lake "B" segment are meeting or exceeding the applicable loading targets and lake water quality standards.

The Vermont DEC Basin Planning process will play an important role in the implementation of the Lake Champlain Phosphorus TMDL. With the adoption of the Lake Champlain Phosphorus TMDL, in 2003, point and nonpoint source management to reduce phosphorus loading has become an important element of basin plans, especially where substantial phosphorus reductions are required by the TMDL for river basins that drain into Lake Champlain. It is likely that necessary changes or additions to the implementation items presented in the TMDL will be identified as the planning process continues.

Chapter 4 Addressing Local Goals for Surface Waters

Water quality impairment was identified as a major concern in the Poultney Mettowee Basin in focus group discussions and public forums. Agricultural runoff, invasive plant species, inadequate sewage treatment, and streambank erosion were the concerns most often mentioned.

Focus group discussions and public forums identified and ranked water quality concerns that are addressed in this water quality management plan for the Poultney Mettowee basin. Surface water quality is impaired by point and nonpoint sources of pollution from agriculture, forestry, and urbanization. The basin planning process emphasizes collaborative efforts to correct water quality problems through voluntary cooperation by landowners and the Poultney Mettowee Natural Resource Conservation District. If, despite efforts, waters still do not meet water quality standards, a TMDL (Total Maximum Daily Load) may still be necessary. The Clean Water Act requires impaired waters to be identified by the State and reported under Section 303(d). For a complete statutory reference for federal and state obligations addressed through this planning process, refer to the statutory index preceding the appendices.

To address both local concerns and general water quality problems, the Agency of Natural Resources, the Poultney Mettowee Watershed Partnership, and others have been working together to address: stream channel instability and streambank erosion, water quality awareness, nonpoint source pollution, impacts to fisheries, pathogens, and aquatic nuisance species. Addressing stream channel instability and streambank erosion will reduce sedimentation, thermal modification, and turbidity in rivers. Improving awareness of water quality will improve both the community's and the Agency's understanding of the present conditions, including pathogen levels, leading to more informed solutions. Improving spread prevention tactics for managing aquatic nuisance species will improve recreational opportunities that will help to foster the community's interest in protecting the water quality necessary to support water-based recreation. Finally, improving fisheries habitat will result in increased native fish populations, which will also be enhanced by a reduction of sedimentation and thermal modification.

The project objectives and strategies identified in this chapter are based on the ongoing efforts of the Poultney Mettowee Watershed Partnership (Partnership), the Poultney Mettowee Natural Resource Conservation District (PMNRCD), the Rutland Regional Planning Commission (RRPC), The Rutland District of the USDA-NRCS, the US Fish & Wildlife Service (USFW), the US Forest Service (USFS), and the VT Agency of Natural Resources (ANR) to improve and protect stream corridors.

The following information contains strategies for addressing the concerns listed above in Chapter 3. The emphasis is on improving water quality by addressing specific issues rather than river areas. (This approach serves to educate and inform about these issues, and provides assistance in management planning for the future.) It should be emphasized that strategies are being developed from the ground-up, and as a result, are still evolving.

The strategies included in this basin plan were developed in a "report card" format. In delineating a timeline and benchmarks, the report card can be used to evaluate the progress gained through the implementation of various strategies. In this regard, the report card can be used to gage the effectiveness of the strategies that have been implemented since the adoption of the basin plan. When it comes time to review the current basin plan in anticipation of drafting a new version, the report card can be used to evaluate the effectiveness of the strategies that were originally developed, and modified or updated if necessary.

The format of the report card is as follows:

Tree planting along the banks of the Mettowee

GOAL: (To improve water quality)

- **Objective** (To implement effective practices that will improve water quality)

  Strategy (The specific practice that can be implemented to achieve the goal)

  - **Lead Agency/Organization:** Who is responsible for implementing the strategy.
  - **Partners:** Other organizations and/or stakeholders needed for implementation.
  - **Potential funding sources:** For implementation of the strategy.
  - **Time frame:** The anticipated time it will take either for implementation of the strategy or to bring about the desired outcome of implementation.
  - **Benchmark:** The desired outcome of implementation of the strategy (i.e., 10 additional river miles where riparian buffers have been re-established).

The following is a list of the most important issues, objectives and strategies that have been identified through the planning process.

4.1 Improving Water Quality

NONPOINT SOURCE POLLUTION

Each section of Lake Champlain has a water quality standard for phosphorus. The standards were set after much study so that, if met, the Lake would not have excessive noxious algae. Unfortunately, several of the segments presently exceed the water quality standard for phosphorus. Therefore a plan or "allocation" to reduce the amount of phosphorus reaching the Lake from each tributary river has been formulated in the Lake Champlain TMDL (Chapter 3).

According to the Lake Champlain Phosphorus TMDL, the Vermont DEC river basin planning process plays an important role in the reduction of nonpoint source pollution (NPS), especially as it pertains to phosphorus. "Basin planning includes assessing both beneficial water-related resources and water impairments, ranking these and carrying out on-the-ground projects to restore and protect waters" (VT DEC, 2002). The watershed approach helps communities address water quality problems caused by NPS pollution and looks at not only a waterbody but also the entire area that drains into it. Public and private groups have developed and used pollution prevention and reduction initiatives and NPS pollution controls, referred to as strategies in this Basin Plan, to clean up our water efficiently. Water quality monitoring and environmental education activities supported by government agencies, industry, volunteer groups, and schools have provided information about NPS pollution.

The process of urbanization is rapidly transforming Vermont's landscape. These changing land uses can have a negative impact on our water resources. The lack of adequate planning, coordination, and management have resulted in the degradation of our waterbodies and the destruction of wildlife habitat. Valuable open space needed to filter runoff and recharge aquifers is being paved or turned into impervious surfaces. This added impervious surface increases runoff that may increase erosion and change drainage patterns so as to concentrate flow and cause flooding. More intense land use also typically generates significant pollutant loadings even when best management practices are used. The Vermont 303(d) list contains numerous waterbodies affected by urbanization and reflect increased recognition that the designated uses of many waterbodies cannot be achieved without incorporating specific low impact development practices that will reduce storm water runoff and the associated pollutant load. In this way, communities can continue to grow without further degrading their waterbodies; and in some cases, will be able to grow to a certain degree while contributing to watershed restoration efforts.

Agricultural land in the basin contributes a substantial percentage of the nonpoint source phosphorus loads to Lake Champlain. For this reason, many farmers have been implementing Best Management Practices (BMPs) to prevent agricultural runoff from entering nearby waterways. Many of the farmers' management practices have been successful. Estimates from 2001 show that a total of 16.1 metric tons of phosphorus per year have been removed from agricultural nonpoint sources in the Basin since 1995 (Source: *Lake Champlain Basin Program Fact Sheet #2 Non-Point Source Pollution*).

GOAL: To reduce nonpoint source pollution

- **Objectives (**Listed from highest priority)

  1. Reduce nutrients and sediments that enter surface waters from agricultural land uses.
  2. Protect geomorphically stable reaches of rivers and streams, especially in critical areas as identified through geomorphic assessments.
  3. Reduce gravel erosion from unpaved roads. Reduce back road runoff and nutrient enrichment of surface waters through better back road practices.
  4. Establish excellent erosion control practice on construction sites as the accepted norm for the watershed.
  5. Institutionalize periodic educational opportunities for municipal officials and others to receive updated information on stormwater management.

Objective 1: Reduce nutrients and sediments that enter surface waters from agricultural land uses.

Strategies:

Agricultural sources of nutrients include fertilizers, manure, and crop residues. The nutrients from these sources are often carried to surface waters by overland runoff. Nutrient levels should decrease as current state and federal programs and better enforcement of Accepted Agricultural Practices work to decrease nonpoint source pollution from agricultural activities.

1. Assist farm operators to enter into cost-share and other conservation programs that will help sustain the working landscape in the basin.

   Lead Agency/Organization: AAFM

   Partners: PMNRCD, USDA/NRCS, EPA

   Potential funding sources: State and federal programs

   Time frame: Ongoing

   Benchmark: Farm operators enroll in cost/share programs

2. Encourage agricultural practices such as nutrient management planning, conservation tillage, fencing, riparian area protection, and the development of alternative livestock watering supply.

   Lead Agency/Organization: PMNRCD

   Partners: AAFM, USDA/NRCS, EPA

   Potential funding sources: State and federal programs

   Time frame: Ongoing

   Benchmark: These types of agricultural practices are occurring

3. Implement riparian buffer planting, river management alternatives analysis, and geomorphically-viable streambank stabilization practices.

   Lead Agency/Organization: PMNRCD

   Partners: AAFM, USDA/NRCS, EPA

   Potential funding sources: State and federal programs

   Time frame: Ongoing

   Benchmark: These activities are occurring

4. Encourage the composting of animal manure and animal mortalities, which have not been widely adopted or promoted.

   Lead Agency/Organization: Composting Association of Vermont

   Partners: AAFM, PMNRCD, USDA/NRCS, EPA

   Potential funding sources: State and federal programs

   Time frame: Ongoing

   Benchmark: Provide educational workshops for agricultural producers

5. Provide technical assistance to farmers who are experiencing loss of productive land as a result of erosion channels in farm fields (Ranked # 7 by the public Prioritization Process).

   Lead Agency/Organization: USDA-NRCS

   Partners: PMNRCD, USDA/NRCS, EPA, AAFM

   Potential funding sources: State and federal programs

   Time frame: 2009

   Benchmark: Farmers experiencing loss of productive land are receiving technical assistance as requested

Objective 2: Protect geomorphically stable reaches of rivers and streams, especially in critical areas as identified through geomorphic assessments.

Strategies:

The Department of Environmental Conservation River Management Program is working with its partners to focus on the long-term benefits of a geomorphic management approach to both property owners and riparian ecosystems. The assessment of stream condition, sensitivity, and adjustment process is an ideal tool for problem solving in a watershed context because it provides partners with an assessment of stable reaches that should be given high priority for conservation as well as those reaches that are out of adjustment, and likely candidates for restoration projects. Geomorphic assessments now underway in the Castleton and Mettowee river watersheds are necessary for restoration projects to proceed in the context of watershed planning and stream channel assessment.

6. Conduct Phase 1 geomorphic assessments for each river system in the basin and use assessment information for planning and project implementation.

   Lead Agency/Organization: PMWP, VTDEC Rivers Management Program

   Partners: USFW, PMNRCD, VTFW, AAFM, USDA-NRCS, Rutland RPC, VT DEC Rivers Management Program, riparian landowners, towns

   Potential funding sources: DEC grant programs, other state and federal programs

   Time frame: Ongoing

   Benchmark: Once strategically located sites have been selected, develop restoration projects based on that assessment information.

7. Work with towns and the Rutland Regional Planning Commission to strengthen riparian and river corridor protection language in town plans and zoning regulations:

   Lead Agency/Organization: Rutland Regional Planning Commission

   Partners: Towns in the basin, VTDEC – Water Quality Division Planning

   Potential funding sources: DEC grant programs, other state and federal programs

Time frame: Ongoing

Benchmark: Strengthen riparian protection language in town plans and zoning regulations for towns in the Poultney Mettowee Basin

8. Fund and implement the Conservation Reserve Enhancement Program (CREP and CRP) for Basin landowners. The federal and state Conservation Reserve Enhancement Program will help to provide a greater level of economic incentive than is presently available from the federal government.

   Lead Agency/Organization: AAFM

   Partners: PMNRCD, USDA/FSA, EPA, NRCS

   Potential funding sources: State and federal programs

   Time frame: By 2006

   Benchmark: Riparian buffer acreage enrolled in CREP

Objective 3: Reduce gravel erosion from unpaved roads. Reduce back road runoff and nutrient enrichment of surface waters through better back road practices.

Strategies:

A survey of Rutland County towns (Rutland NRCD, 1999) estimated that approximately 5,600 cubic yards of road gravel is exported from roads to surface waters annually that contributes to the sedimentation and nutrient enrichment of waterways in the basin.

9. Hold Better Backroads and VTrans workshops with town highway managers and crews to increase awareness of maintenance measures that will reduce back road erosion. Encourage participation in the Better Backroads Program. Provide more funding to conservation districts and regional planning commissions to conduct workshops within their region on erosion control techniques and capital budget planning for road managers, and on the basics of road maintenance needs and policies to support these techniques for selectboards and other town officials.

   Lead Agency/Organization: PMWP

   Partners: VTDEC, VT Local Roads Program, Better Backroads Program, towns in the basin.

   Potential funding sources: Better Backroads Program / PMWP and state and federal programs

   Time frame: 2008

   Benchmark: Host workshops in each major river basin by 2008 (Poultney, Castleton, Hubbardton, and Mettowee)

10. Conduct back road assessments using AOT/ANR Bridge and Culvert protocols. Target bridge and culverts in need of replacement or repair.

    Lead Agency/Organization: Towns in the basin

    Partners: VTANR, VT Local Roads Program, Better Backroads Program, PMWP

    Potential funding sources: Better Backroads Program / PMWP and state and federal programs

    Time frame: 2008

    Benchmark: Make recommendations regarding bridges and culverts in need of replacement or repair based on assessments

Objective 4: Establish excellent erosion control practice on construction sites as the accepted norm for the watershed.

Strategies:

An erosion control plan provides guidance and practices for preventing the discharge of sediment from construction sites, minimizing the extent and duration of soil disturbance, maintaining existing drainage-ways and vegetation, and protecting riparian buffer areas from disturbance. Provisions should be established at the municipal level for erosion control at small construction sites not under the jurisdiction of the state general permit.

11. Create an outreach and education program (using the new Erosion Prevention Handbook: http://www.vtwaterquality.org/DOCSoilErosion.htm) for landowners, contractors, and municipalities that are about to embark on construction projects covering erosion and sediment control plans, necessary permits, and technical assistance that may be available for such projects.

    Lead Agency/Organization: VTDEC, AGC, PMWP

    Partners: LCBP, Rutland RPC, local towns, USDA-NRCS,

    Potential funding sources: VTDEC grant programs, other state and federal programs

    Time frame: Ongoing

    Benchmark: Not applicable

12. As part of EPA phase I stormwater regulations, assist with the issuance of General Permits to sanction the discharge of stormwater from construction sites, which requires the development and submittal of an erosion and sediment control plan for any construction project that disturbs between one and five (or more) acres of soil, including any disturbance of less than five acres which is part of a larger common plan that will result in a total of five or more acres of disturbance. Phase II requirement will extend to any new construction site that disturbs an acre or greater.

    Lead Agency/Organization: EPA, VTDEC

    Partners: Rutland RPC, local towns,

    Potential funding sources: VTDEC grant programs, other state and federal programs

    Time frame: 2007

    Benchmark: Assist 10 towns in the basin to develop MSGP plans.

Objective 5: Institutionalize periodic educational opportunities for municipal officials and others to receive updated information on stormwater.

Strategy:

Lawn runoff, pet waste, erosion, atmospheric deposition, sludge, and septic systems are urban sources of nutrients that are carried to surface waters in stormwater runoff. These sources are able to reach surface waters easily because of the large amount of impervious surfaces in urban areas. Impervious surfaces do not allow runoff and its associated pollutants to be absorbed into the ground. The increased development predicted for the basin has the potential to increase nutrient levels in adjacent surface waters.

13. Hold urban best management practices workshops for municipal officials and residents in the watershed, such as the recent Multi-Sector General permit workshop held in Rutland. Encourage the implementation of stormwater Best Management Practices where stormwater has an impact on surface waters.

    Lead Agency/Organization: VTDEC

    Partners: Rutland RPC, town road crews, PMWP

    Potential funding sources: State and federal programs

    Time frame: Ongoing

    Benchmark: New urban development and implementation of stormwater best management practices.

Culvert on Castleton River

STREAM CHANNEL ADJUSTMENT PROCESSES

The condition of instability (channel adjustment processes) of stream channels generally can be traced to anthropogenic sources such as developments within active floodplains and channel management activities such as gravel mining, dredging, and general changes in watershed hydrology (VTDEC, 2002). There have been many instances of streambank stabilization projects in the watershed in the past, mainly due to agricultural activities and transportation infrastructure. Riprap, with rock or locally available slate, is an inexpensive, effective method of bank stabilization that has been cost-shared with federal NRCS programs.

Stream channel adjustment is common on both major rivers and their tributaries. Natural processes, as well as watershed, channel, and floodplain modifications, including cattle access and crossings and inadequate buffers contribute to channel instability and streambank erosion problems. The loss of cropland is a problem on several of the farms in the watershed. There is also erosion taking place adjacent to critical areas, such as livestock concentration areas, streambanks, gullies and eroding pastures. Streambank and stream channel erosion for rivers in adjustment represent a potentially enormous source of phosphorus loading to Lake Champlain (VTDEC, LC-TMDL, 2002).

The stream channels in the Poultney Mettowee Basin are still recovering from earlier disturbances such as gravel mining and other channel modifications. In the 18th and 19th centuries, the building of roads and railroads within the floodplains, land clearing for agriculture and housing, and the moving of streams to accommodate agriculture resulted in unstable and adjusting river channels. Following the flood of 1973, large-scale channelization practices were employed to reclaim damaged lands. Post-flood channel straightening and gravel mining has had the effect of steepening the stream channels. A steep channel in a relatively flat valley may initiate a bed degradation process referred to as "headcutting." Once a stream begins to headcut, it will typically erode its way through the five-stage channel evolution process, depicted in Figure 7, until it has created a new floodplain at a lower elevation in the landscape.

Figure 7. Five Stages of Channel Evolution

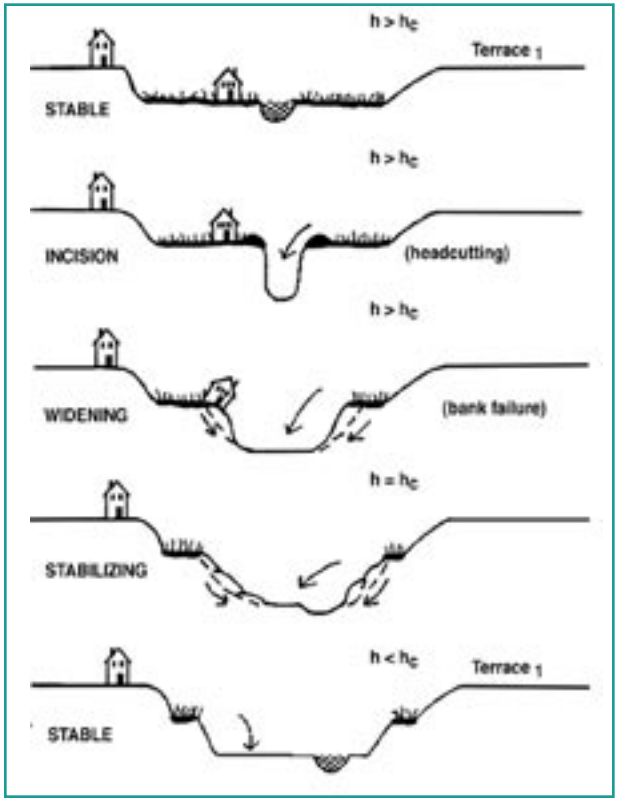

Figure 6. Five stages of channel evolution showing headcutting that leads to bed lowering and floodplain redevelopment. Source: Schumm Channel Evolution Model, 1977 and 1984

Only in the past 2 years has interest begun to increase in considering different methods of stabilization, called natural (or "stable") channel design, where channel management and streambank stabilization methods are designed to be consistent with the channel evolution process. Bank revetments employed essentially "buffer" the ongoing channel adjustments to allow a woody riparian buffer to become established as a more permanent and self-maintaining form of bank stabilization.

GOAL: Encourage stream channel adjustment processes towards a stable regime by encouraging activity that is consistent with the river evolution process and at the same time, work to minimize conflicts, and balance the need to protect economic investments in infrastructure and natural processes while recognizing the dynamic equilibrium of river systems and different phases of adjustment.

- **Objectives (**Listed from highest priority)

The following objectives represent the range of possible outcomes produced through the analysis of river management alternatives. To the greatest extent possible, an analysis of alternatives will precede the implementation of river corridor protection, management and restoration projects (see Appendix E).

1. Based on geomorphic assessments of the Mettowee River, plan, design, and implement riparian restoration projects to control erosion and stabilize streambanks (Ranked # 1 for Issue Prioritization Process). Stabilize sections of the Poultney River streambank identified in the Green Mountain College/ Nature Conservancy (funded in part through the EPA) geomorphic assessment of the river (Ranked # 9 for Issue Prioritization Process).
2. Expand land use practices and programs (Best Management Practices and Accepted Agricultural Practices) that provide a greater emphasis on riparian corridor management activities. Encourage stream channel adjustment processes towards a stable regime and improve riparian buffers.
3. Increase participation and involvement of towns in stream corridor protection. Promote an "Adopt a Stream" program that encourages riparian stewardship by landowners.
4. Develop and implement successful stream restoration projects that incorporate stable channel design techniques.
5. Conduct comprehensive assessments when replacing infrastructure that is in conflict with natural stream stabilization processes, utilizing the recently updated ANR/AOT bridge and culvert assessment protocols.
6. Maintain and enhance relationships among riparian landowners and link riparian corridor restoration efforts where possible.

Objective 1: Based on geomorphic assessments of the Mettowee River, plan, design, and implement riparian restoration projects to control erosion and stabilize streambanks. Stabilize sections of the Poultney River streambank identified in the Green Mountain College/ Nature Conservancy (funded in part through the EPA) geomorphic assessment of the river.

Strategy:

Conduct basin-wide stream geomorphic assessments to identify the physical condition, sensitivity, and adjustment process for rivers and streams in the watershed. Both the Poultney and Mettowee Rivers have undergone certain phases of this assessment process. Researchers from Green Mountain College (GMC) have produced insightful reports based on preliminary geomorphic assessments from 2000 until 2002. Recent efforts to use the ANR Geomorphic Assessment protocols have picked up where these GMC researchers left off. This work serves as a base to conduct in-depth geomorphic assessments of the major rivers in the basin and their tributaries that can lead to the planning and design of projects to control erosion. Protecting stable reaches (conservation reaches) of a river is less expensive and time consuming than attempting to repair eroding streambanks and accelerate channel adjustment processes.

14. Conduct ANR Phase 1 and 2 stream geomorphic assessments in sub-basins throughout the watershed to identify stable and adjusting reaches. Use past geomorphic assessments.

    Lead Agency/Organizations: RRPC and PMWP

    Partners: ANR – Department of Environmental Conservation, Rivers Management Program, USFWS, USFS, NRCS, , PMNRCD, GMC, CSC, and

    Potential funding sources: PMWP with state and federal programs, area colleges, municipal planning grants.

    Time frame: Ongoing

    Benchmark: Increase the linear miles of assessed streams over the next 5 years.

Objective 2: Expand land use practices and programs (Best Management Practices and Accepted Agricultural Practices) that provide a greater emphasis on riparian corridor management activities. Encourage stream channel adjustment processes towards a stable regime and improve riparian buffers.

Strategy:

Ensuring that current Accepted Agricultural Practices (AAPs), Best Management Practices (BMPs) and Acceptable Management Practices (AMPs) are implemented and maintained will lessen land use impacts to river stability. Promoting these best management practices will keep sediment and excess water runoff to a minimum.

15. Implement best management practices as they apply to various land uses to ensure their effectiveness and expand practices to include monitoring and assessment of their effectiveness.

    Lead Agency/Organization: ANR, AAFM, DFPR

    Partners: PMNRCD, PMWP, GMC, DEC, RRPC, USDA-NRCS, USFW, local residents

    Potential funding sources: DEC grant programs, other state and federal programs

    Time frame: Ongoing

    Benchmark: Implement BMPs for various land uses as they apply to riparian areas and surface water protection.

16. Review the current Accepted Agricultural Practices (AAPs) as they apply to farms in the basin to assure the appropriate application of these practices to maximize their efficiency.

    Lead Agency/Organization: AAFM

    Partners: PMNRCD, USDA-NRCS, DEC, USDA/FSA, EPA, and VYCC

    Potential funding sources: State and federal programs

    Time frame: By 2008

    Benchmark: Review of AAP practices used by agricultural operations.

17. Develop and implement river corridor restoration projects on unstable river reaches that include habitat restoration using geomorphic-based stabilization techniques.

    Lead Agency/Organization: USFWS – Partners for Wildlife Program

    Partners: PMWP, PMNRCD, USDA-NRCS, towns, VYCC, stream teams

    Potential funding sources: DEC grant programs, other state and federal programs

    Time frame: Ongoing every spring

    Benchmark: Increase linear miles of riparian zones with trees and shrubs.

18. Increase riparian buffers on State and federal lands.

    Lead Agency/Organization: VTANR, USFW, USFS

    Partners: DFPR, DF&W, Department of Environmental Conservation, towns

    Potential funding sources: State and federal programs

    Time frame: Ongoing

    Benchmark: Increase miles of State and federally owned riparian zones that are vegetated with trees and shrubs.

19. Develop and hold workshops for state employees who issue permits or develop or implement projects that potentially place infrastructure in conflict with natural stream processes.

    Lead Agency/Organization: ANR – EAD, VTDEC

    Partners: VTrans/AOT, VT Local Roads Program

    Potential funding sources: State programs

    Time frame: Ongoing

    Benchmark: Development and presentation of workshops on stream stabilization processes.

Objective 3: Increase participation and involvement of towns in stream corridor protection. Promote an "Adopt a Stream" program that encourages riparian stewardship by landowners.

Strategies:

The Rutland Regional Planning Commission has incorporated strategies into the Rutland Regional Plan that strengthens water quality planning efforts and recommends that towns increase their involvement in the protection of surface waters.

20. Offer information and technical support to selectboards and planners on the local planning, zoning and regulatory opportunities to avoid future conflicts with fluvial erosion hazards and protect or enhance river corridors and water quality. Promote the guidance document, "Local Planning and Zoning Options for Water Quality Protection."

    Lead Agency/Organization: RRPC

    Partners: ANR, Municipal Planners, EPA, PMWP

    Potential funding sources: Clean Water Act Section 604(b) pass through funds, Federal Emergency Management Funds, other state and federal programs

    Time frame: Ongoing

    Benchmark: Language in town plans or zoning that promotes increased protection of water resources in each town.

21. Develop criteria for allocating state river restoration funds and technical assistance that prioritize projects in watersheds where geomorphic assessments have been completed. Provide incentives to towns for riparian buffer protection, including water and shoreline management policies and road maintenance techniques.

    Lead Agency/Organization: VTDEC

    Partners: RRPC, PMWP, towns in the basin.

    Potential funding source: Clean Water Act Section 604(b) pass through funds, other State and federal programs

    Time frame: By 2005

    Benchmark: Development of criteria for allocating river restoration funds and technical assistance.

22. Establish an "Adopt-a-Stream" program that promotes riparian stewardship amongst landowners. Through a river reach analysis process, landowners would be given the stewardship tools necessary to provide for long-term assessment and implementation of river reach adoption.

    Lead Agency/Organization: VTDEC

    Partners: PMWP, towns on a sub-basin level, PMNRCD

    Potential funding source: Not known

    Time frame: Ongoing

    Benchmark: "Adopt-a-Stream" program established in basin.

Objective 4: Develop and implement successful stream restoration projects that incorporate stable channel design techniques.

Strategies:

Based on geomorphic assessments of rivers and streams in the basin, rank restoration projects from highest to lowest priority for river adjustment processes in the most efficient and effective manner. When an opportunity or a crisis makes a river restoration project necessary in an area that has not been surveyed, a geomorphic alternatives analysis-based approach should be used. Consideration should be given to a passive management approach, allowing the river to continue to adjust until it reaches a stable course. The ranking should reflect the following priority order:

I. **Incising reaches**–river reaches that, due to disturbance, have become incised enough (deepening of river channel) to lose access to their floodplain. If access to their floodplain is not restored, the additional flows in the channel will destabilize other reaches.

II. **Moderate to highly degraded sites**–these include sites that require extensive management. In most cases, restoration should only go forward once consideration has been given to upstream stability, sediment budgets, and riparian vegetation. Restoration projects should take place where upstream sites have been stabilized and watershed-wide sediment and vegetation management plans have been implemented. In some cases, downstream sites that have a very high degree of erosion or sedimentation may become a priority over high elevation areas.

III. **Reaches with high recovery potential**–these include reaches that have a potential for self-adjustment, where a passive approach to geomorphic adjustments may be all that is required. Work should focus on reaches that are adjacent to stable reaches. Examples include streams that have access to their floodplain, but lack lateral stability due to a loss of riparian vegetation.

23. Leverage existing resources for implementing stream corridor restoration or protection projects. This may include meeting annually to develop a plan for ranking river corridor restoration.

    Lead Agency/Organization: PMWP

    Partners: ANR, USDA-NRCS, PMNRCD, USFWS, USFS

    Potential funding sources: Disaster Mitigation Funding and other state and federal cost-share programs

    Time frame: Ongoing

    Benchmark: River restoration projects that are supported by more than one resource agency.

24. Assess geomorphic and ecological responses to restoration efforts. Comparisons then could be made with reference data and pre-treatment data to assess the success of restoration efforts.

    Lead Agency/Organization: ANR

    Partners: PMWP, USFWS, RRPC, PMNRCD, GMC, CSC

    Potential funding sources: State and federal programs

    Time frame: By 2009

    Benchmark: A report assessing the morphological and ecological responses to restoration efforts.

25. Purchase or receive donations of conservation easements or property along riparian corridors to conserve the property to allow for river adjustments without conflicting with other land uses.

    Lead Agency/Organization: USDA-NRCS, VLT, and TNC

    Partners: AAFM, ANR, PMNRCD, landowners, municipalities, USFS, Vermont River Conservancy, PMWP

    Potential funding sources: CRP, municipal conservation funds, DFPR Forest Legacy Program, Vermont Housing and Conservation Board, other state and federal programs

    Time frame: Ongoing

    Benchmark: Purchase or donation of property along river corridor.

Objective 5: Conduct comprehensive assessments when replacing infrastructure that is in conflict with natural stream stabilization processes, utilizing the recently updated ANR/AOT bridge and culvert assessment protocols.

Strategies:

26. Hold Better Backroads and VTrans workshops with town highway managers and crews to increase awareness of factors that affect natural stream processes and the cost of stabilizing rivers and streams. Offer a workshop or series of workshops to train citizen groups and others about the natural dynamics of river systems. Continue to host these workshops in conjunction with Green Mountain College and Castleton State College (Ranked # 6 by issue prioritization process).

    Lead Agency/Organization: PMWP, PMNRCD, ANR, VT Local Roads Program

    Partners: VTrans, town road crews, Rutland Regional Planning Commission (TAC)

    Potential funding sources: Better Backroads Program, DEC grant programs

    Time frame: Ongoing

    Benchmark: A series of workshops completed across towns in the watershed.

27. Encourage joint projects between the Agency of Natural Resources River Restoration Teams, Rutland Regional Planning Commission (TAC) and VTrans and town road crews.

    Lead Agency/Organization: ANR

    Partners: RRPC (TAC), Town road crews, VTrans, PMWP

    Potential funding sources: State and federal programs

    Time frame: Ongoing

    Benchmark: Initiation of joint projects that improve riparian corridor management.

Objective 6: Maintain and enhance relationships among riparian landowners and link riparian corridor restoration efforts where possible.

Strategy:

In the Poultney Mettowee Basin, riparian corridors are managed and restored collaboratively by private landowners, the Poultney Mettowee NRCD, USDA-Natural Resource Conservation Service, US Fish and Wildlife Service, US Forest Service, the Vermont Agency of Natural Resources, Vermont Agency of Transportation and others. A collaborative approach is essential. The expense of some of the projects requires many sources of funding; and one group or organization cannot always complete the tasks involved.

The Partnership plays an important role in stream corridor restoration. The labor provided by volunteers is often essential as a form of matching funds needed to earn grants. Volunteers from the community are excellent long-term stewards of remediated areas. Consideration should be given to the objectives of all partners, especially community groups, when developing collaborative efforts.

Implementation of any of the strategies should consider the following:

- The Poultney Mettowee Watershed Partnership's work plan indicates that economic needs must be balanced with environmental concerns. Therefore, potential loss of property, and the interest in voluntary participation in conservation projects should be taken into consideration before including such projects/property in ranking stream corridor protection and restoration.
- The Partnership's mission and goals includes outreach and education, and capacity building as objectives. The Partnership's criteria for projects also include visibility to the public.
- Any assistance to town planning or zoning should be coordinated through the Rutland Regional Planning Commission.

Another strategy that will support local groups follows:

28. Encourage the application of Supplemental Environmental Project (SEP) funds towards community-led projects that improve water quality in the Poultney Mettowee Basin.

    Lead Agency/Organization: ANR

    Potential funding sources: State SEP programs

    Time frame: Ongoing

    Benchmark: Water quality improvement projects in the Poultney Mettowee Basin funded through SEP money.

LANDFILL and SALVAGE YARD ASSESSMENT

The Solid Waste Management Division of the Vermont Department of Environmental Conservation has overseen closure of the unlined Town of Pawlet Landfill. An unnamed tributary to the Mettowee River flowing along the landfill has been listed on Section 303(d) List of Impaired Waters because it receives a discharge of landfill leachate. This unnamed tributary contains elevated levels of iron, manganese and zinc. In the spring of 2000 the landfill was closed and capped. No subsequent leachate has been monitored. Monitoring of ground water in wells has also revealed the mitigation of the leachate. Additional monitoring and assessment is scheduled through 2010, or until it is confirmed over that period that leachate from this site has been eliminated. This unnamed tributary will remain on the State's 303(d) List of Impaired Waters until that time.

A second landfill, the old Fair Haven landfill, has been identified as a site of concern by several sources. The landfill was closed in 1985 but never capped or closed according to a formal plan. Funds were made available through the legislature to conduct a study into informal closure but no funds were made available to implement the plan (1987). The major concern has been that the Castleton River is cutting into the 100-foot high bank of trash from the landfill. Tires, glass and numerous other pieces of trash are in the river itself. The order requiring closure of the Castleton/ Fair Haven landfill cited the potential for adverse impact on adjacent surface water. Supplemental chemical and physical water quality monitoring on three separate sampling dates over the course of the summer of 2002 indicated that surface waters were not impacted. Current monitoring results suggest that problematic leaching is not occurring. The sampling took place primarily for metals analysis to address landfill assessments and hazardous waste investigations as well as general investigations and research of health and ecological effects of metal contamination of the aquatic environment. Despite these monitoring results, concern lingers over this site, and should continue to be monitored until this landfill is properly closed and capped.

The Castleton Area River Project (CARP) has monitored the river adjacent to the landfill site since 1999, and will continue to monitor for pH, conductivity, dissolved oxygen, water temperature, and water clarity. The 2001 CARP report indicates, "The old Fair Haven dumpsite has been an area of concern. There is a great deal of debris in the river, but we also found crayfish and fresh water clams living in the area. We feel these organisms would not be able to live in this area if large levels of toxins were leaching out of the dump".

Recently, the Poultney Mettowee Watershed Partnership has identified a salvage yard in the Poultney River Basin as a site of concern. This is primarily because of its location in the Poultney River floodplain. The dismantling of vehicles for reusable parts and fluids and the sale of remaining materials as scrap that takes place on this site has gone a long way toward lessening the burden on landfills. Unfortunately, some methods used in the dismantling and storage of salvaged vehicles harm the environment such as when the Poultney River periodically inundates vehicles and remaining fluids with floodwaters.

The following objectives are identified to resolve the most pressing issues surrounding landfills and salvage yards.

GOAL: Ensure that these landfills and salvage yards are not posing risks to aquatic habitat and biota as well as human health and existing uses.

- **Objectives (**Listed from highest priority)

  1. Enable the public to determine whether landfill leachate from the old Fair Haven landfill is affecting the Castleton River.
  2. Properly close and cap the old Fair Haven landfill.
  3. Assure that the landfill doesn't produce hazardous leachate in the future.
  4. Improve monitoring and environmental management at salvage yards.

Objective 1: Enable the public to determine whether landfill leachate from the old Fair Haven landfill is affecting the Castleton River.

Strategy:

29. Establish a public web-based database of long-term water quality monitoring data for continued assessment of potential impacts of landfill leachate to the Castleton River.

    Lead Agency/Organization: PMWP, CARP

    Partners: VTDEC, UVM Watershed Alliance, LCBP

    Potential funding sources: LCBP

    Time frame: Ongoing

    Benchmark: On-line database of monitoring information collected by CARP and others.

Objective 2: Properly close and cap the old Fair Haven landfill.

Strategy:

30. Identify potential sources of funding for proper closure of the old Fair Haven Landfill.

    Lead Agency/Organization: ANR-Waste Management Division, Town of Fair Haven

    Partners: Poultney Mettowee Watershed Partnership, Slate Quarries

    Potential funding sources: State Revolving Funds, Municipal bonds

    Time frame: N/A

    Benchmark: Proper closure completed.

31. Carry out the proper capping of the old Fair Haven landfill

    Lead Agency/Organization: ANR-WMD, Town of Fair Haven

    Partners: CARP, PMWP

    Potential funding sources: State legislative appropriation, grants, municipal bonds

    Time frame: Ongoing

    Benchmark: Continued monitoring indicates no leachate post-capping.

Objective 3: Ensure that the landfill doesn't produce hazardous leachate in the future.

Strategy:

32. Analyzing groundwater data and ongoing surface water quality monitoring data will help determine the effectiveness of landfill capping efforts, as well as the appropriateness of sampling and monitoring requirements, and whether additional efforts are needed to detect, prevent or correct any impacts that might occur from landfill leachate.

    Lead Agency/Organization: ANR-WMD, Town of Fair Haven

    Partners: CARP, PMWP

    Potential funding sources: State legislative appropriation, grants, municipal bonds

    Time frame: Ongoing

    Benchmark: Continued monitoring indicates no leachate post-capping.

Objective 4: Improve monitoring and environmental management at salvage yards.

Strategy:

33. Assist salvage yard operators in their evaluation of management practices at junkyards. Assist in the implementation of acceptable management practices for these facilities; provide assistance as these facilities carry out specific Accepted Management Practices, such as the removal of junked automobiles within the floodplain of rivers and streams. Assist salvage yard operators with the removal of junked automobiles adjacent to surface waters and within the floodplain of rivers and streams. Host salvage yard workshops and distribute fact sheets.

    Lead Agency/Organization: ANR-WMD

    Partners: towns in the PM basin, PMWP, VTDEC

    Potential funding sources: Small Business Compliance Assistance Program

    Time frame: Ongoing

    Benchmark: Minimize environmental impacts of active salvage yards. Assist in the clean-up of derelict salvage yards, especially those in close proximity to surface waters.

PATHOGENS

The Agency of Natural Resources, the Poultney Mettowee Watershed Partnership, lake and pond associations, and communities in the basin would like a better understanding of where pathogen sources are a problem. The level of pathogens present in waters is only part of the information needed to identify water quality problems and associated health risks from contact.

Understanding the existing conditions of surface waters is a first step in any water quality protection program. Federal and state agencies and local volunteers have all been involved in collecting data to improve our picture of water quality in the Poultney Mettowee Basin. The types of data collected include information pertaining to pathogens (as measured with the indicator bacteria, *Escherichia coli*), nutrient levels, chemical parameters, and the physical characteristics of lakes, ponds, streams, and rivers. Information about water quality can increase public interest in protecting or restoring surface waters in the basin. In addition, adequate information about levels of bacteria allows the public to make informed decisions on health risks associated with contact recreation.

Information gathered from regular monitoring at swimming areas can reduce human exposure to pathogens and "flag" waters with regular or episodic elevations in pathogens. Frequent monitoring at public swimming areas increases the data and subsequent understanding of episodic events, like septic system failures and runoff from precipitation events. When regular monitoring of bacteria at swim areas is coupled with rainfall data, then rational, preventative closure of swim areas is possible. In addition, regular monitoring of surface waters at other locations in a watershed can be used to identify potential sources of pathogens.

Bracketed bacteria monitoring (above and below suspected sources) can be used to help identify a source of bacterial pollution. Both surface runoff and direct discharges can carry bacteria into surface waters. To identify potential sources, a long-term monitoring program that includes precipitation amounts would be helpful. Following a storm event, increased surface runoff from agricultural and urban landscapes can result in temporarily high bacteria levels in receiving waters. A trend of high bacteria levels, especially during periods of little precipitation, may indicate a regular discharge of human or animal waste, perhaps through a leaking pipe, from waterfowl resting spots, beaver, or from a barnyard. Further investigation of the landscape can help to determine a specific source, whether it is of natural background or of human origin.

GOAL: To identify surface waters with regular or episodic elevations in pathogens and disseminate this information to the public.

- **Objectives (**Listed from highest priority)
  1. Determine locations of high levels of *E. coli* (as indicators of pathogens) in surface waters (with regular or episodic elevations in pathogens) and make these results public. (Ranked # 1 by public prioritization process).
  2. Eliminate sources of *E. coli* where possible and find solutions for ongoing problem areas that contribute high levels of *E. coli*, as indicators of pathogens.

Objective 1: Determine locations of high levels of *E. coli* (as indicators of pathogens) in surface waters (with regular or episodic elevations in pathogens) and make these results public.

Strategies:

Identify public swimming beaches at lakes and ponds (either municipal swimming areas or state parks and other public lands). Work with communities, lake and pond associations, and others who are testing for indicators of pathogens and other health threats.

34. Develop a database for public notification and information regarding water quality monitoring efforts in the basin, specifically how it relates to contact recreation associated with state parks, public beaches and access areas.

    Lead Agency/Organization: PMWP

    Partners: VTANR-FPR, VTDEC, towns in the Poultney Mettowee basin.

    Potential funding sources: LCBP, UVM Watershed Alliance

    Time frame: ongoing

    Benchmark: Database on-line provides accurate and timely information.

35. Analyze *E. coli* samples according to VTDEC monitoring protocols.

    Lead Agency/Organization: PMWP

    Partners: VTANR-FPR, VTDEC.

    Potential funding sources: VTDEC

    Time frame: Ongoing

    Benchmark: Ongoing protocol developed for processing and notification of sampling results.

Objective 2: Eliminate sources of *E. coli* where possible and find solutions for ongoing problem areas that contribute high levels of *E. coli*, as indicators of pathogens.

Strategies:

36. Develop a monitoring program in the Poultney Mettowee basin that will enumerate *E. coli* levels at informal and public swimming holes in the basin. This monitoring program is intended to be used as a routine monitoring tool at swim areas to detect an episodic increase in bacteria levels. Results from such a monitoring program will be used as public notification and information for decision-making for contact recreation activities. The use of VTDEC bacteria monitoring protocols will be imperative (refer to protocols @:http://www.vtwaterquality.org/LakesPonds/ lp_citbactmonguide.pdf).

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

Partners: VTDEC-Water Quality Division - LaRosa lab, Municipal health officers

Potential funding sources: LaRosa grant services, LCBP grants, town health programs

Time frame: Ongoing

Benchmark: Establish an active on-line database of monitoring results for public notification and information.

37. Through bracketed monitoring, investigate areas indicating high *E. coli* to determine the sources.

    Lead Agency/Organization: PMWP

    Partners: VTANR-FPR, VTDEC, towns in the Poultney Mettowee basin.

    Potential funding sources: LCBP, UVM Watershed Alliance

    Time frame: Ongoing

    Benchmark: Identification and remediation of sources contributing to *E. coli*.

38. The Poultney Mettowee Buffer Outreach project and federal cost-share programs should target sensitive riparian areas characterized by a lack of riparian vegetation that would benefit from the re-establishment of a vegetated riparian buffer. Encourage riparian landowners (and incentives, if possible) to maximize the width of buffer zones adjacent to the tributaries and the river itself.

    Lead Agency/Organization: PMNRCD

    Partners: PMWP, USDA-NRCS, VTDEC, towns, riparian landowners

    Potential funding sources: Federal cost-share programs, grants

    Time frame: Ongoing

    Benchmark: Establish additional riparian buffers throughout the basin on an ongoing basis.

39. Fencing livestock out of surface waters should greatly curtail the amount of pathogens entering surface waters. Livestock should be pastured and excluded as far from surface waters as possible, and should use bridges to cross tributaries wherever possible - again, positive incentives would be invaluable.

    Lead Agency/Organization: USDA-NRCS

    Partners: PMNRCD, AAFM, PMWP, VYCC

    Potential funding sources: USDA-NRCS cost-share programs

    Time frame: Ongoing

    Benchmark: Fence out livestock from surface waters from medium and large farm operations agricultural operations throughout the Poultney Mettowee Basin by 2008.

40. Assist basin farmers with manure storage and application practices. Help direct federal cost-share and other funding sources towards manure storage and handling improvement projects. Work with the AAFM to revise BMPs and AAPs where necessary. Manure spreading close to tributaries and the river itself should be discouraged, especially in areas where the ground slopes into the water, and spreading should ideally be completed as early as possible before the ground freezes.

    Lead Agency/Organization: PMNRCD

    Partners: USDA-NRCS, AAFM, VTDEC, PMWP, farms in the Poultney Mettowee Basin

    Potential funding sources: federal cost-share funds, Farm Bill

    Time frame: Ongoing, as necessary

    Benchmark: Improve manure storage and handling practices throughout the basin.

4.2 Aquatic Habitat Restoration and Other Natural Resource Enhancement

THERMAL MODIFICATION

Temperature is a primary regulator of biological activities and an increase in the temperature regime of small streams may stress or eliminate fish species or age classes by increasing their rate of metabolism while, at the same time, reducing the amount of dissolved oxygen in the water. Elevated water temperatures may, therefore, reduce the vigor of cold-water species and make them more susceptible to disease or parasites. Small headwater streams, such as Flower Brook, are most likely to be affected by the clearing of streamside vegetation.

The Mettowee River experiences elevated water temperatures during worst-case summertime conditions, when maximum solar radiation and minimum streamflow conditions are concurrent. The high temperatures have impaired the Mettowee, which is designated as a cold-water fishery, primarily in the summer. The Mettowee River has historically provided for a diverse fish community. The fisheries survey conducted in the 1950's found numerous species of fish including the following; black nose dace, cottus, common (white) sucker, creek chub, long-nose dace, sunfish (likely pumpkin seed), bullhead, catfish, fallfish, yellow perch, common shiner, long-nose sucker, and large-mouth bass (VT Fish & Wildlife, 2000). In addition, several species of trout are present in the Mettowee and its tributaries in different reaches during different times of the year, including brown trout, brook trout, and rainbow trout.

The 1975 Water Quality Management Plan for the Poultney Mettowee Basin identified impairments to the Mettowee River in a discussion of water quality issues. Specifically, the plan stated that the Mettowee River has been subject to over-grazing and intensive agricultural uses of the land immediately adjacent to the river, which may cause a degradation of the water quality (possibly exceeding water quality standards such as dissolved oxygen and coliform bacteria). In addition,

Streambank erosion along the Mettowee

"Agriculture is a moderate source of impairment due to temperature problems, high sediment loads, and nutrient enrichment from agricultural land uses (especially crop and hay production and pasturing), loss and removal of riparian vegetation, and streambank erosion" (VTDEC, 1975). Vermont Fish & Wildlife biologists noted fish kills beginning in the 1970s and continuing to the present due to temperature-related problems due to turbidity and riparian vegetation loss in the Mettowee River and Flower Brook, a tributary draining into the Mettowee.

A nine-mile segment of the Mettowee River is listed as impaired on the Vermont 303(d) List of Impaired Waters (an EPA approved list of waters in each state that do not meet water quality standards) because of high water temperatures documented by previous studies of the River (VTDEC, 2002). This impairment designation was originally based on narrative/descriptive and observation-based information from the late 1980s. A 6-mile segment of the Mettowee River that is a subset of this 9-mile stretch appears on Part A of the 2002 List of Waters for temperature caused impairments. Temperature data were gathered by the Vermont Department of Fish & Wildlife from two sites on the Mettowee River from mid-April to the end of October 1995. The lower site near where Route 153 crosses the river in the eastern portion of Pawlet had high temperatures in much of the daytime in July and August. Thermal monitoring conducted by the TMDL project contractor, ENSR, during the summer of 2001 produced similar results. Their evaluation of conditions during the 2001 summer (a good-case scenario for hot, dry conditions and low flows) confirmed that on several days during the summer, temperatures rose above tolerable levels for cold-water fish sustainability.

According to the ENSR Report (2002), the most effective way to address the thermal impairment issue on the Mettowee River is to increase riparian shading, effectively cooling the waters through a decrease in sunlight exposure. When trees and shrubs are removed along the banks of a stream, the new exposure to sunlight may cause significant increases in water temperature, especially during periods of low flow.

According to the Clean Water Act, states are required to develop a Total Maximum Daily Loading (TMDL) allocation plan for all priority waterbodies on the 303(d) List. Thus, the VT DEC is currently developing a TMDL allocation plan for elevated water temperature in the Mettowee River.

GOAL: Continue to identify ways to minimize thermal modification of the Mettowee by increasing shading that will improve the aquatic habitat of the cold-water fishery.

Objectives (Listed from highest priority)

1. Increase shading in critical areas to help lower water temperatures.
2. Manage the River to Promote Geomorphic and Streambank Stability.
3. Reduce water temperatures entering the mainstem from Flower Brook.

Objective 1: Increase shading in critical areas to help lower water temperatures.

Strategies:

When trees and shrubs are removed along the banks of a stream, the new exposure to sunlight can cause significant increases in water temperature, especially during periods of low flow. Riparian plantings are expected to provide additional shading in critical areas to help lower water temperature in the Mettowee River Basin.

41. Re-establish riparian vegetation along the banks of the Mettowee

    Lead Agency/Organization: PMNRCD

    Partners: USDA-NRCS, USFW, PMWP, VTDEC, GMC, VYCC, riparian landowners.

    Potential funding sources: State (319) and federal (CREP) cost-share programs.

    Time frame: Ongoing

    Benchmark: Increase in linear riparian buffer planting of 5,000 feet along the Mettowee riparian corridor (and/or Flower Brook) by 2005.

The Vermont Rivers Management Program has recently established river and stream assessment protocols to be used throughout the state in assessing the geomorphic stability of rivers and streams. The value of conducting geomorphic assessments to prioritize potential areas for river corridor protection and restoration is becoming well known and widely adopted by river managers. Ultimately, the overarching goal of conducting geomorphic assessments is resolve conflicts between human structures and activity and river dynamics in the most economically and ecologically sustainable manner.

42. Following completion of Phase 2 geomorphic assessment of the Poultney Mettowee River Watersheds, conduct Phase 3 Geomorphic Assessment of project reaches of the Mettowee and tributaries, especially Flower Brook.

    Lead Agency/Organization: VTDEC – Rivers Management Program

    Partners: Rutland Regional Planning Commission, Castleton State College, PMWP, PMNRCD, Towns, riparian landowners, and other technical resource agencies.

    Potential funding sources: Better Backroads Program, DEC grant programs

    Time frame: Ongoing

    Benchmark: The completion of geomorphic assessment workshops in the basin for natural resource managers, town officials, academics, and riparian landowners.

43. Work with landowners and state and federal programs to install fencing along the river to keep livestock out of surface waters and stabilize streambanks. A riparian buffer will be re-established to reduce elevated water temperatures in the Mettowee River (and its tributaries) from increased shading. In order to implement this objective, the buffer outreach project seeks to provide information and outreach to all riparian landowners within the Mettowee watershed.

    Lead Agency/Organization: PMNRCD, PMWP

    Partners: VTFWD, VTDEC, AAFM, Towns, and riparian landowners

    Potential funding sources: EPA 319, LCBP WAGs, PMWP grants.

    Time frame: Ongoing

    Benchmark: Increase awareness of the benefits of buffers for riparian landowners over the next 5 years.

Objective 2: Modify the river channel to promote bank stability.

Strategies:

The Vermont Rivers Management Program has recently established river and stream geomorphic assessment protocols to be used throughout the state in assessing the stability of rivers and streams. The value of conducting geomorphic assessments to prioritize potential areas for restoration is becoming well known and widely adopted by river managers. Ultimately, the overarching goal of conducting geomorphic assessments is resolve conflicts between human structures and activity and river dynamics in the most economically and ecologically sustainable manner.

44. Following completion of Phase 2 geomorphic assessment of the Poultney Mettowee River Watersheds, conduct Phase 3 Geomorphic Assessment of Mettowee and tributaries, especially Flower Brook.

    Lead Agency/Organization: VTDEC – Rivers Management Program

    Partners: Rutland Regional Planning Commission, Castleton State College, PMWP, PMNRCD, Towns, riparian landowners, and other technical resource agencies.

    Potential funding sources: Better Backroads Program, DEC grant programs

    Time frame: Ongoing

    Benchmark: The completion of geomorphic assessment workshops in the basin for natural resource managers, town officials, academics, and riparian landowners.

45. Based on geomorphic assessments and alternatives analysis, undertake channel adjustment and/or restoration projects. Narrowing the Mettowee River channel is predicted to be effective in reducing maximum water temperatures. In addition, channel modifications could provide deeper, cooler pools in which fish could seek refuge during temperature events.

    Lead Agency/Organization: PMNRCD

    Partners: VTDEC, USFW, USDA-NRCS, PMWP, riparian landowners.

    Potential funding sources: State (319) and federal cost-share programs and grants.

    Time frame: Ongoing

    Benchmark: Where possible, install natural channel design treatments to over-widened reaches of the Mettowee River to stabilize riverbanks and enhance cooler water temperatures and flow.

Objective 3: Reduce water temperatures entering the mainstem from Flower Brook.

Strategy:

The water temperature of Flower Brook is higher than that of the Mettowee River. As plans to cool the waters of the Mettowee are implemented, the increased heat load contributed by this tributary will become significant. Therefore, possible management scenarios that could reduce water temperature in Flower Brook should be designed, evaluated, and implemented. Possible management actions include increased riparian shading and stabilizing eroding streambanks.

46. Reduce the water temperature entering the Mettowee River from Flower Brook through enhanced riparian buffer vegetation (shading) and managing toward channel geometry and stability that will support deeper channel cross-sections.

    Lead Agency/Organization: DEC

    Partners: PMNRCD, USFW, USDA-NRCS, RRPC,

Poultney Mettowee Watershed Partnership, towns, and landowners along the Flower Brook sub-basin.

Potential funding sources: EPA 319, LCBP WAGs, USFW, USDA-NRCS cost-share, PMWP

Time frame: Ongoing

Benchmark: Reduce mean summer water temperatures in Flower Brook by 5°F over the next 5 years.

FISHERIES

Several fishery concerns have recently emerged over the last few years. Perhaps of greatest concern for the health of trout fisheries is the appearance of whirling disease in the Batten Kill. The New York Department of Environmental Conservation informed Vermont Fish and Wildlife Department biologists in June of 2002 that whirling disease was found in trout captured in the New York section of the river. According to the Whirling Disease Foundation in Montana, the disease is a parasitic infection that attacks juvenile trout and salmon. The parasite, Myxobolus cerebralis, embeds in the head and spinal cartilage of fingerling trout and multiplies rapidly, putting pressure on an organ in fish that regulates equilibrium. The diseased organ causes fish to swim erratically – or whirl – and have difficulty feeding and avoiding predators. In severe infections, the disease can cause high rates of mortality in young-of-year fish.

Lake St. Catherine

One additional concern regarding fisheries that continues to pose a long-term challenge has been the introduction of an invasive baitfish species, alewife to Lake St. Catherine. First discovered in July 1997, the population in Lake St. Catherine is likely a result of an illegal stocking (Good, personal communication). Based on the impacts that exotic alewives have had on native ecosystems in other lakes, we can predict the specific impacts they are likely to have in Lake St. Catherine. The main impacts of alewives will likely result from competition for zooplankton and predation on eggs and larvae of other fish. As long as alewives remain contained within Lake St. Catherine, some form of management to deal with them is available. However, if alewives were to spread to Lake Champlain and other Vermont waters, there are few options other than living with them. The Vermont Fish and Wildlife Department has been stocking the lake with brown trout, which are aggressive feeders on alewives.

GOAL: To address the decline of native fish populations, especially trout species, due to whirling disease, non-native nuisance species, and other factors having an impact on the health of native fisheries.

- **Objectives (**Listed from highest priority)
  1. Monitor and assess native fish populations to determine what affect whirling disease and invasive species have on those populations.
  2. Monitor the outlet of Lake St. Catherine and Mill Brook for the presence of alewife.
  3. Increase awareness of anglers and boaters about alewives and other aquatic nuisance species and diseases (parasites) that may be affecting healthy fisheries.
  4. Through the use of interpretive signs, brochures and newsletters, educate the public on ways to prevent the spread of aquatic nuisance species.
  5. Identify areas that lack good fish habitat with the help of the Vermont Fish and Wildlife Department and develop habitat improvement projects for these areas.
  6. Identify riparian landowners that are willing to implement streambank restoration projects.

Objective 1: Monitor and assess native fish populations to determine which factors may contribute to whirling disease and the aquatic nuisance species problem (i.e., Alewives in Lake St. Catherine).

Strategy:

47. Work with fisheries biologists and anglers to monitor and assess native fish populations to de-

termine what affect whirling disease and invasive species have on those populations.

Lead Agency/Organization: VT Fish & Wildlife

Partners: Angler groups (Green Mountain Fly Tiers, Orvis, Trout Unlimited)

Potential funding sources: State programs, PMWP grants for monitoring efforts

Time frame: Ongoing

Benchmark: Remain vigilant over fisheries health. Take corrective management action when necessary.

Objective 2: Monitor the outlet of Lake St. Catherine and Mill Brook for the presence of alewife.

Strategy:

48. Since they were discovered, fisheries biologists have worked to develop a management plan without public input. At this time, Vermont Fish and Wildlife fisheries biologists have not developed a plan that will remove the population. Most of the proposed management techniques were cost prohibitive except reducing the alewife population through increased stocking of brown trout, which are aggressive feeders of alewives. Efforts will be made to continue to monitor the outlet of Lake St. Catherine and Mill Brook for the presence of alewives.

    Lead Agency/Organization: VT Fish & Wildlife

    Partners: NYSDEC, angler groups, Green Mountain College

    Potential funding sources: State Programs

    Time frame: Ongoing

    Benchmark: Reduce or eliminate potential of alewife introduction into Mill Brook. Annual monitoring program established to determine the presence and/or absence of alewives for surface waters in the basin.

Objective 3: Increase awareness of anglers and boaters about alewives and other aquatic nuisance species and diseases (parasites) that may be affecting healthy fisheries.

Strategy:

49. Educate anglers and boaters about alewives and other aquatic nuisance species and diseases (parasites) that may be affecting healthy fisheries. Hold workshops and give presentations on these issues for angler groups and associations.

    Lead Agency/Organization: VT Fish & Wildlife

    Partners: PMWP, VTDEC, media contacts (LRFP), Angler groups

    Potential funding sources: VTF&W grants, State programs

    Time frame: Ongoing

    Benchmark: Increase awareness of threats to fisheries among user groups.

Objective 4: Through the use of interpretive signs, brochures and newsletters, educate the public on ways to prevent the spread of aquatic nuisance species.

Strategy:

50. Use interpretive signs and other forms of media educate the public on ways to prevent the spread of aquatic nuisance species.

    Lead Agency/Organization: PMWP

    Partners: LCBP, VTDEC, TNC, lake and pond associations

    Potential funding sources: LCBP grants, state programs, other grants

    Time frame: Ongoing

    Benchmark: Distribute education and outreach materials regarding spread prevention tactics.

Objective 5: Identify areas that lack good fish habitat with the help of the Vermont Fish and Wildlife Department and federal fisheries biologists and develop habitat improvement and demonstration projects for these areas.

Strategy:

51. Identify areas that lack good fish habitat and develop geomorphically-compatible stream habitat improvement projects.

    Lead Agency/Organization: VT Fish & Wildlife

    Partners: PMWP, USFW, USFS, VTDEC, local towns, riparian landowners, angler groups

    Potential funding sources: USFW-PFW, VTF&W grants, state programs, LCBP grants

    Time frame: Ongoing

    Benchmark: Complete a habitat improvement project.

Objective 6: Identify riparian landowners that are willing to implement streambank restoration projects.

Strategy:

52. Identify landowners that are willing to have work done on their property and secure funding for in-stream projects.

    Lead Agency/Organization: PMNRCD

    Partners: USDA-NRCS, USFW-PFW, PMWP, VTF&W

    Potential funding sources: USDA-NRCS federal cost-share, USFW-PFW

    Time frame: Ongoing

    Benchmark: Complete in-stream projects in the Mettowee River basin as determined appropriate by geomorphic assessments.

AQUATIC NUISANCE SPECIES

GOAL: All reasonable means must be taken to control the extent and spread of non-native aquatic nuisance species by methods including outreach, education, and eradication. In addition to lakes and ponds where aquatic invasive exotic species are already a significant source of impairment and/or threat, attention also must be given to controlling aquatic nuisance species infestations that now begin to appear in rivers and streams.

- **Objectives (**Listed from highest priority)

  1. Increase spread prevention education and awareness for boaters, anglers, and other lake/ river users whose actions may contribute to the aquatic nuisance species problem.
  2. Establish Exotic Species Watch programs along surface waters where these programs currently don't exist.
  3. Remove nuisance plant material to the extent feasible and assist in the management of aquatic invasive exotic species.

Objective 1: Increase spread prevention education and awareness for boaters, anglers, and other lake/ river users whose actions may contribute to the aquatic nuisance species problem.

Strategies:

53. Increase education and awareness regarding spread prevention tactics for boaters, anglers, and other lake users. Host seminars and focus group discussions. Promote the work of lake/ river/ watershed associations to educate their members and other residents of towns and communities.

    Lead Agency/Organization: VTDEC – ANS Program

    Partners: FOVLAP, PMWP, VTDEC, VTF&W, LCBP, TNC, lake associations, towns, and angler groups.

    Potential funding sources: State and federal grants, LCBP education grants

    Time frame: Ongoing

    Benchmark: Increase awareness regarding invasive aquatic species.

54. Install additional signage regarding aquatic nuisance species at state and municipal access areas to surface waters and in public locations frequented by surface water users. Increase educational signs at Vermont Fish and Wildlife access areas that highlight the problems associated with invasive species and include tips for boaters and recreationists regarding safe boat transport practices.

    Lead Agency/Organization: VT DEC Lakes and Ponds Program

    Partners: PMWP, VTF&W, LCBP, TNC

    Potential funding sources: LCBP Wayside Exhibit Program

    Time frame: 2009

    Benchmark: 10 signs installed at 10 access areas in 5 years.

Objective 2: Establish Exotic Species Watch programs along surface waters where these programs currently don't exist.

Strategies:

55. Establish Exotic Species Watch programs on surface waters where these programs currently don't exist. Improve communication between lake/ river/ watershed associations, the VTDEC – Aquatic Nuisance Species Program, angler groups, and towns.

    Lead Agency/Organization: VTDEC-ANS Program

    Partners: FOVLAP, PMWP, lake associations, angler groups, towns.

    Potential funding sources: VTDEC-ANS grants, Conservation grants, volunteer initiatives (The Nature Conservancy).

    Time frame: 2005

    Benchmark: Exotic Species Watch programs initiated by major lake and pond associations by 2005.

56. Hold aquatic nuisance species workshops for lake and pond residents to identify aquatic nuisance species of concern in Vermont and those at risk to enter the state.

    Lead Agency/Organization: VTDEC-ANS Program

    Partners: PMWP, lake associations, towns, VTF&W

    Potential funding sources: State funds and grants.

    Time frame: Ongoing

    Benchmark: Prevent new infestations

Objective 3: Remove nuisance plant material to the extent feasible and assist in the management of aquatic nuisance species.

Strategy:

57. Assist efforts by The Nature Conservancy, lake and pond associations, towns and others in the physical removal of invasive exotic plant material.

    Lead Agency/Organization: The Nature Conservancy

    Partners: Poultney Mettowee Watershed Partnership, VTDEC, VTF&W, USFW, VYCC, Municipal Conservation Commissions, Youth groups, Community service volunteers

    Potential funding sources: Volunteer-based, with the exception of VYCC

    Time frame: Ongoing

    Benchmark: Control aquatic nuisance species, especially new infestations.

FLOW AND WATER LEVEL REGULATION

Streamflow and water level regulation can have significant effects on aquatic habitat and biota, aesthetics and other uses and values of the state's waters. Activities that regulate streamflow and water levels include water withdrawals for municipal, domestic, agricultural or industrial uses, hydroelectric dams, and operation of dams used for other purposes.

The Vermont Dam Inventory lists 46 dams in the Poultney Mettowee Basin. Many of these dams are small and are operated run-of-river. That is, they do not manipulate flows or water levels. Some, like Lake Bomoseen, are located at the outlets of natural lakes and control water levels in these lakes.

Some of these dams no longer serve their original purpose (hydropower, recreation, water supply) and are falling into disrepair. Nonetheless, they continue to have ecological impacts such as blocking the movement of fish and other organisms, altering sediment transport, and raising water temperatures. They also may create public safety hazards by exacerbating flooding or causing significant flood damage downstream in the event of failure. They are also economic and legal liabilities for their owners.

Removal of unneeded dams can reap significant benefits and is often less expensive than repairs or reconstruction. Following additional assessment of the dams in the watershed, potential candidates for removal will be identified. Individual projects will be developed in cooperation with the dam owner and local community. Dams that provide significant public benefits would likely be modified to address environmental impacts rather than removed.

Only two dams in the basin are used to generate hydroelectric power. One, Flower Brook Hydro, is a small dam on Flower Brook in Pawlet. The other, Carver Falls on the mainstem of the Poultney, is more significant.

The Carver Falls Hydroelectric Project was first developed in 1894. It has changed considerably over the years, and a new dam section was added following the 1927 flood. The project was acquired by the Central Vermont Public Service Corporation in 1929. The project is currently in the process of obtaining a federal license from the Federal Energy Regulatory Commission. Until recently, the project has not been subject to FERC jurisdiction. The conditions in the license will have a major impact on the river above and below the dam.

Carver Falls is the highest major falls in Vermont and the Lower Poultney River is one of four Outstanding Resource Waters (ORW) in the state. The Lower Poultney was designated an ORW due to exceptional natural, cultural and scenic values.

Adequate flows in the reach between the dam and powerhouse (the bypassed reach) and downstream of the powerhouse are necessary to protect aquatic habitat. The hydroelectric project will be operated in a run-of-river mode that will not re-regulate downstream flows. However, flows in the bypassed reach are needed to support aquatic habitat and aesthetics. Some fluctuation of flows between day and night is acceptable, provided the fluctuations do not impair aquatic habitat.

GOAL: Restore Carver Falls bypass flow to a natural flow regime, improving aquatic biota and habitat. Identify non-functioning dams in the basin for removal, partial breeching, and improved fish passage.

- **Objectives (**Listed from highest priority)

    1. Restore the natural flow regime below Carver Falls
    2. Improve aquatic habitat and aesthetics in the Carver Falls bypass.
    3. Improve aquatic habitat and wetland function in the Carver Falls Project impoundment.
    4. Ensure consistency of the Carver Falls Project operation with the comprehensive management plan and ORW for the Lower Poultney River.
    5. Identify non-functioning dams and coordinate for removal, partial breaching, and/or improved fish passage.

Flower Brook in Pawlet

Objective 1: Restore the natural flow regime below the Carver Falls Project.

Strategy:

58. Operate the Carver Falls Hydroelectric Project in run-of-river mode where flows below the powerhouse equal inflow to the impoundment on an instantaneous basis. Include conditions requiring this mode of operation in the water quality certification issued as part of the FERC licensing process.

    Lead Agency/Organization: CVPS

    Partners: VTDEC, VTDFW, NYSDEC

    Potential funding sources: n/a

    Time frame: 2004

    Benchmark: Implementation of run-of-river operation.

Objective 2: Support aquatic habitat and aesthetics in the Carver Falls bypass.

Strategy:

59. Based on studies conducted during the FERC re-licensing process, conservation flows of 18.5 cfs are necessary in the bypass to support aquatic habitat from May 16 through March 31. From April 1 through May 15, 50 cfs are necessary to support walleye spawning and incubation.

    Based on an aesthetics study, 57 cfs is the threshold flow necessary to provide water over the lower falls. A release of 80 cfs at the dam is needed to provide adequate spill over the lower falls. Vermont Water Quality Standards (2000) requires that waters "consistently exhibit good aesthetic value" including the sounds and sights of falling water. Due to seasonal and daily use patterns, flows can sometimes be reduced during the winter and nighttime hours.

    A bypass flow of 80 cfs to support aesthetics is necessary from April 1 to October 30. However, a flow of 57 cfs at night will provide minimal support and not result in excessive flow fluctuations that would degrade aquatic habitat. These flows will also provide support for aquatic habitat, including walleye spawning in the spring. During the remainder of the year, 18.5 cfs is required in the bypass to support aquatic habitat. These flows should be incorporated into the state water quality certification and FERC license.

    Lead Agency/Organization: CVPS

    Partners: VTDEC, VTDFW

    Potential funding sources: n/a

    Time frame: 2004

    Benchmark: Implementation of bypass flows.

Objective 3: Support aquatic habitat and wetlands in the Carver Falls bypass.

Strategy:

60. Elimination of frequent or large magnitude drawdowns that degrade wetlands and aquatic habitat associated with the Carver Falls impoundment. Run-of-river operation will eliminate frequent drawdowns, and modification of the six-foot flashboards to prevent failure will reduce the likelihood of a large magnitude drawdown.

    Lead Agency/Organization: CVPS

    Partners: VTDEC, VTDFW, NYDEC

    Potential funding sources: CVPS

    Time frame: 2004 for run-of-river, 2006 for flashboard modification

    Benchmark: Drawdowns eliminated with exception for emergency situations.

Objective 4: Ensure consistency of the Carver Falls Project operation with the comprehensive management plan and ORW for the Lower Poultney River.

Strategy:

61. Implementing the three previous strategies should preserve and enhance the exceptional uses and values of the Lower Poultney River described in the Lower Poultney River ORW Report (1992). Ongoing compliance monitoring and follow-up will be necessary to ensure that the previous objectives are met. FERC must determine the consistency of the federal license for the Carver Falls project with Lower Poultney River ORW uses and values.

    Lead Agency/Organization: VTDEC

    Partners: CVPS, FERC

    Potential funding sources: State and federal programs

    Time frame: Ongoing

    Benchmark: Consistent compliance with FERC license articles/401 conditions. Periodic monitoring results indicate compliance with these objectives.

Objective 5: Identify non-functioning dams and coordinate for removal, partial breaching, and/or improved fish passage.

Strategy:

62. Provide technical assistance, landowner outreach regarding dam ownership liability, identify funding opportunities, and coordinate dam removal projects if necessary.

    Lead Agency/Organization: DEC watershed coordinator, DEC Hydrology Section, Vermont Dam Task Force, and Vermont F&W, American Rivers

    Targeted Audience: dam owners

    Partners: VTDEC, VTDFW, towns

    Potential funding sources: FEMA, USFW, USDA-NRCS, Fish America grant

    Time frame: by 2008

    Benchmark: Selectively remove 2 dams

4.3 Conserving the Soil and Water Resources of Agricultural Land

NUTRIENT ENRICHMENT AND SEDIMENTATION

Sedimentation has been identified as the primary cause of surface water impairment to Vermont surface waters. The sources of sedimentation and subsequent nutrient enrichment can be traced back to specific land use practices and transportation infrastructure including: back roads, eroding streambanks, construction sites, and runoff from urban as well as agricultural areas. A direct consequence of sedimentation is associated nutrient enrichment. Nutrients commonly bind to soil particles that result in nutrient loading as soil erosion and subsequent nutrient liberation takes place.

Recent attention has focused on gravel roads and driveways as potential sources of sediment and phosphorus to lakes and streams. Every road or driveway can become a conduit for rainwater or snowmelt, eroding the road material and introducing it to nearby streams or lakes. It is especially critical to maintain driveways in riparian areas due to their proximity to surface waters.

Streams and rivers that are in a channel adjustment process have characteristic features such as eroding banks, channels that cut deep into their beds, and gravel accretion (aggradation) that can have devastating impacts on fish and other aquatic biota.

Although construction activities are usually temporary, erosion from construction sites can cause significant amounts of sediment to enter adjacent waterbodies. Construction activities result in the disturbance of vegetation during the building of homes, roads, bridges, and businesses. Erosion from construction activities can cause loss of topsoil, contamination of water by heavy metals, and phosphorus pollution and algae blooms in lakes and ponds. Excessive sedimentation in streams can lead to stream instability as the channel bed builds up or aggrades.

On a unit area basis, construction sites export sediment at 20 to 2,000 times the rate of other land uses. Suspended sediment can reduce plankton and aquatic plant growth, decrease native fish populations and species diversity, increase water treatment costs, and have an impact on recreational activities. Deposited sediments can smother macroinvertebrate communities, destroy fish spawning and habitat areas, deplete dissolved oxygen, reduce storage and lower design life for reservoirs impoundments and ponds, increase channel aggradation, increase streambank erosion, reduce channel conveyance capacity under bridges and culverts, and diminish recreational and aesthetic uses of waterways (The Center for Watershed Protection).

GOAL: Mitigate sources of nutrient enrichment and sedimentation and eliminate, where possible, export to surface waters.

- **Objectives (**Listed from highest priority)

1. Increase education and awareness of back road erosion impacts on surface waters and promote the financial incentives of good road maintenance.
2. Encourage stream adjustment process towards a stable regime.
3. Continue maintenance of erosion and sediment control practices during construction.
4. Reduce sedimentation and subsequent nutrient enrichment from agricultural sources in the basin through existing district, state, and federal programs.
5. Reduce stormwater runoff from existing developed areas, and implement proper site design, construction techniques, and stormwater treatments for new development.

Objective 1: Increase education and awareness of back road erosion impacts on surface waters and promote the financial incentives of good road maintenance.

Strategy:

63. Provide funding for the Poultney Mettowee NRCD and the Rutland Regional Planning Commission to conduct workshops in the region on erosion control techniques for town road managers.

    Lead Agency/Organization: Vermont ANR

    Partners: PMNRCD, RRPC, towns, VT Local Roads Program, Better Backroads Program

    Potential funding sources: Better Backroads program, EPA pass through funds

    Time frame: ongoing

    Benchmark: Road managers from each town in the watershed invited to workshops.

Objective 2: Encourage stream adjustment process towards a stable regime.

Severe gully erosion

Strategy:

64. Provide training for state and federal technical resource representatives as well as lay people to evaluate stream restoration alternatives and design and implement stream geomorphic and habitat restoration projects.

    Lead Agency/Organization: VTDEC – Rivers Management Program

    Partners: PMNRCD, RRPC, USFW, USFS, USDA-NRCS, PMWP,

    Potential funding sources: State and federal funds

    Time frame: N/A

    Benchmark: Workshops and training held.

Objective 3: Continue maintenance of erosion and sediment control practices during construction.

Strategy:

65. Minimize large pulses of sediment to surface waters that come from exposed soil at construction sites.

    Lead Agency/Organization: VTANR – DEC– Stormwater Program

    Partners: EPA, AOT, AGC, RRPC, towns,

    Potential funding sources: State and federal programs, stormwater permits

    Time frame: Ongoing

    Benchmark: Minimize sediment and nutrient export into surface waters.

Objective 4: Reduce sedimentation and subsequent nutrient enrichment from agricultural sources in the basin through existing district, state, and federal programs.

Strategy:

66. Ensure that adopted Vermont Accepted Agricultural Practices (AAPs) are fully implemented for farming practices to prevent and reduce impacts to surface waters from sedimentation and subsequent nutrient enrichment. Update AAPs where appropriate.

    Lead Agency/Organization: AAFM

    Partners: VTDEC, PMNRCD, towns

    Potential funding sources: State and federal programs

    Time frame: Ongoing

    Benchmark: AAP compliance occurs.

Objective 5: Reduce stormwater runoff from existing developed areas, and implement proper site design, construction techniques, and stormwater treatments for new development.

Strategy:

67. Emphasize the importance of innovative site design and the non-structural means of minimizing stormwater runoff from newly developed sites.

    Lead Agency/Organization: VTANR – DEC – Stormwater Program

    Partners: EPA, AOT, AGC, RRPC, towns, landscaping firms, consultants

    Potential funding sources: State and federal programs, stormwater permits

    Time frame: Ongoing

    Benchmark: Innovative stormwater BMPs implemented.

68. Continue to provide technical assistance to the town of Castleton Source Water Protection Committee to update their Source Protection Plan as it pertains to stormwater runoff in the town and impacts to the Wellhead Protection Area.

    Lead Agency/Organization: VTANR – DEC – Stormwater Program

    Partners: Town of Castleton - Source Water Protection Committee, DEC – Water Supply Division, EPA, NERWA, RRPC, CVR, Northeast RCAP.

    Potential funding sources: State and federal programs, stormwater permits

    Time frame: Ongoing

    Benchmark:

LOSS OF THE WORKING LANDSCAPE

One of the aspects most prized by many people in Vermont today is the rural landscape. Aside from our largest cities, nearly everywhere you go, there are views composed of open fields and forest or woodlots. Most of this is due to the fact that Vermont still has a working landscape. Far more important to our state than the views that bring in tourists and their dollars, these working farms and forests form the backbone of our communities. While providing a living for thousands of Vermonters directly and thousands more indirectly, small farms have been at the heart of who we are as a state for over two hundred years.

Farms are also valuable for the conservation benefits they provide such as cleaner air and water and wildlife habitat. Certain grassland nesting birds thrive in Vermont due to the farms that keep the land open. Many forest dwelling species, such as whitetail deer, benefit from the crop fields and pastures maintained for agricultural purpose as well as the woodlots and forests that are part of most farms.

These working landscapes cannot and should not be taken for granted. In today's global economy, it is increasingly difficult for farmers to make ends meet and thus to retain their farms, land and livelihoods. Many farmers have to sell all or part of their land. Although some farms are bought by larger farms, a lot of former farmland becomes home sites, roads and shopping malls, all of which change the view, contribute to sprawl and change the nature of the community. Furthermore, acre for acre, farmland creates less pollution than does developed land and it can help stabilize local property taxes by preventing rampant growth. According to the USDA's Natural Resource Inventory, more than 2 million acres of rural land, much of it prime farmland, is converted to urban uses every year. As Vermont's pastoral reality erodes, it takes with it some of our quality of life and also the image upon which much of our tourist industry depends.

There are strategies that can be used to preserve farmland. A farmer's options include selling conservation easements to land trusts, diversifying crops to avoid being dependent on only one source of income and trying to run a more efficient operation. A community also can take steps to preserve farms with ideas like taxing farmland at a different rate than other land. The benefits to the community of open space and a working landscape have to be looked at in light of the economic benefit to the community of having the land become developed for housing or business and the loss of tax revenue. However, one Vermont study has shown that undeveloped land costs a town less in services than does developed land. Also, a recent study of two Vermont counties has shown that there is an economic benefit to the community of having the land in farming. This study by the American Farmland Trust shows that farming in Addison and Franklin County contributes over $450 million to the local economy.

The decision to actively preserve agricultural land requires a great deal of information and thought. The methods and routes used to preserve farmland vary from farm to farm and from community to community.

GOAL: Ensuring that the working landscape is not converted to other, more intensive land uses will also be a significant factor in protecting water quality. Every reasonable action and effort should be made to protect the working landscape.

- **Objectives (**Listed from highest priority)

1. Promote programs that keep current agricultural land in production. Assist with the identification of eligible landowners who are willing to transfer development rights through conservation easements on their properties to non-profits such as the Vermont Land Trust or The Nature Conservancy. Where farms are eligible, promote federal cost-share incentives to keep land in production.
2. Promote value-added and diversification programs for farm and forest products.
3. Increase farm and forest product markets especially on the local and regional level.
4. Promote new farmer programs. Encourage new and existing farmers to develop comprehensive nutrient management plans that will result in long-term cost-savings for these operations.
5. Continue to host farm seminars and estate planning workshops that provide the education and outreach necessary for the non-agricultural community to under stand the importance of preserving open land.
6. Continue to support federal initiatives that address the national surplus of milk production. Continue to investigate the creation of a regional dairy compact, such as the former Northeast Dairy Compact that promotes regional collective bargaining.

Objective 1: Promote programs that keep current agricultural land in production.

Strategy:

69. Promote programs that keep current agricultural land in production. Assist with the identification of eligible landowners who are willing to transfer development rights through conservation easements on their properties to non-profits such as the Vermont Land Trust or The Nature Conservancy. Where farms are eligible, promote federal cost-share incentives to keep land in production.

    Lead Agency/Organization: USDA-NRCS

    Partners: Poultney Mettowee – NRCD, VLT, TNC, AAFM, VTDEC

Potential funding sources: Federal cost-share programs, Grants from public agencies, private foundations, or individuals.

Time frame: 2008

Benchmark: Conserve additional acres that keep agricultural land in production.

Objective 2: Promote value-added and diversification programs for farm and forest products.

Strategy:

70. Promote value-added and diversification programs for farm and forest products through marketing and other promotional strategies to encourage consumer markets for locally produced products.

    Lead Agency/Organization: VT AAFM

    Partners: PMNRCD, Vermont Fresh Network, Regional Chamber of Commerce, Rutland County FSA, UVM Ext, Green Mountain College, NOFA, VT Woodlands Association, VT Wood Manufacturers Association, slaughterhouses, farms, Working Farms and Forests Program, Regional Chamber of Commerce.

    Potential funding sources: Federal and state grants, private foundations.

    Time frame: Ongoing

    Benchmark: Farms become more viable as they diversify.

Objective 3: Increase farm and forest product markets especially on the local and regional level.

Strategy:

71. Increase farm and forest product markets especially on the local and regional level by expanding local markets and opportunities for networking.

    Lead Agency/Organization: Vermont Fresh Network, Farm and Schools Program

    Partners: AAFM, NOFA, Community Supported Agriculture programs, Rutland County FSA, UVM Ext, Green Mountain College, Lakes Region Free Press, Rutland Herald.

    Potential funding sources: Area restaurants, regional markets and coops, schools

    Time frame: Ongoing

    Benchmark: Regional agriculture producers have access to regional markets.

Objective 4: Promote new farmer programs.

Strategy:

72. Promote new farmer programs. Encourage new and existing farmers to develop comprehensive nutrient management plans that will result in long-term cost-savings for these operations.

    Lead Agency/Organization: VT Land Link

    Partners: Poultney Mettowee NRCD, VT AAFM, USDA-NRCS, VLT, UVM extension

    Potential funding sources: Federal and state grants, private foundations.

    Time frame: Ongoing

    Benchmark: Old farms are made available to new farmers first (Land Link).

Objective 5: Provide education and outreach to the non-agricultural community.

Strategy:

73. Continue to host farm seminars and estate planning workshops that provide the education and outreach necessary for the non-agricultural community to understand the importance of preserving open land.

    Lead Agency/Organization: Rutland NRCD, Poultney Mettowee NRCD, Green Mountain College

    Partners: RRPC, UVM Extension, VT AAFM

    Potential funding sources: Academic institutions, Federal and state grants

    Time frame: Ongoing

    Benchmark: Increased public awareness of current agriculture issues.

Objective 6: Support federal initiatives that support collective bargaining and regional equity.

Strategy:

74. Continue to support federal initiatives that address the national surplus of milk production. Continue to investigate the creation of a regional dairy compact, such as the former Northeast Dairy Compact that promotes regional collective bargaining.

    Lead Agency/Organization: Vermont Congressional Delegation, VACD-NACD

    Partners: VT AAFM, Vermont FSA, academic institutions, UVM Extension.

    Potential funding sources: Federal and state programs, new legislation

    Time frame: Ongoing

    Benchmark: Creation of a regional compact with collective bargaining weight.

4.4 Improving Public Outreach, Education, and Awareness

PUBLIC ATTITUDES SURVEY

The Poultney Mettowee Watershed Partnership conducted a survey of residents in the watershed regarding their perceptions of water quality problems (1998). The project produced a summary of public attitudes and landowner resource use of residents in the Poultney Mettowee Basin for Vermont and New York. Specific recommendations to conservation districts in planning outreach and education programs, messages, and media as a result of the current research findings are listed in the following table as objectives.

GOAL: Improve opportunities for public involvement in water quality issues for the Poultney Mettowee Basin.

- **Objectives (**Listed from highest priority)

1. Raise awareness of the watershed concept and the connections that residents of each river basin have to the watershed.
2. Undertake specific targeted watershed restoration or project activities.
3. Promote/ enhance/ encourage and provide incentives for municipal planning and zoning efforts with regard to water quality issues.
4. Pursue opportunities for volunteer service
5. Work with Vermont Department of Forests, Parks, and Recreation to improve the "educational trail" aspect of the Delaware & Hudson (D&H) Rail Trail

Objective 1: Raise awareness of the Poultney and Mettowee River watersheds (issues, concerns, projects, opportunities, and actions).

Strategy:

75. Target segmented markets for most effective outreach to stakeholder groups and residents of the watershed.

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

    Partners: PMNRCD, VTANR, AAFM, RRPC

    Potential funding sources: State and federal programs, LCBP E&O grants

    Time frame: Ongoing

    Benchmark: Expand media opportunities

Objective 2: Undertake specific targeted watershed restoration or project activities and provide outreach and awareness of demonstration projects.

Strategy:

76. Based on research findings, fund the efforts of the PMNRCD to promote education and awareness opportunities to implement demonstration projects, provide stewardship consulting, and continue the necessary outreach to all residents of the basin.

    Lead Agency/Organization: PMNRCD

    Partners: PMWP, VTANR, AAFM, USDA-NRCS

    Potential funding sources: State and federal programs.

    Time frame: Ongoing

    Benchmark: PMNRCD has greater visibility.

Objective 3: Contract with towns to encourage water quality improvement through planning, zoning, and municipal projects.

Strategy:

77. Share the findings of the Public Attitudes Survey with municipal officials, including town selectboards and supervisors, village trustees, conservation commissions, and planning board members. Continue to work with Regional Planning Commission, local planning commissions, and selectboards to encourage municipalities and planners to identify important resources in their communities and develop strategies for protecting, restoring, or enhancing them (Ranked # 4 for Issue Prioritization Process).

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

    Partners: RRPC, towns

    Potential funding sources: n/a

    Time frame: Ongoing

    Benchmark: n/a

Castleton Area River Project

Objective 4: Pursue volunteer opportunities for public involvement in water quality issues and projects.

Strategy:

78. Pursue more volunteer opportunities for the public to become more involved in proactive projects to address water quality issues, such as tree planting and water quality monitoring. (Ranked # 9 for Issue Prioritization Process).

    Lead Agency/Organization: PMWP

    Partners: PMNRCD, VTDEC, Lakes Region Free Press, WVNR radio

    Potential funding sources: LCBP E&O grants

    Time frame: Ongoing

    Benchmark: Increase riparian landowner participation.

Objective 5: Find ways to improve the use and function of the D&H Rail Trail.

Strategy:

79. Work with the Vermont Department of Forests, Parks, and Recreation and Vtrans to enhance the Delaware & Hudson (D&H) Rail Trail for recreational use and enjoyment in all seasons. Work to include trailhead signage and interpretive signage along the trail, plantings to shade watercourses along trails. (Ranked # 8 for Issue Prioritization Process).

    Lead Agency/Organization: PMWP

    Partners: PMNRCD, VTFPR, AOT, towns along D&H Rail Trail, RAPAC

    Potential funding sources: State and Federal programs

    Time frame: Ongoing

    Benchmark: Expand access opportunities and promote recreation activities.

USING DIFFERENT FORMS OF MEDIA

The use of different forms of media is imperative for effective outreach and communication during the basin planning process. Only through a successful campaign can partners in the basin planning process begin to craft a meaningful water quality management plan that incorporates the issues and concerns of residents and stakeholders throughout the watershed.

GOAL: Maximize the use of different forms of media to engage the residents and stakeholders in the basin planning process for the Poultney Mettowee Basin.

- **Objectives (**Listed from highest priority)

    1. Continue to provide opportunities for stakeholders and residents of the watershed to participate in the basin planning process by publicizing the process through all forms of media. Send meeting announcements and press releases to all.
    2. Continue to submit and publish weekly articles in the Lakes Region Free Press on water quality issues and current projects undertaken by the Poultney Mettowee Watershed Partnership.
    3. Continue to support and update a webpage specific to the Poultney Mettowee Watershed Partnership and basin planning process. Keep the webpage updated with current announcements, meeting notes, and project details in a timely fashion.
    4. Continue to appear on radio and televisions programs. Appear on the local WVNR radio program "Coffee Break" to discuss local initiatives and the basin planning process on a regular basis. Use local television programs such as "Champlain 2000" and "Across the Fence" and continue to announce opportunities for public involvement during these programs.
    5. Continue to contact residents of the watershed through direct mailings and newsletters.

Objective 1: Maximize public participation in the basin planning process.

Strategy:

80. Outreach should be continuously pursued through all forms of media.

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

    Partners: PMNRCD, Rutland Herald, Lakes Region Free Press, WVNR, WPTZ, WCAX

    Potential funding sources: LCBP and other grants, state and federal programs

    Time frame: Ongoing

    Benchmark: Media opportunities pursued.

Objective 2: Continue the weekly article series regarding the Watershed Partnership in local papers.

Strategy:

81. Submit and publish articles in local and regional newspapers.

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

    Partners: PMNRCD, VTDEC, Rutland Herald, Lakes Region Free Press

    Potential funding sources: n/a

    Time frame: Ongoing

    Benchmark: Articles published.

Objective 3: Update and maintain Watershed Partnership website.

Strategy:

82. Support and promote a web site specific to the Poultney Mettowee Watershed Partnership and the basin planning process.

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

    Partners: Ghostwriters Communications, PMNRCD, VACD,

    Potential funding sources: LCBP grants

    Time frame: Ongoing

    Benchmark: n/a (current)

Objective 4: Continue to pursue opportunities to appear on local and regional radio and television programs.

Strategy:

83. Maintain connections to local and regional television and radio stations that provide programs on local efforts and grass roots initiatives.

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

    Partners: PMNRCD, WVNR (Coffee Break), WPTZ (Champlain 2000), WCAX (Across the Fence)

    Potential funding sources: n/a

    Time frame: Ongoing

    Benchmark: n/a

Objective 5: Update and maintain Watershed Partnership mailing list.

Strategy:

84. Maintain and update mailing list of residents and stakeholders in the watershed.

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

    Partners: PMNRCD, Wash. Co. NY Soil and Water Conservation District, towns

    Potential funding sources: LCBP administrative grants, state and federal grants

    Time frame: Ongoing

    Benchmark: n/a (current)

LAKESHORE PROTECTION

The management of lakeshore areas can have a significant as well as negative impact on a lake's health over time. Removal of shoreline vegetation can increase erosion of the lakeshore and reduce or eliminate the infiltration functions of the vegetation. Increased runoff from roofs, driveways, lawns and uphill development can increase erosion and phosphorus loading. Improper design and installation of shoreline stabilization measures, such as riprap, seawalls, and grading, can increase erosion and sedimentation. Runoff from lawns on which fertilizers, herbicides, and pesticides are used can result in nitrogen, phosphorus, and toxins entering the lake. Runoff from driveways and paths may carry nutrients and sediment (DEC, 1990).

In addition, removal of the native vegetation along a lakeshore has negative impacts on lake habitat. Native vegetation is resistant to most diseases and insects, are adapted to the local climate, can provide good food and habitat for wildlife, and are better adapted to perform the landscape values that many landowners look for. Overhanging branches shade the shallow water and provide fish food in the form of fallen insects and woody debris. Many animal species (birds, reptiles, amphibians and mammals) rely on natural shoreland vegetation to breed, feed and over winter. However, a property whose lawn extends down to the edge of the water can invite unwanted animal species, such as waterfowl, that can elevate pathogenic bacteria levels in localized surface waters.

Lakes also accumulate pollutants entering from the watershed over time. The most common threat to lake water quality is the accumulation of phosphorus and sediment. Excessive phosphorus and/or sediment causes algae blooms, decreased water clarity, nuisance growth of native aquatic plants, and a change in the natural habitat values of a lake. Good land use management is needed throughout the watershed to protect the lake from this ever-present threat. Erosion and runoff from paved or unpaved roads, developed areas, logging operations, impervious surfaces, agricultural operations, and construction activities can contribute to sediment and phosphorus accumulation in lakes and ponds. Failing septic systems result in either effluent surfacing on the ground or in contamination of groundwater. Either situation can cause a human health hazard due to exposure to disease causing bacteria, and nutrient loading to the lake. Septic systems can fail due to inadequate soils, poor design, or construction, inadequate maintenance, or increase from seasonal to year-round use (DEC, 1990).

GOAL: Provide greater lakeshore protection and water quality improvement for residents and users of Vermont's lakes and ponds. Seek compatible activities that achieve this balance.

- **Objectives (**Listed from highest priority)
  1. Pursue educational and outreach opportunities for lakeshore residents regarding good property management practices and impacts to water quality.
  2. Foster partnerships with lake associations to pursue grants and assist with the permitting process to implement lake water quality protection projects and awareness campaigns.
  3. Seek demonstration projects to promote awareness through local media.
  4. Support conservation projects on high priority lands through the purchase of conservation easements or other methods of protection.
  5. Support and promote good municipal shoreland zoning. Refer to VTDEC "Local Planning and Zoning Options for Water Quality Protection".

Objective 1: Pursue educational and outreach opportunities for lakeshore residents.

Strategy:

85. Provide educational and awareness opportunities for lakeshore residents regarding good property management practices

    Lead Agency/Organization: VTDEC – Lakes and Ponds Section

    Partners: UVM Sea Grant, PMWP, FOVLAP, lake associations, towns

    Potential funding sources: State and federal grants and programs, LEAP program

    Time frame: Ongoing

    Benchmark: n/a

Objective 2: Foster partnerships with lake associations.

Strategy:

86. Foster partnerships with lake and pond associations in the basin to pursue joint water quality related projects and assist with the permit process as necessary.

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

    Partners: UVM Sea Grant, Lake associations, Federation of Vermont Lake and Pond Associations (FOVLAP), VTDEC – Lakes and Ponds Section, towns

    Potential funding sources: State and federal programs, LEAP program

    Time frame: Ongoing

    Benchmark: Increased coordination and communication with lake associations.

Objective 3: Seek demonstration projects to promote awareness through local media.

Strategy:

87. Implement demonstration projects adjacent to lakes and ponds to increase awareness and promote good management practices.

    Lead Agency/Organization: Poultney Mettowee Watershed Partnership

    Partners: UVM Sea Grant, Lake associations, FOVLAP, VTDEC – Lakes and Ponds Section, towns

    Potential funding sources: State and federal programs, grants, LEAP program

    Time frame: Ongoing

    Benchmark: Maximize media opportunities.

Objective 4: Support conservation projects along shorelines sensitive to erosion.

Strategy:

88. Identify and conserve sensitive and high priority areas adjacent to lakes and ponds and/ or land within specific lake and pond sub-basins.

    Lead Agency/Organization: VTDEC – Lakes and Ponds Section

    Partners: Lake associations, VLT, Poultney Mettowee Watershed Partnership , towns

    Potential funding sources: Land trust funds, private donations, grants, State land acquisition program, VT Housing and Conservation Board

    Time frame: Ongoing

    Benchmark: Identify and conserve sensitive shorelines.

Objective 5: Support and promote good municipal shoreland zoning.

Strategy:

89. Support and promote good municipal shoreland zoning

    Lead Agency/Organization: Rutland Regional Planning Commission

    Partners: towns, VTDEC, PMWP, VLCT

    Potential funding sources: Municipal Planning Grants, VT Conservation license plate grant program

    Time frame: Ongoing

    Benchmark: Town plans and zoning regulations contain strong language for shoreland and water quality protection.

4.5 Specific Waters of Concern

IMPAIRED WATERS IN THE POULTNEY METTOWEE BASIN

GOAL: To implement strategies that will restore impaired surface waters to comply with Vermont water quality standards.

There are five waterbodies listed on the 2002 Vermont 303(d) List of Impaired Waters in the Poultney Mettowee basin (see Table 7). These waters are designated are based on long-term data that show they consistently do not meet Vermont Water Quality Standards. While certain sources of pollutants can be addressed through better planning, remediation tactics, and land use management, some pollutants are beyond the scope of what is reasonably attainable through the implementation of this plan. Specifically, atmospheric deposition of mercury has caused elevated levels of mercury contamination in the walleye that inhabit the lower Poultney River.

Impairments due to Atmospheric Deposition

Mercury (Hg) contamination is ubiquitous in Vermont's still waters. Mercury is a naturally occurring metal used in a wide variety of applications ranging from the production of household bleach to the mining of gold. Mercury is released into the environment either directly to water via waste systems, or much more commonly, directly to the atmosphere. It is this atmospheric pathway that is largely responsible for mercury contamination in Vermont. The combustion of coal for energy, and incineration of municipal and medical wastes, produces the majority of mercury deposited onto the watersheds of the northeastern US and Eastern Canada.

The physiological consequences of meHg contamination include liver, kidney, and central nervous system dysfunction. A recent study by the National Academy of Sciences concluded that the children of woman who consumed large quantities of mercury-tainted fish during pregnancy showed the clearest evidence of mercury poisoning. Due to mercury contamination, the Vermont Department of Health (VTDOH) presently advises that people limit their consumption of a variety of fish found both in Lake Champlain, and in many other lakes statewide. The current fish advisory is available online (http://www.state.vt.us/health/record/fish.htm).

The management of the walleye fishery in the Poultney River has been and continues to be one way to address this issue. The Lake Champlain Walleye Restoration Plan (1999) describes an ongoing process for taking management actions that are hoped to increase Walleye abundance in Lake Champlain while at the same time gathering information on the factors that may limit natural replenishment of this native species. Vermont Department of Fish and Wildlife (VTF&W) fisheries biologists recognize some limiting factors could conceivably be beyond the ability of VTF&W to overcome. Project managers acknowledge that threats such as atmospheric deposition (i.e., mercury, acid rain) may be beyond their ability to correct. Meanwhile, the issue of atmospheric deposition of mercury must be dealt with on a state and national level.

The acid rain TMDL establishes critical loads of acidity for 30 surface waters affected by acidic, atmospheric deposition. The critical loads establish the necessary levels of acidic deposition to each watershed to allow recovery. More needs to be known about distant sources and transport in order to initiate proper controls. The critical loads provide a framework from which to backtrack and trace the origin and magnitude of the acidity sources to the atmosphere and their transport to Vermont. Combined with atmospheric transport and depositional modeling, the critical loads will provide a basis for evaluating the environmental effectiveness of alternative national or regional emissions control programs, or for quantifying the adverse contributions from specific emission sources.

The remaining impaired surface waters on the 2002 EPA 303(d) list (Table 7) include impacts from land use, landfill leachate, and discharges from wastewater treatment plants. The Solid Waste Division and the Wastewater Management Division of the Vermont Department of Environmental Conservation have already addressed the surface water quality problems due to landfill leachate and wastewater treatment plants respectively. Monitoring and evaluation of the Pawlet landfill has indicated that leachate has abated now that this facility has been properly closed and capped as of

Table 7. Impaired Waters in the Poultney Mettowee Basin

Water Segment Name/ Description	Town(s)	Impairment(s)	Reason for Surface Water Quality Problem
Poultney River (about 3 miles – from Carver Falls upstream 0.5 miles past the confluence with the Castleton River)	Fair Haven, West Haven	Nutrient Enrichment, Erosion	Nutrient enrichment from agricultural runoff and erosion
Poultney River (Mouth upstream to Carver Falls)	Fair Haven, West Haven	Elevated levels of mercury in walleye	Atmospheric deposition, fish consumption advisory in effect
Unnamed tributary to the Hubbardton River	Benson	E. coli, nutrient enrichment, temperature	Benson WWTF discharge possible source, possible land use and wetland sources up stream
Castleton River	Fair Haven	E. coli	WWTF pump station overflows
Mettowee River (Upstream of NY/VT border – 8.2 miles)	Dorset, Rupert, Pawlet, Wells	Temperature	Loss of riparian vegetation, close proximity of agricultural uses
Unnamed tributary to the Mettowee River	West Pawlet	Metals (iron, zinc)	Pawlet Landfill leachate

2001. This tributary will remain on the list until 2010 and will undergo continued monitoring until this date to ensure leachate abatement.

Impairments due to Wastewater Discharges

An impaired tributary to the Hubbardton River due to suspected Benson wastewater treatment facility (WWTF) discharge. To correct high levels of chlorine in the discharge, a dechlorination chamber is currently being constructed at the Benson Wastewater Facility. Construction should be completed shortly and the dechlorination system should be operational later this fall (2003). Other WWTFs in the basin have been or are being upgraded in accordance with conditions outlined in the Lake Champlain Phosphorus TMDL. Currently, Vermont statute regulates discharges of phosphorus (10 V.S.A. § 1266a) and establishes a monthly average phosphorus effluent limit of .8 mg/l for wastewater treatment facilities in the Lake Champlain Basin. Additional phosphorus removal will be attained by specific facilities in the Lake Champlain Basin, including the Fair Haven and Poultney WWTFs, which were required to upgrade these facilities to comply with an annual average load limit of .6 mg/l of effluent phosphorus concentration.

Impairments due to Agricultural Uses

These specific surface water quality problems and the strategies to remediate them are underway and will continue until such time as the waters comply with Vermont Water Quality Standards. The remaining impacts are due to land runoff and are addressed in several of the preceding strategy sections. Additional strategies to address impacts due to agricultural land use practices are also included in Appendix K, the Agricultural Plan for the Poultney Mettowee Basin. In conjunction with addressing thermal modification of river temperatures due to loss of riparian vegetation, Best Management Practices identified in agricultural strategy sections of this basin plan will concurrently restore sections of the Poultney and Mettowee Rivers impaired by nonpoint sources of pollution and nutrient enrichment. Specific strategies identified by the Agency of Agriculture, Farms, and Markets for areas in need of attention due to agricultural impacts include the following:

Poultney River Watershed

The current condition of the lower main stem of the Poultney River (VT02-01 - 2.8 miles) identified in the Vermont Section 303(d) of Impaired Waters List indicates that agriculture is a moderate source of impairment from Carvers Falls to the confluence with Castleton River possibly associated nutrient enrichment and streambank erosion from agricultural runoff. Also, above & below the mouth of the Castleton River (1.0 miles), agriculture is a moderate source of impairment 0.5 miles above and below the confluence with the Castleton River possibly associated with nutrient enrichment from agricultural runoff.

Objective: Decrease the amount of sediments and pathogens entering the Poultney River from agricultural sources.

Strategy:

90. Preserve current agricultural uses for irrigation and animal watering and develop alternative watering systems for these uses in order to eliminate the need for livestock access to surface waters.

    Lead Agency/Organization: USDA-NRCS

    Partners: AAFM, PMNRCD, TNC, VLT, VTDEC

    Potential funding sources: Federal cost share and pass through programs.

    Time frame: 2010

    Benchmark: All livestock in the Poultney River watershed have access to alternative watering supplies and are excluded from surface waters

Compounding this concern are the large farms along this stretch of the Poultney River on the New York with much of the land in corn. New York State does not prevent manure spreading in winter, therefore pathogens, nutrients and sediments may be entering the water from these operations at times when the ground is frozen or during spring runoff and heavy rains. There is however a 100 – 150 foot vegetated buffer along both sides of the river.

On the Vermont side of the lower main stem of the river, one farm is currently participating in EQIP and is implementing several Best Management Practices. Funding for this project is from USDA, VT AAF&M, the 104(b) program and the farmer's cost-share match. However, nutrient management planning is still needed. Wider vegetated buffers along a short stretch of the Poultney River and a quarter mile of the Castleton River would also help. Below the confluence of the Castleton the agricultural operation on the Vermont side has ceased and fields are fallow, with primary succession taking place. There is also a wide buffer surrounding these fields.

Other sections of the Poultney watershed could be improved with additional practices including:

- Fencing along streams to exclude animals with alter native watering systems
- River corridor protection and buffers along waterways
- Stream crossings for animals, walkways and access lanes
- Streambank stabilization
- Improved barnyards and heavy use area protection
- Control of invasive species

Mettowee River Watershed

The current condition of the main stem of the Mettowee River (8.2 miles) identified in the Vermont Section 303(d) of Impaired Waters List indicates that agriculture is a moderate source of impairment due to elevated temperatures from agricultural land uses (especially crop and hay production and pasturing) due to the loss and removal of riparian vegetation. Fisheries biologists have well-documented fill kills in the Mettowee River during hot, dry conditions, affecting primarily cold-water fish species such as brown trout.

Objective: Maintain cooler waters in the Mettowee River through vegetated riparian buffers and enhanced river corridor protection.

Strategy:

91. Re-establish woody riparian buffers along the banks of the Mettowee River and tributaries (especially Flower Brook) with planting of trees and shrubs as well as herbaceous vegetative filter strips along the edges of fields.

    Lead Agency/Organization: USDA-NRCS

    Partners: AAFM, PMNRCD, TNC, VLT, VTDEC

    Potential funding sources: Federal cost share, state CREP allocations, conservation easements

    Time frame: Ongoing

    Benchmark: Re-establishment of riparian buffers along the main stem of the Mettowee River and Flower Brook, especially the critical areas identified in the ENSR Report (VTDEC, 2002).

In addition to this strategy, pasture management and nutrient management would also decrease agricultural runoff, which can also contribute to temperature gains. Overall, technical and financial resources for the implementation of best management practices should be expanded throughout the watershed. Other sections of the Mettowee watershed could be improved with additional practices including:

- Waste storage facilities
- Fencing along streams to exclude animals with alter native watering systems
- Stream crossings for animals, walkways and access lanes
- Roof runoff management
- Silage leachate management
- Improved barnyards and heavy use area protection
- Milkhouse waste management
- Surface and subsurface water diversions
- River corridor protection and buffers along waterways
- Streambank stabilization
- Geomorphic-based stream channel stabilization
- Control of invasive species

Future Needs in the Poultney Mettowee Basin

There are still several unmet needs in the Poultney Mettowee Basin including:

- Increased funding for implementing agricultural best management practices
- Funding to assist farmers in diversifying their operations or transitioning to alternative systems
- Creation of a local youth conservation corps that can serve as a workforce on projects beyond what volunteers can provide
- A dairy program that better serves farmers

LOCAL WATERS OF CONCERN (including waters in need of further assessment)

The waters listed below fall outside the scope of the List of Impaired Waters (the EPA approved 303(d) List of Waters that consistently do not meet Vermont Water Quality Standards) but include problems and actions that have been identified by the Poultney Mettowee Watershed Partnership, the Vermont Department of Environmental Conservation, the public, and other entities. Included in this list are ongoing and future projects that have been identified in a public process and prioritized by the Poultney Mettowee Watershed Partnership.

Table 8. Local Waters of Concern

Name of waterbody	Reason for Concern	Status and/or Recent Efforts as of Sept 2003	Current Action Planned	Future Proposed Action
Gully Brook, tributary of the Castleton River	Sedimentation, flooding, channel instability	High priority – working group established with Traverse Farm & others	EPA 319 Project – Geomorphic Assessment - RRPC (completed Aug '03), channel modification, habitat restoration	2003 – December 2004
Castleton River, Town of Castleton	Stormwater runoff, possible contamination of ground water	High priority – Town of Castleton, Castleton State College	Work group formed – Town of Castleton, NERWA, VTDEC - Water Supply/ Water Quality Division, Castleton State College, RRP	Ongoing. Town in process of updating Source Water Protection Plan
Castleton River, Town of Castleton	Streambank instability, runoff, bank failure	Medium priority, AOT, PMWP interested in site remediation	Transportation Enhancement Grant application denied	Re-apply for AOT grant
West Rutland Marsh, Town of West Rutland	Invasives, need for marsh protection, Important Bird Area – Lake Champlain Birding Trail	High priority – West Rutland, Rutland County Audubon, The Nature Conservancy, USDA-NRCS	Rutland Audubon, TNC working on habitat, invasives. Boardwalk built by the Town (Spring '03). Continued interest in land acquisition.	Ongoing – boardwalk built, land acquisition continues.
Pond Hill Brook, tributary of the Castleton River Lewis Brook, trib of the Poultney	Sedimentation, gully erosion, ag nonpoint source pollution	Medium priority, AAFM, VTDEC, PMNRCD, USDA-NRCS, Town of Castleton	AAFM is monitoring this site. Potential candidate for a medium sized farm agricultural permit.	Ongoing
Castleton River, Town of Fair Haven	Old Fair Haven landfill, suspected landfill leachate, garbage sliding into river	Medium priority, Castleton Area River Project (CARP), PMWP, VTDEC are monitoring this site.	Additional chemical and physical monitoring conducted in summer, 2002.	Annual CARP program, usually second or third week in June.
Hubbardton River, tributary of the Poultney River	Nutrient enrichment, turbidity, sedimentation	High priority, work group formed - TNC, PMNRCD, PMWP, USFW, USDA-NRCS, VTDEC to conserve riparian land	Vermont Land Trust and Nature Conservancy have initiated several conservation programs. PF&W projects, USDA-NRCS cost-share programs with farmers – PMWP - NFWF riparian/ buffer planting projects.	Ongoing, recent Sept '03 meeting identified process for implementing project report objectives and strategies.
Burr Pond, drains to Hubbardton River	Invasives – Eurasian watermilfoil	Medium priority, Milfoil spread prevention efforts desired by pond association.	PMWP Outreach with Burr Pond Assoc. to increase education with increased signage at F&W boat access.	Signs installed 2004
Poultney River, Town of Poultney, D&H Rail Trail	Streambank instability, flooding	Medium priority, working group established with Vtrans, landowners	Investigation into site remediation, potential flood mitigation project.	Stalled since last site visit with Vtrans
Poultney River, Town of Poultney, Teetor site	Streambank instability, erosion, sedimentation	High priority, PMNRCD, USF&W project to stabilize eroding banks.	Summer 2002 – natural channel stabilization project using log vanes – USFW-PFW. Spring/summer 2003 – buffer planting.	Ongoing monitoring to assess channel modification treatments, buffer plantings.

Name of waterbody	Reason for Concern	Status and/or Recent Efforts as of Sept 2003	Current Action Planned	Future Proposed Action
Poultney River, Town of Poultney, Swenor site – WWTF	Streambank instability, sedimentation, nutrient enrichment	High priority, PMNRCD, PF&W project to stabilize eroding banks, buffer planting with GMC	Summer 2002 – natural channel stabilization project using tree vanes – USFW-PFW. Spring/ summer 2003 – buffer planting.	Ongoing monitoring to assess channel modification treatments, buffer plantings.
Poultney River, Lower Poultney River along East Bay road	Back road runoff, sedimentation, garbage dumping	High priority, TNC and PMWP working on strategy for stewardship	Clean-up for "Great Lake Clean-up" by LCBP/ PMWP – 2002, Poultney/ Fair Haven Rotary Club involved. TNC organizes annual cleanup	Ongoing dumping, consideration of closing East Bay Road to through-traffic.
Mill Brook, tributary of the Mettowee River	Flooding, Invasive fish species	Low priority, outreach with landowner, buffer planting	VTF&W is developing a management plan for the Alewife in Lake St. Catherine	Monitored by VTF&W, GMC–slated for implementation in 2004
Wells Brook, Town of Wells, trib of Mettowee	Suspected heavy metal content, esp. Arsenic	High priority, concern of drinking water	VTDEC – Waste Management Division	Continued well monitoring and assessment by town.
Lake St. Catherine, drains into Mettowee River	Aquatic nuisance species (Eurasian watermilfoil and alewives), declining water quality	High priority, ranked as high priority by public, lake association	Outreach with Lake St. Catherine Assoc. to monitor and investigate options with towns and state.	Monitored by Lake St. Catherine Association, PMWP, GMC
Lake St. Catherine, drains into Mettowee River	Potential dam failure	Low priority, FED has assessed dam and determined not to be immediate threat (2002)	Dam face repair and assessment planned for 2004	FED will continue to monitor and assess this situation.
Flower Brook, tributary to Mettowee River	Thermal modification, erosion, lack of riparian buffers	High priority, part of Mettowee TMDL study and geomorphic assessment summer 2002.	Outreach to riparian landowners by PMNRCD/ PMWP – Buffer Outreach Program 2004, Geomorphic assessment completed	Thermal monitoring ongoing. Thermal spikes recorded in monitoring stations.
Unnamed tributary to the Mettowee River, Town of Wells	Suspected landfill leachate, turbidity, sedimentation	Medium priority, site visit determined old landfill in close proximity to trib	Chemical and physical monitoring showed high levels of iron and zinc – summer 2002	VTDEC-Waste Management Division will update
Mettowee River – Rosenbauer/ Waite property	Streambank instability, erosion, channel avulsion	Medium priority, neck cut-off threatens to send sediment plug downstream	Rip-rap and buffer planting summer 2002 have temporarily arrested avulsion	Geomorphic assessment and Mettowee TMDL study have led to general strategies

Chapter 5 Establishing Goals for Managing High Quality Waters

Public involvement is an essential component to restoring river and lake ecology. The Vermont Water Quality Standards state "Public participation shall be sought to identify and inventory problems, solutions, high quality waters, existing uses and significant resources of high public interest." Citizens who make their living from the land have a special opportunity to contribute to water quality protection or an approach that balances environmental considerations in protecting and restoring water resources with economic interests. Without balance, there will be limited progress in achieving the goals of protecting land from the forces of the rivers and the rivers from the runoff of the land (VTDEC, 2002 – Lake Champlain Phosphorus TMDL). Emphasis on the identification of values and expectations for future water quality conditions can only be achieved through public contributions to the planning process.

One important element of basin planning includes establishing management goals for waters that designate both the beneficial uses and values of surface waters and the level of protection to meet the needs and expectations of each community and the state as a whole. The basin planning process should encourage community involvement in identifying (1) existing uses of surface waters, (2) outstanding resource waters, and (3) new classifications and water quality management types for waters in their community. The implementation of these objectives through this basin plan is expected to meet the goals and corresponding objectives identified through the Poultney Mettowee basin planning process, the Poultney Mettowee Watershed Partnership, municipalities, watershed residents, and landowners.

The management goals of each classification and type describe the values and uses of the surface water that are to be protected or achieved. Management goals can be established through the following process:

- Classification of waters and designation of water management types,
- Designation of waters as warm and cold water fisheries,
- Designation of existing uses of a water,
- Designation of waters as Outstanding Resource Waters for specific values (10 VSA § 14242a)

5.1 Typing and Classification

Since the 1960s, Vermont has had a classification system for waters that establishes management goals. These goals describe the uses and values of surface waters that are to be protected or restored through appropriate management. The system includes Class A and B. Class A waters are divided into two subclasses: A(1) and A(2). As part of the Vermont Water Quality Standards revisions in 2000, Class B waters must be divided into Water Management Type 1 B(1), Type 2 B(2) and Type 3 B(3) as part of the basin planning process.

Proposed Classifications and Types for Basin 2:

The watershed coordinator presented a preliminary proposal during 2001 and 2002 in order to begin the process for reviewing the management goals for waters to each municipal selectboard and/or planning commission in the Poultney Mettowee basin. Each town was given an opportunity to provide input for the proposed classification and typing recommendations. Each town was asked to review the proposal to ensure that the Agency of Natural Resources' suggested management goals were compatible with their goals for surface waters. Once the Vermont Water Resources Board adopts the goals as a rule that amends the Vermont Water Quality Standards, it is the intention of the Agency of Natural resources to work to achieve or maintain the level of water quality specified by the established goals described by the designated types or classification

The initial proposal for re-classification and typing is based on current land cover and land use and the

expectation for land use set out in each town plan. The management goals associated with typing and classification pertain to water quality, the means of achieving the goals will relate to land management, stormwater management, the implementation of Accepted Agricultural Practices, riparian corridor protection, erosion control practices for construction sites, better backroad practices, and Acceptable Management Practices for silviculture among others. The quality of surface waters in Vermont is mostly dependent upon the content and amount of surface runoff from surrounding land in addition to the proper operation of wastewater treatment plants.

During the typing and classification process, each town was presented with:

- The classification system for surface water protection in the state of Vermont; (10 VSA § 1253).
- A list of adjacent land uses that would be compatible with the goals for the different categories of surface water protection; and
- The Department of Environmental Conservation opinion of how the expected land uses outlined in each town plan or zoning regulations would support the suggested goals for surface waters (rivers, ponds and wetlands).

Opportunities to discuss the typing and classification proposal will include public hearings on the plan (2003/2004). In addition, the Water Resources Board will hold public hearings on the proposal in the typing and classification proposal during rulemaking.

Classification System

Since the 1960s, Vermont has had a classification system for waters that establishes management goals. These goals describe the values and uses of surface waters that are to be protected or restored through appropriate management. Until recently, the system included two classes: A and B. Class A waters were divided into two subclasses: A(1) and A(2).

Presently all waters above 2,500 feet are classified A(1) by Vermont statute. The management objective for A(1) waters is to maintain their natural condition. Waters used as public water supplies are classified A(2). No A(2) water exists in the town. All the remaining waters are Class B waters. As part of the Water Quality Standards revisions in 2000, the system was changed to divide Class B waters into three management types: B1, B2 and B3. The revised Water Quality Standards require that all basin plans place Class B waters into one of the three management types.

The typing system for Class B waters is for the most part a continuum of acceptable conditions of water quality criteria such as aquatic biota, aquatic habitat and recreational opportunities. A simplification of the B1, B2 and B3 designations would be to say that the spectrum from B3 to B2 to B1 is described as representing "good," "better" and "best" aquatic conditions. All Class B waters must still support the designated uses described in the Vermont Water Quality Standards for Class B waters, which includes suitability for boating, swimming, and drinking with treatment.

Land uses that would best achieve goals for B1, B2 and B3

As the proposal only changes goals for waters that are presently Class B in each town, the focus of discussions with municipalities centered on the explanation of the three management types.

It is assumed that agricultural and silvicultural activities that followed Accepted Agricultural Practices and Acceptable Management Practices respectively comply with the Water Quality Standards (which includes the goals for B1, B2, and B3 management types). For other land uses, the Agency believes that each management type could support the following land uses and still meet their respective water quality goals:

B1

- Predominately forested
- Low density residential
- Roads that do not regularly wash out

B2

- All other land uses and covers not described for B3 that are currently present in the town (water quality violations in Class B waters have been identified and addressed by upgrades to the municipal wastewater treatment facility).

B3

- Waters presently managed for a moderate change in flows or stream habitat because of a dam presence, water level fluctuation or water withdrawal.

Proposal Supports Expected Land Uses Outlined in each Town Plan

The Agency proposal designates most Class B waters in each town as management type B2, which is the middle type of Class B waters. The proposed B1 waters are located predominantly within mountainous terrain and on, or adjacent to, publicly owned lands.

Based on the review of town plans and zoning regulations in the Poultney Mettowee basin, the Department of Environmental Conservation does not believe that the Agency proposal would conflict with each community's expectations for land use in the area. The following describes how the goals of a town plan are evaluated under each water quality management type.

B1

The Agency proposal designates waters B1 where lands are predominately forested, expected land use is predominated by low density residential or a less intensive land use, and roads are stable, meaning that they do not regularly wash out.

A small area of a B1 designated stream and its watershed can include residential and agricultural zones, but the management goal would be to leave this land predominantly forested. Typically, the proposals for B1s are federal, state, and town lands that are maintained in conservation, or occur where the town has already designated the land as a conservation zone.

B2

Most of the surface waters would be designated B2, as this would be a default class and type for waters that are not considered for other typing proposals.

B3

The Agency proposes a B3 type for those waters that are subject to managed water level fluctuations, such as a hydro electric facility or other types of impoundments that experience periodic water-level fluctuations beyond changes in precipitation and runoff. Under these circumstances, the Department of Environmental Conservation would expect moderate changes in aquatic habitat and biota. There are no proposed B3s in the Poultney Mettowee basin.

Effects of Management Goals for Land Use

The range of protection afforded waters by the proposal encourages the more intensive activity in the valleys and sets goals for higher water quality in the headwater areas and more mountainous terrain, which tends to meet town's and residents' expectations for land use.

5.2 Warm Water and Cold Water Designations

In addition to the foregoing classifications and designations, the following lakes, ponds, rivers, and streams are designated for management as Warm Water Habitat by the Vermont Water Quality Standards (2000) which specifies a lower minimum dissolved oxygen concentration than waters in the remainder of the basin which are Cold Water Habitat:

a) All waters west of Vermont Route 22A

b) Austin Pond, Hubbardton

c) Beebe Pond, Hubbardton

d) Billings Marsh Pond, West Haven

e) Burr Pond, Sudbury

f) Coggman Pond, West Haven

g) Echo Lake (Keeler Pond), Hubbardton/Sudbury

h) Half Moon Pond, Hubbardton

i) Hinkum Pond, Sudbury

j) Lake Hortonia, Hubbardton, Sudbury

k) Inman Pond, Fair Haven

l) Lily Pond, Poultney

m) Little Pond, Wells

n) Love's Marsh Castleton

o) Mill Pond (Parson's Mill Pond), Benson

p) Northeast Developer's Pond, Wells

q) Old Marsh Pond, Fair Haven

r) Pine Pond, Castleton

s) Poultney River from Carver's Falls in West Haven to its confluence with Lake Champlain

t) Sunrise Lake, Benson/Orwell

This list of warm and cold water designations does not deviate from their existing status under the Vermont Water Quality Standards (2000). All other unnamed waters in the Poultney Mettowee basin are designated cold waters.

5.3 Existing Uses

All surface waters in Vermont are protected to support uses valued by the public including swimming, boating, and fishing. The degree of protection afforded to these uses in most surface waters is based on the water's management type or class as described in this chapter of the Plan. Some uses are protected absolutely if the Agency of Natural Resources identifies them as existing uses under the anti-degradation policy of the Vermont Water Quality Standards (VWQS).

The Agency identifies "existing" uses of particular waters either during the basin planning process or on a case-by-case basis during application reviews for permits. The following factors are considered by the Agency when identifying existing uses (see VWQS Section 1-03 B):

- Aquatic biota and wildlife that use or are present in the waters;
- Habitat that supports existing aquatic biota, wildlife or plant life;
- The use of waters for recreation or fishing;
- The use of waters for water supply or commercial activity that depends directly on the preservation of an existing high level of water quality; and
- With regard to the factors considered under the first two bullets above, evidence of the use's ecological significance in the functioning of the ecosystem or evidence of the use's rarity.

During the planning process in the Poultney Mettowee Basin, the Department of Environmental Conservation has collected sufficient information to identify the existing uses listed in the following table. The list is not meant to be comprehensive. The public is encouraged to nominate other existing uses, which may be included in the basin plan or catalogued for a more thorough investigation on a case-by-case basis when an application is submitted for an activity that might adversely affect the use. These petitions for existing use considerations must be filed with the Vermont Water Resources Board if outside the scope of this basin plan. Please review the candidates for existing uses in the Poultney Mettowee basin in the following table:

Table 9. Existing Uses of Waters in the Poultney Mettowee Basin

Town	State/ Public Lands	Surface Water	Existing Use
Benson	Pond Woods WMA	Doughty, Spruce Ponds	Swimming and Fishing
Castleton	Bomoseen State Park	Lake Bomoseen	Swimming, Fishing, Boating
Castleton	Crystal Beach (Municipal)	Lake Bomoseen	Swimming, Fishing, Boating
Castleton	Kehoe F&W access	Lake Bomoseen	Swimming, Fishing, Boating
Castleton	Float Bridge F&W access	Lake Bomoseen	Swimming, Fishing, Boating
Castleton	Blueberry Hill WMA	Unnamed tributaries	Fishing
Castleton	Bird Mountain WMA	Unnamed tributaries	Fishing
Castleton	Glen Lake FPR access	Glen Lake	Swimming, Fishing, Boating
Hubbardton	Lake Hortonia F&W access	Lake Hortonia	Swimming, Fishing, Boating
Hubbardton	Half Moon State Park (beach)	Half Moon Pond	Swimming, Fishing, Boating
Poultney	Lake St. Catherine State Park (beach)	Lake St. Catherine	Swimming, Fishing, Boating
Poultney	Buczek Marsh WMA	Buczek Marsh	Fishing
Rupert	Rupert State Forest	Unnamed tributaries	Fishing
Rupert	Mettowee River F&W access	Mettowee River	Fishing
Sudbury	Burr Pond F&W access	Burr Pond	Swimming, Fishing, Boating
Wells	Lake St. Catherine F&W access	Lake St. Catherine	Swimming, Fishing, Boating
West Haven	Ward Marsh WMA	Ward Marsh, Lake Champlain	Fishing
West Rutland	Whipple Hollow WMA	Headwaters of the Castleton River	Fishing
West Rutland	West Rutland State Forest	Unnamed tributaries	Fishing
Poultney	D&H Rail Trail Bridge	Poultney River	Swimming, Fishing

5.4 Designated Uses

A designated use, according to Vermont Water Quality Standards (2000), "means any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water as set forth by the Water Resources Board".

5.5 Outstanding Resource Waters

Lower Poultney River ORW Designation

In June 1991, the Lower Poultney River, delineated from the Poultney/Fair Haven town line down to the "elbow", was designated an Outstanding Resource Water (ORW) by the Vermont Water Resources Board. Based on this designation, the Vermont Agency of Natural resources developed a management plan for the Lower Poultney River that established the following goal: "For that portion of the Lower Poultney River within Vermont borders, the State will seek to manage certain activities affecting the water quality, flows, course, current, and cross-section of the Lower Poultney River to preserve and enhance the exceptional natural, cultural, scenic, and recreational values of the river and river corridor (refer to uses and values included in Section III of the VANR Management Plan for The Lower Poultney River, A Vermont Outstanding Resource)" (1992). This basin plan does not propose new Outstanding Resource Water designations.

The Fair Haven River Committee compiled the information and prepared the petition acting on behalf of the towns of Fair Haven and West Haven who chose to be the petitioners for the ORW status. A description of this stretch of river, a detailed inventory of river and river corridor values and uses, the ORW designation process for the Lower Poultney, and the Agency of Natural Resources Management Plan for this river segment are contained in the August 1992 document The Lower Poultney River: A Vermont Outstanding Resource Water. The inventory portion of this publication contains substantial information on the natural, cultural, and scenic features of the Lower Poultney including descriptions of the river corridor wildlife habitat and natural communities, geologic and hydrologic features, aquatic habitat and fisheries, threatened, endangered and rare plant and animal species, historical sites, scenic areas, and boating, fishing, research and education uses.

5.6 Recommendations for Community Action

The continuing objective will be to implement current strategies, encourage community involvement in identifying existing uses, Outstanding Resource Waters and proposing new classification and typing for waters in their community.

Chapter 6 Implementation of the Basin Plan

Many State and federal agencies, private organizations, and community groups were involved in developing the strategies in this basin plan. The next step will be the implementation of the strategies by these groups and others.

The collaborative process of developing concerns and strategies ensures that participating groups are implementing the Basin Plan. As the Basin Planning Process included discussions with the community and resource agencies, the actions should be a direction in which some of the potential key players are already headed. For other potential key players, the plan will provide ideas and opportunities. Implementation then needs only a small catalyst to start the process or a guiding hand to keep it progressing. For some strategies, the Department of Environmental Conservation will facilitate the implementation process by setting up meetings. For other strategies, implementation will require the distribution of the plan to community groups to use as a resource.

The success of the Basin Plan will not be limited to the implementation of strategies. In addition to strategies, the basin planning process has also developed a network of groups working together to meet common goals. The strength of the network should help leverage existing funds and support from other organizations. If the process has been successful, the next basin planning process will begin with the existing partnerships intact.

Evaluation of the Planning Process

No planning process is complete without feedback on the elements of the plan. This can range from documenting the actions taken to improve water quality to placing a conservation easement on a swimming hole to assure its protection for future generations. Periodically, during the implementation phase of the plan, progress can be measured by checking on the different strategies completed or in progress in various parts of the basin.

Periodically the Poultney Mettowee Watershed Partnership and collaborators must take stock of the process and examine accomplishments in planning and implementation. Subjects to be considered include the adequacy of the process set forth by the Partnership, the progress of the basin planning process, reactions of the public to the process, and the adequacy of resources to conduct planning and implementation. In addition, the Partnership should annually address the accomplishments made that pertain to the Basin Plan and as it applies to the Lake Champlain Basin Program's *Opportunities for Action*, and the Vermont Agency of Natural Resources *Watershed Planning Initiative*.

Progress Reporting

The benchmarks set forth in this basin plan can be revisited every so often to ensure that there are the financial and technical resources allocated to implement these strategies. If these benchmarks are assigned to a specific timeline, the expectation is to achieve the standards established through these benchmarks. Simply stating that a decrease in the loss of land due to erosion or that fish habitat has improved substantially doesn't provide the checks and balances necessary to monitor and evaluate the effectiveness of these strategies. While it may be unreasonable to expect that the basin plan will address every water quality concern within a five-year period, it may be perfectly acceptable to meet expectations within a twenty-year time frame. Under this premise, the proposal to list each benchmark within a specific 5-year cycle should be met to ensure the successful implementation of this basin plan. For this plan to be successful in the Poultney Mettowee basin in the next five years, these benchmarks will be met and/or exceeded.

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Glossary

10 V.S.A., Chapter 47 – Title 10 of the Vermont Statutes Annotated, Chapter 47, Water Pollution Control, which is Vermont's basic water pollution control legislation.

Accepted agricultural practices (AAP) – land management practices adopted by the commissioners or agriculture, food and markets in accordance with applicable State law.

Accepted Management Practices (AMP) – methods of silvicultural activity generally approved by regulatory authorities and practitioners as acceptable and common to that type of operation. AMP's may not be the best methods, but are acceptable.

Aquatic biota – all organisms that, as part of their natural life cycle, live in or on waters.

Basin – one of seventeen planning units in Vermont. Some basins include only one major watershed after which it is named such as the White River Basin. Other Basins include two or major watersheds such as the Poultney, Mettawee.

Best Management Practices (BMP) – means a practice or combination of practices that may be necessary, in addition to any applicable Accepted Agricultural or Silvicultural Practices (examples of AMPs), to prevent or reduce pollution from non-point source pollution to a level consistent with State regulations and statutes. Regulatory authorities and practitioners generally establish these methods as the best manner of operation. BMP's may not be established for all industries or in agency regulations, but are often listed by professional associations and regulatory agencies as the best manner of operation for a particular industry practice.

Classification – a method of designating the waters of the State into categories suitable for different uses in accordance with the provisions of 10 V.S.A §1253.

Designated use – any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water as set forth in §§ 3-02 (A), 3-03(A), and 3-04(A) of these rules.

EPA – The U.S. Environmental Protection Agency.

Existing use – a use that has actually occurred on or after November 28, 1975, in or on waters, whether or not the use is included in the standard for classification of the waters, and whether or not the use is presently occurring

Fluvial geomorphology – a science that seeks to explain the physical interrelationships of flowing water and sediment in varying land forms

Natural condition – the condition representing chemical, physical, and biological characters that occur naturally with only minimal effects from human influences.

Non-point source pollution – waste that reaches waters in a diffuse manner from any source other than a point source including, but not limited to, overland runoff from construction sites, or as a result of agricultural or silvicultural practices.

pH – a measure of the hydrogen ion concentration in water on an inverse logarithmic scale ranging from 0 to 14. A pH under 7 indicates more hydrogen ions and therefore more acidic solutions. A pH greater than 7 indicates a more alkaline solution. A pH of 7.0 is considered neutral, neither acidic nor alkaline.

Point source – any discernable, confined and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which either a pollutant or waste is or may be discharged.

Reference condition – the range of chemical, physical, and biological characteristics of waters minimally affected by human influences. In the context of an evaluation of biological indices, or where necessary to perform other evaluations of water quality, the reference condition establishes attainable chemical, physical, and biological conditions for specific water body types against which the condition of waters of similar water body type is evaluated.

Riparian vegetation – the vegetation growing adjacent to rivers or streams.

Sedimentation – the sinking of soil, sand, silt, algae, and other particles and their deposition frequently on the bottom of rivers, streams, lakes, ponds, or wetlands.

Thermal modification – the change in water temperature

Turbidity – the capacity of materials suspended in water to scatter light usually measured in Jackson Turbidity Units (JTU). Highly turbid waters appear dark and "muddy."

Water Quality Standards – the minimum or maximum limits specified for certain water quality parameters at specific locations for the purpose of managing waters to realize their most beneficial uses. In Vermont, Water Quality Standards include both Water Classification Orders and the Regulations Governing Water Classification and Control of Quality.

Waters – all rivers, streams, creeks, brooks, reservoirs, ponds, lakes, springs and all bodies of surface waters, artificial or natural, which are contained within, flow through or border upon the State or any portion of it.

Watershed – all the land within which water drains to a common area (waterbody)

List of Acronyms Used in this Document

AAP	Accepted Agricultural Practice
AAFM	Vermont Agency of Agriculture, Food & Markets
AGC	Association of General Contractors
Agency	Vermont Agency of Natural Resources
AMP	Acceptable Management Practice
ANCF	Aquatic Nuisance Control Fund
ANR	Vermont Agency of Natural Resources
B1	Class B Water Management Type 1
B2	Class B Water Management Type 2
B3	Class B Water Management Type 3
BASS	Biomonitoring and Aquatic Studies Section, Vermont Water Quality Division
BMP	Best Management Practice
CAV	Composting Association of Vermont
CWA	Federal Clean Water Act
DEC	Vermont Department of Environmental Conservation (WC= watershed coordinator, RM= River Management Section, WS=Wetlands Section, LS=Lakes Section, SMS=Stormwater Management Section, WWMD=Wastewater Management Division, WMD=Waste Management Division, HS=Hydrology Section, PS= Planning Section)
Department	Vermont Department of Environmental Conservation
DFPR	Vermont Department of Forest, Parks and Recreation
EPA	United States Environmental Protection Agency
FOVLAP	Federation of Vermont Lake and Pond Associations
FWD	Vermont Department of Fish and Wildlife
GIS	Geographic Information System
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Source Pollution
NRCD	Natural Resource Conservation District
NRCS	Natural Resource & Conservation Service (Formerly SCS)
ORW	Outstanding Resource Water
RPC	Regional Planning Commission
TMDL	Total Maximum Daily Load
ACOE	United States Army Corp of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
VTDOH	Vermont Department of Health
VTrans	Vermont Agency of Transportation
VYCC	Vermont Youth Conservation Corp
WWTF	Wastewater Treatment Facility

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