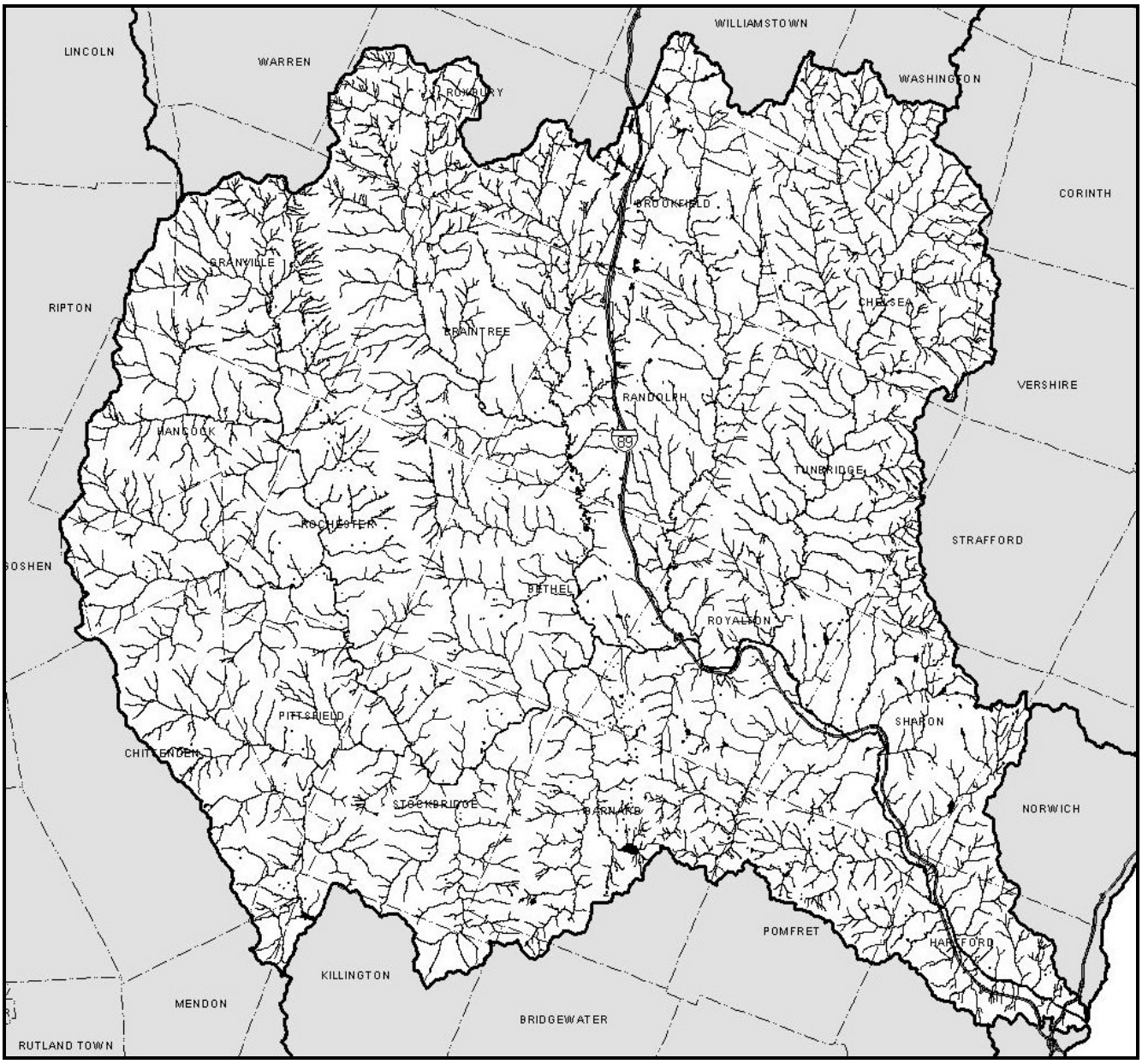

Vermont Agency of Natural Resources

WHITE RIVER BASIN PLAN

A Water Quality Management Plan

November, 2002

THE WHITE RIVER BASIN PLAN WAS PREPARED IN ACCORDANCE WITH 10 V.S.A. § 1253(d), THE VERMONT WATER QUALITY STANDARDS, THE FEDERAL CLEAN WATER ACT AND 40 CFR 130.6.

Approved and adopted:

__<Christopher Recchia>_____ _<November 14, 2002>

Christopher Recchia, Commissioner Date
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Agency of Natural Resources

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Department of Environmental Conservation
Water Quality Division
Waterbury, Vermont 05671-0408

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Vision

The White River is the heart of a healthy watershed, comprised of livable communities surrounded by productive farms and healthy forest and timberlands. It is valued as the longest free flowing river in Vermont and has reached a stable planform, reducing rates of erosion, siltation and streambank failures. Loss of land to erosion has slowed and fish habitat has been improved significantly. Public access to the river has been secured throughout the watershed and basin residents are actively engaged in land use planning and restoration efforts to maintain and enhance the health of the water.

Executive Summary

The White River Basin Plan describes water quality and water resource problems in the basin and recommends strategies for remediation of these problems. The principle purpose of the plan is to improve water quality by guiding the Agency of Natural Resources in its own work and in collaborative projects with the public as well as other State and federal agencies.

Presently, overall water quality in the surface waters of the White River Basin is exceptionally good. In addition, the White River mainstem is unrestricted by dams, making the White River the longest free flowing large river in the State. The water quality and its free flowing nature sustain high quality recreational opportunities as well as habitat for plants and animals. In addition, the water quality supports the use of surface waters for irrigation and drinking water.

Although water quality is exceptionally good overall, impacts to water quality and the uses it supports do exist. Sedimentation is the greatest source of impact to uses, followed by thermal modification, nutrients, turbidity, and pathogens. Streambank destabilization and loss of riparian buffers are the main causes of sedimentation, thermal modification, and turbidity. Numerous land uses contribute nutrients and pathogens.

Basin planning is one tool for 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 surface water 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 public input, including work completed by the White River Partnership, a local watershed group. They are as follows:

- Stream channel instability and streambank erosion
- Lack of awareness of water quality problems
- Extent and quality of public access to recreational opportunities on the water
- Impacts to fisheries

The remediation strategies are based on work that is presently being conducted by the Agency or others and on discussions with the Partnership and other groups. Implementation of these strategies should promote stable stream corridors, which will reduce streambank erosion, the greatest sources of impacts to water quality in the basin. In addition, public awareness of water quality and appreciation for its ability to support public access and fisheries should be increased as strategies are implemented. This awareness and appreciation should work to increase involvement in water quality protection and restoration activities.

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. 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 Agency proposes B3 designations for Silver Lake, Pond Brook, and a segment of each of the following: Flint Brook, Blaisdell Brook, the Third Branch near Bethel Mills Dam, and the First Branch in Tunbridge. The Agency proposes B1 designations for waters listed in Appendix D. Appendix D includes waters that are mostly in mountainous areas and 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, and for Lake Casper, a former water supply that is no longer used for that purpose. The proposal largely represents present-day management of waters in the basin.

Chapter 6 also establishes management goals by identifying existing uses for specific waters. In addition, the chapter stresses the importance of community involvement in developing goals and includes strategies to encourage community involvement.

Within the next five years, the Agency of Natural Resources will focus its efforts in these areas in collaboration with the community and other State or federal agencies as set forth in the plan (Chapters 4, 5 and 6). The next basin plan will document work completed and address any new issues that have emerged.

Chapter 1. Introduction

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

The basin plan describes strategies necessary to protect or improve the values and beneficial uses of surface waters in the White River Basin, such as swimming and fishing. The Agency of Natural Resources has collaboratively developed these strategies and has or will collaboratively implement them as well with the public and other agencies.

The collaborative effort included the identification of local concerns about the values and uses of water. In addition, strategies were developed to address local concerns. The strategies in the plan are available to groups to assist them in deciding where to focus their resources and where to find other potential resources. The strategies will also guide the Agency of Natural Resources in its work, including the remediation of waters that do not meet the Vermont Water Quality Standards. In addition, the plan includes a proposal by the Agency to establish management goals for surface waters. Implementation of strategies began during the basin planning process and will continue until the next basin planning process begins again.

1.2 Identifying Water Quality Problems

Water quality is acceptable when it supports uses that Vermonters understand to be beneficial as well as the technical criteria of the Vermont Water Quality Standards (Standards). Beneficial uses range from recreation to the support of aquatic biota. These uses have been codified in the Standards. At times, the preservation of these diverse, multiple uses may be in conflict. The State must seek a balance among conflicting uses while sustaining each use in accordance with the Standards.

The Agency assesses impacts or threats to these protected uses by using chemical, physical, and biological data, and best professional judgment. The community is also an important resource to the Agency for identifying problems on individual water bodies or general concerns that reflect problems prevalent throughout much of the watershed.

The results of the Agency water quality assessments are located by basin in the following Agency documents:

- The Vermont Department of Environmental Conservation Water Quality and Aquatic Habitat Assessment Reports identify overall and specific water quality problems.

- Section 303(d) 2000 List of Waters and the List of Priority Surface Waters Outside the Scope of the Clean Water Act Section 303(d) identify specific surface waters with water quality problems.

The water quality problems addressed in the basin planning process are based on information from the above documents and on local concerns that are identified during public forums.

1.3 Planning at the Watershed Level

A watershed is the entire area that drains into a particular waterbody either through channelized flow or surface runoff. Preparing a plan at a watershed level allows for the consideration of all contributing sources of surface water to any one waterbody in the watershed.

The Agency of Natural Resources' planning effort to improve or maintain water quality has been conducted at a watershed level since the 1960's. The state is divided into seventeen basins for this purpose. Seven of the basins include the watershed of a single body of water such as in Basin 9, which includes only the White River's watershed. The ten other basins contain two or more watersheds such as Basin 2, which contains the Poultney and the Mettawee River watersheds. The Agency is currently responsible for preparing basin plans for each of the 17 major river basins and updating them every five years.

1.4 History of Watershed Planning in the White River Basin

Basin planning was conducted in Vermont during the 1970's to address point sources of pollution and estimate the assimilative capacity of waters so that sewage treatment plants could be constructed in all municipalities as needed. The White River Basin Plan was completed in 1975, and contained several conclusions and recommendations related to nonpoint source pollution. Some of these, it is interesting to note, are still relevant today. These include a recommendation for an assessment of stream bank erosion to determine its significance as a nonpoint source of pollution; and revegetation for disturbed stream bank area associated with stream bank or channel projects. Several strategies in this basin plan respond to those recommendations.

1.5 Planning as a Collaborative Effort

Planning through a collaborative process with the local communities in the basin, and local, State, and federal governments, and private organizations is the most appropriate approach for developing solutions to Vermont's water quality problems today. Vermont's water quality problems are, for the most part, the result of polluted runoff from many, dispersed activities on the land. This nonpoint source pollution is most effectively addressed through good land stewardship practices, which requires interest and commitment from many people.

Vermont already has more than 65 watershed and river groups, many of who are involved in efforts to address water quality concerns in their community. In addition, thousands of landowners are working to manage their lands to conserve Vermont's waters. Basin planning can

assist local communities in their efforts by focusing resources of the State and others towards community-led priorities.

Another benefit of a collaborative approach is the sharing of information among resource agencies, groups, and individual citizens. This results in more realistic solutions. 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.

1.6 Partners in the White River Basin Planning Process

The collaborative process in the White River Basin began with the work of the White River Partnership. The Partnership formed in 1995 as a group of local citizens interested in preserving the quality of life in the White River Basin. It has become a forum for bringing together the community, local, State, and federal government agencies, and their resources to protect common interests.

To identify common interests or concerns in the community, the Partnership held a series of public forums in 1996. The public forum results and public input during the basin planning process provided the primary local concerns addressed in this basin plan (see Appendix A). The primary concerns are as follows:

- Stream channel instability and streambank erosion
- Lack of awareness of water quality problems
- Extent and quality of public access to recreational opportunities on the water
- Impacts to fisheries

Collaborative efforts have already begun to address these concerns. The basin plan includes a description of the collaborative efforts as well as solutions. The solutions or strategies were developed through a series of focus group sessions and discussions with stakeholders in the basin.

1.7 Use of this Plan

The basin plan has two primary uses:

1. It is a resource to any individual or group that works on watershed issues.

2. It is a guide to the Vermont Agency of Natural Resources in its efforts to protect and improve surface waters to the level required by the Vermont Water Quality Standards.

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

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

Agency programs (described in Appendix B) will use the solutions or strategies in the plan to help guide decisions 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 people 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.

Chapter 2. Description of the White River Basin[1]

2.1 Physical Description

The White River Basin encompasses 710 square miles, draining portions of Addison, Orange, Rutland, Washington and Windsor Counties (see Cover and Appendix C). Forested and pastoral landscapes, and exceptional rivers characterize the basin.

The White River and all its tributaries, stretching over 457 miles, are the prominent hydrological features of the basin. Within the state of Vermont, the White River is significant for being the longest free-flowing river. The White River originates in the Town of Ripton on the slopes of Battell Mountain, then flows southerly and easterly before merging with the Connecticut River in the Town of Hartford. The 50-mile long mainstem of the White River has five major tributaries: the First Branch, the Second Branch, the Third Branch, Locust Creek and the Tweed River. Unlike the White River's mainstem, dams restrict flows on several of the tributaries.

The White River Basin has the fourth fewest lakes and ponds of the 17 major river basins in Vermont. The entire basin has only 39 lakes and ponds. Except for Silver Lake, the remaining 38 lakes and ponds are no larger than 28 acres. At 84 acres, Silver Lake is the largest lake in the basin.

Wetlands are also limited in the basin, covering less than 1 percent of the landscape.

The landscape in the basin is hilly and predominantly forested with the developed and agricultural lands situated in the valleys. Forested land covers 84% of the basin and agricultural land occupies about 7%. Developed land, including residential, commercial, industrial, transportation, and utilities, covers about 5% of the basin. The remaining 4% of the landscape is water (Figure 1). The predominance of forest cover and the small amount of developed land are the primary reasons for the good water quality in most of the basin.

[1] For a more detailed description of the basin and water quality problems see the Vermont DEC 1997 White River Basin Water Quality and Aquatic Habitat Assessment Report for the White River

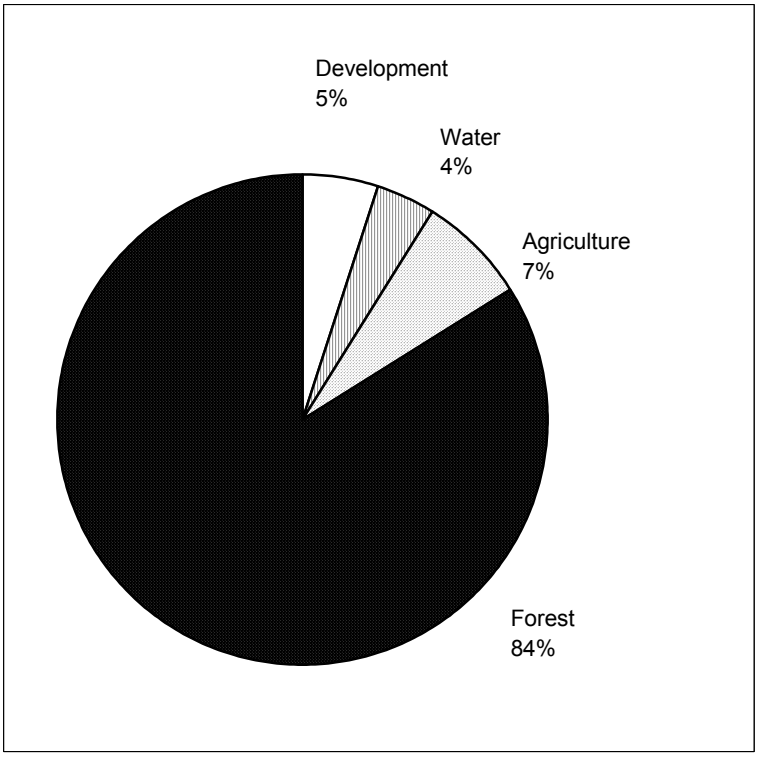

Figure 1. Percent Land Cover in the White River Watershed

2.2 Land Use

The health of the rivers, lakes, and wetlands in the basin can be directly related to land cover types and their associated land use. The level of impact on water quality is low in undisturbed forested landscapes and becomes higher as land uses intensify through the spectrum of agriculture, timber harvesting, housing, industry, and roads (the land uses are listed in no particular order). These more intensive land uses, which are valued by the community, can still support a healthy watershed if stewardship practices reduce discharges to and encroachments on surface water (Two Rivers-Ottauquechee Planning Commission, 1999).

Agricultural Land

Introduction
Agriculture is an important component of the environmental, cultural, and economic make-up of the White River Basin. Land devoted to agriculture makes up 7% of the basin's entirety covering an area of over 34,000 acres. Agricultural land is used for raising everything from horses and dairy cows, to pumpkins, vegetables, hay, and cut flowers.

Of all the land in the watershed owned by farmers, less than half is in crop production. Woodlands expand the diversity of production from farm owned land to include forest products, maple syrup, and firewood.

The impact of agricultural land on the water quality of the White River has been extensive and has been accumulating for over 200 years. In the last 15 years nonpoint source pollution from agriculture has begun to be more aggressively addressed. The major agricultural nonpoint sources of pollution are from cropland erosion, agricultural waste runoff (including manure and milk house waste) and commercial fertilizers. These sources contribute phosphorus and nitrogen, bacteria and other pathogens, organic matter, toxins, and sediment to surface waters.

The water quality impacts of agricultural nonpoint sources of pollution are being addressed by a partnership of federal, State and local organizations. Working together with agricultural producers, the partners are implementing on-farm practices that reduce sediment and nutrient runoff, improve waste and water management, and promote better land-use practices. In Appendix B, a description of the programs that support these partnerships is listed under Agricultural Runoff Control Programs. Limited resources keep implementation at a slow but steady pace, yet significant progress has been made in the four-year history of the partnership.

Historical Highlights

Although the number of farms in the watershed has increased recently, agriculture in Vermont has been decreasing throughout much of the past century. This trend may hit the White River Basin as well. Statewide, 3422 farms have been lost since 1964, cutting in half the number of acres devoted to farming. This land use change could have a dramatic effect on water quality, by opening the land up to development, urbanization, and sprawl.

Culturally, changes in the landscape reduce the pastoral aesthetic aspects that have made Vermont an attractive tourist destination.

The statewide economic characteristics of agriculture can be assumed to hold true for the White River Basin. The current 356 farms in the basin can be estimated to be producing goods worth $29 million in market value.

Under current conditions, if resources and assistance remain the same, it can be expected that farming in the basin will continue at about the same level as today. The loss of dairy farms seems to be offset by the increase in other types of farms.

Market value of products could continue to grow due to increasing prices, increasing product diversity, and increasing sales of value-added products.

Trends for the Future

There are currently 102 dairy farms in the White River Basin. Of these farms, 59 do not have waste management systems. At the current rate of 3 waste management systems per year it will take approximately $1,108,480 and 20 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 3,464 animal units on dairy farms. Thirty-five farms have not yet installed improved barnyards. In order to treat the remaining 6,124 animal units needing treatment at an average cost of $90 per animal unit, it will cost $551,160.

Participation in these programs is voluntary and not all producers are willing to invest in Best Management Practices (BMP). Storage systems contain wastes produced during the winter spreading ban or when animals are confined. Pasture wastes and spread wastes are susceptible to runoff.

With current levels of funding for BMP installation, water quality should gradually improve until 2020 when all dairy farms are treated. Levels of phosphorus and nitrogen in surface waters should decrease. Further improvements will only come if the funding programs continue and are refocused on other types of farming and annual practice implementation such as riparian corridor restoration and nutrient management are implemented. An increase in support for these programs would decrease the amount of time it will take to reach full nutrient containment.

Forest Land

Forestland covers 84% of the White River Basin. Uses of the forest include, but are not limited to, recreation, wildlife habitat and timber harvesting. Outside of areas in the Green Mountain National Forest or in State ownership, forestland is owned for the most part by individuals with diverse goals allowing for a variation in management in terms of uses, strategies, time-frames, and intensity.

Most of the watershed is privately owned and available for harvest. Long-range planning and easement partnerships on public lands will establish some areas where harvesting of the forest will be prohibited. In addition, some private landowners may also establish no-cut zones on their lands. The extent of these areas is still to be determined.

Timber harvesting in Vermont is subject to the Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont (AMPs). The Department of Forests, Parks and Recreation of the Agency provides assistance in several workshops on AMPs offered to loggers and foresters by the VLA (Vermont Loggers Association) and the LEAP (Logger Education to Advance Professionalism) Program. When followed, the AMPs should protect surface water quality by preventing discharges such as silt, sediment, petroleum products and woody debris to streams and lakes. The AMPs also protect the integrity of the stream corridor by requiring that a protective strip of trees be maintained adjacent to surface waters, except at logging road crossings. In 1999, the Agency received six complaints and in 2000, the Agency received four complaints about logging operations in the basin. All of the situations visited were corrected.

Timber harvesting in Vermont has for the most part complied with AMPs due to a combination of education to reduce violations and a good enforcement strategy that emphasizes remediation. The DFPR helps support AMP trainings for loggers held around the State twice a year by the Vermont Forestry Foundation. A team that includes representatives from government and the timber industry handles violations of AMPs. The team assesses compliance with AMPs and makes recommendations for correcting potential problems (see Appendix B for information on AMPs).

Developed Land

Over the last two hundred years, land has been developed adjacent to rivers to take advantage of the benefits the river provides such as travel routes, fertile flood plain soils, hydropower and water supply. In addition, due to the hilly nature of the White River Basin, the desirable land for development is within the flatter valley floors where the river corridors are situated. The roads, houses and parking lots that make up the developed areas cover approximately 5% of the basin. The developed area has generally led to reduced water quality when building resulted in the removal of vegetation along the stream corridor, the filling of flood plains and the disposal of untreated runoff from these areas into the river.

The Vermont Water Quality and Aquatic Habitat Assessment for the White River Basin notes that most of the towns in the basin experienced high population and housing growth rates between 1970 and 1990 (DEC, 1997). The land use changes that are a result of the growing number of houses and increase in people are important in terms of potential and actual water quality and aquatic habitat impacts. Overall, the population of the basin grew approximately 28.1% between 1970 and 1980, 13.0% between 1980 and 1990 and 8% between 1990 and 2000 (based on census statistics for towns located entirely in the basin or with urban areas in the basin). The approximate number of housing units in the basin increased 24.4% from 1980 to 1990. Few towns in the basin have language in their town plans or regulations that protect surface waters from development (see Appendix K). Without careful planning and good local water quality and aquatic habitat protection standards, increasing numbers of houses, driveways, yards, and people will reduce water quality.

The impact of the many acres of roads, highways, and other transportation uses in the White River Basin is difficult to determine, but this land use category covers over 18,000 acres. In addition to the amount of land covered by transportation and utilities, which creates impervious surfaces and changes natural runoff patterns, the location of the roads is often a threat or source of impacts to rivers and streams. Road embankments often encroach on floodplains to stream channels, which may lead to stream channel instability. The White River mainstem has a road along its entire length and there are roads on both sides for much of its length. Roads cross the main stem 22 times, the First Branch 23 times, the Second Branch 21 times, and the Third Branch 12 times (1984 Vermont Atlas and Gazetteer). Even Class IV roads, which are used mostly for recreation and land management (timber, pastures), could be a significant source of impacts. Towns do not generally maintain Class IV roads, resulting in sedimentation of adjacent surface waters if they are overused.

Another problem may arise from road maintenance practices that are not sensitive to water quality. Turnouts taking water and gravel directly to streams, ditching without mulching and seeding the bare soil, grading or widening with sand and gravel going down steep banks to surface waters, and sand and debris reaching the river at the base of a road bridge abutments are all sources of sediment pollution to rivers and streams.

Town zoning and subdivision regulations and state land use regulations help to locate development away from the river corridor. In addition, state stormwater regulations and programs like the Vermont Better Backroads Programs reduce impacts from developed land.

2.3 Water-based Resources

The White River, its tributaries, and associated lakes, ponds and wetlands support aquatic life and habitat and provide recreational opportunities through its fishery, swimming holes, boating runs, and aesthetics. 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 White River that support many of these uses include an unobstructed main stem (no dams) and exceptionally good water quality.

Boating

The White River is heavily used for canoeing, kayaking, and tubing. The White River is known nationally as one of the longest uninterrupted kayak runs on a major river in New England. From Stockbridge to Bethel, the river is considered a classic Vermont white water run. From Bethel to the Connecticut River, the river is mostly quickwater, but there are a variety of short drops and narrows and Class II rapids.

The first portion of the First Branch below Chelsea is Class II with a low Class III segment, and is a nice white water run. The next segment downstream contains a mile of interesting ledges, followed by a nice touring section.

The Third Branch of the White River is boatable from Roxbury to Randolph. White water boating also takes place on the Hancock Branch, from its confluence with the Robbins Branch to the White River. The Hancock Branch is hydrologically distinguished by being the smallest stream in the state known as a white water run.

Swimming

People take advantage of an abundance of swimming holes in the basin. Large swimming holes along the mainstem with jumping ledges include Big Parker Swimming Hole in Bethel, Twin Bridge Swimming Hole in Gaysville, Little Parker in Stockbridge, plus many other unnamed holes. Swimming holes are also located on the Tweed River, the Third Branch in Braintree and on Locust Creek in Bethel. Most swimming holes are not maintained for that use and access is often on private property. Areas that are managed for public access, including swimming are Hancock Over Look, Lions Club Park in Rochester, US Forest Service Peavine Park in Stockbridge, Bethel's Peavine Park, Clifford Park and Lyman Point in Hartford and the swimmer's beach at Silver Lake State Park.

Fish Habitat and Fisheries

The White River Basin is home to a diversity of fish species, many of which support popular recreational fisheries. Three species of trout are found in the White River Basin: brook trout, which is native to Vermont, and brown and rainbow trout, which were introduced throughout the state in the late 1800's and have since become naturalized in the White River Basin. All three of the trout species reproduce naturally in the watershed, using the White River mainstem and its tributaries for both spawning and nursery habitat. Wild populations of native brook trout flourish in the colder, higher elevation streams, while most tributaries and much of the mainstem supports naturalized populations of wild rainbow and brown trout. Smallmouth bass and an occasional walleye are most likely to be found in the larger, deeper waters of the main river downstream of Bethel.

Smaller tributary streams of the White River Basin are managed as wild trout waters, i.e., are not stocked with hatchery-reared trout. In addition, a 3.3-mile section of the White River mainstem in the Stockbridge/Bethel area has been managed solely as a wild trout fishery since 1994, and includes the use of special fishing regulations. The Department of Fish and Wildlife also stocks "catchable" size hatchery-reared trout to supplement recreational fisheries in several larger tributaries of the White River and much of the mainstem.

The Connecticut River and its tributaries, including the White River, have historically supported populations of Atlantic salmon. This species, which spends its adult life in the ocean waters of the North Atlantic and spawns in freshwater streams, was extirpated from the Connecticut River and tributaries in the early 1800's due to the construction of dams, overfishing and pollution. Since 1967, a cooperative program comprised of several State and federal agencies and private organizations has focused on the restoration of this species. Current restoration efforts include the rearing and stocking of juvenile Atlantic salmon in Connecticut River tributaries, and the protection and enhancement of aquatic habitat. The construction of fish passage facilities that allow adult salmon to access upstream spawning habitats, as well as allow juvenile salmon to safely migrate downstream to the ocean, are key components of this program. Although few in number, some adult Atlantic salmon have successfully returned to the White River.

Like the Atlantic salmon, trout populations may also undergo spawning migrations. Trout from mainstem reaches of the White River and its larger tributaries may migrate into smaller tributary streams to spawn. These streams will serve as nursery areas for young trout until they are ready to migrate downstream to mainstem areas. Trout and other species also move upstream and downstream to meet other habitat needs. These movements may be localized or may involve a number of miles of travel. For example, during warm periods in the summer, trout often migrate to coldwater refuges such as the mouths of tributary streams or to areas of groundwater inflow. Likewise, trout and salmon may migrate in the fall to areas providing over wintering habitat. (See Appendix F for more information on trout and salmon spawning and nursery habitat in the White River).

Lake and pond habitat in the White River Basin is limited. A few small natural and artificial ponds with public access provide additional recreational fishing opportunities. Most notable are Ansel Pond (Bethel), Colton Pond (Killington), McIntosh Pond (Royalton), Rood Pond

(Williamstown/Brookfield), Silver Lake (Barnard) and Sunset Lake (Brookfield). Largemouth bass, smallmouth bass, chain pickerel, northern pike, yellow perch, sunfish and bullhead are among the fish species found in one or more of these waters. The Department of Fish and Wildlife also manages some of these ponds with annual stockings of hatchery-reared trout.

Irrigation and Animal Watering

Irrigation and animal watering draws an estimated 230,000 gallons of water per day from surface waters in the White River Basin (see Table 1). In the basin, irrigation needs have increased 7% from 1992 when 23 farms irrigated 2087 acres to 1997 when 26 farms irrigated 2228 acres.

Table 1. The use of water for irrigation and animal watering (United States Geological Service, 1997)[2]

	Irrigation	Animal Watering
Total Gallons per Day	200,000	200,000
% Groundwater	10	75
% Surface Water	90	25

Drinking Water Supplies

Lake John in Royalton and Farnsworth Brook in Braintree are surface waters that are used as public drinking water supplies. In addition, the South Royalton Fire District #1 has applied to the Department of Environmental Conservation for a permit to use the White River as a drinking water supply using a surface water infiltration gallery. The number of surface waters used for private drinking water supplies is unknown.

Significant Natural Communities and Rare, Threatened, and Endangered Species

Three natural community types are integrally connected to the White River. Three occurrences of Calcareous Riverside Seeps are found along the stretch of river that flows through Sharon, Pomfret, and West Hartford. Five occurrences of Sugar Maple-Ostrich Fern Riverine Floodplain Forest community are found along the White River. One occurrence of Riverside Sand or Gravel Shore community, a community that is the product of dynamic river systems, is also found. Spring flooding or other high water and ice scour shape these often sparsely vegetated depositional communities.

A partial inventory of the White River Basin by the Department of Fish and Wildlife identified 60 plant species and nine animal species that are considered rare, threatened, or endangered in the state of Vermont. Figure 2 shows the location of the natural communities and species associated with surface waters in the White River Basin.

Livestock watering is based on the number of reported dairy cows and horses. Irrigation includes agricultural crops and golf course usage.

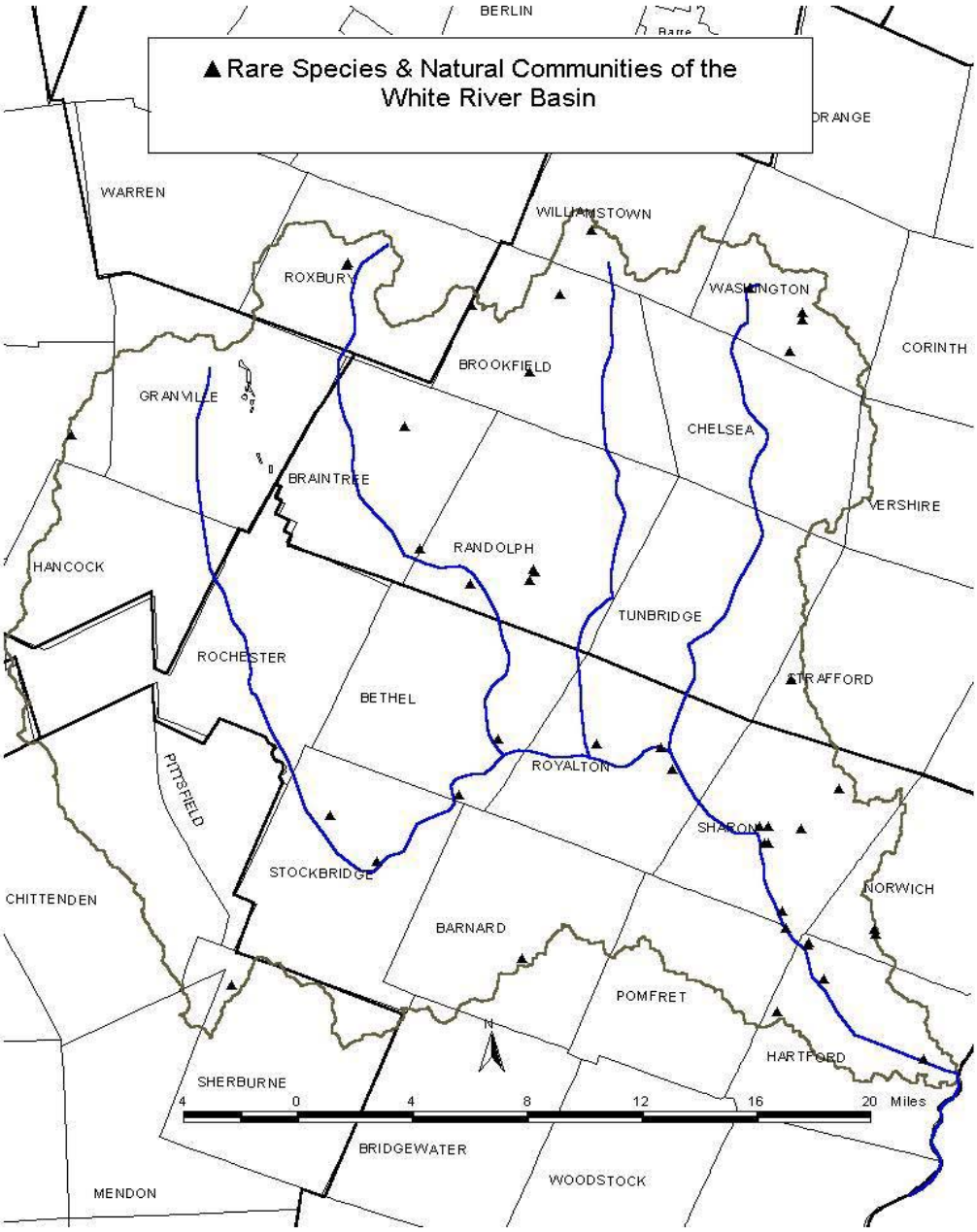

Figure 2. Map of the natural communities and rare, threatened, and endangered species associated with surface waters in the White River Basin (source: Nongame & Natural Heritage Program, FWD)

Chapter 3. Water Quality in the White River Basin

3.1 General Water Quality Problems

The White River and its associated waters exhibit exceptionally good water quality based on the water's ability to support aquatic biota and habitat. As determined during the Agency's 1997 assessment, almost 70% of the river and stream miles fully support aquatic biota and habitat, about 23% of the miles are threatened by some pollutant, condition, or activity, and just over 7% of the miles do not fully support aquatic biota and habitat. The miles described as not fully supporting uses are degraded by sedimentation, thermal modification, turbidity, nutrients, or pathogens or a combination. (See the 1997 White River Watershed Water Quality and Aquatic Habitat Assessment Report by the Vermont Department of Environmental Conservation for more detail). The sources of these problems are listed in Table 2. Specific surface waters in the basin with these problems and others are listed in Chapter 5 in Tables 3-5. The associated impacts from new development, due to the expected growth in the area (Two Rivers-Ottauquechee Regional Commission, 1999), have the potential to exacerbate existing water quality problems. Chapter 4 describes strategies for reducing these top five problems throughout the basin, and Chapter 5 describes strategies for improving water quality in specific waters.

Table 2. The five most prevalent sources of water quality problems in the White River Basin (DEC, 1997)

Water Quality Problem	Sources (Randomly listed)	High Impact (miles)	Moderate or Slight Impacts (miles)	Total Impact (miles)	Threats (miles)
Sedimentation	Streambank de-stabilization, Road maintenance and runoff, Agriculture, Channelization, Dredging, Land development, and Natural Sources	13.5	17.5	31.0	97.2
Thermal Modification	Loss of riparian vegetation, Streambank de-stabilization, Road maintenance, Agricultural land use, Channelization, and Land development	---	27.5	27.5	52.5
Nutrients	Streambank de-stabilization, Agriculture, Land development	---	27.5	27.5	38.0
Turbidity	Streambank de-stabilization, Agriculture, Road maintenance, and runoff, Channelization, Dredging, Land development, and Natural Sources	1.5	11.0	12.5	35.0
Pathogens	Developed land runoff, Agriculture	---	11.0	11.0	38.0

Sedimentation, Thermal Modification, Turbidity

Of the five most prevalent water quality problems in the White River Basin, sedimentation, turbidity, and thermal modification cause the most significant impacts to water quality, resulting

in adverse effects on aquatic biota (fish and aquatic insects). Sedimentation is the accumulation of fine particles or soils on the bottom of a water body and turbidity is the measure of suspended fine particles in the water column. Thermal modification refers to an increased surface water temperature due to human disturbance. In the basin, these water quality problems are largely the result of streams that are unstable or lack a sufficient cover of trees and shrubs along its banks (wooded riparian buffer).

Sedimentation and turbidity are caused primarily by the addition of soil into the stream from eroding stream channels.[3] Stream channels will erode when they are unstable. In addition, streambanks will erode if they lack the deep soil-binding roots provided by a wooded riparian buffer.

Thermal modification occurs when the lack of a wooded riparian buffer and the loss of its associated shade allow the sun to increase water temperatures. Unstable stream channels also increase water temperatures if they become wider in the course of seeking a stable condition, resulting in shallower water levels.

Stream channel instability and lack of riparian buffers result for the most part from cumulative human disturbances, including flood plain encroachments, alteration of riparian vegetation, channelization, wetland drainage, urbanization and in-stream gravel mining. The associated impacts from new development, due to the expected growth in the area, have the potential to result in further disturbances on stream corridors.

Nutrients

Excess amounts of plant nutrients also degrade water quality in the White River Basin. The nutrients that are naturally limited in the environment, such as phosphorus, most commonly cause problems in the environment. High levels of nutrients cause aquatic plants, especially algae, to grow in much greater densities than the aquatic ecosystem can normally support. The increased growth may reduce swimming and boating opportunities, create a foul taste and odor in drinking water, and kill fish. The concentration of nutrients in runoff per acre of land is highest from urban landscapes, followed by agricultural landscapes (Budd and Meals, 1998; Hegman et al., 1999). In the predominately rural White River Basin, agriculture is the primary source of nutrients in surface waters (DEC, 1997). In the future, urban sources may increase unless offset by increased control of urban runoff.

Agricultural sources of nutrients include fertilizers, manure, and crop residues. The nutrients from these sources are often carried to surface waters by overland runoff. Agricultural sources of nutrients are not expected to increase. Under current conditions and if resources and assistance remain the same, the Vermont Department of Agriculture, Food and Markets expects that farming in the basin will continue at about the same level as today. In addition, nutrient levels should decrease as current State and federal programs and better AAP enforcement work to decrease nonpoint source pollution from agricultural activities.

[3] The stream channel includes both the streambank and the bed

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.

Pathogens

Pathogens are any disease-causing organism, including bacteria, viruses, and protozoans. The pathogens that are of concern in Vermont's surface waters are those that are associated with the 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 these organisms pose a risk to human health when ingested through drinking or inadvertently through contact recreation.

The White River Basin is prized for its swimming, tubing, fishing, and boating opportunities. Even a perception that pathogens are present may limit the recreational use of surface waters.

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 ducks, can also contribute pathogens.

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Chapter 4. Resolving Local Water Quality Concerns

To address both local concerns and general water quality problems, the Agency of Natural Resources, the White River Partnership and others have been working together to reduce stream channel instability and streambank erosion, improve public access to waters, improve water quality awareness, and reduce impacts to fisheries. Addressing stream channel instability and streambank erosion will reduce sedimentation, thermal modification, and turbidity in the rivers. Improving awareness of water quality will improve both the community's and the Agency's understanding of present conditions, including pathogen levels, leading to more informed solutions. Improving public access to recreational opportunities will help foster the community's interest in protecting the water quality necessary to support water-based recreation. Finally, improving fisheries habitat will result in increased fish populations, which will also be enhanced by a reduction of sedimentation and thermal modification.

The following is a description of the water quality problems, history of work by many parties regarding these concerns, and the goals, objectives and strategies for future work.

4.1 Stream Channel Instability and Streambank Erosion

Background

Present Condition of Streams in the White River Basin
The upper White River, the Third Branch, Ayers Brook, the Second Branch, and the First Branch are experiencing the most instability and erosion in the basin. In the upper White River and portions of the three branches, unstable channels cause incision, degradation, and aggradation. On other streams, such as Ayers Brook and the Second Branch, erosion is primarily related to lateral channel instability caused by a lack of riparian vegetation.

Stream channel instability
Over time, stable rivers naturally move around within their valleys, but with only minimal changes in their location from year to year. A stable river is able to move its waters and sediment load in balance. The stability of a river channel is based on maintaining a certain flow of water, shape and slope of the channel, and sediment load. When any of these factors change significantly, the river channel must change, resulting in excessive erosion of the streambed or banks.

In the White River Basin, many streams have been destabilized by human actions that filled historic floodplain or reduced access to the floodplain by deepening the channel. The downward erosion due to higher energy levels in the constricted channel eventually results in outward and lateral erosion. In many areas, rivers have over-widened considerably, and are currently filling with sediment to develop new floodplains (see Figure 3).

The stream channels in the White River Basin are still recovering from earlier disturbances such as gravel mining and other channel manipulation. Between 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 river channels. Following the flood of 1973, large-scale channelization practices were employed to reclaim damaged lands. The 1970's and 1980's were also a period of extensive gravel mining in the White River and its tributaries. 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 3, until it has created a new floodplain at a lower elevation in the landscape.

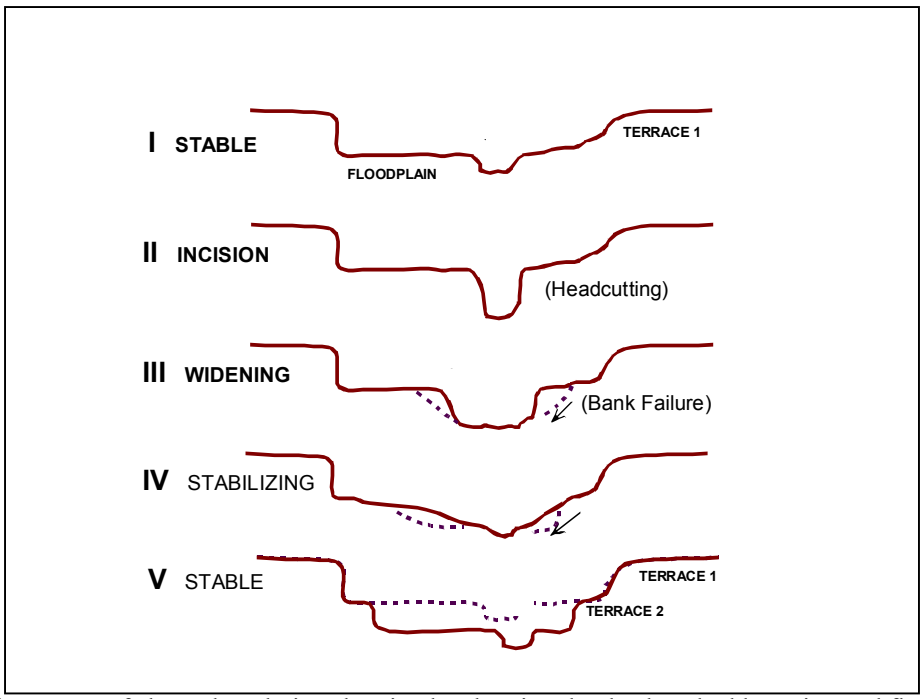

Figure 3. Five stages of channel evolution showing headcutting that leads to bed lowering and floodplain redevelopment. Source: Schumm, 1977 and 1984

The bed erosion that occurs when a meandering river is straightened in its valley is a problem that is compounded through its effects on other reaches of the river. As shown in Figure 4, headcuts will travel upstream and into tributaries, eroding sediments from otherwise stable streambeds. These bed sediments will move into and clog areas downstream leading to lateral scour and erosion of the streambank. Channel evolution processes may take decades to play out. Landowners that have maintained wooded areas along their stream and riverbanks, or have stabilized the riverbanks with rip-rap have experienced eroding banks as the river channel slopes have undercut banks as they adjusted to match the valley slopes, triggered by downstream or upstream channel disturbances.

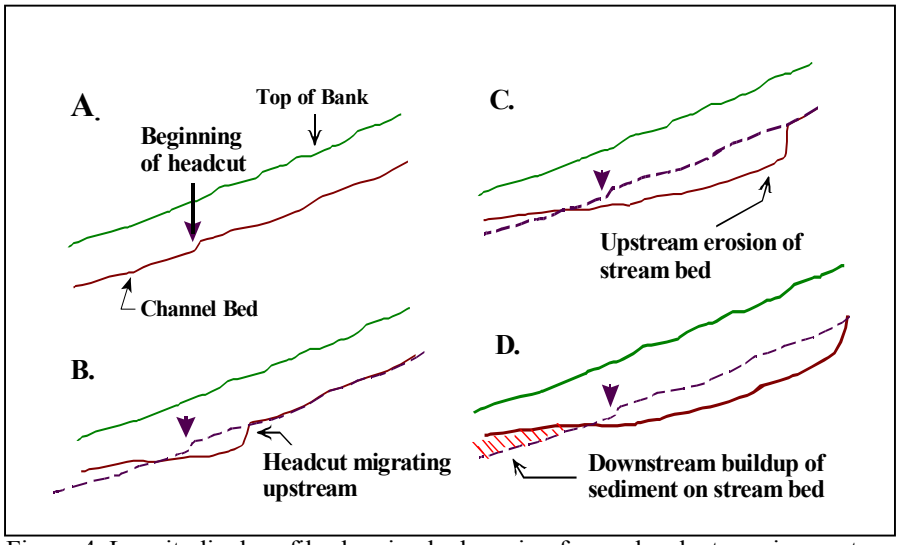

Figure 4. Longitudinal profile showing bed erosion from a headcut moving upstream leading to channel filling downstream. Source: DEC, 2000 (after Schumm 1977 and 1984)

Riparian buffers

Even in areas such as Ayers Brook and the Second Branch where the river channel is stable, the river bank will likely be subject to accelerated erosion if riparian vegetation is absent as described in Section 3.1. Riparian vegetation includes trees, shrubs, and herbaceous plants that grow naturally on and adjacent to the banks of rivers and streams. Although, the width of riparian vegetation needed to protect the bank from erosive forces of the river varies, 50 to 100 feet has often been used as an adequate buffer width.

Along the mainstem of the White River, only 40% of the shore length along the left bank (looking downstream) has a riparian buffer at least 50-feet wide. The right bank is somewhat better protected with 57% having a buffer of at least 50 feet (DEC, 1997). Streams in the White River Basin that are moving back and forth in their valleys, but have access to their floodplains would exhibit considerably less erosion with riparian vegetation holding their banks together.

Riparian buffers also play other roles in maintaining a healthy riverine ecosystem. Vegetated buffers provide shade to reduce surface water temperatures; filter sediments, nutrients, and other pollutants from runoff; provide shade and food for aquatic insects; provide cover and substrate for fish and aquatic insects; provide habitat to species whose life cycles include water and upland; offer cover for species traveling between habitats; slow floodwaters; and control ice damage.

In most situations, a river can recover on its own over time; however, the continuation of human -caused disturbances may keep rivers from reaching a state of equilibrium and lead to more erosion within the stream corridor.

There have been a number of stream corridor stabilization, buffer re-establishment and more recently, natural channel restoration activities over the last 12 years in the White River Basin. Many of these projects have been collaborative efforts by the White River Partnership and state and federal agencies. In the past, the focus has been on bank armoring (lining the bank with stone), but new projects now also include habitat restoration, bioengineering, and riparian plantings. The White River Partnership (Partnership) and others have also begun to survey the condition of the river corridor to identify areas most in need of remediation. The following is a list of projects describing restoration efforts as well as others that address the community's concerns regarding streambank instability and erosion.

The Upper White River Stream Bank Enhancement Project

For many rivers in Vermont, the only strategy for dealing with floods and river instability was to dredge and armor the river channel in order to contain the rare but violent flood flows within the streambanks. The Vermont Agency of Natural Resources and federal agencies expressed concern that the periodic dredging, while appearing to provide flood protection in the short term, was merely setting the stage for the next flood flow to be even more devastating. In 1996, the Partnership, towns, landowners along the river, The Connecticut River Joint Commissions and State and federal agencies began working together on projects to enhance the stability of the upper White River. The program includes bank erosion control, riparian vegetation re-establishment, in-stream habitat enhancement, and channel stability restoration. As a result of the work, a total of 17,800 feet of shoreline has been stabilized and enhanced for property protection, fisheries, and riparian habitat. Twenty-five to one hundred foot wide buffers were re-established on these project sites. The cost of such projects ranged from nominal costs per mile for planting riparian buffers to between $100,000 and $150,000 per mile for major projects that physically restore a stream channel. Restoration practices have included: shaping stream beds, banks, and floodplain; revegetating stream banks and buffers; and structurally protecting stream banks using log and rock vanes, root wads, conifer tree tops, and rock revetments.

The Partnership's Watershed Restoration Business Plan (revised May 22, 2000) describes future river corridor restoration work as follows:

> *The Partnership plans to expand the enhancement project to more sub-watersheds. The Partnership will initiate stream corridor restoration in two sub-watersheds each year for the next three years. Each sub-watershed will have a Stream Team that will work to identify, prioritize and implement river channel and riparian restoration projects. The Partnership's Restoration Projects Manager will work with the Stream Teams to engage community leaders and volunteers to plan, implement, and monitor the projects. To build technical capacity within communities and among State and federal agencies, a consulting fluvial geomorphologist will be contracted to provide assistance with designing river channel restoration when needed (WRP, 2000).*

Buffer survey

Projects in the basin have also focused on developing surveys of existing conditions. To obtain a general picture of buffers on the main stem of the White River, the Agency's Department of Environmental Conservation determined the presence or absence of a 50-foot wide vegetated

buffer using 1992-1994 ortho-photographs. The results of the survey show that the loss of riparian vegetation along the White River mainstem has been substantial (DEC, 1997). The Agency's Department of Fish and Wildlife and the White River Partnership are also surveying riparian buffers for the Third Branch using the 1997 and 1998 1:5000 and 1992-1994 ortho-photographs. The White River Partnership is in the process of mapping these areas.

Erosion survey
With the help of the Two Rivers-Ottauquechee Regional Commission and a Clean Water Act Section 604(b) pass-through grant from the Agency, the Partnership began a project to survey erosion sites and rank the instability of sites in spring 2000. To date, the Partnership has completed the upper White River from Granville to Stockbridge. The Partnership would eventually like to create a basin-wide picture of erosion in the watershed that could help with prioritizing sites for their River Enhancement Projects.

Fluvial geomorphological study
In efforts to assist the Partnership in prioritizing sites for remediation, the USDA Natural Resource Conservation Service (NRCS) has completed a study that goes beyond locating erosion sites and begins to investigate the stability of the stream channel (USDA, 2001). The study provided an important step in understanding the dynamics of the river by classifying stream reaches and assessing conditions using the "Rosgen" stream classification method.[4] The classification describes the condition of the stream and is the first step towards determining the types of instability present and developing a plan for restoration of the Third Branch. The study focused on the Third Branch and Ayers Brook and included the following findings:

- between Randolph and Bethel, the river channel of the Third Branch is unstable, resulting in an acceleration of bank erosion and a widening channel;
- the instability between Randolph and Bethel can be explained partially by the lack or poor condition of riparian corridor vegetation and by gravel mining activities that occurred between 1972 and 1986;
- along Ayers Brook the channel is stable, but the banks are eroding;
- the eroded banks along Ayers Brook appear to be caused by the removal of riparian vegetation; and
- 80% of the sediment in the Third Branch system appears to originate from the erosion of Ayers Brook and the Third Branch, downstream of Randolph.

The report concludes that for watershed restoration goals to be met in the face of an increasing population, the public will have to understand the effects of land use and channel manipulation on river dynamics.

Flow gauges
The White River Partnership placed a gauge on the abutments to the Interstate 89 bridge over the White River to help determine the river's rate of flow. The data can be used to help develop the hydraulic geometry curves that are used in river restoration projects.

[4] See Rosgen, D. (1996)

Hazard assessment and fluvial geomorphology
The Agency's Geology and Water Quality Divisions and the Partnership will expand the work done by USDA to include fluvial geomorphological information on all of the 43 tributaries of the Third Branch. This work may be used to produce the following:

- a map of hazard areas including flood and erosion hazard areas; and
- a specific plan for channel protection, management, and restoration along the Third Branch.

A hazard map would identify areas of high risk for bank failure and erosion during flooding. With these maps, towns can clearly identify areas where development may be an unadvisable investment. The Vermont Geologic Survey plans to work with towns to produce a hazard map for the Third Branch of the White River Basin.

The hazard map will be beneficial to towns adjacent to the Third Branch in their planning efforts. The map could be used to help situate development to avoid property loss and to protect riparian corridors from encroachments. The data collected to produce the map may also be used to develop a plan for channel protection, management, and restoration.

During the summer of 2001, the Agency and the White River Partnership worked with volunteers on the Third Branch to collect data on slope and river instability (fluvial geomorphological information). The use of volunteers enabled the data to be collected in a relatively short time-period. The study found moderately unstable to unstable stream channels in the following brooks: Camp, Gilead, Trout, Thayer, Riford, Flint, Adams, Spear, West Street Tributary, Farnsworth and Open Meadow. Continuing analysis of the study will bring additional information that will eventually be used to develop a hazard map.

Two Rivers-Ottauquechee Regional Commission's review of town plans
A review of town plans show that the protection of water resources by towns is limited. (Two Rivers-Ottauquechee Regional Commission, 1999). Despite local awareness and identification of water quality problems and opportunities, most communities within the region do not have the level of detail incorporated in their plans, regulations and ordinances that would result in good, consistent water quality and aquatic habitat protection.

Chateauguay-No Town Conservation Committee
A partnership of organizations is working to preserve and protect 60,000 acres of the Chateauguay No-Town region. The region includes land within the headwaters of the White River Basin located in parts of Barnard, Stockbridge, Killington, Pittsfield, and Bridgewater. One of their goals is to preserve and protect the upland watershed of the White River through voluntary land stewardship. Their work to date has included development of a Memorandum of Understanding regarding how all town and participating organizations will contribute; compilation of a landowner and parcel database; and development of a resource map. Conservation of lands within this area will increase the protection of stable reaches of headwater streams.

Recommendations – Stream Channel Instability and Erosion

GOAL: PROMOTE STABLE STREAMS AND RIVERS BY ENCOURAGING ACTIVITY THAT IS CONSISTENT WITH THE RIVER'S EFFORTS TO BECOME STABLE AND AT THE SAME TIME, WORK TO MINIMIZE CONFLICTS, AND BALANCE THE NEED TO PROTECT ECONOMIC INVESTMENTS IN INFRASTRUCTURE AND LAND.

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Stable stream channels and wooded riparian buffers reduce the potential for erosion within the stream corridor, thereby protecting water quality. Strategies for meeting this goal are based on an understanding of the present condition of streams and their buffers in the White River Basin, and the factors that are responsible for the condition. The following objectives and strategies are based on the projects listed above that improve or protect stream corridors as well as public input. The most significant lesson learned in this basin and others is that mitigating land uses that place infrastructure in conflict with natural stream processes should be a higher priority than expending the large amounts of resources it takes to attempt to restore a river corridor.

OBJECTIVES LISTED FROM HIGHEST PRIORITY
① **Protect stable reaches**
② **Promote land use practices that enhance stream channel stability and improve riparian buffers**
③ **Encourage increased participation of towns in stream corridor protection**
④ **Develop and implement successful stream restoration projects that incorporate natural channel design to achieve stability**
⑤ **Increase awareness of the costs of replacing infrastructure that is in conflict with natural stream stabilization processes.**
⑥ **Maintain and enhance relationships among partners**

OBJECTIVE ①: STRATEGY

Geomorphic surveys of streams in the watershed identify stable and unstable reaches. This information can be used to identify stable reaches for protection and to design stream restoration projects. The USDA report and the Agency's work in 2001 will produce such a survey for the Third Branch by the end of 2002. Protecting stable reaches (conservation reaches) of a river is less expensive and time consuming than attempting to repair eroding streambanks and restoring channel stability.

1 Conduct DEC Phase I & II geomorphology assessments in subwatersheds throughout the basin.

Lead Agency/Organization: WRP (planning phase has begun as of 10/01)
Partners: DEC, FWD, USFWS, USFS, NRCS
Potential funding sources: WRP and state and federal programs
Time-frame: Ongoing
Benchmark: Increase the linear miles of assessed streams over the next 5 years.

OBJECTIVE ②: STRATEGIES

Appropriate land use practices protect and enhance the river corridor in both stable and unstable reaches. Practices that protect the river corridor ensure an adequate riparian buffer and flood-plain. The floodplain allows the energy of floodwaters to dissipate, reducing erosion. The space provided by a floodplain lacking structures allows an unstable stream channel to shift as it seeks a new equilibrium. Voluntary efforts of landowners are gained through education and economic incentives. Once instituted for the Connecticut River, the federal Conservation Reserve Enhanced Program will help to provide a greater level of economic incentive than is presently available from the federal government.

2 Encourage and support local efforts to protect river corridors: Expand riparian buffer protection programs including enhanced economic incentives to landowners (see list of agricultural programs in Appendix B); encourage landowners to voluntarily stabilize streambanks; use data developed for the hazard map for the Third Branch to identify areas where a vegetated streambank would be considered sufficient to reduce or eliminate erosion; work with willing landowners to establish trees and shrubs within the riparian buffer; and use as demonstration sites particular areas of channel that have been restored through these strategies. Distribute fact sheets written by the Connecticut River Joint Commissions (CRJC), DEC and others on riparian buffer protection.

Lead Agency/Organization: FWD, USFWS, WRP
Partners: Chateauguay-No Town Committee, CRJC, DAFM, local residents, NRCS, National Wildlife Federation, RPC
Potential funding sources: DEC grant programs, other state and federal programs
Time-frame: Ongoing
Benchmark: Not applicable

3 Initiate and fund the Conservation Reserve Enhanced Program (CREP) for White River Basin landowners.

Lead Agency/Organization: DAFM
Partners: NRCD, USDA/FSA, EPA, NRCS
Potential funding sources: State and federal programs
Time-frame: By 2005
Benchmark: 300 acres of riparian buffer are enrolled in CREP

4 Develop and implement river corridor restoration projects on eroding streambanks that include structural protection using bioengineering techniques, e.g., tree revetments.

Lead Agency/Organization: WRP
Partners: NRCS, NRCD, towns, USFWS,
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

5 Increase riparian buffers on State and federal lands.

Lead Agency/Organization: FWD, USFS
Partners:
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

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

Lead Agency/Organization: DEC
Partners: FWD, VTrans
Potential funding sources: State programs
Time-frame: Ongoing
Benchmark: Development and presentation of workshops on stream stabilization processes

OBJECTIVE ③: STRATEGIES

The Two Rivers-Ottauquechee Regional Plan and the Connecticut River Corridor Management Plan (Connecticut River Joint Commissions, 1997) both recommend that towns increase their involvement in the protection of surface waters.

7 Offer information and technical support to selectboards and planners on the local planning, zoning and regulatory opportunities that protect or enhance water quality, including the use of the hazard assessment for the Third Branch.

Lead Agency/Organization: DEC
Partners: Municipal Planners, EPA, RPC, WRP
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 the town

8 Develop criteria for allocating state river restoration funds and technical assistance that prioritize projects in watershed that have begun a geomorphic assessment and in towns with riparian buffer protection, including zoning set backs from water and shoreline management policies and road maintenance techniques.

Lead Agency/Organization:
Partners: DEC, Regional Planning Commissions
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

OBJECTIVE ④: STRATEGIES

Based on a geomorphic survey of rivers in the basin, rank restoration projects as follows if the river system in the watershed is to be stabilized in the most efficient and effective manner (in order from highest to lowest priority).

1. 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.

2. Reaches with high recovery potential - these include reaches that have a potential for self-adjustment, but minimally invasive approaches will accelerate recovery. 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

3. Moderate to highly degraded sites - these include sites that require invasive 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.

When opportunities or a crisis makes a river restoration project necessary in an area that has not been surveyed, a geomorphic analysis-based approach should be used. The projects should focus on areas in the headwaters where they can do the most good and they are the least apt to be disturbed by land practices. Where possible, consideration should be given to allowing the river to continue to shift until it reaches a stable course.

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

Lead Agency/Organization: WRP
Partners: DEC, FWD, RPC, USFS, USFWS
Potential funding sources: Disaster Mitigation Funding and other state and federal programs
Time-frame: Ongoing
Benchmark: River restoration projects that are supported by more than one resource agency

10 Assess both morphological 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: WRP
Partners: DEC, FWD, USFS, USFWS
Potential funding sources: State and federal programs
Time-frame: By 2005
Benchmark: A report assessing the morphological and ecological responses to restoration efforts

11 Purchase or receive donations of conservation easements or property along riparian corridors to conserve the property.

Lead Agency/Organization: ANR, USFS
Partners: DAFM, DFPR, landowners, municipalities, NRCS, Vermont Land Trust, USFS, Upper Valley Land Trust, Vermont Land Trust, Vermont River Conservancy, WRP
Potential funding sources: CRP, municipal conservation funds, The Vermont River Conservancy, Vermont Land Trust, DFPR Forest Legacy Program, other state and federal programs
Time-frame: Ongoing
Benchmark: Property along a riparian corridor bought by a land conservation organization or placed in a conservation easement

OBJECTIVE ⑤: STRATEGIES

12 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.

Lead Agency/Organization: DEC
Partners: VTrans, town road crews, WRP, Regional Planning Commissions
Potential funding sources: Better Backroads Program, DEC grant programs
Time-frame: Ongoing
Benchmark: A series of workshops completed across towns in the watershed

13 Encourage joint projects between the Agency of Natural Resources River Restoration Teams and VTrans and town road crews.

Lead Agency/Organization: DEC
Partners: Town road crews, VTrans, WRP
Potential funding sources: State and federal programs
Time-frame: Ongoing
Benchmark: Initiation of joint projects that improve riparian corridor management

OBJECTIVE ⑥: STRATEGY

In the White River Basin, riparian corridors are managed and restored collaboratively by the private landowners, the White River Partnership, Two Rivers-Ottauquechee Regional Commission, USDA-Natural Resource Conservation Service, US Fish and Wildlife Service, US Forest Service, the VT Agency of Natural Resources, the VT 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, especially, 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 Two Rivers-Ottauquechee Regional Plan and the White River Partnership's business plan both indicate 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 restoration.

- The Partnership's business plan also includes outreach and education, and capacity building as objectives. The Partnership's criteria for projects also include visibility to the public.

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- Any assistance to town planning or zoning should be coordinated through the appropriate regional planning commission.

Another strategy that will support local groups follows:

14 Encourage the application of Supplemental Environmental Project (SEP) funds towards community-led projects that improve water quality in the White River Basin.

Lead Agency/Organization: ANR
Potential funding sources: State programs
Time-frame: Ongoing
Benchmark: Water quality improvement projects in the White River Basin funded through SEP money

4.2 Improving Water Quality Awareness

Background

Understanding the existing condition of surface waters is one of the first steps 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 White River Basin. The types of data collected include information pertaining to bacteria (*E. coli)*, nutrient levels, and the physical characteristics of lakes, streams and rivers. Making the information available to the public can result in increased interest in protecting or remediating the basin's surface waters. In addition, adequate information about *E. coli* levels allows the public to make informed decisions on health risks associated with contact recreation.

Monitoring *E. coli*
The White River is a popular destination for swimming and boating. On one day in June 2001, swimming holes along a 2-3 mile stretch of the White River in Sharon contained about 50 people (Potamis, 2001). However, the recreational use of the waters in the White River Basin can be limited at certain times either by high *E. coli* levels or even the perception that high levels exist. The bacterium *E. coli* lives in the intestines of all warm-blooded animals and its presence in surface waters can therefore be used to indicate the possible presence of pathogens associated with human or animal waste. (For more information on pathogens see Section 3.3).

The Agency of Natural Resources, the White River Partnership, and communities in the basin would like a better understanding of where potential sources of pathogens could be a problem. The level of *E. coli* is only part of the information needed to understand and solve the problem.

Association with health risks
It is difficult to determine actual health risks based on *E. coli* concentrations because of complications in attributing water-borne illnesses to a specific cause. A 1984 EPA study identified the number of people who reported becoming ill after swimming in designated swimming areas contaminated by partially treated wastewater treatment facility effluent (Dufour, 1984). Using the study, EPA determined that a single sample measurement of 235 *E. coli* colony forming units (cfu) per 100 ml of water represented a tolerable level of exposure, resulting in a predicted 8 illness per 1000 swimmers (USEPA, 1986). Vermont's standard of 77 *E. coli* cfu per 100 ml of water equates to a risk level of nearly 0.1 illnesses per 1000 swimmers. Vermont's *E. coli* standard is the most stringent in the nation and is often exceeded due to natural conditions.

Usefulness of Bacteria Monitoring
Regular monitoring at swimming areas can be used to reduce risks to human health from pathogens. In addition, regular monitoring of surface waters throughout a watershed can be used to identify potential sources of pathogens.

Regular monitoring at swim areas enables one to identify episodic events, like septic failures, that threaten the health of swimmers. This allows one to close a swim area and prevent further exposure of swimmers to fecal contaminated water until the cause of the raised bacteria levels can be addressed or until the episode passes and levels return to safe levels.

When regular monitoring of *E. coli* at swim areas is coupled with rainfall data, then preventative closings are possible. Hence, if a pattern emerges that *E. coli* exceeds an acceptable health risk threshold for a certain duration after a specific level of rainfall, then one can close swim areas for a certain duration after that type of rain events. This provides proactive protection of human health, while the source of the *E. coli* is sought in the watershed.

Finally, regular bacteria monitoring over the long term can be used to help identify the source of any fecal pollution. Both surface runoff and direct discharges can carry *E. coli* into surface waters. To distinguish between the two sources, a long-term monitoring program that also includes information on precipitation levels is necessary. Following a storm event, increased surface runoff from agricultural and urban landscapes can result in temporarily high *E. coli* levels in receiving surface waters. A long-term trend of high *E. coli* 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, or from a barnyard. Further investigation of the landscape can help to determine the specific source.

The following is a list of project, some progressing simultaneously with the basin planning process, that address concerns brought up during the public process about increasing awareness of *E. coli* and other water quality problems in the basin:

Department of Environmental Conservation's draft monitoring strategy
DEC is responsible for monitoring and assessing ambient water quality and support of designated uses for all surface waters in the State. In addition, DEC determines whether or not selected waters are in compliance with Vermont's Water Quality Standards. The Water Quality Standards contain a large number of narrative standards and numeric chemical and biological criteria. DEC monitors and assesses water quality for selected criteria on selected waters in a watershed on a five-year rotating schedule. DEC returned to the White River Basin in the 2001 field season, to sample about 25 sites in a watershed that includes 457 miles of rivers

Several volunteer groups have expressed an interest in collecting data that can be of use to both themselves and DEC. The DEC's Water Quality Division is developing a water quality monitoring strategy that incorporates the work of citizen monitoring groups.

Lay monitoring of Silver Lake
Since 1979, the Agency through the Department of Environmental Conservation has worked with volunteer monitors to sample the water quality in lakes and ponds. The Vermont Lay Monitoring Program equips and trains local lake users to measure the nutrient enrichment of lakes by collecting water samples according to the program's EPA-approved Quality Assurance Project Plan. Sampling occurs on a weekly basis during the summer. Many inland lakes in Vermont, such as Silver Lake in the White River Basin, are sampled for transparency using a

Secchi disk. Twelve years of sampling data on Silver Lake indicates mesotrophic conditions. The database establishes a reference point from which to measure future changes in water quality. The citizen lake monitors, together with the Silver Lake Association, share a strong interest in improving the lake's water quality and have worked to reduce nutrient runoff from roads in the watershed. The citizen lake monitors have also assisted DEC in identifying aquatic nuisance species.

Connecticut River Watershed Monitoring Strategy
In the early 1990's, volunteers supported by River Network[5] and the Connecticut River Volunteer Monitoring Program tested for pathogens on a stretch of the White River from the mouth to five miles upstream. In 1990, volunteers found that two of the six sites sampled exceeded the Vermont Water Quality Standards for pathogens. In 1992, they found that four of five samples exceeded the State standard at two sites. Volunteer efforts, however, did not continue beyond 1992.

Federal, state, and citizen groups continue to collect data in the White River Basin through a variety of programs. An intra-agency group is working on developing a strategy for coordinating data collection. The group is working from the monitoring recommendations in the Connecticut River Joint Commissions' Connecticut River Corridor Management Plan (CRJC, 1997). The strategy is to collect important information about the health of the watershed for two purposes: to increase knowledge and awareness, and to identify water quality impairments. The strategy is intended as guidance for the development of local watershed monitoring plans so that data gathered by state and local groups to address similar issues will be consistent.

White River Basin surface waters dataset
An improved digital surface waters data layer was created for the White River Basin in 2000. The Vermont DEC awarded grants to the Vermont Center for Geographic Information (VCGI) and the USDA Natural Resources Conservation Service (NRCS) to upgrade the existing hydrography (mapping of all waterbodies) linework developed from 1:5000 scale orthophotography and to improve it where necessary using infrared aerial photography. The improved data layer provides more accurate information, including flow direction about surface waters than the original data layer.

This watershed-based hydrography data layer supports DEC and local users in the following:

- performing watershed-based modeling and planning in areas such as nonpoint source pollution, erosion, water supply
- tracking water quality
- developing maps

White River Partnership Water Quality Monitoring Project
The White River Partnership began a volunteer monitoring program for the purpose of developing an overall picture of water quality in the watershed and educating citizens about

[5] River Network is a non-profit organization that helps people monitor, protect, and restore rivers and watersheds.

pollutants. The Partnership has worked with River Network and the DEC BASS lab to develop a program to measure *E. coli* levels, turbidity, temperature and conductivity. The Partnership's first field season was in the summer of 2001.

Local schools
Testing for *E. coli* has been part of lesson plans for the Sharon Academy, Randolph High School and the Rochester High School. River Network and the White River Partnership have assisted students and teachers in the basin with *E. coli* testing.

The DEC's notification procedure for high *E. coli* levels
When the disinfection unit of the Bethel wastewater treatment plant failed in the summer of 2000, the public expressed frustration with the amount of time it took for the Agency to inform them of the possible health risks. Developing good communication between State agencies and town officials to advise them of potential health risks would decrease the risk of illness.

The Department of Environmental Conservation has developed a strategy for reducing the amount of time it takes for the Department to inform towns of malfunctioning wastewater treatment plants that are causing high *E. coli* levels in adjacent surface waters. The strategy ensures that samples are processed in DEC's lab expeditiously. In addition, towns will be notified of a contact person at the Department with whom to communicate if any questions should arise.

Recommendations – Awareness of Water Quality

GOAL: DEVELOP A MORE COMPREHENSIVE PICTURE OF THE HEALTH OF THE WHITE RIVER BASIN'S SURFACE WATER AND A PROCESS FOR INCREASING PUBLIC KNOWLEDGE ABOUT WATER QUALITY ISSUES

The following objectives and strategies will assist in the continuation of efforts to develop a comprehensive picture of water quality in the basin and will provide this information to the public.

OBJECTIVES LISTED FROM HIGHEST PRIORITY
① **Identify reference reaches based on biological and morphological information**
② **Improve communication about water quality between State agencies, towns and other stakeholders**
③ **Assist volunteers in conducting water quality monitoring that provides high quality data and addresses relevant concerns in the basin**

OBJECTIVE ①: STRATEGY

In the development of a basin-wide picture of water quality, certain surface waters in their natural condition are identified as reference waters. The condition of all other surface waters can then be judged based on their deviation from the condition of these reference waters.

15 Use all available good quality data on the physical, chemical, and biological values of the waters, and collect any additional necessary data in the basin to establish reference reaches (see Appendix G for existing biological data).

Lead Agency/Organization: DEC
Partners: FWD, WRP
Potential funding source: State and federal programs
Time-frame: By summer 2005
Benchmark: Reference types identified in the basin

OBJECTIVE ②: STRATEGY

An understanding of *E. coli* data by citizen groups can lead to a dialogue within the local community on the importance of adequate treatment of human waste and lead to local solutions. In addition, town health officers can use the information to more accurately decide whether or not swimming areas should be closed.

16 Educate citizens and towns about different pollutants, including the health risk associated with *E. coli* levels, to help them make decisions that protect public health and the environment.

Lead Agency/Organization:
Partners: DEC, DOH, town health officers, WRP
Potential funding source: State programs
Time-frame: Ongoing
Benchmark: Appearance of newspaper articles, stories, columns and other publications or educational forums addressing water quality in the White River Basin.

OBJECTIVE ③: STRATEGY

DEC recognizes that groups involved in water quality monitoring may be able to help DEC find appropriate sample sites and identify potential river reaches of concern. Watershed groups such as The Friends of the Mad River, The Friends of the Winooski River, and River Network (RN) have all indicated that while volunteer groups can collect useful data, they generally do not have the technical or financial resources needed to develop long-term, viable monitoring programs.

To develop successful partnerships, the Agency and volunteer monitoring groups need to be aware of each other's objectives. The formation of citizen monitoring groups who are interested in testing for *E. coli* creates an additional opportunity for the long-term monitoring of waters that are popular for contact recreation. The most significant challenge for volunteers and the community is interpreting how *E. coli* levels relate to a health risk.

17 Develop a written protocol for how the Agency will assist volunteer monitoring groups

Lead Agency/Organization: DEC
Partners: WRP and other watershed groups
Potential funding source: State programs
Time-frame: Ongoing
Benchmark: A plan that describes the process for how ANR will work with volunteer groups

4.3 Public Access

Background

The rivers and lakes in the White River Basin are popular for swimming, boating, tubing, and fishing by both residents and tourists as described in Section 2.3. Maintaining these uses, especially access, is a prevalent concern in the community and one that goes beyond the legal right to reach the water. According to an inventory of access sites used by the public conducted by the White River Partnership and DEC in 2000, a majority of the 49 access sites to the White River are not maintained and are becoming degraded by overuse.

The following is a list of projects, some progressing simultaneously with the basin planning process, that address concerns brought up during the public process about public access in the basin:

Identification of public access concerns in plans
Public access to water for recreation was identified as a concern in the White River Partnership's business plan (White River Partnership, 2000). The Department of Forests, Parks, and Recreation's recreational plan (DFPR, 1994), and the 1999 Two Rivers-Ottauquechee Regional Plan also identify the need to increase and protect public access. In an assessment of the upper White River Watershed, the US Forest Service has identified the development and maintenance of recreational sites as an issue to be addressed (GMNF, 2000).

The Green Mountain National Forest properties
US Forest Service manages 23,030 acres west of Rt. 100 in the upper watershed. This property, which includes several easements, stretches 12 miles along the upper White River and many tributaries. Some of these properties have been purchased through the US Forest Service Right-Of-Way Acquisition Program. On an as-needed basis, the Forest Service will pursue easements over lands or purchase of lands adjacent to their holdings. The program could be used to accommodate access to the White River, and in particular, to the areas in the Upper White River on the west side of the river.

Vermont Department of Fish and Wildlife properties
The State and others have recognized the need to protect access to recreational opportunities by purchasing land adjacent to watercourses. In addition to the Wildlife Management Areas and Fish and Wildlife boat access areas in the White River Basin, over ten sites along the streambanks of the White and its tributaries are in State ownership.

In the 1950's and the 1960's, the Vermont Department of Fish and Wildlife initiated a series of acquisitions of streamside parcels using a federal program to help fund the purchases. The purchases were specifically designed for protecting opportunities for fishing, hunting, and trapping. In many cases, the Department only purchased one floating rod (16 ½ feet) from the stream's ordinary high water mark. Many of the properties need to be relocated.

In the White River Basin, five of these sites appear on the GIS layer of public lands: two along the mid section of the White River and three along the First Branch. From records located in the Department of Fish and Wildlife's Roxbury lab, at least ten more sites apparently exist. They are not shown on any coverage of State lands.

Peavine Trailway
The White River Partnership, the Two Rivers-Ottauquechee Regional Commission, and the Green Mountain National Forest have begun work to create the Peavine Trailway. The project will convert the old Peavine Railroad into a trail, while also conserving valuable farmland and providing public access to a swimming hole.

Vermont Department of Forests, Parks and Recreation (DFPR) Inventory
Between 1990 and 1997, the DFPR inventoried recreation sites open for public use throughout Vermont (DFPR, 1999). The inventory did not include informal sites. Sites were identified using published information and information from town clerk offices. The information collected included site location, availability, and accessibility of recreational opportunities. The data is summarized by county. The sites can also be found on a GIS layer, which can be obtained from the Vermont Center for Geographic Information (VCGI). The data layer can be more helpful than the report in making conclusions about recreational opportunities in the basin because information can be separated out by watershed, whereas the report only separates it out by county.

White River Partnership Inventory
Members of the DownStream Team and the Upper River Stream Team, of the White River Partnership, completed an inventory of access sites along the White River during the summer of 2000. A GIS data layer of the sites was one product of the inventory. The inventory differs from the DFPR inventory (see above) in that it includes informal as well as formal sites and contains data on the condition of sites. The data collected included types of recreational opportunities, number of parking spaces, parking location, access ease, hazards, and degree of erosion. DEC completed a report for the Partnership based on the inventory. The inventory suggests the following:

- Most sites are informal and are not maintained for public use. The data shows that at least 33 of the 49 of the sites used by the public were on private land, or were unofficial sites owned by the State or towns.

- Generally, sites located along the Upper River (Hancock to Bethel) were in better condition than access sites down river (Bethel to Hartford). Access sites along the Upper River had less erosion, poison ivy and garbage and were easier to access than the sites between Bethel and Hartford.

Other problems at particular sites noted in the inventory include erosion of the streambank from unmaintained paths, overgrown paths, parking overflow onto the road right-of-way, and trash. Positive characteristics of the sites include ledges (used for jumping), deep water and good fishing spots. More information on the study can be obtained by contacting the White River Partnership.

Towns' efforts to improve access and recreation

- In 1995, the Sharon Conservation Commission bought property along the White River in the Town of Sharon, and improved it for public access.

- The Town of Hartford Parks and Recreation Department has identified projects to improve access to the river at Clifford Park, Watson Park, and Lyman Point Park. The town would like to make their riverbank visible and accessible to the parks. The town is now in the planning stage of determining how to best create access points and scenic views.

- The Town of Hartford Parks and Recreation Department's Rivers and Parks Educational Program held a daily river program in conjunction with its 2001 summer Ventures Day program. Over 200 youngsters were provided recreational and educational opportunities afforded by local rivers such as kayaking, canoeing, fly fishing, and spin-casting. The participants were also exposed to the many facets of the fragile ecological system of a river and how recreational activities may affect the river system. During the winter season the Department conducts a youth ice fishing derby.

Upper White River Conservation Study

Between 1988 and 1990, the White River Conservation Committee, with the support of the National Park Service Mid-Atlantic Office, Two Rivers-Ottauquechee Regional Commission, and Green Mountain and Finger Lakes National Forests, conducted a formal assessment of landowner attitudes in the upper White River. Consisting of a survey questionnaire mailed to 1537 residents in the towns of Granville, Pittsfield, Hancock, Stockbridge, and Rochester, the assessment found that "many of the problems landowners have with recreational users of the White River stems from a lack of well defined public access points (White River Conservation Committee, 1990). This survey also revealed that approximately 27% of the riverfront property owners restricted certain activities on their land, and about 10% actually posted. Finally the survey illuminated an increased desire for access to swimming areas (38%), picnic areas (28%) and hiking trials (25%). Ninety percent of all respondents felt that state government should take responsibility for maintaining access and public facilities along the river.

DownStream Team Survey

During the summer of 2000, the DownStream Team, with help from DEC, developed and distributed a survey to better understand concerns about river recreation in the White River Basin. In addition, the DownStream Team identified the survey as a tool to increase awareness and begin a discussion within the community around issues in the basin. More than 1700 surveys in total were handed out. The Two Rivers-Ottauquechee Regional Commission sent 700 to their constituents and the DownStream Team distributed 1000 throughout the community. The DownStream Team collected 359 completed surveys. A Sharon Academy student tallied the results of the survey and DEC made the following conclusions from the study:

- The river is a popular recreational resource. The river was used for recreation by 321 of the 359 respondents with swimming, boating, tubing, and fishing being popular.

- The survey indicated that a majority of the respondents were concerned about water quality in the summer of 2000, which was the summer that the river was closed due to a malfunction of the Bethel wastewater treatment plant.

- With regard to public access, the numbers suggest that public and private access sites are both used about equally and that most people have no trouble finding them. However, erosion, trash, poison ivy, and parking were listed as concerns.

- Respondents have numerous other concerns about recreating on the White River. These include overuse of certain sites, recreational user conflicts, and increased postings of traditional access sites.

As the conclusions are not based on a scientifically created survey, the results can only be used for discussion purposes. The tallied responses to the survey can be obtained from the White River Partnership.

Prioritizing sites for improvement
The DownStream Team has developed and prioritized a list of publicly owned sites for potential improvement based on the inventory described above and its members' knowledge of the area.

In developing the list, members of the DownStream Team also worked to incorporate concerns of VTrans regarding cars entering and exiting sites. In addition, they spoke with the State Police about incorporating public safety and avoiding creation of nuisance problems in the design and placement of access sites. The DownStream Team also met with DEC to gain a sense of how much assistance could be expected from the Agency in designing, permitting, and funding the sites.

The criteria that the DownStream Team used to prioritize sites included good public visibility, attractiveness to the public, and ease of accessibility to the handicapped.

The Vermont Youth Conservation Corps
Throughout the State, the Vermont Youth Conservation Corps assists in physical improvements to access sites. The program provides training for teenagers and crew leaders in watershed restoration, streambank stabilization, and trail building (including steps and waterbars). Corps crews are available to work with volunteers on specific projects on either State or private land. Consultants are also available for trail-building and stabilization and/ or restoration workshops. Corps crews are available from early April to mid-October, and must be coordinated with the Conservation Director during the previous season. If enough work can be found in one area of the State, the crew can be recruited from that area.

Recommendations – Public Access

GOAL: IMPROVE & MAINTAIN PUBLIC ACCESS TO WATER-BASED RECREATIONAL USES

Although no one organization is responsible for ensuring sufficient and adequate public access to water-based recreational uses, many different groups are involved in one aspect or another. The following objectives and strategies will assist in the continuation of efforts to address concerns surrounding water-based recreation.

OBJECTIVES LISTED FROM HIGHEST PRIORITY
① **Maintain public and private access sites available for public use**
② **Increase the number of publicly owned access sites**
③ **Encourage recreational use that avoids conflicts with other recreational uses and natural resources**

OBJECTIVE ①: STRATEGIES

Many of the sites that are presently available to the public are not maintained. Overuse or misuse of some of the sites adversely affects the user's and the landowner's experience. Increasing the number of sites available to the public and developing some degree of oversight to reduce erosion, garbage, and other hazards will enhance both the user and the landowner's experiences. The likelihood of landowners revoking access to the public due to misuse may decrease. These improvements should not result in the loss of all informal sites, whose small size, narrow paths, and hidden beaches characterize recreation in the White River Basin.

18 Identify the location and evaluate the condition and accessibility of streamside properties owned by the Department of Fish and Wildlife and publicize the information.

Lead Agency/Organization: WRP (As Stream Teams desire)
Partners: FWD
Potential Funding Source: State and federal programs
Time-frame: By 2005
Benchmark: A map of State-owned sites produced and made available to the public

19 During bridge and road improvement projects, incorporate the improvement or creation of access points to adjacent waters into the design. Any new property needed for an access point should be acquired from a willing landowner.

Lead Agency/Organization: VTrans
Partners: DEC
Potential Funding Source: State and federal programs
Time-frame: Ongoing
Benchmark: New or improved access sites designed into VTrans projects

20 Improve trails to access sites, including cleaning for safety and, trash removal, etc.

Lead Agency/Organization:
Partners: Community groups, towns, USFS
Potential Funding Source: State and federal programs
Time-frame: Ongoing
Benchmark: New commitments made to improve and/or maintain informal access sites

21 Develop agreements with landowners of informal sites to maintain public access, which may include improvement and/or maintenance of the site by another entity.

Lead Agency/Organization: WRP (As Stream Teams desire)
Partners: Landowners, USFS
Potential Funding Source: FWD, and other state and federal programs
Time-frame: Ongoing
Benchmark: New agreements made with landowners to continue or open a public access to water-based recreational opportunities on landowner's property

OBJECTIVE ②: STRATEGY

22 Purchase property or easements on riverside property for public access. Sites most important to the community for recreation should be prioritized for purchase.

Partners: USFS, Vermont River Conservancy, Vermont Land Trust, WRP
Potential Funding Source: State and federal programs, private funds
Time-frame: Ongoing
Benchmark: New riverside properties protected for public access

OBJECTIVE ③:STRATEGY

Any group that looks to improve access to recreational sites may create potential conflicts with other natural resource values. A recreational activity can conflict with other recreational activities, or with the protection of natural resources, and public safety.

For example, areas managed for fishing may not be appropriate for boat launching and swimming. Conflict with natural resources can also occur. River and riverbanks can be habitat for threatened or rare plants and animals, or plant communities such as those associated with seeps and sandy bluffs. Riverbanks need to be vegetated by woody plants to maintain their integrity, and archeological sites often occur along rivers. Paths, parking lots, and increased human activity have the potential to harm these resources if the access is not designed correctly. In addition, the design of access sites must consider safety, including parking and the movement

of cars on and off major road. The improvement should not encourage activity that could become a nuisance for surrounding landowners.

Some of these conflicts are addressed through State and federal permit processes that protect natural resources. It is recognized that citizen groups may not have the resources to address all these issues without assistance.

Other issues surrounding public access will evolve as the community continues to focus on its recreational resources. The survey by the DownStream Team is a start. The DownStream Team and the White River Partnership will continue to be a forum for discussion and community-based solutions for all issues surrounding access.

23 Assist community groups in developing access sites, including assistance in obtaining State and federal permits, design, and implementation.

Lead Agency/Organization: DEC
Partners: National Wildlife Federation, RPC
Potential Funding Source: State and federal programs
Time-frame: Ongoing
Benchmark: Access sites developed by community groups with assistance from the listed partners or others

4.4 Fisheries

Background

Maintaining healthy fisheries in the White River Basin is essential to supporting ecosystem integrity and the recreational opportunities that fishing provides. During public forums held in the basin in the fall of 2000, people expressed an interest in the health of the fisheries in the White River and its tributaries.

Primary concerns in the basin include habitat loss and degradation, fish passage, and maintaining and enhancing self-sustaining wild fish populations. Protection and restoration projects conducted by federal and State agencies as well as local groups, have worked to mitigate sedimentation and water temperature problems and address in-stream habitat complexity. Habitat loss and degradation are further complicated by minor issues such as riparian loss due to invasive exotic plant species, and beaver damage.

Maintaining wild fish populations, and protecting genetic integrity in certain parts of the basin are central to establishing healthy fisheries in the basin. On the basis of fish population surveys conducted by the Vermont Department of Fish and Wildlife and the U.S. Forest Service, tributaries have been shown to support dense populations of trout and contain the majority of salmonid spawning and nursery habitat in the White River Basin.

Tributaries where adult trout migrate to spawn are important to sustaining naturally reproducing populations. On tributaries to the White River, dams without adequate fish ladders and improperly constructed culverts may present migration barriers. In addition to the complete loss of habitat for fish and other aquatic organisms within most culverts, many are installed such that fish cannot swim up through them. Culverts that are too steep, contain little water flow, or have a high drop into streams below are barriers to upstream fish movement. Therefore, careful management of fish passages, and prioritizing the restoration of passage sites based on scientific assessments is essential.

The following is a list of project, some progressing simultaneously with the basin planning process, that address concerns brought up during the public process about fisheries in the basin:

Connecticut River Atlantic Salmon Restoration Program
Since 1967 a cooperative program comprised of several State and federal agencies and private organizations has focused on the restoration of Atlantic salmon. Current restoration efforts include the rearing and stocking of Atlantic salmon in Connecticut River tributaries, and the protection and enhancement of aquatic habitats. The construction of fish passage facilities, which allow adult salmon to access upstream spawning habitats, as well as allow juvenile salmon to safely migrate downstream to the ocean, is a key component of this program. State and federal agencies currently rear and stock thousands of Atlantic salmon fry annually into the White River and its tributaries as part of this cooperative restoration effort. The federal fish hatchery is located in Bethel, Vermont. These salmon inhabit the White River until they are ready for their

seaward migration. Although few in number, some adult Atlantic salmon have successfully returned to the White River.

Vermont Department of Fish and Wildlife Fisheries Management
The Vermont Department of Fish and Wildlife is involved in several activities targeting recreational fisheries in the White River Basin. Fish population and angler-use surveys are routinely conducted to monitor fish population trends and their response to various management strategies. Depending on the results of these assessments, specific waters may be managed as wild, self-supporting fisheries, or may include stocking of hatchery-reared trout to enhance recreational fishing opportunities. Appendix C is a map of high quality resident fish and spawning habitat identified by the Department. The application of various fishing regulations and their enforcement by Fish and Wildlife Game Wardens are important components of these recreational fisheries management strategies.

Habitat Protection
The Departments of Fish and Wildlife and Environmental Conservation are active participants in regulatory proceedings for projects that may have an adverse impact on fisheries and aquatic habitats. The state's land use law, Act 250, provides an important tool for Agency personnel to address issues concerning impacts from development on stream habitats by recommending appropriate riparian buffers, erosion controls and stream crossing guidelines. The stream alteration permit process also provides a mechanism for State fisheries biologists to minimize impacts of bridge and culvert projects and other activities involving stream channels on fish habitat and fish passage needs.

In addition to regulatory processes, local organizations such as Trout Unlimited have also worked on habitat restoration projects throughout the basin.

US Forest Service's Habitat Inventory and Habitat Restoration
The USFS has completed a habitat inventory of the upper White River, major tributaries, the Tweed River, West Branch, Hancock Branch, and many smaller tributaries. The USFS also has a habitat monitoring program for all streams in the Green Mountain National Forest. In 1988, the Green Mountain National Forest, through its national initiative, began to increase their emphasis on aquatic resource management on National Forest and surrounding lands by restoring in-stream and riparian habitat.

Land Acquisition
The Vermont Department of Fish and Wildlife and the U.S. Forest Service have purchased or acquired easements along several miles of streambank within the White River Basin for the purpose of protecting aquatic habitats and/or providing public access to waters for fishing and other recreational activities.

In addition to streambank areas, the Department of Fish and Wildlife purchased, constructed, and currently maintains several ponds with formal access areas in the White River Basin for the purpose of providing recreational fishing opportunities. These include Ansel Pond, Colton Pond, McIntosh Pond and Rood Pond.

Dams

Dams may have significant effects on the water quality, aquatic habitat, recreational use, and aesthetics of the White River Basin. Intact or partially breached dams may impede the movement of fish and other aquatic organisms, restrict the flow of nutrients and sediment (resulting in siltation or channel scour), eliminate riverine habitat by impounding a free-flowing stream, and raise water temperatures or reduce dissolved oxygen levels.

In the fall of 2000, representatives of several state and federal agencies, conservation groups, and others interested in the issue of improving fish habitat began to meet as the Vermont Dam Task Force. The purpose of the meetings was to provide a forum to discuss the regulatory framework related to dam removals and provide feedback on specific projects undertaken by the participants.

The Agency of Natural Resources and Division for Historic Preservation completed an assessment of dams in the White River Basin in 2001. The basis of the assessment was the Vermont Dam Inventory,[6] a database of 1,200 dams in the state. The assessment consisted of field review of the ecological, engineering and cultural characteristics of 104 dams. Fifty-two of the dams were found to be intact and in good condition, and another 10 in various states of disrepair. Thirty-eight dams were either fully or partially breached. In addition, two of the dams in the inventory turned out to be beaver dams. The data gathered during the assessment still have to be compiled, but the Agency now has detailed information that can be used to assist the public and interested groups identify dams that may be good candidates for removal or modification to mitigate their environmental impacts. Relatively few of the dams assessed had significant historical or cultural significance.

Two of the dams are used, or intended to be used, to generate hydroelectric power. Both are under the jurisdiction of the Federal Energy Regulatory Commission. Bethel Mills, on the Third Branch, has been operating since the mid-1980s. Tunbridge Mill, on the First Branch, has not been developed and is not operating. The authorizations for both projects include provisions for upstream and downstream fish passage.

[6] See also Appendix D of the Vermont DEC 1997 White River Watershed Water Quality and Aquatic Habitat Assessment Report. The dam inventory is available from DEC's Water Quality Division.

Recommendations - Fisheries

GOAL: MAINTAIN AND ENHANCE SELF-SUSTAINING FISH POPULATIONS

The following objectives and strategies will assist in the continuation of efforts to address concerns regarding fisheries.

OBJECTIVES LISTED FROM HIGHEST PRIORITY
① **Protect fish populations and their habitat**
② **Reduce impacts to fish habitat**
③ **Maintain free flowing rivers, existing fish passages at dams and culverts, and enhance fish passage where needed**
④ **Restore degraded fish habitat**

OBJECTIVES ① AND OBJECTIVE ④: STRATEGIES

24 Assess fish habitat through the coordination of existing data. Data may include fish and macroinvertebrate populations, riparian condition, in-stream habitat, and physical channel condition, and water quality. Assessment should include the identification of self-sustaining fish populations and any gaps in existing data.

Lead Agency/Organization: FWD
Partners: USFS, WRP
Potential Funding Source: State and federal programs
Time-Frame: By 2005
Benchmarks: A document listing sources of existing data and contact information

25 Identify factors limiting fish populations and having an impact on fish habitat.

Lead Agency/Organization: FWD
Partners: DEC, USFS, WRP, Connecticut River Atlantic Salmon Commission, CRWC, Silvio O. Conte National Fish and Wildlife Refuge
Potential Funding Source: State and federal programs
Time-Frame: By 2005
Benchmarks: A report that describes factors limiting fish populations and factors that have an impact on fish habitat

26 Develop a process to prioritize fish habitat improvement projects. Prioritization should consider the information generated in strategies 24 and 25.

Potential Partners: FWD, Ct. River Watershed Council, Trout Unlimited, USFS, USFWS, WRP
Potential Funding Source: State and federal programs
Time-Frame: By 2005
Benchmarks: A report describing the process for prioritizing fish habitat improvement projects

27 Conduct habitat protection and restoration projects based on the prioritization results (see Strategy 26). In addition, monitor a selection of habitat restoration projects to determine their effects on fish habitat.

Lead Agency/Organization: WRP stream teams
Partners: DEC, FWD, Trout Unlimited, USFS, USFWS, WRP
Potential Funding Source: State and federal programs
Time-Frame: Ongoing
Benchmarks: Completion of habitat protection and restoration projects

OBJECTIVE ② : STRATEGIES

28 Provide state, federal, non-profit groups and the public with assessment information (information gathered in previous strategies) that will assist them in their efforts to protect fish habitat.

Lead Agency/Organization:
Partners: FWD, VTrans, WRP
Potential Funding Source: State and federal programs
Time-Frame: Ongoing
Benchmark: Distribution of fact sheets or reports on fish habitat assessment

29 Provide information on fish habitat needs, including fluvial geomorphic principles, to state and town employees who issue permits or develop projects and regional planning commission staff who also help develop projects to help them assess the potential of projects to affect fisheries habitat.

Lead Agency/Organization:
Partners: DEC, FWD, RPC
Potential funding sources: State and federal programs
Time-frame: Ongoing
Benchmark: Not applicable

OBJECTIVE ③: STRATEGIES

30 Assess existing culverts for fish passage and distribute assessment to state and local road managers.

Lead Agency/Organization: FWD
Partners: VTrans, DEC, RPC, Trout Unlimited, WRP, USFS
Potential Funding Source: Connecticut River Watershed Council
Time-frame: Ongoing
Benchmark: Completion and distribution of road culvert assessments

31 Develop and provide towns with guidelines for installing fish-friendly culvert[7].

Lead Agency/Organization: FWD
Partners: DEC, RPC, VTrans, Trout Unlimited
Potential Funding Source: Connecticut River Watershed Council, state and federal programs
Time-frame: Ongoing
Benchmark: Distribution of guidelines to towns for installing fish-friendly culverts

[7] The Vermont Department of Fish and Wildlife and the Vermont Agency of Transportation are working to together to develop fish and wildlife friendly passages.

32 Evaluate dam assessment data to identify those dams that may be good candidates for removal, modification, or other treatment to improve fish habitat.

Lead Agency/Organization: DEC
Partners: Connecticut River Watershed Council, FWD, WRP Stream Teams, Vt. Office of Historic Preservation
Potential Funding Source: State and federal programs
Time-frame: By 2005
Benchmark: Complete report on evaluation of dams

33 Remove dams based on assessment data and the interest of the dam owners.

Lead Agency/Organization: Vermont Dams Task Force
Partners: Connecticut River Watershed Council, DEC, landowner, Vt. Office of Historic Preservation, WRP Stream Teams
Potential Funding Source: Connecticut River Watershed Council, WHIP, NOAA, Federal Emergency Management Agency funds and other State and federal programs.
Time-frame: Ongoing
Benchmark: Dams are removed

Chapter 5. Specific Waters with Water Quality Problems

GOAL: ENSURE THAT SURFACE WATERS ARE IN COMPLIANCE WITH THE VERMONT WATER QUALITY STANDARDS

The Agency of Natural Resources is responsible for maintaining water quality in each waterbody in accordance with the Vermont Water Quality Standards. Water quality is determined using biological, physical, and chemical criteria. The Agency, through the Department of Environmental Conservation (DEC), monitors selected surface waters for conformance with these criteria, assesses use attainment, and documents violations. Plans for remediation of water quality problems are developed and carried out by the Agency and, where appropriate, the Department of Agriculture, Food and Markets.

In the White River Basin, the Agency has identified impaired waters (Table 3), waters in need of further assessment (Table 4) and waters with altered flow (Table 5). An impaired water has a measured violation of at least one criterion of the Vermont Water Quality Standards. To be called "impaired," the violation of the Vermont Water Quality Standards must be substantiated by data collected through chemical, physical and/or biological monitoring and identified on a listing that DEC prepares for EPA. In addition, DEC or members of the public have identified threats to a number of other river or stream reaches (Tables 4 and 5); however, available data on these waters are insufficient to conclusively demonstrate a violation of Water Quality Standards. The Agency will gather more data on these waters.

5.1 Strategies to Remediate Impaired Waters

Under federal regulations and the most recent EPA guidance, impaired waters must be identified by the State and may need to be reported under §303(d) of the Clean Water Act. If the waterbody is identified as impaired but there are specific regulatory measures in place that, when executed, will bring it into compliance with the Water Quality Standards, it is not required to be reported under §303(d). All other impaired waters where no such legal remedies exist must be reported under §303(d) and scheduled for TMDL development. All impaired waters identified in the White River Basin are reported on the 303(d) List.

In the following section, the Agency and other State agencies propose strategies for restoring waters in the basin based largely on voluntary efforts. It is hoped that these efforts will be sufficient to correct the impairment, achieve Water Quality Standards, and remove the water from the 303d list. If these actions fail to restore the impaired waters, the Agency will require additional actions for determining sources of pollution loads and their reduction by the date noted in the strategies listed below. One method of estimating the necessary pollutant loading reduction is a Total Maximum Daily Load (TMDL) determination. The TMDL program is described in Appendix B.

Table 3. Impaired Waters in the White River Basin

Water Segment Name/Description	Town	Impairment(s)	Reasons for Surface Water Quality Problem(s)
Jones Pond Brook (about 3 miles)	Chelsea	Unknown	Absence of fish; unknown reason(s) 1995 data
Adams Brook (1.5 miles)	Randolph	Undefined	Sediment in runoff from agricultural land and roadway surfaces; elevated nutrient and pathogen levels likely
Skylight Pond	Ripton	PH	Extremely sensitive to acidification from rain on an episodic basis; local geologic conditions offer poor buffering capacity
North Pond	Chittenden	PH	Extremely sensitive to acidification from rain on an episodic basis; local geologic conditions offer poor buffering capacity
All surface waters	Entire basin	Mercury	Elevated levels of mercury in fish tissue likely

The following is a brief description of the current status of each of the impaired waters and strategies for remediation.

Jones Pond Brook

Jones Pond Brook drains a small, predominantly forested watershed (estimated as 500 to 800 acres) that is likely to experience seasonally limited flows. The brook falls beneath the acceptable size threshold for DEC non-game fish biological monitoring protocols.

A Department of Fish and Wildlife fisheries biologist observed a total absence of fish during an electrofishing survey conducted in 1995. In 1996 and 1997, the department surveyed the stream again in the same location and observed multiple year classes of brook trout as well as a low number of blacknose dace. In addition, recent DEC Water Quality Division watershed and stream surveys (September & October 2000) revealed no obvious reason or source for a violation of the Water Quality Standards. The presence of non-game fish in the brook was observed during these recent surveys. It appears that some event, either natural or otherwise, eliminated the fish population in 1995 and the population reestablished in subsequent years. The surveys by the FWD in 1996, 1997 and the DEC surveys in 2000 substantiate the absence of an impairment.

STRATEGY

34 Propose removing brook from the List of Impaired Waters in 2002.

Lead Agency/Organization: DEC
Potential Funding Sources: State programs
Time-frame:2002 (If not removed from list then TMDL schedule for 2013)
Benchmark: Removal of Joes Pond Brook from the draft List of Impaired Waters in 2002

Adams Brook

The source of the impairment to Adams Brook in Randolph is agricultural and roadway runoff. Pollutants carried in runoff include sediment, nutrients and pathogens. In addition, runoff adds to increased flows in stream, which causes erosion of the streambanks. Macroinvertebrate monitoring by DEC indicates that the biological condition measured in 1997 is fair.

A watershed survey in October 2000 by DEC Water Quality Division personnel revealed suspected diffuse sources of runoff. During that survey, the following source areas were identified as likely contributors to the impaired condition of Adams Brook: an eroded tributary east of I-89 and just north of Route 66; an unimproved barnyard; roadside ditching by town road crews and associated exposed soils; raw, eroding banks upstream of the sampling site; runoff from paved and unpaved roadway surfaces (especially I-89) that increases flows, causing notable bedload transport to a tributary of the brook.

Subsequent to the survey, VTrans lined the drainage ditch that ran along the north entrance to the VTrans garage and into the eroded tributary in question with rock. The rock should reduce the amount of erosion and resulting sedimentation caused by the increased flows.

Based on a initial review of agricultural activity in the Adams Brook watershed, the Department of Agriculture, Food, and Markets suggests that the following Best Management Practices would be appropriate for certain farms in the area: improved barnyards and heavy use area protection; roof runoff management; milk-house waste management; stream crossings, walkways and access lanes for animals; fencing along streams to exclude animals; buffers along waterways; and nutrient management planning.

STRATEGIES

35 In the Adams Brook watershed, work with willing landowners to identify appropriate agricultural assistance programs using a nine step planning process by NRCS (see Agricultural Runoff Control Programs in Appendix B and planning process in Appendix H).

Lead Agency/Organization: DAFM, NRCS
Partners: landowners
Potential Funding Sources: Federal programs including EPA
Time-frame: By 2006
Benchmark: Plan describing appropriate BMPs for specific areas

36 Implement practices identified by NRCS described above.

Lead Agency/Organization: DAFM, NRCS
Partners: DEC, landowners, USFWS, WRP
Potential Funding Sources: EPA, Partners for Wildlife. See Appendix B for other federal programs
Estimated Cost (based on work with landowners): $40,000
Time-frame: By 2006
Benchmark: Implementation of BMPs

37 Determine appropriateness of a Watershed Improvement Permit from the Agency of Natural Resources for sections of Adams Brook based on impact from road and parking lot runoff.

Lead Agency/Organization: DEC
Partners: landowners, VTrans, Town of Randolph
Potential Funding Sources: State and federal programs
Time-frame: By 2006
Benchmark: If appropriate, a Watershed Improvement Permit

38 Design and build stormwater treatment structures to handle runoff from impervious areas running into Adams Brook.

Lead Agency/Organization: DEC
Partners: landowners, VTrans
Potential Funding Sources: State and federal programs
Estimated Cost: $100,000
Time-frame: By 2006
Benchmark: Stormwater treatment structures that handle runoff in Adams Brook watershed

39 Evaluate remediation progress through periodic biological monitoring and field inspections.

Lead Agency/Organization: DEC
Potential Funding Sources: State and federal programs
Time-frame: Ongoing
Benchmark: Removal of Adams Brook from the List of Impaired Waters

Skylight Pond

Skylight Pond with a surface area of 2 acres is extremely sensitive to acidification on an event or episodic basis. Skylight Pond is found along the spine of the Green Mountains within the Green Mountain National Forest. As the main source of acidic precipitation is from the Midwest, the Agency of Natural Resources will continue to pressure US EPA to reduce emissions from out-of-state sources.

STRATEGIES

40 Conduct monitoring of pH levels in the pond.

Lead Agency/Organization: DEC
Potential Funding Sources: State and federal programs
Time-frame: Ongoing (TMDL scheduled for 2005)
Benchmark: Periodic monitoring of pH levels in Skylight Pond

North Pond

A review by DEC of the monitoring data from North Pond (surface area 3 acres) indicates the waterbody was incorrectly listed as impaired in the Vermont Year 2000 List of Waters. Existing data does not indicate an impairment. The Lakes and Pond section re-sampled the pond in 2001, which confirmed the absence of an impairment.

STRATEGY

41 Propose removing pond from the List of Impaired Waters in 2002.

Lead Agency/Organization: DEC
Potential Funding Sources: State and federal programs
Time-frame: By 2002
Benchmark: Removal of North Pond in the draft List of Impaired Waters in 2002.

All surface waters

Vermont currently has in effect a fish consumption advisory for all waters due to the presence of elevated mercury (Hg) levels in fish tissues, therefore, all surface waters in the state are listed as impaired. The combustion of coal for energy and the incineration of municipal and medical wastes produces the majority of mercury deposited onto the watersheds of the northeastern US and eastern Canada. The Agency of Natural Resources will continue pressuring US EPA to reduce emissions from out-of-state sources. The Agency's Environmental Assistance Division in the Department of Environmental Conservation will also continue its work to reduce in-state sources of mercury in the environment (see Appendix B).

STRATEGY

42 Determine the level of contamination and the associated risk to human health using fish tissue samples taken from the White River Basin.

Lead Agency/Organization: DEC
Partners: Lake associations
Potential Funding Sources: State and federal programs
Time-frame: By 2005
Benchmark: A report describing the concentration of mercury in fish in at least one lake in the White River Basin

5.2 Strategies for Waters in Need of Further Assessment

Table 4. Waters in need of further assessment because of observed impacts or threats

Water Segment Name/Description	Town	Possible Impairment(s)	Possible Problem Needing Assessment
lower White River (mouth upstream 5 miles)	Hartford	Pathogens	elevated bacteria levels in early 1990's - no recent sampling; unknown source(s)
lower White River	West Hartford	Metals	elevated levels of chromium & nickel in river sediments; unknown source(s)
mid-White River	Royalton	metals, organic enrichment	uncertainty regarding Bethel/Royalton landfill leachate entering river via groundwater
2nd Branch, White River (16 miles)	Brookfield, Randolph, Bethel, Royalton	sediment, nutrients, pathogens	streambank erosion, agricultural runoff, loss of riparian vegetation
3rd Branch, White River (11 miles)	Randolph, Bethel	sediment, nutrients, pathogens	stormwater & agricultural runoff, livestock access, streambank erosion, loss of riparian vegetation, morphological instability
Ayers Brook	Randolph	Metals	elevated levels of chromium & nickel in brook sediments; unknown source(s)
Ayers Brook	Brookfield, Braintree, Randolph	Sediment	morphological instability, loss of riparian vegetation
Spear Brook (0.2 miles)	Randolph	nutrients, sediment	agricultural runoff
upper-White River	Granville, Hancock, Rochester	Sediment	morphological instability
First Branch[8]	Tunbridge, Chelsea	sediment, temperature	loss of riparian vegetation
Open Meadow Brook	Braintree and Brookfield	sediment, nutrients, pathogens	agricultural runoff, streambank erosion
Cold Brook	Braintree and Brookfield	sediment, nutrients, pathogens	agricultural runoff, streambank erosion

Table 4 lists all surface waters in the White River Basin known to be in need of further assessment. A comprehensive assessment of water quality in the basin has not been conducted. The following is a brief description of the current status of each water in Table 4, and strategies for remediation where appropriate.

Upper White River

The combined effects of historical efforts to increase channel capacity by gravel mining and a 1998 flood event destabilized a portion of the upper river channel in Granville. State and federal agencies, towns, landowners along the river and local interests, coordinated by the White River Partnership, initiated efforts to develop a channel restoration design for about 5,000 feet of the

[8] Shaded entries in Table 4 are waters brought to the attention of DEC during the basin planning process

Granville section shortly after the event. The ensuing "natural channel" design called for a two-phase project. The first phase of the restoration, which involved some 1,000 feet of channel, was completed in August, 2000 and included the installation of a riparian buffer and a series of rock vanes and weirs (grade control structures) designed to create the type of natural "step-pool channel" found in steep mountain settings. The second project phase, involving 4,000 feet of river, was largely completed in August, 2001. This phase involved extensive earth work to restore the natural width, depth, meander pattern, and slope of a "riffle-pool" channel and floodplain. Rock vanes, root wads, rock revetments, and bio-engineering methods (consisting of logs and live vegetation) were used to enhance instream habitats and stabilize river banks. The banks were further protected and restored with willow plantings in the fall of 2001 and a riparian buffer was planted using native woody vegetation in the spring of 2002.

After years of instability, dating back to the mid-1930s, and ensuing river channel and habitat degradation, a "natural channel" restoration design, including some rock rip-rap at selected locations, was also developed for a reach of the upper river in Rochester (at the Harvey Farm). The cooperative project, begun and completed in September 2000, has restored and stabilized some 3,300 feet of river channel and riparian buffer.

STRATEGY

43 Design and schedule restoration of the remaining 4,000 feet of the upper White River in the Granville area.

Lead Agency/Organization: WRP
Partners: DEC, FWD, landowners, USFS, USFWS
Potential Funding Sources: State and federal programs
Time-frame: By 2005
Benchmark: Completion of channel restoration project along 4,000 feet of the upper White River.

Middle White River

Groundwater monitoring at and below the landfill has occurred since the landfill's closure (January 1993) and capping later that same year. The Town of Bethel is responsible for conducting a groundwater montitoring program, which was recently revised in the landfill's post-closure certification issued by DEC in February 2001. The Department of Environmental Conservation has no surface water monitoring data indicating any contamination of surface water from leachate associated with the Bethel/Royalton landfill.

STRATEGY

44 Continue monitoring water quality of groundwater as required by the landfill's post-closure certification.

Lead Agency/Organization: Town of Bethel
Potential Funding Sources: Town of Bethel
Time-frame: Twice a year until 2013
Benchmark: Reports to DEC twice a year

Lower White River

Sampling by a River Watch group in the early 1990's found some violations of the standard that indicated the potential presence of pathogens, however, there has been no recent or ongoing monitoring in this river reach. The White River Partnership's volunteer water quality monitoring program has monitored *E. coli* in the basin, including the Lower White River.

STRATEGY

45 Continue to assist the Partnership with their volunteer water quality monitoring program. See Section 4.3, which outlines strategies for assisting volunteer groups.

Spear Brook

The Department of Environmental Conservation (DEC) sampled this waterbody for macroinvertibrates as part of the rotational assessment process in 2001. The data is currently being analyzed to determine compliance with the Vermont Water Quality Standards. In conjunction with a project in need of an Act 250 permit situated in close proximity to the brook, DEC provided comment concerning the importance of buffers between the proposed activity and the brook. DEC believes that such measures, if implemented as part of the project, will help protect the brook's water quality.

STRATEGIES

46 Inspect Spear Brook to determine whether buffers have been reestablished.
Lead Agency/Organization: DEC
Partners:
Potential Funding Sources: State programs
Time-frame: By summer 2003
Benchmark: DEC report describing compliance with Act 250 permit with regard to buffers on Spear Brook

47 Monitor water quality in Spear Brook.
Lead Agency/Organization: DEC
Partners:
Potential Funding Sources: State and federal programs
Time-frame: By 2003
Benchmark: Biological sample taken and analyzed

Second Branch

Sediments, nutrients, and pathogens are having an impact on sixteen miles of the Second Branch from the Williamstown/Brookfield town line to about 1 mile above the White River confluence. Sources of contamination include agricultural runoff, streambank erosion, and loss of riparian vegetation. See below for strategies.

Third Branch

Sediments, nutrients, and pathogens are having an impact on the Third Branch of the White River in Randolph and Bethel. Sources of contamination include storm water and agricultural runoff, direct livestock access to the water, streambank erosion, loss of riparian vegetation, and

morphological instability. In addition a chlorine spill in Randolph on June 24-25, 1999 resulted in a complete kill of all fish species and life stages over approximately 1.5 miles of stream. Conservative estimates of the fish kill based upon previous fish population surveys were determined to be over 26,000 fish, comprising 11 species. As larger fish observed in the kill were 3 years of age or older, a complete short-term recovery is not expected.

In response to a request by the White River Partnership, the US Department of Agriculture undertook a study to provide information about the character, function, and stability of the Third Branch (USDA, 2001). The results indicate the following:

- accelerated bank erosion and widening of the Third Branch below Randolph can partially be explained by the lack or poor condition of riparian corridor vegetation and by historic gravel mining activities; and
- most of the sediment in the Third Branch system appears to be from streambank erosion in Ayers Brook and from bank erosion downstream of Randolph.

For more information on results of the study see the description of the fluvial geomorphological study in section 4.1.

In 1993, and again in 1997, DEC conducted some biological monitoring of the Third Branch. This monitoring showed "good to excellent" levels of macroinvertebrate community integrity. The two sampling locations for this assessment were above and in the vicinity of Randolph. To determine the magnitude, extent, and duration of impact from the accidental discharge of chlorine, additional biological monitoring was performed by DEC in 1999 in Randolph. Downstream of the spill 100 yards, the macroinvertebrate community was severely affected, however, downstream one mile, the community had almost completely recovered. Sampling occurred again in the fall of 2001.

STRATEGIES FOR THE SECOND AND THIRD BRANCH

48 According to the Vermont Department of Agriculture, Food, and Markets, the Second and Third Branch could benefit from many agricultural best management practices. The highest priority practices included waste storage facilities and systems; improved barnyards and heavy use area protection; roof runoff management; milk-house waste management; stream crossings, walkways and access lanes for animals; fencing along streams to exclude animals; riparian forested and herbaceous buffers along waterways; nutrient management planning; pasture management; surface water diversions; sediment basins; streambank stabilization; grade stabilization structures along the river channel; stream channel stabilization; streambank and shoreline protection; and wildlife habitat management.

Lead Agency/Organization: DAFM, NRCS
Partners: Landowners, USFWS
Potential Funding Sources: EPA and other state and federal programs
Time-frame: By 2005
Benchmark: Implementation of BMPs

49 Monitor water quality.

Lead Agency/Organization: DEC
Partners: WRP

Potential Funding Sources: State and federal programs
Time-frame: By 2003
Benchmark: Biological samples taken and analyzed

See Section 4.1 for additional strategies that address stream channel instability and streambank erosion.

Ayers Brook

Loss of riparian buffer is responsible for streambank and sedimentation along Ayers Brook in Brookfield, Braintree, and Randolph. Ayers Brook has a number of agricultural producers within its watershed.

STRATEGY

50 According to the Vermont Department of Agriculture, Food, and Markets, some BMPs to improve water quality on Ayers Brook include fencing along streams to exclude animals; riparian forest buffers and grass filter strips along waterways; stream crossings, walkways and access lanes for animals; streambank stabilization; grade stabilization structures along the river channel; stream channel stabilization; streambank and shoreline protection; waste storage facilities and systems; improved barnyards and heavy use area protection; roof runoff management; milk-house waste management; silage leachate management; nutrient management planning; pasture management; strip cropping; and surface water diversions.

Lead Agency/Organization: DAFM, NRCS
Partners: Landowners, USFWS
Potential Funding Sources: EPA and other state and federal programs
Time-frame: By 2005
Benchmark: Implementation of BMPs

See Section 4.1 for additional strategies that address stream channel instability and streambank erosion.

First Branch

Fisheries biologists from FWD state that the fisheries habitat is compromised due to a loss of riparian vegetation and streambank erosion. These conditions appear to be the result of surrounding land uses.

STRATEGIES

51 Monitor streams for biological conditions.

Lead Agency/Organization: DEC
Partners: FWD
Potential Funding Sources: State programs
Time-frame: By 2003
Benchmark: Biological sample taken and analyzed

See Section 4.1 for additional strategies that address stream channel instability and streambank erosion.

Cold Brook and Open Meadow Brook

There are reported impacts to Cold Brook and Open Meadow Brook from agricultural runoff and streambank erosion.

STRATEGIES

52 Assess and monitor streams for biological health and integrity.

Lead Agency/Organization: DEC
Potential Funding Sources: State programs
Time-frame: By 2003
Benchmark: Biological sample taken and analyzed

53 According to the Vermont Department of Agriculture, Food and Markets, water quality in Cold Brook and Open Meadow Brook watershed could benefit from the implementation of the following agricultural best management practices: waste storage facilities and systems; improved barnyards and heavy use area protection; roof runoff management; milk-house waste management; nutrient management planning; pasture management; alternative watering facilities; stream crossings, walkways and access lanes for animals; fencing along streams to exclude animals; buffers along waterways; streambank stabilization; and surface water diversions.

Lead Agency/Organization: DAFM, NRCS
Partners:
Potential Funding Sources: EPA and other state and federal programs
Time-frame: By 2005
Benchmark: Implementation of BMPs

5.3 Strategies to Remediate Waters Altered by Regulated Flows

Table 5. Waters altered by regulated flows in the White River Basin

Water Segment Name/Description	Location (Town)	Flow Alteration
Silver Lake	Barnard	water level management (lake drawdown) may impair lake's aquatic habitat and/or biota
Pond Brook	Barnard	water level management of Silver Lake may impair brook's aquatic habitat and/or biota
Flint Brook[9]	Roxbury	water withdrawal/diversion to fish hatchery may impair brook's aquatic habitat and/or biota

The following is a brief description of the current status of waters altered by regulated flows and strategies for remediation.

Silver Lake

The dam located at the outlet of Silver Lake (surface area 85 acres) is owned and operated by the Vermont DEC. The management of the lake's water levels is conducted in accordance with rules promulgated by the Vermont Water Resources Board dated June 7, 1968. The Board rule established the water level of the lake at 1,307.5 feet above sea level during the summer season and 1,306 feet above sea level during the winter and non-recreational season. In January 1988, the Vermont Department of Fish & Wildlife (FWD) indicated that aquatic biota, fish and wildlife, and recreational fishing were negatively affected by the 1.5-foot draw-downs due to a loss of pike spawning area and the effect on wetlands.

STRATEGY

54 Determine the extent of near shore area actually exposed by such a draw-down to determine whether the draw-downs may be having a significant negative impact on aquatic biota and habitat in the lake, a situation that would warrant further study and possible corrective action.

Lead Agency/Organization: DEC
Partners: FWD, Silver Lake Association
Potential Funding Sources: State programs
Time-frame: By 2005
Benchmark: A report on the extent of area exposed by draw-downs and likelihood of significant negative impacts to biota

[9] Shaded entries in Table 5 are waters brought to the attention of DEC during the White River Forums (December, 2000)

Pond Brook

Silver Lake drains into Pond Brook, resulting in sudden changes in flows to the brook during the placement and removal of stop logs in the lake's dam. Fisheries biologists in the FWD have conducted fish population surveys on Pond Brook at elevation 950' in 1989, 1990, and 1997. These surveys indicate Pond Brook in this location supports excellent populations of wild brook, brown and rainbow trout as well as slimy sculpin, blacknose dace, longnose dace, creek chub and white sucker. The fact that these species represent both spring and fall spawning strategies indicate a wide variety of suitable habitats currently exists.

STRATEGY

55 Determine whether replacement of the stop logs in the Silver Lake dam each spring is having a significant negative impact on aquatic biota and habitat in the brook, and if so, implement corrective action.

Lead Agency/Organization: DEC
Partners: FWD, Silver Lake Association
Potential Funding Sources: State programs
Time-frame: By 2005
Benchmark: A report on the effects of the management practices of Silver Lake dam on Pond Brook biota.

Flint Brook

The State Roxbury Fish Hatchery withdraws water from Flint Brook to support hatchery operations. A summer 2001 study conducted by the Department of Fish and Wildlife evaluated trout population above and below the withdrawal for the hatchery. The study concluded that "definitive impacts to wild brook trout populations from the Flint Brook withdrawal could not be identified," and that brook trout populations were similar below and above the withdrawal. These conclusions suggest that existing management practices maintain adequate flows to support fish populations below the water withdrawal. However, further study may be needed.

STRATEGY

56 DEC and FWD will cooperatively characterize the hydrology of Flint Brook. Using the 2001 study as a starting point, the DEC and FWD will discuss the findings and make further decisions as to the adequacy of flows in Flint Brook or the need for additional data collection.

Lead Agency/Organization: DEC, FWD
Potential Funding Sources: DEC, FWD
Time-frame: By 2003
Benchmark: The analysis of data collected during the summer of 2001and beyond and institution of mitigation as necessary

Chapter 6. Establishing Management Goals For Surface Waters

GOAL: ESTABLISH MANAGEMENT GOALS WITHIN THE BASIN THAT PROTECT BOTH THE BENEFICIAL USES AND VALUES OF SURFACE WATERS AND MEET THE NEEDS OF THE COMMUNITY

The protection or improvement of water quality and water-related uses can also occur by establishing management goals for particular bodies or stretches of water. The management goals describe the values and uses of the surface water that are to be protected or achieved through appropriate management. Management goals can be established through the following processes, which will be described in this chapter:

- 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.

The Agency of Natural Resources is responsible for designating existing uses and the Vermont Water Resources Board is responsible for all of the other designations. Once the Agency or the Board establishes a management goal, the Agency manages State lands and issues permits to achieve all management goals established for the associated surface water.

Before the Agency recommends, or the Board establishes management goals through a classification or designation of surface waters, input from the public on any proposal is required and considered. The public is also able to present a proposal for establishing management goals to the Agency or the Board to consider at any time.

When the public develops proposals regarding management goals, the community's increased awareness can lead to protection of uses and values by the community and individuals. Proposing Outstanding Resource Waters designations under 10 V.S.A. §1424a or assisting the Agency in designating existing uses require river inventories and studies that can be completed by a citizen group with little technical training. The local involvement in the collection of information about the river creates awareness and cooperation among a broad spectrum of environmental and economic interests. In addition, citizen groups can hold discussions within the community about the uses and values of surface waters with little technical background. This in turn may build consensus within the community on the value of their surface waters and improve land stewardship by individuals and the towns.

During basin planning, the Agency proposes designations for particular waters and could incorporate a proposal by a citizen group as part of a basin plan. In this basin plan, the Agency proposes the designation of new management types for Class B waters and the reclassification of one water from A(2) to B2 as shown on the map in Appendix C. In addition, the Agency

proposes the designation of boating and swimming as existing uses in surface waters listed in Tables 7 and 8.

6.1 Typing and Classification

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. The system includes Classes 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 (B1), Type 2 (B2) and Type 3 (B3) as part of the basin planning process.

The typing system for Class B waters is for the most part a continuum of acceptable conditions for beneficial uses including 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 Water Quality Standards for Class B waters, which includes suitability for boating, swimming, and drinking with treatment.

The present classification of waters in the White River Basin is as follows:

- A(1) – By Vermont statute, all waters above 2,500 feet in elevation. The management objective for A(1) waters is to maintain them in their natural condition.
- A(2) - Waters used as public water supplies. The management objectives for A(2) waters are similar to those of A(1) except that a moderate change to aquatic habitat and biota is permitted to allow for the water level fluctuations of water supply reservoirs. In the White River Basin, Class A(2) waters include Lake Casper and Lake John (Village of South Royalton and Fire District #1 water supply) and approximately two miles of Farnsworth Brook along with its tributaries (Village of East Braintree water supply).
- Class B - All remaining waters

In addition to their present classification of B, the river reaches that receive water from waste-water treatment facilities in Bethel, Chelsea, Randolph, and Royalton have one-mile long Waste Management Zones downstream of each facility's outfall. This zone is designated to accept the discharge of properly treated wastes that prior to treatment contained organisms pathogenic to human beings. Throughout the zone, numeric water quality criteria for Class B waters must be achieved, but increased health risks exist.

Proposal for Typing and Classification of Waterbodies in the White River Basin

In this basin plan, the Agency proposes water management types for all Class B waters. During the five-year interval between basin plans, this proposal should enhance the community's understanding of the classification system. An understanding of the system will allow interested communities to develop their own proposals for re-typing surface waters. When members of a

community have developed a proposal, they may either decide to present their proposal directly to the Water Resources Board at any time or attach it to the Agency's proposal during the next basin planning process.

The Agency of Natural Resources proposal for typing Class B waters in the White River Basin considers existing water quality and attempts to be consistent with each community's expectations for land use. To this end, the effect of present and desired future land use on water quality was considered (see Appendix C for maps illustrating the proposed typing and classification and Appendix D for a list of proposed B1 waters). The Agency used town plans to identify present and desired land uses. The Agency also met with interested towns to ask them to review the proposal for consistency with the town plan.

The proposal designates most Class B waters as B2, which is the middle type of Class B waters. Proposed waters for B1 are located predominantly within mountainous terrain (but below 2500 feet), and within or adjacent to publicly owned lands. All Class B waters that are presently managed for a moderate change in flows or stream habitat because of a dam presence, water level fluctuation, or water withdrawal, are proposed to be designated B3, which allows for flow alterations. Table 6 further describes the proposal for waters of the White River Basin. For more information on the classification system, see Appendix I and the Vermont Water Quality Standards.

Other Waters for Consideration of B1 Designation

Quantitative data compiled by the Vermont Department of Fish and Wildlife identifies streams within the Basin that support quality wild trout fisheries resources. Some but not all of these streams are included in the proposal contained in this plan for B1 designation. The Agency encourages municipalities and organizations to consider these data for possible support of a locally driven proposal for B1 designation of such streams. Although the presence of high quality wild trout populations is not alone enough to indicate that a stream has all characteristics of B1, these populations may be indicative of good water quality, and other criteria characteristic of B1. The map entitled High Quality Fish Habitat (Appendix C) illustrates these waters.

Achieving Management Goals Through Appropriate Land Use

The Agency does not know exactly how waters respond to adjacent agricultural, tree harvesting, and development land uses. In addition, it is difficult to precisely predict the cumulative effects of land use on waters as one moves downstream. It is presumed that the use of good land stewardship will preserve the health of surface waters. The use of Accepted Agricultural Practices (AAPs) and Acceptable Management Practices (AMPs) for silvicultural activities creates a presumption of compliance with the Vermont Water Quality Standards. Good riparian buffers with woody vegetation that bind the soil protect the land and the water and go a long way to creating good conditions in streams and rivers. Implementation of the new stormwater rules adopted by the Agency in all projects reviewed after June 1, 2002 should also help ensure adequate treatment of urban runoff before it reaches surface waters.

Table 6. Proposed classification and water management typing of surface waters in the White River Basin

Waterbody	Present Class or Type	Proposed Class or Type	Rationale
Specific waters in mountainous areas (see Appendix D)	A1 above 2,500, B below 2,500 feet elevation	A1- waters unchanged B1 - Certain waters below 2,500 feet in mountainous areas.	B1 waters have minimal changes from reference conditions[10] for aquatic macroinvertebrates and fish assemblages. This is a probable condition in mountainous regions and a widely held goal for waters in the Green Mountains and on State lands.
Silver Lake (Barnard)	B	B3 - Changes in the aquatic habitat shall be limited to moderate difference from the reference condition consistent with the full support of all aquatic biota and wildlife uses. When such habitat changes are the result of hydrologic modification or water level fluctuation compliance may be determined on the basis of aquatic habitat studies.	Silver Lake is drawn down 18 inches annually with a probable moderate change to the aquatic biota. Water Resources Board issued order in 1968. If this draw-down is not in the public interest a petition should be filed with the Water Resources Board.
Pond Brook below Silver Lake to Locust Creek (Barnard)	B	B3 - Changes in the aquatic habitat shall be limited to moderate difference from the reference condition consistent with the full support of all aquatic biota and wildlife uses. When such habitat changes are the result of hydrologic modification or water level fluctuation compliance may be determined on the basis of aquatic habitat studies.	At a minimum, necessary minimum flows should be maintained during refilling of Silver Lake. Even such minimum flows may result in a moderate difference in the aquatic biota from reference conditions in Pond Brook. Further investigation of minimum and maximum flows, community goals, and condition of Pond Brook are indicated.
Third Branch of White River from Bethel Mills Dam to tail race (Bethel)	B	B3 - Changes in the aquatic habitat shall be limited to moderate difference from the reference condition consistent with the full support of all aquatic biota and wildlife uses. When such habitat changes are the result of hydrologic modification or water level fluctuation compliance may be determined on the basis of aquatic habitat studies.	Moderate difference in habitat from reference conditions (more than minor) probably occurs in impoundment, falls and by-passed reach due to the operation of the impoundment.
Flint Brook from water intake to Roxbury State Fish Hatchery to Third Branch of White River (Roxbury)	B	B3 - Changes in the aquatic habitat shall be limited to moderate difference from the reference condition consistent with the full support of all aquatic biota and wildlife uses. When such habitat changes are the result of hydrologic modification or water level fluctuation compliance may be determined on the basis of aquatic habitat studies.	Withdrawal from Flint Brook during low flows may have a greater than minor influence from reference conditions on Flint Brook's aquatic habitat. Necessary required minimum flows should be established and maintained.

[10]Reference condition is the range of chemical, physical, and biological characteristics of waters minimally affected by human influences.

Waterbody	Present Class or Type	Proposed Class or Type	Rationale
Tunbridge Mill Corporation project (to be developed) from dam to tail race.	B	B3 - Changes in the aquatic habitat shall be limited to moderate difference from the reference condition consistent with the full support of all aquatic biota and wildlife uses. When such habitat changes are the result of hydrologic modification or water level fluctuation compliance may be determined on the basis of aquatic habitat studies.	There will be a moderate difference in habitat from reference conditions (more than minor) in impoundment, falls and by-passed reach due to the operation of the impoundment.
Blaisdell Brook, from the confluence of flows from Spring A (as named by Vermont Pure Springs, Inc.) to the confluence with the Second Branch. (Randolph)	B	B3 - Changes in the aquatic habitat shall be limited to moderate difference from the reference condition consistent with the full support of all aquatic biota and wildlife uses. When such habitat changes are the result of hydrologic modification or water level fluctuation compliance may be determined on the basis of aquatic habitat studies.	Vermont Pure Springs, Inc. is permitted to remove water from a spring that contributes water to Blaisdell Brook. The reduction in flows may result in a more than minor difference from reference condition to the Brook's aquatic habitat.
Lake Casper (South Royalton)	A2	B2 - Changes in the aquatic habitat shall be limited to minor differences from the reference condition consistent with the full support of all aquatic biota and wildlife use.	Pond no longer used for municipal water supply.

6.2 Warm Water and Cold Water Designations

In addition to the foregoing classifications and designations, two ponds, Lamson Pond in Brookfield and Silver Lake in Barnard are designated for management as Warm Water Habitat by the Vermont Water Quality Standards which specifies a lower minimum dissolved oxygen concentration than waters in the remainder of the basin which are Cold Water Habitat.

6.3 Existing Uses

All surface waters in Vermont are managed to support uses valued by the public including swimming, boating, and fishing. The degree of protection afforded to these uses is based on the water's management type or class as described in Section 6.1 of this plan. In particular surface waters, however, 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 state or federal permits. The following factors are considered by the Agency when identifying existing uses (see VWQS Section 1-03 B):

- Aquatic biota and wildlife that utilize or are present in the waters;
- Habitat that support existing aquatic biota, wildlife or plant life;
- The use of the waters for recreation or fishing;

- The use of the water 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 White River Basin, the Department of Environmental Conservation has collected sufficient information to identify the existing uses listed in Tables 7 and 8. The lists are 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 when an application is submitted for an activity that might adversely affect the use.

Boating

Table 7 lists white water and flat water boating as existing uses in several specific segments of the White River, the First Branch and the Hancock Branch. The White River is noted for its long uninterrupted flow from its headwaters to its mouth. No other river in Vermont has such extensive free flowing waters. These segments were identified in the *Vermont's Whitewater Rivers* (DEC, 1989), a comprehensive inventory of Vermont whitewater streams that includes a rating of the importance of each run. Information regarding the use of these rivers for boating was also obtained from the *AMC River Guide* (AMC, 1989) and discussions with boaters.

Table 7. Boating as an existing use of specific waters within the White River Basin

Location	Documentation	Rating (DEC, 1989)	Characteristics that support use	Put in	Take out
Hancock Branch (3 miles)	*Vermont's White Water Rivers*	Important	No dams, good water quality, Class II-III rapids	Road to Texas Falls	Not specified
White River Mainstem Granville to Stockbridge (14 miles)	*AMC River Guide*	Not rated	No dams, good water quality, Class II rapids	1 mile north of Routes 100/ 125 junction in Hancock	Rt. 14 or Rt. 100
White River Mainstem Stockbridge to Bethel (11 miles)	*AMC River Guide, Vermont's White Water Rivers*	Highly Important	No dams, good water quality, quick water through Class II rapids	Rt. 14 or Rt. 100	Rt. 107 Bridge
White River Mainstem Bethel to Connecticut River (25 miles)	*Vermont's White Water Rivers*	Highly Important	No dams, good water quality, quick water though Class II rapids	Rt. 107 Bridge	Bridges at White River Junction

Location	Documentation	Rating (DEC, 1989)	Characteristics that support use	Put in	Take out
First Branch Chelsea to Tunbridge (9 miles)	*AMC River Guide, Vermont's White Water Rivers*	Important	Good water quality, Class II-III rapids	Lower Rt. 110 bridge from side road with permission	Before sawmill dam when river is near Rt. 110

The Department has considered the use of the waters in Table 7 for boating and has found boating to be an existing use based on documentation of recreational value (WQS Section 1-03 B 1a-e).

Swimming

Table 8 lists regionally significant swimming sites. These swimming areas were included in an inventory by the White River Partnership of access points to the White River. The Water Quality Standards aim to provide ambient water quality that protects swimming in the entire White River Basin. The public's recognition of these sites requires that they receive special protection. The Department has given due consideration to the sites listed in Table 8 under the Water Quality Standards (1-03 B 1 a-e) and finds that use of the river for swimming at these sites is far more than incidental. Swimming at these sites constitutes existing uses because the public recognizes them as having high recreational value.

Table 8. Swimming as an existing use of specific waters within the White River Basin

Swimming Sites Name	Town	Location
Hancock Overlook, White River	Hancock	On Rt. 100, 910 ft. north of Rt. 125
Lions Club Park, White River	Rochester	Intersection of Rt. 100 and Beans Bridge Rd.
U. S. Forest Service Peavine Park, White River	Stockbridge	On Pit Rd., 1040 ft. north of Rt. 100
Silver Lake State Park, Silver Lake	Barnard	East side of Hill Rd.
Clifford Park, White River	West Hartford	Off Westfield Drive (located off Quechee West Hartford Rd.)
Lyman Point, White River	Hartford	Intersection of Prospect and Maple St.

6.4 Outstanding Resource Waters

In 1987, the Vermont Legislature passed Act 67, "An Act Relating to Establishing a Comprehensive State Rivers Policy." A part of the law provides protection to rivers and streams that have "exceptional natural, cultural, recreational or scenic values" through the designation of Outstanding Resource Waters (ORW).

The Vermont Water Resources Board has the authority to designate a water as an Outstanding Resource Water (ORW), and can do so either on its own motion, or in response to a petition by State agencies, citizens, or town governments (see 10 V.S.A. §1424a.(a)-(b) in Appendix J). In making its decision, the Board may consider characteristics listed in 10 V.S.A. §1424a.(d)1-14 (see Appendix J). When designating a water as an ORW, the Board bases its decision on one or more of the following values: exceptional natural, cultural, recreational or scenic.

The values of the water that merited the ORW designation are then protected by the Agency during review of permit applications. If the ORW is found to be valuable for water quality, the existing quality "...shall, at a minimum, be protected and maintained" (10 V.S.A. §1424a.d.1) (Section 1-03(D) of the Vermont Water Quality Standards). It is the Agency interpretation that the quality of waters designated as an ORW for *water quality* may not be reduced at all below current conditions. This could have significant implications for growth within the watershed. The standard for review for other values is that regulated activity cannot adversely affect the value.

State statute also reduces the amount of gravel that can be removed from an ORW by a landowner from 50 cubic yards to 10 cubic yards per year (the Agency must be notified 72 hours before any gravel is removed).

Many surface waters in the White River Basin have characteristics that would support an ORW petition. In addition, support from within and outside the basin is present for designating at least the mainstem an ORW.

The maps in Appendix C (High Quality Fish Habitat) show the area of the mainstem that has high recreational use for fishing as noted by the Department of Fish and Wildlife. These waters also have high quality recreational opportunities for swimming and boating and may be considered by municipalities and organizations in a petition for ORW designation.

A report by the National Wildlife Federation supports a designation of the White River as an ORW for *water quality and adequate streamflow* (lack of a dam). The report, "The White River Valuation Study: A report on the Value of Maintaining Natural River Flows on Vermont's White River." (National Wildlife Federation, 1998) also provides information that could be used in preparing a petition to the Board.

Finally, in August 2001, the Vermont Natural Resource Council (VNRC) submitted 65 signatures of people from the White River Basin who support designating the mainstem as an ORW for *water quality as well as recreation.*

The limitation on the amount of gravel that a landowner can remove may be the strongest point of opposition in the basin to an ORW designation. During the basin planning process, the communities in the basin have expressed support for using graveling as a river management tool as well as a source of material for town roads. Although state regulations already limit the extent of these activities without the ORW designation, further limitations may be opposed.

If limitations on the removal of gravel can be accepted by the community in the basin, the ORW petition would be an effective way for a community to develop increased awareness of local rivers and to protect them based on the community's values. To gain the designation, the petition must show that a river has one or more of the fourteen characteristics listed in 10 V.S.A. §1424a.d.1-14 (see Appendix J). The characteristics described are not technical in nature and a community has the choice to come to agreement on any one or more of the fourteen. Local river interest groups and towns have worked with the Agency to develop successful petitions to designate the following four rivers ORWs: Great Falls of the Ompompanoosuc River, the lower Poultney River, the North Branch of Ball Mountain Brook – Pike's Falls, and the Battenkill.

6.5 Recommendations for Further Action

When the public develops proposals for the management of waters in their community, their awareness of the benefits of water quality increases. This increased awareness can lead to the protection of uses and values outside of the State regulatory process.

River studies and the inventory of river uses and values completed through local public involvement may create awareness and cooperation among a broad spectrum of environmental and economic interests. This in turn may build consensus about river values in town conservation and development plans or simply increase the level of stewardship that people use on their own lands.

OBJECTIVE
Encourage community involvement in identifying existing uses, Outstanding Resource Waters and proposing new typing and classification for waters in their community

STRATEGIES

57 Provide technical assistance and information to community-led efforts to develop inventories of natural communities, recreational opportunities, other beneficial values and uses of surface waters.

Lead Agency/Organization: DEC
Partners: Communities, RPC
Potential Funding Source: State and federal programs
Time-frame: Ongoing
Benchmark: Participation of technical staff in community-led effort to develop resource inventories

58 Provide technical assistance and information to community-led efforts to petition for revised water quality management types or classifications. Assistance shall include arranging for input from town governments.

Lead Agency/Organization: DEC
Partners: Town government, RPC
Potential Funding Source: state and federal programs
Time-frame: Ongoing
Benchmark: Participation of technical staff in community-led effort to revise water quality management types or classification

59 Provide technical assistance and information to community-led efforts to develop a proposal for Outstanding Resource Waters designation of any surface water in the White River Basin. Assistance shall include arranging for review by town governments and regional planning commissions for possible effects on landuse.

Lead Agency/Organization: DEC, Watershed Coordinator
Partners: RPC
Potential Funding Source: state and federal programs
Time-frame: Ongoing
Benchmark: Participation of technical staff in community-led efforts to petition for an ORW designation of a surface water

Chapter 7. 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 strategies in the plan are located in Chapters 4, 5, and 6. Chapter 4 describes strategies that address surface water concerns of the local community. Chapter 5 includes strategies to improve specific waters that are impaired or in need of further assessment. Chapter 6 describes strategies to include the community in the development of management goals for surface waters.

The strategies are not directives, but suggested actions that will further the goals and objectives identified by the community and resource agencies. The strategies include a list of potential key players and funding sources that have already expressed interest in implementing the strategy or agree with the goals and objectives in the 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 ensure progress. The Department of Environmental Conservation will facilitate the implementation process for some strategies by setting up meetings and seeking out technical and financial resources. For other strategies, implementation will require the distribution of the plan to community groups to use as a resource.

Implementation of the plan will be based in part on the achievements of benchmarks described in each of the strategies. Where the Agency is involved or where it has received notification from other groups, DEC will document the achievement of benchmarks or progress towards the benchmarks' completion.

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. In the White River Basin, the basin planning process built upon the network that the White River Partnership had already developed. 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 for the White Rive Basin will begin with the existing partnerships intact.

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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.

Acceptable 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 Basin.

Best Management Practices (BMP) - a practice or combination of practices that may be necessary, in addition to any applicable Accepted Agricultural or Silvicultural Practices, to prevent or reduce pollution from nonpoint 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. BMPs 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 the Vermont Water Quality Standards.

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

Impaired water - a water that has documentation and data to show a violation of one or more criteria in the Vermont Water Quality Standards for the water's class or management type.

Improved Barnyards - a series of practices to manage and protect the area around the barn, which is frequently and intensively used by people, animals, or vehicles, by controlling runoff to

prevent erosion and maintain or improve water quality. Practices may include: heavy use area protection, access roads, animal trails and walkways, roof runoff management, and others.

Mesotrophic – An intermediate level of nutrient availability and biological productivity in an aquatic ecosystem.

Natural condition - the condition representing chemical, physical, and biological characters that occur naturally with only minimal effects from human influences.

Nonpoint 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 native or natural vegetation growing adjacent to lakes, 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."

Waste Management System -a planned system in which all necessary components are installed for managing liquid and solid waste, including runoff from concentrated waste areas and silage leachate, in a manner that does not degrade air, soil, or water resources. The purpose of the system is to manage waste in rural areas in a manner that prevents or minimizes degradation of air, soil, and water resources and protects public health and safety. Such systems are planned to

preclude discharge of pollutants to surface or ground water and to recycle waste through soil and plants to the fullest extent practicable.

Water Quality Standards - the minimum or maximum limits specified for certain water quality parameters at specific locations for the purpose of managing waters to support their designated 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 waterbody (river, stream, lake pond or wetland).

List of Acronyms

AAP	Accepted Agricultural Practice
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
CRJC	Connecticut River Joint Commissions
CWA	Federal Clean Water Act
DAFM	Vermont Department of Agriculture, Food & Markets
DEC	Vermont Department of Environmental Conservation
Department	Vermont Department of Environmental Conservation
DFPR	Vermont Department of Forest, Parks and Recreation
DOH	Vermont Department of Health
EPA, USEPA	United States Environmental Protection Agency
FWD	Vermont Department of Fish and Wildlife
GIS	Geographic Information System
GMNF	Green Mountain National Forest
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
RN	River Network
TMDL	Total Maximum Daily Load
UVLSRPC	Upper Valley Lake Sunapee Regional Planning Commission
USACOE	United States Army Corp of Engineers
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VTrans	Vermont Agency of Transportation
VYCC	Vermont Youth Conservation Corp
WRP	White River Partnership
WWTF	Wastewater Treatment Facility

Statutory Index

Federal and State law and regulation call for the review of specific topics in each basin plan. The following is a listing of basin planning requirements that have been extracted from the Vermont Water Quality Standards (WQS), the Federal Register and the Department of Agriculture, Food and Markets' (DAF&M) Accepted Agricultural Practice Regulations (Effective June 29, 1995), their Best Management Practice Regulation (Effective January 27, 1996), and the Memorandum of Understanding between the ANR and the DAF&M. The requirements below are addressed in this basin plan in the section noted in bold adjacent to each requirement.

The Vermont Water Quality Standards

1. Basin plans inventory the existing and potential causes and sources of pollution that may impair the waters. **Chapter 5**

2. Basin plans establish a strategy to improve or restore waters. **Chapter 4, 5 and 6**

3. ....shall seek public participation to identify and inventory problems, solutions, high quality waters, existing uses, other water uses, and significant resources of high public interest. **Appendix A**

4. ....shall consider approved municipal and regional plans adopted under 24 V.S.A. Chapter 117. **Appendix K**

5. ....shall coordinate and cooperate with the Commissioner of DAF&M, as provided for in 6 V.S.A. Chapter 215. **Section 5.1 and 5.2**

6. ....shall identify strategies, where necessary, by which to allocate levels of pollution between various sources as well as between individual discharges. **Section 5.1, 5.2 and 5.3**

7.....should, to extent possible, contain specific recommendations by the secretary that include, but are not limited to the identification of all known:

12 existing uses **Section 6.3**
13 salmonoid spawning or nursery areas important to the establishment or maintenance of such fisheries **Appendix F**
14 reference conditions appropriate for specific waters **Appendix G**
15 any recommended changes in classification and designation of waters **Section 6.1**
16 schedules and funding for remediation **Strategies in Chapter 4 and 5**
17 stormwater management **Appendix B**
18 riparian zone management **Strategies under Section 4.1**
19 other measures or strategies pertaining to the enhancement and maintenance of the quality of waters within the basin. **Strategies in Chapter 4, 5 and 6**

8. In basins that include class B waters which have not been allocated into one or more Water Management Type or Types pursuant to Section 3-06 of the WQS, the basin plan

.....shall propose the appropriate Water Management Type or Types based on both the existing water quality and reasonably attainable and desired water quality management goals. **Section 6.1**

40 CFR, Section 130.6

9. Water Quality Management (WQM) plans....consist of initial plans produced in accordance with sections 208 and 303e of the Clean Water Act (CWA) and certified and approved updates of those plans.

10. State water quality planning should focus annually on priority issues and geographic areas and on the development of water quality controls leading to implementation measures. **Chapter 4 and 5**

11. WQM plans are used to direct implementation. **Strategies in Chapter 4, 5 and 6**

12. WQM plans draw upon the water quality assessments to identify priority point and nonpoint water quality problems, consider alternative solutions and recommend control measures, including the financial and institutional measures necessary for implementing recommended solutions. **Strategies in Chapter 5**

13. State annual work programs shall be based upon the priority issues identified in the State WQM plan. **Strategies in Chapter 4, 5 and 6**

14. The following plan elements shall be included in the WQM plan or referenced as part of the WQM plan if contained in separate documents when they are needed to address water quality problems:

(1) Total maximum daily loads. **Strategies in Chapter 5**

(2) Effluent limitations - including water quality based effluent limitations and schedules of compliance. **Effluent Limitations and Point Source Control Programs in Appendix B**

(3) Identification of anticipated municipal and industrial waste treatment works, including

(a) facilities for treatment of stormwater-induced combined sewer outfalls;

(b) programs to provide necessary financial arrangements for such works;

(c) establishment of construction priorities and schedules for initiation and completion of such treatment works. **Appendix B**

(4) Nonpoint source management and control

(a) describe the regulatory and non-regulatory programs, activities and best management practices (BMPs). (Economic, institutional and technical factors shall be considered....)..... BMPs shall be identified for the nonpoint sources identified in Section 208(b)(2)(F)-(K) of the CWA and other nonpoint sources as follows:

(i) Residual waste

(ii) Land disposal

(iii) Agricultural and silvicultural

(iv) Mines
(v) Construction
(vi) Urban stormwater **Appendix B**

The nonpoint source plan elements outlined in #14 above shall be the basis of water quality activities implemented through agreements or memoranda of understanding between EPA and other departments, agencies or instrumentalities of the United States in accordance with section 304(k) of the CWA.

(5) Identification of management agencies necessary to carry out the plan and provisions for adequate authority for intergovernmental cooperation..... **Strategies in Chapter 4, 5 and 6**

(6) Identification of implementation measures necessary to carry our the plan, including financing, time needed to carry out the plan, and the social, economic and environmental impact of carrying out the plan in accordance with 208(b)(2)(E). **Strategies in Chapter 4, 5 and 6**

(7) Identification and development of programs for the control of dredge or fill material in accordance with section 208(b)(4)(B) of the CWA. **Appendix B**

(8) Identification of any relationship to applicable basin plans developed under section 209 of the CWA. **This is the basin plan**

(9) Identification and development of programs for control of groundwater pollution including the provisions of section 208(b)(2)(K) of the CWA. States are not required to develop groundwater WQM plan elements beyond the requirements of section 208(b)(2)(K) of the CWA, but may develop a groundwater plan element if they determine it is necessary to address a groundwater (water) quality problem [see section 130.6(c)(9) for specifics of the groundwater plan element]. **Appendix B**

Title 6, Ch. 215, Agricultural Nonpoint Sources Pollution Reduction Program and Memorandum of Understanding Between the ANR and DAF&M

15. The Commissioner of DAF&M shall cooperate with the Secretary of ANR in the basin planning process with regard to the agricultural nonpoint source waste components of each basin plan. **Strategies in Chapter 5**

16. Any person with an interest in the agricultural nonpoint source component of the basin planning process may petition the Commissioner (DAF&M) to require, and the Commissioner may require, BMPs in the individual basin beyond accepted agricultural practices (AAPs) adopted by rule, in order to achieve compliance with the water quality goals in section 1250 of Title 10 and any duly adopted basin plan. **Part of process and not basin plan**

17. The Secretary shall retain State and federally mandated responsibilities related to basin planning, water quality management planning and the wasteload allocation process except that the Secretary shall coordinate with the Commissioner DAF&M about those aspects of basin planning and water quality management planning which relate to the agricultural NPS component of each plan. **Strategies in Chapter 5**

18. The Secretary shall be responsible for determining the extent to which designated water uses and water quality standards are supported or impaired and for determining the causes and sources of water quality problems. The Commissioner DAF&M may assist the Secretary with these determinations. **Chapter 3 and 5**

19. The Commissioner DAF&M shall cooperate with the Secretary in basin/water quality management planning processes by preparing appropriate sections of each plan that relate to the implementation of controls and programs affecting agricultural NPS wastes and runoff. **Appendix B and Strategies in Chapter 5**

20. The wasteload allocation process results in the allocation of a river's limited assimilative capacity to receive discharges from point and nonpoint sources. The Commissioner DEC shall be responsible for the designation of wasteload allocations within specific river basins or watersheds. The Commissioner DEC shall coordinate with the Commissioner DAF&M when making determinations regarding the magnitude of any wasteload allocation dedicated to pollution from agriculture nonpoint sources. **Strategies in Chapter 5**

21. The Commissioner DAF&M shall follow the priorities identified in the most recent version of the Vermont State Clean Water Strategy, which describes the nature, location and extent of agricultural NPS pollution and the prioritization of river basins or waterbodies for further action. **The Vermont State Clean Water Strategy was developed in 1993. This Basin Plan supercedes the Vermont State Clean Water Strategy for the White River Basin.**

22. The Commissioner DAF&M, in collaboration with the Commissioner DEC, shall conduct evaluations to determine to what extent and which land treatment measures, including BMPs, are necessary in each basin to achieve water quality standards. **Strategies in Chapter 5**

23. The Commissioner DAF&M shall cooperate with the Commissioner DEC and shall be responsible for preparing descriptions of agricultural NPS programs and practices for the biennial water quality assessment report required by Section 305(b) of the federal Clean Water Act (and for the report required under Title 10 V.S.A. Chapter 47). **Not applicable to basin planning**

24. The Commissioner DEC shall retain the responsibility for evaluating the effectiveness of agricultural NPS control programs in attaining water quality standards. Such evaluations will be based on all available information with an emphasis on water quality monitoring data. The Commissioner DAF&M shall be responsible for determining the effectiveness of land use practices to reduce the release of agricultural pollutants and for compatibility with sound agricultural practices. **Strategies in Chapter 5**