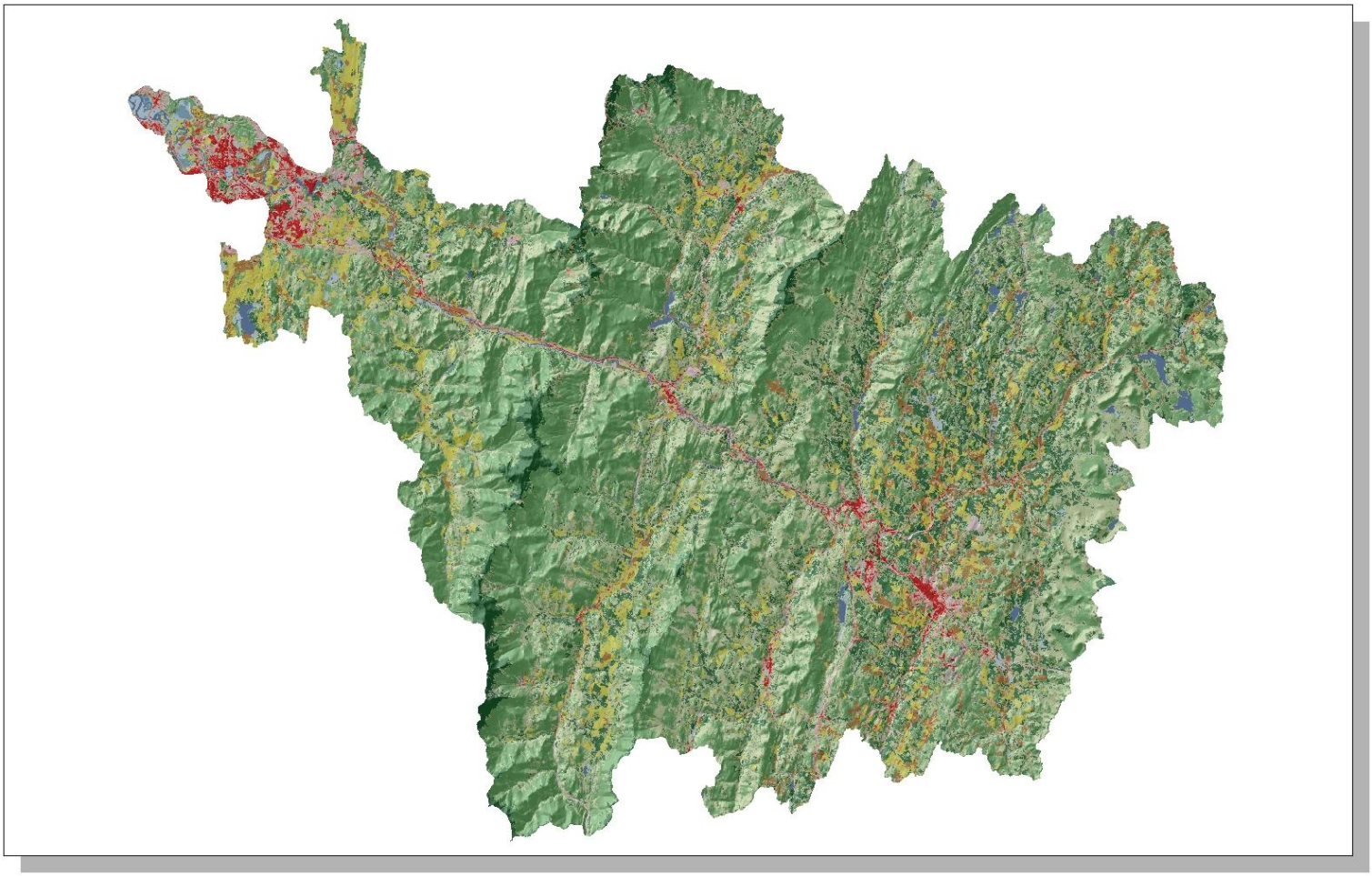
Vermont Agency of Natural Resources

Winooski River Basin
Water Quality Management Plan



MAY 2012

Vermont Surface Water Management Strategy

THE WATER QUALITY PLAN FOR THE BASIN 8 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.[1]

Approved:

5/15/12

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VERMONT

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Cover photo: Winooski River Basin Landuse/Landcover, VANR 2011

[1] The revised Water Quality Standards require that all basin plans place Class B waters into one of the three water management types. However, considerable challenges over the past decade have limited ANR's ability to identify proposed management types, and the Panel's ability to promulgate these designations. These challenges are listed in detail in VDEC's 2010 Report to the Vermont General Assembly on Basin Planning. As such, recommendations for water management types are not presented in this basin plan.

Executive Summary

This river basin water quality management plan (plan) provides an overview of the Winooski River Basin's surface waters and a description of ongoing and future steps to restore and protect those waters. With the purpose of improving both water quality and aquatic habitat, this plan presents the recommendations of local watershed residents, stakeholders from varying interests, the Agency of Natural Resources (VANR) and professionals from other State and federal agencies to guide efforts in the basin over the next five years. The plan's central component is the implementation tables in Chapter 3. The tables include the strategies that address existing and potential threats to surface waters in the basin. The tables' strategies are expected to be revised over the life of the plan as new information is obtained.

The Winooski River Basin includes all surface waters that flow into the Winooski River. The Winooski River has its source in the northeast corner of Washington County in the town of Cabot then courses northwesterly for approximately 90 miles before flowing into Lake Champlain just north of Burlington. The extensive network of rivers, streams, lakes, ponds, and wetlands in the Winooski Basin support many uses including swimming, boating and fishing. Impairments and threats to these uses in the basin include: sedimentation, siltation, turbidity, habitat alterations, nutrients, thermal modifications, flow alterations and metals as well as physical instability and river corridor encroachment.

The top ten priority strategies (unranked) in this management plan follow:

1. Implement steps to address the Bacterial TMDL for the Huntington and Mad Rivers and Allen Brook.
2. Complete stormwater system mapping and illicit discharge detection for Plainfield, Marshfield, Cabot, Berlin and Williamstown.
3. Work with the five towns that have not received a Better Backroad Grant to apply for funding to address road- related water quality problems.
4. Identify culvert replacement projects in the basin, including the Mad River watershed, that will improve geomorphic stability of the stream as well as improve fish passage.
5. Promote agricultural programs in targeted areas that incentivize fencing, buffers, grassed waterways, barnyard treatments, conservation tillage practices, and cover cropping.
6. Work with towns to protect river corridors and promote flood resiliency by establishing Fluvial Erosion Hazard zones and buffer zones in local zoning.
7. Identify wetlands on agricultural lands for phosphorus retention, and in the river corridor for sediment attenuation, prioritize and conserve and/or restore.
8. Hold an annual Vermont Invasive Patrollers (VIP) training to support the establishment of VIP programs for lakes and ponds in the basin.
9. Encourage use of rivers and lakes in the basin to increase people's appreciation.
10. Assist towns to address aging wastewater treatment facilities and associated sewer pipes through the Clean Water Act Revolving State Funds and other funding programs.

Preface The Importance of Basin Planning in the Face of Tropical Storm Irene

Tropical storm Irene dumped up to 7 inches of rain on the narrow river valleys of the Winooski River Basin (Basin 8). A wet August had already saturated soils and runoff quickly filled river channels beyond their recognized floodplains. With a newly acquired energy, rivers and brooks, ripped out roads, bridges, culverts and buildings. The flooding continued down the Winooski River to Lake Champlain, deluging villages and destroying crops.

Bur Irene was not the only weather story of 2011. In the spring, rain and melting snow filled streams, albeit at a slower pace, raising Lake Champlain to record levels, and causing damage to shoreline houses and roads. The early spring storms and Tropical Storm Irene also led to the erosion of river channels as well as the erosion of land, sending plumes of phosphorus-laden sediment into lakes. Over just one week in the spring, the Winooski River deposited 77 metric tons of phosphorus into Lake Champlain, half of the river's typical annual load.

Vermonters can expect to see the intensity and extensiveness of these storms repeated in the future with greater frequency as climate warms. In most cases, the challenges posed by climate change are not new, only expected to intensify. To response to these predictions, the Agency of Natural Resources' (Agency) efforts must include water resource management strategies that address increased precipitation. As storms intensify, runoff will increase, making efforts to decrease or absorb runoff imperative. Both the Basin 8 plan and the Vermont Surface Water Management Strategy are relevant to the challenges ahead as they provide opportunities for reducing stormwater runoff as well as encouraging the protection of the natural landscape that absorbs rainfall.

In the face of the destruction wrought by Irene, the Agency must also assist communities in rebuilding to reduce damages from the next storm. Development and implementation of flood hazard identification and mitigation plans are part of the solution. The Basin 8 plan supports efforts by the Agency and other partners to assist communities in producing robust plans that reduce conflicts with rivers and improve infrastructure to be able to handle greater flows.

To paraphrase Barry Cahoon, an Agency stream alteration engineer: We cannot isolate ourselves from rivers, confine rivers to where we perceive they are "supposed to be, belong, or always were", or ignore the message we have been given that the rivers often need the space we have chosen to take away from them. With all that we have invested over generations, in our homes, our commerce, and our public infrastructure, we have created tremendous conflict with the physical imperatives of rivers when rivers are energized by storm events, now of increasing frequency and magnitude. Some strategic separation and confinement of these incredibly powerful and dynamic natural systems is needed to protect these investments, but this work must be done in a way that embraces an informed recognition and implementation of fluvial conflict reduction options for the benefit of this and future generations, and the rivers themselves.

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Chapter 1 – Introduction

Purpose of the Basin Plan and the Basin Planning Process

The Winooski River Basin water quality management plan describes strategies to restore and protect the values and beneficial uses of surface waters in the Basin, such as swimming, boating and aquatic habitat. The Basin's surface waters include the rivers, streams, ponds and wetlands that drain into the Winooski River, as well as the river itself.

The majority of strategies identified in this plan are the result of a basin planning process that sought community involvement to identify and build upon existing interest and resources in the Basin to protect and improve water quality. The remaining strategies describe the Agency of Natural Resources' (VANR) existing programs and efforts to have all surface waters meet the Vermont Water Quality Standards (VWQS)[2]. In addition to guiding the VANR in its work, these strategies will also assist individuals and groups in identifying resources and opportunities to address water quality issues. The VANR and others began implementing strategies during the basin planning process and will continue implementation until the planning process begins again in five years.

Planning at the Watershed Level

A watershed is a distinct land area that drains into a particular waterbody through either channelized flow or surface runoff. Preparing a plan at a watershed level allows for the consideration of all contributing sources of runoff to the surface waters.

The VANR has conducted water quality assessment and improvement efforts at a watershed level since the 1970s. The state is divided into 17 planning basins for this purpose, with each basin including one or more major river watersheds (Figure 1). The VANR is responsible for preparing river basin water quality management plans for each of the 17 basins and updating them every five years.

In 2010, the VANR developed the Vermont *Statewide Surface Water Management Strategy*,[3] (VSWMS) and will be using the process laid out therein to streamline forthcoming basin plans into "tactical basin plans." The VANR initiated the Winooski River Basin planning process before completing the VSWMS; therefore, this plan will take on attributes of both the old and new basin planning formats. Like the older plans, the majority of strategies address a specific activity that occurs across the landscape or in one specific area and are therefore organized in this plan by land use or land cover. The revision of the plan in five years will use the new

[2] Vermont Water Resources Board, 2011. *Vermont Water Quality Standards*. Montpelier, VT.
[3] http://dec.vermont.gov/watershed/map/strategy.

approach, tactical planning, to focus efforts on remediating specific water bodies identified as stressed, altered or impaired, while promoting protection activities for specific waters that either promote stream equilibrium or maintain certain high quality characteristics.

This plan does take advantage of the web-based VSWMS by providing links to the VSWMS sections. The information includes descriptions of surface water stressors and resulting pollutants, as well as tools for addressing the stressors including monitoring and assessment, technical assistance, regulatory, funding, and educational programs. The resulting Winooski River Basin plan's predominant focus is the implementation of strategies, leaving the background information accessible to interested reader through the VSWMS.

Plan Development as a Collaborative Process

Vermont's water quality problems are predominantly from nonpoint source pollution, the result of runoff from many dispersed activities on the land, such as transportation, cropping, and lawn care and landscaping. Reducing the load of pollutants from these activities requires the participation of many different sectors of the community, each composed of numerous parties. Basin planning, therefore, benefits from a collaborative process with the communities in the basin, local, state, and federal governments, private organizations and individuals, each committing, through the process to contribute to the solution.

As many as 65 volunteer-based groups in the state participate in collaborative efforts with members of their community and resource agencies to improve water quality within their own watersheds. The VANR's basin planning process helps advance existing efforts within the community as well as its own efforts by documenting community-voiced problems and solutions, facilitating the exchange of information among resource agencies, groups, and individual citizens, and finally, directing existing resources towards the priorities of active groups and landowners within the communities. Opening the basin planning process to the entire community also serves to increase public awareness of opportunities to promote and preserve water quality in the basin.

Watershed Council and Watershed Plan Development

In early 2008, the VANR sent out an open invitation to the communities within the watershed to participate in the development of this plan. The community members that came together as a watershed council represented a diverse mix of stakeholders from within the watershed. They included farmers, foresters, business owners, municipal officials, anglers, local watershed and lakeshore organizations, environmental groups, teachers, and regional planners (Appendix A). The Department of Environmental Conservation (VDEC) watershed coordinator and the watershed council went through the following steps:

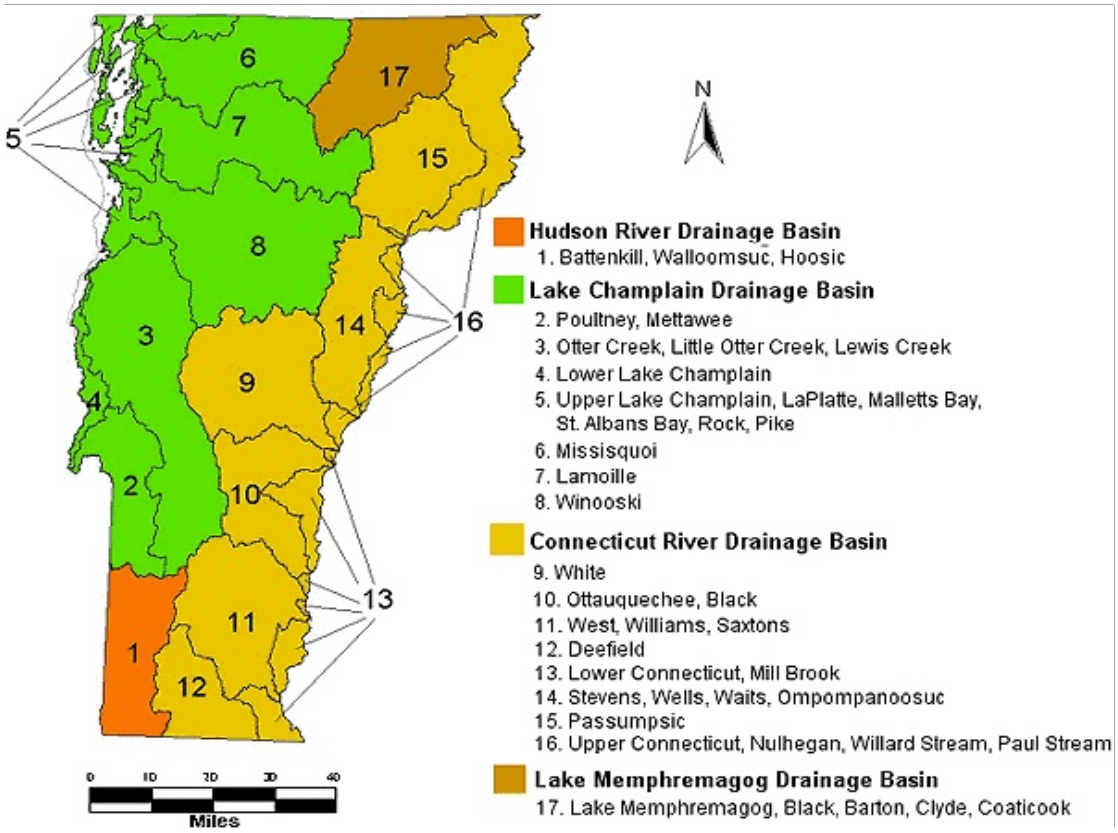

Figure 1 Major Planning Basins in Vermont

- Issue identification
- Issue prioritization
- Strategy and solution development; and
- Identification of resources and funding

Council membership and meeting attendance were continually open to the public (see Appendix B for a list of meetings held). Technical advisors provided the council and watershed coordinator with information necessary to develop strategies to be included within the watershed plan. The watershed council was integral in the development of this document. Each of the council members took on a variety of roles including:

- Encouraging constituents' participation and conducting outreach and education to inform constituents about known watershed issues;
- Developing and conducting watershed forums to identify water resources issues, related community needs, and potential solutions;

- Identifying immediate or ongoing water quality improvement projects to be undertaken during the planning process;
- Guiding the plan through review, revision, and approval process.

Progress Reporting

The key component to the plan is the implementation table that identifies specific strategies, key partners and potential funding sources. This table is a working document that will evolve over the 5-year span of this planning document. As strategies are completed, updates will be added to the table with the status of the strategy as an ongoing report card of work completed. The implementation table for the Winooski River Basin Plan will be available online sometime during 2012.

On an annual basis, the VDEC and key watershed and statewide partner organizations will meet to address the accomplishments made toward achieving the basin plan goals. They will also ensure efforts are moving forward and identify and address any obstacles that may prevent implementation. In addition, as the process continues and new information is made available strategies may be added, modified or targeted more specifically to areas of the basin where they will have greater impact. This review process will keep partners engaged and allow for accountability in achieving the goals laid out in this basin plan.

Chapter 2 – Introduction to Basin 8 Water Quality Conditions and Goals

Basin Description

The Winooski River begins in Cabot, a town in the northeast corner of Washington County, and then courses northwesterly for approximately 90 miles before flowing into Lake Champlain just north of Burlington. Its drainage area of about 1,080 square miles covers 11.9 percent of Vermont. The basin occupies all of Washington County, a little less than half of Chittenden County and small parts of Lamoille and Orange Counties.

The Winooski River has seven important tributaries. Three of the tributaries enter from the north: the Little River joining below the village of Waterbury; the North Branch joining at the city of Montpelier; and Kingsbury Branch joining in East Montpelier. The four remaining tributaries flow from the south: the Huntington River coming in at the village of Jonesville; the Mad River, joining in Middlesex; the Dog River entering just west of the city of Montpelier and the Stevens Branch entering just north of Montpelier.

In addition, 55 State- inventoried lakes and ponds are scattered throughout the basin with a concentration in the Calais, East Montpelier and Woodbury area.

Almost three quarters of the watershed benefits from forest and wetland cover, most of it located in the higher elevations or upper half of the watershed (Table 1). The agricultural and urban (developed land and roads) land use comprise only 12% and 9% of the landscape respectively, a distant second and third. Agriculture is predominantly concentrated along the wide flood plains of the main stem and narrower valleys of its tributaries. The developed or urban areas are concentrated in Chittenden County, but also include small cities and towns located adjacent to the main stem and tributaries. A small percentage of the developed land includes four ski areas and resorts on the slopes of the Green Mountains. The water quality problems identified in the basin later in this chapter tend to be associated with decreasing amounts of natural landcover.

A more detailed description of the basin along with its water-based resources is contained in VDEC's Basin 8 - Winooski River Watershed Water Quality and Aquatic Habitat Assessment Report, date April 28, 2008[4].

[4] https://anrweb.vt.gov/PubDocs/DEC/WSMD/Mapp/Docs/mp_basin8.assessment_report.pdf

Table 1. Land Use and Land Cover for the Winooski River Watershed1

Land Use	Acres	% of Total
Forested	492,480.9	72.4
Agriculture	78,841.9	11.6
Surface Water	33,544.8	4.9
Transportation	32,004.1	4.7
Developed Land[2]	30,021.6	4.4
Wetlands	12,451.7	1.8
Old Field & Barren	1,036.6	0.2
Total:	680,381.6	100.0

1 Vermont Land Cover Classification Project, 1997 (based on satellite photographs from 1991 - 1993).

2 Developed land = residential, commercial, industrial but not transportation, which is listed separately

Water Quality Goals

The VDEC's Watershed Management Division (Division) is responsible for maintaining or improving water quality in surface waters in accordance with the Vermont Water Quality Standards (VWQS)[5]. The Division has three goals related to surface water management:

- Protect, maintain, enhance and restore the Biological, Chemical, and Physical Integrity of all Surface Water
- Support the Public Use and Enjoyment of Water Resources
- Protect the Public Health and Safety

Four objectives support these goals:

Objective A. Minimize Anthropogenic Nutrient and Organic Pollution

Objective B. Protect and Restore Aquatic and Riparian Habitat

Objective C. Minimize Flood and Fluvial Erosion Hazards

Objective D. Minimize Toxic and Pathogenic Pollution, and Chemicals of Emerging Concern

Ten environmental stressors have been identified as threats to water quality in Vermont, requiring that the Division move to address them to achieve the above goals and objectives. Table 2 lists the environmental stressors and provides links to a description of each. Generally, stressors emerge from an activity on the landscape; result in the release of a pollutant, flooding

5 http://dec.vermont.gov/sites/dec/files/documents/WSMD_WaterQualityStandards_2014.pdf

hazard or destruction of aquatic and riparian habitat and overall impact to one of the above goals (Fig. 3) The Division identities the pollutants released by the stressors in assessing threats to goals and objectives. Descriptions of the pollutants of concern in this basin (listed on the top row of Table 2), as well as the relevant sections on each major landuse activity and their influence on water quality are described in the VSWMS.

Table 2. Pollutants or physical alterations present in Basin 8 (VDEC 2008) and associated stressors.

Basin 8 Pollutants / Statewide Stressors	Sedimentation	Other habitat alterations	Nutrients	Flow Altera-tions	Thermal modification	Metals	Turbidity	AIS	Pathogens	Acidity
Acidity										X
Channel Erosion	X		X	X	X		X			
Flow Alteration	X		X	X	X		X			
Encroachment	X	X	X		X		X			
Invasive Species								X		
Land Erosion	X		X			X	X			
Nutrient Loading			X				X			
Pathogens									X	
Toxics						X				
Thermal Stress					X					

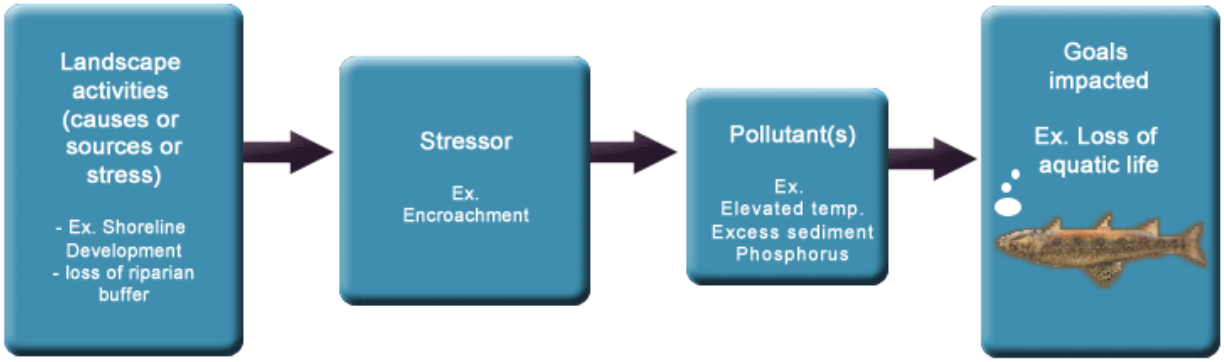

Figure 2. An example of the cascading effects of landscape-level activities that result in stressors and subsequent release of pollutants.

Assessing Water Quality in Surface Waters

In most cases, the Watershed Management Division assesses the health of a water body using biological, chemical and physical criteria and then identifies the source of any impairment. The Division pulls together all readily available information during the development of each basin's Water Quality and Aquatic Habitat Assessment Report and also biennially when the statewide 303(d) List of Impaired Waters and List of Priority Surface Waters Outside the Scope of 303(d) are generated. Chapter 3 includes the lists (Tables 6-9) as well as an explanation of the purpose and use of the lists. Both documents provide a basis for the development of strategies in the plan. In addition to identifying the source of the problem, the documents list the responsible pollutant and/ or physical alterations[6] to aquatic and riparian habitat as well as information about the source if known. Most of the water quality problems stem from a land use activity that results in a release of pollutants carried to surface water by runoff. In some cases, the source is poor management of the waterbody itself or an improperly managed discharge of wastewater or leachate from former dump sites for hazardous or even household waste.

A summary from the VANR Winooski River Basin Water Quality and Aquatic Habitat Assessment Report[7] of overall problems in the basin for rivers and streams as well as for lakes and ponds follows.

[6] Definition of these pollutants can be found in VSWMS http://dec.vermont.gov/sites/dec/files/documents/WSMD_swms_B_Pollutants_Final_V2.pdf.

[7] http://dec.vermont.gov/sites/dec/files/documents/WSMD_mp_basin8.assessmntrpt_Apr2008.pdf

Rivers, streams and wetlands

Based on river miles, sediment and nutrients are the most prevalent pollutants in streams and rivers except at high elevations (Table 3). Physical alterations are also a problem throughout the lower reaches of the watershed, including habitat alteration, general stream channel instability and encroachment into the flood hazard zone. The Winooski River Basin includes a number of hazardous waste sites and old landfills that release heavy metals and other toxic compound, resulting in the impairment or stress of 3.3 miles of stream. More isolated problems specific to particular reaches[8] include, thermal modification, acidity, pathogens and flow alteration. Table 4 includes the hydroelectric facilities located on rivers in Basin 8. The operation of the facilities results in some degree of alteration of flows; however, only the facilities noted on the 2010 List Of Priority Surface Waters Outside The Scope Of Clean Water Act § 303(D) Part F (see Table 9) are responsible for an impairment to the river segment used by the facility. VANR strategies to work with operators to meet VWQS are listed in Table 9.

Table 3. The pollutants and physical alterations that cause impairments, alterations, and stresses and miles of streams impacted in the Winooski watershed.

	Degree of Impact (in miles)		
Cause of Impact or Threat[9]	Impaired/Altered	Stressed	Total miles affected
Sedimentation/siltation	28.7	122.4	151.1
Other habitat alterations	34.6	114.9	149.5
Nutrients	2.3	79.9	82.2
Flow alterations	31.7	21.2	52.9
Temperature	3.0	47.5	50.5
Metals	14.5	21.5	36.0
Turbidity	2.0	28.0	30.0
Pathogens	11.3	7.7	19.0

Table 4. Hydroelectric dams in the Winooski River Basin.

Owner	**Project Name**	**Stream**	**On Part F[10]**
Green Mountain Power	Bolton Falls No. 1	Winooski River	No
Winooski One Partnership	Chace Mill	Winooski River	No
Nantana Mill Dam Partnership	Dog River	Dog River	No
Green Mountain Power	Essex No. 19	Winooski River	No
Green Mountain Power	Gorge No. 18	Winooski River	Yes
Kingsbury Branch Hydroelectric Co., LLC	Kingsbury	Kingsbury Branch	No
Worcester Hydro Co.	Ladds Mill	North Branch Winooski River	No
Green Mountain Power	Middlesex No. 2	Winooski River	Yes

[8] The waters and associated problems are listed in the EPA and state lists (see Table 6-9)

[9] To a lesser degree, acidity and pathogens are a problem and will be addressed by waterbody.

[10] 2010 List Of Priority Surface Waters Outside The Scope Of Clean Water Act § 303(D) Part F – Flow Altered Waters. See Table 9.

Green Mountain Power	Marshfield No. 6	Sucker Brook	Yes
Green Mountain Power	Marshfield No. 6	Mollys Brook	Yes
Algonquin Power Systems, Inc.	Moretown No. 8	Mad River	No
Washington Electric Cooperative	North Branch No. 3	North Branch Winooski River	No
Green Mountain Power	Little River No. 22	Little River	Yes
Winooski Hydroelectric Co.	Winooski 8	Winooski River	No
Moscow Mills, Inc.	Leveille	Little River	No

In addition, monitoring work by the Watershed Management Division has also identified rivers that exceed Vermont Water Quality Standards. Limited biological sampling of rivers in mostly forested watersheds in the basin has identified sites with notably very high water quality, including Stevenson and Ranch Brook in Stowe, Dowsville Brook in Duxbury, the Shepard Brook in Fayston and the Sunny Brook in Northfield. Miles of streams, especially in the upper Winooski, support healthy trout populations, indicating a healthy ecosystem over much of the basin (Appendix C lists locations).

Lakes and ponds

All lakes and ponds in the basin are stressed due to limits on the number of meals or size of meals consumed for one or more fish species due to elevated levels of mercury in fish tissues (Table 5). In many, development of shorelines and alteration of flows (e.g., water level fluctuations) have reduced the quality of the aquatic habitat. Additional problems in lakes and ponds in the basin include sedimentation, increased eutrophication due to nutrient loading and acidity. Aquatic invasive species (AIS) are present in a minority of the lakes and streams, but the potential for introduction of AIS into waters is high throughout the basin. VDEC's on-line Lake Score Card [11] summarizes the available information for specific lakes over four different categories: water quality, habitat, AIS and atmospheric pollution (Figure 3). Of the lakes scored to date, water quality is generally good, few are infested with AIS; however, atmospheric pollution is rated as poor based on the elevated mercury in the fish tissue. Only four lakes have had shoreline and lake habitat evaluations.

11 http://dec.vermont.gov/watershed/lakes-ponds/data-maps/scorecard and http://anrmaps.vermont.gov/websites/kml/wq_scorecard/lp_lsc_googleearthlink.kml

Table 5. Causes of impairments, alterations, and stresses to Winooski Basin lakes, in acres, by designated use.

Assessment of Waterbody	Cause of Impact	Aesthetic	Aquatic Biota, Wildlife, and Aquatic Habitat	Boating, Fishing, and Other Recreational Uses	Fish Consumption	Swimming and Other Primary Contact Recreation
Impaired	pH		44			
	Phosphorus	452	452	452		452
	Sedimentation/Siltation	100	100	100		100
Altered	Flow alteration	397	1,136	397		397
Stressed	Myriophyllum spicatum	1,101	649	1,003		1,003
	Flow alteration	190	676	190		
	Mercury in Fish Tissue				4,220	
	Noxious Aquatic Plants - Algae	235	235	682		682
	Noxious Aquatic Plants - Native	78	78	530		530
	Nutrients	328	328	277		323
	Organic Enrichment - DO		543			
	pH		245			
	Phosphorus	328	328	277		323
	Sedimentation/Siltation	822	945	822		822

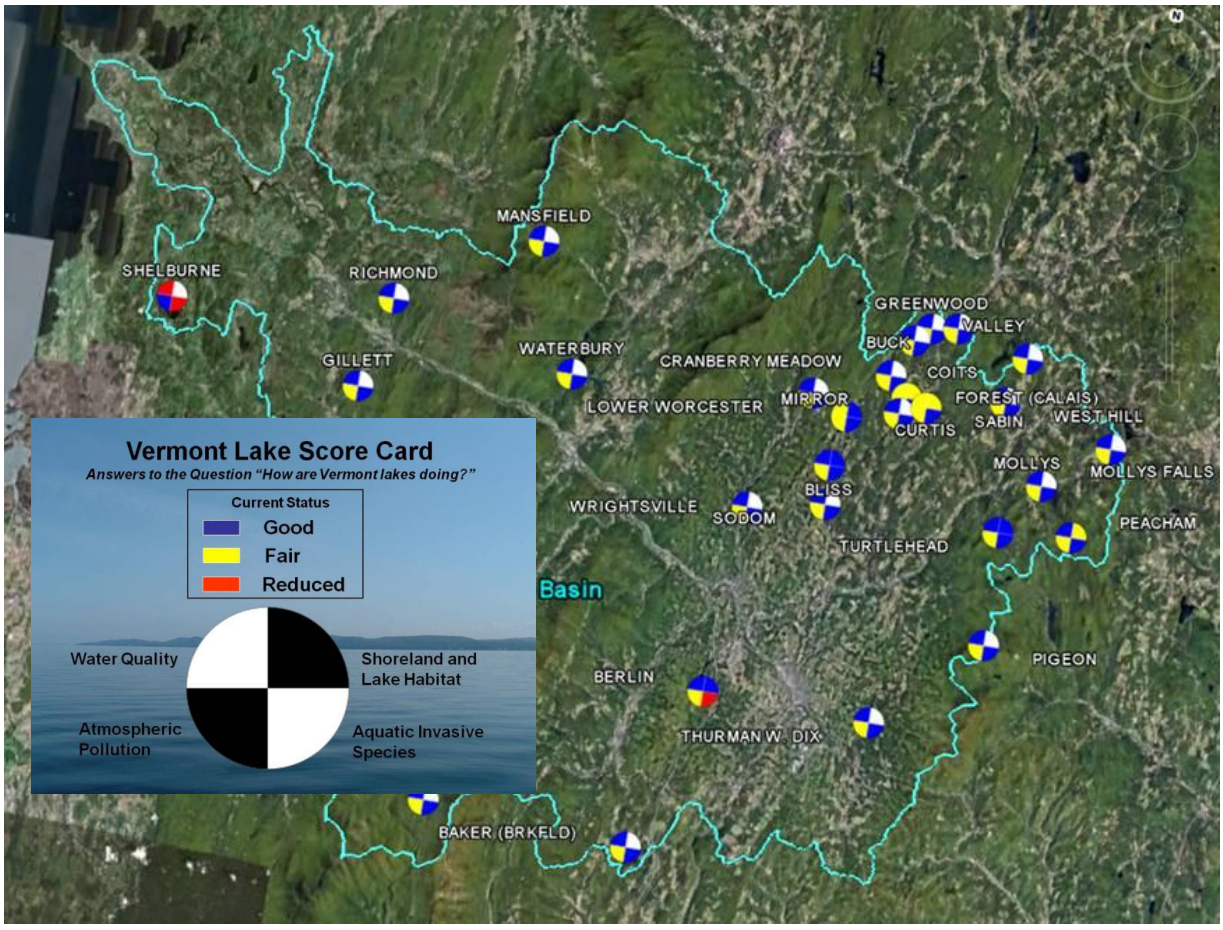

Figure 3. Lake score card for specific Winooski Basin lakes and ponds. Not all lakes or ponds have a score card.

Specific water bodies

Specific waterbodies with impairments and responsible pollutant or physical alterations to aquatic and riparian habitat are listed in 2010 303(d) List of Impaired Waters and List of Priority Surface Waters Outside the Scope of 303(d), see Tables 6-9 in Chapter 3.

Addressing Sources of Pollutants and Physical Alterations to Aquatic and Riparian Habitat

Most pollutants enter surface waters as a point source, a discrete source from a pipe, or as non-point source, carried in precipitation that runs off the landscape (stormwater runoff). The once exception is aquatic invasive species (AIS). Most physical alterations originate from land use activity on or near the waterbody, as well as through point or nonpoint source pollutants. The landuse activities are described in detail in the VSWMS under activities.

Point sources

Point sources are discharges of wastewater and for the most part are managed through VDEC's National Pollutant Discharge Elimination System (NPDES) permitting process. VDEC oversees permitting for pre-treatment and direct discharges of municipal and industrial wastewater treatment facilities and the oversight of concentrated animal feeding operations (CAFOs) (see Appendix D for list). The majority of the pollutant load from point source enters through the direct discharges of municipal wastewater (see Appendix E for an overview of municipal wastewater facilities in the Basin). The permitting process results in discharges that will ensure that receiving waters meet Vermont Water Quality Standards and comply with specific TMDL allocations. To ensure continued compliance, and as part of the tactical planning process, VDEC assesses monitoring results of effluent and receiving waters, and re-evaluates permit conditions during permit renewals every five years.

Nonpoint sources

The quality and volume of runoff is more complicated to control than point sources because effective nonpoint source pollution control requires land management approaches that are in the purview of a multitude of individuals and groups. The Agency regulates some activity on the landscape: VSWMS includes a list of regulatory programs focused on surface water protection (see Tool Kit[12]). The other approach by the Agency is to encourage the unregulated community to adopt practices that protect surface waters. The Agency works with partners to provide grants, technical assistance, education and outreach to help the community better manage stormwater runoff as well as the surface waters themselves. The first section of the next chapter includes strategies for distributing the assistance and ensuring that the community members adopt sustainable behaviors. The strength in the strategies lies in the collaborative approach the agency has taken with other state, federal, non-profit groups and community members to develop and implement the strategies.

[12] [12] http://dec.vermont.gov/sites/dec/files/documents/WSMD_swms_D_Toolbox_Final_V2.pdf

Chapter 3 – Implementation Tables: Addressing water quality problems in the basin

Many of the pollutants or physical alterations listed in Table 2 are a direct result of human activity on the landscape. In this plan, strategies are developed to maintain or achieve high water quality are separated into two sections: the first section categorizes strategies by human activities on the landscape. The categories follow:

A. Land Conversion
B. Stormwater runoff from development
C. Agricultural activities
D. Forestry Management Practices
E. Hydrologic Modification: changes to river flows or water levels
F. River Corridor Encroachment and Channel Erosion
G. Encroachment: wetland buffers, lake shorelands
H. Treated and Untreated Wastewater
I. Transportation infrastructure construction and maintenance
J. Invasive species in aquatic or riparian zones
K. Enhancing the community's environmental ethic

These strategies direct actions towards either specific waterways, watersheds and/or the general activity throughout the basin. Over the next five years, the Agency and partners will implement the strategies, often collaboratively and with the resources listed in Appendix F.

The second section provides strategies for addressing specific waters that appear in the 2010 303(d) List of Impaired Waters and List of Priority Surface Waters Outside the Scope of 303(d) (Tables 6-9) and for the most part, implementation will be overseen by Agency staff. The lists of strategies include:

Strategies for Impaired Waters

Strategies for Waters in Need of Further Assessment

Strategies for Waters altered by Flow Regulation

Strategies for Waters with Channel Alterations

Strategies for Waters with Exotic Species

In addition, the VANR will continue to support programs listed in the VSWMS Tool Kit [13] and will address specific waters with water quality problems as listed in Tables 6-9 as well as stressed and threaten waters listed in the Winooski Basin Water Quality and Aquatic Habitat Assessment Report[14].

Strategies to Address Landscape Activities

The landscape activities are listed below and further described in the VSWMS. VDEC developed the strategies and associated goals and objectives with partners and interested community members during the basin planning process.

The strategies are approaches that can be adopted by interested groups. The Potential Partners include groups and organization that have participated in similar strategies in the past or are interested in participating in a strategy. The list should not be considered all-inclusive and the VANR welcomes the assistance of other groups or individuals in the identification and implementation of strategies.

The funding sources listed (see also Appendix D) are in addition to funds used to support staff of organizations. The exception would be volunteer-based groups that often depend on the listed funding sources to pay staff time to implement a strategy. In addressing these strategies, VANR will work with partners in developing and implementing projects, establishing or continuing monitoring to help better identify source of problems, as well as promoting programs that encourage community members to adopt best management practices.

In each landscape activity section below, the key VANR strategies addressing that activity are listed before the strategies developed during the basin planning process are given. The VANR strategies provide information about how existing programs regulate or manage activities. In addition, a more extensive description of water quality-related state, federal and local programs provided in the VSWMS tool kit. The existing programs and the following strategies comprise the available resources in the Winooski River Basin to improve and protect surface water resources.

[13] http://dec.vermont.gov/sites/dec/files/documents/WSMD_swms_D_Toolbox_Final_V2.pdf
[14] http://dec.vermont.gov/sites/dec/files/documents/WSMD_mp_basin8.assessmntrpt_Apr2008.pdf

A. Land conversion

Goal 1: Preserve forest and farm land to maintain a landscape that protects wildlife and aquatic habitat, water quality and stream equilibrium.

Goal 2: Protect the functions and values of existing wetlands and selectively restore human-altered wetlands.

Summary of VANR's Key Strategies that address land conversion

- Provide technical assistance for managing forests to private landowners through the county foresters.
- Provide financial incentives such as the Use Value Appraisal Program to maintain Vermont's working landscape (agriculture and forestry).
- Encourage restoration of privately owned wetlands through the NRCS Wetland Reserve Program.
- Encourage municipal landuse planning that reduces amount of land developed per unit of housing/commercial development.
- Strategically acquire easements or property in fee.
- Educate the public on the value of forestland, wetlands, and floodplain.

See also Section G. Encroachment for strategies relating to wetland buffers, lake shorelines, and river corridor protection.

The objectives and strategies concerning land conversion developed during the planning process

Objective 1. Coordinate conservation efforts among the watershed's land trusts, watershed groups and conservation organizations.

Objective 2. Encourage stewardship of private land that leads to protection and restoration of natural landscapes.

Objective 3. Assist communities in their efforts to maintain or restore natural landscapes.

Strategy	Potential Partners[15]	Funding[16]
1. Develop criteria for determining priorities with conservation partners in basin. Identify and prioritize important forests, riparian areas and wetlands to protect and conserve based on those criteria.	VFPR, VFWD, VDEC, VRC, other State and federal agencies	
2. Educate landowners about importance of protecting forested landcover and wetland (Vermont's Foresters for the Birds program) and available incentives: e.g., CREP, Current Use/UVA, conservation easements, WRP	VFPR county foresters, NR&CD, NRCD, NRCS, Audubon	USDA, US Forest Service
a. Assist in the promotion of the Friends of the Winooski River "Landowner Assistance Guide"[17]to provide landowners with information about incentives and technical assistance.	FWR, WNRCD, VDEC	
3. Interest communities in protecting land cover that in addition protect water quality also addresses their interest, e.g., trout habitat, water supplies, swimming holes, floodplains, bird habitat. Tools for protection may include establishment of town forests; inclusion of priorities in town plans; zoning for woodland/woodlot, wildlife protection, scenic ridgeline designations; riparian/lake buffer regulations; information about importance of watershed protection practices in VDEC water supply division's letter to towns regarding Source Protection Planning process.	VFPR, VFWD, VDEC, NRCD, Regional Planning Commissions, Land Trusts, VLCT, Town Planning & Conservation Commissions.	319 grants, 604(b) grants, LCBP, Watershed grants.
a. Support the natural resources map project, including development of a map and supporting database identifying the lands and waters in Vermont that support high priority ecosystems, natural communities and habitats and therefore are deserving of conservation and/or restoration.	ANR	See above
b. Using maps and other materials generated from the Forests, Wildlife, and Communities Project in the upper Mad River Watershed, provide technical assistance to planning commissions through build model analysis and planning and zoning strategies to reduce forestland conversion and fragmentation.	ANR, Vermont Natural Resource Council, Mad River Valley Planning District, FMR	See above

[15] See List of Acronyms located at end of section
[16] See Section D for description of potential funding sources
[17] http://winooskiriver.org/Land_Owner_Assistance_Guide

B. Stormwater runoff from development

Goal: Decrease the volume and pollutant load of stormwater runoff from pre and post construction.

Summary of VANR's Key Strategies that Address Stormwater Runoff from Development:

- Issue individual and general permits for construction and post-construction stormwater discharges, municipal stormwater discharges, and stormwater discharges from industrial facilities. Conduct operational site visits to determine compliance.
- Work with responsible parties to develop Water Quality Remediation Plans (WQRPs) for Vermont's five stormwater-impaired mountain watersheds (one exists in Basin 8).
- Implement plans for all twelve of the lowland (non-mountain) TMDLs for stormwater-impaired watersheds (four exist in Basin 8).
- Encourage green infrastructure practices as a stormwater management strategy (Vermont Agency of Natural Resources Green Infrastructure Initiative Strategic Plan 2011 – 2013).
- Control pollution from toxic chemicals and chemicals of emerging concern carried into waterbodies and stormwater ponds via stormwater by reducing the amount of these chemicals in use around the state.

The objectives and strategies concerning stormwater runoff from development developed during the planning process

Objective 1: Support municipal efforts to adopt local stormwater standards and manage stormwater runoff from existing surfaces for projects that fall outside of state jurisdiction.
Objective 2: Encourage individuals and businesses to adopt best management practices that reduce stormwater volume and pollutant load.

Strategy	Potential Partners	Funding
1. Assist in implementation of the Vermont Agency of Natural Resources Green Infrastructure Initiative Strategic Plan 2011 – 2013	VDEC, VFPR, FWR, VLCT, VTrans, WNRCD	ERP, LCBP, 319 grants
2. Assist municipalities in the development and implementation of municipal stormwater management plans as well as overall water quality planning for towns.	CVRPC, FWR, FMR, watershed groups, WMD-VDEC, VTrans, VYCC, municipalities	ERP, VTrans Enhancement, 319 Grants
c. Develop digital stormwater infrastructure maps and IDDE survey for Marshfield, Plainfield, Cabot, Berlin and Williamstown. Add to Barre and Northfield Village's existing IDDE survey.	CVRPC, FWR	See above
d. Present completed maps (see above) for Stowe, Richmond, Waterbury, and Waitsfield to municipal staff and community groups to assist in the identification and implementation of potential stormwater retrofit projects or housekeeping practices.	NRCD, FMR, VDEC	See above
e. Implement projects identified and prioritized through the Waitsfield and Irasville stormwater planning project: a stormwater analysis and a stormwater planning process that will result in recommendations for Low Impact Development (LID) retrofits and incorporation of green infrastructure in new development.	UVM, WNRCD, FWR, VDEC, FMR,	See above
f. Assist municipalities in efforts to incorporate green infrastructure into plans to upgrade or build municipally funded projects through facilitated discussions with engineers at project design stage.	VANR	
g. Develop a guide for town conservation commissions and other natural resource groups to help them identify opportunities to assist in water quality resource protection.	Watershed groups, non-profits	LCBP, Watershed grants

3. Support demonstration projects that encourage adoption of low input lawn care practices, including practices that increase stormwater infiltration rates.	The Blue Program, WNRCD, CAV	ERP, LCBP, Watershed grants,
4. Assist Richmond in building LID structure designed by UVM engineering class spring 2010	VDEC, Town of Richmond,	319 grants, ERP, LCBP grants
5. Assist Montpelier and Burlington in using recently completed town canopy maps to implement Green Infrastructure practices	VDEC, VFPR, FWR, Montpelier, Burlington	319 grants, ERP, LCBP, Watershed grants

C. Agricultural activities

Goal:
Strategically apply best management practices and increase outreach programs to reduce non point source pollution from agricultural sources.

Summary of VANR's Key Strategies that Address Agricultural Activities:

- Identify agriculturally impaired waters through water quality monitoring and where deemed appropriate develop TMDLs.
- Assist with evaluation of conservation practices for their water quality effectiveness.
- Eliminate discharges from production areas of farms by co-implementing Large and Medium Farm Operation permits with AAFM, and thru development of a VT-specific CAFO permit.

The Agency of Natural Resources supports the Agency of Agriculture, Food and Markets work by:

- Arranging for periodic meetings with interagency staff to discuss water quality issues identified through monitoring and assessment, and assign responsibility for follow up actions on specific farms.
- Working with farm operators to ensure compliance with Accepted Agricultural Practices (AAPs).
- Encouraging smaller farms to develop nutrient management plans.
- Encouraging agricultural operations to deal with non-point source pollution from production areas and farm fields.
- Encouraging enrollment in federal and State cost-share programs and providing additional engineering assistance.
- Helping to implement controls to deal with soluble losses from ditching and tiling of farm fields through surface and subsurface connections to natural surface waters.
- Preventing agricultural pesticide movement to surface waters.

The strategies developed by the Agency of Agricultural Food and Markets– see Appendix G for the Basin 8 Water Quality Management Plan - Agricultural Aspects, including more detailed strategies

Strategy	Potential Partners	Funding
1. Increase awareness and use of farm soil health improvement practices	WNRCD, NRCS, VAAFM, UVM Extension, NOFA-VT, Farm operators	USDA-NRCS, VAAFM, VANR, UVM Extension, NOFA-VT, Nonprofit watershed organizations
2. Make available opportunities to share high-cost tillage conservation equipment and practices	VACD, WNRCD, VAAFM, FSA, NRCS, UVM Extension, NOFA-VT, VFB, Farm operators, FWR, Local dealers of custom applications	VAAFM, VANR, USDA-NRCS and RC&Ds
3. Involve the equine community in proactively adopting the Accepted Agricultural Practices (AAPs)	UVM Extension, Vermont Horse Council, 4-H clubs, VANR, WNRCD, VAAFM, USDA-NRCS	USFWS, VAAFM, VANR, NFWF
4. Continue to work with farmers to develop and implement Nutrient Management Plans (NMP)	VACD, VAAFM, WNRCD, NMP, NRCS, UVM Extension, NOFA-VT, VFB, Farm operators	VAAFM, VANR, NRCS, TU, NOFA-VT, UVM Extension
5. Provide more support for grazing and Small Farming Operations (SFOs)	Vermont Beef Producers Association, Vermont Grass Farmers Association, VAAFM, VANR, NRCS, TU, UVM Extension, Vermont Horse Council, Watershed organizations	USFWS, NRCS, TU
6. Increase establishment of buffers on agricultural lands along surface waterways and wetlands	VAAFM, VACD, VFWD, WNRCD, NMP, FSA, FWS, NRCS, VANR, UVM Extension, NOFA-VT, VFB, Farm operators	EPA, FWS, VAAFM, VANR, NFWF, TNC
7. Prevent agricultural pesticide movement to surface waters	VAAFM, WNRCD, FSA, NRCS, VANR, UVM Extension, VFB, Farm operators	USFWS, VAAFM, VANR, NFWF, TNC
8. Provide additional local learning opportunities for farmers	ARS, VACD, WNRCD, VAAFM, FSA, NRCS, UVM Extension, NOFA-VT, VFB, Farm operators	VAAFM, VANR

a. Encourage farmers to continue practices adopted as part of the Mad River Buffer Project. Hold a meeting with all farmers in community to talk about benefits farmers have seen from conversion of corn to grass and provide information about CREP etc.	WNRCD, NRCS, FMR	
9. Increase funding opportunities for water quality Best Management Practices and more flexible and equitable distribution of funding	VACD, VFB, WNRCD, VAAFM, VANR, FSA, NRCS, RC&D, UVM Extension, NOFA-VT, Farm operators	VAAFM, VANR

D. Forestry management practices

Goal: Strategically apply best management practices and increase outreach programs to reduce non point source pollution from forest management activities

Summary of VANR's Key Strategies that Address Forestry Management Practices

- Work with Vermont forest industry to promote use of Acceptable Management Practices (AMPs) in an effort to eliminate discharges resulting from logging operations. AMP Technical Advisory Teams directly assist any logger or landowner when there is a potential discharge, complaint or request for assistance.
- Continue to promote better stream crossing practices on timber harvesting operations using portable skidder bridges.

The objectives and strategies concerning forestry management developed during the planning process

Objective 1. Assist community and forest industry in adopting sustainable logging practices that protect water resources

Strategy	Potential Partners	Funding
6. Increase use of portable skidder bridges as temporary stream crossings on logging operations. Expand and continue existing programs to promote the use and ownership of portable skidder bridges.	VFPR, NRC&D, private forestry consultants, loggers, NRCD and forest landowners	ERP, RC&D, LCBP
7. Provide education and learning opportunities to forest landowners on forest management	VFPR, USFS, logger assn's, forestry assn's, Woodland Owners Assn, academic and vocational institutions	USFS grants, Watershed grants

E. Hydrologic Modification: changes to river flows or water levels

Goal: Address dams and other hydrological alterations that impede fish movement, are responsible for decreased stream transport capacity, littoral zone health or degrade water quality.

Summary of VANR's Key Strategies that Address Hydrologic Modification

- Use the §401 Water Quality Certification process to ensure that hydroelectric projects and water withdrawals that require a federal license or permit meet Vermont Water Quality Standards (see Table 4).
- Participate in the federal hydroelectric project licensing process.
- Continue to support the efforts of the Vermont Dam Task Force to identify opportunities for dam removals where dam owners are willing and funding is available.
- Seek to reduce or eliminate artificial lake level fluctuation and winter drawdowns through public rulemaking or other regulatory tools or voluntary participation.
- Review water withdrawal proposals for snowmaking and other purposes and recommend conditions for Agency or Act 250 permits.

See also Dams in the VSWMS tool kit.

The objectives and strategies concerning hydrologic modification developed during the planning process

Objective 1: Coordinate the efforts of federal, State, and local agencies to remove obsolete and non-essential impoundment structures.

Objective 2: Reduce or eliminate hydrological modifications

Strategy	Potential Partners	Funding
1. Prioritize dams for removal that degrade habitat, present danger due to likelihood of failure, have high restoration potential. A resource includes results of the Nature conservancy's Northeast Aquatic Connectivity Project.	VDEC, Vermont Dam Task Force, The Nature Conservancy	
2. Based on prioritized list when possible, develop removal plans in cooperation with the dam owner, local community and other	RPCs, NRCDs, VDEC, VFWD, American Rivers, and consultants	ERF, NOAA, Trout Unlimited, Partners for Fish and Wildlife Program, WHIP,

Strategy	Potential Partners	Funding
partners.		
3. Identify those dams that are not good removal candidates because they provide significant public benefits and determine what steps can be taken to mitigate their environmental impacts.	See above	See above
4. Monitor water quality below dams to assess health of cold water fishery in river	VFWD, VDEC, watershed groups	LaRosa
5. Consider following projects:		See resource above for following strategies
a. Clark Sawmill Dam in Cabot: Impacts natural sediment transport. Removal would open up all the headwaters. Investigate potential for removal or water management changes.	VDEC, VFWD, FWR,	
b. Wrightsville Dam: 2003 temperature monitoring reveals the potential for temperature moderation in the North Branch and downstream waters if a bottom release was employed. 401 certification describes the project as being designed as a bottom withdrawal, but built intake is located at reservoir surface Work with VFWD to determine fisheries issues and develop plan to address.	VDEC, VFWD, FWR	
c. Waterbury Dam: address impacts of hydroelectric project on fisheries and water quality during FERC relicensing.	VDEC, VFWD	
d. Marshfield-6 hydroelectric facility Reservoir: study the instream flows in the Winooski River in relation to hydroelectric operations.	VDEC, VFWD, FWR, GMP,	
e. Marshfield-8 Dam: Design and application for deconstruction are completed. Deconstruction expected in Summer 2012	dam owner, VDEC, VFWD, USFWS, FWR	USFWS, GMP
f. Hidden Dam , East Montpelier: Investigate potential for removal	VDEC, FWR	
g. Dams on Dog river in Northfield area	FWR	
6. Manage lake draw downs and flow regulation from withdrawals to address aquatic organism passage issues and natural flow regimes: a. Nelson Pond – investigate condition, flow management and landowner interest.	VDEC	

F. River Corridor Encroachment and Channel Erosion

Goal:

Use stream geomorphic and fish habitat assessments (ANR, 2007) in a proactive manner to direct and prioritize stream corridor protection, stream stability restoration projects, pre-disaster mitigation efforts, fluvial erosion hazard mapping, and enhancement of aquatic and riparian habitats for fish and wildlife

Summary of VANR's Key Strategies that Address River Corridor Encroachment and Channel Erosion

- Conduct stream geomorphic assessments and develop river corridor plans to identify and prioritize restoration or protection projects that will help manage a channel back to equilibrium conditions, and protect the river corridor necessary to accommodate the equilibrium channel.
- Provide technical assistance and regulatory oversight of stream alterations.
- Exercise 401 water quality certification authority for the Army Corps 404 "dredge and fill" permit process.
- Provide regulatory oversight of shoreland stabilization projects through the Shoreland Encroachment Permit program.
- Provide technical assistance and encourage towns to increase floodplain protection under the auspices of the FEMA's National Flood Insurance Program. Provide maps, technical assistance and incentives to towns in applying land use regulations to protect areas within the river corridor. In addition, identify reaches through geomorphic assessments that are particularly valuable sediment and nutrient attenuation assets. Identify as high priorities areas in need of permanent protection and conserve irreplaceable functions with the purchase of river corridor easements.
- Provide documentation of floodways, and FEH areas to Act 250 district commissions.

The objectives and strategies concerning river corridor encroachment and channel erosion developed during the planning process

Objective 1. Support efforts that lead to corridor protection and work towards natural stream stability while still protecting infrastructure from flood events.

Objective 2. Use river corridor reports to help identify projects. The reports can be found at https://anrweb.vt.gov/DEC/SGA/finalReports.aspx

Strategy	Potential Partners	Funding
1. Initiate Phase 2 geomorphic assessments at Great Brook in Plainfield, the Great Brook in Middlesex and the Mad River and tributaries in Moretown	CVRPCs, FMR, FWR, NRCDs, VDEC	ERP, LCBP, Watershed grants
2. Assist communities with the development and implementation of river corridor management plans and fluvial erosion hazard plans and mapping in (names of towns) as well as in pre-disaster mitigation efforts in the Mad River and Dog River watersheds and other areas where interest exists.	VDEC, municipalities, RPC, FWR, FMR	ERP, PDM funds, LCBP
3. In towns where flood plain regulations are currently interim because they have no town plan, assist towns in developing a town plan.	CVRPC, VDEC	604(b) Ecosystems funds, municipal planning grants
4. Increase the establishment and enhancement of woody riparian corridors on stable reaches focusing on Allen Brook, Dog, Huntington and Mill Rivers, Muddy Brook, and upper Winooski in conjunction with the Trees for Streams Program	VDEC, VFWD,WNRCD, LNRCD, RPCs, watershed and angler groups, municipalities	ERP, LCBP, WHIP, CREP, and Partners for Fish and Wildlife Program,319 grants, Watershed Grant

5. When land owners become willing, relocate sections of the Stowe bike path based on plans funded through Ecosystem Restoration grant	LCRPC, Stowe Land Trust, VDEC	319 grants, ERP, LCBP, Watershed grants
6. Assist with efforts to obtain conservation easements along corridor of Little River main stem, including community outreach efforts: a. flume demonstrations b. festival attendance c. newspaper articles[18]*	VDEC, Stowe Land Trust	LCBP, Watershed grants
7. Identify partners in upper Little River mainstem (Morristown) to assist in conservation efforts*	VDEC, LNRCD	
8. Identify and secure conservation easements in Dog River in areas that are not bedrock controlled*	VDEC, FWR	319 grants, ERP, LCBP, Watershed grants
9. Review and prioritize projects proposed for Thatcher Brook for implementation*	VDEC-RMP	319 grants, ERP, LCBP, Watershed grants
10. Support efforts to conserve river corridor along the Stevens Branch (Williamstown), upper Winooski (Plainfield, Marshfield and Cabot) and Pekin Brook (Calais), and the North Branch *	VDEC, FWR, VRC	319 grants, ERP, LCBP, Watershed grants
11. Support efforts to conserve river corridor along the Mad River: Provide technical assistance towards efforts that identify priority parcels for conservation. Provide funding for landowner outreach.*	VDEC, FMR, VRC,	319 grants, ERP, LCBP, Watershed grants

[18] Starred actions are identified in respective river corridor plans

G. Encroachment: wetland buffers, lake shorelands

Goal: Protect natural lakeshores and wetlands from unplanned development and improve their management.

Summary of VANR's Key Strategies that Address Encroachment

- Protect significant wetland functions under the Vermont Wetland Rules. Continue to educate community about Rules and assist landowners in complying with rules.
- Provide technical assistance and incentives to towns to adopt shoreline protection.
- Provide documentation of buffers, and lakeshores to Act 250 district commissions.

The objectives and strategies concerning encroachment developed during the planning process

Objective 1. Encourage participation of adjacent landowners in efforts to protect the resource

Objective 2. Create and protect a buffer between the resource and landuse to enhance water quality or aquatic habitat

Strategy	Potential Partners	Funding
1. Assist in efforts to conserve undeveloped lake and pond shorelands.	VDEC Lake Assessment Program, FWD,	ANR, EPA, EPSCoR Streams Program
2. Review and strengthen regional and town plans and zoning bylaws relating to lake protection issues. a. Work with three interested towns towards the adoption of lakeshore ordinances. Use model ordinance developed by VLCT.	VDEC, municipalities, VLCT Municipal Assistance Center, RPCs, and lake associations	604(b) grants
3. Reduce the impact of roads and parking areas. See Section I. Transportation infrastructure: Work with Calais Conservation Commission	VFWD, lakeshore and watershed associations	319 grants, ERP, LCBP, Watershed grants
4. Increase the community's interest in the health of their lakes. a. Distribute and publicize the VDEC-WQ Lake Score Card b. Assist in conducting lakeshore watershed surveys to identify nonpoint sources of pollution	VDEC, lake associations, residents, and municipalities	319 grants, Watershed grants,

5. Develop lakeshore protection projects with watershed or lakeshore associations that focuses on encouraging residents to implement BMPs	VDEC, shoreland property owners, lake associations, Federation of Vermont Lakes and Ponds, FWDD	319 grants, ERP, LCBP, Watershed grants, New England Grassroots Environmental Fund
6. Distribute and publicize WMD guidance document on lake protection strategies.	VDEC-WQ, watershed and lake assn.	
7. Expand NRCD's Trees for Streams Program to include lakes and ponds	NRCD and lakeshore residents	Vt. Watershed Grants, LCBP
8. Investigate strategies for reducing runoff from road to Gillette Pond.	VDEC, Richmond	319 grants, ERP, LCBP, Watershed grants, BBR,
9. Initiate the Lay Monitoring Program at lakes where the program has been idle or nonexistent. Valley, Mirror and East Long Pond in Calais are candidates.	VDEC, lake organizations and/or lake residents	

H. Wastewater

Goal: Manage wastewater discharges from wastewater treatment facilities and onsite systems to protect water resources and their uses.

Summary of VANR's Key Strategies that Address Wastewater

- Regulate septic system installation through the Onsite Program. Towns may consider receiving the authority to administer the permit program and the Wastewater System and Potable Water Supply Rules.
- Implement the Vermont Toxic Discharge Control Strategy (TDCS) to quantify all NPDES discharges in Vermont and to establish water quality criteria and discharge permit limits that can be used to regulate discharges in a manner that will assure that the state water quality standards and receiving water classification criteria are maintained.
- Administer the National Discharge Pollutant Elimination System (NPDES) permit program for discharges from commercial, municipal and industrial wastewater treatment facilities to state surface waters.
- Assist towns in identifying wastewater treatment facilities' (WWTF) needs and obtaining Clean Water State Revolving Funds loans to upgrade municipal wastewater systems to reduce pollutant loads.
- Work with industry to reduce waste that would otherwise be sent to a wastewater treatment plant through pretreatment or pollution prevention options.
- Continue support for monitoring of EC/PPCPs in wastewater effluents at Burlington WWTF outfall.
- Collect quality assured water quality data under "base flow" conditions for use during the permit reauthorization process to assist the VDEC in assessing the potential that each WWTF effluent has to contribute to surface water quality.

Strategy	Potential Partners	Funding
1. Identify and prioritize areas in need of wastewater management planning and develop plan for interested communities.	RPCs, VDEC	604(b)
2. Assist towns to address aging wastewater treatment facilities and associated sewer pipes through the Clean Water Act Revolving State Funds and other funding programs	VDEC	Clean Water Act Revolving State Funds
3. Identify and address sources of high *E. coli* levels identified by Friends of Winooski River water quality monitoring efforts: conduct stream walks, an illicit discharge survey, create a stormwater infrastructure map for Marshfield and Plainfield.	VDEC, FWR	319 grants, ERP, LCBP, Watershed grants
4. Assist in implementation of the Allen Brook, Huntington and Mad River Bacterial TMDL	EPA, VDEC,	319 grants, ERP, LCBP, Watershed grants
5. Assist communities along Dog River in monitoring for *E. coli* at recreational sites that are located in high swimming use areas	VDEC	LaRosa Partnership

I. Transportation infrastructure construction and maintenance

Goals:

Reduce nonpoint source pollution from transportation infrastructure and ensure installation of stream crossing structures in a manner that reduces the public safety hazard and vulnerability to future flood loss as well as improving stream stability.

Summary of VANR's Key Strategies that Address Transportation Infrastructure

- Support the Better Backroads Program (BBR) financially and with some technical assistance. The program hires technical staff to assist towns in identifying road erosion problems and applying for grant funds. The grant funds are used for inventories, capital budget planning, and erosion correction projects, including the stabilization of ditches, culverts, and roadside banks.
- Support Local Road Programs workshops to promote road BMPs to town road crews, including winter maintenance.
- VTrans provides the VANR with road salt application data on state roads. The agency supports VTrans efforts to identify methods for reducing chloride use.
- Monitor chloride levels in surface waters to identify where road salt use may be impacting surface waters
- Continue the outreach and educational efforts of the River Management Program and other Agency of Natural Resources programs.
    - River management engineers and floodplain managers provide technical assistance and regulate new transportation infrastructure when placed within floodplains, stream channels and river corridors.
    - Continue collaborative research and regulatory efforts with VTrans and other partners.

The objectives and strategies concerning transportation developed during the planning process

Objective 1. Assist municipal and state road maintenance entities and trail associated recreational groups in addressing erosion from roads and trails.

Objective 2. Identify and address stream crossings that are not adequately sized or placed

Objective 3. Reduce the amount of salt used and reduce the amount of winter sand that reaches waterways

Strategy	Potential Partners	Funding
1. Assist towns of Cabot, Duxbury, Fayston, Milton, Shelburne, and Worcester in developing a Better Backroads application for a town road project or road assessment.	BBR, VDEC	BBR
2. Encourage town participation in inventories and assessment of transportation infrastructure. Provide current understanding of sources and BMPs (see final report for LCBP's Road drainage network impacts to Lake Champlain water quality.) Help town use a Capital Improvement Budget process to fund.	VDEC, VTrans, Local Roads Program, Vermont RC&Ds, RPCs, and municipalities	BBR grants, 319 grants, ERP, LCBP, Watershed grants
a. Hold workshops with river flume to educate town staff, committees, boards and interested community groups on impacts of roads, culverts, bridges and snow management on streams.	VDEC-RMP, BBR, VT local roads and VTrans, CCRPC, CVRPC	BBR,LCBP, Watershed grants
3. Assist state, town and private property owners to assess and replace or retrofit stream crossing structures that pose significant passage limitations to improve aquatic organism and/or wildlife passage, sediment transport and stream stability.	VDEC, VFWD, RPCs, municipalities	Town Highway (TH) Structures (bridges and culverts), TH Interstate Culverts, TH Class 2 Roadway, BBR grants, and TH Emergency funding programs; USFWS
a. Prioritize the top 5 culvert replacement opportunities in the Mad River watershed	FMR; VDEC, VFWD, Mad River towns and businesses, USFWS, TU	319 grants, ERP, LCBP, Watershed grants
b. Compile assessment	VDEC, VFWD, municipal	BBR, ERP, LCBP,

Strategy	Potential Partners	Funding
information for towns and assist them in understanding and using the information to replace or retrofit culverts and bridges where necessary.	groups, TU	Watershed grants
4. Assist municipalities with the adoptions of new VTrans standards for roads and bridges and other standards that will help towns meet Act 110	CVRPC, Community groups	604(b) ecosystem grants
5. Investigate the interest and feasibility for a hydroseeder rental program that would be available to local town road crews for a nominal expense.	WNRCD	ERP, BBR
6. Assist Bolton in road improvements, including rock lined ditches in Joiner Brook watershed and other watersheds.	VDEC, BBR, Bolton	BBR
7. Assist Huntington and Richmond with identifying and addressing sources of erosion on roads in Huntington River watershed, including Gillette Pond.	VDEC, BBR, Huntington, Richmond town groups	BBR, 319 grants, ERP, LCBP, Watershed grants
8. Using protocol similar to that developed for the White River Basin class 4 roads, map town road related erosion issues, proximity to rivers and streams and possible or existing fluvial erosion. Prioritize road restoration projects .	CVRPC, FMR, FWR, WNRCD	319 grants, ERP, LCBP, Watershed grants
9. Encourage trail building and maintenance BMPs in watersheds of high quality waters.	WNRCD	LCBP, Watershed grants
a. Work with Hinesburg Town Forest Committee to develop and implement a project to improve logging roads in Town forest as well as work with recreational groups to reduce erosion off their trails.	Hinesburg, VFPR, VDEC, WNRCD	319 grants, ERP, LCBP, Watershed grants
10. Identify potential sources of chlorides in the Sunnyside Brook Watershed and develop plan to reduce, including development of BMP to address management of private parking lots and roads	Watershed group, conservation commission	319 grants, LCBP, Watershed grants
11. Work with Mad River Glen to address sediment runoff from parking lot into Mill Brook	FMR, Mad River Glen, VDEC, VTrans	319 grants, ERP, LCBP, Watershed grants

J. Invasive species in aquatic or riparian zones

Goal:
Identify Invasive Plant Management Priorities to achieve the greatest ecological benefit while minimizing the total, long-term workload and project costs.

Summary of VANR's Key Strategies to address invasive species

- Enforce state legislation that limits spread of aquatic invasive species (AIS) to new areas, and regulates the use of mechanical, biological, physical and chemical nuisance control activities in Vermont waters.
- Assist shoreline owners and other community members with the management of AIS by providing technical assistance and financial assistance through the Aquatic Nuisance Control grant-in-aid program.
- Support continued annual state funding for the water chestnut eradication program to ensure successful control and maintain recently achieved milestones.
- Coordinate with Lake Champlain Basin Program on invasive species management in Lake Champlain and its basin.
- Maintain readiness to implement Rapid Response protocols when necessary.

The objectives and strategies concerning AIS developed during the planning process

Objective 1. Increase volunteer involvement.

Objective 2. Reduce spread of invasive plants.

Objective 3. Control existing populations of invasive plants.

Strategy	Potential Partners	Funding
1. Provide education and outreach about the threats invasive species pose, spread prevention practices and applicable state laws prohibiting their transport. Target programs for the public, landscaping professionals, town and state road crews and forest industry personnel.	VDEC , NRCDs, Municipalities, , FPR, TNC, USFS, logger assn's, forestry assn's, Lake associations/residents with technical and materials assistance from VDEC	Aquatic Nuisance Control Grants-in-Aid, LCBP, USFS grants, Watershed Grants, NFWF.

Strategy	Potential Partners	Funding
2. Encourage identification of new aquatic infestations and removal by volunteers through the support of the Vt. Invasive Patroller Programs and other efforts	VDEC, TNC, DFP, AAFM and volunteers	Aquatic Nuisance Control Grants-in-Aid
3. Provide outreach and volunteer recruitment, training, support for invasive plant control activities. Distribute TNC "Community Handbook on Developing Invasive Plant Outreach and Management Activities" when available	Community groups, TNC	Aquatic Nuisance Control Grants-in-Aid, LCBP,
4. Provide information to river users about preventing spread of Didymo, as well as whirling disease and NZ Mud Snail, including information about state restrictions on use of felt waders.	VDEC, VFWD, TU, FWR, FMR	LCBP
5. Protect the integrity of the forested riparian zone by reducing knotweed populations and limit its spread. Encourage community groups to commit their efforts to particular areas for a number of years.	Community groups , TNC	319 grants, ERP, LCBP, Watershed grants
a. Survey tributaries to Dog River to identify infestations of knot weed. Begin removal projects and discussion with town road crews.	Community group, watershed group	319 grants, ERP, LCBP, Watershed grants
6. Develop and implement a long-term plan to remove riparian invasive species from the Richmond floodplain forest.	Richmond community group, TNC	LCBP, Watershed grants

K. Enhancing the community's environmental ethic

Goal:
Increase communities' interest in water resources protection and involvement in best management practices and assessment and restoration projects that protect water resources

Summary of VANR's Key Strategies

- Publish *Out of the Blue* quarterly newsletter.
- Support *Project Wet.*
- Support work of watershed and lakeshore groups through the LaRosa Volunteer Water Quality Monitoring Analytical Services Partnerships.
- Develop web-based maps to provide citizens with access to water resources information.
- Provide education about watershed ecology and fluvial geomorphology.

The objectives and strategies developing during the planning process

Objective 1. Assist community members in adopting stewardship practices that reduces erosion and discharge of pollutants into adjacent rivers and streams

Objective 2. Provide opportunities for people to gain or expand their appreciation of the resource through better understanding of resource and increased water-based recreational opportunities

Strategy	Potential Partners	Funding
1. Increase community's involvement in residential BMPs that protect water resources by developing programs that help people overcome barriers to adopting sustainable behaviors.	VDEC, MS4 entities, LCBP, LCC, The Blue Program, LCI	LCBP, Watershed grants
2. Develop Lake Champlain Basin Program wayside signage to publicize the valuable cold water fishery in the Upper Winooski	FWR, FMR	LCBP wayside program
3. Help teachers connect students with water resources in their towns, e.g., Champlain Basin Education Initiative's Watershed for Every Classroom.	CBEI, VFWD,	LCBP, Watershed grants
4. Assist community groups in developing and implementing volunteer monitoring and assessment programs as well as reporting results to community.	VDEC, FMR, FWR, TU?	LaRosa Partnership grant program
5. Increase access to boating, swimming and fishing	Conservation Commissions,	VFPR trail

Strategy	Potential Partners	Funding
opportunities and publicize access locations: Support VRC in prioritizing swimming holes for every community effort; assist VFWD to develop recreational sites database; promote FWR Paddlers Guide and publicize location of VFWD owned riparian lands and develop recreational guides.	VFWD; FWR, Outdoor recreation businesses and organizations, Regional Planning Commissions, TU, VTrans, municipal road departments	fund; FWD non motorized access money
6. Assist village communities in developing a sustainable relationship with adjacent rivers. Provide opportunities to identify the benefits that the river provides, including natural and recreational resources as well as understanding how development and use of river for wastewater and stormwater disposal adversely affects river.	VDEC, municipal groups, Watershed groups,	LCBP, Watershed grants

Strategies for Impaired and Listed Waters

Under USEPA guidance and federal regulations, impaired waters, meaning those that do not meet Vermont Water Quality Standards, must be identified by the State and reported under §303(d) of the Clean Water Act. Once a water is listed as impaired, it is scheduled for the development of a Total Maximum Daily Load (TMDL). A TMDL is an USEPA-approved document that attempts to limit and allocate discharge loads among the various dischargers to impaired waters in order to assure attainment with the State's water quality standards.

If the waterbody is identified as impaired but has as yet unimplemented regulatory measures in place that are likely to bring it into compliance with Vermont Water Quality Standards, it is not required to have a TMDL but may have an alternative water quality remediation plan in its place. All other impaired waterbodies where no binding remedies exist must be listed and scheduled for Total Maximum Daily Load development.

Water quality assessments and Total Maximum Daily Loads (TMDL) are the result of extensive monitoring efforts by VDEC, VFWD, USEPA and many volunteer monitoring programs. The Watershed Management Division (WMD) takes the monitoring data, interprets water quality studies, stream, lake, and wetland information, and permit compliance data and develops statements of lake or stream condition. These are used to determine if individual waters meet the Vermont Water Quality Standards. For this purpose, WMD maintains an evolving Assessment and Listing Methodology[19] that is compliant with Federal Clean Water Act guidance, and is used to develop lists of waters that are impaired, altered or stressed. The Watershed Management Division also develops total maximum daily load (TMDL) plans, which identify the reductions in pollutants necessary to restore impaired waters.

A TMDL is the calculation of the maximum amount of a pollutant that a waterbody can receive and still meet VWQS. In a broader sense, a TMDL is a plan that identifies the pollutant reductions needed to bring a waterbody back into compliance with VWQS. The TMDL plan also develops a strategy to implement the needed reductions. TMDLs can be calculated to correct water pollution from specific point source discharges, from myriad pollution sources throughout a watershed or more commonly, both.

19 Available at: http://dec.vermont.gov/sites/dec/files/wsm/mapp/docs/WSMD_assessmethod_2016.pdf

A. Strategies for Impaired Waters

Table 6. Waterbodies and cause of impairment included in the 2010 303(d) List of waters Part A - Impaired Surface[20] waters in need of a TMDL and strategies.

Waterbody segment	Pollutants and Source	Strategies
Allen Brook *Williston*	*E. coli*	Williston is developing a stormwater master plan. Assist in implementation.
Muddy Brook, mouth to 7 miles upstream *Williston*	Toxics, nutrients, Temperature due to lack of buffer, land development; erosion	Current state and federal stormwater permits will result in improvement. Encourage ongoing work to improve stormwater management in developed areas, see B.1 and 2 as well as continued work to reduce erosion. Determine Shelburne Pond's contribution to nutrient loading.
Unnamed trib to Muddy Brook, below Alling industrial park (2 mi) *Williston*	Toxics in surface water from past disposal activities	Superfund site: EPA is determining responsible parties
Shelburne Pond	Phosphorus	Consider undertaking a use attainability analysis (UAA), see below
Winooski River above Montpelier WWTF Discharge	*E. coli*. Montpelier WWTF collection system passes combined sewer overflows (CSO)	Continue to work with city to eliminate CSO. Phase 1 and 2 completed.
Huntington River, Vicinity of Bridge Street in Huntington	*E. coli*	Implement *E. coli* TMDL Plan
Waterbury Reservoir	Sediment	Address during FERC relicensing
Inn Brook, river mile (RM) 0.3 to 0.6 *Stowe*	Iron, originating from disturbed soils	Investigate success of Stowe Mt. Resort's treatment at Big Spruce Brook and determine appropriateness of application to Inn Brook
Lower North Branch, Winooski River (Approx. 1 mile) *Montpelier*	*E. coli* from Montpelier WWTF collection system during combined sewer overflows (CSO)	Continue to work with city to eliminate CSO. Phase 1 and 2 completed
Gunner Brook, below Farwell St. Dump (Approx. 0.5 mile) *Barre*	Metals (Cu, Fe), nutrients, sediment from Farwell St. landfill leachate, surface runoff from developed areas	Encourage stormwater management in developed areas, see B.1 and 2; Assess stability of reach adjacent to former Farwell dump site; develop and implement monitoring plan for leachate and river sediments adjacent to dump.
Mad River, Mouth to Moretown (6.2 miles)	*E. coli*: Possible failing septic systems and other unknown sources	Implement Mad River *E. coli* TMDL Plan
Clay Brook, RM 1.8 to RM 2.3 *Warren*	Stormwater, iron from stormwater runoff, erosion from construction activities & gravel parking lot; increased peak stormwater flows	Sugarbush Resort continues to follow VDEC approved stormwater management plan

[20] Vermont Department of Environmental Conservation, 2010. *State of Vermont 2010 303(d) List of Waters.* Vermont Agency of Natural Resources, Waterbury, VT.

Table 7 Waterbodies and cause of impairment included in the 2010 303(d) List of Waters Part B - impaired surface waters that do not need require a TMDL[21]

Waterbody segment	Pollutants and Source	Strategies
Unnamed tributary to the Winooski River	So. Burlington landfill leachate entering surface water	VDEC ordered landfill facility closed and capped. Capping occurred in 1992. The facility's post-closure court order requires water quality monitoring and maintenance of the site. Water quality sampling is conducted semi annually to determine effectiveness of treatment. Water quality improvement is expected over time as water quality treatment & site management continues.
Muddy Brook .01 mile *East Montpelier*	Central Vermont landfill: leachate entering surface waters	VDEC ordered landfill closed and capped in 1993. Due to the slumping of the capping soils in 2001, the original clay cap was removed, the landfill was re-graded and a synthetic cap was installed along with a new toe drain and gas collection system. The landfill's post-closure court order requires water quality monitoring & maintenance of the site. Currently volume of water collected in the drains is significantly less than previously reported.
Big Spruce Brook, RM 0.3 To 0.6 *Stowe*	Sediment impacts, iron seeps	The Stowe Mt. Resort (SMR) identified a localized groundwater seep associated with the practice green was contributing significant iron discharges to the stream and was having a dramatic impact on the macroinvertebrate community. Additionally, intermittent sediment discharges associated with an upstream stormwater sedimentation basin were occurring and placing additional stress on the macroinvertebrate community. SMR implemented projects in 2010 to address the 2 sources. Monitoring will ensure that the brook meets VWQS within a reasonable time period.
Trib (#23) to Stevens Branch, below Williamstown WWTF outfall (0.5mi)	Nutrients - treated effluent discharge to small receiving water	Improvements at the facility in 2005 (aeration system upgrades) were conducted on a voluntary basis by the Town. Recent biological monitoring downstream of the discharge in 2002 and 2005 indicates considerably improved invertebrate and fish communities, at times exceeding minimum criteria. Continue monitoring. Conduct an IDDE study.

[21] Part B. waters have documentation and data indicating impairment and do not meet VT Water Quality Standards. However, according to USEPA Listing Guidance, these waters do not require a TMDL because other pollution control requirements required by local, state, or federal authority are stringent enough to implement any water quality standard (WQS) applicable to such waters.

Basin 8 currently has 23 impaired waterbodies. Twelve will receive TMDLs unless current strategies result in water quality improvement or a UAA is obtained; see below (Table 6). Four do not need a TMDL because they are on their way to recovery through existing efforts and (Table 7). The seven remaining impaired waterbodies have completed and EPA-approved TMDLs. The implementation plans for the seven waterbodies are listed below followed by a rationale for considering a UAA for Shelburne Pond :

Implementation plan for the Winooski River Mercury TMDL – Mouth to Winooski Dam in city of Winooski:

Implementation of the Northeast Regional Mercury TMDL is being carried out in three phases. Phase I, from 1998 to 2003, has a goal of 50 percent reduction from the 1998 baseline and Phase II, from 2003 to 2010, has a goal of 75 percent reduction. In 2011, mercury emissions, deposition, and fish tissue concentration data will be re-evaluated in order to assess progress and set a timeline and goal for Phase III to make remaining necessary reductions to meet water quality standards. The Winooski River mercury impairment is derived from measurements of Walleye that migrate into and out of the river from Lake Champlain. During the summer of 2011, the Lake Champlain Basin Program has sponsored a program to re-measure mercury in Walleye in fulfillment of the envisioned 2011 re-evaluation.

Implementation plan for waterbodies with stormwater TMDLs

Seventeen of Vermont's waters are listed as "impaired" primarily due to urban stormwater runoff, four of those are located in Basin 8. These waters fail to meet the Vermont Water Quality Standards based primarily on biological monitoring data.

Act 140, passed by the General Assembly in 2004, requires that VANR develop a TMDL or water quality remediation plan for each of these waters by January 15, 2010. TMDLs have been developed for Vermont's urban stormwater impaired waters. The Stormwater Management Section in VDEC's Watershed Management. The division has developed an implementation strategy for the TMDLs with input from the Vermont Stormwater Advisory Group (SWAG) using hydrologic modeling software developed by TetraTech, Inc.

During the interim period prior to implementation of the TMDL through a general permit, projects in the affected watersheds (listed below) will have to comply with a "net zero" pollution standard. The following waterbodies have USEPA approved TMDLs:

- Centennial Brook, Mouth to RM 1.2
- Sunderland Brook, RM 3.5 (rt.7) to RM 5.3
- Allen Brook, RM 2.4 to RM 5.0 (Talcott Rd)
- Morehouse Brook, Mouth to RM 0.6

The VDEC's implementation framework for the stormwater TMDLs is supported by USEPA guidance and by case studies of TMDL implementation efforts around the country. The main elements of the VDEC's implementation framework include:

• Reissuance of the MS4 (municipal separate storm sewer system) permit by early 2012 with TMDL implementation requirements.

• Work with MS4 permittees to develop watershed-specific BMP plans that will identify the most cost-effective, feasible, and technically sound stormwater treatment and control projects, and develop a priorities schedule for implementation.

• Work with MS4 permittees to identify "low-hanging" cost effective BMPs for implementation by the MS4 permittees while watershed-specific BMP plans are being developed.

• Creation of watershed-specific BMP plans that identify who will have responsibility for implementation of site specific BMPs. The MS4 permit will place initial responsibility on the MS4 permittees for controlling discharges from the MS4 system to the impaired streams to meet the TMDL targets. The permit will recognize that responsibility for site-specific BMP implementation may be shifted to either a local or a regional utility or to individual dischargers into the MS4 system as necessary to ensure implementation. The VDEC may exercise additional residual designation authority as necessary to ensure that any private dischargers into the MS4 system that are identified as a necessary component of BMP implementation participate in implementation activities.

•. TMDL implementation is also occurring through the new National Pollutant Discharge Elimination System (NPDES) stormwater permit for residually designated discharges. General Permit 3-9030 was issued in November 2009 to over 400+ dischargers in five stormwater-impaired watersheds.

• Acknowledgment that the VDEC will use staged adaptive implementation and management in TMDL implementation.

• Continuing to pursue federal funding for implementation activities.

• Continuing to work with responsible parties in developing Water Quality Remediation Plans (WQRPs) for Vermont's six stormwater-impaired mountain watersheds. Development of a TMDL is ranked as low as these waters will be addressed through a Water Quality Remediation Plan (WQRP) rather than a TMDL plan. Mountain watersheds including Clay Brook differ substantially from urbanized "lowland" watersheds in terms of density of development, geographic position, hydrology, impairment source, and land ownership. USEPA regulations recognize that alternative pollution control requirements may obviate the need for a TMDL if

other pollution control requirements are stringent enough to implement applicable water quality standards within a reasonable period. In Clay Brook, VDEC has determined that a WQRP is the best implementation strategy.

Implementation plan for Hardwood Pond Acid TMDL

The vast majority of acid-forming pollutants are emitted from out of state sources. Implementation of this TMDL is the primary responsibility of USEPA. USEPA began to address acid rain and other water quality impairing air contaminants under Title IV and § 112m of the Clean Air Act. However, 13 years after the 1990 Clean Air Act Amendments, the problem of acid impaired waters remains. The solution is for up-wind states to achieve significant reductions in atmospheric acid from stationary and mobile sources. A good first step would be for USEPA to reverse its rejection of Vermont's "126 petition" (currently in litigation) and require more stringent regulation of major stationary sources of atmospheric acid and other contaminants adversely affecting Vermont.

Implementation plan for Winooski River – Cabot Village E. coli TMDL

A wastewater treatment plant was built in Cabot Village (NPDES permit #3- 1440) eliminating discharges of improperly or untreated sewage into the Winooski River.

Implementation plan for Lake Champlain – Phosphorus TMDL

USEPA disapproved the Vermont 2002 Lake Champlain Phosphorus TMDL on January 24, 2011, obliging USEPA to prepare a new TMDL. VDEC is collaborating with USEPA on this endeavor. Work includes development of an updated lake model to establish new phosphorus total loading capacities for each watershed, and a watershed model to estimate phosphorus loads and potential reductions achievable within major tributary watersheds, including the Winooski. USEPA, VDEC and partners will then identify programs and requirements that will provide reasonable assurance that nonpoint source reductions identified in the TMDL will be achieved. Finally, USEPA will develop load and wasteload allocations (including stormwater waste load applications) for sources or categories of sources in each lake segment. The timeline for the completion of USEPA's TMDL report is 2013. Vermont will be responsible for implementation.

The approach envisioned by USEPA would first develop an initial load reduction estimate based on modeling, and then rely upon VDEC's Tactical Basin Planning approach to identify geographically explicit subwatershed-level actions to achieve the TMDL. An adaptive management approach of incremental implementation with monitoring to verify progress is envisioned. Direct implementation, augmented regulation, and targeted funding are all being discussed by USEPA, VDEC, and stakeholders as tools to implement the TMDL. This is a substantial undertaking, but the work will improve targeting of management practices. Strategies or actions arising out of the TMDL revision that are applicable to the Winooski Basin will augment efforts initiated through the Winooski Basin planning process. As

USEPA's TMDL is finalized, the implementation tables of this Winooski River Basin Plan will be revised to identify and sequence implementation of the subwatershed-specific actions needed to achieve the TMDL load reductions.

Rationale for considering a Use Attainability Analysis for Shelburne Pond

Shelburne Pond is a 452-acre lake located in the Champlain Valley. This shallow, high-alkalinity lake is fringed by large wetlands, and a considerable portion of the lakeshore is in conservation ownership. There is no direct development on the lakeshore, and a mix of agricultural, forest, and low-density residential characterizes the watershed. Over the past 20 years, much of the agricultural lands have gone out of production, and have been replaced by low density, rural single-family homes. Shelburne Pond supports a wide variety of warmwater species, and hosts tremendous waterfowl use. Recreationally, Shelburne Pond supports a large annual contingent of anglers, paddlers, and hunters. The pond is also heavily used in winter for ice activities. It is an ecologically and recreationally significant resource.

Shelburne Pond also has the highest total phosphorus concentration of any lake monitored by WSMD over the long-term. The mean spring total phosphorus concentration is 92 ppb (± 7.2, std. err.), based on 22 years of measurement. During summer, heavy cyanobacteria blooms can develop. WSMD scientists have observed meter-thick accumulations of cyanobacteria along shore, and pervasive bloom conditions across the entire lake surface. Such extreme bloom conditions may preclude recreational uses of the lake, and have prompted the Vt. Department of Health to post warnings against exposure to the blooms. In addition to persistent algal growth, the lake has experienced fish kills in the past due in part to oxygen depletion from excessive productivity. Paradoxically, these prior kills may not have significantly impacted the quality of the present fishery. In summer 2007, a joint EPA-WSMD fish sampling effort on the lake yielded numerous large and even trophy-sized northern pike and largemouth bass, despite a relatively low sampling effort, and poor sampling conditions. Finally, being quite close to the University of Vermont (UVM), Shelburne Pond has been extensively studied by that organization.

In order to address the nutrient impairment on this lake it is necessary to understand the background, or natural phosphorus concentrations that would have been expected absent any major watershed stressors. WSMD's basic hypothesis for this lake has been that it is to some degree naturally eutrophic, augmented by historic land use practices. If this is the case, it would be inappropriate to manage the lake towards a mesotrophic state; or one lower than the historic condition. To address this question, WSMD commissioned a paleolimnological investigation of the lake, from a multidisciplinary team led by UVM. The purpose of this investigation was to determine the likely historic trophic state of the lake, to provide guidelines for management. The results of the analysis, as described in the following quotation, were unambiguous:

"All paleo-productivity proxies indicate that Shelburne Pond was oligo-mesotrophic before European settlement, and has become increasingly productive since the mid 19th century (~1850). Eutrophication rates intensified after ~1900, and reached peak levels during the past two decades (post-1990). Comparison of the sedimentary record with historical data suggests a causal relationship between deteriorating water quality in the pond and human activities in its watershed. Forest clearing since 1810, a switch to mechanized agriculture around ~1850, and intensive dairy farming during most of the 20th century, all resulted in progressive nutrient enrichment.

Despite these significant recent trends, data extending past the post-settlement record suggest that, although generally lower, Shelburne Pond's productivity levels were at times quite significant during the past few thousand years. The causes of these, apparently natural, fluctuations remain to be investigated."

This conclusion is emphatic that the historical background in the pond is a meso-oligotrophic state. What remains unanswered, however, is whether the lake can at this point be returned to that condition. There are two pathways available: 1) set a target concentration, and develop a TMDL with loading allocations; or, 2) conduct a Use Attainability Analysis to identify the current water-quality limitation of the lake, and manage the watershed towards the most realistically attainable condition.

Given the current condition of the watershed, it is difficult to see how reductions of external loads can be achieved in a manner sufficient to meet a loading capacity in Shelburne Pond aimed at an in-lake phosphorus concentration consistent with all recreational uses. The internal sediment recycling in the lake is very likely a dominant phosphorus source; one that is increasing in magnitude with the continuing increases in growth of nitrogen-fixing cyanobacteria that senesce to the lake sediments annually. Given the shallow, windswept nature of the pond, it is unlikely that chemical controls on internal recycling would successfully control the sediment-phosphorus cycle. Likewise, mechanistic solutions to increase sediment-phosphorus retention by aeration would be cost and energy-prohibitive. Given these considerations, WSMD is considering initiating discussions about drafting a Use Attainability Analysis for Shelburne Pond. Such an approach would articulate the need for achievable controls on watershed loads, while acknowledging the existing water quality limitations in Shelburne Pond that result from historical impacts to the lake.

B. Strategies for Waters in Need of Further Assessment

Waters needing further assessment are listed in Vermont 2010 List of Priority Surface Waters Outside the Scope of the Clean Water Act §303(d), Part C[22]. These waters are considered "stressed" but sufficient data has not been collected to either determine the cause of the stress; the degree of the impact; or what needs to be done to reverse the stress. Part C waters are high priority for assessment and monitoring. The VDEC-MAPP will continue to assess the following water bodies to determine whether an impairment exists.

Table 8 Waterbodies and suspected source of impairment included in the 2010 List Of Priority Surface Waters Outside The Scope Of Clean Water Act § 303(D)[23] Part C. Surface Waters In Need Of Further Assessment and assessment plans and strategies.

Waterbody	Pollutants and Source	Assessments to date or planned
Sunnyside Brook *Colchester*	Organic enrichments and sediment from land development. Toxics from past dumping (Champlain Cable and Hampden).	A permeable barrier wall has been installed at the site. Performance Verification Reports indicate that barrier has prevented further migration of contamination. Total degradation of residual contamination is expected.
Graves Brook (mouth upstream to RM.3*Waterbury*	Sediment from encroachment, development, potentially some agriculture.	Biomonitoring planned for 2015
Thatcher Brook *Waterbury to Waterbury Center*	Sediment from morphological instability	Biomonitoring planned for 2015. Implement project identified in Phase II assessment
Bryant Brook *Waterbury*	Sediment, Nutrients	Develop and implement sampling and stressor identification plan
Winooski River (10 miles) below Marshfield no. 6 dam	Low D.O. potentially due to hypolimnetic withdrawl of unlicensed hydrodam	Develop monitoring plan and implement. If D.O. confirmed to be based on hydrodam practices address using Chapter 41 Section 1003.
East Branch Little River Moscow/Stowe border to Sterling Brook	Sediment, nutrients, *E.coli* from land development, agric. runoff, and morphological instability	Biomonitoring planned for 2015
West Branch, Little River, (RM 7.0 to 7.5) *Stowe*	Sediment potentially from past construction erosion	Stowe Mt. Resort continues to conduct water quality monitoring and sediment assessments as part of the SMR Community 2000 Master Development and provides report to ANR per Land use Permit #5L1330
West Branch Little River (0.75 miles upstream of RM 7.5) *Stowe*	Sediment from stormwater flows and runoff from development, hydrologic change	On May 3, 2012, DEC issued an order pursuant to 10 V.S.A. §1272 requiring specific actions by SMR to reduce and eliminate discharge to the waterbody.

[22] https://anrweb.vt.gov/PubDocs/DEC/WSMD/Mapp/Docs/mp_2010_State_Lists_final.pdf

[23] Vermont Department of Environmental Conservation, 2009b. *State of Vermont Year 2008 List of Priority Waters Outside the Scope of Clean Water Act Section 303(d).* Vermont Agency of Natural Resources, Waterbury, VT.

Waterbody	Pollutants and Source	Assessments to date or planned
Long Trail Tributary (lowest 0.1 miles) *Stowe*	Sediment and acid, needs further assessment	See above
West Branch Little River (Rm 8.5 up to headwaters) *Stowe*	Sediment/acid	See above
Hancock Brook *Worcester*	Acid – low pH springtime shock	Biomonitoring planned for 2015
Minister Brook *Worcester*	Acid (see above). and gravel road runoff	Biomonitoring planned for 2015
Jail Branch (Barre City and below 1.5 miles)	Sediment, nutrients, *E.coli* from land development, stormwater runoff, and erosion	Biomonitoring planned for 2015. Follow up and expand existing IDDE study with city
Jail Branch *Washington/Orange*	*E.coli* from unknown sources	Follow up and expand existing IDDE study with city
Stevens Branch (from Barre City limits to mouth, 5.8 miles)	Sediment, nutrients and *E.coli* from urban runoff including suspected floor drains from commercial buildings on river.	Biomonitoring planned for 2015. Follow up and expand existing IDDE study with city
Dog River *Roxbury, Riverton, Northfield Falls*	*E.coli* from residential straight pipes and/or failed septic systems	Encourage community group to take on water quality monitoring project and seek support through the LaRosa Lab. Partnership Program. Continue mapping and IDDE in Dog River towns.
Mad River (Warren Dam to Rte 100)	Sediment from morphological instability and contributions from gravel/sand pit	Biomonitoring planned for 2015. See also respective corridor plan.
Freeman Brook *Warren*	*E.coli* from failed/failing septic systems	Implement Mad River bacterial TMDL
Mill Brook *Warren*	Sediment and iron from land development and disturbed soils, channel alterations	Biomonitoring planned for 2015. Discuss potential of addressing Mad River Glen parking lot with watershed partners.

C. Strategies for Waters altered by Flow Regulation

The following waters are priority waters for management action. FERC-licensed dams included in the list are evaluated during the re-licensing process. New licenses will include conditions specified by VANR so that the projects meet VWQS. Unlicensed hydroelectric dams are under the jurisdiction of the Vermont Public Service Board and VANR provides comments to address water quality and fish and wildlife impacts during any regulatory proceedings. Water withdrawals for snowmaking and municipal water supplies (identified below with a WSID number) may also result in a flow alteration. The snowmaking withdrawals are regulated under ANR *Environmental Protection Rules: Chapter 16 – Water Withdrawals for Snowmaking*. Existing withdrawals are assessed when a snowmaking expansion triggers a review under the rules.

Table 9 Waterbodies and source of flow alterations included in the 2010 List Of Priority Surface Waters Outside The Scope Of Clean Water Act § 303(D) Part F – Flow Altered Waters and strategies.

Waterbody	Pollutants and Source	Current Status/Management or Control Activity
Lower Winooski River Below Gorge #18 Dam *South Burlington*	Artificial flow conditions limit dam spillage	Unlicensed facility – flow management being addressed in PSB proceeding
Joiner Brook (2.9 Miles) *Bolton*	Artificial & insufficient flow below Bolton Valley snowmaking water withdrawal results in non-support 2.9 miles	Subject to review under VANR snow making rules
Winooski River at Middlesex #2 Dam *Middlesex*	Aesthetics altered by artificial dewatering of bypass by hydro	Unlicensed facility
Winooski River at Middlesex Impoundment	Aesthetics & aquatic biota affected by water level fluctuation by hydro (causing streambank erosion).	Unlicensed facility
Thatcher Brook tributaries: Tyler Brook (0.1 mile) and Merriam Brook (0.1 mile) *Waterbury*	All uses affected by artificial & insufficient flow condition below Waterbury Village public water supply withdrawal point	WSID #5284 – Waterbury Village Water Supply
Mollys Falls Brook *Marshfield*	Aquatic habitat & recreation affected by water fluctuations by hydro	Unlicensed facility – Marshfield Dam
Sucker Brook below Peacham Pond (1 mile) *Marshfield*	Artificial flow regulation & condition below hydro	Unlicensed facility– Peacham Pond Dam
Peacham Pond *Marshfield*	Aquatic biota may be affected by water level fluctuation from hydro	Unlicensed facility – Peacham Pond Dam

Waterbody	Pollutants and Source	Current Status/Management or Control Activity
Mollys Falls Reservoir *Marshfield*	Aquatic habitat and recreation affected by water level fluctuation	Unlicensed facility – Marshfield Dam
Lower Little River below Waterbury Dam (2.3 miles) *Waterbury*	Regulation at hydroelectric/flood control dam	FERC licensed facility being reviewed by VANR under CWA § 401
Waterbury Reservoir *Waterbury*	All uses affected by hydro dam	FERC licensed facility being reviewed by VANR under CWA § 401
West Branch Little River (8 miles) *Stowe*	Artificial & Insufficient flow below Mt. Mansfield snowmaking water withdrawal	Ski resort compliance schedule indefinite
Benjamin Falls Brook (aka Pond Brook) *Berlin*	Aesthetics and aquatic biota affected by artificial dewatering from Montpelier and Berlin water supply withdrawals.	WSID #5272
Mill Brook (2.1 miles, *Warren*	Artificial & insufficient flow below Mad River Glen snowmaking water withdrawal modeled at 2.1 miles.	Subject to review under VANR snow making rules
Slide Brook (0.8 miles) *Warren*	Artificial & insufficient flow below Mt. Ellen snowmaking water withdrawal: modeled at 0.8 miles.	Subject to review under VANR snow making rules

D. Strategies for Waters with Channel Alterations

The West Branch of the Little River (5.8 miles) does not meet VWQS because of morphological instability, and on-going channel degradation. This degradation is occurring in response to historic and current human intervention

Investigations of stream geomorphology conducted according to Vermont's Stream Geomorphic Assessment protocols considered with other extensive field investigations indicate that the use of secondary contact recreation on the West Branch does not meet standards due primarily to extensive historical stream channel alterations but also now due to ongoing watershed development and runoff. These earlier alterations have been identified as extensive channel straightening, extensive gravel mining, and floodplain encroachments of transportation and other infrastructure. These historical strategies have set in motion a channel evolution process of degradation and consequent aggradation of channel sediments that is having a negative effect on the aquatic habitat and the fishery. New development and thus runoff and hydrological changes are exacerbating the West Branch channel problems. The waterbody has been assessed as altered and not meeting the VWQS (not impaired) according to the VDEC Assessment and Listing Methodology.

To date, a river corridor plan has been developed and the Town of Stowe has adopted an FEH ordinance for the first six reaches of the West Branch. Strategies, found in Section F, Chapter 3 of this plan, would provide protection to existing flood plain and remove existing encroachment.

E. Strategies for Waters with Aquatic Invasive Species

Parts of the Winooski River include populations of Eurasian watermilfoil, (*Myriophyllum spicaturm*), resulting in its listing as altered from the mouth to Alder Brook. Based on the extent of the population and difficulty in managing the population, no control efforts are planned.

Chapter 4. Management Goals for Surface Waters in Basin 8

Each waterbody in the state has at least one management goal to protect one or more beneficial uses or values. In the basin plan, the Agency of Natural Resources can make or propose changes to management goals for particular bodies or stretches of waters through one or more of the following processes:

- Classification of waters and designation of water management types
- Designation of waters as Outstanding Resource Waters
- Designation of waters as warm and cold water fisheries
- Classification of wetlands
- Identification of existing uses

The Agency of Natural Resources is responsible for determining the presence of existing uses through basin planning or a case-by-case basis. The VANR can propose changes to classification or other designations, but the Vermont Water Resources Panel (Panel) is responsible for establishing a new classification or other designations by rule. Once the VANR or the Panel establishes a management goal, the VANR manages state lands and issues permits to achieve all management goals established for the associated surface water. Before the VANR recommends, or the Panel establishes management goals through a classification or designation of surface waters as a rule, input from the public on any proposal is required and considered. The public is also able to present a proposal for establishing management goals for the Panel to consider at any time. When the public develops proposals regarding management goals, the increased community awareness can lead to protection of uses and values by the community and individuals.

Classification and Water Management Typing

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 practices. The VANR works to implement activities that restore, maintain or protect the management goals. The current classification system includes three classes: A(1), A(2), and B.

Presently in all basins across Vermont, waters above 2,500 feet in elevation are classified A(1) by Vermont statute. In addition, the Water Resources Panel or members of the public can petition that high quality waters with significant ecological value below 2,500 feet be classified as A(1) based upon the public interest. In Basin 8, the only A(1) waters include those above 2,500 feet in elevation. The management objective for A(1) waters is to maintain their natural condition.

The VANR would support efforts to reclassify the following two waters from B to A(1) based on VANR biological monitoring assessments that indicate streams presently meet A(1) criteria:

- Stevenson Brook, Stowe VT08-11 - Flows from forested mountainsides to the Little River Reservoir – insects and fish very good to excellent consistently

- Ranch Brook, Stowe VT08-12 - Many years of very good and excellent data on insects and brook trout population is healthy.

Biological assessments of the following brooks indicate they may meet A(1) criteria, but another year of data is needed to provide adequate assurance.

- Shepard Brook, Fayston VT08-19 - 2000 fish data was assessed as "excellent" and 2005 data were very good to excellent.

- Dowsville Brook, Duxbury VT08-19 - Three years of excellent to very good insect data and the index of biological integrity for the fish community is passing.

- Huntington River, Richmond VT08-10 - from mouth upstream to river mile 12.

- Sunny Brook, Northfield VT08-17 - Post oil spill on this brook, fish and insects were coming in as very good to excellent.

Waters that are managed for the purpose of public water supplies may be designated as Class A(2) Public Water Supplies. The class A(2) waters in Basin 8 that are actively used as a water supply or an emergency water supply are listed in Table 13.

The VANR proposes that the following A(2) waters in Basin 8 be reclassified to Class B because they are no longer used as an active or as emergency water supply:

Surface Water	**Town**	**Former Water Supply**
Unnamed tributary to Alder Brook	Essex	Winooski, Essex Center, Essex Jct., and Pinewood manor
Martin Brook, Reservoir & Tributaries	Williamstown	City of Barre
Bolster reservoir and tributaries, including Pecks Ponds	South Barre	City of Barre
Unnamed brook and tributary	Barre Town	Old village of East Barre

Little John and Milne quarries	Barre Town	Barre Town District #1 for Village of East Barre
Old granite quarry	Barre Town	Barre Town Fire District #4
Location of quarry unknown		Websterville emergency water supply

All the remaining waters in the watershed below 2,500 feet in elevation are Class B waters.

As part of the Water Quality Standards revisions in 2000, the system was changed to allow Class B waters be divided into three management types: B1, B2 and B3. This change was made to furnish a greater level of protection to existing higher quality waters and to recognize attainable uses that could be supported by improvements to existing water quality. 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.

The revised Water Quality Standards require that all basin plans place Class B waters into one of the three water management types. However, considerable challenges over the past decade have limited ANR's ability to identify proposed water management types, and the Panel's ability to promulgate these designations. These challenges are listed in detail in VDEC's 2010 Report to the Vermont General Assembly on Basin Planning. As such, recommendations for water management types are not presented in this basin plan.

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). ORW designation identifies waters that have exceptional natural, recreational, cultural, or scenic values. Depending on the values for which designation is sought, ORW designation may protect exceptional waters through the permits for stream alteration, dams, wastewater discharges, aquatic nuisance controls, solid waste disposal, Act 250 projects and other activities.

Based on data collected by the Watershed Management Division, the VANR would support a community-led effort to petition the following waters as ORW:

- The Huntington River from the Gorge to the confluence with the Winooski (Richmond) due to outstanding recreational, aesthetic and cultural reasons. The Huntington Gorge and the river above and below serve as a major swimming destination for Chittenden County. The steep gorge, the waterfalls, and the forested riverbanks create a gorgeous setting. Culturally the gorge is a former mill site, with foundations remaining nearby.

- North Branch from Worcester Middlesex town line upstream to headwaters based on the river's exceptional natural, scenic and recreational values. Numerous swimming holes, many surrounded by waterfalls, dot the river.

Warm Water and Cold Water Designations

In addition to the foregoing classifications and designations, the following list of waters is designated for management as Warm Water Habitat by the Vermont Water Quality Standards. This designation specifies a lower minimum dissolved oxygen concentration than waters in the remainder of the basin that are designated as Cold Water Habitat:

Table 10. Warm water fisheries in the Winooski Basin

Warm Waters	Acres/miles	Towns
Berlin Pond	293	Berlin
Bliss Pond	46	Calais
Coits Pond	40	Cabot
Cranberry Meadow Pond	28	Woodbury
Curtis Pond	72	Calais
Gillett Pond	30	Richmond
Harwood Pond	44	Elmore
Molly's Pond	38	Cabot
North Montpelier Pond	72	East Montpelier/Calais
Richmond Pond	24	Richmond
Shelburne Pond	452	Shelburne
Sodom Pond	21	East Montpelier/Calais
Winooski River from GMP #19 to Lake Champlain[24]	17.3	Essex, Williston, Colchester
Valley Lake (Dog Pond)	88	Woodbury

[24] This designation is seasonal. For part of the year, the classification is cold-water.

The Basin 8 plan contains no recommendations for changing any of these warm water or cold water designations.

Classification of Wetlands

The Vermont Wetlands Rules adopted pursuant to 10 V.S.A. § 6025(d)(5), classify wetlands into three categories based on an evaluation of the functions and values set forth in statute and these rules. The level of protection provided by the state follows:

Class I wetlands are exceptional or irreplaceable in their contribution to Vermont's natural heritage and, therefore merits the highest level of protection. They are identified on the Vermont significant wetlands inventory maps or by a determination made by the Natural Resources Panel.

Any person may petition the Panel to classify any wetland as a Class I wetland, or to reclassify any Class I wetland to a lower classification, in accordance with the Vermont Administrative Procedures Act, 3 V.S.A. §§ 800-849, these rules and the Natural Resources Board Rules of Procedure.

Class II wetlands are presumed to be significant wetlands. The Secretary may, upon a petition or on his or her own motion, determine whether any wetland is a Class II wetland or a Class III wetland. The Secretary may establish the necessary width of a buffer zone of any Class II wetland as part of any wetland determination pursuant to these rules.

All activities in a Class I or Class II wetland or their associated buffer zones that are not considered an Allowed Use, require a Vermont Wetland Permit or Vermont General Wetland Permit. To receive a Vermont Wetland Permit, the applicant must demonstrate the proposed project will not have an undue, adverse impact on the functions and values of the wetland (Section 9.5a). Avoidance and minimization of impacts to the wetland or buffer zone is required (Section 9.5b).

Class III wetlands are wetlands that are neither a Class I nor a Class II wetland. See 10 V.S.A. § 902(8). They are not afforded protection under the Vermont Wetland Rules, but may receive protection at the federal or municipal level.

The VDEC supports the reclassification of the following wetland to Class I:

- Derway Island, Burlington. Owned by the Winooski Valley Park District, the 120-acre floodplain forest sits just south of the Winooski River just above the river's mouth. The wetland is listed in the *Wetlands of Outstanding Ecological Significance in Chittenden County.* Prepared by the Vermont Department of Fish and Wildlife, March 1992.

Existing uses

During the Basin 8 planning process, VDEC collected sufficient information to document and determine the presence of existing uses for swimming, boating, and fishing on flowing waters using current VDEC procedures (Appendix H). Waters used as active or emergency public drinking surface water supplies were also identified. The VANR presumes that all lakes and ponds that exist within the basin have existing uses of fishing, contact recreation and boating. This simplifying assumption is used because of the well-known and extensive use of these types of waters for these activities based on their intrinsic qualities and to avoid the production and presentation of exhaustive lists of all of these waterbodies across Basin 8. During the VANR's consideration of a permit application that might be deemed to affect these types of uses, this presumption may be rebutted on a case-by-case basis.

The lists presented in Tables 11 through 13 are not intended to represent an exhaustive list of all possible existing uses, Additional existing uses of contact recreation, boating and fishing on/in flowing waters and additional public drinking water supplies may be identified during the VANR's consideration of a permit application or in the future during subsequent basin planning efforts.

Table 11. Determination of existing uses of flowing waters for boating in Basin 8.

Waterbody	Town(s)	Basis for determining the presence of an existing use	Rating of water (class) [25]	Public access: Put in [26]	Public access: Take out
Winooski River: Down town Marshfield	Marshfield	Regularly paddled by Vermont Paddlers Club members(VPC)[27]	II/III	Below Mollys Falls Power House, Cabot Road, Marshfield	Old School House Commons, Marshfield
Winooski River: Marshfield to Winooski #8 Dam	Marshfield, Plainfield, East Montpelier,	WWRV[28] and FWR[29]	I-III	Old School House Commons, Marshfield	Dam Road – adjacent to Winooski #8 Dam
Nasmith Brook	Marshfield	VPC use	III – V	Holt Road	Twinfield High school

[25] Class rating pertains to the difficulty of whitewater passage.
[26] The list of put in and take out points for boats allow for the use of the entire Winooski river between dams for flat water boating.
[27] Pers. Communication, Vermont Paddler's Club Secretary, Ryan McCall, 5/18/11
[28] Jenkins J. and Zika P 1992. *The Whitewater Rivers of Vermont: The Biology, Geography and Recreational Use.* Agency of Natural Resources, Waterbury, VT.,
[29] Friends of the Winooski River, *A Paddling and Natural History Guide to One of Vermont's Great Rivers* www.winooskiriver.org

Waterbody	Town(s)	Basis for determining the presence of an existing use	Rating of water (class) [25]	Public access: Put in [26]	Public access: Take out
Great Brook	Plainfield	VPC use	I-II	Maxifield Road	Recreation Field Road off Mill St.
Winooski River – Kingsbury branch	E. Montpelier	VRC[30] conservation easement for boating access	I	Off Coburn Road, approx. ¾ mile, past the bridge on right.	Winooski main stem take outs
Stevens Branch	Williamstown, Barre Town, Barre & Berlin	FWR & VPC use	I-IV	Brockway Hill Road, Williamstown	Confluence with Winooski, Montpelier
Jail Branch	Barre Town	VPC	III-V	Washington Road at base of Reservoir, Barre Town	Ayers Street, Barre City
North Branch Winooski River	Elmore, Worcester, Middlesex, Montpelier	Let it rain, VPC, FWR	I-V	Route 12 in Elmore	Confluence with Winooski, Montpelier
Hancock Brook	Worcester	VPC and VRC	IV-V	Hampshire Hill Road Worcester	Route 12 Worcester
Minister Brook	Worcester	VPC	III-IV	Minister Brook Road, Worcester	Route 12 in Worcester
Martins Brook	Middlesex	VPC	III-IV	Macey Road, Middlesex	Shady Rill Park, Middlesex
Winooski River: Montpelier to Middlesex Dam	Montpelier, Middlesex	FWR	I/II	Montpelier High School: Put in is `100 yards below the Bailey Ave. bridge. Path is off the bike path.	Just above Middlesex Dam: The take out is on the left just beyond the Rte 100B bridge.
Dog River	Roxbury, Northfield, Berlin, Montpelier	VPC, WWRV, FWR	I-II	Rabbit Hollow Road, Northfield	Confluence with Winooski River, Montpelier under I-89 bridge
Stony Brook	Northfield	VPC	III-IV	Chamberlin Road, Northfield	Confluence with Dog River, Northfield

[30] Vermont River Conservancy

Waterbody	Town(s)	Basis for determining the presence of an existing use	Rating of water (class) [25]	Public access: Put in [26]	Public access: Take out
Cox Brook/Devils Washbowl	Moretown, Berlin & Northfield	VPC	III-V	Devils Washbowl Road, Moretown	Confluence with Dog River, Northfield
Winooski River: below Middlesex Dam to Waterbury	Middlesex, Waterbury	FWR	I/II	south side of river at Middlesex Dam Powerhouse off Rte 100B	Waterbury Recreation Fields: Take out is on the right, near the mouth of Thatcher Brook.
Mad River-Austin Brook confluence park to confluence with Winooski River	Warren, Waitsfield, Fayston, Duxbury, Moretown	WWRV, VPC, FWR	I-V	Picnic area at confluence of Austin Brook and Winooski – Route 100, Warren	Route 2, west of bridge over Winooski River (west of the state highway garage) with parking
Mill Brook	Fayston	VPC	III-IV	German Flats Road, Fayston	Route 17, Fayston
Little River	Stowe, Waterbury	WWRV, VPC	I-III	Tansy Hill Road, Stowe	Confluence with Winooski River
Sterling Brook	Stowe	VPC	III-IV	Sterling Valley Road, Stowe (Stowe Land Trust)	Cole Hill Road, Stowe
Ranch Brook	Stowe	VPC	III-IV	Ranch Valley, Stowe	Route 108, Stowe
Notch Brook/West Branch Little River	Stowe	VPC	III-IV	Bingham Falls, Stowe	Route 108, Stowe
Gold Brook	Stowe	VPC	III-IV	Covered Bridge Road, Stowe	Route 100, Stowe
Winooski River: Bolton to Richmond	Bolton, Richmond	FWR	I/II	Bolton Dam Take Out is located on the left side of the river.	Volunteer Green Richmond: under the Bridge St. bridge
Ridley Brook	Duxbury	VPC, Let it Rain	IV-V	Upper Monroe Trail parking area, Duxbury	River Road, Duxbury
Joiner Brook	Bolton	VPC, Let it Rain	IV-V	Bolton Valley Access Rd	Route 2, Bolton

Waterbody	Town(s)	Basis for determining the presence of an existing use	Rating of water (class) [25]	Public access: Put in [26]	Public access: Take out
Winooski River: Richmond to Essex	Richmond, Jericho, Essex	FWR	I	Volunteer Green Richmond	GMP Access off IBM access rd
Huntington River – 10 miles from Hanksville to just before Huntington Gorge and below lower Huntington gorge to Winooski	Huntington, Starksboro, Richmond	WWRV	II-IV	North of Carse Road bridge, Huntington	Dugway Road, Richmond
Brush Brook	Huntington	VPC, Let it Rain	IV-V	Camel's Hump State Forest	Camel's Hump Road, Huntington
Winooski River: Essex to Winooski	Essex, Williston, Winooski,	FWR	I	Below Essex Dam: off 2A below power generating station. Park at Overlook Park,	Winooski Gorge Dam: After passing through Lime Kiln Gorge, the river turns right. Take out is on the left before river narrows into the gorge.
Mill Brook	Jericho	VPC, Let it Rain	II-IV	Fitzsimonds Road, Jericho	Route 117, Jericho
Winooski River: Winooski to Colchester	Colchester, Burlington, Winooski	FWR	I/II	Millyard Canoe Access in Winooski off Canal St.	VFWD Colchester Point access area off Windermere Road. .

Table 12. Determination of existing uses of flowing waters for fishing in Basin 8.

Surface Water	Location of Use	Town	Documentation
Winooski River	Route 2 Bridge (East side of Waterbury Village) in Waterbury to headwaters	Cabot to Waterbury	Special fishing regulations
Winooski River	Duxbury and Waterbury, from the top of the Bolton Dam in Duxbury and Waterbury upstream to the Route 2 Bridge (east side of Waterbury Village	Duxbury/Waterbury	Special fishing regulations
Winooski River	Ridley Brook mouth upstream to the top of the Bolton Dam in Duxbury and Waterbury.	Bolton/Duxbury/Waterbury	Special fishing regulations
Winooski River	From Preston Brook mouth upstream (approximately 4.4 miles) to the Ridley Brook mouth	Bolton/Duxbury/Waterbury	Special fishing regulations
Winooski River	From the Winooski One Hydro Dam west of Main Street (US 7) in Winooski and Burlington upstream to Preston Brook, Bolton	Duxbury	Special fishing regulations
Winooski River	From the Winooski One Hydro Dam west of Main Street (US 7) in Winooski and Burlington and extending downstream to the downstream side of the first railroad bridge.	Winooski, Burlington	Special fishing regulations
Winooski River	Lake Champlain upstream to the first railroad bridge (approximately 9 mile) in Winooski and Burlington.	Winooski, Colchester, Burlington	Special fishing regulations
Jail Branch	Upstream and down stream of East Barre Dam.	Washington, East Barre	VFWD document WBR trout present. Access at VDEC dam in E. Barre, off Washington St.
North Branch	Worcester Rt 12 brdg north of Russ Pond Bk to Rt 12 brdg north of Hancock Bk	Worcester	Stocked by VFWD
North Branch	Below Rt. 12 bridge south of Washington/Lamoille county line to access across from Moose Hollow road	Middlesex	Stocked by VFWD
Dog River	Winooski River, Berlin/Montpelier, to the downstream edge of the Junction Road Bridge in Berlin/Montpelier	Berlin/Montpelier	Special fishing regulations
Dog River	Downstream edge of the Junction Road Bridge in Berlin/Montpelier upstream to the top of Northfield Falls Dam in Northfield.	All applicable towns	Special fishing regulations

Dog River	Top of Northfield Falls Dam in Northfield upstream to headwaters	Northfield	Special fishing regulations
Chase Brook	From its confluence with the Dog River upstream approximately 1/2 mile to the top of the natural falls in Berlin	Berlin	Special fishing regulations
Mad River	Entire river	Applicable towns	Stocking by VFWD
Little River	US Rt 2 Bridge to its beginning at base of Waterbury Dam	Waterbury	Special fishing regulations
Little River	From the confluence with Winooski River upstream to the Rt 2 bridge in Waterbury	Waterbury	Special fishing regulations
Ridley Brook	Winooski River upstream approx. 1700 ft to first falls	Duxbury	Special fishing regulations
Ridley Brook	First falls to headwaters	Duxbury	Special fishing regulations
Ridley Brook	End of Camels Hump Road to River Road	Duxbury	Stocking by VFWD
Pinneo Brook	Winooski River upstream approx. 100 ft to railroad crossing	Bolton	Special fishing regulations
Pinneo Brook	Railroad crossing to headwaters	Bolton	Special fishing regulations
Joiner Brook	Winooski River upstream approx. 1900 feet to first falls	Bolton	Special fishing regulations
Joiner Brook	First falls to headwater	Bolton	Special fishing regulations
Preston Brook	Winooski River upstream approx. 2600 feet to first falls	Bolton	Special fishing regulations
Huntington River	Entire river	Huntington, Richmond	Stocking by VFWD

Table 13. Determination of existing uses of flowing waters for swimming in Basin 8.

Waterbody	Town	Aesthetic values and use by public confirmed	Public Access
Winooski River Main Stem – Hidden Dam	East Montpelier	Deep pools above barely submerged remains of dam	VTrans owned land, Rt. 2 provides parking area. Also trail from high school and CrossVermont trail goes by
Nasmith Brook – Paradise swimming hole	Plainfield	VSH[31]	Pull off on Nasmith Brook Road. Access from road and bridge ROW

[31] Jerry Jenkins, *Vermont Swimming Hole Study* Agency of Natural Resources, Waterbury, VT

Waterbody	Town	Aesthetic values and use by public confirmed	Public Access
North Branch at Nature Center	Montpelier	Sandy beach at walking bridge with deep pool	City land. Parking at city park and nature center.
Martins Brook - Shady Rill Park	Middlesex	Swimming hole, bedrock controlled grade to create deep swimming holes	Town land with parking. Opposite of Wrightsville parking lots,
Hancock Brook – Upper Pots	Worcester	VSH	VRC conservation easement. Parking .4 miles from the beginning of Hancock Brook Road
Dog River – Jacuzzi swimming hole	West Berlin	VRC	Owned by Town of Berlin. Parking at Fire Department before bridge over Route 12. Trail to swimming hole with wooden steps. Mowed lawn and picnic table above river.
Mad River-River side park	Warren	Friends of Mad River[32]	Public land. Parking lot opposite the Sugarbush Access Road,
Mad River-Picnic Area Cascades		VSH, Friends of Mad River	Public land and parking
Stetson Brook Cascades (Stetson Brook)		VSH, Friends of Mad River	Public land and parking
Mad River-Warren Falls	Warren	VSH, Friends of Mad River	Federal Land. Parking along the right side of Route 100 in front of Forest Service access gate.
Mad River-Lareau's Swimming Hole	Waitsfield	VSH, Friends of Mad River	Public land. Parking lot and sand beach off Route 100
Mad River-Moretown Gorge	Moretown	VSH	Parking lot north of 100B bridge over the Mad River. Take trail to sandy beach below gorge
West Branch - Bingham Falls	Stowe	VSH	State land. Access from a dirt pull off the Mountain Road or through the Stowe Land Trust owned Mill Trail
Moss Glen Brook - Moss Glen Falls	Stowe	VSH	State Land with parking lot
Gold Brook under bridge before Gold Brook Circle	Stowe	VSH	Road and Bridge ROW. Parking pull offs on road

[32] Pers. correspondence with Caitrin Noel, Director, Friends of the Mad River 6/30/11

Waterbody	Town	Aesthetic values and use by public confirmed	Public Access
Ridley Brook	Duxbury	VLT easement includes swimming	Duxbury Land Trust property. Parking on Camels Hump Road opposite Marshall Road
Huntington River -Horsebend swimming hole	Huntington	VSH	Audubon Center land. Parking at trail.
Huntington River -Audubon River Trail Swimming (Audubon Hemlock)	Huntington	VSH	Audubon Center land. Parking at center, accessible by trail.
Huntington River - Lower Audubon Swimming hole (River loop trail swimming hole)	Huntington	VSH	Audubon Center Land. Parking at center, accessible by trail.
Lower Huntington River Gorge (Huntington Gorge Cascade Chain)	Richmond	Richmond Land Trust (RLT) website and VSH study	16 acres of shoreland owned by Richmond Land Trust. Pull offs on Dugway Road

Table 14 Determinations of existing uses of waters for public surface water supplies in Basin 8

Surface Water	Town	Water Supply	Use Status
Thatcher Brook and tributaries	Waterbury	Village of Waterbury	Active
Unnamed tributary to the West Branch	Stowe	Village of Stowe	Emergency use only
Thurman Dix, Lower Reservoir and tributaries	Barre & Orange	City of Barre	Active
Standard & consolidated quarries	Barre	Websterville	Active
Berlin Pond	Berlin, Northfield, Williamstown	City of Montpelier	Active

Acronyms

319	Federal §319 grants for NPS pollution abatement
604(b)	Federal §604b funds for regional planning commissions
AAP	Acceptable Agricultural Practices
AMP	Acceptable Management Practices
AIS	Aquatic Invasive Species
ARS	Agricultural Resources Specialist
BMP	Best Management Practices
BBR	Better Back Roads Program
CAFO	concentrated animal feeding operations
CAV	Composting Association of Vermont
CREP	Conservation Reserve Enhancement Program
CSO	Combined Sewer Overflow
CVRP	Central Vermont Regional Planning Commission
CWA	Clean Water Act
EQIP	Environmental Quality Incentives Program
ERP	Ecosystem Restoration Program
FEH	Fluvial Erosion Hazard
FEMA	Federal Emergency Management Agency
FMR	Friends of the Mad River
FWR	Friends of the Winooski River
IDDE	Illicit Discharge Detection and Elimination
LaRosa	LaRosa Analytical Partnership Program
LCBP	Lake Champlain Basin Program
LEAP	Logger Education to Advance Professionalism
LMP	Lay Monitoring Program
MAPP	Monitoring, Assessment Planning Program (WMD)
NFIP	National Flood Insurance Program
NMP	Nutrient Management Plan
NPS	Nonpoint Source Pollution
NRCD	Natural Resource and Conservation District
NRCS	Natural Resource Conservation Service
ORW	Outstanding Resource Water
RM	River mile
RMP	River Management Program (VANR)
SEP	Supplemental Environmental Project
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TU	Trout Unlimited
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UVM Ext	University of Vermont Extension
VAAFM	Vermont Agency of Agriculture, Food and Markets
VACD	Vermont Association of Conservation Districts
VANR	Vermont Agency of Natural Resources
VDEC	Vermont Department of Environmental Conservation
VDFPR	Vermont Department of Forest Parks and Recreation
VFWD	Vermont Fish and Wildlife Department
VHCB	Vermont Housing and Conservation Board
VIP	Vermont Invasive Patrollers
VLCT	Vermont League of Cities and Towns
VLT	Vermont Land Trust
VSH	Vermont Swimming Hole Study
VTrans	Vermont Agency of Transportation
VRC	Vermont River Conservancy
VWQS	Vermont Water Quality Standards
VYCC	Vermont Youth Conservation Corps
WHIP	Wildlife Habitat Enhancement Program
WMD	Watershed Management Division (VDEC)
WNRCD	Winooski Natural Resources Conservation District
WRP	Wetland Reserve Program
WWTF	Waste Water Treatment Facilities

Glossary

Please see http://dec.vermont.gov/sites/dec/files/documents/WSMD_swms_Glossary.pdf