

Vermont Agency of Natural Resources

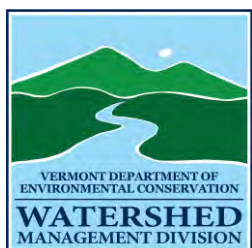
Watershed Management Division

Batten Kill Walloomsac Hoosic



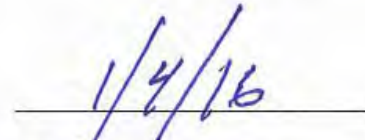
TACTICAL BASIN PLAN


The Hudson River Basin (in Vermont) - Water Quality Management Plan was prepared in accordance with 10 VSA § 1253(d), the Vermont Water Quality Standards¹, the Federal Clean Water Act and 40 CFR 130.6, and the Vermont Surface Water Management Strategy.

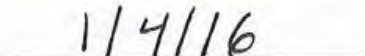


Approved:


Alyssa Schuren, Commissioner


Date


Deb Markowitz, Secretary


Date

Pursuant to Section 1-02 D (5) of the VWQS, Basin Plans shall propose the appropriate Water Management Type of Types for Class B waters based on the existing water quality and reasonably attainable and desired water quality management goals. ANR has not included proposed Water Management Types in this Basin Plan. ANR is in the process of developing an anti-degradation rule in accordance with 10 VSA 1251a (c) and is re-evaluating whether Water Management Typing is the most effective and efficient method of ensuring that quality of Vermont's waters are maintained and enhanced as required by the VWQS, including the anti-degradation policy. Accordingly, this Basin Plan is being issued by ANR with the acknowledgement that it does not meet the requirements of Section 1-02 D (5) of the VWQS.

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Hudson River Basin Tactical Plan Overview

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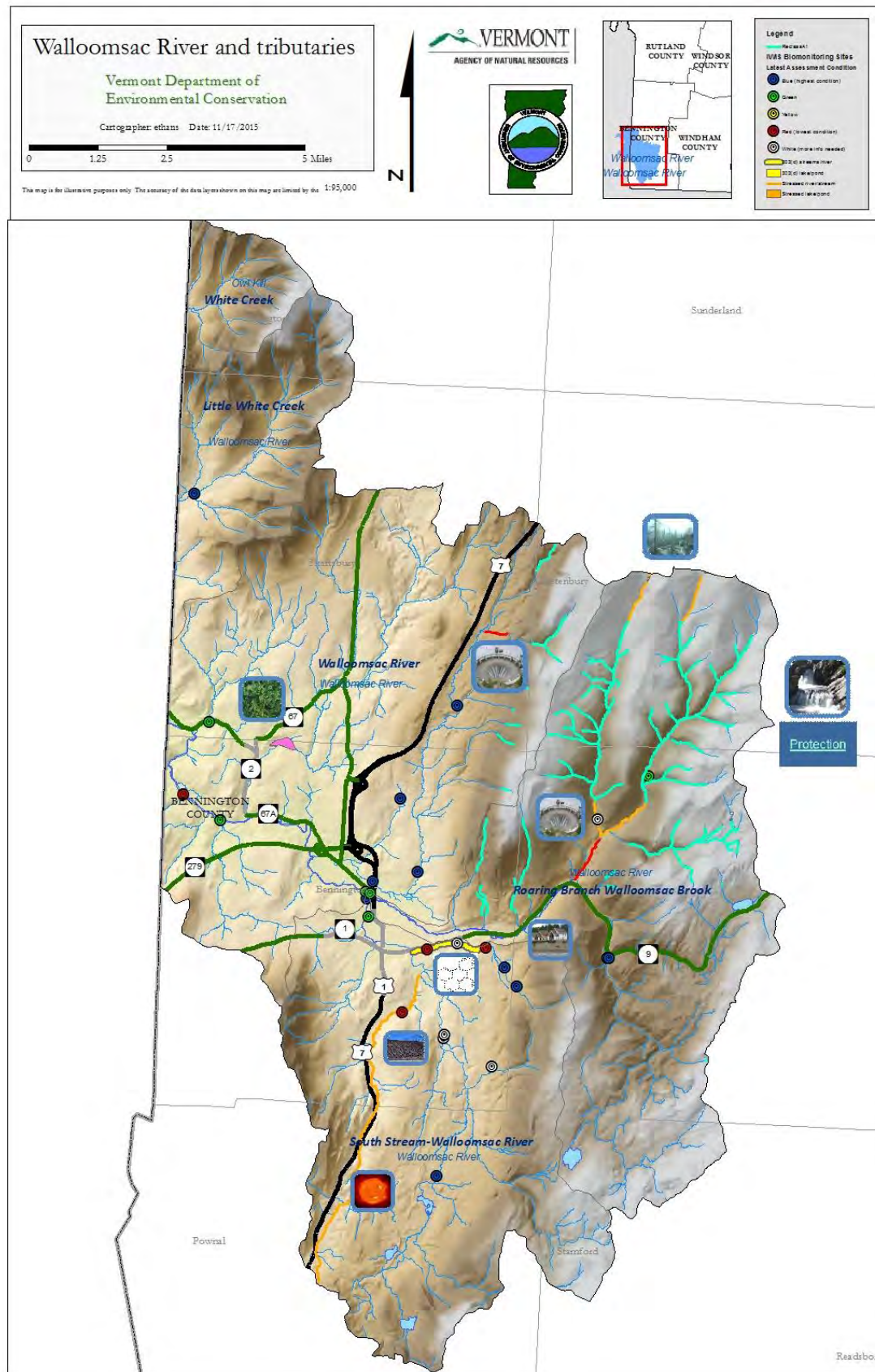


Figure 2. Walloomsac River Basin and Major Stressors



Figure 3. Hoosic River Basin and Major Stressors

Executive Summary

The Hudson River Tactical Basin Plan (also referred to as “Basin 01”) provides an overall view of the health of the basin and defines on-going and future actions to address high-priority stressors

(http://www.vtwaterquality.org/wqd_mgtplan/swms_ch1.htm). Basin 01 consists of the Batten Kill, Walloomsac, and Hoosic River Basins that all eventually flow southwesterly into the Hudson River in New York. The Basin covers just under 430 square miles of southwestern Vermont.

High priority stressors in the Hudson River Basin include Acidity (atmospheric deposition), Encroachment, Channel Erosion, Invasive Species, Thermal Modification, and Land Erosion.

The Batten Kill, Walloomsac, and Hoosic River sub-basins are significant in representing source waters in Vermont for the upper Hudson River. The protection and improvement of the Hudson River sub-basins, including the Batten Kill, Walloomsac, and Hoosic Rivers in Vermont, are reflected in the actions identified in this Tactical Basin Plan. There are also high elevation surface waters that are impaired due to acidity and elevated levels of sediment and nutrients. In addition, there is a good deal of focus on flood and erosion hazard risks in basin waterways. The heart of this plan is the implementation table in Chapter 4, which includes actions to protect or restore surface waters in the basin. Below are the goals and top priority strategies to complete these actions.

The Tactical Plan actions will protect, maintain, and improve surface waters by managing the activities that result in surface water stressors, and address the attendant pollutants associated with them. These actions strategically target specific surface waters in those sub-basins (Figure 1) where their implementation would achieve the greatest benefit to water quality and aquatic habitat as well as being the most cost effective. In general, the Batten Kill, Walloomsac, and Hoosic Rivers are targeted for protection and restoration strategies while various tributaries are targeted for additional water quality and aquatic habitat monitoring and assessment work. This and all Tactical Basin Plans benefit from biennial implementation table updates. For this Hudson River Tactical Plan, ongoing efforts to build flood resiliency will be a featured priority in the first biennial review, to implement priority actions related to ongoing restoration efforts due to Tropical Storm Irene.

On August 28, 2011, Tropical Storm Irene struck the central and southern portions of the State with over 10 inches of rain in many locations. The Batten Kill and Walloomsac

River Basins sustained significant flood damage in some areas due to erosion and flood inundation. This damaged or destroyed roads, bridges, culverts, private and public property, and farmland. The flooding and erosive damage will remain visible for decades but the rivers' response has been to re-create lost floodplains, increase sinuosity and re-distribute sediment throughout the valleys. The new river channels and patterns will offer some mitigation of future flood events. This Plan will emphasize actions that will assist watershed residents and towns to remediate Irene's impacts and enhance the flood resilience of the Basin against future flood events. Future attention to building with flood resiliency in mind will also move the region toward a more sustainable co-existence with our rivers. A number of implementation actions are direct responses to the flooding in order to move in this direction.

Recreational opportunities are extensive in the Basin. The Batten Kill has been designated as an Outstanding Resource Water for fishing and is well-known for paddling.

This Water Quality Management Plan provides a watershed-wide perspective on the health and condition of the water quality and aquatic resources of the basin. As the tactical, or implementation, portion of the [Vermont Surface Water Monitoring Strategy](#) it offers clear actions to protect, maintain, and improve surface waters by managing the activities that cause the known stressor(s) and address the resulting pollutants. Priority has been given to those waters that are identified as facing the greatest challenges due to either degraded conditions already present or the exceptional quality and characteristics that should be protected.

Strategies address both overall regional water quality issues as well as specific actions on targeted waters. The goal is to carry out as many of these actions as possible over the next five years to bring improvements and protections to the regions surface waters.

Priority Actions

Top Ten Actions:

Protect very high quality surface waters throughout the Basin for re-classification and designation of these significant natural resource assets.

Build flood resiliency into regional and municipal planning and projects

Minimize forest fragmentation, especially in large intact-forested headwaters that are not already conserved.

Reduce non-point source pollution from gravel roads by preparing road erosion capital budgets and implementing Best Management Practices (BMPs) in the upper

watersheds that address significant sediment sources (target towns include Pownal, Rupert, and Sandgate).

Restore stream equilibrium and support improved aquatic organism passage (AOP) and habitat - upgrade/replace high priority stream crossings with structures that are geomorphically-compatible. Actively restore aquatic habitat within both stream channels and riparian areas (priority sub-basins include headwaters of the Hoosic, including Roaring Brook and Stamford Stream).

Protect targeted river corridors and wetlands - protect high priority river corridors and wetlands for sediment attenuation assets, flood resiliency, and aquatic and wildlife habitat, and **Minimize flood plain encroachments** - identify and remove high priority flood plain encroachments and implement projects that connect the active river channel to its flood plain (as identified in river basin corridor plans).

Coordinate with the Bennington County Regional Commission and towns in the Basin to update Town Plans and Zoning Regulations to incorporate enabling language for water quality protection and remediation. Incorporate Low Impact development standards into Town Plans and Zoning Regulations to promote these stormwater mitigation strategies.

Implement high priority agricultural BMP needs identified through Agricultural Environmental Management assessments, especially on Small Farm Operations (SFO) throughout the basin.

Develop and implement stormwater master plans (or Rural Road Master Plans as appropriate) as well as implement the highest priority stormwater mitigation projects as identified in Basin towns via the (IDDE) projects (towns include Arlington, Bennington, Manchester Village (and Town), Shaftsbury, Sunderland, and Pownal).

Protect public access to watershed swimming holes, recreational boating, and fishing areas. Related to this, encourage aquatic invasive plants, animals, and pathogens spread prevention efforts in the basin.

Summary of Classification Opportunities.

Water recommended for reclassification to Class A(1):

- Beebe Pond (Sunderland) and tributaries
- Branch Pond Brook
- Bourn Brook (where not already wilderness lands)
- Lye Brook and tributaries (portion forming boundary between Lye Brook Wilderness and non-wilderness GMNF lands)
- South Fork of the Roaring Branch
- Alder Pond (Sunderland) and tributaries
- Black Brook and tributaries, upstream of confluence with Fayville Brook
- North Branch Hoosic River (Cardinal Brook)

Wetlands Class I candidates:

Pownal Bog

Wetlands proposed for study to determine Class I potential:

Batten Kill headwaters

Maple Grove Swamp

Middle Pownal Road Swamp

Accompanying this public review draft, the Vermont Agency of Natural Resources has prepared an online mapping tool that allows the reader to identify the locations of many Hudson River Basin features, and actions identified in the Implementation Table. This resource is [online via this link](#).

Other Priority Actions

- Incorporate River Corridors and flood resiliency strategies into regional plans and municipal planning and zoning updates.
- Work with the US Forest Service to reclassify candidate surface waters within the Green Mountain National Forest from Class B to Class A(1).
- Conduct Stormwater mapping and master planning assessment on the West Branch of Munson Brook and its tributaries that address sediment and stormwater impacts.
- Implement restoration projects prioritized in River Corridor Plans for the Batten Kill, Walloomsac, and Hoosic Rivers and their tributaries
- Protect the intact-forested landscape to reduce forest fragmentation where it is not already conserved.
- Implement stormwater control projects and green infrastructure practices to reduce flows and sediment. Focus areas: Bennington, North Bennington, Manchester, Pownal
- Reduce sediment inputs and thermal stress to Jewitt Brook from land erosion and the loss of riparian habitat.

Chapter 1 - Introduction

Basin Description

The Hudson River Basin and its sub-watersheds are described in detail in Chapter 2.

Purpose of the Tactical Plan

Tactical basin plans are developed according to the goals and objectives of the Vermont Surface Water Management Strategy to protect, maintain, enhance, and restore the biological, chemical, and physical integrity, and public use and enjoyment of Vermont's water resources, and to protect public health and safety. The Tactical Planning Process is outlined in [Chapter 4](#) of the Surface Water Management Strategy.

Many of these recommendations have been implemented or are in progress by ANR and its watershed partners. This tactical plan builds upon those original plan recommendations by promoting specific, geographically explicit actions in areas of the basin that have been identified for intervention, using on-the-ground monitoring and assessment data.

The Vermont Clean Water Act

In 2015 the Vermont Legislature passed Act 64, the Vermont Clean Water Act. This Act strengthens multiple statutes related to water quality in the State. The Act addresses agricultural water quality on small, medium and large farms through the Agency of Agriculture, Food and Markets. Act 64, signed into law by the Governor on June 16, 2015, amended several provisions regarding agricultural water quality. The "accepted agricultural practices" (AAPs) are proposed to be renamed the "required agricultural practices" (RAPs). The AAPs and RAPs are minimum standards by which a farm must manage their agricultural operations. The revised RAPs will be addressed during the 2016 legislative session to include requirements for:

- Small farm certification
- Nutrient storage
- Soil health
- Buffer zones
- Livestock exclusion
- Nutrient management
- Tile drainage (By: January 15, 2018)

Act 64 also establishes water quality requirements for stormwater discharges from new and existing development, industrial and municipal stormwater discharges, and runoff from municipal roads through the Department of Environmental Conservation.

Through the Department of Forests, Parks and Recreation, the Act addresses water quality runoff from forest silvicultural activities. The Act also establishes the requirement that all water quality improvement actions undertaken by the State be integrated by means of Tactical Basin Plans, and establishes partnerships with Regional Planning Commissions, Conservation Districts, and other organizations to support this work. Lastly, the Act establishes a cleanup fund to dedicate resources towards the highest priority water quality remediation actions.

Act 64 is just beginning to be implemented. Drafting procedures and legislative rule-making are in process. The resulting policies and procedures will take several years to be fully implemented, and will ensure improved water quality throughout the state. For more information, readers should review the content of the Clean Water Vermont website, at: <http://cleanwater.vermont.gov/>.

Watershed Partners

There are several active organizations undertaking watershed monitoring, assessment, protection, restoration, and education and outreach projects in the Hudson River Basin. These partners are non-profit, state, and federal organizations working on both private and public lands.

The Batten Kill Watershed Alliance

The Batten Kill Watershed Alliance (BKWA) was created in 2001 to promote good stewardship of the river and its tributaries in both Vermont and New York. The Alliance is fulfilling this mission through investments in the river system and public outreach. They have built partnerships with landowners, river users, and government agencies in both New York and Vermont. The formation of the group was motivated by stakeholder concern about the erosion and channel instability, a decline in the trout population in the 1990s, and conflicts among river users and landowners.

Alliance achievements have included investments in trout habitat improvements and better river dynamics, erosion control and bank stabilization projects, sponsorship of River Stewards, and public presentations on topics concerning the river. The most significant accomplishment has been the installation of cover and shelter structures in the river based on the latest scientific conclusion that this component of habitat is deficient in the river. There is now documented evidence that this kind of habitat improvement can increase the trout population, reversing the earlier decline. This project is ongoing in the Batten Kill in both states. The BKWA is currently involved in projects in White Creek in both NY and VT, and we will be evaluating projects in other tributaries related to damage from tropical storm Irene.

The BKWA is governed by an eleven member board of directors that includes landowners, anglers, canoeists, and community members from both states. Alliance projects are supported by our members, and BKWA has also received grants from organizations such as Trout Unlimited chapters, Green Mountain National Forest, U.S. Fish & Wildlife Service, the Trout & Salmon Foundation, the Orvis Company, the National Fish & Wildlife Foundation, and the Environmental Protection Agency through the River Network.

Bennington County Regional Planning Commission

The Bennington County Regional Commission (BCRC) was created, pursuant to 24 V.S.A. Section 4341, by the seventeen towns and villages it serves and will work with and on behalf of those municipalities to build strong, resilient, and sustainable communities, to foster economic prosperity, and to promote a high quality of life for residents of the region.

This mission is accomplished through direct planning and community development assistance to town and village governments, through preparation and implementation of regional plans and studies, and through synergistic working relationships with local and regional organizations. The BCRC will work cooperatively with local governments to establish and advance regional cohesiveness, actively advocate for adherence to adopted regional policies, and facilitate effective communication between local, state, and federal levels of government.

The Hoosic River Watershed Association (HoorWA)

HoorWA is a 501(c)3 non-profit organization founded in 1986 and based in Williamstown, MA. It is dedicated to the restoration, conservation and enjoyment of the Hoosic River and its watershed, through education, research, and advocacy. HoorWA envisions a watershed that is ecologically sound and adds to the quality of life of its residents. Historically, the organization has achieved a great deal through the volunteer efforts of its members and a very active Board. Support is largely from membership dues and gifts, supplemented with grants for specific projects.

HoorWA conducts a tri-state water quality monitoring program. Results are provided to state agencies and to the public annually in a written report. HoorWA also has an active education and outreach program that includes lectures, hikes, workshops, and rafting trips, frequently in partnership with other organizations. Working with the Village of Hoosick Falls, we are creating a Hoosic River Greenway on an abandoned rail bed. We also conduct regular river cleanups, organize an annual river festival, and put on a tri-state Hoosic River Ride for bicyclists. Finally, HoorWA has a long history of

participation and leadership in river advocacy. This includes regular and active input in regional planning involving the watershed, especially the restoration of river channels; the promotion of low-impact recreational activities along the river (e.g., hiking, biking, kayaking); and participation in public discussion of issues that affect river or watershed health.

The USFS and the Green Mountain National Forest (GMNF)

The USDA Forest Service manages the GMNF, aided by partners, other agencies, and individuals. There are two Ranger Districts: the Manchester in southwest Vermont and the Rochester-Middlebury in central Vermont. The Forest Headquarters is currently located in Rutland, Vermont.

The Green Mountain National Forest (GMNF) encompasses more than 400,000 acres in southwestern and central Vermont, forming the largest contiguous public land area in the State. Characterized by striking scenery that combines rugged mountain peaks with quintessential Vermont villages, the Forest is an attraction for many visitors. The GMNF signifies a multiple-use ethic through its role of providing ecological and science-based forestry stewardship, clean water, diverse vegetation, high-value, high-quality forest products, economical and educational contributions, and trail-based backcountry recreation.

Bennington County Conservation District (and BCSFC)

The Bennington County Conservation District (BCCD) is dedicated to promoting rural livelihoods and protecting natural resources in Southwestern Vermont through the active conservation and protection of

- ❖ Our streams, rivers and lakes - the clean waters they transport, the opportunities for recreation they provide, the organisms (trout! loons!) that live in them.
- ❖ The forests that cloak our Green Mountains and Taconics - the natural areas and wildlife habitats they represent, the clean air and dark skies they protect, the timber and other resources they offer.
- ❖ Our working farms - the fresh and healthy products of all kinds they make available to us, the agricultural economy they sustain, the scenic vistas they preserve.

The Bennington County Sustainable Forestry Consortium (BCSFC)

The Bennington County Sustainable Forest Consortium is a collaboration between landowners, foresters, loggers and other natural resource professionals. The Consortium facilitates the exchange of ideas and experiences to encourage people to

care about our forests. The mission of the BCSFC is to promote responsible use and exemplary stewardship of the woodlands of Bennington County, and in so doing, to sustain the healthy ecosystems and rural livelihoods those forests support.

Better Back Roads Program (BBR) provides technical assistance, grant funding, and educational workshops related to transportation infrastructure and water quality. BBR provides funding for municipalities through the Better Back Roads Grants. Grant funding can be used to undertake road erosion inventories and capital budgets and to implement transportation infrastructure best management practices (BMPs) that address road erosion and improve water quality and aquatic habitat.

Vermont Agency of Transportation (VTrans) manages and maintains miles of State highway and stream crossings within the basin including Routes 4A, 22A, 30, 73, 133, 140, and Interstate 4. VTrans provides technical assistance in the form of hydraulic modeling for bridge and culvert replacements and transportation maintenance. VTrans also provides grant funding to basin municipalities including Structures and Transportation Enhancement grants.

USDA Natural Resources Conservation Service (NRCS) provides cost-share, technical assistance, and targeted support of agricultural best management practices. Additionally, NRCS provides funding and technical assistance for forestry and wildlife habitat projects.

Watershed Municipalities - there are twenty-three towns wholly or partially within the Hudson River Basin within the counties of Bennington and Rutland (Figure 4). Municipalities can protect water resources through town plan language and zoning bylaws. Additionally, towns are responsible for managing large networks of roads, drainage ditches, and stream crossings.

ANR Internal Partners- All Departments within ANR (Fish & Wildlife Department or DFW, Forest, Parks, and Recreation or FPR, and the Department of Environmental Conservation – herein referred to as DEC) and Divisions within them, work collaboratively on a number of watershed assessment, restoration and protection projects. Additionally, DFW and FPR own and manage hundreds of acres of state-owned lands within the basin. Annual stewardship plans are prepared by District Stewardship Teams and includes staff from DFW, FPR, and DEC. Long Range Management Plans of state-owned properties include restoration and protection of water resources. Some specific watershed restoration projects are described in this plan.

The Vermont Lake Wise Program

The Lake Wise Program is offered through the Vermont Lakes and Ponds Section to provide trainings in lake friendly shoreland management to Lake Associations and shoreland property owners. Through Lake Wise, participants receive technical assistance to evaluate specific landscaping practices for fixing erosion and polluted runoff, while improving lake quality and wildlife habitat. Lake Wise participants passing all four categories for driveway; structures and septic systems; recreation areas; and shorefront receive the Lake Wise Award, which can include a beautiful Sign that can be proudly displayed on the property. Lake Associations are also awarded the “Gold Award,” depending on the percentage of shoreland owners participating in Lake Wise.



The goal of Lake Wise is to improve or maintain water quality and in-lake and on-shore wildlife habitat by encouraging lake friendly landscaping practices.

<http://www.vtwaterquality.org/lakes.htm>

Implementation Process

This Tactical Plan spells out clear, attainable goals and targeted strategies to achieve those goals. The plan contains an Implementation Table (Chapter 4) by which progress can be tracked with regard to measurable indicators of each major goal.

Actions defined in the Implementation Table will be addressed over the life of the Hudson River Basin Tactical Basin Plan. Successes and challenges in implementing Actions will be reviewed and addressed in annual meetings with watershed partners. The Tactical Plan will not be a static document. Tropical Storm Irene has taught us that DEC and its partners have to develop adaptive management techniques as new natural and anthropogenic events present themselves. In addition, the implementation of actions and Implementation table itself will be revisited biennially, and be modified accordingly to best address newly emerging information , unanticipated events, and

new requirements such as are anticipated by legislative acts such as Act 110, Act 16, and Act 64, now generally referred to as the Vermont Clean Water Act.

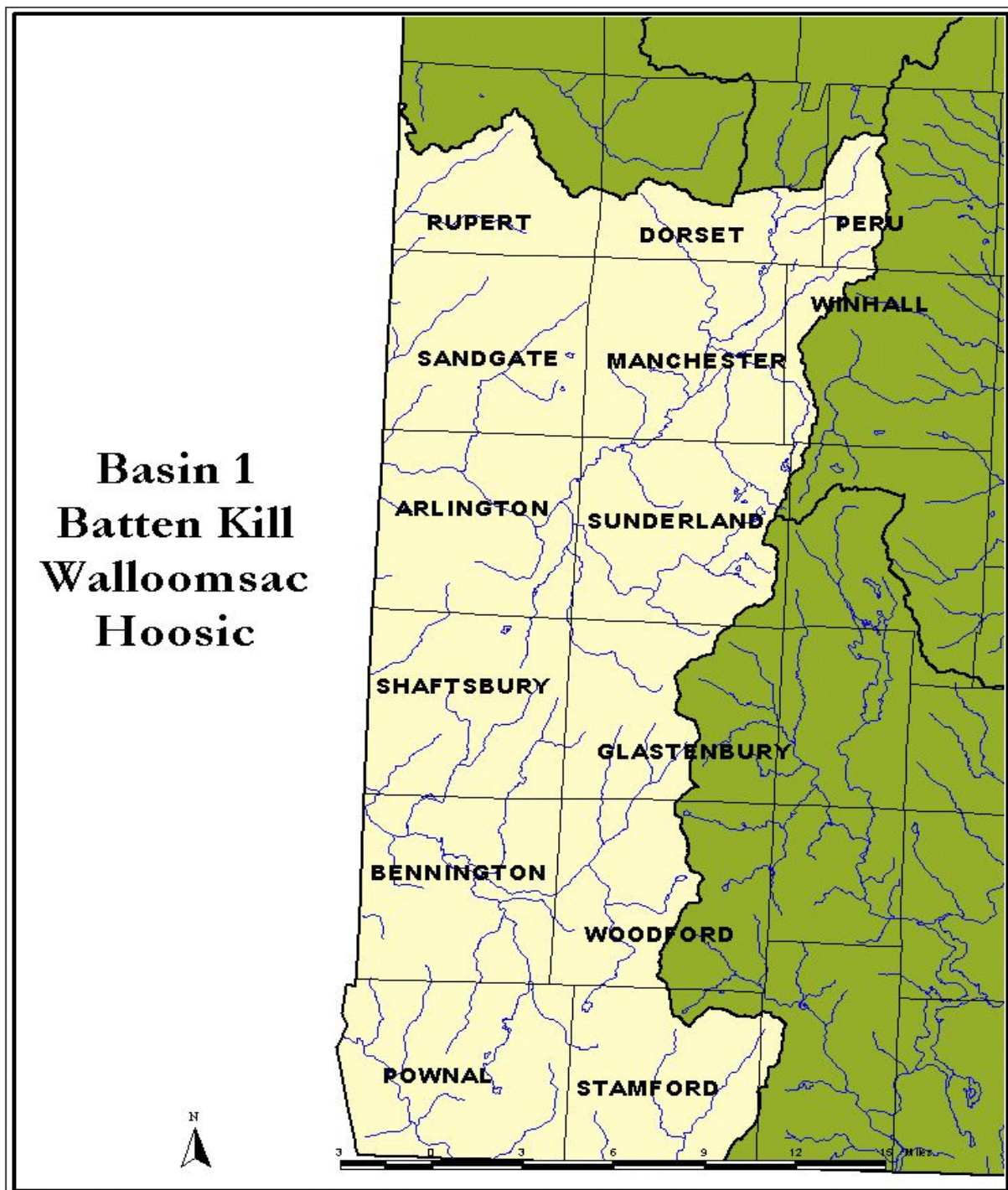


Figure 4. Hudson River Basin (in Vermont) map with municipal delineations.

Chapter 2- Water Quality in the Basin

Watershed Description

The Hudson River Basin has three major tributaries in Vermont. The watershed was broken up into three priority sub-watersheds for the purposes of presenting the information on monitoring and assessment information, priority surface waters identified in each, and priority actions to address those waters and issues.

In this plan, the following sub-watersheds are highlighted for specific intervention based on DEC's evaluation of monitoring and assessment data.

- The Batten Kill
- Walloomsac
- Hoosic

The Walloomsac River is a tributary to the Hoosic River, although broken out as a sub-basin in this Plan as the confluence of the Walloomsac and Hoosic is downstream in New York State. The Batten Kill, Walloomsac, and Hoosic River sub-basins are significant for providing the source waters of Hudson River.

ANR Natural Resource Atlas – Tactical Basin Planning theme

In December 2012 ANR introduced the **Natural Resource Atlas**. Much of the assessment, monitoring, and other information included in Chapter 2 is now accessible through the Natural Resource Atlas. The purpose of the [Natural Resources Atlas](#) is to provide geographic information about environmental features and sites that the Vermont Agency of Natural Resources manages, monitors, permits, or regulates. In addition to standard map navigation tools, the Natural Resources Atlas site allows the viewer to link from sites to documents where available, generate reports, export search results, import data, search, measure, mark-up, query map features, and print PDF maps.

The Natural Resource Atlas now includes a Tactical Basin Planning theme, which highlights the major priorities and implementation categories in each watershed planning basin. The Tactical Planning theme shows where in the basin actions will be targeted. Examples include candidate waters for protection and reclassification, high priority waters for nonpoint source mitigation, priority areas identified for aquatic habitat restoration, opportunities for additional public access to surface waters, and priority waters for additional monitoring and assessment.

The Batten Kill

The Vermont portion of the Batten Kill watershed drains much of the northern portion of Bennington County and includes an area of approximately 200 square miles. The Batten Kill rises in East Dorset and flows south with Mad Tom Brook soon joining it from the southern slope of Mount Tabor. It flows in a southwesterly direction to Arlington and then in a westerly direction to the Hudson River in New York, which it enters at a point one mile north of Schuylerville, New York. Two hundred and seven square miles of the drainage area of the basin are located in the New York portion of the watershed. From source to mouth following the major windings, it measures approximately 55 miles. The length of the river in Vermont is approximately 24 miles (the Vermont portion of the Batten Kill is now undammed as a result of the removal of the Dufresne Dam).

The following river and tributary descriptions for the Vermont portion of the basin were taken in part from the United States Geological Survey, Department of the Interior Publication *Surface Waters of Vermont*.

Mad Tom Brook rises on the southern slope of Mount Tabor in the northwestern part of the town of Peru at an altitude of 2,900 feet above sea level. It flows southward and south-westward to East Dorset where it joins the beginning of the Batten Kill from the north. Its length is about 5 ½ miles and its fall is about 2,100 feet.

The West Branch rises on the northern slope of Bear Mountain in the southeastern part of Rupert at about 2,500 feet above sea level. It flows eastward about 2 miles, then turns and flows southeastward to near Manchester Center. The West Branch has a length of about 9 miles and a fall of 1,800 feet, of which 1,600 feet occurs in the first 2 miles.

Bourn Brook rises in Bourn Pond in the northeastern part of the town of Sunderland at an altitude of 2,500 feet above sea level. It flows somewhat east of north for about 2 miles and then takes a northwesterly course to its junction with the Batten Kill half a mile south of Manchester Center. Its length is about 6 miles and fall about 1,800 feet of which 1,300 feet of drop occurs within 1 ½ miles in the middle of its course.

Lye Brook rises in Lye Brook Meadows in the northeastern part of Sunderland at an elevation of 2,640 feet above sea level. It flows in a northerly direction about 5 miles, then turns abruptly and flows southwestward to its junction with the Batten Kill. Its length is 6 miles and its fall is 1,900 feet of which 1,800 feet occurs in the northward flowing stretch.

Mill Brook rises near the center of Sunderland at an altitude of 2,550 feet above sea level and flows southwestward, westward and northwestward to its junction with the Batten Kill at Sunderland. Its length is approximately 4 ½ miles and its fall about 1,920 feet, of which 1,600 feet occurs within 2 ½ miles of the head of the stream.

Roaring Branch originates at the junction of Branch Pond Brook and Alder Brook west of Kelly Stand. It is approximately 10 miles long and flows overall in a westerly direction with northerly and southerly jogs until the East Arlington area. Just north of East Arlington, Warm Brook joins Roaring Branch from the south. Roaring Branch continues north from there to join the Batten Kill.

The Green River rises in many forking branches on the western slopes of Bear Mountain in the towns of Sandgate and Manchester at an altitude of nearly 3,000 feet above sea level. It flows southwestward to Sandgate then takes a more southerly course to its junction with the Batten Kill in West Arlington. Its length is about 10 miles with a total fall of 2,400 feet from source of highest tributary to the mouth.

Special Values and Features of Batten Kill River Waters

Waterfalls, Cascades, Gorges, and Swimming Holes

Four swimming holes are listed in the 1992 Vermont Swimming Hole Study for the Batten Kill watershed: three are on the Batten Kill itself and one is on Roaring Branch. One of the sites on the Kill is the Wagon Wheel Campground swimming hole, which is accessible to guests at the campground. The river is wooded and shady on both sides and there are shallow pools, instream boulders, small rapids, and a gravel bar. The second site on the Batten Kill itself is just west of Arlington off River Road. The parking area and grassy riverbank belongs to Batten Kill Canoe but the public has been allowed access for swimming and fishing. There is a long, fairly deep pool there. The third site on the river is at the West Arlington covered bridge and is “the most popular swimming area on the Vermont segment of the Batten Kill”. There is a large deep pool, good public access, a small beach, some grassy banks, and good fishing from the bridge piers. The other identified swimming hole in the Batten Kill watershed was Roaring Branch Cascade in Sunderland. This site is a series of pools and cascades with clean water, natural vegetation, and carved rocks.

In addition, the Lye Brook Falls is a cascading drop of the Lye Brook within the Green Mountain National Forest that was once referred to as the Trestle Cascade owing to the fact that an old logging railroad trestle crossed below the falls. The brook drops over the 125-foot cascade in the Town of Manchester.

Significant Natural Communities and Rare, Threatened and Endangered Species of the Batten Kill River Basin

An inventory of significant calcareous fens and riverside seeps done by the Vermont Nongame and Natural Heritage Program found two rich fen communities and one intermediate fen community in the Batten Kill watershed. The two rich fens are located in Manchester: one is a small (1.5 acre) wetland, of which a portion is rich fen, and the other is a relatively large, mostly open fen with a diversity of vegetation types and a large population of a globally rare sedge. A two-acre intermediate fen is found in Shaftsbury and an uncommon water sedge grows there.



Outstanding Resource Water status






On January 8, 1991, the Vermont Water Resources Board designated all Vermont portions of the Batten Kill mainstem and the West Branch of the Batten Kill as Outstanding Resource Waters. They were designated for their exceptional natural, recreational, cultural, and scenic values. The findings of fact and conclusions of law present the case for a “high quality trout stream” due to physical and chemical qualities and a river that provides “exceptional wildlife habitat” with its productive floodplain, intact riparian zone in many places, north-south orientation for migratory birds, slow-moving waters for furbearers, and thriving food chains that begin with aquatic insects and trout.

The case is also made through the ORW designation for the exceptional recreational values including angling and canoeing. Access, aesthetics, a good fishery, and enough water in summer all contribute to the heavy use of the river for recreation. Scenic and cultural values are also presented in the ORW petition.

Batten Kill Watershed Impacts Summary*

Table 1. Water quality condition of rivers, streams, lakes, ponds in Batten Kill Watershed

Stream or lake segment	Mileage & status	Pollutant	Stressor	Source	Other information
Lye Brook	RM 2.5 to headwaters (4.5 miles), Impaired – Part A list	ACID	 Acidity	Aquatic Life Support (ALS)	Atmospheric deposition: critically acidified; chronic acidification
Branch Pond Brook (pond to Roaring Branch)	Branch Pond Brook (pond to Roaring Branch),	ACID		ALS	Atmospheric deposition: critically acidified; chronic acidification

	Impaired – Part A list				
Fayville Branch RM 3.7 to headwaters	RM 3.7 to headwaters, Impaired – Part A list	ACID		ALS	Acidification, acid deposition
Munson Brook	0.8 miles Stressed –	Sediment	 Land erosion	Stormwater runoff, urbanization	High Embeddedness
West Branch	x.x miles Stressed	Sediment		Stormwater runoff, urbanization	High Embeddedness
Batten Kill mainstem	6.2 miles Stressed	Sediment, temperature, habitat alteration		Stormwater runoff, urbanization	Loss of riparian veg, streambank erosion, runoff, lack of habitat features
Bourn Pond, Little Mud Pond, Lye Brook N, Lye Brook S, Branch Pond, Beebe Pond	Impaired acid ponds in the basin	ACID		ALS	Atmospheric deposition: critically acidified; chronic acidification EPA approved TMDL September 30, 2003

***See list of stressors, associated icons, and their descriptions on page 57 – “Stressors, and Causes and Sources of Impairment”**

Assessment Information – Batten Kill and tributaries

Biological monitoring

The Batten Kill's clean water is biologically important because the most diverse and productive aquatic insect communities are associated with streams with cobble or gravel bottoms and well-oxygenated water. This is especially true for mayflies and stoneflies, both major foods for trout. The consistent summer flows of the Batten Kill are also very important for aquatic insects, in particular the larger mayflies and stoneflies. Moreover, it also has a diverse and productive fish community and nationally recognized as a significant trout fishing stream.

The Batten Kill is a quick-water stream with slopes in the 15-20 feet per mile range and hence has many riffles and mild rapids. Streams with abundant riffles and good summer flows have lots of good habitat for mayflies and stoneflies and thus tend to

have the highest populations of these insects. The natural vegetation along the banks of the Kill shades the channel and keeps the summer temperatures down.

The Batten Kill is, essentially, a limestone stream. The limestone is found in the upper and middle parts of the watershed. The limestone has two main effects: it neutralizes organic and inorganic acids that have deleterious biological effects, and it is itself an important nutrient for many plants and animals. Limestone streams invariably have more diverse shoreline plant communities than non-limy streams, have more abundant and diverse stream insect communities, and thus are able to support larger and more rapidly growing fish populations.

(Source: http://www.anr.state.vt.us/dec/waterq/bass/docs/bs_BattenKillmacro.pdf)

Table 2. Macroinvertebrate sampling results for Batten Kill mainstem sites

	rm 32.9	rm 47.0	rm 47.7	rm 48.0	rm 48.2	rm 54.9	rm 55.4	rm 55.5
2003	---	---	---	vg-good	---	---	---	very good
2007	---	---	---	---	---	Exc (VG for fish)	vg-good (VG for fish)	
2008	exc	---	vg-good	---	exc-vgood	---	---	
2010	very good	---	---	---	---	---	very good	
2012	---	very good	exc	---	---	---	---	
2013	very good	very good	---	---	very good	---	---	very good

Table 3. Batten Kill biological monitoring sites

Milepoint	Location description
Rm 32.9	Located immediately below Arlington cemetery off Route 313
Rm 47.0	Located 1300m below new Manchester WWTF, above confluence with Lye Brook above old road crossing
Rm 47.7	Located approximately 300m below new Manchester WWTF
Rm 47.8	Located about 50m above new Manchester WWTF
Rm 48.0	Below Union Street bridge about 300m below/adjacent to large sand bank slide
Rm 48.2	Located immediately below Union St Bridge
Rm 54.9	Below 2nd Route 7A crossing 100m going south. Low gradient reach
Rm 55.4	Immediately below 1st Route 7A bridge going south

Lakes in the Batten Kill Watershed

The Vermont DEC inventory identifies 18 lakes and ponds covering 259 acres in the Batten Kill watershed. Vermont DEC's Lake Protection Classification System is one framework within which lakes can be evaluated for their special significance when compared to other lakes statewide. The Classification System identifies unique lakes based on: wilderness status; occurrence of scenic and natural features; existence of very high water quality; and/or the presence of very rare, threatened, and/or endangered species. In the Batten Kill watershed, two ponds out of eighteen in the DEC assessment database - Bourn and Branch Ponds - are significant for one or more of these reasons.

Lye Brook Wilderness Area is the second largest Wilderness in the Green Mountain National Forest. Lakes, streams, and bogs are scattered throughout its heavily forested 15,680-acre landscape, including Bourn Pond. Bourn Pond in Sunderland is a true wilderness pond with an attractive sphagnum mat floating island. The pond supports populations of two noteworthy aquatic plants, the rare pondweed *Potamogeton confervoides* and the rare burreed *Sparganium fluctuans*. Bourn Pond is critical habitat for breeding common loon.

Branch Pond in Sunderland is outside the Lye Brook Wilderness Area but has a wilderness-like feel. The pond is undeveloped, essentially in a primitive state, but is relatively easily accessed. The pond supports two noteworthy aquatic plants, the rare pondweed *Potamogeton confervoides*, and the rare bladderwort *Utricularia geminiscapa*.

Lake Shaftsbury State Park is on an 84-acre parcel surrounding the small but picturesque Lake Shaftsbury. The area operated as a private campground/cabin resort before it became a state park in 1974. It has become a popular park facility in southwestern Vermont. There is also a developed beach, play area, and picnic area. The "Healing Springs Nature Trail" around the lake is also a popular spot.

Fisheries in the Batten Kill

The Batten Kill located in Bennington County of southwestern Vermont has long been recognized as one of this state's top trout fishing streams and has been grouped with other important trout fisheries of the United States. Prior to the introduction of Brown Trout to the river around 1900, the only salmonid inhabiting the river was the native Brook Trout. Following the initial releases of Brown Trout, the species established itself as a self-sustaining wild population around which the sport fishery developed further and built upon the river's reputation as Vermont's pre-eminent trout stream. All stocking was phased out by 1976 (with the exception of stocking the Dufresne Dam for a put-and-take fishery up until 2010) and since then the river's fishery has been entirely

dependent on wild fish production. In 1991 the river was designated by the Vermont Water Resources Board as the state's first Outstanding Resource Water. Both creel and electroshocking surveys by the Vermont Department of Fish and Wildlife (F&W) have shown a decline in the wild trout populations in the Batten Kill during the 1990s.

The Batten Kill is an exceptional fishery because of its ability to provide high-quality habitat for Brook Trout and Brown Trout. This exceptional habitat is provided by the confluence of several natural features in the same river. These features include: comparatively high summer flows, limestone in the drainage, extensive gravel beds for spawning, good shade along the banks, stable banks only occasionally subject to serious erosion and sedimentation, consistently cold summer water temperatures, a well vegetated watershed with minimal nutrient and sediment pollution, and a naturally reproducing Brook Trout and Brown Trout fishery. The river has stable flows, cool water temperatures favorable to salmonids, good physical habitat providing necessary cover, refuges, spawning and rearing habitats, as well as the food quality and quantity necessary to support a healthy salmonid population.

The status of the Batten Kill's brook and Brown Trout fishery has been monitored since at least 1984 at several index sites. On the upper Batten Kill, there is the Batten Kill (697) Manchester (or the Vermont 11 & 30 bridge) site, and the Batten Kill (766) East Dorset (or the Vermont 7A bridge) site. On the lower Batten Kill, there was a site just outside of Arlington village referred to as the "West Mountain Site", which was scoured out by Tropical Storm Irene and now is too deep to wade and sample and another site down below the West Arlington covered bridge called "Cemetery Run", which has such poor habitat conditions that it was abandoned as a site. The two upper sites are still monitored, however, a relatively new site on the lower Batten Kill called Twin Rivers Habitat Project site is now the longterm site for the lower Batten Kill. That site has been sampled since 2005.

The Batten Kill trout fishery has been one of the state's premier wild trout streams. However in the mid-1990s, there was a "dramatic decline" that has led to much investigation and subsequent actions to bring about a recovery in this nationally-known resource. An ANR Fish & Wildlife District I Trout Population Stream Survey report for the period July 1 2013 to June 30 2014 summarizes the work to date:

In response [to the dramatic decline], the Vermont Fish and Wildlife Department (VDFW) designated the lower 20 miles of the mainstem from the now-removed Dufresne Pond Dam downstream to the New York state line as no-harvest "catch-and-release" fishing only. This took effect at the start of the 2000 open-water trout fishing season and remains in place through at least October 31, 2017. Also in 2000, an interdisciplinary team of fishery and aquatic biologists was established to review possible causes for the population decline and to make recommendations of measures that might be implemented to restore trout populations to levels that sustained quality fishing over years prior to the population decline.

Between 2000 and 2006, much work was done to investigate likely causes for the decline as well as continued management of the fishery under “catch-and-release” only fishing. Insufficient cover habitat was ultimately identified as a likely factor limiting trout abundance, particularly yearling and larger fish. Consequently, VDFW partnered with the U. S. Forest Service, Green Mountain National Forest (USFS); Batten Kill Watershed Alliance (BKWA); private landowners; towns; other state and federal government entities and nongovernmental organizations to undertake in-stream and riparian habitat enhancements.

Beginning in 2005 cooperators began a 6-year project designed to test the “insufficient cover habitat” hypothesis at the Twin Rivers Habitat Project (TRHP) site located 1,000 ft upstream of the confluence of the Green River with the Batten Kill in Arlington. During late summer of 2006 approximately 1,191 feet of river channel was treated with large wood and stone to increase in-stream trout cover. Trout population response to habitat enhancement was evaluated annually through 2010. Results of this evaluation are reported by Cox (2011) under the F-36-R-13 Federal Aid in Sport Fish Restoration reporting segment (VDFW 2011).

A 2011 VDFW report on habitat enhancement noted that: “While no change in mean yearling trout numbers was observed between pre- and post-treatment periods at the control sites, average yearling fish numbers increased 4.9 fold in the treated pool and doubled in the treated riffle. In the pool habitat young-of-year trout numbers also doubled, and modest increases in the range of 1.6-1.8 times pre-treatment levels for fish in the 10-19.9 inch adult size range were observed. These results provide evidence that inadequate refuge habitats may be limiting trout abundance in the Batten Kill.”

Sampling in 2013 at the upper Batten Kill Manchester site, found the total trout per mile number well up from 2010 (the last time it was sampled) and the larger trout (>152mm) also up. Sampling at the upper Batten Kill East Dorset site in 2013 also showed the number of total trout per mile up from 2012 (although this had been down from 2010). The number of larger trout was down slightly from 2012 to 2013 (although both of those years were up from 2010. Graphs showing the history from 1984 to 2013 are on page 5 of the DFW District 1 F-36-R-16 Trout Population Survey Report for the Batten Kill.

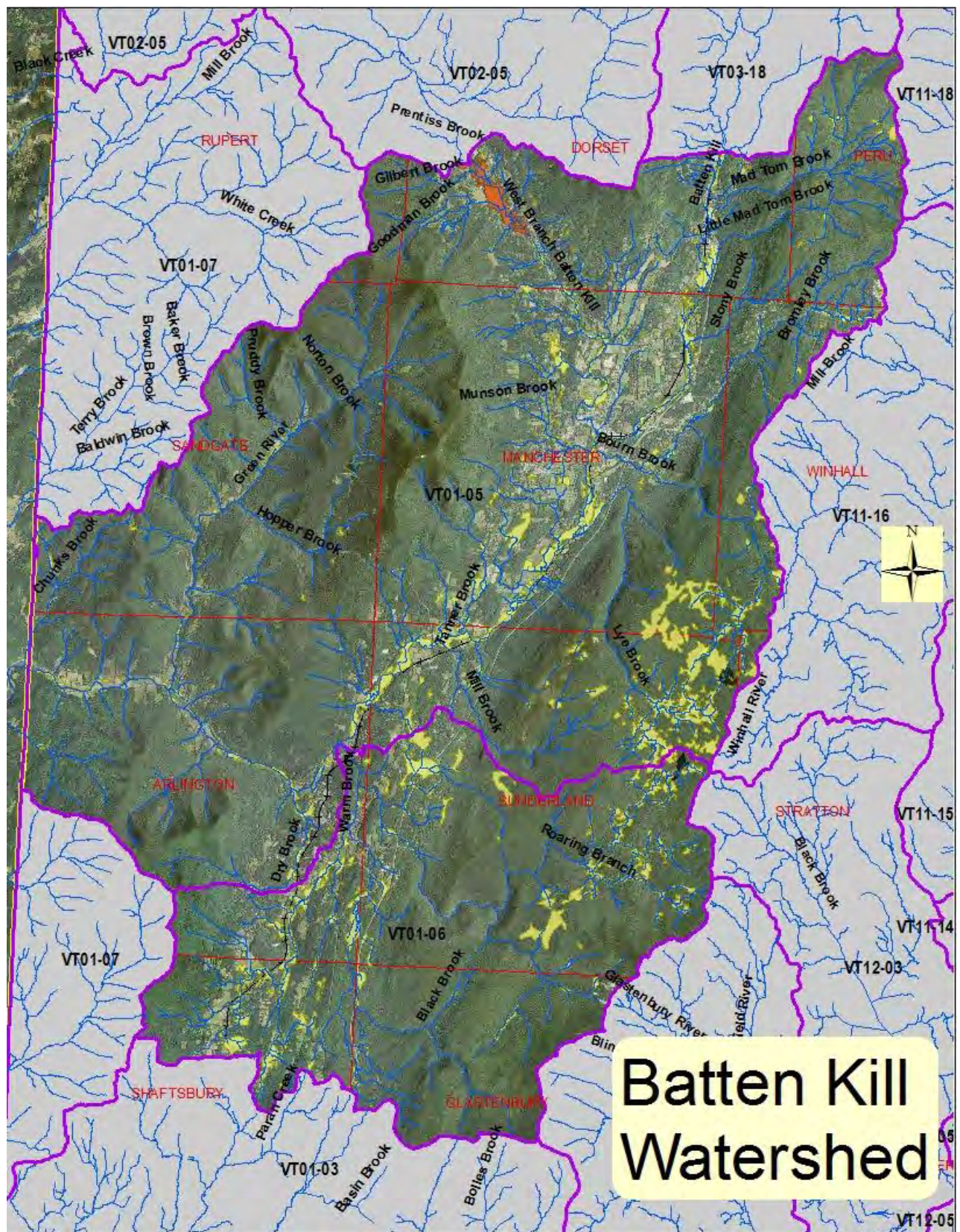
Sampling in 2013 at the lower Batten Kill TRHP site found the total trout per mile down from 2012 to 2013 but the number of larger trout up in the pool habitat section while both the total trout and larger trout numbers were down from 2012 to 2013 in the riffle habitat section. The numbers in both habitats in 2013 were still greater than the numbers in 2010 pre-Tropical Storm Irene.

For the second consecutive year following Tropical Storm Irene flood (August 28 and 29, 2011) two trout population stations on the Roaring Branch, a tributary to the Batten Kill, were sampled to assess changes in trout population abundance and size structure

before and after the flood and in response to habitat mitigation first undertaken in the fall of 2013 and to be continued in 2014. In addition to extensive flood damage, the Roaring Branch was channelized to provide gravel and stone for repair of the adjacent Kelley Stand Road, which was also heavily damaged by floodwaters.

Additionally, a monitoring site was setup on the East Branch just upstream of an area previously inundated by Dufresne Pond. The dam forming this on-stream impoundment was removed by the Vermont Agency of Natural Resources during the summer of 2013 restoring about 2,192 feet of channel to free flowing river and lotic habitat. The VDFW will be monitoring trout population response to habitat conversion over the next several years.

Figure 5. Batten Kill Watershed in Vermont



The Walloomsac River

The Walloomsac River watershed drains much of the south-central portions of Bennington County being bounded by the Batten Kill watershed on the north and the upper Hoosic River watershed on the south. The headwaters of the Walloomsac River are located in Vermont draining 139 square miles of the state before entering New York. The Walloomsac River is a significant tributary to the Hoosic River.

The Walloomsac River begins where South Stream and Jewett Brook join just south of Bennington village. The river winds through Bennington in a northwesterly direction. Just north of Bennington village, the Roaring Branch enters from the east. As a larger river now, the Walloomsac flows northwestward through the northwest portion of the town of Bennington then into New York and to Hoosic Junction where it joins the Hoosic River. In addition to South Stream and the Roaring Branch, the major direct tributaries in Vermont include Jewett Brook, Furnace Brook, Paran Creek, and Cold Spring Brook.

Special Values and Features of Walloomsac River Waters

Waterfalls, Cascades, Gorges, and Swimming Holes

No waterfalls or cascades were reported in the *Waterfalls, Cascades and Gorges* report done for Vermont DEC. However, a small stretch where the stream cascades over ledges was observed on South Stream above and below the Coleville Road Bridge.






Significant Natural Communities and Rare, Threatened and Endangered Species of the Walloomsac River Basin



Four sites from the Walloomsac River watershed were described in the Vermont Department of Fish and Wildlife study of significant calcareous fens and riverside seeps. One site identified is Pownal Bog north of Barber Pond, which is actually a fen community and not a bog. Six rare plants occur at the site as well as four uncommon plants and a rare moss. This two and a half acre peatland has formed in a kettlehole depression. Another small intermediate fen was briefly surveyed in Pownal although it seemed to be a transitional site and so its significance is not known.

The other two sites in the Walloomsac River watershed were found in Shaftsbury. Paran Creek Fen located south of Simeon Dean Road consists of two small rich fens that contain a population of a globally rare sedge. Serendipity Fen is a one-acre fen within a 100-acre plus wetland. It is a rich fen and also has the globally rare sedge in it.

Walloomsac River Watershed Impacts Summary

Table 4. Water quality condition of rivers, streams, lakes, ponds in Walloomsac Watershed

Stream or lake segment	Mileage & status	Pollutant	Stressor	Source	Other information
Barney Brook	mouth to RM 1.5 miles, Impaired – Part A list	Iron precipitate	 Toxics	Downstream of landfill, haz site, and constructed wetlands; silt and iron precipitate causing fish/invert impacts	Aquatic biota not supported from RM 1.5 downstream but healthy above
Hewitt Brook	Stressed	Arsenic and PCB's	 Toxics	Old Bennington Landfill	Monitoring is underway
Basin Brook	Altered by flow regulation	Possible lack of minimum flow below water supply withdrawal point (threat)	 Flow alteration		WSID #5017 - North Bennington Water Dept; serves as back up supply source to gravel well field
Bolles Brook/Roaring Branch, intake to City Stream confluence	1.0 miles, Altered by flow regulation (Part F list)	Possible lack of minimum flow below water supply withdrawal point (threat)	 Flow alteration	Bennington water supply	WSID #5016 - Bennington Water Dep't; assessment of water withdrawal impact difficult given low productivity & low ph effect
Jewett Brook	Stressed – Part C list	temperature	 Thermal modification	ALS	“fair” bugs in 2008 & 2009 – temperature thought to be the stressor
South Stream	Stressed	Nutrient enrichment	Non-erosion nutrients - phosphorus		Hatchery – nutrient criteria issue – though scoring exc. in IBI – very high richness (fish “poor” – 2008)

Stream or lake segment	Mileage & status	Pollutant	Stressor	Source	Other information
Roaring Branch	Stressed	Geomorphic instability	 Encroachment	Floodplain encroachment	Historic manipulation and re-routing of river location
Lake Paran (Bennington)	40 acres Altered – Part E list	Eurasian watermilfoil	 Invasive species	Contact, secondary recreation	Eurasian watermilfoil weevil present (<i>Euhrychiopsis lecontei</i>)
Lake Shaftsbury	27 acres Altered – Part E list	Water Chestnut	Invasive species	Contact, secondary recreation	Handpulling underway, periodic monitoring

Lakes and Ponds in the Walloomsac Watershed

The Vermont DEC inventory has 6 lakes covering 193 acres in the Walloomsac watershed.

Lake Paran, lying partially in Bennington, North Bennington, and Shaftsbury and an impoundment of Paran Creek, it is an important recreation site and views of and across the lake from the dam, boat launch, park, and the old rail spur are unique in the area . In the summer months this is one of the most heavily used waterbodies in the County and the primary swimming spot in the Walloomsac watershed. The Lake Paran Association provides a safe swimming access for local families at a small annual fee. Lake Paran occupies a natural basin at the northern edge of the Village of North Bennington. The lake's current shape, coverage, and depth were established by the railroad dam that was constructed in 1850. The surface area of the lake is now 36 acres and it lies at 647 feet above Mean Sea Level.

Current uses of Lake Paran and adjacent lands include swimming, fishing, non-motorized boating, ice-skating, hiking, and aesthetic appreciation. Protection of the lake's water quality and conservation of surrounding land has been the subject of considerable effort in recent year. Two invasive aquatic plants, Eurasian watermilfoil and water chestnut are known from the lake; watermilfoil was confirmed in the 1980s and water chestnut in 1998. The population fluctuates annually. Past control efforts at the town beach to control watermilfoil include benthic matting and hydroraking; no controls were implemented in recent years. Lakes staff surveyed the lake for water

chestnut yearly, 1998-2014. Any water chestnut plants found were removed by hand. Water chestnut has not been found since 2013.

Because development along the shoreline could cause erosion and lead to other sources of pollution, the Village, as well as the towns of Shaftsbury and Bennington, adopted shoreline protection provisions in their land use regulations that require that a natural buffer be maintained along the shore. Fortunately, a conservation effort involving private landowners, the Vermont Land Trust, the Vermont Housing and Conservation Board, and the Sage City Syndicate has led to conservation of 56 acres and 2,976 feet of shoreline along Lake Paran and the upper portion of Paran Creek. Continued intermunicipal and regional cooperation will be necessary to ensure that water quality is not degraded by point or nonpoint discharges from upstream sources and that conserved lands are properly maintained and used.

Smaller ponds and wetlands are scattered throughout the watershed. Many ponds are adjacent to roadways and add visual interest for passing motorists. Some large wetland complexes, such as the Bradford-Putnam Wetlands or the large complex of wetlands along Jewett Brook, are best explored on foot or by kayak. All of these small water bodies add variety to the landscape, are an important foreground in many views of fields, farms, and hillsides, and harbor a variety of bird and wildlife species.

Vermont DEC's Lake Protection Classification System identifies unique lakes based on: wilderness status; occurrence of scenic and natural features; existence of very high water quality; and/or the presence of very rare, threatened, and/or endangered species. In the Walloomsac watershed, two ponds are significant for these reasons.

Big Pond in Woodford is a heavily developed lake at the headwaters of the Walloomsac River. The lake supports one rare plant species, *Littorella americana*, which is a low-growing aquatic plant of shallow waters.

Lake Hancock (a.k.a. Sucker Pond) in Stamford is a wilderness-like lake with difficult vehicular access. The pond is classified as an A(2) water, and historically served as a water supply for the Town of Bennington. The Town continues to own the pond and an approximately 300-foot buffer around it, and the right-of-way over which the access road passes.

Barber Pond is a 19-acre pond just above the South Stream Management Area. The outfall drains to the management area. The pond is highly visible from South Stream/Barber Pond road and there is a Fish and Wildlife access point. The pond has a maximum depth of 20 feet and the surrounding watershed areas of roughly 170 acres. There are several camps/ homes along the lakeshore.

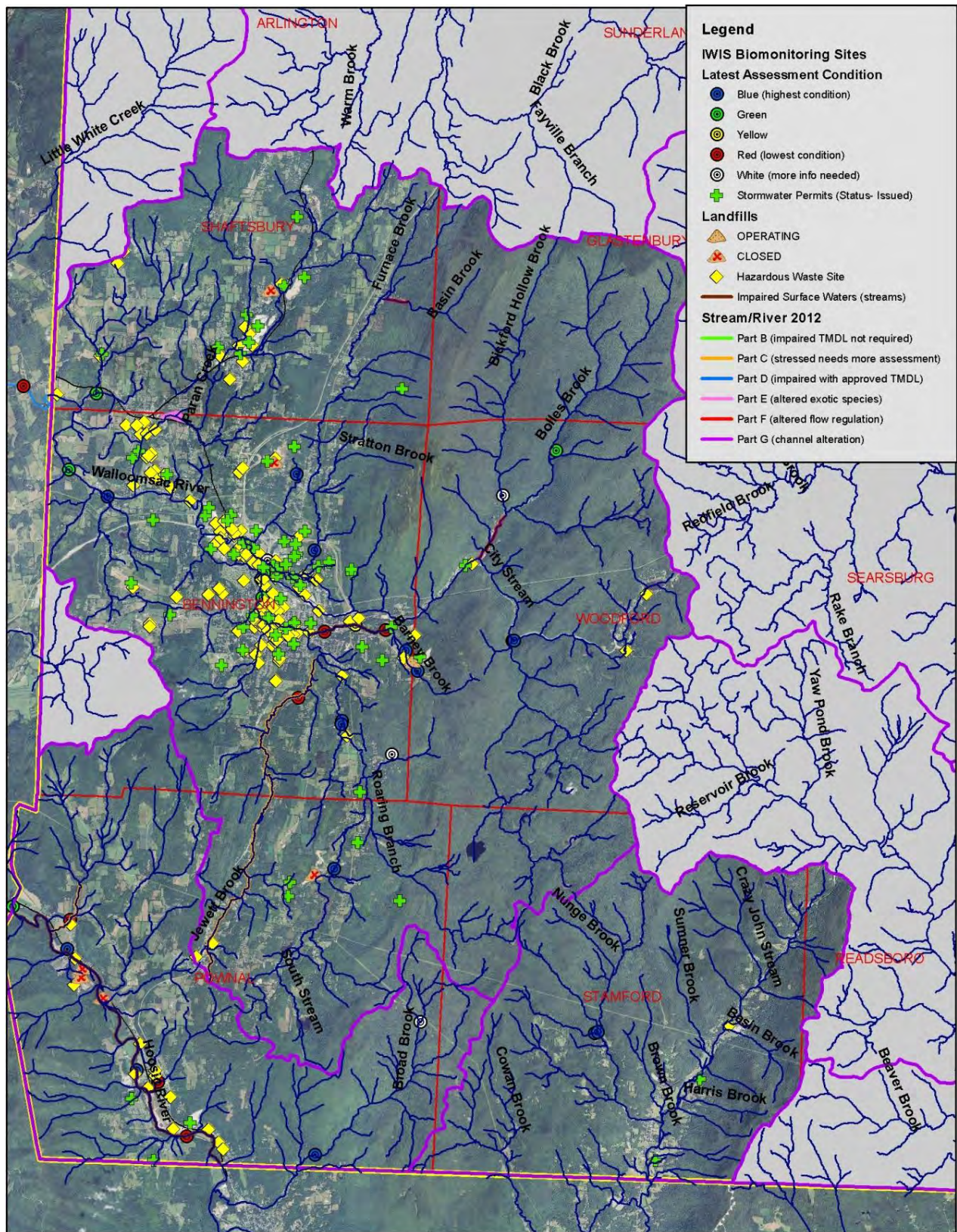


Figure 6. Walloomsac and Hoosic River Watersheds in Vermont (the Walloomsac is a tributary to the Hoosic)




The Hoosic River

The Hoosic River has its source about 2 miles northwest of Dalton, Massachusetts at an elevation of 1,500 feet above sea level. It flows through the extreme southwest corner of Vermont where it drains a small portion of southern Bennington County, an area of approximately 89 square miles. The Vermont tributaries have narrow watersheds and drain the steep slopes of the Green Mountain Range for the most part.

The North Branch of the Hoosic River begins in the town of Stamford, Vermont and flows southwestward to the city of North Adams, Massachusetts where it joins the Hoosic River. Its length is 11 miles. Its principal tributary in Vermont is Roaring Brook. A number of small tributaries also flow down from the mountainsides of the Hoosic Range to join the North Branch.

Hoosic River Watershed Impacts Summary

Table 5. Water quality condition of rivers, streams, lakes, ponds in the Hoosic River Watershed

Stream or lake segment	Mileage & status	Pollutant	Stressors	Source (or use affected)	Other information
Hoosic River	7 miles, <i>Impaired</i> – Part A list	PCBs	 Toxics	Former industrial use	Elevated levels of PCBs in Brown Trout from Mass sources
Ladd Brook	0.4 miles <i>Impaired</i> – Part A list	sediment	 Land erosion	Possibly gravel roads	“poor” & “fair-poor” bugs in 2008, 2009
Tubbs Brook	0.5 miles <i>Stressed</i>	sediment	 Land erosion	Likely due to sedimentation – land erosion from backroads, etc	“fair” bugs in 2008

Special Values and Features of Hoosic River Waters

Waterfalls, Cascades, Gorges, and Swimming Holes

The Waterfalls, Cascades and Gorges inventory and study described one cascade for the watershed. Roaring Brook Cascade on Roaring Brook, which is a tributary to the North

Branch of the Hoosic River, is a small cascade in the town of Stamford. The feature is about 75 to 100 feet long by 15 feet wide with a total drop of about 20 feet.

Significant Natural Communities and Rare, Threatened and Endangered Species of the Hoosic River Basin

A high quality stretch of riverine floodplain forest and one of the very few floodplain forests remaining in southwestern Vermont is located on the hairpin bend in the Hoosic River below North Pownal. The floodplain forest occupies about 25 acres and consists of both sugar maple-basswood-ostrich fern type and successional floodplain forest.

Assessments undertaken in the Hudson River Basin

Several types of assessments are conducted to support tactical basin planning. In the Hudson River Basin, geomorphic assessments, water quality monitoring, and biological monitoring are ongoing. Agricultural Environmental Management assessments have been conducted in certain sub-watersheds, and Better Back Roads inventories have been undertaken in several towns. Stormwater master planning and Illicit Discharge Detection and Elimination infrastructure mapping has been undertaken or is currently in process.

Table 6. Status of assessments for the Hudson River Basin

Sub-Basin	Geo-morphic Assess-ment	Water Quality Monitoring	Bio monitoring (completed / planned)	Agricultural Conservation Planning	Better Backroads/ Road Erosion Inventory	Stormwater master plan or Illicit Discharge Detection
Batten Kill	C	X	O/U/X		X	X
Mill and White Creeks	C		O/U	O	X	C
Walloomsac River	PC	X	O/X		X	X
Hoosic River	PC	X	O/U		X	X

X= proposed in plan C= Completed PC= Partial Completed O= On-going U=Underway

Stream Geomorphic Assessments

Stream geomorphic assessments (SGA) provide the basis for stream alteration regulatory decisions, technical assistance for fluvial conflict resolution, stream corridor protection and restoration, flood hazard mitigation and water quality protection. The assessment data is critical to prioritization of riparian and fluvial process-related water quality restoration and protection projects, project design alternatives analyses, and

project design criteria. SGA provides insight into the social, economic and ecological interrelationships between people and fluvial systems and as such, it is a valuable educational tool. All of the SGA datasets collected in Vermont are compiled in the Stream Geomorphic Assessment Tool database and related Vermont

Online Bridge and Culvert Inventory Tool. These databases are used to ensure that projects are implemented in a manner consistent with and complementary to equilibrium conditions. Much of the Hudson River Basin has been subject to SGA at the Phase I or Phase II level (Figure 2), and Corridor Plans have been established for several watersheds, including the Batten Kill, White and Mill Creeks (tributaries to the Kill), the Walloomsac River and its tributary the Roaring Branch. A description of geomorphic assessment and river corridor management summaries and recommendations from specific sub-watersheds is provided in Appendix G.

Since 2005, Partners in the planning process (BCCD, BCRC, and BKWA) have conducted geomorphic assessments on basin rivers and many of their tributaries to identify priority stream reaches for protection (with assistance from VTDEC – River Management Program)

Table 7. Stream Geomorphic Assessments in the Basin

Date	Watershed	Sub-Watershed	Link to report
11/01/2006	White Creek and Mill Brook	Batten Kill - White Creek	White Creek and Mill Brook Watersheds Phase 1 SGA
12/01/2008	White Creek and Mill Brook	Batten Kill - White Creek	White Creek and Mill Brook Watersheds Phase 2 SGA
12/01/2008	Batten Kill	Batten Kill River	Batten Kill Restoration Study
3/01/2008	Batten Kill	Batten Kill River	Batten Kill River Corridor Plan

2/01/2004	Batten Kill	Batten Kill River	Batten Kill River Phase 1 SGA
12/01/2005	Batten Kill	Batten Kill River	Batten Kill River Phase 2 SGA
1/01/2009	Batten Kill Watershed: Roaring Brook and Fayville Branches	Batten Kill River	Phase 2 Stream Geomorphic Assessment
12/01/2008	Walloomsac and Roaring Branch	Walloomsac - Roaring Branch	Walloomsac River and Roaring Branch Corridor Plan
3/01/2007	Walloomsac and Roaring Branch	Walloomsac - Roaring Brook	Walloomsac River and Roaring Branch Phase 2 SGA
11/01/2006	Walloomsac	Walloomsac	Walloomsac River Phase 1 SGA
9/18/2012	Walloomsac River	Walloomsac	Woodford Packard Floodplain Re-Connection Alternatives Analysis
11/01/2007	Walloomsac Woodford	Walloomsac	Bolles Brook and City Stream Watershed Phase 1 SGA
12/01/2008	Walloomsac Woodford	Walloomsac	Bolles Brook and City Stream Watershed Phase 2 SGA

Basin 1 SGA Status



0 20 Miles



Figure 7. Status of Geomorphic Assessments

General Fisheries Assessment

Vermont Department of Fish & Wildlife Fisheries Management in the Basin

Existing Uses for Fishing:

The VDFW maintains four angler access areas on the Batten Kill main stem and owns over two miles of streambank on the river providing public access to the river. Informal roadside pull-offs are numerous along the lower river also giving anglers access to river. Even though access to most of the river is over private land, the river's long history as a fishing destination has resulted in relatively little land posting (albeit landowner permission is recommended), but this tradition might be expected to change in the future as landownership and attitudes to public access continue to change. Nevertheless, fishing is an existing use on the Batten Kill main stem, in its tributaries and most tributaries to those, as well as in the White Creek sub-watershed.

In addition to stream fisheries, there are several public standing waters in the Batten Kill watershed that are managed recreational fishing. These are Bullhead Pond in Manchester and Dorset, Branch and Beebe ponds in Sunderland, and Shaftsbury Lake in Shaftsbury. Bullhead Pond is stocked annually with yearling Brook Trout and has resident populations of largemouth bass and yellow perch. Branch and Beebe ponds, located on the Green Mountain National Forest, are also annually stocked with fingerling and/or yearling Brook Trout and provide anglers with remote fishing experiences. Shaftsbury Lake is located in Shaftsbury State Park and is stocked with yearling and 2-year old Rainbow Trout and also has resident populations of largemouth bass, bluegill, pumpkinseed, rock bass, chain pickerel, and yellow perch.

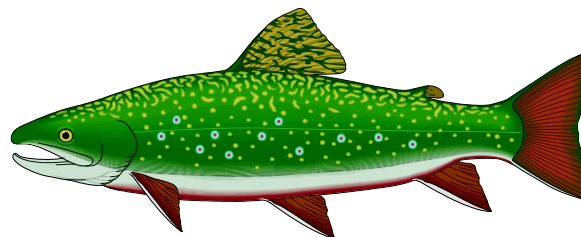
Very High Quality Waters: VDFW trout management guidelines categorize wild trout populations on the basis of population density (pounds of trout per acre and/or numbers of trout ≥ 6 inches (catchable-size) per mile) thresholds. Streams or river segments which presently maintain wild trout population densities in the range of 20-29 pounds/acre and/or 200-399 trout ≥ 6 inches/mile (**W2**) include:

- Batten Kill main stem from New York state line upstream to confluence of West and East branches.
- Green River from confluence with Batten Kill upstream to Sandgate Village.
- West Branch from Factory Falls Dam in Manchester upstream to Marble Mill Dam in Dorset.
- East Branch from confluence with Batten Kill main stem upstream to U. S. Route 7 bridge.

Walloomsac is stocked with rainbow and Brook Trout.¹ Stocking of select Vermont water bodies is an annual activity for the Department of Fish and Wildlife (DF&W). While anglers enjoy the benefits of fishing such areas, the decision to stock a particular stream or lake is not just based on the sport fishing opportunities such an activity provides. The DF&W developed a management plan for trout in 1993 that helped determine which Vermont water bodies should be stocked. Stocking is generally based on several factors: the quality of the natural fish populations, restoration considerations, and the amount of angling that occurs on a body of water. Each year the DF&W fishery biologists evaluate waters around the state to determine the appropriate level of stocking. This scientifically based management is conducted after evaluating the fish populations and angling pressure.²

Bennington Fish Culture Station

Bennington Fish Culture Station, built in 1916, is Vermont's second largest fish culture station. This culture station uses a combination of spring, artesian well, and stream water for raising brook, brown, and Rainbow Trout. The station is located two miles from downtown Bennington on South Stream Road.³



The maintenance of quality fisheries requires the continued assessment aquatic habitat and biota to determine the health of fisheries in the Basin, which also requires the assessment of:

Forested riparian areas - forested buffers along streams, rivers, lakes and ponds are extremely important in maintaining cool water temperatures and stable streambanks and shorelines, filtering pollutants and providing food and shelter for fish and other aquatic populations.

Habitat connectivity - dams and poorly designed culverts can limit the movement of fish and other aquatic populations to critical spawning, feeding and refuge habitats.

Natural hydrologic regimes - regulated stream flows from hydroelectric facilities and

¹ Bennington County Regional Commission, THE REGIONAL PLAN Bennington Region, Vermont, ADOPTED -- May 17, 2007pg. 32

² State of Vermont, Agency of Natural Resources, Fish & Wildlife Department, http://www.vtfishandwildlife.com/fish_sportfish.cfm

³ Id

water withdrawals can reduce habitat availability and quality in downstream reaches. Lake level fluctuations often affect littoral zone habitats and can negatively affect fish and other aquatic populations.

Preventing the introduction of exotic species and pathogens – A variety of non-native invasive aquatic species and harmful pathogens are present in Vermont or surrounding states. Limiting the spread of these detrimental species will help maintain healthy fisheries.

Other Assessments Used to develop the Hudson River Tactical Basin Plan

Transportation Infrastructure Assessments:

- Better Backroad Category “A” Road and Culvert Inventories (Towns)
- Class 4 Roads Assessment
- Water Quality Mapping and Culvert Assessment (BCRC 604 Project)
- Bridge and Culvert Inventory and Assessment for AOP and SGA



Other Assessments:

- Agricultural Environmental Assessments (AEM), ongoing (AAFM, NRCDs)
- Stormwater Mapping and Detecting and Eliminating Illicit Discharges in Bennington County to Improve Water Quality, 2016 (projected)
- Prioritizing Conservation Practices Through Flow Accumulation Modeling of Crop Field Drainage in Western Vermont (USDA-NRCS, 2009)
- VTANR Natural Resource Atlas (Biofinder) Wildlife Corridor mapping

Surface waters exhibiting very high quality biological integrity or fisheries.

Biological integrity

There are several sub-watersheds in the Hudson River Basin that support very high water quality conditions. VTDEC assesses ecological integrity using biological assessments of macroinvertebrate and fish communities. VT Department of Fish and Wildlife assesses wild trout populations and important nursery areas to document very high quality recreational fisheries, which are typically found in surface waters that exhibit clean and cool conditions. Based on VTDEC’s long-term sampling of stream locations in the Hudson River Basin, there are several streams that reliably exhibit ecological integrity consistent with very good or excellent conditions, based on these assessments (Table 3). Certain of these surface waters are candidates for reclassification to Class A(1).

Table 8. Basin streams that support exceptional ecological integrity*

	Name	Basin	River mile (RM*)	Score
VT01-05	Mad Tom Brook	Batten Kill	1.2	Excellent (bugs) – 2010 Excellent-VG (bugs) - 2013
VT01-05	Bourn Brook	Batten Kill	1.6	Very Good (fish- CW) Excellent bugs
VT01-05	Chunks Brook	Batten Kill	0.9	Very good, excellent bugs (2008)
VT01-05	Green River	Batten Kill	0.1	Excellent – bugs in 2007 and in 2013.
VT01-04	Batten Kill	Batten Kill	32.9/ 33.3/ 34.9/ 48.2/ 54.9	Excellent, very good - bugs
VT01-04	Batten Kill	Batten Kill	55.5	Excellent (fish - MW) fish in 1998 and excellent bugs in 2002, very good bugs in 2013
VT01-04	Batten Kill	Batten Kill	55.4	Very Good (fish - MW)
VT01-07	Mill Brook	Batten Kill	2.8	Very Good (fish, 2003)
VT01-07	White Creek	Batten Kill	10.5/ 10.6	Very Good (both) Excellent - bugs
VT01-03	Walloomsac River	Walloomsac	15.4	Very Good (fish - MW) 1998
VT01-03	Walloomsac River	Walloomsac	10.1	Very good – (bugs and fish 2008 and 2013)
VT01-03	Roaring Branch Walloomsac River	Walloomsac	.1	Very Good (fish - MW)
VT01-03	South Stream	Walloomsac	1.1	Excellent (fish - MW)
VT01-03	South Stream	Walloomsac	1 (2)	Very Good (fish - MW) (Excellent – bugs)
VT01-03	City Stream	Walloomsac	2	Excellent – bugs in 2008
VT01-03	Furnace Brook	Walloomsac	1.5, 3.1, 7.1	Excellent (bugs and fish-MW – 2008 and 2013)
VT01-03	Barney Brook	Walloomsac	2.2/ 2.7	Excellent bugs in 2008
VT01-02	Broad Brook	Hoosic	2.4	Excellent – bugs in 2012 and 2013
VT01-01	North Branch Hoosic River (Cardinal Brook)	Hoosic	1.8 (0.1)	Excellent – bugs in 2012 and 2013

*RM = river mile as measured from the mouth upstream (or from the NY stateline). CW = cold water, MW = mixed water (cold/ warm fisheries indices used for community rating score).

**Note - Biological data indicates a consensus very good or excellent condition by one or both groups of fish and macroinvertebrates. Age of data may range from 1 to 15 years, but as assessment data increases in age, other factors must be present (or compensate) for the designation to be made. These factors include a watershed in which there has been and continues to be relatively little human activity, e.g. National Forest Service lands. Also mitigating older biological assessment data is existing physical and chemical data (including geomorphic condition) that would support VHQ biota.*

Very High Quality Lakes

The Lakes and Ponds Management and Protection Section of DEC recently completed a process to identify high quality lakes in the state to prioritize conservation and protection efforts. Lakes were independently ranked in three separate categories using long-term datasets for water quality, biological diversity and unusual or scenic natural features. Scores from the separate categories were combined to identify lakes with exemplary qualities in all three.

Table 9. Lakes and ponds in the Basin that exhibit Very High Quality based on DEC's Best Lakes analysis. Best Lakes Scores are presented under "Supporting Data" if lakes were ranked in any of three categories, along with the rank score from 1 (lowest) to 5 (best) in each: WQ - Water Quality, BD - Biological Diversity, USNF - Unusual or Scenic Natural Features.

Lake/pond	Location	Supporting Data
Bourn Pond	Sunderland (Bourn Brook)	"Best Lake" - top 10% DEC state ranking; USNF (top 5%)
Branch	Sunderland (Branch Pond Brook)	
Hancock (Sucker)	Stamford (Stamford Stream)	
Miller	Arlington	"Best Lake" - top 25% DEC state ranking (biodiversity)

Causes and Sources of Impacts and Threats to Basin 1 Lakes and Ponds

Impairments to lakes in this basin are related to acidification (6 lakes, 139 acres), and to the presence of non-native invasive aquatic species (1 lake, 40 acres). Threats to uses are also caused by siltation (128 acres), invasive species (75 acres), pH (82 acres), nutrients and phosphorus (60 acres), turbidity (51 acres), and the presence of algae (40 acres). Table

8 provides an accounting of the causes of impairments and threats to lakes in this drainage system.

The following sources impair or threaten lake uses in the Batten Kill, Walloomsac, and Hoosic watersheds. Atmospheric deposition of acids, as well as natural susceptibility to low pH is responsible for the acidification of 139 acres and threats to an additional 82 acres. Recreational boating and the associated release of non-native plant propagules is a primary source of the impairment of 40 acres due to the presence of these species, and threatens an additional 99 acres. Other important threats include road runoff and development.

The Lakes and Ponds Scorecard

There are 31 lakes and ponds over 20 acres in size in the Hudson River Basin. Lake and pond water quality and habitat conditions are monitored through numerous study programs including the Spring Phosphorus and Lake Assessment Programs and by the Lay Monitoring Program among others. While many fully support the requirements of the VWQS, most lakes and ponds are affected by atmospheric deposition of pollutants from sources outside of Vermont and several lakes and ponds exhibit high levels of fish mercury.

This lake-specific information is compiled to create the [Vermont Lake Score Card](#), which has been developed to convey a large amount of data gathered and analyzed through these monitoring efforts (Table 10). The Score Card rates Vermont lakes in terms of water quality, invasive species, atmospheric deposition, and shoreland condition. Table 11 provides an assessment of individual lakes from the Vermont Lakes Scorecard.

Table 10. Assessment of Basin lakes and ponds from the Vermont Lakes Scorecard

Lakes Score Card

	Good Conditions
	Fair Conditions
	Stressed or impaired Conditions
	Unassessed

Batten Kill	Town	Shoreland	Invasives	Atmospheric
Beebe	Sunderland			
Branch	Sunderland			
Bourn	Sunderland			
Madeleine	Sandgate			
Lye Brook - S	Sunderland			
Walloomsac River	Town	Shoreland	Invasives	Atmospheric
Lake Shaftsbury	Shaftsbury			
Paran	Bennington			
Hoosic River	Town	Shoreland	Invasives	Atmospheric
Barber	Pownal			
Big	Woodford			
Hancock	Stamford			
South Stream	Pownal			
Thompsons	Pownal			

Very High Quality waters that support recreational fishing

Abundant wild trout populations are defined as supporting multiple age classes of one or more species of wild trout (brook, brown, Rainbow Trout) at levels generally equal to or greater than 1,000 fish/mile and/or 20 pounds/acre. It should be recognized that wild trout populations vary widely from year to year and therefore an individual population may sometimes go below or greatly exceed these values in a given year. Other waters that have not been surveyed may also support similar wild trout densities and may be identified in the future. Certain noteworthy streams are also important to support spawning and nursery habitat for the main stems of Basin 1 Rivers. Tables 11 and 12, respectively, list streams supporting wild trout populations and nursery tributaries. An updated survey of recreational fishery should be conducted regularly

within the basin to update wild trout age classes, species, and quantities.

Table 11. Basin streams supporting Very High Quality significant wild trout populations

Sub-watershed	Streams Surveyed	Description (entire unless otherwise described)
Batten Kill	Mainstem	NY state line upstream to confluence of West & East branches.
Green River	Mainstem	Confluence with Batten Kill upstream.
Bourn Brook	Mainstem	Confluence with Batten Kill upstream.
West Branch	Mainstem	Confluence with Batten Kill upstream.
East Branch	Mainstem	Confluence with Batten Kill upstream.
White Creek	Mainstem	New York state line upstream to confluence with Sandgate Bk. (Branch).

Table 12. Very High Quality spawning and nursery tributaries in the Basin

Sub-watershed	Streams Surveyed	Description
Batten Kill	Mainstem	New York state line upstream to East Dorset source.
Camden Creek	Terry Brook	New York state line upstream into Terry Brook.
Benedict Hollow Bk.	Benedict Hollow Bk.	Confluence with Batten Kill upstream.

Roaring Branch	Mainstem	Confluence with Batten Kill upstream.
	Warm Brook	Confluence with Batten Kill upstream at least to old Hale Co. dam.
Mill Brook	Mainstem	Confluence with Batten Kill upstream.
Bourn Brook	Mainstem	Confluence with Batten Kill upstream.
West Branch	Mainstem	Confluence with Batten Kill upstream.
East Branch	Mainstem	Confluence with Batten Kill upstream.
White Creek	Mainstem	New York state line upstream to confluence with Sandgate Bk. (Branch).

Wetlands in the Basin

Protecting and Preserving Wetlands

In Vermont, wetlands are defined as transitional zones between land and other water bodies. Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Section 404 of the Clean Water Act, EPA). Such areas include but are not limited to marshes, wet meadows, swamps, bogs, and vernal pools. There is over 220,000 acres (over 5% of Vermont) of wetland throughout the State of Vermont. Vermont historically lost 35% of its wetlands before the Vermont Wetlands Rules were placed into effect in 1990. In comparison to other major river basins in the state, Basin 01 is comprised of only 2.7 % wetlands by land cover, making it a lesser common resource by comparison.

Vermont's wetlands are extremely important resources that the Agency of Natural Resources and many other concerned groups are seeking to protect. Wetlands are worthy of protection because of the many valuable and irreplaceable functions they

provide, which include: flood control, water quality protection, wildlife habitat, recreation opportunities, economic benefits, and erosion control. Since the degree to which a wetland serves these functions varies, many wetlands are vital to work in combination with each other as part of a complex, integrated system. A couple of significant wetland complexes in the basin are described below.

Functions and Values of Riparian Wetlands in the Basin

Like freshwater swamps, riparian wetlands are forested, inland, non-tidal wetlands, but are distinguished by their location in the floodplain along river and stream corridors. In the United States, riparian wetlands range from the bottomland hardwood forests of the Southeast to the riparian ecosystems lining the river and stream corridors of the arid Southwest. These wetlands are linear and provide an important link between stream and river systems and adjacent uplands. Indeed, flooding from adjacent waters contributes to these wetlands' regulation of nutrients and organic matter from adjacent uplands. Riparian wetlands also are extremely productive and diverse ecosystems that provide important habitat for wildlife.

South Stream Pond and Wildlife Management Area

The South Stream Wildlife Management Area (WMA) is a 130-acre parcel in Pownal, which is owned by the State of Vermont and managed by the Vermont Fish & Wildlife Department. South Stream Pond is a 24-acre impoundment with emergent vegetation, such as cattails, and open water. A dam is located in the northwestern corner of the WMA where South Stream Pond drains into South Stream. There are alders on the property, but the majority of the landscape is emergent wetland that rims the length of South Stream. This is a great area for waterfowl watching. A rare plant, Hill's pondweed, is located on this WMA.

South Stream Pond is a 24-acre impoundment with emergent vegetation, such as cattails, and open water. A dam is located in the northwestern corner of the WMA where South Stream Pond drains into South Stream. South Stream Wildlife Management Area (WMA) is a 130-acre parcel in Pownal, which is owned by the State of Vermont and managed by the Vermont Fish & Wildlife. There are alders on the property, but the majority of the landscape is emergent wetland that rims the length of South Stream. This is a great area for waterfowl watching.

Greenberg Headwaters Park

The Town of Bennington and partners (the Bennington County Conservation District and others) successfully acquired the Morgan Street Wetlands property (now referred to as the Greenberg Headwaters Park) in 2014 through grants and donations. This 140-

acre mix of open water, streams, wetland and upland is an exemplary natural area just blocks from the community's downtown.

Most of the site, about 108 acres, is a forested marsh or shrub swamp. Jewett Brook and South Stream drain the southern portion of the property. The Walloomsac River, forming at their confluence, cuts through the northern section. All three watercourses are deep enough to be navigable for at least portions of their length at least part of the year. Fish population surveys last done in 1993 documented the presence of wild brook, brown and Rainbow Trout populations in South Stream, and of wild Brown Trout populations in Jewett Brook.

In the wetland, very deep organic soils lie over sandy glaciofluvial deposits. As is typical of the western portion of Bennington County, underlying bedrock is largely metamorphosed limestone. That the land, and probably the water, on this property is "sweet" or alkaline is evidenced by the presence of several lime-loving plant species. The wetland lies like a bowl surrounded by uplands, the highest on the northeast. Early successional forest or abandoned field dominate the upland areas, though scattered giant oaks, cottonwoods and other trees are also present.

Given this mix of natural features, it is not surprising that the Greenberg Headwaters Park site is ranked by the Vermont Agency of Natural Resources as of a type "greatest" and "very high" in biological diversity. Having a natural asset of this quality so close to the Bennington downtown opens endless opportunities for education, natural community research, partnerships with area schools and colleges, special programs and informal outdoor recreation. While North Bennington has Lake Paran as a recreational asset, this conserved wetland offers Bennington residents their own public access to water and natural communities.

Significant Natural Communities and Rare, Threatened and Endangered Species of the Basin

Natural resource elements in the Batten Kill watershed that comprise the biological diversity associated with water and wetlands include a rich fen at its headwaters; Dorset Marsh with rare to uncommon plants; some "sloping fens" in Dorset; some historical locations of Hill's Pondweed; and locations where spotted turtles and where Jefferson's salamander have been found. There are approximately 10 confirmed vernal pools located within the basin, and at least a two dozen more that have been identified through satellite imagery but are unconfirmed in this iteration of the Basin Plan.

Batten Kill watershed

Significant natural communities

An inventory of significant calcareous fens and riverside seeps done by the Vermont Nongame and Natural Heritage Program found two rich fen communities and one intermediate fen community in the Batten Kill watershed. The two rich fens are located in Manchester: one is a small (1.5 acre) wetland, of which a portion is rich fen, and the other is a relatively large, mostly open fen with a diversity of vegetation types and a large population of a globally rare sedge. A two-acre intermediate fen is found in Shaftsbury and an uncommon water sedge grows there.

Vermont DEC's Lake Protection Classification System is one framework within which lakes can be evaluated for their special significance when compared to other lakes statewide. The Classification System identifies unique lakes based on: wilderness status; occurrence of scenic and natural features; existence of very high water quality; and/or the presence of very rare, threatened, and/or endangered species. In the Batten Kill watershed, two ponds out of eighteen in the DEC assessment database are significant for these reasons.

Branch Pond, Sunderland: This pond may be the best example of a wilderness-like pond. The pond is undeveloped, essentially in a primitive state, but is relatively easily accessed. The pond supports two noteworthy aquatic plants, the rare pondweed *Potamogeton confervoides*, and the rare bladderwort *Utricularia geminiscapa*.

Bourn Pond, Sunderland: This is a true wilderness pond with an attractive Sphagnum mat floating island. The pond supports populations of two noteworthy aquatic plants, the rare pondweed *Potamogeton confervoides* and the rare burreed *Sparganium fluctuans*. Bourn Pond is critical habitat for breeding common loons.

Walloomsac River watershed

Significant natural communities

Four sites from the Walloomsac River watershed were described in the Vermont Department of Fish and Wildlife study of significant calcareous fens and riverside seeps. One site identified is Pownal Bog north of Barber Pond, which is actually a fen community and not a bog. Six rare plants occur at the site as well as four uncommon plants and a rare moss. This two and a half acre peatland has formed in a kettlehole depression. Another small intermediate fen was briefly surveyed in Pownal although it seemed to be a transitional site and so its significance is not known.

The other two sites in the Walloomsac River watershed were found in Shaftsbury. Paran Creek Fen located south of Simeon Dean Road consists of two small rich fens that contain a population of a globally rare sedge. Serendipity Fen is a one-acre fen within a 100-acre plus wetland. It is a rich fen and also has the globally rare sedge in it.

Big Pond, Woodford: This pond supports one rare plant species, *Littorella americana*, which is a low-growing aquatic plant of shallow waters.

Hoosic River watershed

Significant natural communities

No lakes with special significance or features have been identified in the Hoosic watershed.

A high quality stretch of riverine floodplain forest and one of the very few floodplain forest remaining in southwestern Vermont is located on the hairpin bend in the Hoosic River below North Pownal. The floodplain forest occupies about 25 acres and consists of both sugar maple-basswood-ostrich fern type and successional floodplain forest.

Stressors, and Causes and Sources of Impairment

Stressors and related pollutants

The [Vermont Surface Water Management Strategy](#) (VDEC 2012) lays out the goals and objectives of the Watershed Management Division to address pollutants and stressors that affect the designated uses of Vermont surface waters. The strategy discusses the 10 major stressors that are managed to protect and improve surface waters. A stressor is defined as a phenomenon with quantifiable damaging effects on surface waters resulting from the delivery of pollutants to a waterbody, or an increased threat to public health and safety. Stressors result from certain activities on the landscape, although occasionally natural factors result in stressors being present. Managing stressors requires the management of associated activities. When landscape activities are appropriately managed, stressors are reduced or eliminated, resulting in the objectives of the Strategy being achieved, and the goals met. The pictures at the right link to the stressor chapters of the Surface Water Management Strategy that describe in detail the stressor, its sources and causes, and the Division's approach to addressing the stressor through monitoring, technical assistance, regulations and funding.

VTDEC uses monitoring and assessment data to assess individual surface waters in relation to Vermont Water Quality Standards and other relevant guidelines (e.g., stream equilibrium standard). The 2014 Assessment and Listing Methodology articulates three categories of surface waters where degradations are noted.

Stressed waters support designated uses, but the water quality and/or aquatic biota/ habitat have been disturbed to some degree by point or by nonpoint sources of human origin and the water may require some attention to maintain or restore its high quality. In some instances, stressed waters may have documented disturbances or impacts and the water needs further assessment to confirm impairment.

The Vermont Surface Water Management Strategy identifies 10 major stressors that impact surface waters...click to choose stressor for more information.



Figure 8. List of Stressors

Altered waters are affected by lack of flow, water level or flow fluctuations, modified hydrology, physical channel alterations, documented channel degradation or stream type change is occurring and arises from some human activity, OR where the occurrence of exotic species has had negative impacts on designated uses. The aquatic communities are altered from the expected ecological state.

Impaired waters are those surface waters where there are chemical, physical and/or biological data collected from quality assured and reliable monitoring efforts that reveal 1) an ongoing violation of one or more of the criteria in the Water Quality Standards and 2) that a pollutant of human origin is the most probable cause of the violation. Impaired waters are those that require pollution control efforts under one or more provisions of the Clean Water Act. The most common mechanism to address an impaired water is the development and promulgation of a Total Maximum Daily Load.

Specific surface waters that are in need of further assessment, and impaired waters in need of a TMDL or other Clean Water Act pollution control effort are shown in Tables 1, 4, and 5 above and the subwatershed-specific sections of this Plan. In addition, the highest priority stressors for streams in the Hudson River Basin are also shown in Tables 1, 4, and 5 and for lakes in Table 10. The specific pollutants or conditions that cause stress or impairment on the designated uses of surface waters in the Hudson River Basin that result from each stressor include nutrients (and sediment), temperature, pathogenic bacteria, and invasive species.

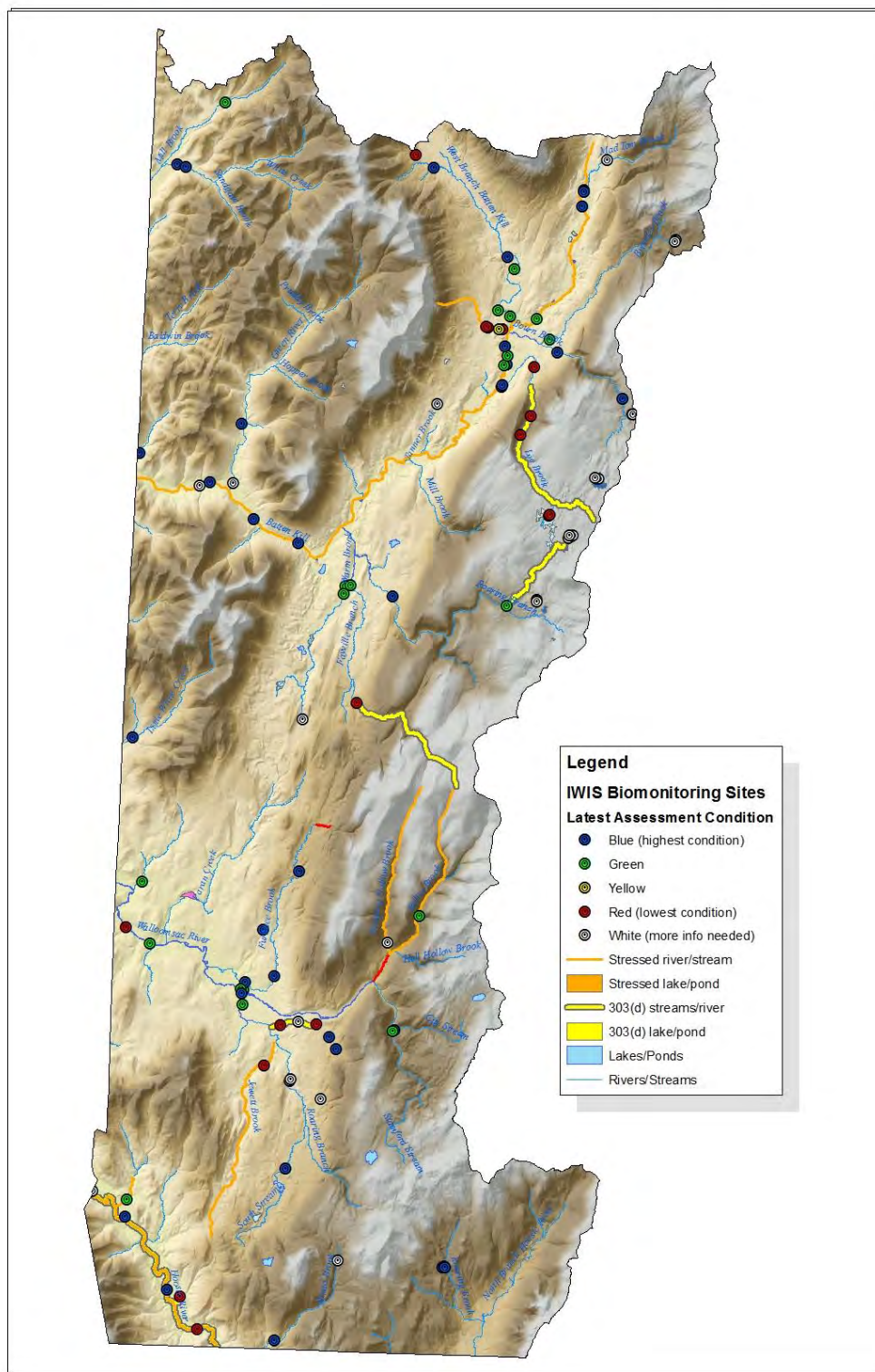


Figure 9. Impaired, altered, or stressed waters on the Vermont Priority Waters List (Hudson River Basin)




*"Altered" in this instance, refers to non-native invasive species present in densities sufficient to alternative biological communities. For example, overall plant density is classified as "moderate," indicating locally abundant (50% or greater coverage) growth, or "heavy," (75% or greater littoral cover overall) indicating growth in most shoreline areas.


Causes and Sources of Impacts to Basin 1 Lakes and Ponds

Impairments to lakes in this basin are related to acidification (6 lakes, 139 acres), and to the presence of non-native invasive aquatic species (2 lakes, 75 acres). Threats to uses are also caused by siltation (128 acres), the spread of invasive aquatic species, pH (82 acres), nutrients and phosphorus (60 acres), turbidity (51 acres), and the presence of algae (40 acres). Table 8 provides an accounting of the causes of impairments and threats to lakes in this drainage system.

The following sources impair or threaten lake uses in the Batten Kill, Walloomsac, and Hoosic watersheds. Atmospheric deposition of acids, as well as natural susceptibility to low pH is responsible for the acidification of 139 acres and threats to an additional 82 acres. Recreational boating and the associated release of non-native plant propagules is a primary source of the impairment of 40 acres due to the presence of these species, and threatens an additional 99 acres. Other important threats include road runoff and development.

Table 13. Lakes and ponds that are Impaired (I), Altered (A), or Stressed (S) in the Hudson River basin, along with current management approach

Lake	Stressor/ source	Management intervention
Lake Paran	 Invasive species	Eurasian watermilfoil management control via appropriate, integrated control approaches
Lake Shaftsbury	 Invasive species	Water Chestnut discovered in 2013 - Ongoing surveying and hand-pulling
All lakes and ponds threatened by AIS	 Invasive species	Spread prevention. Support, promote, expand invasive patrollers program

Lake	Stressor/ source	Management intervention
Beebe Branch Bourn Lye Brook – S Lye Brook - N Little Mud	 <p>acidity atmospheric deposition: extremely sensitive to acidification; episodic acidification</p>	EPA approved TMDL 2003

Lakes in Basin 1 that Need Further Assessment

There are 10 lakes and ponds in this drainage system identified as needing further assessment at this time. A summary of information from the Lake Assessment database is provided below. There are several very small ponds (less than 10 acres in size) in the basin for which Vermont DEC has little or no information. The DEC Lakes and Ponds Management and Protection Program supports local group efforts to undertake these assessments. The accessibility of all of these smaller lakes to the public is unknown. Those 10 lakes and ponds are:

Barber Pond, Pownal: Assessment is needed to determine if sedimentation is having an impact on this pond.

Equinox Pond, Manchester: Vermont DEC has no information nor data on this pond, which should be reassessed during the next Basin 1 assessment cycle. There is no public access to this waterbody and is held in private ownership.

Lake Hancock, Stamford (AKA Sucker Pond): The degree to which off-road vehicles is causing sedimentation at the access should be monitored. The lake was last assessed by Vermont DEC in 2009. A recommendation of that assessment is to restrict access by 4WD vehicles to the immediate shoreline areas of the pond. The South of Route 9 Integrated Resource Project (USFS-GMNF) recommends installing erosion and drainage control structures along Sucker Pond Trail, as well as restricting unauthorized motorized vehicle access to the lake. DEC will collaborate with USFS and BCCD.

Kent Hollow Pond, Sandgate: The question of whether this remote waterbody is a pond or an emergent marsh wetland has yet to be documented. A site visit is necessary to determine the exact nature of this pond.

Little Mud Pond, Winhall: This pond should be reassessed for acidification.

Lake Madeleine, Sandgate: This pond has not been visited by Vermont DEC since the mid-1980's. It is presently posted against public access.

Miller Pond, Arlington: This marshy pond is thought to be of extremely high wildlife value, and a follow-up visit to verify this is in order.

Shaftsbury Lake, Shaftsbury: An assessment of trophic status is warranted on this recreational lake.

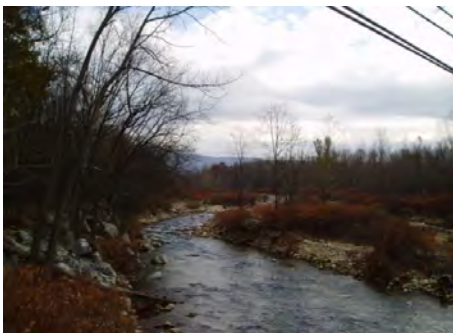
South Stream Pond, Pownal: South Stream Pond is a 24-acre impoundment with emergent vegetation, such as cattails, and open water, and can also be considered an open water wetland based on soil type, vegetation, and setting.

Thompsons Pond, Pownal: This lake was last visited by Vermont DEC in 2002. There is limited access to a "swimming pond" just downstream of the spillway from the main pond. Water clarity is good and shoreline is fairly intact, with some areas periodically hayed. The pond association indicates that the pond supports a trout fishery.

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

The Hudson River Basin experienced flood damage during Tropical Storm Irene in 2011, including localized damage to major roads and bridges along significant sub-basins, especially within the southern portion of the Walloomsac River Basin in Bennington County.

The many opportunities presented by Tropical Storm Irene for the enhancement of flood resiliency are limited by funding for restoration of these areas. Given the need for protection of critical flood attenuation assets and new pollution control fixes for non-flood related problems, Basin Planning emerges as a critical prioritization tool for Vermont's restoration and resiliency efforts. In recognition of this, DEC planners and river scientists have engaged in a collaborative process with Regional Planning Commissions to map critical infrastructure damage, and prioritize restoration.



Bennington Floodplain Restoration Project before construction: failing berm looking upstream from Park Street Bridge (left) and looking downstream toward Park Street Bridge (right)

Managing stormwater runoff

Stormwater runoff from developed lands including the road network is one of the greatest threats to water quality in Vermont. Stormwater runoff is any form of precipitation that flows over the land during or after a storm event or because of snowmelt. On undeveloped lands, a portion of this runoff is absorbed into the ground through infiltration and the rest takes a slow path to nearby rivers, lakes and ponds. On developed lands, however, infiltration is reduced by impervious surfaces such as roads, rooftops, and driveways. This leads to an increased frequency and intensity of flooding as well as a greater likelihood that runoff will become contaminated with pollutants. The result is increased erosion and property damage, endangered or degraded aquatic and terrestrial habitats, and threats to public health via recreation sports and contaminated drinking water.

Stormwater runoff management is a major priority within the Hudson River Basin because of the chronic nutrient enrichment condition in the Hudson River, which is a high priority for restoration and water quality attainment by New York DEC (source: http://www.dec.ny.gov/docs/water_pdf/pwluhudasmt.pdf). While a majority of the urbanized areas of the Basin exist in New York State (including the communities of Glens Falls and Queensbury), there are urban areas and rural road networks within the Vermont portion of the basin that contribute stormwater runoff. Unmitigated runoff results in channel erosion, land erosion, nutrient loading, and even thermal stress. Although the Hudson River Basin in Vermont is predominantly rural, some developed areas do exist (Arlington, Bennington, Manchester, etc.) and are recommended for stormwater master planning to better understand and deal with the effects of stormwater runoff in the basin. Actions listed in Table 15 will address the current data gaps related to stormwater runoff.

Given the history of stormwater issues in other watersheds (Winooski and Otter Creek); it is prudent that the issue be addressed pro-actively. Many of the stormwater issues associated with developed lands can be mitigated and prevented using Low Impact Development (LID) and Green Infrastructure (GI) systems and practices. These emerging concepts strive to manage stormwater and pollutants by restoring and maintaining the natural hydrology of a watershed. Rather than funneling stormwater off site through pipes and infrastructure, these systems focus on infiltration, evapotranspiration, and storage as close to the source as possible. Typical practices include green roofs, rain gardens, cisterns, porous pavements, infiltration planters, buffer zones, and sustainable site design. These practices could go a long way towards preventing future stormwater problems.

Forested Lands in the Basin

Logging and Forested Land

Forested lands contribute the lowest amounts of nutrients, sediment and other pollutants into Vermont streams per acre as compared to other land use. This, however, does not mean that impacts from forestry should be not be considered for possible improvements to water quality, especially because forestland makes up a significant percentage of land cover in the Basin. The major sources of NPS pollution from forested lands are erosion from logging operations and associated roads and staging areas.

Much of the erosion can be prevented by following Acceptable Management Practices (AMPs) for maintaining water quality on logging jobs in Vermont. These practices list buffers along streams and road construction guidelines among other practices that protect water quality, and provide protections for the landowner and logger if the practices are followed.

Landowners can play a large part in encouraging good silvicultural practices by working with a forester to develop a management plan. On lots over 25 acres landowners can enroll in Vermont's Use Value Appraisal Program which requires the development of a 10 year forest management plan certified by the Department of Forests Parks and Recreation (DFPR) in exchange for property tax rates based on forestland value. Landowners can also make a contract when hiring a logger stipulating certain protective practices to limit erosion.

Managing and Protecting Headwaters for Water Quality

Headwater streams make up a large proportion of the total length and watershed area of fluvial networks, and are partially characterized by the large volume of organic matter) and invertebrate inputs from the riparian forest, relative to stream size. Much of those inputs are exported to downstream reaches through time where they potentially subsidize river communities.⁴ Organic matter entering headwater systems consists of leaves, woody debris, detritus, and waste products of plants and animals. Microorganisms living in the stream use this material for food, transforming the organic

⁴ ECOLOGICAL LINKAGES BETWEEN HEADWATERS AND DOWNSTREAM ECOSYSTEMS: TRANSPORT OF ORGANIC MATTER, INVERTEBRATES, AND WOOD DOWN HEADWATER CHANNELS¹ Mark S. Wipfli, John S. Richardson, and Robert J. Naiman²

matter from an unusable form (inorganic carbon) into food for other organisms (organic carbon). This process is the basis of the food web in freshwater ecosystems.⁵

While each headwater stream is short and narrow, they collectively represent a majority of the drainage network of any watershed management unit. Consequently, it makes sense to focus on headwater streams in any watershed plan. Identifying and implementing priority conservation practices for forest landowners on the headwater stream level is important in watershed management for several reasons:

- Controlling soil erosion on logging trails
- Improving stream crossings
- Restoring forest riparian buffers along streams
- Stabilizing erosion-prone soils.

Protection of Headwaters

A river begins at its headwaters, a network of small upstream tributaries. When most people think of headwaters, they think of mountain creeks. In addition, headwater streams can be intermittent or perennial. Intermittent streams are those that contain flowing water only during wet periods, while perennial streams contain water year-round. Headwater streams comprise the largest total number and most linear miles of streams in the Basin. Because they occupy a broad range of climatic and geological conditions found in Vermont, headwater ecosystems collectively represent enormous diversity.

Headwaters supply food and critical nutrients as the headwaters are a critical food source for the entire river. Because of their intimate connection to the surrounding landscape, headwater streams deliver nutrients and organic material - like fallen leaves to downstream reaches, sustaining aquatic life downstream.

Headwaters influence downstream conditions in a number of ways. In addition to food, the headwaters provide other materials like water and sediments, essential to river health. Natural sediment delivery to streams begins with the hill slopes above intermittent and headwater stream channels. Interconnected with wetlands and groundwater, headwaters help regulate natural river flow.

While headwaters are important for their downstream influences, they are also important in their own right as geologically and biologically distinctive and diverse

5 HYDROLOGIC CONNECTIVITY AND THE CONTRIBUTION OF STREAM HEADWATERS TO ECOLOGICAL INTEGRITY AT REGIONAL SCALES Mary C. Freeman, Catherine M. Pringle, and C. Rhett Jackson²

ecosystems. Headwaters support rich and varied communities of plants and animals. While the in-stream fauna may be relatively simplified and commonly characterized by pollution intolerant animals, the biological diversity of certain groups such as amphibians is greater in headwater regions than anywhere else within a drainage basin.

A number of headwater restoration projects either have been implemented or are currently underway in the Batten Kill, Walloomsac, and Hoosic Basin. Additionally, the USFS has implemented a number of headwater restoration projects in the Green Mountain National Forest portion of the Basin. Recently, the Forest Service has proposed additional Large Woody Debris Stream Restoration Projects as part of the South of Route 9 Integrated Resource Project.

Addressing the Impacts of Forestry on Water Quality

Major land use changes over the past three centuries have dramatically changed Vermont streams. From a completely forested landscape to a mostly open one and back again, the centuries have wreaked havoc on the condition, habitat and biology of our waterways. Today 85% of the basin is re-forested. The forest industry in Bennington counties has produced thousands of board feet of sawlogs and veneer logs every year, representing highest county volumes in the state in recent years, including thousands of cords of pulpwood. This production is a major economic factor in the region and forest-related jobs are important to the local economy.

One common practice affecting stream health is the clearing of wood debris from streams. With the focus on flood resiliency and forest health in the basin, the best practice to protect streams from erosion is by enhancing a healthy riparian buffer and allowing larger woody debris to remain in the stream channel. Numerous studies document how large woody debris (LWD) influences channel morphology and plays an important role in aquatic habitat creation and maintenance.

Agriculture in the Basin

The Batten Kill, Walloomsac, and Hoosic Basin, at 272,249 acres, stretches across nearly all of Bennington County⁶. Agriculture, the dominant historical land use of the state, now maintains only a fraction of its former pastoral acreage in Bennington County and across the state, estimated at a high of 75% statewide in the 1800's⁷. Though agriculture

6 Vermont Center for Geographic Information. 2008. GIS Shapefiles: VT County Boundaries 2006, VT Subbasin Boundaries 2003. www.vcgi.org.

7 Cronon, W. 1983. *Changes in the Land: Indians, Colonists and the Ecology of New England*. Hill & Wang.

is now the second largest land use type in the watershed, it is far below the acreage that is forested.

While agriculture gives the landscape a rural character, it also lends it an economic base, a cultural identity and an environment that combines field, forest, pasture and village. Bennington County farms are producing beef, dairy, sheep, poultry, hay, and vegetables. Farm-owned forestland extends farm production into maple syrup and forest products. In 2002, Bennington County maintained the greatest acreage of cherries, plums, and foliage plants and one of the greatest counts of pheasants statewide.

Agriculture, as a working landscape, provides many benefits to the environment and the surrounding community. Fields and pastures provide large tracts of open space and are habitat for many species of birds and mammals. As field soils absorb rainwater more readily than paved and other impervious surfaces, fewer nutrients are released from an acre of agricultural land than from an acre of developed land. Farms recycle farm-produced wastes, such as manure and spoiled feed, into soil amendments. Farms also work to prevent runoff of soil, nutrients and pathogens through land management practices like cover cropping, filter strips, no-till and strip farming.

Agricultural activities have had an impact on the environment of the Basin for well over 300 years. The accumulated effects of animal and crop production have sent varying degrees of pollutants into the basin's waterways over the centuries. Agriculture in the watershed also has the potential to impact the environment. Though the river miles and lake acreage of the Basin affected by agriculture represent none of the total impaired and only 17% of total threatened miles and acreage, the effects of agriculture on water quality should not be ignored. Excess nutrients, pathogens and sediments all can leave the farm when erosion control methods fail or heavy rains and floods inundate fields.

Agricultural Land

Federal, State and private agencies have taken steps to protect farmland and farm water quality through many of the programs listed in the 'Programs to Address Issues' section. This land protection ensures the availability of agricultural land for future food and fiber production and provides those presently working the farm with some financial assistance to help them succeed. These programs often include assistance for installing conservation practices on the farm that reduce non-point source pollution such as fencing animals out of streams to prevent damage to streambanks and

providing them with alternative watering systems. Unfortunately, federal and state cost-share dollars for these practices are limited and competitive.

Now, more than ever, farmers are under considerable pressure to sustain economically viable and environmentally sound farming operations. Farmers must face labor issues, foreign competition, competing land use pressures, regulations concerning husbandry, genetics, food safety and stricter water quality regulations under the State's Accepted Agricultural Practices (AAPs), which are slated to be promulgated as Required Agricultural Practices (RAPs) during the 2016 legislative session. .

Currently, all farms in Vermont must meet the Accepted Agricultural Practices (AAPs) which are statewide regulatory requirements for agricultural land use practices created to reduce the nonpoint pollutant discharges through implementation of improved farming techniques rather than investments in structures and equipment.

In complying with these new AAP's, farmers must address nine key water quality protection principles:

- No Direct Discharge of wastes to surface waters
- Nutrient and Pesticide Storage and setback requirements
- Nutrient and Pesticide Application, setback and soil testing requirements
- Soil Cultivation designed to minimize erosion
- Waste Management to minimize impacts to water quality
- Buffer Zones maintained on crop land
- Farm Structure design and setbacks
- Streambank Stabilization to federal standards
- Groundwater Quality impacts minimized.

Beyond the AAPs and large and medium farm regulations, many farms install Best Management Practices (BMPs), which are voluntary practices to correct a current waste management problem on a specific farm. BMPs typically involve the installation of structures, such as manure storage systems, milkhouse waste treatment, stream fencing to reduce agricultural NPS pollution, and a variety of other practices that improve water quality. The expense of installing many of these practices makes federal and state funding necessary to make them affordable for farmers.

The Batten Kill, Walloomsac, and Hoosic Basin remains rural and maintains a diverse agricultural industry. While development pressure is a concern of local towns most are committed to maintaining the rural, agricultural nature of the area. The economics of agriculture, however, will determine the future character of the basin.

Direct discharges to surface waters in the Hudson River Basin

There are three municipal wastewater treatment facilities that are subject to NPDES discharge permits in the Hudson River Basin (Table 15). All of these facilities are subject to State of Vermont issued National Pollutant Discharge Elimination System (NPDES) permits.

As part of a necessary refinement of the facility-specific phosphorus wasteload allocations, the VTDEC Watershed Management Division (WSMD), with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions for phosphorus, and determine the “reasonable potential” that Wastewater Treatment Facilities (WWTF's) have to cause or contribute to downstream water quality impairment. Certain permit conditions for two of the below facilities are aimed at further clarifying the discharges’ impact on the water quality of the receiving waters by requiring instream monitoring.

Table 14. Hudson River Basin Wastewater Treatment Facilities and other Facilities Subject to NPDES Direct Discharge Permits

Facility (permit #)	Permit expiration date	Design flow MGD	IWC* 7Q10 /LMM	Treatment type	Receiving water
Bennington WWTF 3-1261	9/30/2016	5.1000	0.196/0.100	Secondary/tertiary with chlorine disinfection	Walloomsac River
Manchester WWTF 3-1153	9/30/2015	0.6000	0.046/0.024	Secondary/lagoon with chlorine disinfection	Batten Kill
Pownal WWTF 3-1493	6/30/2016	0.2600	0.005/0.002	Sequencing batch reactor with ultraviolet light disinfection	Hoosic River

* Instream Waste Concentration – or the proportion of river flow at lowest base (7Q10) and low median monthly (LMM) flow attributable to discharge, for the facility design flow. Note that the IWC is specific to the flow of receiving water.

Facility-specific information

Bennington WWTF

The facility, which was upgraded from primary treatment in 1985, consists of two primary settling tanks, four trains of rotating biological contactors (RBCs) and secondary clarification followed by chlorine disinfection and de-chlorination. Due to

water quality considerations, the facility also has a sand filtration system that is operated in the summer months to meet effluent limits. Discharge permit conditions require upstream and downstream nutrient and biomonitoring in the Walloomsac River to assess the impact of the discharge.

Manchester WWTF

The Manchester WWTF was initially constructed in 1979 and currently provides secondary treatment of wastewater and consists of a two-cell lagoon system followed by chlorine disinfection and de-chlorination. A 20-year engineering evaluation was completed in 1999. Because of reportedly mild nutrient enrichment observed below the discharge to the Batten Kill, permit conditions require upstream and downstream nutrient and biological assessments.

Pownal WWTF

The Pownal WWTF consists of sequential batch reactor technology with ultraviolet disinfection prior to discharge to the Hoosic River. Due to the capacity of the UV disinfection system in attaining only a consistent E. coli concentration of 160 colonies/100 mls rather than the customary 77 colonies/100mls, a mixing zone of 200 feet from the outfall was established for E. coli in the Hoosic River. From a public health perspective, it was determined that there was less risk associated with the E. coli mixing zone than from toxicity risk to aquatic biota and human health of chlorinated compounds by using chlorine disinfection.

Surface waters Used as Public Drinking Supplies in the Hudson River Basin

The following are currently listed as waters that are managed for the purpose of public water supplies and designated as Class A(2) Public Water Supplies (note – the watershed delineation of Class A(2) waters can be viewed via the ANR Natural Resource Atlas from this link: <http://anrmaps.vermont.gov/websites/anra5/>).

Batten Kill Watershed

- An unnamed tributary to Bromley Brook (0.5 mile)
- **Village of Manchester water supply.** (No longer used). The first unnamed tributary to Bromley Brook and all waters within its watershed upstream of the Manchester Water Co. intake. The tributary is the first tributary entering from the southeast (adjacent to TH 26) upstream of Bromley Brook's confluence with Bourn Brook. The intake is approximately 0.5 mile upstream of its juncture with Bromley Brook.

Walloomsac River Watershed

- Basin Brook (VT01-03 Basin Brook, WSID #5017) and Furnace Brook (5.0 miles)

- **Village of North Bennington water supply.** Basin Brook and all waters within its watershed to and including the North Bennington Reservoir in the Towns of Glastenbury and Shaftsbury. (Furnace Brook is not a water supply).
- Bolles Brook (5.3 miles)
 - **Village of Bennington water supply.** That portion of Bolles Brook and all waters within its watershed in the Towns of Glastenbury and Woodford upstream of the Bennington water intake.
- Sucker Pond (Lake Hancock) & tributaries (70 acres)
- Barney Brook (1.3 miles)
 - **Village of Bennington water supply.** That portion of Barney Brook and all waters within its watershed in the Town of Woodford upstream of the water intake.
- Unnamed tributary to South Stream (1.0 mile)
 - **Village of Bennington water supply.** That a portion tributary to South Stream and all waters within its watershed in the Town of Woodford upstream of the water intake in Bennington.

Hoosic River Watershed

- Roaring Branch (2.3 miles)
 - **Town of Bennington Water supply.** That portion of Roaring Branch and all waters within its watershed in the Town of Stamford upstream of the water intake in Pownal.
- Unnamed tributaries (2.9 miles)
 - **Village of Pownal water supply.** That portion of unnamed tributaries and their watersheds on Mann Hill in the Town of Pownal upstream of the water intake in Oak Hill Cemetery.
- Unnamed tributaries (Reservoir and 0.8 miles)
- Hollow Brook and Ladd Brook (1.5 miles)
 - **Village of North Pownal water supply.** (a) Reservoir Hollow Brook and reservoir and all waters within its watershed. (Reservoir is approx. 0.5 mile upstream of the Hoosic River).
 - **Village of Pownal water supply.** Ladd Brook and all waters within its watershed in the Town of Pownal.

Chapter 3- Management Goals for Surface Waters in the Hudson River Basin

The protection or improvement of water quality and water-related uses can be promoted by establishing specific management goals for particular bodies or stretches of water. The management goals describe the values and uses of the surface water that are to be protected or achieved through appropriate management. In Chapter 2 of this plan, a number of waters were identified as being of notable high quality, and these, as well as other unique areas, may be candidates for establishing alternate management goals or augmented protections through one of the processes that are further described below.

- Opportunities for reclassification of waters
- Identification of Existing Uses
- Opportunities for designation of Outstanding Resource Waters
- Re-classification of wetlands
- Designation of waters as warm and cold-water fisheries.

The Agency of Natural Resources is responsible for determining the presence of existing uses on a case-by-case basis or through basin planning, and is also responsible for classification or other designations. Once the Agency establishes a management goal, the Agency manages state lands and issues permits to achieve all management goals established for the associated surface water. Before the Agency recommends management goals through a classification or designation action, input from the public on any proposal is required and considered. The public may present a proposal for establishing management goals for Agency consideration 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.

Public involvement is an essential component to restoring and protecting river and lake ecology. The Vermont Water Quality Standards state “Public participation shall be sought to identify and inventory problems, solutions, high quality waters, existing uses and significant resources of high public interest.” Emphasis on the identification of values and expectations for future water quality conditions can only be achieved through public contributions to the planning process.

Opportunities for Reclassification

Class A(1), A(2) and B Waters

Presently in all basins across Vermont, waters above 2,500 feet in elevation are classified A(1) by Vermont statute. Currently in the Hudson River Basin, 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. DEC has documented that certain streams (and/ or reaches) have the biological integrity to be so designated as Class A(1) (that occur below 2500'). A handful of surface waters that occur below 2500' that currently attain Class A(1) biological integrity and are candidates for reclassification include:

- Beebe Pond (Sunderland) and tributaries
- Branch Pond Brook
- Bourn Brook (where not in Wilderness lands)
- South Fork of the Roaring Branch and tributaries
- Pond identified by VTDEC as "ALDER" Pond (Sunderland) and tributaries
- Black Brook and tributaries upstream of confluence with Fayville Brook
- Lye Brook and tributaries (portion forming boundary between Lye Brook Wilderness and non-wilderness GMFLNF lands)
- Cardinal Brook

Surface waters used as public water supplies are classified A(2). The only class A(2) waters in Basin 01 that is not used as a water supply is Basin Brook (Walloomsac River Basin). Hence, the only candidate A(2) water for reclassification to Class B is Basin Brook.

Existing Uses

There are many identified special uses, features, and values of the Hudson River Basin and its numerous tributaries including waterfalls, cascades, whitewater boating stretches, and swimming holes. All surface waters in Vermont are managed to support uses valued by the public including swimming, boating, and fishing. The degree of protection afforded to these uses is based on the water's class as described above. In particular surface waters, however, the existence of uses is protected absolutely if the Agency of Natural Resources identifies them as existing uses under the anti-degradation policy of the Vermont Water Quality Standards. Specifically, this means that an existing use may not be eliminated by the issuance of a permit or other action where compliance with the Water Quality Standards is assessed (DEC Anti-degradation Procedure, 2012). The Agency identifies existing uses of particular waters either during the basin planning process or on a case-by-case basis during application reviews for

state or federal permits. During the Hudson River Basin planning process, DEC has reviewed:

- The existing use of the waters for swimming;
- The existing use of waters for boating;
- The existing use of the water for water supply, and
- The existing use of water for recreational fishing.

It is VDEC's long-standing stipulation that all lakes and ponds in the basin have existing uses of swimming, boating and fishing. Likewise, we recognize that fishing activities in streams and rivers are widespread throughout the state and can be too numerous to document. The Vermont Water Quality Standards stipulate that existing uses may be documented in any surface water location where that use has occurred since November 28, 1975. Therefore information presented in Appendix A should be viewed as only a partial accounting of known fishing uses based upon limited criteria and does not change protection under the Clean Water Act or Vermont Water Quality Standards for waters not listed.

All surface waters in the Basin – including all rivers and streams are identified as supporting swimming and fishing as an existing use unless otherwise noted. A table of Existing Uses appears in Appendix A.

Outstanding Resource Waters

In 1987, the Vermont Legislature passed Act 67, “An Act Relating to Establishing a Comprehensive State Rivers Policy.” A part of Act 67 provides protection to rivers and streams that have “exceptional natural, cultural, recreational or scenic values” through the designation of Outstanding Resource Waters (ORW). 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 invasive controls, solid waste disposal, Act 250 projects and other activities.

As indicated in Section 2.B. (above), the Batten Kill has been designated as an outstanding resource water for natural, cultural, recreational, and scenic values. Currently, there are no other ORW designations in the Hudson River Basin or candidates that were brought forth during the planning process for this basin plan.

Wetland Re-classification Opportunities

Many of the Hudson River Basin's rivers and streams, lakes and ponds, and wetlands currently achieve a very high quality of water and aquatic habitat and are exceptional

places to swim, fish, boat, and otherwise enjoy. Some of these are identified in Chapter 2 (above). In addition to protecting and improving water resources by managing stressors, there is the opportunity to protect surface waters by identifying and documenting the very high quality and preserving those conditions or features through various classifications or designations. Several statewide references and reports available to the exceptional ecological quality or recreational uses of Vermont surface waters. A major new resource, the Agency's [BioFinder](#), provides a statewide application identifying surface water and riparian areas with a high contribution to biodiversity.

Reclassification of irreplaceable and exemplary wetlands to Class I

It is policy of the State of Vermont to identify and protect significant wetlands and the values and functions they serve in such a manner that the goal of no net loss of such wetlands and their functions is achieved. Based on an evaluation of the extent to which a wetland provides functions and values it is classified at one of three levels:

Class I: Exceptional or irreplaceable in its contribution to Vermont's natural heritage and therefore merits the highest level of protection

Class II: Merits protection, either taken alone or in conjunction with other wetlands

There is currently one Class I wetland in the Hudson River Basin. The 262 acre Dorset Marsh lies at the headwaters of both the Batten Kill and the Mettowee and is one of very few "Class I" wetlands in Vermont (so designated in 1992). As part of the development of this tactical basin plan, the Agency has identified a handful of wetlands that warrant study for Class I potential. As part of the development of this tactical basin plan, a handful of wetlands warrant study for Class I potential. These wetlands are listed below. Those wetlands that satisfy criteria for designation may be proposed for such designation through Departmental rulemaking authority, and as consistent with the Vermont Wetland Rules.

Wetlands proposed for Class I Wetland Classification include:

- Pownal Bog

Wetlands in the Hudson River basin that warrant further study for Class I potential include:

- Batten Kill headwaters
- Maple Grove Swamp
- Middle Road Swamp

Fish Habitat Designations (Warm Water Fish Habitat)

All wetlands and the following waters are designated as warm water fish habitat for purposes of the Vermont Water Quality Standards:

Batten Kill, Walloomsac, Hoosic Basin

(a) Lake Hancock (Sucker Pond), Stamford

(b) Thompsons Pond, Pownal

The WQS specifies a lower minimum dissolved oxygen concentration than waters in the remainder of the basin, which are Cold-Water Habitat.

There are no proposed changes to warm water fish habitat designations at this time.

Cold Water Fish Habitat

All waters not designated as warm water fish habitat above are designated as cold-water fish habitat for the Hudson River Basin, as noted in the Vermont Water Quality Standards, 2010. No changes to cold-water fish habitat designations are proposed in this basin plan at this time.

Chapter 4- Watershed Improvement Actions and the Implementation Table

The tactical plan implementation table (Table 15) identifies objectives for the Hudson River Basin, and frames-out specific actions to achieve the stated objectives. Action items include both necessary data collection and assessment efforts, and specific implementation activities. It is envisioned that the action items will be accomplished within the next five years. Action items reflect many of the primary goals and objectives identified in the Statewide Surface Water Management Strategy. This implementation table serves to identify high priority implementation actions and tasks that provide opportunities for all stakeholders in surface water management across each major river basin to pursue and secure technical and financial support for implementation. Specific locations for target actions are being mapped coincident with the release of this public review draft, and will be displayed [online at this link](#). A more general description of strategies necessary to protect, maintain, enhance, or restore surface waters in this Basin is presented following the Implementation Table.

Monitoring and Assessment Projects

Subbasin/ Basin	Town	Stream segment	Activity/ Stressor addressed	Project Description	Source	Potential Partners
Monitoring and Assessment						
Lye Brook/ Batten Kill	Manchester/ Sunderland	Entire Basin, Bourn and Branch Basins	Atmospheric deposition	VMC - Bourn & Branch Pond water chemistry data (nutrients) and temperature	LRTAP	USFS, VMC, VDEC
Lye Brook/ Batten Kill	Manchester	T3.01 A & B, T3.02-A & B	Flood resiliency/ Encroachment, channel erosion	modeling of berm removal	Historic and ongoing channel management	VDEC (RMP), Town of Manchester, BCCD, BKWA

Subbasin/ Basin	Town	Stream segment	Activity/ Stressor addressed	Project Description	Source	Potential Partners
Lye Brook/ Batten Kill	Manchester	Biomonitoring locations (rm 1.8)	Protection	Additional monitoring	Older (1990's) biomonitoring data (confirm VHQ)	VDEC-BASS
Bourn Brook/ Batten Kill	Manchester	Biomonitoring locations (rm 1.6)	Protection	Additional monitoring	Older (1990's) biomonitoring data (confirm VHQ)	VDEC-BASS
Munson Brook/ Batten Kill	Manchester	1 mile Stressed	Runoff from Developed Lands/ Land erosion, nutrient loading	Additional monitoring, stormwater mapping, IDDE	Impervious areas, Town of Manchester.	Town of Manchester, VDEC, BCRC, TU, Orvis, SVAC
West Branch/ Batten Kill	Manchester	0.6 miles Stressed	Runoff from Developed Lands/ Land erosion, nutrient loading	Additional monitoring, stormwater mapping, IDDE	Impervious areas, Town of Manchester	Town of Manchester, VDEC, BCRC
Warm Brook, Fayville Branch, Dry Brook, Batten Kill	Arlington, East Arlington	All surface waters within municipality	Runoff from Developed Lands/ Land erosion, nutrient loading	Additional monitoring, stormwater mapping, IDDE	Impervious areas, Town of Arlington	Town of Arlington, VDEC, BCRC, BCCD
Roaring Branch, Batten Kill	Manchester	T2.01	Flood resiliency/ Encroachment, channel erosion	modeling of berm removal	Historic and ongoing channel management	VDEC (RMP), Town of Manchester, BKWA, BCCD

Subbasin/ Basin	Town	Stream segment	Activity/ Stressor addressed	Project Description	Source	Potential Partners
Batten Kill mainstem	Manchester		Dufresne dam removal project/ flow alteration	Post dam removal assessment		VDFW, TU, VDEC-BASS, BKWA
Hopper Brook/ Batten Kill	Sandgate	Headwaters downstream of high elevation impoundments	Flow alteration due to the Lake Madeline hydro facility	Bio-monitoring for the impacts associated with that operation, specifically downstream flow regulation		VDEC-BASS, VDEC RMP, LPMPP
Batten Kill mainstem	All towns in the basin	Mainstem and tributaries (esp. Green)	Invasives	Monitor for the presence of Didymo and Whirling Disease		VDFW, VDEC, USFS, TU, BCCD, BKWA
Lake Shaftsbury/ Batten Kill	Shaftsbury	Entire Lake	Invasives	Monitor for the spread of Water Chestnut – pull where necessary		VDEC-LPMPP, VDFPR; BCCD
Paran Creek/ Walloomsac	North Bennington	3.0 miles	Potential industrial runoff, urban sources	Biomonitoring scheduled for fall, 2015. Water quality monitoring proposed	Unknown	Lake Paran Recreation, Inc., BCCD
Paran Creek/ Walloomsac	Shaftsbury	All surface waters within municipality	Runoff from Developed Lands/ Land erosion, nutrient loading	Additional monitoring, stormwater mapping, IDDE	Impervious areas, Town of Arlington	Town of Arlington, VDEC, BCRC, BCCD

Subbasin/ Basin	Town	Stream segment	Activity/ Stressor addressed	Project Description	Source	Potential Partners
Lake Paran/ Walloomsac	North Bennington	Altered Entire lake	Invasives - weevil present; noted natural milfoil decline in 1991	Encourage spread prevention on all lakes and ponds in the basin – see Vermont Invasive Patrollers Program		VDEC, Lake Paran Recreation, Inc.. BCCD
Basin Brook/ Walloomsac	North Bennington	Entire basin upstream of water supply withdrawal point Altered by flow regulation	Possible lack of minimum flow below water supply withdrawal point (threat)	Discontinue/ reclassify?	WSID #5017 - North Bennington Water Dept; serves as back up supply source to gravel well field	Town of North Bennington, VDEC - GWDWPP
Bolles Brook (includes Bickford Hollow and Hell Hollow/ Roaring Branch, intake to City Stream confluence/ Walloomsac	Glastenbury Woodford	1.0 miles, Altered by flow regulation (Part F list)	Possible lack of minimum flow below water supply withdrawal point (threat)	Assessment of water withdrawal impact difficult given low productivity & low ph effect	WSID #5016 - Bennington Water Dep't;	Bennington, VDEC - GWDWPP
Barney Brook/ Wallomsac	Bennington, Woodford	RM 0.2 - 1.5	Stressed due to leachate entering brook from Burgess Landfill and Burgess Superfund Site/ Toxics	VDEC BASS lab is working with local organizations to determine sources	Iron precipitate	Bennington, VDEC – WMD, VDEC - BASS

Subbasin/ Basin	Town	Stream segment	Activity/ Stressor addressed	Project Description	Source	Potential Partners
Jewett Brook/ Walloomsac	Pownal	1.0 miles <i>Stressed</i> – Stressed List	Temperature/ thermal modification	Conduct thermal monitoring, riparian buffer gap analysis	Unknown (AG, developed land) FAIR BIO DATA 2008	VDFW, VDEC, TU, BCRC, BCCD, VAAFM
Ladd Brook/ Hoosic	Pownal	0.4 miles <i>Impaired</i> – Part A list	Indication of sediment stress; potential impacts from eroding gravel roads/ Land Erosion	Road Erosion Inventory and Assessment, RERA shows high % of potential risk	Back road erosion	VDEC, Town of Pownal, Vtrans-BBR, BCCD
Tubbs Brook/ Hoosic	North Pownal	0.5 miles <i>Stressed</i> – Stressed List	Land erosion – SGA candidate?	Conduct abbreviated SGA to determine sources	Unknown, Land erosion	VDEC – RMP, Town of Pownal, BCRC
Hoosic	North Pownal, Pownal	<i>Impaired</i> , entire 7 mile length in Vermont	PCBs/ Toxics	Continued monitoring of No. Pownal Tannery Superfund site		VDEC-WMD, VDEC-BASS
Hoosic	North Pownal, Pownal	<i>Impaired</i> , entire 7 mile length in Vermont	Encroachment, channel erosion, land erosion, nutrients, protection (flood resiliency)	River Corridor Plan	Phase 2 SGA (2009) calls out next phase	VDEC-RMP, BCRC, BCCD

Project Identification, Development, and Implementation

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Batten kill						
Mad Tom	Dorset, East Dorset		Protection	Reclassification – A1	BASS data (?)	VDEC, USFS, BKWA
Mad Tom	East Dorset	T7.01	Channel erosion	Modeling of berm removal	Batten Kill RCP	VDEC – RMP, Vtrans, BCCD
West Branch	Manchester	T6.01, T6.02	Channel erosion, Land erosion, nutrient loading	Identify and implement GSI stormwater management projects for village. Encourage centralized stormwater treatment system where dense development exists. Locate treatment areas based on locations of soils with high infiltration potential	Urban sources	Town of Manchester, VDEC – ERP, BCCD
Bromley Brook	Manchester	First tributary US from confluence with Bourn Brook	Flow alteration	Reclassification from A2 to B (abandoned)	No longer used	Manchester Water Co., VDEC - GWDWPP

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Bourn Brook	Manchester, Bondville	(where not Wilderness lands)	Protection	Reclassification – (USFS “Wild & Scenic” candidate) scenic beauty, cultural significance, recreational trail	BASS data (?), USFS monitoring and assessment	VDEC – MAPP, USFS, BKWA
Bourn Brook	Manchester	T4.01	Encroachment	Modeling of berm removal	Batten Kill RCP	VDEC - RMP, Town of Manchester, landowners, BKWA, BCCD
Bourn Pond	Sunderland	Lakeshore (T4.06)	Thermal modification, land erosion, encroachment	Address unsanctioned camping encroachment into shoreline areas	Lye Brook Monitoring Coop	USFS, VDEC – LPMPP, BCCD
Lye Brook	Manchester, Sunderland,	Portion forming boundary between Lye Brook Wilderness and non-wilderness GMFLNF lands	Protection	Reclassification – A1 (also W&S)	BASS data (?)	VDEC – MAPP, USFS, BKWA
Lye Brook	Manchester	T3.02-A & B	Channel erosion, encroachment	Berm removal, river corridor easement, wetland protection	Lye Brook RCP	Town of Manchester, VDEC – RMP, BCCD, BKWA

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Lye Brook	Sunderland	headwaters	Atmospheric deposition	Acid deposition mitigation	Atmospheric deposition LRTAP	VDEC, EPA approved TMDL, USFS
Branch Pond	Sunderland	headwaters	Encroachment, land erosion, thermal modification	Address unsanctioned camping encroachment into shoreline areas	Lye Brook Monitoring Coop	USFS, VDEC – LPMPP, GMC
Branch Pond Brook	Sunderland		Protection	Reclassification – A1	BASS data (?)	VDEC – MAPP, USFS, BKWA
Roaring Branch	Sunderland	T2.04-B & C	Protection	River Corridor easement (highest priority from SGA-RCP). Town of Sunderland has adopted FEH	TS Irene scour, So. Of rte. 9 IRP	VDEC - RMP, Town of Sunderland, landowners, BKWA, BCCD
Roaring Branch (South Branch, US of the Kelly Stand RD/ FR 6)	Sunderland	T2S2.01, T2S2.02	Protection	Reclassification to A1 (below 2500')	BASS data (?)	VDEC – MAPP, USFS, Town of Sunderland, BKWA, BCCD
Munson Brook	Manchester	RM 0.2 and upstream of Route 7A	Channel erosion, Land erosion, nutrient loading	Conduct SWMP to identify highest priorities for SW retrofit and GSI implementation (scheduled for 2016)	BASS data	VDEC – ERP, Town of Manchester, BCRC, BCCD, Orvis

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Munson Brook	Manchester	RM 0.2 and upstream of Route 7A	Channel erosion, Land erosion, nutrient loading	Identify and implement GSI stormwater management projects for village. Encourage centralized stormwater treatment system where dense development exists. Locate treatment areas based on locations of soils with high infiltration potential	BASS data	VDEC - ERP, Town of Manchester, BCCD, Orvis
Green River	Sandgate	Basin-wide	Land erosion	Work with towns in the Basin to implement back road BMPs to address sedimentation from gravel road runoff	RERA, BBR inventories (category A)	VDEC – SW, Vtrans – BBR, BCRC, Town of Sandgate, BCCD

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Batten Kill mainstem	Manchester	Mainstem reaches	Channel erosion, Land erosion, nutrient loading	Identify and implement GSI stormwater management projects for village. Encourage centralized stormwater treatment system where dense development exists. Locate treatment areas based on locations of soils with high infiltration potential	BASS data, VDFW	VDEC – ERP, BCCD, Town of Manchester, BKWA
Batten Kill mainstem	Manchester	M10, M11	Nutrient loading	Work with Ekwanok and Manchester Country Clubs to become “VT Green Links” courses	VDEC-BASS	VDEC, Vermont Small Business Development Center, Ekwanok and Manchester Country Clubs, BKWA, BCCD

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Batten Kill mainstem	Manchester, Sunderland, Arlington	Entire mainstem	Encroachment, land erosion, thermal modification	Promote rebuffering opportunities through BCCD "Trees for Streams" program	Loss of riparian veg, streambank erosion, runoff, lack of habitat features	BCCD, VDEC – RMP, VDEC – BASS, VDFW, BKWA
Batten Kill mainstem	Dorset	Entire mainstem	Nutrient loading	Work with VSFHS to ensure manure management activities and watering activities are adhering to RAPs	Equine management activities	VAAFM, BCCD, NRCS
Batten Kill mainstem	Manchester	M10	Protection	Potential river corridor easement just upstream from confluence with Bourn Brook	Batten Kill RCP	VDEC - RMP, landowners, BKWA
Batten Kill mainstem	Manchester	M5(E)	Encroachment, Thermal modification	Re-buffer western portion of streambank (RB)	NRCS, CREP	VAAFM, BCCD, NRCS, VLT, BKWA

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Batten Kill mainstem	All towns in Basin	All waters	Land erosion	Develop and implement stormwater management plan for private and public roads. Use Road erosion Risk layer and map points of stormwater inputs to ditches to assist in project prioritization	VDEC Erosion and RERA/ Sediment Source Risk Maps	VDEC - SW, Municipalities, Vtrans-BBR, BCRC, BCCD
Batten Kill mainstem	All towns in Basin	Mainstem and tributaries	Invasives	Assist in the development of, and Implement Batten Kill Cisma	BK Cisma	Principle and supporting partners of the Cisma, BCSFC, BCCD
Batten Kill	All towns in Basin	All waters	Land erosion, encroachment, channel erosion	Identify and implement needed Better Backroads BMPs for roads identified in BBR – Category “A” inventories	VDEC Erosion and Sediment Source Risk Maps	BCRC, VDEC, Municipalities, Vtrans-BBR, BKWA, BCCD

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Warm Brook	East Arlington	Entire mainstem	Encroachment, land erosion, thermal modification	Promote rebuffering opportunities through BCCD "Trees for Streams" program	Loss of riparian veg, streambank erosion, runoff, lack of habitat features	BCCD, VDEC – RMP, VDEC – BASS, VDFW
Fayville Branch	East Arlington	T2S1S1.03 and T2S1S1.02-B*	Channel erosion	Berm removal *Pending alternatives analysis	Batten Kill RCP	VDEC-RMP, Town of Arlington, BCCD
Fayville Branch	East Arlington	T2S1S1.01-A* and T2S1S1.01-B**	Protection	Protection/attenuation/ river corridor easement **Highest priority from SGA	Batten Kill RCP Prouty Hill RD	VDEC-RMP, BKWA, Town of Arlington, BCCD
Fayville Branch	East Arlington, Glastenbury	Entire basin US of Route 7	Protection	W&S candidate for scenic values	VDEC-BASS	VDEC-BASS, USFS, BKWA
Black Brook (trib to Fayville Branch)	Glastenbury	Black Brook and tributaries upstream of confluence with Fayville Branch	Protection	Reclassification – A1	BASS data	VDEC-MAPP, USFS, BKWA
Mill Creek	Rupert	M01T1.04	Protection	Bank stabilization using LWD revetments and riparian buffer plantings	Mill/ White RCP	BKWA, BCCD, VDEC-ERP

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Mill Creek	Rupert	Basin-wide	Land erosion, encroachment	Identify and implement needed Better Backroads BMPs for roads identified in BBR – Category “A” inventories	VDEC Erosion and Sediment Source Risk Maps	BCRC, VDEC, Municipalities, Vtrans-BBR, BCCD
Mill Creek	Rupert	M01T1S1.01	Land erosion	SW LID mitigation project at Rupert Town Garage	Rupert SWMP	VDEC – ERP, BCRC, Town of Rupert, BCCD
Mill Creek	Rupert	M01T1.04 (Antone Mountain View RD)	Land erosion	Stabilize large gully where concentrated runoff enters Mill Brook	Rupert SWMP	VDEC – ERP, Town of Rupert, BCCD, BKWA
Sandgate Brook (Mill Creek)	Rupert	M03T1.03 (Sandgate RD)	Land erosion/ channel erosion	Stabilize downstream incision from culvert outfall – plunge pool, check dams, armoring	Rupert SWMP	BBR, VDEC – ERP, Town of Rupert, BCCD
Mill Creek	Rupert	M05 (Kent Hollow RD)	Land erosion	Replace Undersized Culvert	Rupert SWMP	BBR, Vtrans, Town of Rupert, BCCD
Mill Creek	Rupert	M01T1.01, M01T1.02 (Youlin RD, Hebron RD)	Land erosion	Backroad erosion issues - ditching	Rupert SWMP	BBR, Town of Rupert, BCCD

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
White Creek	Rupert	Basin-wide	Land erosion, encroachment	Identify and implement needed Better Backroads BMPs for roads identified in BBR – Category “A” inventories	VDEC Erosion and Sediment Source Risk Maps	BCRC, VDEC, Municipalities, Vtrans-BBR, BCCD
Walloomsac						
Paran Creek	North Bennington, Shaftsbury	Basin US of Lake Paran	Land erosion, encroachment	Identify and implement GSI stormwater management projects for village. Locate LID retrofits and treatment areas based on locations of soils with high infiltration potential	VDEC-BASS	Lake Paran Inc., VDEC-SW, Town of North Bennington, BCCD
Lake Paran	North Bennington	Develped lakeshore areas within 250’	Land erosion, encroachment – fostering the spread of invasives	Conduct Lakewise assessment and implement LID-GSI projects	VDFW access area, North Bennington Recreation Area	Lake Paran Recreation Inc., VDEC-LPMPP, BCCD

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Barney Brook	Bennington, Woodford	RM 0.2 - 1.5	Toxics	Mitigate sources of iron precipitate	Potential landfill leachate	VDEC-WMD, VDEC-BASS, Town of Bennington
Roaring Branch	Bennington, Stamford, Woodford	GMNF reaches	Channel erosion	Increase instream LWD – up to 175 pieces/ mile	TS Irene scour, So. Of rte. 9 IRP	USFS, TU
Roaring Branch	Bennington	M06T3.03	Protection, Channel erosion, encroachment	Acquire property adjacent to channel to prevent future development; modeling of fill removal to restore floodplain access	Channel Management and River Corridor Protection Plan, Roaring Branch SGA	VDEC-RMP, F&W, BCCD, Town of Bennington
Bolles Brook	Woodford	M6T3.05A	Land erosion, encroachment	Remove new RB berm to open access to flood chute	Woodford RCP, Roaring Branch SGA	VDEC-RMP, BCCD, Town of Bennington
Stamford Stream	Woodford, Stamford	Headwaters and areas around Sucker Pond/ Hancock Lake	Class 4 road erosion/ Land erosion	Work with ATV/ 4WD clubs to develop and implement back road BMPs on Stagecoach Road	So. Of rte. 9 IRP	USFS, BCCD, VDEC-ERP
Sucker Pond/ Lake Hancock		Headwaters and areas around Sucker Pond/ Hancock Lake	Class 4 road erosion/ Land erosion	Controlled access points	So. Of rte. 9 IRP	USFS, BCCD, VDEC-ERP

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
City Stream	Woodford	M6T3.05S1.01A	Protection	Protect confluence area from further development/FEH	Woodford RCP	VDEC-RMP, Town of Woodford, landowners
City Stream	Woodford	M6T3.05S1.04D	Encroachment, land erosion	Move parking area out of river corridor	Woodford RCP	VDEC-RMP, Town of Woodford, landowners
Jewitt Brook	Pownal, Bennington	Approximately 1 mile downstream of Pownal Center	Thermal modification	Bank stabilization using LWD revetments and riparian buffer plantings	VDEC-BASS	VDEC-RMP, BCCD, Towns of Bennington and Pownal
Walloomsac mainstem	Bennington	M06, M07, M08, and tribs	Channel erosion, Land erosion, nutrient loading	Conduct SWMP to identify highest priorities for SW retrofit and GSI implementation (scheduled for 2016)	BASS data	VDEC – ERP, Town of Bennington, BCRC, BCCD
Hoosic						
Broad Brook	Pownal	GMNF reaches	Habitat restoration/ Channel erosion	Increase instream LWD – up to 175 pieces/ mile	TS Irene scour, So. Of rte. 9 IRP	USFS, TU

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Tubbs Brook	Pownal	Basin-wide	Land erosion, encroachment	Identify and implement needed Better Backroads BMPs for roads identified in BBR – Category “A” inventories	RERA groundtruthing, road inventory and assessment	Vtrans-BBR, VDEC-SW, BCRC, Town of Pownal, BCCD
Ladd Brook	Pownal	Basin-wide	Land erosion, encroachment	Identify and implement needed Better Backroads BMPs for roads identified in BBR – Category “A” inventories	RERA groundtruthing, road inventory and assessment	Vtrans-BBR, VDEC-SW, BCRC, Town of Pownal, BCCD
Hoosic	Pownal, North Pownal	Entire 7 miles segment in VT	PCBs/ Toxics	Site remediation complete, ongoing M&A indicates effective treatment, no further action proposed at this time	PCBs	VDEC-WMD, VDEC-BASS, EPA

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners
Hoosic River	Pownal	M02	Encroachment, channel erosion	Relocate berm adjacent to WWTF to accommodate a small floodplain for flow and sediment attenuation	Hoosic Phase 2 SGA	VDEC-ERP, VDEC-RMP, Town of Pownal (WWTF), BCCD
Hoosic River	Pownal	M06	Protection	Bank stabilization using LWD revetments and riparian buffer plantings	Hoosic Phase 2 SGA	BCCD, HoorWA, VDEC-ERP, VDEC-RMP
Basin-wide	All towns	All waters Land erosion, nutrients	Land erosion, encroachment	Install riparian buffers and enhance nutrient management on agricultural land	Farm assessments	NRCS, VAAFM, UVM extension, BCCD
Basin-wide	All towns	All waters	Land erosion, nutrients	Identify and implement needed BMPs for agricultural fields identified as at moderate to high risk for erosion.	DEC Erosion and Sediment Source Risk Maps	NRCS, VAAFM, UVM extension, BCCD
Basin-wide	All Towns	All impounded surface waters	Flow alteration	Identify opportunities for dam removal and/or retrofits	VT Dam Task Force Dam statewide assessment of candidate dams	VDEC, USFWS, VT Dam task Force, TU, municipalities

Table 16. Implementation Table

General Watershed Strategies

River Corridor Protection and Restoration

Goal: Manage rivers and streams throughout Basin 1 towards dynamic equilibrium

Objective: To protect and conserve the riparian corridor and preserve floodplains in (or restored to) their natural state to provide functions related reducing the number and severity of floods, helping handle stormwater runoff, minimizing non-point water pollution and storing sediment and understanding the importance values and aesthetics of floodplains.

1). Recommendation:

Complete River Corridor Plans for the Hoosic (mainstem), Walloomsac, Batten Kill Tributaries and sub-watersheds.

Lead Agency/Organization: VDEC, BCRC, BCCD

Partners: Towns in the basin, VDEC River Management Program

Potential funding sources: ERP/ CWIF

Time frame: Ongoing

2). Recommendation:

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

Lead Agency/Organization: Bennington Regional Planning Commission, Local Municipalities

Partners: Towns in the basin, VTDEC – Water

Quality Division Planning

Potential funding sources: 604(b), VCWA

Time frame: Ongoing

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

3). Recommendation:

Educate the general public about the importance and interconnected nature of managing our watersheds towards stream equilibrium.

Lead Agency/Organization: BCRC, BCCD, BKWA, HooRWA

Partners: Vermont DEC River Management Program

Potential funding sources: 604(b), VCWA

Time frame: Ongoing

Benchmark: Adoption & Enforcement of Model FEH Ordinance

4). Recommendation:

Restore dynamic equilibrium to county watercourses by implementing the proposed targeted projects in the river corridor plan

Lead Agency/Organization: BKWA, HooRWA, BCCD, VANR

Partners: Vermont DEC River Management Program

Potential funding sources: ERP/ CWIF

Time frame: Ongoing

Benchmark: Number of implementation projects

5). Recommendation: Adopt FEH/River Corridor ordinances in towns throughout Basin

Lead Agency/Organization: BCRC, BCCD, Local Municipalities

Partners: Vermont DEC River Management Program

Potential funding sources: 604(b), VCWA

Time frame: Ongoing

Benchmark: Number of communities adopting & enforcing FEH

6). Recommendations: Approach individual landowners about protecting river corridor, purchase easements and protect existing floodplains.

Lead Agency/Organization: BKWA, HooRWA, BCCD

Partners: Vermont ANR, VLT, TNC, TPL

Potential funding sources: ERP/ CWIF

Time frame: Ongoing

Benchmark: Number of River Corridor partners

Protecting, Preserving and Maintaining Lakes and Ponds

Vermont's lakes and ponds are beautiful recreational resources as well as critical elements in the ecology and habitat of the State. Keeping them in good shape or restoring them and rethinking the actions people take on the landscape are key elements to the long-term management and protection of these assets in the Basin. All those who live, work or play on the shores or in the watersheds of lakes have an important responsibility to take steps to minimize their impact on the lake, whether it be replanting the shoreline, preventing soil erosion, preventing the spread of invasive species, or practicing eco-friendly lawn care.

Goal: Protect natural lake shorelines from unplanned development and encourage better management of highly developed lake shorelines. Minimize adverse land use activities in lake watersheds, within the lake shoreline, and within lakes and ponds themselves.

Objective: Encourage comprehensive lake protection or restoration by managing lake watersheds and diverse land uses, and influencing individual behaviors to adopt best management practices and policies concurrent with the Shoreland Protection Act and the LakeWise Program.

7). Recommendation: Map wilderness, wilderness-like and undeveloped lake and pond shorelines. Comprehensive mapping of undeveloped shorelines will be essential in development of protection actions of these areas

Lead Agency/Organization: BCRC, BCCD,

Partners: Vermont ANR

Potential funding sources: Vermont Watershed Grants, 604(b)

Time frame: Ongoing

Benchmark: Number of shorelines mapped and identified

8). Recommendation: Review regional and town plans and zoning bylaws information relating to lake protection issues– Identify towns in basin with inadequate protection as plans and bylaws come up for review and revision. Much water resource protection will occur at the municipal level as Vermont does not have statewide shoreline protection. Through the on-going local planning and zoning processes, town programs can be updated to provide increasing protection of valuable shoreline resources.

Lead Agency/Organization: BCRC, VLCT,

Partners: Vermont ANR

Potential funding sources: Vermont Watershed Grants, 604(b)

Time frame: Ongoing

Benchmark: Number of towns/municipalities increasing language in planning documents

9). Recommendation: Conduct lake watershed surveys in selected watershed lakes and ponds to identify nonpoint sources of pollution and the actions needed to control them. Conduct Lake and Watershed Surveys and develop a plan including a list of non-point source problems in need of addressing, education needs, and town program needs. Correct identified non-point source problems through demonstration or implementation projects.

Lead Agency/Organization: BCCD, HooRWA, Lake Association

Partners: Vermont ANR

Potential funding sources: Vermont Watershed Grants

Time frame: Ongoing

Benchmark: Number of surveys done

10). Recommendation: Promote regular maintenance of lakeshore camp septic tanks. Encourage lake homeowners to pump out septic systems on a regular basis. Inadequate and failing lakeshore septic systems can contribute to discharges of phosphorus and E. coli to adjacent waterways

Lead Agency/Organization: Lake Association, Towns/Municipalities

Partners: Vermont ANR

Potential funding sources: Vermont Watershed Grants

Time frame: Ongoing

Benchmark: Identify lakeshore areas with elevated levels of E. coli and bracket monitor for potential sources to identify and mitigate illicit discharge and/or failing septic systems.

11). Recommendation: Conduct camp/landowner education, shoreline property management workshops, outreach to new lake and pond landowners.

Lead Agency/Organization: BCCD, Lake Association

Partners: Vermont ANR

Potential funding sources: Vermont Watershed Grants

Time frame: Ongoing

Benchmark: Number of events held.

12). Recommendation: Recruit volunteers for the Lakes Lay Monitoring Program

Lead Agency/Organization: Lake Association, BCCD

Partners: Vermont ANR

Potential funding sources: Lay Monitoring Program, LaRosa Partnership, Watershed Grants

Time frame: Ongoing

Benchmark: Number of lake monitoring programs started

Protecting and Preserving Wetlands

In Vermont, wetlands are defined as transitional zones between land and other water bodies. Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Section 404 of the Clean Water Act, EPA). Such areas include but are not limited to marshes, wet meadows, swamps, bogs, and vernal pools. There is over 220,000 acres (over 5% of Vermont) of wetland throughout the State of Vermont. Vermont historically lost 35% of its wetlands before the Vermont Wetlands Rules were placed into effect in 1990. In comparison to other major river basins in the state, Basin 01 is comprised of only 2.7 % wetlands by land cover, making it a lesser common resource by comparison.

Vermont's wetlands are extremely important resources that the Agency of Natural Resources and many other concerned groups are seeking to protect. Wetlands are worthy of protection because of the many valuable and irreplaceable functions they provide, which include: flood control, water quality protection, wildlife habitat, recreation opportunities, economic benefits, and erosion control. Since the degree to which a wetland serves these functions varies, many wetlands are needed to work in combination with each other as part of a complex, integrated system.⁸

Goal: No net loss of wetland function or acreage throughout the basin.

Objective: To protect and conserve wetlands and their buffer zones by identifying the resource on the landscape, minimizing encroachments, restoring lost functions and conserving pristine and high quality wetlands.

13). Recommendation:

Design, Study and Implement strategies for protecting wetlands through watershed planning.

⁸ STATE of VERMONT, Governors Clean and Clear Action Plan: Clean and Clear Stormwater Education: <http://www.anr.state.vt.us/cleanandclear/SWed.htm>

Including:

- 1). Compile Wetland Information on a Watershed Basis
- 2). Create an Inventory of Wetlands in the Watershed
- 3). Review existing plans
- 4). Assess Local Wetland Protection Capacity
- 5). Identify Wetland Partners and Roles
- 6). Define Wetland Goals and Objectives for the Watershed
- 7). Define specific wetland objectives
- 8). Identify historic wetlands coverage
- 9). Determine wetland functions
- 10). Determine individual wetland condition
- 11). Project effects of future land use changes on wetlands
- 12). Identify wetlands that fall outside of Federal and State jurisdiction

Lead Agency/Organization: BCCD, BCRC, BKWA, GMNF, HoorWA

Partners: Vermont ANR

Potential funding sources: Vermont Watershed Grants

Time frame: Ongoing

Benchmark: Identification and assessment of wetlands

Watershed Projects and Assessments Completed by ANR and/or its Partners during the Planning Process

DEC recognizes that several important projects were completed during the planning process by DEC's watershed partners, either independently or with DEC support. The projects include:

The Roaring Branch Restoration Project in Bennington

The Rivers program, in partnership with the Town of Bennington, completed Phase I and Phase II of a large flood plain restoration project along the Roaring Branch. Bennington is situated in a particularly hazardous location on an alluvial fan at the foot of the Green Mountains. The Roaring Branch is a tremendously dynamic and powerful force at times of flood, delivering astounding volumes of boulders, rock and woody debris into the urbanized area. For 150 years or more, this

municipality and its residents have struggled with the river, attempting to confine it and control it with a system of earthen berms and structural levees.

Unfortunately, for village residents and town taxpayers, the river has won most of the contests, breaching and then catastrophically avulsing through the berms, inundating residential and industrial areas, and devastating public infrastructure including roads and bridges. Each flood would trigger a spasm of channel dredging and reconstruction of the temporary and inadequately confining structural elements along the channel margins. These channelization practices did not provide long-term protection of the property and infrastructure behind the berms. Rather, these structures remained extremely vulnerable to the next flood.

In 2008, Bennington formed a partnership with the DEC and initiated a public process to adopt Fluvial Erosion Hazard (FEH) bylaws in which additional development encroachments into currently undeveloped areas of the river corridor are prohibited. The ordinance model and FEH zone map were provided by the Rivers Program. Support for the town selectboard and planning commission through the adoption process was also provided by Rivers Program staff.

In response to the town adoption of the FEH bylaws, the Rivers Program pursued ERP (formerly C&C) funds to design and construct a major flood plain restoration project. This project consisted of removing 3,500 linear feet of earthen berms, involving over 35,000 cubic yards of earth and rock excavation, construction of a new engineered, armored berm set well back from the river, and the restoration of approximately 12 acres of functioning floodplain within a critical area of the village.

The partially completed project was severely tested by Tropical Storm Irene. While the project did receive some structural damage, it otherwise performed as anticipated and, in the opinion of Bennington town officials and DEC, damages in the project area would have been orders of magnitude worse, had the project not been implemented.

The Roaring Branch caused a partial breach of the new armored berm at the transition point where the flood plain narrows from the new restored section to the upstream approach to the Park Street Bridge. This damaged area has since been reconstructed as part of the town flood recovery operations.

Based on pre-project surveyed cross sections, an estimated 550,000 cubic yards of sediment, primarily composed of gravel, cobbles and boulders, was deposited in a one-mile reach of the Roaring Branch from the confluence with the Walloomsac River upstream to the VT 9 Bridge. This provides a clear indication of how hazardous a situation exists in Bennington where an active alluvial fan through an urbanized area is confined to the width of the river channel, and why the restoration and protection of any overbank portion of the active fan is a critically necessary action for the protection of public safety.

The Watershed Management Division has been working with the Town of Bennington and its engineering consultants (Milone & MacBroom) to excavate a large percentage of the sediment, to remove the confining berms and to extend and complete the designed flood plain restoration project up to the Branch Street, or 'Brooklyn' bridge.

List of Acronyms:

319	Federal Clean Water Act, Section 319
604(b)	Federal Clean Water Act, Section 604b
AAFM	Agency of Agriculture, Food, and Markets
AAPs	Accepted Agricultural Practices
AEM	Agricultural Environmental Management
AEP	American Electric Power
AMA	Agricultural Management Assistance Program
AMPs	Acceptable Management Practices (for logging)
ANR	Agency of Natural Resources
ANS	Aquatic Invasive Species
AOP	Aquatic Organism Passage
ARS	Agricultural Resource Specialists
BASS	VDEC Biomonitoring and Aquatic Studies Section
B&C	Bridge and Culvert
BBR	Better Backroads
BCCD	Bennington County Conservation District
BCRC	Bennington County Regional Commission

BKWA	Batten Kill Watershed Alliance
BMP	Best Management Practices
CCPI	Cooperative Conservation Partnership Initiative
CRP	Conservation Reserve Program
CREP	Conservation Reserve Enhancement Program
CWIP	Clean Water Initiative Program (CWIF – Clean Water Initiative Fund)
CWSRF	Clean Water State Revolving Fund
DEC	Vermont Department of Environmental Conservation
DFPR	Vermont Department of Forests, Parks and Recreation
DFW	Vermont Department of Fish and Wildlife
DPW	Department of Public Works
DWSRF	Drinking Water State Revolving Fund
EBTJV	Eastern Brook Trout Joint Venture
EQIP	Environmental Quality Incentive Program
EPA	Environmental Protection Agency
ERP	Ecosystem Restoration Program
EU	Existing Use
FAP	Farm Agronomic Practices
FEH	Fluvial Erosion Hazard
FERC	Federal Energy Regulatory Commission
FPR	Department of Forests, Parks, and Recreation
FSA	Farm Service Agency (USDA)
GIS	Geographic Information System
GSI	Green Stormwater Infrastructure
HoorWA	Hoosic River Watershed Association
IDDE	Illicit Discharge Detection (and) Elimination
LFO	Large farm Operation
LID	Low Impact Development
LiDAR	Light Detection and Ranging
LIG	Local Implementation Grants (LCBP)
LIP	Landowner Incentive Program
LTP	Land Treatment Planner
LWD	Large Woody Debris
MAPP	Monitoring, Assessment and Planning Program

MFO	Medium Farm Operation
NEMO	Nonpoint Education for Municipal Officials
NMP	Nutrient Management Plan
NEGEF	New England Grassroots Environmental Fund
NFWF	National Fish and Wildlife Foundation
NOFA	Northeast Organic Farming Association of Vermont
NPDES	National Pollution Discharge Elimination System
NPS	Non-point source pollution
NRCD	Natural Resource Conservation District
NRCS	Natural Resources Conservation Service
(NY) DEC	New York Department of Environmental Conservation
ORW	Outstanding Resource Water
PDM	Pre-Disaster Mitigation
PFW	Partners for Fish and Wildlife
R, T&E	Rare, Threatened and Endangered Species
RCP	River Corridor Plan
RMP	River Management Program
RPC	Regional Planning Commission
SEP	Supplemental Environmental Program
SFO	Small Farm Operation
SGA	Stream Geomorphic Assessment
SPA	Source Protection Area
SVNMP	Southern Vermont Nutrient Management Program
SWCD (NY)	Soil and Water Conservation District (New York)
SWMP	Stormwater master plans
TFS	Trees for Streams
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TU	Trout Unlimited
USDA	United States Department of Agriculture
USDA – NRCS	US Department of Agriculture – Natural Resource Conservation District
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USFS	United States Forest Service

USGS	United States Geological Survey
UVA	Use Value Appraisal program, or Current Use Program
UVM	University of Vermont
VAAFMM	Vermont Agency of Agriculture, Food and Markets
VABP	Vermont Agricultural Buffer Program
VANR	Vermont Agency of Natural Resources
VCWA	Vermont Clean Water Act
VDEC	Vermont Department of Environmental Conservation
VDHP	Vermont Department of Historic Preservation
VDH	Vermont Department of Health
VEM	Vermont Emergency Management
VFB	Vermont Farm Bureau
VDFW	Vermont Fish and Wildlife Department
VGS	Vermont Geological Survey
VHCB	Vermont Housing and Conservation Board
VHQQ	Very high quality waters
VINS	Vermont Institute of Natural Science
VIP	Vermont Invasive Patrollers
VLCT	Vermont League of Cities and Towns
VLRP	Vermont Local Roads Program
VLT	Vermont Land Trust
VRC	Vermont River Conservancy
WWLG	Warm water low gradient

References and Resources

A Comparative Assessment of the Water Quality and Macroinvertebrate Assemblage Characteristics of the Batten Kill with Several Other Wild Trout Streams in Vermont. August 2003. Biomonitoring and Aquatic Studies Section, Vermont Department of Environmental Conservation, Waterbury, Vermont.

A-76 Town Road and Bridge Standards. January 23, 2013, Vermont Agency of Transportation.

Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont, 2006, Vermont Department of Forests, Parks and Recreation, www.vtfpr.org/watershed/documents/Amp2006.pdf

Basin 1 - Batten Kill, Walloomsac River & Hoosic River Watersheds Water Quality and Aquatic Habitat Assessment Report, 2015. Watershed Management Division, Vermont Department of Environmental Conservation, Montpelier, VT.

Batten Kill Trout Management Plan 2007-2012, 2007, Cox, Vermont Department of Fish and Wildlife. Waterbury, VT

Calcareous Open Fens and Riverside Seeps of Vermont: Some Sites of Ecological Importance, March 1995. Elizabeth Thompson and Robert Popp for the Vermont Nongame and Natural Heritage Program and U.S. Environmental Protection Agency.

Floodplain Forest of Vermont: Some Sites of Ecological Significance, July 1998. Eric Sorenson et al. for the Agency of Natural Resources, Department of Fish & Wildlife, Nongame and Natural Heritage Program.

Guidelines for the Design of Stream/Road Crossings for Passage of Aquatic Organisms in Vermont, 2009 R. Kirn. Vermont Department of Fish and Wildlife. Waterbury, VT

Interim Anti-degradation Implementation Procedure. Vermont Department of Environmental Conservation. 2012.

Hardwood Swamps of Vermont: Distribution, Ecology, Classification, and Some Sites of Ecological Significance, 2004 by Sorenson, Popp, Lew-Smith, Engstrom, Lapin, and Ferguson

Northern White Cedar Swamps and Red Maple-Northern White Cedar Swamps of Vermont: Some Sites of Ecological Significance, 1998 by Sorenson, Engstrom, Lapin, Popp, and Parren

Road Design and Maintenance Handbook 1999. Vermont Local Roads Program, Colchester, VT.

Softwood Swamps of Vermont: Distribution, Ecology, Classification, and Some Sites of Ecological Significance, 2010 by Sorenson, Popp, Engstrom, Lapin, and Farrell.

The River Swimming Holes of Vermont by Jenkins, Benjamin, and Dorney. Vermont Agency of Natural Resources, Water Quality Division, 1992.

Vermont Dam Assessment: 2001 Project Report, November 2001. Vermont Agency of Natural Resources and Vermont Division of Historic Preservation.

Vermont Swimming Hole Study, March 1992. Jerry Jenkins, Deborah Benjamin and Jane Dorney for the Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division.

Vermont Water Quality Standards 2011. Vermont Natural Resources Board, Montpelier, VT.

Vermont Wetland Rules 2011. Vermont Natural Resources Board, Montpelier, VT.

Vermont's Whitewater Rivers: Their Geology, Biology, and Recreational Use, January 1989. Jerry Jenkins and Peter Zika for the Vermont Agency of Natural Resources, Department of Environmental Conservation.

Waterfalls, Cascades and Gorges, September 1985. Jerry Jenkins and Peter Zika for the Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division.

Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont, November 2000. Elizabeth Thompson and Eric Sorenson, The Nature Conservancy and the Vermont Department of Fish and Wildlife.

Glossary

10 V.S.A., Chapter 47 - Title 10 of the Vermont Statutes Annotated, Chapter 47, Water Pollution Control, which is Vermont's basic water pollution control legislation.

Accepted Agricultural Practices (AAP) - land management practices adopted by the Secretary of Agriculture, Food and Markets in accordance with applicable State law.

Acceptable Management Practices (AMP) - methods to control and disperse water collecting on logging roads, skid trails, and log landings to minimize erosion and prevent sediment and temperature changes in streams.

Aquatic biota - all organisms that, as part of their natural life cycle, live in or on waters.

Basin - one of fifteen planning units in Vermont. Some basins include only one major watershed after which it is named such as the Lamoille River Basin. Other Basins include two or major watersheds such as the Poultney/ Mettawee Basin.

Best Management Practices (BMP) - a practice or combination of practices that may be necessary, in addition to any applicable Accepted Agricultural or Silvicultural Practices, to prevent or reduce pollution from nonpoint source pollution to a level consistent with State regulations and statutes. Regulatory authorities and practitioners generally establish these methods as the best manner of operation. BMPs may not be established for all industries or in agency regulations, but are often listed by professional associations and regulatory agencies as the best manner of operation for a particular industry practice.

Classification - a method of designating the waters of the State into categories with more or less stringent standards above a minimum standard as described in the Vermont Water Quality Standards.

Designated use - any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water as set forth in §§ 3-02 (A), 3-03(A), and 3-04(A) of the Vermont Water Quality Standards.

Existing use - a use that has actually occurred on or after November 28, 1975, in or on waters, whether or not the use is included in the standard for classification of the waters, and whether or not the use is presently occurring

Fluvial geomorphology - a science that seeks to explain the physical interrelationships of flowing water and sediment in varying land forms

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

Improved Barnyards - a series of practices to manage and protect the area around the barn, which is frequently and intensively used by people, animals, or vehicles, by controlling runoff to prevent erosion and maintain or improve water quality. Practices may include: heavy use area protection, access roads, animal trails and walkways, roof runoff management, and others.

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

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

Nonpoint source pollution - waste that reaches waters in a diffuse manner from any source other than a point source including, but not limited to, overland runoff from construction sites, or as a result of agricultural or silvicultural activities.

pH - a measure of the hydrogen ion concentration in water on an inverse logarithmic scale ranging from 0 to 14. A pH under 7 indicates more hydrogen ions and therefore more acidic solutions. A pH greater than 7 indicates a more alkaline solution. A pH of 7.0 is considered neutral, neither acidic nor alkaline.

Point source - any discernible, confined and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which either a pollutant or waste is or may be discharged.

Reference condition - the range of chemical, physical, and biological characteristics of waters minimally affected by human influences. In the context of an evaluation of biological indices, or where necessary to perform other evaluations of water quality, the reference condition establishes attainable chemical, physical, and biological conditions for specific water body types against which the condition of waters of similar water body type is evaluated.

Riparian vegetation - the native or natural vegetation growing adjacent to lakes, rivers, or streams.

Sedimentation - the sinking of soil, sand, silt, algae, and other particles and their deposition frequently on the bottom of rivers, streams, lakes, ponds, or wetlands.

Thermal modification - the change in water temperature

Turbidity - the capacity of materials suspended in water to scatter light usually measured in Jackson Turbidity Units (JTU). Highly turbid waters appear dark and “muddy.”

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

Water Quality Standards - the minimum or maximum limits specified for certain water quality parameters at specific locations for the purpose of managing waters to support their designated uses. In Vermont, Water Quality Standards include both Water Classification Orders and the Regulations Governing Water Classification and Control of Quality.

Waters - all rivers, streams, creeks, brooks, reservoirs, ponds, lakes, springs and all bodies of surface waters, artificial or natural, which are contained within, flow through or border upon the State or any portion of it.

Watershed - all the land within which water drains to a common waterbody (river, stream, lake pond or wetland).

Hudson River Basin Plan Appendices

Appendix A. Existing Use Tables

Appendix B. Lakes and Ponds Program Priorities for Basin 01

Appendix C. Hudson River Basin Plan Public Comments and Responsiveness Summary

Appendix A – Existing Use Tables

Surface Water	Location of Use	Watershed	Town	Documentation of Existing Use
Batten Kill	Mainstem	Batten Kill	All towns	Popular flatwater boating river
Mad Tom Brook	From just west of Dorset and Peru town line	Batten Kill	Dorset	Archives VPC trip reports
Little Mad Tom Brook	From just west of Dorset and Peru town line	Batten Kill	Dorset	Archives VPC trip reports
Bourn Brook	Off of TH 26 east of the town line	Batten Kill	Winhall and Manchester	http://www.nicholasgottlieb.com/2013/11/13/bourne-brook/
Lye Brook	Entire Lower Gorge	Batten Kill	Sunderland and Manchester	Archives VPC trip reports

Appendix B. Lakes and Ponds Program Priority Activities in Basin 1

Program staff and watershed association partners work together on many lake protection projects. See descriptions below for more information.

Name	Town	Lake Area	Lakeshore Assessment	LakeWise	AIS Spread Prevention	Monitoring
Barber Lake (Lake Potter)	Pownal	19		Seeking demonstration properties and partners. Conduct local workshops for lakeshore contractors on BMPs		
Barbos Lake	Sandgate	7				
Beebe Pond	Sunderland	8				
Big Pond (Woodford Lake)	Woodford	31				LMP
Bourn Pond	Sunderland	55				
Branch Pond	Sunderland	34				
Bullhead Pond	Manchester	5				
Dufresne Pond	Manchester	8				
Equinox Pond	Manchester	15				
Lake Hancock (Sucker Pond)	Stamford	51				
Hopper Pond	Sandgate	1				
Unnamed Pond referred to by DEC as Kent Hollow	Sandgate	10				
Little Mud Pond	Winhall	21				
Lost Pond	Sunderland	2				
Unnamed Pond referred to by DEC as Lye Brook - N	Sunderland	10				
Unnamed Pond referred to by DEC as Lye Brook - S	Sunderland	18				

Lake Madeleine	Sandgate	20			
Unnamed Pond referred to by DEC as Miller	Arlington	11			
Lake Paran	Bennington	40		Looking for interested volunteer monitors; Establish public access greeter program	Eurasian watermilfoil control
Pickerel	Manchester	9			
Shaftsbury Lake	Shaftsbury	27		Implement AIS decontamination SOPs at state park	Water chestnut search and removal techniques
South Stream Pond	Pownal	24			
South Village Pond	Dorset	5			
Thompsons Pond	Pownal	28			

The Vermont Lake Wise Program

The Lake Wise Program is offered through the Vermont Lakes and Ponds Program to provide trainings on lake-friendly shoreland management. Recent data from Vermont and the nation has shown that shoreline development can pose a significant threat to lake water quality. Through Lake Wise, lake property is assessed in four categories of property management—shoreland, recreation area, driveway, and septic /structures. Technical assistance then helps property owners identify locations where the use of best management practices can control run-off and prevent erosion. Properties that meet all Lake Wise criteria receive the Lake Wise award and accompanying sign designating their property as lake-friendly. Lake Associations are also eligible for the “Gold Award” if they assist 15% of their fellow lake residents to participate in Lake Wise.

For more information, contact Amy Picotte at amy.picotte@vermont.gov or (802) 490-6128



Vermont Invasive Patrollers (VIPs)

VIPs are local volunteers who monitor a waterbody for new invasive species. They are trained to distinguish between native and invasive aquatic plants and animals during routine systematic surveys. These individuals provide a vital line of defense in Vermont’s efforts to protect lake ecology and recreation. Finding an invasive organism before it becomes well established in a lake or pond increases management options and may make eradication possible.

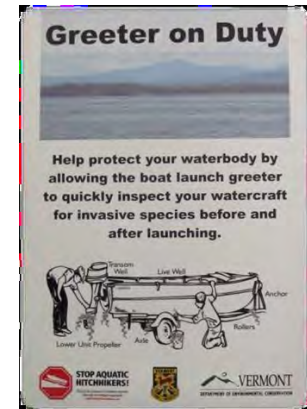
For more information, contact Bethany Sargent at bethany.sargent@vermont.gov or (802)490-6129



The Vermont Public Access Greeter Program

The Lakes and Pond Program partners with local watershed associations to operate greeter programs at lake access points. Public access greeters educate lake visitors about invasive species, provide courtesy watercraft inspections and STOP introductions while providing needed data on the ways invasive organisms hitch rides on equipment. In 2014, greeters intercepted and removed aquatic invasive species 361 times, more than half of the recorded intercepts for the year.

For more information, contact Josh Mulhollem at josh.mulhollem@vermont.gov or (802)490-6121



The Lay Monitoring Program (LMP)

For more than 35 years, the Lakes and Ponds Program has provided technical training and support for local water quality monitors around the state. Following a rigorously documented and quality assured method, these volunteers track changes in chlorophyll, phosphorus and lake transparency. The data support protection and restoration activities around the lake and in the watershed. Currently, there are monitors on approximately 55 inland lakes and 15 locations on Lake Champlain.

For more information, contact Bethany Sargent at Bethany.sargent@vermont.gov or (802)490-6129



Appendix C. Public Comments and Responsiveness Summary

Basin 01 Tactical Basin Plan Responsiveness Summary December 31, 2015

Comment:

- 1) Now that BCRC will be doing a corridor plan for the Hoosic it should be mentioned in several places where it is not now mentioned.

Response:

Duly noted. The Implementation Table identifies the Hoosic River as a priority to develop a river corridor plan to address encroachment, channel erosion, land erosion, nutrients, and protection (flood resiliency) in the Monitoring and Assessment Projects section of the Table (page 81).

Comment:

- 2) Any RMP project that involves towns and landowners is something Bennington County Conservation District has routinely been involved in – coming up with the conceptual project design, writing the grant, and coordinating it.

Response:

Duly noted and strategies have been amended to reflect this as appropriate.

Comment:

- 3) I noticed an error on page 84, in the row below (regarding habitat restoration within the GMNF):

Roaring Branch (towns: Manchester, East Arlington): GMNF reaches - Habitat restoration/ Channel erosion, encroachment	Increase
instream LWD – up to 175 pieces/ mile TS Irene scour, So. Of rte. 9 IRP	

Response:

Duly noted and corrected. The reference should have been made to the Roaring Branch in the Towns of Woodford and Bennington, a tributary to the Walloomsac River.

Comment:

- 4) What is the source of the quotation on page 30? (and generally, the section above might be tightened up). And could you import the graph from the FW report and delete the text re those findings? Actually, reading further, I wonder if this section could be absorbed in the fisheries discussion beginning on p. 42

Response:

This section was prepared by VT Dept of Fish and Wildlife Fisheries Biologist Ken Cox as VDFW provides content on fisheries assessments and management overview in relevant sections of tactical basin plans. Those two fisheries sections have been refined and amended for clarity.

Comment:

- 5) Kelly Nolan has consulted for the Battenkill Conservancy for years. I believe he has done some sampling in VT. jkn@rwaa.us

Response:

Duly noted. VTDEC has collaborated with Kelly Nolan and the Batten Kill Conservancy for past water quality monitoring efforts.

Comment:

- 6) Want to comment on the re-permitting process? Manchester is overdue and the others are almost due.

Response:

As required by their 2010 operating permit, the Town of Manchester applied to DEC for a renewal of their operating permit on March 20, 2015. The application is in evaluation with the Wastewater Management Program of DEC's Watershed Management Division. The re-permitting process is described by Chapter 13 of the Environmental Protection rules, and associated amendments, which can be found here: <http://www.vtwaterquality.org/www/htm/discharge.htm#npdes>.

Comment:

- 7) Regarding the A(2) – surface water supply identified as “Village of Bennington water supply - Lake surface and all waters within its watershed in Stamford.” - Is this different from Sucker Pond? Here and below the use of "Village" confuses me.

Response:

Duly noted and corrected. The reference to A2 Public Water Supply designation (for the Village of Bennington) in Stamford was duplicative, and should have been in reference to Lake Hancock (Sucker Pond) and tributaries listing which remains an active designated A2 listing in the Plan.

Comment:

- 8) This paragraph is confusing (page 71). If you are trying to say that all >2500' elevation waters are A1, but others might also qualify, why not something like "All Vermont waters above 2500' are classified A1 by statute. In addition, waters" and describe the additional criteria. Then a list, like"
- A1 waters
 - All waters above 2500"
 - Potential A1 waters
 - Bourn Brook
 - Bourn Pond etc.

Response:

Duly noted and amended for clarification.

Comment:

- 9) For “Warm water fish habitat (designations)” - I'm sure this is right, but what about Lake Paran, Lake Shaftsbury, Paran Creek, the headwaters of Warm Brook in Shaftsbury, where it winds through huge wetlands, and others? BTW, I know nothing about the mechanics of these designations...

Response:

The surface waters referenced in this section (Lake Hancock and Thompsons Pond) have been so designated in the VT Water Quality Standards based on fisheries monitoring and assessment data. Additional surface waters may be so designated based on supplemental monitoring and assessment data. The Water Quality Standards specify a lower minimum dissolved oxygen concentration than waters in the remainder of the basin, which are Cold-Water Habitat. There are no proposed changes to warm water fish habitat designations at this time.

Comment:

- 10) Regarding the small hydroelectric project on Hopper Brook in Sandgate, on the western slope of Mt. Equinox. At one time, the project consisted of three facilities, two storage and one generation: Lake Madeleine, Barbo's Lake and Hopper Pond. Since the dams are part of an unlicensed (by FERC) hydroelectric facility it is regulated by the state. The Public Service Board has jurisdiction, not DEC. The plan should briefly describe the project, whether it is still operated and, if so, how it is operated. Further, the plan should identify any water quality issues associated with that operation, specifically downstream flow regulation.

Response:

The Vermont Dam Inventory indicates that the facility is currently in-service, and water quality monitoring data for Lake Madeline itself indicate excellent water quality chemistry (2008).

VTDEC has not conducted water quality monitoring Hopper Brook (a tributary to the Green River which flows into the Batten Kill) and therefore cannot speculate on the impacts of these impoundments on receiving waters. The Plan has been amended to request BASS monitoring for Hopper Brook for the next round of the monitoring rotation (i.e., 2018).

Comment:

- 11) In Chapter 2, the description of the Batten Kill beginning on page 22 should note that the Vermont portion of the main stem is undammed.

Response:

Duly noted and description revised accordingly.

Comment:

- 12) The Lake Shaftsbury description on page 27 should note that the WsMD lakes inventory database classifies the outlet type as “artificial.” That implies, to me at least, that no lake would exist without the dam.

Response:

Lake Shaftsbury is indeed a lake formed from impoundment.

Comment:

- 13) The description of fisheries on page 27 states that all stocking was phased out by 1976. Stocking of Dufresne Pond for a put-and-take fishery continued until around 2010. Ken Cox would know the exact year.

Response:

Duly noted and revised accordingly.

Comment:

- 14) At Lake Paran, described on page 34, the outlet type is classified as artificial in the lakes inventory. The way the plan describes the lake implies, to me at least, that it is a natural lake, expanded in size when the dam was constructed. But, the lakes inventory database suggests it was a free flowing stream.

Response:

Lake Paran is also an impoundment.

Comment:

- 15) There is very little mention of dams in Chapter 2. A narrative description of dams and their impacts, and a map and listing of dams in the basin should be included, as was done in the recently released basin 11/13 plan. Further, there should be a paragraph noting that a hydroelectric project recently began operating at the Vermont Tissue Dam on the Walloomsac. Finally specific reference should be made to the Pownal Tannery Dam, which is being redeveloped under an existing FERC exemption issued in 1983.

- 16) I didn't note any specific dam assessment or removal projects in the implementation table in Chapter 4. If none have been identified, that's fine. However, The Nature Conservancy and its partners (which include the Vermont Natural Resources Council, the USFWS, Vermont Fish and Wildlife and DEC) are just starting an evaluation of dams in the state to assess the potential ecological benefits that would result from dam removal. A project to review the results when they are available and determine if specific dam removal projects should be pursued (and supported) should be included in the table.
- 17) The implementation table (on pp. 79-80) includes two monitoring and assessment projects intended to address flow regulation below public water supply withdrawals. The proposed projects are rather vague and open ended. DEC should take leadership in developing plans to conduct any necessary studies and implement changes in the operation of these facilities, using its regulatory authority if necessary, to address any impacts they cause.

Response:

15 - The Plan does not specifically address the newly operating Tissue Paper Dam hydro although issues around the dam operation were partially addressed during the Basin Planning Process (such as the relocation of lightly contaminated spoils excavated from behind the dam) and through the DEC River Management Program and DEC Waste Management Division. As this project was already in the regulatory process (and associated permitting queue) during the Basin Planning Process, it was beyond the scope of this iteration of the Basin 01 Tactical Basin Plan.

The Plan identifies (as a strategies in the Implementation Table) the current assessment of the Tannery Dam (Site remediation complete, ongoing M&A indicates effective treatment, no further action proposed at this time) as well as the continued monitoring of No. Pownal Tannery Superfund site (page 79) due to toxics/ PCBs.

The Plan does call out the issue of habitat connectivity associated with dams and poorly designed culverts (page 43) as well as geomorphic incompatibility, and applauds the recent Dufresne Dam removal project and the benefit to the fishery (page 30).

It should be noted that general education and awareness around the 10 known water quality stressors in Vermont are addressed in each major heading in the Vermont Surface Water Management Strategy (SWSWMS). The impact of Flow Alterations on both biological integrity and geomorphic condition are included in this comprehensive overview of this stressor and additional information can be obtained within that Chapter here:

http://www.watershedmanagement.vt.gov/wqd_mgtplan/stressor_flowalt.htm

Tactical Basin Plans are intended to be streamlined water quality management plans and implementation vehicles for the Statewide Surface Water Management Strategy, which is so referenced in each Tactical Basin Plan in order to ensure that these Plans focus on the priority issues and associated actions within each major river basin. By referencing the SWSWMS, we hope to eliminate redundancies and maintain a streamlined approach to Plan development.

#16 – Duly noted and incorporated into the final version of the Plan.

#17 - Duly noted - There are a handful of known impacts due to flow alterations in the basin – primarily in the form of water withdrawals from Class A(2) water supplies. Where documented, there are strategies identified in the Plan to monitor those in need of further assessment (e.g., Bolles Brook which includes Bickford Hollow and Hell Hollow/ Roaring Branch, intake to City Stream confluence/ Walloomsac) - 1.0 miles listed as altered by flow regulation (Part F list), due to the possible lack of minimum flow below water supply withdrawal point (threat), and where the assessment of water withdrawal impact may be difficult given low productivity & low pH effect. In addition, the Plan recommends the re-classification of WSID #5017 – from Class A(2) to Class B (the North Bennington Water Dept. which was identified as back up supply source but no longer in use).