Vermont Agency of Natural Resources

Watershed Management Division

WHITE RIVER TACTICAL BASIN PLAN

July 2013

Photograph Credit- Carol Langstaff

This White River Basin - Water Quality Management Plan was prepared in accordance with 10 VSA § 1253(d), the Vermont Water Quality Standards[1], the Federal Clean Water Act and 40 CFR 130.6, and the Vermont Surface Water Management Strategy.

Vermont Surface Water Management Strategy

Approved[1]:

7/12/13

David Mears, Commissioner — Date

Department of Environmental Conservation

7-12-13

Deb Markowitz, Secretary — Date

Agency of Natural Resources

1) 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 exiting 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.

The Vermont Agency of Natural Resources is an equal opportunity agency and offers all persons the benefits of participating in each of its programs and competing in all areas of employment regardless of race, color, religion, sex, national origin, age, disability, sexual preference, or other non-merit factors.

This document is available upon request in large print, braille or audiocassette.

VT Relay Service for the Hearing Impaired

1-800-253-0191 TDD>Voice - 1-800-253-0195 Voice>TDD

Author's Note:

The White River Tactical Basin Plan is dedicated to all those who live, work, and play in the White River watershed, and especially to those residents, businesses, towns, and organization stewards that care deeply about the basin's streams, lakes, ponds, wetlands, and watershed.

Table of Contents

List of Figures

List of Tables

Executive Summary

The White River Tactical Basin Plan provides an overall view of the health of the basin and defines on-going and future actions s to address high-priority stressors (http://www.vtwaterquality.org/wqd_mgtplan/swms_ch1.htm). The high priority stressors in the White River Basin include encroachment, channel erosion, nuisance and invasive species spread prevention, land erosion, pathogens, thermal stress, acidity, and flow alteration.

The White River is significant for being one of the last free-flowing rivers in Vermont. It is the longest undammed tributary to the Connecticut River at approximately 56 miles. This is an important attribute, especially as to how it contributes to recreational boating and aquatic organism passage. This attribute should be protected for future generations.

The Tactical Plan actions will protect, maintain, and improve surface waters by managing the activities that cause the known stressor(s) and address the resulting pollutants. These actions are strategically targeted to those White River sub-basins (Figure 1) and specific waters where their implementation would achieve the greatest benefit to water quality and aquatic habitat while being the most cost effective. In general, the Upper White, Mid-White, Tweed River and portions of the Third Branch sub-basins are targeted for watershed restoration and protection strategies while the First and Second Branches, and remaining portions of the Third Branch are identified for additional water quality and aquatic habitat monitoring and assessment work. The Lower White will be a priority in future years.

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 White River Basin sustained severe flood damage in some areas due to erosion and flood inundation. Roads, bridges, culverts, private and public property, and farmland were damaged or destroyed. This Plan emphasizes actions that will assist watershed residents and towns to remediate Irene's impacts and better prepare the Basin for future flood events by assisting communities in becoming more flood resilient.

The top priority actions in the White River Tactical Basin Plan include the following:

- **Determine sources of *E. coli* and nutrient loads, especially in the Branches, and implement high priority agricultural Best Management Practice (BMP) needs identified through Agricultural Environmental Management assessments.**

- **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.
- **Minimize flood plain encroachments -** identify and remove high priority flood plain encroachments and implement flood plain restoration projects that connect the active river channel to its flood plain.
- **Restore stream equilibrium and support improved aquatic organism passage (AOP) and habitat -** upgrade/replace high priority stream crossings that are geomorphically-compatible and thus can accommodate AOP. Actively restore aquatic habitat within both stream channels and riparian areas.
- **Implement a remediation plan that addresses sources of iron precipitate sources in the impaired Smith Brook watershed.**
- **Protect targeted river corridors and wetlands** - protect high priority river corridors and wetlands for sediment attenuation assets, flood resiliency, and aquatic and wildlife habitat.
- **Protect the White River main stem as a free-flowing, undammed river ecosystem**
- **Map and protect undeveloped lakeshores** for the basin's lakes and ponds.
- **Protect public access to watershed swimming holes, recreational boating, and fishing areas.**
- **Raise awareness of aquatic invasive and nuisance plants, animals, and pathogens spread prevention in the basin.**

Accompanying this Plan, the Vermont Agency of Natural Resources has prepared an online mapping tool that allows the reader to identify the locations of many White River Basin features, and actions identified in the Implementation Table. This resource is online via this link.

Chapter 1 - Introduction

A. Basin Description

The DEC White River Assessment Report, 2012 indicates that the White River Basin encompasses 710 square miles or approximately 454,400 acres in Vermont draining portions of Addison, Orange, Rutland, Washington, and Windsor Counties. The White River itself is approximately 56 miles long. It originates in the town of Ripton on the slope of Battell Mountain then flows southerly and easterly before emptying into the Connecticut River at White River Junction in the town of Hartford. Major tributaries to the White River include the First, Second, and Third Branches entering the main stem from the north and the Tweed River entering from the southwest. The watershed and its sub-watersheds are described in detail in Chapter 2.

B. 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.

ANR completed a White River Basin Plan in 2002. That plan contained 59 recommendations to protect and restore water quality and aquatic habitat in the basin. 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.

C. Watershed Partners

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

The White River Partnership (WRP) is a grassroots, non-profit organization that works to improve the long-term health of the White River. Since 1996, the WRP has worked to address these concerns by uniting citizens, schools, businesses, towns, local and

regional organizations, and state and federal agencies to implement on-the-ground programs designed to evaluate the health of the watershed, to protect and restore the watershed, and to raise awareness about watershed issues, including sustainable agriculture, forestry, and recreational uses watershed.

The WRP has coordinated numerous watershed assessment, restoration, and protection projects working independently and in collaboration with partners including:

- Water quality (Chapter 2) and crayfish monitoring
- River corridor planning and protection (Chapter 2 and Appendix G)
- Aquatic organism passage (see Chapter 4)
- Class IV Roads evaluation and erosion control program (see Chapter 4 and Appendix F)
- Watershed resident stewardship program
- River clean-up coordination
- Riparian buffer plantings
- Educational programs

The United States Department of Agriculture Forest Service (USFS) is currently restoring large woody debris in smaller streams using a technique called "Chop and Drop." Chop and Drop involves selecting and directionally felling whole trees into the stream channel to create large woody debris structures. Large woody debris provides in-stream habitat in the form of shade and resting areas for fish and aquatic organisms.

The USFS has been using Chop and Drop primarily on small streams in the basin where the trees being felled are considerably longer than the bank full width of the stream. The trees in these situations tend to anchor themselves without the need for large heavy equipment. Some of this wood, however, may subsequently be moved downstream by the high flows of springtime. Forest Service employees are monitoring the movement of large woody debris on a sample of these smaller, second-order streams to better understand where this debris moves to and its effectiveness in its new location.

Additionally the USFS is addressing aquatic organism barriers in several areas of the upper White River sub-basin. Streams provide important connections within a watershed for fish and wildlife that need to move in search of food or to reach habitat suitable for reproduction. Some animals, such as amphibians and reptiles can also be affected when they are forced to cross roads where they become vulnerable to mortality from traffic, exposure to predators, and other dangers. The range of species includes everything from invertebrates such as crayfish, fish, amphibians such as spring salamanders, reptiles such as wood turtles, and mammals such as muskrats and mink.

The GMNF is also involved in the establishment and maintenance of riparian buffers on its lands.

Two Rivers Ottauquechee Regional Commission (TRORC) is an association of thirty municipalities in east-central Vermont. TRORC is governed by a Board of Representatives appointed by each of our member towns. The Commission's staff provides technical services to local, state and federal levels of government and to the Region's non-profits and businesses. TRORC watershed-related programs include:

- Tropical Storm Irene Recovery and municipality assistance
- Emergency Management
- GIS Services
- Land Use Planning
- Transportation Planning

White River Natural Resources Conservation District (NRCD) is a locally-led and operated organization that promotes and supports soil and water conservation. The mission of the District is to "help provide conservation assistance to the people living in the area through education programs and partnerships with federal, state, and local entities involved in natural resources management." Some specific programs include:

- The Cover Crop Incentives Program
- AEM (Appendix E)
- Portable Skidder Bridge Rental Program

Agricultural Resource Specialist (ARS) Program is offered by the Vermont Association of Conservation Districts (www.vacd.org) and is supported by funding from the Vermont Agency of Agriculture, Food, and Markets (VAAFM). Three main services are offered to farmers:

- Accepted Agricultural Practices Assistance (AAPA)
- Agricultural Environmental Management (AEM)
- Farm Well Water Testing (FWWT)

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 73, 100, 110, 12, 12A, 14, 107, 132, and Interstate 89. 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-nine towns wholly or partially within the White River watershed within the counties of Addison, Orange, Rutland, Washington, and Windsor (Figure 1.). 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 Partners- All Departments within ANR (FWD, FPR, and DEC) and Divisions within them, work collaboratively on a number of watershed assessment, restoration and protection projects. Additionally, FWD and FPR own and manage thousands of acres of state-owned lands within the basin. Annual stewardship plans and Long Range Management Plans of state-owned properties include restoration and protection of water resources; actions which are integrated into this plan.

D. 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 White River 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. The implementation of actions and Implementation table itself may be modified during the implementation of this plan to best address any unanticipated events.

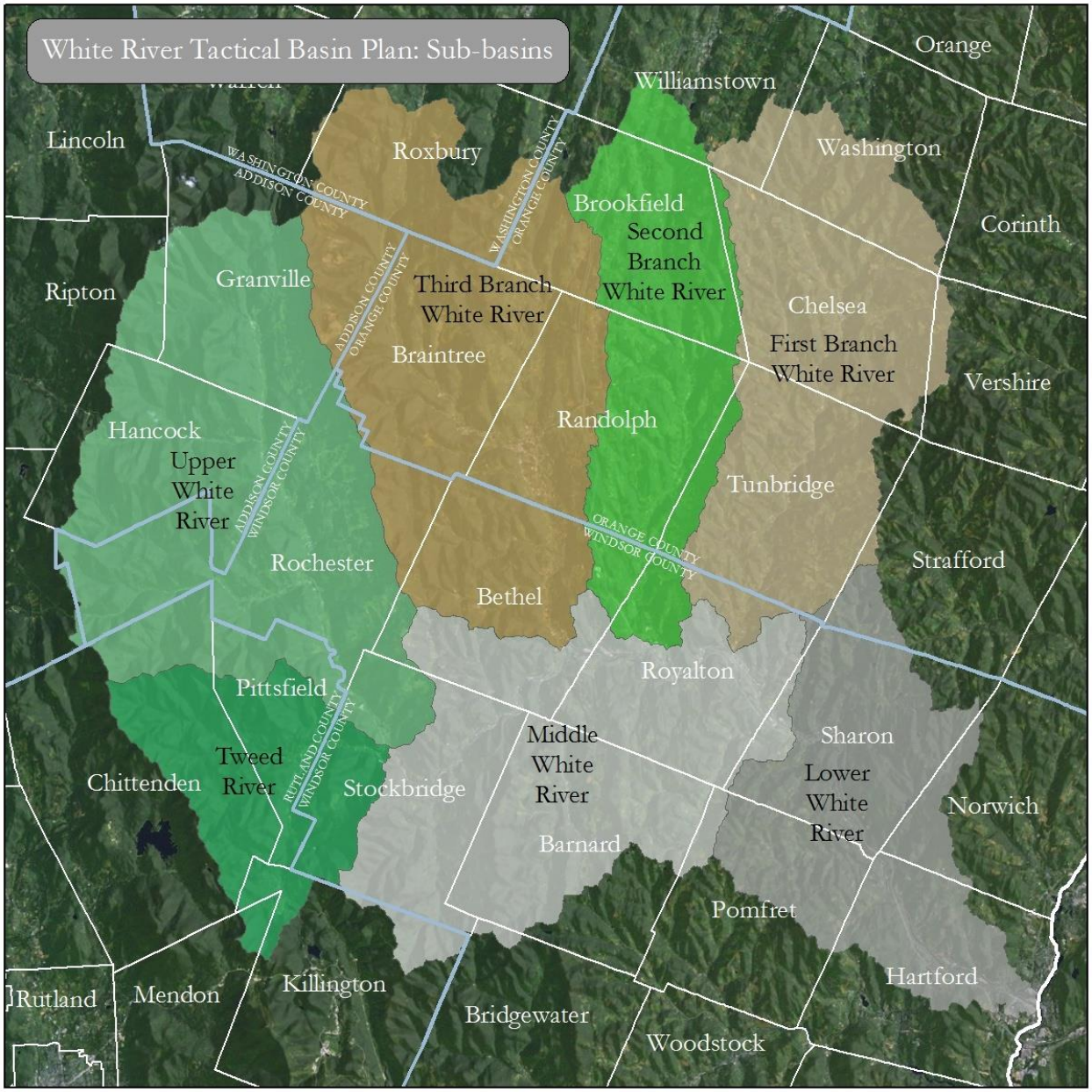


Figure 1. White River Basin map with major sub-basins and municipalities.

Chapter 2- Water Quality in the Basin

A. Watershed Description

The White River has four major tributaries: the First Branch with a length of 24 miles and drainage area of 103 square miles; the Second Branch with a length of 20 miles and a drainage area of 74 square miles; the Third Branch with a length of 19 miles and a drainage area of 136 square miles; and the Tweed River with a length of 10 miles and a drainage area of 51 square miles. The sub-watersheds are described in greater detail later in this Chapter.

The watershed was broken up into seven sub-watersheds for the purposes of presenting the information on the:

- Upper White River;
- Tweed River;
- Mid-White River;
- Third Branch.
- Second Branch; and,
- First Branch;
- Lower White River sub-watersheds;

In this plan, the following sub-watersheds are highlighted for specific intervention based on DEC's evaluation of monitoring and assessment data. These are the First Branch, Second Branch, Third Branch, Upper and Tweed River, for which more detail is given in this chapter.

The White River is significant for being one of the last free-flowing rivers in Vermont. The entire length of the main stem of the White River, at approximately 50 miles, is the longest free-flowing large river in the state because of the lack of flow-regulating dams. It is unique and significant for aquatic biota including fisheries, boating, tubing, and swimming.

Natural Resource Atlas

In December 2012 ANR introduced the Natural Resource Atlas**.** Many of the assessment, monitoring, and other information included in Chapter 2 will be accessible through the Natural Resource Atlas in the near future. The **Natural Resource Atlas** replaces the following ANR GIS tools: **Environmental Interest Locator, Well Locator, and the Stream Geomorphic Assessment Tool**. We have heard feedback from many of our customers over the years. Much of this feedback lead to the two-year long effort to

an upgraded ANR's web mapping applications to the latest in web mapping technology. The **Natural Resources Atlas** now includes all of the data and functionality previously found in three separate applications.

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.

B. Assessments undertaken in the White River Basin

Several types of assessments are conducted to support tactical basin planning. In the White River, geomorphic assessments, water quality monitoring, and biological monitoring are ongoing. Agricultural Environmental Management assessments have been implemented in certain sub-watersheds, and Better Back Roads capital inventories are planned for the Branches. Stormwater planning and Illicit Discharge Detection and Elimination infrastructure mapping are also planned or in process.

Table 1. Status of assessments for the White River Basin

Sub-Basin	Geomorphic Assessment	Water Quality Monitoring	Bio monitoring (completed / planned)	Agricultural Environmental Management Assessment	Better Backroads/ Road Erosion Inventory	Stormwater Inventory or Illicit Discharge Detection
Upper White	C	O	2010 / 2014			X
Tweed River	C	O	2010 / 2014			
Middle White	U	O	2010 / 2014			X
Lower White	X	O	2010 / 2014			X
First Branch	PC	O	2010 / 2014	U	X	X
Second Branch	X	O	2010 / 2014	U	X	
Third Branch	PC/U	O	2010 / 2014	X	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 also 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 White Basin has been subject to SGA at the Phase I or Phase II SGA (Figure 2.), and Corridor Plans have been established for several watersheds. For Phase 2 assessed streams and rivers, 64% of these assessed reaches are in Stage III of channel evolution. This means these streams have scoured away their beds, and are now widening and beginning to build up sediments in the channel. Only during greater flood events, if at all, are they able to access their floodplains - only about 15% of the assessed reaches appear to have access to floodplains on a 1-2 year basis. Further, 84 bridges and 454 culverts have been assessed using DEC Stream Geomorphic Assessment protocols to identify structures that may have some degree of geomorphic incompatibility with the stream. A description of geomorphic assessment and river corridor management summaries and recommendations from specific sub-watersheds is provided in Appendix G.

Table 2. Stream Geomorphic Assessments in the Basin.

Date	Sub-watershed	Watershed	Link to report
3/15/2010	White River Watershed	White River - Mainstem	River Corridor Plan for the White River and tributaries in Sharon, VT
4/18/2008	Tweed River	White River - Mainstem	Tweed River Watershed Corridor Plan
2/01/2008	Upper White	White River - Mainstem	Upper White River Corridor Plan
11/01/2006	Ayers Brook	White River - Third Branch	Ayers Brook Phase 1 and 2 SGA
6/22/2007	Ayers Brook	White River - Third Branch	Ayers Brook River Corridor Management Plan

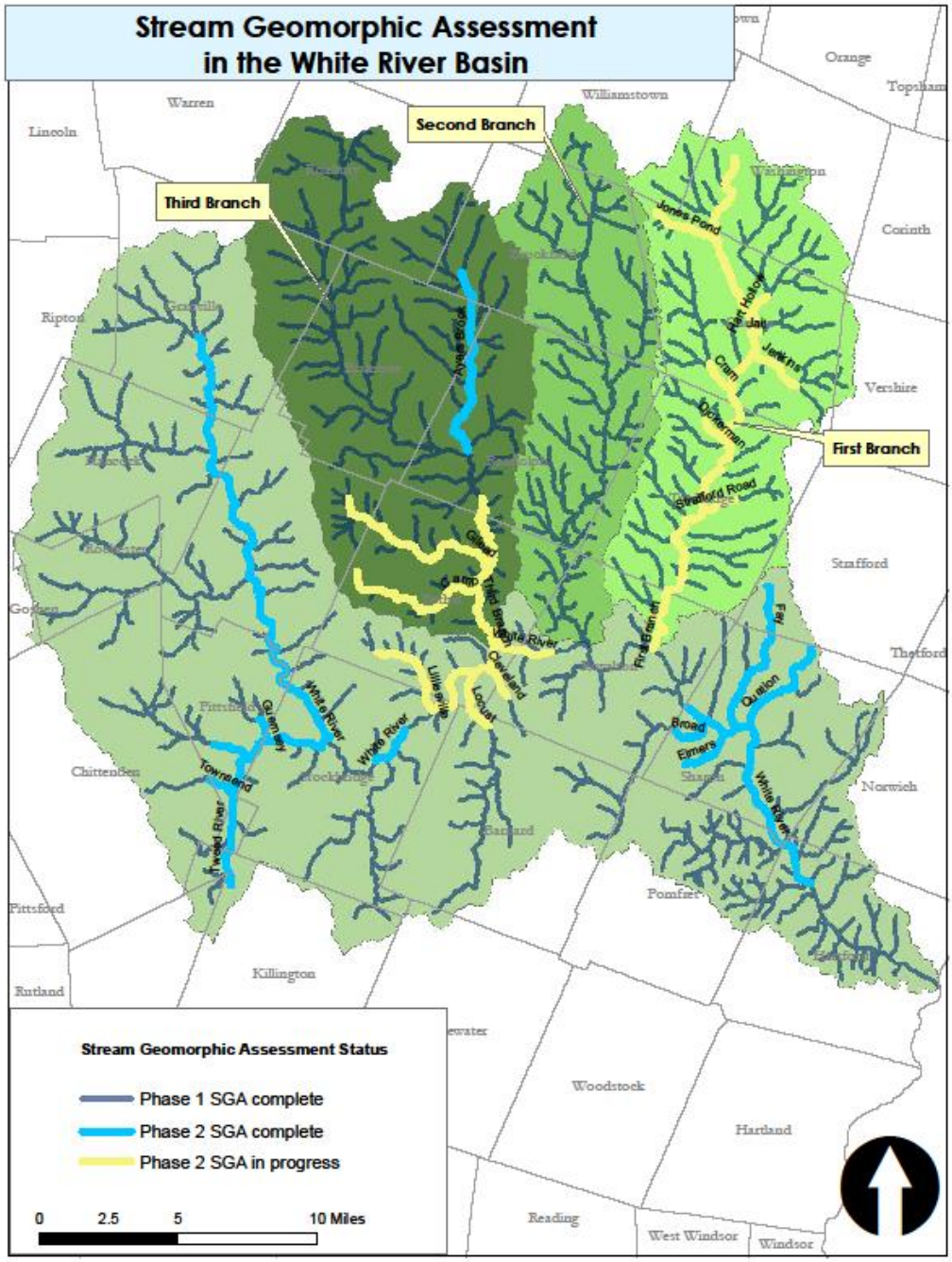


Figure 2. Stream geomorphic assessments conducted in the White River Basin through 2013.

General Fisheries Assessment

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

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

The Connecticut River and its tributaries, including the White River, historically supported populations of Atlantic salmon. This species, which spends its adult life in the ocean waters of the North Atlantic and spawns in freshwater streams, was extirpated from the Connecticut River and tributaries in the early 1800s due to the construction of dams, overfishing and pollution. Since 1967, a cooperative program comprised of several state and federal agencies and private organizations has focused on the restoration of this species. The Service continues to monitor, assess, and research Atlantic Salmon and improve habitat for the species. The salmon in the classroom project will also continue. The construction of fish passage facilities that allow adult salmon to access upstream spawning habitats, as well as allow juvenile salmon to safely migrate downstream to the ocean is a key component of this program. Although few in number, some adult Atlantic salmon have successfully returned to the White River. Due to low adult returns and the science supporting salmon restoration, the U.S. Fish and Wildlife Service decided to discontinue the program, cooperating states, including Vermont, will discontinue stocking Atlantic salmon for the Connecticut River program. Fry stocking of Atlantic salmon during 2013 will be less than 10% of the number of fish

normally stocked. Stocking of Atlantic salmon in Vermont for this program is expected to be discontinued after 2013.

Small natural and man-made ponds provide additional recreational fishing opportunities, where public access is available. Most notable are Ansel Pond (Bethel), Colton Pond (Killington, presently drained due to damage from TS Irene), McIntosh Pond (Royalton), Rood Pond (Williamstown/Brookfield), Silver Lake (Barnard) and Sunset Lake (Brookfield). Largemouth bass, smallmouth bass, chain pickerel, northern pike, yellow perch, sunfish and bullhead are among the fish species that are found in one or more of these waters. The Department of Fish and Wildlife also manages some of these ponds with annual stockings of hatchery-reared trout.

C. Surface waters exhibiting very high quality biological integrity or fisheries.

Biological integrity

There are several sub-watersheds in the White River that support very high water quality condition. VTDEC assesses ecological integrity using biological assessments of macroinvertebrate and fish communities, which are assessed on a gradient from "poor" at the most impacted, to "excellent" at the most natural. 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 105 stream locations in the White River watershed, several sub-watersheds reliably exhibit very good or even excellent ecological integrity (Table 3).

Table 3. Basin streams that support Very High Quality ecological integrity

Water	Location	Supporting Data
Bingo Brook	Rochester and Hancock	Excellent macros, White River Assessment
Chittenden Brook	Rochester	Excellent-very good macros, White River Assessment
Smith Brook	Rochester	Excellent macros, White River Assessment
Howe Brook	Hancock	White River Assessment
White River	At and upstream of river mile 32.4	20 years of monitoring data

Very High Quality Lakes

Best Lakes – White River Basin

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.

Three lakes in the White River Basin, Rood, Mitchell and North, were ranked in the top 30% of the ***Best Lakes*** in Vermont. Rood was the highest ranked of the three, with high scores for both Water Quality and Biological Diversity. Mitchell was also ranked high for Water Quality and Biological Diversity. North Pond (Brookfield) was ranked lowest of these three overall, but has qualities represented in all three categories including Unusual Scenic or Natural Features. All three lakes were included in ANR's BioFinder Analysis, which means that they were determined to be the best examples of their lake type in Vermont. The **BioFinder** lake types were classified with physical data (trophic status, alkalinity and depth) that are known to influence biological communities. Many Lakes in the basin were ranked for one or more categories in the ***Best Lakes*** analysis, but not high enough to be among the overall highest ranked in the state. These lakes are presented in Table 4.

Table 4. 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/sub-basin	Supporting Data
Rood Pond	Williamstown/Second Branch	"Best Lake"- top 20% DEC state ranking; WQ (4), BD (5), USNF (0)
Mitchell Pond	Sharon/lower White	"Best Lake"- top 20% DEC state ranking; WQ (5), BD (3), USNF (0)
North Pond	Brookfield/Second Branch	"Best Lake"- top 30% DEC state ranking; WQ (1), BD (4), USNF (2)
Mud Pond	Braintree/Third Branch	Wilderness-like scoring/scenic area
Pickles Pond	Brookfield/Second Branch	Shoreline is undisturbed and intact, BD (1)
North Pond	Chittenden/Tweed	Scenic wilderness pond
Crescent Pond	Sharon/lower White	Lakeshore and watershed primarily forested; WQ (3) and BD (1)
South Pond	Brookfield/Second Branch	BD (4)
McIntosh Pond	Royalton/Middle White	WQ (4)

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 stem of the White River. Tables 5 and 6, 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 5. Basin Streams supporting Very High Quality significant wild trout populations

Sub-watershed	Streams Surveyed	Description (entire unless otherwise described)
Upper White	Patterson Brook	Above Bowl Mill Bridge
	Clark Brook	
	Alder Meadow Brook	Above Route 100 Bridge
	Deer Hollow Brook	
	Hancock Branch	Above confluence with Tucker Brook
	Robbins Branch	
	Marshs Brook	
	West Branch	
	Brandon Brook	
	Bingo Brook	
	Corporation Brook	
	Chittenden Brook	
	Smith Brook	
Tweed River	Michigan Branch	
	Townsend Brook	
Third Branch	Upper Third Branch	Above Riford Brook
	Woodward Brook	
	Flint Brook	
	Sandusky Brook	
	Gilead Brook	
	Ayers Brook	Above East Braintree
	Open Meadow Brook	
Second Branch	Second Branch	Above East Brookfield
	Halfway Brook	
	Snows Brook	
	Kingsbury Brook	
First Branch	Upper First Branch	Above Chelsea Village
	SouthWashington Brook	Above confluence of first tributary
	Jail Brook	
	Cram Brook	
	Jenkins Brook	
	Bicknell Brook	
	Dickerman Brook	
	Potash Road Brook	
Lower		
	Fay Brook	
	Mitchell Brook	

Table 6. Very High Quality Wild Trout Spawning and Nursery Tributaries to the White River main stem

Sub-watershed	Streams Surveyed	Description
Tweed	Tweed/Michigan Branch	entire
Middle	Stony Brook	entire
	Lilliesville Brook	entire
	Locust Creek/Pond Brook	entire
Lower	Broad Brook	entire
	Whitewater Brook	entire
	Mill Brook	entire

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

There are 143 occurrences of species or natural communities in the White River watershed that are considered of statewide significance. Of these, 87 are plant species, 15 are animal species, 40 are natural communities, and one is a bat hibernaculum. Five of the significant community occurrences are Sugar Maple-Ostrich Fern Riverine Floodplain Forest community. One of the community occurrences is the Riverside Sand or Gravel Shore community - a community that is the product of dynamic river systems. Spring flooding or other high water and ice scour shape these often sparsely vegetated depositional communities.

Some of the other significant natural communities are various unique and interesting wetland communities including Rich Fens, Red Maple-Black Ash Seepage Swamps, and Hemlock-Balsam Fir-Black Ash Seepage Swamps among others.

D. Stressors, and Causes and Sources of Impairment

Stressors and related pollutants

The Vermont Surface Water Management Strategy identifies 10 major stressors that result in pollutant delivery and habitat alteration in Vermont's surface waters. 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) to measure the attainment of surface water designated uses, where three categories of impact may be documented.

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.

Altered waters are impacted 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.

Based upon the available monitoring and assessment data, the highest priority stressors in the White River Basin are shown by Table 7. The specific pollutants or conditions that cause stress or impairment on the designated uses of surface waters in the White River Basin that result from each stressor are shown for streams in Table 8, and for lakes and ponds in Table 9.

Table 7. Major stressors affecting surface waters in the Basin. A complete description of each stressor, including management intervention, is available by hyperlink from each stressor icon.

STRESSOR (Click to access the relevant SWMS chapter)	Description
ACIDITY 	Acidification of Vermont's lakes and streams is a major problem caused primarily by the atmospheric deposition of acidic nitrogen and sulfur compounds (e.g., acid rain). Acidification can also result from runoff of active or abandoned mines. Acidification is widespread in the higher-elevations of Vermont, resulting in considerable impacts to lake and stream biology.
CHANNEL EROSION 	Excessive channel erosion occurs throughout Vermont and is brought about by human activities that alter runoff patterns and channel morphology and lead to stream disequilibrium. Channels and floodplains that have the capacity to store sediment and associated nutrients are now transporting these materials. Excessive channel erosion adversely affects stream habitat, and higher loads of nutrients and sediments have become pollutants in downstream receiving waters such as inland lakes and Lake Champlain.
ENCROACHMENT 	The placement of public or private infrastructure upon lakeshores, wetlands and river corridors results in the loss of riparian zone buffers, increasing sunlight penetration of shallows, and reducing habitat quantity and quality. Encroachments along river corridors can also create or perpetuate stream disequilibrium, both immediately adjacent to the structure, and in areas far upstream or downstream. Encroachments are pervasive along Vermont lakes and streams. In wetlands, fill, alteration of vegetation, and changes to hydrology result in a loss of the functions and values. Lakes with poor lakeshore habitat from overdevelopment can be three times more likely to have poor ecological integrity.
INVASIVE SPECIES 	Invasive species such as Eurasian watermilfoil, Japanese knotweed, purple loosestrife, and water chestnut cause severe impacts to aquatic habitat. These species readily out-compete native plants, algae, and animals, ruin recreational opportunities, and alter entire ecosystem functions. Invasive species are spreading rapidly throughout Vermont surface waters, especially lakes, and are transported from one waterbody to the next by humans

STRESSOR (Click to access the relevant SWMS chapter)	Description
FLOW ALTERATION 	Altering the natural flow regime of rivers and streams (i.e., impounding or dewatering) or the natural fluctuations of lake levels affects the extent and quality of aquatic, riparian and wetland habitats, water temperature, dissolved oxygen and other aspects of water chemistry, including concentrations of toxins in aquatic organisms. Flow alteration is an inevitable consequence of water withdrawals and hydroelectric power generation, so these activities must be properly managed to avoid affecting aquatic biota and recreational uses.
LAND EROSION 	Erosion of sediments off land surfaces delivers both sediment and nutrients to surface waters. These sediments can readily alter the dynamic equilibrium of naturally functioning stream channels, resulting in stream instability and delivery of sediments and nutrients to downstream waters. Land erosion occurs in all landscape types (urban areas, dirt roads, and improperly managed forest and farms).
NUTRIENT LOADING 	Direct discharge or runoff of nutrients also occurs independently of channel or land-based erosion. Wastewater treatment facilities, septic systems, and fertilizer usage in residential areas and agricultural settings deliver nutrients directly to waters. Nutrients like phosphorus and nitrogen are beneficial in naturally occurring low levels, but excess nutrient loading results in eutrophication of lakes and streams, and increase the likelihood of toxic algae growth.
PATHOGENS 	Pathogenic organisms may occasionally be present in Vermont's surface waters. When swimmers are exposed to pathogens in excessive levels, they may become ill, typically with gastrointestinal distress. Pathogenic organisms are the result of fecal contamination from several sources: poorly maintained septic systems, unmanaged agricultural runoff, pet waste, and natural sources. Vermont employs a readily measured indicator organism called *E. coli* to assess the potential presence of pathogens from warm-blooded animals.

STRESSOR (Click to access the relevant SWMS chapter)	Description
THERMAL STRESS 	Excess warming occurs as a result of riparian buffer removal, the impoundment of water, cooling water discharge, and climate change. Excessive warming of surface waters affects aquatic species that are intolerant of warm temperature. Further, excess warming can turn an otherwise cool babbling brook into bathwater; an undesirable effect on a hot day.

Table 8. Pollutants or conditions that impair or stress water quality or habitat in Basin streams

Pollutant or Condition	**SWMS stressor**	**Impaired streams (miles and percent)**	**Stressed streams (miles and percent)**	**Total Impact (miles and percent)**
Sediment/Siltation	Encroachment, Channel erosion, land erosion	0 (0%)	109.0 (23.8%)	109.0 (23.8%)
E. coli	Pathogens	0 (0%)	103.0 (22.5%)	103.0 (22.5%)
Temperature	Thermal stress,	0 (0%)	85.3 (18.7%)	85.3 (18.7%)
Physical habitat alterations	channel erosion	0 (0%)	52.3 (11.4%)	52.3 (11.4%)
Nutrients	Channel erosion, land erosion, Non-erosion nutrients	0 (0%)	27.5 (6.0%)	27.5 (6.0%)
Iron precipitate	Toxics	0.2 (0.04%)	0.5 (0.11%)	0.7 (0.15%)

Table 9. Pollutants or conditions that impair or stress water quality or habitat in Basin lakes and ponds.

Resulting Pollutant or Condition	SWMS stressor	Impaired or altered* lake acres and %	Stressed lake acres and %	Total Impact (acres and %)
Eurasian Water Milfoil	Invasive species	0 (0%)	70 (16.7%)	70 (16.7%)
Impoundment /dewatering	Flow alteration	84 (20.1%)	3 (0.72%)	87 (20.8%)
Mercury in Fish Tissue	Toxics	0 (0%)	418 (100%)	418 (100%)
Nutrients	Encroachment, Channel erosion, land erosion	0 (0%)	109 (26.1%)	109 (26.1%)
pH	Acidity	2 (0.48%)	27 (6.5%)	29 (6.9%)
Sedimentation/Siltation	Encroachment, Channel erosion, land erosion	0 (0%)	124 (29.7%)	124 (29.7%)

The White River basin has relatively few lake acres compared to other basins in the state. Currently, Eurasian Water Milfoil is not present in any of the basin's lakes and ponds, although they are threatened by nearby infested ponds, thereby stressed (See Table 24 for plan actions addressing aquatic invasive and nuisance spread prevention).

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 the subwatershed-specific sections of this Plan.

Impacts to White River Watershed's habitat features from Irene

On August 28, 2011, the State of Vermont was severely impacted by Tropical Storm Irene. Seven to ten inches of rain fell on the southern two-thirds of the state in a 24-hour period. This event has been described as a 100 year plus flood event in many parts of the State including the White River Basin. Irene was one of Vermont's worst natural disasters in magnitude, intensity and impact, with the notable exception of the 1927 flood. The White River Basin experienced severe erosion and flood inundation,

damaging and destroying roads, bridges, culverts, private and public property, and farmland. The Upper and Mid-White River, Tweed River, and Third Branch sub-basins saw both significant severe erosional and flood inundation damage, while the lower main stem's damage was mostly flood inundation damaging properties within the flood plain and river corridor.

Damage suffered from Tropical Storm Irene required immediate and in some cases extensive stream channel alteration to protect life and property and rebuild critical transportation infrastructure. However, a significant amount of in-stream activity was also conducted without proper consultation and oversight or for reasons beyond

Figure 3. Gilead Brook, pre-restoration.

Figure 4. Gilead Brook post-restoration.

necessary flood recovery. These activities continued for several months after the flood event and covered several areas of the White River Basin. According to R. Kirn (2012), long-term monitoring studies in Vermont indicate that, in the absence of post-flood channel alterations, wild trout populations generally recover within 2-4 years. Where aquatic habitat has been severely altered through streambed and natural wood mining, channel widening and straightening, complex habitat features will need to re-established before improvements in fish and aquatic populations can be expected. While relatively short reaches of impacted streams may recover in a matter of years, the recovery of longer reaches may take decades and will depend upon the availability and mobility of upstream sources of coarse streambed material and natural wood, as well as the magnitude and frequency of future flood events. These impacts are described more completely in Appendix B (Kirn R., 2012).

Efforts have been underway to restore habitat to steams that were damaged, either by flooding, or hasty reconstruction in the immediate recovery. As one example, Figure 3 shows Gilead Brook which was heavily altered, creating an over-widened, homogenous

channel with poor habitat quality. Figure 4 shows a partially restored stream with a properly sized bankfull width, berms removed, floodplain access restored, and the installation of boulder clusters and rock weirs for aquatic habitat. Partial restoration of dredged streams in the White River basin was completed with technical and financial assistance provided by DEC, USFWS, USFS, and the WRP. Much restoration work still needs to be done in this and other basins impacted by TS Irene (See Chapter 4 Flood Resiliency and related Actions in Table 24 for more information).

Water Quality Monitoring and Bacteria

Since 2001, the White River Partnership has undertaken several water quality monitoring programs to evaluate water quality conditions throughout the watershed. During 2001-2008, the WRP and volunteers collected data on turbidity, conductivity, Escherichia coli (*E. coli*), water temperature, pebble counts, and stream crossing cross sections at numerous sites. During 2006-2012, they also collected data on *E. coli*, total phosphorus, total nitrogen, total suspended solids, and turbidity (Gerhardt, 2009). Gerhardt (2009) reports water chemistry conditions were generally good throughout the watershed, however there were of potentially problematic results including:

- Higher *E. coli* levels in all the branches but especially the Second Branch. The valley floors on the Branches support large numbers of agricultural fields, especially hay, corn, and livestock grazing in close proximity to waterways. These areas commonly lack adequate riparian buffers that would otherwise filter runoff before it reaches streams. If not adequately stored or handled, manure and other animal wastes could be sources of fecal contamination. Additionally, failed septic systems could contaminate waterways. For more information about *E. coli* see the Pathogen Stressor (Table 7. above). Summary tables of *E. coli* monitoring data are included in the Sub-basin Descriptions section below. Sub-basin summary tables are measured as geometric mean in colonies per 100 milliliters. The Environmental Protection Agency (EPA) standard for contact recreation (swimming) is 126 E. coli/100 ml as a geometric mean, while individual sample values in excess of 235 E. coli/ 100ml may indicate the need to close a swimming area .

Managing stormwater runoff

Stormwater runoff from developed lands 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.

To date, the issues associated with stormwater runoff in the White River Basin have not been completely assessed which is why mitigation of stormwater runoff does not play a prominent role in this plan. However, it is clear that unmitigated runoff can have devastating consequences such as channel erosion, land erosion, nutrient loading, and even thermal stress. In more rural areas of the basin, gravel road runoff is a significant source of sediment, especially in small headwater streams. Many of the recently completed river corridor management plans (Upper, Tweed, Ayers, and Town of Sharon plans) recommend addressing sources of sediment from gravel roads to promote stream equilibrium. In more urban areas of the basin such as Bethel, Hartford, Randolph, and South Royalton, impervious surfaces can potentially generate large volumes of runoff, influencing downstream waterways.

In the coming years, DEC will lend support towards efforts to assess both these areas. For gravel roads and other transportation infrastructure, DEC, WRP, DFW, and TRORC have been and will continue to assist municipalities in developing road erosion capital budgets and completing bridge and culvert assessments. In the more urban areas, efforts will include Illicit Discharge Detection and Elimination studies as well as Stormwater Master Planning. These assessments will allow for a better understanding of the effects of stormwater runoff in the basin, which will ultimately allow us to better target technical and financial resources.

DEC is supportive of efforts to proactively mitigate stormwater runoff in the basin, especially if those efforts involve the use of Low Impact Development (LID) and Green Stormwater Infrastructure (GSI) systems and practices. Many of the stormwater issues associated with developed lands can be mitigated and prevented through LID and GSI. These emerging concepts strive to manage stormwater and pollutants by restoring and maintaining, or emulating 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 (See Table 24 for plan actions addressing stormwater and gravel roads).

E. Sub-basin Descriptions

Based upon the 2012 Assessment Report, and the available monitoring and assessment data, the following sub-watershed specific summaries have been prepared. (See Section C and Tables 3-6 above for descriptions of VHQW streams and ponds and sub-basin locations).

The Upper White

The Upper White River mainstem sub-watershed comprises approximately 24 miles of stream extending from the headwaters of the White River in Ripton, downstream to just upstream of the Tweed River confluence in Stockbridge. The Upper White sub-watershed includes all or parts of the towns of Granville, Hancock, Rochester, Pittsfield, Stockbridge, Bethel, Braintree, Chittenden, Goshen, and Ripton. The drainage area is approximately 143 square miles. (Redstart Consulting, 2007) Major tributaries to the Upper White main stem include Clark Brook, Patterson Brook, Alder Meadow Brook, Deer Hollow Brook, Kendall Brook, Clark Brook, Hancock Branch, Robbins Branch, Tunnel Brook, Marshs Brook, Howe Brook, Nason Brook, Rogers Brook, Breakneck Brook, Cold Brook, West Branch, Chittenden Brook, Brandon Brook, and Bingo Brook. The largest tributary is the West Branch with a drainage area of 43.4 square miles.

The Upper White watershed is approximately 87% forested, 5% water and forested wetland, 5% agricultural, and 3% developed (transportation and commercial and residential development). The majority of the row crops and haylands are located along the main stem and tributary river corridors while majority of the steep valley walls are forested. Most of the lands on the western side of the valley are owned and operated by the USDA Forest Service (USFS).

Special Values and Features

Waterfalls, Cascades and Gorges

One of the very well-known waterfalls, Moss Glen Falls I, that was described in the Waterfalls, Cascades and Gorges Report (DEC, 1988) and is marked on most Vermont maps and in the Gazetteers, is located on Deer Hollow Brook in Granville Gulf Natural Area. It is actually a high-angle cascade that drops approximately 30 feet over a rock face 15 to 25 feet wide. It is a popular scenic attraction on Route 100 that now has a boardwalk and observation platform for access and viewing.

Another equally well-known waterfall is Texas Falls on the Hancock Branch in Hancock. It is a small gorge and cascade with a small falls and some nice pools. It is especially beautiful in the spring following snowmelt. The area has been developed by the U.S. Forest Service with trails, and observation and picnic areas. It is listed on the Vermont Fragile Areas Registry.

Rare, Threatened or Endangered Species or Significant Natural Communities

This upper portion of the watershed has three identified significant natural communities, 25 rare, threatened, or endangered plants, and four rare, threatened or endangered animals.

Impacts or Stresses

E. coli Sampling Results

Table 10. WRP *E. coli* sampling results for the Upper White River Sub-basin- Geometric mean (number in parenthesis is number of singles samples > 235 colonies/100 ml.)

Site name and river mile	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
West Branch 44.8	74(1)	---	16 (0)	13(0)	14	---	---	---	---	---
Lions' Club Park 46.6	57(0)	95(3)	88 (0)	52 (0)	51(1)	47(1)	33(0)	56(1)	40(0)	186(3)
Taylor Meadow Road 49.7	---	---	---	---	---	---	---	---	24(0)	81(1)
Hancock Branch 54.2	57(0)	78(2)	---	---	14(0)	21(0)	29(0)	59(0)	---	---
Clark Brook 61.1	---	---	---	---	---	---	---	---	---	---

Waters on the Vermont Priority Surface Waters Lists

There are no stretches of river or stream on the 2012 303(d) List of Waters (impaired surface waters) in this part of the watershed.

There is one stream that is on the Vermont Priority Waters List, Part C – Waters in Need of Further Assessment because potential impacts have been identified.

Table 11. Part C.-List of Priority Waters in the Upper White

Water body identification	Stream	Possible pollutant	Possible problem
VT09-07	Hancock Branch	acidity, sediment	

Table 12. Part D.- Waters that have EPA-Approved TMDLs in the Upper White

Waterbody	Pollutant	Previously Identified Problem	Status
Skylight Pond, Ripton	Acid	Atmospheric Deposition	EPA approved TMDL 9/20/2004

Tweed River

The Tweed River basin is approximately 51 square miles in size and the main stem of the Tweed is approximately 10 miles long from its headwaters in Killington to the confluence of the White River main stem. Major tributaries include Guernsey Brook, the West Branch, and Townsend Brook. All or portions of the towns of Stockbridge, Pittsfield, Killington, Mendon, and Chittenden. The Tweed River basin is approximately 90% forested. Approximately 3-4% of the basin is in agricultural production, much of it intensely row cropped. Approximately 3-4% of the watershed is developed and water covers about 4% of the area. The Tweed River basin is characterized by steep to extremely steep valley walls on both sides of most streams.

Special Values and Features

Swimming Holes

Dailey's Bend is a swimming hole on the Tweed River not far from where it enters the White River. It consists of two nice pools connected by a small cascade. There is excellent swimming and bathing with nice rocks to sit on. Although not far from Route 100 north of the Route 107 junction, the spot feels secluded.

Rare, Threatened or Endangered Species or Significant Natural Communities

There is one significant natural community identified in the Tweed River subwatershed and four plant species that are rare. Two of the plant occurrences are Nuttall's waterweed (*Elodea nutallii*).

Impacts and Stresses

E. coli Sampling Results

Table 13. WRP *E. coli* sampling results for the Tweed River Sub-basin- Geometric mean (number in parenthesis is number of singles samples > 235)

Site name and river mile	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Tweed River mouth 0.2	---	---	---	---	---	---	---	---	27(0)	106(2)
Bartlet Brook confluence 0.6	36(2)	---	30(0)	34(0)	---	---	---	---	---	---
South Hill Road 1.1	---	---	---	---	---	41(2)	43(1)	44(1)	---	---

Vermont Priority Surface Waters Lists

There are no river or stream segments from the Tweed River sub-watershed currently on either the Vermont impaired waters list or on any of the other priority waters lists that identify known or potential water quality or aquatic habitat problems. *E. coli* sampling by the White River Partnership from 2008 to 2010 on one site on the Tweed River show low *E. coli* numbers (geometric means in the 40s). There are also no lakes and ponds from this portion of the watershed that are on any of the lists.

Middle White River

For planning purposes, the Middle White River subwatershed consists of the White River mainstem from the Sharon/Royalton town line upstream to the mouth of the Tweed River and all the tributaries to this reach (not including the three branches that are treated separately). The named tributaries in the middle portion of the White River watershed include Broad, Sewall, Cleveland, Locust, Little Stony, Stony, Davis Hill, Perkins, Johnson, Mink Basin, Windfall, Fletcher, Lilliesville, Taggard, Boutwell, and Broughton Brooks.

Special Values and Features

Swimming Holes

There were six swimming holes identified on this stretch of the White River in the Vermont Swimming Hole Study (DEC, 1992). Three of the six have moderate to heavy swimming use and are in well-known areas.

- Cobb Bridge Swimming Hole is upstream of Gaysville under a bridge just off Route 107. It has a large deep pool with a sand beach and ledges for jumping. People fish as well as swim and picnic at the site and it is a popular spot. The aesthetics of the site were degraded when the old bridge was replaced with a wider concrete bridge with new abutments, but the swimming is still excellent.

- Dean Hill Swimming Hole has a large deep pool for swimming and jumping at a forested bend in the river just upstream of Gaysville. The ledges for jumping are ten to forty feet high and the pool is ten feet deep. It too is also used for fishing.

- Twin Bridge Swimming Hole is right at the Gaysville bridge (which was two bridges before the 1927 flood hence its name). This is a well-used spot for swimming, jumping, gathering, picnicking, and tubing. A private campground is located on the river just downstream of the pool and bridge and campers use this area as well.

Rare, Threatened or Endangered Species or Significant Natural Communities

There are nine significant natural communities, 12 rare, threatened, or endangered plants, and four rare, threatened, or endangered animals identified in the Middle White River watershed. A cobblestone tiger beetle and a Jefferson salamander have been found in this area.

Impacts or Stresses

Waters on the Vermont Priority Surface Waters Lists

There are no river or stream segments on the Vermont impaired waters list for the Middle White River sub-watershed. Silver Lake is on Part F – Waters Altered by Flow Regulation. The former Water Resources Panel issued an order on December 2011 that called for suspension of the winter drawdown of the lake in 2014. That is, the final

drawdown will be during the winter of 2013-2014. The three-year implementation period is intended to provide time for shoreline property owners (including Silver Lake State Park) to take steps to protect their property from potential ice damage. During the interim period, the drawdown is being managed by the State Dam Safety Engineer.

Didymo is documented in the White River between the confluence of Stony Brook and the confluence of Cleveland Brook, and is presumed to be present downstream to the confluence with the Connecticut River. It may have been carried to reaches upstream as well. Didymosphenia geminata, commonly known as didymo or rock snot, is a species of diatom that can form thick extensive mats on the bottom of rivers and streams. It is not considered a human health risk, but it can affect stream habitats, and sources of food for fish and make recreational activities unpleasant. The macroinvertebrate community was rated only "fair" at two sites on the White River affected by didymo. Didymo is considered a nuisance organism (Please see the Implementation Table 24 in Chapter 4 for plan recommendations in addressing spread prevention of aquatic nuisance and invasive species).

E. coli Sampling Results

Table 14. WRP *E. coli* sampling results for the Middle White River Sub-basin- Geometric mean (number in parenthesis is number of singles samples > 235 colonies/100 ml.)

Site name and river mile	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Vermont Law School 18.7	71(2)	107(1)	86(1)	---	---	92(1)	108 (2)	120 (2)	---	---
Paynes Beach 19.0	----	----	----	86 (0)	99(1)	101(2)	---	---	---	---
Pinch Rock 19.4									86(1)	336(6)
Fox Stand 22.3	---	148(2)	152(1)	125(3)	131(1)	153(3)	---	---	---	---
Royalton 22.8	114(3)	---	---	---	---	---	---	---	---	---
Bethel below WWTF 25.2	110(2)	103(2)	160(3)	72 (0)	89(2)	87(1)	110 (2)	144 (2)	---	---
Peavine Park Bethel 25.8	---	----	---	---	---	---	---	---	48(0)	133(2)

Site name and river mile	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bethel above WWTF 26.0	50(1)	52(0)	70(0)	37(1)	47(1)	45(0)	59 (2)	84(2)	---	---
Locust Creek mouth 27.8	34(0)	36(0)	53(0)	46(0)	67(0)	79(2)	13 (1)	36(1)	---	---
Gaysville Bridge	---	49(0)	5(0)	33(0)	51(1)	46(1)	46(2)	87(2)	43(0)	178(4)
Stony Brook	---	---	---	12(0)	11(0)	30(0)	---	---	---	---
Stockbridge School 33.4	48(1)	---	---	---	---	---	---	---	---	---
Peavine Stockbridge 37.3	---	---	---	---	---	---	---	---	60(0)	189(5)

The Third Branch

The Third Branch begins in Roxbury and flows south in a valley that it shares with Route 12A. Woodard Brook and Flint Brook join the Third Branch in Roxbury. The Third Branch then flows south through the eastern corner of Granville with Sandusky Brook and East Granville Brook coming in from the west. It then flows southeasterly into and through the town of Braintree. Cahee Brook, another Flint Brook, and Riford Brook join the Third Branch in Braintree. The Third Branch flow becomes more easterly as it goes from Braintree to Randolph village center. Thayer Brook joins the Third Branch and the relatively large sub-watershed of Ayers Brook adds it drainage to the Branch. The Third Branch continues southerly where Gilead Brook and Camp Brook join the Third Branch from the west in the town of Bethel. The Third Branch confluence to the White River main stem is in Bethel Village. The Third Branch and many of these tributaries where negatively impacted by post Tropical Storm Irene channelization, dredging and berming (see pages 30-32 and Appendix B.)

Special Values and Features

Waterfalls, Cascades and Gorges

Webb Falls is on Sandusky Brook in Granville and is a 25-foot high waterfall with a pool at the base. There are sculpted rocks on which to sunbathe and ledges for diving.

Above the falls are a set of low cascades and narrow pools. Sandusky Brook is a tributary to the Third Branch.

Rare, Threatened or Endangered Species or Significant Natural Communities

There are six identified significant natural communities in the Third Branch subwatershed: two rich fens, two swamps, a floodplain forest, and an emergent marsh. There are five rare, threatened, or endangered plants species including bog willow and slender naiad; three animal species including a tiger beetle and wood turtle; and one bat hibernaculum.

An inventory and study of the state's floodplain forest communities was conducted by the state Natural Heritage Program in 1997 and it was during that inventory that the White River floodplain communities were described. Along the Third Branch, from Gilead Brook upstream to above Randolph Village, there is a stretch containing a number of significant floodplain forest communities. This 6.5 mile length of floodplain vegetation may be an important wildlife corridor as well as buffer for the aquatic habitat.

Impacts or Stresses

E. coli Sampling Results

Table 15. WRP *E. coli* sampling results for the Third Branch Sub-basin- Geometric mean (number in parenthesis is number of singles samples > 235 colonies/100 ml)

Site and rivermile	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Mouth 0.3	---	---	---	---	---	---	---	---	109(3)	398(5)
Stock Farm Road 4.3	183(3)	166(2)	---	103(1)	161(3)	179(4)	115(2)	172(2)	117(1)	300(5)
Golf Course Bridge 9.3	242(6)	190(6)	---	86 (0)	123(2)	146(4)	112(2)	116(1)	---	---
Randolph Rec Park 11.5	---	---	---	---	---	---	---	---	52(0)	134(3)
Riford Brook Road 14.6	---	---	---	---	---	---	---	---	58(0)	171(3)
Thresher Road	43(0)	78(1)	56(0)	---	41(1)	82(2)	---	---	---	----

Site and rivermile	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
18.2										
Ayers Brook	270(5)	340(7)	211(3)	113(0)	175(3)	279(6)	134(3)	302(3)	---	---
Adams Brook (Adams Brook) 2.7	129(5)	33(1)	39(0)	105(1)	15(1)	26(0)	1 (1)	32(0)	---	---

Waters on the Vermont Priority Surface Waters Lists

There is one stream on the 2010 Vermont 303(d) or Impaired Waters list.

Smith Brook is a small tributary to the Third Branch of the White River just downstream of Randolph Village. The Biomonitoring and Aquatic Studies Section (BASS) monitored Smith Brook for macroinvertebrates and chemistry in 2006 and additional chemistry in 2007. The overall community assessment was fair at the adjacent site and failed to meet Vermont's Water Quality Standards for Class B waters. As such, it was placed on the DEC's 303d Impaired Waters list.

The levels of iron were above the chronic criteria and the manganese levels were also high. At the river mile 0.2 site adjacent to the landfill, the biological community reflects a stream influenced by landfill leachate with a significantly reduced macroinvertebrate density when compared to the river mile 0.3 upstream site.

Records indicate (Hengstenberg, 2005) that the area behind the Pleasant View Cemetery was an old dump site used by the Town until the early 1970s when they began to develop a new facility on the other side of Bean Road. The Towns of Randolph and Braintree disposed of their refuse by open dump methods and covering with layers of earth. Over the years, what was once a ravine has been filled with trash. Large piles of junk cars, sheet metal, appliances, and tires were noted immediately adjacent to Smith Brook.

Other than the presence of iron precipitate in Smith Brook, there is no information about what chemicals, if any, are present in the brook as a result of the old dumpsite. If the property owner grants permission for access to the site, the Waste Management Division will use a contractor paid for through the Environmental Contingency Fund to develop a sampling plan to determine what risk the dumpsite poses to the environment. The contractor will sample water and sediments in Smith Brook for the

presence of volatile organics compounds, semi-volatile organics compounds, arsenic and heavy metals. These results will be shared with the property owner and Town of Randolph. Based on the results, the Waste Management Division will work with the Watershed Management Division to determine appropriate next steps for this site.

There are five stream stretches that are on the Vermont Priority Waters List, Part C – Waters in Need of Further Assessment (Table 16) because potential impacts have been identified.

Table 16. Part C.- List of Priority Waters for the Third Branch

Stream	Possible Pollutant	Potential Problem
Cold Brook	Sediment, nutrients, E. coli, organic enrichment	Agricultural runoff, streambank erosion
Ayers Brook	Metals (Ni,Cr)	Elevated levels of Cr & Ni in stream sediment
Ayers Brook from its mouth up to Brookfield Gulf	Sediment	Morphological instability
Third Branch from Randolph/Ayers Brook down to Bethel	Sediment, nutrients, E. coli	Stormwater, ag runoff, livestock access, streambank erosion, riparian vegetation loss, morphological instability
Third Branch	E. coli	Elevated E coli, source unknown

Ayers Brook is a tributary to the Third Branch of the White River. The Ayers Brook watershed is 37 square miles in size and is located within the towns of the Towns of Randolph, Braintree, Brookfield, and Roxbury. The headwaters of Ayers Brook have steep slopes while most reaches flow through a relatively gentle gradient valley. The watershed is predominately forested with agriculture located within the river corridor.

Water quality monitoring data from the WRP indicates that Ayers Brook has high *E. coli* numbers. According to the Town of Randolph the high *E. coli* numbers may be the result of a failed septic system and broken sewer line. The Town has begun addressing these issues. Thermograph stations established by the WRP also indicate highs of 78 degrees at the confluence. The Ayers Brook River Corridor Plan (2006) described many tributaries and the main stem experiencing high rates of bank erosion. The bank erosion has been accelerated due to land use activities and channel and flood plain

modifications. Significant channel straightening, bank armoring, and flood plain encroachment have occurred within this river system both on the main stem and lower reaches of the tributaries. The river has cut down into the streambed resulting in loss of flood plain access and increased energy within the channel. The increased energy within the channel has led to severe bank erosion and subsequent channel widening. Along much of the main stem, the channel is currently migrating laterally to recreate a new flood plain at a lower elevation to dissipate the energy and become more stable.

It also appears as though many wetlands in this watershed may have been altered to accommodate agricultural and residential needs. Channel avulsions, braiding, flood chutes, and steep riffles indicate that Ayers Brook has a high sediment load as the result of streambank erosion, mass failures, planform adjustment, cropland and gully erosion.

Route 12 is the dominant lateral constraint that has impacted the channel. Route 12 is located within the river corridor. Hard armoring placed in order to protect this infrastructure has led to increased instability in the system. Minor roads also impact the tributaries in many places." Twelve undersized stream crossings were identified on Ayers Brook as well as 5 old bridge abutments causing excessive degradation, aggradation, and/or scour in the river channel. Channel widening was found to be the dominant adjustment process on half the reaches assessed. Seventy five percent of the reaches assessed had little or no riparian buffers. One small dam is located on Farnsworth Brook.

The lower portions of Flint Brook in Roxbury are on the 2012 F.-List of Waters altered by flow regulation due to a possible lack of minimum flow below the fish hatchery. The FWD's fish rearing hatchery was destroyed during Tropical Storm Irene. The hatchery is scheduled to be rebuilt in the near future, at which time flow issues should be addressed.

The Second Branch

The Second Branch of the White River begins in Williamstown with streams coming out of Staples Pond and Rood Pond and flows through Williamstown Gulf down into a narrow valley in Brookfield. The Second Branch then flows south through Brookfield with Sunset Brook joining from the west. It continues south into Randolph with Snows, Halfway, Blaisdell, Osgood, Penny, Peak, and Conant Brooks all joining the Second Branch in the town of Randolph. The Second Branch then flows through the eastern corner of Bethel into Royalton then through the western portion of Royalton before it joins the White river in North Royalton. The Second Branch is about 20 miles long and drains a 74 square mile watershed.

Special Values and Features

The Second Branch of the White River has three covered bridges that span it. From upstream near East Randolph heading downstream, there is Braley Bridge, Gifford Bridge, and Kingsbury Bridge all built in 1904.

Rare, Threatened or Endangered Species or Significant Natural Communities

There are five significant natural communities identified in the Second Branch watershed including three different swamp types and a rich fen. There are 14 rare, threatened, or endangered plant species including bog willow and straight-leaf pondweed. There are two rare, threatened, or endangered animal species including the Jefferson salamander.

Impacts or Stresses

Much of the Second Branch is characterized by agricultural activities. Severe erosion has been documented that may affect designated uses, including trout production (See Chapter 4 Project Highlight Addressing Agricultural NPS pollution and Table 24 for related projects and plan actions).

E. coli Sampling Results

There are no stretches of river or stream on the 2012 303(d) List of Waters (impaired surface waters) in this part of the watershed. However, ongoing *E. coli* sampling by the White River Partnership has shown elevated levels of *E. coli.*

Table 17. White River Partnership *E. coli* sampling results for the Second Branch Sub-basin - Geometric mean (number in parenthesis is number of singles samples > 235 colonies/100 ml.)

Site and river mile	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Mouth 0.5	---	---	---	---	---	---	---	---	247(5)	691(7)
Dugout Road 9.8	333 (7)	513 (9)	243 (6)	227 (4)	188 (4)	300 (8)	144 (2)	228 (3)	231(4)	1086(8)
Braley Bridge 13.0	---	575 (4)	---	---	---	---	---	---	---	---
East Hill Road 21.9	324 (8)	316 (6)	188 (1)	---	225 (6)	217 (4)	72 (1)	171 (2)	---	---

Vermont Surface Waters Priority Lists

There are two reaches in the Second Branch watershed that are on the 2012 Part C of the List of Priority Surface Waters outside the Scope of CWA Section 303(d) - Part C are waters that are in need of further assessment because a potential impact has been identified. Field investigations are needed to see land uses and stream conditions above the macroinvertebrate sampling sites on the Kingsbury and *E. coli* sampling sites on the Second Branch.

Table 18. Part C- List of Priority Waters for the Second Branch

Wbid	Stream	Possible Pollutant	Potential Problem
VT09-05	Kingsbury Brook	temperature, nutrients	Agricultural runoff, loss of riparian veg.
VT09-05	Second Branch – from East Brookfield to one mile above the White	sediment, nutrients, *E. coli*	Agricultural runoff, streambank erosion

The First Branch

The headwaters of the First Branch originate in the hills of Washington and both perennial and intermittent streams converge north of the Chelsea/Washington line to form the First Branch. This stream flows south through Chelsea with Jail Brook entering from the east and further downstream, Cram Brook, entering from the west. The First Branch continues south through Tunbridge with first Dickerman Brook then Farnham Branch and Russell Brook as well as unnamed tributaries joining before the First Branch joins the White River in South Royalton. The First Branch is 24 miles long and drains a 103 square mile watershed.

Special Values and Features

The First and Second Branches of the White River have one of the greatest concentrations of covered bridges in the state. The First Branch has six covered bridges and, from upstream down, they are Moxley Bridge in Chelsea then Flint Bridge, Larkin Bridge, Mill Bridge, Cilley Bridge, and Howe Bridge in Tunbridge. All but Larkin Bridge, which was built in 1902, were built in the 1800s.

Rare, Threatened or Endangered Species or Significant Natural Communities

Four Rich Fen natural communities have been identified in the First Branch watershed and two rare plants species have been found as well.

Waterfalls and Cascades

There are scenic falls on Dickerman Brook in a hemlock forest away from the road. There is about a 20-foot high waterfall with cascades above it.

Impacts or Stresses

There are no stretches of river or stream on the 2012 303(d) List of Waters (impaired surface waters) in this part of the watershed.

E. coli Sampling Results

Ongoing *E. coli* sampling by the White River Partnership has shown elevated levels of *E. coli* and there needs to be some pollution source assessments done. Table 19. below contains the WRP *E. coli* sampling data.

Table 19. White River Partnership *E. coli* sampling results for the First Branch Sub-basin- River Geometric mean (number in parenthesis is number of singles samples > 235 colonies/100 ml.)

Site and river mile	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Mouth 0.3	---	---	---	---	---	---	---	---	304(7)	445(7)
Cilley Bridge 5.9	131(4)	144(3)	---	116	143	247(3)	82(1)	194(3)	---	---
Chelsea Rec Park 15.2	250(5)	---	---	98	138	153(3)	79(1)	173(4)	116(0)	321(5)

Vermont Surface Waters Priority Lists

There are two reaches of the First Branch that are on the 2012 Part C of the List of Priority Surface Waters outside the Scope of CWA Section 303(d) - Part C. are waters that are in need of further assessment because a potential impact has been identified. One of these listings is the *E. coli* issue just mentioned above and the next step for this issue is to determine whether there are any natural contributions to the *E. coli* levels seen (beaver, other) or whether they are all anthropogenic sources.

Table 20. Part C.-List of of Priority Waters for the First Branch.

Stream segment	Possible pollutant	Potential Problem
First Branch	*E. coli*	Sources of elevated *E. coli* numbers, sources unknown
First Branch – Chelsea to mouth	sediment, temperature	Soil & streambank erosion

The Lower White

For planning purposes, the Lower White River sub-watershed consists of the White River mainstem from its mouth upstream to the Sharon/Royalton town line and the tributaries to this reach. The tributaries include Jericho, Dimick, Podunk, Tigertown, Mill, Mitchell, High Pole, Quation, Fay, Whitewater Broad, and Sewall Brooks.

Extensive logging of the watershed's forest from early European settlement, as well as use of the White River for log drives, has contributed to the physical condition of the river and its tributaries today. Sharon was particularly affected by major floods, such as the 1927 flood, and dredging and gravel mining have contributed to instability of the river. The lower White River's channel-spanning bedrock features have had a role in reducing the degree of downcutting in this area; still, in many places, there is a loss of floodplain access.

A total of 23.5 river miles were physically assessed in the town of Sharon in 2010, including reaches on the main stem and four major tributaries (Quation Brook, Fay Brook, Broad Brook, and Elmers Brook). On the lower White River, three out of four segments are in "fair" geomorphic condition (one segment is "good"). On Quation Brook, five out of eight segments are in "good" condition (two are "fair" and one "poor"). On Fay Brook, 9 out of 13 segments are in "fair" condition, while four are "good." Elmers and Broad Brooks had just five segments assessed; they were either "fair" or "good".

Because of the naturally more confined valleys of the Lower White, areas for flood attenuation are limited. However, important floodplain protection along the tributaries may be important.

Special Values and Features

Significant Natural Communities and Rare, Threatened, and Endangered Species

There are 14 significant natural communities found along the lower White River or on its tributaries. All but one are riverine or wetland natural communities such as Calcareous Riverside Seeps or Rich Fens. Twenty-five rare, threatened, or endangered plants have been identified as well as three rare animals or threatened or endangered animals. A number of the significant natural communities identified in the basin are communities integrally connected to the White River itself. Three of the community occurrences are Calcareous Riverside Seeps found along the stretch of river that flows through Sharon, Pomfret and West Hartford. Two occurrences of the state-listed threatened tiger beetle have been found in the Lower White River sub watershed.

Impacts or Stresses

E. coli Sampling Results

There are slightly elevated *E. coli* numbers from the White River Partnership (WRP) sampling (Table 21.) that has been done on the Lower White River.

Table 21. WRP *E. coli* sampling results for the Lower White River Sub-basin- Geometric mean (number in parenthesis is number of singles samples > 235 colonies/100 ml.)

Site and river mile (mouth upstream)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Watson Park 1.4	58(3)	71(0)	78(2)	100(1)	30(0)	89(2)	105(2)	84(1)	62(1)	120(3)
Dimick Brook 6.4	96(4)	99(2)	107(2)	47(0)	53(2)	--	---	---	---	---
W Hartford Bridge 7.3	---	92(1)	12(0)	---	---	62(1)	101(3)	99(2)	61(2)	156(4)
Mill Brook[1] 8.4 and 0.1	66(3)	---	---	19 (0)	31(2)	38(1)	45(1)	27(1)	---	---
Sharon 13.0	114(4)	113(1)	85(2)	110(3)	105(2)	---	---	---	---	---
White Brook[2]	---	---	---	---	---	112(3)	150(3)	201(3)	---	---

Site and river mile (mouth upstream)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
15.1										
Sharon Academy 15.3	---	---	---	---	---	---	---	---	94(2)	285(5)

1. From 2001 to 2006, the Mill Brook site was on the mainstem then from 2007 to present, it was on Mill Brook itself

2.The Sharon site at rm 13.0 was moved to this White Brook site at mainstem rm 15.1 due to access.

Waters on the Vermont Priority Surface Waters Lists

Two stretches of the White River are on the 2012 Vermont Priority Waters List, Part C – Waters in Need of Further Assessment. The *E. coli* listing needs review because there are many years of data and it does not really need "further assessment". The levels of *E. coli* found over the years in the Lower White River, especially below Sharon, have not been very high.

Table 22. Part C.- List of Priority Waters for the Lower White

Stretch	Possible pollutant	Possible problem
White River – mouth to Bethel	*E. coli*	Elevated levels of *E. coli* in early 1990s and 2001 to 2003
White River in West Hartford	Metals – Ni, Cr	Elevated levels of Nickel and Chromium in sediments

F. Direct discharges to surface waters in the White River Basin

Overview

There are four municipal wastewater treatment facilities and two fish hatcheries that are subject to NPDES discharge permits in the White River Basin (Table 17). All of these facilities are subject to State of Vermont issued NPDES permits.

An overarching consideration for the issuance of permits in the White River Basin is the Long Island Sound TMDL for nitrogen. This multi-state TMDL has been promulgated with interim wasteload and nonpoint source nitrogen load allocations. As of the

issuance of this Plan, all facilities are operating under administrative continuance of existing permits while the wasteload allocations are being refined. Specifically, the WSMD is implementing a wasteload allocation plan and permitting strategy in all CT River direct discharges to account for the new nitrogen limitations, to meet an interim total Vermont load of 1,727 lbs. N/day. Under that strategy, permit reauthorizations are proceeding for the Royalton and Chelsea facilities early in 2013, followed by Randolph, then Bethel.

As part of a necessary refinement of the facility-specific nitrogen wasteload allocations, WSMD, with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions for nitrogen, which is only recently regulated by the States of Vermont and New Hampshire.

Table 23. White 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
Randolph WWTF (3-1198)	6/30/2011	0.40	0.08 / 0.02	Activated sludge with extended aeration	Third Branch of the White River
Chelsea WWTF (3-1197)	3/31/2010	0.055	0.059 / 0.013	Activated sludge with extended aeration	White River at Chelsea
Bethel WWTF (3-1280)	12/31/2012	0.12	0.003 / 0.001	Extended aeration	White River at Bethel
Royalton WWTF (3-1165)	12/31/2009	0.07	0.001 / 0.001	Aerated lagoon with disinfection	White River at Royalton
VT F+W Roxbury Hatchery (3-0362)	9/30/2010	0.59	0.47/0.197 (a) 0.57/0.22 (b)	Currently being permitted - see facility-specific information	Third Branch White River
White R. National Hatchery (NA)	6/30/2012	6.62	0.25 / 0.11		White River (at Bethel)

* 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

Bethel

The town of Bethel is assisting WSMD's efforts to refine load allocations for the nitrogen TMDL by providing WSMD staff access to sample effluents as part of a study of low-cost retrofit options for nitrogen removal optimization. The WSMD anticipates re-authorizing this permit in 2014, following review of the data and refinement of the overall wasteload allocation plan. As is customary for facilities that are 20 years of age, the Bethel facility is subject to a requirement for an engineering analysis to identify necessary repairs, equipment, or process improvements to maintain effluent quality and facility operation.

Chelsea

The town of Chelsea is assisting WSMD's efforts to refine load allocations for the nitrogen TMDL by conducting voluntary sampling of several forms of nitrogen. The WSMD anticipates re-authorizing this permit in 2013, following review of the available data.

Randolph

The town of Randolph is assisting WSMD's efforts to refine load allocations for the nitrogen TMDL by conducting voluntary sampling of several forms of nitrogen. The WSMD anticipates re-authorizing this permit in 2014, following review of the available data. The Department's 2013 Municipal Pollution Control Project Priority List identifies refurbishment of a facility pump station as eligible for Clean Water State Revolving Fund loan support during the period 2013-2016.

Royalton

The town of Royalton is assisting WSMD's efforts to refine load allocations for the nitrogen TMDL by conducting voluntary sampling of several forms of nitrogen. The WSMD anticipates issuance of a draft reauthorized permit in March of 2013. The Department's 2013 Municipal Pollution Control Project Priority List identifies wastewater system improvements as eligible for Clean Water State Revolving Fund loan support for design work in 2013, with the possibility of additional construction loan support in 2017.

Roxbury Fish Hatchery

The Roxbury Fish Hatchery trout rearing ponds were destroyed by the floodwaters of Tropical Storm Irene. As part of the reconstruction efforts for this facility, WSMD has already established new effluent limitations to which the facility will be permitted using the flow statistics used in prior permit cycles (a). The new flow statistics for this facility (b) will be used upon the subsequent re-authorization.

White River National Fish Hatchery

The White River National Fish Hatchery also sustained significant damage during Tropical Storm Irene. WSMD anticipates reviewing the White River Hatchery permit coincident with the reconstruction of this facility.

Chapter 3- Management Goals for Surface Waters in the White 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.

- Identification of existing uses
- Opportunities for designation of Outstanding Resource Waters.
- Opportunities for reclassification of waters.
- 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.

Classification

Since the 1960s, Vermont has had a classification system for waters that establishes management goals. Setting water quality management goals is the responsibility of the Vermont Water Resources Panel. These goals describe the values and uses of surface waters that are to be protected or restored through appropriate management practices. The Agency works to implement activities that restore, maintain or protect the management goals. The current classification system includes three classes: A(1), A(2), and B.

A. 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. In Basin 9, 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 streams have the water quality to be so designated, which are proposed. DEC recognizes and supports the United States Forest Service's consideration that all Class B surface waters occurring in designated wilderness areas below 2,500 ft. be reclassified to A(1). Insofar as designated wilderness areas are off-limits to all forms of development and mechanized activity of any kind, a management goal of "waters in their natural condition" is appropriate and supportable. Other surface waters currently attaining Class A(1) biological integrity are Bingo Brook in Rochester and Hancock, and Smith Brook in Rochester.

Waters used as public water supplies are classified A(2). The only class A(2) waters in Basin 9 that is currently actively used is Lake John. There are two additional A(2) waters that are no longer used. The first, Lake Casper was previously a water supply for the Village of South Royalton. DEC recommends that Lake Casper be reclassified from A2 to B to preclude management of the pond as a water supply, as this is no longer appropriate[1]. In addition, Farnsworth Brook is not recognized by the DEC Drinking Water and Groundwater Protection Program as a public water supply, and thus is also recommended for reclassification from A2 to B for the same reason.

The current Water Quality Standards require that all basin plans place Class B waters into one of the three water management types. Pursuant to § E 700, Act SS01 of 2009, the Legislature directed the Agency of Natural Resources to grant funds to the Two Rivers Ottauquechee Regional Commission and Windham Regional Commission for

[1] Please see additional explanation regarding these classifications in Appendix I, comment 19.

the purpose of developing recommendations for water management types for the White River basin and the West, Williams and Saxton's River basin, respectively. The legislative language also directed the commissions to submit to the Agency of Natural Resources and the Natural Resources Board the recommended water management type designations by January 31, 2011. TRORC and ANR fulfilled these requirements, and the Water Management Typing recommendations were provided to the Natural Resources Board. Between the time of delivery of the recommendations to the Natural Resources Board and July 1, 2012, the Board took no action on the recommendations. As of July 1, 2012, authority for the promulgation of the WQS and related rules moved to Agency of Natural Resources.

In the development of this Tactical Basin Plan, the Agency has re-reviewed the recommendations developed by TRORC, and compared these against the surface waters the Agency has identified in Section 2.C and Chapter 3 of this Plan. The surface waters recommended for B(1) designation by the TRORC analysis provided a sound starting point for ANR's efforts to document the existence of very high quality waters in the Basin. ANR's analysis focused on the identification of those surface waters in the White River basin that are documented to exceed specific criteria established for biological integrity and fishery quality. For a number of surface waters, this plan promotes protections that exceed the TRORC Typing recommendations, including: all waters within the USFS Wilderness Area less than 2,500 feet in elevation; Bingo, Smith, and Farnsworth Brooks; and, Lake Casper. In many instances, ANR data substantiated the TRORC recommendations, based on biological integrity or fishery quality, and these waters are so-identified in Section 2.C. A dynamic, map-based comparison of the TRORC recommendations and the Agency's proposal for reclassification and lists of very high quality waters may be found online at this link.

As consistent with prior Plans issued by ANR, this Plan does not make specific recommendations for water management types. However, the surface waters identified in Section 2.C have been listed specifically in recognition of their elevated quality. It is the intent of the Agency to provide protections to the very high quality condition of these surface waters coincident with application of the Agency's Anti-degradation Procedure. Further, the list of waters in Section 2.C is intended to be used by municipalities to impart additional municipal protections as determined to be appropriate. The Agency, in partnership with TRORC, will provide technical assistance to municipalities who are interested in promoting further surface water protections.

B. Existing Uses

There are many identified special uses, features, and values of the White River and its numerous tributaries including waterfalls, cascades, whitewater boating stretches, and swimming holes. All surface waters in Vermont are managed to support designated 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 White River Basin planning development, DEC has identified:

- 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 DEC's long-standing stipulation that all lakes and ponds in the basin have existing uses of swimming, boating and fishing. During the planning process, DEC has collected sufficient information to identify the existing uses listed in Appendix A for rivers and streams. The list is not meant to be exhaustive. The public is encouraged to nominate other existing uses, which may be included in the basin plan or catalogued for a more thorough investigation when an application is submitted for an activity that might adversely affect the use.

C. 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 nuisance

controls, solid waste disposal, Act 250 projects and other activities. At the present time there are no ORW designations in Basin 9.

The White River is the longest free-flowing and impoundment-free tributary of the Connecticut River and should be protected as such. Recreational features include high angler use (≥ 400 angler hours/mile) and a significant wild trout fishery. There were six swimming holes identified on the middle White River in the *Vermont Swimming Hole Study,* 1992. Three of the six have moderate to heavy swimming use and are in well-known areas. Thirty-eight swimming sites were identified on the White River mainstem (Appendix A). DEC would support efforts that would petition the designation of the White River accordingly. The White River merits this designation of ORW status for recreation because of its excellent boating, tubing, fishing, and swimming opportunities.

D. Other High Quality Waters

Many of the White 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 excellent quality and preserving those excellent 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. Other printed statewide inventories include: *Waterfalls, Cascades, and Gorges of Vermont* by Jenkins and Zika 1985; *Whitewater Rivers of Vermont: Their Biology, Geography and Recreational Use* by Jenkins and Zika 1992; *The River Swimming Holes of Vermont* by Jenkins, Benjamin, and Dorney 1992; *Calcareous Open Fens and Riverside Seeps of Vermont: Some Sites of Ecological Importance*, 1995 by Thompson and Popp; *Floodplain Forests of Vermont: Some Sites of Ecological Significance*, 1998 by Sorenson, Lapin, Engstrom and Popp; *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; *Softwood Swamps of Vermont: Distribution, Ecology, Classification, and Some Sites of Ecological Significance*, 2010 by Sorenson, Popp, Engstrom, Lapin, and Farrell. In addition, there are numerous regional inventories and descriptions of water and wetland resources.

E. Class 1 Wetland Designation

There are only three Class 1 wetlands designated in Vermont to date but there are many that may qualify for the augmented protections conferred by this classification. A Class I wetland means a wetland that: (A) is identified on the Vermont significant wetlands inventory maps as a Class I wetland; or (B) the Secretary of ANR determines, based on an evaluation of the extent to which the wetland serves the functions and values set forth at 10 V.S.A. § 6025(5)(A)-(K) and in Section 5 of the Vermont Wetland Rules, is exceptional or irreplaceable in its contribution to Vermont's natural heritage and, therefore, merits the highest level of protection. See 10 V.S.A. § 902(6).

Potential candidates for reclassification to Class 1 include Barnard Fen and Nyes Swamp, and additional data will be collected by ANR to determine if these sites could meet Class 1 criteria.

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: Lamson Pond in Brookfield and Silver Lake in Barnard. For Warm Water Fish Habitat, the WQS specifies a lower minimum dissolved oxygen concentration than waters in the remainder of the basin which are Cold Water Habitat. No changes to warm water fish habitat designations are proposed by this plan.

Cold Water Fish Habitat

All waters not designated as warm water fish habitat above are designated as cold water fish habitat for the White River basin in the Vermont Water Quality Standards. No changes to cold water fish habitat designations are proposed in this plan.

F. Irrigation and Animal Watering

Water from the White River system is an important resource for agriculture. Farms use a combination of drilled wells, springs and surface water for livestock watering. Vegetables, cut flowers, orchards, berries, and nursery stock are all supported by limited irrigation.

Chapter 4- Watershed Improvement Actions and the Implementation Table

The tactical plan implementation table (Table 24) identifies specific objectives for the White 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 mapped online at this link.

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

DEC recognizes that good ideas that emerge from planning efforts often proceed prior to the final issuance of the plan being developed. Several important projects were completed during the planning process by DEC's watershed partners, either independently or with DEC support. The projects include:

- In-stream habitat and AOP upgrade projects completed in Clark, Patterson, Deer Hollow Brooks- USFS and DFW
- Riparian buffer plantings scheduled for in spring 2013 at Peavine, Corral, Tupper Terraces, Auction Barn Flats, and River Bend National Forest Sites – USFS
- River corridor protection projects in Upper and Third (Ayers) sub-basins – DEC, VLT, and WRP
- Bank stabilization using soil bioengineering techniques- main stem in South Royalton- USFS and WRP
- Rochester culvert upgrades- USFS, USFWS, WRP, DEC, and DFW
- BBR capital budgets and implementation projects in Randolph and Chelsea- TRORC, DEC, and DFPR
- Class 4 road projects- Norwich, Sharon, Braintree, Roxbury, and Tunbridge- BBR, DEC, WRP, TRORC, DFPR, YCC, and towns
- Floodplain encroachment removals/HMGP sites- TRORC and WRP
- Buffer plantings- WRP (watershed-wide)

- Post-Irene dredging partial remediation- Gilead, Camp Brook, Lilliesville Brook- DEC, WRP, and USFWS
- Post-Irene culvert upgrades/replacements- Tweed River and Camp Brook- DEC and DFW
- Review of municipal floodplain bylaws- Rochester, Pittsfield, Stockbridge- TRORC and DEC

Project Highlight- Addressing Agricultural Non-point Source Pollution

In a collaborative process, DEC has been working with VACD's Agricultural Resource Specialists (ARS), AAFM, and the White River Natural Resources Conservation District (WRNRCD) to identify and remediate possible sources of agricultural runoff. Since 2011, the WRNRCD has implemented the AEM program in the First, Second, and Third Branches. These sub-watersheds were targeted for the AEM program as the result of water quality monitoring findings. Several farmers have been participated in the program to identify possible farm natural resource concerns affecting waterways. By farmer request, or through outreach efforts, ARS Staff meet on the farm with stakeholders over several planning visits. Over the course of these visits, ARS Staff draw on local natural resource conservation specialists—engineers, agronomists, and other planners—to ensure that conservation recommendations and practices are planned and tailored to match each farm's unique characteristics. This collaborative process seeks to identify the most effective means to solve a resource concern to benefit both the natural environment and farm efficiency as much as possible. Numerous BMP have been implemented through the AEM process in the First, Second, and Third Branches including livestock fencing, riparian buffer plantings, barn roof runoff, and barnyard improvements.

Project Highlight- Class 4 Roads Project

The Class 4 Roads Project is a collaborative project that began in 2009. Project partners include: TRORC, DEC, DFPR, BBR, WRP, YCC, and several municipalities. Class 4 roads are typically located higher up in waters within narrow valleys containing high gradient streams. These roads are often used by home and camp owners, loggers, and for horseback riding, mountain biking and all-terrain vehicles. These roads are most often only minimally maintained and are disproportionately responsible for sediment and nutrient loading to waterways. Stressors from these roads include land erosion, channel erosion, and encroachments.

The project identified 377 Class 4 road segments in 28 towns totaling 206 miles in the basin. GIS mapping identified road segments within 50 feet of surface waters or having

slopes greater than 20% or having more than 2 road crossing per mile. Approximately 75 road segments were walked and erosion potential evaluated and ranked. Forty seven sites were ranked a low priority for erosion, while 28 road segments ranked medium or high for erosion potential (Appendix F). Sedimentation to waterways was observed at the medium and high ranked sites.

Project partners secured funding from the Ecosystem Restoration Program, Connecticut River Mitigation and Enhancement Fund, and Better Backroads Program. Over a dozen sites have been restored using BMP practices such as culvert headers (Figure 5), culvert outlet stabilization, stone-lined waterways, reinforced stream crossings, and water bar installation. Most of the restored sites withstood the significant precipitation and severity of TS Irene with minimal damage compared to those sites yet restored. Additional sites will be restored as funded is secured.

Figure 5.- Class 4 Road culvert header installation (Photo credit Greg Russ)

Project Highlight- Rochester Stream Crossing Upgrades

TS Irene significantly affected the Town of Rochester. The storm caused numerous stream crossings to be completely destroyed or outflanked, taking out large segments of town and state road networks. Due to the catastrophic failure of transportation infrastructure, the town was briefly isolated immediately after the storm. Access in and out of town was limited to helicopter or all-wheel drive vehicles. After a couple of weeks, town and state highway crews temporarily restored stream crossings and road networks.

The Town of Rochester working in collaboration with the White River Partnership, FEMA, USFS, USFWS, DEC, and DFW, identified seven stream crossings to upgrade for both geomorphic equilibrium and aquatic organism passage upgrades. As of this plan writing, two of the seven crossings have been upgraded with the others scheduled for upgrades in the coming field seasons. The Marshs Brook culvert upgrade is shown in the photos below.

Figure 6.- Marshs Brook Road before photo of double undersized culverts (Photo credit Greg Russ)

Figure 7.- Marshs Brook Road after the installation of an AOP-friendly crossing (Photo credit Greg Russ)

About Flood Resiliency

The Vermont Legislature passed Act 16, which takes effect in July 2014. The Act requires municipal and regional plans to incorporate a "flood resilience" component of element. Working towards resiliency means both proactively reducing vulnerabilities to flooding and flood damage, and improving response and recovery efforts when flood events do occur, so that communities bounce back quickly long term economic, social, and natural resource impacts. The effort will include using maps to identify local flood hazard areas, pointing to specific areas that should be protected because they slowdown or attenuate floodwaters (including floodplains, river corridors, forests and wetlands) and recommending specific strategies and policies that will help protect these areas and reduce the risks facing existing development. ANR will provide resources, such as river corridor maps, and assistance to make flood resiliency an integral part of town planning. Numerous Tactical Plan Actions will assist communities in becoming more flood resilient including: Actions 4-11, 12-14, 15-18, 21-25, 35-36, 38-42 and 46-51.

The Tactical Plan Implementation Table

Table 24. below is organized in four columns, the first of which describes the action, the second lists the partners that will be implementing the actions, the third includes the potential funding sources, and the fourth column includes target location for the action to be completed. All actions identified here are considered high priority recommendations and every effort will be made to implement these actions within five years following the approval of this plan. That said, unforeseen events such as landowner unwillingness to move forward, lack of funding, or changes on the ground may prohibit the implementation of certain actions. Other actions will likely develop after the initial distribution of the plan and may be addressed within the same time period or in future updates to this plan.

Table 24.- Implementation Table - Restoration, Protection and Assessment and Monitoring Actions – all Actions are scheduled to be implemented from 2013-2018

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Objective- re-classify waters to better define current uses and/or better protect water quality, aquatic habitat, and recreational uses			
Action 1- DEC recommends that the main stem of the White River be designated an Outstanding Resource Water (ORW) for recreation value for boating, tubing, swimming, and fishing. DEC would support a locally lead effort to do so.	DEC, WRP, TRORC	N/A	Main stem (Extent to be determined during any ORW re-classification effort)
Action 2- DEC recommends that all streams within USFS designated Wilderness Areas within the basin and not already classified as A1 be re-classified from B to A1. In addition, Bingo Brook (Rochester) and Smith Brook (Goshen) should be considered for reclassification	DEC, WRP, TRORC	N/A	See ANR Natural Resource Atlas
Action 3- DEC recommends that Farnsworth Brook and Lake Casper be re-classified from A2 to B since they are no longer used as public water supplies	DEC	N/A	Farnsworth Brook and Lake Casper
Objective- Improve aquatic organism passage (AOP), geomorphic compatibility, and habitat- upgrade/replace high priority stream crossings that can both accommodate AOP and are geomorphically-compatible. Identify and prioritize dams that impede AOP. Actively restore aquatic habitat both within stream channels and riparian areas. (Also see Appendix G for locations)			

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 4.- prioritize stream crossings for upgrades for aquatic organism passage by sub-basin and town. Contact municipalities and/or private landowners, GMNFS, and VTrans to further develop priorities. Focus on replacing structures to accommodate both AOP and geomorphic equilibrium.	DEC, DFW, WRP, TRORC, USFWS,USFS, VTrans, and municipalities	VTrans Structures grant, USFWS AOP, FEMA HMG	Watershed-wide
Action 5.- Complete stream crossing assessments and run through AOP and geomorphic compatibility screens. Include the assessment of privately-owned structures	DEC, WRP, VDFW, USFWS, USFS	MEF, USFWS, ERP	Watershed-wide
Action 6- Initiate a dialogue and work group regarding high priority VTrans-owned crossings to upgrade for fish passage on state highways, the interstate and rail corridors	VTrans, DEC, DFW, WRP, TU, TRORC, and USFWS	N/A	Routes 14, 132, 100, I-89, and VTrans rail line
Action 7.- Develop a dam removal feasibility study and prioritization to remove impediments to AOP on four specific waters.	DEC, USFWS, TU, and DFW	ERP, MEF	First Branch, Quation Brook, Fay Brook, Randolph Village dam on the Third Branch
Action 8- Establish a portable skidder bridge rental program for timber harvests within the GMNFS.	DEC, DFPR, USFS, WRNRCD, and DFW	MEF, GMNFS, ERP	Lands within the USFS within the basin- Upper White and Tweed River sub-basins

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 9- Expand the existing portable skidder bridge rental program in the basin by constructing 2 additional bridges and making them available to loggers	DEC, DFPR, and WRNRCD	MEF, ERP, SEP	Watershed-wide
Action 10- Continue and expand riparian buffer programs. Prioritize buffer plantings based upon recommendations in completed P2 and River Corridor Plans and target where previous studies have documented excessive water temperatures.	WRP and DEC	ERP, Watershed License Plate, MEF	First Branch, Second Branch, main stem between the Tweed River confluence and the West Branch and reaches described in Appendix G
Action 11- Undertake in-stream aquatic habitat enhancement projects	USFS, DEC, USFWS, and DFW	USFS, USFWS, VTRANS (if appropriate)	Bowl Mill reach of the main stem in Granville and Post-Irene dredged sites (Appendix B)
Objective-Identify and remove high priority flood plain encroachments and implement projects that connect the active river channel to its flood plain (see Appendix G for additional reach locations)			
Action 12- map and prioritize flood plain encroachment parcels for possible removal/restoration based upon geomorphic equilibrium, flood inundation, fluvial erosion hazards and past flood damage with a focus on developed flood plains within village centers.	WRP, DEC, TRORC, municipalities.	FEMA HMG, ERP	Rochester, Hancock, Granville, Pittsfield, Bethel, West Hartford, Sharon, Braintree, and Stockbridge

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 13- Continue to promote better floodplain and corridor protection in the towns to address encroachment and minimize channel management.	TRORC, WRP, DEC, municipalities	ERP, 604(b)	Watershed-wide with an emphasis on Bethel and Stockbridge
Action 14- Undertake floodplain restoration and buffer planting projects for parcels approved for HMGP buyouts	TRORC	HMGP and ERP	Approximately 40 sites in the White
Objective- protect important river corridors and wetlands- protect high priority river corridors and wetlands for sediment attenuation assets, aquatic and wildlife habitat, and flood plain protection (see Appendix G for additional reach locations)			
Action 15- Secure permanent protection of river corridors through easements or buyouts and flood plain encroachment removals	TRORC, DEC, Town of Pittsfield, and landowners	FEMA HMGP, DEC ERP, MEF	Tweed, Ayers
Action 16- Secure permanent protection and restoration of the river corridor and floodplain within the Village of Hancock including the salvage yard	TRORC, WRP, DEC, landowner(s), and the Town of Hancock	FEMA HMGP, DEC ERP, MEF	Upper White, Hancock
Action 17- Protect significant riparian natural communities from development and/or excessive logging by improving zoning bylaws and/or fee simple purchases or conservation of development rights	DEC, DFW Fisheries Division and NGNHP, DFPR, TRORC, and VRC	VRC/VHCB, MEF	Lower White, middle White, First Branch (4 Rich Fens), Third Branch (Randolph to Gilead Brook)
Action 18- Collect additional data necessary to assess wetlands using new criteria for possible re-classification from Class 2 to Class 1.	DEC, DFW NGNHP	ERP, MEF	Barnard Fen Nyes Swamp

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Objective- protect public access to watershed swimming holes, significant waterfalls, recreational boating, and fishing areas			
Action 19- Compile a list of high priority privately-owned sites to secure permanent public access to swimming holes and waterfalls through permanent easements.	WRP, VRC, DEC, and select towns	VHCB, VRC, MEF	Watershed-wide
Action 20- Inventory additional possible public access areas for swimming, boating, and fishing within the Second Branch watershed.	DEC, FWD, WRP	VRC, VHCB, LARC	Second Branch
Objective- reduce non-point source pollution from gravel roads by implementing Best Management Practices (BMPs) in the upper watersheds that address significant sediment sources			
Action 21- Conduct BBR capital budget inventories for road-related erosion, AOP impediments, and river-road conflicts with an emphasis on flood resiliency parameters.	Focus towns, Better Backroads technician, DEC	BBR grant, ERP, MEF	Stockbridge, Bethel, Braintree, and Brookfield
Action 22- Implement high priority road BMP and river-road conflict remediation as identified in Capital Budgets. Some examples of practices include: stone-lined drainage ditches, culvert headers, culvert outlet stabilization, gully stabilization, road shoulder and embankment stabilization, drainage culvert upgrades, and/or road relocations away from waterways.	DEC, BBR, participating municipalities	BBR, MEF, and ERP	Upper and Tweed and Taggart Brook and Taggart Brook Road

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 23- Continue implementation of high and medium priority erosion remediation projects identified in the White River Class 4 Road Inventory and conduct outreach to Class 4 Road user groups to enhance stewardship of these resources	WRP, DFPR, DEC, BBR, YCC, and municipalities	BBR, MEF, ERP grants	High and medium priority projects in Class 4 Road Inventory (Appendix F)
Action 24- Encourage towns to adopt locally appropriate Bridge and Road Standards meeting VTRANS minimum guidelines	DEC, TRORC, and municipalities	N/A	Watershed-wide
Action 25- Conduct road erosion BMP, river-road conflict remediation, and stream crossing workshops	DEC, BBR, VT Local Roads Program, TRORC	Local roads, ERP	Upper, mid-White, and/or Third Branch
Objective- address sources of iron precipitate in the impaired Smith Brook watershed.			
Action 26-. Develop a sampling plan to determine what risk the dumpsite poses to the environment. Sample water and sediments in Smith Brook for the presence of volatile organics compounds, semi-volatile organics compounds, arsenic and heavy metals. Based on the results, the Waste Management Division will work with the Watershed Management Division and property owners to determine appropriate next steps for this site.	Town of Randolph, DEC AMPP and Waste Management Division, andWRP	Environmental Contingency Fund	Smith Brook (Randolph), Third Branch
Objective- address creosote discharge to the White River in Royalton			

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 27- Design and install practices that will address creosote discharges to the White River from the truss bridge decking in Royalton. Determine if other similar stream crossings are causing an impact.	DEC, WRP, Town of Royalton	MEF, VTrans Enhancement grant	Bridge Street Bridge, main stem in Royalton
Objective- map and protect undeveloped lakeshores for the basin's lakes and ponds			
Action 28- Conduct a GIS level inventory of undeveloped lakeshores in the basin using DEC's Lakes and Ponds' and other relevant methodologies	DEC Lakes and Ponds staff, TRORC	DEC staff and 604(b)	Mud Pond- (Braintree) Crescent Pond- (Sharon) Pickles Pond- (Brookfield) North Pond- (Chittenden)
Action 29- Prioritize lakeshore protection projects for the basin and begin securing permanent lakeshore protection easements.	TRORC, DEC, VRC	VRC, VHCB, ERP	Ponds above plus "Best Lakes"
Action 30- Promote and initiate the Lake Wise program (see Appendix C.)	Watershed lakeshore landowners		Silver Lake- (Barnard)
Objective- determine possible sources of E. coli; human, wildlife and agricultural. Implement practices that will address non-natural sources of E. coli			
Action 31- Bracket potential sources of bacteria through windshield surveys, additional monitoring sites, and possible sanitary surveys	WRP, DEC	LaRosa Lab grant and DEC staff time	First, Second, and Third Branches

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 32- Implement targeted (selective) agricultural BMPs that will address possible sources of E. coli such as repairing malfunctioning manure pits and manure storage areas, livestock fencing, riparian buffers, barnyard manure management, and nutrient management	DEC, AAFM, and White River NRCD	MEF, AAFM cost-share programs, EQIP	First, Second, and Third Branch sub-basins
Objective- identify high priority agricultural sources of NPS pollution and implement agricultural BMP needs that could address potential sources of sediment, nutrients and bacteria entering waterway (also see Appendix F for livestock exclusion needs)			
Action 33- Conduct AEM assessments in targeted sub-basins to better determine possible sources of sediment, channel erosion, encroachments, and nutrients	AAFM, White River NRCD, DEC	MEF, 319	First, Second, and Third Branch sub-basins
Action 34- Implement BMPs prioritized from AEM assessments that address sediment, nutrient and bacteria sources	AAFM, White River NRCD, DEC	AAFM cost-share programs, EQIP, MEF, ERP	First, Second, and Third Branch sub-basins
Objective- undertake additional water quality, aquatic community, and aquatic habitat monitoring and assessment to better target remediation and protection actions of DEC and its partners			
Action 35- Inventory high priority agriculturally-impacted wetlands for restoration. High priority wetlands are those that are sediment and phosphorus attenuation areas.	DEC, Ducks Unlimited, White River NRCD, AAFM, and NRCS	ERP, MEF, NRCS Wetland Reserve and DU funding	Second and Third Branch sub-basins

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 36- Complete additional Phase 1 and 2 Geomorphic Assessments and River Corridor Management Plans for the basin.	WRP, TRORC, and DEC	ERP, MEF, and FEMA, MGP	Priority order: Remaining portions of mid-main stem and tributaries, remaining portions of the Upper, remaining portions of the Third Branch, the Second Branch, and remaining lower main stem.

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 37-- Undertake additional biological community monitoring	DEC MAPP	DEC staff-N/A	Perkins Brook, Stockbridge; West Branch, Tweed River; Cram Brook, Chelsea; Jenkins Brook, Chelsea; Dickerman Brook; Kingsbury Brook, Randolph; Cold Brook, Brookfield; Open Meadow Brook, Brookfield; Woodward Brook; Sandusky Brook; Farnsworth Brook; Lake Casper.
Objective- reduce the impacts from stormwater runoff from developed lands			
Action 38- Complete IDDE and stormwater mapping inventories and recommendation plans	DEC	ERP	WRJ/Hartford, Randolph, Chelsea, Rochester, and South Royalton
Action 39- Implement high priority recommendations from IDDE Stormwater Mapping Report (Action 38)	DEC, TRORC, WRP	ERP	WRJ/Hartford, Randolph, Chelsea, Rochester, and South Royalton

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 40- Undertake Green Infrastructure demonstration projects throughout the watershed	DEC, TRORC, WRP, and DFPR Urban Forestry Program	ERP and Green Infrastructure Municipal Outreach Project	WRJ/Hartford, Randolph, Chelsea, Rochester, and South Royalton
Action 41- Provide outreach to municipalities regarding stormwater zoning and bylaws	DEC, TRORC, DFPR Urban Forestry Program	ERP and Green Infrastructure Municipal Outreach Project	WRJ/Hartford, Randolph, Chelsea, Rochester, and South Royalton
Action 42- Provide technical assistance to towns in implementing high priority stormwaters best management practices (Action 38)	DEC, TRORC, DFPR Urban Forestry Program	ERP and Green Infrastructure Municipal Outreach Project	WRJ/Hartford, Randolph, Chelsea, Rochester, and South Royalton
Objective- reduce the spread of aquatic invasive and nuisance species			
Action 43- Raise awareness of aquatic invasive and nuisance plants, animals, and pathogens spread prevention (see Appendix D.)	DEC, TU, and WRP	ANC Grant-in Aid	Watershed-wide
Action 44- Hold an annual Vermont Invasive Patrollers (VIP) training to support the establishment of VIP programs in the basin.	**DEC/** Watershed Groups	NA	Watershed-wide

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 45- Support new and existing public access greeter programs. Encourage greeter programs on waters with invasives (e.g. Eurasian watermilfoil) to provide information to recreational users and to encourage actions to prevent water body to water body transport.	**DEC**/ Lake and Watershed Groups Communities	ANC Grant-in-Aid, Watershed Grants	Watershed-wide
Objective- restore stream reaches dredged after Tropical Storm Irene and assist communities in becoming more flood resilient (see Appendix B and Appendix F for specific reaches			
Action 46- Assess municipalities for resiliency against catastrophic loss from both fluvial erosion and flood inundation damages	DEC, TRORC, WRP, municipalities	FEMA HMGP, ERP, 604(b)	Watershed-wide
Action 47- Prepare plans for village centers located within delineated river corridors that identify high priority floodplain encroachments for removal and other floodplain protection and restoration measures	TRORC, DEC, and municipalities	FEMA HMGP, ERP, 604(b)	Watershed-wide
Action 48- Inventory highly sensitive and vulnerable State highway transportation infrastructure and river-road conflicts. Develop a remediation and avoidance plan for these areas	DEC and VTrans	VTrans Enhancement and ERP grants	Corridors along Routes12, 12A, 73, 14, 107, 132, and 100
Action 49- Identify and restore high priority post-Irene dredged areas for remediation needs. High priority sites are those where aquatic habitat resources were degraded and sites where dredging has left infrastructure vulnerable to future events.	DEC, GMNFS, USFWS, WRP, TU	USFS, USFWS, ERP, FEMA HMGP, VTRANS	See Appendix B and Appendix G.

Objective and Associated Actions	Partners	Potential Funding Sources	Implementation Location
Action 50- Protect undeveloped headwater areas to promote flood resiliency and aquatic habitat protection through revisions to town plans and zoning bylaws	TRORC, DEC, municipalities	604 (b), ERP, MEF	Watershed-wide
Action 51- Delineate river corridors and develop river corridor build-out analysis for stream reaches significantly impacted by TS Irene and share information with planning commissions and select boards	DEC, TRORC, and municipalities	604(b), ERP, MPG	See Appendix B and Appendix G

List of Acronyms

319 Federal Clean Water Act, Section 319
604(b) Federal Clean Water Act, Section 604b
AAP Accepted Agricultural Practice
AEM Agricultural Environmental Management Agency Vermont Agency of Natural Resources
AMA Agricultural Management Assistance Program
AMP Acceptable Management Practice
ANS Aquatic Nuisance Species
AOP Aquatic Organism Passage
AR American Rivers
ARS Agricultural Resource Specialist
B1 Class B Water Management Type 1
B2 Class B Water Management Type 2
B3 Class B Water Management Type 3
BASS Biomonitoring and Aquatic Studies Section, Vermont Water Quality Division
BBR Better Backroads
BMP Best Management Practice
C&C Clean & Clear Program
CWSRF Clean Water State Revolving Fund
CRP Conservation Reserve Program
CREP Conservation Reserve Enhancement Program
CRWC Connecticut River Watershed Council
CWA Federal Clean Water Act
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
EQIP Environmental Quality Incentive Program
EU Existing Use
FAP Farm Agronomic Practices
FEH Fluvial Erosion Hazard
FERC Federal Energy Regulatory Commission
FSA Farm Service Agency (USDA)
GIS Geographic Information System
IDDE Indirect Discharge Elimination
LID Low Impact Development
LIP Landowner Incentive Program
LTP Land Treatment Planner
LWD Large Woody Debris
MAPP Monitoring, Assessment and Planning Program
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
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
SGA Stream Geomorphic Assessment
SPA Source Protection Area
TFS Trees For Streams
TMDL Total Maximum Daily Load
TNC The Nature Conservancy
TRORC Two Rivers Ottauquechee Regional Commission
TS Tropical Storm (Irene)
TU Trout Unlimited
USDA United States Department of Agriculture
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
VAAFM Vermont Agency of Agriculture, Food and Markets
VABP Vermont Agricultural Buffer Program
VANR Vermont Agency of Natural Resources
VDHP Vermont Department of Historic Preservation
VDH Vermont Department of Health
VEM Vermont Emergency Management
VFB Vermont Farm Bureau
VFWD Vermont Fish and Wildlife Department
VGS Vermont Geological Survey
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

References and Resources

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

A Genetic Classification of Floodplains, Geomorphology, 4 (1992) 459-486 . G.C. Nanson and J. C. Croke

Assessment of the Environmental Effects Associated with Wooden Bridges Preserved with Creosote, Pentachlorophenol, or Chromated Copper Arsenate. Kenneth M. Brooks for the USDA Forest Service Forest Products Laboratory.

Ayers Brook River Corridor Management Plan, June 22, 2007. Michael Blazewicz and Mary Nealon, Bear Creek Environmental for the White River Partnership.

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.

Connecticut River Watch Program Summary Reports, 1990 - 1993.

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 K. Bates and 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

Impacts to Stream Habitat and Wild Trout Populations in Vermont Following Tropical Storm Irene – Kirn, R. 2012. Vermont Fish and Wildlife Department Annual Report.

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

River Corridor Plan for the White River and Tributaries in Sharon, Vermont, March 15, 2010. Prepared by Fitzgerald Environmental Associates, LLC for Two Rivers-Ottauquechee Regional Planning Commission

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.

Town Road and Bridge Standards, January 23, 2013

Tropical Storm Irene and the White River Watershed of Vermont: Flood Magnitude and Geomorphic Impacts, 2012. George Springston, Kristen Underwood, Keith Robinson, and Ned Swanberg.

Tweed River Watershed Corridor Plan, April 18, 2008. Prepared for the White river Partnership and Vermont Agency of Natural Resources, Department of Environmental Conservation by Redstart Consulting.

Upper White River Corridor Plan, July 2007. Prepared by Redstart Consulting for the White River Partnership

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.

Water Quality Remediation, Implementation and Funding Report, 2013. Prepared for the Vermont General Assembly in Accordance with Act 138 (2012), Section 119 Water Quality Remediation, Implementation, and Funding Report

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.

White River Basin Water Quality Management Plan, November 1975. Agency of Environmental Conservation, Department of Water Resources (now the Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division).

White River Basin Plan, December 2002. Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division.

White River Watershed Assessment: Third Branch Stream Classification, February 2001. Prepared for the White River Partnership by the USDA Natural Resources Conservation Service.

White River Watershed Water Quality and Aquatic Habitat Assessment Report, 2013. Agency of Natural Resources, Department of Environmental Conservation, Watershed Management Division.

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 of silvicultural activity generally approved by regulatory authorities and practitioners as acceptable and common to that type of operation. AMPs may not be the best methods, but are acceptable.

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

Basin - one of 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).

White River Basin Plan Appendices

Appendix A. Existing Use Tables

Appendix B. Impact to White River Watershed's Fisheries from Irene

Appendix C. Lakes and Ponds Assessment for the White River Basin

Appendix D. Didymo and Aquatic Invasive Species and Fish and Wildlife Pathogen Precautions

Appendix E. Vermont's Agricultural Environmental Management (AEM) Program for the White River Basin

Appendix F. Medium and High Priority Basin Class 4 Road Sites for Restoration

Appendix G. White River Basin River Corridor Planning Summaries and High Priority Project Recommendations

Appendix H. Regulatory and Non-regulatory Programs that contain BMPs Applicable to Protecting and Restoring Waters in the White River Basin

Appendix I. Basin Plan Public Comments and Responsiveness Summary

Appendix A – Existing Use Tables

Swimming as an Existing Use

There are a number of popular swimming holes both on the White River mainstem and on its tributaries. The locations described below are also generally some of the most scenic and aesthetically pleasing spots on the river. Recreational tubing is also a major contact recreation activity on most of the main stem downstream of Rochester and in the lower portions of the Tweed River. All sites listed on Table A.1 are significant for swimming. Most of the sites listed here are accessed through publicly owned lands such as stream crossing right-of-ways. Many locations that are privately owned with private access are not included in Table A.1. Landowner permission should be sought before using these resources.

Table A.1. Name and location of swimming sites* in the White River Basin

Swimming Sites Name, Waterbody	Town	Location
Hancock Overlook, White River	Hancock	On Rt. 100, 910 ft. north of Rt. 125
Silver Lake State Park, Silver Lake	Barnard	East side of Hill Rd.
Clifford Park, White River	West Hartford	Off Westfield Drive (located off Quechee West Hartford Rd.)
Lyman Point, White River	Hartford	Intersection of Prospect and Maple St.
Watson Park, White River	Hartford	White River Junction
West Hartford Bridge, White River	Hartford	Gravel pullout on north side of bridge on river side of Route 14
Mill Brook confluence with the White River	Pomfret	Parking area at White River Lane and Pomfret Road
Fisherman's Rapid, White River	Sharon	River side of Route 14
Quarter Mile Put-in, White River	Sharon	Pullout river side of Route 14

Sharon Dam, White River	Sharon	Gravel access road off Route 14
Sharon Bridge, White River	Sharon	Paved pullout on River Road side of bridge
VTrans Quonset Hut, White River	Sharon	Pullout on VTrans Garage access drive
White Brook Road, White River	Sharon	Pullout across from White Brook Road
Sharon Academy Pullout, White River	Sharon	Large pullout across from Sharon Academy
Sharon River Access, White River	Sharon	Parking area
Avery's Rock, White River	Royalton	Paved pullout on river side of Route 14
Vermont Law School, White River	South Royalton	VLS parking lot
Payne's Beach, White River	Royalton	Lion's Club parking lot
Sinclair Rock, White River	Royalton	Small pullout on Route 14
Pinch Rock, White River	Royalton	Gravel pullout
Royalton Bridge, White River	Royalton	Fire hydrant access road with public parking area
Fox Stand Bridge, White River	Royalton	VFWD parking area
Peavine Park, White River and Third Branch confluence	Bethel	Town park parking lot
Cleveland Brook Pullout, White River	Bethel	VTrans pullout Route 107
Route 107 Pullout, White River	Bethel	VTrans pullout Route 107
Gayesville Bridge, White River	Stockbridge	Post Office parking lot

Stony Brook Bridge, White River and Stony Brook confluence	Stockbridge	Route 107 south of Stony Brook bridge pullout
Cobb Bridge, White River	Stockbridge	Blackmer Blvd. river right
Refrigerator Flats, White River	Stockbridge	VFWD parking lot off Route 107
Tweed River at Route 107 Bridge	Stockbridge	Route 107 bridge pullout
Lower Tweed River, White River	Stockbridge	Upstream of Timber Hawk parking lot
Peavine Stockbridge, White River	Rochester	GMNFS parking area on Pit Road just north of Route 100
Jerusalum Hill Pullout, White River	Rochester	Pullout on Route 100 across from Jerusalum Hill Road
Liberty Hill Road Bridge, White River	Rochester	Parking area upstream of Liberty Hill bridge on river right
Wildwood Flower, White River	Rochester	Route 100 pullout upstream of the State Garage Road bridge
Route 73 Bridge, White River	Rochester	Route 100 pullout upstream of Route 73 bridge
Rochester Recreation Fields, White River	Rochester	Town recreation field parking area
Lions Club Park, White River	Rochester	Intersection of Route 100 and Beans Bridge Road
River Bend, White River	Rochester	GMNFS parking area river left downstream of Route 100 bridge across from Quarry Hill Road
Hancock Overlook, White River	Hancock	GMNFS parking area river right upstream of Hancock Village
CCC Camp, West Branch	Rochester	GMNFS parking area off Route 73

Third Branch Floodplain Forest, Third Branch	Randolph	Parking area just past Prince Street
Randolph Recreation Field, Third Branch	Randolph	Town recreation field parking lot
Tunbridge Recreation Field and pool, First Branch	Tunbridge	Town recreation field parking area
Chelsea Recreation Park	Chelsea	Downstream of Chelsea Village, Route 110 recreation parking area

*Many of these sites also provide recreational boating, tubing, and fishing access.

Recreational Boating as an Existing Use

The White River has one of the longest uninterrupted kayak runs on a major river in New England and is known nationally for this fact. From Stockbridge to Bethel, the river is considered a classic Vermont whitewater run. The first three miles from Stockbridge contains intermittent Class II rapids. The last three miles to Bethel are quickwater. From Bethel to the Connecticut River, the river is mostly quickwater, but there are a variety of short drops and narrows and Class II rapids.

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

The Third Branch of the White River is boatable from Roxbury to Randolph. Whitewater boating also takes place on the Hancock Branch, from its confluence with the Robbins Branch to the White River. The Hancock Branch is hydrologically distinguished by being the smallest stream in the state known to be used as a whitewater run. It is a Class II run with some Class III spots, lots of rocks and current.

A number of locations are good whitewater boating stretches in the basin. The White River main stem is used extensively for flat water canoeing and kayaking by the several local outfitter businesses as well as the general public. All sites listed on Table A.2 are rated significant for boating (DEC, 1989) or were otherwise brought to DEC's attention. Many canoe access areas and dam portages have been established on the main stem. Anyone boating these reaches should carefully scout routes before launching.

Table A.2 . Waters used for recreational boating in the basin

Location	Documentation	Rating (DEC, 1989)	Characteristics that support use	Put in	Take out
Hancock Branch (3 miles)	Vermont's White Water Rivers	Important	No dams, good water quality, Class II-III rapids	Road to Texas Falls	Not specified
White River Mainstem Stockbridge to Bethel (11 miles)	AMC River Guide, Vermont's White Water Rivers	Highly Important	No dams, good water quality, quick water through Class II rapids	Rt.14 or Rt. 100	Rt. 107 Bridge
White River Mainstem Bethel to Connecticut River (25 miles)	Vermont's White Water Rivers	Highly Important	No dams, good water quality, quick water though Class II rapids	Rt. 107 Bridge	Bridges at White River Junction
First Branch Chelsea to Tunbridge (9 miles)	AMC River Guide, Vermont's White Water Rivers	Important	good water quality, Class II-III rapids	Lower Rt. 110 bridge from side road with permission	Before sawmill dam when river is near Rt. 110

Recreational Fishing

There are many sites in the watershed where angling occurs. The Vermont Fish and Wildlife Department (VFWD) owns several direct public access for fishing. Some of the fishing access areas are included in the Table A.3 below.

Table A.3 Recreational Fishing as an Existing Use of Specific Waters within the White River Watershed

Site Name/Waterbody	Location	Documentation
Ansel Pond	Sanders Road, Bethel	VFWD Access
McIntosh Pond	McIntosh Pond Road, Royalton	VFWD Access
Rood Pond	Rood Pond Road, Williamstown	VFWD Access and riparian lands
Colton Pond	State owned land surrounding pond, dam, and access area	VFWD Access and riparian lands
Silver Lake	Vermont State Campground, Barnard	VDFPR State Campground
Streams		
White River	From the Route 100 Bridge in Stockbridge to the Railroad Bridge in West Hartford	Greater than 400 angler hours/mile*
White River	I-89 overpass, West Hartford Village	VFWD riparian land
White River	Foxstand Royalton Hill Road- both sides of the river, Royalton	VFWD Access and riparian lands
White River	Downstream of Tweed River confluence on the south bank, Stockbridge (Feigenwinter parcel)	VFWD riparian land
White River	Downstream of confluence of Locust Creek on the south bank, Bethel	VFWD riparian land
White River	Confluence with Lilliesville Brook- both sides of the White River, Stockbridge	VFWD riparian land
White River	Downstream of Bethel Bridge along the south bank at Graham Street, Bethel	VFWD riparian land
Tweed River	South bank between Bartlett Brook and Route 107 Bridge, Stockbridge	VFWD riparian land
Tweed River	South bank at the confluence with the White River, Stockbridge (Stanley Works parcel)	VFWD riparian land
Stony Brook	The riparian lands upstream of the Davis Hill Brook confluence contained within the Nes Newell WMA, Stockbridge and Barnard	VFWD Les Newell Wildlife Management Area
Perkins Brook	All, Stockbridge	VFWD Les Newell Wildlife Management Area

Site Name/Waterbody	Location	Documentation
Davis Hill Brook	All Davis Hill Brook lands within the Les Newell WMA	VFWD Les Newell Wildlife Management Area
Johnson Brook	All Johnson Brook lands within the Les Newell WMA	VFWD Les Newell Wildlife Management Area
Taggort Brook	All Taggort Brook lands within the Les Newell WMA	VFWD Les Newell Wildlife Management Area
Fletcher Brook	All of Fletcher Brook lands within the Les Newell WMA	VFWD Les Newell Wildlife Management Area
Locust Creek	Upper Locust Creek watershed riparian lands within the Lest Newell WMA	VFWD Les Newell Wildlife Management Area
Pond Brook	Blackmer Road, Barnard (One rod strip approximately 200 feet long on each side of Pond Brook north and south of Blackmer Road)	VFWD riparian land
First Branch	Below Moxley covered bridge, Chelsea	VFWD riparian land
First Branch	Foundry Road, Tunbridge (One rod strip along both banks north of Foundry Road for 7/10 mile)	VFWD riparian land
First Branch	Justin Morrill Highway, Tunbridge (One rod strip about 955' along the west bank between Tuttle Brook confluence north to the mouth of the unnamed tributary that flows into the First Branch from the west.	VFWD riparian land
Second Branch	Upstream of Braley Road, Randolph (One rod strip on the east bank from Braley Road covered bridge north ~7/10 of a mile)	VFWD riparian land
Second Branch	Route 14 and Kingsbury Road, Randolph	VFWD riparian land
Third Branch	From VDFW offices in Roxbury downstream to the first train trestle crossing	VFWD riparian land
Third Branch	Above and below the confluence with Riford Brook, Braintree	VFWD riparian land
Third Branch	Above and below the confluence with Ayers Brook at Montague Golf Club	VFWD riparian land
Thayer Brook	Thayer Brook riparian areas in the upper watershed within the Rochester WMA	VFWD Rochester WMA
Riford Brook	Riford Brook riparian areas in the upper	VFWD Rochester

Site Name/Waterbody	Location	Documentation
	watershed with the Rochester WMA	WMA

* A significant component of the fishery dependent upon wild trout.

Drinking Water Supplies

Drinking water systems within the watershed include impoundments, lakes, ponds, streams, well points, dug wells, gravel, and gravel screened wells, gravel open-end casings, rock wells and springs. Waters within the watershed that are designated as drinking water supplies are listed in Table A.4. Most other municipalities in the watershed use ground water wells for drinking water supplies

Surface waters used for public drinking water supplies are Lake John in Royalton. In addition, a surface water infiltration gallery for the White River in Royalton is currently in the process of being permitted. The number of surface waters used for private drinking water supplies is unknown.

Table A.4. Water Supply as an Existing Use within the White River Watershed.

Water Body	Location	Extent	Documentation
Lake John	Royalton	Lake John and waters within its watershed	Village of South Royalton and Fire Department #1 water supply
White River (new listing)	South Royalton	Intake at Carpenter Field	Village of South Royalton secondary water supply

Appendix B - Impact to White River Watershed's Fisheries from Irene

Damage suffered from Tropical Storm Irene required immediate and in some cases extensive stream channel alteration to protect life and property and rebuild critical transportation infrastructure. However, a significant amount of instream activity was also conducted without proper consultation and oversight or for reasons beyond necessary flood recovery. These activities continued for several months after the flood event and covered a wide area of the central and southern portion of the state.

Post-flood activities which were detrimental to aquatic habitat quality and diversity included large scale removal of streambed material and natural wood, berming of streambed materials to raise streambank elevations and the straightening of stream channels. These activities resulted in homogeneous, overwidened stream channels comprised of small substrates and lacking the diversity of habitats, flows and depths necessary to support robust aquatic populations.

Long-term monitoring studies in Vermont indicate that, in the absence of post-flood channel alterations, wild trout populations generally recover within 2-4 years. Where aquatic habitat has been severely altered through streambed and natural wood mining, channel widening and straightening, complex habitat features will need to re-establish before improvements in fish and aquatic populations can be expected. While relatively short reaches of impacted streams may recover in a matter of years, the recovery of longer reaches may take decades and will depend upon the availability and mobility of upstream sources of coarse streambed material and natural wood, as well as the magnitude and frequency of future flood events.

The *Irene Recovery Report* indicated that the state transportation system incurred damage to over 200 road segments and 200 bridges, while towns reported over 2,000 road segments, 300 bridges and more than 1,000 culverts were damaged or destroyed (Lunderville 2011).

Vermont Department of Fish and Wildlife staff conducted roadside assessment of in-stream habitat degradation throughout the central and southern portion of Vermont. In some instances, assessments were obtained from Agency of Natural Resources and watershed organization staff intimately familiar with specific stream reaches. Field maps were used to demarcate reaches of stream with minor or major in-stream habitat degradation as described below:

1. **Minor –** Channel activities limited to providing channel dimension and/or capacity <u>or</u> are confined to a localized area directly associated with restoring transportation infrastructure (bridge, road) or protecting buildings, water supply, wastewater system, etc. from imminent loss. Diversity of streambed materials and sizes and other

habitat structural features (e.g. large wood, woody riparian vegetation) are little changed. Examples:

a. Streambank stabilization (e.g. riprap) largely done from top of bank.
b. Berming using only alluvium deposited in floodway and not from within channel.
c. Limited removal of large wood or streambed deposits that obstruct channel(s) and/or pose direct threat to transportation infrastructure.

2. **Major –** Channel has been significantly altered resulting in bed largely devoid of habitat features. Includes the removal of coarse materials and/or large natural wood. Channel is substantially homogenized.

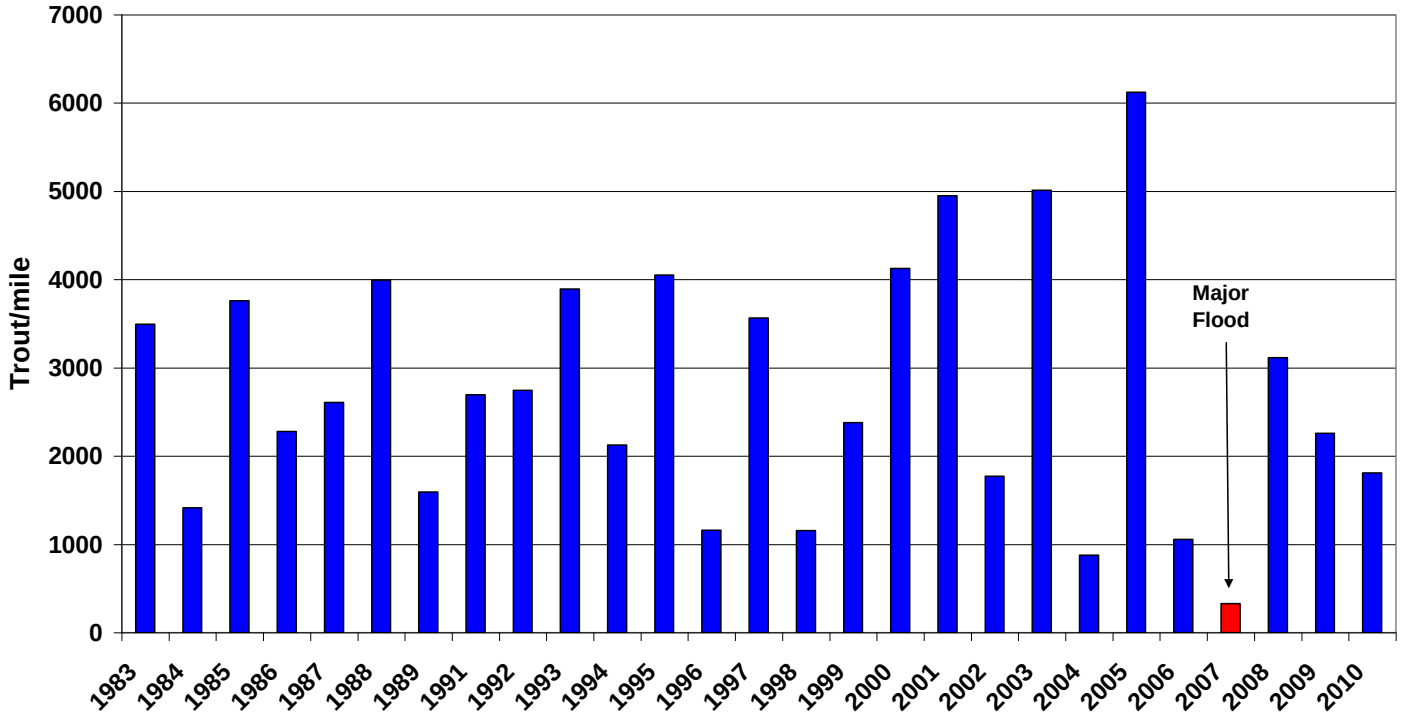
   Examples:

   a. Extensive channel straightening and widening.
   b. Streambed substrate and large natural wood extraction.
   c. Channel berming involving streambed materials.

Watershed	Subwatershed	Major impact (feet)	Minor impact (feet)
White River	Mainstem	12550	0
	Alder Meadow Brook	4000	10650
	Broad Brook	1340	0
	First Branch	200	0
	Hancock Branch	12800	0
	Lilliesville Brook	5000	1600
	Locust Creek	10000	0
	Stony Brook	11300	0
	Third Branch	54110	2020
	Tweed River	15050	0

	West Branch	11300	0
	Marshs Brook	1500	0
	Nason Brook	1700	0
	Clark Brook	500	0
	unnamed tributary	1700	
	watershed total	143050	14270

Figure 3. Lilliesville Brook Wild Trout Populations
Vermont Department of Fish and Wildlife Surveys
1983-2010



Appendix C - Lakes and Ponds Actions the White River Basin (X indicates high priority items)

LAKE	Town	Acres	Lakeshore Assessment Priority?	Shoreland Protection & Conservation Easements?	LakeWise Priority?
CRESCENT	Sharon	17.84	X (Done)	X	
LAMSON	Brookfield	26.46		X	
MITCHELL	Sharon	27.58		X	
MUD (BRAINT)	Braintree	4.68	X	X	
NORTH (BRKFLD)	Brookfield	27.59		X	
NORTH (CHITDN)	Chittenden	4.80	X	X	
PICKLES	Brookfield	15.05	X	X	
ROOD	Williamstown	23.60		X	
SILVER (BARNRD)	Barnard	80.99			X
SOUTH (BRKFLD)	Brookfield	17.07		X	
SUNSET (BRKFLD)	Brookfield	24.62			X
TWIN	Brookfield	15.39		X	

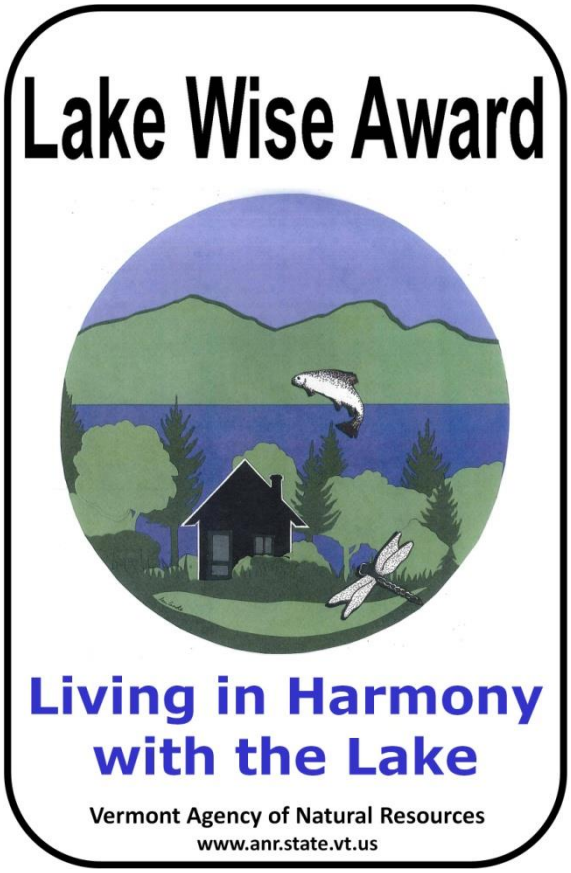
The Vermont Lake Wise Program

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

To learn more about Lake Wise contact Amy Picotte at amy.picotte@state.vt.us or (802) 490-6128



Appendix D – Didymo and Aquatic Invasive Species and Fish and Wildlife Pathogen Precautions.

As recreational or professional users of Vermont's aquatic resources, we all have the potential to spread aquatic invasive species, didymo, and fish and wildlife pathogens from stream to stream and watershed to watershed. Responsible stewards of our state waters take precautions to minimize the spread of these threats.

Follow these 'Best Practices' to minimize the spread of aquatic invasive species, didymo, and fish and wildlife pathogens. This approach is modeled after New Zealand's widely-used 'Check, Clean, Dry' strategy. While designed to address the spread of didymo, these practices will help to minimize the spread of aquatic invasive species and fish and wildlife pathogens as well.

BEST PRACTICES for minimizing the spread of didymo, other aquatic invasive species, and fish and wildlife pathogens while using Vermont's waters:

- All Users - Disinfect your gear, boat, and everything else that comes in contact with the water before traveling between different bodies of water or watersheds. For disinfection procedures, visit
- http://www.anr.state.vt.us/dec/waterq/lakes/htm/ans/lp_didymo.htm
- All Users - If you move around to fish, boat, play or work, construct and use a simple, portable disinfection kit.
- All Users - When possible, fish, boat, play or work in a single waterbody in a single day, rather than traveling between multiple water bodies without appropriate precautions.
- All Users - Visually inspect your boat, gear and equipment before entering and leaving the water. Remove all plants, plant fragments, animals, mud or other debris and discard in the trash.
- Anglers - When practical, fish in a downstream direction. This doesn't mean you can't wade upstream a bit to fish that nice run upstream – think on a watershed scale. By fishing at the mouth of a large river in the morning, then going to the headwaters in the afternoon without disinfecting your gear, you've potentially spread didymo upstream to the whole stream, which may not be infected. Most algae and aquatic invasive species can't swim upstream.

- Anglers - Consider the use of easily disinfected wading gear.
- Anglers, Guides, Outfitters - Designate waders/boots/canoes/tubes etc… for different watersheds or have multiple sets available for same-day travel, when needed.
- Canoeists, Kayakers, Boaters, Tubers - Remove drain plug and drain any water prior to leaving boat loading/unloading area. Don't move water between waterbodies.

For more information regarding aquatic invasive species, contact Ann Bove at

(802) 490-6120 or ann.bove@state.vt.us

Appendix E - Vermont's Agricultural Environmental Management (AEM) Program for Basin 9.

The Agricultural Resource Specialist (ARS) Program is offered by the Vermont Association of Conservation Districts (VACD) and supported by funding from the Vermont Agency of Agriculture. One service ARS staff offer to farmers is the Agricultural Environmental Management (AEM) program. The AEM program is a statewide, confidential, and voluntary program that helps landowners protect the quality of their natural resources—the foundation of a farm's economic viability and longevity. Farmers are important stewards of Vermont's working landscape and through the five-tiered AEM program, ARS staff help landowners: 1) assess conservation needs, 2) document farm practices, 3) prioritize farm improvements, 4) gain access to State, Federal and Conservation District cost-share programs, and 5) evaluate results to maximize efficiency of farm management practices.

By farmer request, or through outreach efforts, ARS Staff meet on the farm with stakeholders over several planning visits. Over the course of these visits, ARS Staff draw on local natural resource conservation specialists—engineers, agronomists, and other planners—to ensure that conservation recommendations and practices are planned and tailored to match each farm's unique characteristics. This collaborative process seeks to identify the most effective means to solve a resource concern to benefit both the natural environment and farm efficiency as much as possible. For example, in planning a livestock exclusion project for streambank protection, discussion with stakeholders can bring up points which illustrate both the conservation benefit and the improved farming efficiency of a practice. With the installation of exclusion fencing along the brook, and a watering trough installed in each paddock, thirsty livestock no longer need to travel a half mile to drink in the brook. Now, animals are off of the streambank and more of their time can be spent grazing and ruminating, improving weight gain rates and profits for a beef operation.

The VACD ARS program actively seeks out small farms that are willing to collaborate in the conservation planning process. For 2013, ARS staff statewide are using the AEM process to develop and implement up to nine simple, cost-effective conservation projects funded through an Ecosystem Restoration Grant from Vermont's Agency of Natural Resources. Project examples include: improvement of animal trails and laneways, upgrading and improving barnyard areas, and installation of fencing and stream crossings to limit uncontrolled access to waterways by farm animals. Where projects identified for implementation are more costly, ARS staff will help farmers apply for alternative funding sources through State and Federal cost-share programs. The AEM process aims to take a holistic look at a farm operation and help farmers connect with the resources required to meet their management challenges.

Appendix F. Medium and High Priority Basin Class 4 Road Sites for Restoration

Road Name	Town	Erosion Priority Ranking	Full or Partial Implementation Completed (Y or N)
Taylor Hill Road	Brookfield	High	N
Beedle Road	Chelsea	High	N
Wilbur Fiske Road	Tunbridge	High	Y
TH 44	Washington	High	N
TH13	Chittenden	High	Y
Cram Hill Road	Roxbury	High	Y
Chateauguay	Barnard	High	N
Kennedy	Granville	High	N
Frye (segment 1)	Tunbridge	Medium-High	N
Frye (segment 2)	Tunbridge	Medium-High	N
Maple Hill	Hancock	Medium	N
Braintree Mountain Road	Braintree	Medium	Y
Carpenter Road	Chelsea	Medium	N
Clay Slide	Washington	Medium	N
Liberty Hill	Pittsfield	Medium	N
Raynor	Roxbury	Medium	Y
Winterberry	Bethel	Medium	N
Sue Spaulding Road	Norwich	Medium	N
Burton Woods	Norwich	Medium	Y
Freeman	Pomfret	Medium	N
TH 45	Rochester	Medium	N
Sugarhouse Road	Sharon	Medium	Y
Clifford Farm Road	Sharon	Medium	Y
Fletcher Brook Road	Stockbridge	Medium	N
Stony Brook Road	Stockbridge	Medium	N
TH 37	Stockbridge	Medium	N
Smith Hill	Barnard	Medium-Low	N

Appendix G- White River Basin River Corridor Management Plan Summaries and High Priority Recommendations

Lower White Sub-basin- (mouth to Royalton-Sharon line)**-** info from River Corridor Plan for the White River and tributaries in the Town of Sharon, 2010 and DEC Water Quality and Aquatic Habitat Assessment Report, 2013)

- Quation Brook- 5 high priority culvert replacements/retrofits for geomorphic compatibility or AOP
- Fay Brook**-** 2 high priority culverts replacements/retrofits and 1 bridge replacement
- Elmer's Brook- 2 high priority culverts and 1 bridge replacement
- Broad Brook- 1 high priority culvert
- White River- 2 high priority bank failures/erosion
- Several river corridor easements/buyouts and buffers proposed
- Broad Brook- major WR spawning trib
- Whitewater Brook- heavily used spawning stream for rainbow trout.
- Mitchell Brook- AOP barriers I-89 and Route 14
- Podunk Brook- I-89 and Route 14 AOP barriers
- Restoration of habitat and stream equilibrium in reaches dredged post TS Irene (lower Broad Brook, Sharon)

Middle White River Sub-basin (Tweed to Royalton-Sharon town line) info from DEC Water Quality and Aquatic Habitat Assessment Report, 2013

- P2 and River Corridor Management Planning underway in the Town of Bethel main stem reaches and direct tribs and Third Branch
- Restoration of habitat and stream equilibrium in reaches dredged post TS Irene (Lilliesville, Locust Creek, and Stony Brook)

Upper White Sub-basin (above Tweed) info from DEC Water Quality and Aquatic Habitat Assessment Report 2012, Upper White River Corridor Plan 2007, and Upper White Integrated Resource Project USFS 2010

- Seven stream crossings have been targeted for replacement in Rochester post-Irene and will accommodate AOP (White River AOP committee- funded allocated) *(2 crossings replacement projects completed)*

- Many reaches are channelized/incised and lost flood plan access and serve as transport reaches. Most reaches are 'sensitive' to disturbance.
- Flood plain restoration and protection is a priority.
- Sedimentation and associated degradation of aquatic habitat are primary issue of concern mostly from erosion from steep valley wall slopes and bank erosion
- River corridor protection (R18, R19, R20, R21, R22, R23, R24A/B, R25)
- Fencing/buffers (R18A, R19, R20, R22, R23, R24A/B, R25)
- Structure upgrades/removals (R18C, R21A)
- Active in-stream/flood plain restoration (R19A/B, R20, R22, R24A/B, R25)
- Higher water temps and in-stream sedimentation
- Increase LWD/mile (double) and improve AOP at crossings in Clark, Patterson, and Deer Hollow Brooks (USFS goal- 2 miles)- *(completed by USFS)*
- Increase buffers in Bowl Mill River section (Granville)
- Restoration of habitat and stream equilibrium in reaches dredged post TS Irene (West Branch, Hancock Branch, Upper White main stem Granville to Stockbridge line, Nason Brook, Marshs Brook, and Clark Brook)

Tweed River Sub-basin (from Tweed River Watershed Corridor Plan, 2008 and DEC Water Quality and Aquatic Habitat Assessment Report, 2013)-

- Several high priority fencing and buffer projects were identified
- Several river corridor protection projects identified
- Replace structures- Stonewood Crossing and Baker's Road (T6.04A and B)
- Restoration of a high priority incised reach was identified in reach T6.03 Tweed River (B and C)
- Arrest headcut Tweed River (T6.06)
- Replace Guernsey Brook Route 100 stream crossing *(done- post-Irene)*
- Additional bridge and culvert assessment data needed
- Post-Irene stream crossing update- 1 undersized town culvert in Killington failed and will be replaced with BF+ AOP ☺ structure; 1 undersized culvert failed and replaced with BF+ AOP ☺ bridge, 3 private undersized bridges failed- one replaced with BF+AOP ☺ bridge (Stonewood Crossing structure above), one not replaced, and one replaced with pre-Irene undersized bridge; and one Pittsfield town failed bridge repaired (approximately BF). Baker's Road structure (identified for replacement above) was plugged and took out road but did not fail (not replaced).
- Restoration of habitat and stream equilibrium in reaches dredged post TS Irene (Tweed River and lower reaches of Michigan Brook)

First Branch Sub-basin (preliminary First Branch River Corridor Management Plan recommendations from Dan Ruddell, Redstart Consulting, 2013)

- P2 and River Corridor Planning underway on the First Branch. Preliminary recommendations include: the identification of high priority buffer and river corridor protection reaches in Chelsea and Tunbridge, possible partial or full removals of dams in Chelsea, a possible berm removal in Tunbridge, a road configuration, and abridge abutment removal in Tunbridge. The Town of Tunbridge is currently considering a Fluvial Erosion Hazard Overlay District.

Second Branch Sub-basin

- Additional assessment needed for possible higher E. coli, sediment/bank erosion
- Need Phase II and River Corridor Plan
- Need Wetland inventory

Third Branch Sub-basin (from DEC Water Quality and Aquatic Habitat Assessment Report, Gerhardt Report, and Ayers Brook River Corridor Plan)

- 6.5 miles of important riparian wildlife habitat/travel corridor between Gilead Brook and Randolph Village on the Third Branch
- Additional geomorphic assessment scheduled for 2013-2014
- Restoration of habitat and stream equilibrium in reaches dredged post TS Irene (Gilead Brook, Camp Brook, Third Branch in Braintree

Ayers Brook (from Ayers Brook River Corridor Management Plan, 2007)

All reaches fell within the 'Fair" geomorphic condition indicating major active adjustments are occurring.

Twelve undersized stream crossing were identified on Ayers Brook as well as 5 old bridge abutments causing excessive degradation, aggradation, and/or scour in the river channel. Channel widening was found to be the dominant adjustment process on half the reaches assessed. Seventy five percent of the reaches assessed had little or no riparian buffers. One small dam is located on Farnsworth Brook.

In 1997 NRCS determined that "most of the sediment in the Third Branch system appears to be from streambank erosion in Ayers Brook and from streambank erosion downstream of Randolph."

Recommended Actions:

- Upgrade stream crossings- T2.04 (including Route 12 bridge), T2.03, T2.02, T2.01
- Minimize future encroachments
- Protect and reestablish woody riparian vegetation- T2.04, T2.03, T2.02, T2.01
- Livestock fencing- T2.04
- BBR practices
- Additional bridge and culvert assessment

Appendix H - Regulatory and Non-regulatory Programs Applicable to Protecting and Restoring Waters in Basin 9

The Vermont Surface Water Management Strategy maintains a continually updated roster of regulatory and non-regulatory technical assistance programs.

Regulatory programs may be accessed at:

http://www.vtwaterquality.org/wqd_mgtplan/swms_appA.htm

Non-regulatory programs may be accessed at:

http://www.vtwaterquality.org/wqd_mgtplan/swms_appD.htm

Appendix I - Basin Plan Public Comments and Responsiveness Summary

This Tactical Basin Plan was issued as a Public Review Draft coincident with a public meeting notice on May 14, 2013. Three public comment meetings were held to receive comment, on May 30th in Rochester, June 5th in Sharon, and June 6th in Bethel. Comments received at any time during the comment period, verbally or in writing, were catalogued and are responded to in this summary. The public comment period closed June 14th, 2013. In some instances where comments were redundant among multiple commenters, these were combined. Comments are summarized and addressed as follows. In addition, minor technical corrections made to the plan in revisions are also described.

Comment 1- Table 8 and 9 should specify totals and/or percentages of the total for clarity

DEC Response- Tables 8 and 9 (Pollutants or conditions that impair or stress water quality in Basin streams and lakes) now includes percentages.

Comment 2- The Section on Stormwater runoff deserves more attention. For example, simply because data is not available does not mean that stormwater management in the White River and other basins is not a priority. Instead, it simply means that the issue has not been studied. It should be, and the Implementation Table (formerly Table 18 now Table 24) should reflect this lack of information and appropriate steps to remedy it. VNRC also takes issue with the statement that LID practices can mitigate and prevent many stormwater issues. They can, but only if they are required and widely implemented which is not reflective of the current regulatory schema.

DEC Response- To date, the issues associated with stormwater runoff in the White River Basin have not been completely assessed which is why mitigation of stormwater runoff does not play a prominent role in this plan. However, it is clear that unmitigated runoff can have devastating consequences such as channel erosion, land erosion, nutrient loading, and even thermal stress. Although the White River Watershed is predominantly rural, some developed areas do exist (Bethel, Hartford, Randolph, South Royalton, etc.). In the coming years, DEC will lend support towards efforts to assess these areas. Efforts may include Illicit Discharge Detection and Elimination studies as well as Stormwater Master Planning. These assessments will allow for a better understanding of the effects of stormwater runoff in the basin, which will ultimately allow us to better target technical and financial resources.

Assessments of stormwater runoff in the basin will take time. However, we recognize that issues should be addressed sooner rather than later, especially given the history of stormwater issues in other watersheds (Winooski and Otter Creek). As a result, DEC is supportive of efforts to pro-actively mitigate stormwater runoff in the basin, especially if

those efforts involve the use of Low Impact Development (LID) and Green Stormwater Infrastructure (GSI) systems and practices. Many of the stormwater issues associated with developed lands can be mitigated and prevented through LID and GSI. 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.

Also, in terms of the action table, we have added additional actions related to:

- Outreach to towns regarding stormwater zoning and bylaws
- Technical assistance to towns

Comment 3- The section "Impacts or Stresses," among others, fails to recognize that the ANR has and must utilize its Residual Designation Authority and authority under Vermont law to abate pollution sources. In general, the document fails to recognize this authority and instead appears to assume that pollution abatement is voluntary. It is not. The document states in one instance that action will be considered "if the property owner grants permission for access to the site." Known violation of the Vermont Water Quality Standards requires action by the Agency. A similar approach is taken towards agricultural discharges in the basin. The Agency has and should exercise its authority to abate discharges from agricultural activities.

DEC Response- The Department continues to exercise Residual Designation Authority for stormwater discharges that contribute to a violation of water quality standards. To date, Residual Designation Authority (RDA) has been applied in five stormwater-impaired waters, statewide, and will be expanded to the remaining stormwater-impaired waters in the near future. Although there are no stormwater-impaired waters in the White River basin, the Department will implement RDA in the White River basin if warranted by the required factual analysis. (Also see Comment 16 and the DEC Response for additional information).

Comment 4- VNRC urges the Agency to consider creation of a document that guides organizations through the Outstanding Resource Water designation process. This document would be of tremendous value to local and statewide organizations wishing to recommend such a list. However the Agency should also consider the benefits of them undertaking these designations as well.

DEC Response- The idea of developing a document to guide organizations through the ORW designation process is a good one. DEC will seriously consider developing such a document. DEC is currently developing more specific, science-based criteria for reviewing potential waters for Outstanding Resource Water Designation. Additionally, DEC is working with the Legislature in determining the process of designating waters as ORW.

Comment 5- We suggest further refinement and including more basin-specific information on the Section "Other High Quality Waters."

DEC Response- We describe specific Very High Quality and High Quality Waters and other significant watershed attributes within Chapter 2 in the Sub-watershed Description Section. The "Other High Quality Waters" Section is meant to only describe these waters in general terms and, in addition, some references used in identifying High Quality Waters.

Comment 6- Where acronyms or program terms are used they should be explained so that the document is more accessible to the lay person (i.e. what is a "303d list", "stressor", "encroachment", "Agricultural Environmental Management", etc.).

DEC Response- In a few instances, acronyms were used before they were fully described within the tactical plan. The plan was revised to always include a full description of programs or organizations with acronyms in parenthesis after the first mention of that program or organization and then abbreviated with an acronym thereafter. The revision also now includes referencing to sections within the plan that further describe the organization or program included within the plan or appendices. For example Agricultural Environmental Management (AEM, Appendix…)

Comment 7- Since the Plan refers to the "West Branch" of the White River as a major tributary, adding Ayers Brook, which is of equal importance, would seem appropriate.

DEC Response- For the purposes of watershed planning, the White River watershed was divided into major planning sub-watersheds or sub-basins. These planning sub-basins include: the Upper, Middle, and Lower White, the First, Second, and Third Branches and the Tweed River sub-basins. Neither the West Branch nor Ayers Brook have been identified as major watershed planning sub-basins. In the Watershed Description Section of Chapter 2, the West Branch was also called out and description of drainage area size. Ayers Brook was not specifically called out in this section of the tactical plan, it was described in detail later in Chapter 2 under the Sub-basin Description Section under the Third Branch. DEC recognizes that this is not consistent and could cause confusion. Therefore, DEC has moved narrative about the West Branch to the Sub-basin Section for better consistency.

Comment 8- Two Rivers-Ottauquechee Regional Commission is referred to by several different acronyms/"nicknames" (TRORC, TRORPC, 2 Rivers) in the draft and we recommend using "TRORC," and adding this to the acronym list.

DEC Response- The inconsistencies within the plan describing Two Rivers Ottauquechee Regional Commission acronyms has been changed to TRORC.

Comment 9- Figure 3 loses distinction when reproduced in black and white.

DEC Response- DEC recognizes that Figure 3 loses distinction when reproduced in black and white. We feel that most readers will be reviewing the document electronically. DEC can accommodate plan reviewers with hard copies of the plan for those without internet access.

Comment 10- It is not clear why Mitchell and North (Brookfield) ponds were not listed on page 22 just above Section C.

DEC Response- Mitchell Pond (Sharon) and North Pond (Brookfield) are now included within Table 7 (Lakes and Ponds in the Basin that exhibit Very High Quality).

Comment 11- Figures on total numbers of waterbodies and stream miles in the basin would be good to have, perhaps at the start of Chapter 2.

DEC Response- DEC has now added total number of waterbodies and stream miles for the basin in Chapter 2 under the Watershed Description Section.

Comment 12- Howe Brook and the main stem above mile 32.4 were listed in Table 3 but not Table 5 and we are not sure if this omission is an error.

DEC Response- Howe Brook and the upper main stem above river mile 32.4 were listed under Table 3 as streams supporting Very High Water Quality for ecological integrity, primarily based upon their consistently high ecological condition (very good to excellent ratings for biocriteria). Table 5 on the other hand describes stream reaches exhibiting Very High Water Quality for recreational fisheries. These Very High Water Quality criteria are distinctively different, hence the separate listings. VHQW recommendations can be based upon one or more attributes and are listed accordingly. It is DEC's intention to protect that specific attribute(s).

Comment 13- We believe that A1 reclassification is supported in additional areas, primarily headwater streams along the eastern ridge of the VT 100 valley. TRORC specifically did not propose A1 waters in our earlier efforts as we viewed changing any class B waters to A outside of our charge. We look forward to working with the agency on this particular issue.

As a general proposal, we support A1 classification on all upland streams in undeveloped, forested areas, within and outside of public lands, especially where they start as A1 waters. These are concentrated in the upland areas on the east and west sides of the VT 100 valley, the east side of the eastern range of the VT 100 valley and in headwaters areas in the northeastern corner of the watershed. We can prepare a stream specific list and map. The Agency's willingness to provide map-based comparisons of TRORC's recommendations and ANR's proposed reclassification should be commended, as it demonstrates a transparent process and, to a degree, the Agency's "thought process."

DEC Response- DEC agrees that there are likely additional waters in the basin that could be reclassified to A1 at a future date. Within this document, DEC listed all waters within the basin that could currently meet A1 criteria based upon existing water quality monitoring and assessment data. In addition, the Department also consulted with the USFS to develop the Tactical Plan recommendation of A1 reclassification for all surface waters within Designated Wilderness Areas. The justification for this latter set of surface waters is that all lands within nationally designated Wilderness are managed in their natural condition, an approach that is entirely consistent with the VWQS definition for A1 waters. DEC would support additional monitoring and assessment in the watershed which could identify additional A1 candidate waters. DEC also acknowledges that managing waters to A1 contains with it very strong regulatory and management implications, such as limiting the size of septic systems.

Comment 14- Non-point source pollution from agriculture is a concern as evidenced by the many actions that relate to it in the Implementation Table, but there is not any direct identification of this as a major concern in specific stretches as well as likely causes. There is (sic) likely available data that can be used to bracket these trouble spots more tightly. Farms only enjoy a presumption of compliance; any actual impacts to water quality remain violations.

DEC Response- DEC has now added a summary of the White River Partnership's long term *E. coli* monitoring summaries in tabular format for each sub-basin. Additionally DEC has added information contained within the river corridor plans (moved from the appendices to Chapter 2 in the Sub-basin description section. (Please see Comment 16 and DEC Response below for additional information).

Comment 15- "Tubing" is a major activity on the White from Rochester to the mouth of the river. We are not sure if this should be under boating or swimming, but contact recreation with the water is not limited to swimming holes and should be acknowledged.

DEC Response- Tubing is an important form of contact recreation in the watershed. The term "tubing" has been added to several sections of the latest Tactical Plan version.

Comment 16- more rigorous enforcement of permitting is not given as an action and should be as people need to know there might be consequences of violating permit conditions, AMPs or AAPs.

DEC Response- The Department recognizes its responsibility to address direct discharges from agricultural operations and works closely with the Vermont Agency of Agriculture (VAAFM) to ensure thorough and appropriate responses to complaints and concerns. DEC inspects farms annually, both with the Environmental Protection Agency and individually, and recently issued a CAFO (Concentrated Animal Feeding Operation) permit that gives DEC the authority to require farms that have discharges to obtain this DEC-administered permit, and will implement it in the White River Basin when appropriate.

In addition to DEC's authority, VAAFM oversees the state's Large Farm Operation individual permits, the Medium Farm Operation general permit and the Accepted Agricultural Practice regulations that are mandatory for all small farm operations. DEC and VAAFM have processes in place to ensure that all water quality concerns are handled quickly and appropriately. DEC hired a new agricultural water quality specialist last year to specifically address this regulatory coordination.

Additional language is added to the White River Plan to help clarify the Department's water quality regulatory authority and its firm commitment to enforcing violations of state regulations.

Comment 17- We commend the Agency recognition of very high quality lakes in the White River Basin: Rood, Mitchell, and North. However, it is somewhat unclear whether "Best Lakes" in Action 29 is referring to Rood, Mitchell, and North Ponds, or if it is referring to all lakes and ponds listed in Table 4 (which includes Rood, Mitchell, and North Ponds). If, in fact, Action 29 is referring to those 3 lakes (which we ultimately believe that it is), we ask that Rood, Mitchell, and North Ponds are specifically added to the "Implementation Location" column on the Implementation Table. This would make it very clear to the reader that the Agency intends to protect these very high quality waters by securing permanent lakeshore protection easements. As a further protection for Rood, Mitchell and North Ponds, the Agency may also consider monitoring water quality, biological diversity and other parameters to ensure none of the Basin stressors identified in Table 7 begin impacting each ecosystem.

DEC Response- Specific lakes have now been identified in the Implementation Table to clarify any confusion. Water quality of Rood, Mitchell and North Ponds will continue to be monitored as part of the Spring Phosphorus monitoring program. Local stewards of these lakes should be encouraged to become Lay Monitors for these lakes. This would assist the Agency in collecting summer trend data and potential earlier detection of changes in water quality from the stressors identified in Table 7. Each lake is included in the Comprehensive

Summer Lake Assessment rotation and will be sampled for summer water quality in the open water and at the outlet and inlets. This sampling effort also includes the sampling of littoral macroinvertebrates, sediment diatoms, crayfish, aquatic plants as well as littoral and riparian habitat quality. Mitchell is slated to be sampled in 2013 for a Comprehensive Summer Lake Assessment. Rood was sampled in 2012 as part of the National Lake Assessment and included many of the same parameters measured as part of the Summer Lake Assessment Program. North Pond was sampled in the early 2000s as part of the Lake Biocriteria Project where plankton, water quality and macroinvertebrates were sampled. These combined sampling efforts provide both baseline biological data as well as long term water quality data to be used in assessing changes to these lakes.

Comment 18- The statement in the middle of page 33, which states, "stormwater runoff is not currently a major priority within the White River watershed because little data about its impact exists" is troubling. Despite the area's rural character, now is the time to determine the effect of stormwater on the basin instead of treating it as a non-priority because little data exists. Gravel road runoff is a major contributor to sedimentation in smaller streams in the watershed. Action 22 in the Implementation Table calls out road runoff as an issue. In addition, areas such as Randolph and Bethel villages have large areas of impervious surface. We acknowledge that the Agency recognizes stormwater runoff can cause serious water quality problems, and some of the action items in the Implementation Table seek to address its potential impact. However, we suggest that stormwater runoff be framed in a slightly more proactive way. The Plan seems to already envisage a proactive path to reducing and/or better understanding the impact of stormwater on the White River Basin.

DEC Response- (Please see Comment and Response 2 above that addresses a very similar comment)

Comment 19- Section A in Chapter 3 recommends the classification of Lake Casper be changed from A2 to B to "provide a higher level of protection" but the section does not explain how doing so will provide a higher level of protection. According to the Anti-Degradation Policy contained in the Vermont Water Quality Standards (VWQS), water bodies exhibiting high water quality "shall be managed to maintain and protect the higher water quality and minimize risk to existing and designated uses." VWQS 1-03(C)(1)(2011). The VWQS do permit a "limited reduction" if it can be shown that specific situations or unintended consequences will occur. *Id.*(C)(2). However, the basin plan does not demonstrate how any of those three situations/consequences specified in the VWQS will occur in order to justify the reduction in water quality of a designated A2 water. Therefore, by reclassifying Lake Casper and Farnsworth Brook from A2 to B waters, it does not seem as though the water quality of these waterbodies will be protected at all, but in fact, be allowed to degrade to an unknown degree. This is especially true if the Agency fails to indicate whether these bodies of water will be designated B1, B2, or B3 (or any similar sub-section of

Class B waters ANR intends to use in the future), all of which have specific water quality criteria that are required to be met. There is an inherent difference between reclassifying an A2 water to a B3 water, and classifying an A2 water to a B1 water. The latter would provide a higher level of water quality protection than the former. We understand that water sampling and analysis of Lake Casper and Farnsworth Brook would be required to designate them as B1 waters, but we believe this would be a worthwhile investment.

DEC Response- The reclassification from Class A2-Pubic Water Supply to Class B does not constitute a downgrade in water quality protections, nor does the reclassification constitute a "limited reduction." Under the VWQS, Class B waters trigger different management objectives from Class A2 waters. In particular, Class B waters are managed to support all designated uses, whereas Class A2 waters are managed with the primary goal of providing raw water supply. Where waters are no longer used for public water supply, they no longer require artificial controls designed to manage water supplies and therefore a Class A2 designation is no longer appropriate. Moreover, reclassifying Lake Casper and Farnsworth Brook from Class A2 to Class B will provide them with additional protections, including preventing limited reductions caused by artificial controls, ensuring they are available for public use, and increased aquatic biota and habitat protection.

Reclassifying Lake Casper and Farnsworth Brook from Class A2 to Class B will prevent limited reductions caused by artificial controls. VWQS indicates that waters designated A2 are managed for the purpose of public water supply. Although 2-05B stipulates that these water supplies shall be managed in a manner that assures compliance with all facets of VWQS, the primary purpose is for provision of raw water supply, which typically requires the implementation of artificial controls. As such, artificial controls are commonly exercised upon these waters to ensure achievement of water supply goals that may not align with management that protects other uses, such as aquatic biota and habitat. Various water supply management techniques temporarily interfere with the goal of maintaining high quality aquatic habitat, including filter backflushing, pond treatment with clarifying agents, littoral habitat removal, or inter-pond transfers. These actions do not violate other provisions of VWQS per-se, but they may adversely affect aquatic habitat, and would not be permitted in Class B waters.

Reclassifying Lake Casper and Farnsworth Brook from Class A2 to Class B will ensure they are available for public use. Numerous A2 water supply ponds are closed to public use by the relevant municipalities so as to protect water supply integrity; a form of management for the purpose of public water supply. Vermont law does not permit this preclusion of public access to other waters of the State except in rare instances. In other words, Class B waters very rarely have instances where public access to designated uses is precluded, whereas it is a common occurrence for Class A2 waters. Public uses that may be precluded in A2 waters include swimming, boating, and fishing.

Reclassifying Lake Casper and Farnsworth Brook from Class A2 to Class B will provide these water bodies with increased aquatic biota and habitat protection. The VWQS criteria for aquatic life and habitat provide a higher level of protection in Class B waters. In particular, 3-03.B.3 provides that biological integrity changes are limited to no more than moderate changes in aquatic biota and habitat from reference conditions. Class B waters receive increased protections for aquatic biota as these higher levels of biological attainment can be precluded by artificial controls used to manage Class A2 waters.

Finally, DEC agrees that sampling of the subject waters is merited. These actions have been added to the implementation table of the plan; action 37.

Comment 20- Reclassifying the Barnard Fen and the Nyes Swamp wetlands to Class 1 would provide better protection to the wetland ecosystem, and consequently, water quality and water retention benefits as well.

DEC Response- Agreed!

Comment 21- As a follow up to my questions about your bacteria testing, attached is a pre-publication version of an article I wrote about the obstacles to storm water managers to adapt to using new techniques that more accurately identify illicit sources of bacteria (in the storm water context -- human sewage). You'll find an appendix at the end that lists the top studies detecting human-source bacteria in storm water.

DEC Response- DEC appreciates this information, and would gladly engage in a conversation with any relevant stakeholders regarding newly emerging options for IDDE in the Basin.

Comment 22- While the authors of the proposed White River Tactical Basin Management Plan obviously care deeply about the water quality of the river and the health of its aquatic inhabitants, I feel there is not enough emphasis put on the safety of the people living within its valley. It is my observation that the post-Tropical Storm Irene channel of the White and its tributaries in many places have been filled in with an excess of gravel and sediment. Large amounts of debris choke its course and some of its banks are precariously unstable. It is my opinion that the first priorities of the new river management plan should be the sensible extraction of gravel from the river channel. This will increase its hydraulic capacity in the event of the next flood, create a deeper, colder channel for fish, put local contractors to work and provide an abundance of inexpensive gravel for local roads. This will invariably lead to less erosion by allowing road crews to maintain a proper crown on gravel roads.

Another priority should be the thoughtful removal of left over tree snags and other debris. During the next period of high water, this debris will undoubtedly be sent down stream to

lodge in bridges and culverts and once again flood out the residences living along the river. Lastly, I feel it is important to strategically shore up and armor the most unstable banks before more sediment and debris enter the river system. To my knowledge none of these issues are addressed in the newly proposed river plan.

DEC Response- State policy regarding stream and river corridor management is based upon existing State Statutes, the new Stream Alteration Permit, Act 138, and other state law and policy that guide the Department's staff and partners in managing and regulating activities in Vermont's streams and river corridors. These documents also outline appropriate emergency measures to protect life and property immediately after or prior to a flood event.

The State has also funded and overseen many assessments of streams and river corridors as part of river corridor management plans undertaken by professional consultants. These assessments and river corridor management plans often serve as a blueprint in determining causes of stream instability and in identifying high priority stream reaches for undertaking "active" or more "passive" approaches to managing the State's streams.

In general terms, the State has recognized that previous and on-going straightening (channelizing) and dredging (gravel removal and/or berming) Vermont's streams have caused streams to become more unstable, or to be in disequilibrium. A stream system is generally in "equilibrium" or stable if the sediment entering a reach is equal to the sediment being transported through the reach. When excessive sediment is deposited within a reach of stream, channel beds rise or aggrade. When there is a sediment deficiency, channel beds cut down or degrade. Removing excessive amounts of gravel or sediment within a reach throws this system out of balance, resulting in increased erosion of the beds and banks and increased instability. For example, removing excessive amounts in a stream reach that is undergoing degradation can exacerbate stream erosion and future flooding damages.

This is further exacerbated by development or encroachment within river corridors and floodplains and having to protect this infrastructure. Development or berming of materials within the active floodplain restricts the river ability to dissipate its energy onto the floodplain, causing increased stream energy within river channels. This increase in stream energy often caused additional streambank and channel bottom erosion which often results in additional damage to public and private properties.

The State recognizes that there are appropriate times and locations within reaches of river that will have to be more actively managed where conflicts between the river and built environment need to be more actively managed. In these specific instances, it may be appropriate to selectively and thoughtfully remove gravel or woody debris, especially immediately upstream or adjacent to stream crossings and other private and public infrastructure, such as roads and homes. The revised Vermont Stream Alteration Permit now requires consultation with Stream Alteration Engineers before removal of woody

debris. All in-stream management implementation should be in consultation with the appropriate Department's Stream Alteration Engineer.

The Vermont Legislature recently passed Act 16, which takes effect in July 2014. The Act requires municipal and regional plans to incorporate a "flood resilience" component of element. Working towards resiliency means both proactively reducing vulnerabilities to flooding and flood damage, and improving response and recovery efforts when flood events do occur, so that communities bounce back quickly long term economic, social, and natural resource impacts. The effort will include using maps to identify local flood hazard areas, pointing to specific areas that should be protected because they slowdown or absorb floodwaters (including floodplains, river corridors, forests and wetlands) and recommending specific strategies and policies that will help protect these areas and reduce the risks facing existing development. ANR will provide resources, such as river corridor maps, and assistance to make flood resiliency an integral part of town planning.

The draft White River Tactical Basin Plan specifically addresses many of the issues that you have described in your comments. Some of the Actions are listed as Actions addressing sediment from roads or upgrading culverts for aquatic habitat or geomorphic compatibility or protecting and restoring floodplains. By implementing these Actions, residents in the watershed will be "safer" and better prepared for future flood events. Numerous Tactical Plan Actions will assist communities in becoming more flood resilient including: Actions 4-11, 12-14, 15-18, 21-25, 35-36, 38-42 and 46-51.

Specific recommendations in the plan Implementation Table include the areas of: stream crossing (bridge and culvert) upgrades, floodplain and restoration and protection, flood resiliency, addressing river-road conflicts, and implementing gravel road best management practices.

Comment 23- What are the regulatory implications of designating the White River as an Outstanding Resource Water (ORW), for example buffer setbacks?

DEC Response- The Tactical Plan recommends designating the White River main stem as an ORW for Recreation. This recommendation is largely due to the fact that the White River is the largest free-flowing and un-dammed river in Vermont. The primary goal of this recommendation is to protect the White River as a free-flowing river for recreational boating. Additionally, the White River has high angler use and dozens of public access areas for swimming, boating, tubing, and fishing.

Regulation implications of designating the White River as an ORW will likely include the prohibition of any future dam construction on the river. Additionally, gravel extraction

limits per landowner are reduced from 50 cubic yards per year down to 10 cubic yards per year for all ORW waters, although there will be exceptions to these limits to protect life and property. There are no new setback requirements or regulations for designating a water as an ORW.

Other Technical Corrections:

As part of DEC's review of the Plan, the flow statistics applied to Chapter 2, section F were re-computed as these had not been examined in several years. Revised flow statistics are incorporated into Table 23. Specific revisions are explained in the following.

Randolph WWTF:

- IWC updated because new 7Q10 is calculated as 7.43 cfs, based on several years of new flow data.

Chelsea WWTF:

- Design flow- There was a rounding error. The permit states a design flow of 0.055 MGD.
- IWC updated because new 7Q10 is calculated as 1.36 cfs and LMM as 6.62 cfs, based on several years of new flow data, and averaging of two similar, approximately equidistant USGS gages

Roxbury Hatchery:

- IWC updated because new 7Q10 is calculated as 0.689 cfs and LMM as 3.31 cfs, based on several years of new flow data.

White River National Hatchery:

- Design flow- The 18.75 value was an old design flow prior to 1997. It was updated to 6.62 MGD on the 2007 permit. Also, slight changes to 7Q10 and LMM from several years of new flow data result in updated IWC values.